Autonics

12th TOTAL CATALOGUE

Sensors


Proximity Sensors


Area Sensors


Fiber Optic Sensors


Pressure Sensors


Photoelectric Sensors


Door/Door Side Sensors


Rotary Encoders

Controllers


Timers


Temperature Controllers


Panel/Pulse Meters


SSRs


Graphic/Logic panels


Field Networks Devices


SMPS


Counters


Display units

Stepper Motors/ Drivers/Motion Controllers


5-phase Stepper Motors


2/5-phase Stepper Motor Drivers


Programmable Motion Controllers

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Caution For Your Safety

※ Please observe all safety considerations for safe and proper the unit operation to avoid hazards.
※ Please observe the following for safety.

⚠ **Warning**	Failure to follow these instructions may result in serious injury or death.
⚠ **Caution**	Failure to follow these instructions may result in personal injury or product damage.

※ The symbols used on the unit and instruction manual represent the following
⚠ symbol represents caution due to special circumstances in which hazards may occur.

⚠ Warning

1. **Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/ disaster prevention devices, etc.)**
   Failure to follow this instruction may result in personal injury, fire, or economic loss.
2. **The unit must be installed on a device panel before use.**
   Failure to follow this instruction may result in electric shock.
3. **Do not connect, repair, or inspect the unit while connected to a power source.**
   Failure to follow this instruction may result in electric shock.
4. **Check the terminal numbers before connecting the power source and measurement input.**
   Failure to follow this instruction may result in fire.
5. **Do not disassemble or burn up because lithium battery is used for memory protection.**
   (applicable models: LA8N, LE8N, LR5N, LE7M-2, LE365S-41, LE4S, GP Series)
   Failure to follow this instruction may result in explosion.
6. **Do not touch power terminals or the unit after cutting OFF the power within 30 sec.**
   (applicable models: SPC1, SPA, MD5-HF14, MD5-HF28 Series)
   Failure to follow this instruction may result in electric shock.
7. **Do not connect power directly without load.**
   (applicable the unit : proximity sensor)
   Failure to follow this instruction may result in inner components damage.
8. **Do not units as safety device.**
   Failure to follow this instruction may result in product damage, or personal injury.
9. **Ground with F.G. terminal individually.**
   (applicable models: SPC1, MD5-HF14, MD5-HF28, SPA Series)
   Failure to follow this instruction may result in electric shock.
10. **Use reinforced insulation DC power for power of DC input type.**
    Failure to follow this instruction may result in electric shock.
11. **Install the unit after considering counter-plan against power failure.**
    (applicable products: stepper motors & drivers)
    Failure to follow this instruction may result in personal injury or product damage by releasing holding torque of motor.
12. **Do not put a finger or any object into the unit.**
    Failure to follow this instruction may result in fire or electronic shock.
13. **Do not disassemble or modify the unit. Please contact us if necessary.**
    Failure to follow this instruction may result in fire, electronic shock, or product damage.
14. **Install protection equipment for board type unit**.
    Failure to follow this instruction may result in fire.
15. **Adjust the volume switch with the insulated screw driver.**
    Failure to follow this instruction may result in electronic shock.
16. **The units are not safety device for preventing from personal injury or product damage. Please use the unit in a common use.**
    (applicable models: BW, BWP, BWPK Series)
17. **Do not use the unit as safety device for press or cutter.**
    (applicable models: BW, BWP, BWPK Series)
    Failure to follow this instruction may result in personal injury.
18. **Do not disassemble the unit while it is operating.**
    (applicable products: stepper motors & drivers, motion controllers)
    Failure to follow this instruction may result in personal injury, economic loss or malfunction.
19. **The emergency stop is required during operating.**
    (applicable products: stepper motors & drivers, motion controllers)
    Failure to follow this instruction may result in personal injury or product damage.
20. **Do not separate a terminal block while it is operating.**
    (applicable products: stepper motors & drivers, motion controllers)
    Failure to follow this instruction may result in personal injury, economic loss or malfunction.

⚠ Caution

1. **Do not use the unit outdoors.**
   Failure to follow this instruction may result in electric shock or shorten the life cycle of the unit.
2. **When connecting the power input or measuring input, make sure to use AWG20(0.5mm^2) and tighten the terminal screw bolt above 0.74N·m to 0.90N·m.**
   Failure to follow this instruction may result in fire due to contact failure.
3. **Use the unit within the rated specifications.**
   Failure to follow this instruction may result in fire or shorten the life cycle of the unit.
4. **Do not use loads beyond the rated switching capacity of the relay contact.**
   Failure to follow this instruction may result in insulation failure, contact failure, contact bonding, relay damage, or fire.
5. **Do not use water or oil-based detergent when cleaning the unit. Use dry cloth to clean the unit**
   Failure to follow these instructions may result in electric shock or fire.
6. **Do not use the unit where flammable or explosive gas, humidity, direct sunlight, radiant heat, vibration, and impact may be present.**
   Failure to follow this instruction may result in fire or explosion.
7. **Keep dust and wire residue from flowing into the unit.**
   Failure may result in fire or product malfunction

8. Check the polarity contact before wiring the unit.
Failure to follow this instruction may result in fire or explosion or product damage.

9. Check the polarity of power before connecting thermocouple sensor.
(applicable product: temperature controllers)
Failure to follow this instruction may result in fire or explosion.

10. Refer to the wire specifications for power and load connection by load current.
(applicable models: SPC1, SPA Series, stepper motors & drivers)
Failure to follow this instruction may result in fire or explosion.

11. Tighten bolts on terminal block with the specified tightening torque.
(applicable models: SPC1 Series)
For the specified tightening torque, refer to the user manual of the unit.
Failure to follow this instruction may result in fire due to contact failure.

12. Do not touch the unit during operation or after stopping. The unit emits high temperature of heat.
(applicable models: SPC1, SPA Series, stepper motors & drivers)
Failure to follow this instruction may result in burn.

13. Do not short circuit the load.
Failure to follow this instruction may result in product damage or a malfunction.

14. Do not use the unit for corrosive gas, liquid.
(applicable product: pressure sensors)
Failure to follow this instruction may result in product damage.

15. Do not insert any sharp or pointed object into the pressure port.
(applicable product: pressure sensors)
Failure to follow this instruction may result in damage to diaphragm damage and malfunction.

16. Do not apply beyond rated pressure.
(applicable product: pressure sensors)
Failure to follow this instruction may result in damage to diaphragm damage and malfunction.

17. Refer to the connection diagrams and check the connection correctly before supplying the power.
Failure to follow this instruction may result in fire, electronic shock, or product damage.

18. When connecting to power, install current breaker.
(applicable models: SPC1, MD5-HF14, MD5-HF28 Series)
Failure to follow this instruction may result in fire.

19. Turn OFF the power when power is failed.
(applicable product: stepper motors & drivers, motion controllers)
Failure to follow this instruction may result in personal injury or product damage due to sudden movement when recover power failure.

20. Supply power to the unit after checking control input signal.
(applicable product: stepper motors & drivers, motion controllers)
Failure to follow this instruction may result in personal injury or product damage by sudden movement.

21. Do not turn on the HOLD OFF signal input while it is maintaining vertical position.
(applicable product: stepper motors & drivers)
Failure to follow this instruction may result in personal injury or product damage by releasing holding torque of motor.

22. Install safety device when it is required to remain the vertical position after turn off the power.
(applicable product: stepper motors & drivers)
Failure to follow this instruction may result in personal injury or product damage by releasing holding torque of motor.

23. Check if HOLD OFF signal input is ON when it is required to set the output manually.
(applicable product: stepper motors & drivers)
Failure to follow this instruction may result in personal injury by sudden movement.

24. Stop the unit when mechanical problem occurs.
(applicable product: stepper motors & drivers, motion controllers)
Failure to follow this instruction may result in fire or personal injury.

25. Do not touch terminals when testing pressure or insulation resistance.
Failure to follow this instruction may result in electric shock.

26. Do not put obstacles around the unit which may obstruct ventilation.
(applicable models: SPC1, SPA Series, stepper motors & drivers)
Failure to follow this instruction may result in product damage or malfunction of peripheral equipment by heat.

27. The surface temperature of the motor may reach 70℃ **in normal operating conditions. Please place a warning sign in conditions where someone may approach the operating motor.**
(applicable product: stepper motors)
Failure to follow this instruction may result in burn.

28. Do not carry the unit by the cable or rotor.
(applicable product: stepper motors)
Failure to follow this instruction may result in personal injury or product damage.

29. Make sure to install covers on rotating components..
(applicable product: stepper motor)
Failure to follow this instruction may result in personal injury.

30. The cable of power and output line should not be long.
Failure to follow this instruction may result in product damage or malfunction due to surge.

⚠	**General precaution** Indicate general warning, caution or danger.

(A) Photoelectric Sensors

NEW

Push Button Type Photomicro Sensors BS5-P Series

NEW

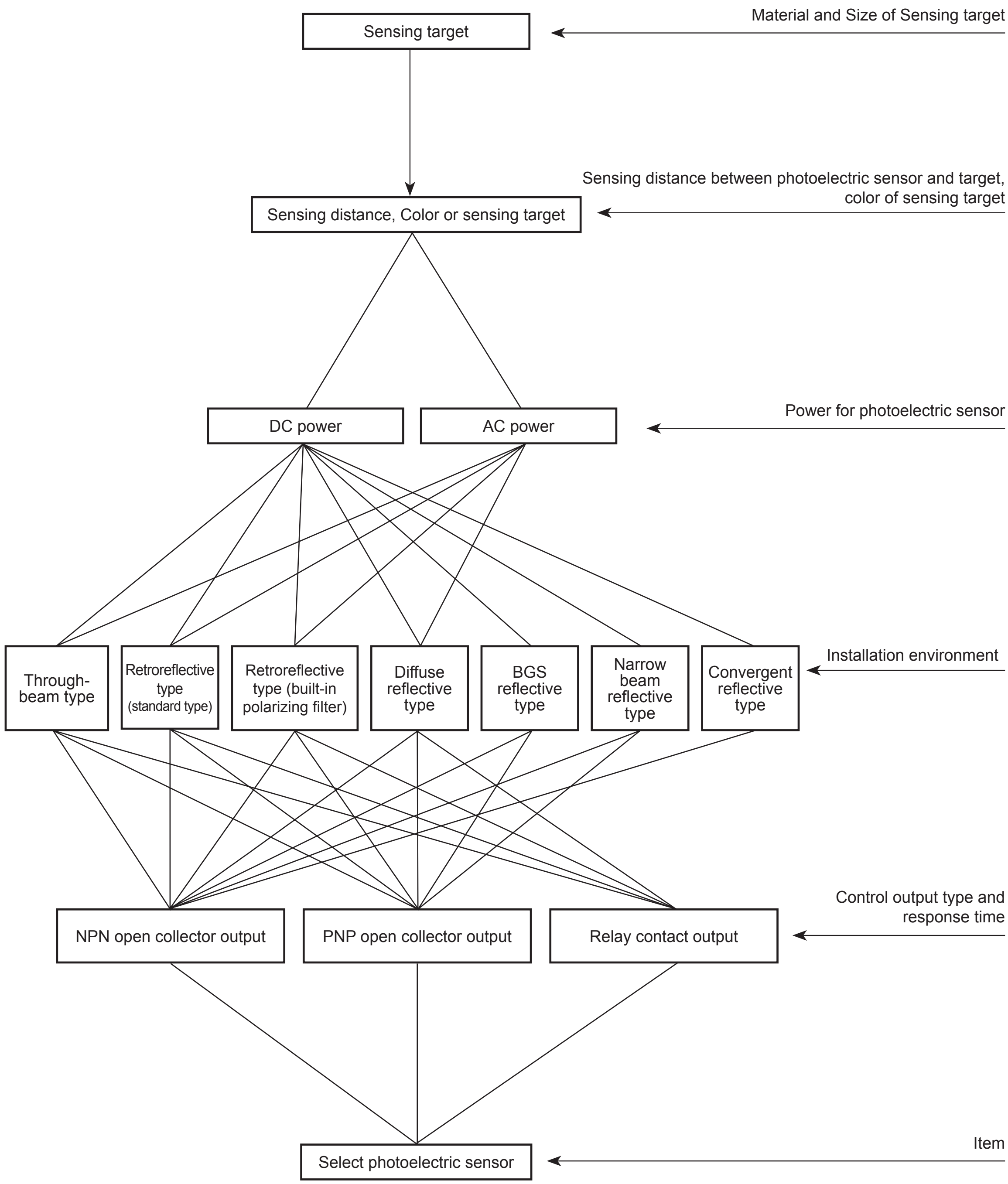
4-CH U-shaped Type BUM Series

Ultra-compact amplifier built-in type BTS Series

Ultra-slim and amplifier built-in type BTF Series

Liquid level sensor BL Series

■ Selection Method For Photoelectric Sensor



■ Ordering Information (Photoelectric Sensor)

BEN | 10 | M – T | F | R | ⬚ | □ – □ | □ – P

Item	Code	Description
NPN/PNP	P	PNP open collector output
	No mark	NPN open collector output
Connection type	No mark	Cable type
	C	Connector type
Timer	T	Built-in Timer
	No mark	Standard type
Diffuse/Narrow beam type	No mark	Reflective type (diffuse type)
	N	Narrow beam type (BR, BRP series only)
Emitter/Receiver	1	Emitter
	2	Receiver
Control output	R	Contact output (relay)
	T	Solid-state output (transistor)
Power supply	D	DC power
	F	Power supply built-in
	S	Adjuster included (BUP series only)
Sensing type	D	Diffuse reflective type
	M	Retroreflective type (standard type)
	P	Retroreflective type (built-in polarizing filter)
	T	Through-beam type
	Number	Sensing distance (BUP series only)
Sensing distance unit	M	m
	No mark	mm
Sensing distance	Number	Sensing distance
Item	BX	Photoelectric sensor Series
	BEN	
	BA	
	※1 BPS	
	※1 BM/BMS	
	※1 BR/BRP	
	※1 BUP/BUM	
	※1 BY/BYS	
	BYD	

※1: ‘S’ represents lateral sensing type.
‘P’ represents plastic case type.

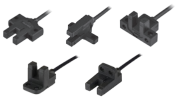
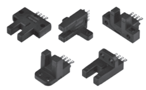
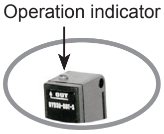
BJN | 50 | □ – N | D | T | □ | ⬚ – □ – P

Item	Code	Description
NPN/PNP	P	PNP open collector output
	No mark	NPN open collector output
Connection type	No mark	Cable type
	C	Connector type
Emitter/Receiver	1	Emitter
	2	Receiver
Operation mode	L	Light ON
	D	Dark ON
	No mark	Mode switching
Control output	T	Solid-state output (transistor)
Power supply	D	DC power
Sensing type	D	Diffuse reflective type
	P	Retroreflective type (built-in polarizing filter)
	T	Through-beam type
	N	Narrow beam reflective type
	B	BGS reflective type
	L	Convergent reflective type
Sensing distance unit	M	m
	No mark	mm
Sensing distance	Number	Sensing distance
Item	BJ	Small long sensing distance photoelectric sensor
	BJN	Micro-spot photoelectric sensor
	BJG	Transparent sensing photoelectric sensor
	BTS	Ultra-compact amplifier built-in type
	BTF	Ultra-thin photoelectric sensor

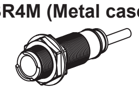
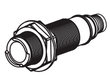
※⬚ This information is intended for product management of through-beam type models. It is not required when ordering a model.
※This ordering information is only for reference. For ordering a specific model, check the ordering information of the model.
※There is no photomicro sensor (BS5 series), push button type photomicro sensor (BS5-P series) and liquid level sensor (BL series) in this ordering information.

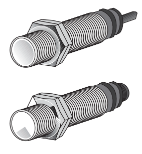
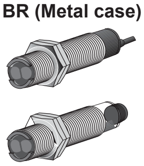
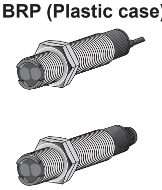
Product Overview

Appearance	Sensing type	Sensing distance (light source)	Model	Power supply	Response speed	Control output	Reference
BTF Series CE 	Through-beam type	1m (red LED)	**BTF1M-TDTL** **BTF1M-TDTD**	12-24VDC	Max. 1ms	NPN open collector output	**A-9 to 12**
			BTF1M-TDTL-P **BTF1M-TDTD-P**			PNP open collector output	
	Diffuse reflective type	5 to 30mm (red LED)	**BTF30-DDTL** **BTF30-DDTD**			NPN open collector output	
			BTF30-DDTL-P **BTF30-DDTD-P**			PNP open collector output	
	BGS reflective type (convergent reflective type)+ (narrow spot type)	1 to 15mm (red LED)	**BTF15-BDTL** **BTF15-BDTD**			NPN open collector output	
			BTF15-BDTL-P **BTF15-BDTD-P**			PNP open collector output	
BTS Series CE 	Through-beam type	1m (red LED)	**BTS1M-TDTL** **BTS1M-TDTD**	12-24VDC	Max. 1ms	NPN open collector output	**A-13 to 18**
			BTS1M-TDTL-P **BTS1M-TDTD-P**			PNP open collector output	
	Retroreflective type	10 to 200mm (red LED)	**BTS200-MDTL** **BTS200-MDTD**			NPN open collector output	
			BTS200-MDTL-P **BTS200-MDTD-P**			PNP open collector output	
	Convergent reflective type	5 to 15mm (red LED)	**BTS15-LDTL** **BTS15-LDTD**			NPN open collector output	
			BTS15-LDTL-P **BTS15-LDTD-P**			PNP open collector output	
		5 to 30mm (red LED)	**BTS30-LDTL** **BTS30-LDTD**			NPN open collector output	
			BTS30-LDTL-P **BTS30-LDTD-P**			PNP open collector output	
BJ Series CE   **Connector type**	Through-beam type	15m (infrared LED)	**BJ15M-TDT** **BJ15M-TDT-C**	12-24VDC	Max. 1ms	NPN open collector output	**A-19 to 25**
			BJ15M-TDT-P **BJ15M-TDT-C-P**			PNP open collector output	
		10m (red LED)	**BJ10M-TDT** **BJ10M-TDT-C**			NPN open collector output	
			BJ10M-TDT-P **BJ10M-TDT-C-P**			PNP open collector output	
		7m (red LED)	**BJ7M-TDT**			NPN open collector output	
			BJ7M-TDT-P			PNP open collector output	
	Retroreflective type	Polarizing filter built-in 0.1 to 3m (red LED)	**BJ3M-PDT** **BJ3M-PDT-C**			NPN open collector output	
			BJ3M-PDT-P **BJ3M-PDT-C-P**			PNP open collector output	
	Diffuse reflective type	1m (infrared LED)	**BJ1M-DDT** **BJ1M-DDT-C**			NPN open collector output	
			BJ1M-DDT-P **BJ1M-DDT-C-P**			PNP open collector output	
		300mm (red LED)	**BJ300-DDT** **BJ300-DDT-C**			NPN open collector output	
			BJ300-DDT-P **BJ300-DDT-C-P**			PNP open collector output	
		100mm (infrared LED)	**BJ100-DDT** **BJ100-DDT-C**			NPN open collector output	
			BJ100-DDT-P **BJ100-DDT-C-P**			PNP open collector output	
		30mm (infrared LED)	**BJG30-DDT**			NPN open collector output	
	BGS reflective type (convergent reflective type)+ (narrow spot type)	10 to 30mm (red LED)	**BJ30-BDT**		Max. 1.5ms	NPN open collector output	
			BJ30-BDT-P			PNP open collector output	
		10 to 50mm (red LED)	**BJ50-BDT**			NPN open collector output	
			BJ50-BDT-P			PNP open collector output	
	Narrow beam reflective type (micro spot type)	30 to 70mm (red LED)	**BJN50-NDT**		Max. 1ms	NPN open collector output	
			BJN50-NDT-P			PNP open collector output	
		70 to 130mm (red LED)	**BJN100-NDT**			NPN open collector output	
			BJN100-NDT-P			PNP open collector output	

Appearance	Sensing type	Sensing distance (light source)	Model	Power supply	Response speed	Control output	Reference
BS5 Series Cable type 	Through-beam type (not modulated)	5mm (red LED)	**BS5-L1M** **BS5-K1M** **BS5-T1M** **BS5-Y1M** **BS5-V1M**	5-24VDC	Received light : Max. 20µs Interrupted light : Max. 100µs	NPN open collector output	**A-26 to 29**
			BS5-L1M-P **BS5-K1M-P** **BS5-T1M-P** **BS5-Y1M-P** **BS5-V1M-P**			PNP open collector output	
Connector type 			**BS5-L2M** **BS5-K2M** **BS5-T2M** **BS5-Y2M** **BS5-V2M**			NPN open collector output	
			BS5-L2M-P **BS5-K2M-P** **BS5-T2M-P** **BS5-Y2M-P** **BS5-V2M-P**			PNP open collector output	
BA Series 	Diffuse reflective type	2m (infrared LED)	**BA2M-DDT**	12-24VDC	Max. 1ms	NPN open collector output	**A-30 to 32**
			BA2M-DDTD				
			BA2M-DDT-P			PNP open collector output	
			BA2M-DDTD-P				
BY Series Standard type 	Through-beam type	500mm (infrared LED)	**BY500-TDT**	12-24VDC	Max. 1ms	NPN open collector output	**A-33 to 35**
 Side sensing type			**BYS500-TDT**				
BYD Series 	Through-beam type	3m (infrared LED)	**BYD3M-TDT**	12-24VDC	Max. 1ms	NPN open collector output	**A-36 to 41**
			BYD3M-TDT-P			PNP open collector output	
Operation indicator  **BYD30-DDT-U** **BYD50-DDT-U**	Convergent reflective type	10 to 30mm (infrared LED)	**BYD30-DDT**		Max. 3ms	NPN open collector output	
			BYD30-DDT-U				
			Timer built-in **BYD30-DDT-T**				
		10 to 50mm (infrared LED)	**BYD50-DDT**				
			BYD50-DDT-U				
			Timer built-in **BYD50-DDT-T**				
	Diffuse reflective type	100mm (infrared LED)	**BYD100-DDT**				
BPS Series 	Through-beam type	3m (infrared LED)	**BPS3M-TDT**	12-24VDC	Max. 1ms	NPN open collector output	**A-42 to 43**
			BPS3M-TDTL				
			BPS3M-TDT-P			PNP open collector output	
			BPS3M-TDTL-P				
BM Series 	Through-beam type	3m (infrared LED)	**BM3M-TDT**	12-24VDC	Max. 3ms	NPN open collector output	**A-44 to 48**
	Retroreflective type	0.1 to 1m (infrared LED)	**BM1M-MDT**				
	Diffuse reflective type	200mm (infrared LED)	**BM200-DDT**				

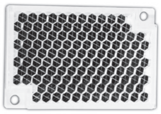
Product Overview

Appearance	Sensing type	Sensing distance (light source)	Model	Power supply	Response speed	Control output	Reference
BMS Series CE 	Through-beam type	5m (infrared LED)	**BMS5M-TDT**	12-24VDC	Max. 1ms	NPN open collector output	**A-49 to 53**
			BMS5M-TDT-P			PNP open collector output	
	Retroreflective type	0.1 to 2m (infrared LED)	**BMS2M-MDT**			NPN open collector output	
			BMS2M-MDT-P			PNP open collector output	
	Diffuse reflective type	300mm (infrared LED)	**BMS300-DDT**			NPN open collector output	
			BMS300-DDT-P			PNP open collector output	
BEN Series CE (DC only) 	Through-beam type	10m (infrared LED)	**BEN10M-TFR**	24-240VAC/ 24-240VDC	Max. 20ms	Relay output	**A-54 to 60**
			BEN10M-TDT	12-24VDC	Max. 1ms	NPN/PNP open collector output	
	Retro-reflective type (standard type)	Standard type 0.1 to 5m (infrared LED)	**BEN5M-MFR**	24-240VAC/ 24-240VDC	Max. 20ms	Relay output	
			BEN5M-MDT	12-24VDC	Max. 1ms	NPN/PNP open collector output	
	Retro-reflective type (built-in polarzing filter)	Polarizing filter built-in 0.1 to 3m (red LED)	**BEN3M-PFR**	24-240VAC/ 24-240VDC	Max. 20ms	Relay output	
			BEN3M-PDT	12-24VDC	Max. 1ms	NPN/PNP open collector output	
	Diffuse reflective type	300mm (infrared LED)	**BEN300-DFR**	24-240VAC/ 24-240VDC	Max. 20ms	Relay output	
			BEN300-DDT	12-24VDC	Max. 1ms	NPN/PNP open collector output	
BX Series CE 	Through-beam type	15m (infrared LED)	**BX15M-TFR** Timer built-in **BX15M-TFR-T**	24-240VAC/ 24-240VDC	Max. 20ms	Relay output	**A-61 to 68**
			BX15M-TDT Timer built-in **BX15M-TDT-T**	12-24VDC	Max. 1ms	NPN/PNP open collector output	
	Retro-reflective type (standard type)	Standard type 0.1 to 5m (infrared LED)	Timer built-in **BX5M-MFR** Timer built-in **BX5M-MFR-T**	24-240VAC/ 24-240VDC	Max. 20ms	Relay output	
	Retro-reflective type (built-in polarzing filter)		**BX5M-MDT** Timer built-in **BX5M-MDT-T**	12-24VDC	Max. 1ms	NPN/PNP open collector output	
	Retro-reflective type (standard type)	Polarizing filter built-in 0.1 to 3m (red LED)	**BX3M-PFR** Timer built-in **BX3M-PFR-T**	24-240VAC/ 24-240VDC	Max. 20ms	Relay output	
	Retro-reflective type (built-in polarzing filter)		**BX3M-PDT** Timer built-in **BX3M-PDT-T**	12-24VDC	Max. 1ms	NPN/PNP open collector output	
	Diffuse reflective type	700mm (infrared LED)	**BX700-DFR** Timer built-in **BX700-DFR-T**	24-240VAC/ 24-240VDC	Max. 20ms	Relay output	
			BX700-DDT Timer built-in **BX700-DDT-T**	12-24VDC	Max. 1ms	NPN/PNP open collector output	
BR Series CE **BR4M (Metal case)**   **Connector type**	Through-beam type	4m (infrared LED)	**BR4M-TDTL** **BR4M-TDTL-C**	12-24VDC	Max. 1ms	NPN open collector output	**A-69 to 74**
			BR4M-TDTD **BR4M-TDTD-C**				
			BR4M-TDTL-P **BR4M-TDTL-C-P**			PNP open collector output	
			BR4M-TDTD-P **BR4M-TDTD-C-P**				

Appearance	Sensing type	Sensing distance (light source)	Model	Power supply	Response speed	Control output	Reference
BR Series CE **BR20M (Metal case)** 	Through-beam type	20m (infrared LED)	**BR20M-TDTL** **BR20M-TDTL-C**	12-24VDC	Max. 1ms	NPN open collector output	**A-69 to 74**
			BR20M-TDTD **BR20M-TDTD-C**			PNP open collector output	
			BR20M-TDTL-P **BR20M-TDTL-C-P**			NPN open collector output	
			BR20M-TDTD-P **BR20M-TDTD-C-P**			PNP open collector output	
BR (Metal case)  **Connector type**	Retro-reflective type	0.1 to 3m (red LED)	**BR3M-MDT** **BR3M-MDT-C**			NPN open collector output	
			BR3M-MDT-P **BR3M-MDT-C-P**			PNP open collector output	
			BRP3M-MDT **BRP3M-MDT-C**			NPN open collector output	
			BRP3M-MDT-P **BRP3M-MDT-C-P**			PNP open collector output	
	Diffuse reflective type	100mm (infrared LED)	**BR100-DDT** **BR100-DDT-C**			NPN open collector outpu	
			BR100-DDT-P **BR100-DDT-C-P**			PNP open collector output	
			BRP100-DDT **BRP100-DDT-C**			NPN open collector output	
			BRP100-DDT-P **BRP100-DDT-C-P**			PNP open collector output	
BRP (Plastic case)  **Connector type**		400mm (infrared LED)	**BR400-DDT** **BR400-DDT-C**			NPN open collector output	
			BR400-DDT-P **BR400-DDT-C-P**			PNP open collector output	
			BRP400-DDT **BRP400-DDT-C**			NPN open collector output	
			BRP400-DDT-P **BRP400-DDT-C-P**			PNP open collector output	
	Narrow beam reflective type	200mm (infrared LED)	**BR200-DDTN** **BR200-DDTN -C**			NPN open collector output	
			BR200-DDTN-P **BR200-DDTN-C-P**			PNP open collector output	
			BRP200-DDTN **BRP200-DDTN-C**			NPN open collector output	
			BRP200-DDTN-P **BRP200-DDTN-C-P**			PNP open collector output	
BUP Series CE 	Through-beam type	30mm (infrared LED)	**BUP-30** **BUP-30S** Adjuster built-in	12-24VDC	Max. 1ms	NPN open collector output	**A-75 to 76**
			BUP-30-P **BUP-30S-P** Adjuster built-in			PNP open collector output	
		50mm (infrared LED)	**BUP-50** **BUP-50S** Adjuster built-in			NPN open collector output	
			BUP-50-P **BUP-50S-P** Adjuster built-in			PNP open collector output	
BUM Series CE NEW 	Through-beam type	40mm (infrared LED)	**BUM4-40D-W-4M**	18-35VDC	Max. 1ms	NPN open collector output	**A-77 to 78**
			BUM4-40D-W-2M/A				
			BUM4-40D-W-3M/A				
			BUM4-40D-W-4M/A				
			BUM4-40D-W-2M/B				
			BUM4-40D-W-3M/B				
			BUM4-40D-W-4M/B				
BL Series CE 	Through-beam type	—	**BL13-TDT**	12-24VDC	Max. 2ms	NPN open collector output	**A-79 to 82**
			BL13-TDT-P			PNP open collector output	
BS5-P Series CE NEW 	Push button type	—	**BS5-P1ML**	12-24VDC	—	NPN open collector output	**A-83 to 86**
			BS5-P1ML-P			PNP open collector output	
			BS5-P1MD			NPN open collector output	
			BS5-P1MD-P			PNP open collector output	

Product Overview

◎ Reflector

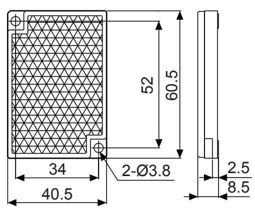


(MS-2)

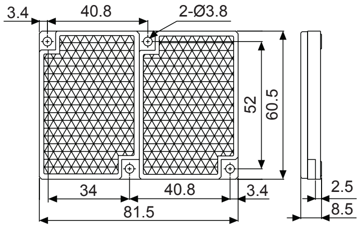
Retroreflective photo sensor is sold with a basic reflector. You can select other reflectors for the proper install environment.
※Select proper reflector size for the install space.
※Basically the bigger reflector size has the longer sensing distance.
※Reflectors with high reflectivity (MS-2S, MS-3S) tend to have longer sensing distance than a basic reflector's sensing distance.

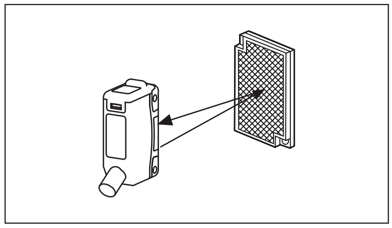
(unit: mm)

● **MS-2, MS-2A, MS-2S (reflectors with high reflectivity)**

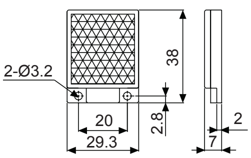


● **MS-3, MS-3S (reflectors with high reflectivity)**

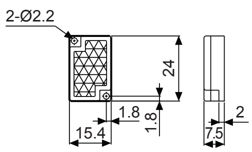




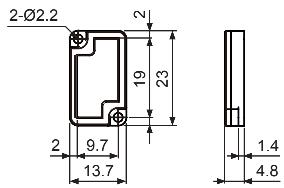
● **MS-4**



● **MS-5**

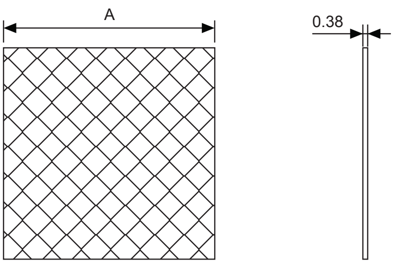


● **MS-6**



◎ Retroreflective tape

※Use the retroreflective tape at the place where is difficult to mount a reflector of the retroreflective photoelectric sensor.
※According to the environment, select the proper retroreflective tape. (Cut the tape before using.)
※Generally, the sensing distance and minimum sensing target size increase as tape size increases.



(unit: mm)

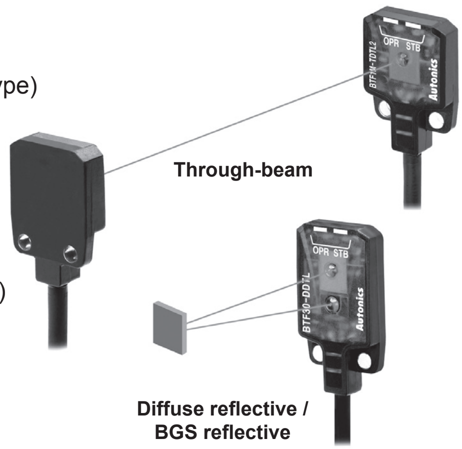
Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

※There may be a ±0.02mm error in thickness dimension.

Ultra-slim And Amplifier Built-in Type

■ Features

- Ultra-thin size of only 3.7mm
  - W13 x H19 x L3.7mm (through-beam type)
  - W13 x H24 x L3.7mm (diffuse reflective type, BGS reflective type)
- Detection methods and minimum target size
  - Through-beam type (BTF1M): Ø2mm
  - Diffuse reflective type (BTF30): Ø0.2mm (at distance 10mm)
  - BGS reflective type (BTF15): Ø0.2mm (at distance 10mm)
- Detecting distance may vary by environmental factors
- Maximum detection distance: 1m (through-beam type)
- Stability indicator (green LED) and operation indicator (red LED)
- Stainless steel 304 mounting brackets
- IP67 protection structure (IEC standard)



⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Specifications

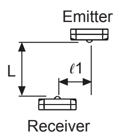
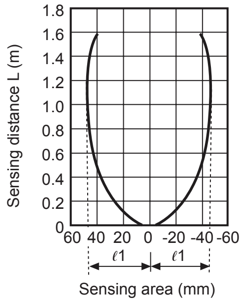
Model: NPN open collector output	**BTF1M-TDTL**	**BTF1M-TDTD**	**BTF30-DDTL**	**BTF30-DDTD**	**BTF15-BDTL**	**BTF15-BDTD**
Model: PNP open collector output	**BTF1M-TDTL-P**	**BTF1M-TDTD-P**	**BTF30-DDTL-P**	**BTF30-DDTD-P**	**BTF15-BDTL-P**	**BTF15-BDTD-P**
Sensing type	Through-beam		Diffuse reflective		BGS reflective	
Sensing distance	1m		5 to 30mm (non-glossy white paper 50×50mm)		1 to 15mm (non-glossy white paper 50×50mm)	
Sensing target	Opaque materials of max. Ø2mm		Opaque materials, Translucent materials			
Min. sensing target	Opaque materials of Ø2mm		Ø0.2mm (sensing distance 10mm)		Ø0.2mm non-illuminated objects (sensing distance 10mm)	
Hysteresis	—		Max. 20% at rated sensing distance		Max. 5% at rated sensing distance	
Reflectivity characteristics (black/white error)	—		—		Max. 15% of maximum sensing distance	
Response time	Max. 1ms					
Power supply	12-24VDC ±10% (ripple P-P: max. 10%)					
Current consumption	Max. 20mA (this is for each emitter and receiver of through-beam type)					
Light source	Red LED (650nm)					
Operation mode	Light ON	Dark ON	Light ON	Dark ON	Light ON	Dark ON
Control output	NPN or PNP open collector output ●Load voltage: Max. 26.4VDC ●Load current: Max. 50mA ●Residual voltage - NPN:Max. 1V, PNP:Max. 2V					
Protection circuit	Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit					
Indicator	Operation indicator: Red LED, Stability indicator: Green LED					
Insulation resistance	Over 20MΩ (at 500VDC megger)					
Noise immunity	±240V the square wave noise (pulse width:1μs) by the noise simulator					
Dielectric strength	1,000VAC 50/60Hz for 1 minute					
Vibration	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock	500m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times					
Environment: Ambient illumination	Sunlight: Max. 10,000lx Incandescent lamp: Max. 3,000lx (receiver illumination)					
Environment: Ambient temperature	-25 to 55℃, storage: -40 to 70℃					
Environment: Ambient humidity	35 to 85%RH, storage: 35 to 85%RH					
Protection structure	IP67 (IEC standards)					
Material	Case: Polybutylene terephthalate, Sensing part: Polymethyl methacrylate, Bracket: SUS304 (steel use stainless 304), Bolt: Carbon steel, Sleeve: SUS304 (steel use Stainless 304)					
Cable	Ø2.5mm, 3-wire, 2m (emitter of through-beam type: Ø2.5, 2-wire, 2m) (AWG28, core diameter: 0.08mm, number of cores: 19, insulator out diameter: Ø0.9mm)					
Accessory	Fixing bracket, Bolts					
Approval	CE					
Unit weight	Approx. 40g		Approx. 25g			

※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature Data

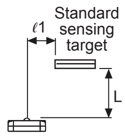
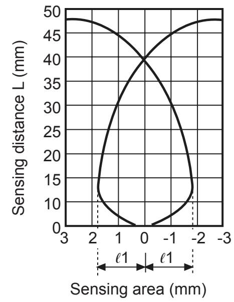
◎ Through-beam

● BTF1M-TDTL / BTF1M-TDTL-P

Sensing area characteristic	
Measuring method	Data
	

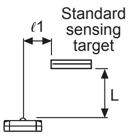
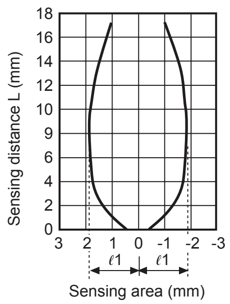
◎ Diffuse reflective

● BTF30-DDTL / BTF30-DDTL-P

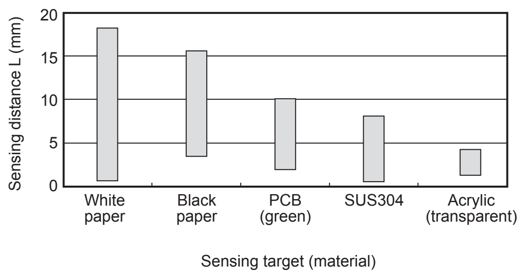
Sensing area characteristic	
Measuring method	Data
	

◎ BGS reflective

● BTF15-BDTL / BTF15-BDTL-P

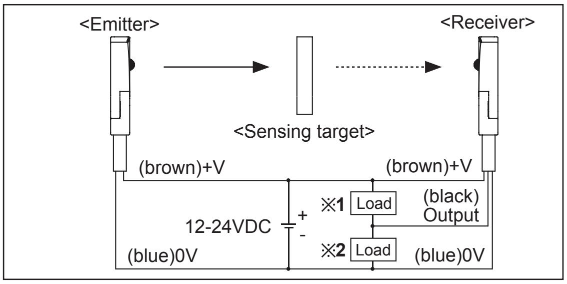
Sensing area characteristic	
Measuring method	Data
	

Sensing distance by material

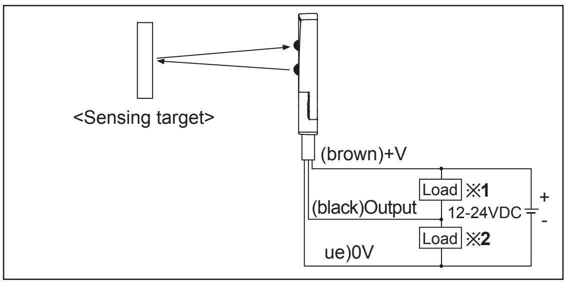


■ Connections

● Through-beam



● Diffuse reflective/BGS reflective

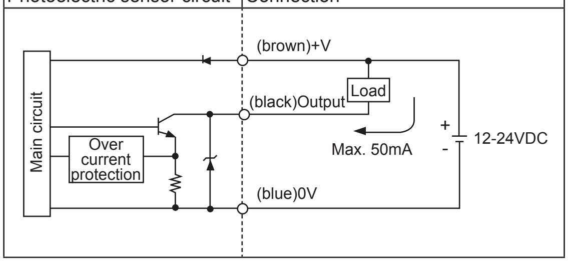


※1: Load connection for NPN output
※2: Load connection for PNP output

■ Control Output Diagram

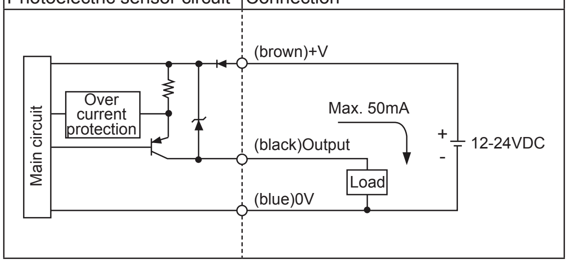
● NPN open collector output

Photoelectric sensor circuit	Connection



● PNP open collector output

Photoelectric sensor circuit	Connection



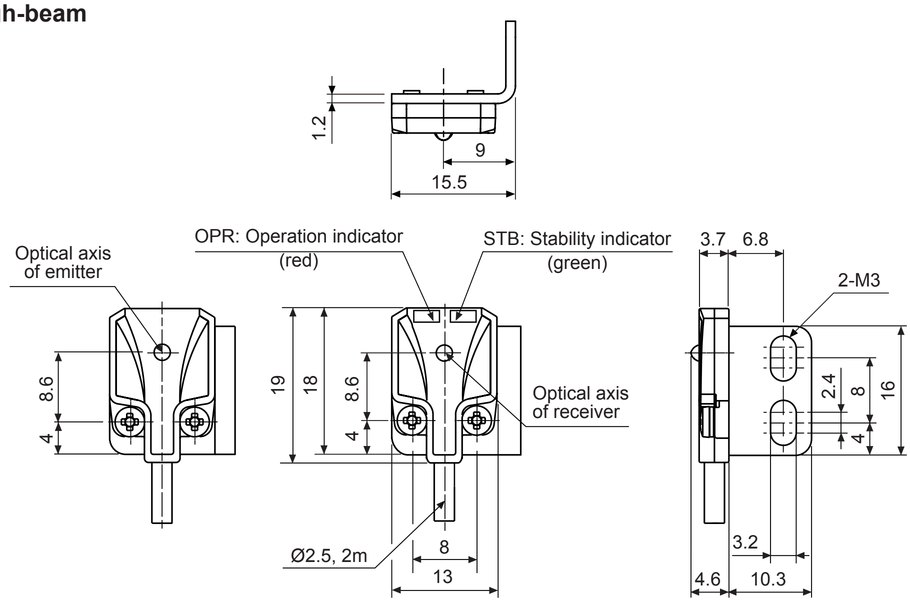
■ Operation Mode

Operation mode	Light ON		Dark ON	
Receiver operation	Received light Interrupted light		Received light Interrupted light	
Operation indicator (red LED)	ON OFF		ON OFF	
Transistor output	ON OFF		ON OFF	

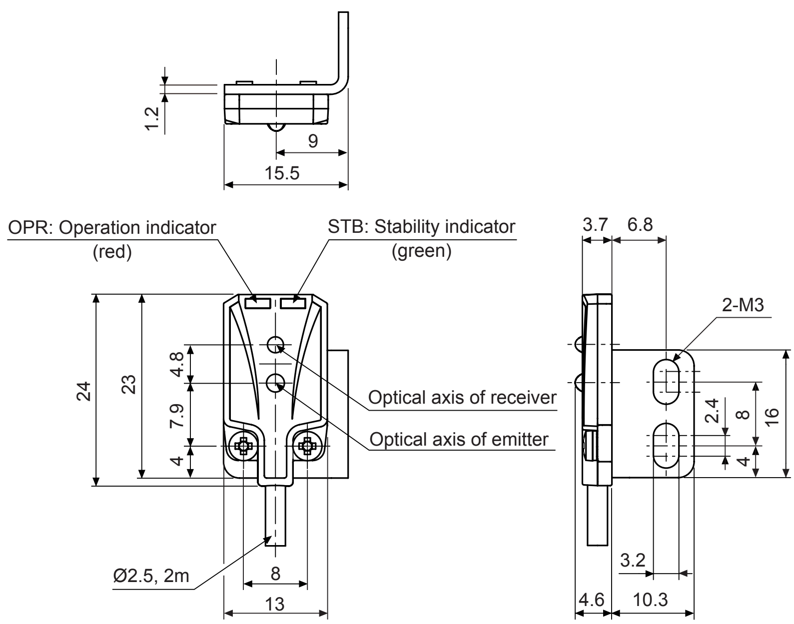
■ Dimensions

(unit: mm)

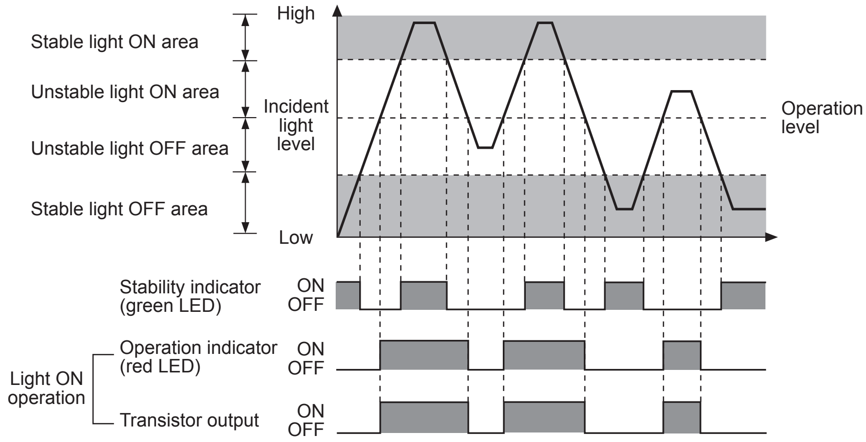
● Through-beam



● Diffuse reflective/BGS reflective



▣ Operation Timing Diagram



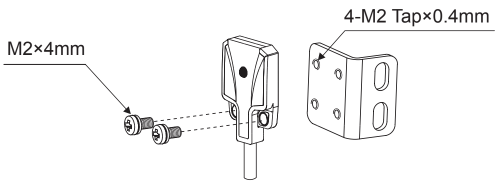
※The waveforms of "Operation indicator" and "Transistor output" are for Light ON operation.
They are opposite operation for Dark ON operation.

▣ Mounting And Sensitivity Adjustment

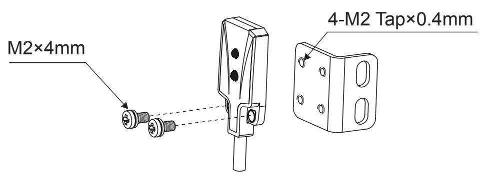
◎ For mounting

Please use bolts M2 for mounting this sensor and the tightening torque is under 0.3 N·m.
※Do not impact on the unit with hard objects and do not bend the cable part too much. It may cause damage to waterproof function.

● Through-beam

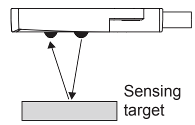


● Diffuse reflective/BGS reflective

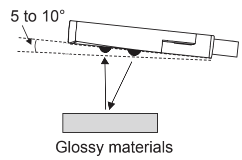


※ Notice for BGS reflective type

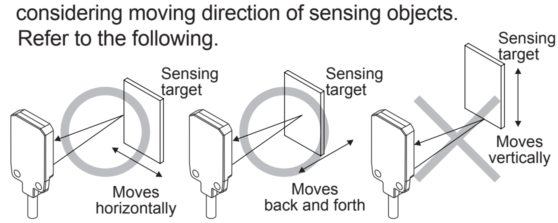
1) Make sure that the sensing side of this sensor is parallel with the surface of each sensing object.



2) If the sensing object has glossary surface or high reflection, the sensor tilts from 5 to 10˚as shown in the figure.
Make sure whether the sensor is influenced by any background objects.



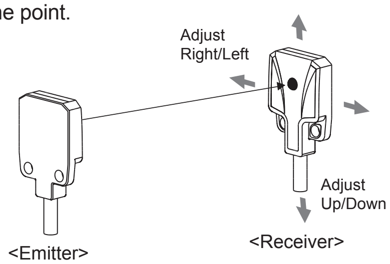
3) Make sure to install the sensor in the proper direction with considering moving direction of sensing objects.
Refer to the following.



◎ Optical axis adjustment

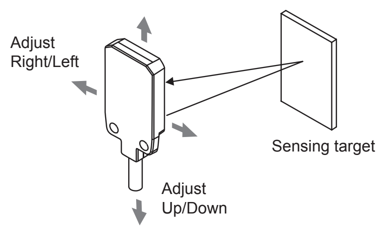
● Through-beam

Set the emitter and the receiver facing each other and adjust these up·down, right·left after checking the point of operating the stability indicator. Fix the emitter and the receiver at the center of the point.



● Diffuse reflective/BGS reflective

After placing a sensing target, fix it in the middle of position where the stability indicator operates when adjusting the sensor to up·down, right·left. Make sure that the sensing side of the sensor is parallel with the surface of each sensing target.

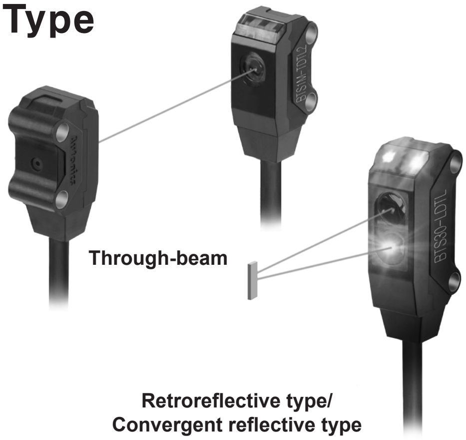


(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Ultra-compact, Amplifier Built-in Type

■ Feature

- Ultra-slim width of only 7.2mm
  - W7.2 x H18.6 x L9.5mm (through-beam type)
  - W7.2 x H24.6 x L10.8mm (retroreflective type, convergent reflective type)
- Detection methods and minimum target size
  - Through-beam type (BTS1M): Ø2mm
  - Retroreflective type (BTS200): Ø2mm (at distance 100mm)
  - Convergent reflective type (BTS15/BTS30): Ø0.15mm (at distance 10mm)
- Detecting distance may vary by environmental factors
- Maximum detection distance: 1m (through-beam type)
- Stability indicator (green LED) and operation indicator (red LED)
- Stainless steel 304 mounting brackets
- IP67 protection structure (IEC standard)



⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Specifications

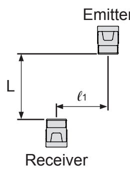
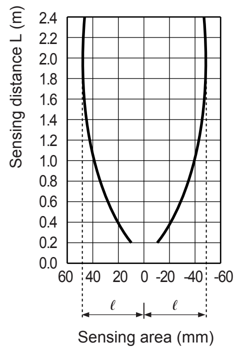
Model	NPN open collector output	BTS1M-TDTL	BTS1M-TDTD	BTS200-MDTL	BTS200-MDTD	BTS30-LDTL	BTS30-LDTD	BTS15-LDTL	BTS15-LDTD
	PNP open collector output	BTS1M-TDTL-P	BTS1M-TDTD-P	BTS200-MDTL-P	BTS200-MDTD-P	BTS30-LDTL-P	BTS30-LDTD-P	BTS15-LDTL-P	BTS15-LDTD-P
Sensing type		Through-beam type		Retroreflective type		Convergent reflective type			
Sensing distance		1m		10 to 200mm※1 (MS-6)		5 to 30mm (non-glossy white paper 50×50mm)		5 to 15mm (non-glossy white paper 50×50mm)	
Sensing target		Opaque material of max. Ø2mm		Opaque material of max. Ø27mm		Opaque material, Translucent materials			
Min. sensing target		Opaque material of Ø2mm		Opaque material of Ø2mm※2 (sensing distance 100mm)		Ø0.15mm (sensing distance 10mm)			
Hysteresis distance		—		—		Max. 15% of maximum sensing distance			
Response time		Max. 1ms							
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)							
Current consumption		Max. 20mA (in case of through-beam type, this value is for each emitter and receiver)							
Light source		Red LED (650nm)							
Operation mode		Light ON	Dark ON	Light ON	Dark ON	Light ON	Dark ON	Light ON	Dark ON
Control output		<NPN or PNP open collector output> ·Load voltage: max. 26.4VDC ·Load current: max. 50mA ·Residual voltage - NPN: max. 1V, PNP: max. 2V							
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit							
Indicator		Operation indicator: Red LED, Stability indicator: Green LED							
Insulation resistance		Over 20MΩ (at 500VDC megger)							
Noise immunity		±240V the square wave noise (pulse 1㎲)							
Dielectric strength		1,000VAC 50/60Hz for 1 min							
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times							
Environment	Ambient illumination	Sunlight: max. 10,000ℓx, Incandescent lamp: max. 3,000ℓx (receiver illumination)							
	Ambient temperature	-20 to 55℃, storage: -30 to 70℃							
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH							
Protection structure		IP67 (IEC standard)							
Material		Case: Polybutylene terephthalate, Sensing part: Polymethyl methacrylate, Bracket: SUS304 (steel use Stainless 304), Bolt: Carbon steel, Sleeve: SUS304 (steel use stainless 304)							
Cable		Ø2.5mm, 3-wire, 2m (emitter of through-beam type: Ø2.5mm, 2-wire, 2m) (AWG 28, core wire diameter: 0.08mm, no. of core wire: 19, insulator diameter: Ø0.9mm)							
Accessory		Bracket A: 2, Sub-bracket for through-beam type: 2, M2 bolt: 4		Reflector (MS-6),Bracket A, Sub-bracket for reflective type, M2 bolt: 2		Bracket A, Sub-bracket for reflective type, M2 bolt: 2			
Approval		CE							
Weight※3		Approx. 97g (approx. 45g)		Approx. 70g (approx. 25g)		Approx. 68g (approx. 25g)			

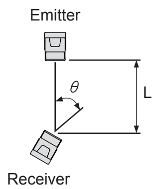
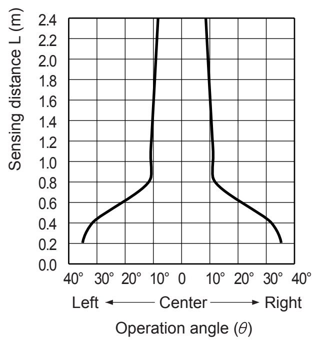
※1: When using reflective tapes, the Reflectivity vary by the size of the tape.
Please refer to the '■ Reflectivity By Reflective Tape Model' table before using the tape.
※2: It will vary by the installation environment and sensing conditions.
Please refer to the '◎ Conditions of min. sensing target and installations (retroreflective type)'.
※3: The weight is with packaging and the weight in parenthesis is only unit weight.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature Data

◎ Through-beam

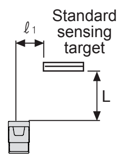
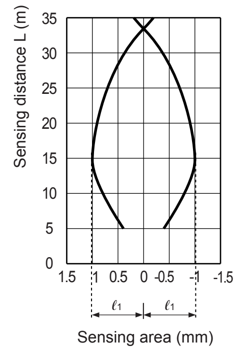
● **BTS1M-TDTL / BTS1M-TDTL-P**

Sensing area characteristic	
Measuring method	Data
	

Sensing area characteristic	
Measuring method	Data
	

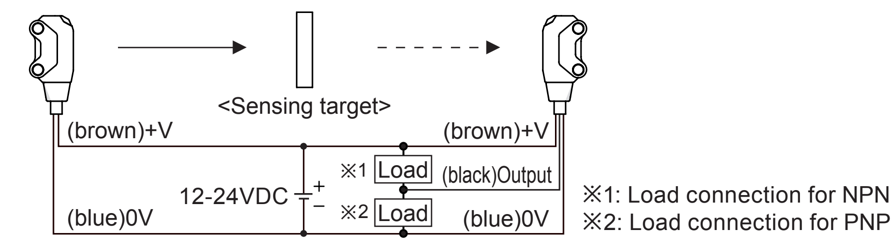
◎ Convergent reflective type

● **BTS30-LDTL / BTS30-LDTL-P**

Sensing area characteristic	
Measuring method	Data
	

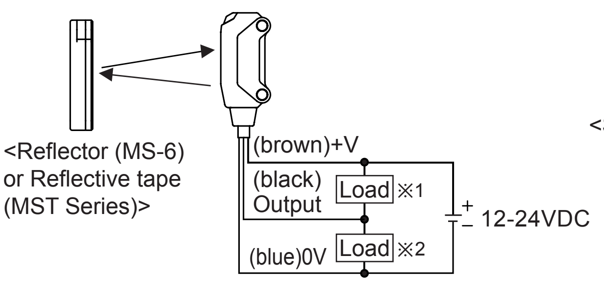
■ Connections

● **Through-beam**

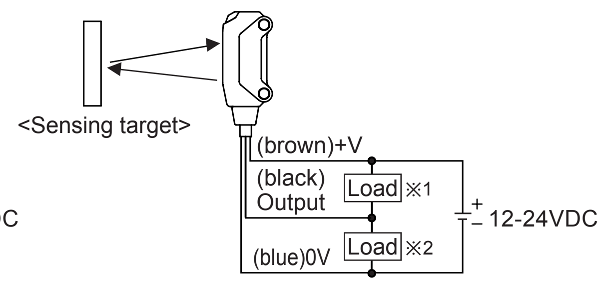


※1: Load connection for NPN
※2: Load connection for PNP

● **Retroreflective type**

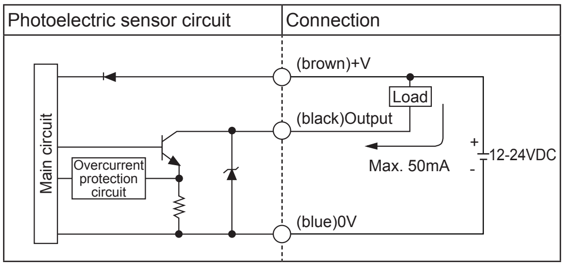


● **Convergent reflective type**

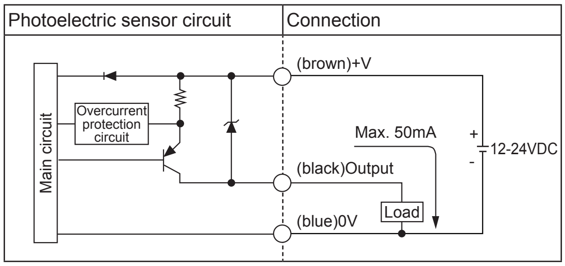


■ Control output diagram

● **NPN open collector output**



● **PNP open collector output**



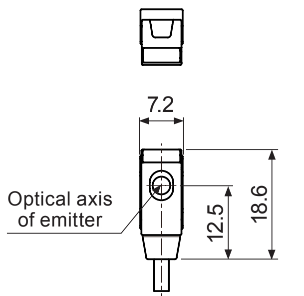
■ Operation Mode

Operation mode	Light ON	Dark ON
Receiver operation	Received light Interrupted light	Received light Interrupted light
Operation indicator (red LED)	ON OFF	ON OFF
Transistor output	ON OFF	ON OFF

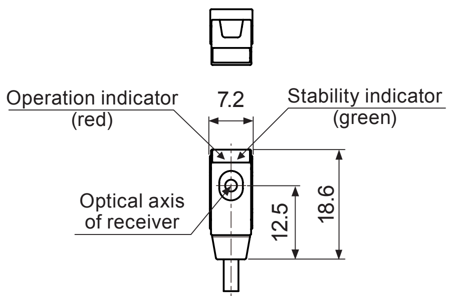
■ Dimensions

● **Through-beam**

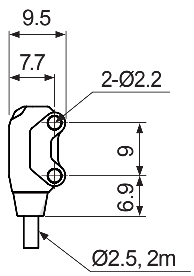
(unit: mm)



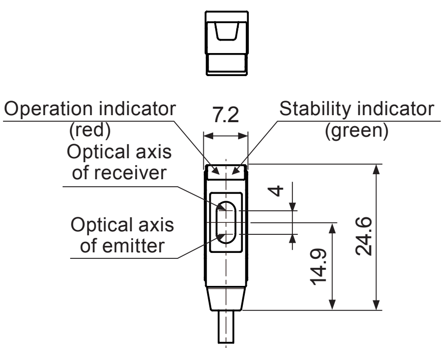
<Emitter>



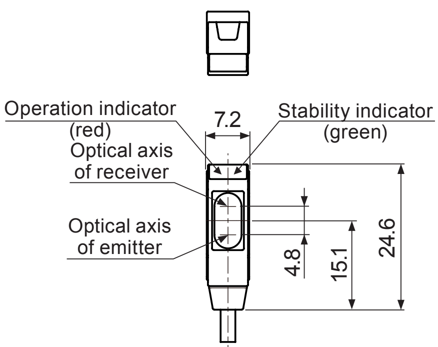
<Receiver>



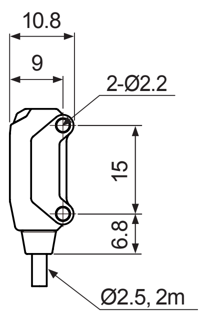
● **Retroreflective type / Convergent reflective type**



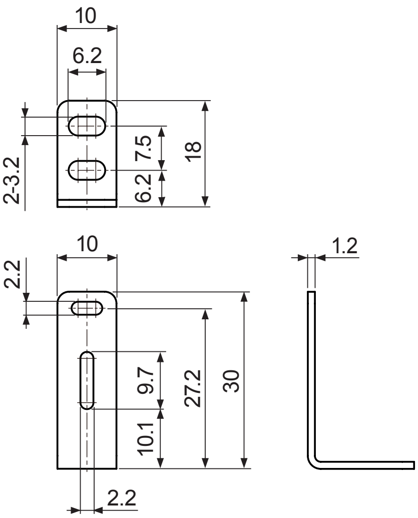
<Retroreflective type>



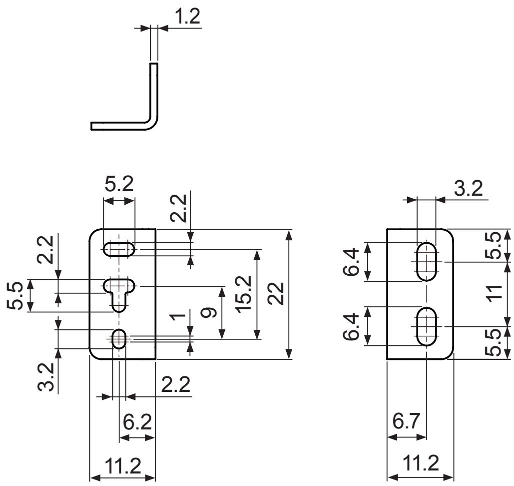
<Convergent reflective type>



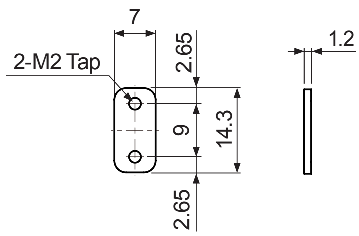
● **Bracket A**



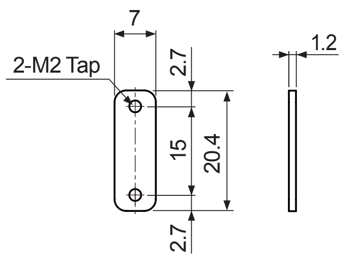
● **Bracket B (sold separately)**



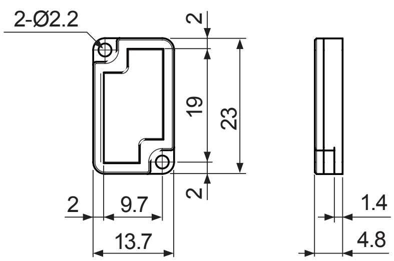
● **Sub-bracket for through-beam type**



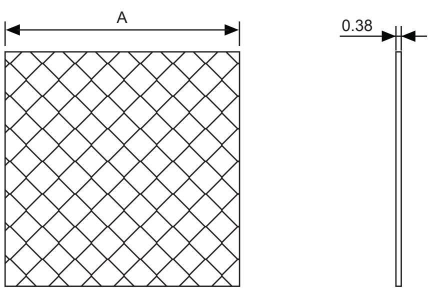
● **Sub-bracket for reflective type**



● **Reflector (MS-6)**



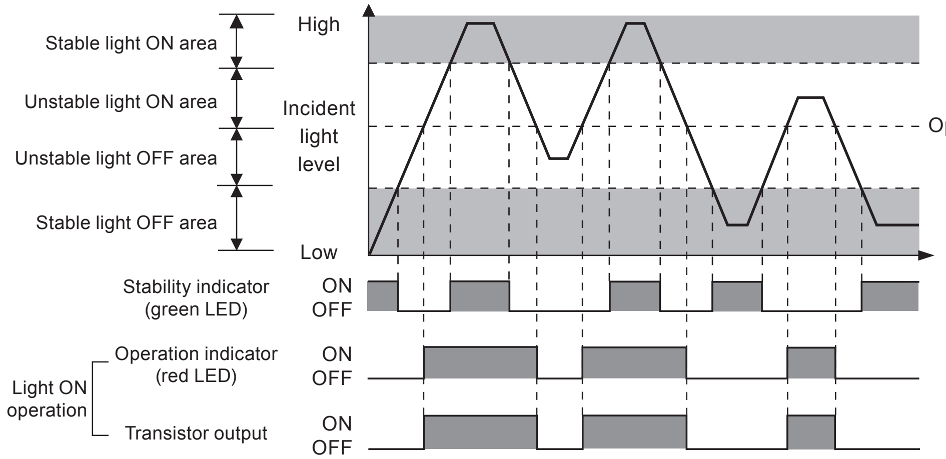
● **Reflective tape (sold separately)**



(unit: mm)

Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

■ Operation Timing Diagram



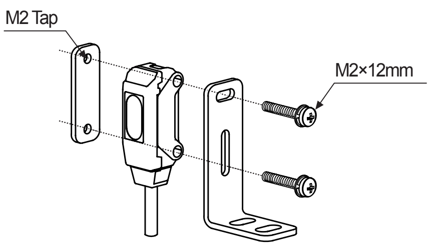
※ The waveforms of "Operation indicator" and "Transistor output" are for Light ON operation. They are reversed for for Dark ON operation.

■ Mounting And Sensitivity Adjustment

◎ Installation

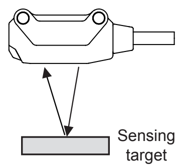
Use M2 bolts to install this sensor, and keep the tightening torque under 0.3N.m

※Please use with caution, as impact against firm objects or excessive bending of cables may cause damage to the waterproof function.

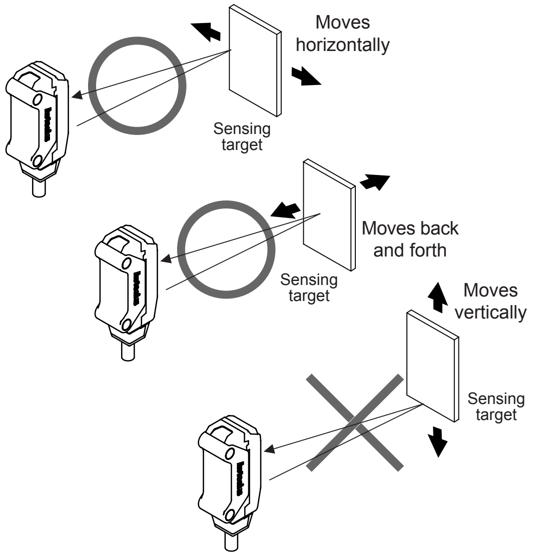


※Cautions during installation of convergent reflective type

1)Make sure that the sensing side of this sensor is parallel to the surface of each object.



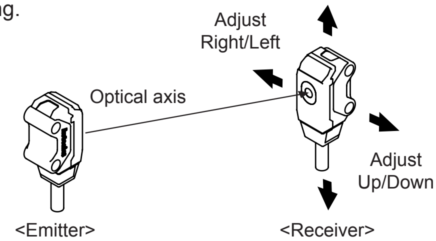
2)Make sure to install the sensor after carefully considering the moving direction of the sensing objects. Refer to the illustration below:



◎ Optical axis adjustment

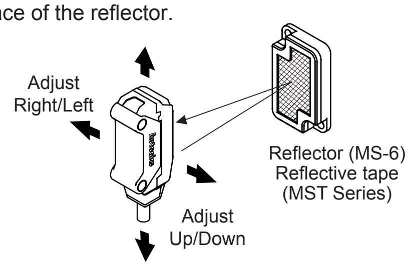
● Through-beam type

Set the emitter and the receiver facing each other. Adjust the emitter or the receiver up, down, left, right and fix the unit at the center position where the stability indicator is operating.



● Retroreflective type

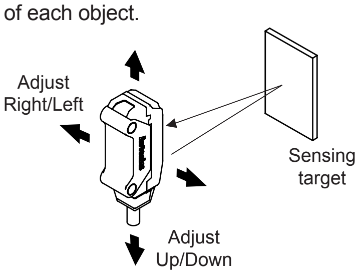
Place the sensor and the reflector (MS-6) or reflective tape facing each other. Adjust the reflector up, down, left, right and fix the reflector at the center position where the stability indicator is operating.
Make sure that the sensing side of the sensor is parallel to the surface of the reflector.



※Please use reflective tape (MST Series) for where a reflector is not installed.

● Convergent reflective type

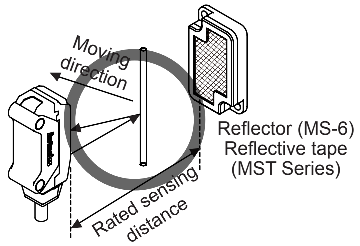
Place the sensing target, then adjust the sensor up, down, left, right and fix the sensor at the center position where the stability indicator is operating.
Make sure that the sensing side of the sensor is parallel to the surface of each object.



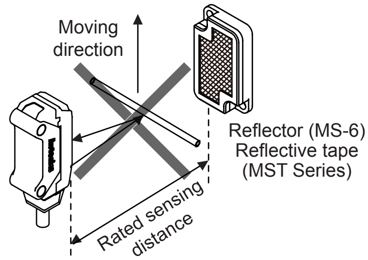
◎ Conditions of min. sensing target and installations (retroreflective type)

When installing the retroreflective photoelectric sensor, be sure to check the moving direction of sensing targets. Please refer to the [Figure 1, 2].
As the [Figure 3], please consist the center between the sensor and the reflector (MS-6) or reflective tape, and check the stable Light ON operations (operation (red)/ stability (green) indicators turn ON). Min. sensing target is detected 100mm away from the sensor (example).

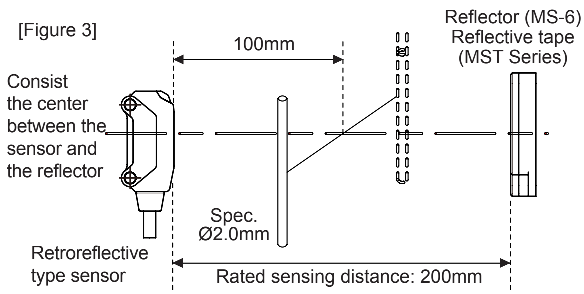
[Figure 1]



[Figure 2]



[Figure 3]



※The size of minimum sensing target will vary by the installation environment of the reflector (MS-6) and the sensing position and material of the sensing target.

▣ Reflectivity By Reflective Tape Model

MST-50-10 (50×50mm)	95%
MST-100-5 (100×100mm)	100%
MST-200-2 (200×200mm)	100%

※This reflectivity is based on the reflector (MS-6).
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.
※For using reflective tape, installation distance should be min. 20mm.

Compact And Long Sensing Distance Type

■ Features

■ Long distance sensing type

- High performance lens with long sensing distance
  - Through-beam type: 15m
  - Diffuse reflective type: 1m
  - Polarized retroreflective type: 3m (MS-2A)
- M.S.R. (Mirror Surface Rejection) function (polarized retroreflective type) for detecting mirrors or highly reflective targets
- Compact size: W10.6 × H32 × L20mm
- Light ON/Dark ON operation mode switch
- Sensitivity adjuster
- Built-in reverse polarity protection circuit and output overcurrent (short-circuit) protection circuit
- Mutual interference prevention function (except through-beam type)
- Excellent noise immunity and minimal influence from ambient light
- IP65 protection structure (IEC standard) / IP67 for BJ-C connector types

(MS-2A) (MST-□)

Connector type

Please read "Caution for your safety" in operation manual before using.

CE

※The model name with '-C' is connector type.
※MST-□ is sold separately.

■ Specifications

Type		Long distance sensing type						
Model	NPN open collector output	BJ15M-TDT BJ15M-TDT-C	BJ10M-TDT BJ10M-TDT-C	BJ7M-TDT	BJ3M-PDT BJ3M-PDT-C	BJ1M-DDT BJ1M-DDT-C	BJ300-DDT BJ300-DDT-C	BJ100-DDT BJ100-DDT-C
	PNP open collector output	BJ15M-TDT-P BJ15M-TDT-C-P	BJ10M-TDT-P BJ10M-TDT-C-P	BJ7M-TDT-P	BJ3M-PDT-P BJ3M-PDT-C-P	BJ1M-DDT-P BJ1M-DDT-C-P	BJ300-DDT-P BJ300-DDT-C-P	BJ100-DDT-P BJ100-DDT-C-P
Sensing type		Through-beam			Polarized retroreflective type	Diffuse reflective		
Sensing distance		15m	10m	7m	0.1 to 3m※1 (MS-2A)	1m (non-glossy white paper 300×300mm)	300mm (non-glossy white paper 100×100mm)	100mm (non-glossy white paper 100×100mm)
Sensing target		Opaque material of min. Ø12mm		Opaque material of min. Ø8mm	Opaque material of min. Ø75mm	Translucent, opaque materials		
Hysteresis		—				Max. 20% at sensing distance		
Response time		Max. 1ms						
Power supply		12-24VDC±10% (ripple P-P: max.10%)						
Current consumption		Emitter/Receiver: Max. 20mA			Max. 30mA			
Light source		Infrared LED (850nm)	Red LED (660nm)	Red LED (650nm)	Red LED (660nm)	Infrared LED (850nm)	Red LED (660nm)	Infrared LED (850nm)
Sensitivity adjustment		Sensitivity adjuster						
Operation mode		Light ON/Dark ON operation mode switch						
Control output		NPN or PNP open collector output ●Load voltage: Max. 26.4VDC ●Load current: Max. 100mA ●Residual voltage - NPN: Max. 1V, PNP: Max. 2.5V						
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit, mutual interference prevention function (except through-beam type)						
Indicator		Operation indicator: Red LED, Stable indicator: Green LED (emitter's power indicator: Green)						
Insulation resistance		Over 20MΩ (at 500VDC megger)						
Noise immunity		±240V the square wave noise (pulse width:1μs) by the noise simulator						
Dielectric strength		1000VAC 50/60Hz for 1minute						
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours						
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times						
Environ-ment	Ambient illumination	Sunlight: Max. 11,000lx, Incandescent lamp: Max. 3,000lx (receiver illumination)						
	Ambient temperature	-25 to 55℃, storage: -40 to 70℃						
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH						
Protection structure		BJ: IP65 (IEC standard), BJ-C: IP67 (IEC standard)						
Material		Case: Polycarbonate+Acrylonitrile butadiene styrene, LED Cap: Polycarbonate, Sensing part: Polymethyl methacrylate, Bracket: SUS304 (steel use stainless 304), Bolt: Steel chromium molybdenum, Nut: Steel chromium molybdenum, Sleeve: Brass, Ni-plate						
Cable※2		BJ: Ø3.5mm, 3-wire, 2m (emitter of through-beam type: Ø3.5mm, 2-wire, 2m) (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)						
Accesso-ries	Common	Fixing bracket, Bolt, Nut, Adjuster driver						
	Individual	—			Reflector (MS-2A)	—		
Approval		CE						
Unit weight		BJ: Approx. 90g, BJ-C: Approx. 20g			BJ: Approx. 60g BJ-C: Approx. 30g	BJ: Approx. 45g, BJ-C: Approx. 10g		

※1: The sensing distance is extended from 0.1 to 4m or 0.1 to 5m when using optional reflector MS-2S or MS-3S.
When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "■ Reflectivity By Reflective Tape Model" table before using the tapes.
※2: M8 connector cable is sold separately. (cable - AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm)
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

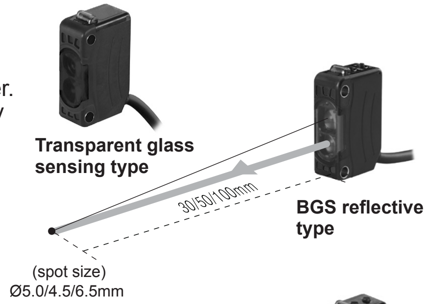
Transparent Glass Sensing/BGS Reflective/Micro Spot Type

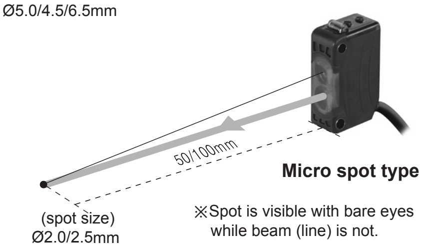
■ Features

■ BGS reflective type
- BGS (background suppression) minimizes detection errors from Zbackground objects and the color or material of target objects. Also the detecting distance can be configured with the sensitivity adjuster.
- Visible light source allows users to identify the sensing area, and the tiny spot size minimizes influence from surrounding objects

■ Transparent glass sensing type / Micro spot type
- Stable detection of transparent targets (LCD, PDP, glass etc.) (transparent glass sensing types)
- Check sensing area with visible micro spot (micro spot types)
- Detect tiny objects (minimum target size: Ø0.2mm copper wire)

■ Commonness
- Compact size: W10.6 × H32 × L20mm
- Light ON/Dark ON operation mode switch (except BJG30-DDT)
- Sensitivity adjuster (except BJG3-DDT)
- Built-in reverse polarity protection circuit and output overcurrent (short-circuit) protection circuit
- Mutual interference prevention function (except BGS reflective type)
- Excellent noise immunity and minimal influence from ambient light
- IP65 protection structure (IEC standard)





⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ Specifications

Type		Transparent glass sensing type		BGS reflective type※1		Micro spot type	
Model	NPN open collector output	**BJG30-DDT**		**BJ30-BDT**	**BJ50-BDT**	**BJN50-NDT**	**BJN100-NDT**
Model	PNP open collector output	—		**BJ30-BDT-P**	**BJ50-BDT-P**	**BJN50-NDT-P**	**BJN100-NDT-P**
Sensing type		Diffuse reflective		BGS reflective		Narrow beam reflective	
Sensing distance		30mm (non-glossy white paper 100×100mm)	15mm (transparent glass 50×50mm, t=3.0mm)	10 to 30mm (non-glossy white paper 50×50mm)	10 to 50mm (non-glossy white paper 50×50mm)	30 to 70mm	70 to 130mm
Sensing target		Transparent glass, opaque materials, translucent		Translucent, opaque materials		Translucent, opaque materials	
Min. diameter of transmitting spot		—		Approx. Ø5.0mm	Approx. Ø4.5mm	Approx. Ø2.0mm	Approx. Ø2.5mm
Min. sensing target		—				Approx. min. Ø0.2mm (copper wire)	
Hysteresis		Max. 20% at sensing distance		Max. 10% at sensing distance		Max. 25% at sensing distance	Max. 20% at sensing distance
Response time		Max. 1ms		Max. 1.5ms		Max. 1ms	
Power supply		12-24VDC ±10% (ripple P-P: max.10%)					
Current consumption		Max. 30mA					
Light source		Infrared LED (850nm)		Red LED (660nm)		Red LED (650nm)	
Sensitivity adjustment		—		Sensitivity adjuster			
Operation mode		Light ON fixed		Light ON/Dark ON operation mode switch			
Control output		NPN open collector output ●Load voltage: Max. 26.4VDC ●Load current: Max. 100mA ●Residual voltage: Max. 1V		NPN or PNP open collector output ●Load voltage: Max. 26.4VDC ●Load current: Max. 100mA ●Residual voltage - NPN: Max. 1V, PNP: Min. 2.5V			
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit, mutual interference prevention function (except BGS reflective type)					
Indicator		Operation indicator: Red LED, Stability indicator: Green LED					
Insulation resistance		Over 20MΩ (at 500VDC megger)					
Noise immunity		±240V the square wave noise (pulse width:1µs) by the noise simulator					
Dielectric strength		1,000VAC 50/60Hz for 1 min					
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times					
Environment	Ambient illumination	Sunlight: Max. 11,000lx, Incandescent lamp: Max. 3,000lx (receiver illumination)					
Environment	Ambient temperature	-25 to 55℃, storage: -40 to 70℃					
Environment	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH					
Protection structure		IP65 (IEC standard)					
Material		Case: Polycarbonate+Acrylonitrile butadiene styrene, LED Cap: Polycarbonate, Sensing part: Polymethyl methacrylate, Bracket: SUS304 (steel use stainless 304), Bolt: Steel chromium molybdenum, Nut: Steel chromium molybdenum, Sleeve: Brass, Ni-plate					
Cable		Ø3.5mm, 3-wire, 2m (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)					
Accessories		Fixing bracket, Bolt		Fixing bracket, Bolt, Nut, Adjuster driver			
Approval		CE					
Unit weight		Approx. 45g		Approx. 50g		Approx. 45g	

※1: In case of BGS sensing type, black/white difference is max. 10% of sensing distance and sensitivity adjustment range is -10% of max. sensing distance (based on non-glossy white paper).

※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

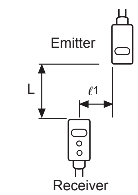
■ Feature Data

◎ Through-beam type

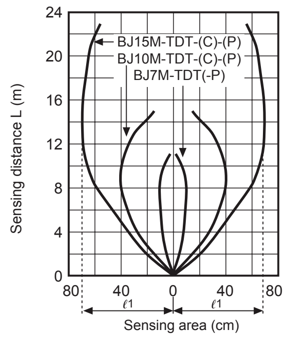
● BJ15M-TDT- (C)- (P) / BJ10M-TDT- (C)- (P) / BJ7M-TDT- (P)

Parallel shifting characterisitic

Measuring method

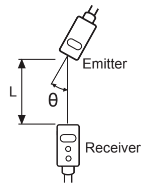


Data

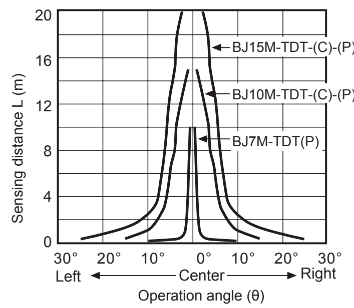


Angle characteristic

Measuring method



Data

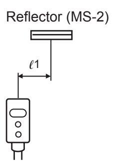


◎ Retroreflective type

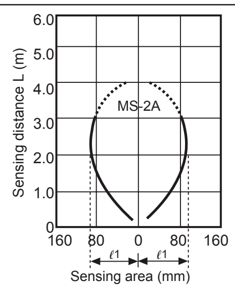
● BJ3M-PDT- (C)- (P)

Parallel shifting characterisitic

Measuring method

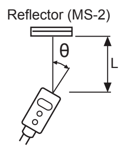


Data

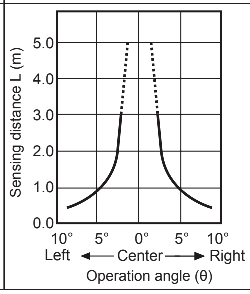


Sensor angle characteristic

Measuring method

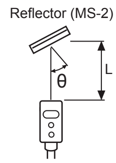


Data

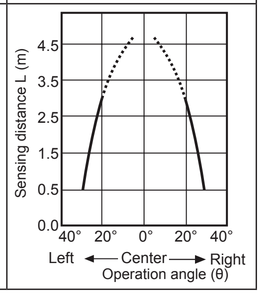


Reflector angle characteristic

Measuring method



Data

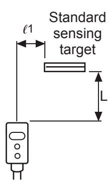


◎ Diffuse/Narrow beam reflective type

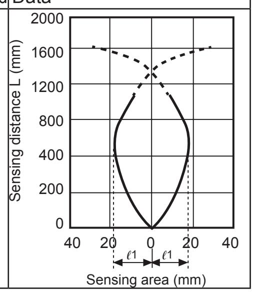
● BJ1M-DDT- (C)- (P)

Sensing area characteristic

Measuring method



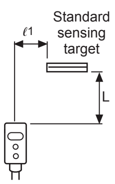
Data



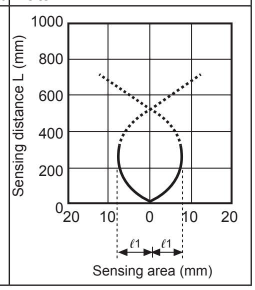
● BJ300-DDT- (C)- (P)

Sensing area characteristic

Measuring method



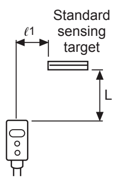
Data



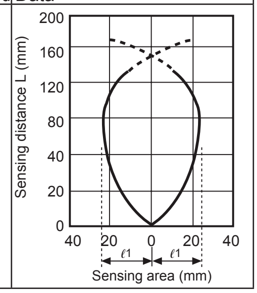
● BJ100-DDT- (C)- (P)

Sensing area characteristic

Measuring method



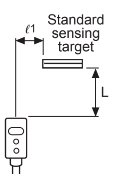
Data



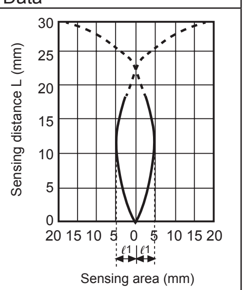
● BJG30-DDT

Sensing area characteristic

Measuring method



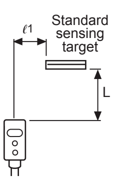
Data



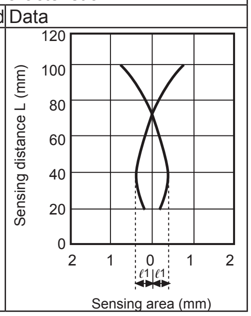
● BJN50-NDT- (P)

Sensing area characteristic

Measuring method



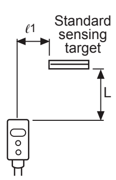
Data



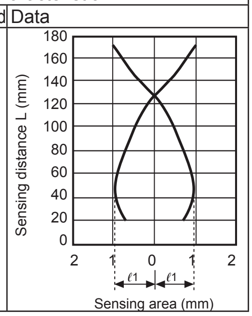
● BJN100-NDT- (P)

Sensing area characteristic

Measuring method



Data



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

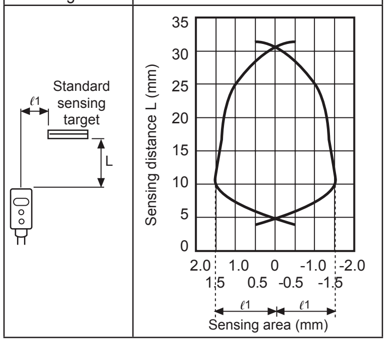
■ Feature Data

◎ BGS reflective type

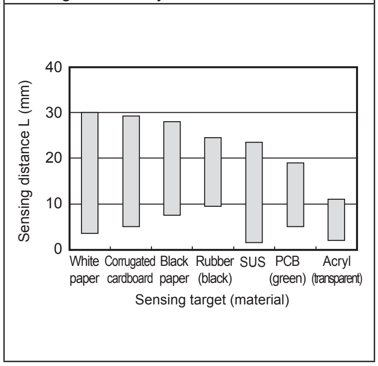
● **BJ30-BDT / BJ30-BDT-P**

Sensing area characteristic

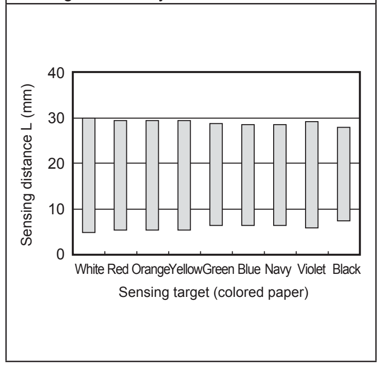
Measuring method | Data



Sensing distance by material



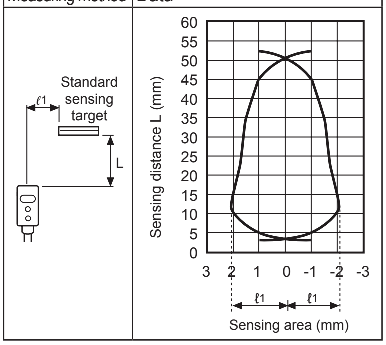
Sensing distance by color



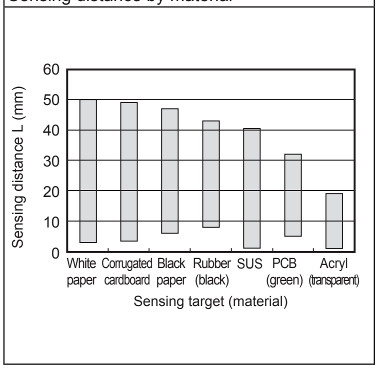
● **BJ50-BDT / BJ50-BDT-P**

Sensing area characteristic

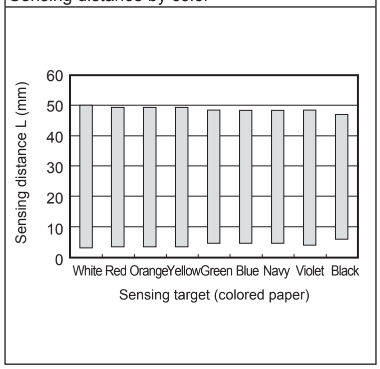
Measuring method | Data



Sensing distance by material

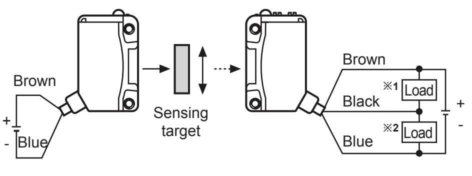


Sensing distance by color

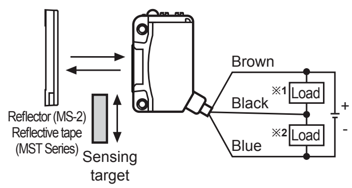


■ Connections

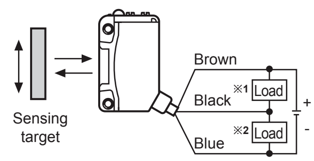
● **Through-beam type**



● **Retroreflective type**

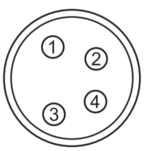


● **Diffuse/Narrow beam/ BGS reflective type**



※1: Load connection for NPN output
※2: Load connection for PNP output

■ Connections For Connector Part



M8 Connector pin

Connector pin No.	Cable colors	Function
①	Brown	Power Source (+V)
②	White	—
③	Blue	Power Source (0V)
④	Black	Output

※Connector pin ② is N·C (not connected) terminal.

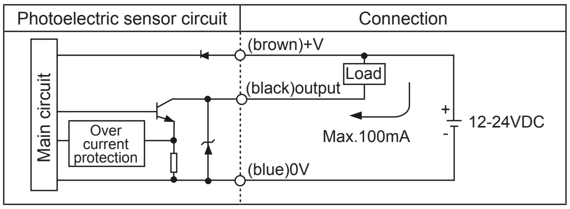
● **Connector cable (sold separately)**

※Connector cable model
: CID408-□ , CLD408-□
※Please refer to G-6 for connector cable.

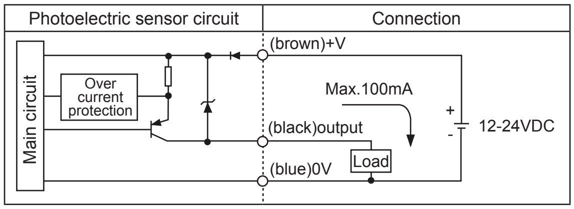
Long Sensing Distance/BGS Reflective/Micro Spot Type

▣ Control Output Diagram

● **NPN open collector output**



● **PNP open collector output**



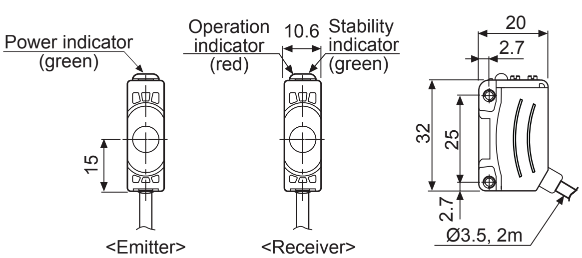
▣ Operation Mode

Operation mode	Light ON	Dark ON
Receiver operation	Received light / Interrupted light	Received light / Interrupted light
Operation indicator (red LED)	ON / OFF	ON / OFF
Transistor output	ON / OFF	ON / OFF

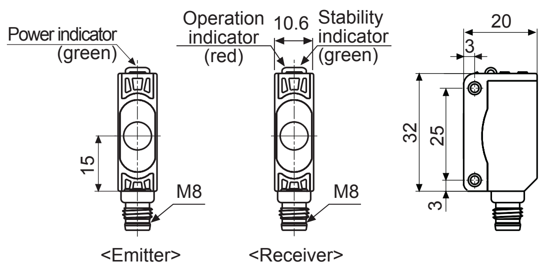
▣ Dimensions

(unit: mm)

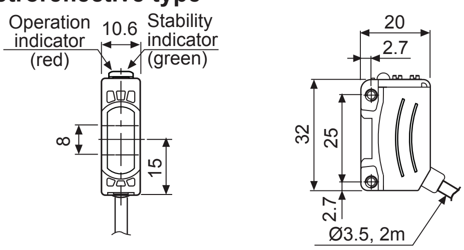
●**Through-beam type**



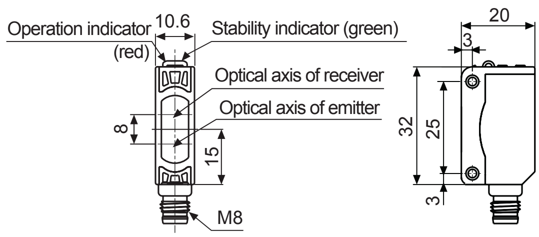
●**Through-beam type (connector type)**



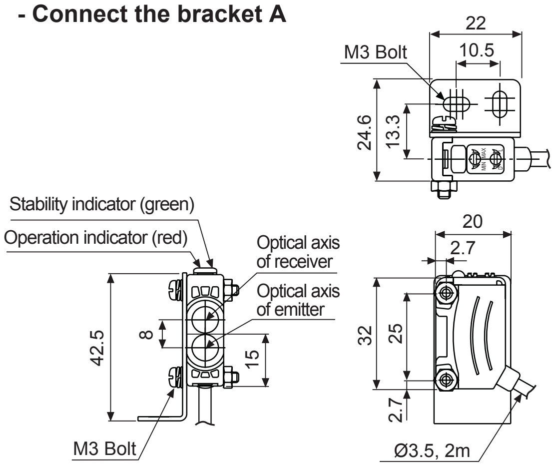
● **Retroreflective type**



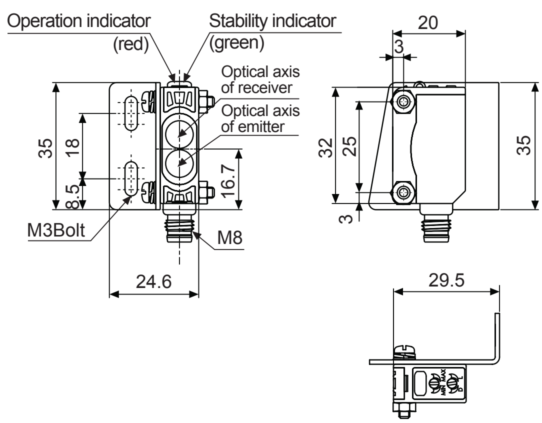
● **Retroreflective type (connector type)**



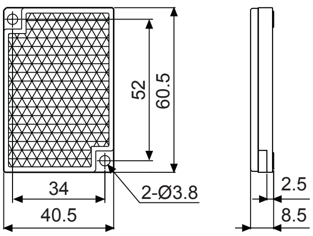
● **Diffuse/Narrow beam/BGS reflective type**
- Connect the bracket A



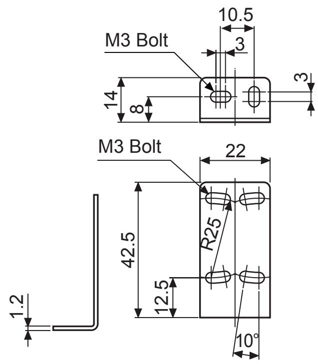
● **Diffuse reflective type (connector type)**
- Connect the bracket B



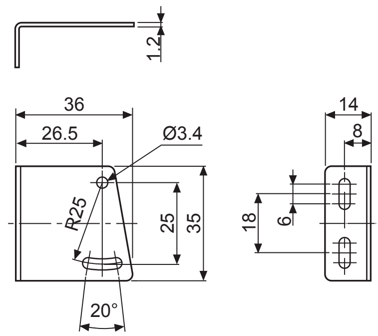
- **Reflector**
  (accessory: MS-2A,
  sold separately: MS-2S, MS-3S)



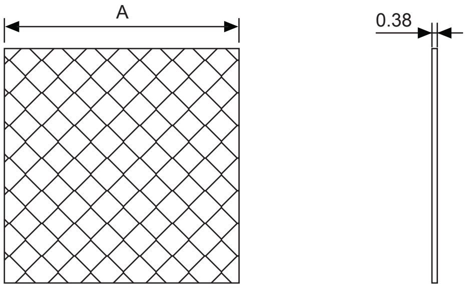
- **Bracket A**



- **Bracket B** (sold separately)



- **Reflective tape (sold separately)**

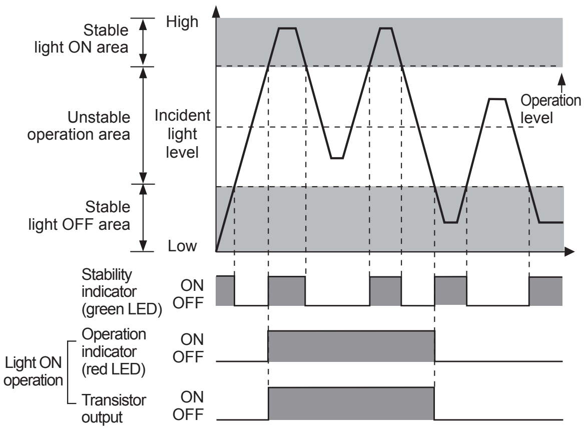


(unit: mm)

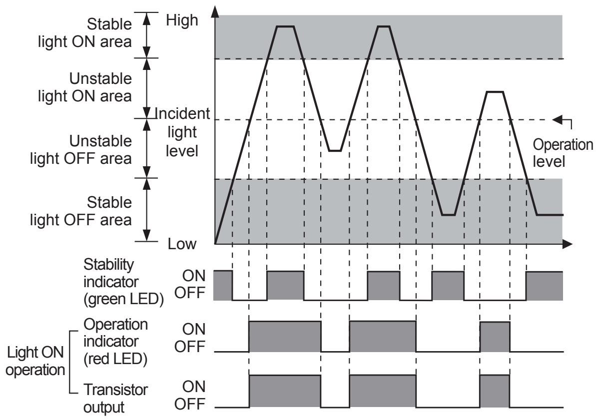
Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

▣ Operation Timing Diagram

- **Through-beam type**



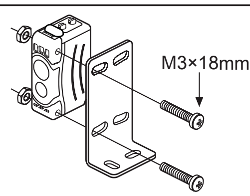
- **Retroreflective/Diffuse/Narrow beam/ BGS reflective type**



※The waveforms of “Operation indicator” and “Transistor output” are for Light ON operation.
They are opposite operation for Dark ON operation.

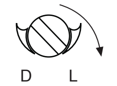
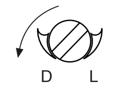
▣ Mounting And Sensitivity Adjustment

◎ For mounting



Please use bolts M3 for
mounting of sensor,
set the tightening torque under 0.5N·m.

◎ Switching of operation mode

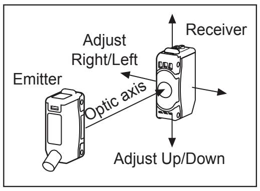
Light ON operation		Turn the operation mode switch to the end of right (L direction), it is set as Light ON.
Dark ON operation		Turn the operation mode switch to the end of left (D direction), it is set as Dark ON.

※For through-beam type, the operation mode switch is built-in the receiver.

◎ Optical axis adjustment

●Through-beam type

1. Place the emitter and the receiver facing each other and supply the power.
2. After adjusting the position of the emitter and the receiver and checking their stable indicating range, mount them in the middle of the range.

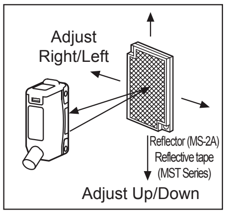


3. After mounting this unit, check the operation of the sensor and lighting of the stability indicator in both status. (none or sensing target status)

※When the sensing target is translucent or small (under sensing target of '■ **Specifications**'), it may not be detected by the sensor because the light can penetrate it.

● Retroreflective type

1. Place the sensor and the reflector (or reflective tape) facing each other and supply the power.
2. After adjusting the position of the sensor and reflector (or reflective tape) and checking their stable indicating range, mount them in the middle of the range. (none or sensing target status)

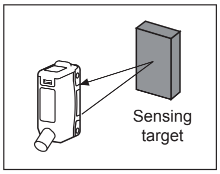


3. After mounting this unit, check the operation of the sensor and in both status. (none or sensing target status)

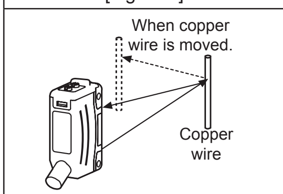
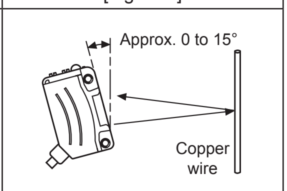
※Please use reflective tape (MST Series) for where a reflector is not installed.

● Diffuse/Narrow beam/BGS reflective type

After placing a sensing target, adjust the sensor to up or down, right or left.
Then, fix the sensor in the center of position where the stability is operating.

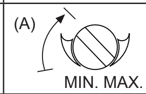
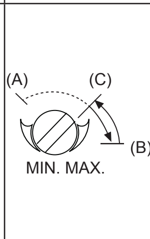
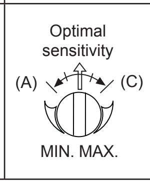


● Object (copper wire) detection <Micro spot type>

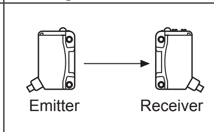
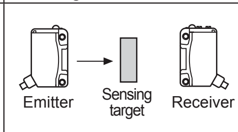
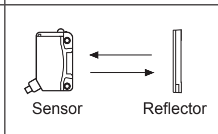
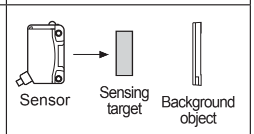
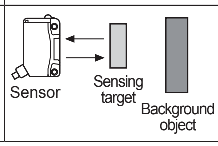
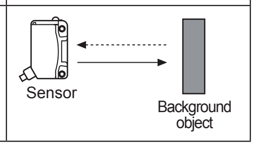
[Figure 1]	[Figure 2]
	

※Mount the sensor slanted at an angle ranged 0 to 15° shown above as [Figure 2] for stable detection to detect as shown in [Figure 1].

■ Sensitivity Adjustment

Order	Position	Description
1		Turn the sensitivity adjuster to the right of min. and check position (A) where the operation indicator is turned ON in "Light ON status".
2		Turn the sensitivity adjuster more to the right of position (A), check position (B) where the operation indicator is turned ON. And turn the sensitivity adjuster to the left, check position (C) where the operation indicator is turned OFF in "Light OFF status". ※If the operation indicator is not turned ON although the sensitivity adjuster is turned to the max. position, the max. position is (C).
3		Set the sensitivity adjuster at the center of (A) and (C). To set the optimum sensitivity, check the operation and lighting of stability indicator with sensing target or without it. If the stability indicator is not turned ON, please check the sensing method again because sensitivity is unstable.

※No sensitivity adjustment function available for BJG30-DDT models.

	Light ON status	Light OFF status
Through-beam type		
Retro-reflective type		
Diffuse/ Narrow beam/ BGS reflective		

※Set the sensitivity to operate in stable light ON area and the reliability for the environment (temperature, voltage, dust etc) is increased. In unstable light ON area, be sure to check the variation of environment.
※Do not apply excessive force on the sensitivity adjuster or operation mode switch, they may be broken.
※Please use reflective tape (MST Series) for where a reflector is not installed.

■ Reflectivity By Reflective Tape Model

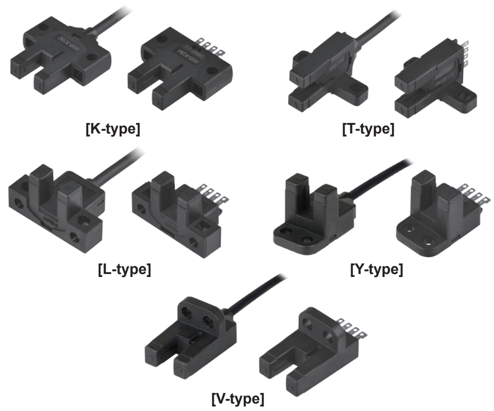
MST-50-10(50×50mm)	40%
MST-100-5(100×100mm)	60%
MST-200-2(200×200mm)	100%

※This reflectivity is based on the reflector (MS-2A).
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.
※For using reflective tape, installation distance should be min. 20mm.

Photomicro Sensor

■ Features

● Ultra compact, Built-in amplifier, NPN/PNP open collector output
● Various selection by installation position (appearance: K, T, L, Y, V type)
● Light ON / Dark ON selectable by control terminal/cable
● High speed response frequency: 2kHz
● Wide range of power source: 5-24VDC (easy to connect with various IC, relay, programmable controller etc)
● Dust resistance structure : Protecting by window of emitter/receiver
● Red LED status indication



⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Ordering Information

BS 5 – K 2 M – P

Item	Code	Description
Control output	No mark	NPN open collector output
	P	PNP open collector output
Size	M	Middle
Connection type	1	Cable type
	2	Connector type
Appearance	K	K-Type
	T	T-Type
	L	L-Type
	Y	Y-Type
	V	V-Type
Sensing distance	5	Unit: mm (fixed)
Item	BS	Photo electronic sensor

■ Specifications

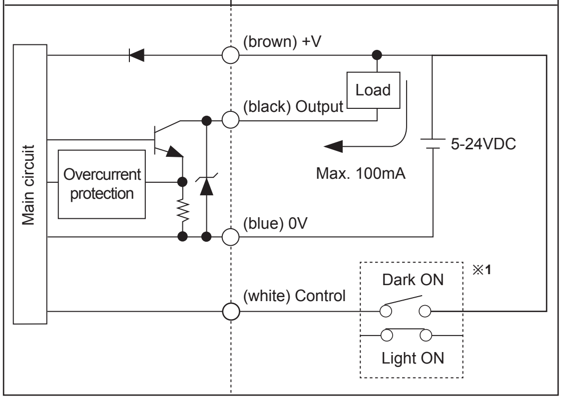
Model	NPN open collector output	BS5-K1M	BS5-T1M	BS5-L1M	BS5-Y1M	BS5-V1M	BS5-K2M	BS5-T2M	BS5-L2M	BS5-Y2M	BS5-V2M
	PNP open collector output	BS5-K1M-P	BS5-T1M-P	BS5-L1M-P	BS5-Y1M-P	BS5-V1M-P	BS5-K2M-P	BS5-T2M-P	BS5-L2M-P	BS5-Y2M-P	BS5-V2M-P
Sensing type		Through-beam (not modulated)									
Sensing distance		5mm fixed									
Sensing target		Ø0.8×2mm Opaque materials									
Hysteresis		0.05mm									
Response time		Light ON : Max. 20µs, Dark ON : Max. 100µs									
Response frequency※1		2kHz									
Power supply		5-24VDC ±10% (ripple P-P : max. 10%)									
Current consumption		Max. 30mA (at 26.4VDC)									
Light source		Infrared LED (940nm)									
Operation mode		Light ON / Dark ON selectable by control cable					Light ON / Dark ON selectable by control terminal				
Control output		NPN or PNP open collector output ●Load voltage : Max. 30VDC ●Load current : Max. 100mA ●Residual voltage : Max. 1.2V									
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit									
Indicator		Operation Indicator: red LED									
Connection		Cable type					Connector type				
Insulation resistance		Over 20MΩ (at 250VDC megger)									
Noise immunity		±240V the square wave noise (pulse width:1µs) by the noise simulator									
Dielectric strength		1,000VAC 50/60Hz for 1minute									
Vibration		1.5mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 2 hours									
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times									
Environ-ment	Ambient illumination	Fluorescent lamp : Max. 1000lx (receiver illumination)									
	Ambient temperature	-20 to 55℃, storage : -25 to 85℃									
	Ambient humidity	35 to 85%RH, storage : 35 to 85%RH									
Protection structure		IP50 (IEC standard)									
Material		Polybutylene terephthalate									
Cable		Ø3mm, 4-wire, 1m (AWG28, core diameter: 0.08mm, number of cores: 19, insulator out diameter: Ø0.88mm)					—				
Approval		CE									
Weight※2		Approx. 50g (approx. 30g)									

※1: The value from revolving the circle panel which duty ratio is 1:1. ※2: The weight includes packaging. The weight in parenthesis in for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

Control Output Diagram

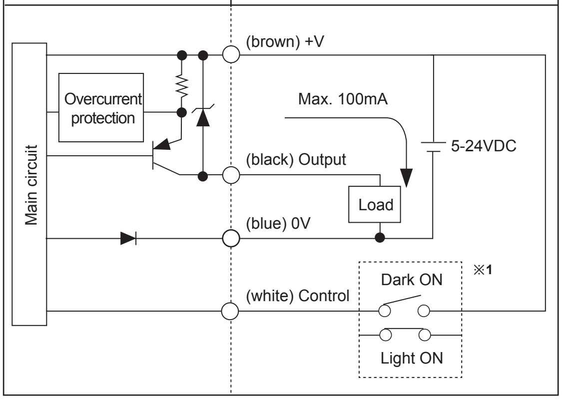
● **NPN open collector output**

Photoelectric sensor circuit	Connection



● **PNP open collector output**

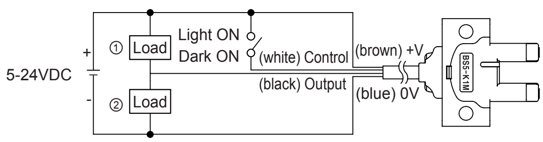
Photoelectric sensor circuit	Connection



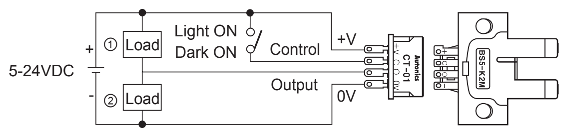
※1: Operation mode selection : Connect (white) Control (terminal) into terminal (brown) +V to operate Light ON mode. Dark ON mode is available with disconnection status.

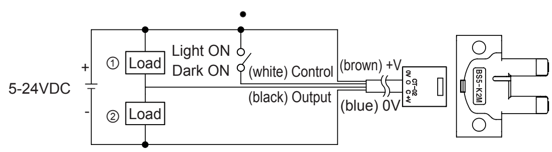
Connections

Cable Type



Connector Type



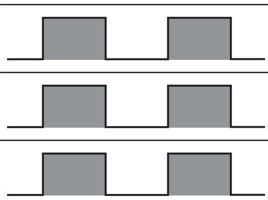


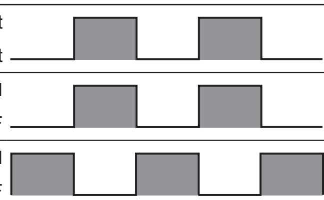
※Connect the unit using the connector (CT-01, sold separately), the connector cable (CT-02, sold separately). If it is soldered on terminal pin directly without the connector, the connector cable. It may cause product damage.

①Load connection for NPN output ②Load connection for PNP output

Operation Mode

Operation mode	Light ON	Dark ON
Receiver operation	Received light / Interrupted light	Received light / Interrupted light
Operation indicator (red LED)	ON / OFF	ON / OFF
Transistor output	ON / OFF	ON / OFF



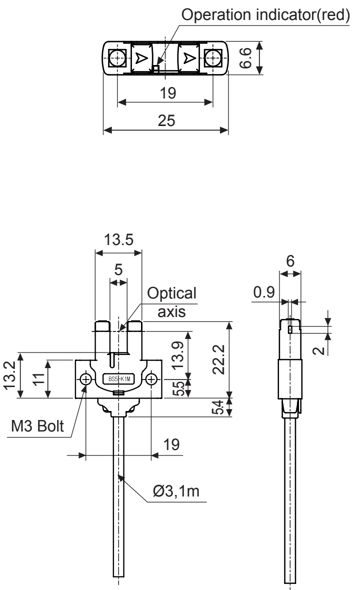


※If the control output terminal is short-circuited or overcurrent condition exists, the control output turns OFF due to protection circuit.

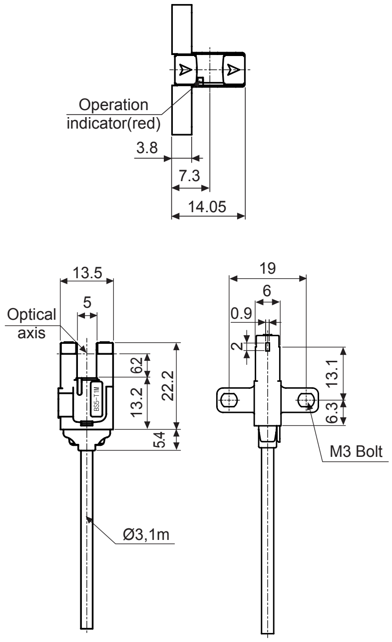
■ Dimensions

(unit: mm)

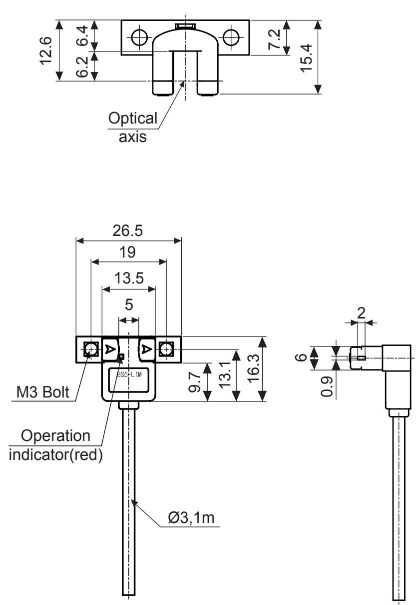
● BS5-K1M / BS5-K1M-P



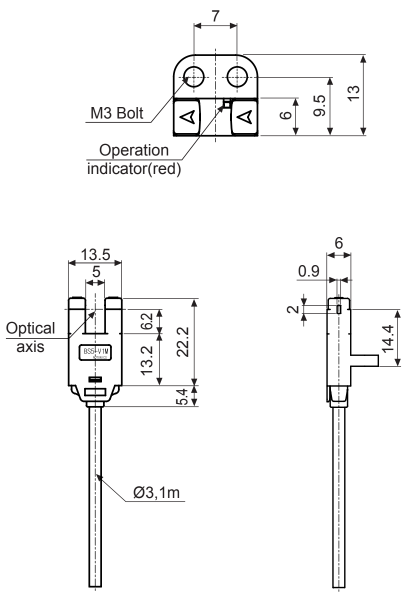
● BS5-T1M / BS5-T1M-P



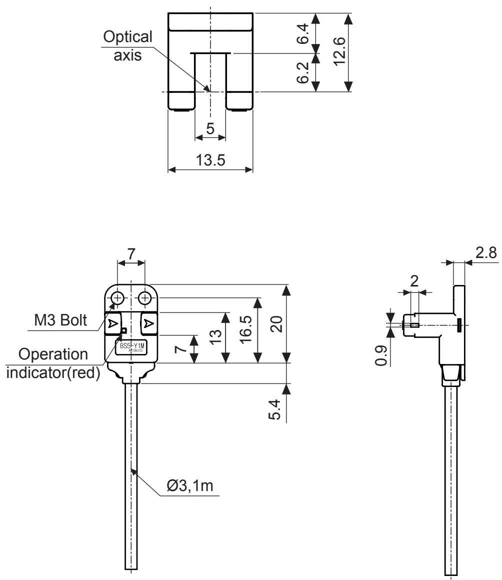
● BS5-L1M / BS5-L1M-P



● BS5-V1M / BS5-V1M-P



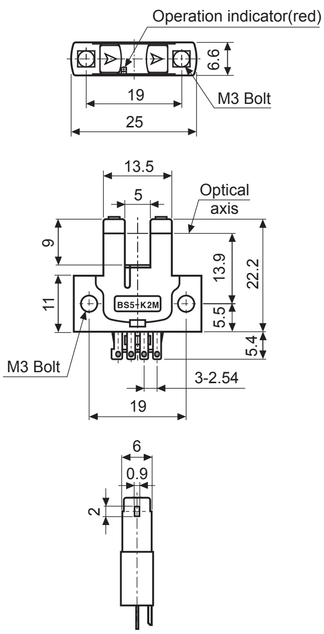
● BS5-Y1M / BS5-Y1M-P



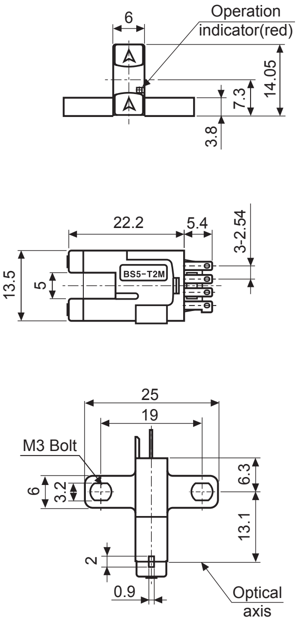
■ Dimensions

(unit: mm)

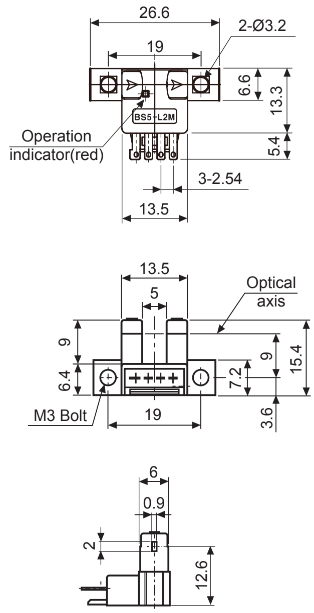
● BS5-K2M / BS5-K2M-P



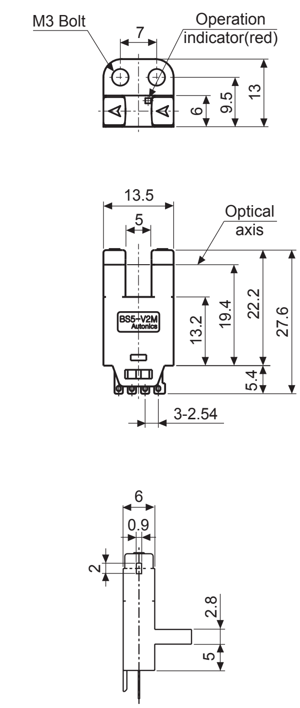
● BS5-T2M / BS5-T2M-P



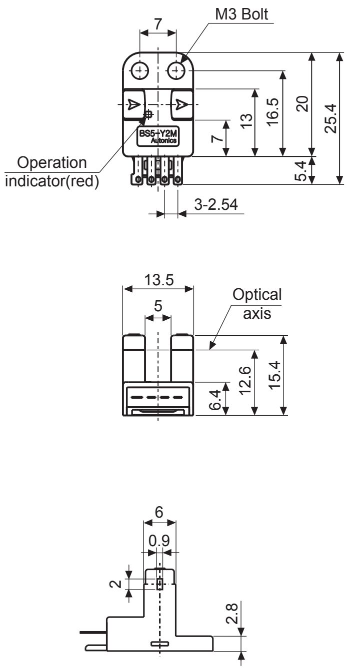
● BS5-L2M / BS5-L2M-P



● BS5-V2M / BS5-V2M-P

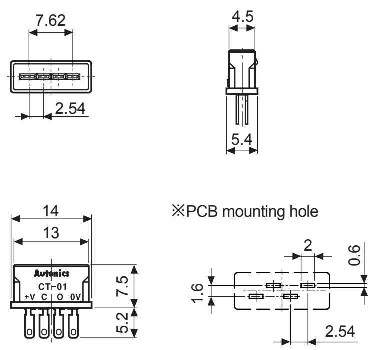


● BS5-Y2M / BS5-Y2M-P

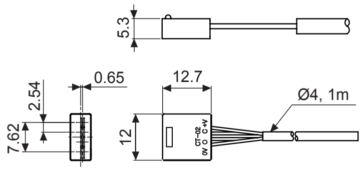


● Connector type (sold separately)

● Connector (CT-01)



● Connector (CT-02)



※Cable: Ø4mm, 4-wire, 1m
(AWG22, Core wire diameter: 0.08mm,
No. of core wire: 60, Insulator out diameter:
Ø1.2mm)
※Cable length is available to option.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Small, Diffuse Reflective Type With Long Sensing Distance

■ Features

- Realization of long sensing distance (2m) by special optical design
- Protection structure IP64 (IEC standard)
- Built-in stability indicator
- Includes sensitivity adjustment function
- 2 color LED display

Please read "Caution for your safety" in operation manual before using.

CE

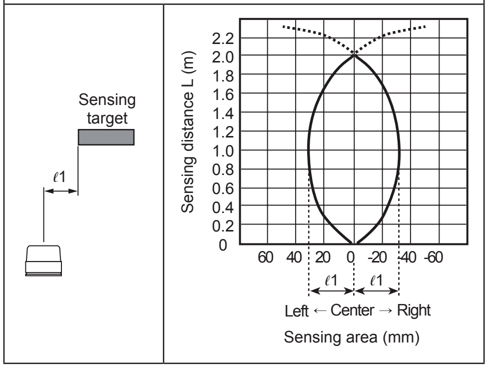
■ Specifications

Model	NPN open collector	**BA2M-DDT**	**BA2M-DDTD**
	PNP open collector	**BA2M-DDT-P**	**BA2M-DDTD-P**
Sensing type		Diffuse reflective	
Sensing distance		2m (non-glossy white paper 200×200mm)	
Sensing target		Translucent, opaque materials	
Hysteresis		Max. 20% at sensing distance	
Response time		Approx. 1ms	
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)	
Current consumption		Max. 15mA (max. 30mA when the output is ON)	
Light source		Infrared LED (850nm)	
Sensitivity adjustment		Sensitivity adjuster	
Operation mode		Light ON	Dark ON
Control output		NPN or PNP open collector output ●Load voltage: Max. 26.4VDC ●Load current: Max. 100mA ●Residual voltage - NPN: Max. 1V, PNP: Min. 2.5V	
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit	
Indicator		●Operation indicator: Red LED ●Stability indicator: Orange LED (light on), Green LED (dark on)	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator	
Dielectric strength		1000VAC 50/60Hz for 1minute	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Environ-ment	Ambient illumination	Sunlight: Max. 11,000lx, Incandescent lamp: Max. 3,000lx (receiving illumination)	
	Ambient temperature	-25 to 55℃, storage: -25 to 70℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Protection structure		IP64 (IEC standard)	
Material		Case: Acrylonitrile butadiene styrene, Sensing part: Polycarbonate, Indicator: Polycarbonate, Adjuster: IXEF	
Cable		Ø3mm, 3-wire, 2m (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)	
Accessory		Adjuster driver	
Approval		CE	
Unit weight		Approx. 50g	

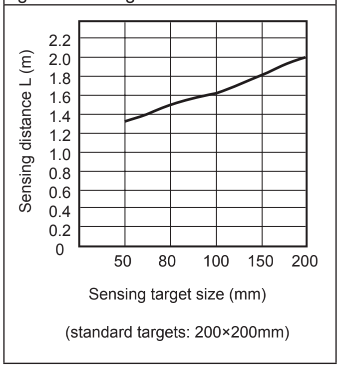
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature Data

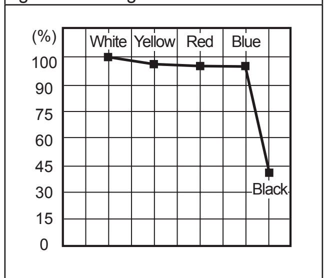
Sensing area characteristic



Sensing distance against the target size



Sensing distance against the target color

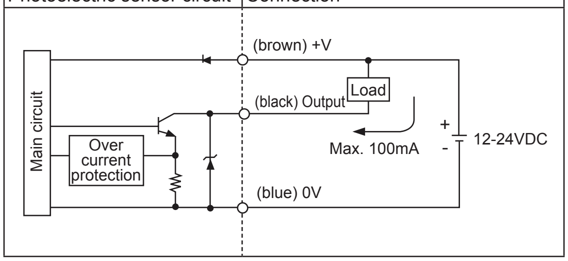


In case non-glossy white paper is 100%

■ Control Output Diagram

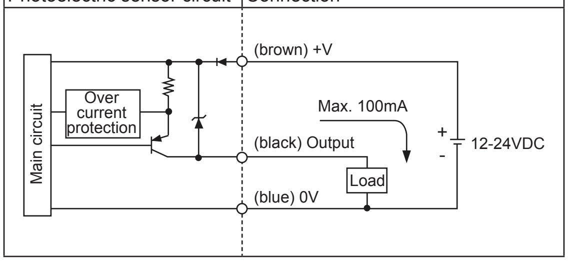
● NPN open collector output

Photoelectric sensor circuit	Connection

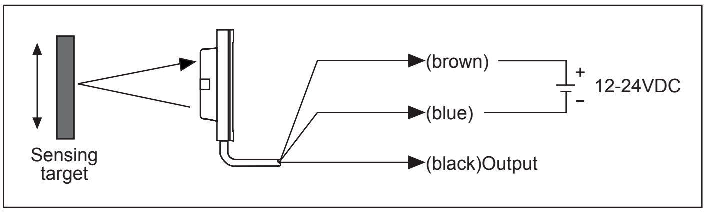


● PNP open collector output

Photoelectric sensor circuit	Connection

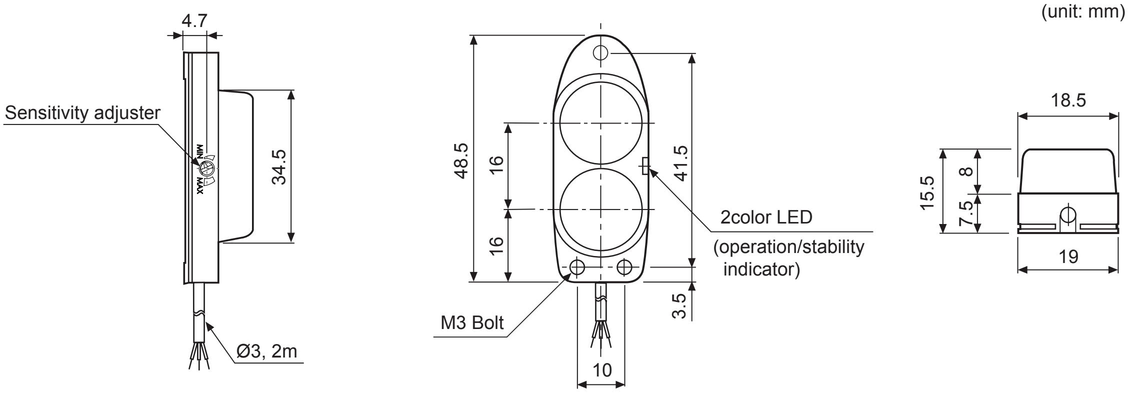


■ Connections



■ Dimensions

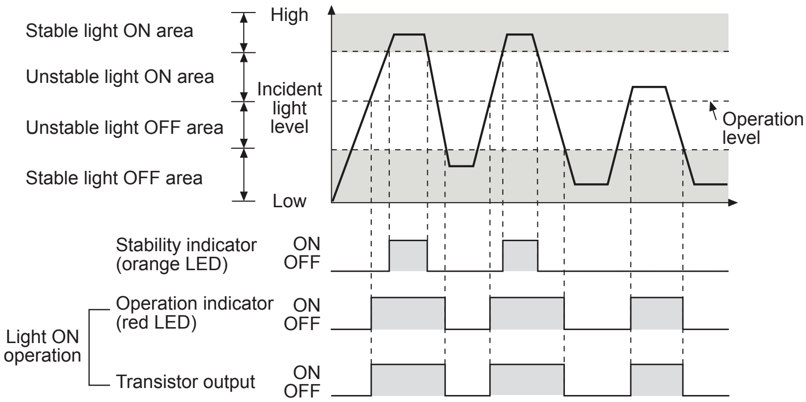
(unit: mm)



▣ Operation Mode

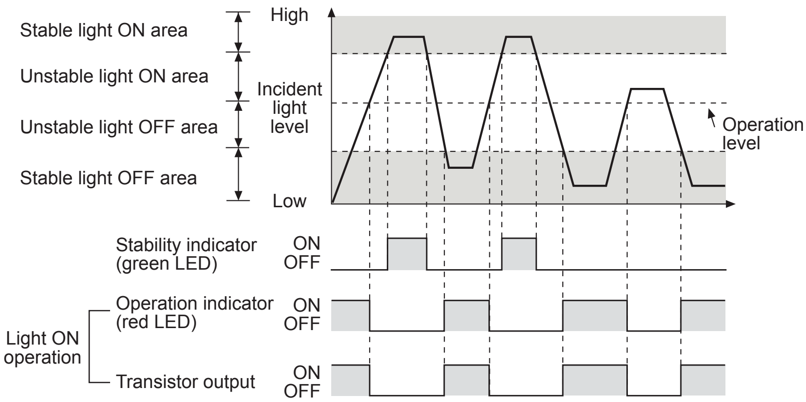
If the control output terminal is short-circuit or over current than the rated current flows the unit, the sensor does not operate normally by protection circuit.

● Light ON



(control output according to amount of receiving light)

● Dark ON

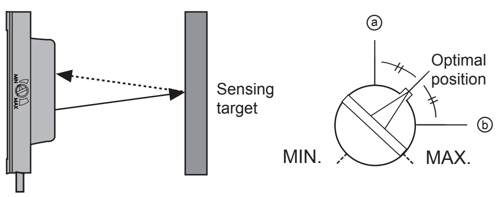


(control output according to amount of receiving light)

▣ Mounting And Sensitivity Adjustment

Install the sensor to the desired place and check the connections.
Supply the power to the sensor and adjust the optical axis and the sensitivity as follow ;

● Optical axis adjustment



Mount this unit at the center where the stability indicator turns ON with moving the unit toward right or left, up or down.

● Adjustment

1. When sensing the object, set the sensitivity adjuster in stable Light ON area (orange: Light ON, green: Dark ON) as shown '▣ **Operation mode**'.
2. The sensitivity should be adjusted depending on a sensing target or mounting place.
3. Set the target at a position to be detected by the beam, then turn the sensitivity adjuster until position ⓐ where the operation indicator turns ON from min. position of the sensitivity adjuster
4. Take the target out of the sensing area, then turn the sensitivity adjuster until position ⓑ where the operation indicator turns ON. If the indicator dose not turn ON, max. position is ⓑ.
5. Set the sensitivity adjuster at the center of two switching position ⓐ, ⓑ.

※The sensing distance indicated on specification chart is for 200×200mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
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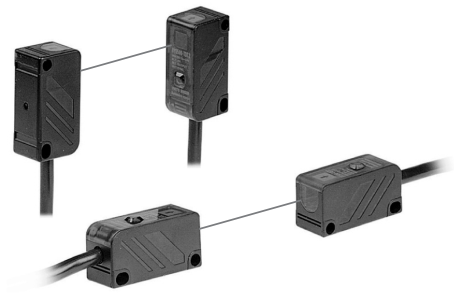
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Small Emitter/Receiver Synchronizing Type

■ Features

- Small size: W12×H30×L16mm
- Minimize malfunction by extraneous light by synchronizing emitter and receiver
- Built-in reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit
- Fast response speed: Max. 1ms

⚠ **Please read "Caution for your safety" in operation manual before using.**



■ Specifications

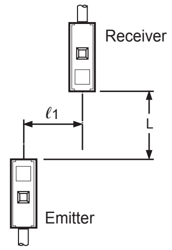
Model		Standard type	Side sensing type
		BY500-TDT	**BYS500-TDT**
Sensing type		Through-beam	
Sensing distance		500mm	
Sensing target		Opaque materials of min. Ø5mm	
Response time		Max. 1ms	
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)	
Current consumption		Max. 30mA	
Light source		Infrared LED (940nm)	
Operation mode		Dark ON	
Control output		NPN open collector output ● Load voltage: 30VDC ● Load current: Max. 100mA ● Residual voltage: Max. 1V	
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit	
Indicator		Operation indicator: red LED	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator	
Dielectric strength		1,000VAC 50/60Hz for 1minute	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Environ-ment	Ambient illumination	Sunlight: Max. 11,000lx Incandescent lamp: Max. 3,000 lx (receiving illumination)	
	Ambient temperature	-10 to 60℃, storage: -25 to 70℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Protection structure		IP50 (IEC standard)	
Material		Case: Acrylonitrile butadiene styrene, Sensing part: Acrylic, Bracket: Steel plate cold commercial, Bolt: Steel chromium molybdenum, Nut: Steel chromium molybdenum	
Cable		Ø4mm, 4-wire, 2m (emitter of through-beam type: Ø4mm, 3-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)	
Accessories		Fixing bracket, Bolts, Nuts	
Unit weight		Approx. 150g	

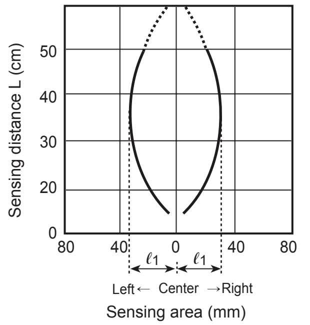
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature Data

Parallel shifting characteristic

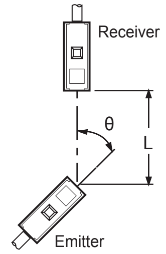
Measuring method	Data

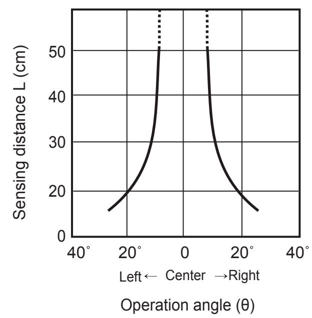




Angle characteristic

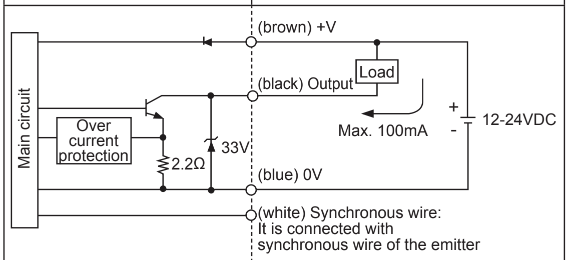
Measuring method	Data





■ Control Output Diagram

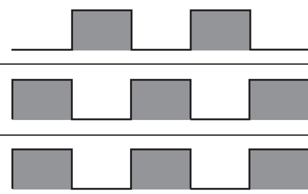
Photoelectric sensor circuit	Connection



※Applicable models: BY500-TDT2, BYS500-TDT2 (receiver)

■ Operation Mode

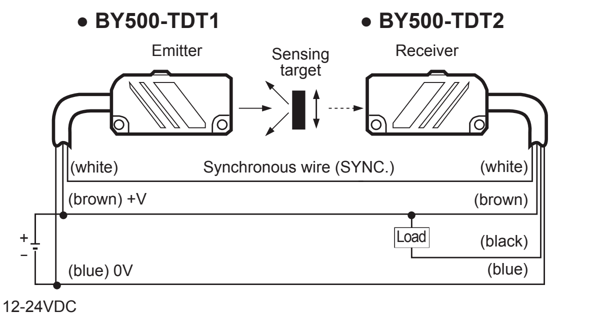
Operation mode	Dark ON
Receiver operation	Received light / Interrupted light
Operation indicator (red LED)	ON / OFF
Transistor output	ON / OFF

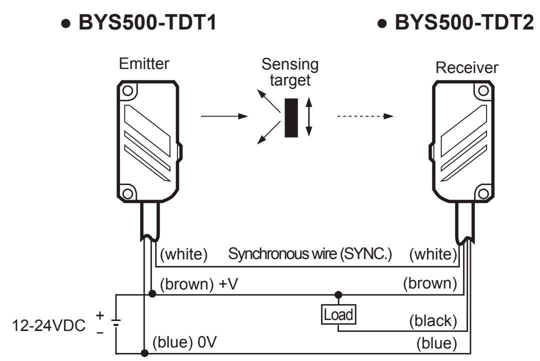


※If the control output terminal is short-circuited or overcurrent condition exists, the control output turns OFF due to protection circuit.
※Please supply the power to the brown and the blue wires of the emitter and Synchronous wire (white) of the receiver must be connected with that of the emitter.

■ Connections

Standard type (dark on)	Side Sensing type (dark on)



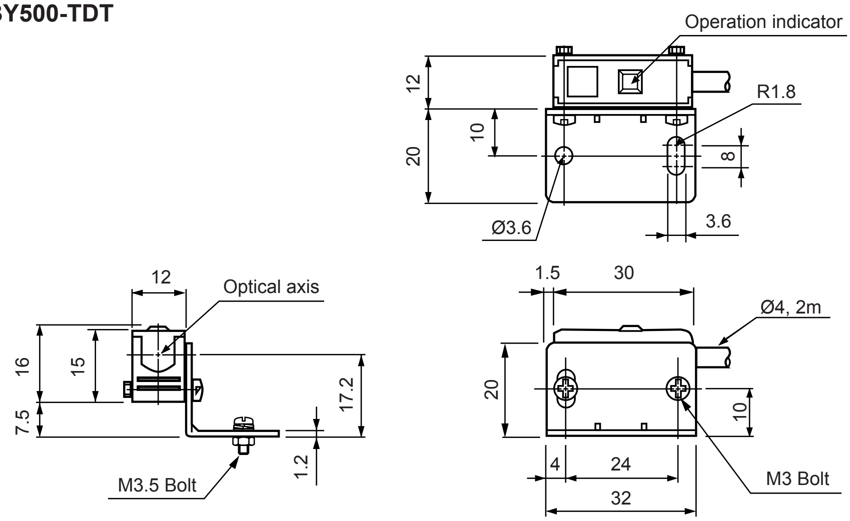


※The power of the emitter and the receiver must be supplied from the same power line.
※Synchronous wire (white) of the receiver must be connected with that of the emitter, or it may cause malfunction.

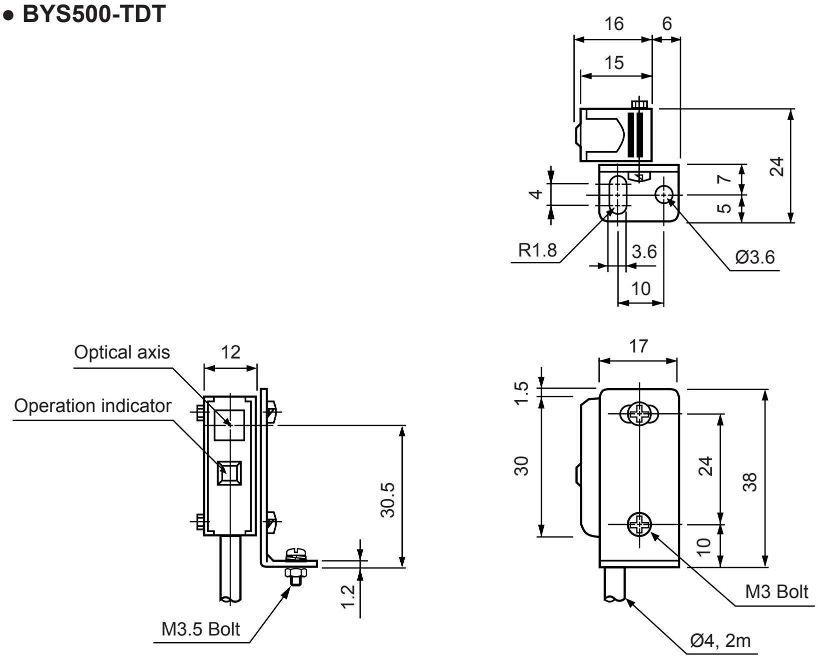
■ Dimensions

(unit: mm)

● **BY500-TDT**



● **BYS500-TDT**

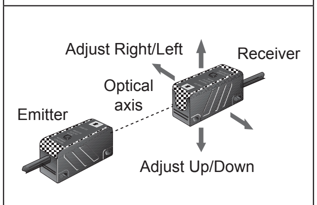


■ Mounting And Sensitivity Adjustment

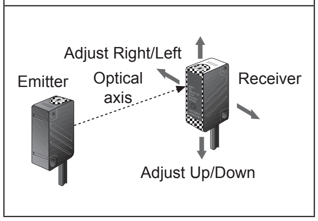
1. Supply the power to the sensor, after installing the emitter and the receiver facing each other.
2. Set the receiver in the middle of position where the operation indicator turns ON adjusting the receiver to the right and the left or up and down.
3. Fix both units tightly after checking that the unit detects the target.

※If a sensing target is translucent body or smaller than Ø5mm, it might not be detected because the because light penetrate it.

Standard type (BY500-TDT)



Side sensing type (BYS500-TDT)

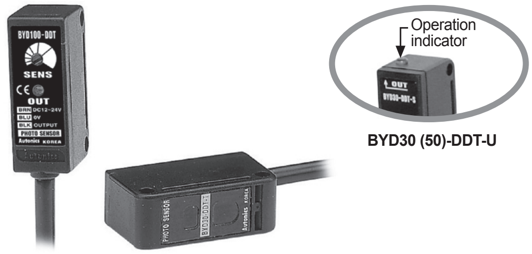


BYD Series

Small Diffuse Reflective And Convergent Reflective Type

■ Features

- Easy installation by compact size
- Superior detection not affected by color of target (convergent reflective type)
- Operation indicator is located on the top (BYD30-DDT-U, BYD50-DDT-U)
- Easy to adjust the response time via Timer function (off delay time: 0.1 to 2 sec variable)
- Built-in reverse polarity protection circuit and output overcurrent (short-circuit) protection circuit



⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

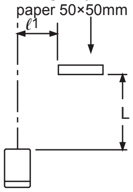
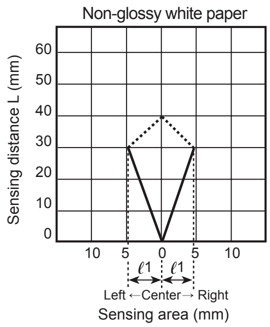
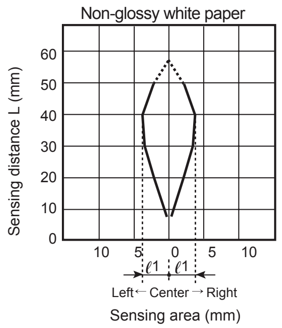
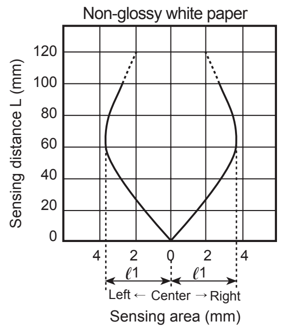
■ Specifications

Model		**BYD30-DDT BYD30-DDT-U※1 BYD30-DDT-T※2**	**BYD50-DDT BYD50-DDT-U※1 BYD50-DDT-T※2**	**BYD100-DDT**	**BYD3M-TDT**	**BYD3M-TDT-P**
Sensing type		Convergent reflective		Diffuse reflective	Through-beam	
Sensing distance		10 to 30mm (non-glossy white paper 50×50mm)	10 to 50mm (non-glossy white paper 50×50mm)	100mm (non-glossy white paper 50×50mm)	3m	
Sensing target		Translucent, opaque materials			Opaque materials of Min. Ø6mm	
Hysteresis		Max. 10% at sensing distance		Max. 25% at sensing distance	—	
Response time		Operation: Max. 3ms, Return: Max. 100ms (when the timer adjuster is minimum)		Operation: Max. 3ms Return: Max. 100ms	Max. 1ms	
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)				
Current consumption		Max. 35mA			Max. 30mA	
Light source		Infrared LED				
Sensitivity adjustment		Fixed		Sensitivity adjuster	Fixed	
Operation mode		Light ON fixed			Dark ON (Light ON: option)	
Control output		NPN open collector output ●Load voltage: Max. 30VDC ●Load current: Max. 50mA ●Residual voltage: Max. 1V			NPN or PNP open collector output ●Load voltage: Max. 30VDC ●Load current: Max. 100mA ●Residual voltage - NPN: Max.1V, PNP: Max. 2.5V	
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit				
Timer function		Built-in timer (off delay) Delay Time: Max. 0.1 to 2 sec (timer adjuster)		—		
Indication		Operation indicator: red LED				
Insulation resistance		Over 20MΩ (at 500VDC megger)				
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator				
Dielectric strength		1,000VAC 50/60Hz for 1minute				
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours				
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times				
Environ-ment	Ambient illumination	Sunlight: Max. 11,000lx, Incandescent lamp: Max. 3,000lx (receiver illumination)				
	Ambient temperature	-20 to 65℃, storage: -25 to 70℃				
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH				
Protection structure		Standard type: IP64 (IEC standards)/ ※1,※2: IP50 (IEC standards)		IP50 (IEC standard)	IP64 (IEC standard)	
Material		Case: Acrylonitrile butadiene styrene, Sensing part: Acrylic, Bracket: Steel Plate Cold Commercial, Bolt: Steel Chromium molybdenum, Nut: Steel Chromium molybdenum, Sleeve: Brass, Ni-plate				
Cable		Ø3.5mm, 3-wire, 2m (emitter of through-beam type: Ø3.5mm, 2-wire, 2m) (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)				
Accessory		Adjuster driver, Fixing bracket A, M3 Screws, Nuts			Fixing bracket A, M3 Screws, Nuts	
Approval		CE				
Unit weight		Approx. 70g			Approx. 150g	

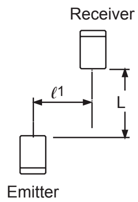
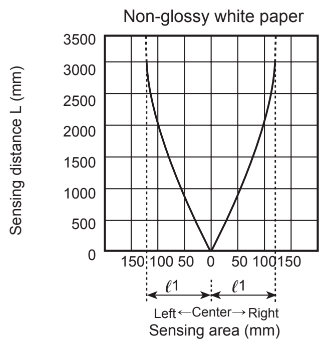
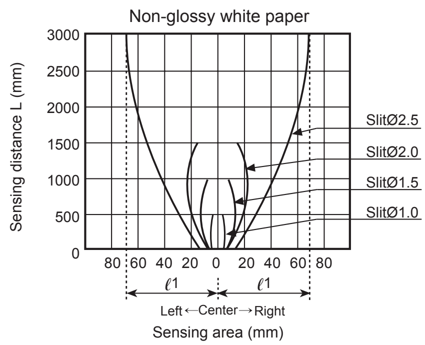
※1: Operation indicator is on the top. ※2: OFF delay timer is built-in. (delay time: max. 0.1 to 2sec)
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature Data

◎ Sensing distance (convergent/diffuse reflective type)

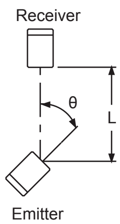
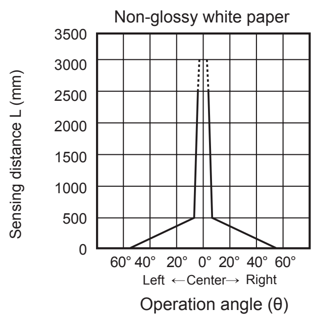
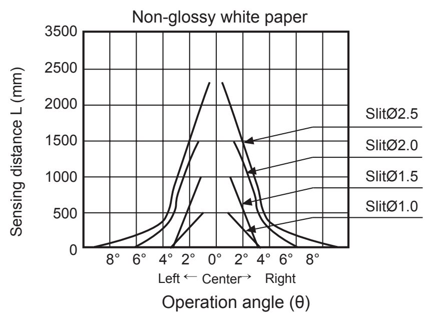
Measuring method	BYD30-DDT(-U) / BYD30-DDT-T	BYD50-DDT(-U) / BYD50-DDT-T	BYD100-DDT
Standard sensing target: Non-glossy white paper 50×50mm 			

◎ Parallel shifting (through-beam type)

Measuring method	BYD3M-TDT	BYD3M-TDT (SLIT)
		

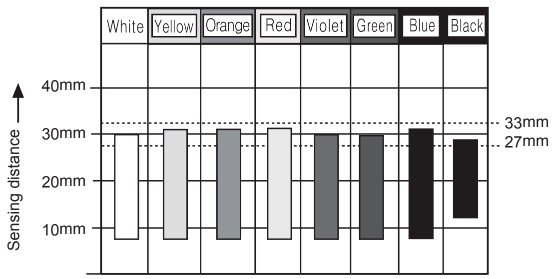
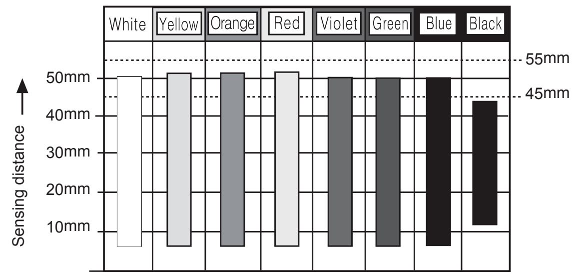
※Above characteristic is from 400mm sensing distance to install transmitted beam type slit (Ø1, Ø1.5, Ø2, Ø2.5).

◎ Sensor angle (through-beam type)

Measuring method	BYD3M-TDT	BYD3M-TDT (SLIT)
		

※Above characteristic is from 400mm sensing distance to install transmitted beam type slit (Ø1, Ø1.5, Ø2, Ø2.5).

▣ Sensing Distance By Color (Convergent Reflective Type)

BYD30-DDT (-U), BYD30-DDT-T	BYD50-DDT (-U), BYD50-DDT-T
 ※Size of sensing target: Non-glossy paper 50×50mm	 ※Size of sensing target: Non-glossy paper 50×50mm

1)This model is photoelectric sensor with stable convergent detection type, therefore it is not affected by color or material within the range of sensing distance as specified in chart.
2)It is able to detect target stably because of small effect from background.

▣ Operation Mode

● BYD30-DDT (-U), BYD50-DDT (-U), BYD100-DDT ● BYD30-DDT-T, BYD50-DDT-T

Operation mode	Light ON	Light ON
Receiver operation	Received light Interrupted light	Received light Interrupted light Ta
Operation indicator (red LED)	ON OFF	ON OFF t T t T
Transistor output	ON OFF	ON OFF

※T: Setting time by the timer adjuster (0.1 to 2 sec)
※t: Max. 3ms (When the timer adjuster is minimum)
※If Ta is shorter than T, transistor output will be ON.

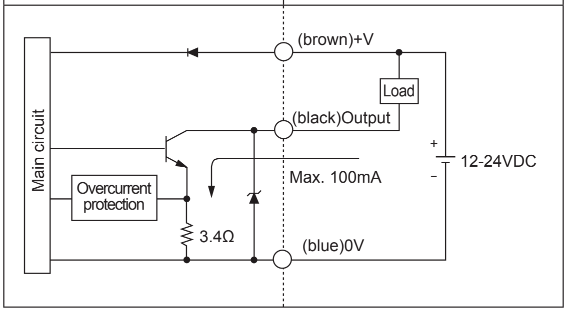
● BYD3M-TDT, BYD3M-TDT-P

Operation mode	Light ON	Dark ON
Receiver operation	Received light Interrupted light	Received light Interrupted light
Operation indicator (red LED)	ON OFF	ON OFF
Transistor output	ON OFF	ON OFF

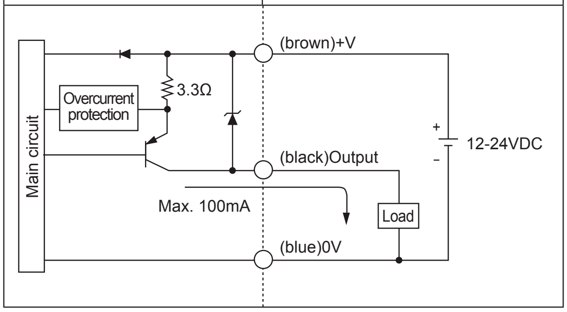
※To prevent malfunction, output of units keeps the state of OFF for 0.5sec after power ON.
※If the control output terminal is short-circuited or overcurrent condition is existed, the control output will turn off due to protection circuit.
※Light ON mode is customizable.

■ Control Output Diagram

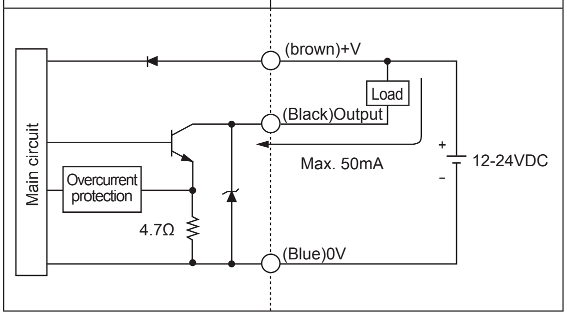
● BYD3M-TDT2



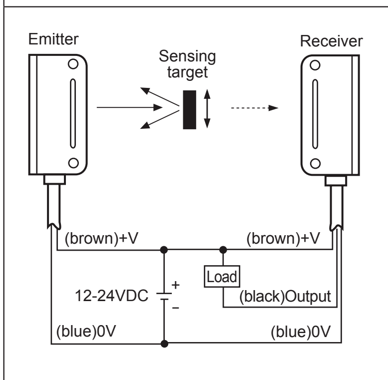
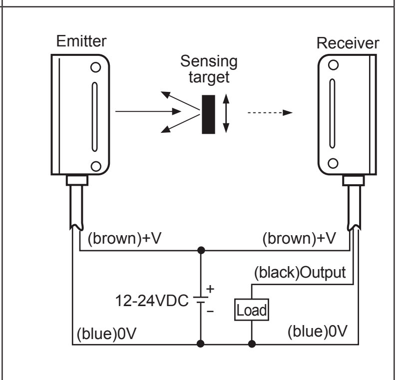
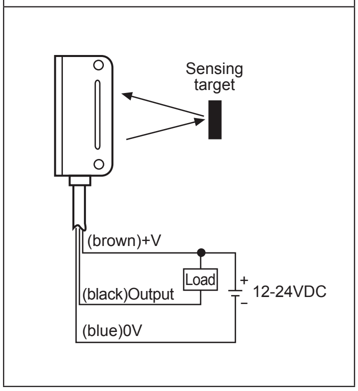
● BYD3M-TDT2-P



● BYD30-DDT (-U), BYD50-DDT (-U)
● BYD30-DDT-T, BYD50-DDT-T
● BYD100-DDT



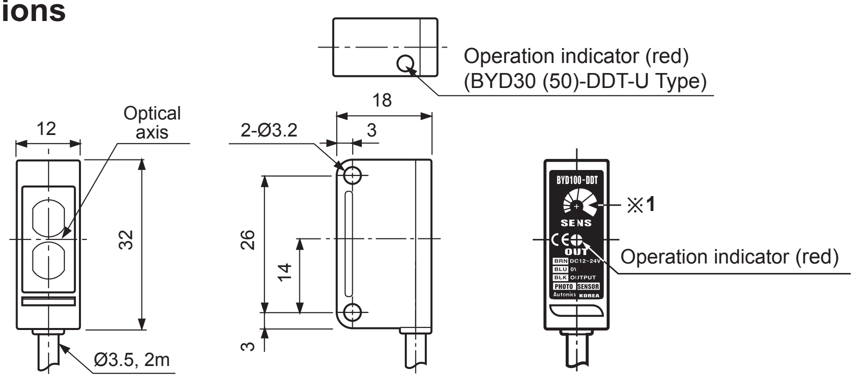
■ Connections

BYD3M-TDT	BYD3M-TDT-P	BYD30-DDT (-U), BYD50-DDT (-U), BYD30-DDT-T, BYD50-DDT-T, BYD100-DDT
		

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

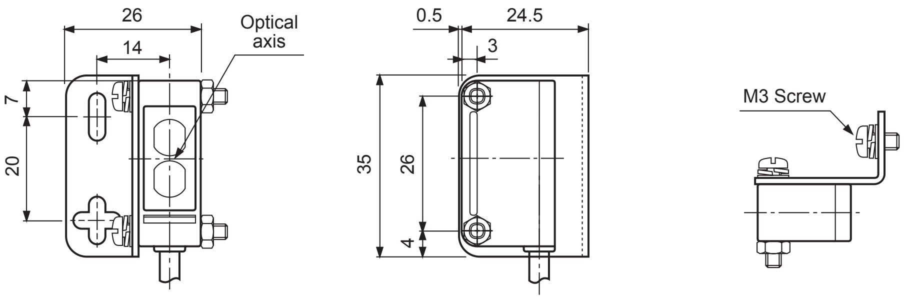
■ Dimensions

(unit: mm)

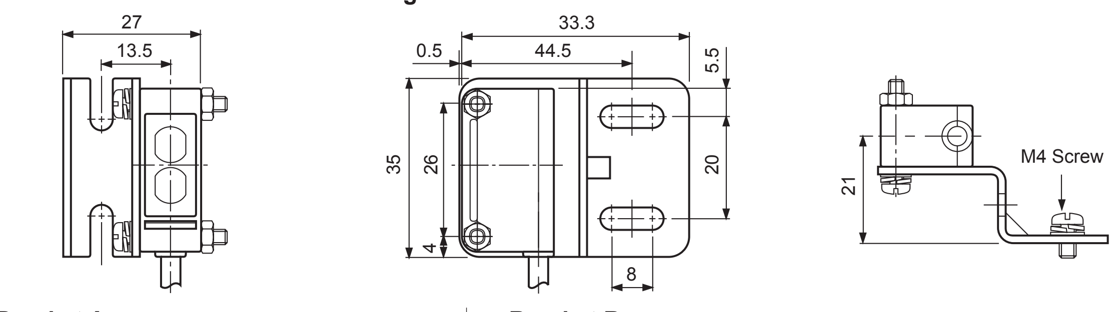


※1: Built-in timer type: Timer adjuster,
Diffuse reflective type: Sensitivity adjuster

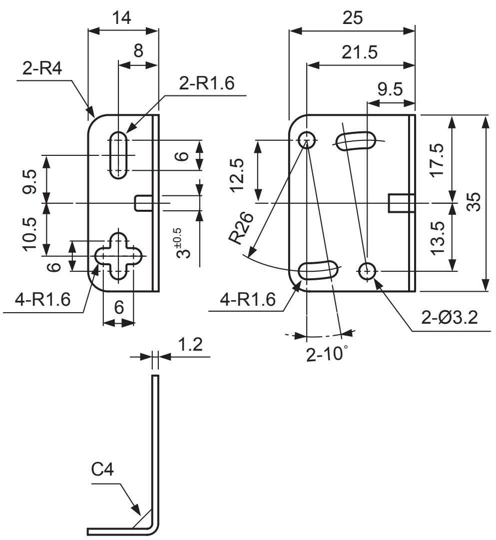
● **Bracket A dimension when mounting**



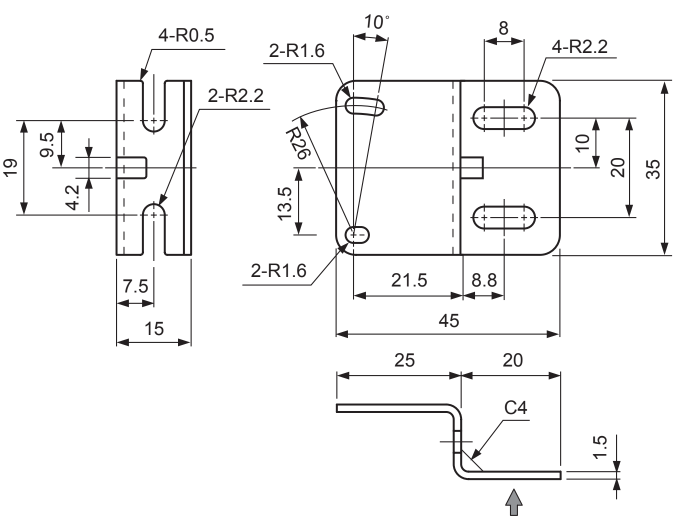
● **Bracket B dimension when mounting**



● **Bracket A**



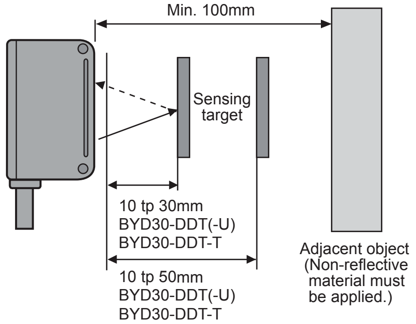
● **Bracket B**



▣ Mounting And Sensitivity Adjustment

◎ Convergent reflective type

1. Supply the power to the sensor after installing the sensor.



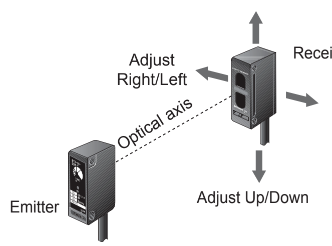
2. Install a target at sensing position and adjust the sensor to right and left or up and down to be at the right angle against the optical axis and fix it at stable operating position.
   Keep the distance BYD30-DDT, (-T), (-U): 10 to 30mm BYD50-DDT, (-T), (-U): 10 to 50mm between the photo-electric sensor and the target.
3. Adjust the response time up to the optimum status in case of timer built-in type. Keep the distance min. 100mm between the photoelectric sensor and the background of the target. It may cause malfunction by reflection light of the background.

※The sensing distance indicated in the specification chart is that of non-glossy white paper in the target size 50×50mm. The sensing distance may be changed by the size of the target, reflectance of the target.

◎ Through-beam type

1. Supply the power to the photoelectric sensor, after setting the emitter and the receiver facing each other.
2. Set the receiver in the middle of the operation range of the operation indicator by adjusting the receiver and the emitter right and left, up and down.
3. After the adjustment, check the stability of operation by putting the object at the optical axis.

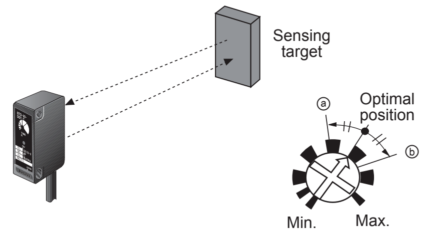
※If the sensing target is translucent body or smaller than Ø6mm, it can be missed by sensor because light penetrate it.



◎ Diffuse reflective type

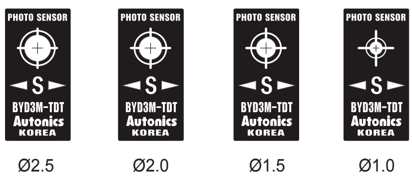
1. The sensitivity should be adjusted depending on a sensing target or mounting place.
2. Set the target at a position to be detected by the beam, then turn the sensitivity adjuster until position ⓐ where the operation indicator turns ON from min. position of the asensitivity adjuster.
3. Take the target out of the sensing area, then turn the sensitivity adjuster until position ⓑ where the operation indicator turns ON. If the indicator dose not turn ON, max. position is ⓑ.
4. Set the sensitivity adjuster at the center of two switching position ⓐ, ⓑ.

※The sensing distance indicated on specification chart is for 50×50mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.



▣ Accessory (sold separately)

● **Slit (Model name: BYD3M-ST)**



● **Min. sensing target and Max. sensing distance by slit Ø**

- Attach the slit on receiver and emitter together.

SLITØ	Min. sensing target	Min. sensing distance
Ø1.0	Opaque materials of Min. Ø0.8	500mm
Ø1.5	Opaque materials of Min. Ø1.5	700mm
Ø2.0	Opaque materials of Min. Ø2.0	1200mm
Ø2.5	Opaque materials of Min. Ø2.5	2300mm

※This slit is for BYD3M-TDT (-P) only.
※Total 8 pieces, 2 pieces of each Ø, are packed.
※This slit is sticker for attachment, please remove the dirt on lens of the photoelectric sensor before using it.

Slim Photoelectric Sensor For Long Sensing Distance

■ Features

- Easy to mount by Flat type
- Realization of 3m sensing distance as small size
- Protection structure IP67 (IEC standard)

⚠ **Please read "Caution for your safety" in operation manual before using.**

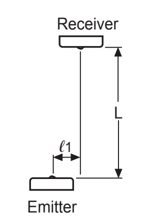
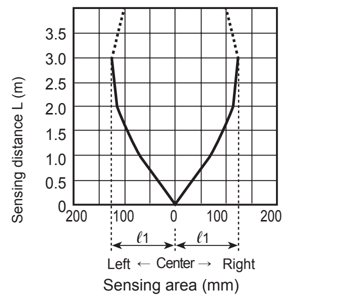
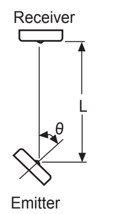
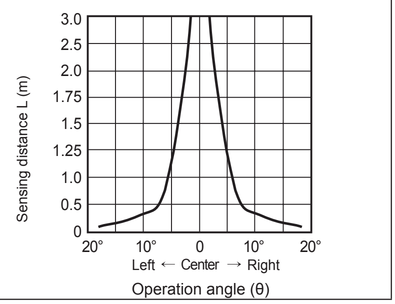
CE

■ Specifications

Model	NPN open collector output	**BPS3M-TDT**	**BPS3M-TDTL**
	PNP open collector output	**BPS3M-TDT-P**	**BPS3M-TDTL-P**
Sensing type		Through-beam	
Sensing target		Opaque materials of Min. Ø5mm	
Operation mode		Dark ON	Light ON
Sensing distance		3m	
Response time		Max. 1ms	
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)	
Current consumption		Max. 20mA	
Light source		Infrared LED (850nm)	
Control output		NPN or PNP open collector output ●Load voltage: Max. 30VDC ●Load current: Max. 100mA ●Residual voltage - NPN: Max. 1V, PNP: Max. 2.5V	
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit	
Indicator		Emitter - Power indicator: Red LED, Receiver - Operation indicator: Red LED	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Noise immunity		±240V the square wave noise (pulse width: 1µs) by the noise simulator	
Dielectric strength		1,000VAC 50/60Hz for 1minute	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Environ-ment	Ambient illumination	Sunlight: Max. 11,000lx , Incandescent lamp: Max. 3,000lx (receiver illumination)	
	Ambient temperature	-25 to 65℃, storage: -25 to 70℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 90%RH	
Protection structure		IP67 (IEC standard)	
Material		Case: Polycarbonate, Bolt: Steel chromium molybdenum, Nut: Steel chromium molybdenum	
Cable		Ø3mm, 3-wire, 2m (emitter of through-beam type: Ø3mm, 2-wire, 2m) (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)	
Approval		CE	
Unit weight		Approx. 66g	

※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

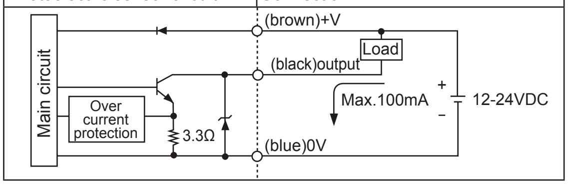
■ Feature Data

Measuring method	Parallel shifting characteristic	Measuring method	Sensor angle characteristic
			

■ Control Output Diagram

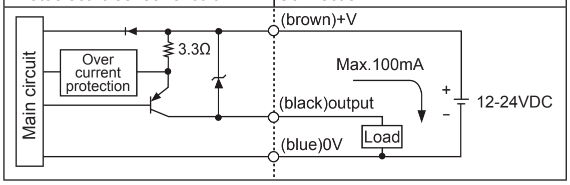
● NPN open collector output

Photoelectric sensor circuit	Connection



● PNP open collector output

Photoelectric sensor circuit	Connection



■ Operation Mode

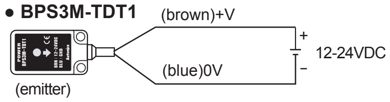
Operation mode	Light ON		Dark ON	
Receiver operation	Received light Interrupted light		Received light Interrupted light	
Operation indicator (red LED)	ON OFF		ON OFF	
Transistor output	ON OFF		ON OFF	

※If the control output terminal is short-circuited or overcurrent condition exists, the control output turns OFF due to protection circuit.
※Dark ON mode is standard and Light ON (Received Light: ON) mode is customizable.

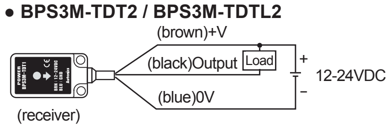
■ Connections

NPN open collector output

● **BPS3M-TDT1**

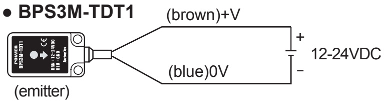


● **BPS3M-TDT2 / BPS3M-TDTL2**

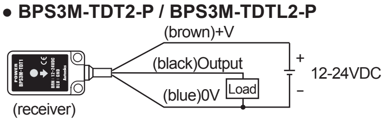


PNP open collector output

● **BPS3M-TDT1**

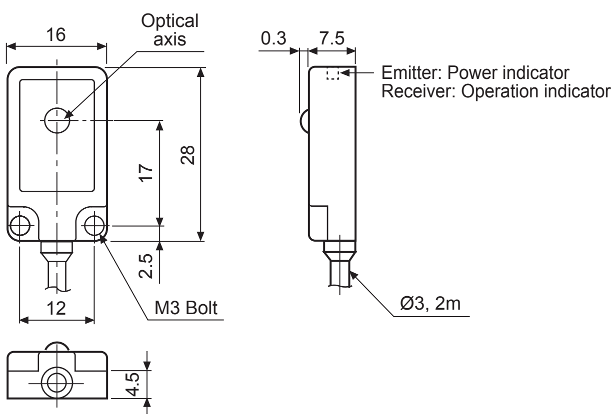


● **BPS3M-TDT2-P / BPS3M-TDTL2-P**

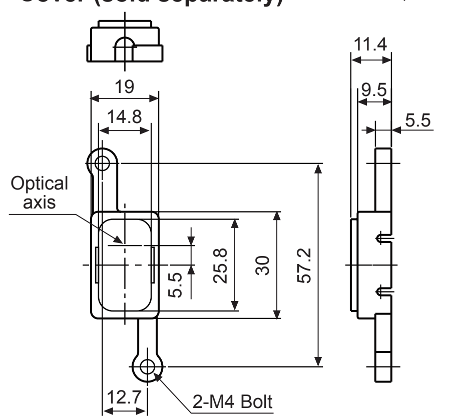


■ Dimensions

(unit: mm)



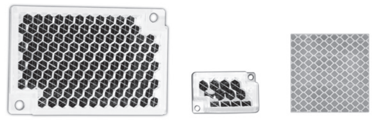
●Cover (sold separately)



Small And Light, Common Type

■ Features

- Easy to mount at a narrow space with small size and light weight.
- Convenient to adjust the sensitivity by external sensitivity adjustment control. (diffuse reflective type only)
- Easy to mount by screw type in mounting hole.
- Built-in reverse polarity protection circuit.



(MS-2) (MS-5) (MST-□)

⚠ Please read "Caution for your safety" in operation manual before using.

CE

※MS-5, MST-□ is sold separately.

■ Specifications

Model		BM3M-TDT	BM1M-MDT	BM200-DDT
Sensing type		Through-beam	Retroreflective	Diffuse reflective
Sensing distance		3m	0.1 to 1m※1	200mm (non-glossy white paper 200×200mm)
Sensing target		Opaque materials of Min. Ø8mm	Opaque materials of Min. Ø60mm	Transparent, Translucent, Opaque materials
Hysteresis		—		Max. 10% at rated setting distance
Response time		Max. 3ms		
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)		
Current consumption		Max. 45mA	Max. 40mA	
Light source		Infrared LED (940nm)		
Sensitivity adjustment		Fixed		Sensitivity adjuster
Operation mode		Dark ON		Light ON (Dark ON: option)
Control output		NPN open collector output ●Load voltage: Max. 30VDC ●Load current: Max. 100mA ●Residual voltage: Max. 1V		
Protection circuit		Reverse polarity protection circuit		
Indication		Operation indicator: red LED		
Insulation resistance		Over 20MΩ (at 500VDC megger)		
Noise immunity		±240V the square wave noise (pulse width: 1µs) by the noise simulator		
Dielectric strength		1,000VAC 50/60Hz for 1minute		
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times		
Environ-ment	Ambient illumination	Sunlight: Max. 11,000lx Incandescent lamp: Max. 3,000lx (receiver illumination)		
	Ambient temperature	-10 to 60℃, storage: -25 to 70℃		
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH		
Material		Case: Acrylonitrile butadiene styrene, Sensing part: Polycarbonate, Bracket: Steel plate cold commercial, Bolt: Steel chromium molybdenum, Nut: Steel chromium molybdenum	Case: Acrylonitrile butadiene styrene, Sensing part: Acrylic, Bracket: Steel plate cold commercial, Bolt: Steel chromium molybdenum, Nut: Steel chromium molybdenum	
Cable		Ø4mm, 3-wire, 2m (emitter of through-beam type: Ø4mm, 2-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)		
Acces-sories	Individual	—	Reflector (MS-2)	Adjuster driver
	Common	Fixing bracket, Bolt, Nut		
Approval		CE		
Unit weight		Approx. 170g	Approx. 105g	Approx. 88g

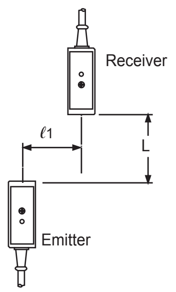
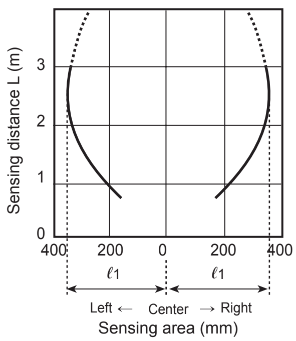
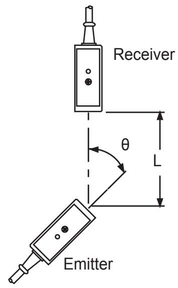
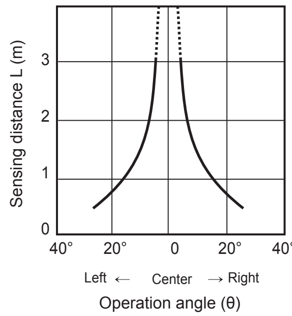
※1: It is mounting distance between sensor and reflector MS-2 and it is the same when MS-5 is used. It is detectable under 0.1m. When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "■Reflectivity By Reflective Tape Model" table before using the tapes.

※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature Data

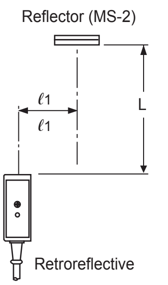
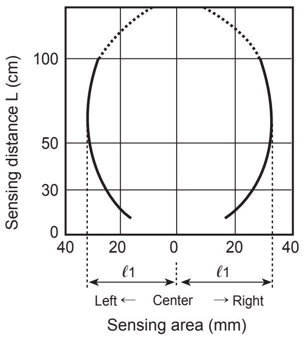
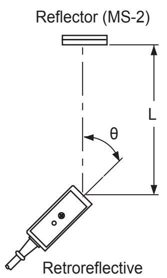
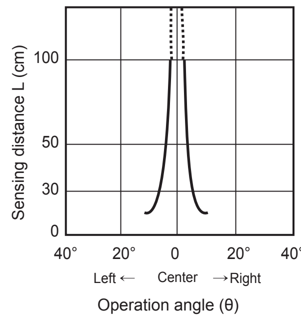
◎ Through-beam type

● BM3M-TDT

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data
			

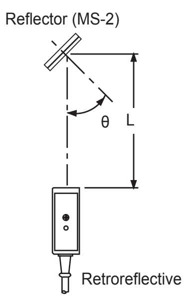
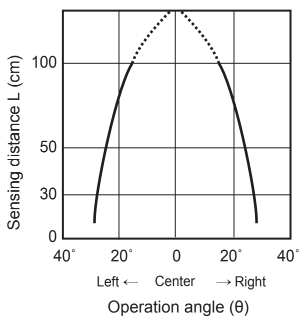
◎ Retroreflective type

● BM1M-MDT

Parallel shifting characteristic		Sensor angle characteristic	
Measuring method	Data	Measuring method	Data
			

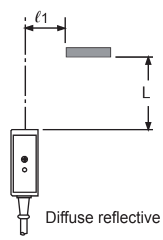
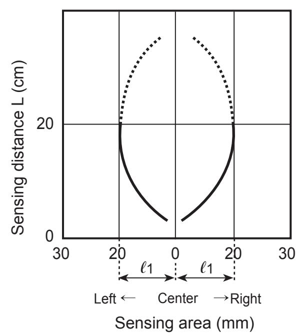
◎ Retroreflective type

● BM1M-MDT

Reflector angle characteristic	
Measuring method	Data
	

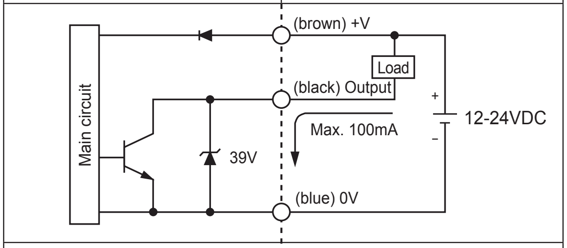
◎ Diffuse reflective type

● BM200-DDT

Sensing area characteristic	
Measuring method	Data
Standard sensing target: Non-glossy white paper 200×200mm 	

Control Output Diagram

Photoelectric sensor circuit	Connection



Through-beam: **BM3M-TDT2** Diffuse reflective: **BM200-DDT**
Retroreflective: **BM1M-MDT**

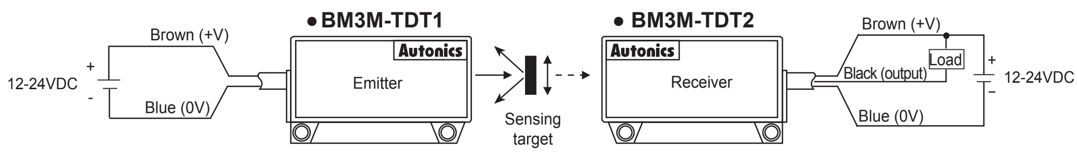
Operation Mode

Operation mode	Light ON
Receiver operation	Received light / Interrupted light
Operation indicator (red LED)	ON / OFF
Transistor output	ON / OFF

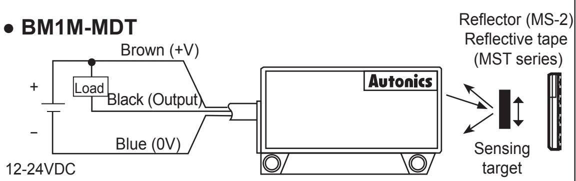
Operation mode	Dark ON
Receiver operation	Received light / Interrupted light
Operation indicator (red LED)	ON / OFF
Transistor output	ON / OFF

Connections

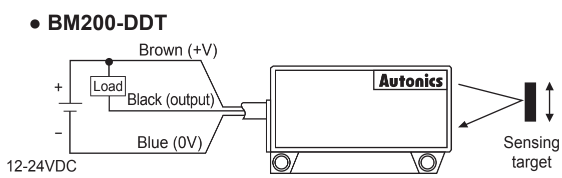
Through-beam (Dark ON)



Retroreflective (Dark ON)

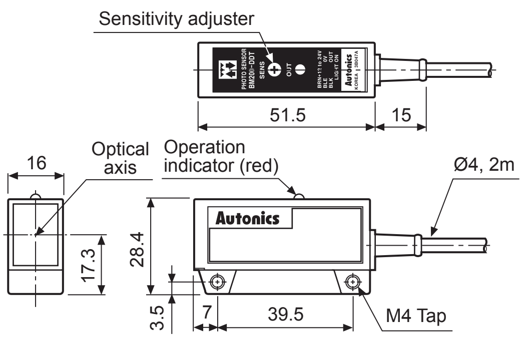


Diffuse reflective (Light ON)

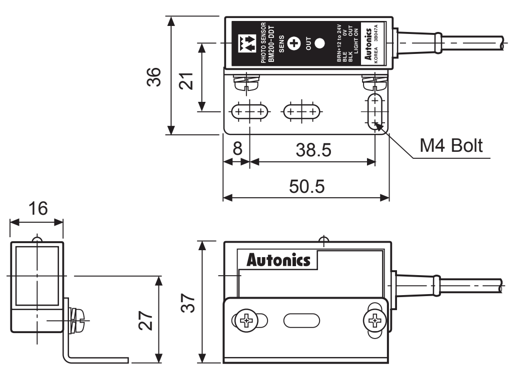


Dimensions

(unit: mm)

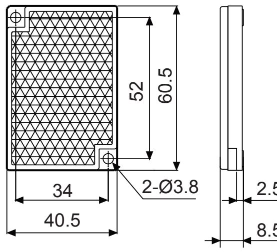


● Connect the bracket

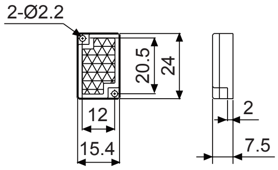


● **Reflector**

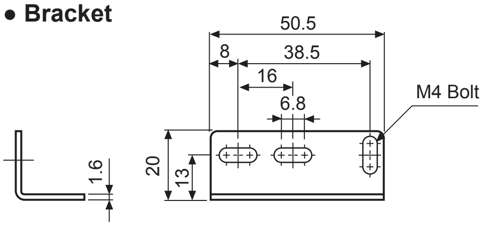
· **MS-2**



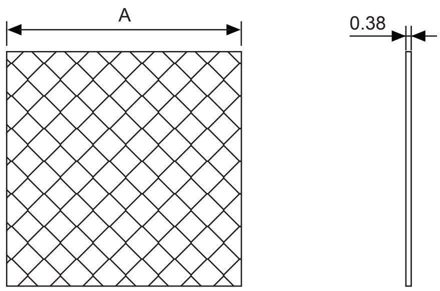
· **MS-5 (sold separately)**



● **Bracket**



● **Reflective tape (sold separately)**



(unit: mm)

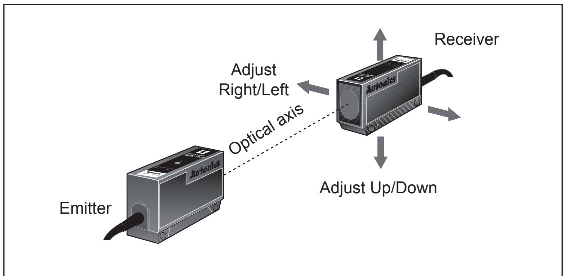
Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

▣ Mounting And Sensitivity Adjustment

◎ Through-beam type

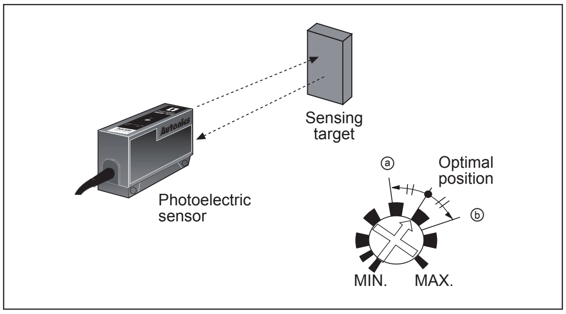
1. Supply the power to the photoelectric sensor, after setting the emitter and the receiver facing each other.
2. Set the receiver in center of position in the middle of the operation range of indicator by adjusting the receiver or the emitter right and left, up and down.
3. After the adjustment, check the stability of operation by putting the object at the optical axis.

※If the sensing target is translucent body or smaller than Ø8mm, it can be missed by sensor because light penetrate it.



◎ Diffuse reflective type

1. The sensitivity should be adjusted depending on a sensing target or mounting place.
2. Set the target at a position to be detected by the beam, then turn the sensitivity adjuster until position ⓐ where the operation indicator turns ON from min. position of the sensitivity adjuster.
3. Take the target out of the sensing area, then turn the sensitivity adjuster until position ⓑ where the operation indicator turns ON. If the indicator dose not turn ON, max. position is ⓑ.
4. Set the sensitivity adjuster at the center of two switching position ⓐ, ⓑ.

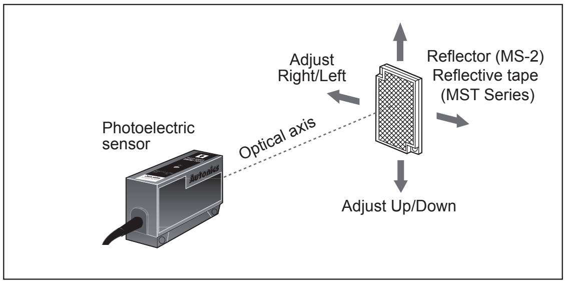


※The sensing distance indicated on specification chart is for 200×200mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.

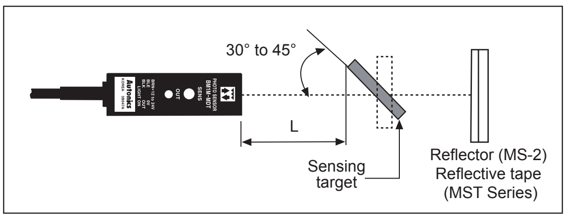
◎ Retroreflective type

1. Supply the power to the photoelectric sensor, after setting the photoelectric sensor and the reflector (MS-2) or reflective tape face to face.
2. Set the photoelectric sensor in the position which indicator turns on, by adjusting the reflector, reflective tape or the sensor right and left, up and down.
3. Fix both units tightly after checking that the unit detects the target.

※If using more than 2 photoelectric sensors in parallel, the space among them should be more than 30cm.

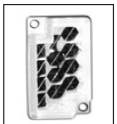


※If reflectance of target is higher than non-glossy white paper, it might cause malfunction by reflection from the target when the target is near to photoelectric sensor. Therefore put enough space between the target and the photoelectric sensor or the surface of the target should be installed at angle of 30° to 45° against optical axis.



※If the mounting place is too narrow, please use MS-5 instead of MS-2.

※Please use reflective tape (MST series) for where a reflector is not installed.


<MS-5>

■ Reflectivity By Reflective Tape Model

MST-50-10 (50×50mm)	70%
MST-100-5 (100×100mm)	110%
MST-200-2 (200×200mm)	170%

※This reflectivity is based on the reflector (MS-2).

※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.

※For using reflective tape, installation distance should be min. 20mm.

High Speed Response Type With Built-in Output Protection Circuit

■ Features

- Reverse power polarity and overcurrent
- Response time: Max. 1ms
- Light ON/Dark ON mode selectable by control wire
- Sensitivity adjuster (except for through-beam type)

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

(MS-2) (MS-5) (MST-□)

※MS-5, MST-□ is sold separately.

■ Specifications

Model	NPN open collector output	**BMS5M-TDT**	**BMS2M-MDT**	**BMS300-DDT**
Model	PNP open collector output	**BMS5M-TDT-P**	**BMS2M-MDT-P**	**BMS300-DDT-P**
Sensing type		Through-beam	Retroreflective	Diffuse reflective
Sensing distance		5m	0.1 to 2m ※1	300mm (non-glossy white paper 100×100mm)
Sensing target		Opaque materials of Min. Ø10mm	Opaque materials of Min. Ø60mm	Translucent, Opaque materials
Hysteresis		—		Max. 20% at rated setting distance
Response time		Max. 1ms		
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)		
Current consumption		Max. 50mA	Max. 45mA	
Light source		Infrared LED (940nm)		
Sensitivity adjustment		—		Sensitivity adjuster
Operation mode		Selectable Light ON or Dark ON by control wire		
Control output		NPN or PNP open collector output ●Load voltage: Max. 30VDC ●Load current: Max. 200mA ●Residual voltage - NPN: Max. 1V, PNP: Max. 2.5V		
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit		
Indicator		Operation indicator: Red LED, Power indicator: Red LED (BMS5M-TDT1)		
Insulation resistance		Over 20MΩ (at 500VDC megger)		
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator		
Dielectric strength		1000VAC 50/60Hz for 1minute		
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times		
Environment	Ambient illumination	Sunlight: Max. 11,000lx, Incandescent lamp: Max. 3,000lx		
Environment	Ambient temperature	-10 to 60℃, storage: -25 to 70℃		
Environment	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH		
Material		Case: Acrylonitrile butadiene styrene, Sensing part: Polycarbonate, Bracket: Steel plate cold commercial, Bolt: Steel chromium molybdenum, Nut: Steel chromium molybdenum	Case: Acrylonitrile butadiene styrene, Sensing part: Acryl, Bracket: Steel plate cold commercial, Bolt: Steel chromium molybdenum, Nut: Steel chromium molybdenum	
Cable		Ø5mm, 4-wire, 2m (emitter of through-beam type: Ø5mm, 2-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)		
Accessories	Individual	—	Reflector (MS-2), Adjuster driver	Adjuster driver
Accessories	Common	Fixing bracket, Bolts/nuts		
Approval		CE		
Unit weight		Approx. 180g	Approx. 110g	Approx. 100g

※1: It is mounting distance between sensor and reflector MS-2 and it is the same when MS-5 is used. It is detectable under 0.1m.
When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "■Reflectivity By Reflective Tape Model" table before using the tapes.

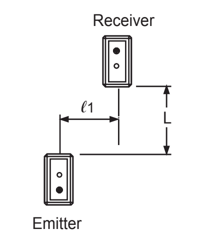
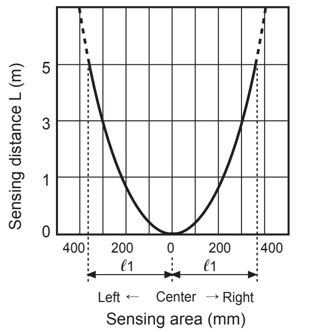
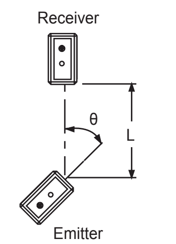
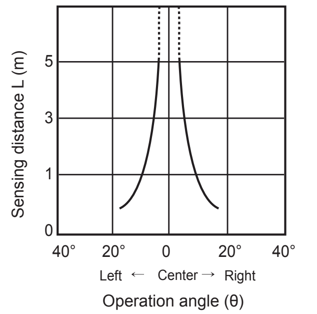
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Feature Data

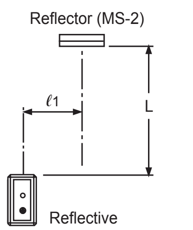
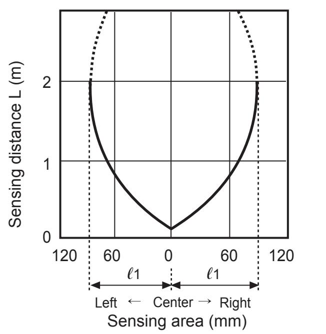
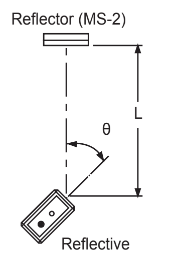
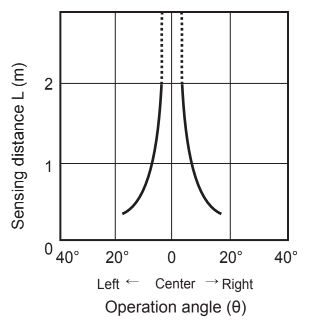
◎ Through-beam type

● BMS5M-TDT ● BMS5M-TDT-P

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data
			

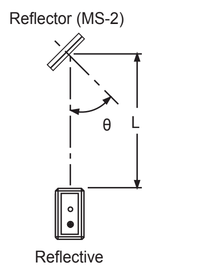
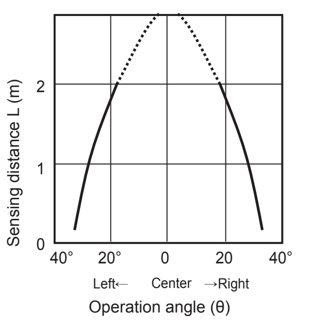
◎ Retroreflective type

● BMS2M-MDT ● BMS2M-MDT-P

Parallel shifting characteristic		Sensor angle characteristic	
Measuring method	Data	Measuring method	Data
			

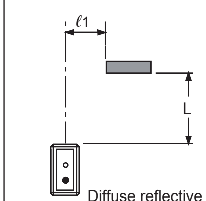
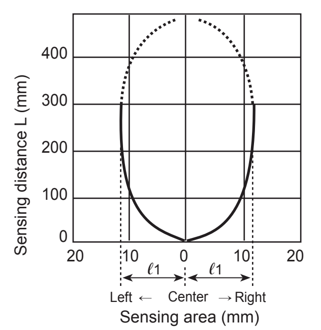
◎ Retroreflective type

● BMS2M-MDT ● BMS2M-MDT-P

Reflector angle characteristic	
Measuring method	Data
	

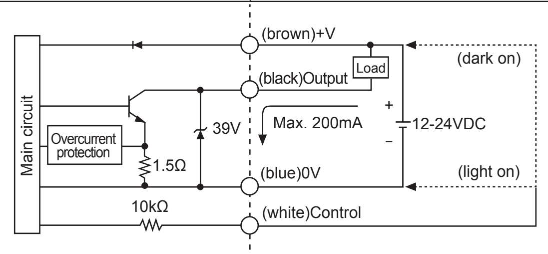
◎ Diffuse reflective type

● BMS300-DDT ● BMS300-DDT-P

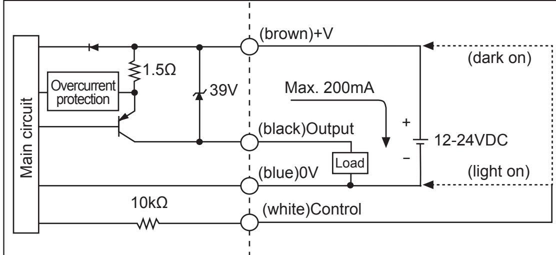
Sensing area characteristic	
Measuring method	Data
Standard sensing target: Non-glossy white paper 100×100mm 	

■ Control Output Diagram

● NPN open collector output

Photoelectric sensor circuit	Connection
	
Through-beam: **BMS5M-TDT2**, Retroreflective: **BMS2M-MDT** Diffuse reflective: **BMS300-DDT**	

● PNP open collector output

Photoelectric sensor circuit	Connection
	
Through-beam: **BMS5M-TDT2-P**, Retroreflective: **BMS2M-MDT-P** Diffuse reflective: **BMS300-DDT-P**	

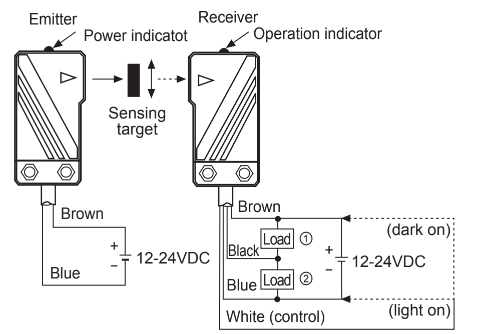
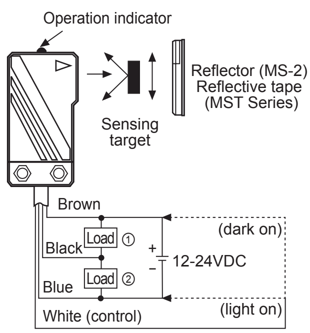
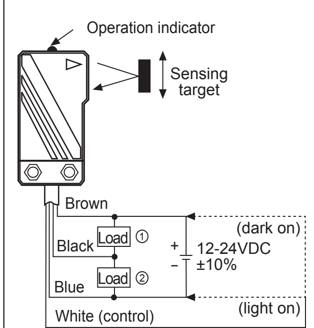
※Select Light ON / Dark ON by control wire. - Light ON: Connect control wire to 0V / Dark ON: Connect control wire to +V

■ Operation Mode

Operation mode	Light ON	Dark ON
Receiver operation	Received light Interrupted light 	Received light Interrupted light 
Operation indicator (red LED)	ON OFF 	ON OFF 
Transistor output	ON OFF 	ON OFF 

※To prevent malfunction, this sensor maintains control output OFF for 0.5 sec. after supplying the power.
※If the control output terminal is short-circuited or overcurrent condition exists, the control output turns OFF due to protection circuit.

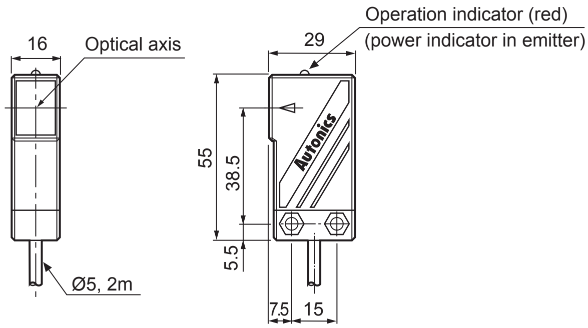
■ Connections

BMS5M-TDT, BMS5M-TDT-P	BMS2M-MDT, BMS2M-MDT-P	BMS300-DDT, BMS300-DDT-P
		
①Load connection for NPN output ②Load connection for PNP output	①Load connection for NPN output ②Load connection for PNP output	①Load connection for NPN output ②Load connection for PNP output

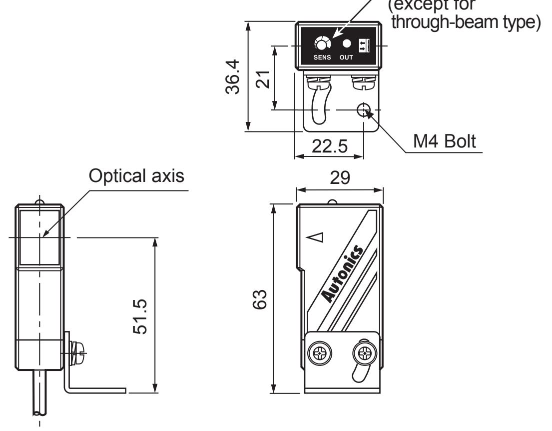
※Dark ON mode is on when control line is opened.

■ Dimensions

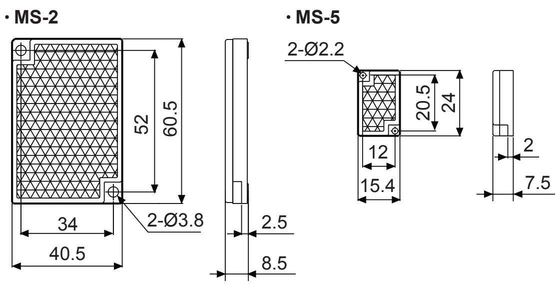
(unit: mm)



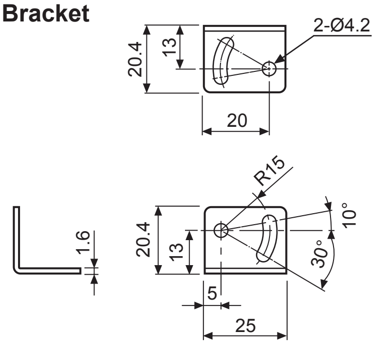
● Connect the bracket



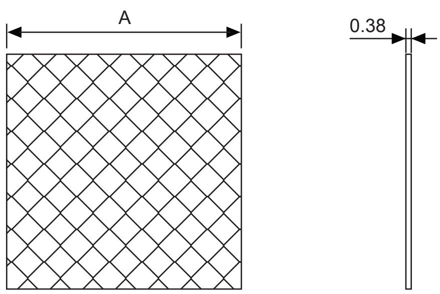
● Reflector



● Bracket



● Reflective tape (sold separately)



(unit: mm)

Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

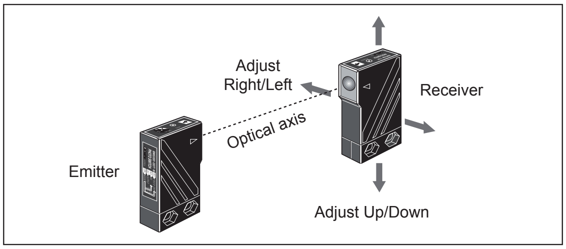
▣ Mounting And Sensitivity Adjustment

Install the sensor to the desired place and check the connections.
Supply the power to the sensor and adjust the optical axis and the sensitivity as follow ;

◎ Optical axis adjustment

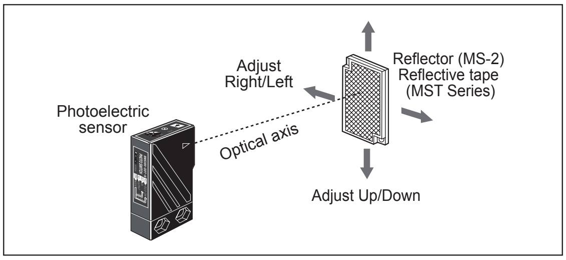
● Through-beam type

Set the photoelectric sensor in the middle of the operation range of the operation indicator by adjusting the receiver or emitter right and left, up and down.

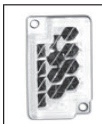


● Retroreflective type

Mount the photoelectric sensor and the reflector or reflective tape facing each other then fix them in the middle of operation range of the operation indicator by adjusting the reflector (or reflective tape) right and left, up and down.

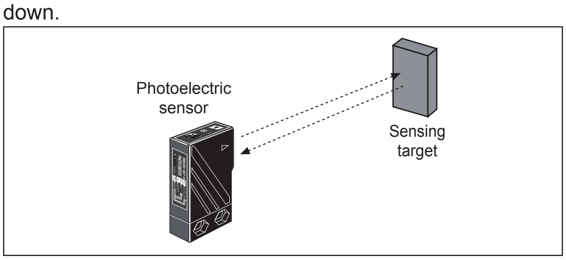


※If the mounting place is too narrow, please use MS-5 instead of MS-2.
※Please use reflective tape (MST series) for where a reflector is not installed.


<MS-5>

● Diffuse reflective type

Mount the photoelectric sensor and the target then fix them in the middle of operation range of the operation indicator by adjusting the photoelectric sensor right and left, up and down.

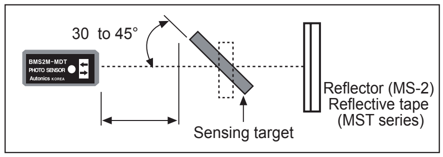


◎ Sensitivity adjustment

● Retroreflective type

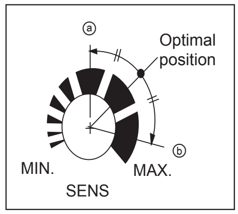
Fix the sensitivity adjuster at max. position and then check if the sensor operates normally to pass the target within sensing area of the sensor.
If the sensor does not work normally by noise or external light, turn the sensitivity adjuster slowly up to the position.

※If reflectance of target is higher than non-glossy white paper, it might cause malfunction by reflection from the target when the target is near to the photoelectric sensor. Therefore enough space between the target should be used and the photoelectric sensor or the surface of the target should be mounted at angle of 30° to 45° against optical axis.



● Diffuse reflective type

Set the target at a position to be detected by the beam, then turn the sensitivity adjuster until position ⓐ where the operation indicator turns ON from min. position of the sensitivity adjuster up to position ⓐ which the operation indicator turn ON from min.



Take the target out of the sensing area, then turn the sensitivity adjuster until position where the indicator turns ON. If position ⓑ is not checked, the max. position is ⓑ. Set the sensitivity adjuster in the middle of two switching position ⓐ, ⓑ.
※Please be aware not to make the unstable operation of sensor by background and mounting side.

▣ Reflectivity By Reflective Tape Model

MST-50-10 (50×50mm)	90%
MST-100-5 (100×100mm)	120%
MST-200-2 (200×200mm)	190%

※This reflectivity is based on the reflector (MS-2).
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.
※For using reflective tape, installation distance should be min. 20mm.

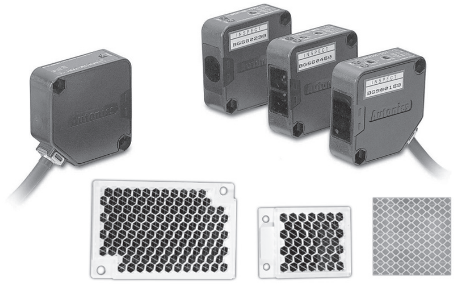
Compact, Amplifier Built-In Type With Universal Voltage

▣ Features

- Small and power supply built-in type
- Easy installation with LED indicators on product
- Light ON/Dark ON operation mode switch
- Status and output LED indication
- Built-in IC photo diode for disturbing light and electrical noise

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE



(MS-2) (MS-4) (MST-□)

※MS-4, MST-□ is sold separately.

▣ Specifications

- **Free power, Relay contact output type**

Model		**BEN10M-TFR**	**BEN5M-MFR**	**BEN3M-PFR**	**BEN300-DFR**
Sensing type		Through-beam	Retroreflective (standard type)	Retroreflective (built-in polarizing filter)	Diffuse reflective
Sensing distance		10m	0.1 to 5m※1	0.1 to 3m※1	300mm (non-glossy white paper 100×100mm)
Sensing target		Opaque materials of Min. Ø16mm	Opaque materials of Min. Ø60mm		Translucent, Opaque materials
Hysteresis		—			Max. 20% at ratedsetting distance
Response time		Max. 20ms			
Power supply		24-240VAC ±10% 50/60Hz, 24-240VDC ±10% (ripple P-P: max. 10%)			
Current consumption		Max. 4VA			
Light source		Infrared LED (850nm)		Red LED (660nm)	Infrared LED (940nm)
Sensitivity adjustment		—	Sensitivity adjuster		
Operation mode		Light ON/Dark ON operation mode switch			
Control output		Relay contact output ● Relay contact capacity: 30VDC 3A of resistive load, 250VAC 3A resistive load ● Relay contact composition: 1c			
Relay life cycle		Mechanically: Min. 50,000,000 operation, Electrically: Min. 100,000 operation			
Light receiving element		Photo IC			
Indicator		Operation indicator: Red LED, Stability indicator: Green LED (the red lamp on Emitter of transmitted beam type is for power indication)			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Insulation type		Double or strong insulation (Mark: ▣, Dielectric voltage between the measured input and the power: 1kV)			
Noise immunity		±1,000V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength		1000VAC 50/60Hz for 1minute			
Vibration	Mechanical	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
	Malfunction	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 minutes			
Shock	Mechanical	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times			
Environ-ment	Ambient illumination	Sunlight: Max. 11,000lx, Incandescent lamp: Max. 3,000lx (receiver illumination)			
	Ambient temperature	-20 to 65℃, storage: -25 to 70℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP50 (IEC standard)			
Material		Case, Case cover: Heat resistant Acrylonitrile butadiene styrene, Sensing part: Polycarbonate (with polarizing filter: polymethyl methacrylate), Bracket: Steel Plate cold commercial, Bolt: steel chromium molybdenum, Nut: steel chromium molybdenum			
Cable		Ø5mm, 5-wire, 2m (emitter of through-beam type: Ø5mm, 2-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)			
Accessory	Individual	—	Reflector (MS-2)		—
	Common	Adjuster driver, Fixing bracket, Bolts, Nuts			
Unit weight		Approx. 354g	Approx. 208g		Approx. 195g

※1: The sensing distance is specified with using the MS-2 reflector and the same as the MS-4 reflector. Sensing distance is the setting range of the reflector. The sensor can detect under 0.1m.
When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "▣Reflectivity By Reflective Tape Model" table before using the tapes.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

● **DC power, Solid state output type**

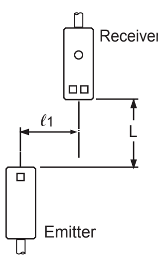
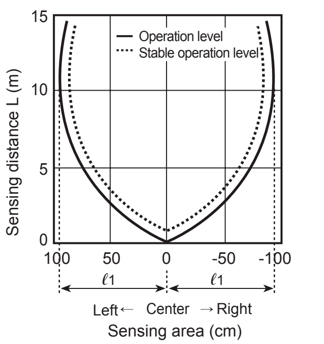
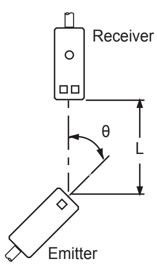
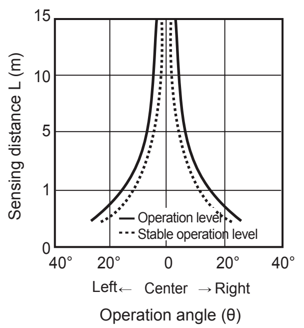
Model	**BEN10M-TDT**	**BEN5M-MDT**	**BEN3M-PDT**	**BEN300-DDT**
Sensing type	Through-beam	Retroreflective	Retroreflective (with polarizing filter)	Diffuse reflective
Sensing distance	10m	0.1 to 5m ※1	0.1 to 3m ※1	300mm (non-glossy white paper 100×100mm)
Sensing target	Opaque materials of Min. Ø16mm	Opaque materials of Min. Ø60mm		Translucent, Opaque materials
Hysteresis	—			Max. 20% at rated setting distance
Response time	Max. 1ms			
Power supply	12-24VDC ±10% (ripple P-P: max. 10%)			
Current consumption	Max. 50mA			
Light source	Infrared LED (850nm)		Red LED (660nm)	Infrared LED (940nm)
Sensitivity adjustment	—	Sensitivity adjuster		
Operation mode	Light ON/Dark ON operation mode switch			
Control output	NPN open collector / PNP open collector simultaneous output ●Load voltage: Max. 30VDC ●Load current: Max. 200mA ●Residual voltage - NPN: Max. 1V, PNP: Max. 2.5V			
Protection circuit	Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit			
Light receiving element	Photo IC			
Indicator	Operation indicator: Red, Stability indicator: Green (the red lamp on Emitter of transmitted beam type is for power indication)			
Insulation resistance	Over 20MΩ (at 500VDC megger)			
Noise immunity	±240V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength	1000VAC 50/60Hz for 1minute			
Vibration	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
Environment - Ambient illumination	Sunlight: Max. 11,000lx Incandescent lamp: Max. 3,000lx (receiver illumination)			
Environment - Ambient temperature	-20 to 65℃, storage: -25 to 70℃			
Environment - Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure	IP50 (IEC standard)			
Material	Case, Case cover: Heat resistant Acrylonitrile butadiene styrene, Sensing part: Polycarbonate (with polarizing filter: polymethyl methacrylate), Bracket: Steel plate cold commercial, Bolt: Steel chromium molybdenum, Nut: steel chromium molybdenum			
Cable	Ø5mm, 4-wire, 2m (emitter of through-beam type: Ø5mm, 2-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator diameter: Ø1.25mm)			
Accessory - Individual	—	Reflector (MS-2)		—
Accessory - Common	Adjuster driver, Fixing bracket, Bolts, Nuts			
Approval	CE			
Unit weight	Approx. 342g	Approx. 200g		Approx. 187g

※1: The sensing distance is specified with using the MS-2 reflector and the same as the MS-4 reflector. Sensing distance is the setting range of the reflector. The sensor can detect under 0.1m.
When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "▣Reflectivity By Reflective Tape Model" table before using the tapes.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature data

◎ Through-beam type

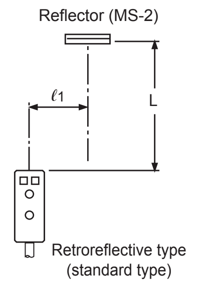
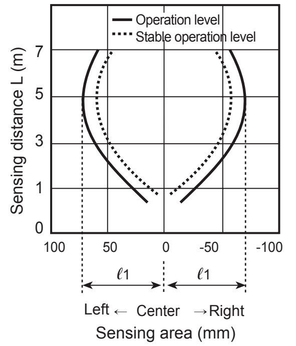
● **BEN10M-TFR** ● **BEN10M-TDT**

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data
			

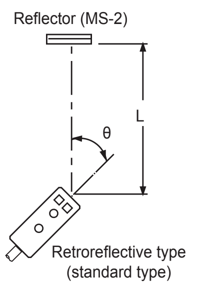
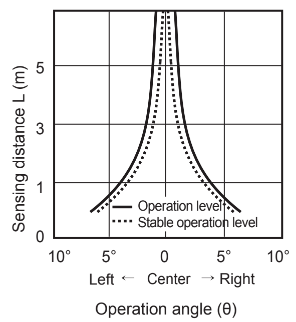
■ Feature Data

◎ Retroreflective type (standard type)

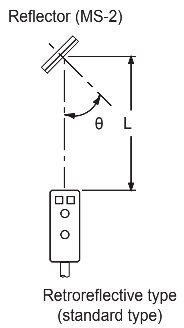
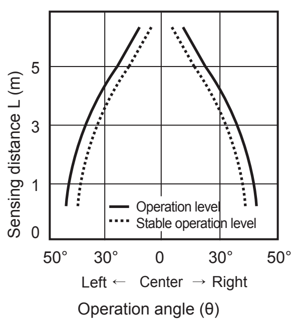
● BEN5M-MFR ● BEN5M-MDT

Parallel shifting characteristic	
Measuring method	Data
	

● BEN5M-MFR ● BEN5M-MDT

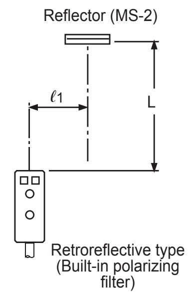
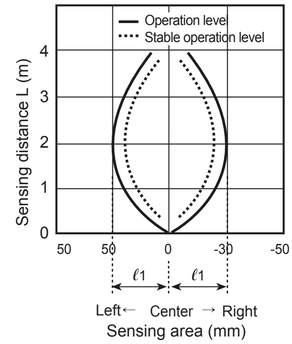
Sensor angle characteristic	
Measuring method	Data
	

● BEN5M-MFR ● BEN5M-MDT

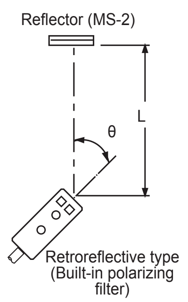
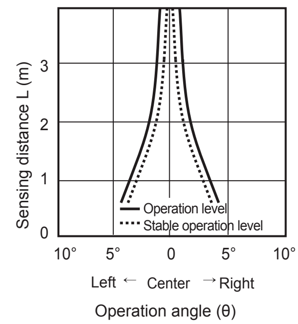
Reflector angle characteristic	
Measuring method	Data
	

◎ Retroreflective type (built-in polarizing filter)

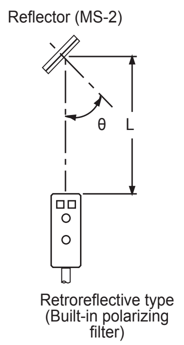
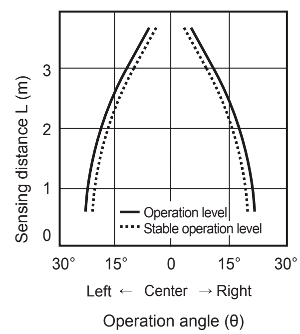
● BEN3M-PFR ● BEN3M-PDT

Parallel shifting characteristic	
Measuring method	Data
	

● BEN3M-PFR ● BEN3M-PDT

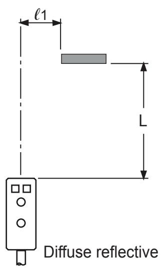
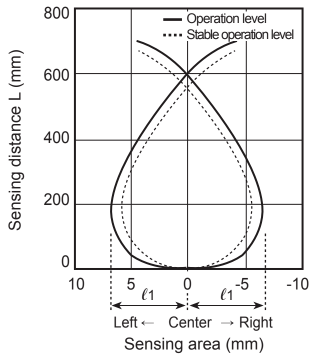
Sensor angle characteristic	
Measuring method	Data
	

● BEN3M-PFR ● BEN3M-PDT

Reflector angle characteristic	
Measuring method	Data
	

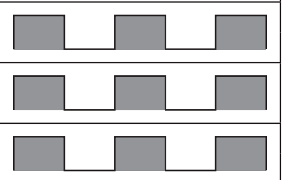
◎ Diffuse reflective type

● BEN300-DFR ● BEN300-DDT

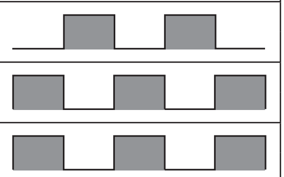
Sensing area characteristic	
Measuring method	Data
Standard sensing target: Non-glossy white paper 100×100mm 	

■ Operation Mode

Operation mode	Light ON	
Receiver operation	Received light Interrupted light	
Operation indicator (red LED)	ON OFF	
Transistor output	ON OFF	



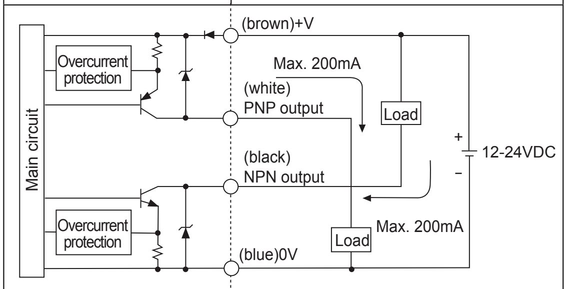
Operation mode	Dark ON	
Receiver operation	Received light Interrupted light	
Operation indicator (red LED)	ON OFF	
Transistor output	ON OFF	



■ Control Output Diagram

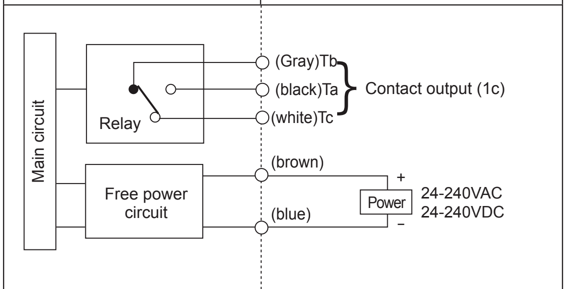
● DC voltage (NPN/PNP synchronous output)

Photoelectric sensor circuit	Connection



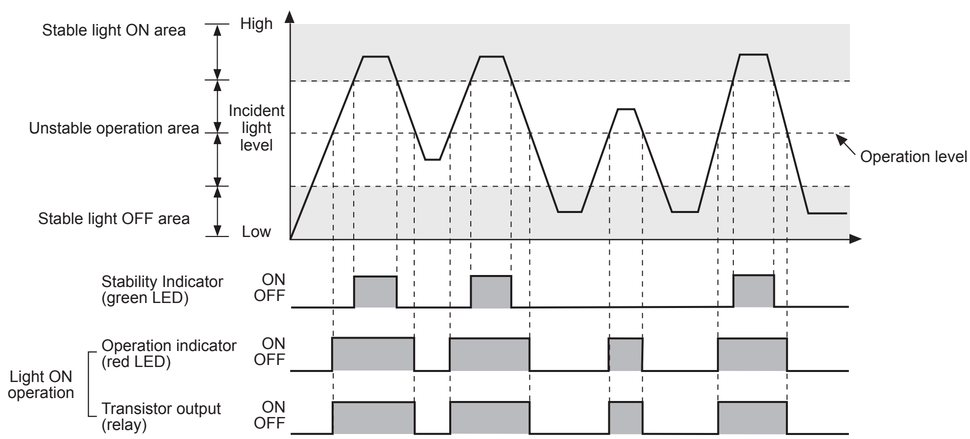
● Free power (Relay contact output)

Photoelectric sensor circuit	Connection



※In case of product with the output protection device, if terminals of control output are short circuited or overcurrent condition exists, the control output turns OFF due to protection circuit.

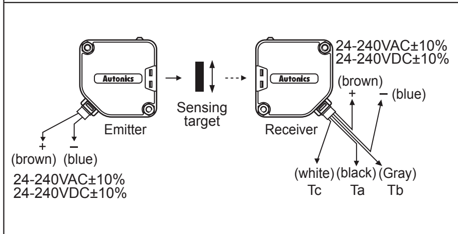
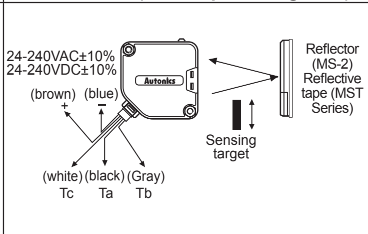
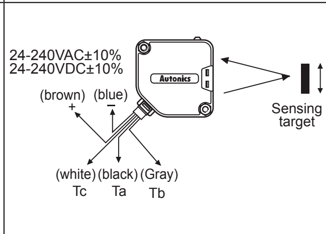
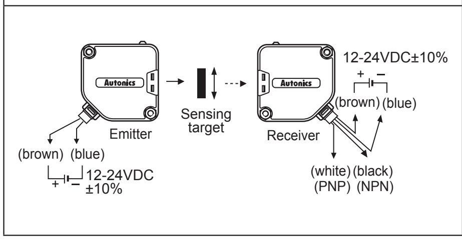
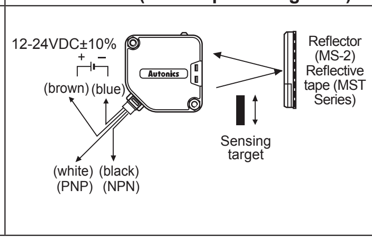
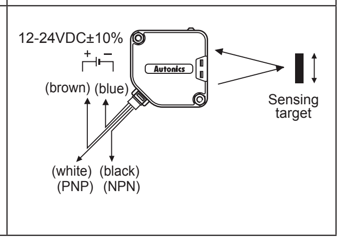
■ Operation Timing Diagram



※The waveforms of "Operation indicator" and "Transistor output" are for Light ON operation.
They are opposite operation for Dark ON operation.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

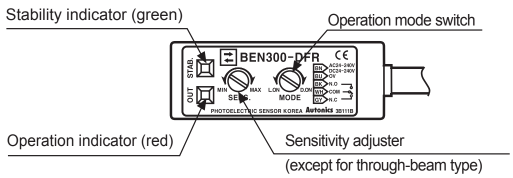
Connections

Through-beam	Retroreflective	Diffuse reflective
● **BEN10M-TFR1** ● **BEN10M-TFR2**	● **BEN5M-MFR (standard type)** ● **BEN3M-PFR (built-in polarizing filter)**	● **BEN300-DFR**
		
● **BEN10M-TDT1** ● **BEN10M-TDT2**	● **BEN5M-MDT (standard type)** ● **BEN3M-PDT (built-in polarizing filter)**	● **BEN300-DDT**
		

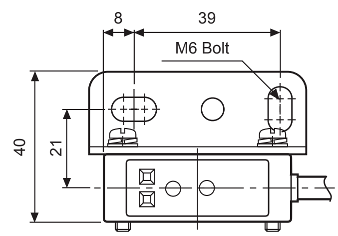
※ Unused line must be insulated.

Dimensions

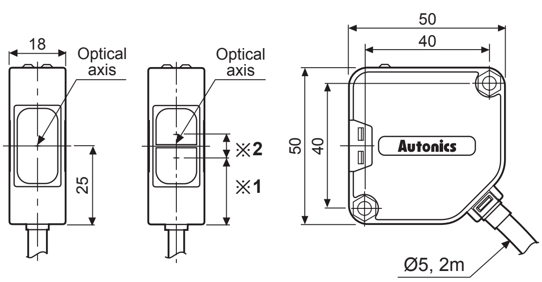
(unit: mm)

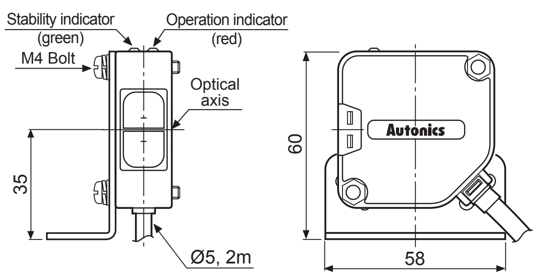


● **Connect the bracket**



●Through-beam ●Retroreflective
●Diffuse reflective

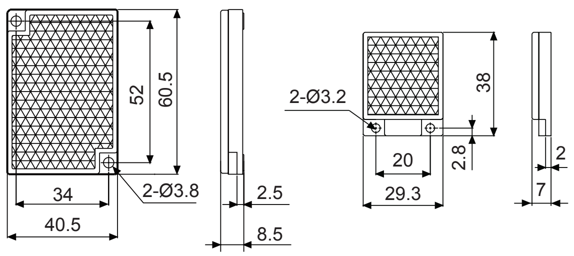




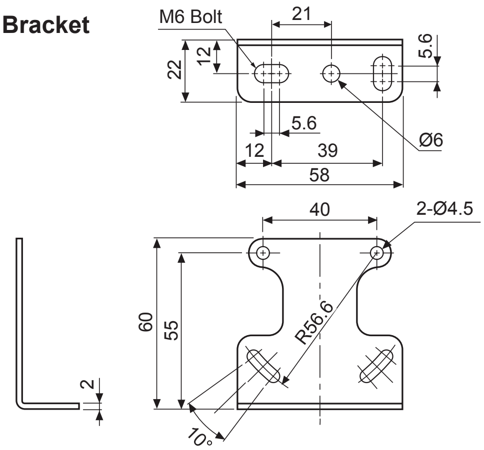
※1: Retroreflective: 21.25mm, Diffuse reflective: 20.25mm
※2: Retroreflective: 7.5mm, Diffuse reflective: 9.5mm

● **Reflector**

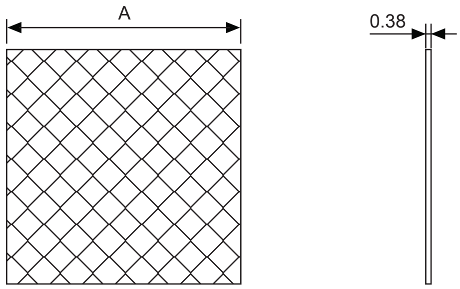
· **MS-2** · **MS-4 (sold separately)**



● **Bracket**



● **Reflective tape (sold separately)**



(unit: mm)

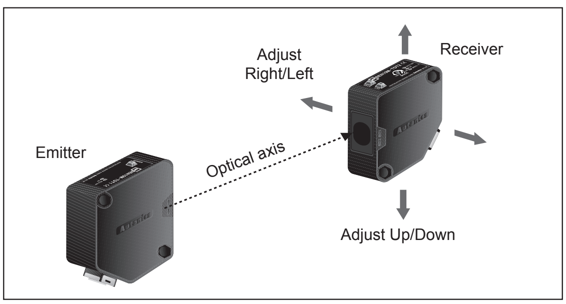
Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

■ Mounting and sensitivity adjustment

◎ Through-beam type

1. Supply the power to the photoelectric sensor, after setting the emitter and the receiver facing each other.
2. Set the receiver in center of position in the middle of the stability range of indicator by adjusting the receiver or the emitter right and left, up and down.
3. After the adjustment, check the stability of operation by putting the object at the optical axis.

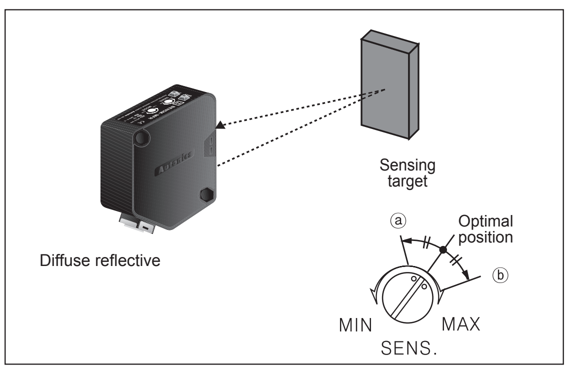
※If the sensing target is translucent body or smaller than Ø16mm, it can be missed by sensor because light penetrate it.



◎ Diffuse reflective type

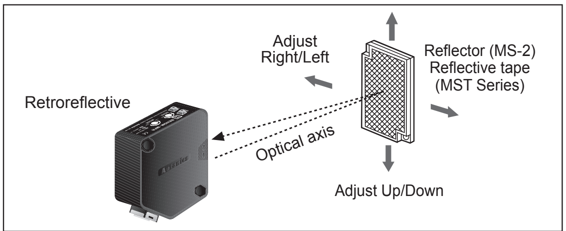
1. The sensitivity should be adjusted depending on a sensing target or mounting place.
2. Set the target at a position to be detected by the beam, then turn the sensitivity adjuster until position ⓐ where the operation indicator turns ON from min. position of the sensitivity adjuster.
3. Take the target out of the sensing area, then turn the sensitivity adjuster until position ⓑ where the operation indicator turns ON. If the indicator dose not turn ON, max. position is ⓑ.
4. Set the sensitivity adjuster at the center of two switching position ⓐ, ⓑ.

※The sensing distance indicated on specification chart is for 100×100mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.

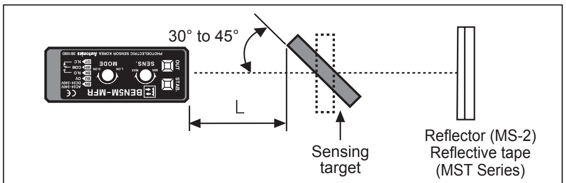


◎ Retroreflective type

1. Supply the power to the photoelectric sensor, after setting the photoelectric sensor and the reflector or reflective tape face to face.
2. Set the photoelectric sensor in the position which indicator turns on, by adjusting the reflector or the sensor right and left, up and down.
3. Fix both units tightly after checking that the unit detects the target.



※If using more than 2 photoelectric sensors in parallel, the space among them should be more than 30cm.
※If reflectance of target is higher than non-glossy white paper, it might cause malfunction by reflection from the target when the target is near to photoelectric sensor. Therefore put enough space between the target and the photoelectric sensor or the surface of the target should be installed at angle of 30° to 45° against optical axis. (When a sensing target with high reflectance near by, photoelectric sensing with the polarizing filter should be used.)
※Sensitivity adjustment: Refer to the diffuse reflective type's.

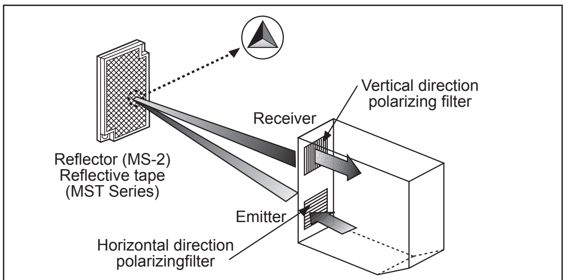


※If the mounting place is too narrow, please use MS-4 instead of MS-2.
※Please use reflective tape (MST series) for where a reflector is not installed.


<MS-4>

◎ Retroreflective type with polarizing filter

The light passed through the polarizing filter of the emitter reaches to the MS-2 reflector or reflective tape converting as horizontal direction. It reaches to the receiver element of polarizing filter converting as vertical by the MS-2 reflector or reflective tape. Therefore, this type can also detect reflective mirror.



※Please use reflective tape (MST Series) for where a reflector is not installed.

■ Reflectivity By Reflective Tape Model

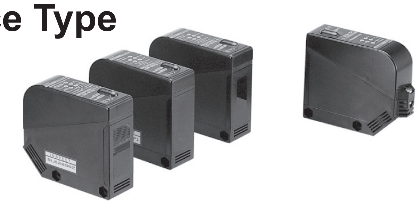
	Standard	Built-in polarizing filter
MST-50-10 (50×50mm)	90%	70%
MST-100-5 (100×100mm)	130%	90%
MST-200-2 (200×200mm)	140%	120%

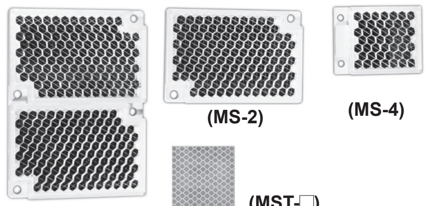
※This reflectivity is based on the reflector (MS-2).
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.
※For using reflective tape, installation distance should be min. 20mm.

Terminal Type And Long Sensing Distance Type

■ Features

- Sensitivity adjuster
- Timer function: ON Delay, OFF Delay, One-shot Delay
- NPN/PNP open collector output (DC power type)
- Self-diagnosis function (green LED turns on in stable level)
- Wide power supply range: Universal 24-240VDC/24-240VAC
- Protection structure IP66 (IEC standard)





(MS-2) (MS-4)

(MS-3) (MST-□)

※MS-4, MST-□ is sold separately.

⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Specifications

◎ Free power type, Relay contact output type

Model	Standard type	BX15M-TFR	BX5M-MFR	BX3M-PFR	BX700-DFR
	With Timer	BX15M-TFR-T	BX5M-MFR-T	BX3M-PFR-T	BX700-DFR-T
Sensing type		Through-beam	Retroreflective (standard type)	Retroreflective (built-in polarizing filter)	Diffuse reflective
Sensing distance		15m	0.1 to 5m (MS-2)※1	0.1 to 3m (MS-3)※2	700mm (non-glossy white paper 200×200mm)
Sensing target		Opaque materials of Min. Ø15mm	Opaque materials of Min. Ø60mm		Translucent, opaque material
Hysteresis		—			Max. 20% at rated setting distance
Response time		Max. 20ms			
Power supply		24-240VAC ±10% 50/60Hz, 24-240VDC ±10% (ripple P-P: max. 10%)			
Power consumption		Max. 3VA			
Light source		Infrared LED (850nm)		Red LED (660nm)	Infrared LED (940nm)
Sensitivity adjustment		Sensitivity adjuster			
Operation mode		Light ON/Dark ON operation mode switch			
Control output		Relay contact output (contact capacity: 30VDC 3A, 250VAC 3A at resistive load, contact composition: 1c)※3			
Relay life cycle		Mechanically: Min. 50,000,000, Electrically: Min. 100,000			
Self-diagnosis output		Self-diagnosis indiactor (green LED) turns on at stable operation			
Timer function		Selectable ON Delay, OFF Delay, One Shot Delay by slide switch [Delay Time: 0.1 to 5sec (timer adjuster)]			
Indicator		Operation indicator: yellow LED, Self-diagnosis indicator: green LED			
Connection		Terminal connection			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Insulation type		Double or strong insulation (mark: ⧈, dielectric voltage between the measured input and the power: 1.5kV)			
Noise immunity		±1,000V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength		1500VAC 50/60Hz for 1minute			
Vibration	Mechanical	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
	Malfunction	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 minutes			
Shock	Mechanical	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times			
Environment	Ambient illumination	Sunlight: Max. 11,000lx, Incandescent lamp: Max. 3,000lx (receiver illumination)			
	Ambient temperature	-20 to 55℃, storage: -25 to 70℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP66 (IEC standard)			
Material		Case, Lens cover: Polycarbonate, Sensing part: Acrylic, Bracket: Steel plate cold commercial, Bolt: Steel chromium molybdenum, Nut: Steel chromium molybdenum			
Accessory	Individual	—	Reflector (MS-2)	Reflector (MS-3)	—
	Common	Adjuster driver, Fixing bracket, Bolts, Nuts			
Approval		CE			
Unit weight		TFR: Approx. 225g TFR-T: Approx. 226g	MFR: Approx. 130g MFR-T: Approx. 131g	PFR: Approx. 148g PFR-T: Approx. 149g	DFR: Approx. 115g DFR-T: Approx. 116g

※1: It is the same when using the MS-4 reflector (sold separately). The sensor can detect under 0.1m.
※2: When using the MS-2 reflector, the sensing distance is 0.1 to 2m. The sensor can detect under 0.1m.
When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "■Reflectivity By Reflective Tape Model" table before using the tapes.
※3: Relay contact output of 1a type is option.
※Relay contact output of 1a type is option.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Specifications

◎ DC power type, Solid state output type

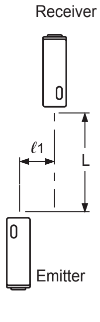
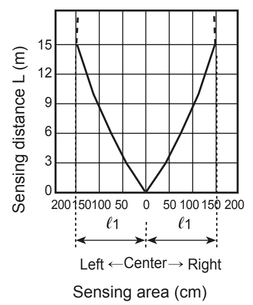
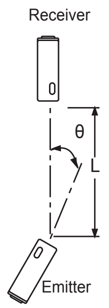
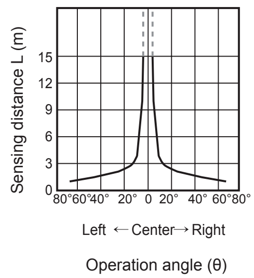
Model	Standard type	**BX15M-TDT**	**BX5M-MDT**	**BX3M-PDT**	**BX700-DDT**
	With Timer	**BX15M-TDT-T**	**BX5M-MDT-T**	**BX3M-PDT-T**	**BX700-DDT-T**
Sensing type		Through-beam	Retroreflective (standard type)	Retroreflective (built-in polarizing filter)	Diffuse reflective
Sensing distance		15m	0.1 to 5m (MS-2)※1	0.1 to 3m (MS-3)※2	700mm (non-glossy white paper 200×200mm)
Sensing target		Opaque materials of Min. Ø15mm	Opaque materials of Min. Ø60mm		Translucent, opaque material
Hysteresis		—			Max. 20% at rated setting distance
Response time		Max. 1ms			
Power supply		12-24VDC ±10% (ripple P-P:max. 10%)			
Current consumption		Max. 50mA			
Light source		Infrared LED (850nm)		Red LED (660nm)	Infrared LED (940nm)
Sensitivity adjustment		Sensitivity adjuster			
Operation mode		Light ON/Dark ON operation mode switch			
Control output		NPN or PNP open collector output ●Load voltage: Max. 30VDC ●Load current: Max. 200mA ●Residual voltage - NPN:Max. 1V, PNP:Max. 2.5V			
Self-diagnosis output		NPN open collector output (green LED turns on at stable operation and output (transistor output) turns on) ●Load voltage: Max. 30VDC ●Load current: Max. 50mA ●Residual voltage - Max. 1V(50mA), PNP: 0.4V(16mA)			
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit			
Timer function		Selectable ON Delay, OFF Delay, One Shot Delay by slide switch [Delay Time: 0.1 to 5sec (timer adjuster)]			
Indicator		Operation indicator: Yellow LED, Self-diagnosis indicator: Green LED			
Connection		Terminal connection			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength		1500VAC 50/60Hz for 1minute			
Vibration	Mechanical	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
	Malfunction	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 minutes			
Shock	Mechanical	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times			
Environment	Ambient illumination	Sunlight: Max. 11,000lx, Incandescent lamp: Max. 3,000lx (receiver illumination)			
	Ambient temperature	-20 to 55℃, storage: -25 to 70℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP66 (IEC standard)			
Material		Case, Lens cover: Polycarbonate, Sensing part: Acrylic, Bracket: Steel plate cold commercial, Bolt: Steel chromium molybdenum, Nut: Steel chromium molybdenum			
Accessory	Individual	—	Reflector (MS-2)	Reflector (MS-3)	—
	Common	Adjuster driver, Fixing bracket, Bolts, Nuts			
Approval		CE			
Unit weight		TDT: Approx. 211g TDT-T: Approx. 212g	MDT: Approx. 123g MDT-T: Approx. 124g	PDT: Approx. 141g PDT-T: Approx. 142g	DDT: Approx. 116g DDT-T: Approx. 117g

※1: It is the same when using the MS-4 reflector (sold separately). The sensor can detect under 0.1m.
※2: When using the MS-2 reflector, the sensing distance is 0.1 to 2m. The sensor can detect under 0.1m.
When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "■ Reflectivity By Reflective Tape Model" table before using the tapes.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

▣ Feature Data

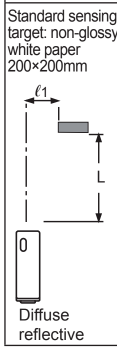
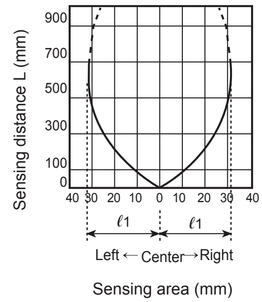
◎ Through-beam type

- **BX15M-TFR / BX15M-TFR-T**
- **BX15M-TDT / BX15M-TDT-T**

Parallel shifting characteristic		Angle Characteristic	
Measuring method	Data	Measuring method	Data
			

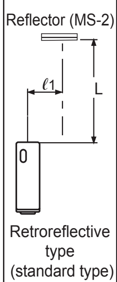
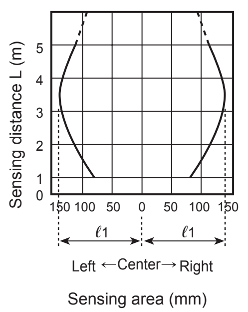
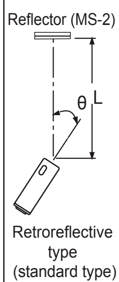
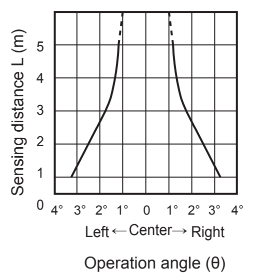
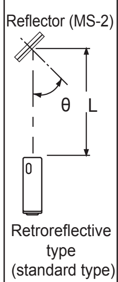
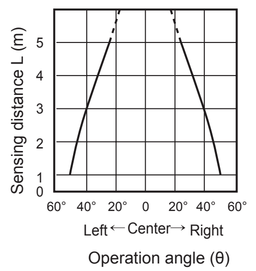
◎ Diffuse reflective type

- **BX700-DFR / BX700-DFR-T**
- **BX700-DDT / BX700-DDT-T**

Sensing area	
Measuring method	Data
	

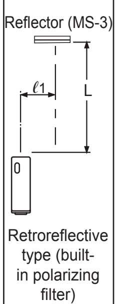
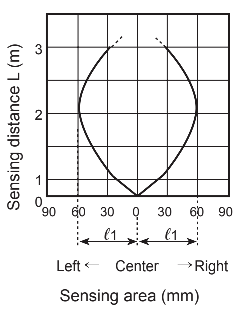
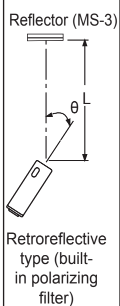
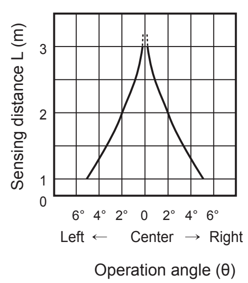
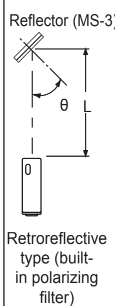
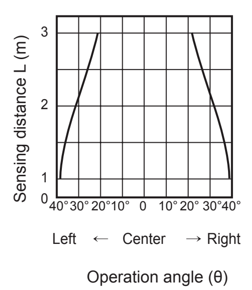
◎ Retroreflective type

- **BX5M-MFR / BX5M-MFR-T** • **BX5M-MDT / BX5M-MDT-T**

Parallel shifting characteristic		Angle Characteristic		Reflector angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data
					

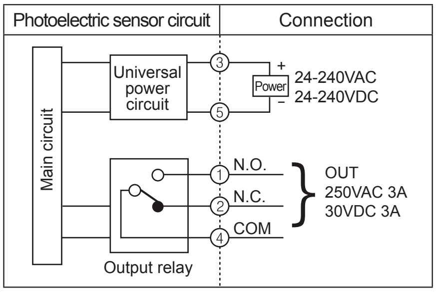
◎ Retroreflective type (Built-in polarizing filter)

- **BX3M-PFR /BX3M-PFR-T** • **BX3M-PDT / BX3M-PDT-T**

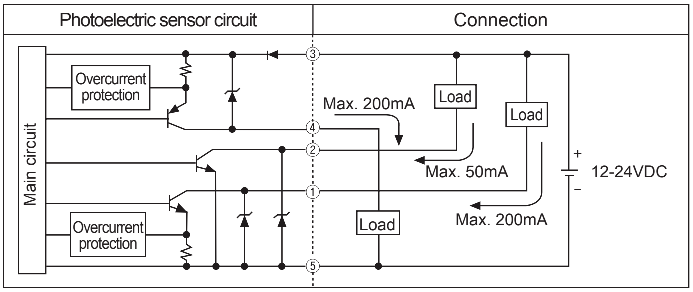
Parallel shifting characteristic		Sensor angle characteristic		Reflector angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data
					

■ Control Output Diagram

◎ Free power type (Relay contact output)

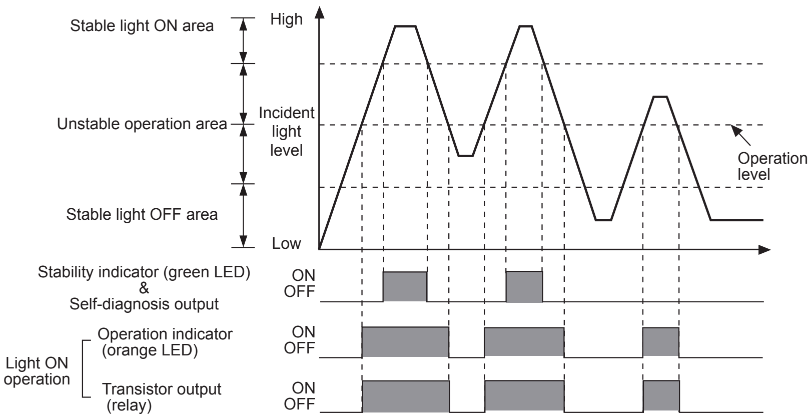


◎ DC power type (NPN/PNP open collector simultaneous output)



※In case of product with the output protection device, if terminals of control output are short-circuited or overcurrent condition exists, the control output will turn off due to protection circuit.

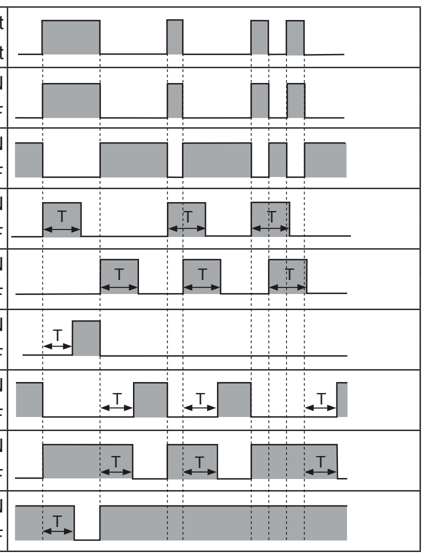
■ Operation Timing Diagram



※The waveforms of "Operation indicator" and "Transistor output" are for Light ON operation. They are opposite operation for Dark ON operation.
※If the control output terminal is short-circuit or over current than the rated current flows in the unit, the sensor does not operate normally by protection circuit.

■ Timer Mode

Timer mode	Switch position S1	Switch position S2	Operation mode \ Status of light	
				Received light / Interrupted light
Normal	ON	ON	Light ON	ON / OFF
			Dark ON	ON / OFF
One-shot Delay	ON	OFF	Light ON	ON / OFF
			Dark ON	ON / OFF
ON Delay	OFF	ON	Light ON	ON / OFF
			Dark ON	ON / OFF
OFF Delay	OFF	OFF	Light ON	ON / OFF
			Dark ON	ON / OFF

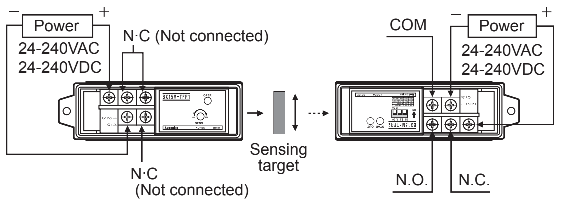


※T: Time can be set by the timer adjuster.
※Conversion to other timer modes is applied after a former mode is finished.

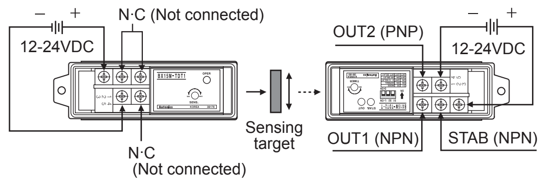
▣ Connections

◎ Through-beam type

● BX15M-TFR1 ● BX15M-TFR2 BX15M-TFR2-T

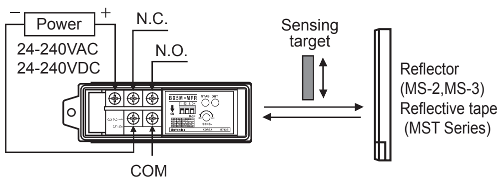


● BX15M-TDT1 ● BX15M-TDT2 BX15M-TDT2-T

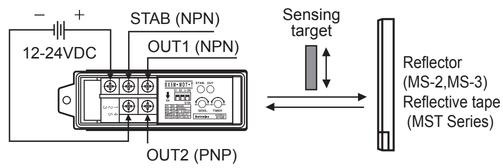


◎ Retroreflective type / Retroreflective type with polarizing filter

● BX5M-MFR, BX5M-MFR-T (standard type)
● BX3M-PFR, BX3M-PFR-T (built-in polarizing filter)

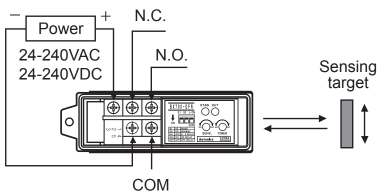


● BX5M-MDT, BX5M-MDT-T (standard type)
● BX3M-PDT, BX3M-PDT-T (built-in polarizing filter)

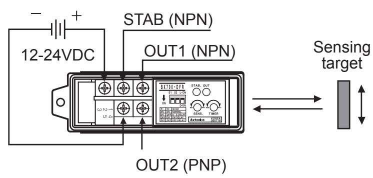


◎ Diffuse reflective type

● BX700-DFR, BX700-DFR-T

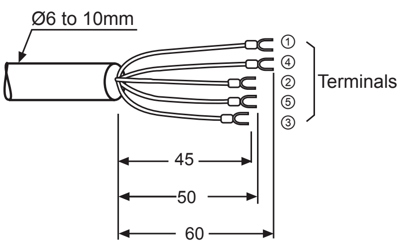


● BX700-DDT, BX700-DDT-T

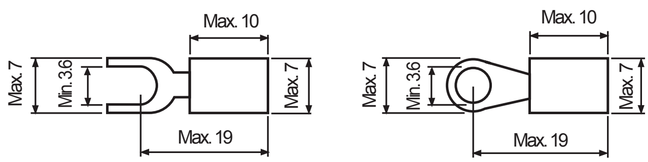


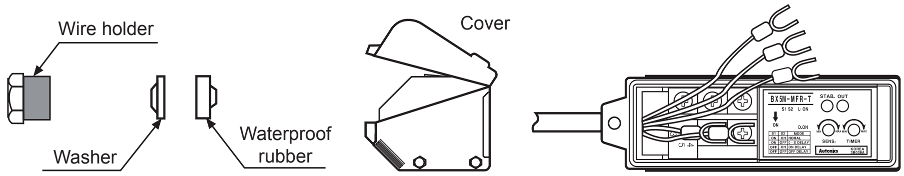
◎ Cable

(unit: mm)



●Crimp terminal size

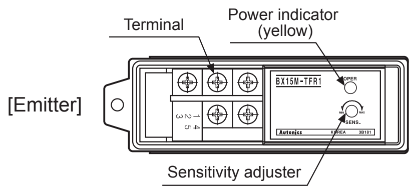


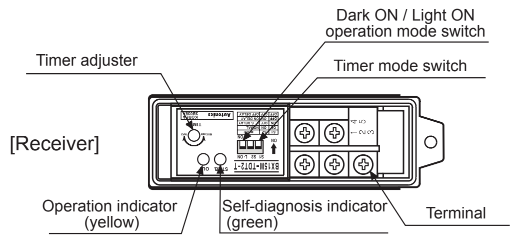


※To connect the wires on the terminal, following as above figures.
※Select the round wire with the size of Ø6 to 10mm for the waterproof and tighten the cable holder by torque of 1.0 to 1.5N·m.
※To connect the wires on the terminal, tighten screws by torque of 0.8N·m.

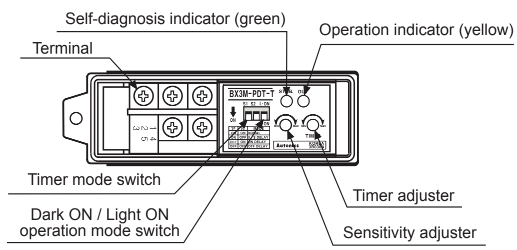
▣ Front Panel Identification

◎ Through-beam type

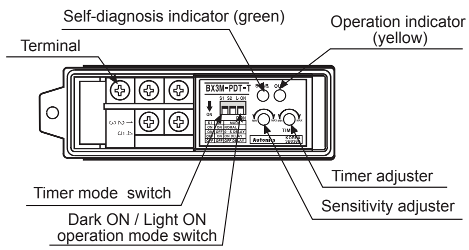




◎ Retroreflective type (Standard type, Built-in polarizing filter)



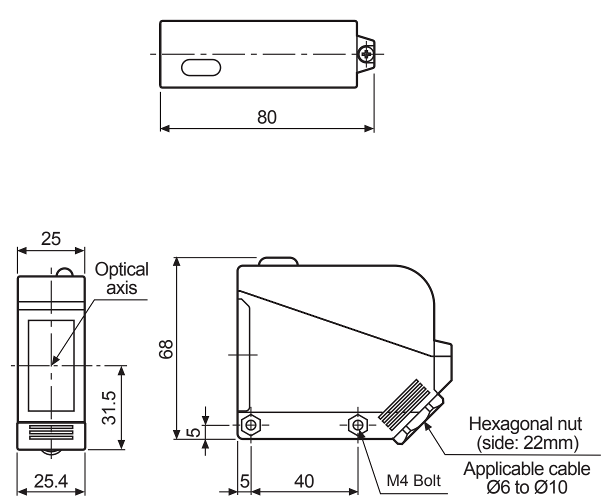
◎ Diffuse reflective type



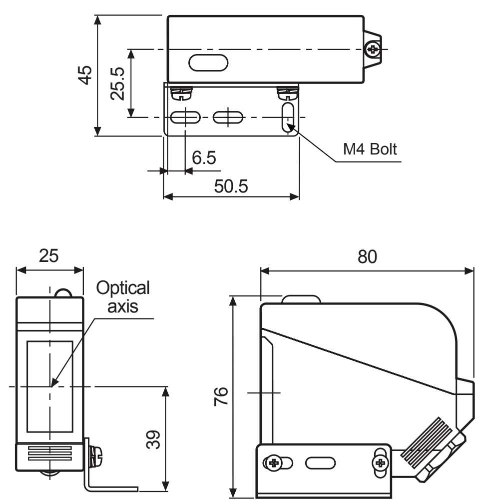
※There are no timer mode switch and the timer adjuster in no timer function type.

▣ Dimensions

(unit: mm)



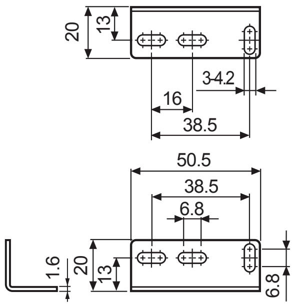
● **Connect the bracket**



▣ Dimensions

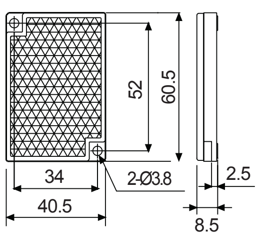
(unit: mm)

● **Bracket**

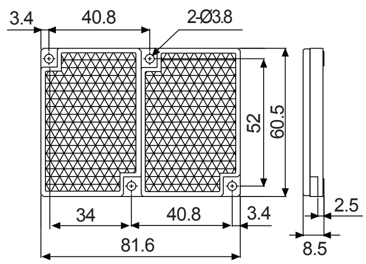


● **Reflector**

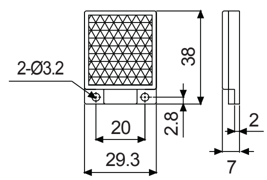
· **MS-2**



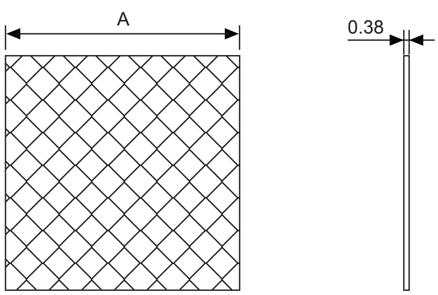
· **MS-3 (sold separately)**



· **MS-4 (sold separately)**



● **Reflective tape (sold separately)**



(unit: mm)

Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

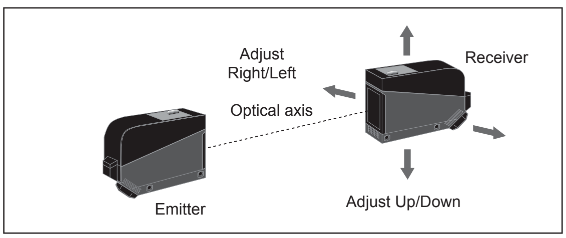
▣ Mounting And Sensitivity Adjustment

◎ Through-beam type

1. Supply the power to the photoelectric sensor, after setting the emitter and the receiver facing each other.
2. Set the receiver in center of position in the middle of the operation range of indicator by adjusting the receiver or the emitter right and left, up and down.
3. After the adjustment, check the stability of operation by putting the object at the optical axis.

※If the sensing target is translucent body or smaller than Ø15mm, it can be missed by sensor because light penetrate it.

※Sensitivity adjustment: Refer to the diffuse reflective type's.

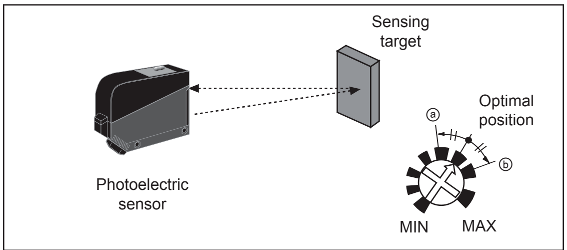


◎ Diffuse reflective type

1. The sensitivity should be adjusted depending on a sensing target or mounting place.
2. Set the target at a position to be detected by the beam, then turn the sensitivity adjuster until position ⓐ where the operation indicator (yellow LED) turns ON and the self-diagnosis indicator (green LED) turns OFF from min. position of the sensitivity adjuster.
3. Take the target out of the sensing area, then turn the sensitivity adjuster until position ⓑ where the operation indicator (yellow LED) turns OFF and the self-diagnosis indicator (green LED) turns ON. If the indicators do not operate, max. position is ⓑ.
4. Set the sensitivity adjuster at the center of two switching position ⓐ, ⓑ.

※Above sensitivity adjustment is for Light ON mode. If it is for Dark ON mode, operation indicator (yellow LED) operates opposite.

※The sensing distance indicated on specification chart is for 200×200mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.



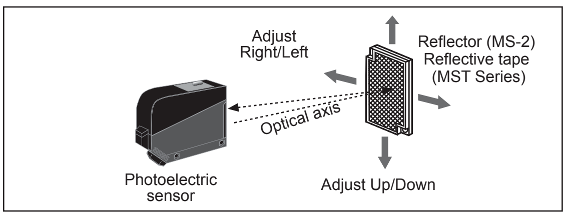
◎ Retroreflective type

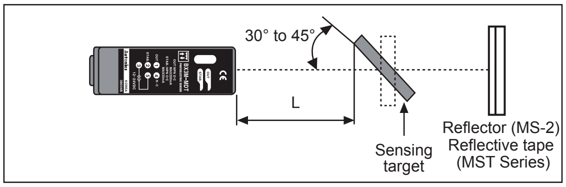
1. Supply the power to the photoelectric sensor, after setting the photoelectric sensor and the reflector or reflective tape face to face.
2. Set the photoelectric sensor in the position which indicator turns on, by adjusting the reflector (or reflective tape) or the sensor right and left, up and down.
3. Fix both units tightly after checking that the unit detects the target.

※If using more than 2 photoelectric sensors in parallel, the space among them should be more than 30cm.

※If reflectance of target is higher than non-glossy white paper, it might cause malfunction by reflection from the target when the target is near to photoelectric sensor. Therefore put enough space between the target and the photoelectric sensor or the surface of the target should be installed at angle of 30° to 45° against optical axis. (When a sensing target with high reflectance near by, photoelectric sensing with the polarizing filter should be used.)

※Sensitivity adjustment: Refer to the diffuse reflective type's.





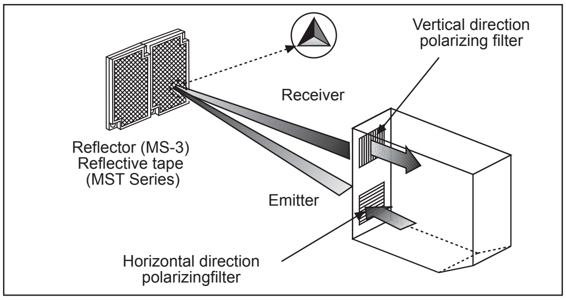
※If the mounting place is too narrow, please use MS-4 instead of MS-2.

※Please use reflective tape (MST Series) for where a reflector is not installed.


<MS-4>

◎ Retroreflective type (Built-in polarizing filter)

The light passed through the polarizing filter of the emitter reaches to the MS-3 reflector or reflective tape converting as horizontal direction. It reaches to the receiver element of polarizing filter converting as vertical by the MS-3 reflector or reflective tape. Therefore, this type can also detect reflective mirror.



※Please use reflective tape (MST Series) for where a reflector is not installed.

■ Reflectivity By Reflective Tape Model

Model	Standard	Built-in polarizing filter
MST-50-10 (50×50mm)	90%	30%
MST-100-5 (100×100mm)	100%	40%
MST-200-2 (200×200mm)	110%	60%

※This reflectivity is based on the reflector (MS-2).

※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.

※For using reflective tape, installation distance should be min. 20mm.

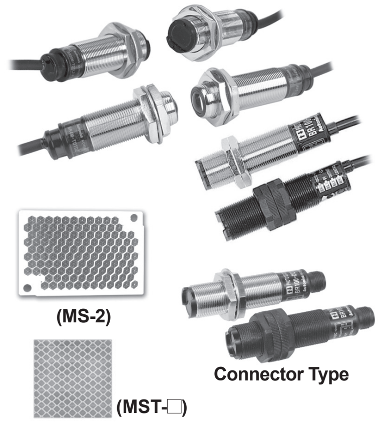
Upgraded Cylindrical (Ø18mm) Type

■ Features

- Realizes long sensing distance (20m) (through-beam type)
- Superior noise resistance with digital signal processing
- High-speed response time under 1ms
- Built-in reverse polarity protection circuit and output overcurrent (short-circuit) protection circuit
- Suitable for sensing in narrow space (narrow beam type)
- External sensitivity adjustment (except Through-beam type)
- Light ON, Dark ON switchable by control wire (except Through-beam type)
- Excellent environment-resistance performance with glass lens(BR4M)
- Protection structure IP66 (IEC standard)

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE



(MS-2)

Connector Type

(MST-□)

※The model name with '-C' is connector type.
※MST-□ is sold separately.

■ Specifications

Model	NPN open collector output	BRP100-DDT	BR100-DDT	BRP400-DDT	BR400-DDT	BRP200-DDTN	BR200-DDTN	BRP3M-MDT	BR3M-MDT	BR4M-TDTD BR20M-TDTD	BR4M-TDTL BR20M-TDTL
		BRP100-DDT-C	BR100-DDT-C	BRP400-DDT-C	BR400-DDT-C	BRP200-DDTN-C	BR200-DDTN-C	BRP3M-MDT-C	BR3M-MDT-C	BR4M-TDTD-C BR20M-TDTD-C	BR4M-TDTL-C BR20M-TDTL-C
	PNP open collector output	BRP100-DDT-P	BR100-DDT-P	BRP400-DDT-P	BR400-DDT-P	BRP200-DDTN-P	BR200-DDTN-P	BRP3M-MDT-P	BR3M-MDT-P	BR4M-TDTD-P BR20M-TDTD-P	BR4M-TDTL-P BR20M-TDTL-P
		BRP100-DDT-C-P	BR100-DDT-C-P	BRP400-DDT-C-P	BR400-DDT-C-P	BRP200-DDTN-C-P	BR200-DDTN-C-P	BRP3M-MDT-C-P	BR3M-MDT-C-P	BR4M-TDTD-C-P BR20M-TDTD-C-P	BR4M-TDTL-C-P BR20M-TDTL-C-P
Case		Plastic	Metal	Plastic	Metal	Plastic	Metal	Plastic	Metal	Metal	Metal
Sensing type		Diffuse reflective				Narrow beam reflective		Retroreflective		Through-beam	
Sensing distance		100mm (non-glossy white paper 50×50mm)		400mm (non-glossy white paper 100×100mm)		200mm (non-glossy white paper 100×100mm)		0.1 to 3m※1 (MS-2)		4m / 20m	
Sensing target		Translucent, Opaque materials						Opaque materials of min. Ø60mm		Opaque materials of min. Ø15mm	
Hysteresis		Max. 20% at rated setting distance						—			
Response time		Max. 1ms.									
Power supply		12-24VDC ±10% (ripple P-P: Max. 10%)									
Current consumption		Max. 45mA									
Light source		Infrared LED (940nm)		Infrared LED (850nm)				Red LED (660nm)		Infrared LED (850nm)	
Sensitivity adjustment		Adjustable (sensitivity adjuster)								Fixed	
Operation mode		Selectable Light ON or Dark ON by control cable (white)								Dark ON	Light ON
Control output		NPN or PNP open collector output ●Load voltage: Max. 30VDC ●Load current: Max. 200mA ●Residual voltage - NPN: Max. 1V, PNP: Max. 2.5V									
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit									
Indicator		Operation indicator: red LED, Power indicator: red LED (only for emitter of through-beam type)									
Insulation resistance		Over 20MΩ (at 500VDC megger)									
Noise immunity		±240V the square wave noise (pulse width: 1µs) by the noise simulator									
Dielectric strength		1000VAC 50/60Hz for 1 minute									
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours									
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times									
Environment	Ambient illumination	Sunlight: Max. 11,000lx, Incandescent lamp: Max. 3,000lx (receiver illumination)									
	Ambient temperature	-10 to 60℃, storage: -25 to 75℃									
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH									
Protection structure		IP66 (IEC standard) (BR20M Series: IP67)									
Material		●Case - BRP: Polyamide (black) BR: Brass, Ni-plate ●Sensing part - Polycarbonate lens ●Nut: C3604BDS-F ●Washer: Steel plate cold commercial						●Case - BRP3M: Polyamide (black) BR3M: Brass, Ni-plate ●Sensing part - Acrylic lens ●Nut: C3604BDS-F ●Washer: Steel plate cold commercial		●Case - Brass, Ni-plate ●Sensing part - BR4M: Glass lens BR20M: Polycarbonate lens ●Nut: C3604BDS-F ●Washer: Steel plate cold commercial	
Cable		●BR (P): Ø5mm, 4-wire, 2m (emitter of through-beam type: Ø5mm, 2-wire, 2m / receiver: Ø5mm, 3-wire, 2m) (AWG 22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm) ●BR (P)-C: M12 connector									
Acce-ssory	Individual	Adjuster driver						Adjuster driver, Reflector (MS-2)		—	
	Common	BR: Fixing nuts, Washer / BRP: Fixing nuts									
Approval		CE									
Weight		●BRP Series: Approx. 100g ●BR Series: Approx. 120g ●BRP-C Series: Approx. 70g (approx. 30g)※2 ●BR-C Series: Approx. 90g (approx. 50g)※2								●BR Series: Approx. 300g ●BR-C Series: Approx. 150g (approx.110g)※2	

※1: The sensing distance is specified with using the MS-2 reflector. Sensing distance is the setting range of the reflector. The sensor can detect under 0.1m. When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "■ Reflectivity By Reflective Tape Model" table before using the tapes.
※2: The weight inclndes packaging. The weight in parenthesis is for unit only.
※Tightening torque for connector is 0.39 to 0.49N.m.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature Data

◎ Diffuse reflective type / Narrow beam reflective type

<table>
<tr><td colspan="2">●BR100-DDT-□(-P)/BRP100-DDT-□(-P)</td><td colspan="2">●BR400-DDT-□(-P)/BRP400-DDT-□(-P)</td><td colspan="2">●BR200-DDTN-□(-P)/BRP200-DDTN-□(-P)</td></tr>
<tr><td colspan="2">Sensing area characteristic</td><td colspan="2">Sensing area characteristic</td><td colspan="2">Sensing area characteristic</td></tr>
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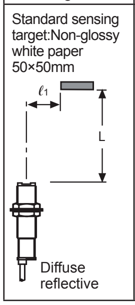
<td>
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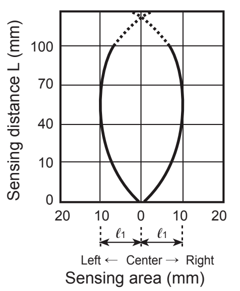
<td>
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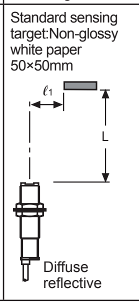
<td>
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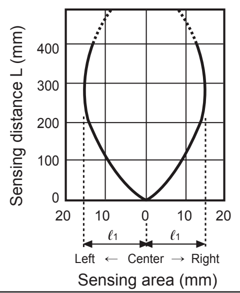
<td>
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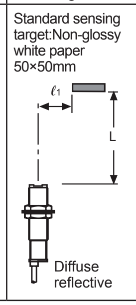
<td>
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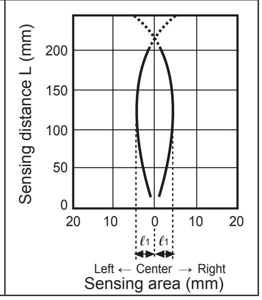
<td>
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◎ Retroreflective type

● BR3M-MDT-□(-P) / BRP3M-MDT-□(-P)

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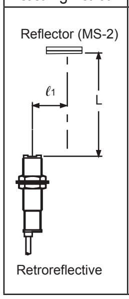
<td>
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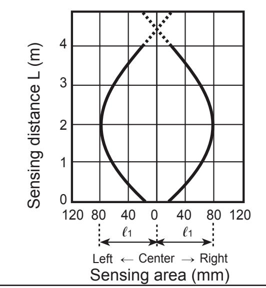
<td>
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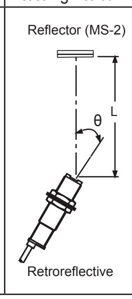
<td>
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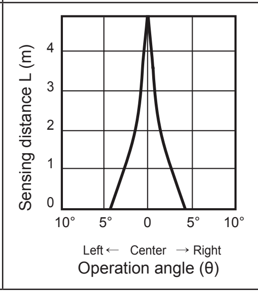
<td>
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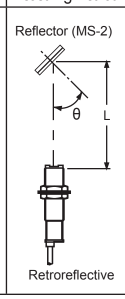
<td>
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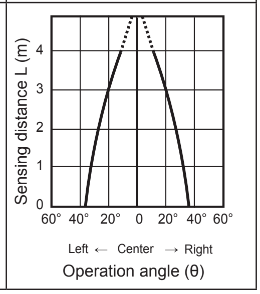
<td>
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◎ Through-beam type

● BR4M-TDT□-□ / BR4M-TDT□-□-P

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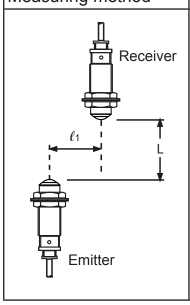
<td>
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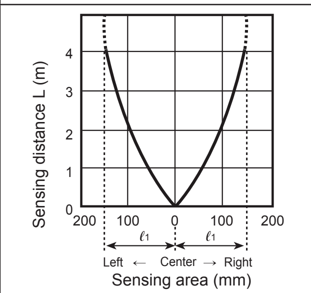
<td>
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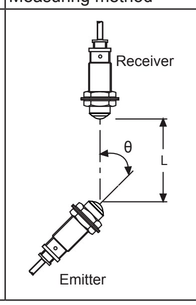
<td>
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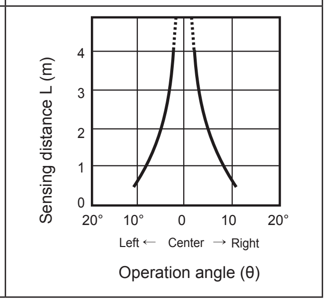
<td>
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● BR20M-TDT□-□ / BR20M-TDT□-□-P

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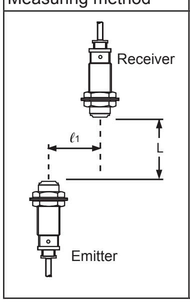
<td>
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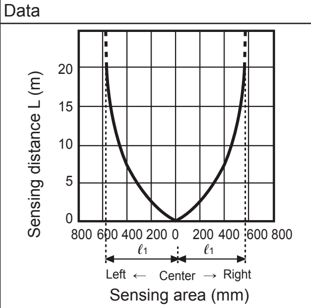
<td>
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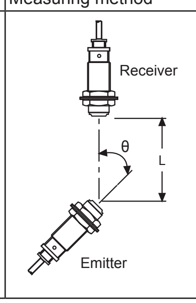
<td>
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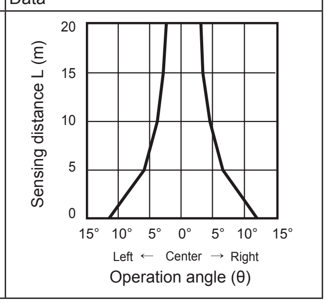
<td>
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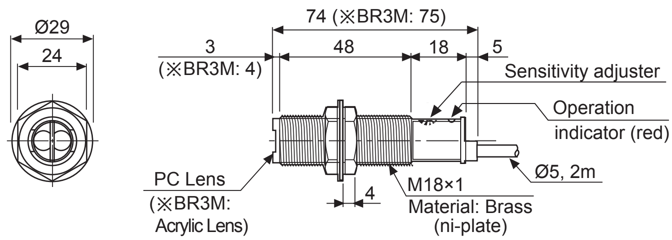
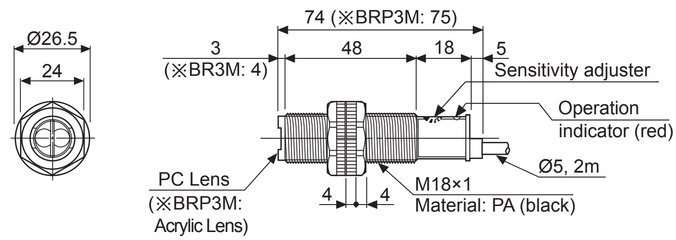
■ Dimensions

(unit: mm)

- **BR100-DDT / BR100-DDT-P**
- **BR400-DDT / BR400-DDT-P**
- **BR200-DDTN / BR200-DDTN-P**
- **BR3M-MDT / BR3M-MDT-P (※)**



- **BRP100-DDT / BRP100-DDT-P**
- **BRP400-DDT / BRP400-DDT-P**
- **BRP200-DDTN / BRP200-DDTN-P**
- **BRP3M-MDT / BRP3M-MDT-P (※)**



- **BR4M-TDTD / BR4M-TDTD-P / BR4M-TDTL / BR4M-TDTL-P BR20M-TDTD / BR20M-TDTD-P / BR20M-TDTL / BR20M-TDTL-P**

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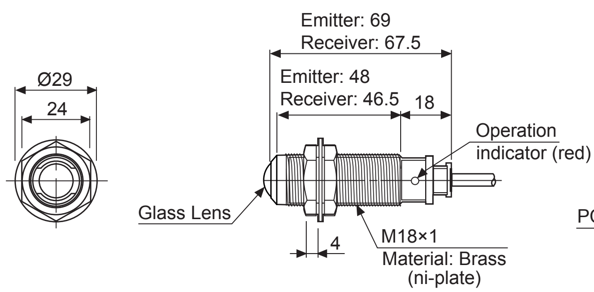

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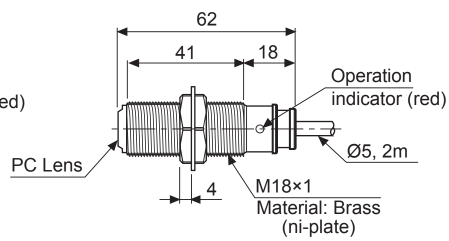
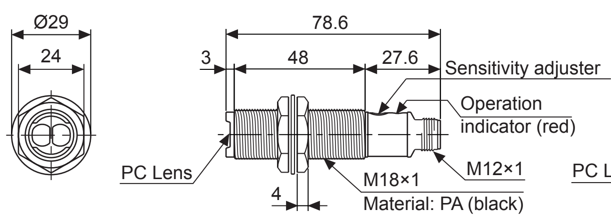


- **BR100/200/400-DDT(N)-C(-P)**



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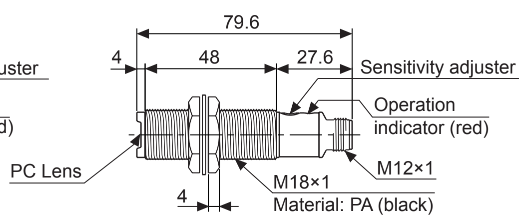
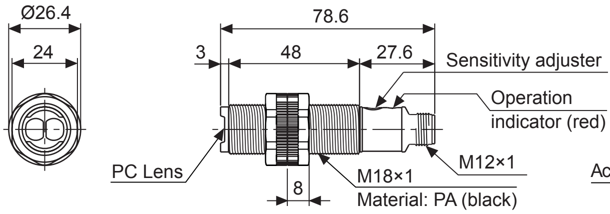
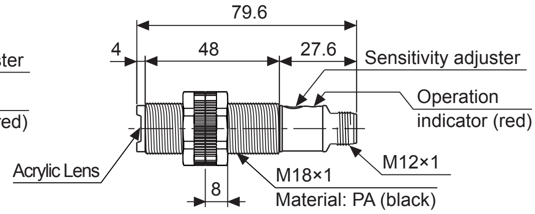


(unit: mm)

- **BRP100/200/400-DDT(N)-C(-P)**



- **BR3M-MDT-C(-P)**



- **BR4M-TDTD(L)-C(-P)**

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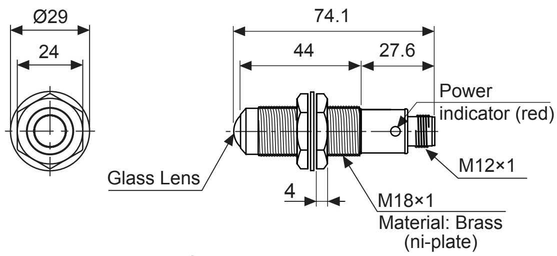
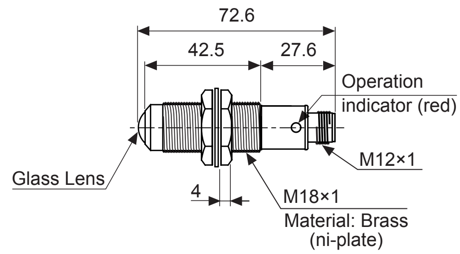
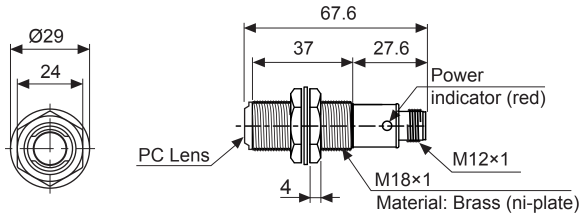


<Receiver>

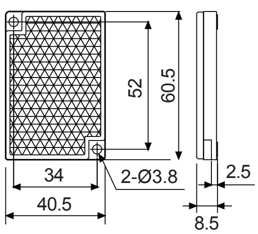


- **BR20M-TDTD (L)-C (-P)**

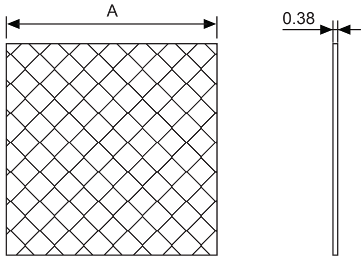


- **Reflector**

<MS-2>



- **Reflective tape (sold separately)**



(unit: mm)

Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

■ Operation Mode

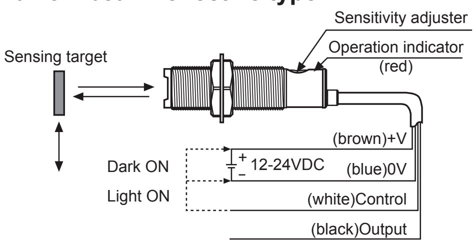
Operation mode	Light ON	Dark ON
Receiver operation	Received light Interrupted light	Received light Interrupted light
Operation indicator (red LED)	ON OFF	ON OFF
Transistor output	ON OFF	ON OFF

※The transistor output is held OFF for 0.5 sce after supplied power in order to prevent malfunction of this photoelectric sensor (except through-beam type).

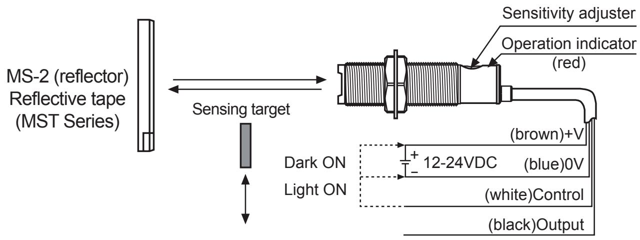
※If the control output terminal is short-circuited or flown over rated current, the control signal is not output normally due to protection circuit.

■ Connections

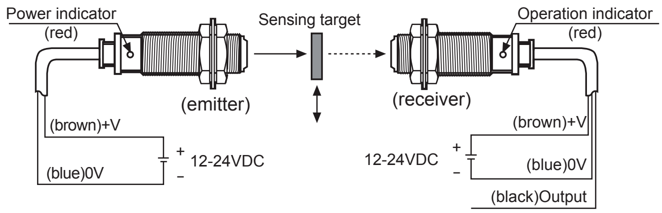
● Diffuse reflective type / Narrow beam reflective type



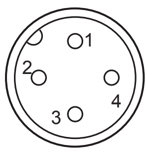
● Retroreflective type



● Through-beam type



■ Connections For Connector Part



M12 Connector pin

Connector pin No.	Cable colors	Application		
		Diffuse/ Narrow beam reflective/ Retroreflective type	Through-beam type	
			Emitter	Receiver
1	Brown	24VDC	24VDC	24VDC
2	White	CONTROL	N.C	GND
3	Blue	GND	GND	GND
4	Black	OUTPUT	N.C	OUTPUT

● Connector cable (sold separately)

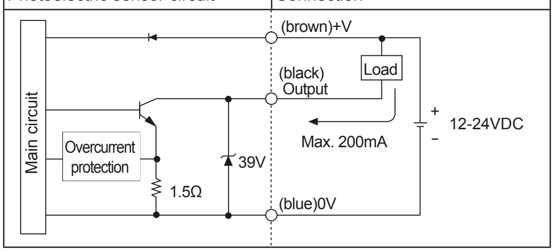
※Please refer to the G-6 for connector cable.

■ Control Output Diagram

● NPN open collector output

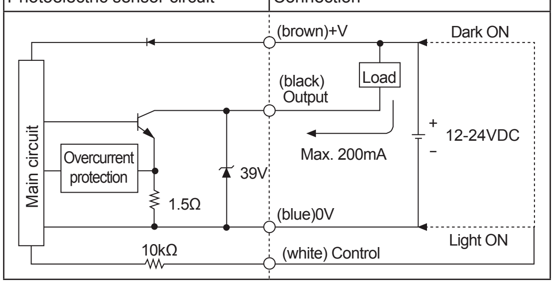
Through-beam (receiver)

Photoelectric sensor circuit	Connection



Diffuse reflective/Narrow beam reflective/Retroreflective

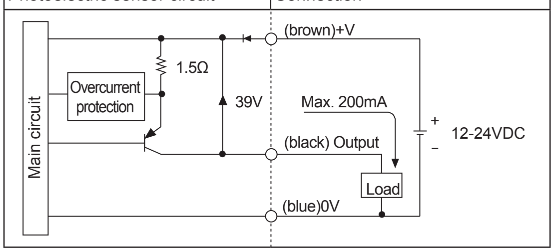
Photoelectric sensor circuit	Connection



● PNP open collector output

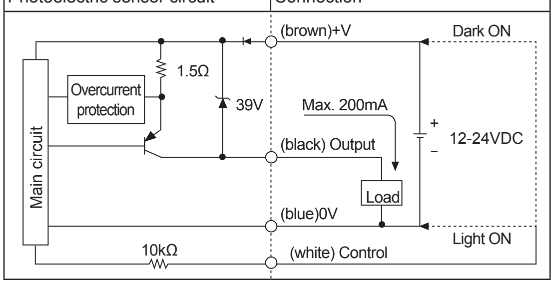
Through-beam (receiver)

Photoelectric sensor circuit	Connection



Diffuse reflective/Narrow beam reflective/Retroreflective

Photoelectric sensor circuit	Connection



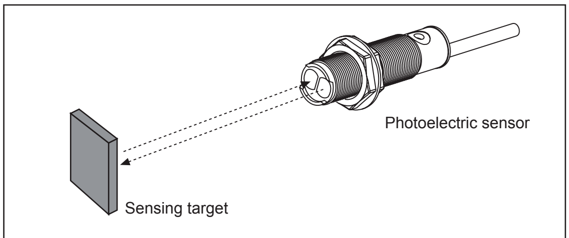
※Before using this unit, select Light ON/Dark ON with control cable. (light on: connect control cable with 0V / dark on: connect control cable with +V)
※Control cable is only for Diffuse reflective/Narrow beam reflective/Retroreflective type.

▣ Mounting And Sensitivity Adjustment

Install the sensor to the desired place and check the connections. Supply the power to the sensor and adjust the optical axis and the sensitivity as follow ;

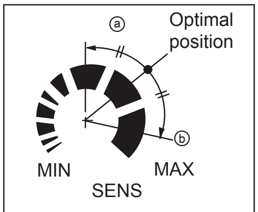
◎ Diffuse reflective/Narrow beam reflective type

1. The sensitivity should be adjusted depending on a sensing target or mounting place.



2. Set the target at a position to be detected by the beam, then turn the sensitivity adjuster until position ⓐ where the operation indicator turns ON from min. position of the sensitivity adjuster.
3. Take the target out of the sensing area, then turn the sensitivity adjuster until position ⓑ where the operation indicator turns ON. If the indicator dose not turn ON, max. position is ⓑ.
4. Set the sensitivity adjuster at the center of two switching position ⓐ, ⓑ.

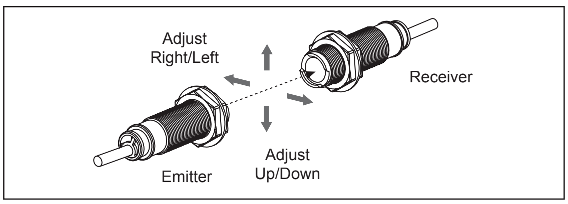
※The sensing distance indicated on specification chart is for 100×100mm or 50×50mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.



◎ Through-beam type

1. Supply the power to the photoelectric sensor, after setting the emitter and the receiver facing each other.
2. Set the receiver in center of position in the middle of the operation range of indicator by adjusting the receiver or the emitter right and left, up and down.
3. After the adjustment, check the stability of operation by putting the object at the optical axis.

※If the sensing target is translucent body or smaller than Ø15mm, it can be missed by sensor because light penetrate it.



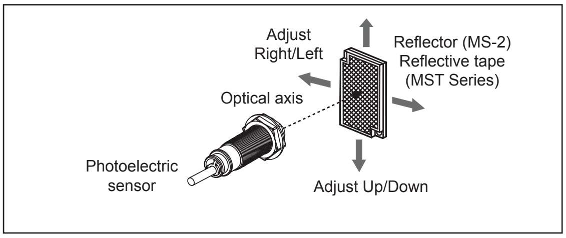
◎ Retroreflective type

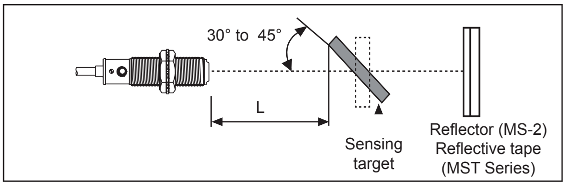
1. Supply the power to the photoelectric sensor, after setting the photoelectric sensor and the reflector (MS-2) or reflective tape face to face.
2. Set the photoelectric sensor in the position which indicator turns on, by adjusting the reflector or the sensor right and left, up and down.
3. Fix both units tightly after checking that the unit detects the target.

※If using more than 2 photoelectric sensors in parallel, the space among them should be more than 30cm.

※If reflectance of target is higher than non-glossy white paper, it might cause malfunction by reflection from the target when the target is near to photoelectric sensor. Therefore put enough space between the target and the photoelectric sensor or the surface of the target should be installed at angle of 30° to 45° against optical axis. (when a sensing target with high reflectance near by, photoelectric sensing with the polarizing filter should be used.)

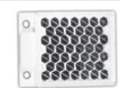
※Sensitivity adjustment: Refer to the diffuse reflective type's.





※If the mounting place is too narrow, please use MS-4 instead of MS-2.

※Please use reflective tape (MST Series) for where a reflector is not installed.


<MS-4>

▣ Reflectivity By Reflective Tape Model

MST-50-10 (50×50mm)	80%
MST-100-5 (100×100mm)	120%
MST-200-2 (200×200mm)	140%

※This reflectivity is based on the reflector (MS-2).

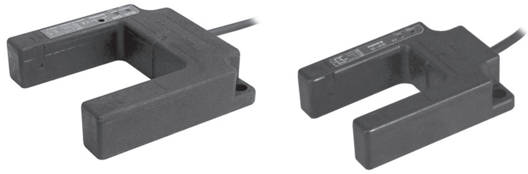
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.

※For using reflective tape, installation distance should be min. 20mm.

Reinforced Plastic Case U-shaped Type

■ Features

- Improvs noise resistance to disturbance light
- Max. 1ms high speed response type
- Built-in reverse polarity protection circuit and output overcurrent (short-circuit) protection circuit
- Light ON / Dark ON Selectable by control wire
- Protection structure IP66 (IEC standard) : BUP-30, BUP-50



⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

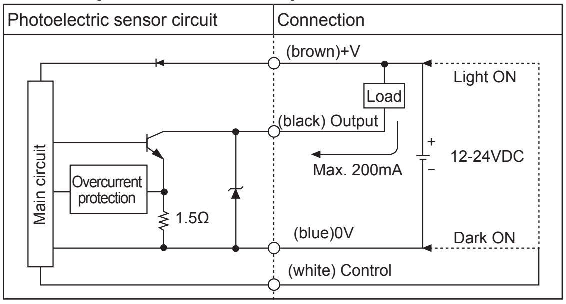
■ Specifications

Model	NPN open collector output	**BUP-30**	**BUP-30S**	**BUP-50**	**BUP-50S**
	PNP open collector output	**BUP-30-P**	**BUP-30S-P**	**BUP-50-P**	**BUP-50S-P**
Sensing type		Through-beam			
Sensing target		Opaque materials of min. Ø4mm	Opaque materials of min. Ø1.5mm	Opaque materials of min. Ø4mm	Opaque materials of min. Ø1.5mm
Operation mode		Selectable Light ON or Dark ON by control wire			
Sensing distance		30mm		50mm	
Response speed		Max. 1ms			
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)			
Current consumption		Max. 30mA			
Light source		Infrared LED (940nm)			
Sensitivity adjustment		Fixed	Sensitivity adjuster	Fixed	Sensitivity adjuster
Control output		NPN or PNP open collector output ●Load voltage: Max. 30VDC ●Load current: Max. 200mA ●Residual voltage - NPN: Max. 1V, PNP: Max. 2.5V			
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit			
Indication		Power indicator: green LED, Operation indicator: red LED			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Noise immunity		±240V the square wave noise (pulse width: 1µs) by the noise simulator			
Dielectric strength		1,000VAC 50/60Hz for 1 minute			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
Environment	Ambient illumination	Sunlight: Max. 11,000lx Incandescent lamp: Max. 3,000lx (receiving illumination)			
	Ambient temperature	-25 to 65℃[BUP-30S (-P) & BUP-50S (-P): -10 to 60℃], storage: -25 to 70℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP66 (IEC standard)	IP50 (IEC standard)	IP66 (IEC standard)	IP50 (IEC standard)
Material		Case: Acrylonitrile butadiene styrene, Cap: Polycarbonate			
Cable		Ø4mm, 4-wire, 2m (AWG22, core diameter: 0.08mm, number of cores: 60, insulation out diameter: Ø1.25mm)			
Accessory		—	Adjuster driver	—	Adjuster driver
Approval		CE			
Unit weight		Approx. 90g		Approx. 140g	

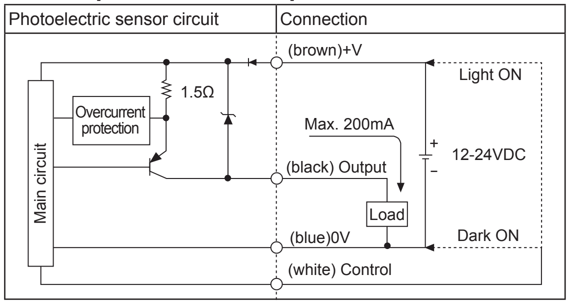
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Control Output Diagram

● **NPN open collector output**



● **PNP open collector output**



※Select Light ON / Dark ON by control wire. - Light ON: Connect control wire to +V / Dark ON: Connect control wire to 0V

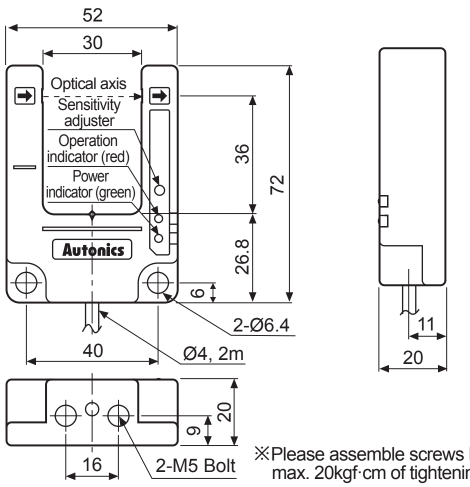
■ Operation Mode

Operation mode	Light ON		Dark ON	
Receiver operation	Received light Interrupted light		Received light Interrupted light	
Operation indicator (red LED)	ON OFF		ON OFF	
Transistor output	ON OFF		ON OFF	

■ Dimensions

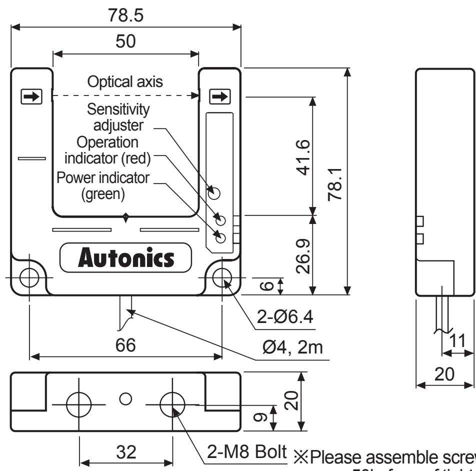
(unit: mm)

● **BUP-30, BUP-30-P, BUP-30S, BUP-30S-P**



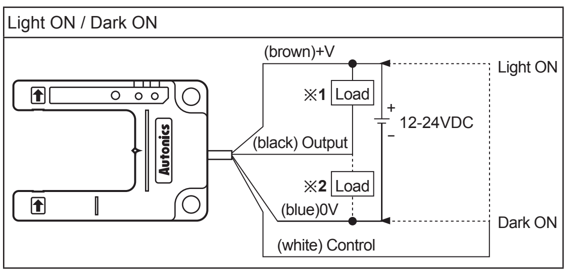
※Please assemble screws M5 with max. 20kgf·cm of tightening torque.

● **BUP-50, BUP-50-P, BUP-50S, BUP-50S-P**



※Please assemble screws M8 with max. 50kgf·cm of tightening torque.

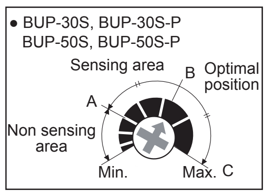
■ Connections



※1: Load connection for NPN open collector output
※2: Load connection for PNP open collector output

■ Mounting And Sensitivity Adjustment

Check the position where the photoelectric sensor will be used and the connection then supply the power and set sensitivity as below.



When placing a target within sensing range of sensor, turn the sensitivity adjuster from the minimum position and check the position 'A' where the operation indicator is turned on (dark on) or turned off (light on). Turn the sensitivity adjuster to 'B' in the middle between 'A' and 'C' which is the maximum sensitivity position, this will be the optimal sensitivity position. (the operation indicator can be operated at the lowest sensitivity position.)

4-CH U-shaped Type

NEW

■ Features

- Highly reliable 4 channel detection
- High-speed response time under 1 ms
- Built-in reverse polarity protection circuit and output overcurrent (short-circuit) protection circuit
- IP65 protection structure (IEC standard)

Please read "Caution for your safety" in operation manual before using.

■ Specifications

Model	BUM4-40D-W-4M	BUM4-40D-W-2M/A	BUM4-40D-W-3M/A	BUM4-40D-W-4M/A	BUM4-40D-W-2M/B	BUM4-40D-W-3M/B	BUM4-40D-W-4M/B
Sensing type	Through-beam						
Sensing distance	40mm						
Sensing target	Opaque materials of min. Ø4.0mm						
Sensing CH	4 channels						
Hysteresis	Max. 1ms						
Power supply	18-35VDC ±10% (ripple P-P: max. 10%)						
Current consumption	Max. 50mA						
Light source	Infrared LED (940nm)						
Operation mode	Dark ON						
Control output	NPN open collector output (individual 4 outputs) • Load voltage: Max. 35VDC, • Load current: Max. 100mA, • Residual voltage: Max. 4V						
Protection circuit	Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit						
Indicator	Output indicator: red LED, Power indicator: green LED						
Insulation resistance	Over 20MΩ (at 500VDC megger)						
Noise immunity	±240V the sqaure wave noise (pulse width 1μs) by noise simulator						
Dielectric strength	1000VAC 50/60Hz for 1 min						
Vibration	1.5mm amplitude at frequency of 10to 55Hz (for 1 min) in each of X, Y, Z directions for 2 hours						
Shock	500m/s² (approx. 50G) in each of X, Y, Z directions for 3 times						
Environment: Ambient illumination	Sunlight: Max. 11000lx , Incandescent lamp: Max. 3000lx (receiver illumination)						
Environment: Ambient temperature	-25 to 65℃, storage: -25 to 70℃						
Environment: Ambient humidity	35 to 85%RH, storage: 35 to 85%RH						
Protection	IP65 (IEC standards)						
Material	Case, Cover: ABS						
Cable	Ø6.0mm, 8-wire (AWG 22, core diameter: Ø1.2, number of cores: 60)						
Cable length	4m	2m	3m	4m	2m	3m	4m
Bracket	—	H01/H04 (G01)			H03/H04 (G02)		
Approval	CE						
Weight	Approx. 510g (approx. 500g)	Approx. 1.5kg (approx. 500g)					

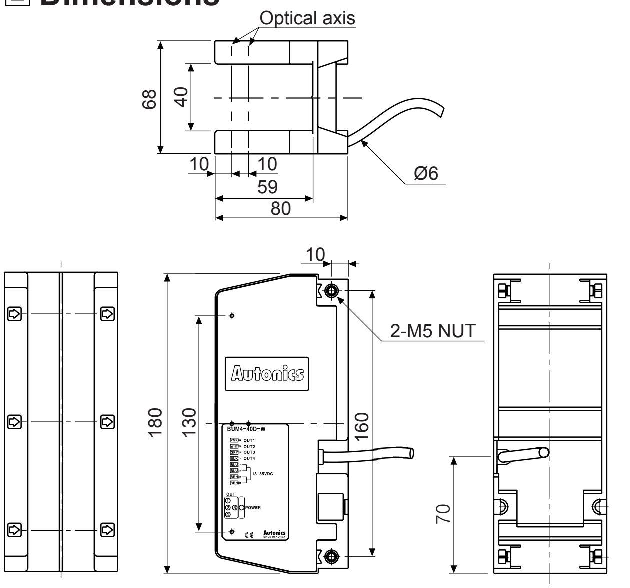
※1: The weight is with packaging and the weight in parenthesis is only unit weight.
※The temperature or humidity mentioned in Environment indicates a non-freezing or condensation environment.

■ Operation Mode

Operaiton mode	Dark ON
Receiver operation	Received light Interrupt light
Operation indicator (LED)	ON OFF
Transistor output	ON OFF

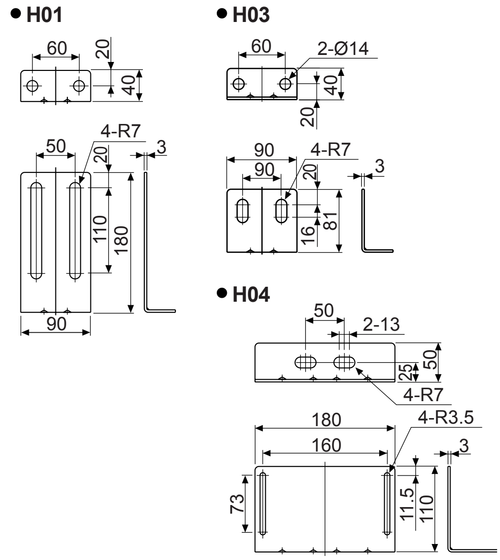
When shorting control output terminal or flow over the rated current, protection circuit operates and normal signal is not output.

■ Dimensions

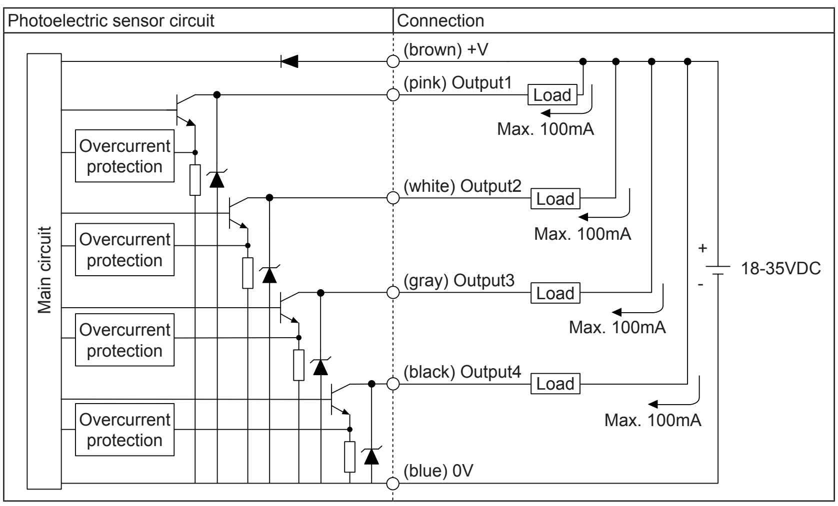


◎Bracket

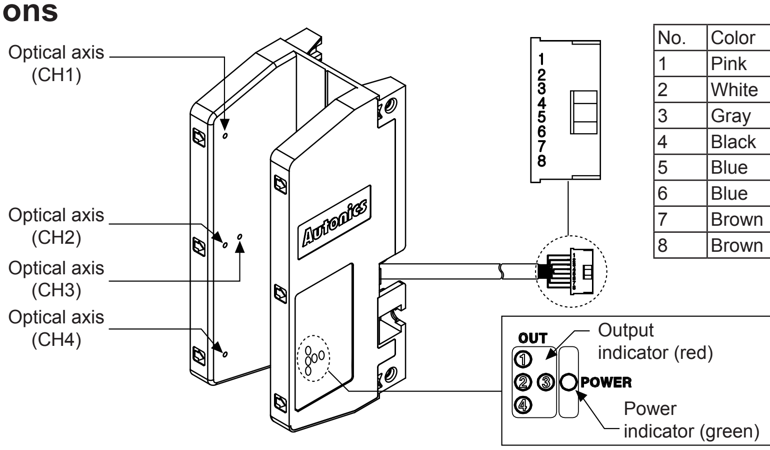
(unit: mm)



■ Control Output Diagram



■ Connections



No.	Color	Name
1	Pink	OUT1
2	White	OUT2
3	Gray	OUT3
4	Black	OUT4
5	Blue	0V
6	Blue	
7	Brown	+V
8	Brown	

Liquid Level Sensor For Mounting Pipe (Through-Beam)

Features

- Detects liquid in a transparent/semitransparent pipe diameter Ø6 to 13mm, thickness 1mm
- Compact size: W23×H14×L13mm
- Selectable Light ON/Dark ON operation mode by operation mode switching button
- Easy to check operation status by operation mode indicator [green LED (Light ON: on, Dark ON: off)], operation indicator [red LED]
- Built-in reverse polarity protection circuit and output overcurrent (short-circuit) protection circuit
- IP64 of protection structure (IEC standards)

Please read "Caution for your safety" in operation manual before using.

CE

Model

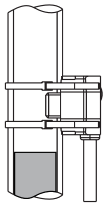
Model	Pipe diameter	Sensing type	Power supply	Control output
BL13-TDT	Ø6 to 13mm	Through-beam	12-24VDC ±10%	NPN open collector output
BL13-TDT-P				PNP open collector output

Specifications

Model	NPN output	**BL13-TDT**
	PNP output	**BL13-TDT-P**
Sensing type		Through-beam
Applicable pipe		Using binding band: Ø6 to 13mm, Using protection bracket: Ø12.7mm (1/2 inch) transparent pipes in 1mm thicknes s (FEP (fluoroplastic) or with equivalent transparency)
Standard sensing target		Liquid in a pipe※1
Response time		Max. 2ms
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)
Current consumption		Max. 30mA
Light source		Infrared LED (950nm)
Operation mode		Light ON/Dark ON operation mode switch button
Control output		NPN or PNP open collector output ●Load voltage: Max. 30VDC ●Load current: Max. 100mA ●Residual voltage: Max. 1V
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit
Indicator		Operation indicator: Red LED, Operation mode indicator: Green LED
Insulation resistance		Over 20MΩ (at 500VDC megger)
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator
Dielectric strength		1,000VAC 50/60Hz for 1 minute (between all terminals and case)
Vibration		1.5mm amplitude or 300m/s² at frequency of 10 to 55Hz in each of X, Y, Z direction for 2 hours
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times
Environ-ment	Ambient illumination	Sunlight/Incandescent lamp: Max. 3,000lx for each (receiver illumination)
	Ambient temperature	10 to 55℃, storage: -25 to 65℃
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Protection structure		IP64 (IEC standards)
Material		Case: Polycarbonate
Cable		Ø2.5, 3-wire, 1m (AWG28, Core diameter: 0.08mm, Number of cores: 19, Insulator diameter: Ø0.9)
Accessory		Binding band: 2, Anti-slip tube: 2
Approval		CE
Unit weight		Approx. 30g

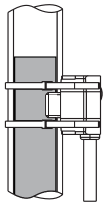
※1: This may not detect the liquid with low transparent, with high viscosity, or with floating matters.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

▣ Operation Mode



Absent liquid (light on)

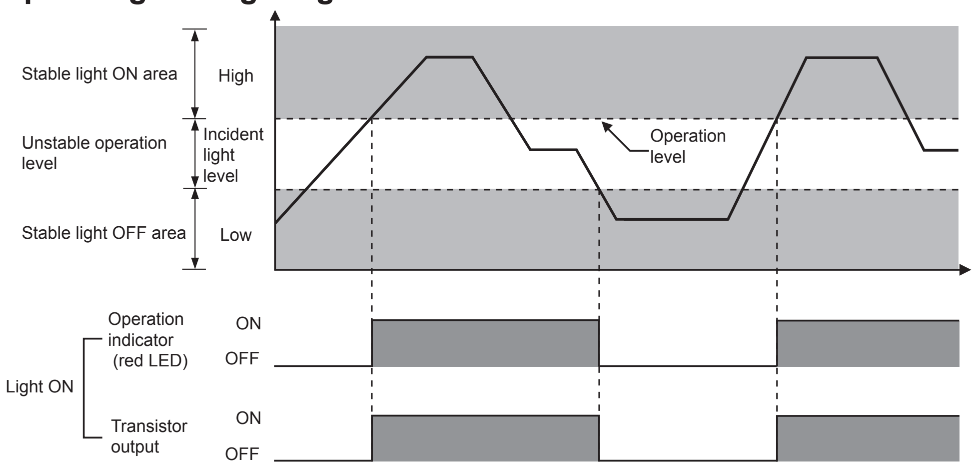
Operation mode	Light ON
Receiver operation	Received light Interrupted light
Operation indicator (red LED)	ON OFF
Transistor output	ON OFF



Present liquid (dark on)

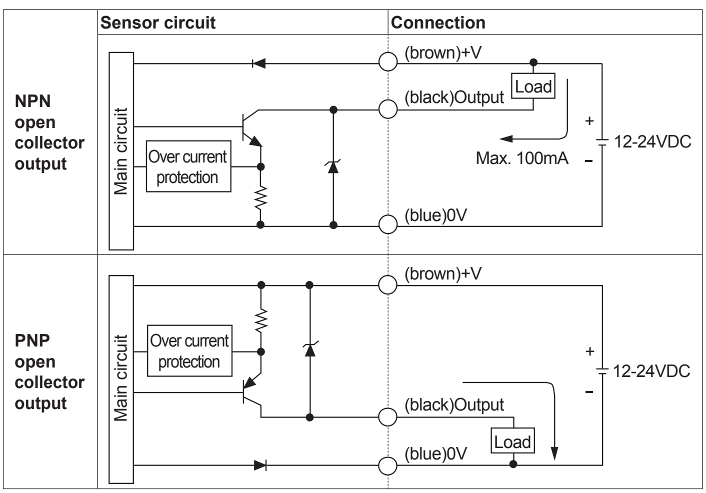
Operation mode	Dark ON
Receiver operation	Received light Interrupted light
Operation indicator (red LED)	ON OFF
Transistor output	ON OFF

▣ Operating Timing Diagram

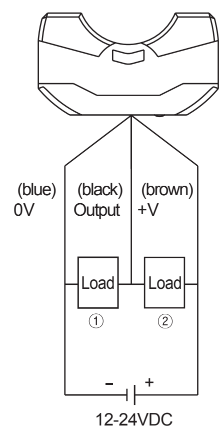


※The waveforms of 'Operation indicator' and 'Transistor output' are for Light ON, it is operated as reverse in Dark ON.

▣ Control Output Circuit Diagram



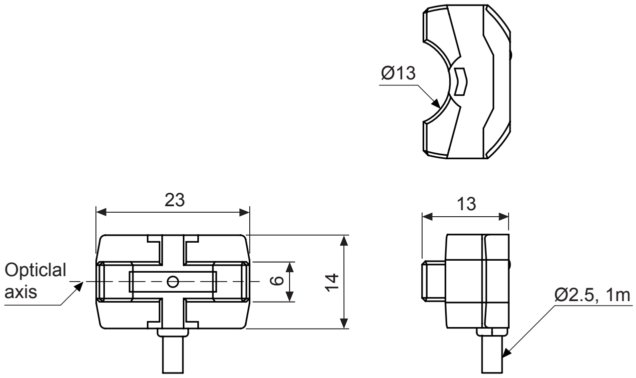
▣ Connection

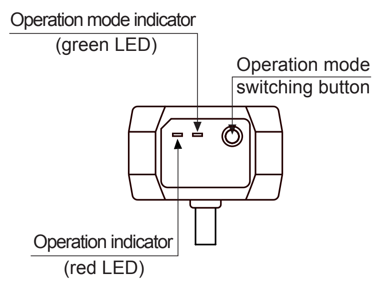


①Load connection for PNP output
②Load connection for NPN output

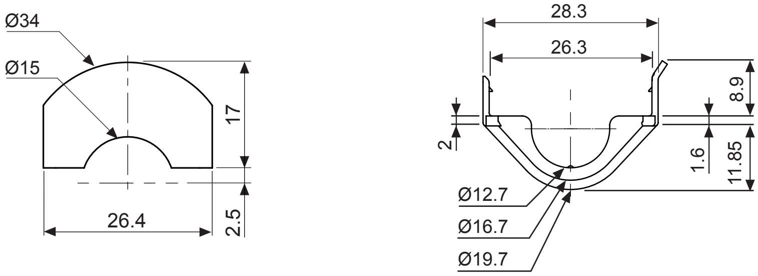
▣ Dimensions

(unit: mm)





◎ **Protection bracket (BK-BL13-P(sold separately))**

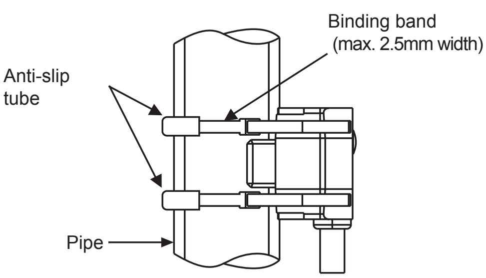


※For using the protection bracket, only Ø12.7mm (1/2 inch) pipes are available.

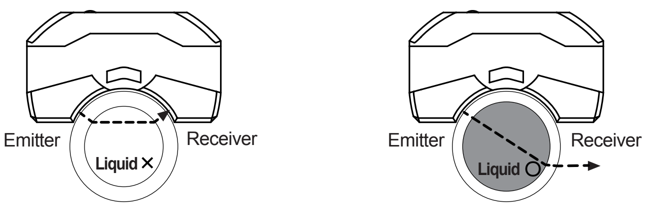
▣ Installation

If installing this unit at opaque pipes, it is impossible to detect accurately. Install this unit at the rated pipes.
Using binding band: Ø6 to 13mm, Using protection bracket: Ø12.7mm (1/2 inch)

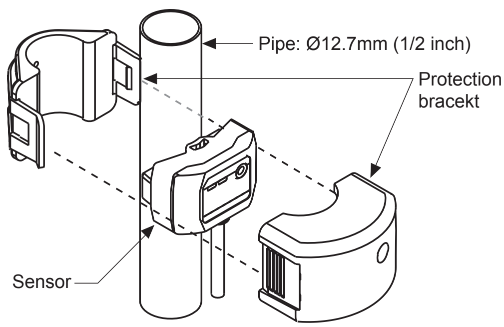
- If installing this unit at an opaque pipe, it is impossible to detect accurately. Install this unit at the rated pipe.
- Fix a pipe and this sensor tightly with binding bands and anti-slip tubes as the below figure and cut the spare part of binding bands with scissors or a knife.
- When connecting binding bands, be careful not to transform a pipe.



※Principle of operation
It detects whether there is liquid or not in a pipe by refractive index of light.



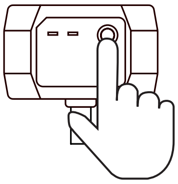
◎ Protection bracket (sold separately)
Choose a location on the pipe and attach the sensor and the protection bracket.



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Functions

● Operation mode switching

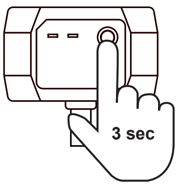


Light ON ⟷ Press operation mode switching button once ⟷ Dark ON

Light ON: Operation mode indicator (green LED) ON

Dark ON: Operation mode indicator (green LED) OFF

● Operation mode lock setting



Lock operation mode ⟷ Press operation mode switching button for over 3 sec. (until operation mode indicator flashes) ⟷ Unlock operation mode

※If you press the operation mode switching button (less than 3 sec) in lock operation status and the operation mode indicator (green LED) flashes 3 times.

Push Button Type Photomicro Sensors

NEW

■ Features

- Button operation enables accurate detection regardless of material, color, or reflectance of target object
- Optimized for transport detection of semiconductor wafer enclosures (FOUP, FOSB, etc.)
- Optical detection of button operation guarantees mechanical life cycle of 5 million operations
- Total of 4 red LED indicators (side:2, top:2) for higher visibility of operation status
- Increased product durability with steel mounting brackets
- Emitter OFF function and check stable operation functions
- Built-in reverse polarity protection circuit and output overcurrent (short-circuit) protection circuit

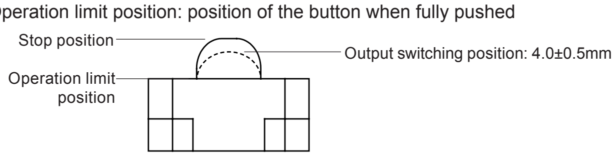
⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Specifications

Model	NPN open collector output	BS5-P1ML	BS5-P1MD
	PNP open collector output	BS5-P1ML-P	BS5-P1MD-P
Operation method※1		Push button type	
Button operation ※2	Stop position	5.0±0.4mm	
	Output switching position	4.0±0.5mm	
	Operation limit position	Below 0mm	
Operation load※3		Max. 3N (max. 0.3kgf)	
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)	
Current consumption		Max. 35mA	
Light source		Infrared LED (940nm)	
Operation mode		Light ON (output OFF when button is pushed)	Dark ON (output ON when button is pushed)
Control output		NPN or PNP open collector output ·Load voltage: Max. 26.4VDC ·Load current: Max. 50mA ·Residual voltage: Max. 1V	
External input※4	NPN output	Emitter OFF: short at 0V or max. 0.25V (outflow current max. 30mA) Emitter ON: open (leakage current max. 0.4mA)	
	PNP output	Emitter OFF: short at +V or min. -0.25V of +V (absorption current max. 30mA) Emitter ON: open (leakage current max. 0.4mA)	
	Response	Under 1ms	
Protection circuit		Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit	
Indicator		Operation indicator: Red LED	
Insulation resistance		Over 20MΩ (at 250VDC megger)	
Noise immunity		±240V of square wave noise (pulse width:1 μs) from the noise simulator	
Dielectric strength		1,000VAC at 50/60Hz for 1min	
Vibration		1.5mm amplitude at 10 to 55Hz frequency in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Mechanical life cycle		Min. 5,000,000 operations (1 operation = stop position - operation limit position - stop position)	
Environ-ment	Ambient illuminance	Fluorescent lamp: max. 1,000lx (receiver illuminance)	
	Ambient temperature	-20 to 55℃, storage: -25 to 70℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Protection structure		IP40 (IEC standard)	
Material		Case: Polycarbonate + Glass fiber, Button: Polyoxymethylene, Sleeve: SUS304 (steel use Stainless 304)	
Cable		Ø3mm, 4-wire, 1m (AWG 28, core diameter: 0.08mm, no. of core wires: 19, insulator diameter: Ø0.88mm)	
Weight※5		Approx. 50g (approx. 30g)	

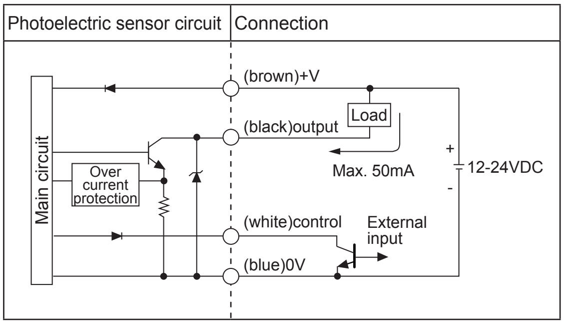
※1: Detection occurs when the button is pushed and the light source is blocked.
※2: Stop position: position of the button without any applied pressure
Output switching position: position where the output switches ON/OFF
Operation limit position: position of the button when fully pushed



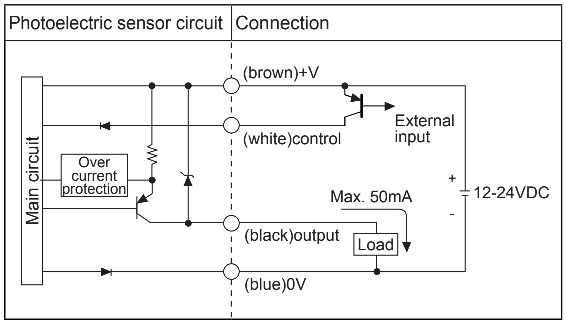
※3: Pressure required to push the button from stop position to output switching position
※4: External input when using emitter OFF function or check stable operation functions.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature and humidity of environment resistance are rated at non-freezing or condensation.

Control Output Diagram

- **NPN open collector output**



- **PNP open collector output**

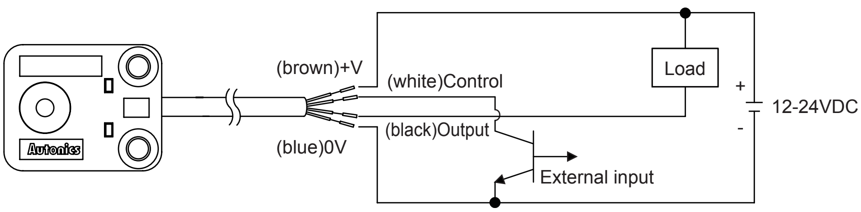


Operation Mode

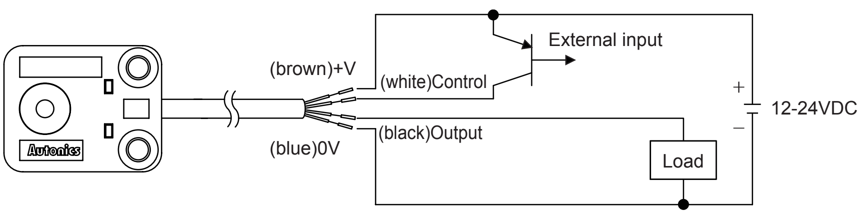
Operation mode	Light ON(Output OFF when button is pushed)	Dark ON(Output ON when button is pushed)
Button position	Pushed Raised	Pushed Raised
Receiver operaion	Received light Interrupted light	Received light Interrupted light
Operation indicator (redLED)	ON OFF	ON OFF
Transistor output	ON OFF	ON OFF

Connections

- **NPN open collector output**

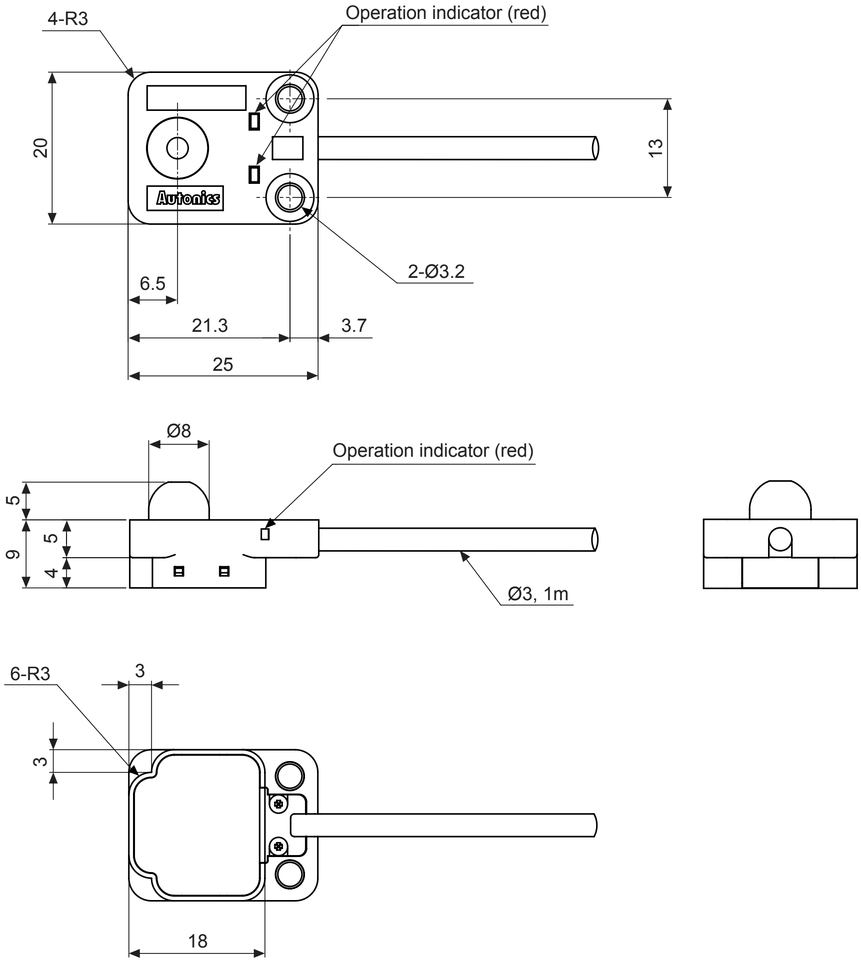


- **PNP open collector output**



■ Dimensions

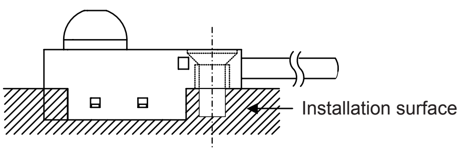
(unit: mm)



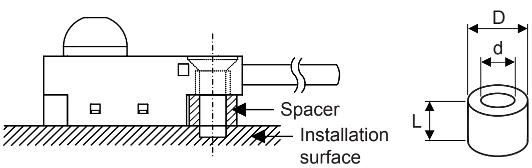
■ Installation

Use M3 countersunk screws to install the unit. The tightening torque should be less than 0.59N·m (6.0kgf·cm).
Installation methods differ depending on the installation surface.

1) Installation on non-flush surface
Install the sensor after fitting the sensor in the opening as shown in the figure below.



2) Installation on flush surface
Insert a spacer between the installation surface and the mounting surface of the sensor as shown in the figure below.



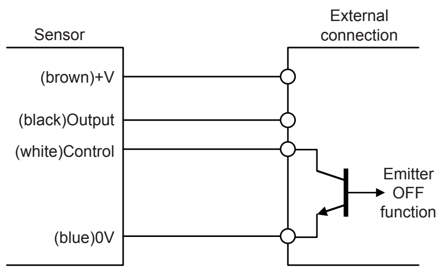
※Recommended size
D: 6mm
d: 3.3mm
L: 4±0.1mm

■ Functions

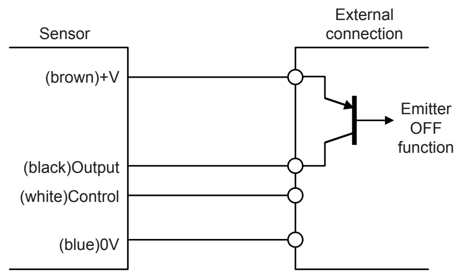
● Emitter OFF function

The emitter LED can be turned ON/OFF without pushing the button, to test for stable operation of the receiver.

NPN open collector output



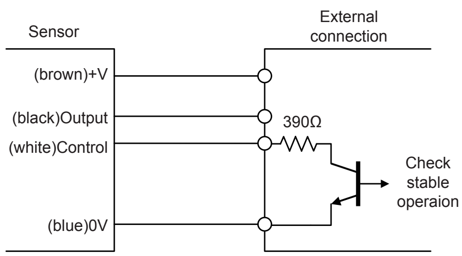
PNP open collector output



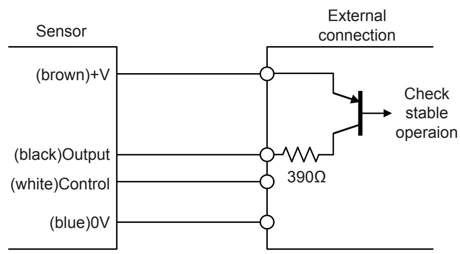
● Check stable operation function

Reduces the LED intensity by approximately 20% while button is not pushed, and check that the receiver is still receiving light (same transistor ON status as at 100%) This ensures that sensor will not malfunction due to changing light intensity.

NPN open collector output



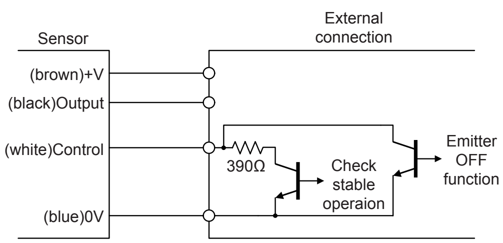
PNP open collector output



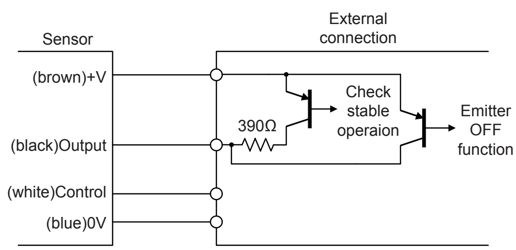
● Simultaneous use of emitter OFF and check stable operation function

Follow the circuit diagram below:

NPN open collector output



PNP open collector output



※When using the emitter OFF function and check stable operation function simultaneously, the transistor used should be able to open and close 50mA/10V and resistance should be over 1/8W. Failure may cause product damage.

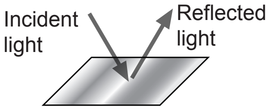
MST (Retroreflective Tape)

■ Features

- Easy attached at curved surface or narrow space
- Available to cut the tape according to the environment
- High retroreflective performance per unit

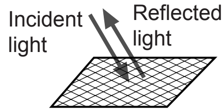
※Retroreflection: Reflected light reflects as same direction of incident light unlike general reflections.

·General reflections

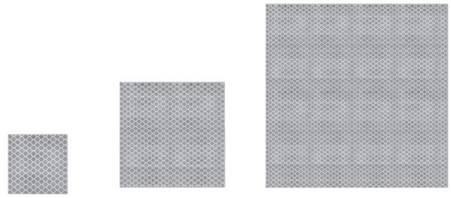


General retroreflective tape

·Retroreflection



MST Series

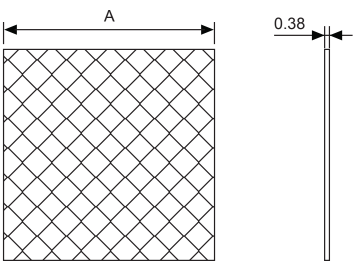


MST-50-10 (50×50mm) MST-100-5 (100×100mm) MST-200-2 (200×200mm)

■ Specifications

Model		MST-50-10	MST-100-5	MST-200-2
Applied sensor		Retroreflective type: BM1M-MDT, BMS2M-MDT-□, BR3M-MDT-□-□, BEN5M-MDT, BEN5M-MFR, BX5M-MDT, BX5M-MDT-T, BX5M-MFR, BX5M-MFR-T, BTS200-MDT□-□ Retroreflective type (built-in polarizing filter): BJ3M-PDT-□-□, BEN3M-PDT, BEN3M-PFR, BX3M-PDT-□, BX3M-PFR-□		
Size		50×50mm	100×100mm	200×200mm
Meterial		Surface film: Polymethyl methacrylate, Prism layer: Polycarbonate, Adhesive layer: Acrylic		
Environ -ment	Ambient temperature	-35 to 65℃ (available temperature: 10 to 30℃)		
Packaging (per unit)		10	5	2

■ Dimensions



(unit: mm)

Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

※There may be a ±0.02mm error in thickness dimension.

■ Reflectivity By Reflective Tape Model

◎ Standard type

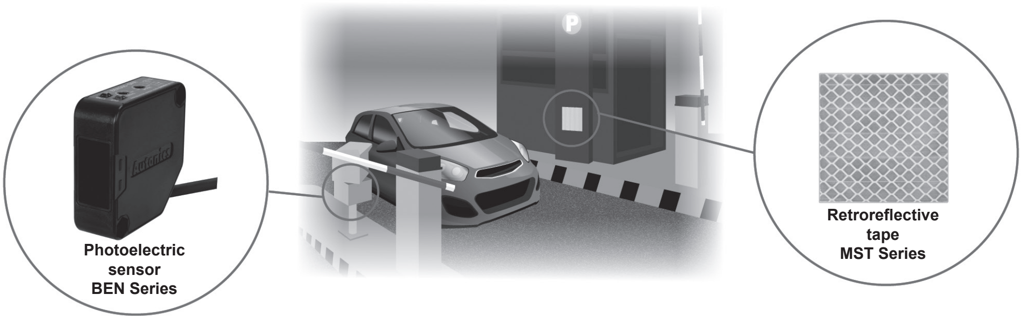
Model	BM1M-MDT	BMS2M-MDT-□	BR3M-MDT-□-□	BEN5M-MDT	BX5M-MDT-□	BTS200-MDT□-□
MST-50-10	70%	90%	80%	90%	90%	95%
MST-100-5	110%	120%	120%	130%	100%	100%
MST-200-2	170%	190%	140%	140%	110%	100%

◎ Retroreflective type (built-in polarizing filter)

Model	BJ3M-PDT-□-□	BEN3M-PDT	BX3M-PDT-□
MST-50-10	40%	70%	30%
MST-100-5	60%	90%	40%
MST-200-2	100%	120%	60%

※The reflective tape has higher reflectivity due to bigger size than the reflector.
※Reflectivity may vary depending on usage environment, installation conditions, and reflective tape size.
※Generally, the sensing distance and minimum sensing target size increase as tape size increases.
※For using reflective tape, installation distance should be min. 20mm.

▣ Applications

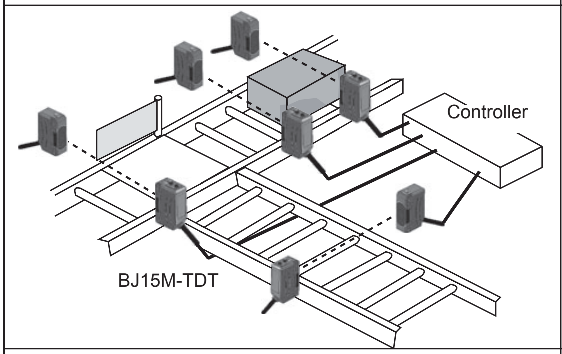


▣ Proper Usage

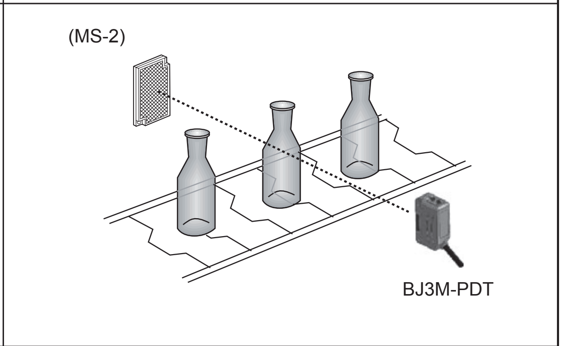
- Please clean the adhesive side of the reflective tape with a dry cloth before applying the tape.
- Do not press prism layer of the tape.
- Please clean the tape regularly to maintain optimal performance.
  When cleaning, please use neutral detergents only. DO NOT use chemical solvents.
- If the reflective surface is damaged, performance may decline.

■ Applications

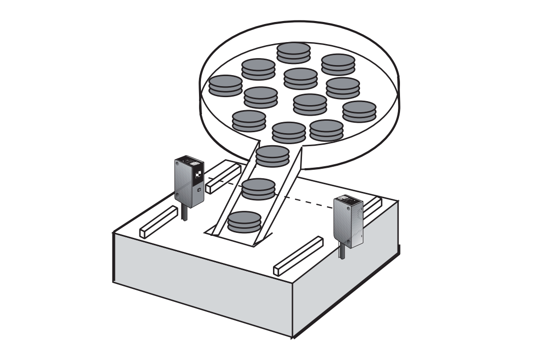
Automatic conveyor line



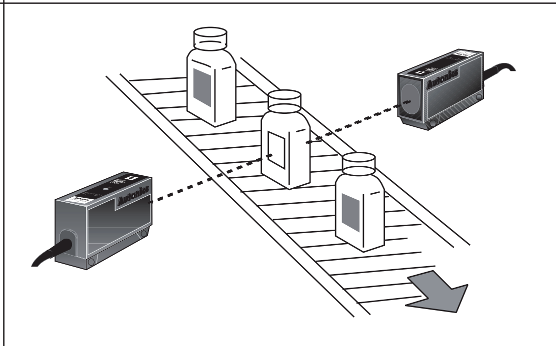
Sensing present / absence of transparent bottles



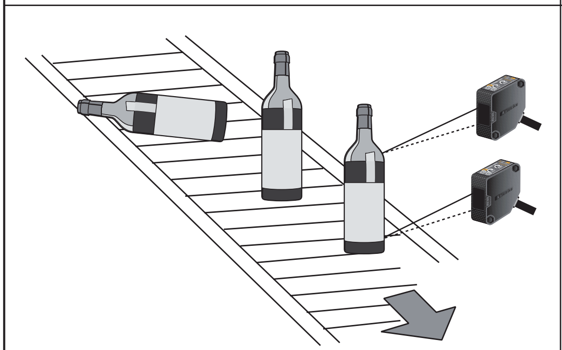
Sensing passing objects in narrow place



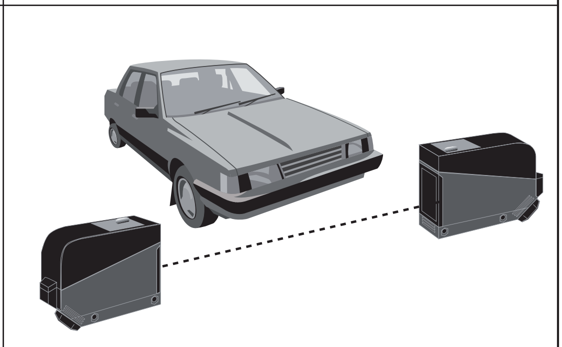
Label sensing of transparent bottles



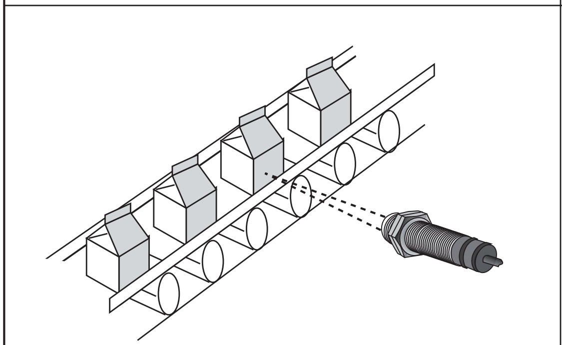
Sensing fallen bottles



Sensing passing of the cars

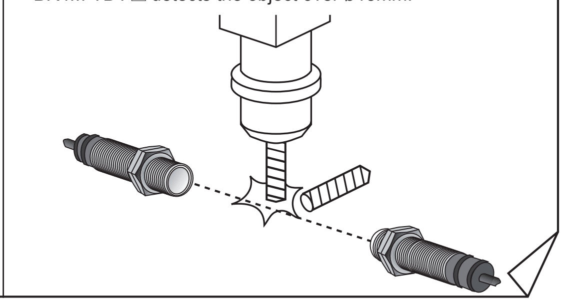


Sensing milk packs



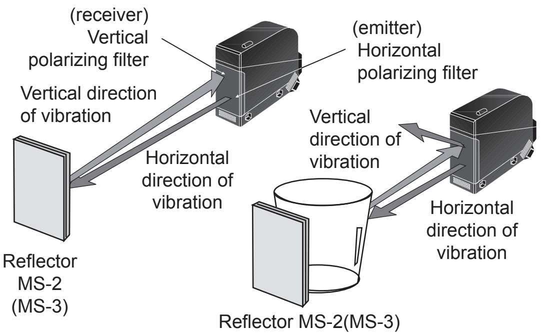
Sensing broken drill blades

※If a drill blade is thin, it may not be detected because BR4M-TDT□ detects the object over ø15mm.



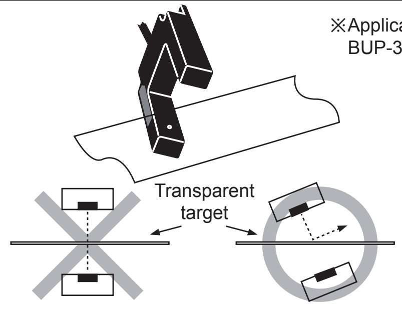
■ Applications

Built-in polarizing filter type



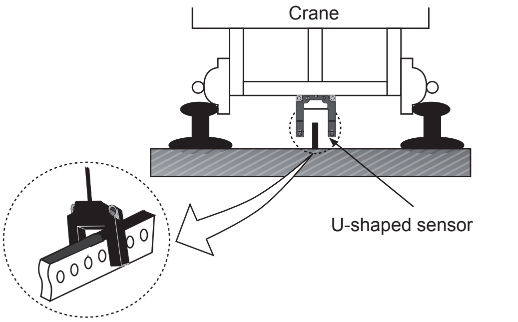
Sensing transparent vinyl

※Application model
BUP-30, BUP-50

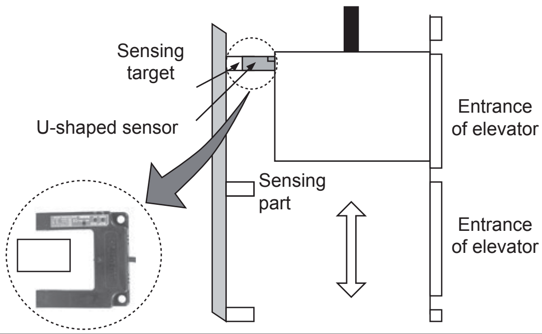


< Installation method for transparent object >

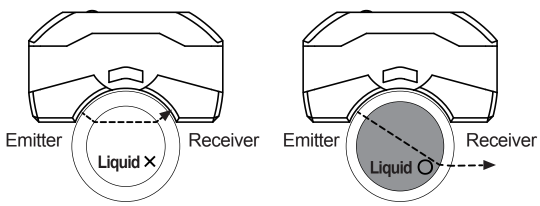
Sensing position of moving targets



Sensing position of an elevator



Sensing liquid within pipe



▣ Photoelectric Sensor Overview

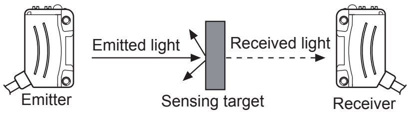
Sensors are differentiated depending on applied media. Light, one of the media, is also utilized for a sensor which is called a photoelectric sensor. It is a non-contact type which is applicable to sensing presence, passing, size, color and brightness of the target object.

▣ Classification By Sensing Method

Photoelectric sensors can be classified into three categories depending on sensing type.

◎ Through-beam photoelectric sensor

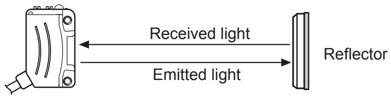
Through-beam beam type is to detect a target by using the difference of light intensity depending on presence of target with placing an emitter and a receiver face to face.
Long sensing distance is available and it is not affected by background.

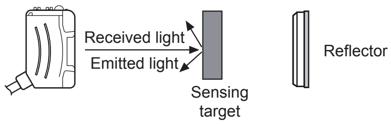


◎ Retroreflective photoelectric sensor

● Retroreflective type(standard type)

Retroreflective type uses a photoelectric sensor which is integrated with emitter and receiver, and a reflector with high light radiant in order to detect a target by comparing difference of light amount determined by the presence of target between the sensor and reflector.

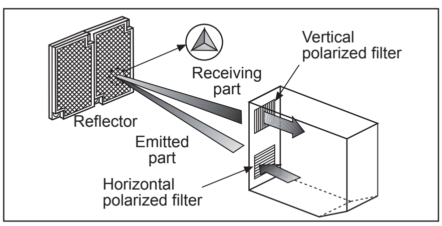


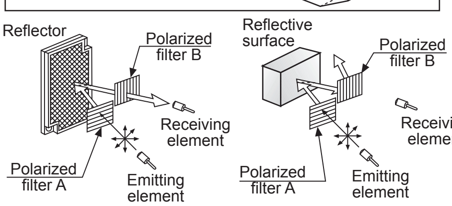


Using highly reflective objects is limited but it depends on install method, it could be available to use.

● Retroreflective type(built-in polarized filter)

Like the standard type of retroreflective photoelectric sensor, polarized filter type uses a photoelectric sensor which is integrated with emitter and receiver and reflector. The emitter part and receiver part in the sensor have each polarized filter for receiving reflected light from the reflector which make the light polarized at 90°.



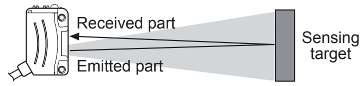


◎ Diffuse reflective photoelectric sensor

Diffuse reflective is to detect a target by direct reflection off the target object. (emitter / receiver in one body)

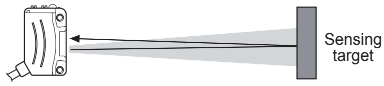
● Standard diffuse reflective type

Light source is diffused after passing the lens, detects a target by comparing difference of light amount which depends on size, color and brightness of the target object.



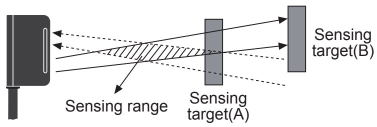
● Narrow beam type

Narrowed beam spot size after passing the lens has little effect on background. It is suitable for sensing in narrow space or sensing small size of the target object.



● Convergent reflective type

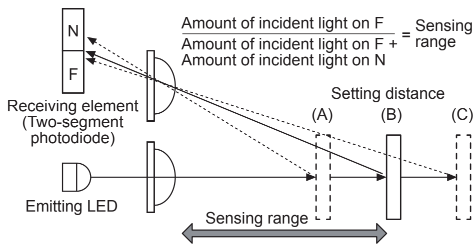
Convergent reflective type sensed the limited area (checked part) where optical source is crossed.
In the figure below, the sensing target at (A) can be detected while the target at (B) cannot. Due to detecting the limited area by optical source, there is little effect by background but it is not simple to modify sensing distance and sensing target in a specific area (within 50mm).



● BGS(background suppression) type

It detects range of set distance which is applied the algorithm of triangulation principle which is for measuring the place where the reflected light forms an image on the receiving element or the optical system. Also it has little effect by size, color and surface condition of the sensing target and no effect on the background. Strong at temperature, power and voltage changes and available detect to sensing distance over 100mm.

※Triangulation : Emitting light forms an image on the receiving light element after it is reflected on the sensing target. In case sensing target is located at (B), the same amount of reflected light will be received on both N and F part of receiving element. In case sensing target is located closer (A), larger amount of reflected light will be received on N part and less amount of light on F part. In case sensing target is located further (C), both N and F part will receive the reflected light vice versa. Therefore, sensing distance can be determined with calculating the amount of reflected light on both parts of receiving element (two-segment photodiode).



Technical Description

▣ Glossary

◎ LED : Light Emitting Diode

A semiconductor diode emits light when an electric current passes through it. The color and brightness of LED is determined by the component, construction ratio, impurities of PN junction for improving single crystal which is made with gallium(Ga) to mixed crystal.

- Infrared LED : Using P-N junction for GaAs
- Red LED : Adding impurities Zn, O to GaP
- Green LED : GaP/Green light emitting/ Yellowish green emitting is used due to low efficiency.
- Yellowish green LED : Adding N to GaP / Higher emitting efficiency than Green emitting.

The most common emitting element for photoelectric sensor is IRED having high emitting efficiency and large outputs. Red or green LED is also frequently used according to applications.

◎ Photo diode

A photo diode is a type of diode capable of converting light into either current or voltage when light reached to P layer. PN or PIN junction used. Si is generally used for semiconductor.
PIN photodiode is commonly used as receiving elements to catch optical signal with high response and frequency. Applicable to photoelectric sensor's receiving elements, PCM transmission for optical communication, and TV/ VTR remote controller's receiving parts.

◎ Photo transistor

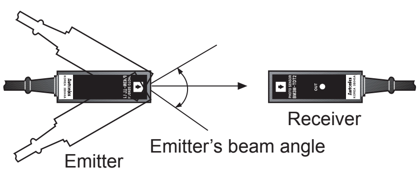
Compared to photo diodes, photo transistor has amplifying action by transistor. Control easily due to high receiving sensitivity for Base current. Thus it is available in a wide range of photoelectric sensors.

◎ Sensing target

The sensing target serves as a reference for measuring basic performance.

◎ Beam angle

Angle range for normal sensing by the sensors.



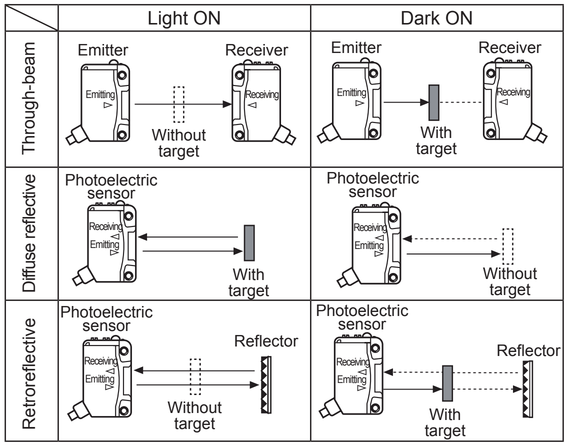
◎ Operation mode

● Light ON

Output switching elements (transistor or Relay) become ON when the receiver receives emitting light from the emitters.

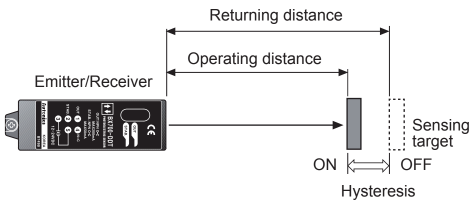
●Dark ON

Output switching elements (transistor or Relay) become ON when the receiver does not receive emitting light from the emitters.



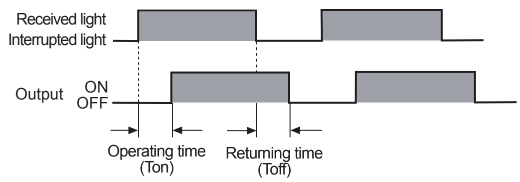
◎ Hysteresis (reflective type)

Distance difference between operating distance and returning distance.



◎ Response time

The time lag between light received point and the point on which output operation becomes ON.(Light ON)
Generally, response time is represented as operation time (Ton). [Operating time (Ton) ≒ Returning time (Toff)]



▣ Major Features

● Non-contact detection

Photoelectric sensor is a non-contact type which does not have any impact on the sensing target.

● Wide range of sensing target

Applicable to a wide range of materials including transparent glass, metal, plastic, wood and liquid.

● High speed response time

Use light as the medium, it is able to detect the moving object with high speed.

● Superior distinction performance

Use several characteristics of light, various kinds of sensors are developed. They are able to detect presence, passing, size, color, and brightness of the sensing target.

● Easy to control application environment

Easy to control sensing range and environment of photoelectric sensor by using lens such as half mirror, shield boards, slit.

- **Low influence from magnetic field and vibration**

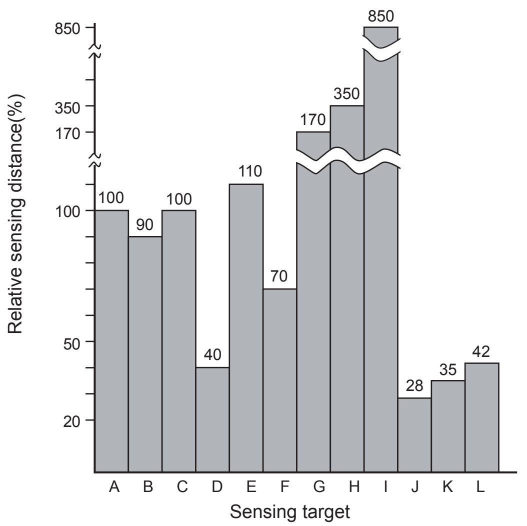
Use light when photoelectric sensor detect the sensing target, it is less affected by magnetic and vibration.

- **Color identification**

The rate at which an object reflects or absorbs light depends on both the wavelength of the emitted light and the color of the object. This property can be used to detect colors.

▣ Sensing Objects Of Diffuse Reflective Type Sensors

◎ Sensing distance according to color



A: Non-glossy white paper(standard)
B: Corrugated card board with yellow color
C: Veneer board
D: Non-glossy black paper(Brightness 3)
E: Bakelite board with yellow color
Acrylic board (black)
Vinyl resin (red)
F: Vinyl resin (orange)
G: Rubber board
H: Aluminum board
I: Reflective bar
J: Rusty steel bar Ø10
K: Black cloth (towel)
L: Dark Blue cloth(towel)

※It shows ratio of sensing object each detection distance based on non-glossy white paper is 100%. Relative sensing distance depends on the model and sensing object size.

※Convergent reflective type is not affected by color or material within range of sensing distance as specified in chart.

◎ Sensing distance and range against the sensing target condition

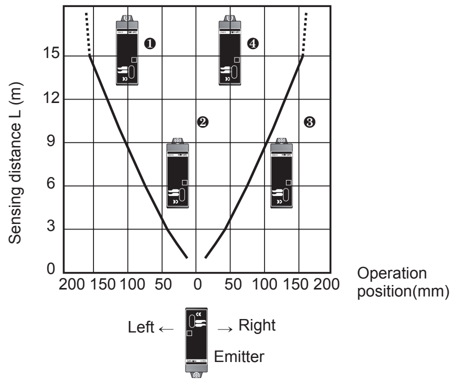
- The reflectivity of the sensing target surface is higher, the sensing distance is longer.
- The size of the sensing target is bigger, the sensing distance is longer.
- The rate of reflection of the sensing target is lower, the sensing area is more narrow. However in the case of white non-glossy paper, it has lower reflectivity than glossy SUS or aluminum, but the property of sensing area is better by diffused reflection of the surface of the white paper.

▣ Feature Data

The following describes about the feature data.

◎ Example of parallel shifting characteristic (Through-beam type)

This characteristic for through-beam type, indicates about width of light for the emitter.



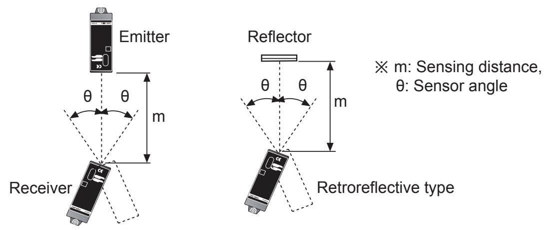
As shown in the figure, the receiver 1, 2, 4 operate normally but the receiver No. 3 does not operate normally because it is out of the width of light. Refer to this data when placing several sensors in parallel, it is able to prevent mutual inference. In case installing the receiver at 9m point (as ② in the figure), there must be 110mm interval between each unit in order to prevent mutual interference.

◎ Sensing distance characteristic (Diffuse reflective type)

This is featured as data of diffuse reflective type sensors same as the parallel shifting characteristic.

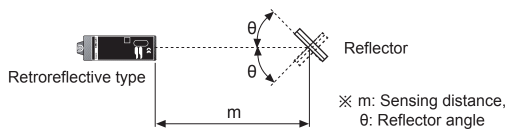
◎ Angle sensor characteristic (Through-beam type, Retroreflective type)

After fixing the emitter(or reflector), and the receiver(sensor) moves towards the center axis from right or left, up or down until operation becomes OFF.



◎ Reflector angle characteristic (Retroreflective type)

Move a reflector towards center axis from right or left, up or down with fixing the receiver until operation becomes OFF.



▣ Proper Usage

◎ Precaution for proper installation

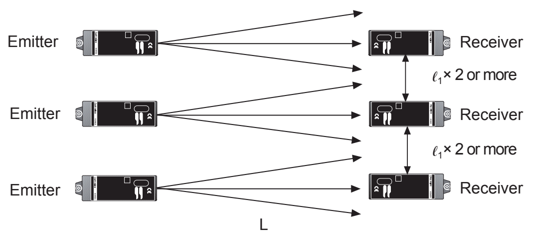
- Make sure to secure sensing space(sensing stability) when selecting and installing the sensor.
- Make sure that diameter of sensor lens (Ø) is smaller than sensing target when selecting the sensor.
- If there are any possibilities to be damaged by sensing targets, use protection covers for protecting photoelectric sensors.
- In case the sensor is applied to high frequency machines, such as ultrasonic welding machine, etc, insulate the sensor and high frequency machines using insulating boards to prevent malfunction from induced current.
- Keep the cable as short as possible. In case of cable extension, make sure that thickness of the cable shall be over $0.3mm^2$. Be careful of voltage drop.
- Photoelectric sensor is generally applied for machine, or equipment. It is easy to have the effect of vibration or shock. In order to prevent this effect, please following countermeasures before using.
  ① Do not make sensor's main body touch the sensing target directly.
  ② Use sturdy material supports in order not to be affected by vibration or shock.
  ③ Tighten fixed bracket's bolts and nuts.
- If photoelectric lens are dirty by dust, clean with a dried towel softly. Do not use organic solvent, such as thinners, etc.
- Avoid dust or any corrosion causing environments.

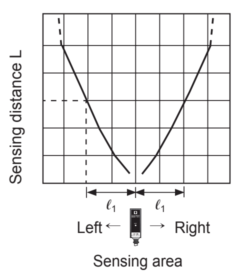
◎ Countermeasures for mutual interference

In the case of using the photoelectric sensors closely, you should make countermeasures because of interference which affects to other's operation.

● Through-beam type

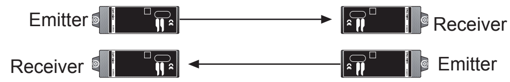
① Increase the separation distance with referring to parallel shifting feature data.



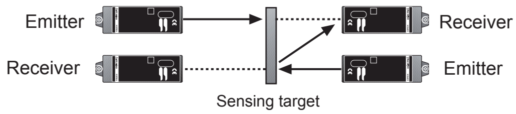


[Parallel shifting characteristic feature data]

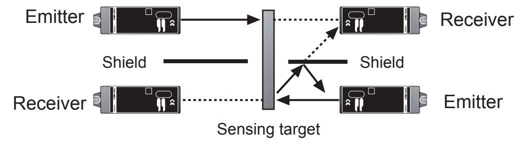
② Place the emitter and the receiver alternately.



In this case, if the photo sensor is installed closely like [Figure 1], it can cause malfunction. User needs to install a shield like [Figure 2].

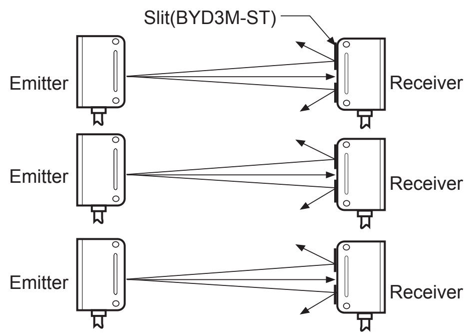


[Figure 1]



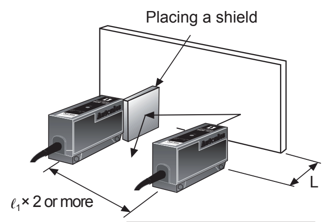
[Figure 2]

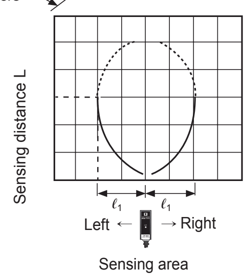
③ Narrow the light by using slits on the receiver.



● Diffuse reflective type, convergent reflective type

① Check the install distance which has no interference at the sensing area characteristics of the sensor. Install the sensor with the 2 times longer operating position(ℓ1) than sensing distance(L).
② Install shield between sensors.



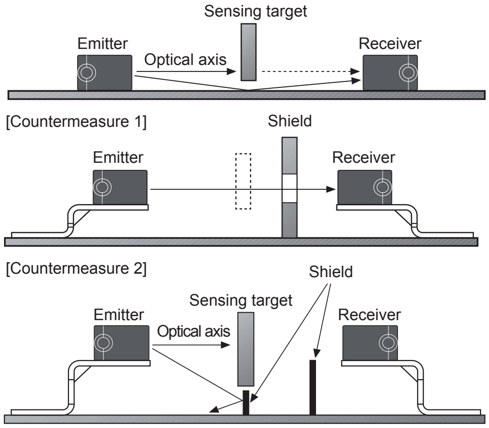


[Sensing area feature data]

◎ Influence of surroundings

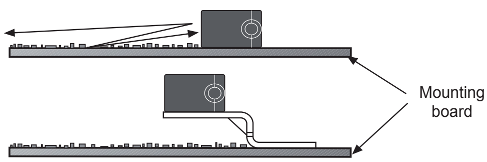
●Through-beam type

Emitted light is not completely interrupted by a sensing target because some amount of emitted light gets reflected light from the mounting board and enters into the receiver.



●Diffuse reflective type

1. Effect of install surface
In case a diffuse reflective sensor is mounted on a rough mounting plate, the reflected light causes photoelectric sensor's malfunction. For preventing this, please mount the sensor with bracket.



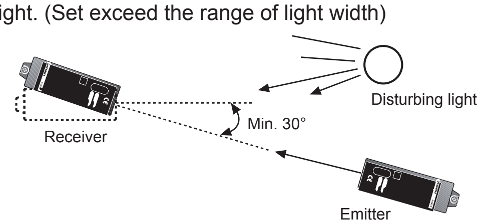
2. Effect of the surrounding object
Even though the surrounding object such as wall is far apart from the sensing target, the object is able to affect the detection.
Countermeasure:
① Paint the background in black color to reduce reflected light.
② Increase the distance from the background.
③ Select convergent reflective type sensor.

◎ Influence of disturbing light

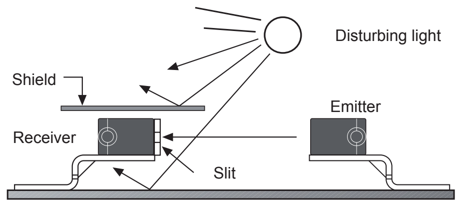
There are two types of photoelectric sensors which are modulated type and non-modulated type.
Modulated type is not affected by normal disturbing light. But it can be affected by strong disturbing light or modulated disturbing light.

- Strong disturbing light : Direct rays of sunlight
- Modulated disturbing light : Arc welding spark, Inverter fluorescent.

1. Set the optical axis of the receiver more than 30° difference with the entering light direction of disturbing light. (Set exceed the range of light width)

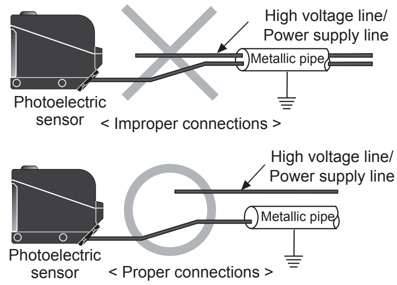


2. Attach slits or protection cover on the receiver.

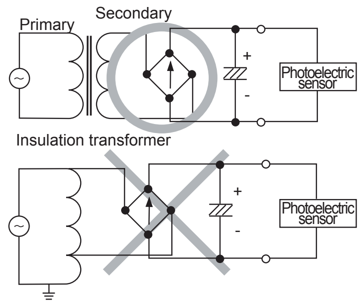


◎ Operation power and grounding

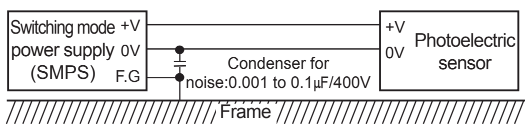
- In case of commercial power, use power supply with low noise/voltage variations. Avoid using the unit around the power generators or high voltage lines.
- Do not connect high voltage power source line and sensor's cable power line together. It may cause product damage or malfunction. Please wire lines separately.



- In case of DC power photoelectric sensors, use insulation transformer for rectified power supply with ±10% ripple.



- In case power is supplied from switching mode power supply, ensure that the frame ground (F.G.) terminal of the power supply is connected to an ground and connect a condenser for noise removal between 0V and F.G. terminal. (Usually the condenser is equipped in switching mode power supply units)



In case of sensor's material is metal, ground the metal case to prevent electrostatic or product malfunction due to noise.

◎ Precaution for power supply

- Please do not operate the sensors ON/OFF by power.
- It is required at least 500ms for stable sensor operations after power supply is ON.

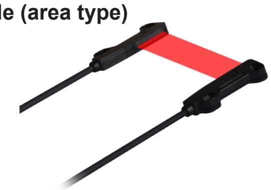
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

(B) Fiber Optic Sensors

Line-up

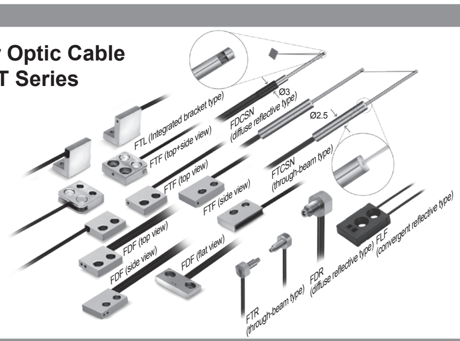
Digital Indicating Type Fiber Optic Amplifier BF5 Series

Fiber Optic Cable (area type) FTW Series



Communication Converter BFC Series

Fiber Optic Cable FD/FT Series



Ordering Information

■ Ordering Information (Fiber Optic Amplifier)

BF 5 R - D 1 - N

N	NPN open collector output
P	PNP open collector output
1	Standard type
D	Dual display type
S	Single display type
R	Red LED
G	Green LED
B	Blue LED
5	Series
BF	Fiber Sensor

BF 4 R P - E

No mark	Standard type
E	External synchronization input type
R	Remote sensitivity setting type
No mark	NPN open collector output
P	PNP open collector output
R	Red LED
G	Green LED
4	Series
BF	Fiber Sensor

BF 3 RX - P

No mark	NPN open collector output
P	PNP open collector output
RX	Red LED
3	Series
BF	Fiber Sensor

■ Ordering Information (Fiber Optic Cable)

F T ☐ - 4 20 - 10 ☐ S

Item	Code	Description
Option	S	Small hood
Cable type	No mark	Standard type (-40 to 70℃)
	H	Heat-resistance (-40 to 105℃)
	H1	Heat-resistance (-40 to 150℃)
	H2	Heat-resistance (-40 to 250℃)
	R	Flexible type (R1, R2)
	B	Break-resistant type (R5)
Fiber diameter	05	Ø0.5mm
	06	Ø0.6mm
	10	Ø1.0mm
	13	Ø1.3mm
	14	Ø1.4mm
	15	Ø1.5mm
	20	Ø2.0mm
	F	Ø0.5mm, Ø0.25mm×4 (coaxial type)
	F1	Ø0.5mm, Ø0.25mm×9 (coaxial type)
	F2	Ø1.0mm, Ø0.265mm×16 (coaxial type)
Cable length	05	0.5m
	10	1m
	20	2m
	10M	10m
Hood diameter (nut)	15	Ø1.5mm
	2	Ø2mm (M2)
	3	Ø3mm (M3)
	4	Ø4mm (M4)
	6	Ø6mm (M6)
Head form	No mark	Standard type (bolt type)
	W11	Area type (sensing height 11mm)
	P	Plastic injection molding type
	S	SUS type (SUS length 90mm)
	S1	SUS type (SUS length 35mm)
	S2	SUS type (SUS length 45mm)
	C	Cylinder type
	CS	Cylinder+SUS type (SUS length 15mm)
	H	Fire cable protection tube
	LU	L type/Top view (height 12.2mm)
	LU1	L type/Top view (height 17.2mm)
	LU2	L type/Top view (height 22.2mm)
	F	Flat type/Flat view
	FN	Flat type/Side view
	FU	Flat type/Top view (up)
	FB	Flat type/Side view+Top view (bending)
	R	Right-angle
Sensing type	T	Through-beam type
	D	Diffuse reflective type
	L	Convergent reflective type
Fiber material	F	Plastic Fiber cable
	G	Glass Fiber cable

※Please refer to page B-45 to 52 (Fiber optic cable specification) for exact model name of fiber optic cable, or it might cause wrong model selection not existing in the above ordering information.

Product Overview

■ Fiber Optic Amplifier

Appearance	Characteristic	LED	Model	Power supply	Response speed	Control output	Reference
CE 	Dual display type	Red	**BF5R-D1-N**	12-24VDC	Ultra fast mode (50µs), Fast mode (150µs), Standard mode (500µs), Long distance mode (4ms), Ultra long distance mode (10ms)	NPN open collector output	**B-9 to 26**
		Green	**BF5G-D1-N**				
		Blue	**BF5B-D1-N**				
		Red	**BF5R-D1-P**			PNP open collector output	
		Green	**BF5G-D1-P**				
		Blue	**BF5B-D1-P**				
	Single display type	Red	**BF5R-S1-N**		Fast mode (150µs), Standard mode (500µs), Long mode (4ms)	NPN open collector output	
		Red	**BF5R-S1-P**			PNP open collector output	
CE 	Standard type	Red	**BF4R**		Max. 0.5ms (Frequency 1) Max.0.7ms (Frequency 2)	NPN open collector output	**B-33 to 40**
		Green	**BF4G**				
		Red	**BF4RP**			PNP open collector output	
		Green	**BF4GP**				
	External synchronization input type	Red	**BF4R-E**			NPN open collector output	
		Green	**BF4G-E**				
	Remote sensitivity setting type	Red	**BF4R-R**				
		Green	**BF4G-R**				
	Built-in twin adjuster type	Red	**BF3RX**		Max. 1ms	NPN open collector output	**B-41 to 44**
			BF3RX-P			PNP open collector output	

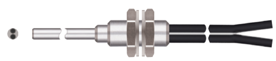
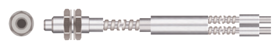
※Sensing type depends on the type of fiber cable.

■ Fiber Optic Amplifier Communication Converter

Appearance	Characteristic	Model	Power supply	Communication speed	Control output	Reference
CE 	Setting 32 fiber optic amplifier units simultaneously by communication converter	**BFC-N**	12-24VDC	1200, 2400, 4800, 9600, 19200, 38400bps	NPN open collector output	**B-27 to 32**
		BFC-P			PNP open collector output	

※Connectable fiber optic amplifier unit: BF5 Series

■ Fiber Optic Cable (Diffuse Reflective Type)

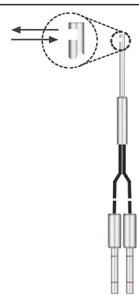
Type		Appearance	Feature	Sensing distance (mm) (based on Non-glossy white paper)	Cable length (L)	Model	Reference
Bolt type	Standard type		M3	40 ※2	1m (Free cut)	**FD-310-05**	**B-45 to 53**
			M3	40 ※2	2m (Free cut)	**FD-320-05**	
			M4			**FD-420-05**	
			M3 (SUS type, 90mm)	40 ※2	2m (Free cut)	**FDS-320-05**	
			M3 (SUS type, 45mm)			**FDS2-320-05**	
			M4 (SUS type, 90mm)			**FDS-420-05**	
			M4 (SUS type, 45mm)			**FDS2-420-05**	
			M6	120 ※2	2m (Free cut)	**FD-620-10**	
			M6 (SUS type, 90mm)	120 ※2	2m (Free cut)	**FDS-620-10**	
			M6 (SUS type, 45mm)			**FDS2-620-10**	
	Heat-resistant type		M6	120 ※2	2m (Free cut)	**FD-620-10H**	
			M6	160 ※2	2m (Free cut)	**FD-620-15H1**	
			M4 (Glass type)	100 ※2	2m	**GD-420-20H2**	
			M6 (Glass type)			**GD-620-20H2**	
	Flexible type ※3		M3	35 ※1	2m (Free cut)	**FD-320-05R**	
			M4			**FD-420-05R**	
			M6	130 ※1	2m (Free cut)	**FD-620-10R**	
	Break-resistant type ※3		M3	35 ※2	2m (Free cut)	**FD-320-06B**	
			M4			**FD-420-06B**	
			M6	100 ※2	2m (Free cut)	**FD-620-13B**	

※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED.
It is applied to 40% of sensing distance for BF3RX.
※3:
- **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install it in the many places as the change of the intensity of radiation by bending is small.
- **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.

※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-3) should be used for cutting fiber cable.]
※Glass type is for BF5, BF4 Series.

Product Overview

▣ Fiber Optic Cable (Diffuse Reflective Type)

Type		Appearance	Feature	Sensing distance (mm) (based on Non-glossy white paper)	Cable length (L)	Model	Reference
Bolt type	Coaxial type		M3	40※2	2m (Free cut)	**FD-320-F**	
			M3	60※2	2m (Free cut)	**FD-320-F1**	
			M6	120※2	2m (Free cut)	**FD-620-F2**	
Cylinder type	Standard type		Ø3mm	40※2	2m (Free cut)	**FDC-320-05**	
			Ø3mm (SUS type, 15mm)	40※2	2m (Free cut)	**FDCS-320-05**	
	Break-resistant type※3		Ø3mm	35※2	2m (Free cut)	**FDC-320-06B**	
	Standard type		Ø3mm Side view	30※1	2m	**FDCSN-320-05**	**B-45 to 53**
Flat type	Flexible type		Top view	35※1	1m (Free cut)	**FDFU-210-05R**	
			Side view	30※1	1m (Free cut)	**FDFN-210-05R**	
			Flat view	30※1	1m (Free cut)	**FDF-210-05R**	
Right angle	Flexible type		M6	120※1	1m (Free cut)	**FDR-610-10R**	
Plastic	Standard type		Plastic injection molding type	120※2	2m (Free cut)	**FDP-320-10**	

▣ Fiber Optic Cable (Convergent Reflective Type)

Type		Appearance	Feature	Sensing distance (mm) (based on Non-glossy white paper)	Cable length (L)	Model	Reference
Flat type	Standard type		Convergent reflective type	8※1	2m	**FLF-320-10**	**B-45 to 53**

※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED.
It is applied to 40% of sensing distance for BF3RX.
※3: • **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.
※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-3) should be used for cutting fiber cable.]

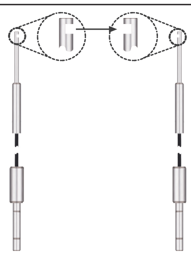
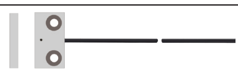
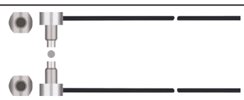
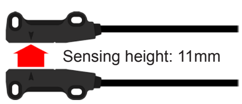
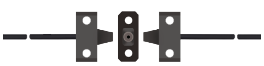
▣ Fiber Optic Cable (Through-Beam Type)

Type		Appearance	Feature	Sensing distance (mm) (based on Non-glossy white paper)	Cable length (L)	Model	Reference
Bolt type	Standard type		M3	150※2	1m (Free cut)	**FT-310-05**	**B-45 to 53**
			M3	150※2	2m (Free cut)	**FT-320-05**	
			M3 (SUS type, 90mm)	150※2	2m (Free cut)	**FTS-320-05**	
			M3 (SUS type, 45mm)			**FTS1-320-05**	
			M3 (SUS type, 45mm)			**FTS2-320-05**	
			M4	500※2	2m (Free cut)	**FT-420-10**	
			M4 (SUS type, 90mm)	500※2	2m (Free cut)	**FTS-420-10**	
			M4 (SUS type, 45mm)	500※2	2m (Free cut)	**FTS2-420-10**	
	Heat-resistant type		M4	300※2	2m (Free cut)	**FT-420-10H**	
			M4	500※2	2m (Free cut)	**FT-420-15H1**	
			M4 (Glass type)	400※2	2m	**GT-420-13H2**	
	Flexible type※3		M3	110※1	2m (Free cut)	**FT-320-05R**	
			M4	500※1	2m (Free cut)	**FT-420-10R**	
	Break-resistant type※3		M3	110※2	2m (Free cut)	**FT-320-06B**	
			M4	400※2	2m (Free cut)	**FT-420-13B**	
Cylinder type	Standard type		Ø1.5mm	150※2	2m (Free cut)	**FTC-1520-05**	
			Ø2mm	150※2	2m (Free cut)	**FTC-220-05**	
			Ø2mm (SUS type, 15mm)	150※2	2m (Free cut)	**FTCS-220-05**	
			Ø3mm	150※2	2m (Free cut)	**FTC-320-10**	

※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED.
It is applied to 40% of sensing distance for BF3RX.
※3: • **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install it in the many places as the change of the intensity of radiation by bending is small.
• **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.
※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-3) should be used for cutting fiber cable.]
※FT-420-13 was discontinued. FT-420-13B is replacement.

Product Overview

▣ Fiber Optic Cable (Through-Beam Type)

Type		Appearance	Feature	Sensing distance (mm) (based on Non-glossy white paper)	Cable length (L)	Model	Reference
Cylinder type	Flexible type※3		Ø3mm	110※1	2m (Free cut)	**FTC-220-05R**	
	Break-resistant type※3		Ø3mm	110※1	2m (Free cut)	**FTC-1520-06B**	
	Standard type		Ø2.47mm Side view	120※1	2m	**FTCSN-2520-05**	
Flat type	Flexible type		Top view	110※1	1m (Free cut)	**FTFU-210-05R**	
			Side view	110※1	1m (Free cut)	**FTFN-210-05R**	
			Flat view	100※1	1m (Free cut)	**FTF-210-05R**	**B-45 to 53**
			Side view+ Top view (Bending)	110※1	1m (Free cut)	**FTFB-210-05R**	
			L type top view height 12.2mm	500※1	1m (Free cut)	**FTLU-310-10R**	
			L type top view height 17.2mm			**FTLU1-310-10R**	
			L type top view height 22.2mm			**FTLU2-310-10R**	
Right angle	Flexible type		M4	460※1	1m (Free cut)	**FTR-410-10R**	
Area type	Flexible type		Ø1mm	750※4	1m (Free cut)	**FTW11-210-10R**	
Plastic	Standard type		Plastic injection molding type	500※2	2m (Free cut)	**FTP-320-10**	

※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED.
It is applied to 40% of sensing distance for BF3RX.
※3: • **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install it in the many places as the change of the intensity of radiation by bending is small.
• **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.
※4: The sensing distance is a standard for BF5 Series, and it is varied by operation mode.
(Ultra fast mode: 450mm / Fast mode: 750mm / Standard mode: 1400mm / Long distance mode, Ultra long distance mode: 1800mm)
※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-3) should be used for cutting fiber cable.]

Dual Digital Display Type Fiber Optic Amplifiers

■ Features

- Dual-display for light incident level and setting value (BF5□-D)
- Enables to detect the minute object with 1/10,000 high resolution
- Enables to detect with high-speed moving object (response speed 50µs)
- 5 response speeds
  : Ultra fast mode (50µs), High speed mode (150µs), Standard mode (500µs), Long distance mode (4ms), Ultra long distance mode (10ms)
- Anti-saturation setting function prevents malfunction by saturated light
- Added ultra long distance mode (10ms) of response speed
- Easy sensitivity setting
- Long lasting amplifier regardless of element's life degradation or temperature change
- Multiple sensitivity setting modes available
  : auto tuning, 1 point (maximum sensitivity), 2 point, positioning teaching
- Up to 8 units enable to connect with mutual interference prevention function using side connectors
- Auto channel setting function for multiple installations
- Adopts red, green, blue light sources for various environment
- Slim design (W10×H30×L70mm)

⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Specifications

Display type		Dual Display type			Single Display type
Model	NPN open collector output	**BF5R-D1-N**	**BF5G-D1-N**	**BF5B-D1-N**	**BF5R-S1-N**
	PNP open collector output	**BF5R-D1-P**	**BF5G-D1-P**	**BF5B-D1-P**	**BF5R-S1-P**
Light source		Red LED (660nm)	Green LED (530nm)	Blue LED (470nm)	Red LED (660nm)
Power supply		12-24VDC±10%			
Current consumption		Max. 50mA			
Operation mode		Light ON / Dark ON Selectable			
Control output		NPN or PNP open collector ●Load voltage: Max. 24VDC ●Load current: Max. 100mA ●Residual voltage - NPN: Max. 1V, PNP: Max. 3V			
Protection circuit		Reverse polarity protection, overcurrent protection, surge absorption			
Response time		Ultra Fast: 50µs, Ultra Long: 10ms (only for dual display type), Fast: 150µs, STD: 500µs, Long: 4ms			
Display method		●Incident light level: Red, 4-digit, 7-segment ●SV: Green, 4-digit, 7-segment ●Main output indicator: Red LED			●Incident light level / SV: Red, 4-digit, 7-segment ●Main output indicator: Red LED
Display function		Incident light level / SV display [4,000/10,000 resolution], Percentage display, High/Low peak value display, Normal / Reversed display (only for dual display type)			
Sensitivity setting		Manual sensitivity setting, teaching sensitivity setting (auto tuning, 1 point, 2 point teaching, positioning teaching)			Manual sensitivity setting, teaching sensitivity setting (auto tuning)
Mutual interference prevention		Max. 8 unit sets (automatically set regardless of response time)			
Initializing		Initializing as factory mode			—
Energy saving		Normal / Energy saving 1 / Energy saving 2			—
Timer		OFF, OFF Delay, ON Delay, One-shot			OFF, 10ms OFF Delay timer, 40ms OFF Delay timer
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1 min			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times			
Environ-ment	Ambient illumination	Incandescent lamp: Max. 3000lx Sunlight: Max. 11000lx (received illumination)			
	Ambient temperature	-10 to 50°C, storage: -20 to 70°C			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP40 (IEC standards)			
Material		Case: Polybutylene terephthalate, Cover: Polycarbonate			
Fiber cable Tightening torque		Min. 2kgf			
Accessory		Connector type wire (Ø4mm, 3-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm), Side connector			
Approval		CE			
Weight※1		Approx. 138g (approx. 20g)			

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

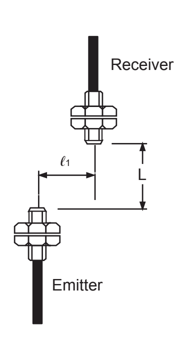
▣ Feature Data

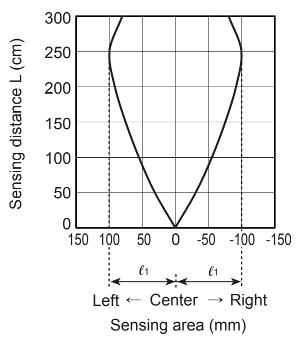
◎ Ultra fast [UFSt] mode

● Through-beam type

- Measurement: BF5□ + FT-420-10

Parallel shifting characteristic	
Measuring method	Data

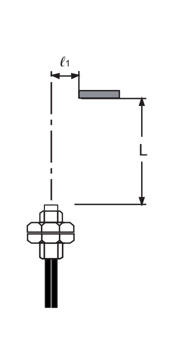


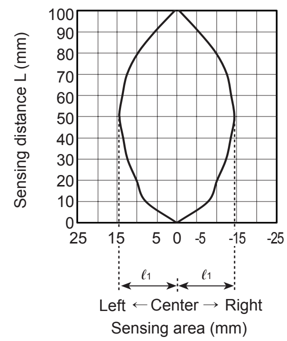


● Diffuse reflective type

- Measurement: BF5□ + FD-620-10

Sensing area characteristic	
Measuring method	Data



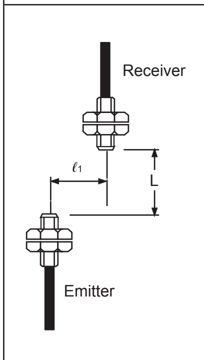


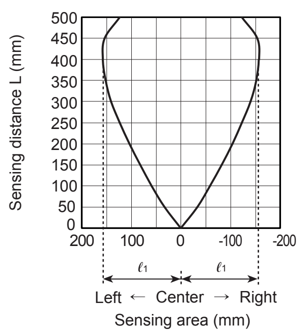
◎ Fast [FSt] mode

● Through-beam type

- Measurement: BF5□ + FT-420-10

Parallel shifting characteristic	
Measuring method	Data

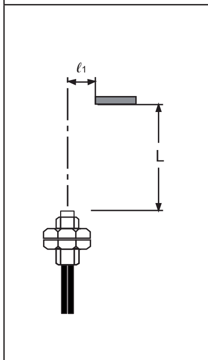


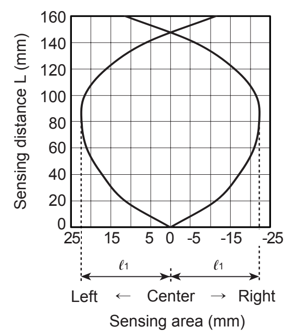


● Diffuse reflective type

- Measurement: BF5□ + FD-620-10

Sensing area characteristic	
Measuring method	Data



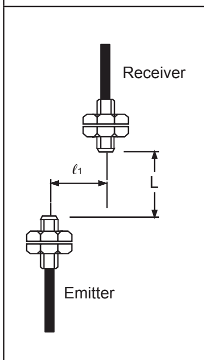


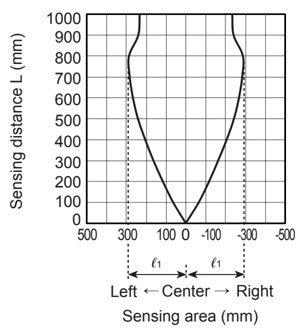
◎ Standard [Std] mode

● Through-beam type

- Measurement: BF5□ + FT-420-10

Parallel shifting characteristic	
Measuring method	Data

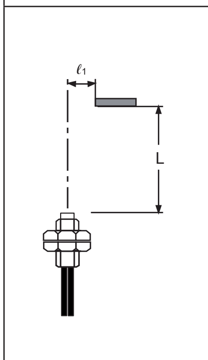


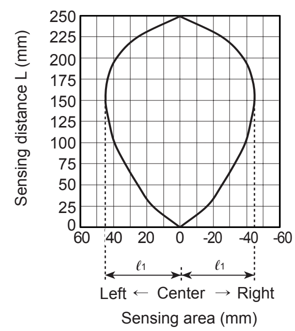


● Diffuse reflective type

- Measurement: BF5□ + FD-620-10

Sensing area characteristic	
Measuring method	Data



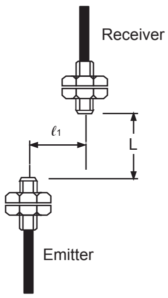
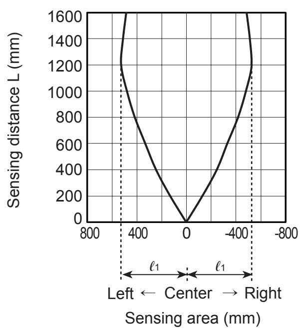


▣ Feature Data

◎ Long [LonG] mode

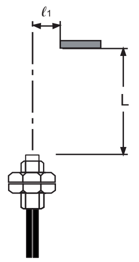
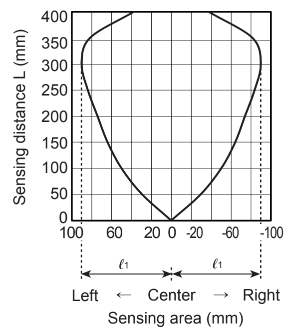
• Through-beam type

- Measurement: BF5□ + FT-420-10

Parallel shifting characteristic	
Measuring method	Data
	

• Diffuse reflective type

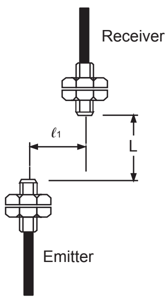
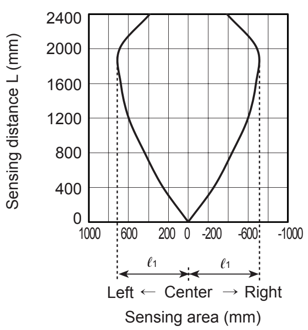
- Measurement: BF5□ + FD-620-10

Sensing area characteristic	
Measuring method	Data
	

◎ Ultra long [ULoG] mode

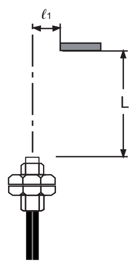
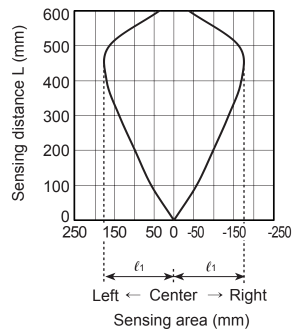
• Through-beam type

- Measurement: BF5□ + FT-420-10

Parallel shifting characteristic	
Measuring method	Data
	

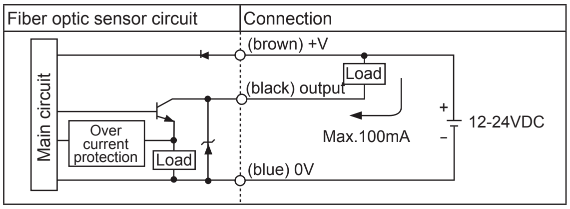
• Diffuse reflective type

- Measurement: BF5□ + FD-620-10

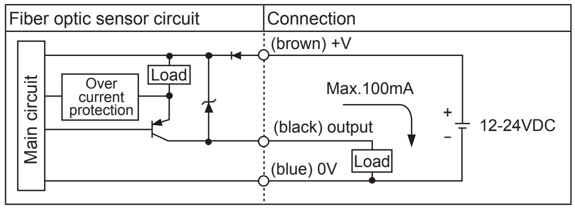
Sensing area characteristic	
Measuring method	Data
	

▣ Control Output Diagram

● **NPN open collector output**



● **PNP open collector output**

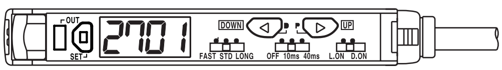


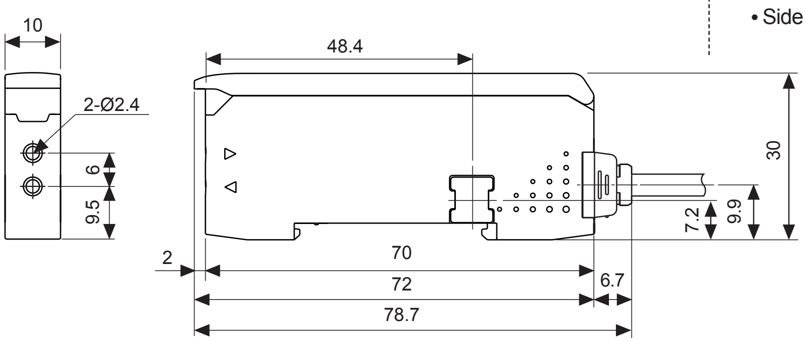
▣ Dimensions

(unit: mm)

● **BF5□-D1-□**

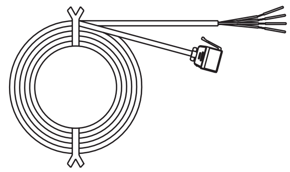
● **BF5R-S1-□**



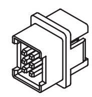


● **Accessories**

• Connector type wire (length: 2m)



• Side connector

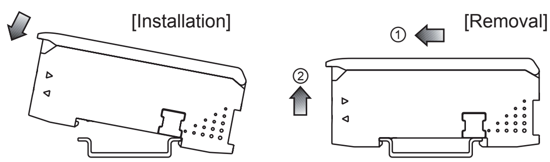


▣ Installations

◎ Amplifier unit mounting

● Installation: Hang up the backside holder on the DIN rail and press the unit toward the DIN rail.

● Removal: Slide the back part of the unit as the ① figure and lift up the unit as the ② figure.



◎ Amplifier unit connection

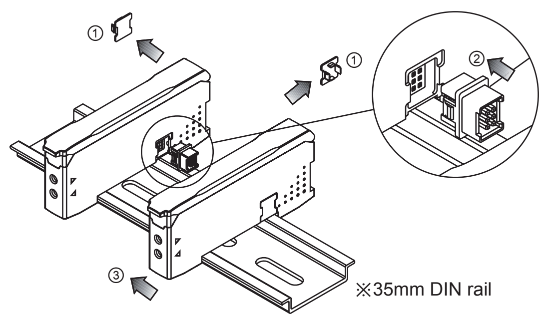
● Remove the side cover at the connecting side as the figure ① and connect the side connector as the figure ②.

※Be sure that if you connect a side connector with excessive force, it may cause extruded pins.

● After mounting the unit on the DIN rail, push gently both units to fasten each other.

※Make sure that connections between the unit case and connectors are correct. Improper connection may cause malfunction of channel setting and mutual interference prevention functions.

※Do not supply the power while connecting / disconnecting amplifier units.

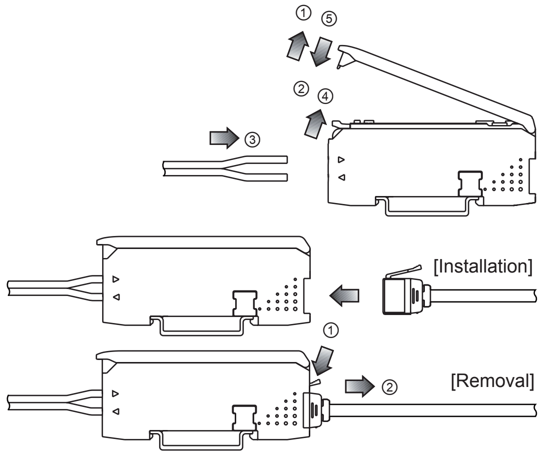


◎ Fiber cable connection

- Lift up the protective cover ① and push down the lock lever to the direction of ② to release the lock setting.
- Insert the cable to the direction of ③ with slightly moving up and down 15°, and gently press into the unit until the cable is completely inserted (inserted length: around 13mm).
- Lift up the lock lever to lock the lock setting ④ and close the protective cover to ⑤.

◎ Wire connector connection

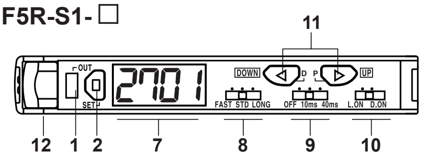
- Insert the connector into the amplifier unit until it clicks into right position.
- When removing the connector, pull out the connector to the ① direction by pressing the lever downside to the ② direction.



▣ Unit Descriptions

- **BF5□-D1-□**

- **BF5R-S1-□**



1. Control output indicator (red)
: Used to indicate control output provided by comparing SV and actual incident light level
2. Sensitivity setting key
: Used to execute each operation and to set sensing sensitivity
3. PV display part (4-digit, red, 7-segment)
: Used to indicate incident light level and parameters
4. SV display part (4-digit, green, 7-segment)
: Used to indicate SV and setting data
5. Up/down key
- Used to up/down setting values
- Used to Fine-adjusting sensitivity

6. MODE key
- Used to enter into program mode / data Bank mode
- Used to move each parameter

7. PV/SV display part (4-digit, red, 7-segment)
: Used to indicate incident light level / SV and parameters
8. Response time setting switch: FAST, STD, LONG
9. Timer setting switch
: Used to select OFF Delay time (OFF, 10ms, 40ms)
10. Operation mode setting switch
: Used to select Light ON / Dark ON
11. Up/Down key
- Used to up/down setting values
- Used to enter into each mode
- Used to Fine-adjusting sensitivity

12. Lock lever

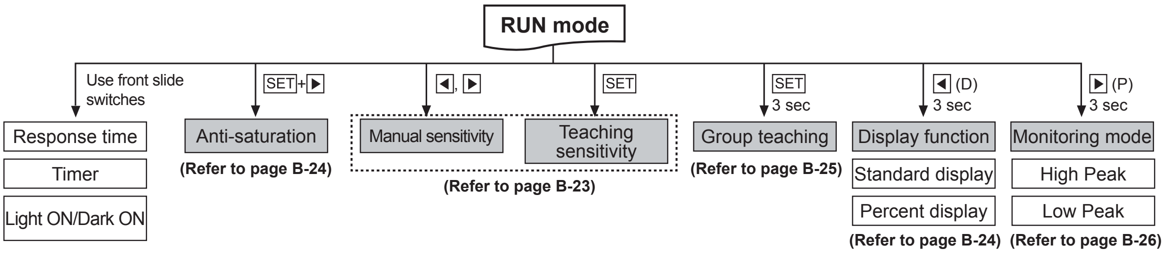
▣ Parameter Setting

- **BF5□-D1-□**

RUN mode

- SET + ▶ → Anti-saturation (Refer to page B-22)
- ◀, ▶ → Manual sensitivity; SET → Teaching sensitivity (Refer to page B-14 to 16)
- SET 3 sec → Group teaching (Refer to page B-16 to 17)
- MODE → Monitoring mode
  - High peak
  - Low peak
  - (Refer to page B-22)
- MODE 3 sec → Program mode
  - Response time
  - Display function
  - Display direction
  - Timer operation mode
  - Time setting
  - Sensitive setting mode
  - Energy saving
  - Light ON/Dark ON
  - Channel
  - Communication enable/disable
  - Lock
  - (Refer to page B-17 to 19)
- MODE 5 sec → Data Bank mode
  - Data Load
  - Data Save
  - Copy
  - Load All
  - Save All
  - (Refer to page B-19 to 21)
- MODE 7 sec → Initializing function mode
  - Initialize
  - (Refer to page B-22)

● BF5R-S1-□



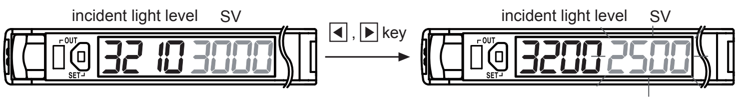
Dual display type (※Refer to page B-14 to 22.)

■ Sensitivity Setting Mode

※There are two methods available for sensitivity setting - manual/teaching sensitivity setting.
Select the method most suitable for your application.

◎ Manual sensitivity setting (Fine-adjusting sensitivity)

● The setting is to set the sensitivity manually.
● Used to fine-adjusting sensitivity after the teaching sensitivity setting.
● Incident light level is still displayed on the PV display part during setting.



① Press the ◀ and ▶ keys to set the value.
② There is no additional key for completing the setting. After completing setting and no key input for 3 sec, let set value flashing twice (every 0.5 sec) and automatically it saved and returned to RUN mode.

◎ Teaching sensitivity setting (Auto-tuning, One-point, Two-point, Positioning)

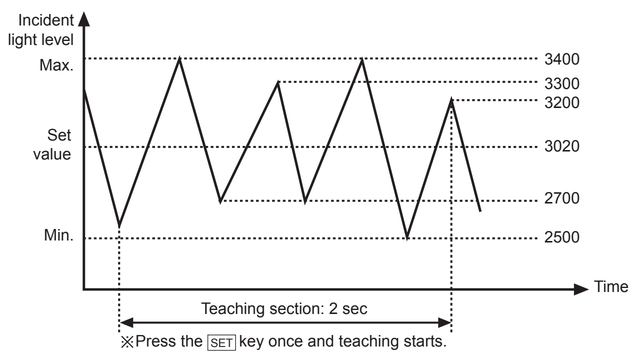
● How to enter into sensitivity setting mode in RUN mode
Press the SET key once and teaching starts automatically.
When teaching is completed, this unit returns to RUN mode automatically.
● The PV display part displays the set teaching mode parameter and the SV display part displays the progressing status while teaching is in the process.
※If there is no key operation for 60 sec after entering into teaching mode, it automatically returns to RUN mode.

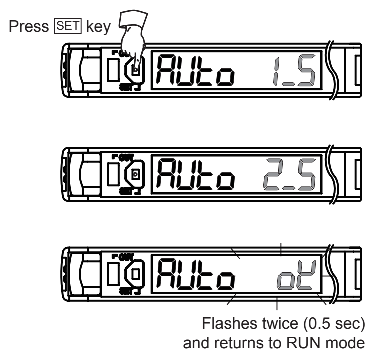
1) Auto-tuning

※Suitable when unstable incident light level of sensing object or when sensing fast moving objects.
※Auto-tune automatically sets the sensitivity by using the average value of the incident light level within a certain period.

$$\text{Set\_value} = \frac{P1+P2+\cdots+Pn\text{-}1+Pn}{n}$$

● Set Teaching mode parameter[SEnS] to AUto.

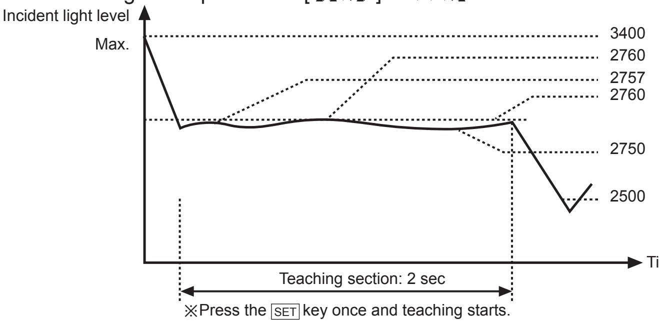


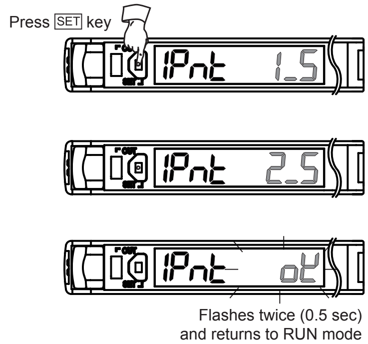


2) One-point teaching mode

※One of teaching modes that sets the maximum sensitivity by teaching one sensitivity setting point when setting the SV with no sensing object (Reflective) or when setting the SV with incident light level 0 (Through-beam) / Suitable for the applications no effect of dust or background.

● Set Teaching mode parameter [SEnS] to 1Pnt.





※SV range for sensing distance.

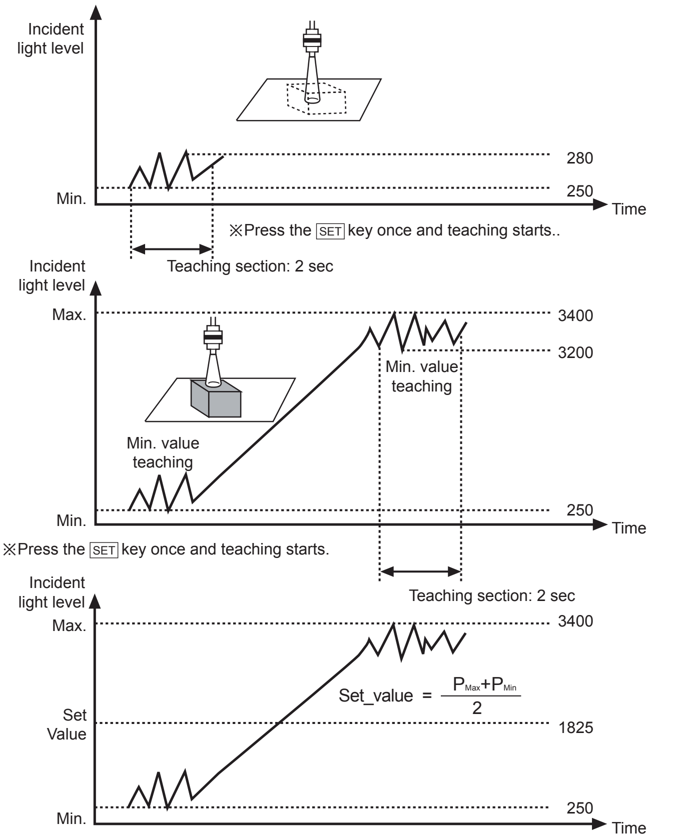
Response Time	Teaching when incident light level is 0	Teaching when incident light level is saturated
UFSt	In case incident light level is 0, set to 10-digit.	In case incident light level is saturated, set to 3980-digit.
FSt		
Std		
LoG	In case incident light level is 0, set to 5-digit.	In case incident light level is saturated,set to 9980-digit.
ULoG		

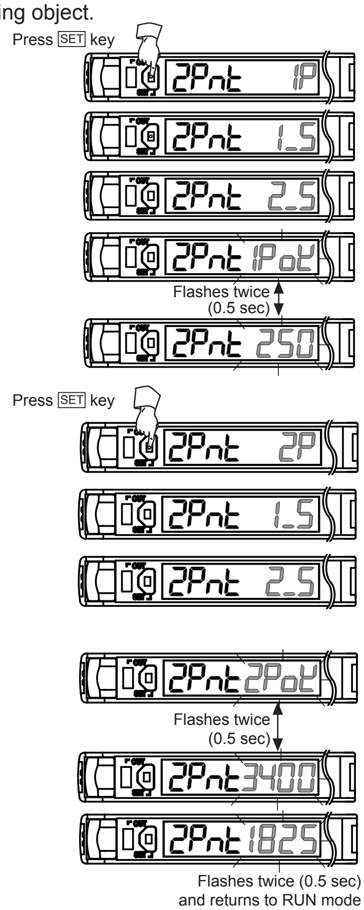
3) Two-point teaching mode

※Suitable when incident light level is stable or when sensing object is slow or at stopped position.

※One of teaching modes that sets the sensitivity by using average value of two incident light levels obtained from two point teaching - one point with a sensing object and another point without a sensing object.

● Set Teaching mode parameter [SEnS] to 2Pnt.



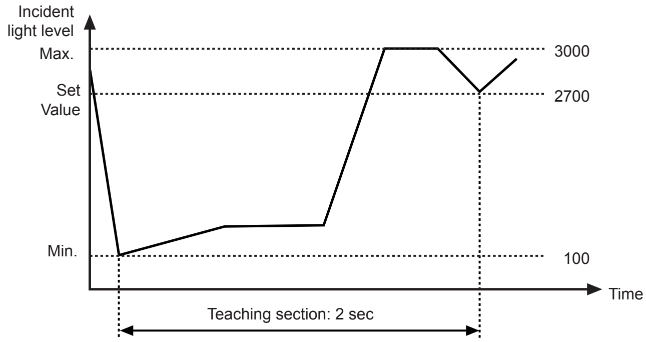


※Make sure that two point teaching must be done within 60 sec after one point teaching. If not, teaching mode is cancelled and it returns to RUN mode.

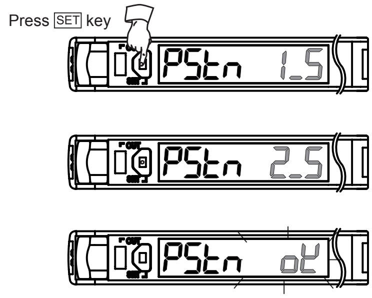
4) Positioning teaching mode

※One of teaching modes that sets the sensitivity by 90% of max. incident light level when sensing an object with a hole on the surface (Through-beam) or sensing a moving object with curve (Reflective).

● Set Teaching mode parameter [SEnS] to PStn.



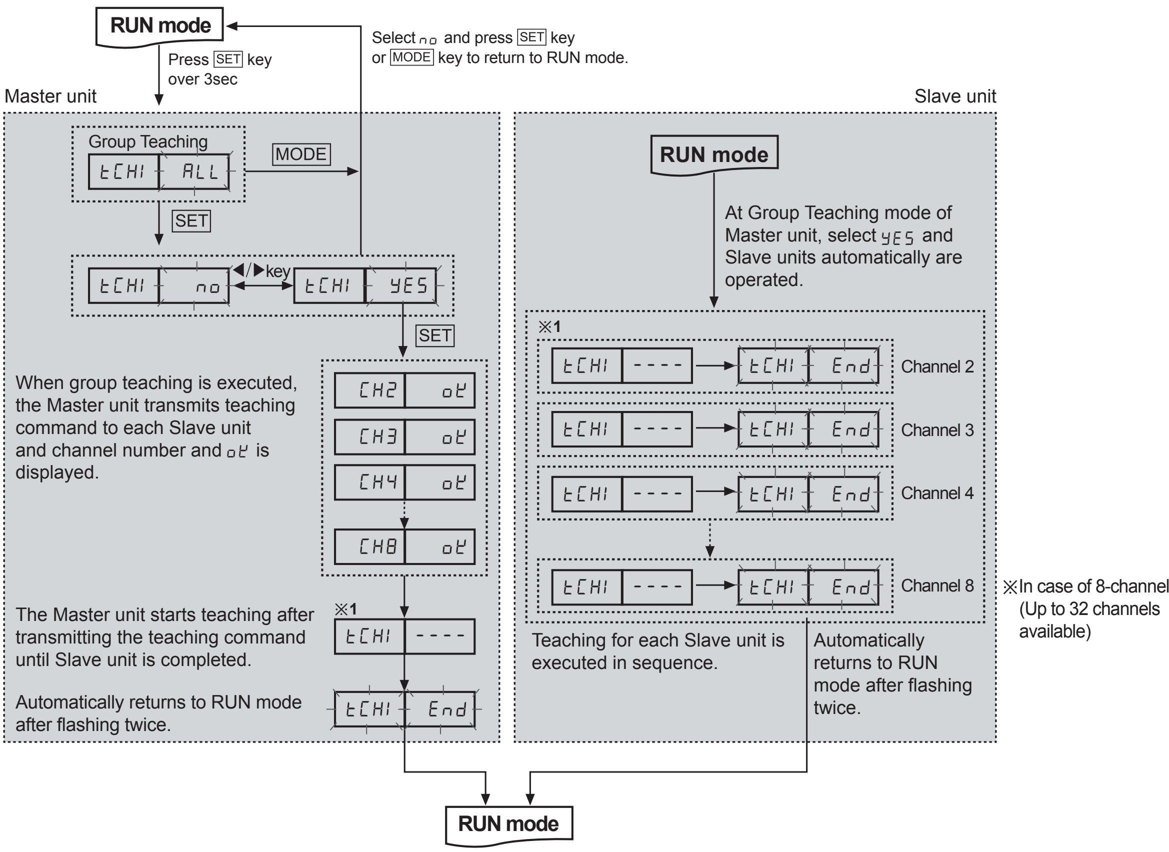
※Press the SET key once and teaching starts.



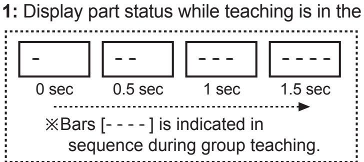
Flashes twice (0.5 sec) and returns to RUN mode

■ Group Teaching mode

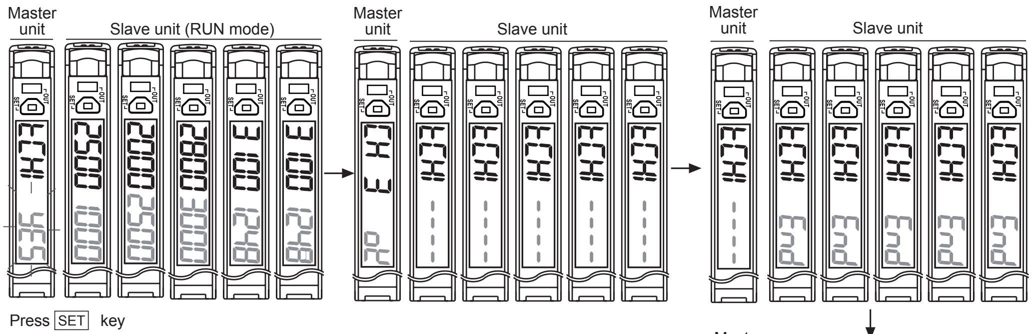
A function to set the sensitivity of Slave amplifier units according to the command of Master amplifier unit (a certain amplifier unit) in a successive and collective way.

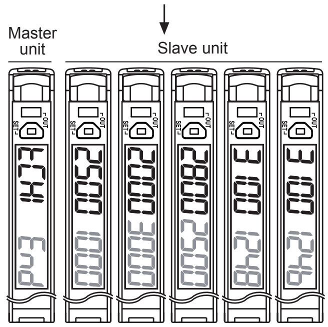


※1: Display part status while teaching is in the process



● **Master / Slave unit display during group teaching mode**





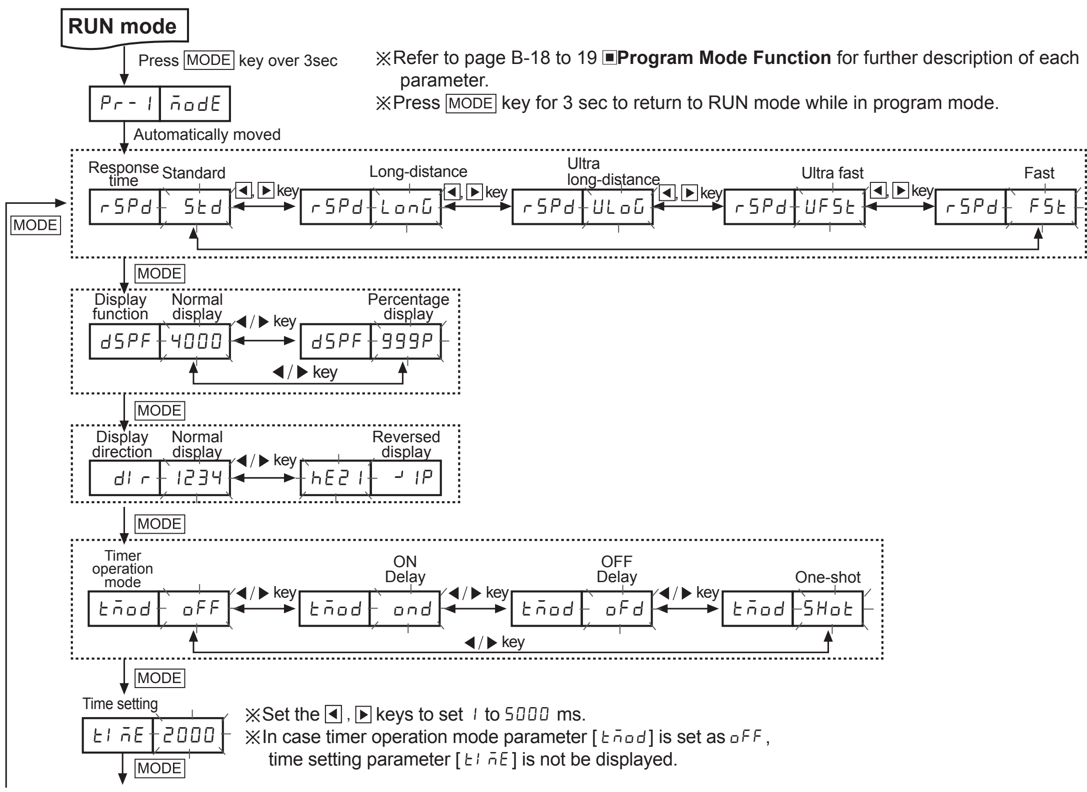
① The Master unit displays channel number on the PV display part and ok on the SV while group teaching is executed.
② Slave units display tCH1 on the PV display parts and ---- flashes every 0.5 sec on the each SV display part while group teaching is executed. When teaching is completed, Slave units flash SV twice and display tCH1 on the each PV display part and End on the SV display parts. Then, they automatically return to RUN mode.
③ The Master unit starts teaching after transmitting teaching command to Slave units. When teaching is completed, the Master unit flashes SV twice and displays tCH1 on the PV display part and End on the SV display part. Then, they automatically return to RUN mode.

▣ Program Mode Setting

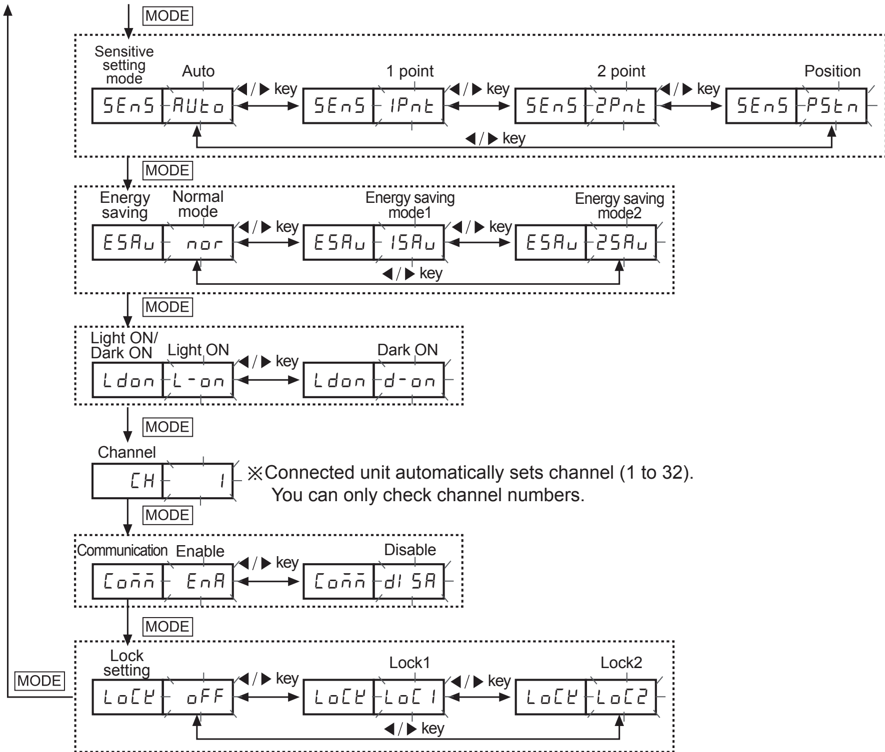
- When entering into program mode, parameters lights ON on the PV display part and setting values flashes every 0.5 sec on SV display part. Use the ◀, ▶ keys to set each setting value.
- Press the MODE key one time after setting each parameter to save each setting and enter into next mode.
- If the key lock is set, unlock the key lock before setting parameters.

◎ Program mode flow

※Refer to page B-18 to 19 ▣**Program Mode Function** for further description of each parameter.
※Press MODE key for 3 sec to return to RUN mode while in program mode.



※Set the ◀, ▶ keys to set 1 to 5000 ms.
※In case timer operation mode parameter [tnod] is set as oFF, time setting parameter [tInE] is not be displayed.



▣ Program Mode Function

◎ Response time setting [rSPd]

A function to set the response time of control output - 4 response modes selectable.

- Ultra fast [UFSt] mode: 50µs
- Fast [FSt] mode: 150µs
- Standard [Std] mode: 500µs
- Long-distance [LonG] mode: 4ms
- Ultra long-distance [ULoG] mode: 10ms

◎ Display function [dSPF]

A function to select incident light level display mode on PV display window: Standard display [4000] / Percentage display [999P]

- Display range of standard mode: 0 to 4000 (0 to 9999, in case of long distance mode)
- Display range of percentage mode: 0P to 999P (Decimal point is not displayed)

◎ Display direction setting function [dIr]

A function to reverse the display direction to suit the unit in the location for installation: Normal display / Reversed display selectable.

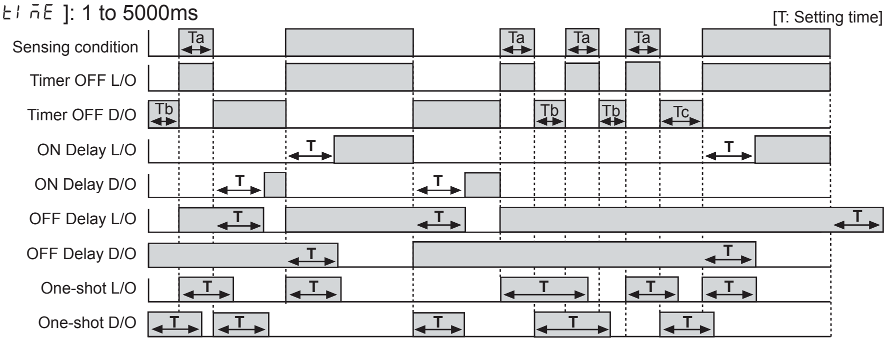
※Reversed display is upside-down (180°) display of normal display.

◎ Timer function [Timer operation mode: tmod, Time setting: tImE]

Used when external device's response time is too late or when control output time is too short due to small sensing object - 3 modes are available.

- Timer Off [oFF]: Not using timer function.
- On Delay [ond]: Delays control output ON time from OFF for a certain period of setting time.
- Off Delay [oFd]: Delays control output OFF time from ON for a certain period of setting time.
- One-shot [SHot]: Turns control output ON or OFF within a certain period of setting time.
- Setting time [tImE]: 1 to 5000ms
- **Time chart**

[T: Setting time]



※Setting time: T>Ta , T>Tb , T>Tc>Tb

◎ Energy saving function [ESAu]
A function to save unit's power consumption by reducing power supply to display parts in case of no setting input within 60 sec.
- ● Selectable from 2 power saving modes
- - Normal mode [nor]: Main output indicator (OUT), PV/SV display part ON
- - Energy saving mode 1 [1SAu]: Main output indicator (OUT) and PV display part ON
- - Energy saving mode 2 [2SAu]: Main output indicator (OUT) ON

◎ Light ON / Dark ON switching function [Ldon]
A function to set Light ON - control output is ON when incident light level is higher than setting value Dark ON - control output is ON when incident light level is lower than setting value.

◎ Communication enable / disable setting function [Comm]
A function to set communication write [enable (EnA) / disable (dISA)] for Slave amplifier units while certain instructions (Load/Save/Copy) or Group teaching is in progress by the Master amplifier unit.

◎ Lock function [LoCK]
Two types of key lock setting are available in order to prevent SV changes by careless.

	oFF	LoC1	LoC2
Sensitivity setting	●	◐	◐
Data Bank mode	●	○	○
Program mode	●	◐	○
Parameter initialization	●	○	○

※●: Check / Setting both available
◐: Check available
○: Check / Setting both unavailable

● In case of [LoC2]mode, it is not available to use the lock function first to enter into parameter mode.

■ Data Bank Setting
A function to save settings for group amplifier units in each data Bank by using Master unit's command or by adjusting one amplifier unit's setting and to load required data Bank without resetting for each unit's parameters and setting values.
- ● LOAD [LoAd]: Loads preset data bank (bAK0, 1, 2) and applies it to the amplifier unit. Detailed Bank parameters can be read and changed.
- ● SAVE [SAuE]: Saves one amplifier unit settings in one of data bank (bAK0, 1, 2).
- ● COPY [CoPY]: Copies the currently loaded Bank by Master's instructions to the other amplifier units (1:1) or the whole amplifier units (1: M).
- ● LOAD ALL [LdAL]: Selects one data bank by Master's instructions and loads it to entire group units.
- ● SAVE ALL [SuAL]: Selects one data bank by Master's instructions and saves it in entire group units.

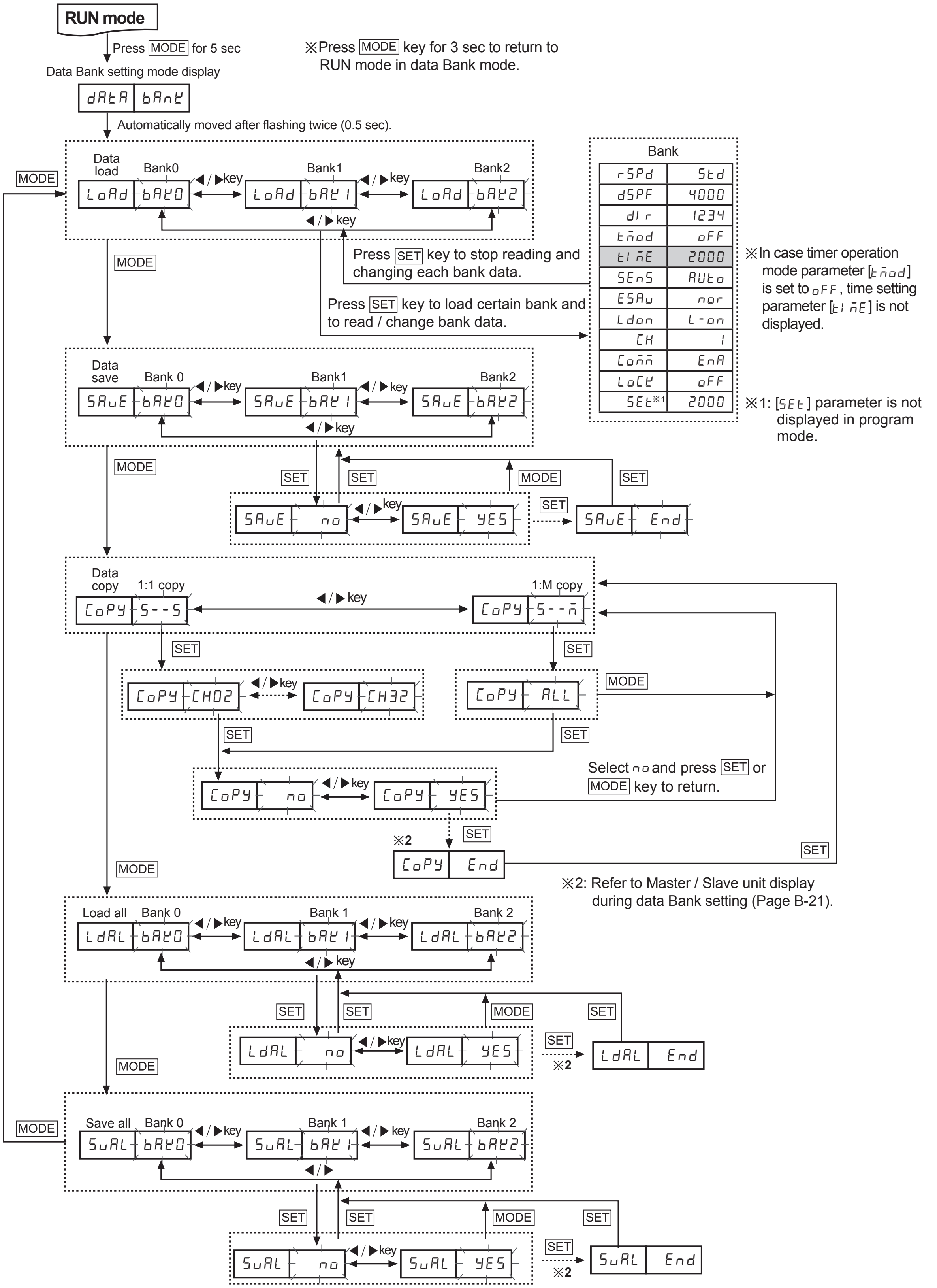
※For BF5□-D1-□, three data banks are available ([bAK0], [bAK1] and [bAK2]) so that three different sensing object information can be saved. Each Bank can be read and changed. It allows users to detect three different sensing objects with one amplifier unit without resetting each parameter.

※Data bank function can be executed only if all amplifier units are in RUN mode.

※Copy/Load All/Save All functions are applicable only if multiple amplifier units are connected.

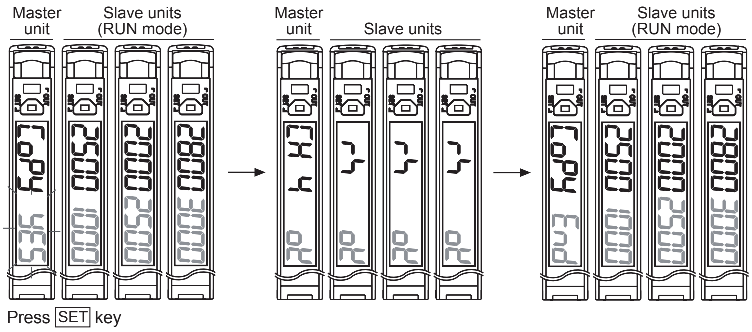
※If lock function is set (LoC1/LoC2) on amplifier units or if the Slave unit is set to communication disable[dISA], Load and Save command for the unit is not executed.

◎ Data Bank mode flow



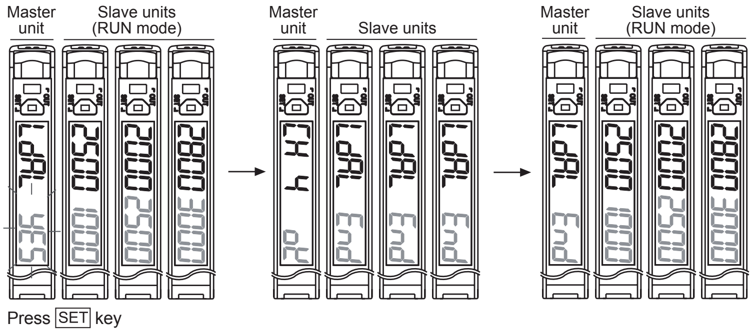
◎ Master / Slave unit display during data Bank setting

● **Copy All**



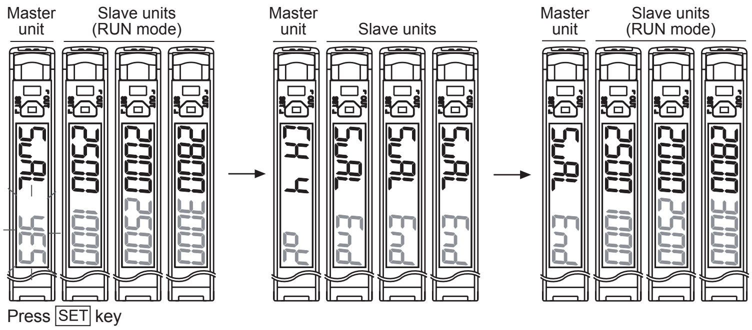
① While Copy All is executed, the Master unit displays the channel number on the PV display part and oK on the SV display part.
② While Copy All is executed, the Slave units display rH on the PV display part and oK on the SV display part and they return to RUN mode.
③ When Copy All is completed, the Master unit displays CoPY on the PV display part and End on the SV display part. Press the SET key to return to Data Copy mode.
※In case of 1:1 Copy, it progresses likewise.

● **Load All**



① While Load All is executed, the Master unit displays the channel number on the PV display part and oK on the SV display part.
② While Load All is executed, the Slave units display LdAL on the PV display part and End on the SV display part and they return to RUN mode.
③ When Load All is completed, the Master unit displays LdAL on the PV display part and End on the SV display part. Press the SET key to return to Load All mode.

● **Save All**



① While Save All is executed, the Master unit displays the channel number on the PV display part and oK on the SV display part.
② While Save All is executed, the Slave units display SuAL on the PV display part and End on the SV display part and they return to RUN mode.
③ When Save All is completed, the Master unit displays SuAL on the PV display part and End on the SV display part. Press the SET key to return to Save All mode.

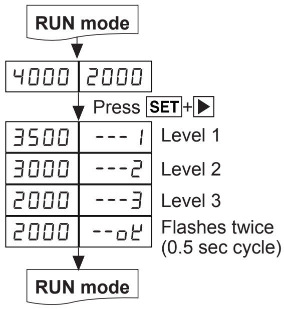
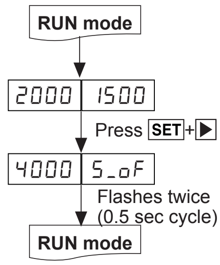
※If communication write enable / disable parameter [Comm] for the Slave unit is set to disable dISA while Save All, Load All or Copy is executed, the master unit displays channel number on the PV display part and dISA on the SV display part.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Anti-Saturation Setting Function

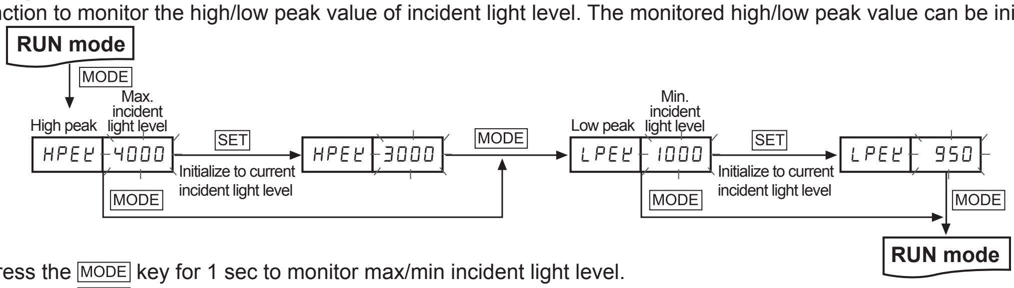
- When the sensing target comes too close and it is saturation status, this function changed to the optimize status.
- Press the SET+▶ keys one time and anti-saturation function is operated automatically. There are max. 10 levels.
- Press the SET+▶ keys one time again and anti-saturation function is cleared.
- During anti-saturation, the SV display part displays current level.
- When response mode is ultra fast [UFSt], fast [FSt] or standard [Std] and incident light level is lower than 2200, this function is cleared and this unit returns RUN mode automatically. When response mode is long distance [LonG], ultra long distance [ULoG] and incident light level is lower than 5500, this function is cleared and this unit returns RUN mode automatically.

※This function is not operated when incident light level is lower by each mode (UFSt, FSt, Std: 2200, ULoG, LonG: 5500).
※If saturation status is too high and it does not reach the target value, it stops at level 10 and this unit returns RUN mode.
※When anti-saturation function is set, control output operation may be changed.

Anti-saturation function ON	Anti-saturation function OFF
	

▣ High Peak, Low Peak Function

A function to monitor the high/low peak value of incident light level. The monitored high/low peak value can be initialized.

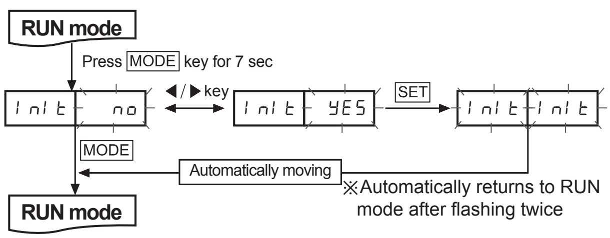


① Press the MODE key for 1 sec to monitor max/min incident light level.
② Press the MODE key to initialize max/min value to current incident light level during monitoring.
③ Press the MODE key to return to RUN mode.

▣ Initializing Function

A function to initialize all parameters about default value in case of mis-setting or mis-operation.
※Set lock function [LoCK] to oFF to execute Initializing Function.
※High peak value[HPEK] and low peak value[LPEK] shall not be initialized.

◎ Parameter initialize flow



① Press the MODE key for 7 sec in RUN mode. Init parameter turns ON on PV display part and no flashes every 0.5sec on SV display part.
② Press the MODE key once again to return to RUN mode without executing initializing Function.
③ Select YES using the ◀, ▶ keys and press the SET key. Init flashes twice on both PV and SV display parts.
④ When parameter initialization is completed, it automatically returns to RUN mode.

◎ Parameter value for initialization (factory default)

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
rSPd	Std	tmod	oFF	Ldon	L-on
dSPF	4000	SEnS	AUto	Comm	EnA
dIr	1234	ESAu	nor	LoCK	oFF
SV: 2000, Bank 0 to 2: Initialized					

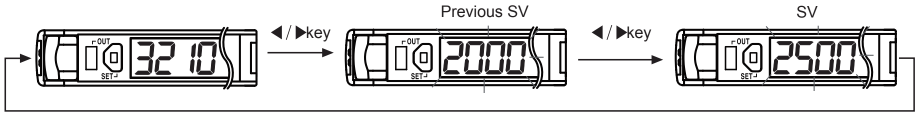
Single display type (※Refer to page B-23 to 26.)

■ Sensitivity Setting Mode

**※There are two methods available for sensitivity setting - manual or teaching mode.
Select the most suitable method for your application.**

◎ Manual sensitivity setting (Fine-adjusting sensitivity)

- The setting is to set the sensitivity manually.
- Used to fine-adjust sensitivity after the teaching sensitivity setting.
- Incident light level is still displayed on the PV/SV display part during SV setting.

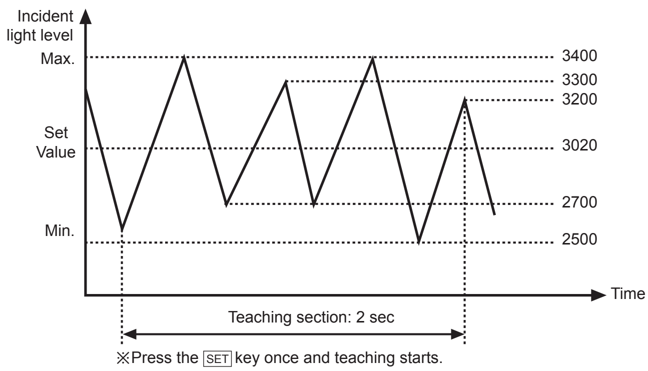


① Press the ◀ or ▶ key once in RUN mode, then previous SV flashes twice (every 0.5 sec).
② Press the ◀ and ▶ keys to set the value.
③ There is no additional key for completing the setting. If there is no key input for 3 sec after completing setting, newly set value flashes twice (every 0.5 sec) and automatically is saved and it returns to RUN mode.

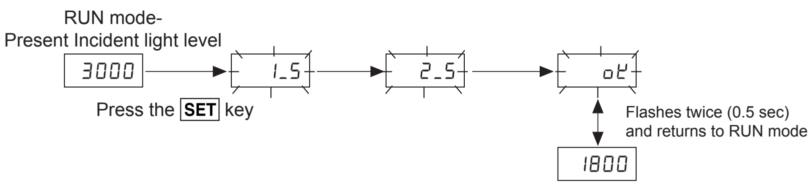
◎ Teaching sensitivity setting (Auto tuning)

- For BF5R-S1-□ model, teaching sensitivity setting mode is fixed to auto-tuning.

※This mode is easy for the sensitivity when incident light level of sensing object is not stable or moves fast.
※One of teaching modes that sets the sensitivity by using average value of the maximum and minimum incident light level within a certain period.



$$\text{Set\_value} = \frac{P1+P2+\cdots+Pn\text{-}1+Pn}{n}$$



① In RUN mode, press the SET key once with the desired sensing target.
② When pressing the SET key once, and teaching starts and is progressed automatically for 2 sec.
③ After completing teaching, oK is flashes twice for 0.5 sec and it returns to RUN mode.

▣ Function

◎ Response time setting

Use front slide switch to set response time.

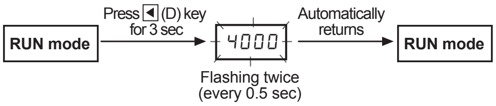
- Fast (FAST) mode: 150μs
- Standard (STD) mode: 500μs
- Long distance (LONG) mode: 4ms

◎ Display function (Factory mode: standard display)

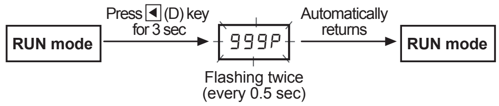
A function to select incident light level display on display part.

- Display range of standard mode: 0 to 4000 (0 to 9999, in case of long distance mode)
- Display range of percentage mode: 0P to 999P (Decimal point is not displayed)

<When changing to standard display mode>



<When changing to percentage display mode>

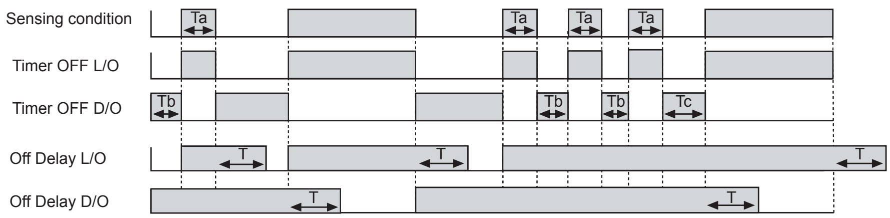


◎ Timer function

※For the BF5R-S1-□ model (single display type), only OFF Delay mode is available. Select the setting time (OFF/10ms/40ms) using the front slide switch.

- **Time chart**

[T = 10ms or 40ms]



※Setting time: T>Ta , T>Tb , T>Tc>Tb

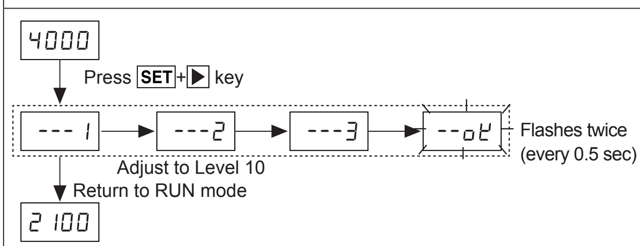
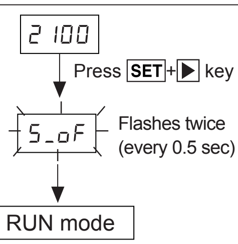
◎ Light ON / Dark ON switching function

A function to set Light ON - control output is ON when incident light level is higher than setting value and Dark ON - control output is ON when incident light level is lower than setting value.
BF5R-S1-□ (Single display type) model uses the front slide switch to set each mode.

▣ Anti-Saturation Setting Function

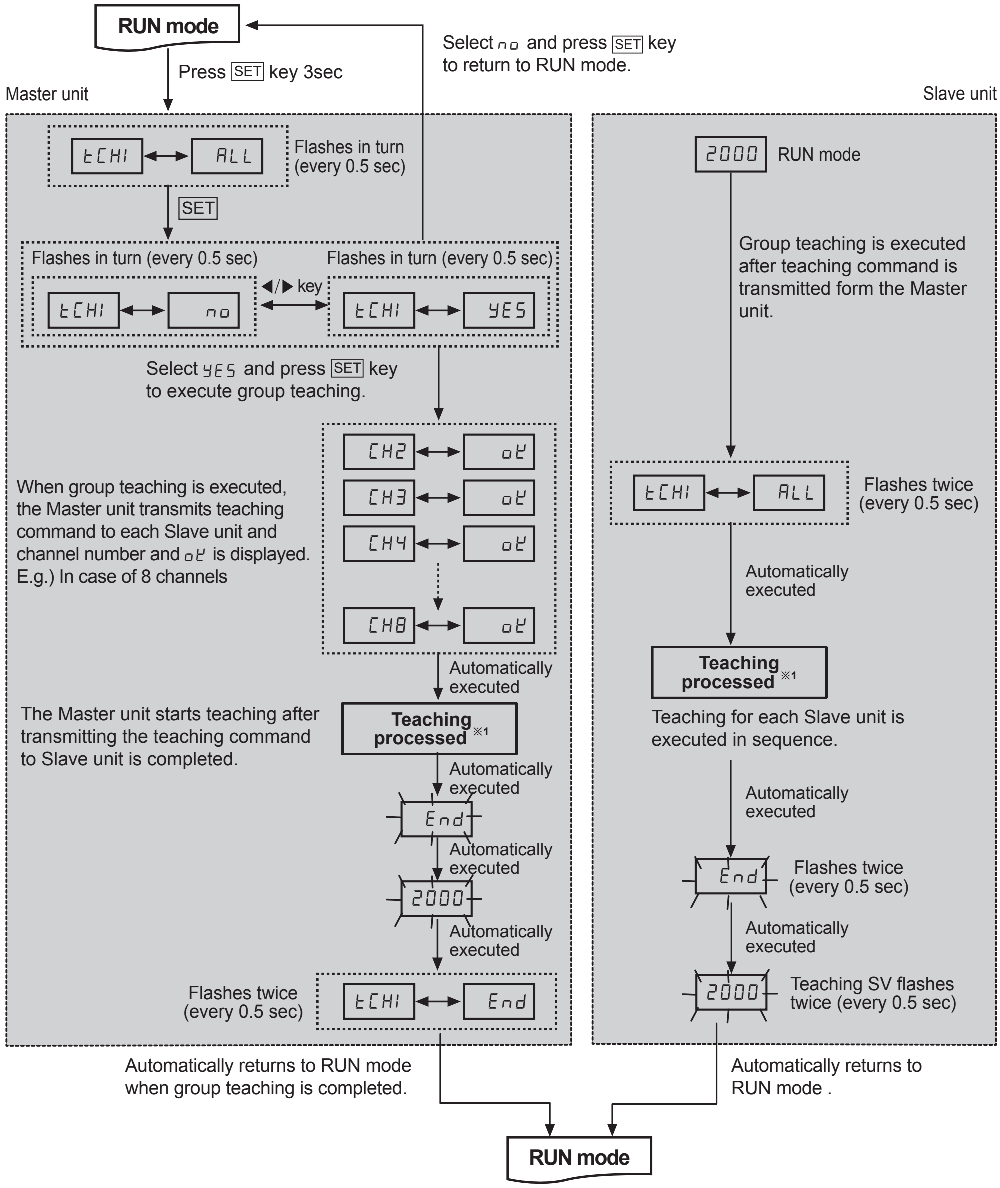
- When the sensing target comes too close and it is saturation status, this function changed to the optimize status.
- Press the SET+▶ keys one time and anti-saturation function is operated automatically. There are max. 10 levels.
- Press the SET+▶ keys one time again and anti-saturation function is cleared.
- During anti-saturation, the PV/SV display part displays current level.
- When response mode is fast [**FST**] or standard [**STD**] and incident light level is lower than 2200, this function is cleared and this unit returns RUN mode automatically. When response mode is long distance [**LONG**] and incident light level is lower than 5500, this function is cleared and this unit returns RUN mode automatically.

※This function is not operated when incident light is lower by each mode (**FST**, **STD**: 2200, **LONG**: 5500).
※If saturation status is too high and it does not reach the target value, it stops at level 10 and this unit returns RUN mode.
※When anti-saturation function is set, control output operation may be changed.

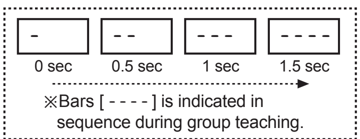
Anti-saturation function ON	Anti-saturation function OFF
	

■ Group Teaching

A function to set the sensitivity of Slave amplifier units according to the command of Master amplifier unit (a certain amplifier unit) in a successive and collective way.



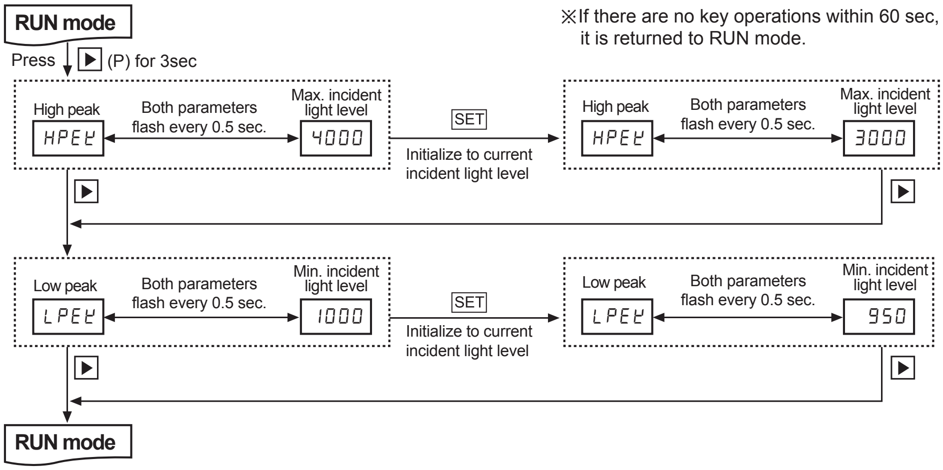
※1: Display part status while teaching is in the process



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ High Peak, Low Peak Function

A function to monitor the high/low peak value of incident light level. The monitored high/low peak value can be initialized.



Dual display / Single display common features

▣ Program Mode Function

◎ Amplifier units connection using side connector

In case multiple amplifier units are connected, the power for one unit will be supplied to all connected units.

◎ Auto channel setting function

- The channel for each amplifier unit - connected by side connector - is automatically set in a certain direction (→) as soon as power is supplied. Channel number is increasing one by one.
- Auto set channel can be checked in channel parameter in program mode.
- In case of BF5R-S1-□, auto set channel can be checked only when initial power is supplied. (Not available afterwards).
- Channel range: 1 to 32 (applied the same to all models)

※**Note that auto set channel cannot be changed and the channel number of each amplifier unit is not saved in case of power OFF.**

▣ Mutual Interference Prevention Function

A function to set different light receiving time for each amplifier unit in case of installing the fiber cable adjacently in order to prevent mutual interference occurring. (Set automatically when power is turned ON.)
※Mutual interference function is allowed up to maximum 8 amplifier units regardless of the unit model and response time.

▣ Error Code

Error code	Cause	Troubleshooting
ErrL	In case incident light level is below the min range when teaching.	Increase the incident light level above min range.
Err	In case overcurrent inflow occurs into output circuit.	Remove overcurrent through overload.
Erb	● In case Slave is failed to execute Master's instructions due to unstable communication line connection during Group Copy / Load / Save / Teaching. ● In case other communication errors occur	● Check amplifier unit's connection again. ● Check circuit and hardware around side connector.

Digital Fiber Optic Amplifier (BF5) Communication Converter

■ Features

- Sets all Functional performance and parameters from external devices (PL, PLC)
- Supports various communications
  : RS485 communication, Serial Communication, SW input
- Connected up to 32 amplifier units (BF5 series)
- Slim design with depth 10mm (W10×H30×L70mm)

⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ User Manual

- Visit our web site (www.autonics.com) to download user manual and communication manual.
- User manual describes for specifications and function, and communication manual describes for RS485 communication (Modbus RTU protocol) and parameter address map data.

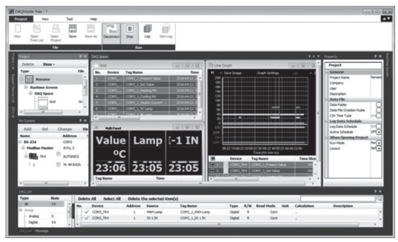
■ Comprehensive Device Management Program (DAQMaster)

- DAQMaster is comprehensive device management program to set parameter and manage monitoring data.
- Visit our website (www.autonics.com) to download user manual and comprehensive device management program.

< Computer specification for using software >

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS-232 serial port (9-pin), USB port

< DAQMaster screen >



■ Specifications

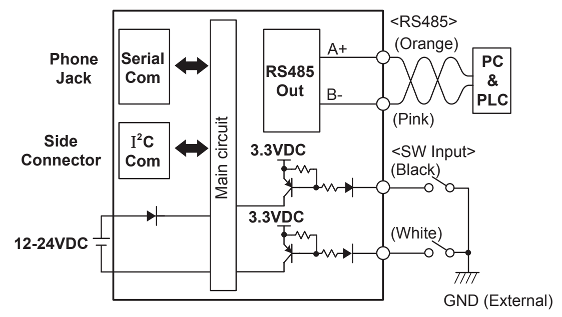
Model		NPN Solid-state input	PNP Solid-state input
		BFC-N	BFC-P
Power supply※1		12-24VDC ±10%	
Current consumption		Max. 40mA	
SW input (SW1, SW2)		LOW: 0-1V, HIGH: 5-24V	
		SW1/SW2 - HH: Standby, HL: BANK0, LH: BANK1, LL: BANK2	SW1/SW2 - LL: Standby, LH: BANK0, HL: BANK1, HH: BANK2
Communication function		RS485 communication, serial communication, SW input	
Communication speed		1200, 2400, 4800, 9600, 19200, 38400bps	
Indication		● Parameter: Red 4-digit 7-segment ● Set value: Green 4-digit 7-segment ● Indicator: TX indicator (red), RX indicator (green)	
Function		● Real-time monitoring (incident light level, on/off state) ● Executes every BF5 feature and sets parameter by external device (PC, PLC)	
Environ-ment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Vibration		1.5 mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Protection structure		IP40 (IEC standard)	
Material		Case: Polybutylene terephthalate, Cover: Polycarbonate	
Accessory		Connector type wire (Ø4mm, 3-wire, 2m) (AWG 22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm), Side connector	
Approval		CE	
Unit weight		Approx. 15g	

※1: Power is supplied from the voltage of the amplifier unit connected by a side connector.
※Environment resistance is rated at no freezing or condensation.

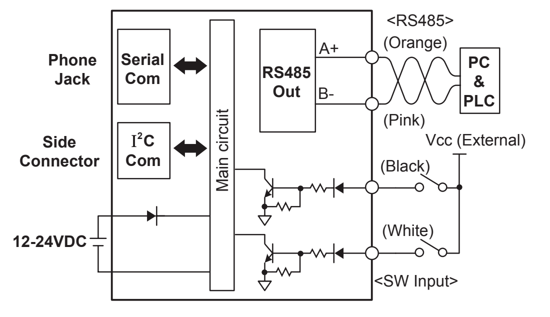
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Control Output Diagram And Terminal Connections

BFC-N

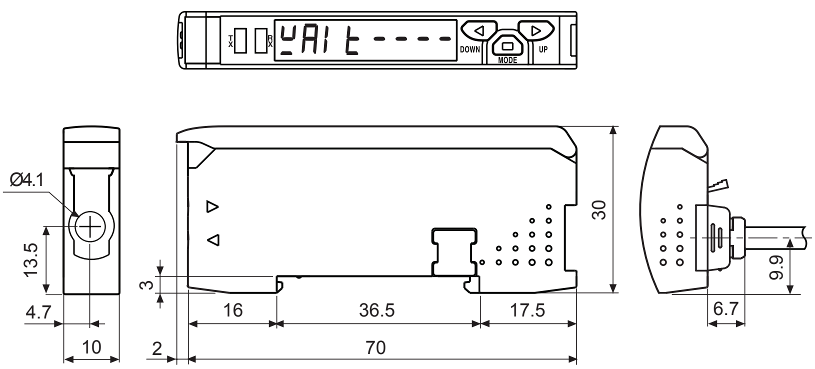


BFC-P



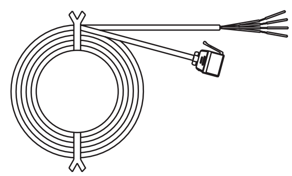
■ Dimensions

(unit: mm)

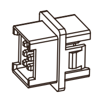


● **Accessories**

• Connector type wire (length: 2m)



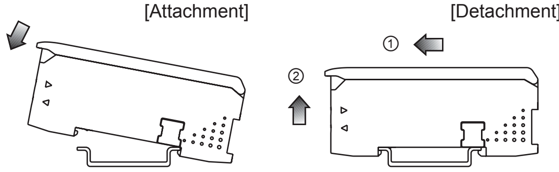
• Side connector



■ Installations

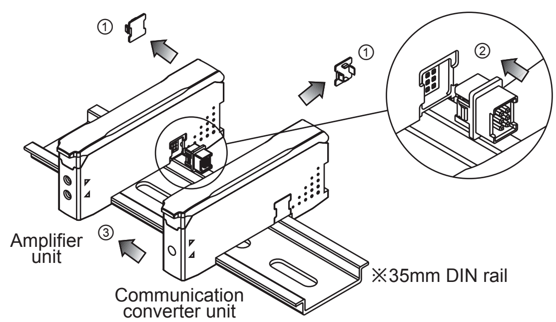
◎ DIN rail installations

● Attachment: Hang up the backside holder on the DIN rail and press the unit toward the DIN rail.
● Detachment: Slide the back part of the unit as the ① figure and lift up the unit as the ② figure.



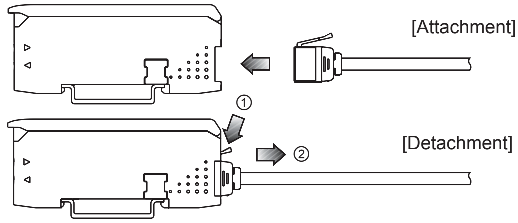
◎ Communication converter unit (BFC series) and Amplifier unit (BF5 series) Connection

● Remove the side cover at the side of communication converter unit where amplifier unit will be connected.
● Attach the side connector to the socket on the side of the communication converter.
※Be sure that if you connect a side connector with excessive force, it may cause extruded pins.
● After attaching the communication converter unit and the amplifier unit to the DIN rail, push gently to make both units fastened into each other.
※Improper connection may cause malfunction.
※Do not supply the power while connecting or disconnecting.



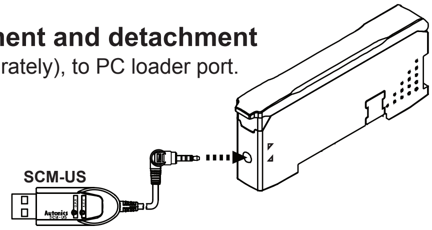
◎ Connector cable attachment and detachment

● Attachment: Insert the connector cable into the installed communication converter unit on DIN rail until it clicks.
● Detachment: Pull out the connector cable by pressing the connector cable lever downside.



◎ USB to Serial converter (SCM-US) attachment and detachment

● Connect the USB to Serial converter, SCM-US (sold separately), to PC loader port.



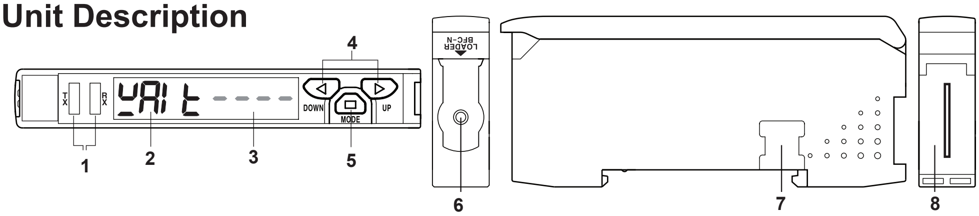
■ Communication Converter (sold separately)

● **SCM-38I**
(RS232C to RS485 converter)
CE

● **SCM-US48I**
(USB to RS485 converter)
CE

● **SCM-US**
(USB to serial converter)
CE

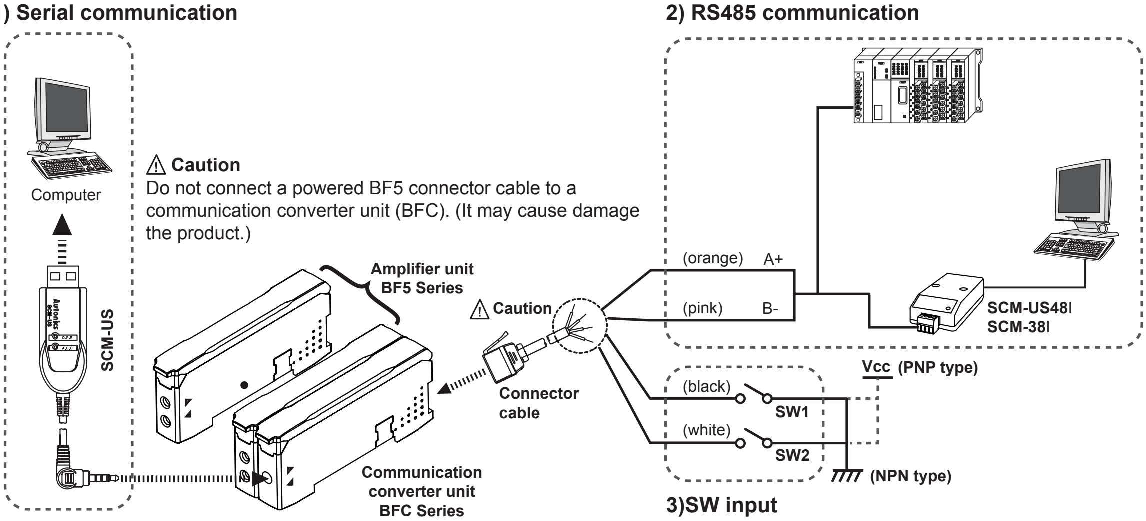
■ Unit Description



1. **TX (Send)-Red LED, RX (Receive)-Green LED:** Turns on when communicating and inputting SW.
2. **Parameter indication (4-digit red 7seg.):** Indicates parameter and processes of communication instruction/execution.
3. **Set value indication (4-digit green 7seg.):** Indicates set value and process of communication instruction/execution.
4. **UP, DOWN key:** To modify set value
5. **MODE key:** To shift or select parameter when entering parameter setting mode.
6. **PC loader port:** In case of PC communication, use USB to Serial converter (SCM-US, sold separately).
7. **Side cover:** To connect an amplifier unit, use a side connector (accessory). Remove a side cover to connect an amplifier unit.
8. **Connector cable port:** Terminal for attaching a connector cable (accessory) is used for RS485 communication or SW input.

■ Communication Mode

This communication converter unit supports 2 communication modes and SW input mode.
You can use only 1 mode of 3 modes.



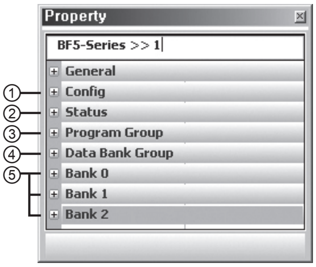
1) Serial communication

① Connect the USB to Serial converter (SCM-US, sold separately) to the PC loader port for communicating with PC.
② It is very easy to manage parameters and monitor data of connected amplifier units (BF5 series) by using the integrated management program DAQMaster (free).

2) RS485 communication

- PLC connection: ① Connect directly to a PLC by using RS485 communication cable of the communication converter unit.
  ② Amplifier units (BF5 series) can be controlled through PLC.
- PC connection: ① Connect PC by using Communication converter (SCM-38I, SCM-US48I, sold separately).
  ② It is very easy to manage parameters and monitor data of connected amplifier units (BF5 series) by using the comprehensive device management program DAQMaster (free).

※Following is a screen of DAQMaster properties window of a computer connected communication converter unit.



① Config
Indicates the number of amplifier units connected to the communication converter unit (BFC).

② Status
Indicates the information of the selected amplifier unit (dual, single) by channel, connected to communication converter unit (BFC).

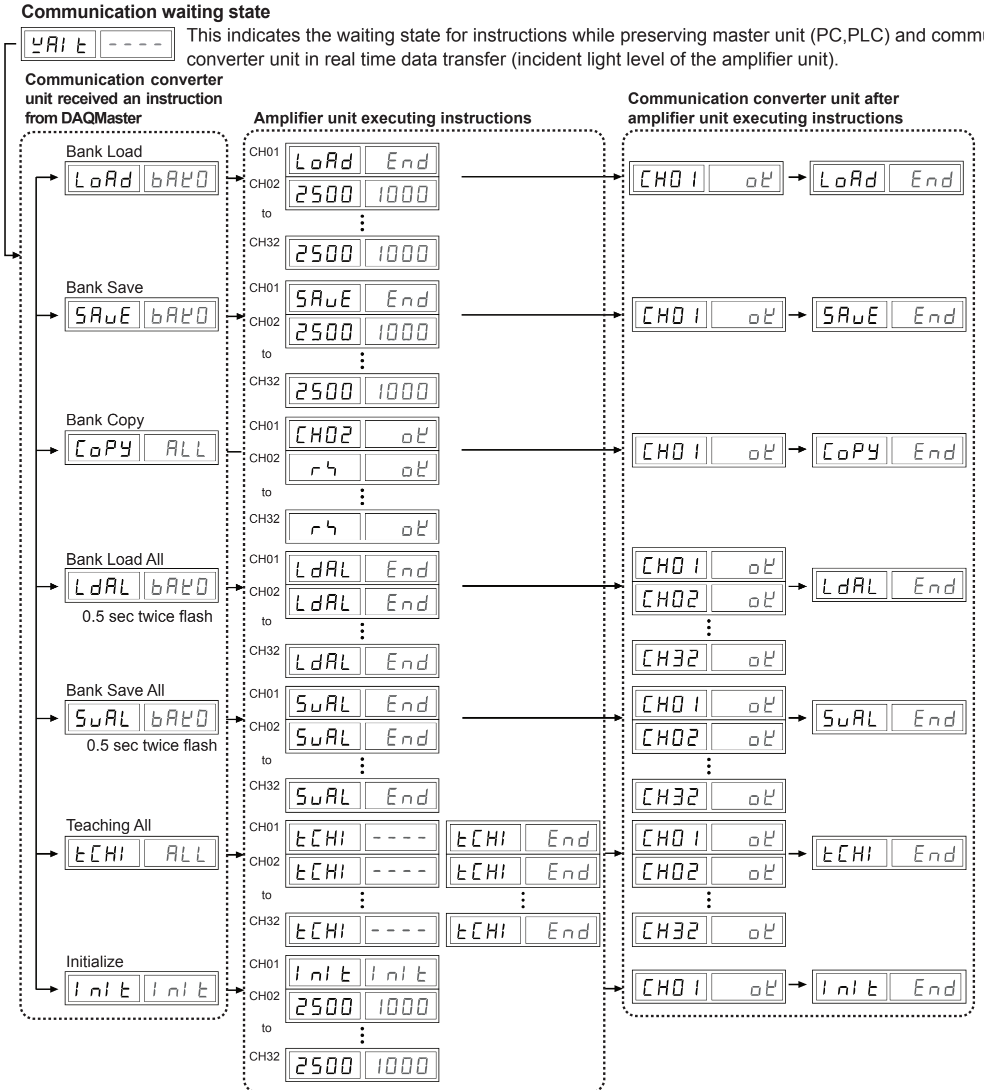
③ Program group
Set values of the amplifier unit can be changed. When set values of the amplifier unit are changed, TX (red) and RX (green) LEDs on communication converter unit will flash indicating application of set values to the amplifier unit.

④ Data Bank Group
Data bank and group teaching features of amplifier unit can be set. Amplifier unit can be initialized as well.

※Indications appear on communication converter and amplifier units depending on applied instruction as below.

Communication waiting state

This indicates the waiting state for instructions while preserving master unit (PC,PLC) and communication converter unit in real time data transfer (incident light level of the amplifier unit).



⑤ **Data Bank:** Set value of data bank (Bank 0, Bank 1, Bank 2) can be saved.

3)SW input

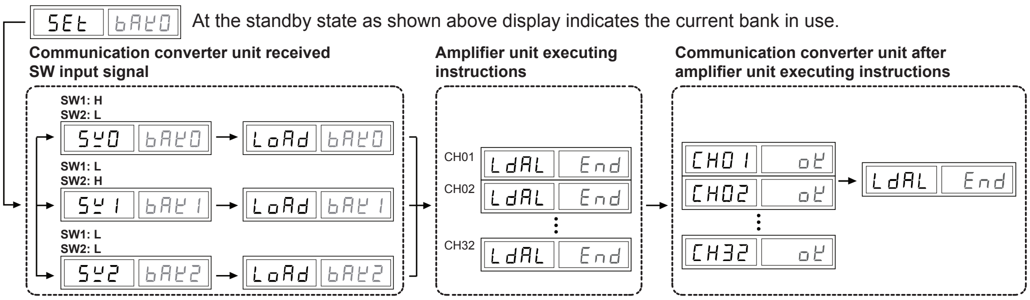
SW input is a feature which allows amplifier unit connected with the communication converter unit to load all banks.
Applying signals to SW1 (Black) and SW2 (White) of the connector cables connected to the communication converter unit allows change of banks as shown in chart 1. (SW input signal duration should be longer than 3 seconds.)

[Chart 1] Bank selection table based on SW input

	Bank	NPN		PNP	
		SW1	SW2	SW1	SW2
1	Standby signal (Using set Bank)	H	H	L	L
2	Bank 0	H	L	L	H
3	Bank 1	L	H	H	L
4	Bank 2	L	L	H	H

※Indications appear on communication converter and amplifier units depending on applied instruction as below.

SW input standby state

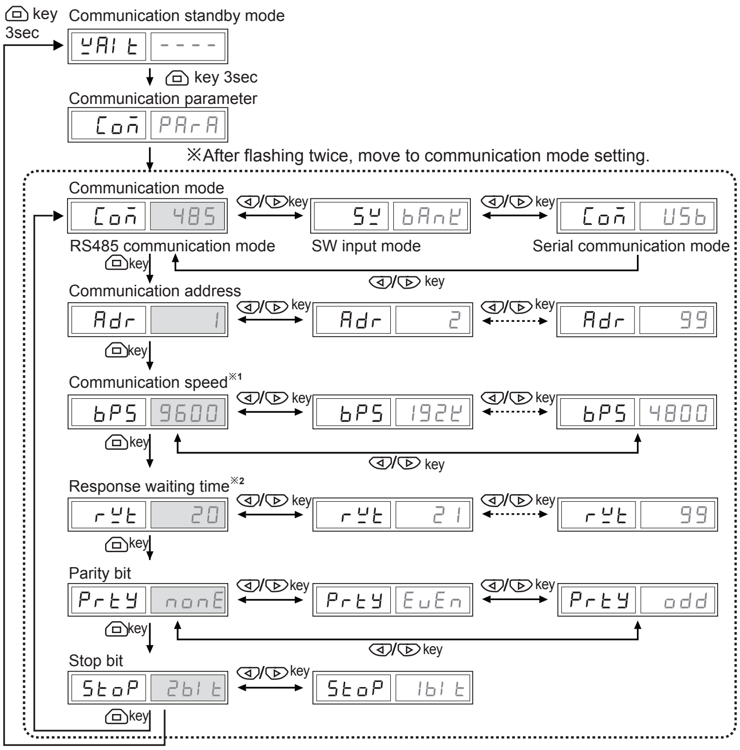


< Communication specification >

Standard	EIA RS485	Standard	EIA RS485
Maximum connections	31 (address setting: 01 to 99)	Response wating time	20 to 99ms
Communication method	2-wire half duplex	Start bit	1-bit (fixed)
Synchronization method	Asynchronous	Stop bit	1-bit, 2-bit
Effective communication distance	Max. 800m	Parity bit	None, Even, Odd
Communication speed	1200, 2400, 4800, 9600, 19200, 38400bps	Data bit	8-bit (fixed)
		Protocol	Modbus RTU

※It is not allowed to set overlapping communication address at the same communication line.
※Please use a proper twist pair for RS485 communication.

■ Parameter Setting



※1:

Communication speed display	
Speed	Display
1200	1200
2400	2400
4800	4800
9600	9600
19200	192k
38400	384k

※2: Communication response waiting time ranges is 20 to 99ms (Depending on the number of amplifier units connected, response time may increase up to 350ms.)

※▭: Factory default

■ Error Code

Error code	Cause	Troubleshooting
ErA	Reading/Writing errors occur while processing data in EEPROM of amplifier unit.	Check the circuitry around EEPROM inside the product.
Erb	● Slave fails to execute Master's group instructions such as Copy/Load/Save/Teaching sent through communication line due to unstable communication line. ● Other communication problems.	● Check the connection status between communication unit and amplifier units. ● Check the circuitry around the side connector and hardware condition.

Solution methods for communication problems

1) Communication errors during Serial or RS485 connections
- Check if the communication mode selected in communication converter unit suits in installation environment.
- Check and equalize the address of communication converter unit and address set in DAQMaster.
- Check and equalize the communication port of communication converter unit and the communication port number set in DAQMaster.

2) Communication errors during SW signal input
- Check if the communication mode set in communication converter unit is SW input mode (SW Bank).
- Check if the connections are made thoroughly depending on NPN or PNP input type.

High Reliability Of Fiber Optic Amplifier For Convenient Mounting

■ Features

- High speed response: Max. 0.5ms
- Auto sensitivity setting (button setting)/Remote sensitivity setting
- External synchronization input, mutual interference protection, self-diagnosis
- Reverse power polarity and short-circuit (overcurrent) protection circuit
- Timer function: Selectable None / 40ms OFF Delay timer (fixed) (standard type, remote sensitivity setting type only)
- Automatically selectable Light ON / Dark ON
- Precise detection of small target and easy to install in the complicated place

⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Specifications

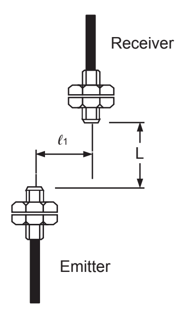
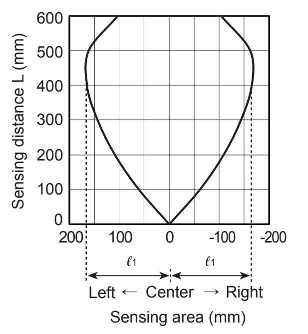
Model	Standard type				External synchronization input type		Remote sensitivity setting type	
	BF4RP	**BF4GP**	**BF4R**	**BF4G**	**BF4R-E**	**BF4G-E**	**BF4R-R**	**BF4G-R**
Light source	Red LED (660nm)	Green LED (525nm)	Red LED (660nm)	Green LED (525nm)	Red LED (660nm)	Green LED (525nm)	Red LED (660nm)	Green LED (525nm)
Power supply	12-24VDC ±10% (ripple P-P: max.10%)							
Current consumption	Max. 45mA							
Operation mode	Light ON/Dark ON switching							
Control output	NPN or PNP open collector output ● Load voltage: Max. 30VDC ● Load current: Max. 100mA ● Residual voltage - NPN: Max. 1V (load current: 100mA), Max. 0.4V (load current: 16mA) / PNP: Max. 2.5V							
Protection circuit	Reverse polarity protection circuit, short-circuit (overcurrent) protection circuit							
Response time	Max. 0.5ms (frequency 1), Max. 0.7ms (frequency 2)							
Sensitivity setting	Sensitivity setting button (ON/OFF)							
Indicator	Control output indicator (OUT): Red LED, Stability indicator (STAB): Green LED (turns ON at stable light ON/OFF level)							
Mutual interference prevention	Built-in differential frequency mode (frequency 1 (normal mode): max. 0.5ms, frequency 2: max. 0.7ms)							
Self-diagnosis output	ON state under unstable sensing (when the target stays for 300ms in unstable level), ON state when control output is short-circuited ● Load voltage: Max. 30VDC ● Load current: Max. 50mA ● Residual voltage - NPN: Max. 1V (load current: 50mA), Max. 0.4V (load current: 16mA) / PNP: Max. 2.5V							
Input of stop transmission function	—				Built-in		—	
External synchronization function	—				Built-in (gate/trigger)		—	
Remote sensitivity setting function	—				—		Built-in	
Timer function	OFF delay (40ms)				—		OFF delay (40ms)	
Insulation resistance	Over 20MΩ (at 500VDC megger)							
Noise immunity	±240V the square wave noise (pulse width: 1μs) by the noise simulator							
Dielectric strength	1,000VAC 50/60Hz for 1 minute							
Vibration	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times							
Environment - Ambient illumination	Sunlight: Max. 11000lx, Incandescent lamp: Max. 3000lx (received illumination)							
Environment - Ambient temperature	-10 to 50℃, storage: -20 to 70℃							
Environment - Ambient humidity	35 to 85% RH, storage:35 to 85% RH							
Material	Case: Heat-resistance acrylonitrile butadiene styrene, Cover: Polycarbonate							
Cable	Ø4mm, 4-wire, 2m (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)				Ø4mm, 6-wire, 2m (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)			
Accessory	Mounting bracket, Bolts, nuts							
Approval	CE							
Weight※1	Approx. 120g (approx. 65g)							

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature Data

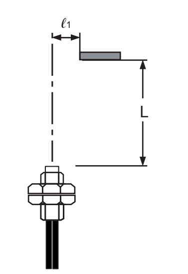
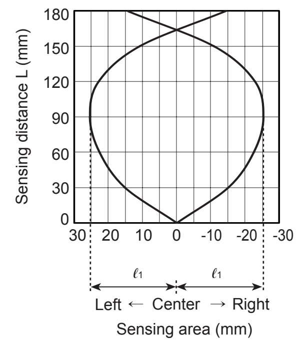
◎ Through-beam type

● **Measurement: BF4□(-□)+ FT-420-10**

Parallel shifting characteristic	
Measuring method	Data
	

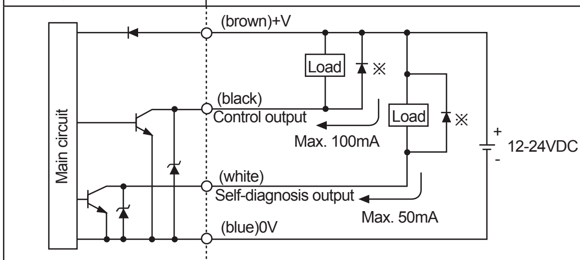
◎ Diffuse reflective type

● **Measurement: BF4□(-□) + FD-620-10**

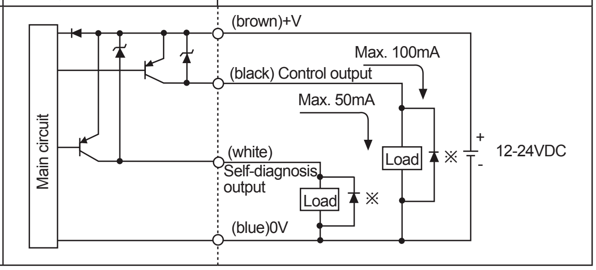
Sensing area characteristic	
Measuring method	Data
	

■ Control Output Diagram

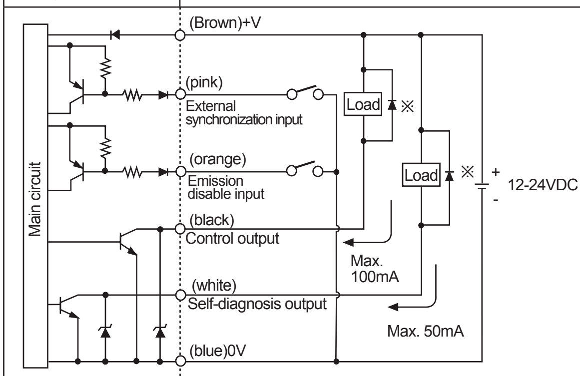
BF4R / BF4G	
Fiber optic sensor circuit	Connection



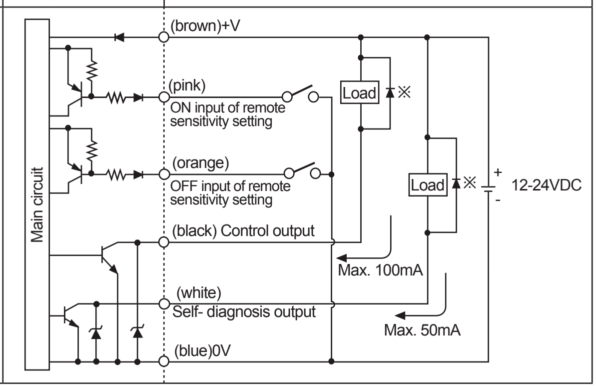
BF4RP / BF4GP	
Fiber optic sensor circuit	Connection



BF4R-E / BF4G-E	
Fiber optic sensor circuit	Connection



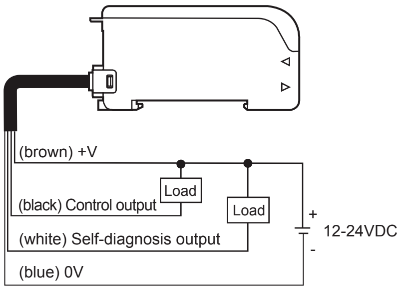
BF4R-R / BF4G-R	
Fiber optic sensor circuit	Connection



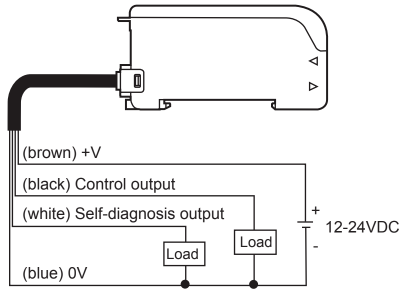
※Connect Diode at external terminal for inductive load.

■ Connections

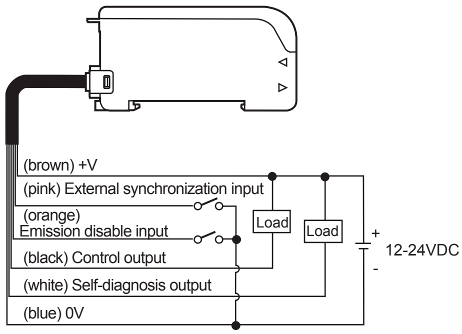
● BF4R / BF4G



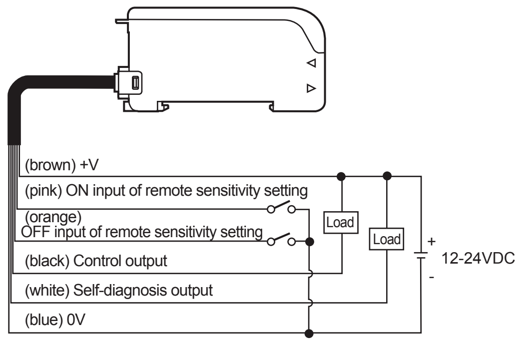
● BF4RP / BF4GP



● BF4R-E / BF4G-E

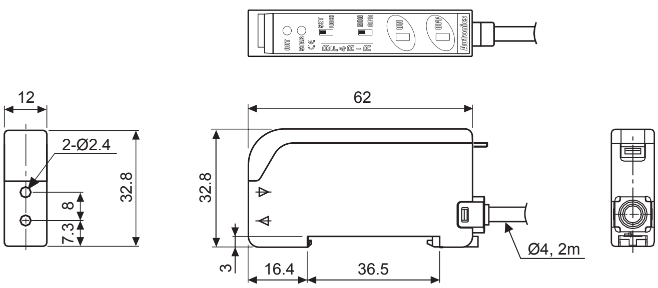


● BF4R-R / BF4G-R

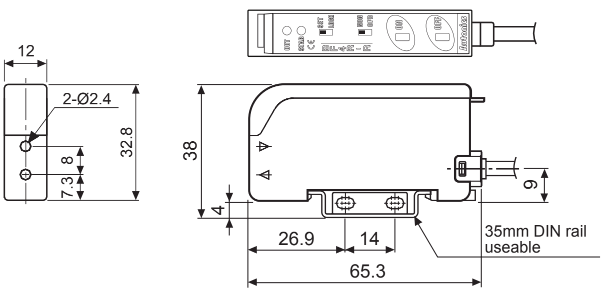


■ Dimensions

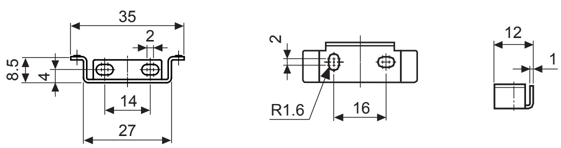
(unit: mm)



● Connect the bracket



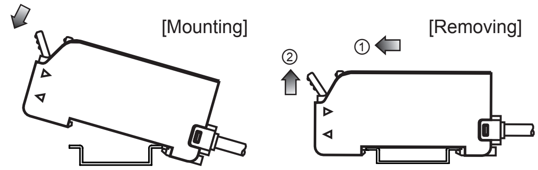
● Bracket



▣ Installations

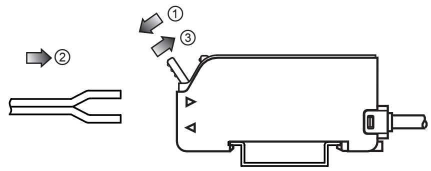
◎ Mounting amplifier unit

- Hook the front part of the amplifier on DIN rail. Press the rear part of the amplifier on DIN rail.
- Push the back of amplifier toward ① and lift the hole for fiber toward ② up then simply take it out without tools.



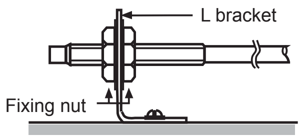
◎ Installation of fiber optic cable

- Lift up the protective cover to the ① direction to release the lock setting.
- Insert the cable to the ② direction and adhere between the cable and the inside of the amplifier unit.
  (insert depth: approx. 10mm)
- Place up the lock lever to ③ direction to lock the lock setting and close the protective cover.

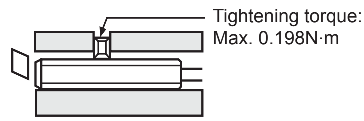


◎ Connection of fiber optic cable & amplifier

- **In case of using L bracket**



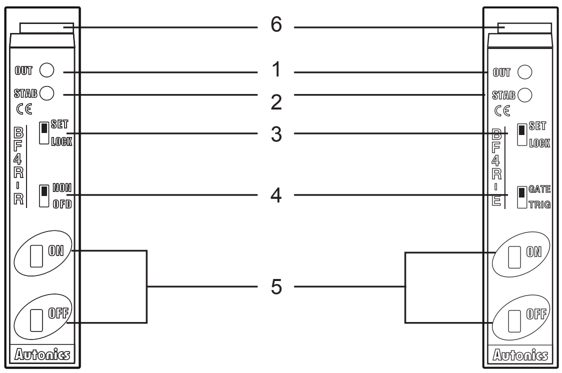
- **In case of using screw**



※Notice: If setting bolt is tightened with over specified tightening torque, hood of fiber optic cable may be damaged.

▣ Unit Description

- **Standard type (BF4R/BF4RP/BF4G/BF4GP)**
  Remote sensitivity setting type (BF4□-R)
- **External synchronization input type (BF4□-E)**



1. Control output indicator (red): Turns ON or OFF by control output status.
2. Stability indicator (green): Turns ON at stable light ON/OFF level.
3. Mode setting switch - SET: Set the switch to [**SET**] to use set the function.
- LOCK: Set the switch to [**LOCK**] not to set the function.

4. Timer setting switch (standard type, remote sensitivity setting type)
- NON: Set the switch to [**NON**] not to use timer function.
- OFD: Set the switch to [**OFD**] to use OFF Delay timer function.

External synchronization setting switch (external synchronization input type)
- GATE: Set the switch to [**GATE**] to use external synchronization as gate synchronization.
- TRIG: Set the switch to [**TRIG**] to use external synchronization as trigger synchronization.

5. Sensitivity setting button: Used for sensitivity setting
6. Lock lever: Used for connecting fiber optic cable.

■ Mode Setting

Change the mode setting switch to **[SET]** ↑ **SET** / **LOCK**

- **Sensitivity setting**
  - Light ON
    - Press the **[ON]** button at light ON
    - Press the **[OFF]** button at light OFF
  - Dark ON
    - Press the **[OFF]** button at light ON
    - Press the **[ON]** button at light OFF
  - The stability indicator **[STAB]** flashes once when the difference of sensitivity between ON and OFF is enough. (flashes 5 times when the difference is not enough)
- **Set/Relase the interference prevention function**
  - Press **[ON]**+**[OFF]** at the same time for 2 sec.
  - The stability indicator **[STAB]** flashes continuously
  - Set the interference prevention function
    - Frequency 1: Press the **[ON]** button (Frequency 1, response time : max. 0.5ms)
    - Frequency 2: Press the **[OFF]** button (Frequency 2, response time : max. 0.7ms)
  - The stability indicator **[STAB]** turns OFF

Set the mode setting switch to **[LOCK]**. (completes setting) ↓ **SET** / **LOCK**

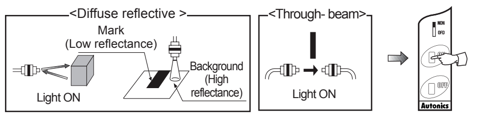
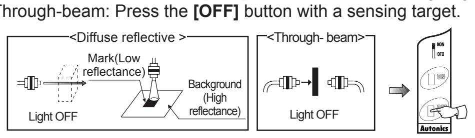
■ Sensitivity Adjustment

Before sensitivity setting, install the fiber optic cable.
After completing the setting, do not move or bend the fiber optic cable. If not, it may cause incorrect detection.

◎ Adjustment by the sensitivity setting button (common)

● Light ON

The control output turns on at Light ON status and turns off at Light OFF status.

Order	**Setting method**
①	Mount the fiber optic cable within sensing distance.
②	Change the mode setting switch to [**SET**].
③	Diffuse reflective: Press the **[ON]** button with a sensing target. Through-beam: Press the **[ON]** button without a sensing target. 
④	The stability indicator [STAB] (green) flashes at ON state. (check the target position)
⑤	Diffuse reflective: Press the **[OFF]** button without a sensing target. Through-beam: Press the **[OFF]** button with a sensing target. 
⑥	•When there is enough sensitivity difference between ON state and OFF state, the stability indicator **[STAB]** flashes one time only at stable sensing level. •When there is not enough sensitivity difference between ON state and OFF state, the stability indicator **[STAB]** flashes five times at unstable sensing level. ※The sensitivity can be set at unstable sensing area.
⑦	Change the mode selection switch to [**LOCK**] to fix the set sensitivity. Even though the sensitivity setting button is touched, setting sensitivity shall not be changed.

※When the power is OFF, the set sensitivity is saved.

● Dark ON

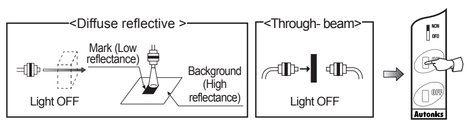
The control output turns off at Light ON status and turns on at Light OFF status.

<How to set sensitivity>

The setting order are same as Light ON mode except ③ & ⑤. The ③ & ⑤ order is opposite from Light ON.

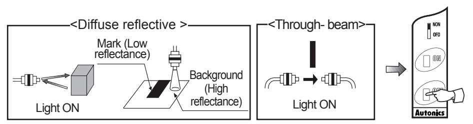
- ③ state

Diffuse reflective: Press the [**ON**] button without a sensing target.
Through-beam: Press the [**ON**] button with a sensing target.



- ⑤ state

Diffuse reflective: Press the [**OFF**] button with a sensing target.
Through-beam: Press the [**OFF**] button without a sensing target.



◎ Setting as max. sensitivity (common)

① Set the mode setting switch to [**SET**].
② If there is no sensing target,
- **Light ON**: Press the [**ON → OFF**] button
- **Dark ON**: Press the [**OFF → ON**] button

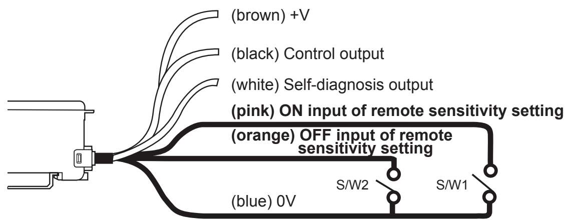
③ Set the mode selection switch to [**LOCK**] mode.

※**External sensitivity setting**
- **Light ON** (From above ③)
  External sensitivity setting **ON** input (High→Low→High)
  External sensitivity setting **OFF** input (High→Low→High)
- **Dark ON Mode** (From above ③)
  External sensitivity setting **OFF** input (High→Low→High)
  External sensitivity setting **ON** input (High→Low→High)

< Application >
- To extend sensing distance (diffuse reflective type):
  If fiber optic sensor is used in place where there are targets with high reflectivity and low reflectivity, it is able to get stable detection by adjusting max. sensitivity.
- Used at bad environment (through-beam type):
  If fiber optic sensor is used in place where there is lots of dust or moisture, it might cause malfunction.
  It can perform the stable detection by using max. sensitivity.

◎ Remote sensitivity adjustment [BF4□-R]

Remote sensitivity setting type, BF4□-R can adjust the sensitivity with input signal lines without the mode setting switch.



● Light ON
- ON input of remote sensitivity setting (SW1):
  Turns ON the SW1 and then turn OFF instead of ③ state of adjustment by the sensitivity setting button.
- OFF input of remote sensitivity setting (SW2):
  Turns on the SW2 and then turn OFF instead of ⑤ state of adjustment by the sensitivity setting button.

● Dark ON
- OFF input of remote sensitivity setting (SW2):
  Turns on the SW2 and then turn OFF instead of ③ state of adjustment by the sensitivity setting button.
- ON input of remote sensitivity setting (SW1):
  Turns on the SW1 and then turn OFF instead of ⑤ state of adjustment by the sensitivity setting button.

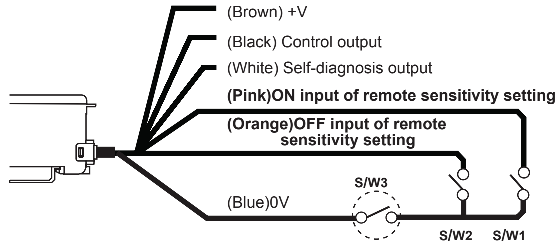
<External sensitivity setting input signal condition>

State	Signal condition
High	4.5-30VDC or Open
Low	0-1VDC

※Input impedance:10kΩ

◎ Prohibition of inputting External sensitivity setting [BF4□-R]

Even though mode switch is at Lock position, it is able to input external sensitivity setting when Switch 1 and Switch 2 are ON. Therefore please install Switch 3 in order to prevent from malfunction as below.
※SW3 - OFF: Disable to set external sensitivity
※SW3 - ON: Enable to set external sensitivity

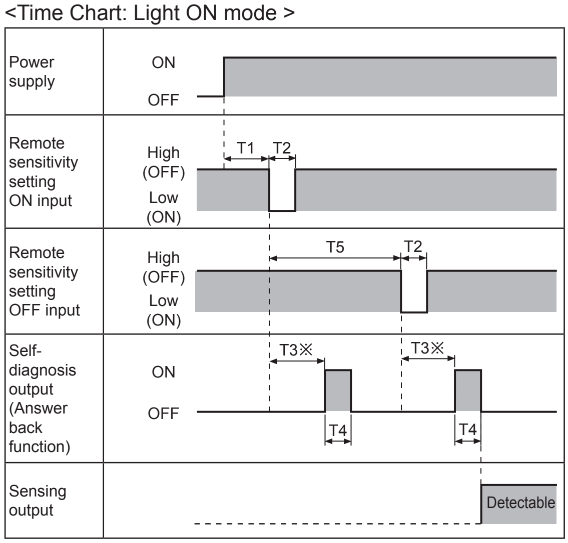


Switch for prohibiting sensitivity setting

◎ Self-diagnosis output (answer back) function [BF4□-R]

When ON or OFF input of remote sensitivity setting is applied, after 300ms, self-diagnosis output turns on for 40ms and then the sensor keeps normal sensing state. (Note: Time chart)
※Self-diagnosis output does not turn on if there is no difference of sensitivity between ON input and OFF input and stable sensing is not executed, but stable sensing operates after 340ms.

<Time Chart: Light ON mode >

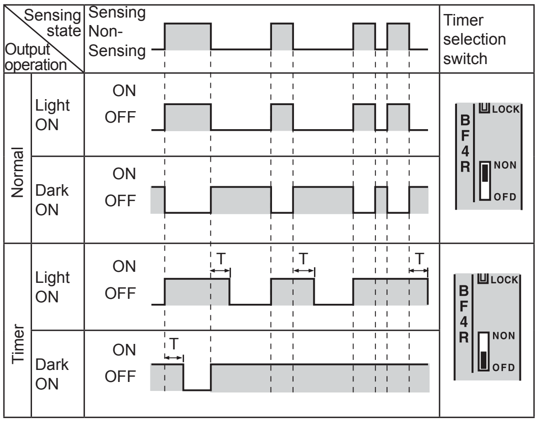


※During period T3 (approx. 300ms), do not change the received light value by moving the object, etc.
- T1≥1,000ms : after power turns ON, it can be set after 1sec.
- T2≥5ms : ON/OFF input time of remote sensitivity setting must be min. 5ms
- T3≒300ms : when ON/OFF input of remote sensitivity setting is applied, self-diagnosis output turns ON after 300ms)
- T4≒40ms : ON time of self-diagnosis output
- T5≥500ms : when ON input of remote sensitivity setting is applied, apply OFF input of remote sensitivity setting after 500ms

■ Timer (OFF Delay) Function [BF4R/BF4G/BF4RP/BF4GP/BF4□-R]

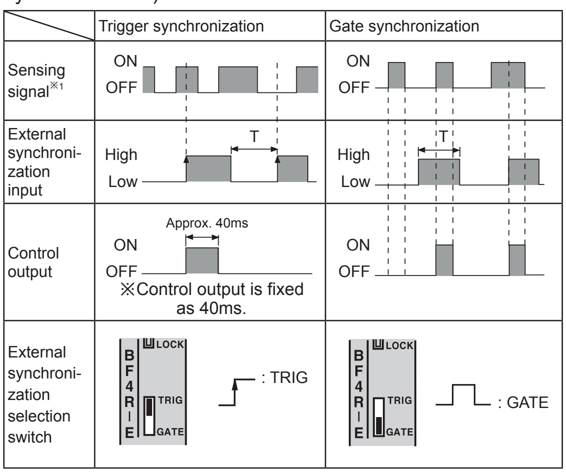
Standard type and Remote sensitivity setting type both contain the built-in OFF Delay timer, approx. 40ms. The timer works when the timer selection switch is set to **[OFD]**. The output turns off after remaining for additional 40ms at OFF position of the sensing output. It is useful when the response time of the connected device is slow or when the sensing signal from a tiny object is too short.

<Time Chart> T≒40ms



■ External Synchronization Input Function [BF4R□-E]

By using external synchronization function, the time for making sensing can be specified by external synchronization. (trigger synchronization and gate synchronization)



※1: Right before transfer detection signal of the sensor as control output.

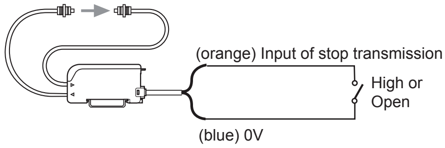
※T≥0.5ms (using interference prevention function: T≥0.7ms)

<Input signal condition for External synchronization>

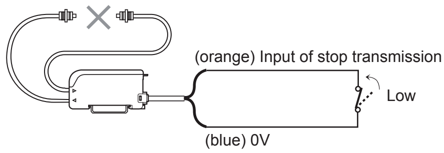
State	Signal condition
High	4.5-30VDC or Open
Low	0-1VDC

■ Stop Transmission Function [BF4□-E]-Operation Test

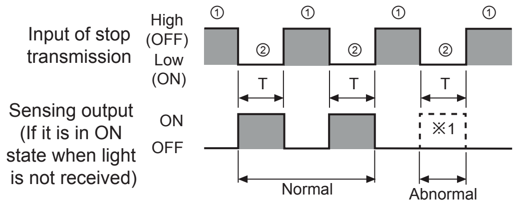
This function is available under light ON state only and it is for checking normal state of the sensor.



[If input of stop transmission is at High or Open state, light is transmitted.]



[If input of stop transmission is at Low, light is transmitted.]



※①: Transmission area, ②: Stop transmission area

※1: If transmission is stopped, control output must turn on, but if control output does not turn on, it seems that sensor has some problems.

※T≥0.5ms
(when using interference prevention function T≥0.7ms)

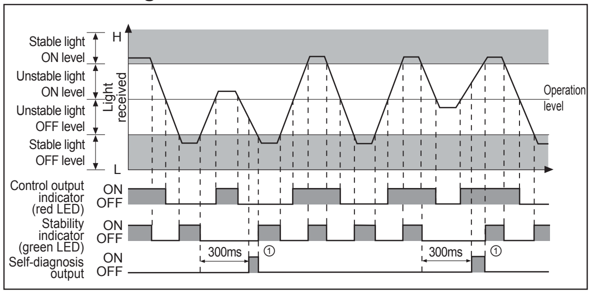
<Input signal condition for Stop transmission>

State	Signal condition
High	4.5-30VDC or Open
Low	0-1VDC

▣ Self-Diagnosis Function (common)

When fiber hood is contaminated by dust, transmitted light is lowered by element ability loss or received light is lowered by missing of optical axis, the self-diagnosis output will turn on.

● In case of Light ON



● When detecting state remains over 300ms at unstable light ON/OFF level, the self diagnosis output turns ON. In case of stable light ON/OFF level, the self diagnosis output turns OFF. (① position)

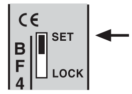
▣ Mutual Interference Prevention Function (common)

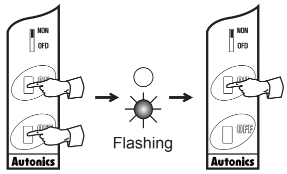
Two fiber optic cables can be mounted very closely by setting different transmission frequencies.

●Interference prevention function (operation of differential frequency mode)

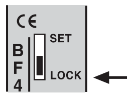
First sensor- Frequency 1 (response time: max. 0.5ms)

① Set the mode setting switch to [**SET**].
② Press the [**ON**] + [**OFF**] buttons for 2 sec at the same time.
③ The Stability indicator [**STAB**] flashes continuously.
④ **Press the [ON] button.**
⑤ The Stability indicator [**STAB**] turns off.



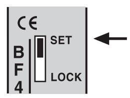


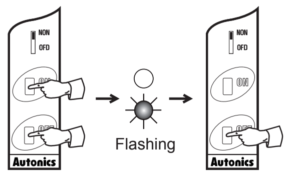
⑥ Set the mode setting switch to [**LOCK**].



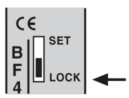
Second sensor- Frequency 2 (response time: max. 0.7ms)

① Set the mode setting switch to [**SET**].
② Press the [**ON**] + [**OFF**] buttons for 2 sec at the same time.
③ The Stability indicator [**STAB**] flashes continuously.
④ **Press the [OFF] button.**
⑤ The Stability indicator [**STAB**] turns off.





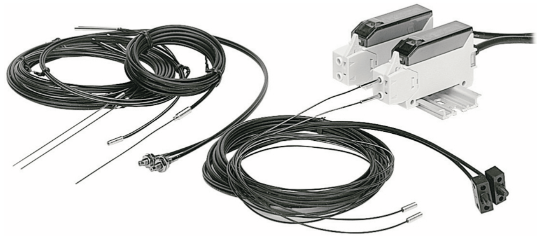
⑥ Set the mode setting switch to [**LOCK**].



High Accuracy Fiber Optic Amplifier With Twin Adjuster

■ Features

- Convenient DIN rail mounting type
- Response time: Max. 1ms
- Enables to adjust sensitivity with high accuracy by dual adjuster
- Selectable Light ON/Dark ON operation mode by control wire
- Reverse power polarity and short-circuit (overcurrent) protection circuit
- Enables to use for explosion proof (fiber part)
- Adjustable length with free cut type fiber optic cable



⚠ **Please read "Caution for your safety" in operation manual before using.**

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Specifications

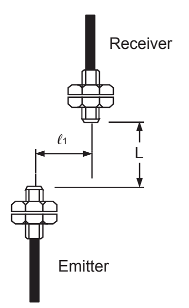
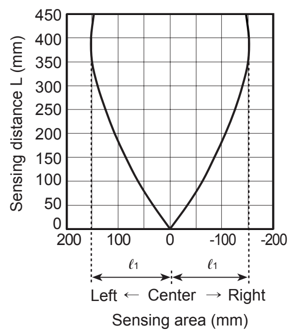
Model		**BF3RX**	**BF3RX-P**
Response time		Max. 1ms	
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)	
Current consumption		Max. 40mA	
Light source		Red LED (660nm)	
Sensitivity adjustment		Sensitivity adjuster (dual adjustment: coarse adjustment, fine adjustment)	
Operation mode		Selectable Light ON or Dark ON by control cable	
Control output		NPN or PNP open collector output ●Load voltage: Max. 30VDC ●Load current: Max. 200mA, ●Residual voltage - NPN: Max. 1V, PNP: Max. 2.5V	
Protection circuit		Reverse power polarity, output short-circuit protection circuit	
Indication		Operation indicator: Red LED	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Noise immunity		±240V the square wave noise (pulse width: 1μs)by the noise simulator	
Dielectric strength		1,000VAC 50/60Hz for 1minute	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Environment	Ambient illumination	Sunlight: Max. 11,000lx, Incandescent lamp: Max. 3,000lx (receiver illumination)	
	Ambient temperature	-10 to 50℃, storage: -25 to 70℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Material		Case: Acrylonitrile butadiene styrene, Cover: Polycarbonate	
Cable		Ø5mm, 4-wire, 2m (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)	
Accessory		Sensitivity adjuster driver, Mounting bracket, Bolts, Nuts	
Unit weight		Approx. 90g	

※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature Data

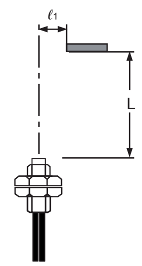
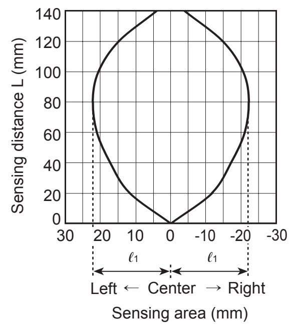
◎ Through-beam type

- **Measurement: BF3RX + FT-420-10**

Parallel shifting characteristic	
Measuring method	Data
	

◎ Diffuse reflective type

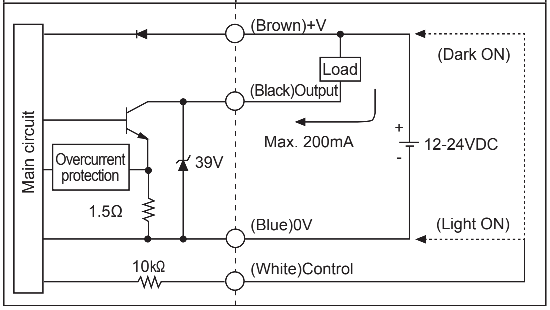
- **Measurement: BF3RX + FD-620-10**

Sensing area characteristic	
Measuring method	Data
	

■ Control Output Diagram

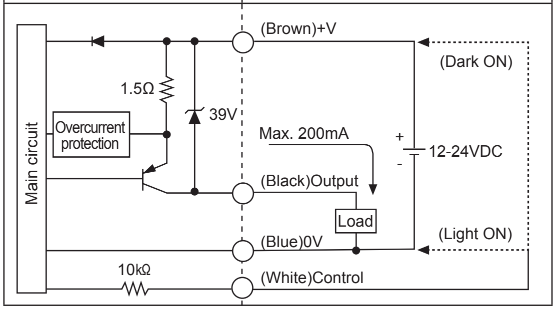
- **BF3RX**

NPN open collector output	
Fiber optic sensor circuit	Connection



- **BF3RX-P**

PNP open collector output	
Fiber optic sensor circuit	Connection



※When selecting Dark ON or Light ON, please use control wire (White)
- Light ON: Connect control wire to 0V
- Dark ON: Connect control wire to +V

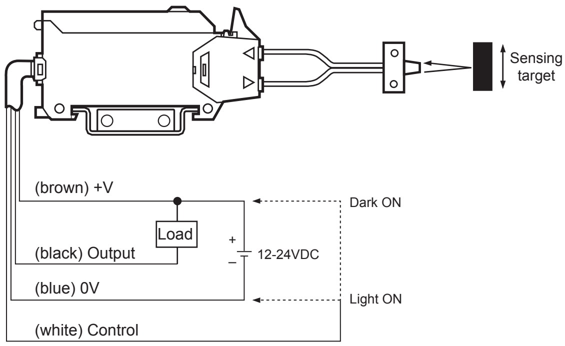
■ Operation Mode

Operation mode	Light ON	
Receiver operation	Received light Interrupted light	
Operation indicator (red LED)	ON OFF	
Transistor output	ON OFF	

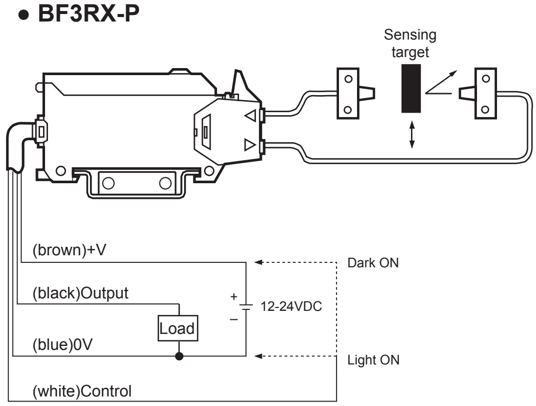
Operation mode	Dark ON	
Receiver operation	Received light Interrupted light	
Operation indicator (red LED)	ON OFF	
Transistor output	ON OFF	

Connections

● BF3RX



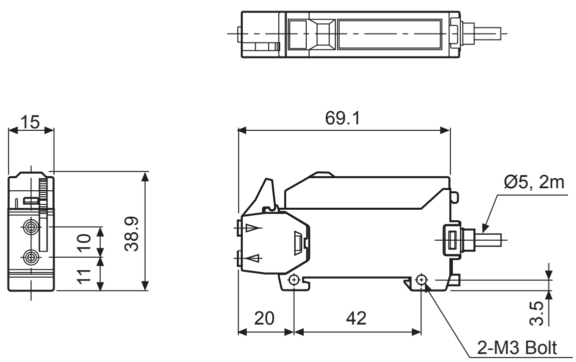
● BF3RX-P



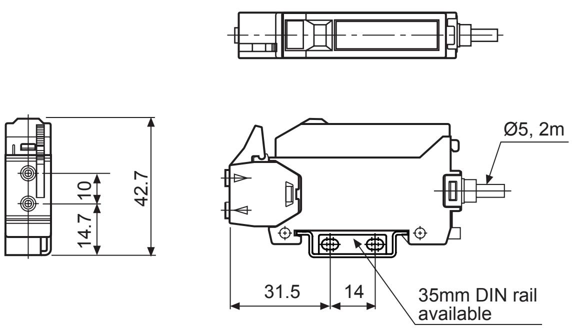
※Enables to use diffuse reflective type or through-beam type according to the fiber optic cable.
※Adapter marked fiber optic cable should be used with adapter ().
※GT-420-13H2 cannot be used because the length inserted into amp is too short.

Dimensions

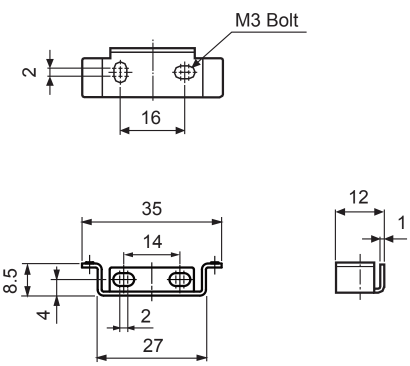
(unit: mm)



● Connect the bracket



● Bracket

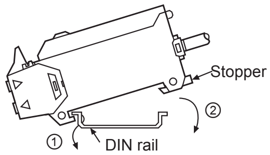


■ Installations

◎ Mounting amplifier unit

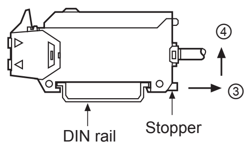
● When mounting the amplifier

①Hook the front part of the amplifier on DIN rail (or bracket).
②Press the rear part of the amplifier on DIN rail (or bracket).



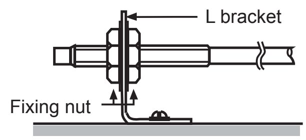
● When releasing the amplifier

Push the back of amplifier toward ③ and lift the hole for fiber toward ④ up then simply take it out without tools.

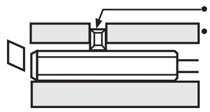


◎ Installation of fiber optic cable

● In case of using L bracket



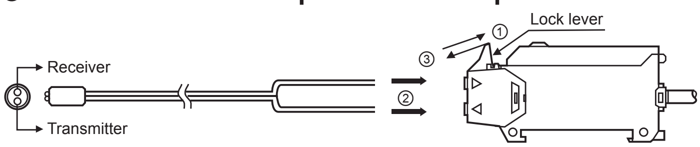
● In case of using screw



• Setting bolt: Max. M3
• Tightening torque: Max. 2kgf·cm

※Notice: If setting bolt is tightened with over specified tightening torque, hood of fiber optic cable may be damaged.

◎ Connection of fiber optic cable & amplifier



① Open the lock lever to "↙" direction.
② Insert the fiber optic cable in the amplifier slowly. (Depth: approx. 21mm)
③ Close the lock lever to "↗" direction.

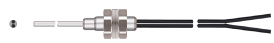
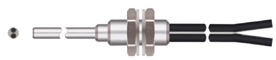
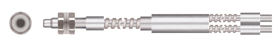
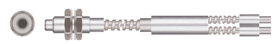
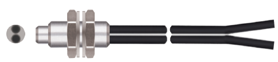
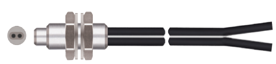
■ Sensitivity Adjustment

◎ Adjustment by the sensitivity setting button (common)

● Adjust as the optimum sensitivity according to the order as below.
● Please observe below chart because operation lamp will be changed by sensing method.

Order	Sensing type		Adjustment	Adjuster	
	Reflective	Through-beam		COARSE	FINE
1	Initial setting		The adjuster (coarse) should be fixed at min and fixed at center (▼) for Fine adjustment.	Min.	(-) (+)
2	Light ON	Light ON	Fix the adjuster (coarse) to ON position by turning clockwise slowly when light is being received.	ON Min.	(-) (+)
3	Light ON	Light ON	Turn the adjuster (fine) until it is OFF toward (-), and turn until it is ON toward (+) again, then confirm that this will be A position.	The adjuster is not required to set afterward.	ON A OFF (-) (+)
4	Dark ON	Dark ON	And then turn the adjuster (fine) until it is ON toward (+), and turning until it is OFF toward (-) again when light is not received. Then confirm that this position will be B position. (When it will not be ON, max. position will be B.)		OFF B ON (-) (+)
5	—	—	Fix it at the middle of A and B position. This will be the best position to set.		A B (-) (+)
6	Light ON	Light ON	If you cannot adjust as above method, set the adjuster (fine) at max. position toward (+), then execute again.	Min.	(-) (+) Max.

■ Diffuse Reflective Type

Type		Appearance	Feature	Sensing distance (mm) (based on Non-glossy white paper)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Bolt type	Standard type		M3	40※2	Ø0.03	R15	1m (Free cut)	-40 to 70℃	**FD-310-05**
			M3	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FD-320-05**
			M4	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FD-420-05**
			M3 (SUS type, 90mm)	40※2	Ø0.03	R15 (SUS part R10)	2m (Free cut)	-40 to 70℃	**FDS-320-05**
			M3 (SUS type, 45mm)						**FDS2-320-05**
			M4 (SUS type, 90mm)						**FDS-420-05**
			M4 (SUS type, 45mm)						**FDS2-420-05**
			M6	120※2	Ø0.03	R30	2m (Free cut)	-40 to 70℃	**FD-620-10**
			M6 (SUS type, 90mm)	120※2	Ø0.03	R30 (SUS part R10)	2m (Free cut)	-40 to 70℃	**FDS-620-10**
			M6 (SUS type, 45mm)						**FDS2-620-10**
	Heat-resistant type		M6	120※2	Ø0.03	R30	2m (Free cut)	-40 to 105℃	**FD-620-10H**
			M6	160※2	Ø0.03	R50	2m (Free cut)	-40 to 150℃	**FD-620-15H1**
			M4 (Glass type)	100※2	Ø0.03	R50	2m	-40 to 250℃	**GD-420-20H2**
			M6 (Glass type)						**GD-620-20H2**
	Flexible type ※4		M3	35※1	Ø0.0125	R1	2m (Free cut)	-40 to 60℃	**FD-320-05R**
			M4						**FD-420-05R**
			M6	130※1	Ø0.04	R1	2m (Free cut)	-40 to 60℃	**FD-620-10R**
	Break-resistant type ※4		M3	35※2	Ø0.0125	R5	2m (Free cut)	-40 to 60℃	**FD-320-06B**
			M4						**FD-420-06B**
			M6	100※2	Ø0.0125	R5	2m (Free cut)	-40 to 60℃	**FD-620-13B**

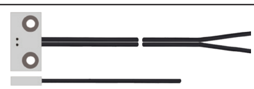
※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED. It is applied to 40% of sensing distance for BF3RX.
※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.
※4: • **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install it in the many places as the change of the intensity of radiation by bending is small.
• **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.
※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable. [(FC-3) should be used for cutting fiber cable.]
※Glass type is for BF5, BF4 Series.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Fiber Optic Cable

■ Diffuse Reflective Type

(based on Non-glossy white paper)

Type		Appearance	Feature	Sensing distance (mm)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Bolt type	Coaxial type		M3	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FD-320-F**
			M3	60※2	Ø0.03	R30	2m (Free cut)	-40 to 70℃	**FD-320-F1**
			M6	120※2	Ø0.03	R30	2m (Free cut)	-40 to 70℃	**FD-620-F2**
Cylinder type	Standard type		Ø3mm	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FDC-320-05**
			Ø3mm (SUS type, 15mm)	40※2	Ø0.03	R15 (SUS part R10)	2m (Free cut)	-40 to 70℃	**FDCS-320-05**
	Break-resistant type※4		Ø3mm	35※2	Ø0.0125	R5	2m (Free cut)	-40 to 60℃	**FDC-320-06B**
	Standard type		Ø3mm Side view	30※1	Ø0.0125	R15	2m	-40 to 60℃	**FDCSN-320-05**
Flat type	Flexible type		Top view	35※1	Ø0.0125	R1	1m (Free cut)	-40 to 60℃	**FDFU-210-05R**
			Side view	30※1	Ø0.0125	R1	1m (Free cut)	-40 to 60℃	**FDFN-210-05R**
			Flat view	30※1	Ø0.0125	R1	1m (Free cut)	-40 to 60℃	**FDF-210-05R**
Right angle	Flexible type		M6	120※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FDR-610-10R**
Plastic	Standard type		Plastic injection molding type	120※2	Ø0.03	R30	2m (Free cut)	-40 to 70℃	**FDP-320-10**

■ Convergent Reflective Type

(based on Non-glossy white paper)

Type		Appearance	Feature	Sensing distance (mm)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Flat type	Standard type		Convergent reflective type	8※1	Ø0.0125	R25	2m	-40 to 60℃	**FLF-320-10**

※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED.
It is applied to 40% of sensing distance for BF3RX.
※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.
※4: • **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.
※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-3) should be used for cutting fiber cable.]

■ Through-Beam Type

(based on Non-glossy white paper)

Type		Appearance	Feature	Sensing distance (mm)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Bolt type	Standard type		M3	150※2	Ø0.5	R15	1m (Free cut)	-40 to 70℃	**FT-310-05**
			M3	150※2	Ø0.5	R15	2m (Free cut)	-40 to 70℃	**FT-320-05**
			M3 (SUS type, 90mm)	150※2	Ø0.5	R15 (SUS part R10)	2m (Free cut)	-40 to 70℃	**FTS-320-05**
			M3 (SUS type, 45mm)						**FTS1-320-05**
			M3 (SUS type, 45mm)						**FTS2-320-05**
			M4	500※2	Ø1	R30	2m (Free cut)	-40 to 70℃	**FT-420-10**
			M4 (SUS type, 90mm)	500※2	Ø1	R30 (SUS part 10)	2m (Free cut)	-40 to 70℃	**FTS-420-10**
			M4 (SUS type, 45mm)	500※2	Ø1	R30 (SUS part 10R)	2m (Free cut)	-40 to 70℃	**FTS2-420-10**
	Heat-resistant type		M4	300※2	Ø1	R30	2m (Free cut)	-40 to 105℃	**FT-420-10H**
			M4	500※2	Ø1	R50	2m (Free cut)	-40 to 150℃	**FT-420-15H1**
			M4 (Glass type)	400※2	Ø1	R25	2m	-40 to 250℃	**GT-420-13H2**
	Flexible type※4		M3	110※1	Ø0.3	R1	2m (Free cut)	-40 to 60℃	**FT-320-05R**
			M4	500※1	Ø0.5	R1	2m (Free cut)	-40 to 60℃	**FT-420-10R**
	Break-resistant type※4		M3	110※1	Ø0.3	R5	2m (Free cut)	-40 to 60℃	**FT-320-06B**
			M4	400※1	Ø0.6	R5	2m (Free cut)	-40 to 60℃	**FT-420-13B**
Cylinder type	Standard type		Ø1.5mm	150※2	Ø0.5	R15	2m (Free cut)	-40 to 70℃	**FTC-1520-05**
			Ø2mm	150※2	Ø0.5	R15	2m (Free cut)	-40 to 70℃	**FTC-220-05**
			Ø2mm (SUS type, 15mm)	150※2	Ø0.5	R15 (SUS part10R)	2m (Free cut)	-40 to 70℃	**FTCS-220-05**
			Ø3mm	150※2	Ø1	R30	2m (Free cut)	-40 to 70℃	**FTC-320-10**

※1: The sensing distance is a standard for BF5 Series.

※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED. It is applied to 40% of sensing distance for BF3RX.

※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.

※4: • **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install it in the many places as the change of the intensity of radiation by bending is small.

• **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.

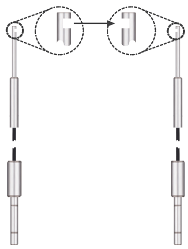
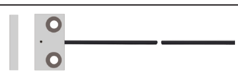
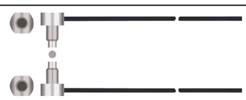
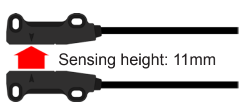
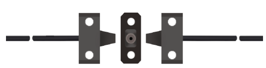
※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable. [(FC-3) should be used for cutting fiber cable.]

※FT-420-13 was discontinued. FT-420-13B is replacement.

※Glass type is for BF5R, BF4R Series.

Fiber Optic Cable

▣ Through-Beam Type

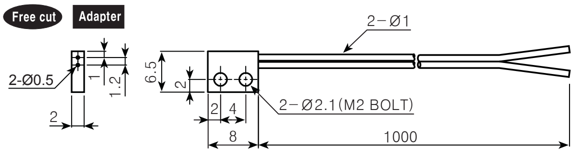
Type		Appearance	Feature	Sensing distance (mm) (based on Non-glossy white paper)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Cylinder type	Flexible type※4		Ø3mm	110※1	Ø0.3	R1	2m (Free cut)	-40 to 60℃	**FTC-220-05R**
	Break-resistant type※4		Ø3mm	110※2	Ø0.3	R5	2m (Free cut)	-40 to 60℃	**FTC-1520-06B**
	Standard type		Ø2.47mm Side view	120※1	Ø0.0125	R15	2m	-40 to 60℃	**FTCSN-2520-05**
Flat type	Flexible type		Top view	110※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FTFU-210-05R**
			Side view	110※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FTFN-210-05R**
			Flat view	100※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FTF-210-05R**
			Side view+ Top view (Bending)	110※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FTFB-210-05R**
			L type Top view height 12.2mm	500※1	Ø0.06	R1	1m (Free cut)	-40 to 60℃	**FTLU-310-10R**
			L type Top view height 17.2mm						**FTLU1-310-10R**
			L type Top view height 22.2mm						**FTLU2-310-10R**
Right angle	Flexible type		M4	460※1	Ø0.5	R1	1m (Free cut)	-40 to 60℃	**FTR-410-10R**
Area type	Flexible type		Ø1mm	750※5	Ø0.07	R2	1m (Free cut)	-40 to 60℃	**FTW11-210-10R**
Plastic	Standard type		Plastic injection molding type	500※2	Ø1	R30	2m (Free cut)	-40 to 70℃	**FTP-320-10**

※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED.
It is applied to 40% of sensing distance for BF3RX.
※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.
※4: • **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install it in the many places as the change of the intensity of radiation by bending is small.
• **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.
※5: The sensing distance is a standard for BF5 Series, and it is varied by operation mode.
(Ultra fast mode: 450mm / Fast mode: 750mm / Standard mode: 1400mm / Long distance mode, Ultra long distance mode: 1800mm)
※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-3) should be used for cutting fiber cable.]

■ Dimensions

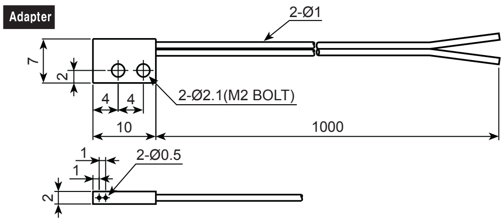
Model	Diffuse reflective type
FDFU-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303

Free cut Adapter



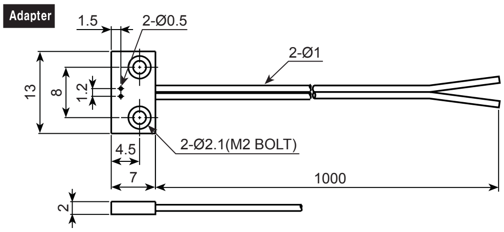
Model	Diffuse reflective type
FDFN-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303

Free cut Adapter



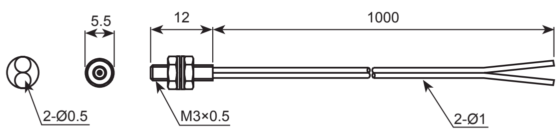
Model	Diffuse reflective type
FDF-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303

Free cut Adapter



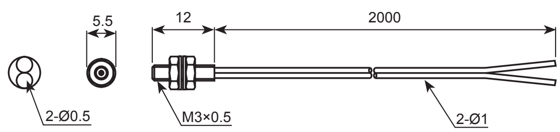
Model	Diffuse reflective type
FD-310-05	M3-D0.5

Free cut Adapter



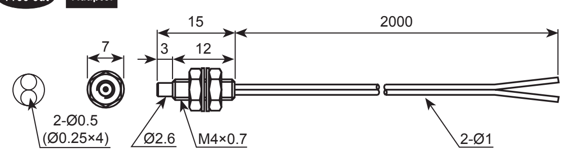
Model	Diffuse reflective type
FD-320-05(R)	M3-D0.5

Free cut Adapter



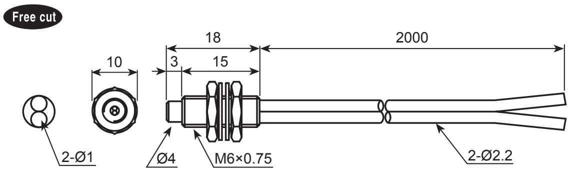
Model	Diffuse reflective type
FD-420-05(R)	M4-D0.5

Free cut Adapter



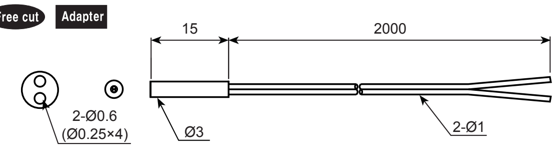
Model	Diffuse reflective type
FD-620-10(R)	M6-D1.0

Free cut



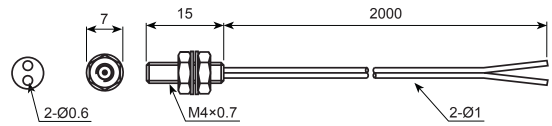
Model	Diffuse reflective type
FDC-320-06B	M3-D0.6

Free cut Adapter



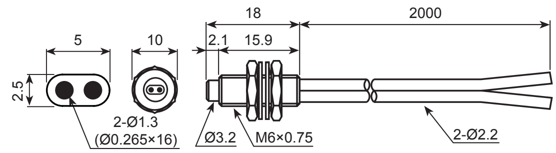
Model	Diffuse reflective type
FD-420-06B	M4-D0.6

Free cut Adapter



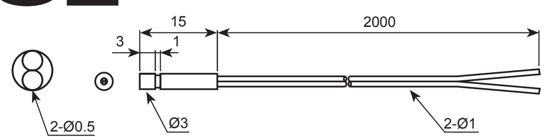
Model	Diffuse reflective type
FD-620-13B	M6-D1.3

Free cut



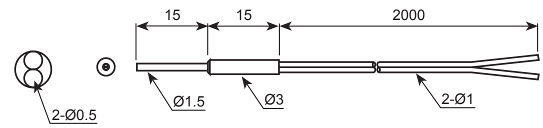
Model	Diffuse reflective type
FDC-320-05	Ø3-D0.5

Free cut Adapter



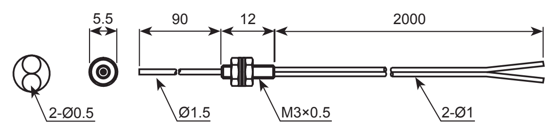
Model	Diffuse reflective type
FDCS-320-05	Ø3-D0.5 / Stainless steel Ø1.5×15mm

Free cut Adapter



Model	Diffuse reflective type
FDS-320-05	M3-D0.5 / Stainless steel Ø1.5×90mm

Free cut Adapter



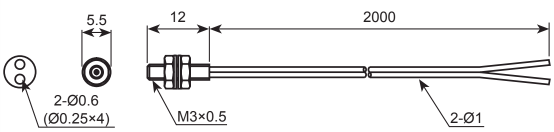
Fiber Optic Cable

■ Dimensions

Model	Diffuse reflective type

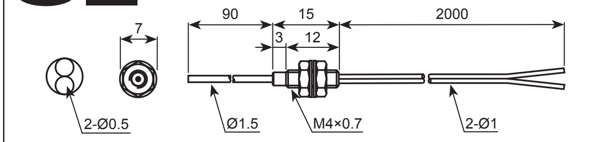
FD-320-06B — M3-D0.6

Free cut Adapter



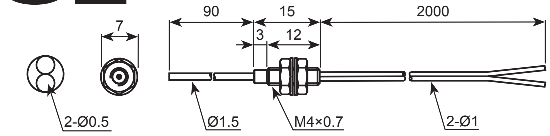
FDS2-320-05 — M3-D0.5 / Stainless steel Ø1.5×45mm

Free cut Adapter



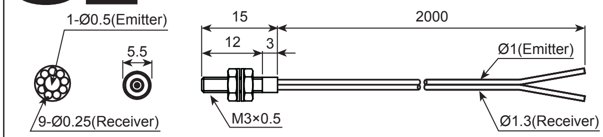
FDS-420-05 — M4-D0.5 / Stainless steel Ø1.5×90mm

Free cut Adapter



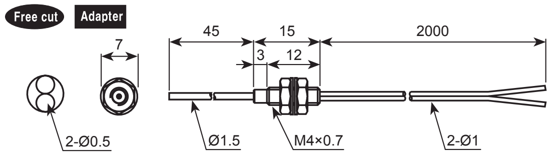
FD-320-F1 — Co-axial M3 / Ø0.5, Ø0.25×9

Free cut Adapter



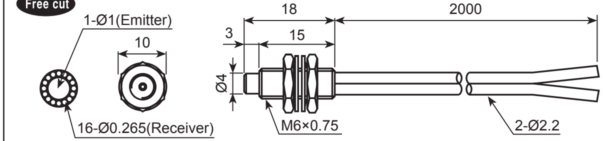
FDS2-420-05 — M4-D0.5 / SUS Ø1.5×45mm

Free cut Adapter



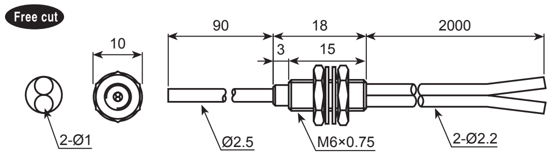
FD-620-F2 — Co-axial M6 / Ø1.0, Ø0.265×16

Free cut



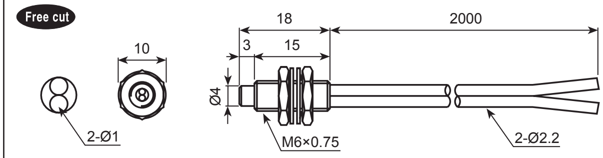
FDS-620-10 — M6-D1.0 / SUS Ø2.5×90mm

Free cut



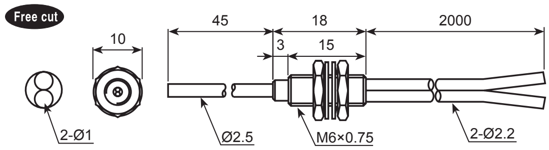
FD-620-10H — M6-D1.0 / Heat-resistant 105℃

Free cut



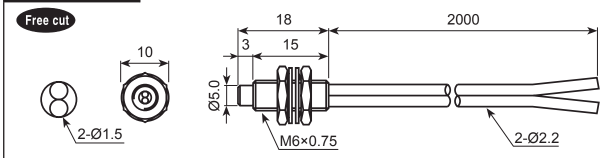
FDS2-620-10 — M6-D1.0 / SUS Ø2.5×45mm

Free cut



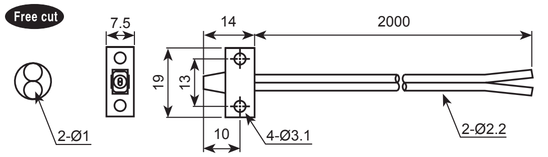
FD-620-15H1 — M6-D1.5 / Heat-resistant 150℃

Free cut

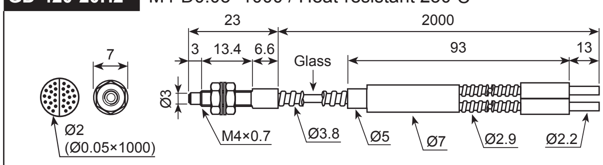


FDP-320-10 — D1.0×2 / Plastic

Free cut

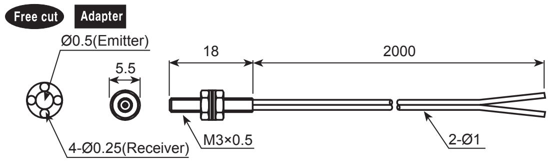


GD-420-20H2 — M4-D0.05×1000 / Heat-resistant 250℃

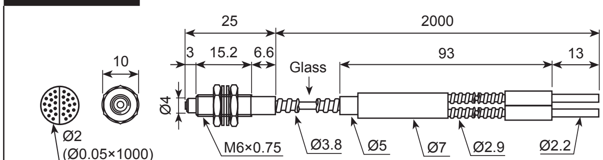


FD-320-F — Co-axial M3 / Ø0.5, Ø0.25×4

Free cut Adapter

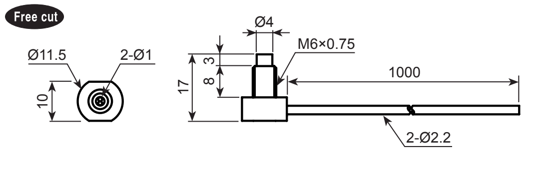


GD-620-20H2 — M6-D0.05×1000 / Heat-resistant 250℃

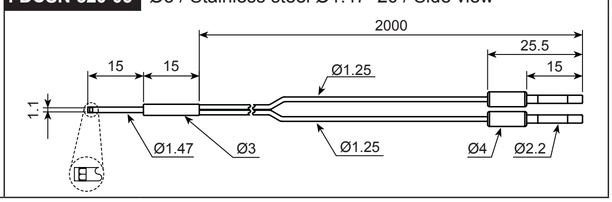


FDR-610-10R — M6-D1.0 / ※Hood material: Stainless steel type 303

Free cut

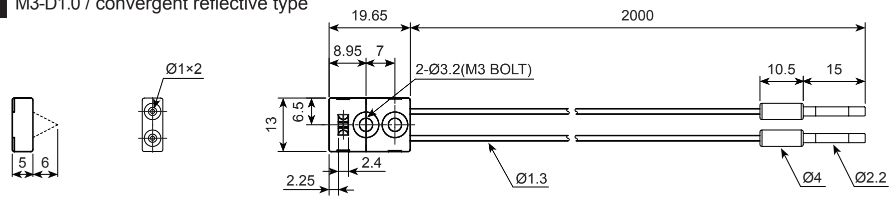


FDCSN-320-05 — Ø3 / Stainless steel Ø1.47×20 / Side view

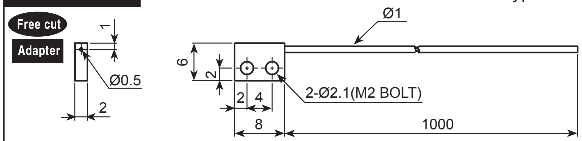


■ Dimensions

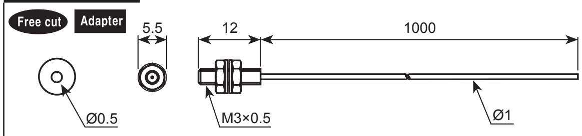
Model	Convergent reflective type
FLF-320-10	M3-D1.0 / convergent reflective type



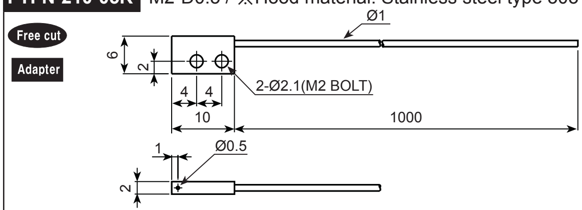
Model	Through-beam type
FTFU-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303



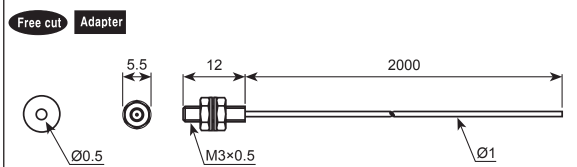
Model	Through-beam type
FT-310-05	M3-D0.5



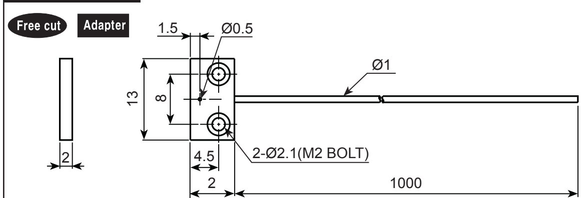
Model	Through-beam type
FTFN-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303



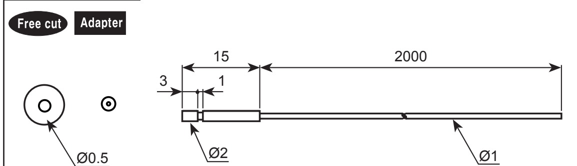
Model	Through-beam type
FT-320-05(R)	M3-D0.5



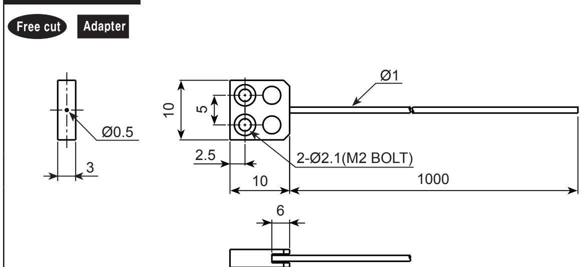
Model	Through-beam type
FTF-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303



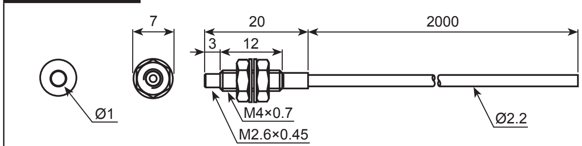
Model	Through-beam type
FTC-220-05(R)	Ø2-D0.5



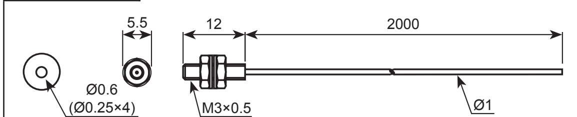
Model	Through-beam type
FTFB-210-05R	M2-D0.5 / ※Hood material: Aluminum



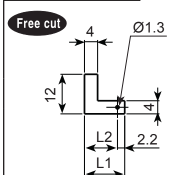
Model	Through-beam type
FT-420-10R	M4-D1.0

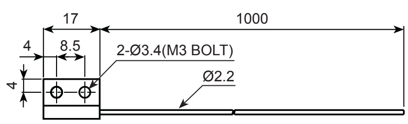


Model	Through-beam type
FT-320-06B	M3-D0.6



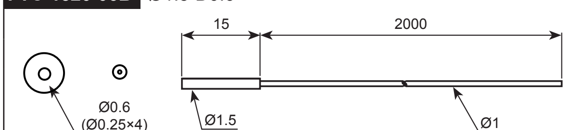
Model	Through-beam type
FTLU-310-10R FTLU1-310-10R FTLU2-310-10R	M2-D0.5 / ※Hood material: Aluminum



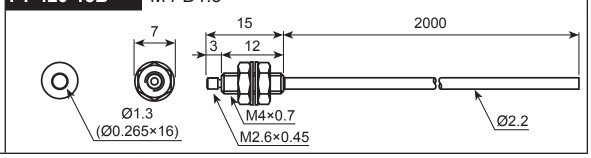


Model	L1	L2
FTLU-310-10R	12.2	10
FTLU1-310-10R	17.2	15
FTLU2-310-10R	22.2	20

Model	Through-beam type
FTC-1520-06B	Ø1.5-D0.6



Model	Through-beam type
FT-420-13B	M4-D1.3



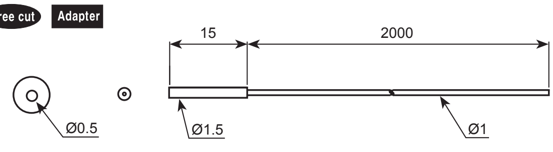
Fiber Optic Cable

■ Dimensions

Model | Through-beam type

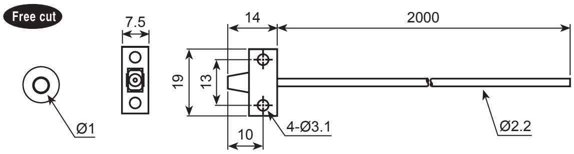
FTC-1520-05 Ø1.5-D0.5

Free cut Adapter



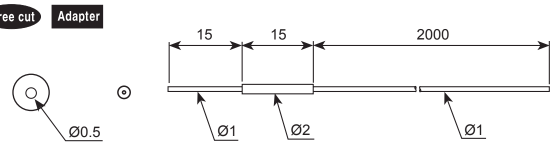
FTP-320-10 D1.0 / Plastic

Free cut



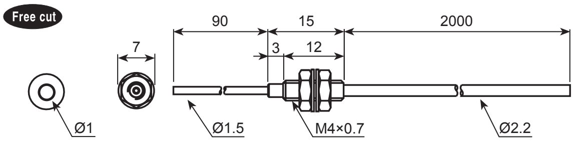
FTCS-220-05 Ø2-D0.5 / SUS Ø1.0×15mm

Free cut Adapter



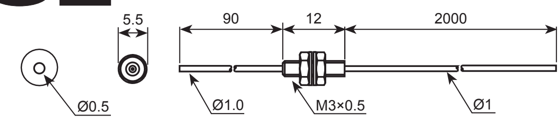
FTS-420-10 M4-D1.0 / Stainless steel Ø1.5×90m

Free cut



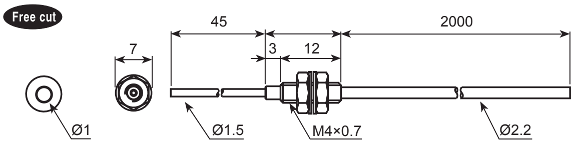
FTS-320-05 M3-D0.5 / SUS Ø1.0×90mm

Free cut Adapter



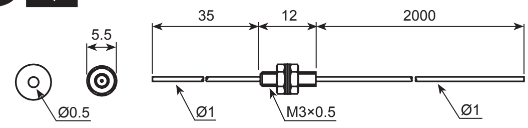
FTS2-420-10 M4-D1.0 / Stainless steel Ø1.5×45m

Free cut



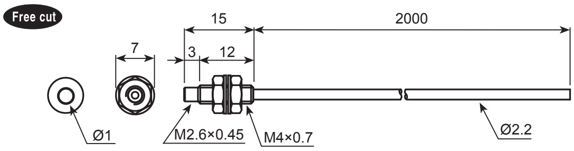
FTS1-320-05 M3-D0.5 / SUS Ø1.0×35mm

Free cut Adapter



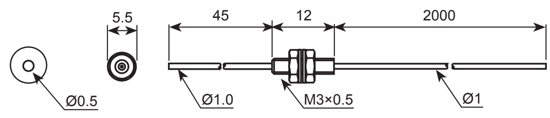
FT-420-10H M4-D1.0 / Heat-resistant 105℃

Free cut



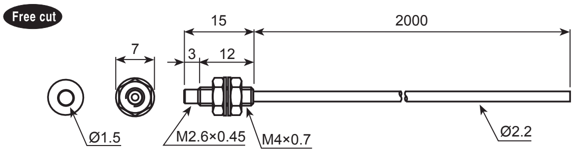
FTS2-320-05 M3-D0.5 / SUS Ø1.0×45mm

Free cut Adapter



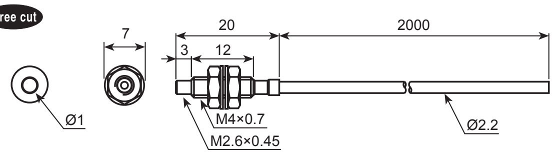
FT-420-15H1 M4-D1.5 / Heat-resistant 150℃

Free cut

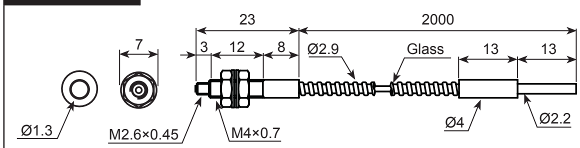


FT-420-10 M4-D1.0

Free cut



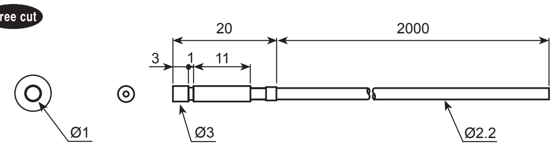
GT-420-13H2 M4-D1.3 / Heat-resistant Max. 250℃ / Glass



Glass fiber with Ø2.9 sus protective armor.

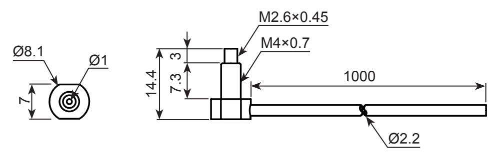
FTC-320-10 Ø3-D1.0

Free cut



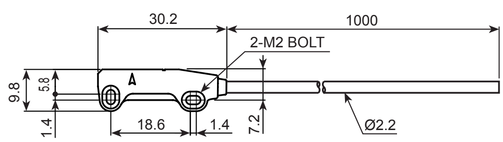
FTR-410-10R M4-D1.0 ※Hood material: Stainless steel type 303

Free cut

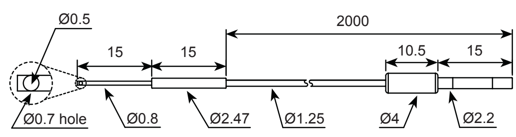


FTW11-210-10R M2-D1.0

Free cut



FTCSN-2520-05 Ø2.47-D0.5 / Stainless steel Ø0.8×15mm / Side view



▣ Lens Unit For Long Distance Detection (sold separately)

◎ Model : FTL-M26

<Lens unit> <Mounting at cable>

◎ Mounting of lens

Mount the lens unit on the 3mm projecting point of the front hood.

◎ Ambient temperature range of lens unit

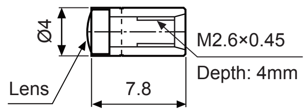
It should be used within -40 to 100℃. (not over 100℃.)

◎ Applicable fiber optic cable and max. mounting distance

- **FT-420-10 : 2500mm**
- **FT-420-10H : 1500mm**

◎ Dimensions

(unit: mm)

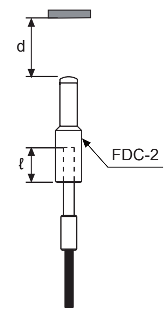
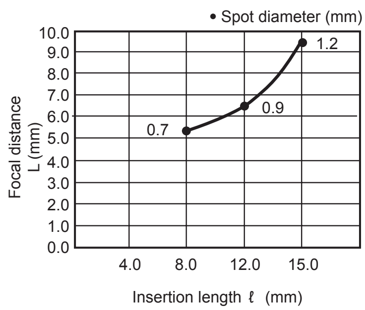


▣ Micro Spot Fiber Optic Cable And Lens Unit (sold separately)

◎ Model

- Fiber optic cable: **FDC-320-F**
- Micro spot lens: **FDC-2**

◎ Feature data

Measuring method	Beam spot characteristic
	

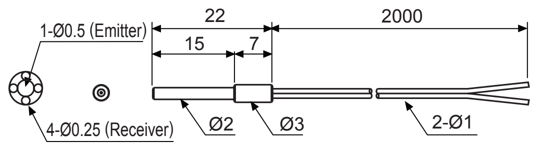
◎ Ambient temperature range of lens unit

It should be used within -40 to 100℃. (not over 100℃.)

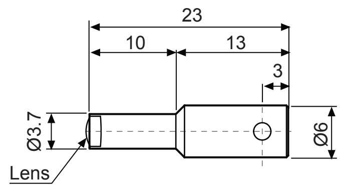
◎ Dimensions

(unit: mm)

● **FDC-320-F**



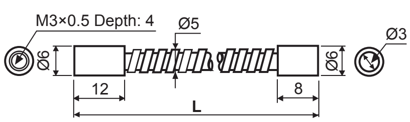
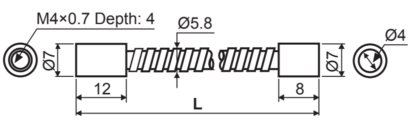
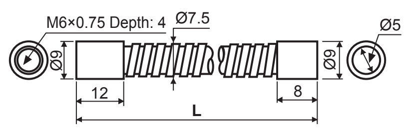
● **FDC-2**



▣ Protection Tube For Fiber Optic Cable (sold separately)

◎ Application

: Protect cable from impact or cutting (unit: mm)

Model	Appearance and Dimension	L
FTH-305		500
FTH-310		1000
FTH-405		500
FTH-410		1000
FDH-605		500
FDH-610		1000

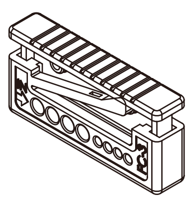
※Additional 8mm is for tube coupling.

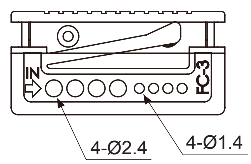
▣ Accessory

◎ Fiber cutter

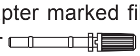
Applications: Cutting fiber optic cable, free cut type

● **FC-3**

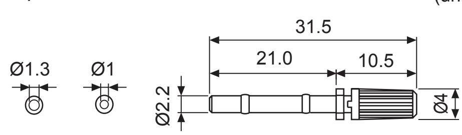




◎ Adapter

Adapter : Adapter marked fiber optic cable should be used with adapter 

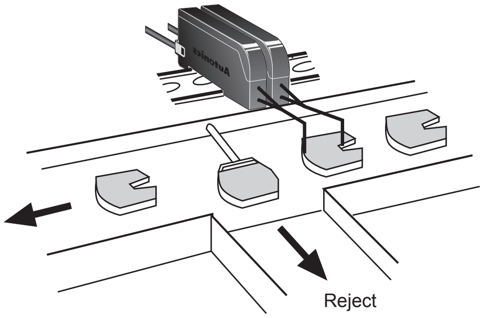
(unit: mm)



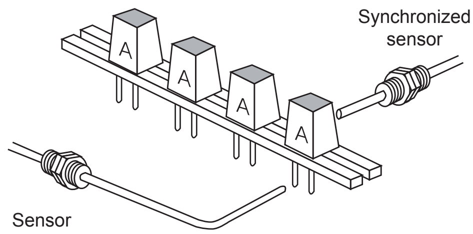
※The inside diameter Ø1 (standard and black)
※The inside diameter Ø1.3(Only applied to the receiver of FD-320-F1 and dark gray.)

■ Applications

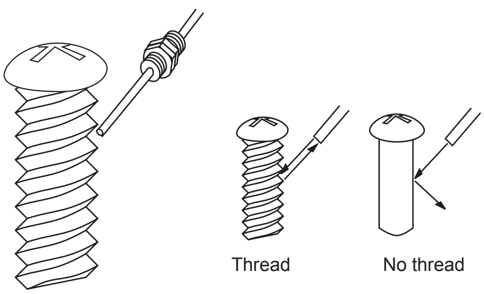
Sensing form of targets



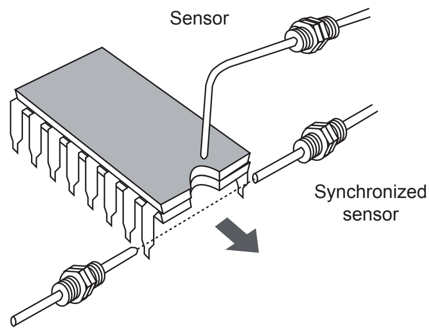
Sensing components leads



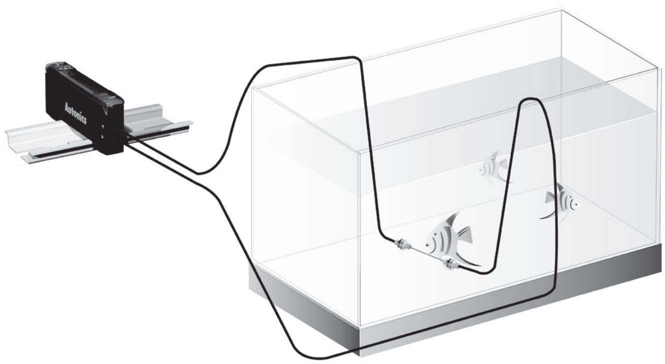
Sensing presence / absence of taps



Sensing IC directions



Available under water or in gas (except amplifier)



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

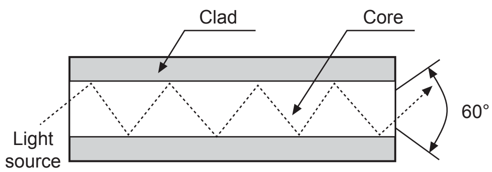
▣ Fiber Optic Sensors Overview

Fiber optic sensor applies for mark, and small object detection with fiber optic cable instead of photo sensor lens. With flexible characteristics of fiber optic cable, fiber optic sensor is able to install in the limited space. Because of this, demand of fiber optic sensor is increasing these days.

▣ Fiber Optic Cable Detection Principle And Configuration

◎ Fiber optic cable configuration

As shown the below figure, one optical fiber is composed of core which is high refractive index and clad. The incident light from the one side of the fiber will be projected and go ahead to other side section during repeating total reflection at the boundary of core and clad. In this case, the angel of reflection is 60° and is spared like a cone. This optical fiber bundle with exterior coating such as silicon rubber or vinyl chloride is called optical fiber cable.



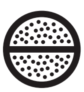
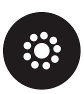
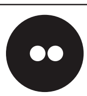
▣ Classification Of Optical Fiber Cable

◎ The material list of optical fiber cable

Plastic type and glass type are used for optical fiber sensor.

	Plastic optical fiber	Glass optical fiber
Material	Ø0.5 to 1mm single or dual wire made by synthetic resins of poly acrylics	Make a stainless cable by several number of 30 to 50µ glass fiber
Exterior coating	Polyethylene or vinyl chloride	Silicon rubber tube, stainless spiral tube, heat stress tube
Advantage	Light weight and economical	High light penetration ratio, strong heat
Dis-advantage	Low light penetration ratio and weak heat	Heavy, expansive, easy to be cut

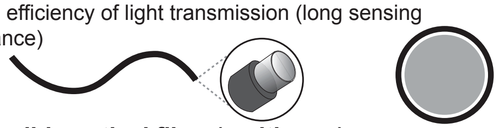
◎ The shape list of optical fiber cable

Type	Shape	Characteristic
Parallel (normal)		Use for only plastic optical fiber cable. Floodlight and light interception are structured in parallel. It is the type of transferring
Coaxial		The center area and the surrounding area are separated. This type has the same detecting ability which is the operating position even though the object passes from any direction.
Split		Floodlight and light interception are separate, suitable to detect mark, usually used for glass optical fiber.

◎ The characteristic list of optical fiber cable

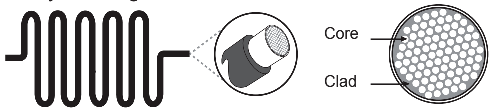
● Standard optical fiber (single core)

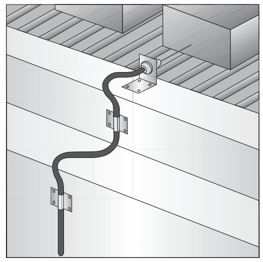
High efficiency of light transmission (long sensing distance)

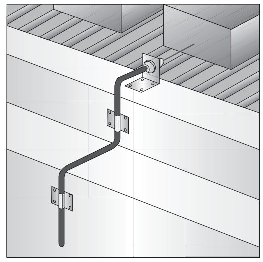


● Flexible optical fiber (multi core)

A large number of ultra-fine cores are all surrounded by cladding. Easy to install in the many places where are bending areas because in the change of the intensity of radiation by bending is small.

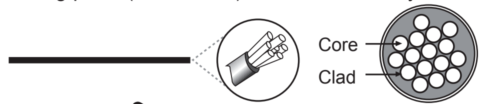


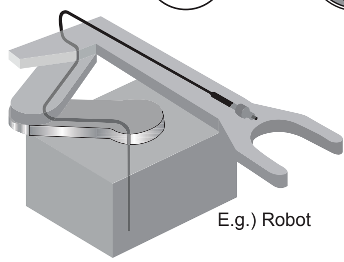

Standard type (R15 / R30)


Flexible type (R1)

● Break-resistant optical fiber

The fiber units contain a large number of independent fine fibers, ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.




E.g.) Robot

▣ The Feature Of Optical Fiber Cable

◎ The radius of allowable stress for bending

The optical fiber cable is able to be used in bend condition as much as user wants, but as the rate bend is increasing, the optical transmission rate is also decreased. And if the radius of bending is less than the radius of allowable stress for bending, the optical transmission rate is decreased rapidly. Please caution that the cable is not bent less than the radius of the allowable stress for bending.

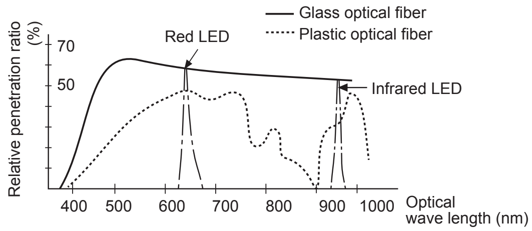
(plastic optical fiber)

- Flexible type: R1
- Break-resistant type: R5
- Standard, Coaxial type: R30 or R15
- Heat-resistant type: R30 or R50

Technical Description

◎ The optical transmission rate

The optical transmission rate is decided by the wave length, the material, length of the optical fiber, and the using source of light for the optical fiber cable. The optical transmission rate of the optical wavelength decided by the wavelength and the material of the optical fiber is the same as below picture. Especially the difference of the optical transmission rate of plastic optical fiber cable is bigger than glass optical fiber cable, and the efficiency of the red light source is higher than the efficiency of the infrared light source.

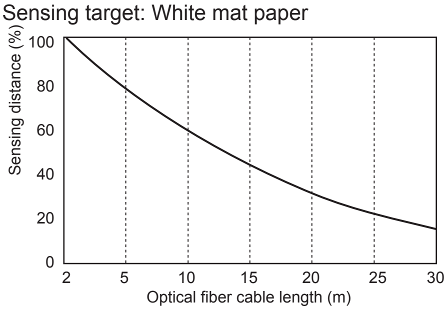


For the length of optical fiber cable and the optical transmission rate by the optical penetration ratio, when the length of optical fiber cable is long, the penetration rate is decreased, and the rate of diminution is changed by the light source.

◎ The Characteristic of sensing distance by the length of the optical fiber cable

The sensing distance is changed by the length of the optical fiber cable. And by the cutting condition of the end of the optical fiber cable, more than 20% of the sensing distance can be declined, and it can be changed by the types of the optical fiber cable.

● Optical fiber cable: FD-620-10
Sensing target: White mat paper



▣ Optical Fiber Sensor

The optical fiber sensor uses the optical fiber cable instead of lens which is the absolute item for the traditional photo sensor. It is able to be attached on any places by flexibility of the optical fiber.

◎ The Characteristic of optical fiber sensor

● Flexibility

• Easy to install at the narrow or difficult place
• It does not need to install the fiber amplifier toward the sensing targets.

● Subminiature sensing front end

• It is able to detect a small object (Ø is small and the microscopic objects)
• It is able to attach close to the detected object.
• No space constraints because of small size

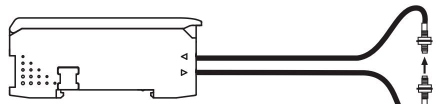
● The property of cable (heat-resisting property,exterior)

• It is able to detect in high temperature. (use heat-resisting optical fiber cable)
• It is able to use as explosion proof type because current does not flow on the fiber cable include front end sensing part.
• It is able to get stable detecting operating because it is not affected by noise.

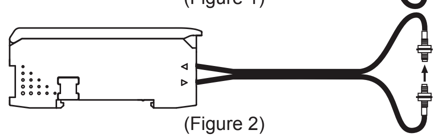
◎ The sensing method of the optical fiber sensor

The optical fiber sensor is classified as the through-beam type and the diffuse reflective type by the sensing method, and can be selected by purpose.

● There are two kinds of optical fiber sensors for through-beam type. One is using two separate fiber cables as shown (Figure 1). Another is using a parallel optical fiber cable as shown (Figure 2).

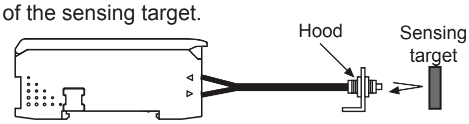


(Figure 1)



(Figure 2)

● For the diffuse reflective type, two parallel fiber cables are connected at one hood. Please caution that the sensing distance is changed by the surrounding color of the sensing target because this way detects the reflected light of the sensing target.



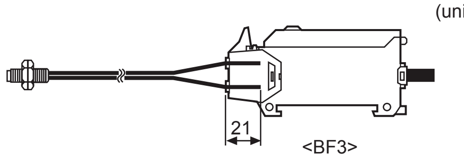
▣ Proper Usage

◎ The insertion depth of optical fiber cable

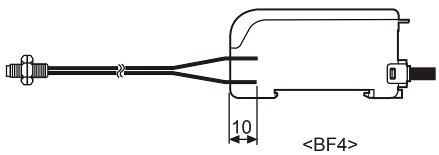
Please insert the optical fiber cable as following way.
The sensing distance is decreased if the insertion depth is not enough.

● The external diameter Ø2.2mm optical fiber cable

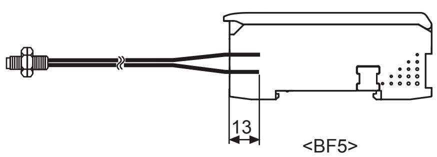
(unit: mm)



<BF3>



<BF4>

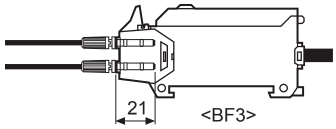


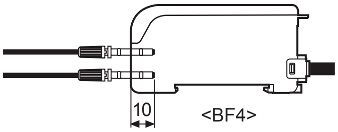
<BF5>

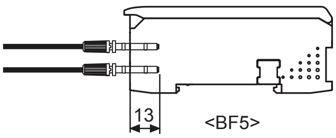
●The external diameter Ø1.0mm optical fiber cable

Please use the attached adapter when inserting the external diameter Ø1mm optical fiber cable.

(unit: mm)



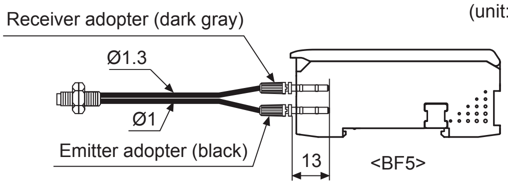




● Coaxial type optical fiber cable

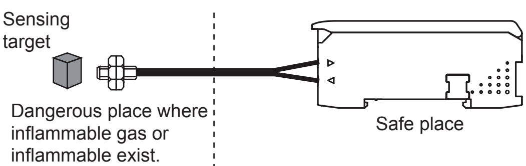
For the model FD-320-F1 of coaxial type fiber cable, the external diameters are Ø1mm for emitter and Ø1.3mm for receiver. Caution that the insertion position of the emitter cable (Ø1) and the receiver cable (Ø1.3) should not be changed each other. (also BF3 and BF4 series)

(unit: mm)

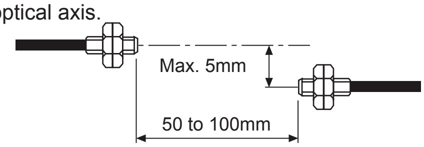


◎ Install optical fiber sensor

- If the wire of the optical fiber sensor is set with high-tension wire or power line, it may cause malfunction or trouble. Please use separate wiring or single pipe to escape them.
- Please locate the optical fiber hood of the optical fiber sensor at the dangerous place, and locate fiber amplifier at the safe place.



- The optical fiber sensor needs to be installed close to the sensing target as you can, because the receiver level can be low when the sensing distance is long. The light transmitted from the optical fiber wires spreads of about 60° columnar.
- Please block strong light sources (sunlight, spotlight) with the shading plate. The strong light sources should not be at the angel of directivity of the receiver face of the optical fiber cable.
- When the optical fiber sensor is installed by through-beam type, it should be within 5mm from the center of the optical axis.

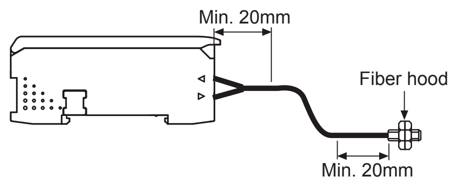


- When the side of the optical fiber cable is dirty, clean it with dry cloth. Do not use the organic solvent based thinner.
- Do not potentiate excessively such as compress or pull at the hood part of the optical fiber cable.

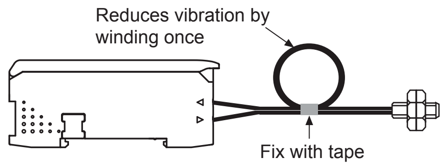
Tension of the optical fiber cable	
Diameter of the optical cable	Tensile strength
Ø0.5mm	Max. 1kgf
Ø1.0mm	Max. 3kgf

※Caution: When more than allowable force is potentiated at the optical fiber cable, the cable can get damage.

- Do not bend within 20mm from amplifier and fiber hood.

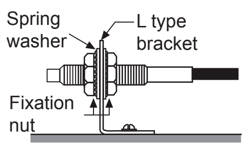


- After installing the optical fiber sensor, please keep the remained cable as following way. (When cable is folded by vibration, the rate of light is reduced.)



- Do not potentiate excessively at the nut to close when fixing the hood of the optical fiber cable. (Refer tightening torque of the type of the optical fiber cable)

< Bolt type >

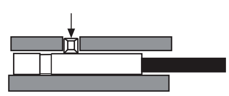


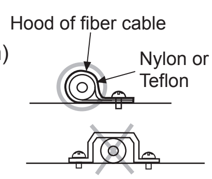
Tightening torque of fiber hood bolt	
Diameter	Tightening torque
M3	Max. 3kgf·cm
M4	Max. 8kgf·cm
M6	Max. 10kgf·cm

※Caution: When more than allowable torque is applied at the bolt of the fiber hood, the fiber hood can get damage.

< Cylinder type >

- Set bolt (max. M3)
- Tightening torque (max. 2kgf·cm)

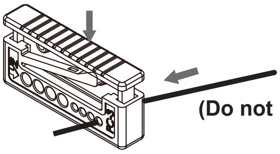




Technical Description

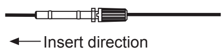
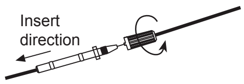
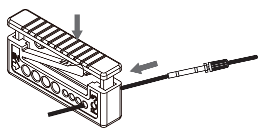
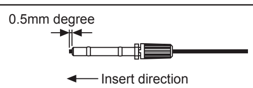
◎ Install optical fiber sensor

● If the wire of the optical fiber sensor is set in a pipe with high-tension wire or power line, it may cause malfunction or trouble. Please use separate wiring or single pipe to escape them.
● Please cut the cable at once. If the surface of the cut is broken, or gets grooves, the sensing distance is short.
● Do not use the hole which had used at once.
The cutting surface is not good. The sensing distance is short. Please use another hole.
● Please use our given cutter (FC-3). Do not cut the cable with a cutting nipper or stationery (cutter, scissors).

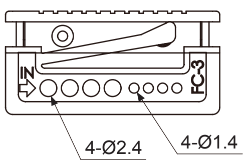


(Do not use a nipper or cutter.)

● The external diameter Ø1mm (Ø1.3mm) optical fiber cable should be cut according to the following order..

①	Shipment in the pre-tightening condition as shown on the right.	
②	Unscrew to the arrow direction and move it.	
③	Insert the cable into the cutter (FC-3).	
④	After locating the adopter like picture on the right, screw it.	

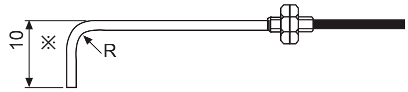
● Fiber cable cutter (FC-3)



◎ The bending radius of SUS type fiber cable

The bending radius (R) of the stainless pipe (SUS) should be as big as possible.
If the bending radius is small, the sensing distance is also short.

< Bend the end of the SUS >



< Bend SUS in front of the hood >

※Caution 1: When bending SUS, do not bend it less than 10mm.
※Caution 2: The length of SUS for FTS-230-05 type is 35mm. Please do not bend SUS as user can.

◎ Service temperature of fiber cable

● The service temperature of standard type of fiber cable is -40 to 70℃. If the surrounding temperature is high, the penetration ratio of the light becomes low. If user wants to use in the high temperature, please use the heat-resisting type optical fiber cable.

● Heat-resisting optical fiber cable

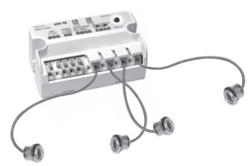
Detection method	Fiber material	Model	Ambient temperature
Diffuse reflective type	Plastic	FD-620-10H	-40 to 105℃
		FD-620-15H1	-40 to 150℃
	Glass	GD-420-20H2	-40 to 250℃
		GD-620-20H2	-40 to 250℃
Through-beam type	Plastic	FT-420-10H	-40 to 105℃
		FT-420-10H1	-40 to 150℃
	Glass	GT-420-14H2	-40 to 250℃

(C) Door/Area Sensors

Cross-Beam Area Sensor
BWC Series

Economical Door Side Sensor
ADS-SE1/2 Series

Door Side Sensor
ADS-SE Series

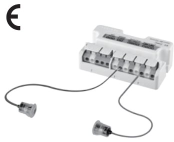


Product Overview

■ Auto Door Sensor

Appearances	Sensing type	Mounting height	Model	Power supply	Cover color	Control output	Reference
	Diffuse reflective type	2.0 to 2.7m	**ADS-AF**	24-240VAC/ 24-240VDC	Silver	Relay output	**C-3 to 9**
			ADS-AE	12-24VAC/ 12-24VDC			

■ Door Side Sensor

Appearances	Sensing type	Sensing distance	Model	Power supply	Response time	Control output	Reference
	Through-beam type	10m	**ADS-SE**	12-24VAC/ 12-24VDC	Max. 50ms	Relay output	**C-10 to 15**
CE 	Through-beam type	10m	**ADS-SE1/2**	12-24VAC/ 12-24VDC	Max. 50ms	Relay output	**C-16 to 21**

■ Area Sensor

Appearances	Sensing type	Sensing distance	Model	Power supply	Response time	Control output	Reference
CE  (Aluminum case)	Through-beam type	1 to 7m	**BWC40-□□H**	12-24VDC	Max. 12ms	NPN open collector output	**C-22 to 26**
			BWC40-□□HD				
			BWC80-14H				
			BWC80-14HD				
CE  (Aluminum case)	Through-beam type	0.1 to 7m	**BW20-□□**		Max. 12ms	NPN open collector output	**C-27 to 32**
			BW40-□□				
			BW20-□□P			PNP open collector output	
			BW40-□□P				
CE  (Plastic case)	Through-beam type	0.1 to 5m	**BWP20-□□**		Max. 6ms	NPN open collector output	**C-33 to 37**
			BWP20-□□P			PNP open collector output	
Picking sensor CE  (Plastic case)	Through-beam type	0.1 to 3m (Long sensing distance mode)	**BWPK25-05**		Max. 30ms	NPN open collector output	**C-38 to 42**
		0.05 to 1m (Short sensing distance mode)	**BWPK25-05P**			PNP open collector output	

Auto Door Sensor

■ Features

- Adjustable hold time switch (2, 7, 15 seconds)
- 4-step detection angle adjustment (7.5°, 14.5°, 21.5°, 28.5°)
- Adjustable detection area (left/right area elimination)
- Max. detection area: 2460 mm x 86 mm (height 2.7 m)
- Wide range power supply:
  24-240 VAC / 24-240 VDC (universal AC/DC type),
  12-24 VAC / 12-24 VDC (universal AC/DC type)
- Built-in microprocessor

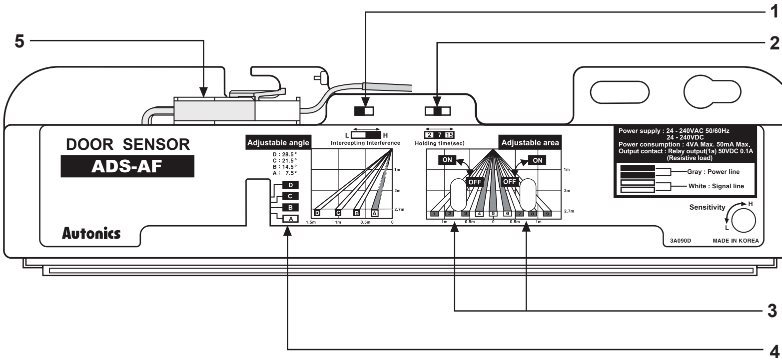
⚠ Please read "Caution for your safety" in operation manual before using.

■ Specifications

Model		ADS-AF	ADS-AE
Cover color		Silver	
Power supply		24-240VAC ±10% 50/60Hz, 24-240VDC ±10% (ripple P-P: max. 10%)	12-24VAC ±10% 50/60Hz, 12-24VDC ±10% (ripple P-P: max. 10%)
Power consumption		Max. 4VA (at 240VAC)	Max. 2VA (at 24VAC)
Control output	Contact type	1a	
	Contact capacity※1	50VDC 0.1A (resistive load)	
Relay life cycle		Mechanical: Min. 20,000,000 times, Electrical: Min. 50,000 times	
Mounting height		2.0m to 2.7m (max. sensing distance: 3.0m)	
Sensing method		Infrared reflection method	
Sensing area		9 Point (refer to the below chart)	
Output holding time		Time delay approx. 0.5sec	
Holding time of stationary sensing		Selectable 2sec, 7sec, 15sec (selectable by holding time setting switch)	
Interference prevention		H, L (selectable by interference prevention switch)	
Front sensing area		7.5°, 14.5°, 21.5°, 28.5°: 4 steps variable (adjusting by angle adjuster)	
Adjustable sensing area		(1, 2, 3 area), (7, 8, 9 area) Eliminate each by each : Adjusting with eliminating right/left sensing area lever	
Light source		Infrared emitting diode (modulated)	
Indicator		Operation indicator: Orange LED, Green LED, Red LED (refer to C-8 for the display status in operation)	
Connection method		Connector wire connection	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Noise immunity		±2,000V the square wave noise (pulse width:1μs) by the noise simulator	
Dielectric strength		1,000VAC 50/60Hz for 1 minute	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 2 hours	
Shock		100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Environment	Ambient illumination	Sunlight: Max. 3,000lx ,Incandescent lamp: Max. 3,000lx (receiver illumination)	
	Ambient temperature	-20℃ to 50℃, storage: -20 to 70℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Accessory		Cable: 2.5m, Mounting screw: 2, Mounting template	
Protection structure		IP50 (IEC standard)	
Material		Case: Acrylonitrile butadiene styrene, Lens: Acryl, Lens cover: Acryl	
Unit weight		Approx. 320g	

※1: Do not use Load which is beyond the rated capacity of contact point of Relay.
It can cause bad insulation, contact fusion, bad contact, relay breakdown, and fire etc.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

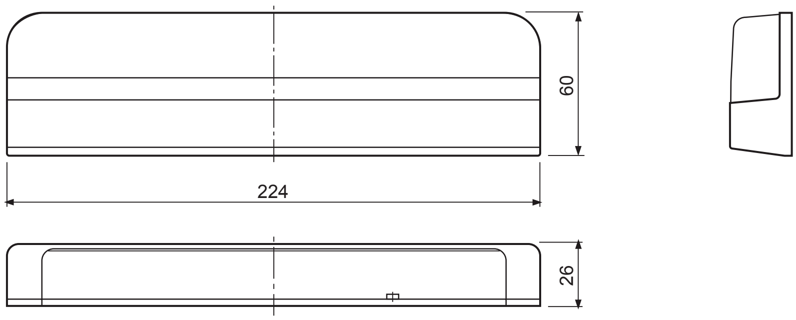
■ Unit Description



1. Interference prevention switch
2. Holding time setting switch
3. Eliminating right/left sensing area lever
4. Angle adjuster
5. Body connector

■ Dimensions

(unit: mm)

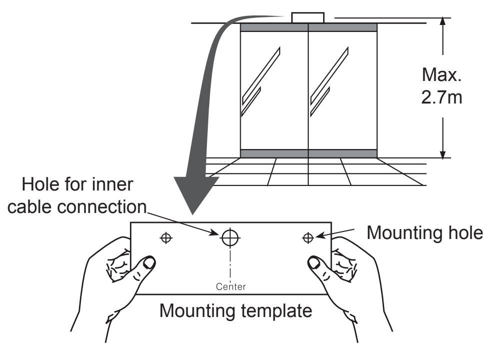


■ Mounting Method

Installation order

1. Attach mounting template at mounting position
(mounting height: 2.0m to 2.7m)

- Drill Ø3.4mm hole based on mounting template.
- In case of wiring the cable on the wall to hide the cable, drill Ø9mm hole.
- Install the unit after removing the mounting template.



⚠ Caution

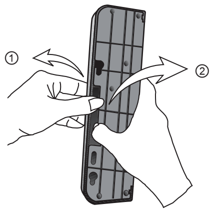
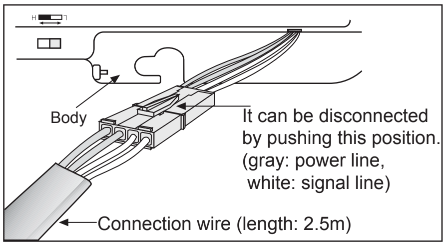
⚠ Warning It may cause electric shock.

- When this unit is used with cable outlet removed from cover, it must be installed indoors.
(Electric shock or damage can occur if water flows through cable outlet.)

⚠ Caution People can be jammed in the door.

- If this unit is installed higher than 2.7m in height, it may not detect short children.
- If this unit is installed lower than 2.0m in height, it may not work properly.

■ Installation

Installation order	⚠Caution
2. Please fix the unit with screws bolt after removing protection cover off. 	**⚠ Caution Mounting the unit** • Do not put excessive tightening torque on screw bolt when mounting this unit. It may result in mounting hole damage. **<How to remove protection cover>** • Pulling left thumb toward ①, key lock will be released and pull right thumb toward ②, protection cover and body will be detached.
3. Connect the code part of the extension cable to main control part. • Please install the connector in order to connect with the body.	
4. Connect the connector of the body and the connector of the extension cable. 	**⚠ Caution Connection of the connector** • Plug in the connector of the extension cable and the connector of the unit. The unit may not work normally by inferior contact.

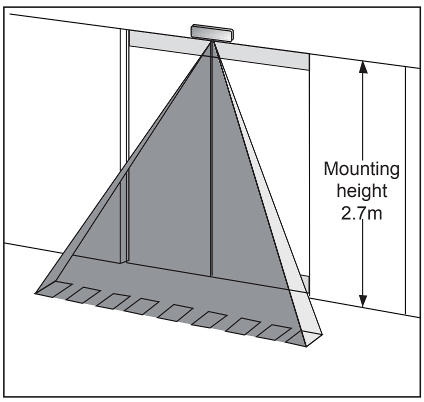
■ Adjustment

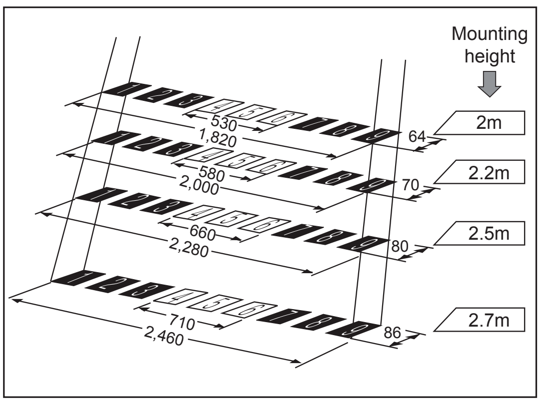
Please turn ON the power.

1. Check of the sensing area

This unit has characteristic of the sensing area as below chart and figure.

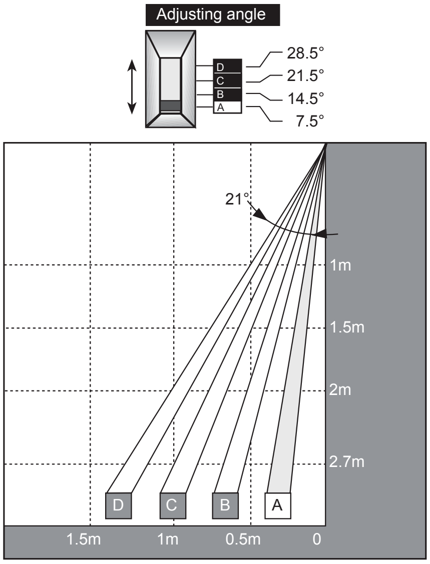
(unit: mm)





■ Adjustment

2. Adjustable sensing area
Adjustable 7° in each step.
(sensing area angle step: 7.5° to 28.5°)

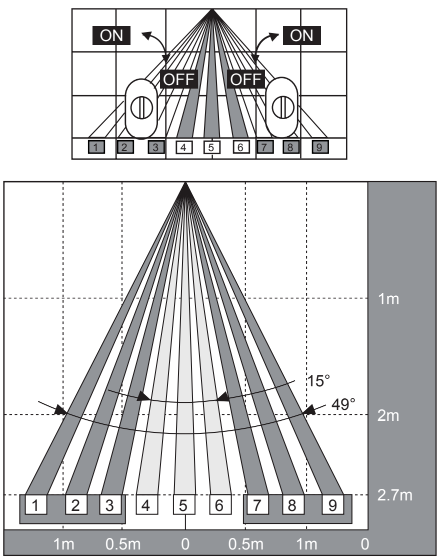


⚠ **Caution** **People can be jammed in the door.**

• The unit is not safety sensor. Install the fail-safe device before using the unit.

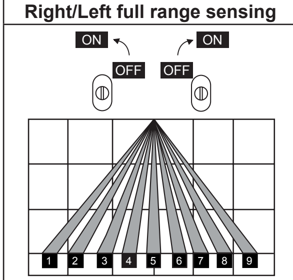
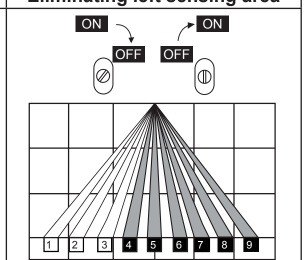
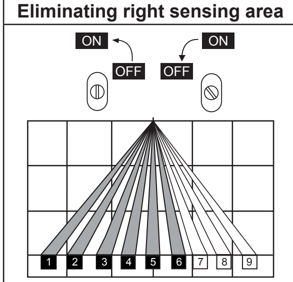
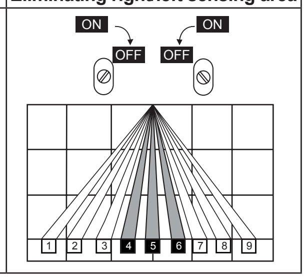
3. Adjustment of Left, Right sensing area width

Sensing area width 1, 2, 3 can be eliminated by left lever, 789 by right lever.
• Use the unit as removing non-sensing area by the lever adjusting width at narrow sensing area.
※Turn the adjuster till it stops it toward arrow direction by a (-)driver.



⚠ **Caution** **Doors may malfunction.**

• When eliminating the right/left sensing range, be sure to install the unit at place where a person approaches at the front of the door.
• In case of eliminating sensing area width: If a person approaches at the side of the door, they may not be detected and the door will not open.
• The sensing range for position of eliminating lever is as below.
• It can eliminate 1, 2, 3 by left lever and 7, 8, 9 by right lever at the once.

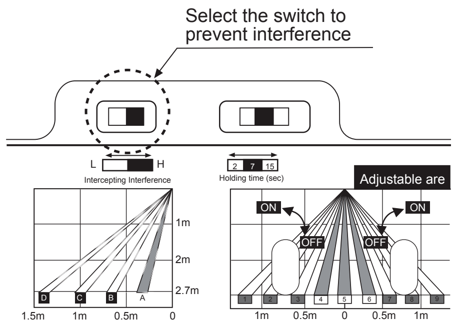
Right/Left full range sensing	Eliminating left sensing area
	
Eliminating right sensing area	**Eliminating right/left sensing area**
	

※It is not able to eliminate individual areas like elimination of area 1 or 7.

■ Adjustment

4. How to set the switch for interference prevention

In case of using several door sensors adjacently, please set the interference prevention switches of the sensors differently.

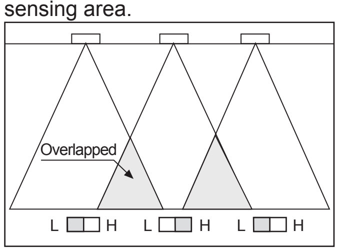


⚠ Caution Doors may malfunction.

When several door sensors are installed simultaneously without considering any interference prevention, it may cause malfunction by another door sensor even though there is no moving object.

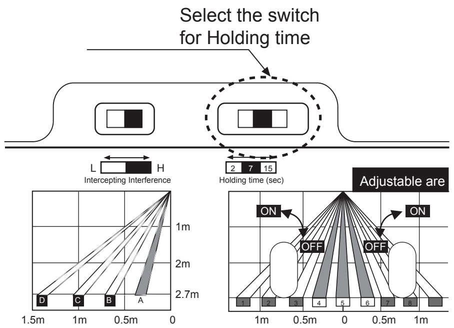
< Interference prevention >

If sensing area of the door sensors is overlapped, set each switch in difference or install the unit on non-overlapped sensing area.



5. Holding time switch setting

It is able to set the holding time by the holding time switch. (selectable 2sec, 7sec, 15sec)



⚠ Caution People can be jammed in the door.

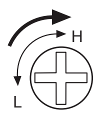
- The unit is not safety sensor. Install the fail-safe device before using the unit.
- The door will close after the time set by the holding time switch.

<Holding time>

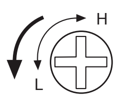
When people or objects stay in sensing area after the set 7sec for holding time it will sensing the stationary people or objects for set time by the holding time switch, and then the sensor's output turns off after set time.
(when people or objects stay in sensing area, output turns ON for only the set time and after the set time, output turns OFF and the door is close.)

6. Sensitivity Setting

- Even though people in the sensing area, if the sensor does not operate, turning the adjuster up to H.
  The sensitivity will be increased.



- Even though people in the sensing area, if the sensor operated, turning the adjuster up to L.
  The sensitivity will be decreased.

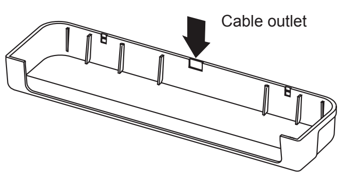


⚠ Caution Door can be opened and closed.

Please check the normal operation by turning the power ON/OFF after finishing the sensitivity setting.
It may not operate normally after wrong sensitivity setting.

7. Unit cover and stripping

- Mount the cover on the unit.
- In case of using outlet to wire exposed cable, remove the cable outlet as below.



- Wrench and strip the protection cover putting a flathead screwdriver.

⚠ Warning It may cause electric shock.

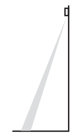
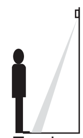
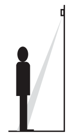
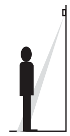
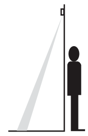
- Use this unit with unit cover.
- Be sure that this unit does not come in direct touch with water. It may cause a damage to the equipment or cause electric shock.
- In case of without the cable outlet, the unit must be installed at inner position of door.
- Be sure that cable outlet does not come in direct touch with water. It may cause a damage to the equipment or cause electric shock.

■ Adjustment

8. Sensitivity After turning on the power, please stand by in the condition without moving object in the sensing area.	• If it is not passed for 3 sec after turning the power, holding detection is impossible

9. Check of sensing operation

Check sensing operation as the below table.

Entry activation		 Turning on the power	 Turning on the power	 Enter the sensing area	 Holding sensing	 Out of sensing area
Operation indicator	Orange	LED ON	LED OFF	LED OFF	LED OFF	LED OFF
	Green	LED OFF	LED ON	LED OFF	LED ON	LED ON
	Red	LED OFF	LED OFF	LED ON	LED OFF	LED OFF
Output contact		OFF	OFF	ON	After holding time, OFF	After 0.5sec, OFF

10. Maintenance
- If the sensing lens is unclean, the unit may cause malfunction.
- In this case,please clean it with dry tissue and natural detergent.
- Do not use an organic materials such as benzene, etc. It may cause malfunction of sensing part.

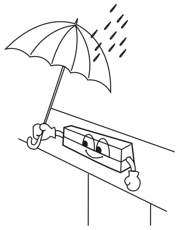
⚠ Warning **It may cause electric shock.**
- Do not wash the unit with water.
- Do not repair or disassemble the unit.

■ Troubleshooting

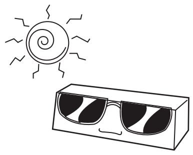
Malfunction	Cause	Troubleshooting
It does not work.	Power voltage	Check the power cable and adjust power voltage.
	Cable cut, disconnection	Check connector and wiring.
Sometimes it does not work.	The sensing lens are unclean	Clean the lens with dry tissue and natural detergent.
The door is opened even if people do not enter in sensing area.	There are moving objects.	Check surrounding environment for installation.
	By occurring sudden change of sensing area.	Check surrounding environment for installation.
	Sensing area is overlapped.	Install the unit to avoid overlap for sensing area. Set the switch intercepting interference.
	There is the equipment such as motor, neon lamp, generator, or high voltage line causing strong electric wave, noise.	Do not install the equipment causing strong electric wave, noise near the sensor.
	A drop of water is placed at the lens.	Remove a drop of water.

Installation Environment

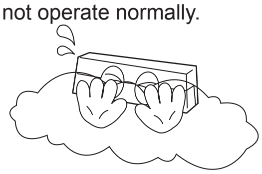
1. This product is not qualified for waterproof.
   Please install without being directly contacted with rain or snow, etc.
   It may cause breakdown and short circuit.



2. Do not install in the place where having reflecting light like sunshine directly reaches.
   It may does not operate normally.

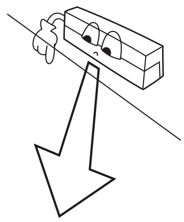


3. Do not install in the place where smoke and vapor occurs. It may do not operate normally.



4. If you place a movable object in the sensing area, it may cause malfunction by sensing the object because of natural phenomenon like wind, etc.

5. The sensing lens must be installed face to the door's threshold. If it faces the wall or roof, it may not operate normally.



Caution For Using

⚠ Warning **It may cause electric shock.**

- Do not take off its cover when the unit is operating.
  If water is penetrated into the cable outlet, it may cause human injury or cause electric shock.
- When using this unit with cable outlet removed, this unit must be installed indoors. If installing it outdoors, it may cause electric shock or damage by direct contact with water when the water inflows through cable outlet.
- Do not wash the unit with water. Be careful not the water inflow into this unit. It may cause damage or cause electric shock.
- Do not repair or disassemble the sensor. It may cause damage or cause electric shock.

⚠ Caution **Be careful of human injury by the door.**

- Do not install this unit at place higher than 2.7m.
  It may not sense small children due to lack of sensitivity.
- Do not install this unit under 2m.
  It may not operate normally.
- The unit is not safety sensor. Install the fail-safe device before using the unit.

\- Even if the unit is installed at closest side from the door, it is dangerous due to the difficulty of sensing at the closest side from the door. It is not able to detect children or the old and the infirm continuously and they can be jammed in the door.

-This unit holds the door for holding time. When the holding time passed, the door is closed. A person or an object can be jammed in the door.

⚠ Warning **It may cause electric shock.**

- When eliminating the right/left sensing area, be sure to make the object from the front of the door.
  When eliminating the right/left sensing area, it is hard to detect the enter from the width direction, it may cause human injury because the door is not opened.

⚠ Caution **It may cause malfunction.**

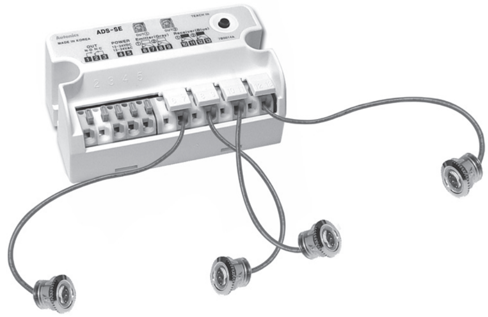
- When wiring the photoelectric sensor with high voltage line, power line in the same conduit, it may cause malfunction. Therefore please wire separately or use different conduit.
- Do not install this unit at place where there is dust or corrosive gas.
- The wire connection shall be used as short as possible in order to avoid malfunction by surge.
- When it is covered by dirt at lens, please clean the lens with dry cloth, but do not use any organic materials such as alkali, acid, chromic acid.

Door Side Sensor

■ Features

- Long sensing distance: 0 to 10m
- High ambient intensity of illumination:
  Max. 100,000lx of sunlight
- Easy to connect sensor head to controller
- Easy sensitivity setting
  (automatic sensitivity setting by one push method)
- Self-diagnosis function
- Compact Size (W77×L44×H30mm)

⚠ **Please read "Caution for your safety" in operation manual before using.**



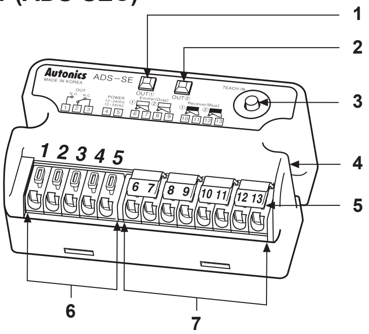
■ Specifications

Model		**ADS-SE**
Sensing type		Through-beam type
Sensing distance		0 to 10m
Power supply		12-24VAC ±10% 50/60Hz / 12-24VDC ±10% (ripple P-P: max. 10%)
Power/Current consumption		AC: Max. 2VA / DC: Max. 50mA
Contact output	Contact composition	1c
	Contact capacity※1	50VDC 0.3A (resistive load)
	Relay life cycle	Mechanical- Min. 5,000,000 operations, Electrical- Min. 100,000 operations
Response time		Approx. 50ms (from light OFF)
Output holding time		Approx. 500ms (from light ON)
Available sensor set		2set
Indicator		Operation indicator: Red LED, Green LED(Refer to C-14 to 15 for the display status in operation)
Light source		Infrared LED (850nm modulated)
Environ-ment	Ambient illumination	Sunlight: Max. 100,000lx (receiver illumination)
	Ambient temperature	-20 to 55℃, storage: -25 to 60℃
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Protection structure		IP30 (IEC standard)
Sensor cable length		10m
Sensor cable		Ø2.4mm, 1-wire, 5m (AWG26, core diameter: 0.16mm, number of cores: 7, insulator out diameter: Ø1.32mm)
Material		Sensor - Holder: Acrylonitrile butadiene styrene, Lens: Polymethyl methacrylate, Lens guide: Polycarbonate, Nut: Cu-Zn Controller - Housing: Acrylonitrile butadiene styrene, Cover: Acrylonitrile butadiene styrene, LED CAP: Polymethyl methacrylate, Bolt: Steel chromium molybdenum (brass, Ni-plate)
Accessory		Sensor: 1 set (ADS-SH), Fixing bolt for controller: 2 pieces
Unit weight		Approx. 300g

※1: Do not use Load which is beyond the rated capacity of contact point of Relay.
It can cause bad insulation, contact fusion, bad contact, relay breakdown, and fire etc.
※Please purchase 1 set of sensor separately when mounting 2 sets of sensor.
※The mounting bracket of sensor (ADS-SB12, ADS-SB10) is sold separately.
※It is enable to purchase a controller separately.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

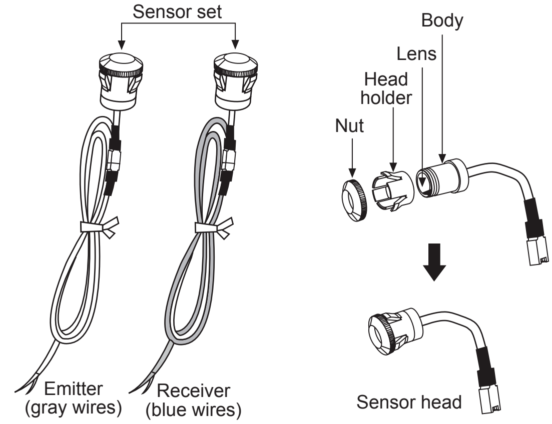
▣ Unit Description

● Controller (ADS-SEC)



1. Display LED (red)
2. Display LED (green)
3. Sensitivity setting button
4. Mounting hole
5. Wiring connection button
6. Terminal for power and output (1 to 5)
7. Terminal for emitter/receiver of sensor (6 to 13)

● Sensor (ADS-SH)

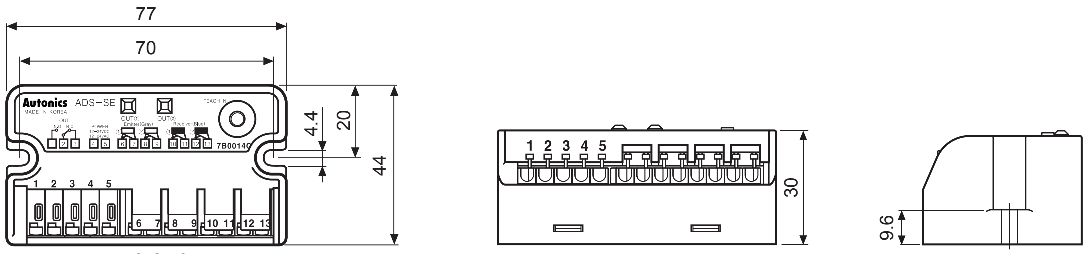


※It is able to use 2 sets of the sensor with this product.
If it is necessary, purchase a set more for using.

▣ Dimensions

(unit: mm)

● Controller (ADS-SEC)

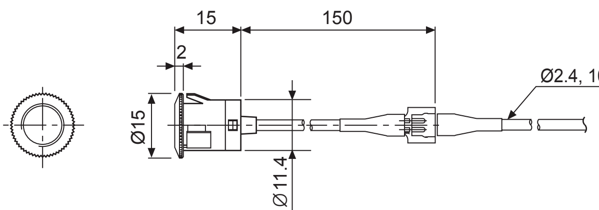


<ADS-SEC>

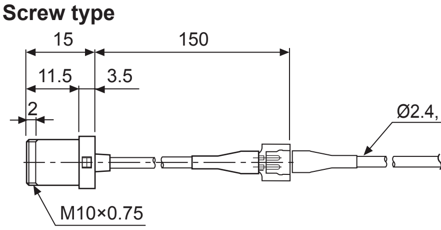
※It is able to purchase a controller (ADS-SEC) separately.

● Sensors (ADS-SH)

• One push type

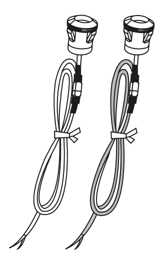


• Screw type



● Option

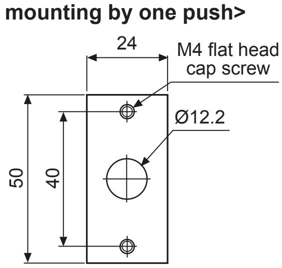
• Sensor set



<ADS-SH>

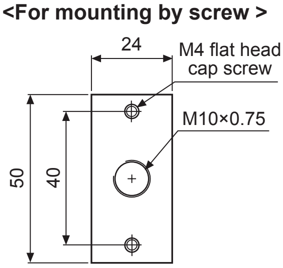
• Bracket

<For mounting by one push>



<ADS-SB12>

<For mounting by screw >

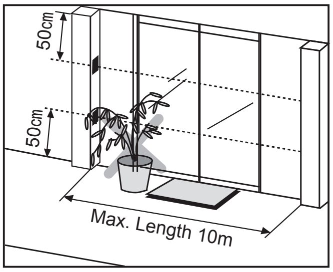


<ADS-SB10>

■ Installation

◎ Caution for sensor installation

1. Sensing distance is 10m.
   Install it in the rated distance.
2. Install the sensor with more than 50cm gap from the bottom and ceiling.
   It may cause malfunction by reflected beams from the surface of the bottom and ceiling.
3. Do not put obstacles between the emitter and the receiver.
   It may cause malfunction.
4. This product is for indoor. Avoid the place where exposed in direct sunlight or is in over rated intensity of illumination.



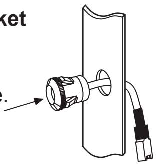
1. Make a hole on the side post of auto door as follows.

● When not using the mounting bracket
- Mounting hole of sensor head: Ø$12.2^{\pm 0.1}$mm
- Panel thickness of sensor head: $1.5^{\pm 0.1}$mm

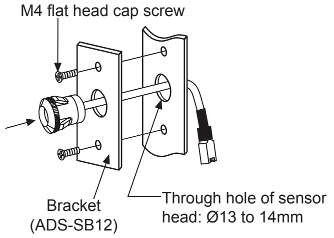
● When using the mounting bracket
- Through hole of sensor head: Ø13 to Ø14mm
- Screw hole for fixing the bracket: M4 Tap or Ø3.5mm

2. Mount the sensor head in the mounting hole

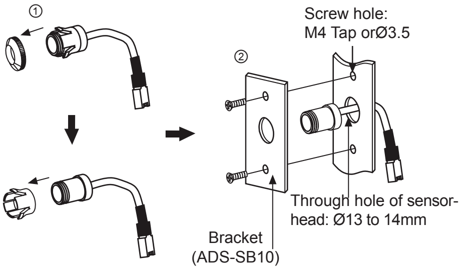
● When not using the mounting bracket
- One push method
  Insert the sensor head into the mounting hole like the right picture.



● When using the mounting bracket
- One push method
  1) Install the sensor head at the bracket first.
  2) Fix the bracket by screws on the place for installing.



- **Screw method**
  1) Remove nuts and the head holder from the sensor head.
  2) Install the sensor head on the bracket.
  3) Fix the bracket on the side post of the door by screws.



※The mounting bracket is sold separately.
If necessary, please purchase it for using.

⚠ Caution For mounting hole

- Check the mounting holes for the head of the emitter and the receiver are in parallel for the optical axes.
- Grind around the mounting holes drilled smoothly.
  It may hurt a person by the sharp part and cause malfunction by sensor head inclined.

⚠ Caution When installing in One push method

- Check the nuts are fixed on the sensor body tightly.
- Install that there is no gap between the nuts and the side of the door (or bracket). It may cause malfunction because sensitivity setting is not available as the optical axes are not matched if sensor body is inclined.

⚠ Caution After installing the sensor head

- Check the damage such as scratches or pollutant on the lens of the sensor head.
  It may cause malfunction in the condition of shading light or lack of sensitivity by dust.

⚠ Caution For maintenance and mending

- Keep the sensor head clean.
  It may not operate normally.
  Clean it by a piece of close with a neutral detergent.
  Do not use organic solvent.
  It may cause damage to lens of the head by organic solvent.
- Do not wash the head part of the sensor.
  Sensor by water, it may cause product damage.

▣ Installation

◎ Controller installation

• Fix controller with the bolts (M4×20, 2pcs). Process the fixing hole of controller by M4 included in the package. Refer to dimension for installation.

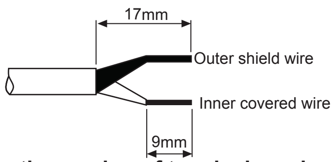
⚠ Warning When fixing controller

• Do not screw the bolts too tightly. The fixing hole of controller may be broken.

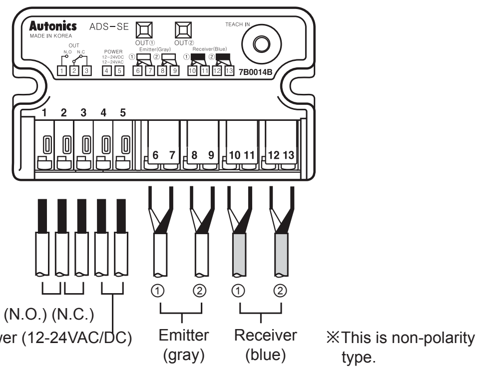
◎ Wiring connection

1. Follow as below when adjusting wiring length.

1) Cut off the wiring length as much as user needs.
2) Connect the wire to the terminal after taking off the wire covering. It is easy to connect if soldering the end of the wires.

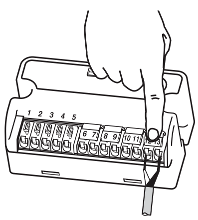


2. Match wires in the number of terminals and connect them.



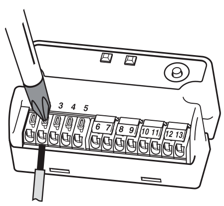
● Connection method for sensor

• Put outer shield and inner covered wires at once, pressing the insert button, then take off from the button.



● Connection method for power and output wires

• Put the wires pressing the terminal ends by a driver etc.



• Allowable diameter of power and output wires
- Single wire: Ø0.12 to 1.6mm² (AWG26 to 16)
- Stranded wire: Ø0.13 to 1.5mm² (AWG26 to 16)

⚠ Warning It may cause electric shock.

• Be sure of connecting wires in power off.

⚠ Caution It may cause damage to this product.

• Follow the left picture when cutting off the wires of sensor head. If the cover of wire is taken off too much, it may cause damage to this product as the end of both wires is shorted.

⚠ Caution Do not extend the wire of sensor head.

• Do not connect extended wire to the wire of sensor head. It may cause malfunction by noise.

⚠ Caution It may cause damage to this product.

• Do not connect two wires or more to a terminal.

⚠ Caution Wiring connection

• It does not operate normally if the wiring is connected conversely.

⚠ Caution It may cause damage to this product.

• Make sure of connecting power wire to the terminal 4, and 5. Otherwise, It may cause damage to this product.

▣ Proper Usage

◎ Sensitivity setting

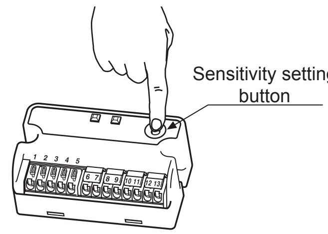
Set sensitivity after mount this product for a normal operation. It sets the optimum sensitivity automatically at the controller according to installed environment.

Order	LED display	Status
Press sensitivity setting button ↓ After more than 1sec ↓ Take off from button	Red/Green Flashed by turns ↓ Red/Green All LED OFF ↓ Flashed at once ↓ Displaying operation status	Ready ↓ The beginning of sensitivity setting ↓ The end of sensitivity setting
Check LED display after setting the sensitivity.		

※When sensitivity setting button is pressed less than 1sec sensitivity setting is cancelled, then it operates by previous setting.

⚠ Caution For mounting hole

- Check the wiring again with the connection diagram.
- When set the sensitivity, the transmitted beam must not be shaken and cut off.
- Do not put obstacles like a pot on the passage of the through beam.
- It may cause malfunction in above cases from lack of sensitivity or abnormal sensitivity setting.



◎ Sensitivity status and check after setting sensitivity

☼: light ON, ◐: flash, ●: light OFF

Connecting sensor	LED display		Status	
	Red	Green	After setting sensitivity	In operation
1set	☼	●	Sensitivity setting success	Received light
	◐	◐	Sensitivity setting failure	Emitter disconnection or sensor cable extention
	◐	●	—	Lack of sensitivity
	●	●	—	Interrupted light
2set	☼	☼	1, 2-channel sensitivity setting success	1, 2-channel received light
	☼	◐	1-channel sensitivity setting success, 2-channel sensitivity setting failure	2-channel lack of sensitivity
	☼	●	—	1-channel received light, 2-channel interrupted light
	◐	☼	1-channel sensitivity setting failure, 2-channel sensitivity setting success	1-channel lack of sensitivity
	●	☼	—	1-channel interrupted light, 2-channel received light
	◐	◐	1, 2-channel sensitivity setting failure	1, 2-channel lack of sensitivity or emitter disconnection
	●	●	—	1, 2-channel interrupted light

● After complete sensitivity setting for using one set of sensor, red LED is flashing, green LED is off and only red LED displays the operation status.

※After complete sensitivity setting in using two sets of sensors, red LED indicates the operation status of receiver set by receiver ① and green LED indicates the operation status of receiver set by receiver ②.

※Self-diagnosis function: If lack of sensitivity occurs by optical axes not matched and pollution by dust on the lens of emitter/receiver etc., the LED of normal operation channel flashes due to unstable operation.

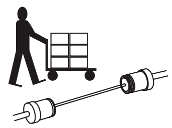
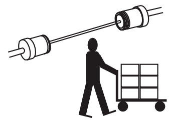
● Check process for sensitivity setting failure

1. Check obstacles between the heads of emitter receiver.
2. Check pollutant on the lens of emitter receiver.
3. Check wires cut off and the connection with the connection diagram on the controller.
4. Check if the head of emitter/receiver is inclined or not.
5. Set sensitivity again after removing above problem.

※When sensitivity setting is failure even though above problem is solved, please contact us.

■ Operation Check

Please check the operation flow chart below. ☼: light ON, ●: light OFF

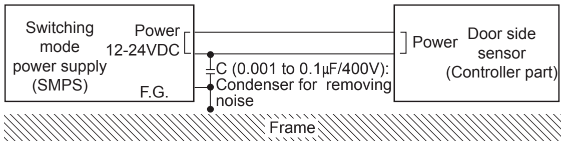
Operation					
Status		Power OFF	• Normal operation • No human or any material between sensors	Human or material is passing between sensors (When cutting off the transmitted beam)	After human or material is passed
LED display		●	☼ (red/green)	●	☼ (red/green)
Relay output	N.O.	OPEN	OPEN	CLOSE	OPEN
	N.C.	CLOSE	CLOSE	OPEN	CLOSE

■ Troubleshooting

Malfunction	Cause	Troubleshooting
It does not work.	Power voltage	Check the power cable and adjust power voltage.
	Cable disconnection, incorrect connection	Please check wiring and terminal.
	Rated sensing distance	Use it in rated sensing distance.
Sometimes it does not work.	Pollution by pollutant on the lens of Emitter Receiver.	Remove the pollutant.
It is operated even if people does not enter in sensing area.	Rated sensing distance	Use it in rated sensing distance.
	There are obstacles between Emitter and Receiver.	Remove obstacles.
	There is equipment generating strong noise or ratio wave (Motor, Generator, High-tension wire).	Keep away from the equipment generating strong noise or ratio wave.

■ Caution During Use

1. When two sets of sensor are mounted closely, it may cause mutual interference by the emitter of other sensor. Therefore, please install them to avoid the interference by exchanging the head of Emitter and Receiver and by keeping the distance between the heads in more than 50cm.
2. When sensor head is installed on the ceiling or floor closely, it may cause malfunction by receiving the reflected beam. Therefore, please install it by keeping the suitable height (more than approx. 50cm) from the ceiling or floor.
3. When the target is a translucent or small object (Max. Ø15mm) it may not detect as the light transmits them.
4. When wire sensor in the same pipe laying with the high-tension wire or power line, it may cause malfunction. Therefore, please use separated wiring or pipe laying.
5. What sensor is used in much dusty or corroded place, it may cause malfunction. Please avoid these places when installing.
6. When making the length of the wiring (power wire or output wire) long, it may cause malfunction by surge etc.
7. When the lens of sensor head is polluted by dust etc., please clean it by dried cloth slightly. Do not use organic solvent like thinner.
8. When switching mode power supply is used as the source of supplying power, please ground F.G. terminal and install a condenser for removing noise between 0V and F.G. terminal as following drawing.

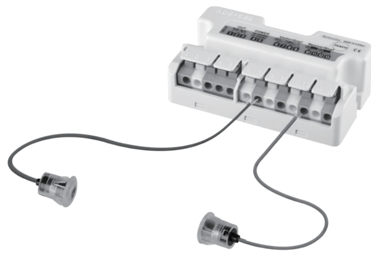


(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Door Side Sensor

■ Features

- Long sensing distance: 0 to 10m
- High ambient intensity of illumination:
  Max. 100,000lx of sunlight
- Easy to connect sensor head to controller
- Easy sensitivity setting
  (automatic sensitivity setting by one push method)
- Self-diagnosis function
- Compact Size (W77×L44×H24mm)
  : minimized max. 20% than existing product
  (based on depth)



Please read "Caution for your safety" in operation manual before using.

CE

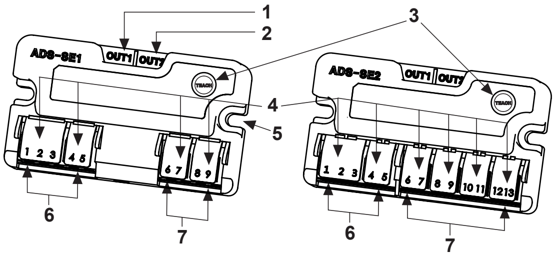
■ Specifications

Model		ADS-SE1 (1-channel)	ADS-SE2 (2-channel)
Sensing type		Through-beam type	
Sensing distance		0 to 10m	
Power supply		12-24VAC ±10% 50/60Hz / 12-24VDC ±10% (ripple P-P: max. 10%)	
Power consumption/Current		AC: Max. 2VA, DC: Max. 50mA	
Control output	Contact composition	1c	
	Contact capacity※1	50VDC 0.3A (resistive load)	
	Relay life cycle	Mechanical- Min. 5,000,000 operations, Electrical- Min. 100,000 operations	
Response time		Approx. 50ms (from light OFF)	
Output holding time		Approx. 500ms (from light ON)	
Available sensor set		1-channel	2-channel
Indicator		OUT1 indicator: Red LED, OUT2 indicator: Green LED (Refer to C-20 for the display status in operation)	
Light source		Infrared LED (850nm modulated)	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1min) in each X, Y, Z direction for 2 hours	
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times	
Environ-ment	Ambient illumination	Sunlight: Max. 100,000lx (receiver illumination)	
	Ambient temperature	-20 to 55℃, storage: -25 to 60℃	
	Ambient humidity	35 to 85% RH, storage: 35 to 85% RH	
Protection structure		IP30 (IEC standard)	
Sensor cable length		5m	
Sensor cable		Ø2.4mm, 1-wire, 5m (AWG26, core diameter: 0.16mm, number of cores: 7, insulator out diameter: Ø1.32mm)	
Material		Sensor - Holder: Acrylonitrile butadiene styrene, Lens: Polymethyl methacrylate, Lens guide: Polycarbonate, Nut: Polycarbonate Controller - Housing: Acrylonitrile butadiene styrene, Cover: Acrylonitrile butadiene styrene, Bolt: Steel chromium molybdenum (brass, Ni-plate)	
Accessory		Sensor 1set (ADS-SHP), Fixing bolt (M4×20) for controller: 2	
Approval		CE	
Weight※2		Approx. 450g (approx. 300g)	

※1: Do not use Load which is beyond the rated capacity of contact point of Relay.
It can cause bad insulation, contact fusion, bad contact, relay breakdown, and fire etc.
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Please purchase 1 set of sensor separately when mounting 2 sets of sensor.
※The mounting bracket of sensor (ADS-SB12, ADS-SB10) is sold separately.
※It is enable to purchase a controller (ADS-SEC1/2) separately.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Identification

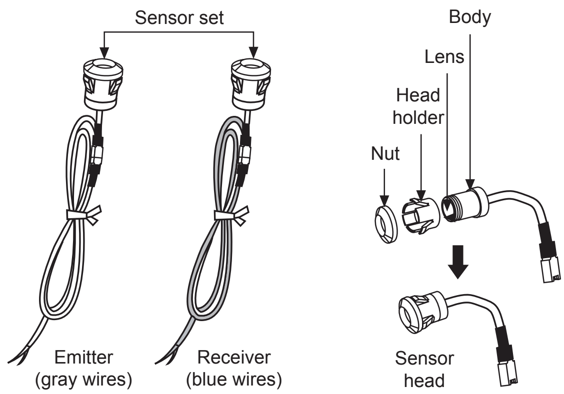
● Controller (ADS-SEC1/2)



<ADS-SEC1> <ADS-SEC2>

1. OUT1 indicator (red)
2. OUT2 indicator (green)
3. Sensitivity setting key (TEACH)
4. Wiring connection button
5. Mounting hole
6. Power and output connection terminal (1 to 5)
7. Emitter/Receiver sensor connector terminals
   • ADS-SEC1: 6 to 9
   • ADS-SEC2: 6 to 13

● Sensor (ADS-SHP)

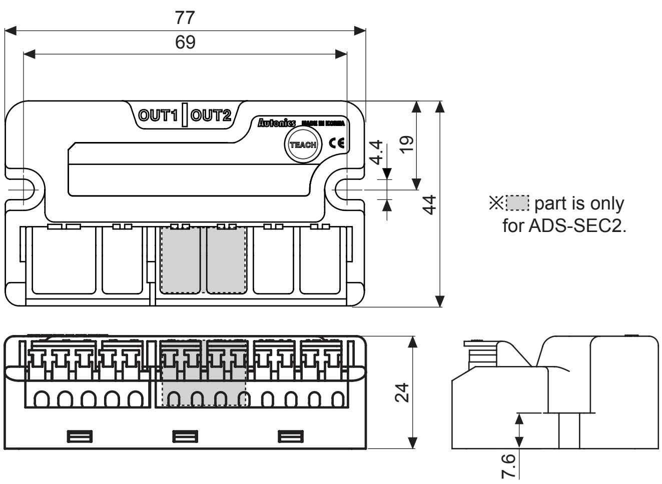


※To mount a sensor with a nut and a head holder, use the bracket for one push method.
※To mount a sensor without a nut and a head holder, use the bracket for screw method.
※ADS-SE2 is available to 2 sets of sensors at the same time. Additional 1 set of sensors is sold separately.

■ Dimensions

(unit:mm)

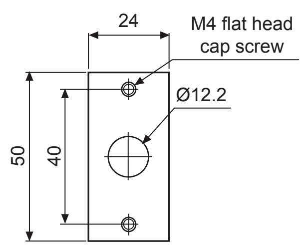
● Controller (ADS-SEC1/2)



※Controller (ADS-SEC1/2), Sensor (ADS-SHP:5m) are sold separately.

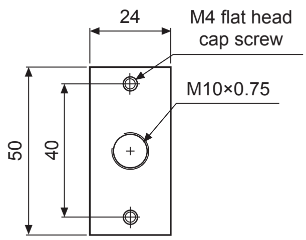
● Bracket (sold separately)

• One push method



<ADS-SB12>

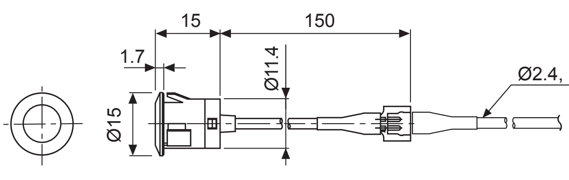
• Screw method



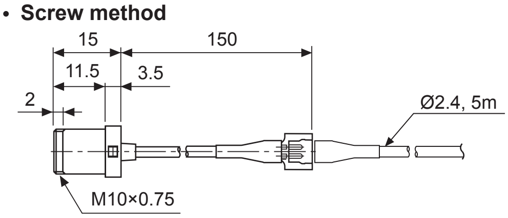
<ADS-SB10>

● Sensor (ADS-SHP)

• One push method



• Screw method



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(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Installation

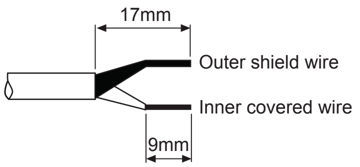
◎ Controller

1. Follow as below when adjusting wiring length.

- Cut off the wiring length as much as user needs.
- Connect the wire to the terminal after taking off the wire covering. It is easy to connect if soldering the end of the wires.

※Be sure of connecting wires in power off.

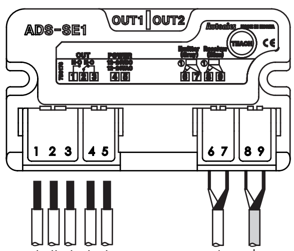
※Follow the figure when cutting off the wires of sensor head. If the cover of wire is taken off too much, it may cause damage to this product as the end of both wires is shorted.



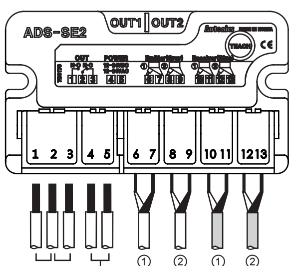
2. Match wires in the number of terminals and connect them.

- Do not connect extended wire to the wire of sensor head. It may cause malfunction by noise.
- Do not connect two wires or more to a terminal.

<1-channel>

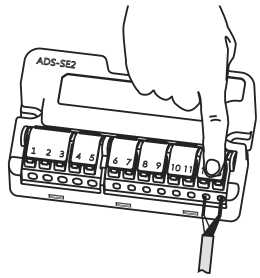


<2-channel>



● Connection method for power and output wires

- Press a connecting button and wiring it.
- It does not operate normally if the wiring is connected conversely.
- Make sure of connecting power wire to the terminal 4, and 5. Otherwise, It may cause damage to this product.
- Allowable diameter of power and output wires
  -Single and Stranded wire: 0.2 to 1.5 mm^2



⚠ Caution for installing controller

- Fix a controller with 2 fixing bolts.
- Process the fixing holes of a controller by M4.
  Refer to "▣ Dimension" for the position of holes.
- Do not tighten bolts to fix a controller. The fixing holes of controller may be broken.

◎ Sensor

1. Make a hole on the side post of auto door as follows.

● When not using the mounting bracket

① One push method
- Mounting hole for sensor head: Ø12.2$^{\pm0.1}$mm
- Panel thickness for sensor head: 1.5$^{\pm0.5}$ mm

② Screw method
- Mounting hole for sensor head: M10×0.75mm
- Panel thickness for sensor head: 1.5$^{\pm0.5}$ mm

● When using the mounting bracket

① One push method
- Through hole for sensor head: Ø13 to 14mm
- Fixing screw hole for bracket: M4 Tap or Ø3.5mm

② Screw method
- Through hole for sensor head: Ø13 to 14mm
- Fixing screw hole for bracket: M4 Tap or Ø3.5mm

※Check the mounting holes for the head of emitter and receiver are in parallel for the optical axes.

※Grind around the mounting holes drilled smoothly. It may hurt by sharp parts and cause malfunction by the inclined sensor head.

2. Mount sensor heads to the mounting holes.

● **When not using the bracket**

① One push method

• Put the sensor head into the mounting hole as the figure.

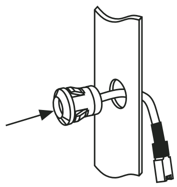
※Check the nuts are fixed on the sensor body tightly.

※Install the sensor with no gap between the nut and the side of the door (or panel).

② Screw method

• Put the sensor head to the mounting hole.

※Install the sensor with no gap between the panel and the sensor.



● **When using the bracket**

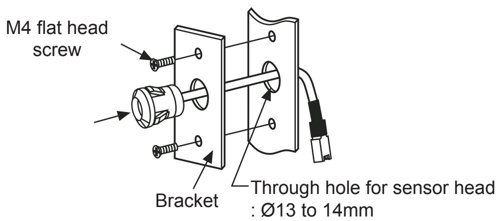
① One push method

• Put the sensor head to the bracket.

• Fix the bracket to the desired place by screws.

※Check the nut is fixed to the sensor body tightly.

※Install the sensor with no gap between the nut and the side of the door (or bracket).



② Screw method

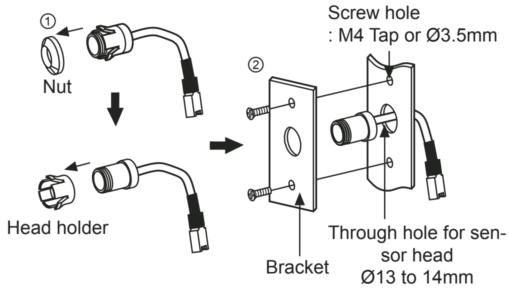
• Remove the nut and head holder from the sensor head.

• Install the sensor head to the bracket.

• Fix the bracket on the side post of the door by screws.

※It may cause malfunction because sensitivity setting is not available as the optical axes are not matched if sensor body is inclined.

※Check the damage such as scratches or pollutant on the lens of the sensor head. It may cause malfunction in the condition of interrupted light or lack of sensitivity by dust.



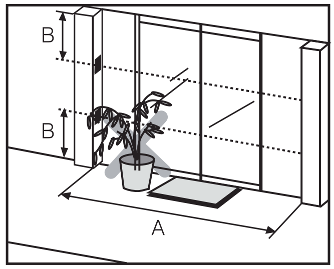
⚠ **Caution for sensor installation**

● The rated sensing distance is 10m (A).Install the sensors within the rated sensing distance.

● Install the sensor with more than 50cm (B) gap from the bottom and ceiling. It may cause malfunction by reflected beams from the surface of the bottom and ceiling.

● Do not put obstacles between Emitter and Receiver, or it may cause malfunction.

● This product is for indoor. Avoid the place where exposed in direct sunlight or it is in over rated intensity of illumination.



▣ Sensitivity Setting

◎ Sensitivity setting

Sensitivity setting is required when a user installs this unit at first or there is malfunction due to lack of sensitivity. Depending on the sensing distance, the controller automatically sets the optimum sensitivity for the best operation.

◎ Order of Sensitivity setting

Sensitivity setting key adjustment	Indicator	Status
Press sensitvity setting key	Red/Green indicators flashe in turn	Ready sensitivity setting
After 1 sec during pressing sensitivity setting key	Red/Green indicators turn OFF	Starts sensitivity setting
	Red/Green indicators flashes	Completes sensitivity setting
Completes sensitivity setting	Indicates operation status	

※When pressing the sensitivity setting key below 1 sec, the sensitivity setting is canceled and it operates as the latest setting. If sensitivity is not enough or the setting is not correct, this unit may have malfunction.

● **Check the followings when sensitivity setting is failed.**

①Check there are obstacles between Emitter/Receiver heads.

②Check there is dirt on the head lens of Emitter/Receiver.

③Check the wires are disconnected or connected properly as the label (connection diagram).

④Check the heads of Emitter/Receiver are inclined.

⑤Check the above items and resolve the problems and set the sensitivity again.

◎ Indicator

☼: ON, ◐: Flash, ●: OFF

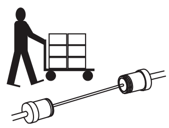
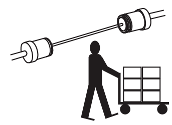
Connected sensor	Indicator		Status	
	OUT1 (red)	OUT2 (green)	After setting sensitivity	In operation
1-channel (ADS-SE1/2)	☼	●	Sensitivity setting success	Received light
	◐	◐	Sensitivity setting failure	Emitter disconnection or sensor cable extention
	◐	●	—	Lack of sensitivity
	●	●	—	Interrupted light
2-channel (ADS-SE2)	☼	☼	1, 2-channel sensitivity setting success	1, 2-channel received light
	☼	◐	1-channel sensitivity setting success, 2-channel sensitivity setting failure	2-channel lack of sensitivity
	☼	●	—	1-channel received light, 2-channel interrupted light
	◐	☼	1-channel sensitivity setting failure, 2-channel sensitivity setting success	1-channel lack of sensitivity
	●	☼	—	1-channel interrupted light, 2-channel received light
	◐	◐	1, 2-channel sensitivity setting failure	1, 2-channel lack of sensitivity or emitter disconnection
	●	●	—	1, 2-channel interrupted light

※For ADS-SE2, OUT1 indicator (red) is for Receiver status set sensitivity by Emitter of 1-channel and OUT2 indicator (green) is for Receiver status set sensitivity by Emitter of 2-channel.
※If lack of sensitivity occurs by not-matched optical axes or pollution on the lens of emitter/receiver during self diagnostic function, for ADS-SE1, the OUT1 indicator (red) turns ON. For ADS-SE2, the OUT indicator of the channel lack of received light turns ON.

■ Operation Check

Please check the operation flow chart below.

☼: ON, ●: OFF

Operation		Power OFF			
Status			• Normal operation • No human or any material between sensors	Human or material is passing between sensors (when cutting off the transmitted beam)	After human or material is passed
Indicator (OUT1 red/OUT2 green)		●	☼	●	☼
Relay output status	N.O.	OPEN	OPEN	CLOSE	OPEN
	N.C.	CLOSE	CLOSE	OPEN	CLOSE

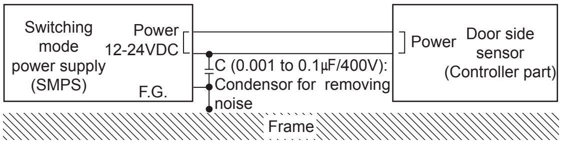
■ Troubleshooting

Malfunction	Cause	Troubleshooting
It does not work.	Power voltage	Check the power cable and adjust power voltage.
	Cable disconnection, incorrect connection	Please check wiring and terminal.
	Rated sensing distance	Use it in rated sensing distance.
Sometimes it does not work.	Pollution by pollutant on the lens of Emitter Receiver.	Remove the pollutant.
It is operated even if people does not enter in sensing area.	Rated sensing distance	Use it in rated sensing distance.
	There are obstacles between Emitter and Receiver.	Remove obstacles.
	There is equipment generating strong noise or ratio wave (Motor, Generator, High-tension wire).	Keep away from the equipment generating strong noise or ratio wave.

■ Caution For Using

1. When two channels of sensor are mounted closely, it may cause mutual interference by the emitter of other sensor. Therefore, please install them to avoid the interference by exchanging the head of Emitter and Receiver and by keeping the distance between the heads in more than 50cm.
2. When sensor head is installed on the ceiling or floor closely, it may cause malfunction by receiving the reflected beam. Therefore, please install it by keeping the suitable height (more than approx. 50cm) from the ceiling or floor.
3. When the target is a translucent or small object (Max. Ø15mm) it may not detect as the light transmits them.
4. When wire sensor in the same pipe laying with the high-tension wire or power line, it may cause malfunction. Therefore, please use separated wiring or pipe laying.
5. What sensor is used in much dusty or corroded place, it may cause malfunction. Please avoid these places when installing.
6. When making the length of the wiring (power wire or output wire) long, it may cause malfunction by surge etc.
7. When the lens of sensor head is polluted by dust etc., please clean it by dried cloth slightly.

   Do not use organic solvent like thinner.
8. When switching mode power supply is used as the source of supplying power, please ground F.G. terminal and install a condenser for removing noise between 0V and F.G. terminal as following drawing.



Cross-Beam Area Sensor

■ Features

- 3-point cross-beam netting method minimizes non-sensing area and increases sensing ability
- Long sensing distance 7m
- 7 models of number of optical axes (4 to 20) and optical axis pitch (40,80mm), sensing height (120 to 1,040mm)
- Easy installation by installation mode function
- Built-in interference protection, self-diagnosis function
- High luminance indicators for emitter and receiver to check the status at side, front, and long distance
- Protection structure IP65 (IEC structure)

Please read "Caution for your safety" in operation manual before using.

■ Applications

Screen door for subway platform and dangerous industry environment

■ Ordering Information

BWC 40 – 14 H

Operation mode	H	Light ON
	HD	Dark ON
Number of optical axes	Number	4 to 20
Optical axis pitch	40	40mm pitch
	80	80mm pitch
Item	BWC	Cross-beam area sensor

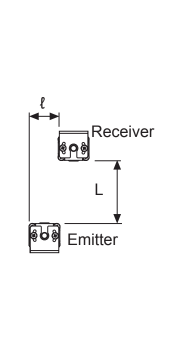
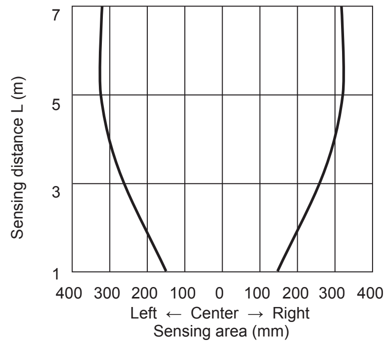
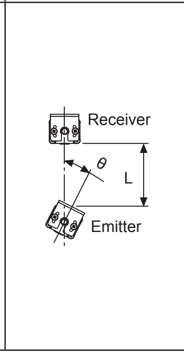
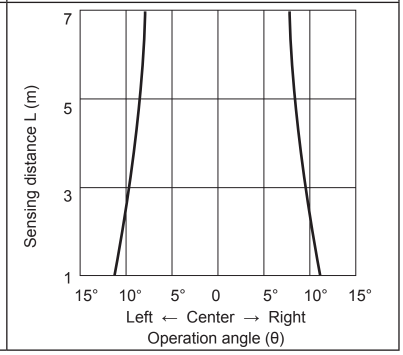
■ Specifications

Model		BWC40-□□H	BWC40-□□HD	BWC80-14H	BWC80-14HD
Sensing type		Through-beam type			
Sensing distance		1.0 to 7.0m			
Sensing target		Opaque material of min. Ø50mm		Opaque material of min. Ø90mm	
Optical axis pitch		40mm		80mm	
Number of optical axes		4/10/12/16/18/20		14	
Sensing height		120 to 760mm		1,040mm	
Beam pattern		3-point cross-beam netting type			
Response time		Max. 50ms			
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)			
Current consumption		Max. 100mA			
Light source		Infrared LED (850nm modulated)			
Operation mode		Light ON	Dark ON	Light ON	Dark ON
Control output		NPN open collector output •Load voltage: max. 30VDC, •Load current: max. 100mA, •Residual voltage: max. 1V			
Protection circuit		Reverse power polarity, Output short-circuit protection			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Synchronization type		Timing method by synchronous cable			
Self-diagnosis		Transmitted-received light monitoring, direct light monitoring, output circuit monitoring			
Interference protection		Interference protection by frequency changing setting			
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulation			
Dielectric strength		1,000VAC 50/60Hz for 1 min			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
Environment	Ambient illumination	Ambient light: Max. 100,000lx (received light side illumination)			
	Ambient temperature	-10 to 55℃, storage: -20 to 60℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP65 (IEC standard)			
Material		Case: Aluminum, Sensing part and indicator: Acrylic			
Cable		Ø5mm, 4-wire, 300mm, M12 connector			
Accessory		Bracket A: 4, Bracket B: 4, Fixing bolt: 8			
Approval		CE			
Weight※1		Approx. 2.1kg (approx. 1.7kg) (based on BWC80-14H)			

※1: The weight includes packaging. The weight in parenthesis is for unit only.

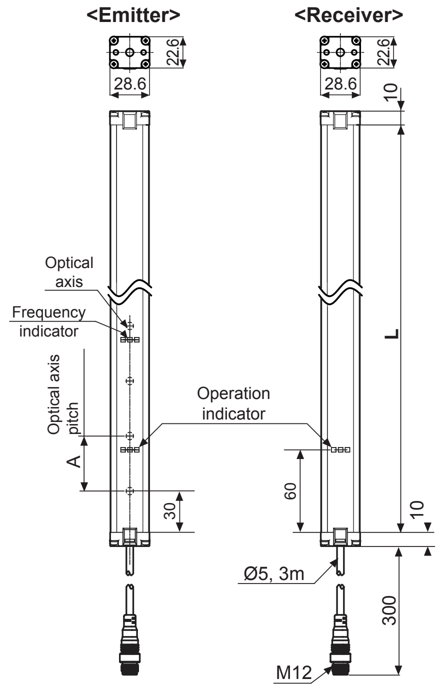
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature Data

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data
			

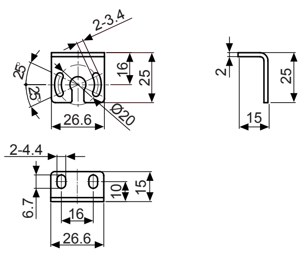
■ Dimensions

(unit: mm)

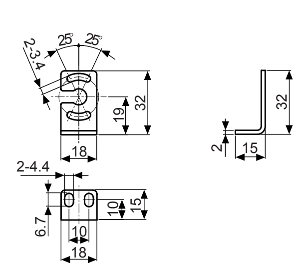


Model	L	A
BWC40-04H/HD	160	40
BWC40-10H/HD	400	
BWC40-12H/HD	480	
BWC40-16H/HD	640	
BWC40-18H/HD	720	
BWC40-20H/HD	800	
BWC80-14H/HD	1120	80

● Bracket A

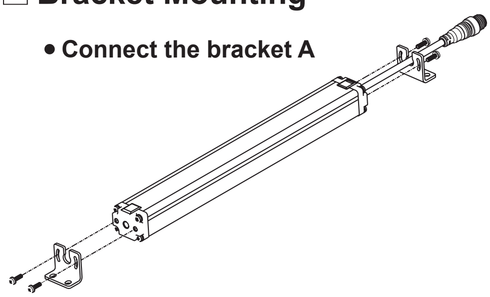


●Bracket B

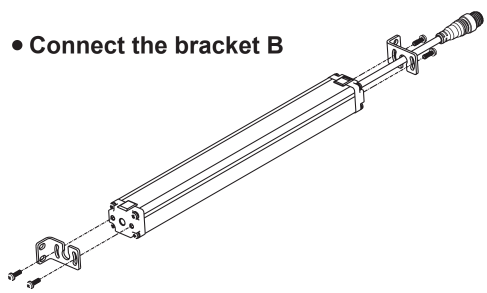


■ Bracket Mounting

● Connect the bracket A

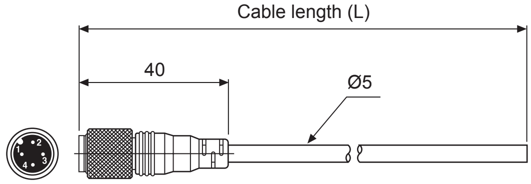


● Connect the bracket B



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

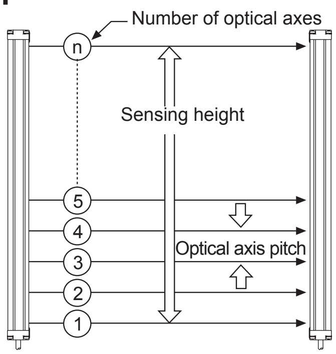
■ Connection Cable (sold separately)



Type	Model	L	Cable color
For emitter	CID4-3T	3m	Black
	CID4-5T	5m	
	CID4-7T	7m	
	CID4-10T	10m	
For receiver	CID4-3R	3m	Gray
	CID4-5R	5m	
	CID4-7R	7m	
	CID4-10R	10m	

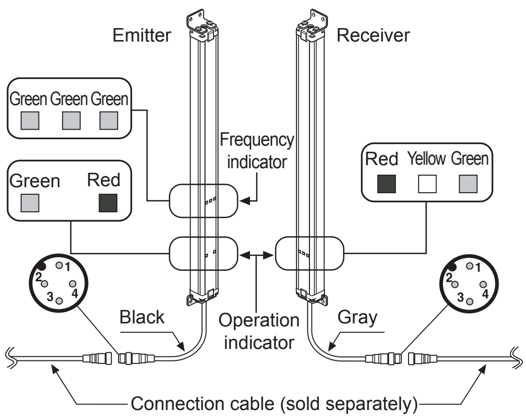
※Connection cable is sold separately as one set; each of emitter's and receiver's.

■ Optical Axis Pitch/Number Of Optical Axes/Sensing Height



Model	Number of optica axes	Sensing height	Optical axis pitch
BWC40-04H/HD	4	120mm	40mm
BWC40-10H/HD	10	360mm	
BWC40-12H/HD	12	440mm	
BWC40-16H/HD	16	600mm	
BWC40-18H/HD	18	680mm	
BWC40-20H/HD	20	760mm	
BWC80-14H/HD	14	1,040mm	80mm

■ Structure



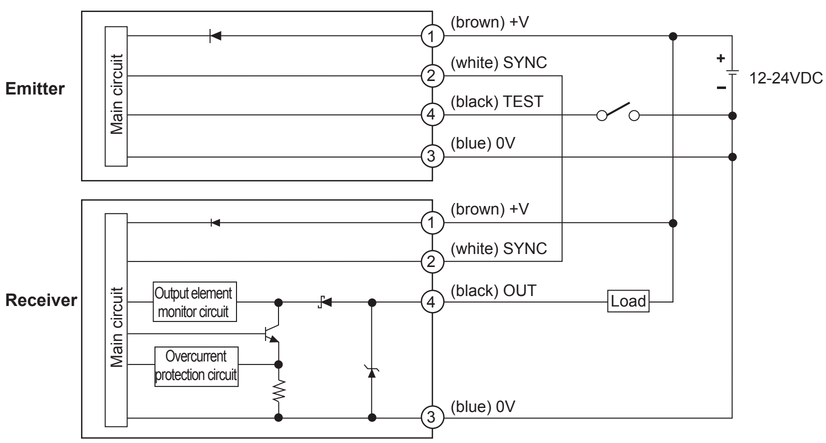
< Operation indicator>

LED color	Emitter	Receiver
Green	Power	Stable light ON
Yellow	—	Unstable area
Red	Installation mode	Stable light OFF

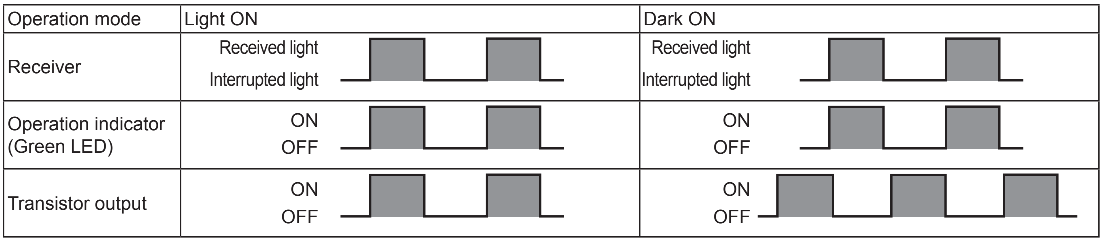
<Wiring connection>

Pin No	Cable color	Emitter	Receiver
1	Brown	12-24VDC	12-24VDC
2	White	Sync	Sync
3	Blue	0V	0V
4	Black	Mode	OUT

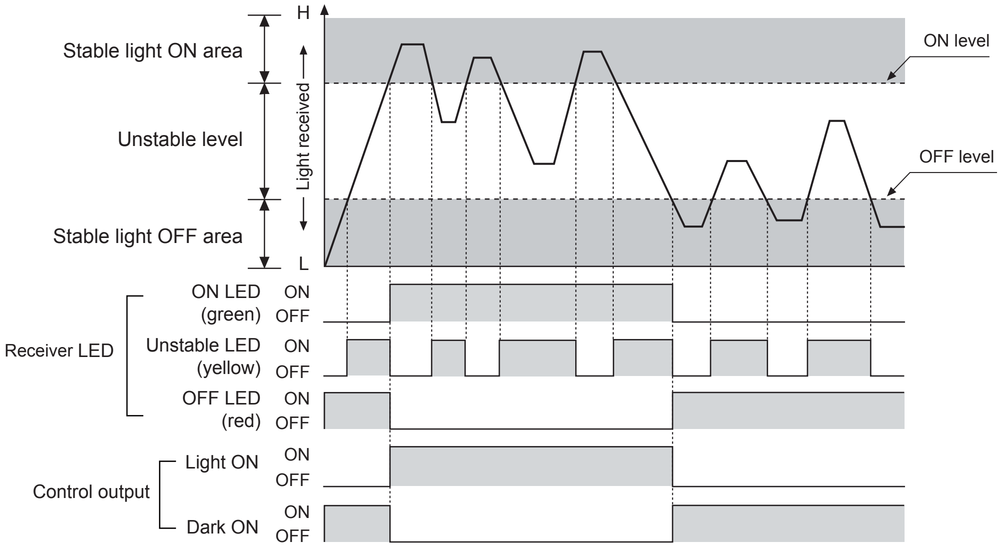
■ Control Output Circuit



■ Operation Mode



■ Operation Timing Diagram



■ Functions

◎ Interference protection

You can change transmitted light frequency to prevent interference from several units.
To change transmitted light frequency, input 0V to terminal 4 (black) MODE (for over 1 sec) of Emitter during normal operation.
Frequency type is displayed by the frequency indicator.

☼: ON, ●: OFF

Transmitted light frequency	Frequency indicator		
	Green 1	Green 2	Green 3
Frequency A	☼	●	●
Frequency B	●	☼	●
Frequency C	●	●	☼
Frequency D	☼	●	☼
Frequency E	☼	☼	☼

◎ Installation mode

This function is for stable installation.
To enter installation mode, supply the power with inputting 0V to terminal 4 (black) MODE of Emitter.

☼: ON, ●: OFF, ◑: Flash

Item	Emitter		Receiver			Control output
	Green	Red	Green	Yellow	Red	
Normal installation	●	◑	☼	●	◑	OFF
Hysteresis section	●	◑	●	☼	◑	OFF
Abnormal installation	●	◑	●	●	◑	OFF

◎ Self-diagnosis

If there is malfunction during normal operation by regular self-diagnosis, control output turns OFF and operation indicator displays the state.

●Diagnosis items

① Break of light emitting element
② Break of Emitter
③ Break of adjacent emitting elements more than 2
④ Break of receiver
⑤ Emitter failure
⑥ Malfunction of synchronous cable

※For more information about operation indication display, to "■ **Operation Indicator Display**" at page C-26.

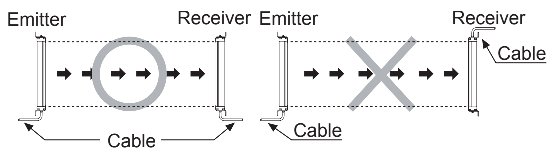
■ Installation

For the first installation, enter installation mode.

① Entry method for installation mode: Supply the power with inputting 0V to terminal 4 (black) MODE of Emitter.
② After entering installation mode, install the unit at the position where green LED of receiver operation indicator turns ON.
③ After installation, re-supply the power to the unit.

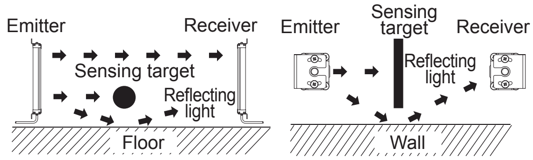
◎ For direction of installation

Emitter·Receiver should be installed in same up/down direction.



◎ For reflection from the surface of wall/flat

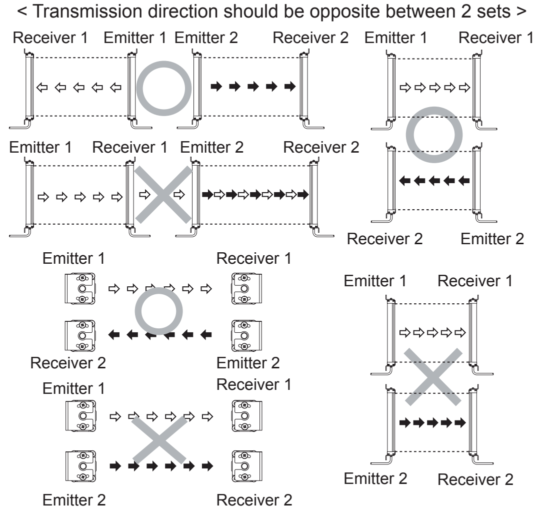
When installing it as below, the light reflected from the surface of wall and flat is not shaded. Please check whether it operates normally or not with a sensing target before using. (interval distance: min. 0.5m)



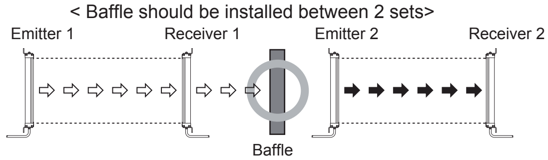
◎ For protection of interference

It may cause interference when installing more than 2 sets of the sensor. In order to avoid the interference of the sensor, please install as following figures and use interference protection function

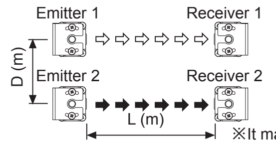
< Transmission direction should be opposite between 2 sets >



< Baffle should be installed between 2 sets>



<It should be installed out of the interference distance>



Sensing distance (L)	Installation allowable distance (D)
0.1 to 3m	Over 0.4m
Over 3m	L×tan8°=L×0.14

※It may be different by installation environment.

■ Operation Indicator Display

Item	Emitter		Receiver				
	Indicator		Indicator			Control output	
	Green	Red	Green	Yellow	Red	Light ON	Dark ON
Power supply	☼	●	—	—	—	—	—
Break of emitter	▶▶	◀◀	—	—	—	—	—
Break of light emitting element	▶	▶	◀	▶	▶	OFF	ON
Break of adjacent emitting elements more than 2	◑	◑	▶	▶	▶	OFF	ON
Stable light ON	—	—	☼	●	●	ON	OFF
Unstable light ON	—	—	☼	☼	●	ON	OFF
Unstable light OFF	—	—	●	☼	☼	OFF	ON
Stable light OFF	—	—	●	●	☼	OFF	ON
Break of receiver	—	—	▶▶	●	◀◀	OFF	ON
Control output over current	—	—	▶	◀	☼	OFF	ON
Synchronous line malfunction	—	—	◑	●	◑	OFF	ON
Emitter failure (time out)	—	—	◑	◑	◑	OFF	ON

Indicators	
☼	Lighting
●	Light out
◑	Flashing by 0.5 sec
◑ ◑ or ◑ ◑ ◑	Flashing simultaneously by 0.5 sec
▶ ◀	Cross-flashing by 0.5 sec
▶ ▶ ▶	Cross-flashing by 0.5 sec

■ Troubleshooting

Malfunction	Causes	Troubleshooting
Non-operation	Power supply	Supply the rated power.
	Cable incorrect connection or disconnection	Check the wiring connection.
	Out of rated sensing distance	Use it within rated sensing distance.
Non-operation in sometimes	Pollution by dirt of sensor cover	Remove dirt by soft brush or cloth.
	Connector connection failure	Check the assembled part of the connector.
Control output is OFF even though there is not a target object.	Out of the rated sensing distance	Use it within the rated sensing distance.
	There is an obstacle to cut off the emitted light between emitter and receiver	Remove the obstacle.
	There is strong electric wave or noise generator such as motor, electric generator, or high voltage line, etc.	Separate the strong electric wave or noise generator.
Operation indicator displays break of emitter	Break of emitter	Contact our service center.
Operation indicator displays break of receiver	Break of receiver	
Operation indicator displays break of light emitting elements	Break of light emitting element	
Operation indicator displays emitter failure	Emitter failure	
	Bad wiring connection of synchronous cable in emitter and receiver	Check the wiring connection in emitter and receiver.
Check the wiring connection in emitter and receiver	Control output line is shorted out.	Check the wiring connection.
	Over load	Check the rated load capacity.

Area Sensor

■ Features

- Long sensing distance up to 7m
- 22 types of products
  (optical axis: 20/40mm, sensing height: 120 to 940mm)
- Minimizes unsensing area with 20mm optical axis pitch (BW20-□)
- Easy to recognize at side, front, and long-distance
  by high brightness LED of Emitter and Receiver
- Includes self-diagnosis function, mutual interference prevention
  function, external diagnosis function.
- Protection structure IP65 (IEC standard)

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Specifications

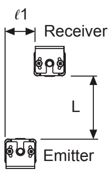
Model	NPN open collector output (standard)	**BW20-08 BW20-12 BW20-16**	**BW20-20 BW20-24 BW20-28**	**BW20-32 BW20-36 BW20-40**	**BW20-44 BW20-48**	**BW40-04 BW40-06 BW40-08**	**BW40-10 BW40-12 BW40-14**	**BW40-16 BW40-18 BW40-20**	**BW40-22 BW40-24**
	PNP open collector output	**BW20-08P BW20-12P BW20-16P**	**BW20-20P BW20-24P BW20-28P**	**BW20-32P BW20-36P BW20-40P**	**BW20-44P BW20-48P**	**BW40-04P BW40-06P BW40-08P**	**BW40-10P BW40-12P BW40-14P**	**BW40-16P BW40-18P BW40-20P**	**BW40-22P BW40-24P**
Sensing type		Through-beam							
Sensing distance		0.1 to 7m							
Sensing target		Opaque materials of min. Ø30mm				Opaque materials of min. Ø50mm			
Optical axis pitch		20mm				40mm			
Number of optical axis		8 to 48				4 to 24			
Sensing height		140 to 940mm				120 to 920mm			
Response time		Max. 10ms							
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)							
Current consumption		Emitter: Max. 120mA, Receiver: Max. 120mA							
Light source		Infrared LED (850nm modulated)							
Operation mode		Light ON (fixed)							
Control output		NPN or PNP open collector output • Load voltage: Max. 30VDC • Load current: Max. 100mA • Residual voltage - NPN: Max. 1V, PNP: Min. 2.5V							
Protection circuit		Reverse power polarity, Output short-circuit protection							
Insulation resistance		Over 20MΩ (at 500VDC megger)							
Synchronization type		Synchronized by synchronous line							
Self-diagnosis		Emitter/Receiver light circuit monitoring, Direct light monitoring, Output circuit monitoring							
Interference protection		Interference protection by master/slave function							
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulation							
Dielectric strength		1,000VAC 50/60Hz for 1minute							
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hour							
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times							
Environment	Ambient illumination	Ambient light : Max. 100,000lx							
	Ambient temperature	-10 to 55°C, storage: -20 to 60°C							
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH							
Protection structure		IP65 (IEC standard)							
Material		• Case: Aluminum • Cover, Sensing part: Acrylic							
Cable		Ø5mm, 4-core, 300mm, M12 connector							
Accessory		Bracket A: 4, Bracket B: 4, Fixing bolt: 8							
Approval		CE							
Weight※1		Approx. 2.1kg (approx. 1.4kg) (BW20-48)				Approx. 2.1kg (approx. 1.4kg) (BW40-24)			

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature and humidity of environment resistance is rated at non-freezing or condensation.

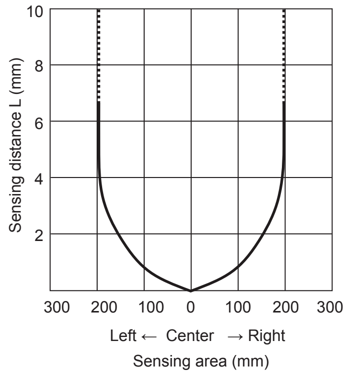
■ Feature Data

Parallel shifting characteristic

Measuring method

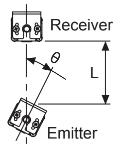


Data

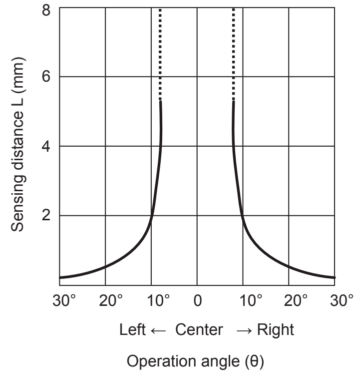


Angle characteristic

Measuring method

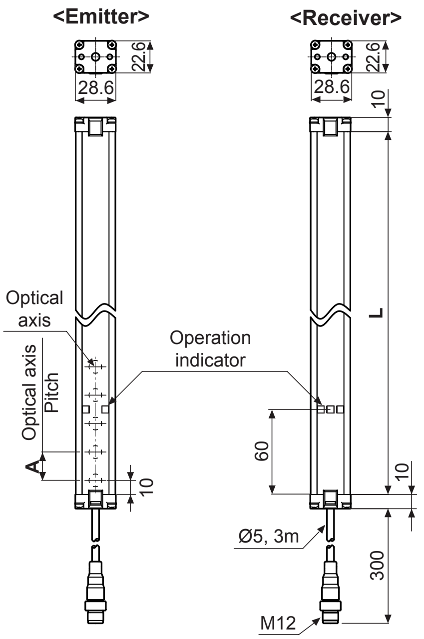


Data



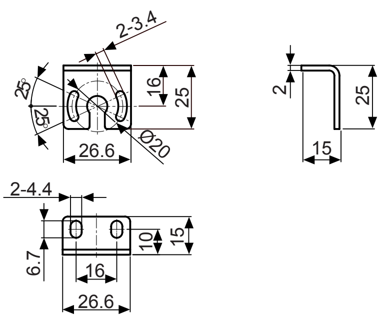
■ Dimensions

(unit: mm)

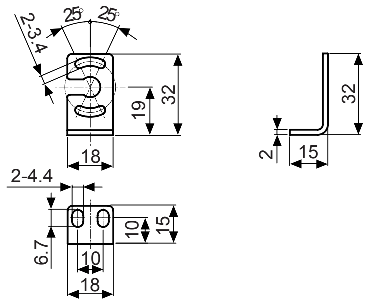


Model	L	A	Model	L	A
BW20-08(P)	160	20	BW40-04(P)	160	40
BW20-12(P)	240		BW40-06(P)	240	
BW20-16(P)	320		BW40-08(P)	320	
BW20-20(P)	400		BW40-10(P)	400	
BW20-24(P)	480		BW40-12(P)	480	
BW20-28(P)	560		BW40-14(P)	560	
BW20-32(P)	640		BW40-16(P)	640	
BW20-36(P)	720		BW40-18(P)	720	
BW20-40(P)	800		BW40-20(P)	800	
BW20-44(P)	880		BW40-22(P)	880	
BW20-48(P)	960		BW40-24(P)	960	

● **Bracket A**

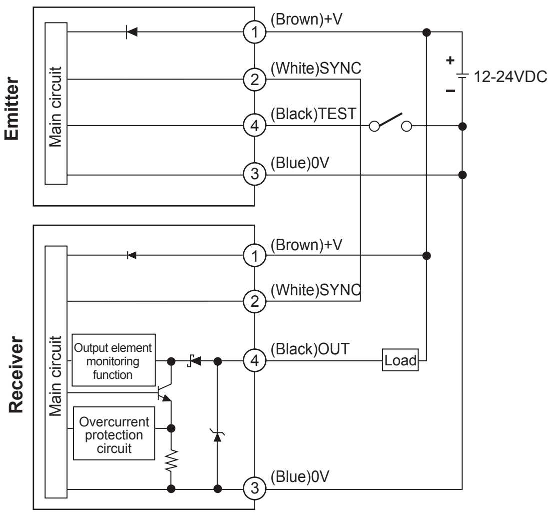


● **Bracket B**

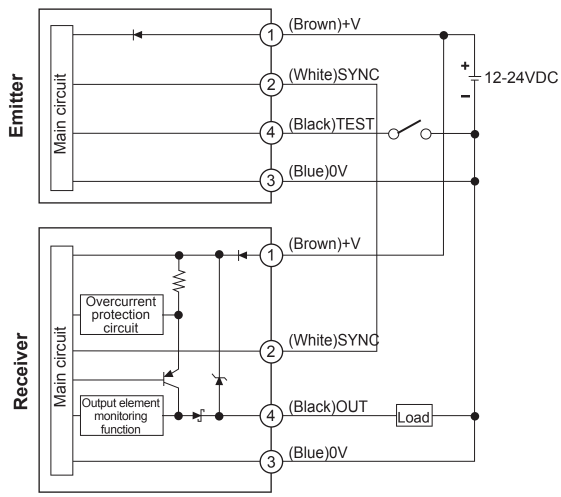


■ Control Output Diagram

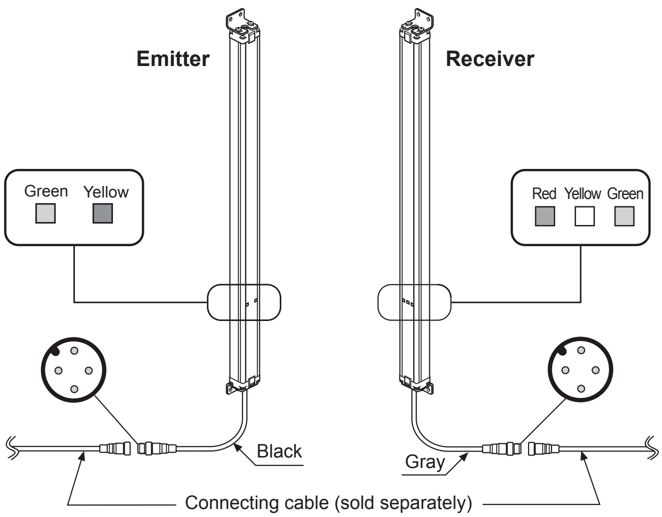
● NPN open collector output



● PNP open collector output



■ Structure



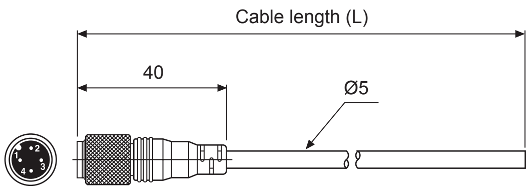
<Operation indicator >

LED color	Emitter	Receiver
Green	POWER	ON
Yellow	TEST (M/S)	UNSTABLE
Red	—	OFF

<Wiring Connection >

Pin No	Cable color	Emitter	Receiver
1	Brown	12-24VDC	12-24VDC
2	White	SYNC	SYNC
3	Blue	0V	0V
4	Black	TEST (M/S)	OUT

■ Connecting Cable (sold separately)

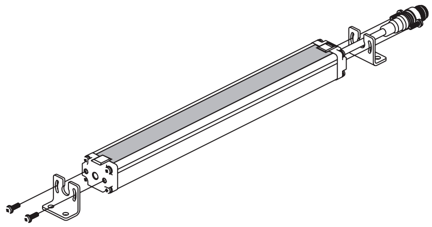


	Model	L	Cable color
Emitter	CID4-3T	3m	Black
	CID4-5T	5m	
	CID4-7T	7m	
	CID4-10T	10m	
Receiver	CID4-3R	3m	Gray
	CID4-5R	5m	
	CID4-7R	7m	
	CID4-10R	10m	

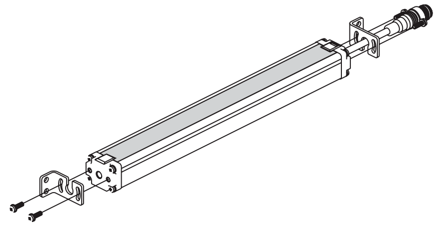
※Connecting cable is sold separately as one set; each of emitter's and receiver's.

■ Bracket Mounting

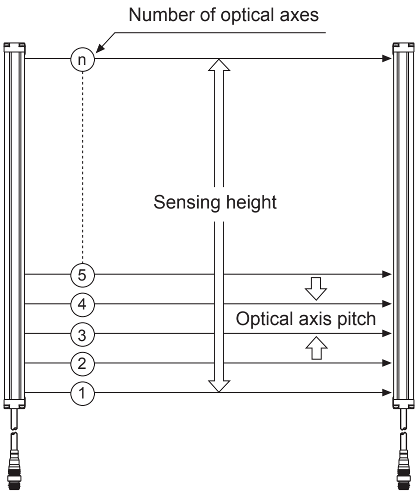
● Connect the bracket A



● Connect the bracket B



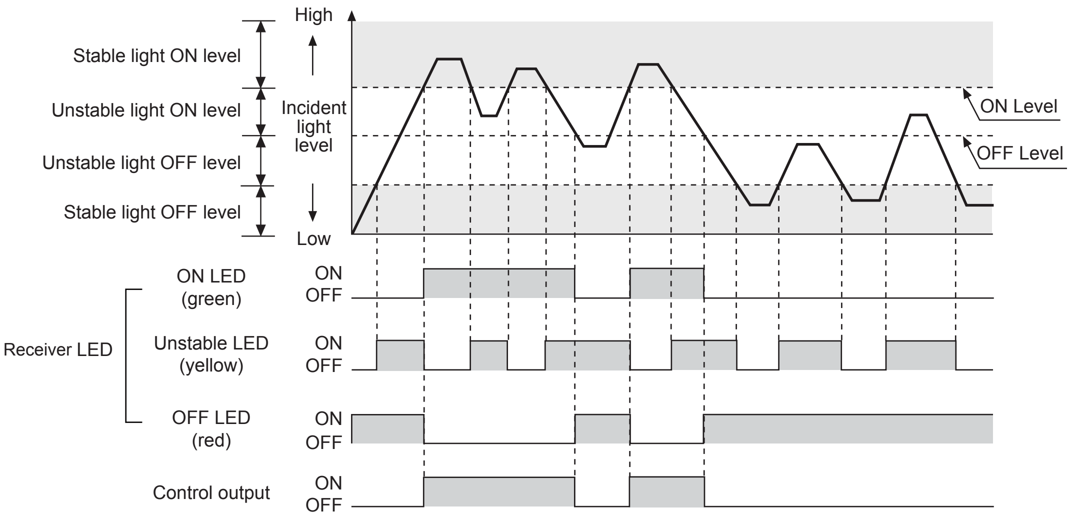
■ Optical Axis Pitch/Number Of Optical Axis/Sensing Height



Model	Number of optical axes	Sensing height	Optical axis pitch	Model	Number of optical axes	Sensing height	Optical axis pitch
BW20-08(P)	8	140mm		BW40-04(P)	4	120mm	
BW20-12(P)	12	220mm		BW40-06(P)	6	200mm	
BW20-16(P)	16	300mm		BW40-08(P)	8	280mm	
BW20-20(P)	20	380mm		BW40-10(P)	10	360mm	
BW20-24(P)	24	460mm		BW40-12(P)	12	440mm	
BW20-28(P)	28	540mm	20mm	BW40-14(P)	14	520mm	40mm
BW20-32(P)	32	620mm		BW40-16(P)	16	600mm	
BW20-36(P)	36	700mm		BW40-18(P)	18	680mm	
BW20-40(P)	40	780mm		BW40-20(P)	20	760mm	
BW20-44(P)	44	860mm		BW40-22(P)	22	840mm	
BW20-48(P)	48	940mm		BW40-24(P)	24	920mm	

■ Operation Timing Diagram

● Operation mode: Light ON only

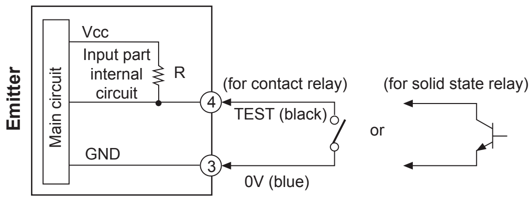


▣ Function

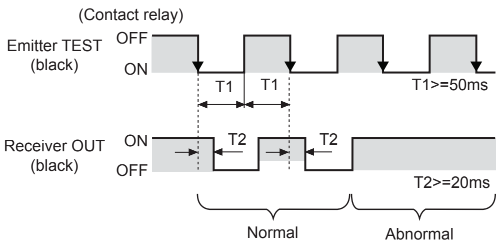
◎ Light emitted stop (external diagnosis)

When TEST input (black) of emitter is 0V, emit is stopped and yellow LED of emitter flashes. It is available to check whether sensor operates properly with stopping the transmission when TEST input (black) of emitter is 0V. (It is changed to light OFF status when emit the transmission is stopped, control output of receiver is OFF.)

● **Connections for TEST input**



● **Control output pulse by TEST input**



◎ Self-diagnosis

Control output will be OFF and operating indicator is ON when malfunction is checked by self-diagnosis regularly in normal operation.

● **Diagnosis items**

- Emitter: ① Break of light emitting element
  ② Break of light emitter
  ③ Malfunction of MASTER/SLAVE line (operation in MASTER)
- Receiver: ① Break of light receiver
  ② Overcurrent at output part
  ③ Synchronous line noise

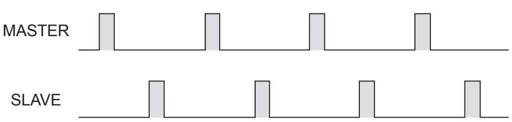
● Refer to C-26, "▣ **Operation indicator**" for the display operation of diagnosis.

◎ Interference protection

In case of using 2 sensors in parallel in order to extend sensing width, it may cause sensing error because as light interference.

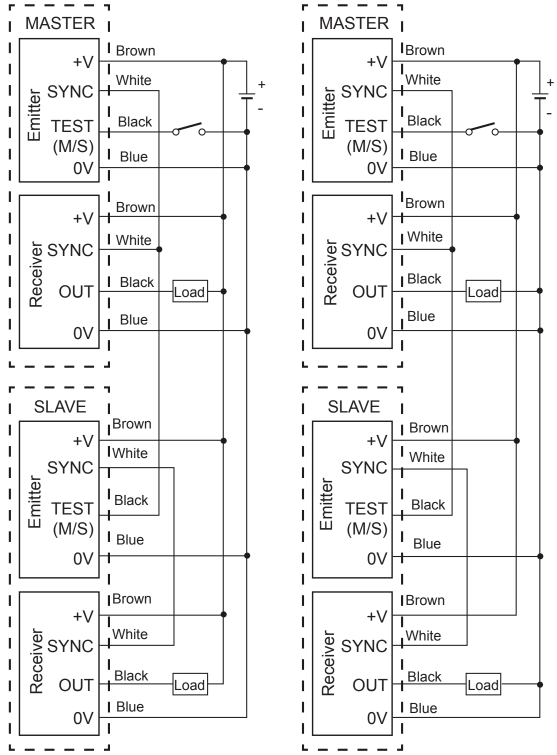
This function is operating a sensor as MASTER and another sensor as SLAVE to avoid these sensing errors by the light interference.

● **Time chart for MASTER/SLAVE transmission pulse**



● **MASTER/SLAVE connections**

<NPN open collector output > <PNP open collector output >

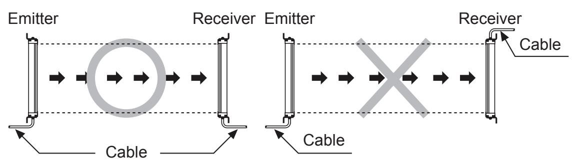


※Connect 'TEST (M/S)' of SLAVE emitter to 'SYNC' of MASTER.

▣ Installation

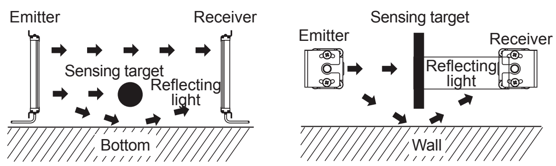
◎ For direction of installation

Emitter and receiver should be installed in same up/down direction.



◎ For reflection from the surface of wall and flat

When installing it as below the light reflected from the surface of wall and flat will not be shaded. Please, check whether it operates normally or not with a sensing target before using. (Interval distance: Min. 0.5m)

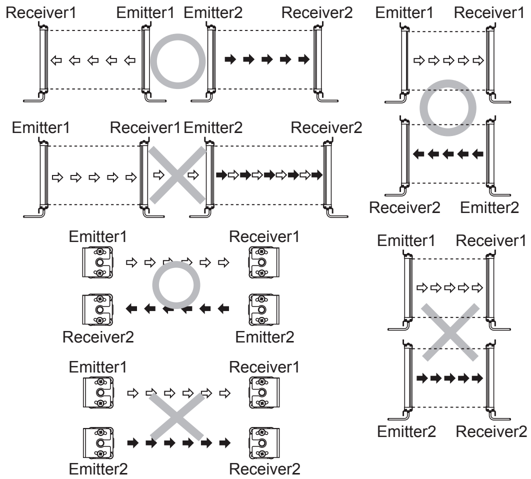


(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

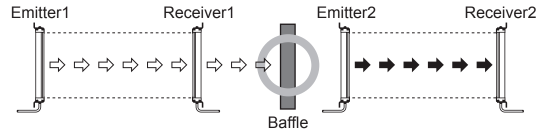
◎ For prevention of interference

It may cause interference when installing more than 2 sets of the sensor. In order to avoid the interference of the sensor, please install as following figures and use the interference protection function.

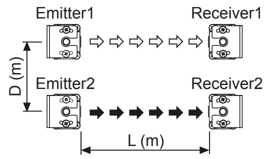
- **Transmission direction should be opposite between 2 sets**



- **Baffle should be installed between 2 sets**



- **It should be installed out of the interference distance**



Sensing distance (L)	Installation allowable distance (D)
0.1 to 3m	Min. 0.4m
Min. 3m	L×tan8°= L×0.14 min

※There can be a little different based on installation environment.

▣ Operation Indicator

Item	Emitter Indicator Green	Emitter Indicator Red	Receiver Indicator Green	Receiver Indicator Yellow	Receiver Indicator Red	Receiver Control output Light ON
Power ON	☼	●	–	–	–	–
MASTER operation	☼	●	–	–	–	–
SLAVE operation	☼	☼	–	–	–	–
Test input	☼	◑	–	–	–	–
Break of emitter	▶▶	◀◀	–	–	–	–
Break of light emitting element	▶	◀	▶	▶	▶	OFF
Install mode: Normal installation	●	◑	☼	●	◑	OFF
Install mode: Hysteresis installation	●	◑	●	☼	◑	OFF
Install mode: Abnormal installation	●	◑	●	●	◑	OFF
Stable light ON	–	–	☼	●	●	ON
Unstable light ON	–	–	☼	☼	●	ON
Unstable dark ON	–	–	●	☼	☼	OFF
Stable dark ON	–	–	●	●	☼	OFF
Break of receiver	–	–	▶▶	●	◀◀	OFF
Control output overcurrent	–	–	▶	◀	☼	OFF
Synchronous line noise	–	–	◑	●	◑	OFF
Emitter failure(Time out)	–	–	◑	◑	◑	OFF

Display classification list	
☼	Light ON
●	Light OFF
◑	Flashing by 0.5 sec
◑ ◑ or ◑ ◑ ◑	Flashing simultaneously by 0.5 sec
▶ ◀	Cross-Flashing by 0.5 sec
▶ ▶ ▶	Sequence-Flashing by 0.5 sec

▣ Troubleshooting

Malfunction	Cause	Troubleshooting
Non-operation	Power supply	Supply rated power.
	Cable incorrect connection or disconnection	Check the wiring.
	Rated connection failure	Use it within rated sensing distance.
Non-operation in sometimes	Pollution by dirt of sensor cover	Remove dirt by soft brush or cloth.
	Connector connection failure	Check the assembled part of the connector.
Control output is OFF even though there is not a target object.	Out of rated sensing distance	Use within rated sensing distance.
	There is an obstacle to cut off the light emitted between emitter and receiver	Remove the obstacle.
	There is a strong electric wave or noise generated by motor, electric generator, high voltage line etc.	Put away the strong electric wave or noise generator.
LED displays for break of light emitting element	Break of light emitting element	Contact our company.
LED displays for break of emitter	Break of light emitting circuit	
LED displays for break of receiver	Break of light emitting receiving element	
LED displays for synchronous line malfunction	Synchronous line incorrect connection or disconnection	Check the wiring.
	Break of synchronous circuit of emitter or receiver	Contact our company.
LED displays for over current	Control output line is shorten	Check the wiring.
	Over load	Check the rated load capacity.
LED displays for emitter malfunction	Emitter malfunction	Treat after checking the emitter display LED.

Flat Area Sensor With Plastic Case

Features

- **13mm slim body with fresnel lens**
- Adoption of plastic (PC/ABS) injection case
- Various functions; stop transmission, interference prevention, lightening/flashing JOB indicator, Light ON/Dark ON operation by switch
- Easy to recognize at side, front, and long-distance by high brightness LED of Emitter and Receiver
- Fast response time up to 7ms
- 4 models with various optical axes (8 to 20) and sensing height (140 to 380mm)
- Protection structure IP40 (IEC standard)

Please read "Caution for your safety" in operation manual before using.

CE

Specifications

Model	NPN open collector output	BWP20-08	BWP20-12	BWP20-16	BWP20-20
	PNP open collector output	BWP20-08P	BWP20-12P	BWP20-16P	BWP20-20P
Sensing type		Through-beam			
Sensing distance		0.1 to 5m			
Sensing target		Opaque materials of min. Ø30mm			
Optical axis pitch		20mm			
Number of optical axis		8	12	16	20
Sensing height		140mm	220mm	300mm	380mm
Response time		Max. 6ms (frequency B selection is max. 7ms)			
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)			
Current consumption		Emitter: Max. 80mA, Receiver: Max. 80mA			
Light source		Infrared LED (850nm modulated)			
Operation mode		Light ON/Dark ON by switch			
Control output		NPN or PNP open collector output • Load voltage: Max. 30VDC • Load current: Max. 150mA • Residual voltage - NPN: Max. 1V, PNP: Min. 2.5V			
Protection circuit		Reverse power polarity, Output short-circuit protection			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Synchronization type		Synchronized by synchronous line			
Interference protection		Interference protection by transmission frequency selection			
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulation			
Dielectric strength		1,000VAC 50/60Hz for 1 minute			
Vibration		1.5mm amplitude or 300m/s² at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
Environment	Ambient illumination	Ambient light: Max. 10,000lx (received light side illumination)			
	Ambient temperature	-10 to 55℃, storage: -20 to 60℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP40 (IEC standard)			
Material		Case: Polycarbonate/Acrylonitrile butadiene styrene, Sensing part: Polymethyl methacrylate			
Cable		Ø3.5mm, 4-wire, 3m (emitter: Ø3.5mm, 4-wire, 3m) (AWG 24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)			
Approval		CE			
Weight※1		Approx. 480g (approx. 280g)	Approx. 520g (approx. 320g)	Approx. 620g (approx. 360g)	Approx. 680g (approx. 430g)

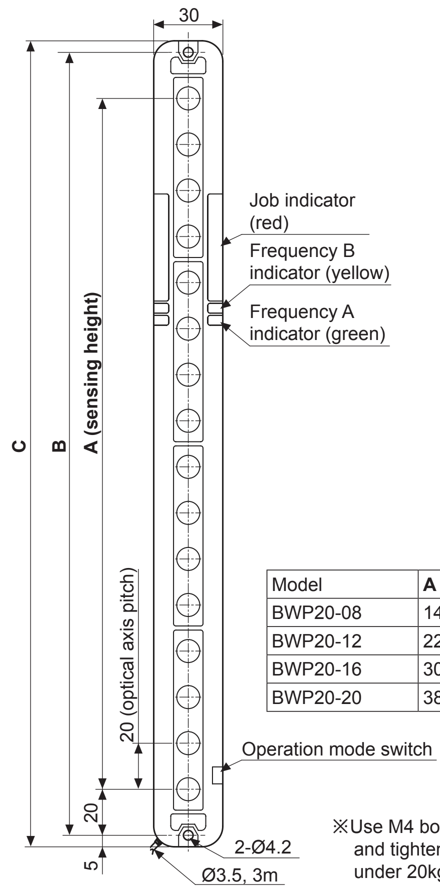
※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

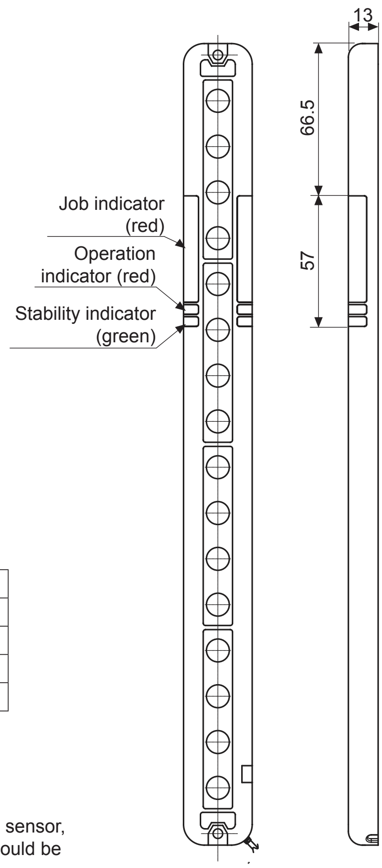
■ Dimensions

(unit: mm)

<Emitter>



<Receiver>



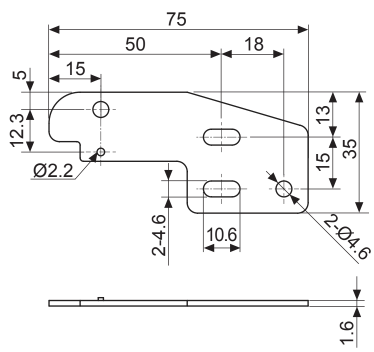
Model	A	B	C
BWP20-08	140	180	190
BWP20-12	220	260	270
BWP20-16	300	340	350
BWP20-20	380	420	430

※Use M4 bolt for installing sensor, and tightening torque should be under 20kgf·cm

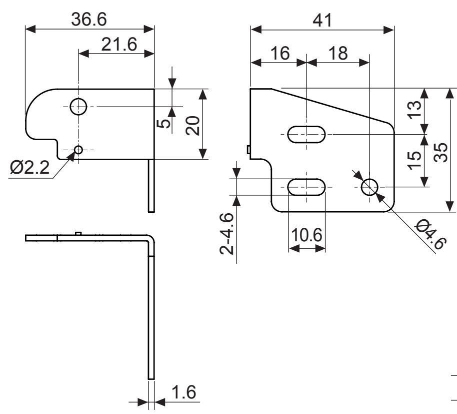
<Bracket>: sold separately

(unit: mm)

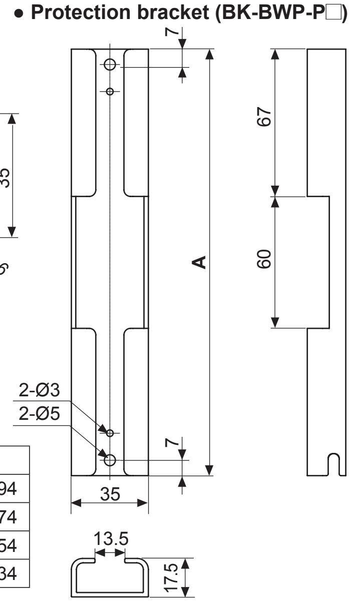
● **Flat bracket (BK-BWP-ST)**



● **L-shaped bracket (BK-BWP-L)**

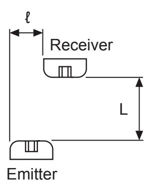
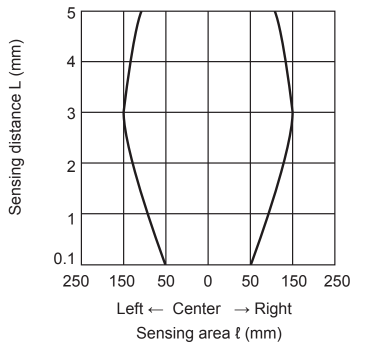
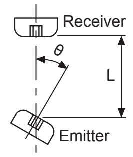
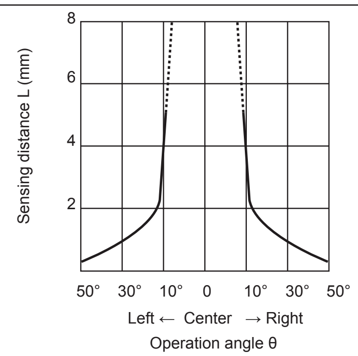


● **Protection bracket (BK-BWP-P□)**



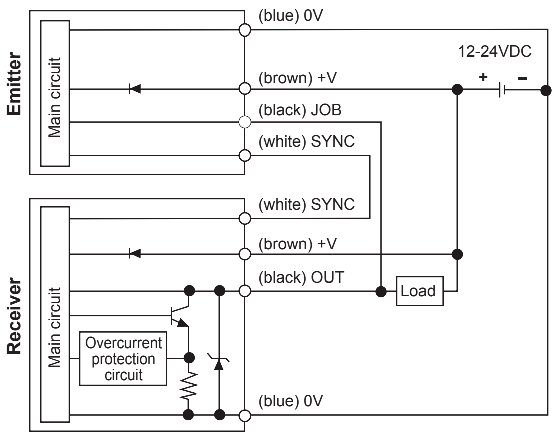
Model	A
BK-BWP-P08	194
BK-BWP-P12	274
BK-BWP-P16	354
BK-BWP-P20	434

▣ Feature Data

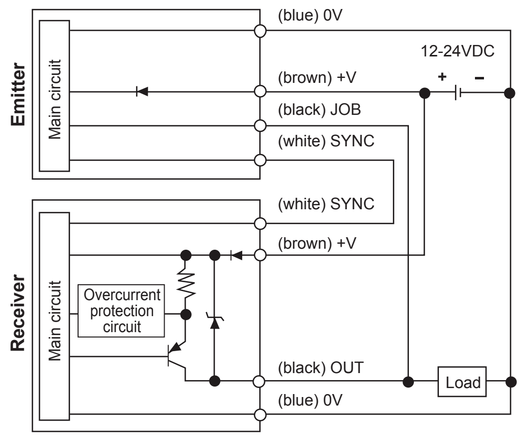
Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data
			

▣ Input/Output Circuit And Connection Diagram

● NPN open collector output

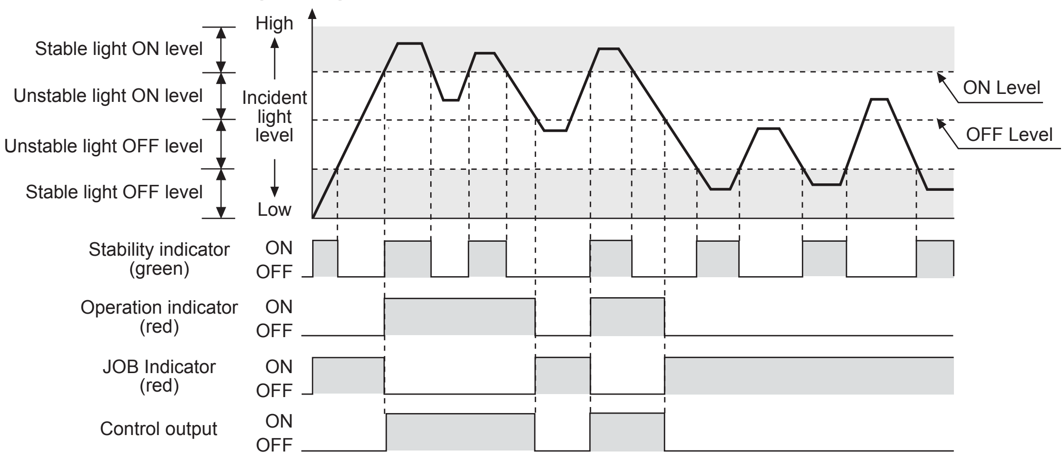


● PNP open collector output



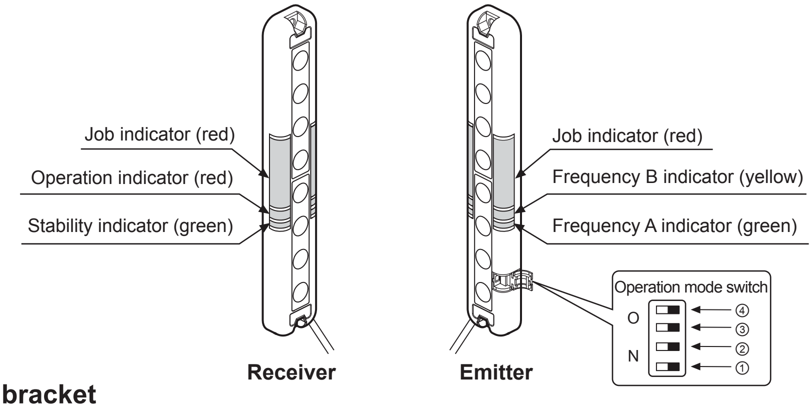
※If the receiver OUT (black) line and the emitter JOB (black) line are not connected each other, the JOB indicator of the emitter is not operated and maintain the light status.

▣ Operation Timing Diagram



※The waveforms of operation indicator, job indicator, and control output are the state of operation for Light ON, but in case of Dark ON, it is opposite operation against Light ON mode.

■ Structure



◎ Mounting of bracket

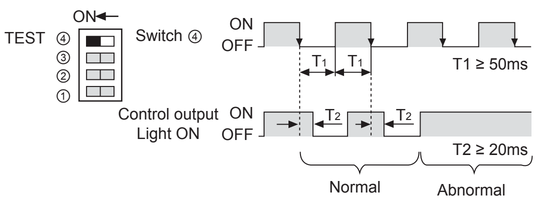
No	Function	Switch OFF	Switch ON
①	Transmission frequency selection	Frequency A	Frequency B
②	Light ON/Dark ON selection	Light ON operation	Dark ON operation
③	Steady/flashing light of Job indicator selection	Job indicator with Steady light	Job indicator with Flashing light
④	Job/TEST selection	Normal mode	TEST mode

■ Functions

◎ TEST (stop transmission)

When selecting TEST mode, emit is stopped and green &yellow LED of emitter flashes. It is available to check whether sensor operates properly with stopping the transmission in TEST mode. It is changed to light OFF status when emit the transmission is stopped, control output is OFF in Light ON mode and ON in Dark ON mode.

● **Control output pulse for TEST input**



◎ Light-ON / Dark-ON operation mode

The control output is ON when it is light ON in Light ON and the control output is ON when it is light OFF in Dark ON. It is available to select with user's preference.

	Operation mode switch	Control output operation
Light ON	ON ④ ③ ② ① Light ON	It is ON when it is light ON.
Dark ON	ON ④ ③ ② ① Dark ON	It is ON when it is light OFF.

◎ Interference prevention

In case of using 2pcs of sensor in serial or parallel in order to extend sensing width, it may cause sensing error because of light interference.
This function is operating a sensor in transmission frequency A and another sensor in transmission frequency B to avoid these sensing errors by the light interference.

	Operation mode switch	Frequency A, B indicator
Sensor Ⓐ (transmission frequency A)	ON ④ ③ ② ① FREQ.A	JOB INDI. Frequency B (yellow) Frequency A (green)
Sensor Ⓑ (transmission frequency B)	ON ④ ③ ② ① FREQ.B	JOB INDI. Frequency B (yellow) Frequency A (green)

◎ Lightening/Flashing JOB indicator

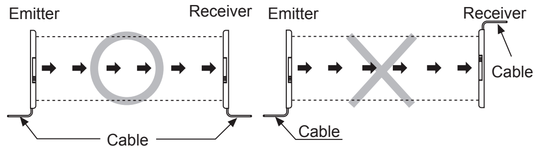
JOB indicator will be lighted and flashed to make out work sensing operation more easily.

Operation mode switch	JOB indicator operation
ON ④ ③ ② ① Lighting	Lighting indicator
ON Flashing ④ ③ ② ①	Flashing indicator

▣ Installation

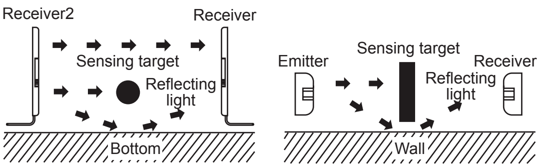
◎ For direction of installation

Emitter and receiver should be installed as same up/down position.



◎ For reflection from the surface of wall and flat

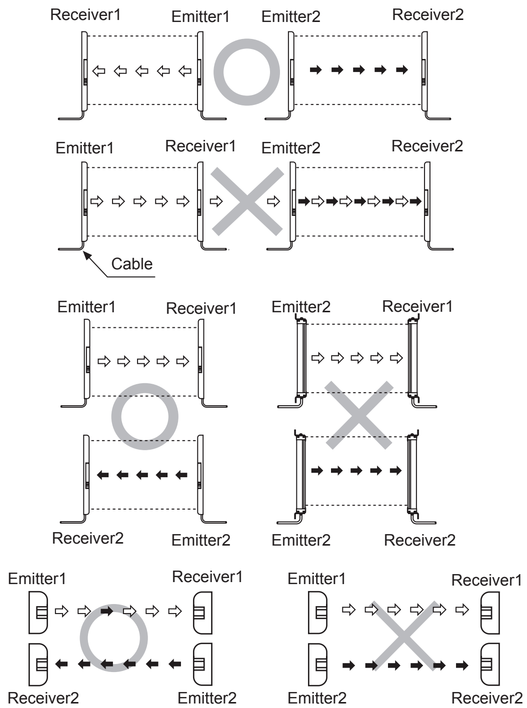
When installing it as below the light reflected from the surface of wall and flat will not be shaded. Please, check whether it operates normally or not with a sensing target before using. (interval distance: min. 0.3m)



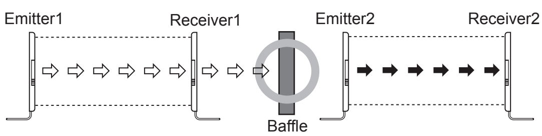
◎ For prevention of interference

It may cause interference when installing more than 2 sets of the sensor. In order to avoid the interference of the sensor, please install as following figures and use the interference protection function.

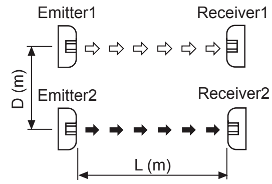
- **Transmission direction should be opposite between 2 sets**



- **Baffle should be installed between 2 sets.**



- **It should be installed out of the interference distance**



Sensing distance (L)	Installation allowable distance (D)
0.1 to 1m	Min. 0.2m
Min. 1m	Min. 0.3m

※It may be a little different based on installation environment.

▣ Operation Indicator

Item	Emitter			Receiver			
	Indicator			Indicator			Control output
	Green	Yellow	JOB Indicator	Green	Red	JOB Indicator	
Power on	☼	●	—	—	—	—	—
FREQ. A operation	☼	●	—	—	—	—	—
FREQ. B operation	☼	☼	—	—	—	—	—
TEST	▶	◀	☼	☼	●	☼	OFF
Stable light ON	—	—	●	☼	☼	●	ON
Unstable light ON	—	—	●	●	☼	●	ON
Unstable light OFF	—	—	☼	●	●	☼	OFF
Stable light OFF	—	—	☼	☼	●	☼	OFF
Flashing function ON	—	—	◑	☼	●	◑	OFF
Synchronous line malfunction	—	—	☼	▶	◀	☼	OFF
Overcurrent	—	—	☼	◑	◑	☼	OFF

Display classification list	
☼	Light ON
●	Light OFF
◑	Flashing by 0.3 sec
◑ ◑	Flashing simultaneously by 0.3 sec
▶ ◀	Cross-Flashing by 0.3 sec

※The operation of 'Operation indicator (red)', 'Job indicator (red)', 'Control output' is for Light ON, in case of Dark ON, it is opposite operation against Light ON. (In case, malfunction of synchronous line and over current, control output is OFF regardless of the mode.)

▣ Troubleshooting

Malfunction	Cause	Troubleshooting
Non-operation	Power supply	Supply rated power.
	Cable incorrect connection or disconnection	Check the wiring.
	Rated connection failure	Use it within rated sensing distance.
Non-operation in sometimes	Pollution by dirt of sensor cover	Remove dirt by soft brush or cloth.
	Connector connection failure	Check the assembled part of the connector.
Control output is OFF even though there is not a target object.	Out of rated sensing distance	Use within rated sensing distance.
	There is an obstacle to cut off the light emitted between emitter and receiver	Remove the obstacle.
	There is a strong electric wave or noise generated by motor, electric generator, high voltage line etc.	Put away the strong electric wave or noise generator.
LED displays for synchronous line malfunction	Synchronous line incorrect connection or disconnection	Check the wiring.
	Break of synchronous circuit of emitter or receiver	Contact our company.
LED displays for over current	Control output line is shorten	Check the wiring.
	Over load	Check the rated load capacity.

Ultra-Flat (Width 10mm) Picking Sensor

■ Features

● Plastic injection case
● Slim body (W30×H140×T10mm)
● Long/Short sensing distance mode
(sensing distance selection function)
● Mutual interference prevention (frequency switching function)
● Selectable Light ON/Dark ON operation mode by switch
● Picking indicator includes
● Protection structure IP40 (IEC standard)

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ Specifications

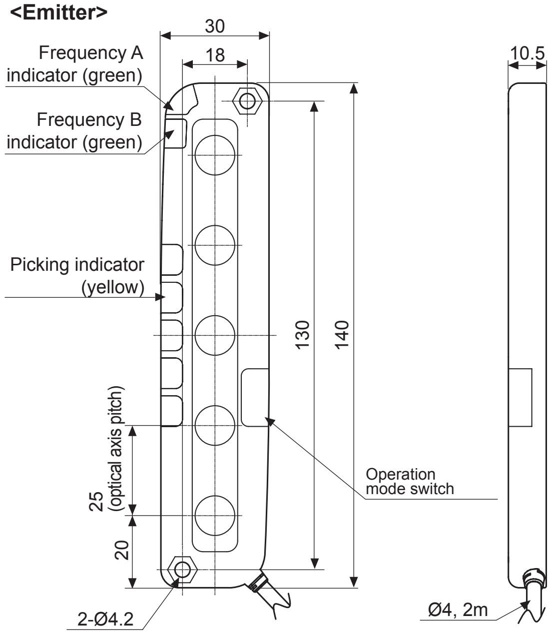
Model	NPN open collector output	**BWPK25-05**
	PNP open collector output	**BWPK25-05P**
Sensing type		Through-beam
Sensing distance	Long distance mode	0.1 to 3m
	Short distance mode	0.05 to 1m
Sensing target		Opaque materials of min. Ø35mm
Optical axis pitch		25mm
Number of optical axis		5
Sensing height		100mm
Response time		Max. 30ms
Power supply		12-24VDC ±10% (ripple P-P: max. 10%)
Current consumption		Emitter: Max. 60mA, Receiver: Max. 60mA
Light source		Infrared LED (850nm modulated)
Operation mode		Selectable Light ON/Dark ON by switch
Control output		NPN or PNP open collector output • Load voltage: Max. 30VDC • Load current: Max. 150mA • Residual voltage - NPN: Max. 1V, PNP: Min. 2.5V
Protection circuit		Reverse power polarity, Output short-circuit (overcurrent) protection
Insulation resistance		Over 20MΩ (at 500VDC megger)
Interference protection		Interference protection by transmission frequency selection
External picking input		Non-contact or contact input • NPN open collector output: Lighting (0-2V), Light out (5-30V or open) • PNP open collector output: Lighting (4-30V), Light out (0-3V or open)
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulation
Dielectric strength		1,000VAC 50/60Hz for 1minute
Vibration		1.5mm amplitude or 300m/s^2 at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times
Environment	Ambient illumination	Sunlight: Max. 10,000lx, Incandescent lamp: Max. 3,000lx (received light side illumination)
	Ambient temperature	-10 to 55℃, storage: -20 to 60℃
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Protection structure		IP40 (IEC standard)
Material		Case: Polycarbonate/Acrylonitrile butadiene styrene, Sensing part: Polymethyl methacrylate
Cable		Ø4.0mm, 4-wire, 2m (emitter: Ø4.0mm, 3-wire, 2m) (AWG 22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)
Approval		CE
Weight※1		Approx. 220g (approx. 180g)

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

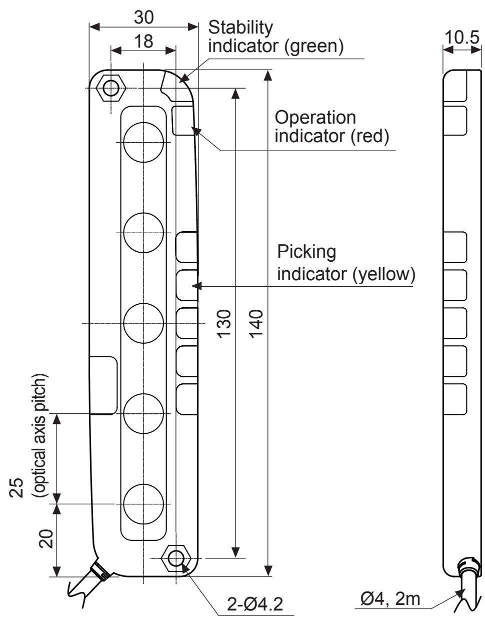
■ Dimensions

(unit: mm)

<Emitter>

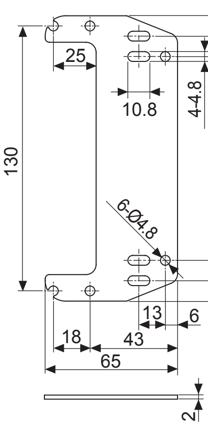


<Receiver>

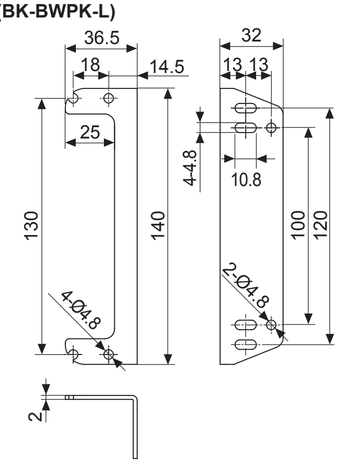


<Bracket>: sold separately

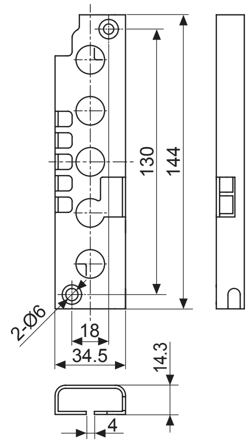
- **Flat bracket (BK-BWPK-ST)**



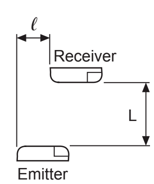
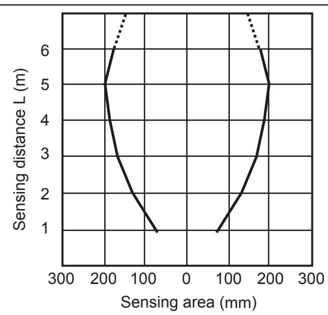
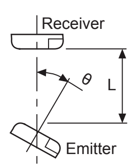
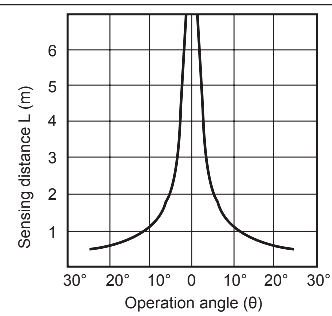
- **L-shaped bracket (BK-BWPK-L)**



- **Protection bracket (BK-BWPK-P)**

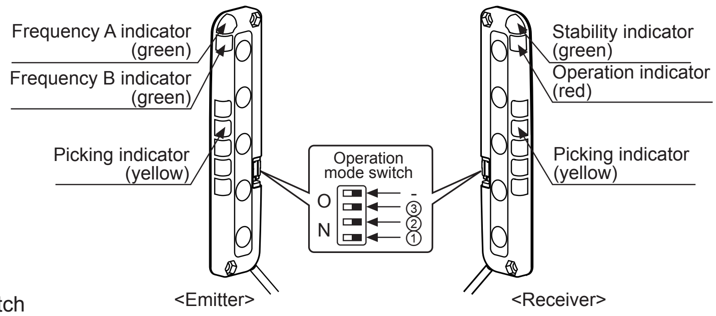


■ Feature Data

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data
			

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Structure

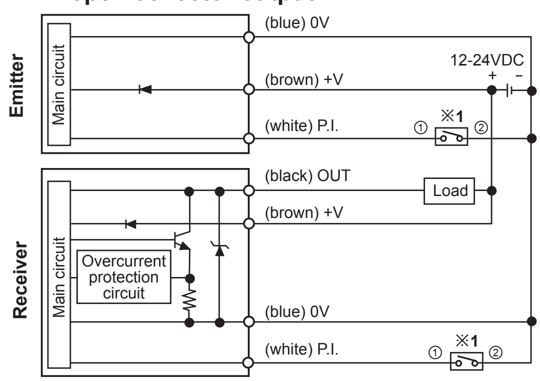


◎ Operation mode switch

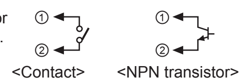
No	Function		Switch OFF	Switch ON
①	Selection of transmission frequency		Frequency A	Frequency B
②	Selection of operation indicator		Lighting indicator	Flashing indicator
③	Emitter	Selection of sensing distance mode	Long mode	Short mode
	Receiver	Selection of operation mode	Light ON	Dark ON

■ Input/Output Circuit And Connection Diagram

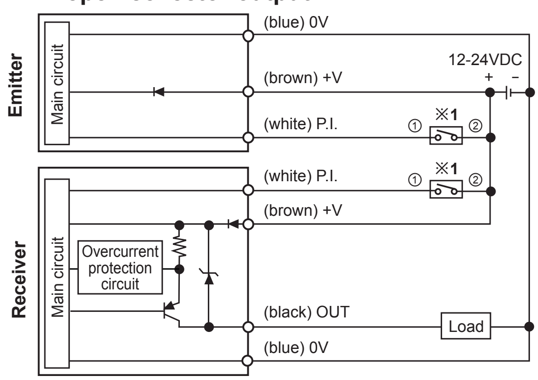
● NPN open collector output



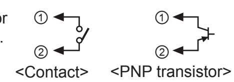
※1: Picking input (P.I): Contact or transistor is ON, and picking indicator operates.



● PNP open collector output

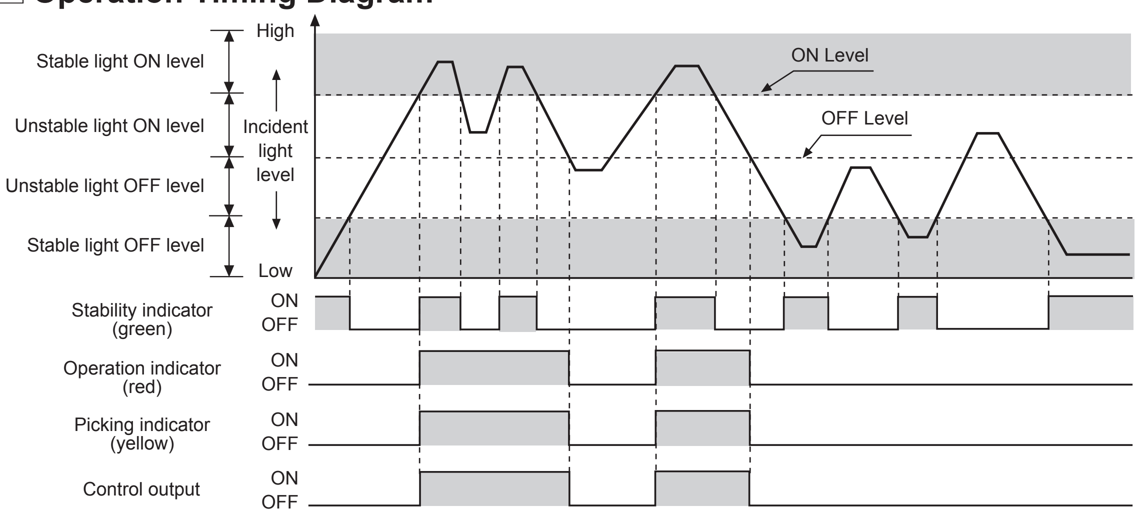


※1: Picking input (P.I): Contact or transistor is ON, and picking indicator operates.



※Picking indicator: When external picking input (P.I) is short-circuited with OUT (Black), it is operated same as ON/OFF status of control output.

■ Operation Timing Diagram



※The above diagram is the state of operation for Light ON, but in case of Dark ON, it is opposite operation against Light ON.
※Picking indicator is operated by connecting picking input line and output line. (If not connecting these, picking indicator is OFF regardless of operation mode.)

■ Operation Indicator

Item	Emitter			Receiver			
	Indicator			Indicator			Control output
	Green	Green	Picking indicator (yellow)	Green	Red	Picking indicator (yellow)	
Power on	☼	●	–	–	–	–	–
FREQ. A operation	☼	●	–	–	–	–	–
FREQ. B operation	☼	☼	–	–	–	–	–
Stable light ON	–	–	☼	☼	☼	☼	ON
Flashing function ON	–	–	◑	☼	☼	◑	ON
Unstable light ON	–	–	☼	●	☼	☼	ON
Unstable light OFF	–	–	●	●	●	●	OFF
Stable light OFF	–	–	●	☼	●	●	OFF
Overcurrent	–	–	●	◑ ◑		●	OFF

Display classification list	
☼	Light ON
●	Light OFF
◑	Flashing by 0.3 sec
◑ ◑	Flashing simultaneously by 0.3 sec

※The operations of 'Operation indicator' and 'Picking indicator (red)' for stable light ON level, unstable light ON level, unstable light OFF level, and stable light OFF level are for Light ON. (In case of overcurrent, control output is OFF regardless of operation mode.)

■ Function

◎ Switching of Long/Short mode (selectable sensing distance)

The rated sensing distance is 3m for Long mode, 1m for short mode.
It minimizes interference setting as short mode when using more than 3 sets closely together.

	Operation mode switch (emitter)	Rated sensing distance
Long mode	③ ② ① Long	3m
Short mode	Short ③ ② ①	1m

◎ Interference protection

In case of using 2 pcs of sensor in serial or parallel in order to extend sensing width, it may cause sensing error because of light interference.
This function is operating a sensor in transmission frequency A and another sensor in transmission frequency B to avoid these sensing errors by the light interference.

	Operation mode switch (emitter+receiver)	Frequency A, B indicator (emitter)
Sensor Ⓐ (Transmission frequency A)	③ ② ① FREQ.A	Frequency A (green) Frequency B (green)
Sensor Ⓑ (Transmission frequency B)	FREQ.B ③ ② ①	Frequency A (green) Frequency B (green)

◎ Light ON/Dark ON mode

The control output is ON when it is light ON in Light ON and the control output is ON when it is light OFF in Dark ON. It is available to select with user's preference.

	Operation mode switch (receiver)	Control output operation
Light ON	③ ② ① Light ON	It is ON when it is light ON.
Dark ON	Dark ON ③ ② ①	It is ON when it is light OFF.

◎ Switching of Lighting/Flashing of Picking indicator

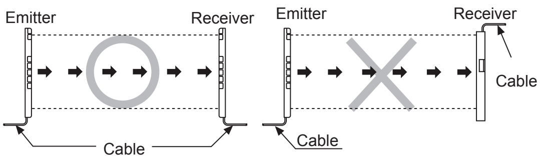
Picking indicator is lighting or flashing to make out work sensing operation more easily.

	Operation mode switch (emitter+receiver)	Picking indicator operation
Lighting	③ ② ① Lighting	Lighting indicator
Flashing	Flashing ③ ② ①	Flashing indicator

Installation

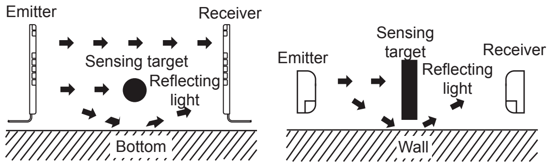
For direction of installation

Emitter and receiver should be installed as same up/down position.



For reflection from the surface of wall and flat

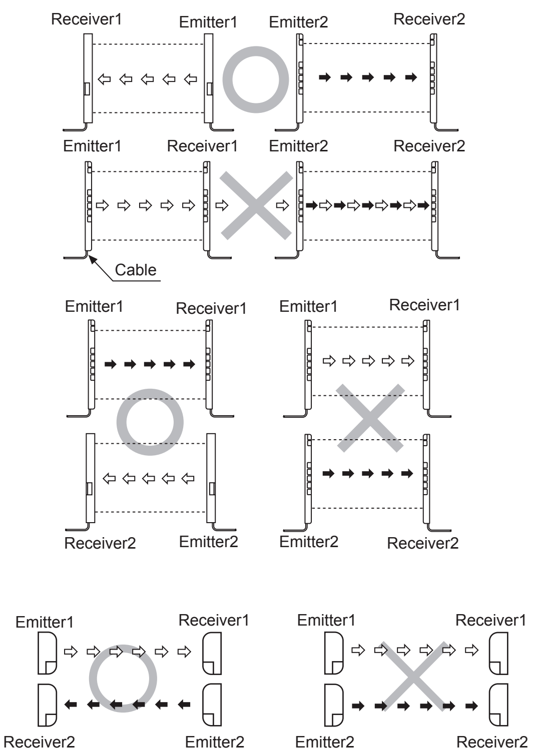
When installing it as below the light reflected from the surface of wall and flat will not be shaded. Please, check whether it operates normally or not with a sensing target before using. (interval distance: min. 0.3m)



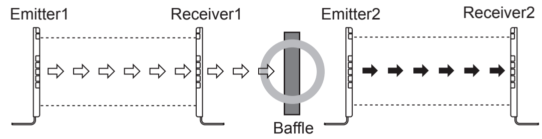
For prevention of interference

It may cause interference when installing more than 2 sets of the sensor. In order to avoid the interference of the sensor, please install as following figures and use the interference protection function.

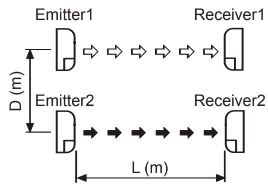
- **Transmission direction should be opposite between 2 sets**



- **Baffle should be installed between 2 sets.**



- **It should be installed out of the interference distance**



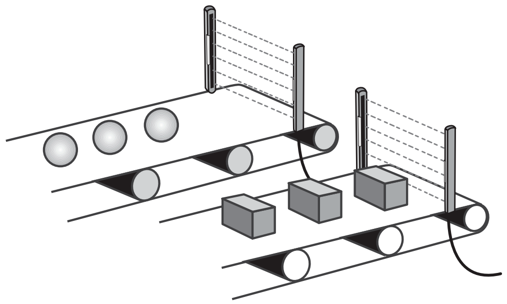
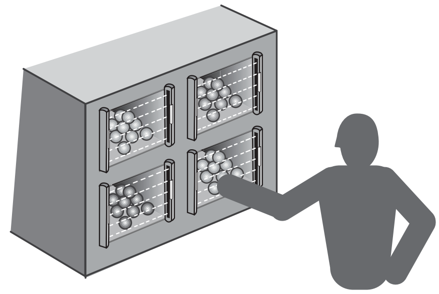
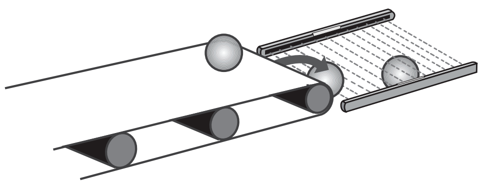
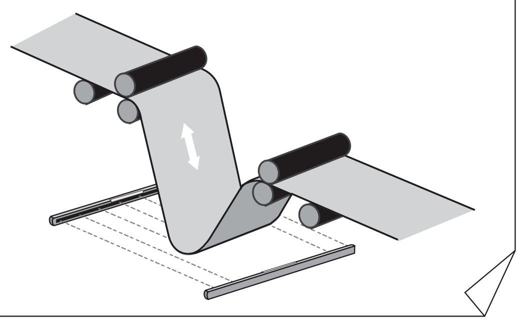
Sensing distance (L)	Installation allowable distance (D)
0.1 to 1m	Min. 0.1m
Min. 1m	Min. 0.2m

※It may be a little different based on installation environment.

Troubleshooting

Malfunction	Cause	Troubleshooting
Non-operation	Power supply	Supply rated power.
	Cable incorrect connection or disconnection	Check the wiring.
	Rated connection failure	Use it within rated sensing distance.
Non-operation in sometimes	Pollution by dirt of sensor cover	Remove dirt by soft brush or cloth.
	Connector connection failure	Check the assembled part of the connector.
Control output is OFF even though there is not a target object.	Out of rated sensing distance	Use within rated sensing distance.
	There is an obstacle to cut off the light emitted between emitter and receiver	Remove the obstacle.
	There is a strong electric wave or noise generated by motor, electric generator, high voltage line etc.	Put away the strong electric wave or noise generator.
LED displays for over current	Control output line is shorten	Check the wiring.
	Over load	Check the rated load capacity.

■ Applications

Sensing arrival of components	Sensing of approaching object or person
	
Sensing of fallen object	Sensing of lengthened part
	

(D) Proximity Sensors

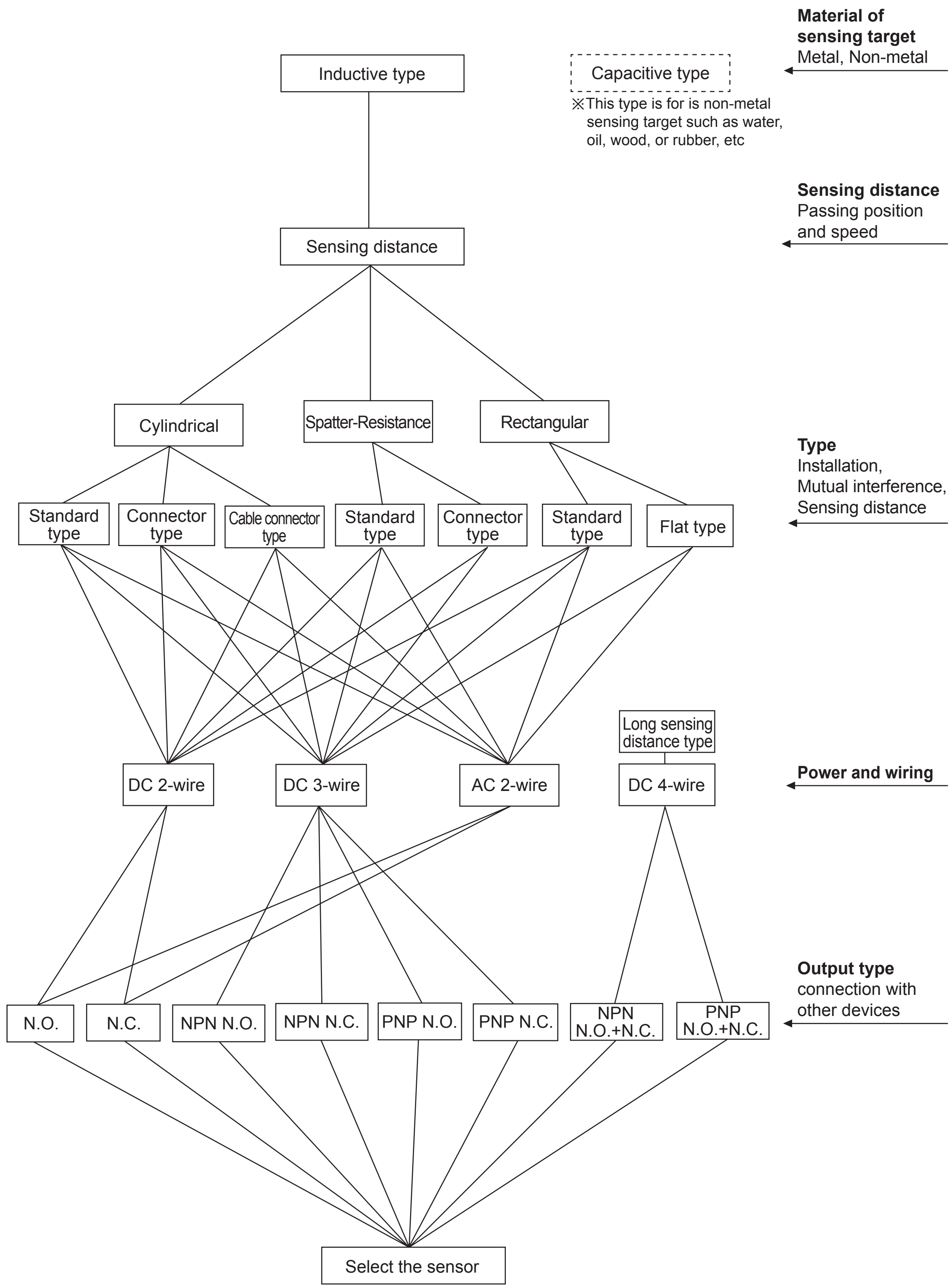
Line-up

Cylindrical, Spatter-Resistance, Connector Type PRACM Series

Line-up

Cylindrical, Long Sensing Distance, Spatter-Resistance, Connector Type PRDACM Series

▣ Proximity Sensor Selection



■ Ordering Information (Cylindrical Type)

P R □ □ □ □ 18 – 8 D N – □

Item	Code	Description
Standard/ Cable material	No mark	Standard type
	I※1	IEC standard
	V	Oil resistant cable
	IV	Oil resistant cable (IEC standard)
Output type	N	NPN N.O.
	N2	NPN N.C.
	P	PNP N.O.
	P2	PNP N.C.
	O※2	Normally Open
	C※2	Normally Closed
Voltage	D	12-24VDC
	X	12-24VDC (non-polar)
	A	100-240VAC
Sensing distance	Number	Sensing distance (mm)
Dimension	Number	Diameter of head (mm)
Wire	No mark	DC 3-wire type, AC 2-wire type
	T	DC 2-wire type
Body size	No mark	Standard type
	S※3	Short body
	L	Long body
Connection	No mark	Cable type
	CM	Connector type
	W	Cable connector type
Feature	No mark	Standard type
	DA	Long sensing distance spatter-resistance type
	A	Spatter resistance type
	D	Long sensing distance type
Shape	R	Cylindrical type
Item	P	Inductive proximity sensor
	C	Capacitive proximity sensor

※1: IEC standard item is available and add "-I" to the end of model.
※2: Normally Open, Normally Closed output are only for DC 2-wire and AC 2-wire type.
※3: Short type is only for DC 3-wire of PR12 type.

■ Ordering Information (Rectangular Type)

P S □ 17 – 5 D N □ – □

Item	Code	Description
Frequency	No mark	Standard type
	F※1	Differential frequency type
Sensing position	No mark	Standard type
	U※2	Upside sensing type
Output type	N	NPN N.O.
	N2	NPN N.C.
	P	PNP N.O.
	P2	PNP N.C.
	O※3	Normally Open
	C※3	Normally Closed
	N3※4	NPN N.O.+N.C.
	P3※4	PNP N.O.+N.C.
Voltage	D	12-24VDC (AS Type:12-48VDC)
	A	100-240VAC
Sensing distance	Number	Sensing distance (mm)
Dimension	Number	Side length of head (mm)
Output	No mark	DC 3-wire type, AC 2-wire type
	T※5	DC 2-wire type
Shape	S	Square
	SN	Square (new design)
	SD	Long distance square
	FI	Flat type (Injection case)
Item	P	Inductive proximity sensor
	A	Inductive long distance proximity sensor

※1: Differential frequency type is only for PSN17 type.
※2: Upside sensing type is only for PS12, PSN17 type.
※3: Normally Open, Normally Closed output are only for DC 2-wire and AC 2-wire type.
※4: N3, P3 output is only for AS80 type.
※5: DC 2-wire type is only for PSN17 type.

Product Overview

▣ Standard Type

● PR Series (Cylindrical, Cable Type Proximity Sensor)

CE

Cable	Sensing side diameter	Appearance Classification: Standard type, Shield	Standard type, Non-shield	Long body, Shield	Long body, Non-shield	Sensing distance (mm): Shield	Sensing distance (mm): Non-shield	Response frequency (Hz): Shield	Response frequency (Hz): Non-shield	Model (Shield/Non-shield)
AC 2-wire type 12-24VDC	M12					2	4	20	20	PR12-2/4AO PR12-2/4AC
	M18					5	8	20	20	PR18-5/8AO PR18-5/8AC
	M18					5	8	20	20	PRL18-5/8AO PRL18-5/8AC
	M30					10	15	20	20	PR30-10/15AO PR30-10/15AC
	M30					10	15	20	20	PRL30-10/15AO PRL30-10/15AC
DC 2-wire type 12-24VDC	M08					1.5	2	1500	1000	PRT08-1.5/2DO PRT08-1.5/2DC
	M12					2	4	1500	500	PRT12-2/4DO PRT12-2/4DC
	M18					5	8	500	350	PRT18-5/8DO PRT18-5/8DC
	M30					10	15	400	200	PRT30-10/15DO PRT30-10/15DC
DC 3-wire type 12-24VDC	M08					1.5	2	1500	1000	PR08-1.5/2DN PR08-1.5/2DP PR08-1.5/2DN2※ PR08-1.5/2DP2※
	M08					1.5	2	1500	1000	PRL08-1.5/2DN PRL08-1.5/2DP PRL08-1.5/2DN2※ PRL08-1.5/2DP2※
	M12					2	4	1500	1000	PR12-2/4DN PR12-2/4DP PR12-2/4DN2※ PR12-2/4DP2※
	M12	Short 35.5	Short 35.5			2	4	1500	1000	PRS12-2/4DN PRS12-2/4DP PRS12-2/4DN2※ PRS12-2/4DP2※
	M12					—	4	—	500	PRL12-2/4DN PRL12-2/4DP
	M18					5	8	500	350	PR18-5/8DN PR18-5/8DP PR18-5/8DN2※ PR18-5/8DP2※
	M18					5	8	500	350	PRL18-5/8DN PRL18-5/8DP PRL18-5/8DN2※ PRL18-5/8DP2※
	M30					10	15	400	200	PR30-10/15DN PR30-10/15DP PR30-10/15DN2※ PR30-10/15DP2※
	M30					10	15	400	200	PRL30-10/15DN PRL30-10/15DP PRL30-10/15DN2※ PRL30-10/15DP2※

"※" mark can be customized.

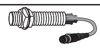
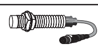
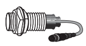
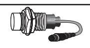
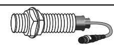
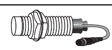
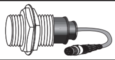
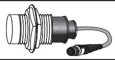
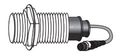
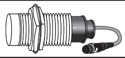
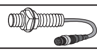
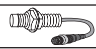
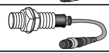
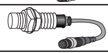
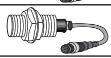
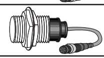
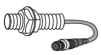
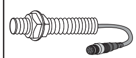
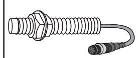
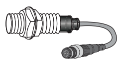
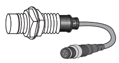
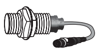
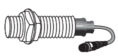
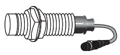
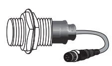
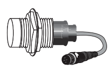
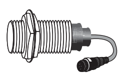
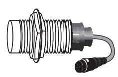
● PR Series (Cylindrical, Cable Type Proximity Sensor, Non-Polarity)

CE

Cable	Sensing side diameter	Appearance Classification: Standard type, Shield	Standard type, Non-shield	Long body, Shield	Long body, Non-shield	Sensing distance (mm): Shield	Sensing distance (mm): Non-shield	Response frequency (Hz): Shield	Response frequency (Hz): Non-shield	Model (Shield/Non-shield)
DC 2-wire type 12-24VDC	M12					2	4	1500	500	PRT12-2/4XO PRT12-2/4XC
	M18					5	8	500	350	PRT18-5/8XO PRT18-5/8XC
	M30					10	15	400	200	PRT30-10/15XO PRT30-10/15XC

● PRW Seires (Cylindrical, Cable Connector Type Proximity Sensor)

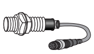
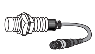
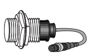
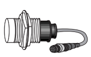
CE

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
AC 2-wire type 100-240VAC	M12					2	4	20	20	PRW12-2/4AO PRW12-2/4AC
	M18					5	8	20	20	PRW18-5/8AO PRW18-5/8AC
						5	8	20	20	PRWL18-5/8AO PRWL18-5/8AC
	M30					10	15	20	20	PRW30-10/15AO PRW30-10/15AC
						10	15	20	20	PRWL30-10/15AO PRWL30-10/15AC
DC 2-wire type 12-24VDC	M08					1.5	2	1500	1000	PRWT08-1.5/2DO PRWT08-1.5/2DC
	M12					2	4	1500	500	PRWT12-2/4DO PRWT12-2/4DC
	M18					5	8	500	350	PRWT18-5/8DO PRWT18-5/8DC
	M30					10	15	400	200	PRWT30-10/15DO PRWT30-10/15DC
DC 3-wire type 12-24VDC	M08					1.5	2	1500	1000	PRW08-1.5/2DN PRW08-1.5/2DP PRW08-1.5/2DN2※ PRW08-1.5/2DP2※
						1.5	2	1500	1000	PRWL08-1.5/2DN PRWL08-1.5/2DP PRWL08-1.5/2DN2※ PRWL08-1.5/2DP2※
	M12					2	4	1500	1000	PRW12-2/4DN PRW12-2/4DP PRW12-2/4DN2※ PRW12-2/4DP2※
	M18					5	8	500	350	PRW18-5/8DN PRW18-5/8DP PRW18-5/8DN2※ PRW18-5/8DP2※
						5	8	500	350	PRWL18-5/8DN PRWL18-5/8DP PRWL18-5/8DN2※ PRWL18-5/8DP2※
	M30					10	15	400	200	PRW30-10/15DN PRW30-10/15DP PRW30-10/15DN2※ PRW30-10/15DP2※
						10	15	400	200	PRWL30-10/15DN PRWL30-10/15DP PRWL30-10/15DN2※ PRWL30-10/15DP2※

"※" mark can be customized.

● PRW Series (Cylindrical, Cable Connector Type Proximity Sensor, Non-Polarity)

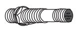
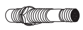
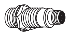
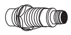
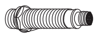
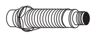
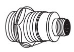
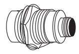
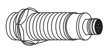
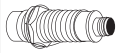
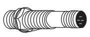
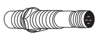
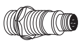
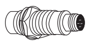
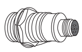
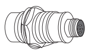
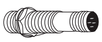
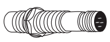
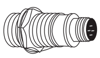
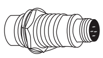
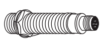
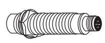
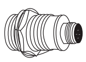
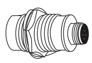
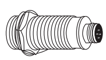
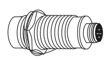
CE

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
DC 2-wire type 12-24VDC	M12					2	4	1500	500	PRWT12-2/4XO PRWT12-2/4XC
	M18					5	8	500	350	PRWT18-5/8XO PRWT18-5/8XC
	M30					10	15	400	200	PRWT30-10/15XO PRWT30-10/15XC

Product Overview

● PRCM Series (Cylindrical, Connector Type Proximity Sensor)

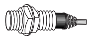
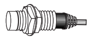
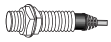
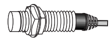
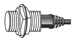
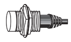
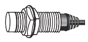
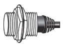
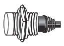
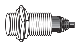
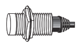
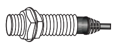
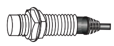
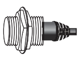
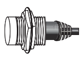
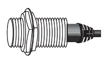
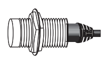
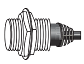
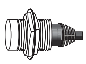
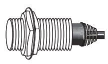
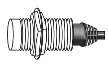
CE

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
AC 2-wire type **100-240VAC**	M12					2	4	20	20	PRCM12-2/4AO PRCM12-2/4AC
	M18					5	8	20	20	PRCM18-5/8AO PRCM18-5/8AC
						5	8	20	20	PRCML18-5/8AO PRCML18-5/8AC
	M30					10	15	20	20	PRCM30-10/15AO PRCM30-10/15AC
						10	15	20	20	PRCML30-10/15AO PRCML30-10/15AC
DC 2-wire type **12-24VDC**	M12					2	4	1500	500	PRCMT12-2/4DO PRCMT12-2/4DC
	M18					5	8	500	350	PRCMT18-5/8DO PRCMT18-5/8DC
	M30					10	15	400	200	PRCMT30-10/15DO PRCMT30-10/15DC
DC 3-wire type **12-24VDC**	M12					2	4	1500	1000	PRCM12-2/4DN PRCM12-2/4DP PRCM12-2/4DN2※ PRCM12-2/4DP2※
	M18					5	8	500	350	PRCM18-5/8DN PRCM18-5/8DP PRCM18-5/8DN2※ PRCM18-5/8DP2※
						5	8	500	350	PRCML18-5/8DN PRCML18-5/8DP PRCML18-5/8DN2※ PRCML18-5/8DP2※
	M30					10	15	400	200	PRCM30-10/15DN PRCM30-10/15DP PRCM30-10/15DN2※ PRCM30-10/15DP2※
						10	15	400	200	PRCML30-10/15DN PRCML30-10/15DP PRCML30-10/15DN2※ PRCML30-10/15DP2※

"※" mark can be customized.

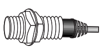
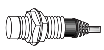
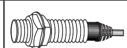
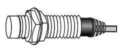
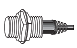
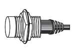
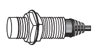
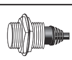
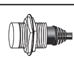
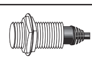
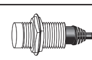
● PRD Series (Cylindrical, Long Sensing Distance, Cable Type Proximity Sensor)

CE

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
DC 2-wire type 12-24VDC	M12					4	8	450	400	PRDT12-4/8DO PRDT12-4/8DC
						4	8	450	400	PRDLT12-4/8DO PRDLT12-4/8DC
	M18					7	14	250	200	PRDT18-7/14DO PRDT18-7/14DC
						7	14	250	200	PRDLT18-7/14DO PRDLT18-7/14DC
	M30					15	25	100	100	PRDT30-15/25DO PRDT30-15/25DC
						15	25	100	100	PRDLT30-15/25DO PRDLT30-15/25DC
DC 3-wire type 12-24VDC	M12					4	8	500	400	PRD12-4/8DN PRD12-4/8DP PRD12-4/8DN2 PRD12-4/8DP2
						4	8	500	400	PRDL12-4/8DN PRDL12-4/8DP PRDL12-4/8DN2 PRDL12-4/8DP2
	M18					7	14	300	200	PRD18-7/14DN PRD18-7/14DP PRD18-7/14DN2 PRD18-7/14DP2
						7	14	300	200	PRDL18-7/14DN PRDL18-7/14DP PRDL18-7/14DN2 PRDL18-7/14DP2
	M30					15	25	100	100	PRD30-15/25DN PRD30-15/25DP PRD30-15/25DN2 PRD30-15/25DP2
						15	25	100	100	PRDL30-15/25DN PRDL30-15/25DP PRDL30-15/25DN2 PRDL30-15/25DP2

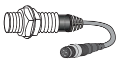
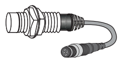
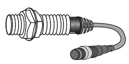
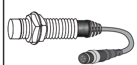
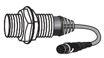
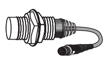
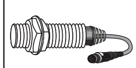
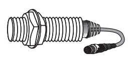
● PRD Series (Cylindrical, Long Sensing Distance, Cable Type Proximity Sensor, Non-Polarity)

CE

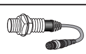
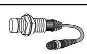
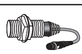
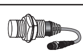
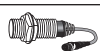
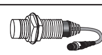
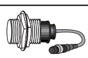
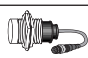
Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
DC 2-wire type 12-24VDC	M12					4	8	450	400	PRDT12-4/8XO PRDT12-4/8XC
						4	8	450	400	PRDLT12-4/8XO PRDLT12-4/8XC
	M18					7	14	250	200	PRDT18-7/14XO PRDT18-7/14XC
						7	14	250	200	PRDLT18-7/14XO PRDLT18-7/14XC
	M30					15	25	100	100	PRDT30-15/25XO PRDT30-15/25XC
						15	25	100	100	PRDLT30-15/25XO PRDLT30-15/25XC

Product Overview

● PRDW Series (Cylindrical, Long Sensing Distance, Cable Connector Type Proximity Sensor)

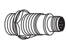
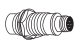
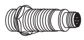
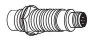
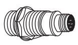
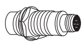
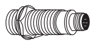
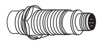
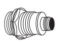
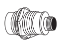
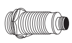
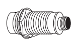
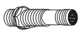
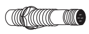
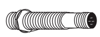
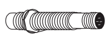
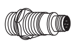
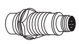
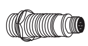
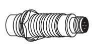
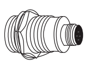
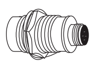
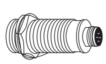
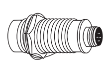
Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
DC 2-wire type 12-24VDC	M12					4	8	450	400	PRDWT12-4/8DO PRDWT12-4/8DC
	M18					7	14	250	200	PRDWT18-7/14DO PRDWT18-7/14DC
						7	14	250	200	PRDWLT18-7/14DO PRDWLT18-7/14DC
	M30					15	25	100	100	PRDWT30-15/25DO PRDWT30-15/25DC
DC 3-wire type 12-24VDC	M12					4	8	500	400	PRDW12-4/8DN PRDW12-4/8DP PRDW12-4/8DN2 PRDW12-4/8DP2
						4	8	500	400	PRDWL12-4/8DN PRDWL12-4/8DP PRDWL12-4/8DN2 PRDWL12-4/8DP2
	M18					7	14	300	200	PRDW18-7/14DN PRDW18-7/14DP PRDW18-7/14DN2 PRDW18-7/14DP2
						7	14	300	200	PRDWL18-7/14DN PRDWL18-7/14DP PRDWL18-7/14DN2 PRDWL18-7/14DP2
	M30					15	25	100	100	PRDW30-15/25DN PRDW30-15/25DP PRDW30-15/25DN2 PRDW30-15/25DP2
						15	25	100	100	PRDWL30-15/25DN PRDWL30-15/25DP PRDWL30-15/25DN2 PRDWL30-15/25DP2

● PRDW Series (Cylindrical, Long Sensing Distance, Cable Connector Type Proximity, Sensor, Non-Polarity)

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
DC 2-wire type 12-24VDC	M12					4	8	450	400	PRDWT12-4/8XO PRDWT12-4/8XC
	M18					7	14	250	200	PRDWT18-7/14XO PRDWT18-7/14XC
						7	14	250	200	PRDWLT18-7/14XO PRDWLT18-7/14XC
	M30					15	25	100	100	PRDWT30-15/25XO PRDWT30-15/25XC

● PRDCM Series (Cylindrical, Long Sensing Distance, Connector Type Proximity Sensor)

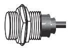
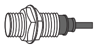
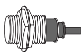
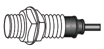
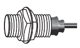
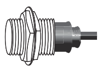
CE

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
DC 2-wire type 12-24VDC	M12					4	8	450	400	PRDCMT12-4/8DO PRDCMT12-4/8DC
						4	8	450	400	PRDCMLT12-4/8DO PRDCMLT12-4/8DC
	M18					7	14	250	200	PRDCMT18-7/14DO PRDCMT18-7/14DC
						7	14	250	200	PRDCMLT18-7/14DO PRDCMLT18-7/14DC
	M30					15	25	100	100	PRDCMT30-15/25DO PRDCMT30-15/25DC
						15	25	100	100	PRDCMLT30-15/25DO PRDCMLT30-15/25DC
DC 3-wire type 12-24VDC	M12					4	8	500	400	PRDCM12-4/8DN PRDCM12-4/8DP PRDCM12-4/8DN2 PRDCM12-4/8DP2
						4	8	500	400	PRDCML12-4/8DN PRDCML12-4/8DP PRDCML12-4/8DN2 PRDCML12-4/8DP2
	M18					7	14	300	200	PRDCM18-7/14DN PRDCM18-7/14DP PRDCM18-7/14DN2 PRDCM18-7/14DP2
						7	14	300	200	PRDCML18-7/14DN PRDCML18-7/14DP PRDCML18-7/14DN2 PRDCML18-7/14DP2
	M30					15	25	100	100	PRDCM30-15/25DN PRDCM30-15/25DP PRDCM30-15/25DN2 PRDCM30-15/25DP2
						15	25	100	100	PRDCML30-15/25DN PRDCML30-15/25DP PRDCML30-15/25DN2 PRDCML30-15/25DP2

Product Overview

● PRA Series (Cylindrical, Spatter-Resistance, Cable Type Proximity Sensor)

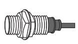
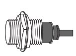
CE

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
AC 2-wire type **100-240VAC**	M12					2	—	20	—	PRA12-2AO PRA12-2AC
	M18					5	—	20	—	PRA18-5AO PRA18-5AC
	M30					10	—	20	—	PRA30-10AO PRA30-10AC
DC 2-wire type **12-24VDC**	M12					2	—-	1500	—-	PRAT12-2DO PRAT12-2DC
	M18					5	—	500	—	PRAT18-5DO PRAT18-5DC
	M30					10	—	400	—	PRAT30-10DO PRAT30-10DC
DC 3-wire type **12-24VDC**	M12					2	—	1500	—	PRA12-2DN PRA12-2DP PRA12-2DN2※ PRA12-2DP2※
	M18					5	—	500	—	PRA18-5DN PRA18-5DP PRA18-5DN2※ PRA18-5DP2※
	M30					10	—	400	—	PRA30-10DN PRA30-10DP PRA30-10DN2※ PRA30-10DP2※

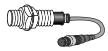
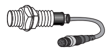
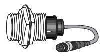
"※" mark can be customized.

● PRA Series (Cylindrical, Spatter-Resistance, Cable Type Proximity Sensor, Non-Polarity)

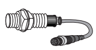
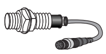
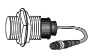
CE

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
DC 2-wire type **12-24VDC**	M12					2	-	1500	-	PRAT12-2XO PRAT12-2XC
	M18					5	-	500	-	PRAT18-5XO PRAT18-5XC
	M30					10	-	400	-	PRAT30-10XO PRAT30-10XC

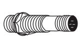
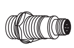
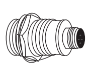
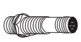
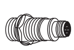
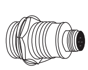
● PRAWT Series (Cylindrical, Spatter-Resistance, Cable Connector Type Proximity Sensor)

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
DC 2-wire type 12-24VDC	M12					2	—	1500	—	PRAWT12-2DO PRAWT12-2DC
	M18					5	—	500	—	PRAWT18-5DO PRAWT18-5DC
	M30					10	—	400	—	PRAWT30-10DO PRAWT30-10DC

● PRAWT Series (Cylindrical, Spatter-Resistance, Cable Connector Type Proximity Sensor, Non-Polarity)

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
DC 2-wire type 12-24VDC	M12					2	—	1500	—	PRAWT12-2XO PRAWT12-2XC
	M18					5	—	500	—	PRAWT18-5XO PRAWT18-5XC
	M30					10	—	400	—	PRAWT30-10XO PRAWT30-10XC

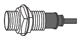
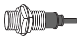
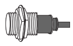
● PRACM Series (Cylindrical, Spatter-Resistance, Connector Type Proximity Sensor)

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
DC 2-wire type 12-24VDC	M12					2	—	1500	—	PRACMT12-2DO PRACMT12-2DC PRACMT12-2DO-I PRACMT12-2DC-I
	M18					5	—	500	—	PRACMT18-5DO PRACMT18-5DC PRACMT18-5DO-I PRACMT18-5DC-I
	M30					10	—	400	—	PRACMT30-10DO PRACMT30-10DC PRACMT30-10DO-I PRACMT30-10DC-I
DC 3-wire type 12-24VDC	M12					2	—	1500	—	PRACM12-2DN PRACM12-2DP PRACM12-2DN2 PRACM12-2DP2
	M18					5	—	500	—	PRACM18-5DN PRACM18-5DP PRACM18-5DN2 PRACM18-5DP2
	M30					10	—	400	—	PRACM30-10DN PRACM30-10DP PRACM30-10DN2 PRACM30-10DP2

Product Overview

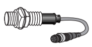
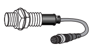
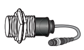
● PRDAT Series (Cylindrical, Long Sensing Distance, Spatter-Resistance, Cable Type Proximity Sensor)

CE

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
DC 2-wire type 12-24VDC	M12					4	—	450	—	PRDAT12-4DO PRDAT12-4DC PRDAT12-4DO-V PRDAT12-4DC-V
	M18					7	—	250	—	PRDAT18-7DO PRDAT18-7DC PRDAT18-7DO-V PRDAT18-7DC-V
	M30					15	—	100	—	PRDAT30-15DO PRDAT30-15DC PRDAT30-15DO-V PRDAT30-15DC-V

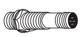
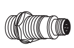
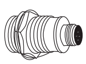
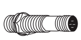
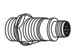
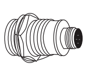
● PRDAWT Series (Cylindrical, Long Sensing Distance, Spatter-Resistance, Cable Connector Type Proximity Sensor)

CE

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
DC 2-wire type 12-24VDC	M12					4	—	450	—	PRDAWT12-4DO PRDAWT12-4DC PRDAWT12-4DO-I PRDAWT12-4DC-I
	M18					7	—	250	—	PRDAWT18-7DO PRDAWT18-7DC PRDAWT18-7DO-I PRDAWT18-7DC-I PRDAWT18-7DO-IV PRDAWT18-7DC-IV
	M30					15	—	100	—	PRDAWT30-15DO PRDAWT30-15DC PRDAWT30-15DO-I PRDAWT30-15DC-I PRDAWT30-15DO-IV

● PRDACM Series (Cylindrical, Long Sensing Distance, Spatter-Resistance, Connector Type Proximity Sensor)

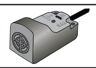
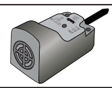
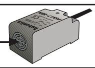
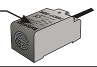
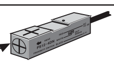
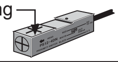
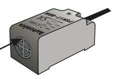
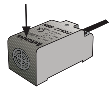
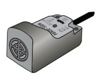
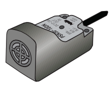
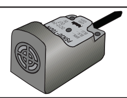
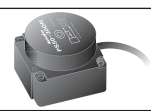
CE

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
DC 2-wire type 12-24VDC	M12					4	—	450	—	PRDACMT12-4DO PRDACMT12-4DC PRDACMT12-4DO-I PRDACMT12-4DC-I
	M18					7	—	250	—	PRDACMT18-7DO PRDACMT18-7DC PRDACMT18-7DO-I PRDACMT18-7DC-I
	M30					15	—	100	—	PRDACMT30-15DO PRDACMT30-15DC PRDACMT30-15DO-I PRDACMT30-15DC-I
DC 3-wire type 12-24VDC	M12					4	—-	500	—-	PRDACM12-4DN PRDACM12-4DP PRDACM12-4DN2 PRDACM12-4DP2
	M18					7	—	300	—	PRDACM18-7DN PRDACM18-7DP PRDACM18-7DN2 PRDACM18-7DP2
	M30					15	—	100	—	PRDACM30-15DN PRDACM30-15DP PRDACM30-15DN2 PRDACM30-15DP2

■ Rectangular

● PS/PSN Series (Rectangular, Standard Type Proximity Sensor)

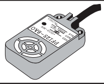
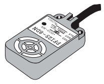
CE

Cable	Sensing side diameter	Appearance Classification: Standard type (front sensing)	Appearance Classification: Upper sensing type	Sensing distance (mm)	Response frequency (Hz)	Model (Shield/Non-shield)
AC 2-wire type 100-240VAC	Frame size 25mm			5	20	PSN25-5AO PSN25-5AC
	Frame size 30mm			10	20	PSN30-10AO PSN30-10AC
				15	20	PSN30-15AO PSN30-15AC
	Frame size 40mm			20	20	PSN40-20AO PSN40-20AC
DC 2-wire type 12-24VDC	Frame size 17mm	Front sensing (standard type) 		5	700	PSNT17-5DO PSNT17-5DC
			Upside sensing (U type) 	5	700	PSNT17-5DOU※ PSNT17-8DCU※
DC 3-wire type 12-24VDC	Frame size 12mm	Front sensing (standard type) 		4	500	PS12-4DN PS12-4DP PS12-4DN2※
			Upside sensing (U type) 	4	500	PS12-4DNU PS12-4DPU PS12-4DN2U※
	Frame size 17mm	Front sensing (standard type) 		5	700	PSN17-5DN PSN17-5DP PSN17-5DN2※ PSN17-5DP2※ PSN17-5DN-F
				8	200	PSN17-8DN PSN17-8DP PSN17-8DN2※ PSN17-8DP2※ PSN17-8DN-F PSN17-8DP-F PSN17-8DN2-F※ PSN17-8DP2-F※
			Upside sensing (U type) 	5	700	PSN17-5DNU PSN17-5DPU PSN17-5DN2U※ PSN17-5DP2U※
				8	200	PSN17-8DNU PSN17-8DPU PSN17-8DN2U※ PSN17-8DP2U※ PSN17-8DNU-F PSN17-8DPU-F PSN17-8DN2U-F※ PSN17-8DP2U-F※
	Frame size 25mm			5	350	PSN25-5DN PSN25-5DP PSN25-5DN2※ PSN25-5DP2※
	Frame size 30mm			10	250	PSN30-10DN PSN30-10DP PSN30-10DN2※ PSN30-10DP2※
				15	200	PSN30-15DN PSN30-15DP PSN30-15DN2※ PSN30-15DP2※
	Frame size 40mm			20	100	PSN40-20DN PSN40-20DP PSN40-20DN2※ PSN40-20DP2※
	Frame size 50mm			30	50	PS50-30DN PS50-30DP PS50-30DN2※ PS50-30DP2※

"※" mark can be customized.

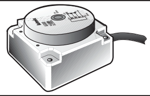
Product Overview

- **PFI Series (Rectangular, Flat Type Proximity Sensor)**

Cable	Sensing side diameter	Appearance Classification		Sensing distance (mm)	Response frequency (Hz)	Model (Shield/Non-shield)
		Standard type (front sensing)	Upper sensing type			
AC 2-wire type 100-240VAC	Frame size 25mm			8	20	PFI25-8AO PFI25-8AC
DC 3-wire type 12-24VDC	Frame size 25mm			8	200	PFI25-8DN PFI25-8DP PFI25-8DN2※ PFI25-8DP2※

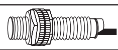
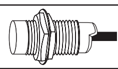
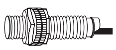
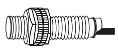
"※" mark can be customized.

- **AS Series (Rectangular, Long Sensing Distance Type Proximity Sensor)**

Cable	Sensing side diameter	Appearance Classification		Sensing distance (mm)	Response frequency (Hz)	Model (Shield/Non-shield)
		Standard type (front sensing)	Upper sensing type			
DC 4-wire type 12-48VDC	Frame size 80mm			50	30	AS80-50DN3 AS80-50DP3

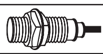
▣ Capacitive Type

- **CR Series (Cylindrical, Capacitive Type Proximity Sensor)**

Cable	Sensing side diameter	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
		Standard type		Long body						
		Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
AC 2-wire type 100-240VAC	M18					8	—	20	—	CR18-8AO CR18-8AC
	M30					—	15	—	20	CR30-15AO CR30-15AC
DC 3-wire type 12-24VDC	M18					8	—	50	—	CR18-8DN CR18-8DP CR18-8DN2※
	M30					—	15	—	50	CR30-15DN CR30-15DP CR30-15DN2※

▣ Transmission Coupler

- **PET18-5 (Transmission Coupler)**

Sensing side distance	Appearance Classification				Sensing distance (mm)		Response frequency (Hz)		Model (Shield/Non-shield)
	Standard type		Long body						
	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	Shield	Non-shield	
M18					5	—	—	—	PET18-5

※Transmittable Proximity sensor: PRT18-5D□, PRCMT18-5D□, PR18-5D□, PRCM18-5D□, PRL18-5D□, PRCML18-5D□.

Cylindrical Type Proximity Sensor

■ Features

- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit (DC 3-wire type)
- Built-in surge protection circuit
- Built-in over-current protection circuit (DC type)
- Long life cycle and high reliability, and simple operation
- IP67 protection structure (IEC standard)
- Replaceable for micro switches and limit switches

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ Specifications

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

Model	PRT08-1.5DO PRT08-1.5DC PRT08-1.5DO-V	PRT08-2DO PRT08-2DC	PRT12-2[D]O PRT12-2[D]C	PRT12-4[D]O PRT12-4[D]C	PRT18-5[D]O PRT18-5[D]C	PRT18-8[D]O PRT18-8[D]C	PRT30-10[D]O PRT30-10[D]C PRT30-10DO-V	PRT30-15[D]O PRT30-15[D]C
Sensing distance	1.5mm	2mm	2mm	4mm	5mm	8mm	10mm	15mm
Hysteresis	Max. 10% of sensing distance							
Standard sensing target	8×8×1mm (iron)		12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance	0 to 1.05mm	0 to 1.4mm	0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operating voltage)	12-24VDC (10-30VDC)							
Leakage current	Max. 0.6mA							
Response frequency※1	1.5kHz	1kHz	1.5kHz	500Hz		350Hz	400Hz	200Hz
Residual voltage※2	Max. 3.5V (non-polarity type is Max. 5V)							
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃ (for PRT08 Series: ±20% Max.)							
Control output	2 to 100mA							
Insulation resistance	Over 50MΩ (at 500VDC megger)							
Dielectric strength	1,500VAC 50/60Hz for 1 minute							
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock	500m/s² (approx. 50G) in X, Y, Z direction for 3 times							
Indicator	Operation indicator: Red LED							
Environment - Ambient temperature	-25 to 70℃, storage: -30 to 80℃							
Environment - Ambient humidity	35 to 95% RH, storage: 35 to 95% RH							
Protection circuit	Surge protection circuit		Surge protection circuit, Over-current protection circuit					
Protection structure	IP67 (IEC standard)							
Cable	Ø3.5mm, 3-wire, 2m (AWG24, Core diameter: 0.08mm, Number of cores: 40, Insulator diameter: Ø1mm)		Ø4mm, 2-wire, 2m		Ø5mm, 2-wire, 2m			
			(AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm)					
Material	Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)							
Approval	CE							
Weight※3	Approx. 64g (approx. 52g)		Approx.84g (approx. 72g)		Approx.122g (approx. 110g)		Approx.207g (approx. 170g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Before using non-polarity type, check the condition of connected divice because residual voltage is 5V.
※3: The weight includes packaging. The weight in parentheses in for unit only.
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※Environment resistance is rated at no freezing or condensation.

▣ Specifications

● DC 3-wire type

Model	PR08-1.5DN PR08-1.5DP PR08-1.5DN2 PR08-1.5DP2 PRL08-1.5DN PRL08-1.5DP PRL08-1.5DN2 PRL08-1.5DP2	PR08-2DN PR08-2DP PR08-2DN2 PR08-2DP2 PRL08-2DN PRL08-2DP PRL08-2DN2 PRL08-2DP2	PR12-2DN PR12-2DP PR12-2DN2 PR12-2DP2 PRS12-2DN PRS12-2DP PRS12-2DN2 PRS12-2DP2	PR12-4DN PR12-4DP PR12-4DN2 PR12-4DP2 PRS12-4DN PRS12-4DP PRS12-4DN2 PRS12-4DP2 PRL12-4DN PRL12-4DP	PR18-5DN PR18-5DP PR18-5DN2 PR18-5DP2 PR18-5DN-V PRL18-5DN PRL18-5DP PRL18-5DN2 PRL18-5DP2	PR18-8DN PR18-8DP PR18-8DN2 PR18-8DP2 PRL18-8DN PRL18-8DP PRL18-8DN2 PRL18-8DP2	PR30-10DN PR30-10DP PR30-10DN2 PR30-10DP2 PRL30-10DN PRL30-10DP PRL30-10DN2 PRL30-10DP2	PR30-15DN PR30-15DP PR30-15DN2 PR30-15DP2 PRL30-15DN PRL30-15DP PRL30-15DN2 PRL30-15DP2
Sensing distance	1.5mm	2mm	2mm	4mm	5mm	8mm	10mm	15mm
Hysteresis	Max. 10% of sensing distance							
Standard sensing target	8×8×1mm (iron)		12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance	0 to 1.05mm	0 to 1.4mm	0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operation voltage)	12-24VDC (10-30VDC)							
Current consumption	Max. 10mA							
Response frequency※1	1.5kHz	1kHz	1.5kHz	500Hz		350Hz	400Hz	200Hz
Residual voltage	Max. 2.0V		Max. 1.5V					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃, PR08 Series: Max. ±20%							
Control output	Max. 200mA							
Insulation resistance	Over 50MΩ (at 500VDC megger)							
Dielectric strength	1,500VAC 50/60Hz for 1 minute							
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock	500m/s² (approx. 50G) in X, Y, Z direction for 3 times							
Indicator	Operation indicator: Red LED							
Environment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃							
Environment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH							
Protection circuit	Surge protection circuit, Reverse polarity protection circuit, Over-current protection circuit							
Protection structure	IP67 (IEC standard)							
Material	Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)							
Cable	Ø3.5mm, 3-wire, 2m (AWG24, Core diameter: 0.08mm, Number of cores: 40, Insulator diameter: Ø1mm)		Ø4mm, 3-wire, 2m		Ø5mm, 3-wire, 2m			
			(AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm)					
Approval	CE							
Weight※2	PR: Approx. 64g (approx. 52g) PRL: Approx. 66g (approx. 54g)		PR: Approx. 84g (approx. 72g) PRS: Approx. 82g (approx. 70g) PRL: Approx. 88g (approx. 76g)		PR: Approx. 122g (approx. 110g) PRL: Approx. 142g (approx. 130g)		PR: Approx. 207g (approx. 170g) PRL: Approx. 247g (approx. 210g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parentheses in for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Specifications

● AC 2-wire type

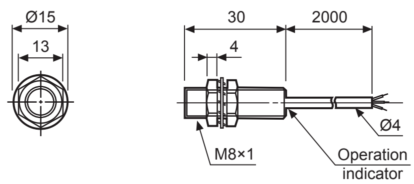
Model	PR12-2AO PR12-2AC	PR12-4AO PR12-4AC	PR18-5AO PR18-5AC PRL18-5AO PRL18-5AC	PR18-8AO PR18-8AC PRL18-8AO PRL18-8AC	PR30-10AO PR30-10AC PRL30-10AO PRL30-10AC	PR30-15AO PR30-15AC PRL30-15AO PRL30-15AC
Sensing distance	2mm	4mm	5mm	8mm	10mm	15mm
Hysteresis	Max. 10% of sensing distance					
Standard sensing target	12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance	0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operation voltage)	100-240VAC (85-264VAC)					
Leakage current	Max. 2.5mA					
Response frequency※1	20Hz					
Residual voltage	Max. 10V					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃					
Control output	5 to 150mA		5 to 200mA			
Insulation resistance	Over 50MΩ (at 500VDC megger)					
Dielectric strength	2,500VAC 50/60Hz for 1 minute					
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock	500m/s² (approx. 50G) in X, Y, Z direction for 3 times					
Indicator	Operation indicator: Red LED					
Environ-ment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
Environ-ment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit	Surge protection circuit					
Protection structure	IP67 (IEC standard)					
Cable	Ø4mm, 2-wire, 2m		Ø5mm, 2-wire, 2m			
Cable	(AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm)					
Insulation type	Double insulation or reinforced insulation (Mark: ⧈, dielectric strength between the measuring input part and the power part: 1kV)					
Material	Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC)					
Approval	CE					
Weight※2	Approx. 84g (approx. 66g)		PR: Approx. 130g (approx. 118g) PRL: Approx. 142g (approx. 130g)		PR: Approx. 207g (approx. 170g) PRL: Approx. 245g (approx. 208g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parentheses in for unit only.
※Environment resistance is rated at no freezing or condensation.

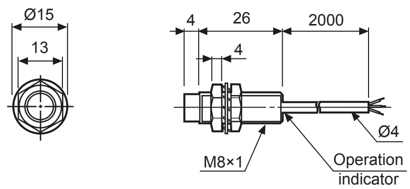
■ Dimensions

(unit: mm)

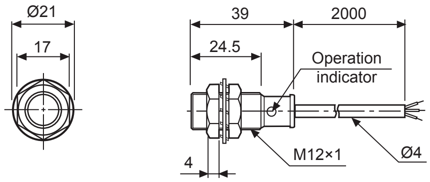
● PT(T)08-1.5D□



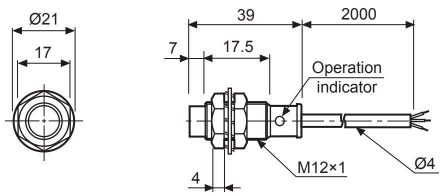
● PT(T)08-2D□



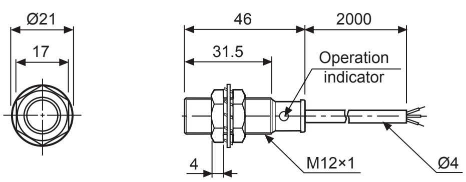
● PRS12-2D□



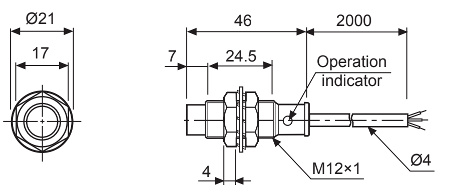
● PRS12-4D□



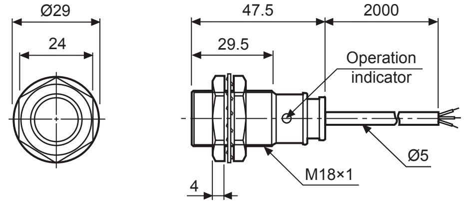
● PT(T)12-2D□



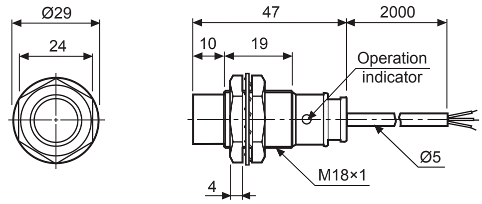
● PT(T)12-4D□



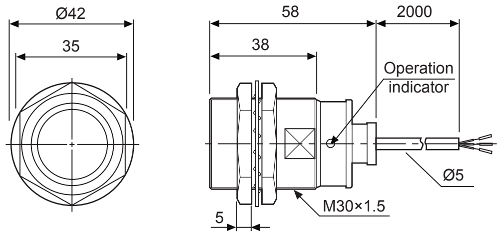
● PT(T)18-5D□



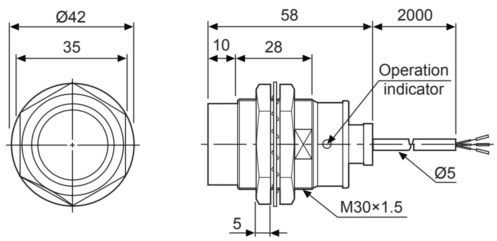
● PT(T)18-8D□



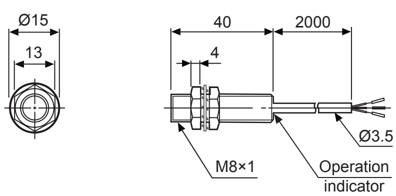
● PT(T)30-10D□



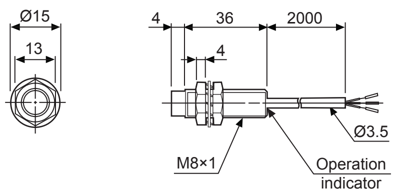
● PT(T)30-15D□



● PRL08-1.5D□



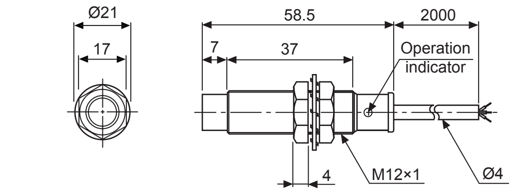
● PRL08-2D□



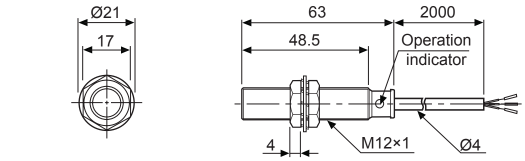
■ Dimensions

(unit: mm)

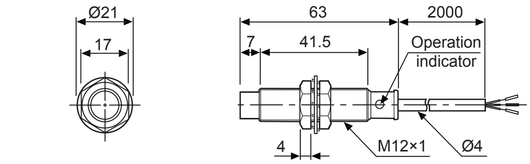
- **PRL12-4D□**



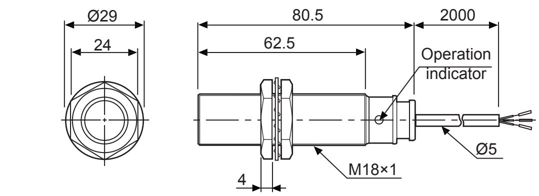
- **PR12-2A□**



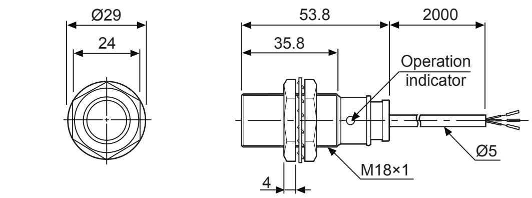
- **PR12-4A□**



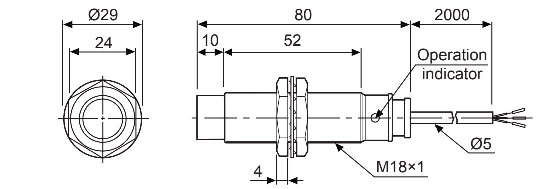
- **PRL18-5D□** • **PRL18-5A□**



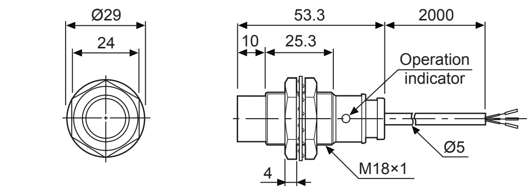
- **PR18-5A□**



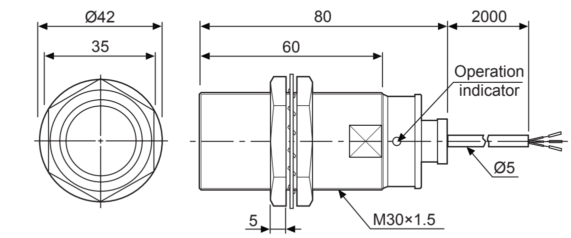
- **PRL18-8D□** • **PRL18-8A□**



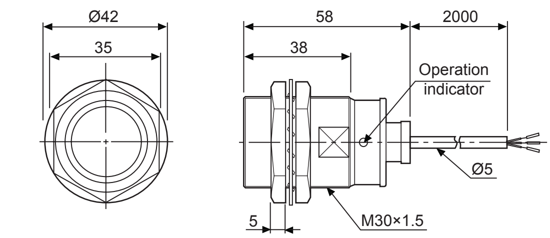
- **PR18-8A□**



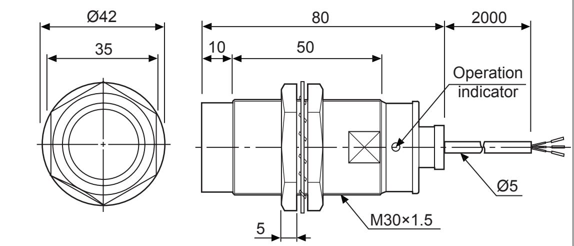
- **PRL30-10D□** • **PRL30-10A□**



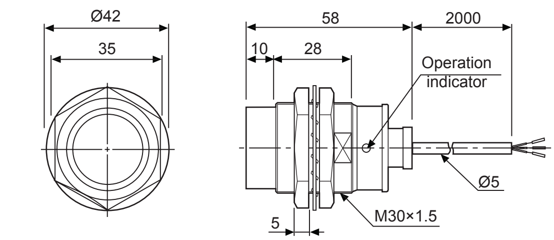
- **PR30-10A□**



- **PRL30-15D□** • **PRL30-15A□**

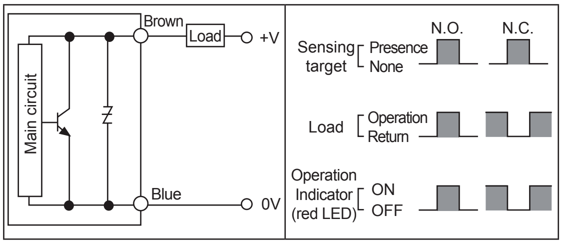


- **PR30-15A□**



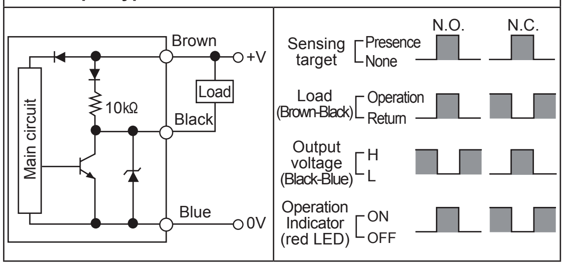
■ Control Output Diagram And Load Operation

◎ DC 2-wire type

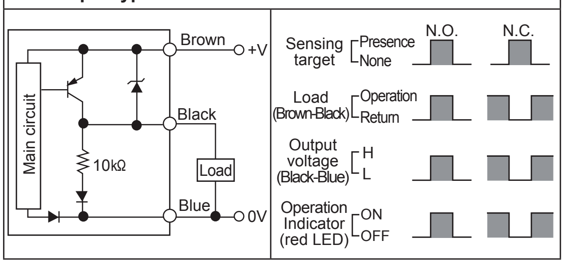


◎ DC 3-wire type

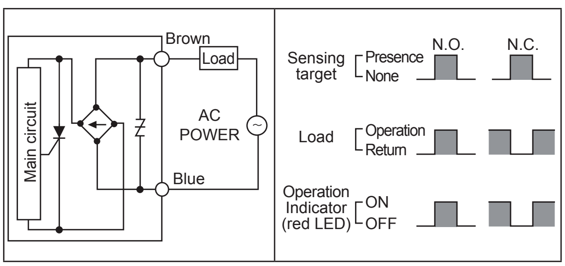
NPN output type



PNP output type

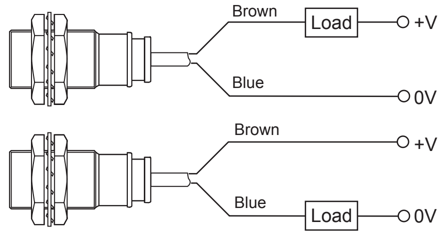


◎ AC 2-wire type



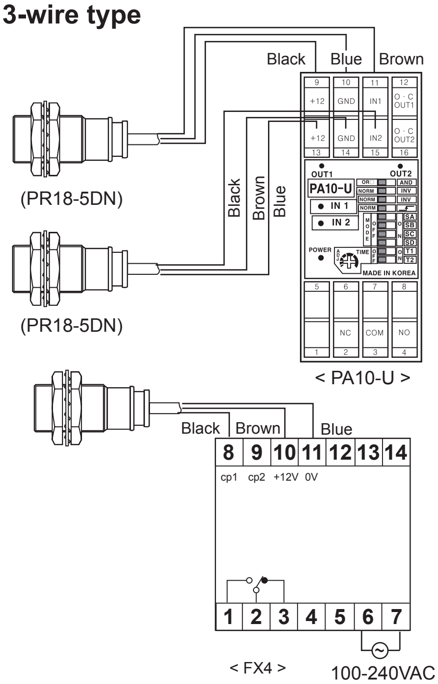
■ Connections

◎ DC 2-wire type

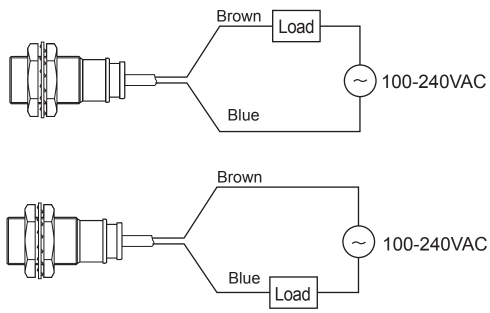


※The load can be connected to either wire.

◎ DC 3-wire type



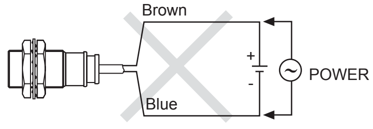
◎ AC 2-wire type



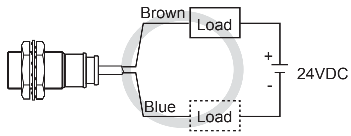
※The load can be connected to either wire.

■ Proper Usage

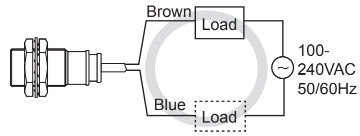
◎ Load connections



< DC 2-wire type & AC 2-wire type >



< DC 2-wire type >

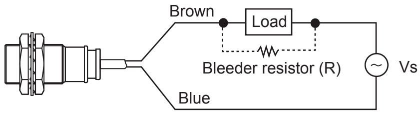


< AC 2-wire type >

When using DC or AC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● **AC 2-wire type**



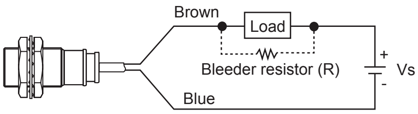
110VAC: Min. 20kΩ 3W
220VAC: Min. 39kΩ 10W

It may cause return failure of load by residual voltage. If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \le \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[I:Action current of load, R:Bleeder resistance, P:Permissible power]

● **DC 2-wire type**



Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

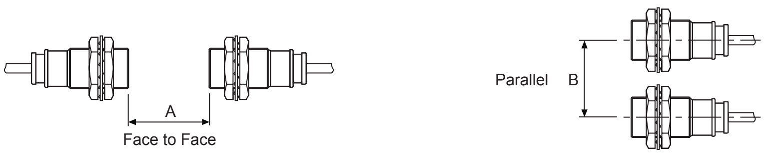
※W value of Bleeder resistor should be bigger for proper heat dissipation.

$$R \le \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

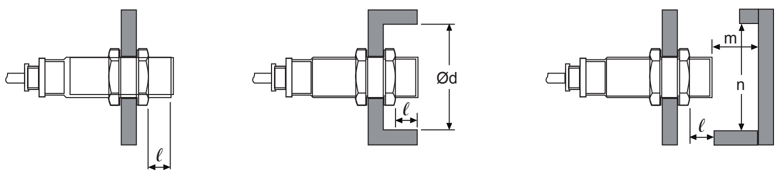
[Vs: Power supply, Io: Min. action current of proximity sensor, Ioff: Return current of load, P : Number of Bleeder resistance watt]

◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.



When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



(unit: mm)

Item \ Model	PR08-1.5D□ PRT08-1.5D□	PR08-2D□ PRT08-2D□	PT(T)12-2D□ PRS12-2D□ PR12-2A□	PT(T)12-4D□ PRS12-4D□ PR12-4A□	PT(T)18-5D□ PRL18-5D□ PR18-5A□ PRL18-5A□	PT(T)18-8D□ PRL18-8D□ PR18-8A□ PRL18-8A□	PT(T)30-10D□ PRL30-10D□ PR30-10A□ PRL30-10A□	PT(T)30-15D□ PRL30-15D□ PR30-15A□ PRL30-15A□
A	9	12	12	24	30	48	60	90
B	16	24	24	36	36	54	60	90
ℓ	0	8	0	11	0	14	0	15
Ød	8	24	12	36	18	54	30	90
m	4.5	6	6	12	15	24	30	45
n	12	24	18	36	27	54	45	90

Cylindrical Cable Connector Type Proximity Sensor

■ Features

- Shorten the time of maintenance with the body
- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit (DC 3-wire type)
- Built-in surge protection circuit
- Built-in over-current protect protection circuit
- IP67 protection structure (IEC standard)
- Replaceable for micro switches and limit switches

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ Specifications

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

Model	PRWT08-1.5DO PRWT08-1.5DC PRWT08-1.5DO-I PRWT08-1.5DC-I PRWT08-1.5DO-V PRWT08-1.5DC-V PRWT08-1.5DO-IV PRWT08-1.5DC-IV	PRWT08-2DO PRWT08-2DC PRWT08-2DO-I PRWT08-2DC-I PRWT08-2DO-V PRWT08-2DC-V PRWT08-2DO-IV PRWT08-2DC-IV	PRWT12-2$\boxed{D}$O PRWT12-2$\boxed{D}$C PRWT12-2$\boxed{D}$O-I PRWT12-2$\boxed{D}$C-I	PRWT12-4$\boxed{D}$O PRWT12-4$\boxed{D}$C PRWT12-4$\boxed{D}$O-I PRWT12-4$\boxed{D}$C-I	PRWT18-5$\boxed{D}$O PRWT18-5$\boxed{D}$C PRWT18-5$\boxed{D}$O-I PRWT18-5$\boxed{D}$C-I	PRWT18-8$\boxed{D}$O PRWT18-8$\boxed{D}$C PRWT18-8$\boxed{D}$O-I PRWT18-8$\boxed{D}$C-I	PRWT30-10$\boxed{D}$O PRWT30-10$\boxed{D}$C PRWT30-10$\boxed{D}$O-I PRWT30-10$\boxed{D}$C-I PRWT30-10DO-V PRWT30-10DC-IV	PRWT30-15$\boxed{D}$O PRWT30-15$\boxed{D}$C PRWT30-15$\boxed{D}$O-I PRWT30-15$\boxed{D}$C-I PRWT30-15$\boxed{D}$O-V PRWT30-15$\boxed{D}$C-IV
Sensing distance	1.5mm	2mm		4mm	5mm	8mm	10mm	15mm
Hysteresis	Max. 10% of sensing distance							
Standard sensing target	8×8×1mm (iron)		12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance	0 to 1.05mm	0 to 1.4mm		0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operation voltage)	12-24VDC (10-30VDC)							
Leakage current	Max. 0.6mA							
Response frequency※1	1.5kHz	1kHz	1.5kHz	500Hz		350Hz	400Hz	200Hz
Residual voltage※2	Max. 3.5V (non-polarity type is Max. 5V)							
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃ (for PRWT08 Series: ±20% Max.)							
Control output	2 to 100mA							
Insulation resistance	Over 50MΩ (at 500VDC meggera)							
Dielectric strength	1,500VAC 50/60Hz for 1 minute							
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times							
Indicator	Operation indicator: Red LED							
Environment – Ambient temperature	-25 to 70℃, storage: -30 to 80℃							
Environment – Ambient humidity	35 to 95%RH, storage: 35 to 95%RH							
Protection circuit	Surge protection circuit		Surge protection circuit, Over-current protection circuit					
Protection structure	IP67 (IEC standard)							
Material	Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Heat-resistant Acrylonitrile butadiene styrene, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)							
Cable	Ø4mm, 2-wire, 300mm, M12 connector				Ø5mm, 2-wire, 300mm, M12 connector			
Approval	CE							
Weight※3	Approx. 44g (approx. 32g)		Approx. 54g (approx. 42g)		Approx.70g (approx. 58g)		Approx. 134g (approx. 122g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Before using non-polarity type, check the condition of connected device because residual voltage is 5V.
※3: The weight includes packaging. The weight in parentheses in for unit only.
※Please fasten the vibration part with Teflon type.
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※The last 'V' of model name is for the model with oil-resistance reinforced cable.
※Environment resistance is rated at no freezing or condensation.

■ Specifications

● DC 3-wire type

Model		PRW08-1.5DN PRW08-1.5DP PRW08-1.5DN2 PRW08-1.5DP2 PRW08-1.5DN-V PRW08-1.5DP-V PRW08-1.5DN2-V PRW08-1.5DN2-V PRWL08-1.5DN PRWL08-1.5DP PRWL08-1.5DN2 PRWL08-1.5DP2	PRW08-2DN PRW08-2DP PRW08-2DN2 PRW08-2DP2 PRW08-2DN-V PRW08-2DP-V PRW08-2DN2-V PRW08-2DP2-V PRWL08-2DN PRWL08-2DP PRWL08-2DN2 PRWL08-2DP2	PRW12-2DN PRW12-2DP PRW12-2DN2 PRW12-2DP2	PRW12-4DN PRW12-4DP PRW12-4DN2 PRW12-4DP2	PRW18-5DN PRW18-5DP PRW18-5DN2 PRW18-5DP2 PRWL18-5DN PRWL18-5DP PRWL18-5DN2 PRWL18-5DP2	PRW18-8DN PRW18-8DP PRW18-8DN2 PRW18-8DP2 PRWL18-8DN PRWL18-8DP PRWL18-8DN2 PRWL18-8DP2	PRW30-10DN PRW30-10DP PRW30-10DN2 PRW30-10DP2 PRW30-10DN-V PRW30-10DP-V PRW30-10DN2-V PRW30-10DP2-V PRWL30-10DN PRWL30-10DP PRWL30-10DN2 PRWL30-10DP2	PRW30-15DN PRW30-15DP PRW30-15DN2 PRW30-15DP2 PRW30-15DN-V PRW30-15DP-V PRW30-15DN2-V PRW30-15DP2-V PRWL30-15DN PRWL30-15DP PRWL30-15DN2 PRWL30-15DP2
Sensing distance		1.5mm	2mm		4mm	5mm	8mm	10mm	15mm
Hysteresis		Max. 10% of sensing distance							
Standard sensing target		8×8×1mm (iron)		12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance		0 to 1.05mm	0 to 1.4mm		0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operation voltage)		12-24VDC (10-30VDC)							
Current consumption		Max. 10mA							
Response frequency※1		1.5kHz	1kHz	1.5kHz	500Hz		350Hz	400Hz	200Hz
Residual voltage		Max. 2V		Max. 1.5V					
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃ (for PRW(L)08 series: ±20% Max.)							
Control output		200mA							
Insulation resistance		Min. 50MΩ (at 500VDC megger)							
Dielectric strength		1,500VAC 50/60Hz for 1minute							
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times							
Indicator		Operation indicator: Red LED							
Environ-ment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃							
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH							
Protection circuit		Surge protection circuit, Reverse polarity protection circuit, Over-current protection circuit							
Protection structure		IP67 (IEC standard)							
Material		Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Heat-resistant Acrylonitrile butadiene styrene Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)							
Cable		Ø4mm, 3-wire, 300mm, M12 connector				Ø5mm, 3-wire, 300mm, M12 connector			
Approval		CE							
Weight※2		PRW: Approx. 44g (approx. 32g) PRWL: Approx. 46g (approx. 34g)		Approx. 54g (approx. 42g)		PRW: Approx. 70g (approx. 58g) PRWL: Approx. 90g (approx. 78g)		PRW: Approx. 134g (approx. 122g) PRWL: Approx. 195g (approx. 158g)	

● AC 2-wire type

Model		PRW12-2AO PRW12-2AC	PRW12-4AO PRW12-4AC	PRW18-5AO PRW18-5AC PRWL18-5AO PRWL18-5AC	PRW18-8AO PRW18-8AC PRWL18-8AO PRWL18-8AC	PRW30-10AO PRW30-10AC PRWL30-10AO PRWL30-10AC	PRW30-15AO PRW30-15AC PRWL30-15AO PRWL30-15AC
Sensing distance		2mm	4mm	5mm	8mm	10mm	15mm
Hysteresis		Max. 10% of sensing distance					
Standard sensing target		12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance		0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operation voltage)		100-240VAC (85-264VAC)					
Leakage current		Max. 2.5mA					
Response frequency※1		20Hz					
Residual voltage		Max. 10V					
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃					
Control output		5 to 150mA		5 to 200mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)					
Dielectric strength		2,500VAC 50/60Hz for 1minute					
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times					
Indicator		Operation indicator: Red LED					
Environ-ment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit		Surge protection circuit					
Protection structure		IP67 (IEC standard)					
Material		Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Heat-resistant Acrylonitrile butadiene styrene, Standard cable (black): Polyvinyl chloride (PVC)					
Cable		Ø4mm, 2-wire, 300mm, M12 connector		Ø5mm, 2-wire, 300mm, M12 connector			
Approval		CE					
Weight※2		Approx. 54g (approx. 42g)		PRW: Approx. 78g (approx. 66g) PRWL: Approx. 90g (approx. 78g)		PRW: Approx. 134g (approx. 122g) PRWL: Approx. 195g (approx. 158g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.

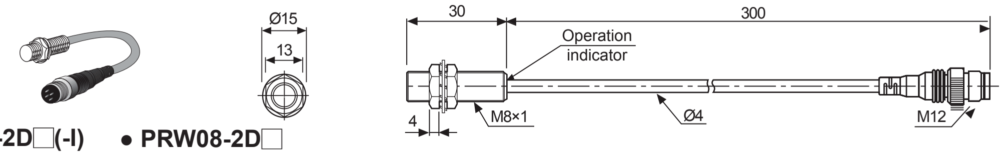
※2: The weight includes packaging. The weight in parentheses in for unit only.

※The last 'V' of model name is for the model with oil-resistance reinforced cable. ※Environment resistance is rated at no freezing or condensation.

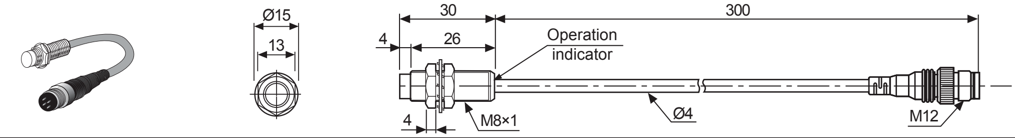
■ Dimensions

(unit: mm)

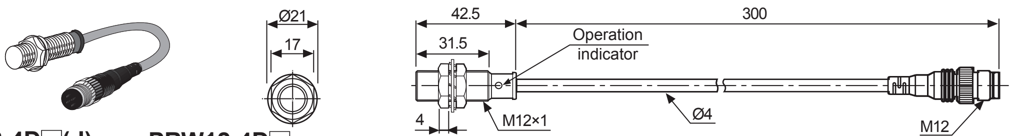
● PRWT08-1.5D□(-I) ● PRW08-1.5D□



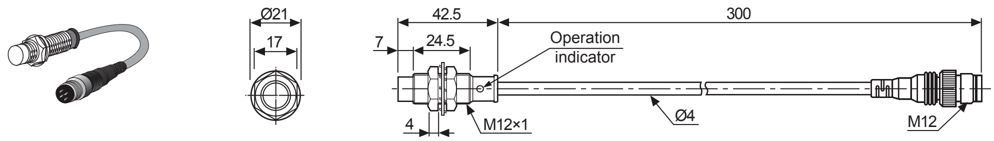
● PRWT08-2D□(-I) ● PRW08-2D□



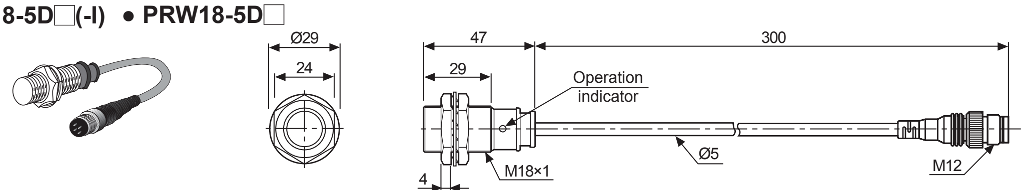
● PRWT12-2D□(-I) ● PRW12-2D□



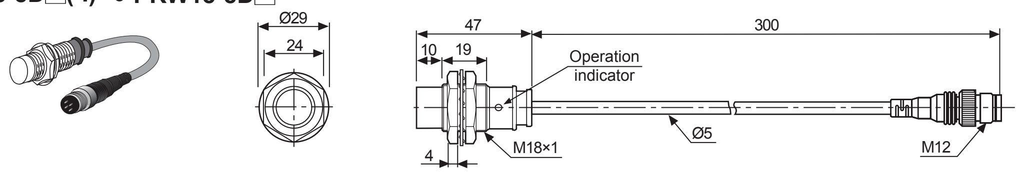
● PRWT12-4D□(-I) ● PRW12-4D□



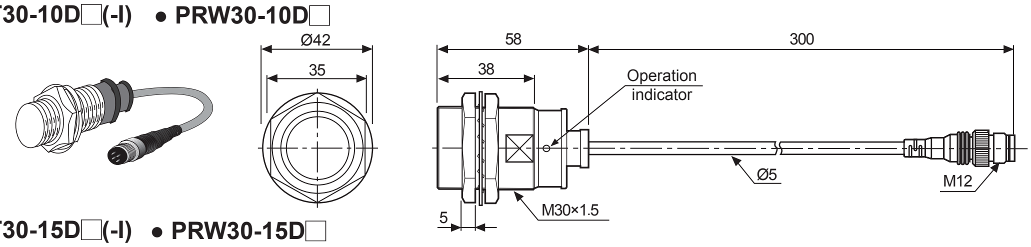
● PRWT18-5D□(-I) ● PRW18-5D□



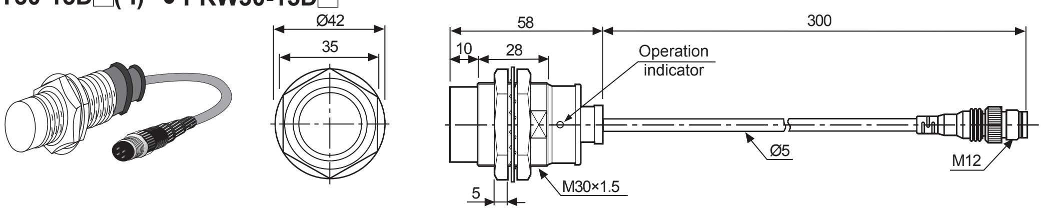
● PRWT18-8D□(-I) ● PRW18-8D□



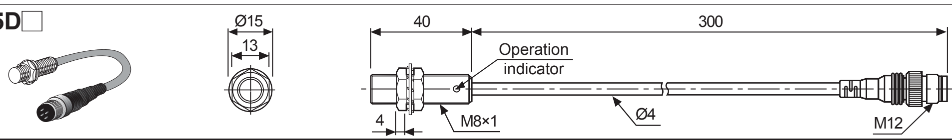
● PRWT30-10D□(-I) ● PRW30-10D□



● PRWT30-15D□(-I) ● PRW30-15D□



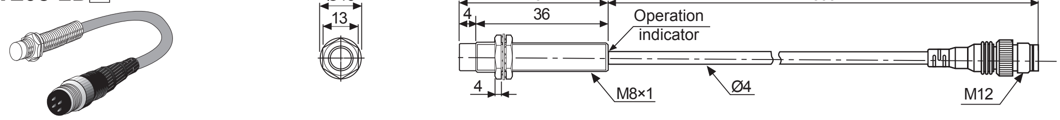
● PRWL08-1.5D□



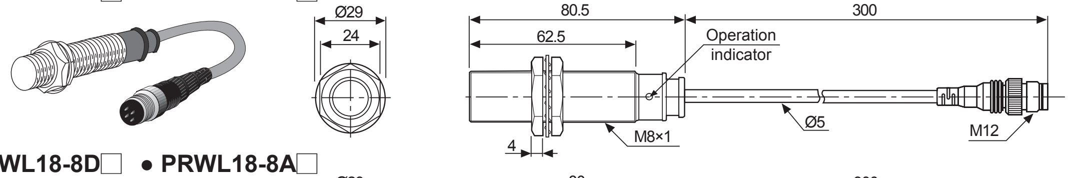
■ Dimensions

(unit: mm)

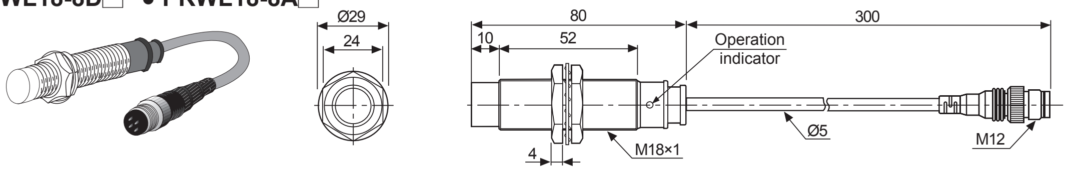
● PRWL08-2D□



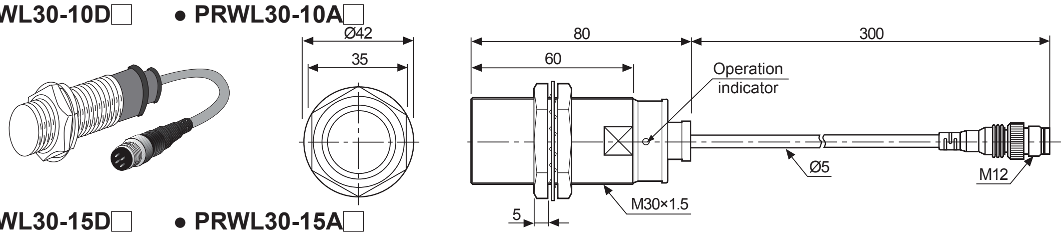
● PRWL18-5D□ ● PRWL18-5A□



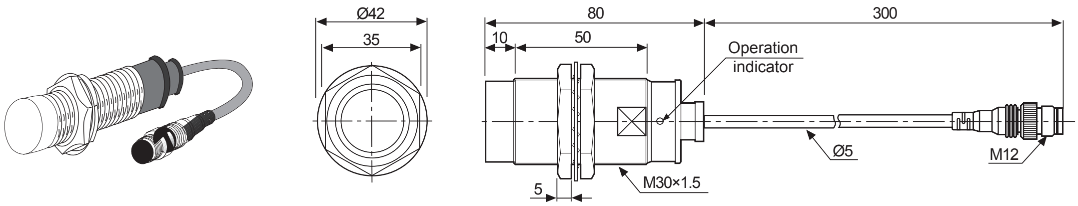
● PRWL18-8D□ ● PRWL18-8A□



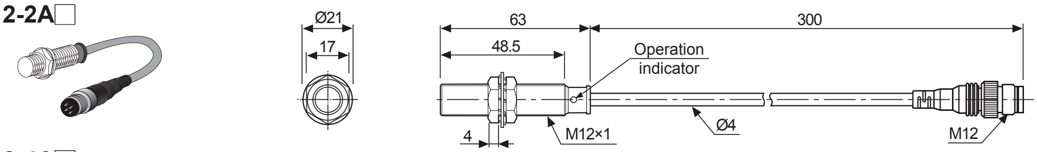
● PRWL30-10D□ ● PRWL30-10A□



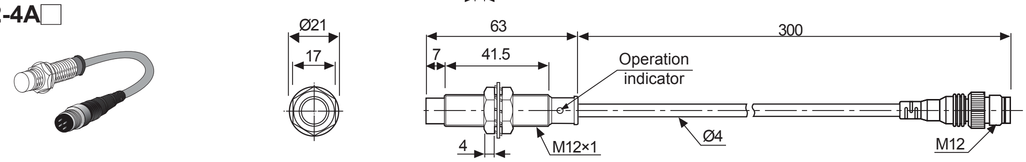
● PRWL30-15D□ ● PRWL30-15A□



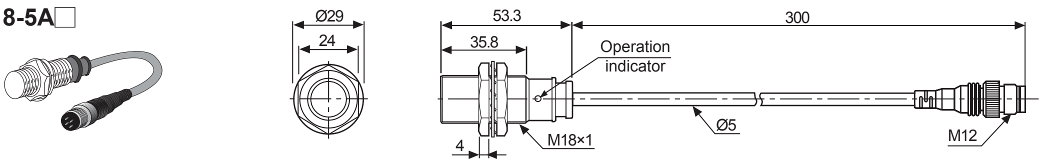
● PRW12-2A□



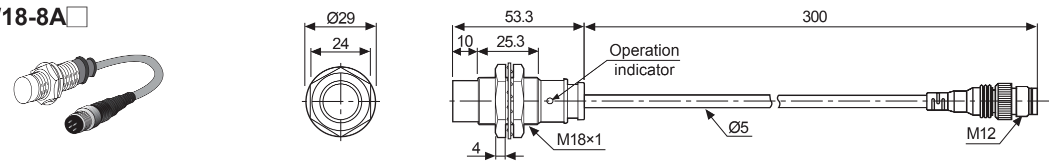
● PRW12-4A□



● PRW18-5A□



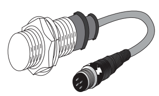
● PRW18-8A□

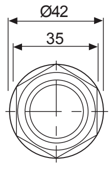


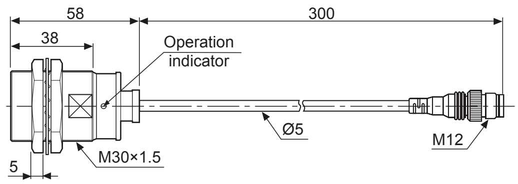
■ Dimensions

(unit:mm)

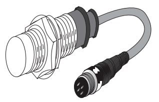
● PRW30-10A□

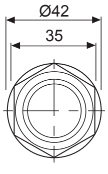


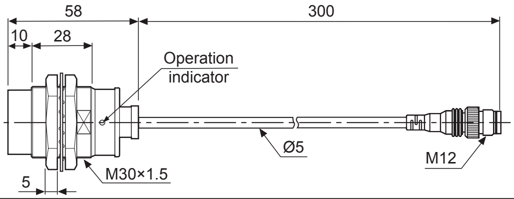




● PRW30-15A□

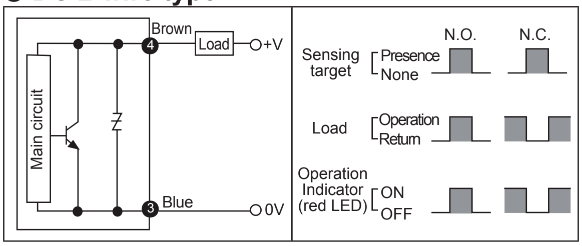






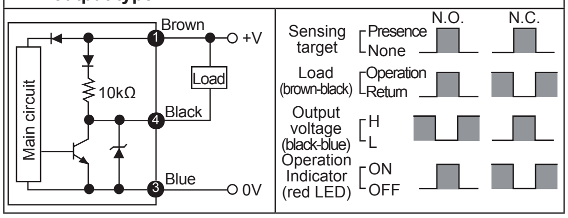
■ Control Output Diagram And Load Operation

◎ DC 2-wire type

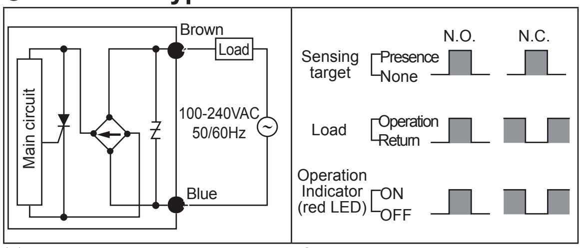


◎ DC 3-wire type

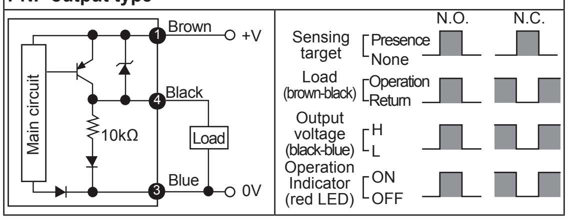
NPN output type



◎ AC 2-wire type



PNP output type

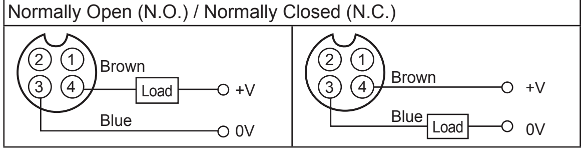


※The number in a circle is pin no. of connector.

■ Wiring Diagram

◎ DC 2-wire type (standard type)

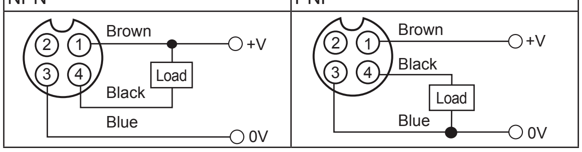
Normally Open (N.O.) / Normally Closed (N.C.)



※Pin ①, ② are not used terminals.
※When using DC 3-wire type of connector cable, black (12-24VDC) and blue (0V) cables can be used.

◎ DC 3-wire type

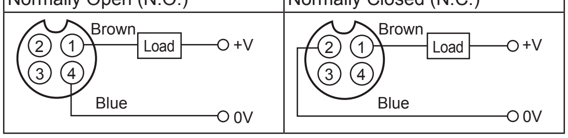
NPN	PNP



※Please fasten the cleat of connector not to shown the thread. (0.39 to 0.49N·m)
※Please fasten the vibration part with Teflon tape.
※Refer to the G-6 for IEC standard connector cables and specifications.

◎ DC 2-wire type (IEC standard type)

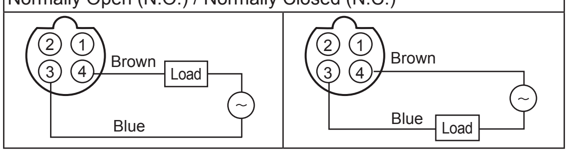
Normally Open (N.O.)	Normally Closed (N.C.)



※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The type, pin arrangement of connector based upon IEC standard is being developed.
※Please put "I" behind of standard type for purchasing IEC standard product. E.g.)PRWT12-4DO-I
※Please put "I" behind of model name for selecting proximity sensor by IEC standard. E.g.)CID2-2-I, CLD2-2-I

◎ AC 2-wire type

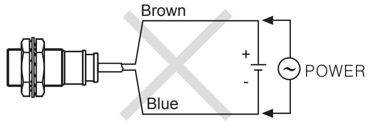
Normally Open (N.O.) / Normally Closed (N.C.)



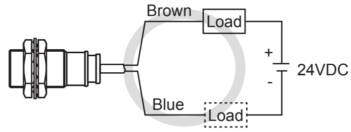
※In case of AC switching type, ② and ③, ① and ④ are connected to each other inside.

■ Proper Usage

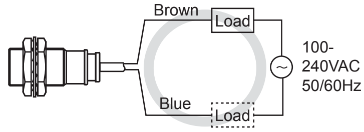
◎ Load connections



<DC 2-wire type & AC 2-wire type >



< DC 2-wire type >

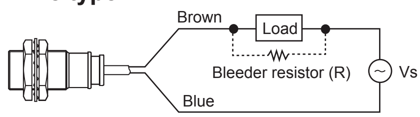


< AC 2-wire type >

When using DC or AC 2-wire type proximity sensor, the load must be connected otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● AC 2-wire type



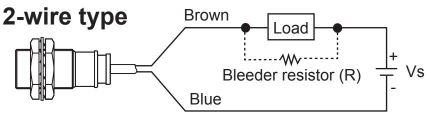
110VAC: Over 20kΩ 3W
220VAC: Over 39kΩ 10W

It may cause return failure of load by residual voltage.
If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \leq \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[I:Action current of load, R:Bleeder resistance, P:Permissible power]

● DC 2-wire type



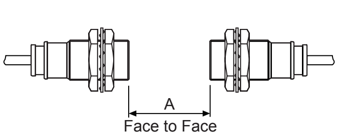
Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

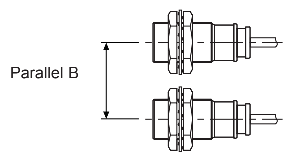
$$R \leq \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[Vs: Power supply, Io: Min. action current of proximity sensor
Ioff: Return current of load, P: Number of Bleeder resistance watt]

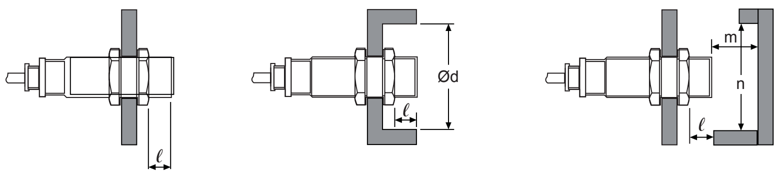
◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.





When sensors are mounted on metallic panel, it must be prevented sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



(unit: mm)

Model / Item	PRW08-1.5D□ PRWT08-1.5D□ PRWL08-1.5D□	PRW08-2D□ PRWT08-2D□ PRWL08-2D□	PRWT12-2D□ PRW12-2A□	PRWT12-4D□ PRW12-4A□	PRWT18-5D□ PRW(L)18-5D□ PRW(L)18-5A□	PRWT18-8D□ PRW(L)18-8D□ PRW(L)18-8A□	PRWT30-10D□ PRW(L)30-10D□ PRW(L)30-10A□	PRWT30-15D□ PRW(L)30-15D□ PRW(L)30-15A□
A	9	12	12	24	30	48	60	90
B	16	24	24	36	36	54	60	90
ℓ	0	8	0	11	0	14	0	15
Ød	8	24	12	36	18	54	30	90
m	4.5	6	6	12	15	24	30	45
n	12	24	18	36	27	54	45	90

Cylindrical Connector Type Proximity Sensor

■ Features

- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit (DC 3-wire type)
- Built-in surge protection circuit
- Built-in over-current protection circuit (DC type)
- IP67 protection structure (IEC standard) for connector part
- Replaceable for micro switches and limit switches

⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Specifications

● DC 2-wire type

Model	**PRCMT12-2DO** **PRCMT12-2DC** **PRCMT12-2DO-I** **PRCMT12-2DC-I**	**PRCMT12-4DO** **PRCMT12-4DC** **PRCMT12-4DO-I** **PRCMT12-4DC-I**	**PRCMT18-5DO** **PRCMT18-5DC** **PRCMT18-5DO-I** **PRCMT18-5DC-I**	**PRCMT18-8DO** **PRCMT18-8DC** **PRCMT18-8DO-I** **PRCMT18-8DC-I**	**PRCMT30-10DO** **PRCMT30-10DC** **PRCMT30-10DO-I** **PRCMT30-10DC-I**	**PRCMT30-15DO** **PRCMT30-15DC** **PRCMT30-15DO-I** **PRCMT30-15DC-I**
Sensing distance	2mm	4mm	5mm	8mm	10mm	15mm
Hysteresis	Max. 10% of sensing distance					
Standard sensing target	12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance	0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operating voltage)	12-24VDC (10-30VDC)					
Leakage current	Max. 0.6mA					
Response frequency※1	1.5kHz	500Hz	350Hz	400Hz	200Hz	
Residual voltage	Max. 3.5V					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃					
Control output	2 to 100mA					
Insulation resistance	Over 50MΩ (at 500VDC megger)					
Dielectric strength	1,500VAC 50/60Hz for 1minute					
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each of X, Y, Z directions for 2 hours					
Shock	500m/s² (approx. 50G) in each of X, Y, Z directions for 3 times					
Indicator	Operation indicator: Red LED					
Environment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
Environment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit	Surge protection circuit, Over-current protection					
Protection structure	IP67 (IEC standard)					
Material	Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate					
Approval	CE					
Weight※2	Approx. 38g (approx. 26g)		Approx. 60g (approx. 48g)		Approx. 154g (approx. 142g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parentheses in for unit only.
※There is IEC standard connector cable. Refer to the G-6 about IEC standard connector wires and specifications.
※Environment resistance is rated at no freezing or condensation.

■ Specifications

● DC 3-wire type

Model		**PRCM12-2DN PRCM12-2DP PRCM12-2DN2 PRCM12-2DP2**	**PRCM12-4DN PRCM12-4DP PRCM12-4DN2 PRCM12-4DP2**	**PRCM18-5DN PRCM18-5DP PRCM18-5DN2 PRCM18-5DP2 PRCML18-5DN PRCML18-5DP PRCML18-5DN2 PRCML18-5DP2**	**PRCM18-8DN PRCM18-8DP PRCM18-8DN2 PRCM18-8DP2 PRCML18-8DN PRCML18-8DP PRCML18-8DN2 PRCML18-8DP2**	**PRCM30-10DN PRCM30-10DP PRCM30-10DN2 PRCM30-10DP2 PRCML30-10DN PRCML30-10DP PRCML30-10DN2 PRCML30-10DP2**	**PRCM30-15DN PRCM30-15DP PRCM30-15DN2 PRCM30-15DP2 PRCML30-15DN PRCML30-15DP PRCML30-15DN2 PRCML30-15DP2**
Sensing distance		2mm	4mm	5mm	8mm	10mm	15mm
Hysteresis		Max. 10% of sensing distance					
Standard sensing target		12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Sensing distance		0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operating voltage)		12-24VDC (10-30VDC)					
Current consumption		Max. 10mA					
Response frequency※1		1.5kHz	500Hz	500Hz	350Hz	400Hz	200Hz
Residual voltage		Max. 1.5V					
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃					
Control output		Max. 200mA					
Insulation resistance		Over 50MΩ (at 500VDC megger)					
Dielectric strength		1,500VAC 50/60Hz for 1minute					
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each of X, Y, Z directions for 2 hours					
Shock		500m/s² (approx. 50G) in each of X, Y, Z directions for 3 times					
Indicator		Operation indicator: Red LED					
Environ-ment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit		Surge protection circuit, Reverse polarity protection circuit, Over-current protection					
Protection structure		IP67 (IEC Standard)					
Material		Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate					
Approval		CE					
Weight※2		Approx. 38g (approx. 26g)		PRCM: Approx. 61g (approx. 49g) PRCML: Approx. 85g (approx. 73g)		PRCM: Approx. 146g (approx. 134g) PRCML: Approx. 181g (approx. 169g)	

● AC 2-wire type

Model		**PRCM12-2AO PRCM12-2AC**	**PRCM12-4AO PRCM12-4AC**	**PRCM18-5AO PRCM18-5AC PRCML18-5AO PRCML18-5AC**	**PRCM18-8AO PRCM18-8AC PRCML18-8AO PRCML18-8AC**	**PRCM30-10AO PRCM30-10AC PRCML30-10AO PRCML30-10AC**	**PRCM30-15AO PRCM30-15AC PRCML30-15AO PRCML30-15AC**
Sensing distance		2mm	4mm	5mm	8mm	10mm	15mm
Hysteresis		Max. 10% of sensing distance					
Standard sensing target		12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Sensing distance		0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operating voltage)		100-240VAC (85-264VAC)					
Leakage current		Max. 2.5mA					
Response frequency※1		20Hz					
Residual voltage		Max. 10V					
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃					
Control output		5 to 150mA		5 to 200mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)					
Dielectric strength		2,500VAC 50/60Hz for 1minute					
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each of X, Y, Z directions for 2 hours					
Shock		500m/s² (approx. 50G) in each of X, Y, Z directions for 3 times					
Indicator		Operation indicator: Red LED					
Environ-ment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit		Surge protection circuit					
Protection structure		IP67 (IEC Standard)					
Insulation type		Double insulation or reinforced insulation (Mark: ⧈, dielectric strength between the measuring input part and the power part: 1kV)					
Material		Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate					
Approval		CE					
Weight※2		Approx. 42g (approx. 30g)		PRCM: Approx. 66g (approx. 54g) PRCML: Approx. 78g (approx. 66g)		PRCM: Approx. 154g (approx. 142g) PRCML: Approx. 194g (approx. 182g)	

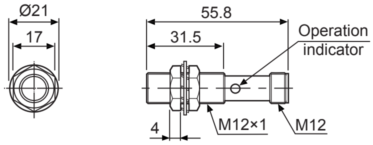
※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parentheses in for unit only.
※ Environment resistance is rated at no freezing or condensation.

PRCM Series

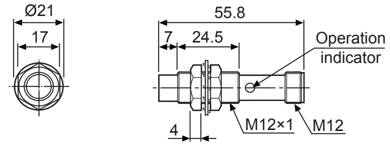
■ Dimensions

(unit: mm)

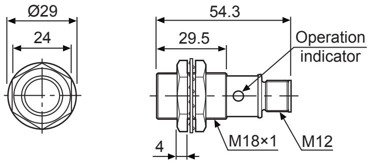
- **PRCM12-2D□ / PRCMT12-2D□(-I)**



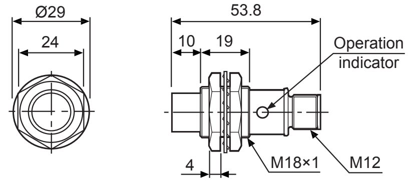
- **PRCM12-4D□ / PRCMT12-4D□(-I)**



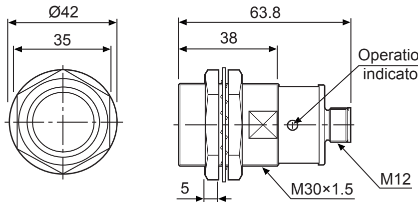
- **PRCM18-5D□ / PRCMT18-5D□(-I)**



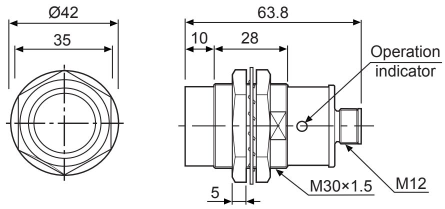
- **PRCM18-8D□ / PRCMT18-8D□(-I)**



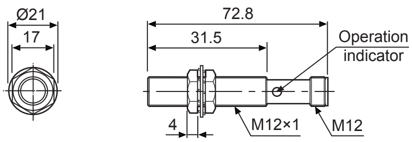
- **PRCM30-10D□ / PRCMT30-10D□(-I)**



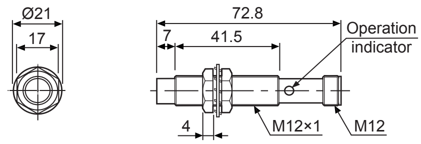
- **PRCM30-15D□ / PRCMT30-15D□(-I)**



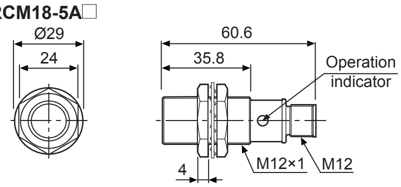
- **PRCM12-2A□**



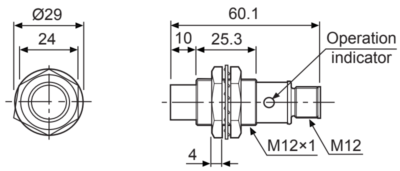
- **PRCM12-4A□**



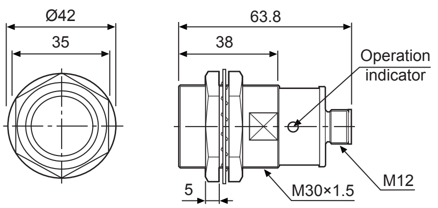
- **PRCM18-5A□**



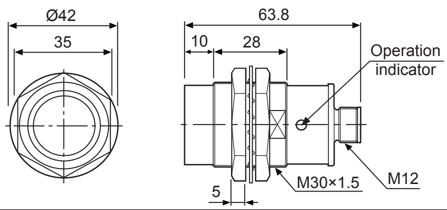
- **PRCM18-8A□**



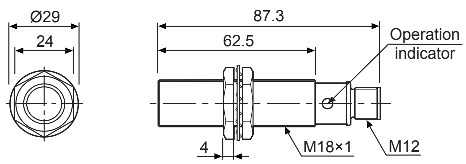
- **PRCM30-10A□**



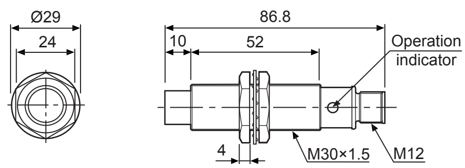
- **PRCM30-15A□**



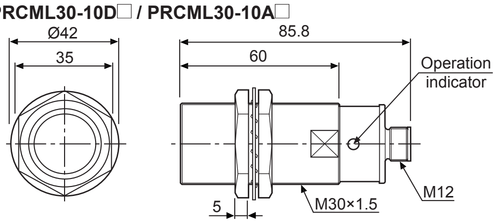
- **PRCML18-5D□ / PRCML18-5A□**



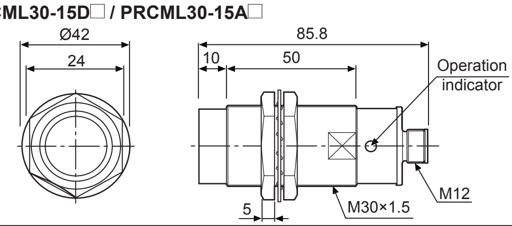
- **PRCML18-8D□ / PRCML18-8A□**



- **PRCML30-10D□ / PRCML30-10A□**

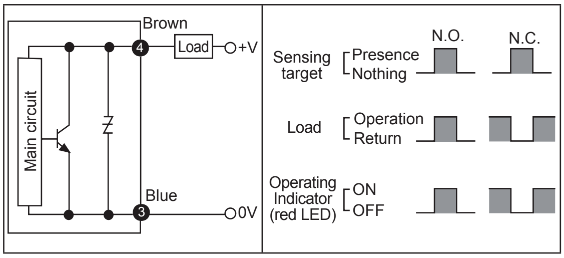


- **PRCML30-15D□ / PRCML30-15A□**



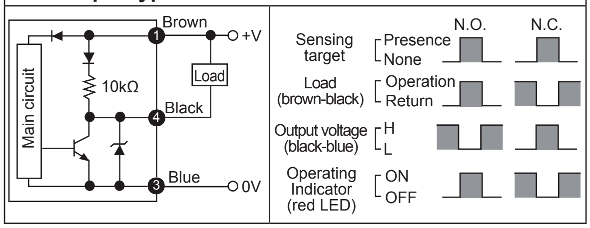
■ Control Output Diagram and Load Operation

◎ DC 2-wire type

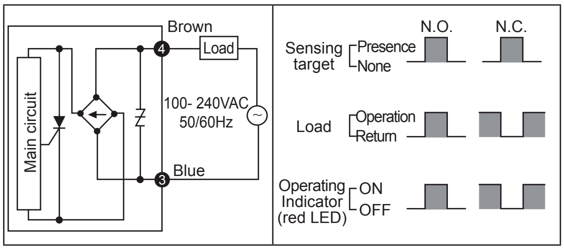


◎ DC 3-wire type

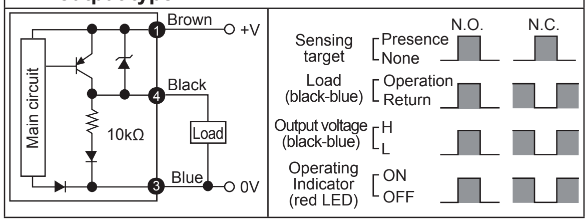
NPN output type



◎ AC 2-wire type



PNP output type

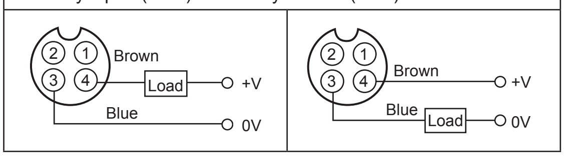


※The number in a circle is pin no. of connector.

■ Wiring Diagram

◎ DC 2-wire type (standard type)

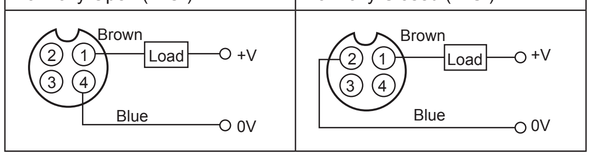
Normally Open (N.O.) / Normally Closed (N.C.)



※Pin ①, ② are not used terminals.
※For DC 3-wire type connector cable, it is available to use with black wire (12-24V DC) and blue wire (0V).

◎ DC 2-wire type (IEC standard type)

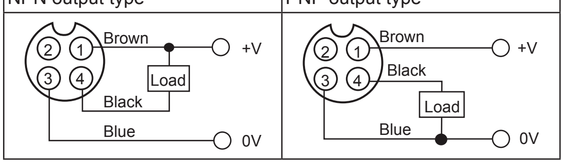
Normally Open (N.O.)	Normally Closed (N.C.)



※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The pin arrangement of connector applying IEC standard is being developed.
※Please attach "I" at the end of the name of standard type for purchasing the IEC standard product.
E.g.) PRCMT12-4DO-I
※The connector cable for IEC standard is being developed. Please attach "I' at the end of the name of standard type.
E.g.) CID2-2-I, CLD2-5-I

◎ DC 3-wire type

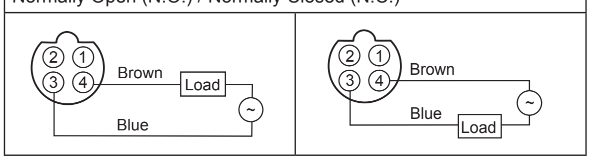
NPN output type	PNP output type



※Please fasten the cleat of connector not to shown the thread. (0.39 to 0.49N·m)

◎ AC 2-wire type

Normally Open (N.O.) / Normally Closed (N.C.)

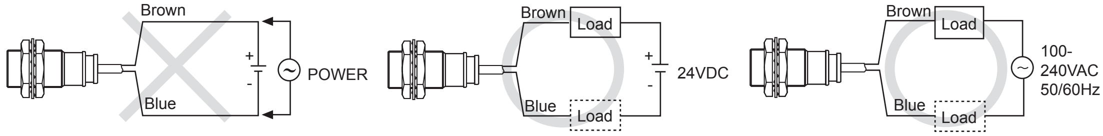


※In AC inductive type, ② and ③, ① and ④ are connected inside of the connector cable.

※Please fasten the vibration part with Teflon tape.
※Refer to the G-6 about IEC standard connector wires and specifications.

■ Proper Usage

◎ Load connections

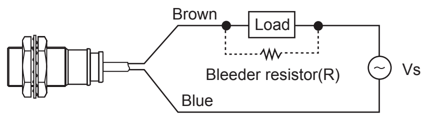


< DC 2-wire type & AC 2-wire type >   < DC 2-wire type >   < AC 2-wire type >

When using DC or AC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ Load connections

● **AC 2-wire type**



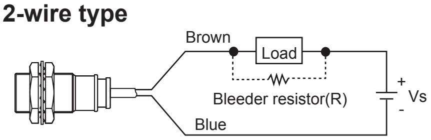
110VAC: Min. 20kΩ 3W
220VAC: Min. 39kΩ 10W

It may cause return failure of load by residual voltage.
If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$R \leq \frac{Vs}{I}(k\Omega)$ $P > \frac{Vs^2}{R}(W)$

[I:Action current of load, R:Bleeder resistance, P:Permissible power]

● **DC 2-wire type**



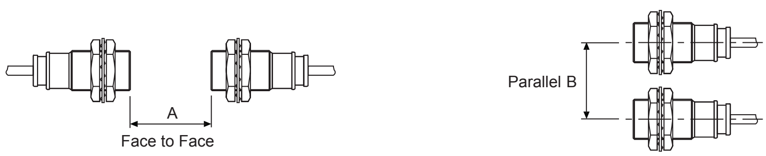
Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

$R \leq \frac{Vs}{Io\text{-}Ioff}(k\Omega)$ $P > \frac{Vs^2}{R}(W)$

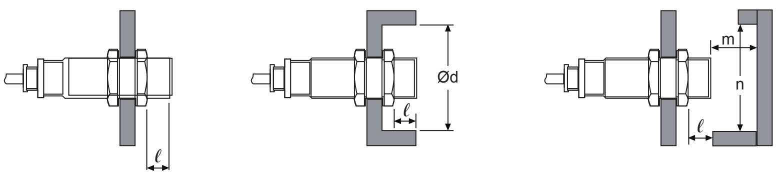
[Vs: Power supply, Ioff: Return current of load, Io: Min. action current of proximity sensor, P : Number of Bleeder resistance watt]

◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.



When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



(unit: mm)

Item \ Model	PRCMT12-2D□ PRCM12-2D□ PRCM12-2A□	PRCMT12-4D□ PRCM12-4D□ PRCM12-4A□	PRCMT18-5D PRCM(L)18-5D PRCM(L)18-5A	PRCMT18-8D□ PRCM(L)18-8D□ PRCM(L)18-8A□	PRCMT30-10D□ PRCM(L)30-10D□ PRCM(L)30-10D□	PRCMT30-15D PRCM(L)30-15D PRCM(L)30-15A
A	12	24	30	48	60	90
B	24	36	36	54	60	90
ℓ	0	11	0	14	0	15
Ød	12	36	18	54	30	90
m	6	12	15	24	30	45
n	18	36	27	54	45	90

Cylindrical, Long Sensing Distance, Cable Type Proximity Sensor

■ Features

- Long sensing distance
  (1.5 to 2 times longer sensing distance guaranteed compared to existing models)
- Improved the noise immunity with dedicated IC
- Built-in surge protection, reverse polarity protection, over-current protection circuit
- Long life cycle and high reliability, and simple operation
- Red LED operation indicator
- IP67 protection structure (IEC standard)
- Replaceable for micro switches and limit switches
- Strain relief cables: improved flexural strength of cable connecting component

⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Specifications

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

Model	**PRDT12-4 [D] O** **PRDT12-4 [D] C** **PRDT12-4DO-V** **PRDT12-4 [D] C-V** **PRDLT12-4DO** **PRDLT12-4DC** **PRDLT12-4DO-V** **PRDLT12-4DC-V**	**PRDT12-8 [D] O** **PRDT12-8 [D] C** **PRDT12-8 [D] O-V** **PRDT12-8 [D] C-V** **PRDLT12-8DO** **PRDLT12-8DC** **PRDLT12-8DO-V** **PRDLT12-8DC-V**	**PRDT18-7 [D] O** **PRDT18-7 [D] C** **PRDT18-7 [D] O-V** **PRDT18-7 [D] C-V** **PRDLT18-7 [D] O** **PRDLT18-7 [D] C** **PRDLT18-7 [D] O-V** **PRDLT18-7 [D] C-V**	**PRDT18-14 [D] O** **PRDT18-14 [D] C** **PRDT18-14 [D] O-V** **PRDT18-14 [D] C-V** **PRDLT18-14 [D] O** **PRDLT18-14 [D] C** **PRDLT18-14 [D] O-V** **PRDLT18-14 [D] C-V**	**PRDT30-15 [D] O** **PRDT30-15DC** **PRDT30-15 [D] O-V** **PRDT30-15DC-V** **PRDLT30-15DO** **PRDLT30-15DC** **PRDLT30-15DO-V** **PRDLT30-15DC-V**	**PRDT30-25 [D] O** **PRDT30-25 [D] C** **PRDT30-25 [D] O-V** **PRDT30-25 [D] C-V** **PRDLT30-25DO** **PRDLT30-25DC** **PRDLT30-25DO-V** **PRDLT30-25DC-V**
Sensing distance	4mm	8mm	7mm	14mm	15mm	25mm
Hysteresis	Max. 10% of sensing distance					
Standard sensing target	12×12×1mm (iron)	25×25×1mm (iron)	20×20×1mm (iron)	40×40×1mm (iron)	45×45×1mm (iron)	75×75×1mm (iron)
Setting distance	0 to 2.8mm	0 to 5.6mm	0 to 4.9mm	0 to 9.8mm	0 to 10.5mm	0 to 17.5mm
Power supply (operating voltage)	12-24VDC (10-30VDC)					
Leakage current	Max. 0.6mA					
Response frequency※1	450Hz	400Hz	250Hz	200Hz	100Hz	
Residual voltage※2	Max. 3.5V (non-polarity type is Max. 5V)					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃					
Control output	2 to 100mA					
Insulation resistance	Over 50MΩ (at 500VDC megger)					
Dielectric strength	1,500VAC 50/60Hz for 1 minute					
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock	500m/s² (approx. 50G) in X, Y, Z direction for 3 times					
Indicator	Operation indicator: Red LED					
Environment: Ambient temp.	-25 to 70℃, storage: -30 to 80℃					
Environment: Ambient humi.	35 to 95% RH, storage: 35 to 95% RH					
Protection circuit	Surge protection circuit, Reverse polarity protection circuit, Over-current protection circuit					
Material	Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Heat-resistant Acrylonitrile butadiene styrene Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)					
Cable	Ø4mm, 2-wire, 2m		Ø5mm, 2-wire, 2m			
	AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm					
Approval	CE					
Protection structure	IP67 (IEC standard)					
Unit weight	PRDT: Approx. 74g PRDLT: Approx. 94g	PRDT: Approx. 72g PRDLT: Approx. 92g	PRDT: Approx. 115g PRDLT: Approx. 145g	PRDT: Approx. 110g PRDLT: Approx. 140g	PRDT: Approx. 175g PRDLT: Approx. 215g	PRDT: Approx. 180g PRDLT: Approx. 220g

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Before using non-polarity type, check the condition of connected divice ※because residual voltage is 5V.
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※The last 'V' of model name is for the model with oil-resistance reinforced cable.
※Environment resistance is rated at no freezing or condensation.

▣ Specifications

● DC 3-wire type

Model	PRD12-4DN PRD12-4DP PRD12-4DN2 PRD12-4DP2 PRDL12-4DN PRDL12-4DP PRDL12-4DN2 PRDL12-4DP2	PRD12-8DN PRD12-8DP PRD12-8DN2 PRD12-8DP2 PRDL12-8DN PRDL12-8DP PRDL12-8DN2 PRDL12-8DP2	PRD18-7DN PRD18-7DP PRD18-7DN2 PRD18-7DP2 PRDL18-7DN PRDL18-7DP PRDL18-7DN2 PRDL18-7DP2	PRD18-14DN PRD18-14DP PRD18-14DN2 PRD18-14DP2 PRDL18-14DN PRDL18-14DP PRDL18-14DN2 PRDL18-14DP2	PRD30-15DN PRD30-15DP PRD30-15DN2 PRD30-15DP2 PRD30-15DN-V PRD30-15DP-V PRD30-15DN2-V PRD30-15DP2-V PRDL30-15DN PRDL30-15DP PRDL30-15DN2 PRDL30-15DP2	PRD30-25DN PRD30-25DP PRD30-25DN2 PRD30-25DP2 PRD30-25DN-V PRD30-25DP-V PRD30-25DN2-V PRD30-25DP2-V PRDL30-25DN PRDL30-25DP PRDL30-25DN2 PRDL30-25DP2
Sensing distance	4mm	8mm	7mm	14mm	15mm	25mm
Hysteresis	Max. 10% of sensing distance					
Standard sensing target	12×12×1mm (iron)	25×25×1mm (iron)	20×20×1mm (iron)	40×40×1mm (iron)	45×45×1mm (iron)	75×75×1mm (iron)
Setting distance	0 to 2.8mm	0 to 5.6mm	0 to 4.9mm	0 to 9.8mm	0 to 10.5mm	0 to 17.5mm
Power supply (operating voltage)	12-24VDC (10-30VDC)					
Leakage current	Max. 10mA					
Response frequency※1	500Hz	400Hz	300Hz	200Hz	100HZ	100Hz
Residual voltage	Max. 1.5V					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃					
Control output	200mA					
Insulation resistance	Over 50MΩ (at 500VDC megger)					
Dielectric strength	1,500VAC 50/60Hz for 1 minute					
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock	500m/s² (approx. 50G) in X, Y, Z direction for 3 times					
Indicator	Operation indicator: Red LED					
Environment: Ambient temp.	-25 to 70℃, storage: -30 to 80℃					
Environment: Ambient humi.	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit	Surge protection circuit, Reverse polarity protection circuit, Over-current protection circuit					
Protection structure	IP67 (IEC standard)					
Material	Case/Nut: Nickel plated Brass, Washer: Nickel plated Iron, Sensing surface: Heat-resistant Acrylonitrile butadiene styrene, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant Polyvinyl chloride (PVC)					
Cable	Ø4mm, 3-wire, 2m		Ø5mm, 3-wire, 2m			
	AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm					
Approval	CE					
Unit weight	PRD: Approx. 74g PRDL: Approx. 94g	PRD: Approx. 72g PRDL: Approx. 92g	PRD: Approx. 115g PRDL: Approx. 145g	PRD: Approx. 110g PRDL:Approx. 140g	PRD: Approx. 175g PRDL: Approx. 215g	PRD: Approx. 180g PRDL: Approx. 220g

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.

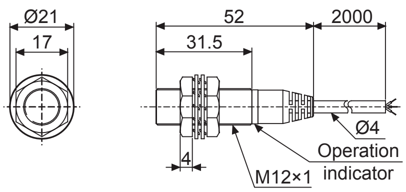
※The last 'V' of model name is for the model with oil-resistance reinforced cable.

※Environment resistance is rated at no freezing or condensation.

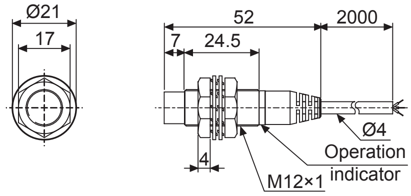
■ Dimensions

(unit: mm)

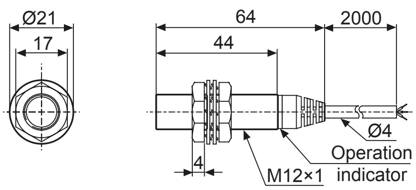
● **PRD(T)12-4D□**



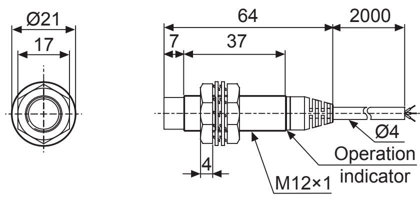
● **PRD(T)12-8D□**



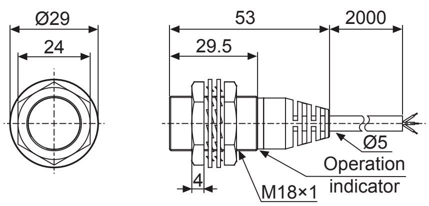
● **PRDL(T)12-4D□**



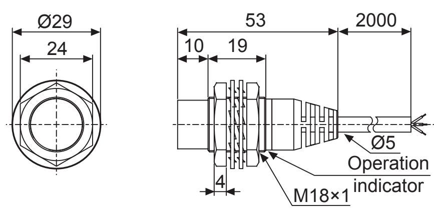
● **PRDL(T)12-8D□**



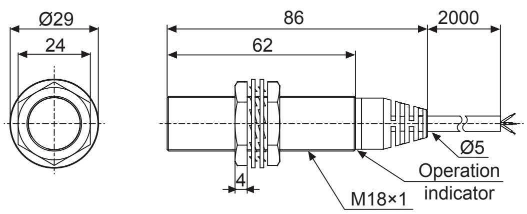
● **PRD(T)18-7D□**



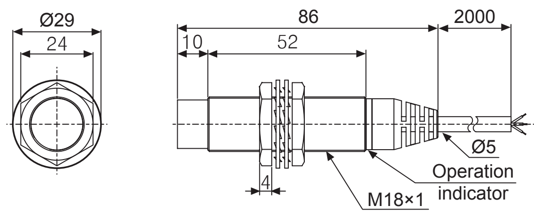
● **PRD(T)18-14D□**



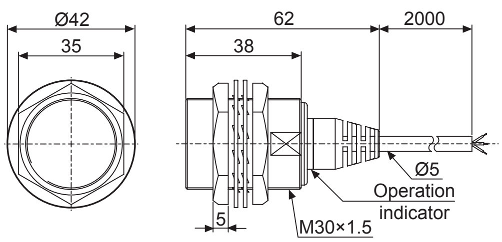
● **PRDL(T)18-7D□**



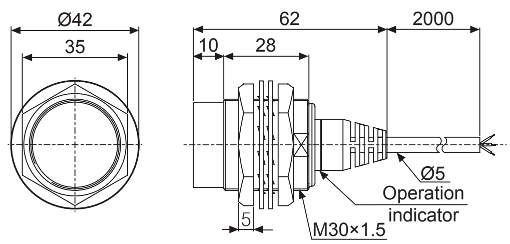
● **PRDL(T)18-14D□**



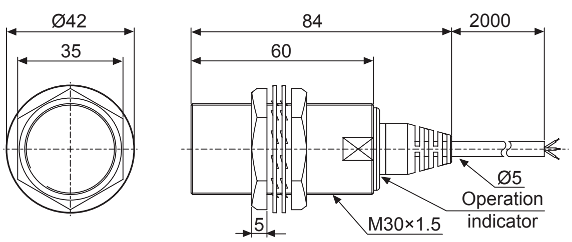
● **PRD(T)30-15D□**



● **PRD(T)30-25D□**



● **PRDL(T)30-15D□**



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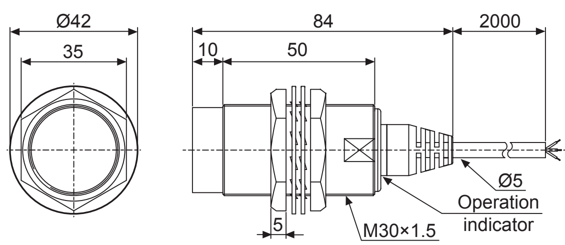
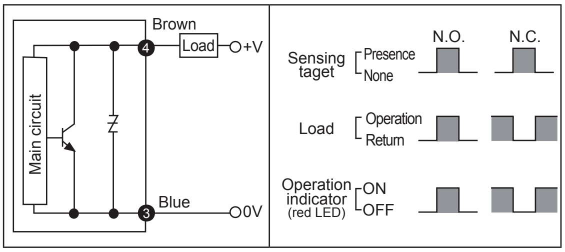


▣ Control Output Diagram And Load Operation

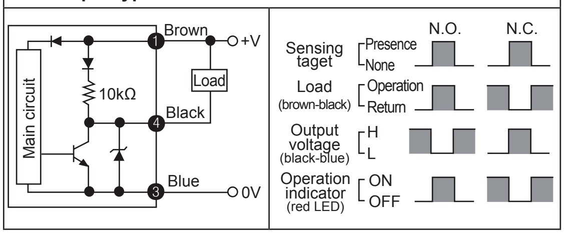
◎ DC 2-wire type



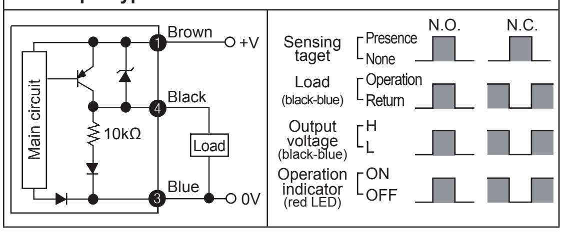
※The number in a circle is pin no. of connector.

◎ DC 3-wire type

NPN output type

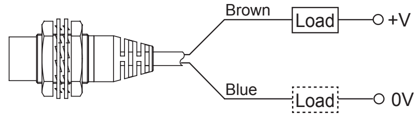


PNP output type



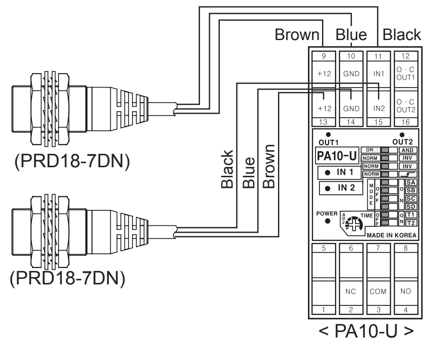
▣ Connections

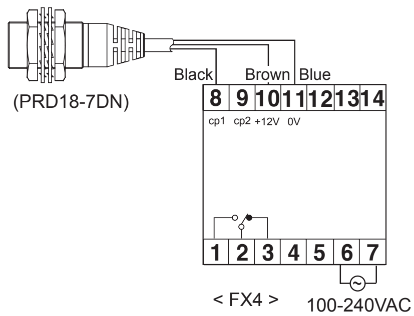
◎ DC 2-wire type



※The load can be connected to either wire.

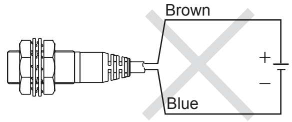
◎ DC 3-wire type



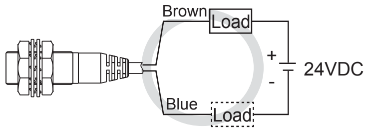


■ Proper Usage

◎ Load connections



< DC 2-wire type >

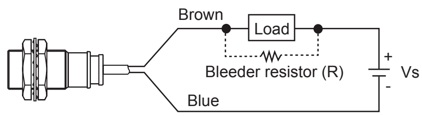


< DC 2-wire type >

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

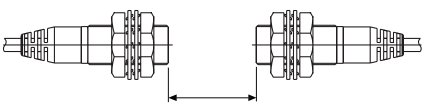
※W value of Bleeder resistor should be bigger for proper heat dissipation.

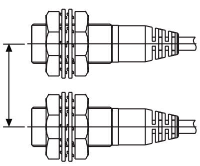
$$R \le \frac{Vs}{Io\text{-}Ioff}\ (k\Omega) \qquad P > \frac{Vs^2}{R}\ (W)$$

[Vs: Power supply, Io: Min. action current of proximity sensor, Ioff: Return current of load, P : Number of Bleeder resistance watt]

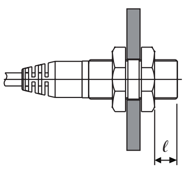
◎ Mutual-interference & Influence by surrounding metals

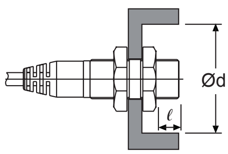
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.

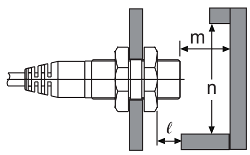




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







(unit: mm)

Item \ Model	PRDT12-4□□ PRDLT12-4□□	PRDT12-8□□ PRDLT12-8□□	PRDT18-7□□ PRDLT18-7□□	PRDT18-14□□ PRDLT18-14□□	PRDT30-15□□ PRDLT30-15□□	PRDT30-25□□ PRDLT30-25□□
A	24	48	42	84	90	150
B	24	36	36	54	60	90
ℓ	0	11	0	14	0	15
Ød	12	36	18	54	30	90
m	12	24	21	42	45	75
n	18	36	27	54	45	90

Cylindrical, Long Sensing Distance, Cable Connector Type Proximity Sensor

■ Features

- Long sensing distance
  (1.5 to 2 times longer sensing distance guaranteed compared to existing models)
- Improved the noise immunity with dedicated IC
- Built-in surge protection, reverse polarity protection, over-current protection circuit
- Long life cycle and high reliability, and simple operation
- Red LED operation indicator
- IP67 protection structure (IEC standard)
- Replaceable for micro switches and limit switches
- Strain relief cables: improved flexural strength of cable connecting component

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ Specifications

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

Model	PRDWT12-4DO PRDWT12-4DC PRDWT12-4DO-I PRDWT12-4DC-I PRDWT12-4DO-IV PRDWT12-4DC-IV	PRDWT12-8DO PRDWT12-8DC PRDWT12-8DO-I PRDWT12-8DC-I PRDWT12-8DO-IV PRDWT12-8DC-IV	PRDWT18-7DO PRDWT18-7DC PRDWT18-7DO-I PRDWT18-7DC-I PRDWT18-7DO-IV PRDWT18-7DC-IV PRDWLT18-7DO-IV PRDWLT18-7DC-IV	PRDWT18-14DO PRDWT18-14DC PRDWT18-14DO-I PRDWT18-14DC-I PRDWT18-14DO-IV PRDWT18-14DC-IV	PRDWT30-15DO PRDWT30-15DC PRDWT30-15DO-I PRDWT30-15DC-I PRDWT30-15DO-IV PRDWT30-15DC-IV	PRDWT30-25DO PRDWT30-25DC PRDWT30-25DO-I PRDWT30-25DC-I PRDWT30-25DO-IV PRDWT30-25DC-IV
Sensing distance	4mm	8mm	7mm	14mm	15mm	25mm
Hysteresis	Max. 10% of sensing distance					
Standard sensing target	12×12×1mm (iron)	25×25×1mm (iron)	20×20×1mm (iron)	40×40×1mm (iron)	45×45×1mm (iron)	75×75×1mm (iron)
Setting distance	0 to 2.8mm	0 to 5.6mm	0 to 4.9mm	0 to 9.8mm	0 to 10.5mm	0 to 17.5mm
Power supply (operating voltage)	12-24VDC (10-30VDC)					
Leakage current	Max. 0.6mA					
Response frequency※1	450Hz	400Hz	250Hz	200Hz	100Hz	
Residual voltage※2	Max. 3.5V (non-polarity type is Max. 5V)					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃					
Control output	2 to 100mA					
Insulation resistance	Over 50MΩ (at 500VDC megger)					
Dielectric strength	1,500VAC 50/60Hz for 1 minute					
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock	500m/s² (approx. 50G) in X, Y, Z direction for 3 times					
Indicator	Operation indicator: Red LED					
Environment — Ambient temp.	-25 to 70℃, storage: -30 to 80℃					
Environment — Ambient humi.	35 to 95% RH, storage: 35 to 95% RH					
Protection circuit	Surge protection circuit, Reverse polarity protection circuit, Over-current protection circuit					
Material	Case/Nut: Nickel plated Brass, Washer: Nickel plated Iron, Sensing surface: Heat-resistant ABS Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant Polyvinyl chloride (PVC)					
Cable	Ø4mm, 2-wire, 2m		Ø5mm, 2-wire, 2m			
	M12 connector, 300mm (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm)					
Approval	CE					
Protection structure	IP67 (IEC standard)					
Unit weight	PRDWT: Approx. 44g	PRDWT: Approx. 42g	PRDWT: Approx. 80g PRDWLT: Approx. 42g	PRDWT: Approx. 75g PRDWLT: Approx. 105g	PRDWT: Approx. 140g	PRDWT: Approx. 145g

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Before using non-polarity type, check the condition of connected divice ※because residual voltage is 5V.
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※The last 'V' of model name is for the model with oil-resistance reinforced cable.
※Environment resistance is rated at no freezing or condensation.

■ Specifications

● DC 3-wire type

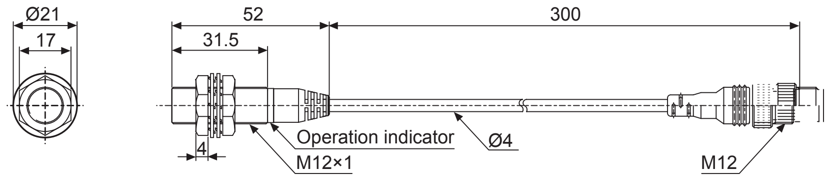
Model	**PRDW12-4DN PRDW12-4DP PRDW12-4DN2 PRDW12-4DP2 PRDW12-4DN-V PRDW12-4DP-V PRDW12-4DN2-V PRDW12-4DP2-V PRDWL12-4DN PRDWL12-4DP PRDWL12-4DN2 PRDWL12-4DP2**	**PRDW12-8DN PRDW12-8DP PRDW12-8DN2 PRDW12-8DP2 PRDW12-8DN-V PRDW12-8DP-V PRDW12-8DN2-V PRDW12-8DP2-V PRDWL12-8DN PRDWL12-8DP PRDWL12-8DN2 PRDWL12-8DP2**	**PRDW18-7DN PRDW18-7DP PRDW18-7DN2 PRDW18-7DP2 PRDW18-7DN-V PRDW18-7DP-V PRDW18-7DN2-V PRDW18-7DP2-V PRDWL18-7DN PRDWL18-7DP PRDWL18-7DN2 PRDWL18-7DP2**	**PRDW18-14DN PRDW18-14DP PRDW18-14DN2 PRDW18-14DP2 PRDW18-14DN-V PRDW18-14DP-V PRDW18-14DN2-V PRDW18-14DP2-V PRDWL18-14DN PRDWL18-14DP PRDWL18-14DN2 PRDWL18-14DP2**	**PRDW30-15DN PRDW30-15DP PRDW30-15DN2 PRDW30-15DP2 PRDW30-15DN-V PRDW30-15DP-V PRDW30-15DN2-V PRDW30-15DP2-V PRDWL30-15DN PRDWL30-15DP PRDWL30-15DN2 PRDWL30-15DP2**	**PRDW30-25DN PRDW30-25DP PRDW30-25DN2 PRDW30-25DP2 PRDW30-25DN-V PRDW30-25DP-V PRDW30-25DN2-V PRDW30-25DP2-V PRDWL30-25DN PRDWL30-25DP PRDWL30-25DN2 PRDWL30-25DP2**
Sensing distance	4mm	8mm	7mm	14mm	15mm	25mm
Hysteresis	Max. 10% of sensing distance					
Standard sensing target	12×12×1mm (iron)	25×25×1mm (iron)	20×20×1mm (iron)	40×40×1mm (iron)	45×45×1mm (iron)	75×75×1mm (iron)
Setting distance	0 to 2.8mm	0 to 5.6mm	0 to 4.9mm	0 to 9.8mm	0 to 10.5mm	0 to 17.5mm
Power supply (operating voltage)	12-24VDC (10-30VDC)					
Leakage current	Max. 10mA					
Response frequency※1	500Hz	400Hz	300Hz	200Hz	100HZ	100Hz
Residual voltage	Max. 1.5V					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃					
Control output	200mA					
Insulation resistance	Over 50MΩ (at 500VDC megger)					
Dielectric strength	1,500VAC 50/60Hz for 1 minute					
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock	500m/s² (approx. 50G) in X, Y, Z direction for 3 times					
Indicator	Operation indicator: Red LED					
Environ-ment: Ambient temp.	-25 to 70℃, storage: -30 to 80℃					
Environ-ment: Ambient humi.	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit	Surge protection circuit, Reverse polarity protection circuit, Over-current protection circuit					
Protection structure	IP67 (IEC standard)					
Material	Case/Nut: Nickel plated Brass, Washer: Nickel plated Iron, Sensing surface: Heat-resistant ABS, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant Polyvinyl chloride (PVC)					
Cable	Ø4mm, 3-wire, 2m		Ø5mm, 3-wire, 2m			
Cable	M12 connector, 300mm (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm)					
Approval	CE					
Unit weight	PRDW: Approx. 44g PRDWL: Approx. 64g	PRDW: Approx. 42g PRDWL: Approx. 62g	PRDW: Approx. 80g PRDWL: Approx. 110g	PRDW: Approx. 75g PRDWL: Approx. 105g	PRDW: Approx. 140g PRDWL: Approx. 180g	PRDW: Approx. 145g PRDWL: Approx. 185g

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※The last 'V' of model name is for the model with oil-resistance reinforced cable.
※Environment resistance is rated at no freezing or condensation.

■ Dimensions

(unit: mm)

● **PRDW(T)12-4D□**



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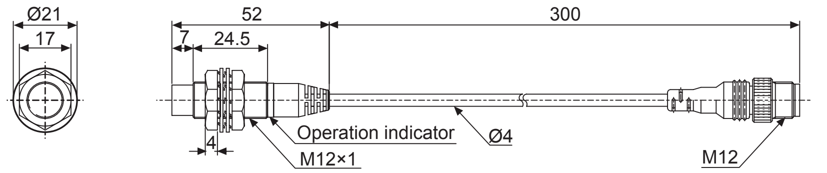
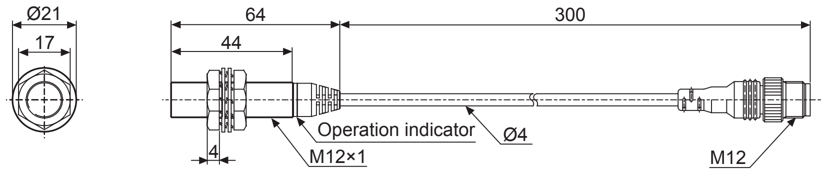
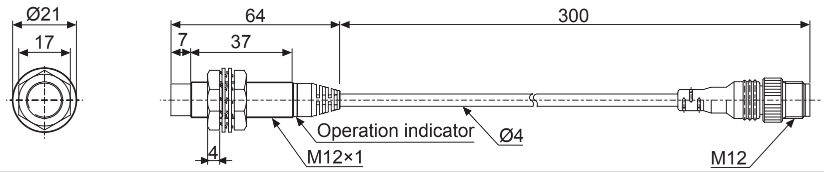


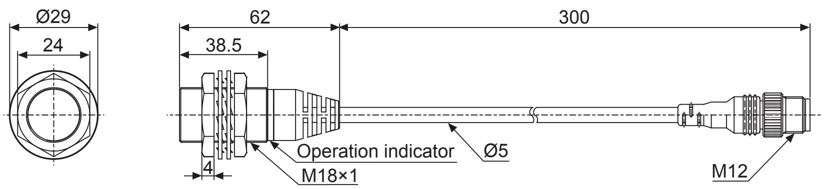
● **PRDWL12-4D□**



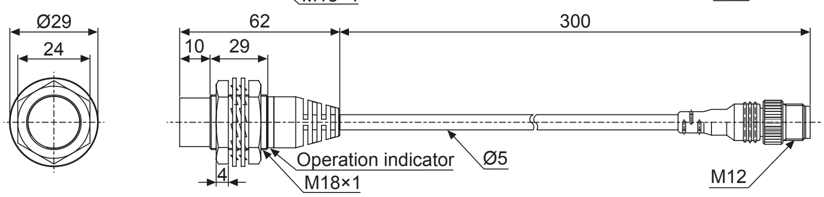
● **PRDWL12-8D□**



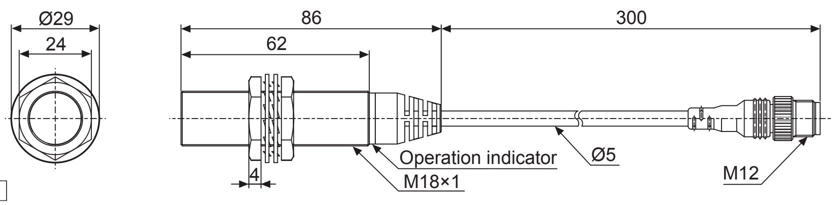
● **PRDW(T)18-7D□**



● **PRDW(T)18-14D□**



● **PRDWL(T)18-7D□**



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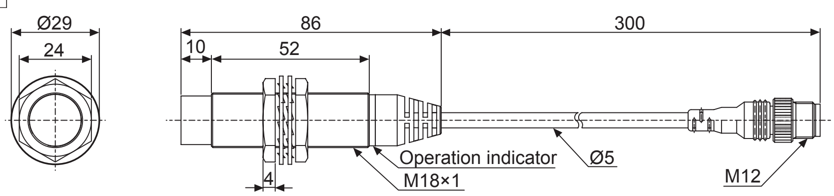
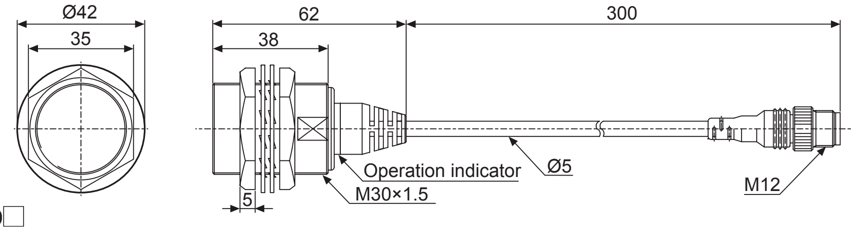


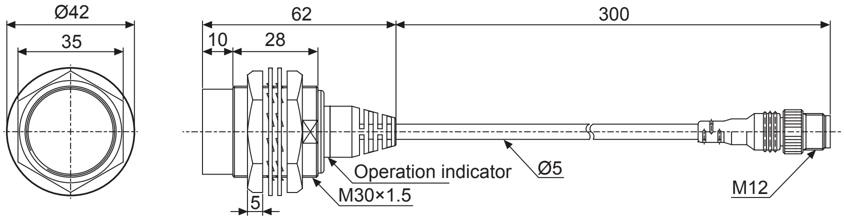
■ Dimensions

(unit: mm)

● **PRDW(T)30-15D□**



● **PRDW(T)30-25D□**



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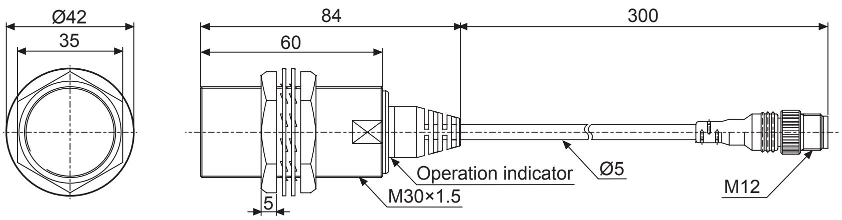
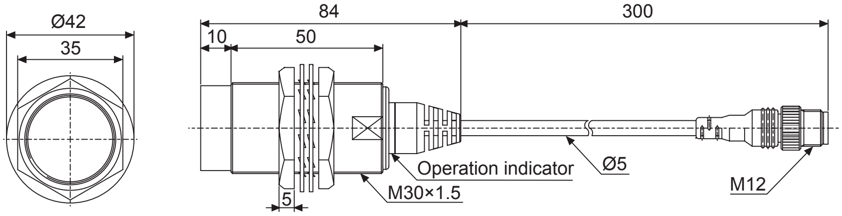
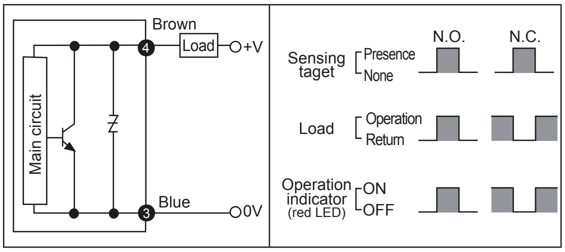


● **PRDWL(T)30-25D□**



▣ Control Output Diagram And Load Operation

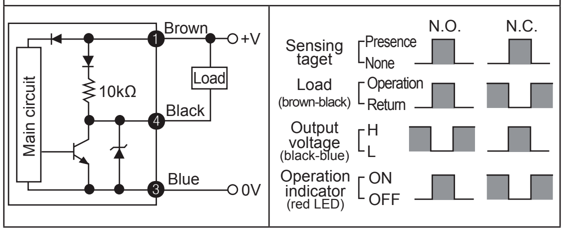
◎ DC 2-wire type



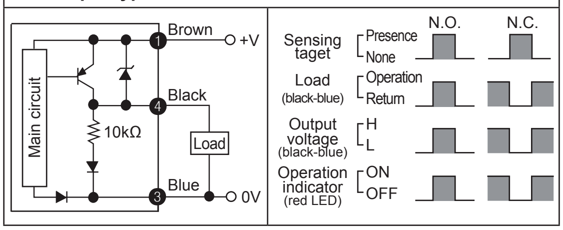
※The number in a circle is pin no. of connector.

◎ DC 3-wire type

NPN output type



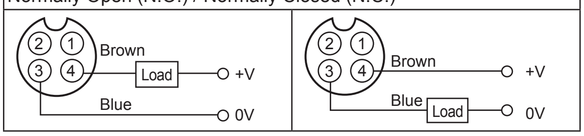
PNP output type



▣ Wiring Diagram

◎ DC 2-wire type (standard type)

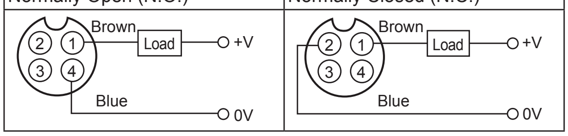
Normally Open (N.O.) / Normally Closed (N.C.)



※Pin ①, ② are not used terminals.
※When using DC 3-wire type of connector cable, black (12-24VDC) and blue (0V) cables can be used.

◎ DC 2-wire type (IEC standard type)

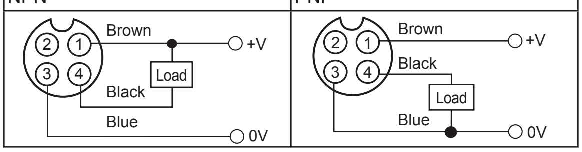
Normally Open (N.O.) | Normally Closed (N.C.)



※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The type, pin arrangement of connector based upon IEC standard is being developed.
※Please put "I" behind of standard type for purchasing IEC standard product. E.g.) PRAWT12-4DO-I
※Please put "I" behind of model name for selecting proximity sensor by IEC standard. E.g.) CID2-2-I, CLD2-2-I

◎ DC 3-wire type

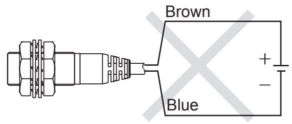
NPN | PNP



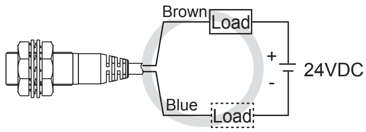
※Please fasten the cleat of connector not to shown the thread. (0.39 to 0.49N·m)
※Please fasten the vibration part with Teflon tape.
※Refer to the G-6 for IEC standard connector cables and specifications.

■ Proper Usage

◎ Load connections



< DC 2-wire type >

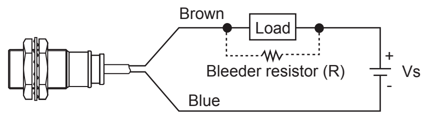


< DC 2-wire type >

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● **DC 2-wire type**



Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

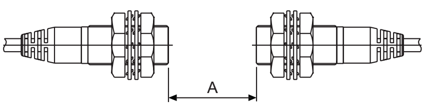
※W value of Bleeder resistor should be bigger for proper heat dissipation.

$$R \leq \frac{Vs}{Io\text{-}Ioff}\ (k\Omega) \qquad P > \frac{Vs^2}{R}\ (W)$$

[Vs: Power supply, Io: Min. action current of proximity sensor, Ioff: Return current of load, P : Number of Bleeder resistance watt]

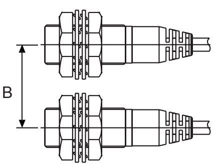
◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.

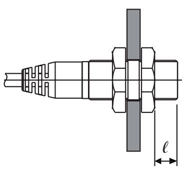


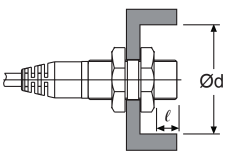
Face to Face

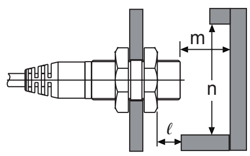
Parallel B



When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







(unit: mm)

Item \ Model	PRDWT12-4□□	PRDWT12-8□□	PRDWT18-7□□ PRDWLT18-7□□	PRDWT18-14□□	PRDWT30-15□□	PRDWT30-25□□
A	24	48	42	84	90	150
B	24	36	36	54	60	90
ℓ	0	11	0	14	0	15
Ød	12	36	18	54	30	90
m	12	24	21	42	45	75
n	18	36	27	54	45	90

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Cylindrical Long Sensing Distance, Connector Type Proximity Sensor

■ Features

- **Long sensing distance (1.5 to 2 times longer sensing distance guaranteed compared to existing models)**
- Advanced durability as comprehensive existing case and rear cap structure
- Easy to check operation from various angles with 4-side LED
- Shorten the time of maintenance
- Improved the noise immunity with dedicated IC
- Built-in surge protection, reverse polarity protection, over-current protection circuit
- Red LED operation indicator
- IP67 protection structure (IEC standard)

Please read "Caution for your safety" in operation manual before using.

CE

■ Specifications

● DC 2-wire type

Model※1		PRDCMT12-4DO PRDCMT12-4DC PRDCMT12-4DO-I PRDCMT12-4DC-I	PRDCMT12-8DO PRDCMT12-8DC PRDCMT12-8DO-I PRDCMT12-8DC-I	PRDCMT18-7DO PRDCMT18-7DC PRDCMT18-7DO-I PRDCMT18-7DC-I PRDCMLT18-7DO PRDCMLT18-7DC PRDCMLT18-7DO-I PRDCMLT18-7DC-I	PRDCMT18-14DO PRDCMT18-14DC PRDCMT18-14DO-I PRDCMT18-14DC-I PRDCMLT18-14DO PRDCMLT18-14DC PRDCMLT18-14DO-I PRDCMLT18-14DC-I	PRDCMT30-15DO PRDCMT30-15DC PRDCMT30-15DO-I PRDCMT30-15DC-I PRDCMLT30-15DO PRDCMLT30-15DC PRDCMLT30-15DO-I	PRDCMT30-25DO PRDCMT30-25DC PRDCMT30-25DO-I PRDCMT30-25DC-I
Sensing distance		4mm	8mm	7mm	14mm	15mm	25mm
Hysteresis		Max. 10% of sensing distance					
Standard sensing target		12×12×1mm (iron)	25×25×1mm (iron)	20×20×1mm (iron)	40×40×1mm (iron)	45×45×1mm (iron)	75×75×1mm (iron)
Setting distance		0 to 2.8mm	0 to 5.6mm	0 to 5.6mm	0 to 9.8mm	0 to 10.5mm	0 to 17.5mm
Power supply (operating voltage)		12-24VDC (10-30VDC)					
Leakage current		Max. 0.6mA					
Response frequency※2		450Hz	400Hz	250Hz	200Hz	100Hz	100Hz
Residual voltage		Max. 3.5V					
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃					
Control output		2 to 100mA					
Insulation resistance		Over 50MΩ (at 500VDC megger)					
Dielectric strength		1,500VAC 50/60Hz for 1 minute					
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times					
Indicator		Operation indicator: Red LED					
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit		Surge protection circuit, Reverse polarity protection circuit, Over-current protection circuit					
Material		Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Heat-resistant Acrylonitrile butadiene styrene					
Approval		CE					
Protection structure		IP67 (IEC standard)					
Unit weight※3	Existing	PRDCMT: Approx. 26g PRDCMLT: Approx. 36g		PRDCMT: Approx. 48g PRDCMLT: Approx. 66g		PRDCMT: Approx. 142g PRDCMLT: Approx. 182g	
	Upgrade	Approx. 23.5g	Approx. 22g	Approx. 46.5g	Approx. 42.5g	Approx. 160g	Approx. 165g

※1: PRDCMT series is going to upgrade performance (4-side LED) and structure (comprehensive existing case and rear cap type).
※2: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※3: **Upgrade unit weight is only for PRDCMT. Refer to the existing unit weight for the other models or existing products.**
※Environment resistance is rated at no freezing or condensation.

Specifications

● DC 3-wire type

Model		PRDCM12-4DN PRDCM12-4DP PRDCM12-4DN2 PRDCM12-4DP2 PRDCML12-4DN PRDCML12-4DP PRDCML12-4DN2 PRDCML12-4DP2	PRDCM12-8DN PRDCM12-8DP PRDCM12-8DN2 PRDCM12-8DP2 PRDCML12-8DN PRDCML12-8DP PRDCML12-8DN2 PRDCML12-8DP2	PRDCM18-7DN PRDCM18-7DP PRDCM18-7DN2 PRDCM18-7DP2 PRDCML18-7DN PRDCML18-7DP PRDCML18-7DN2 PRDCML18-7DP2	PRDCM18-14DN PRDCM18-14DP PRDCM18-14DN2 PRDCM18-14DP2 PRDCML18-14DN PRDCML18-14DP PRDCML18-14DN2 PRDCML18-14DP2	PRDCM30-15DN PRDCM30-15DP PRDCM30-15DN2 PRDCM30-15DP2 PRDCML30-15DN PRDCML30-15DP PRDCML30-15DN2 PRDCML30-15DP2	PRDCM30-25DN PRDCM30-25DP PRDCM30-25DN2 PRDCM30-25DP2 PRDCML30-25DN PRDCML30-25DP PRDCML30-25DN2 PRDCML30-25DP2
Sensing distance		4mm	8mm	7mm	14mm	15mm	25mm
Hysteresis		Max. 10% of sensing distance					
Standard sensing target		12×12×1mm (iron)	25×25×1mm (iron)	20×20×1mm (iron)	40×40×1mm (iron)	45×45×1mm (iron)	75×75×1mm (iron)
Setting distance		0 to 2.8mm	0 to 5.6mm	0 to 4.9mm	0 to 9.8mm	0 to 10.5mm	0 to 17.5mm
Power supply (operating voltage)		12-24VDC (10-30VDC)					
Current consumption		Max. 10mA					
Response frequency※1		500Hz	400Hz	300Hz	200Hz	100Hz	100Hz
Residual voltage		Max. 1.5V					
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃					
Control output		Max. 200mA					
Insulation resistance		Over 50MΩ (at 500VDC megger)					
Dielectric strength		1,500VAC 50/60Hz for 1 minute					
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times					
Indicator		Operation indicator: Red LED					
Environ-ment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit		Surge protection circuit, Reverse polarity protection circuit, Over-current protection circuit					
Protection structure		IP67 (IEC standard)					
Material		Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Heat-resistant Acrylonitrile butadiene styrene					
Approval		CE					
Unit Weight		PRDCM: Approx. 26g PRDCML: Approx. 34g		PRDCM: Approx. 48g PRDCML: Approx. 66g		PRDCM: Approx. 142g PRDCML: Approx. 182g	

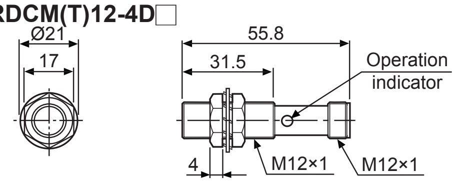
※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※Environment resistance is rated at no freezing or condensation.

Dimensions

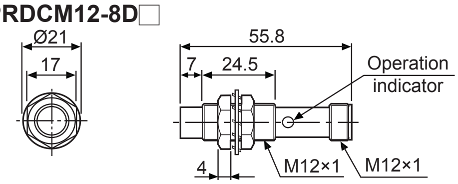
◎ PRDCM(T) Series

(unit: mm)

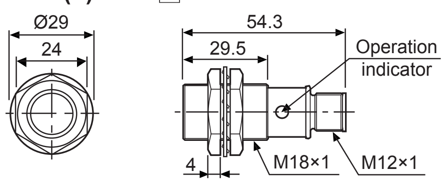
● PRDCM(T)12-4D□



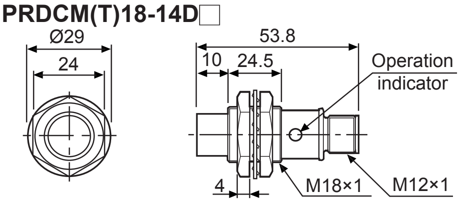
● PRDCM12-8D□



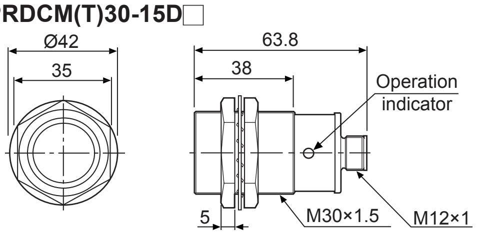
● PRDCM(T)18-7D□



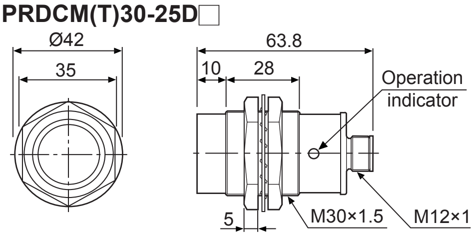
● PRDCM(T)18-14D□



● PRDCM(T)30-15D□



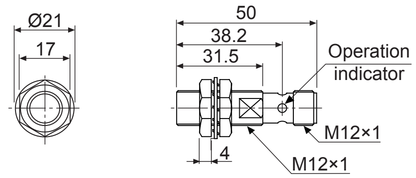
● PRDCM(T)30-25D□



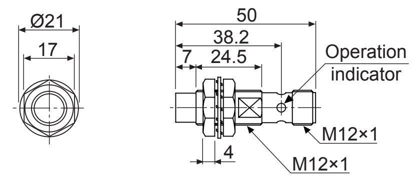
■ Dimensions

◎ PRDCMT Series

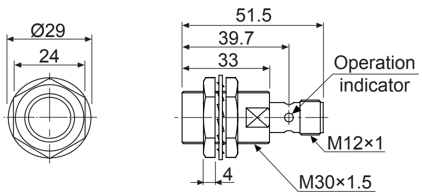
● **PRDCMT12-4D□**



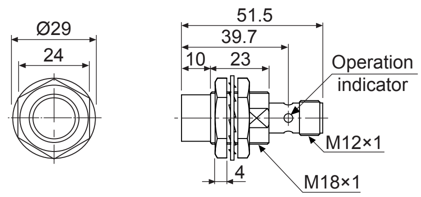
● **PRDCMT12-8D□**



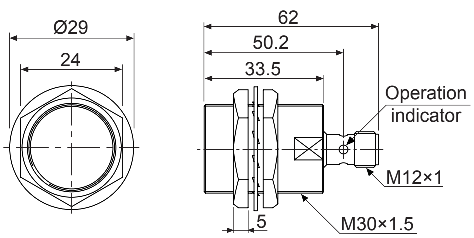
● **PRDCMT18-7D□**



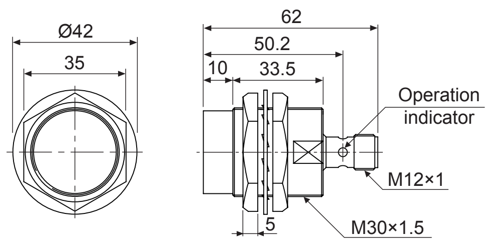
● **PRDCMT18-14D□**



● **PRDCMT30-15D□**

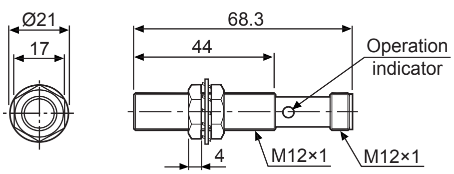


● **PRDCMT30-25D□**

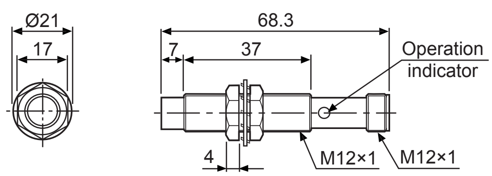


◎ PRDCML(T) Series

● **PRDCML12-4D□**



● **PRDCML12-8D□**



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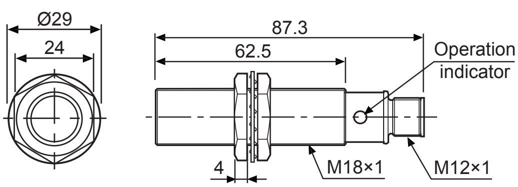

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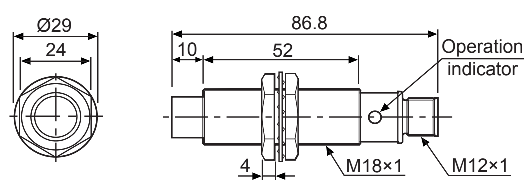
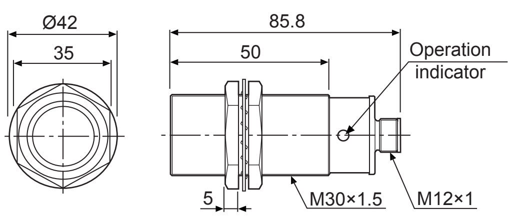


● **PRDCML(T)30-15D□**



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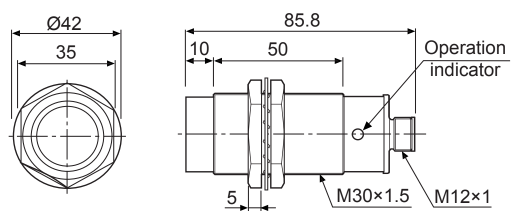
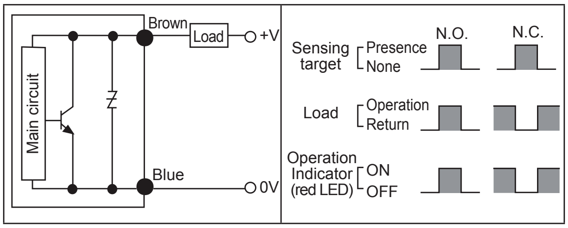


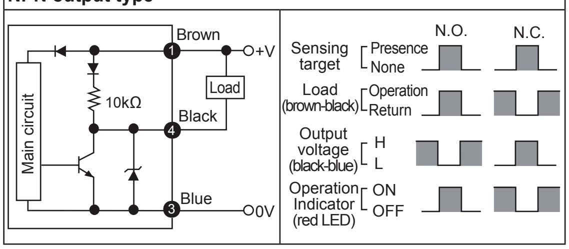
■ Control Output Diagram And Load Operation

◎ DC 2-wire type

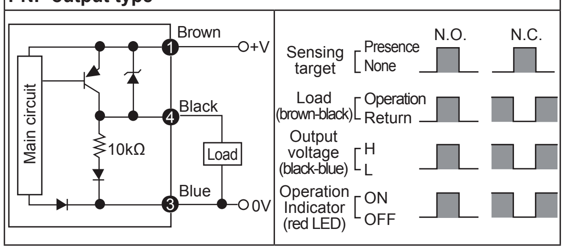


◎ DC 3-wire type

NPN output type



PNP output type

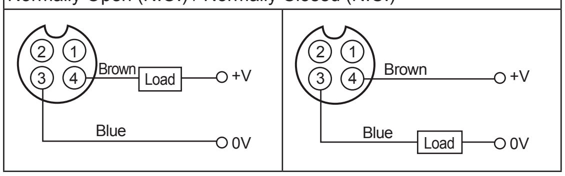


※The number in a circle is pin no. of connector.

■ Wiring Diagram

◎ DC 2-wire type (standard type)

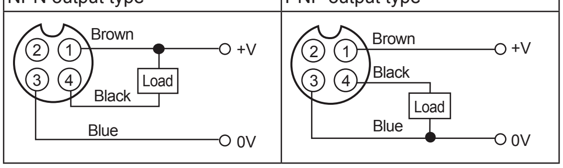
Normally Open (N.O.) / Normally Closed (N.C.)



※Pin ①, ② are not used terminals.
※For DC 3-wire type connector cable, it is available to use with black wire (12-24VDC) and blue wire (0V).

◎ DC 3-wire type

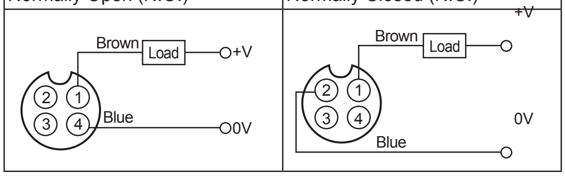
NPN output type / PNP output type



※Please fasten the cleat of connector not to shown the thread. (0.39 to 0.49N·m)

◎ DC 2-wire type (IEC standard type)

Normally Open (N.O.) / Normally Closed (N.C.)

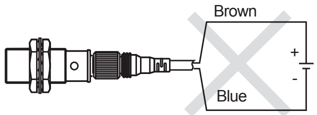


※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The pin arrangement of connector applying IEC standard is being developed.
※Please attach "I" at the end of the name of standard type for purchasing the IEC standard product. E.g.)PRDCMT12-4DO-I
※The connector cable for IEC standard is being developed. Please attach "I' at the end of the name of standard type. E.g.)CID2-2-I, CLD2-5-I

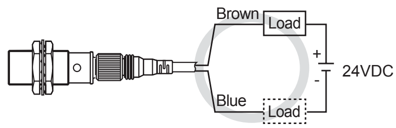
※Please fasten the vibration part with Teflon tape.
※Refer to page G-6 about IEC standard connector wires and specifications.

▣ Proper Usage

◎ Load connections



< DC 2-wire type >

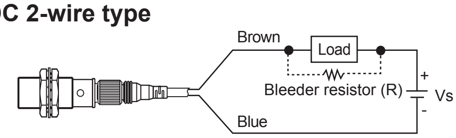


< DC 2-wire type >

When using DC 2-wire type proximity sensor, the load must be connected otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



It may cause return failure of load by residual voltage.
If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \leq \frac{Vs}{I} (k\Omega) \qquad P > \frac{Vs^2}{R} (W)$$

[I:Action current of load, R:Bleeder resistance, P:Permissible power]

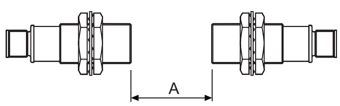
Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

$$R \leq \frac{Vs}{Io\text{-}Ioff} (k\Omega) \qquad P > \frac{Vs^2}{R} (W)$$

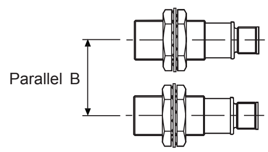
[Vs: Power supply, Io: Min. action current of proximity sensor, Ioff: Return current of load, P : Number of Bleeder resistance watt]

◎ Mutual-interference & Influence by surrounding metals

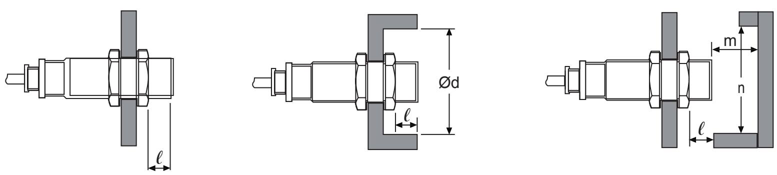
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.



Face to Face



When sensors are mounted on metallic panel, you must prevent the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



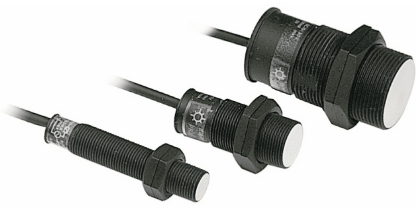
(unit: mm)

Item \ Model	PRDCMT08-2D□	PRDCMT08-4D□	PRDCMT12-4D□	PRDCM(T)18-7D□	PRDCM(T)18-7D□	PRDCM(T)18-14D□	PRDCM(T)18-15D□	PRDCM(T)18-25D□
	—	—	PRDCML12-4D□	PRDCML12-8D□	PRDCML(T)18-7D□	PRDCML(T)18-14D□	PRDCML(T)18-15D□	PRDCML(T)18-25D□
A	12	24	24	48	42	84	90	150
B	16	24	24	36	36	54	60	90
ℓ	0	10	0	11	0	14	0	15
Ød	8	24	12	36	18	54	30	90
m	6	12	12	24	21	42	45	75
n	12	24	18	36	27	54	45	90

Cylindrial, Spatter-Resistance, Cable Type Proximity Sensor

■ Features

- Coated with teflon against thermal resistance (prevention of malfunction due to spatter)
- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit (DC 3-wire type)
- Built-in surge protection circuit
- Built-in over-current protection circuit (DC type)
- IP67 protection structure (IEC standard)
- Replaceable for spatter-resistance type limit switches



⚠ **Please read "Caution for your safety" in operation manual before using.**

■ The Characteristic Of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with teflon against thermal resistance.
Also, the protection cover sold optionally has the same function.

■ Specifications

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

Model	**PRAT12-2$\boxed{D}$O** **PRAT12-2$\boxed{D}$C** **PRAT12-2DO-C** **PRAT12-2DC-V**	**PRAT18-5$\boxed{D}$O** **PRAT18-5$\boxed{D}$C**	**PRAT30-10$\boxed{D}$O** **PRAT30-10$\boxed{D}$C** **PRAT30-10DO-C** **PRAT30-10DC-V**
Sensing distance	2mm	5mm	10mm
Hysteresis	Max. 10% of sensing distance		
Standard sensing target	12×12×1mm (iron)	18×18×1mm (iron)	30×30×1mm (iron)
Setting distance	0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)	12-24VDC (10-30VDC)		
Leakage current	Max. 0.6mA		
Response frequency※1	1.5kHz	500Hz	400Hz
Residual voltage※2	Max. 3.5V (non-polarity type is Max. 5V)		
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃		
Control output	2 to 100mA		
Insulation resistance	Over 50MΩ (at 500VDC megger)		
Dielectric strength	1,500VAC 50/60Hz for 1 minute (between all terminals and case)		
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock	500m/s² (approx. 50G) in each X, Y, Z directions for 3 times		
Indicator	Operation indicator: Red LED		
Environment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
Environment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit	Surge protection circuit, Over-current protection circuit		
Protection structure	IP67 (IEC standard)		
Cable	Ø4mm, 2-wire, 2m	Ø5mm, 2-wire, 2m	
	AWG22, Core diameter: 0.8mm, Number of cores: 60, Insulator diameter: Ø1.25mm		
Material	Case/Nut: Teflon coated brass, Washer: Teflon coated iron, Sensing surface: Teflon, Standard cable (black): Polyvinyl chloride (PVC)		
Approval	CE		
Weight※3	Approx. 84g (approx. 72g)	Approx. 122g (approx. 110g)	Approx. 207g (approx. 170g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Before using non-polarity type, check the condition of connected divice because residual voltage is 5V.
※3: The weight includes packaging. The weight in parentheses in for unit only.
※Refer to the G-5 for IEC standard caonnector cables and specifications.
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※Environment resistance is rated at no freezing or condensation.

■ Specifications

● DC 3-wire type

Model		**PRA12-2DN** **PRA12-2DP** **PRA12-2DN2** **PRA12-2DP2**	**PRA18-5DN** **PRA18-5DP** **PRA18-5DN2** **PRA18-5DP2**	**PRA30-10DN** **PRA30-10DP** **PRA30-10DN2** **PRA30-10DP2**
Sensing distance		2mm	5mm	10mm
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	18×18×1mm (iron)	30×30×1mm (iron)
Setting distance		0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)		12-24VDC (10-30VDC)		
Current consumption		Max. 10mA		
Response frequency※1		1.5kHz	500Hz	400Hz
Residual voltage		Max. 1.5V		
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃		
Control output		Max. 200mA		
Insulation resistance		Over 50MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 minute		
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (appox. 50G) in each X, Y, Z direction for 3 times		
Indicator		Operation indicator: Red LED		
Environ-ment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit		Surge protection circuit, Reverse polarity protection circuit, Over-current protection circuit		
Protection structure		IP67 (IEC standard)		
Cable		Ø4mm, 3-wire, 2m	Ø5mm, 2-wire, 2m	
		AWG22, Core diameter: 0.8mm, Number of cores: 60, Insulator diameter: Ø1.25mm		
Material		Case/Nut: Teflon coated brass, Washer: Teflon coated iron, Sensing surface: Teflon, Standard cable (black): Polyvinyl chloride (PVC)		
Approval		CE		
Weight※2		Approx. 84g (approx. 72g)	Approx. 122g (appox. 110g)	Approx. 207g (approx. 170g)

● AC 2-wire type

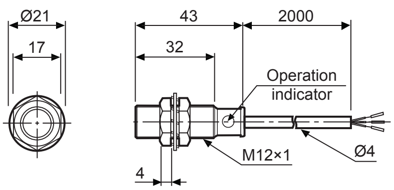
Model		**PRA12-2AO** **PRA12-2AC**	**PRA18-5AO** **PRA18-5AC**	**PRA30-10AO** **PRA30-10AC**
Sensing distance		2mm	5mm	10mm
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	18×18×1mm (iron)	30×30×1mm (iron)
Setting distance		0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)		100-240VAC (85-264VAC)		
Leakage current		Max. 2.5mA		
Response frequency※1		20Hz		
Residual voltage		Max. 10V		
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃		
Control output		5 to 150mA	5 to 200mA	
Insulation resistance		Over 50MΩ (at 500VDC megger)		
Dielectric strength		2,500VAC 50/60Hz for 1 minute		
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times		
Indicator		Operation indicator: Red LED		
Environ-ment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit		Surge protection circuit		
Protection structure		IP67 (IEC standard)		
Cable		Ø4mm, 2-wire, 2m	Ø5mm, 2-wire, 2m	
		AWG22, Core diameter: 0.8mm, Number of cores: 60, Insulator diameter: Ø1.25mm		
Material		Case/Nut: Teflon coated brass, Washer: Teflon coated iron, Sensing surface: Teflon, Standard cable (black): Polyvinyl chloride (PVC)		
Insulation type		Double insulation or reinforced insulation (Mark: ⧈, Dielectric strength between the measuring input part and the power part: 1.5kVAC)		
Approval		CE		
Weight※2		Approx. 78g (approx. 66g)	Approx. 118g (approx. 106g)	Approx. 207g (approx. 170g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parentheses in for unit only.
※Environment resistance is rated at no freezing or condensation.

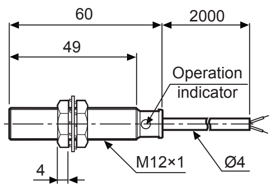
■ Dimensions

(unit: mm)

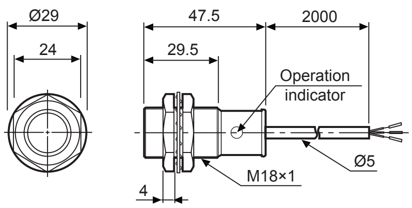
● PRA12-2D□ / PRAT12-2D□



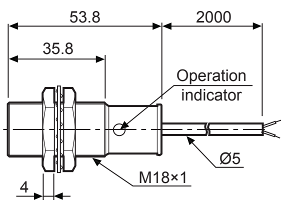
● PRA12-2A□



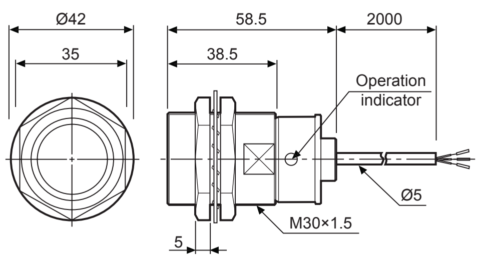
● PRA18-5D□ / PRAT18-5D□



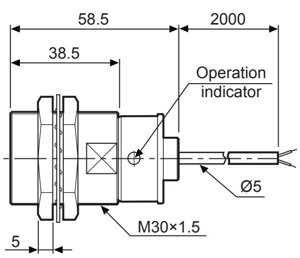
● PRA18-5A□



● PRA30-10D□ / PRAT30-10D□

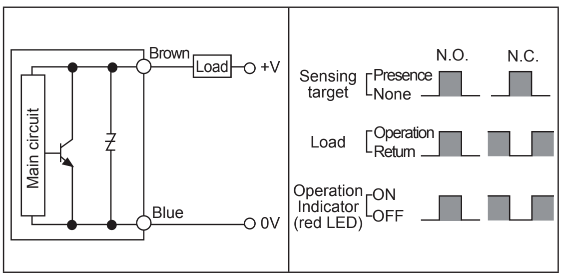


● PRA 30-10A□

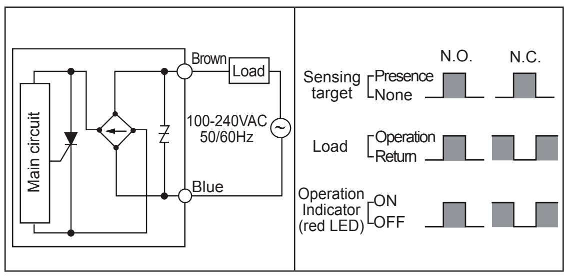


■ Control Output Diagram And Load Operation

◎ DC 2-wire type

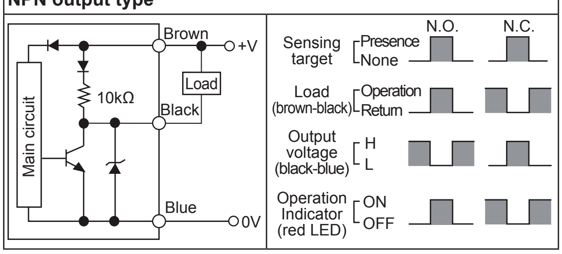


◎ AC 2-wire type

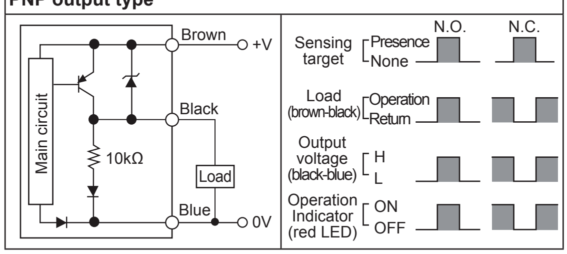


◎ DC 3-wire type

NPN output type



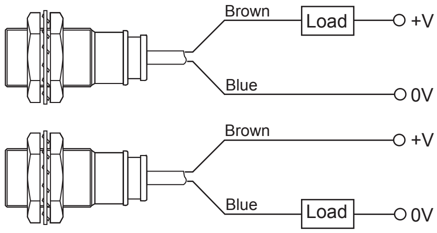
PNP output type



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

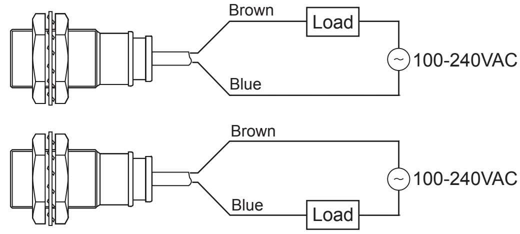
▣ Connections

◎ DC 2-wire type



※The load can be connected to either wire.

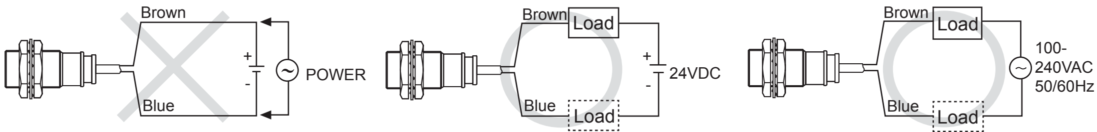
◎ AC 2-wire type



※No need to consider polarity for non-polarity type of power supply.

▣ Proper Usage

◎ Load connections

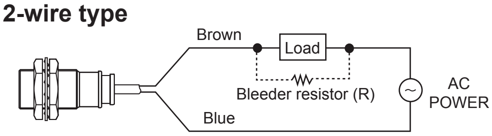


<DC 2-wire type & AC 2-wire type> <DC 2-wire type> <AC 2-wire type>

When using DC or AC 2-wire type proximity sensor, the load must be connected otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● **AC 2-wire type**



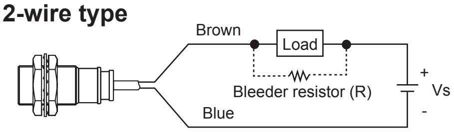
110VAC : Min. 20kΩ 3W
220VAC : Min. 39kΩ 10W

If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \leq \frac{Vs}{I} (k\Omega) \qquad P > \frac{Vs^2}{R} (W)$$

[I:Action current of load, R:Bleeder resistance, P:Permissible power]

● **DC 2-wire type**



Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

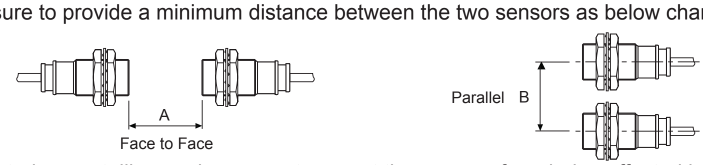
※W value of Bleeder resistor should be bigger for proper heat.

$$R \leq \frac{Vs}{Io\text{-}Ioff} (k\Omega) \qquad P > \frac{Vs^2}{R} (W)$$

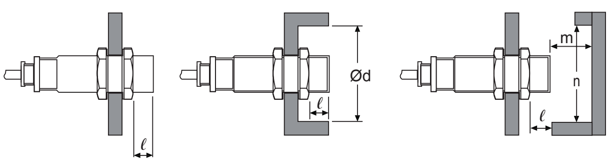
[Vs : Power supply, Io : Min. action current of proximity sensor
Ioff : Return current of load, P : Number of Bleeder resistance watt]

◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of th may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.



When sensors are mounted on metallic panel, you must prevent the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



(unit: mm)

Model / Item	PRA□12-2□□	PRA□18-5□□	PRA□30-10□□
A	12	30	60
B	24	36	60
ℓ	0	0	0
Ød	12	18	30
m	6	15	30
n	18	27	45

Cylindrial, Spatter-Resistance, Cable Connector Type

■ Features

- Coated with teflon against thermal resistance (prevention of malfunction due to spatter)
- Improved the noise immunity with dedicated IC
- Built-in surge protection circuit
- Built-in over-current protection circuit
- IP67 protection structure (IEC standard)
- Replaceable for spatter-resistance type limit switches

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ The Characteristic Of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with teflon against thermal resistance.
Also, the protection cover sold optionally has the same function.

■ Specifications

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

Model	PRAWT12-2DC PRAWT12-2DO-I	PRAWT18-5$\boxed{D}$O PRAWT18-5$\boxed{D}$C PRAWT18-5$\boxed{D}$O-I PRAWT18-5$\boxed{D}$C-I	PRAWT30-10$\boxed{D}$O PRAWT30-10$\boxed{D}$C PRAWT30-10$\boxed{D}$O-I PRAWT30-10$\boxed{D}$C-I
Sensing distance	2mm	5mm	10mm
Hysteresis	Max. 10% of sensing distance		
Standard sensing target	12×12×1mm (iron)	18×18×1mm (iron)	30×30×1mm (iron)
Setting distance	0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)	12-24VDC (10-30VDC)		
Leakage current	Max. 0.6mA		
Response frequency※1	1.5kHz	500Hz	400Hz
Residual voltage※2	Max. 3.5V (non-polarity type is Max. 5V)		
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃		
Control output	2 to 100mA		
Insulation resistance	Over 50MΩ (at 500VDC megger)		
Dielectric strength	1,500VAC 50/60Hz for 1 minute (between all terminals and case)		
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock	500m/s² (approx. 50G) in each X, Y, Z directions for 3 times		
Indicator	Operation indicator: Red LED		
Environment - Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
Environment - Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit	Surge protection circuit, Over-current protection circuit		
Protection structure	IP67 (IEC standard)		
Cable	M12 connector, 300mm (AWG22, Core diameter: 0.8mm, Number of cores: 60, Insulator diameter: Ø1.25mm)		
Material	Case/Nut: Teflon coated brass, Washer: Teflon coated iron, Sensing surface: Teflon, Standard cable (black): Polyvinyl chloride (PVC)		
Approval	CE		
Weight※3	Approx. 84g (approx. 72g)	Approx. 70g (approx. 58g)	Approx. 134g (approx. 122g)

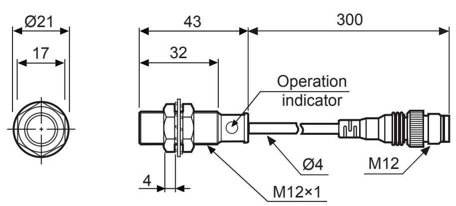
※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Before using non-polarity type, check the condition of connected divice because residual voltage is 5V.
※3: The weight includes packaging. The weight in parentheses in for unit only.
※Refer to the G-5 for IEC standard caonnector cables and specifications.
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※Environment resistance is rated at no freezing or condensation.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

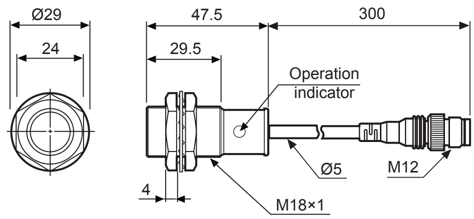
■ Dimensions

(unit: mm)

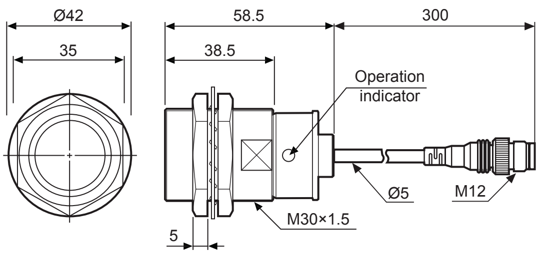
● **PRAWT12-2D□**



● **PRAWT18-5D□**

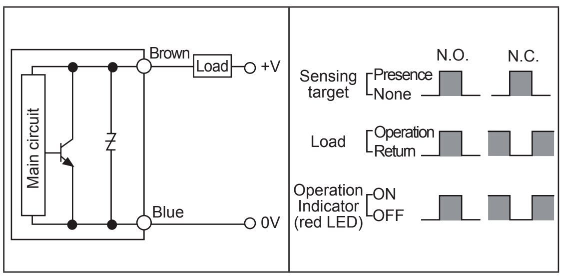


● **PRAWT30-10D□**



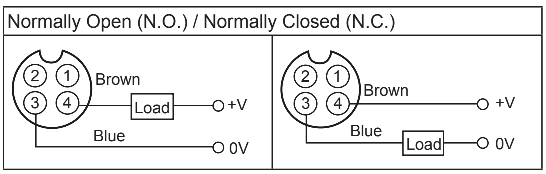
■ Control Output Diagram And Load Operation

◎ DC 2-wire type



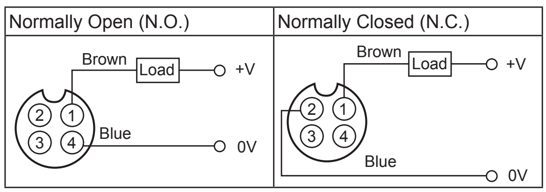
■ Wiring Diagram

◎ DC 2-wire type (standard type)



※①, ② are not used terminals.

◎ DC 2-wire type (IEC standard type)



※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.

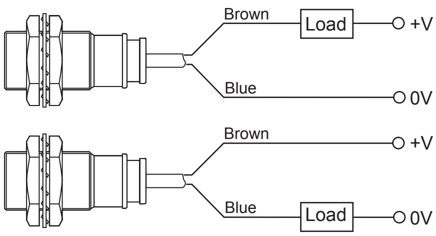
※The pin arrangement of connector applying IEC standard is being developed.

※Please attach "I" at the end of the name of standard type for purchasing the IEC standard product.
E.g.) PRAWT12-2DO-I

※The connector cable for IEC standard is being developed.
Please attach "I' at the end of the name of standard type.
E.g.) CID2-2-I, CLD2-5-I

■ Connections

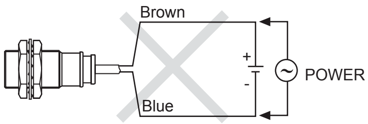
◎ DC 2-wire type



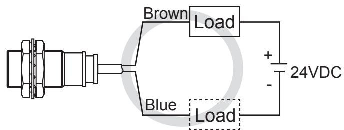
※The load can be connected to either wire.
※No need to consider polarity for non-polarity type of power supply.

■ Proper Usage

◎ Load connections



<DC 2-wire type>

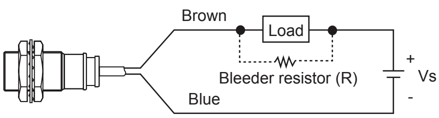


<DC 2-wire type>

When using DC 2-wire type proximity sensor, the load must be connected otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● **DC 2-wire type**



If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \le \frac{V_s}{I}(k\Omega) \qquad P > \frac{V_s^2}{R}(W)$$

[I:Action current of load, R:Bleeder resistance, P:Permissible power]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

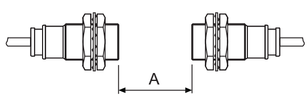
※W value of Bleeder resistor should be bigger for proper heat.

$$R \le \frac{V_s}{I_o - I_{off}}(k\Omega) \qquad P > \frac{V_s^2}{R}(W)$$

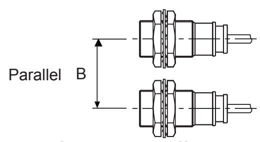
[Vs : Power supply, Io : Min. action current of proximity sensor
Ioff : Return current of load, P : Number of Bleeder resistance watt]

◎ Mutual-interference & Influence by surrounding metals

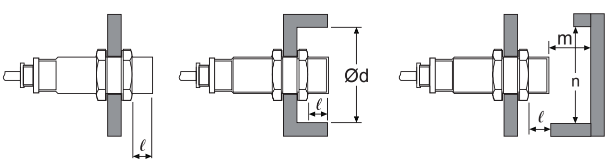
When several proximity sensors are mounted close to one another a malfunction of th may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.



Face to Face



When sensors are mounted on metallic panel, you must prevent the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



(unit: mm)

Item \ Model	PRAWT12-2□□	PRAWT18-5□□	PRAWT30-10□□
A	12	30	60
B	24	36	60
ℓ	0	0	0
Ød	12	18	30
m	6	15	30
n	18	27	45

Cylindrical Spatter-Resistance Connector Type Proximity Sensor

■ Features

Line-up

- Coated with teflon against thermal resistance (prevention of malfunction due to spatter)
- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit (DC 3-wire type)
- Built-in surge protection circuit, over-current protection circuit
- IP67 protection structure (IEC standard)
- Replaceable for spatter-resistance type limit switches

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ The Characteristic Of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with teflon against thermal resistance.
Also, the protection cover sold optionally has the same function.

■ Specifications

● DC 2-wire type

Model	**PRACMT12-2DO** **PRACMT12-2DC** **PRACMT12-2DO-I** **PRACMT12-2DC-I**	**PRACMT18-5DO** **PRACMT18-5DC** **PRACMT18-5DO-I** **PRACMT18-5DC-I**	**PRACMT30-10DO** **PRACMT30-10DC** **PRACMT30-10DO-I** **PRACMT30-10DC-I**
Sensing distance	2mm	5mm	10mm
Hysteresis	Max. 10% of sensing distance		
Standard sensing target	12×12×1mm (iron)	18×18×1mm (iron)	30×30×1mm (iron)
Setting distance	0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)	12-24VDC (10-30VDC)		
Leakage current	Max. 0.6mA		
Response frequency※1	1.5kHz	500Hz	400Hz
Residual voltage	Max. 3.5V		
Affection by Temp.	Max ±10% for sensing distance at ambient temperature 20℃		
Control output	2 to 100mA		
Insulation resistance	Over 500MΩ (at 500VDC megger)		
Dielectric strength	1,500VAC 50/60Hz for 1 minute		
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock	500m/s² (approx. 50G) in each of X, Y, Z directions for 3 times		
Indicator	Operation indicator: Red LED		
Environment – Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
Environment – Ambient humidity	35 to 95% RH, storage: 35 to 95% RH		
Protection circuit	Surge protection circuit, Over-current protection circuit		
Protection structure	IP67 (IEC standards)		
Material	Case/Nut: Teflon coated brass, Washer: Teflon coated iron, Sensing surface: Teflon		
Approval	CE		
Weight※2	Approx. 38g (approx. 26g)	Approx. 61g (approx. 49g)	Approx. 146g (approx. 134g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parentheses in for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Specifications

● DC 3-wire type

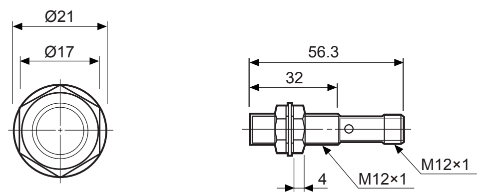
Model	PRACM12-2DN PRACM12-2DP PRACM12-2DN2 PRACM12-2DP2	PRACM18-5DN PRACM18-5DP PRACM18-5DN2 PRACM18-5DP2	PRACM30-10DN PRACM30-10DP PRACM30-10DN2 PRACM30-10DP2
Sensing distance	2mm	5mm	10mm
Hysteresis	Max. 10% of sensing distance		
Standard sensing target	12×12×1mm (iron)	18×18×1mm (iron)	30×30×1mm (iron)
Setting distance	0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)	12-24VDC (10-30VDC)		
Current consumption	Max. 10mA		
Response frequency※1	1.5kHz	500Hz	400Hz
Residual voltage	Max. 1.5V		
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃		
Control output	Max. 200mA		
Insulation resistance	Over 500MΩ (at 500VDC megger)		
Dielectric strength	1,500VAC 50/60Hz for 1 minute		
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock	500m/s² (appox. 50G) in each X, Y, Z direction for 3 times		
Indicator	Operation indicator: Red LED		
Environ-ment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
Environ-ment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit	Surge protection circuit, Reverse polarity protection circuit, Over-current protection circuit		
Protection structure	IP67 (IEC standard)		
Material	Case/Nut: Teflon coated brass, Washer: Teflon coated iron, Sensing surface: Teflon		
Approval	CE		
Weight※2	Approx. 38g (approx. 26g)	Approx. 61g (approx. 49g)	Approx. 146g (approx. 134g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parentheses in for unit only.
※Environment resistance is rated at no freezing or condensation.

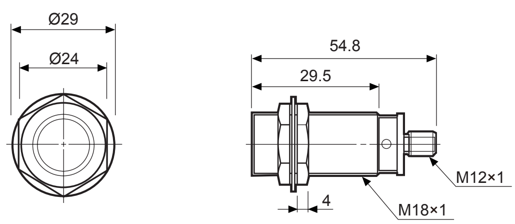
■ Dimensions

(unit: mm)

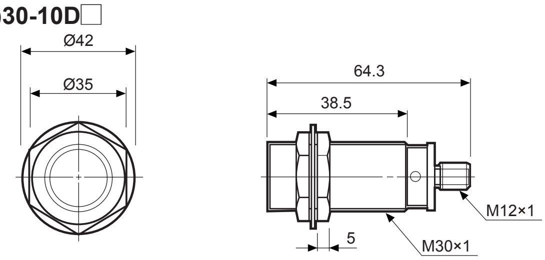
● PRACM(T)12-2D□



● PRACM(T)18-5D□

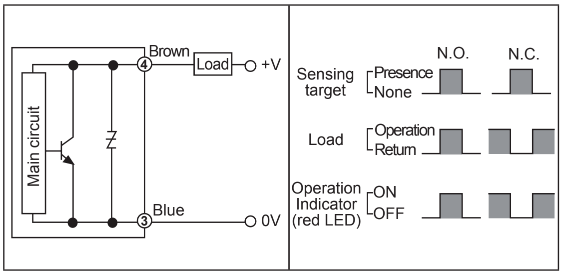


● PRACM(T)30-10D□



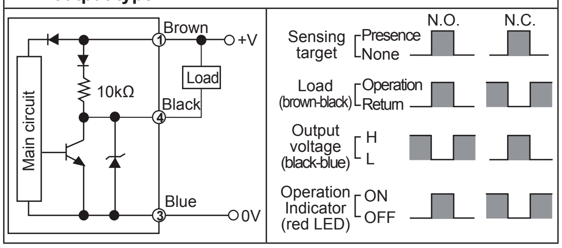
■ Control Output Diagram And Load Operation

◎ DC 2-wire type

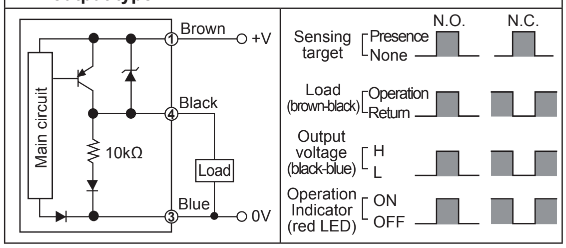


◎ DC 3-wire type

NPN output type



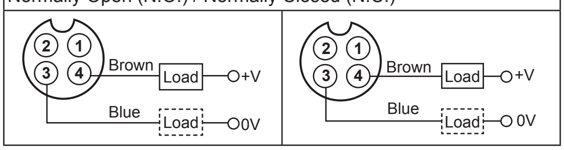
PNP output type



■ Wiring Diagram

◎ DC 2-wire type (standard type)

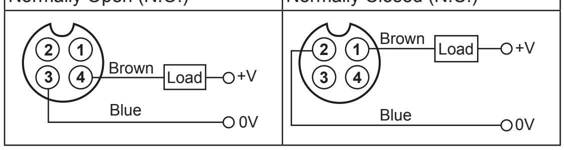
Normally Open (N.O.) / Normally Closed (N.C.)



※Pin ①, ② are not used terminals.
※For DC 3-wire type connector cable, it is available to use with use black wire (12-24VDC) and blue wire (0V).

◎ DC 2-wire type (IEC standard type)

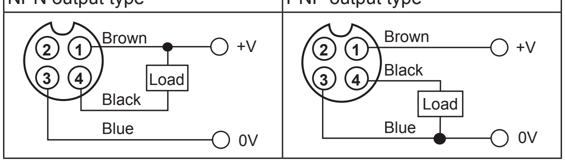
Normally Open (N.O.)	Normally Closed (N.C.)



※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The pin arrangement of connector applying IEC standard is being developed.
※Please attach "I" at the end of the name of standard type for purchasing the IEC standard product.
E.g.) PRACMT12-2DO-I
※The connector cable for IEC standard is being developed. Please attach "I" at the end of the name of standard type.
E.g.) CID2-2-I, CLD2-5-I

◎ DC 3-wire type

NPN output type	PNP output type

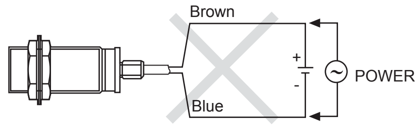


※Please fasten the cleat of connector not to shown the thread. (0.39 to 0.49N·m)

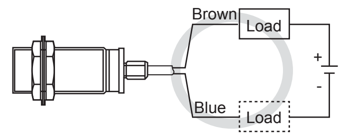
※Please fasten the vibration part with Teflon tape.
※Refer to the G-6 about IEC standard connector wires and specifications.

■ Proper Usage

◎ Load connections



< DC 2-wire type >

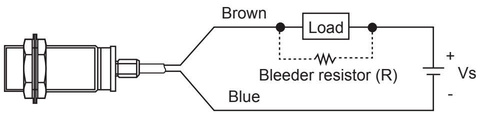


< DC 2-wire type >

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● **DC 2-wire type**



If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \leq \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[I:Action current of load, R:Bleeder resistance, P:Permissible power]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

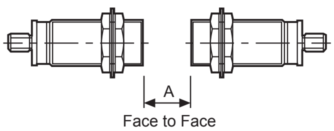
※W value of Bleeder resistor should be bigger for proper heat.

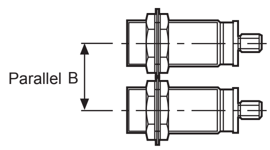
$$R \leq \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[Vs : Power supply, Io : Min. action current of proximity sensor
Ioff : Return current of load, P : Number of Bleeder resistance watt]

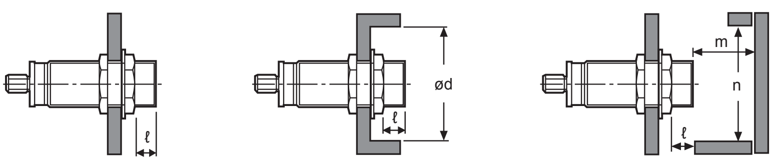
◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.





When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



(unit: mm)

Model / Item	PRACMT12-2D□ PRACM12-2D□	PRACMT18-5D□ PRACM18-5D□	PRACMT30-10D□ PRACM30-10D□
A	12	30	60
B	24	36	60
ℓ	0	0	0
Ød	12	18	30
m	6	15	30
n	18	27	45

Cylindrical, Long Sensing Distance, Spatter-Resistance, Cable Type

■ Features

- Long sensing distance
  (1.5 to 2 times longer sensing distance guaranteed compared to existing models)
- Coated with the material against thermal resistance
  (prevention of malfunction due to spatter)
- Improved the noise immunity with dedicated IC
- Built-in surge protection, over-current protection circuit
- Red LED operation indication
- IP67 protection structure (IEC standard)
- Replaceable for spatter-resistance type limit switches

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ The Characteristic Of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with teflon against thermal resistance.
Also, the protection cover sold optionally has the same function.

■ Specifications

● DC 2-wire type

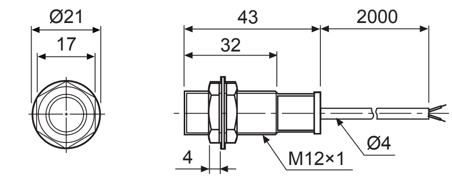
Model		**PRDAT12-4DO** **PRDAT12-4DC** **PRDAT12-4DO-V** **PRDAT12-4DC-V**	**PRDAT18-7DO** **PRDAT18-7DC** **PRDAT18-7DO-V** **PRDAT18-7DC-V**	**PRDAT30-15DO** **PRDAT30-15DC** **PRDAT30-15DO-V** **PRDAT30-15DC-V**
Sensing distance		4mm	7mm	15mm
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	20×20×1mm (iron)	45×45×1mm (iron)
Setting distance		0 to 2.8mm	0 to 4.9mm	0 to 10.5mm
Power supply (operating voltage)		12-24VDC (10-30VDC)		
Leakage current		Max. 0.6mA		
Response frequency※1		450Hz	250Hz	100Hz
Residual voltage		Max. 3.5V		
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃		
Control output		2 to 100mA		
Insulation resistance		Over 50MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 minute		
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z directions for 3 times		
Indicator		Operation indicator: Red LED		
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit		Surge protection circuit, Over-current protection circuit		
Protection structure		IP67 (IEC standard)		
Cable		Ø4mm, 2-wire, 2m	Ø5mm, 2-wire, 2m	
		AWG22, Core diameter: 0.8mm, Number of cores: 60, Insulator diameter: Ø1.25mm		
Material		Case/Nut: Teflon coated brass, Washer: Teflon coated iron, Sensing surface: Teflon, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)		
Approval		CE		
Weight※2		Approx. 84g (approx. 72g)	Approx. 134g (approx. 122g)	Approx. 221g (approx. 184g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parentheses in for unit only.
※Environment resistance is rated at no freezing or condensation.

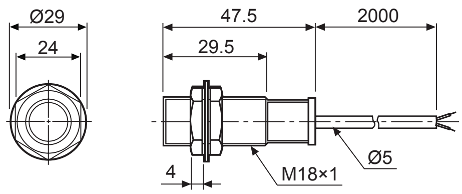
■ Dimensions

(unit: mm)

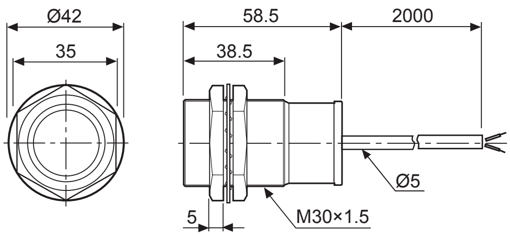
● PRDAT12-4D□



● PRDAT18-7D□

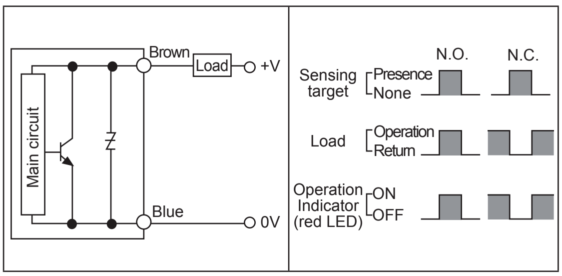


● PRDAT30-15D□



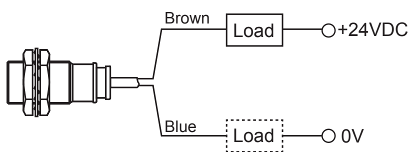
■ Control Output Diagram And Load Operation

◎ DC 2-wire type



■ Connections

◎ DC 2-wire type

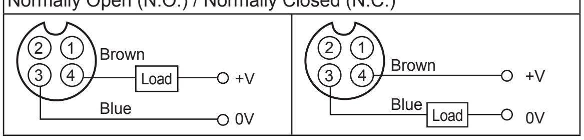


※For using DC 2-wire type, connect load before suppling the power and using this unit, or inner element may be damaged.
※The load can be connected to either wire.

■ Wiring Diagram

◎ DC 2-wire type (standard type)

Normally Open (N.O.) / Normally Closed (N.C.)

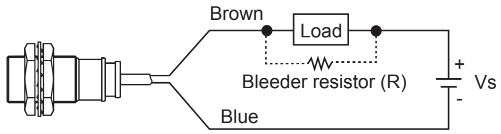


※Pin ①, ② are not used terminals.
※When using DC 3-wire type of connector cable, black (12-24VDC) and blue (0V) cables can be used.

▣ Proper Usage

◎ In case of the load current is small

● DC 2-wire type



Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

It may cause return failure of load by residual voltage.
If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$R \leq \frac{Vs}{I}(k\Omega)$ $P > \frac{Vs^2}{R}(W)$

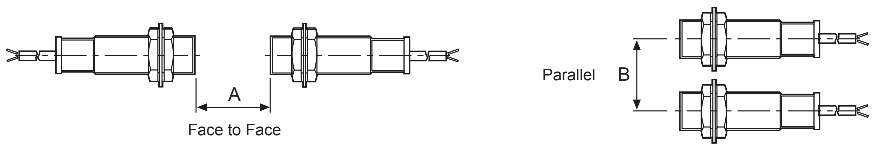
[I:Action current of load, R:Bleeder resistance, P:Permissible power]

$R \leq \frac{Vs}{Io\text{-}Ioff}(k\Omega)$ $P > \frac{Vs^2}{R}(W)$

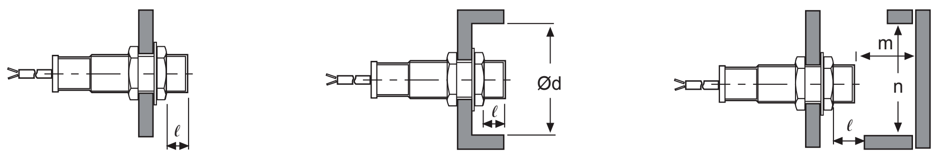
[Vs: Power supply,
Ioff: Return current of load,
Io: Min. action current of proximity sensor,
P : Number of Bleeder resistance watt]

◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.



When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



(unit: mm)

Item \ Model	PRDAT12-4D□	PRDAT18-7D□	PRDAT12-15D□
A	24	42	90
B	24	36	60
ℓ	0	0	0
Ød	12	18	30
m	12	21	45
n	18	27	45

Cylindrical, Long Sensing Distance, Spatter-Resistance, Cable Connector type, Proximity Sensor

■ Features

- Long sensing distance
  (1.5 to 2 times longer sensing distance guaranteed compared to existing models)
- Coated with the material against thermal resistance
  (prevention of malfunction due to spatter)
- Improved the noise immunity with dedicated IC
- Built-in surge protection, over-current protection circuit
- Red LED operation indication
- IP67 protection structure (IEC standard)
- Replaceable for spatter-resistance type limit switches

⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ The Characteristic Of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with teflon against thermal resistance.
Also, the protection cover sold optionally has the same function.

■ Specifications

● DC 2-wire type

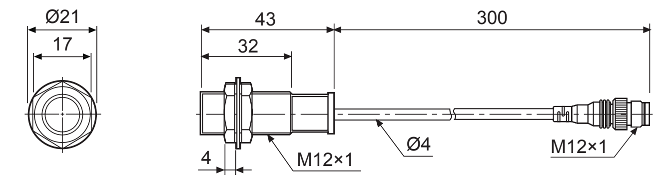
Model	**PRDAWT12-4DO** **PRDAWT12-4DC** **PRDAWT12-4DO-I** **PRDAWT12-4DC-I**	**PRDAWT18-7DO** **PRDAWT18-7DC** **PRDAWT18-7DO-I** **PRDAWT18-7DC-I** **PRDAWT18-7DO-IV** **PRDAWT18-7DC-IV**	**PRDAWT30-15DO** **PRDAWT30-15DC** **PRDAWT30-15DO-I** **PRDAWT30-15DC-I** **PRDAWT30-15DO-IV**
Sensing distance	4mm	7mm	15mm
Hysteresis	Max. 10% of sensing distance		
Standard sensing target	12×12×1mm (iron)	20×20×1mm (iron)	45×45×1mm (iron)
Setting distance	0 to 2.8mm	0 to 4.9mm	0 to 10.5mm
Power supply (operating voltage)	12-24VDC (10-30VDC)		
Leakage current	Max. 0.6mA		
Response frequency※1	450Hz	250Hz	100Hz
Residual voltage	Max. 3.5V		
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃		
Control output	2 to 100mA		
Insulation resistance	Over 50MΩ (at 500VDC megger)		
Dielectric strength	1,500VAC 50/60Hz for 1 minute		
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock	500m/s² (approx. 50G) in each X, Y, Z directions for 3 times		
Indicator	Operation indicator: Red LED		
Environment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
Environment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit	Surge protection circuit, Over-current protection circuit		
Protection structure	IP67 (IEC standard)		
Cable	Ø4mm, 2-wire, 2m	Ø5mm, 2-wire, 2m	
	M12 connector, 300mm		
Material	Case/Nut: Teflon coated brass, Washer: Teflon coated iron, Sensing surface: Teflon, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)		
Approval	CE		
Weight※2	Approx. 54g (approx. 42g)	Approx. 77g (approx. 65g)	Approx. 155g (approx. 143g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parentheses in for unit only.
※Environment resistance is rated at no freezing or condensation.

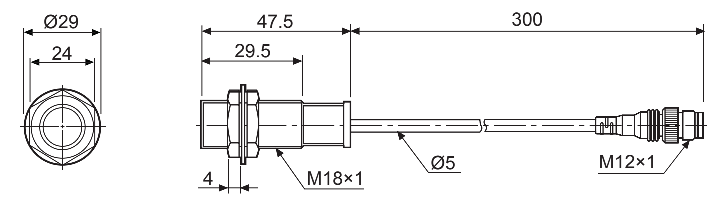
▣ Dimensions

(unit: mm)

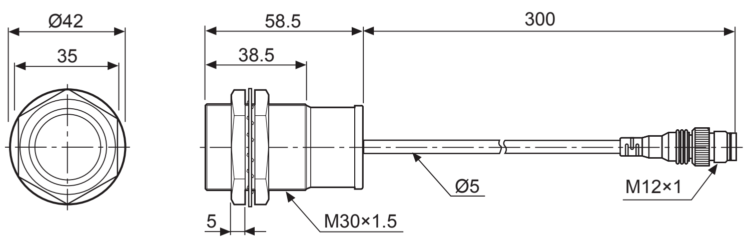
● **PRDAWT12-4D□**



● **PRDAWT18-7D□**

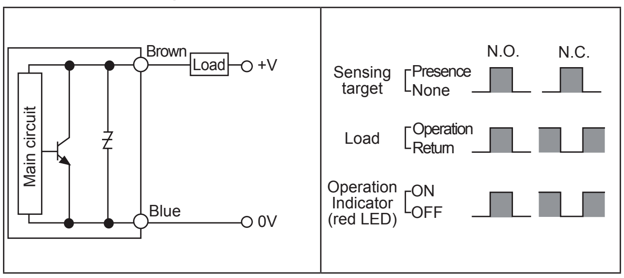


● **PRDAWT30-15D□**



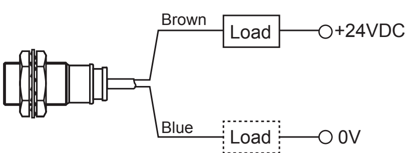
▣ Control Output Diagram And Load Operation

◎ DC 2-wire type



▣ Connections

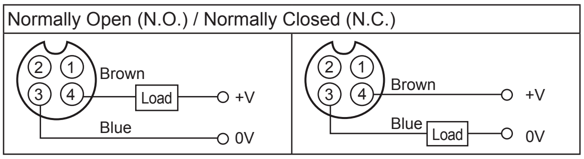
◎ DC 2-wire type



※For using DC 2-wire type, connect load before suppling the power and using this unit, or inner element may be damaged.
※The load can be connected to either wire.

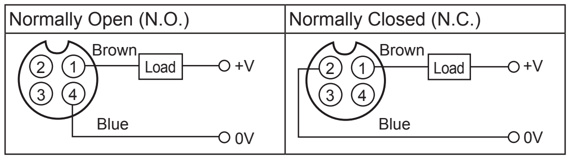
▣ Wiring Diagram

◎ DC 2-wire type (standard type)



※Pin ①, ② are not used terminals.
※When using DC 3-wire type of connector cable, black (12-24VDC) and blue (0V) cables can be used.

◎ DC 2-wire type (IEC standard type)

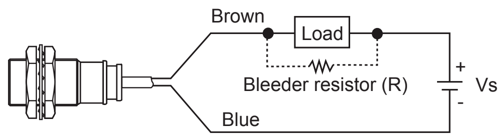


※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The type, pin arrangement of connector based upon IEC standard is being developed.
※Please put "I" behind of standard type for purchasing IEC standard product. E.g.) PRDAWT18-7DO-I
※Please put "I" behind of model name for selecting proximity sensor by IEC standard. E.g.) CID2-2-I, CLD2-2-I

▣ Proper Usage

◎ In case of the load current is small

● **DC 2-wire type**



Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

It may cause return failure of load by residual voltage. If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \leq \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

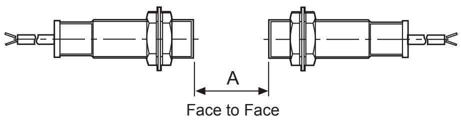
[I:Action current of load, R:Bleeder resistance, P:Permissible power]

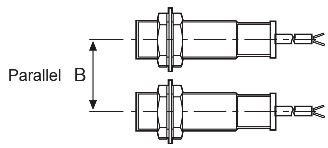
$$R \leq \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[Vs: Power supply,
Ioff: Return current of load,
Io: Min. action current of proximity sensor,
P : Number of Bleeder resistance watt]

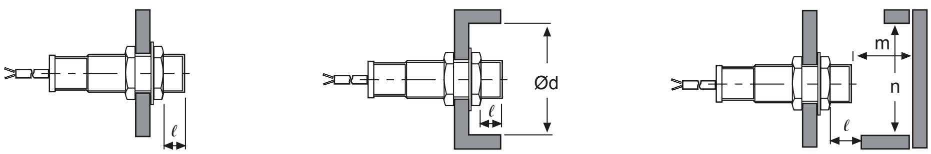
◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.





When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



(unit: mm)

Item \ Model	PRDAWT12-4D□	PRDAWT18-7D□	PRDAWT30-15D□
A	24	42	90
B	24	36	60
ℓ	0	0	0
Ød	12	18	30
m	12	21	45
n	18	27	45

Long Distance Cylindrical Spatter-Resistance Connector Type Proximity Sensor

Line-up

Features

- Coated with teflon against thermal resistance (prevention of malfunction due to spatter)
- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit (DC 3-wire type)
- Built-in surge protection circuit, over-current protection circuit
- IP67 protection structure (IEC standard)
- Replaceable for spatter-resistance type limit switches

Please read "Caution for your safety" in operation manual before using.

CE

The Characteristic Of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with teflon against thermal resistance.
Also, the protection cover sold optionally has the same function.

Specifications

● DC 2-wire type

Model		PRDACMT12-4DO PRDACMT12-4DC PRDACMT12-4DO-I PRDACMT12-4DC-I	PRDACMT18-7DO PRDACMT18-7DC PRDACMT18-7DO-I PRDACMT18-7DC-I	PRDACMT30-15DO PRDACMT30-15DC PRDACMT30-15DO-I PRDACMT30-15DC-I
Sensing distance		4mm	7mm	15mm
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	20×20×1mm (iron)	45×45×1mm (iron)
Setting distance		0 to 2.8mm	0 to 4.9mm	0 to 10.5mm
Power supply (operating voltage)		12-24VDC (10-30VDC)		
Leakage current		Max. 0.6mA		
Response frequency※1		450Hz	250Hz	100Hz
Residual voltage		Max. 3.5V		
Affection by Temp.		Max ±10% for sensing distance at ambient temperature 20℃		
Control output		2 to 100mA		
Insulation resistance		Over 500MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 minute		
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each of X, Y, Z directions for 3 times		
Indicator		Operation indicator: Red LED		
Environ-ment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95% RH, storage: 35 to 95% RH		
Protection circuit		Surge protection circuit, Over-current protection circuit		
Protection structure		IP67 (IEC standard)		
Material		Case/Nut: Teflon coated brass, Washer: Teflon coated iron, Sensing surface: Teflon		
Approval		CE		
Weight※2		Approx. 38g (approx. 26g)	Approx. 61g (approx. 49g)	Approx. 146g (approx. 134g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parentheses in for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Specifications

● DC 3-wire type

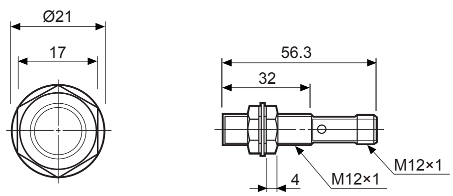
Model		PRDACM12-4DN PRDACM12-4DP PRDACM12-4DN2 PRDACM12-4DP2	PRDACM18-7DN PRDACM18-7DP PRDACM18-7DN2 PRDACM18-7DP2	PRDACM30-15DN PRDACM30-15DP PRDACM30-15DN2 PRDACM30-15DP2
Sensing distance		4mm	7mm	15mm
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	20×20×1mm (iron)	45×45×1mm (iron)
Setting distance		0 to 2.8mm	0 to 4.9mm	0 to 10.5mm
Power supply (operating voltage)		12-24VDC (10-30VDC)		
Leakage current		Max. 10mA		
Response frequency※1		500Hz	300Hz	100Hz
Residual voltage		Max. 1.5V		
Affection by Temp.		Max ±10% for sensing distance at ambient temperature 20℃		
Control output		Max. 200mA		
Insulation resistance		Over 500MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 minute		
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each of X, Y, Z directions for 3 times		
Indicator		Operation indicator: Red LED		
Environ-ment	Ambient temperature	-25 to 70℃ , storage: -30 to 80℃		
	Ambient humidity	35 to 95% RH, storage: 35 to 95% RH		
Protection circuit		Surge protection circuit, Reverse polarity protection circuit, Over-current protection circuit		
Protection structure		IP67 (IEC standard)		
Material		Case/Nut: Teflon coated brass, Washer: Teflon coated iron, Sensing surface: Teflon		
Approval		CE		
Weight※2		Approx. 38g (approx. 26g)	Approx. 61g (approx. 49g)	Approx. 146g (approx. 134g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parentheses in for unit only.
※Environment resistance is rated at no freezing or condensation.

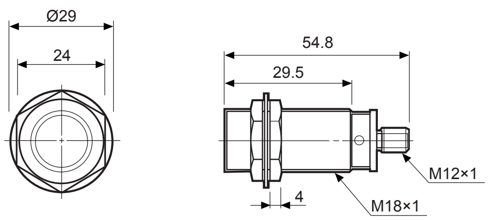
■ Dimensions

(unit: mm)

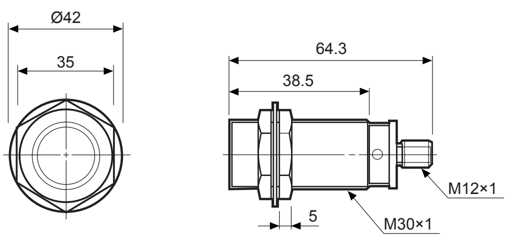
● PRDACM(T)12-2D□



● PRDACM(T)18-5D□

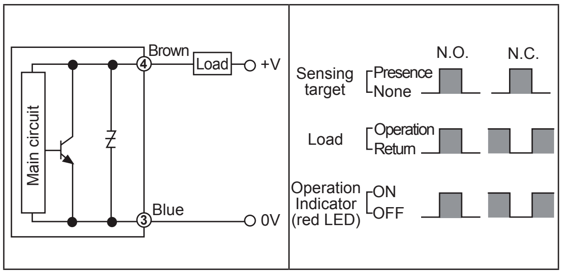


● PRDACM(T)30-10D□

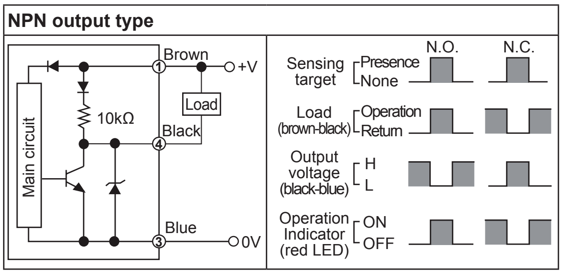


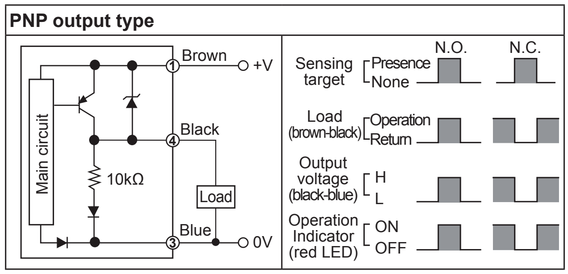
▣ Control Output Diagram And Load Operation

◎ DC 2-wire type



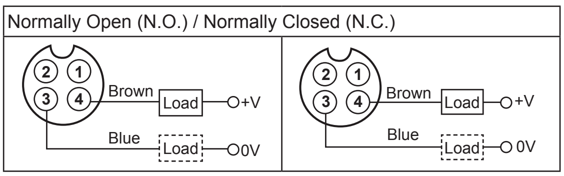
◎ DC 3-wire type





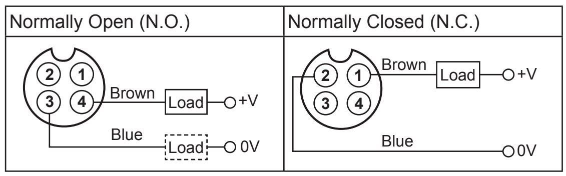
▣ Wiring Diagram

◎ DC 2-wire type (standard type)



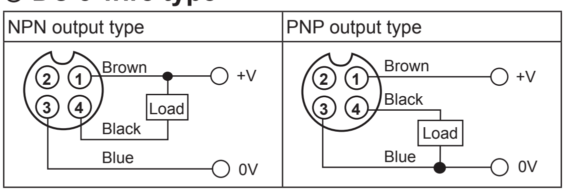
※Pin ①, ② are not used terminals.
※For DC 3-wire type connector cable, it is available to use with use black wire (12-24VDC) and blue wire (0V).

◎ DC 2-wire type (IEC standard type)



※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The pin arrangement of connector applying IEC standard is being developed.
※Please attach "I" at the end of the name of standard type for purchasing the IEC standard product.
E.g.) PRDACMT12-4DO-I
※The connector cable for IEC standard is being developed. Please attach "I" at the end of the name of standard type.
E.g.) CID2-2-I, CLD2-5-I

◎ DC 3-wire type

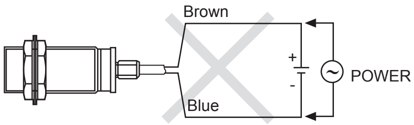


※Please fasten the cleat of connector not to shown the thread. (0.39 to 0.49N·m)

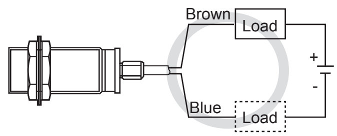
※Please fasten the vibration part with Teflon tape.
※Refer to the G-6 about IEC standard connector wires and specifications.

■ Proper Usage

◎ Load connections



< DC 2-wire type >

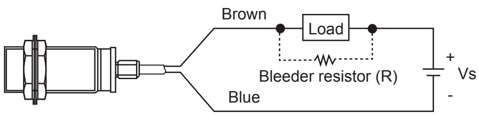


< DC 2-wire type >

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● **DC 2-wire type**



If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$R \leq \frac{Vs}{I}(k\Omega)$ $P > \frac{Vs^2}{R}(W)$

[I:Action current of load, R:Bleeder resistance, P:Permissible power]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

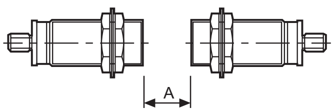
※W value of Bleeder resistor should be bigger for proper heat.

$R \leq \frac{Vs}{Io\text{-}Ioff}(k\Omega)$ $P > \frac{Vs^2}{R}(W)$

[Vs : Power supply, Io : Min. action current of proximity sensor
Ioff : Return current of load, P : Number of Bleeder resistance watt]

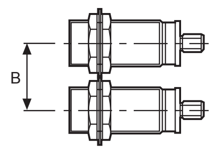
◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.

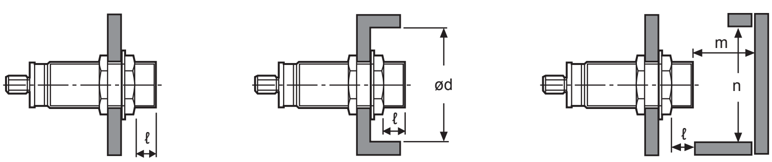


Face to Face

Parallel



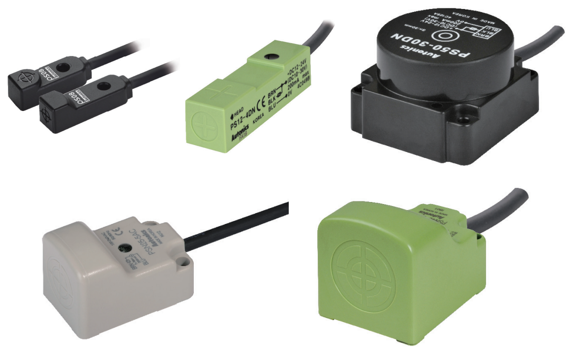
When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



(unit: mm)

Item \ Model	PRDACMT12-4D□ PRDACM12-4D□	PRDACMT18-7D□ PRDACM18-7D□	PRDACMT30-15D□ PRDACM30-15D□
A	24	42	90
B	24	36	60
ℓ	0	0	0
Ød	12	18	30
m	12	21	45
n	18	27	45

Rectangular, Standard Type Proximity Sensor



CE

Various Sizes

Various Protection Circuits

IP67

Compact Size (PS08)

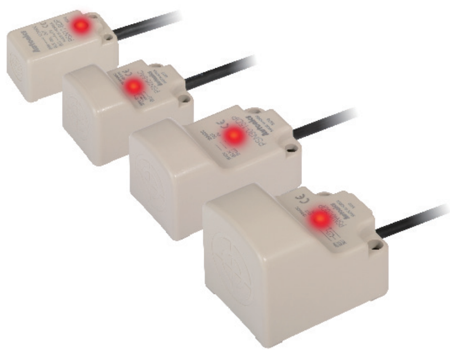
Response Frequency (PS08)

▣ Features

[Common Features]

- **Various Sizes Available For Diverse Applications**
  8×8 mm, 12×12 mm, 17×17 mm, 25×25 mm, 30×30 mm, 40×40 mm, 50×50 mm

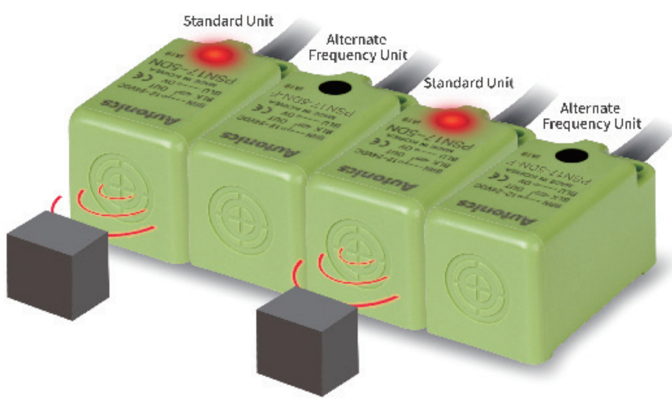
- **IP67 Protection Structure**
  IP67 protection structure allows stable and error-free operation even in wet or dusty environments.



[PSN17 Features]

- **Operation Status Indicator (Red LED)**

The vibrant LED operation indicators (red) allow users to quickly and easily identify operation status.

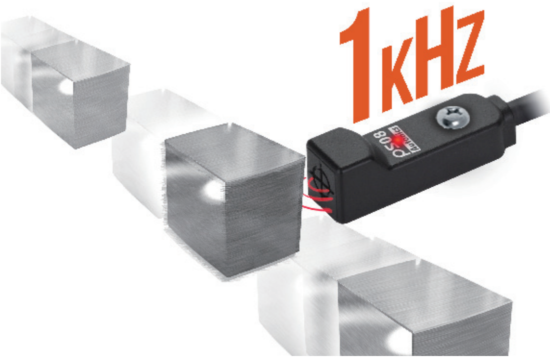


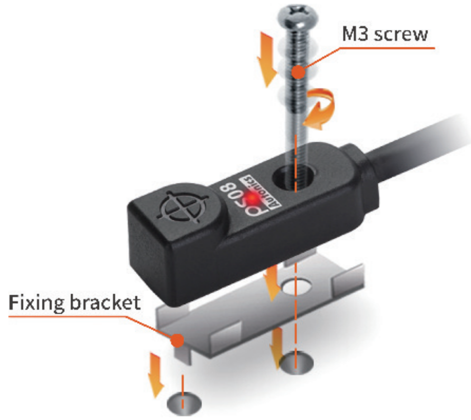
▣ Features

[PS08 Features]

● **1 kHz Response Frequency**
1 kHz response frequency allows detection of fast moving targets.

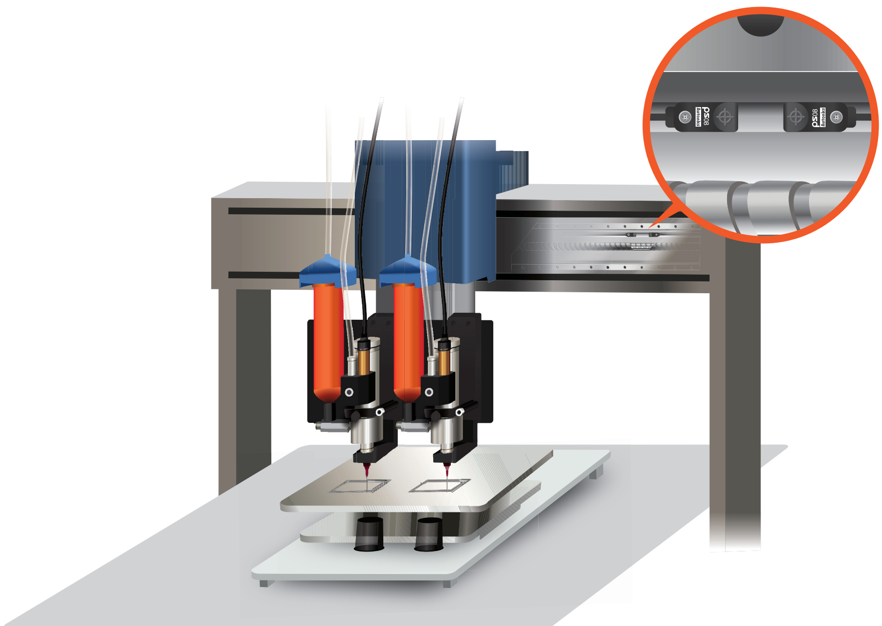
● **Installation Using M3 Screw**
Easy installation with standard M3 screws





▣ Application

Compact rectangular inductive proximity sensors PS08 series used for position control of cartesian coordinate robots (linear robots)



Rectangular, Standard Type Proximity Sensor

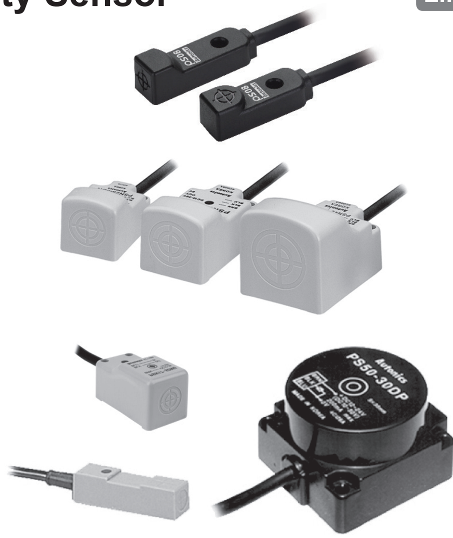
Line-up

■ Features

- Improved the noise immunity with dedicated IC
- Long life cycle and high reliability
- Red LED status indication
- Built-in surge protection circuit
- Built-in over-current protection circuit (DC type)
- Built-in reverse polarity protection circuit (DC 3-wire type)
- IP67 protection structure (IEC standard)

[PS08]
- Compact design (□8mm) allows easy installation in limited spaces
- High-speed response frequency: 1kHz
- Easy M3 bolt installation

[PSN17]
- Dual frequency function allows adjacent installation



⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Specifications

● **DC 2-wire type**

※The existing PST17 is upgraded its function and design and changed as PSNT17.
※The case color of Normal Close type is changed from orange to gray.

Model		**PSNT17-5DO** **PSNT17-5DC**	**PSNT17-5DOU** **PSNT17-5DCU**
Sensing distance		5mm	
Hysteresis		Max. 10% of sensing distance	
Standard sensing target		18×18×1mm (iron)	
Setting distance		0 to 3.5mm	
Power supply (operating voltage)		12-24VDC (10-30VDC)	
Leakage current		Max. 0.6mA	
Response frequency※1		700Hz	
Residual voltage		Max. 3.5V	
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃	
Control output		2 to 100mA	
Insulation resistance		Over 50MΩ (at 500VDC megger)	
Dielectric strength		1,500VAC 50/60Hz for 1 minute	
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Indicator		Operation indicator: Red LED	
Environ-ment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃	
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH	
Protection circuit		Surge protection circuit, Over-current protection circuit	
Protection structure		IP67 (IEC standard)	
Cable		Ø4mm, 2-wire, 2m (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm)	
Approval		CE	
Unit weight		Approx. 71g	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※Environment resistance is rated at no freezing or condensation.

● DC 3-wire type

※The existing PST17 is upgraded its function and design and changed as PSN17.
※The case color of PNP output type is changed from orange to gray.

● PS Series

Model	**PS08-2.5DN** **PS08-2.5DP** **PS08-2.5DN2** **PS08-2.5DP2** **PS08-2.5DNU** **PS08-2.5DPU** **PS08-2.5DN2U** **PS08-2.5DP2U**	**PS12-4DN** **PS12-4DP** **PS12-4DN2** **PS12-4DNU** **PS12-4DPU** **PS12-4DN2U**	**PS50-30DN** **PS50-30DP** **PS50-30DN2** **PS50-30DP2**
Sensing distance	2.5mm	4mm	30mm
Hysteresis	Max. 20% of sensing distance	Max. 10% of sensing distance	
Standard sensing target	8×8×1mm (iron)	12×12×1mm (iron)	90×90×1mm (iron)
Setting distance	0 to 1.7mm	0 to 2.8mm	0 to 21mm
Power supply (operation voltage)	12-24VDC (10-30VDC)		
Current consumption	Max. 10mA		
Response frequency※1	1,000Hz	500Hz	50Hz
Residual voltage	Max. 1.5V		
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃		
Control output	Max. 200mA		
Insulation resistance	Over 50MΩ (at 500VDC megger)		
Dielectric strength	1,500VAC 50/60Hz for 1minute		
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times		
Indicator	Operation indicator: Red LED		
Environment - Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
Environment - Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit	Surge protection circuit, Over-current protection circuit, Reverse polarity protection circuit		
Protection structure	IP67 (IEC standard)		
Cable	Ø2.5mm, 3-wire, 1m	Ø4mm, 3-wire, 2m	Ø5mm, 3-wire, 2m
	AWG28, Core diameter: 0.08mm, Number of cores: 19, Insulator out diameter: Ø1.25	AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25	
Material	Case: PC, Standard cable (black): Polyvinyl chloride (PVC).	Case: Heat-resistant Acrylonitrile butadiene styrene, Standard cable (black): Polyvinyl chloride (PVC)	Case: PBT, Standard cable (black): Polyvinyl chloride (PVC).
Approval	CE		
Weight※2	Approx. 30g (approx. 16g)	Approx. 77g (approx. 62g)	Approx. 256g (approx. 220g)

● PSN Series

※The case color of Normally Closed type is changed from orange to gray.

Model	**PSN17-5DN** **PSN17-5DP** **PSN17-5DN2** **PSN17-5DP2** **PSN17-5DNU** **PSN17-5DPU** **PSN17-5DN2U** **PSN17-5DP2U** **PSN17-5DN-F**	**PSN17-8DN** **PSN17-8DP** **PSN17-8DN2** **PSN17-8DP2** **PSN17-8DNU** **PSN17-8DPU** **PSN17-8DN2U** **PSN17-8DP2U** **PSN17-8DN-F** **PSN17-8DP-F** **PSN17-8DN2-F** **PSN17-8DNU-F** **PSN17-8DPU-F** **PSN17-8DN2U-F**	**PSN25-5DN** **PSN25-5DP** **PSN25-5DN2** **PSN25-5DP2**	**PSN30-10DN** **PSN30-10DP** **PSN30-10DN2** **PSN30-10DP2**	**PSN30-15DN** **PSN30-15DP** **PSN30-15DN2** **PSN30-15DP2**	**PSN40-20DN** **PSN40-20DP** **PSN40-20DN2** **PSN40-20DP2**
Sensing distance	5mm	8mm	5mm	10mm	15mm	20mm
Hysteresis	Max. 10% of sensing distance					
Standard sensing target	18×18×1mm (iron)	25×25×1mm (iron)		30×30×1mm (iron)	45×45×1mm (iron)	60×60×1mm (iron)
Setting distance	0 to 3.5mm	0 to 5mm	0 to 3.5mm	0 to 7mm	0 to 10.5mm	0 to 14mm
Power supply (operation voltage)	12-24VDC (10-30VDC)					
Current consumption	Max. 10mA					
Response frequency※1	700Hz	200Hz	300Hz	250Hz	200Hz	100Hz
Residual voltage	Max. 1.5V					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃					
Control output	Max. 200mA					
Insulation resistance	Over 50MΩ (at 500VDC megger)					
Dielectric strength	1,500VAC 50/60Hz for 1minute					
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock	500m/s² (approx. 50G) in X, Y, Z direction for 3 times					
Indicator	Operation indicator: Red LED					
Environment - Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
Environment - Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit	Surge protection circuit, Over-current protection circuit, Reverse polarity protection circuit					
Protection structure	IP67 (IEC standard)					
Cable	Ø4mm, 3-wire, 2m (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25)					
Material	Case: Heat-resistant Acrylonitrile butadiene styrene, Standard cable (black): Polyvinyl chloride (PVC)					
Approval	CE					
Weight※2	Approx. 71g	Approx. 70g		Approx. 111g		Approx. 185g

● AC 2-wire type

Model		PSN25-5AO PSN25-5AC	PSN30-10AO PSN30-10AC	PSN30-15AO PSN30-15AC	PSN40-20AO PSN40-20AC
Sensing distance		5mm	10mm	15mm	20mm
Hysteresis		Max. 10% of sensing distance			
Standard sensing target		25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)	60×60×1mm (iron)
Setting distance		0 to 3.5mm	0 to 7mm	0 to 10.5mm	0 to 14mm
Power supply (operating voltage)		100-240VAC (85-264VAC)			
Leakage current		Max. 2.5mA			
Response frequency※1		20Hz			
Residual voltage		Max. 10V			
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃			
Control output		5 to 200mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,500VAC 50/60Hz for 1 minute			
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in X, Y, Z direction for 3 times			
Indicator		Operation indicator: Red LED			
Environ-ment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃			
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH			
Protection circuit		Surge protection circuit			
Protection structure		IP67 (IEC standard)			
Cable		Ø4mm, 2-wire, 2m (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm)			
Approval		CE			
Unit weight		Approx. 65g	Approx. 106g		Approx. 152g

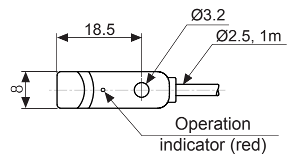
※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※Environment resistance is rated at no freezing or condensation.

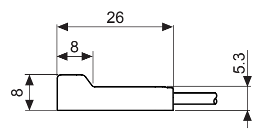
■ Dimensions

(unit: mm)

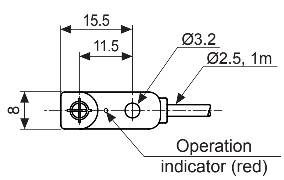
● PS08

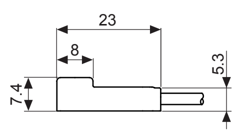
● Standard type



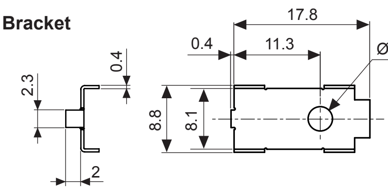


● Upper sensing type

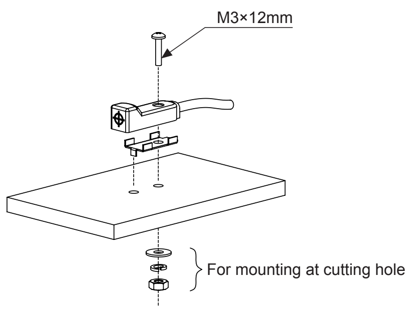




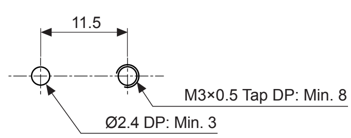
● **Bracket**



※Installing bolts must be a M3×12mm truss bolt and tightening strength should be max. 5kgf.cm.
If installing this unit not as this method, it may cause damage to the functions.



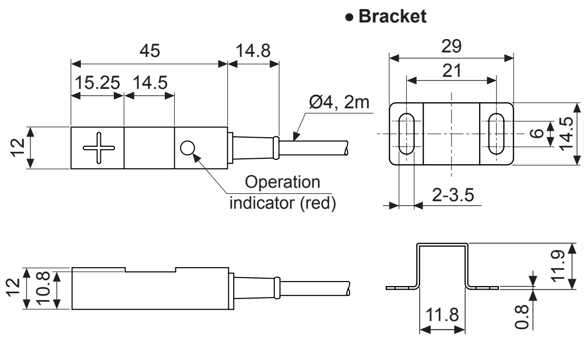
● **Mounting hole cut-out**



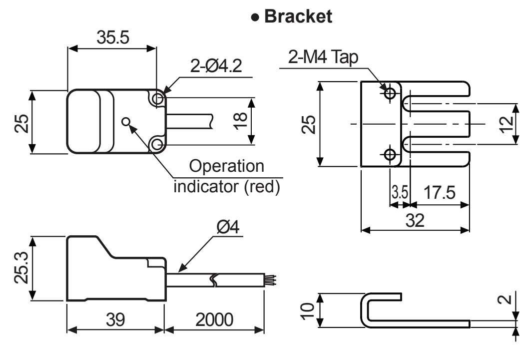
■ Dimensions

(unit: mm)

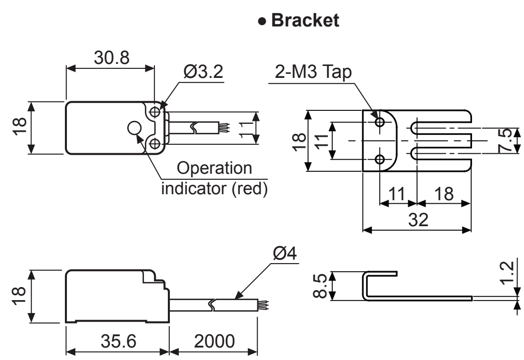
● PS12



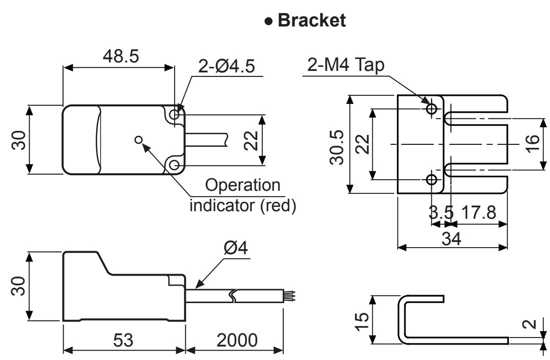
● PSN25



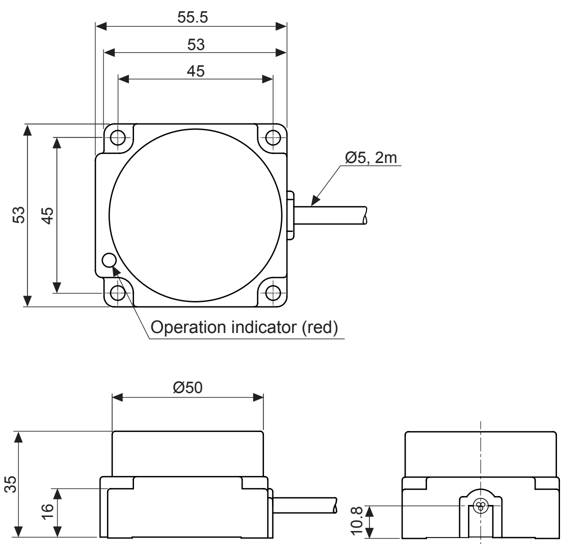
● PSN17 / PSNT17(Former : PS17/ PST17)



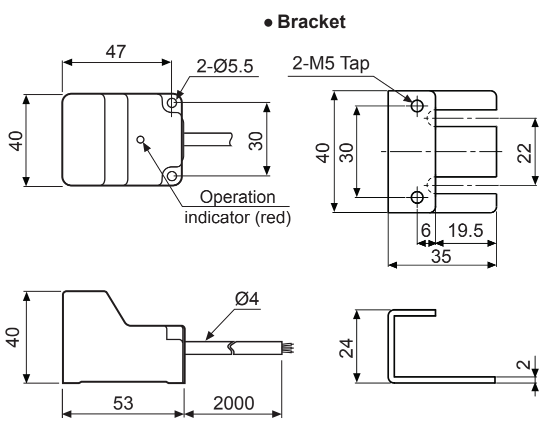
● PSN30



● PS50

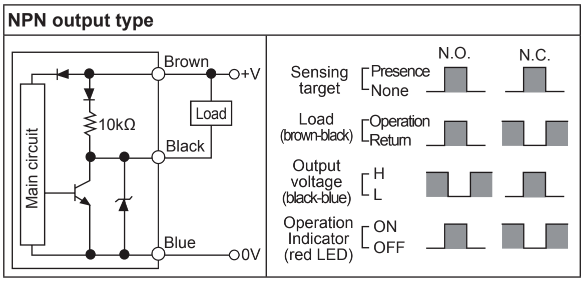


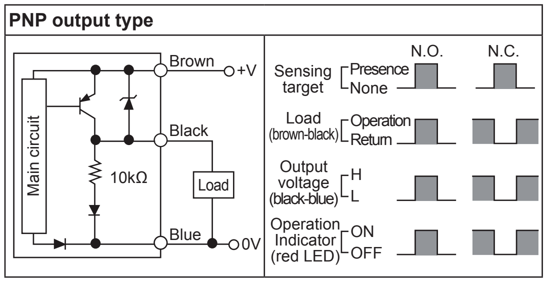
● PSN40



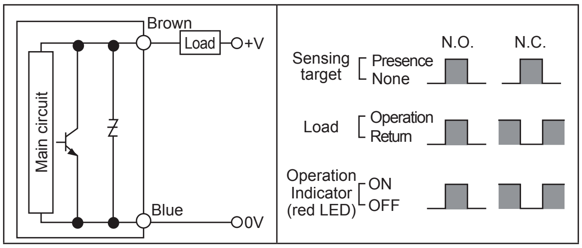
■ Control Output Diagram And Load Operation

◎ DC 3-wire type

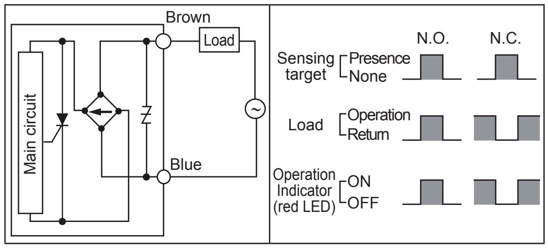




◎ DC 2-wire type

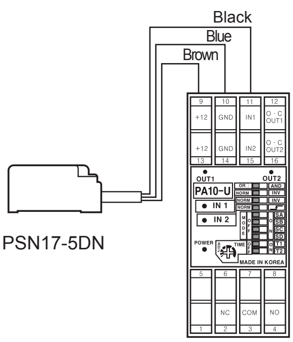


◎ AC 2-wire type

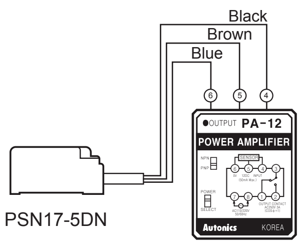


■ Connections

◎ DC 3-wire type



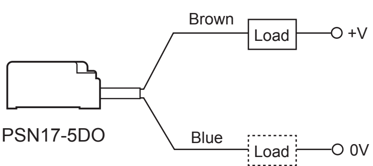
< PA10-U >



< PA-12 >

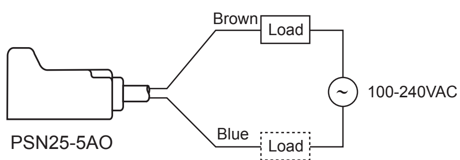
※There is NPN/PNP selection switch in PA-12.

◎ DC 2-wire type



※The load can be connected to either wire.

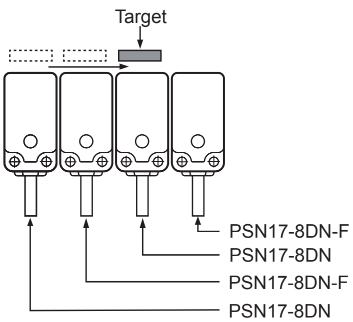
◎ AC 2-wire type



※The load can be connected to either wire.

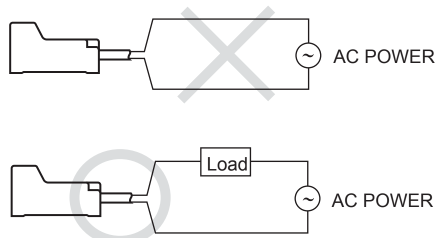
■ Proper Usage

◎ Differential frequency



When installing several proximity sensor closely, it may cause malfunction due to mutual interference. Therefore, please use differential frequency for the application
※Differential frequency type is only for 17 square.

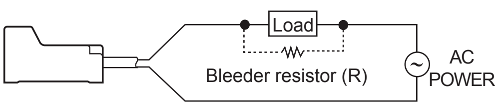
◎ Connection of the power supply



When using DC 2-wire and AC 2-wire type, a load must be connected before applying power; otherwise, components can be damaged.

◎ In case of the load current is small

● **AC 2-wire type**



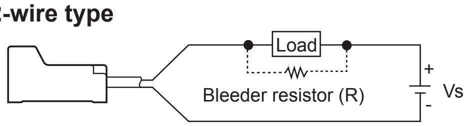
110VAC: Min. 20kΩ 3W
220VAC: Min. 39kΩ 10W

It may cause return failure of load by residual voltage.
If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \le \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[I: Action current of load, R: Bleeder resistance, P: Permissible power]

● **DC 2-wire type**



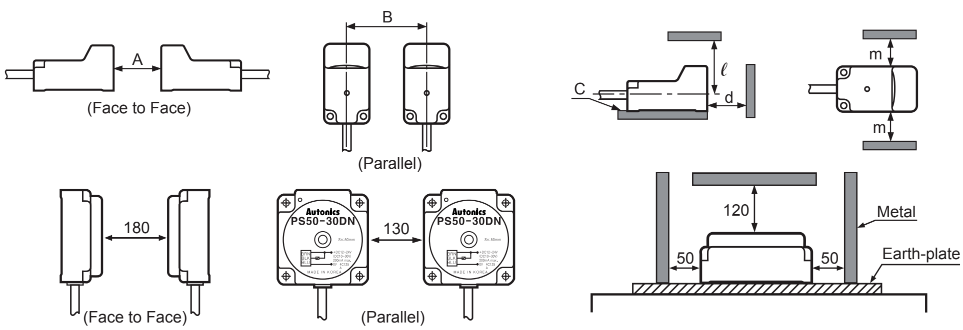
Please make the current on proximity sensor smaller than the return current of load by connecting a Bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

$$R \le \frac{Vs}{Io-Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[Vs: Power supply, Io: Min. action current of proximity sensor
Ioff: Return current of load, P: Number of Bleeder resistance watt]

◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.



(unit: mm)

Item \ Model	PS08	PS12	PSN17 / PSNT17		PSN25	PSN30		PSN40
	2.5mm	4mm	5mm	8mm	5mm	10mm	15mm	20mm
A	16	24	30	48	30	60	90	120
B	16	24	36	40	40	50	65	70
C	5	5	5	5	5	5	5	5
d	15	12	15	24	15	30	45	60
ℓ	11	18	24	33	25	30	45	45
m	8	12	18	20	20	25	35	35

Rectangular, Flat Type Proximity Sensor

■ Features

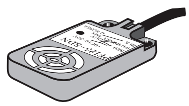
- Easy to mount in narrow space by flat structure (height: 10mm)
- Improved the noise immunity with dedicated IC (DC type)
- Built-in reverse polarity protection circuit, over-current protection circuit (DC type)
- Built-in surge protection circuit
- Red LED operation indicator
- IP67 protection structure (IEC standard)
- Replaceable for micro switches and limit switches

⚠ Please read "Caution for your safety" in operation manual before using.

CE

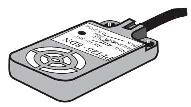
■ Type

◎ DC 3-wire type

Appearance	Model
	**PFI25-8DN**
	PFI25-8DP
	PFI25-8DN2 ※
	PFI25-8DP2 ※

※ mark can be customized.

◎ AC 2-wire type

Appearance	Model
	**PFI25-8AO**
	PFI25-8AC

■ Specification

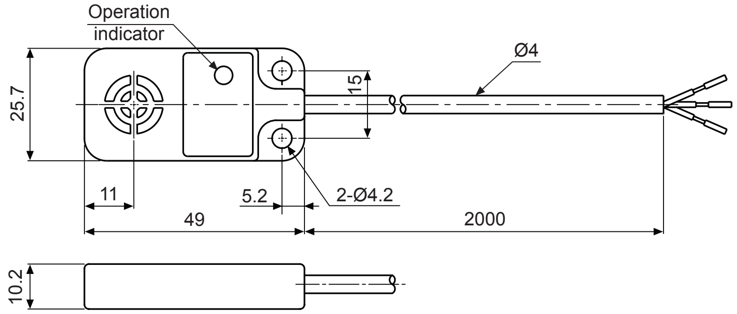
Model		**PFI25-8DN** **PFI25-8DN2** / **PFI25-8DP** **PFI25-8DP2**	**PFI25-8AO** **PFI25-8AC**
Sensing distance		8mm	
Hysteresis		Max. 10% of sensing distance	
Standard sensing target		25×25×1mm (iron)	
Setting distance		0 to 5.6mm	
Power supply (operating voltage)		12-24VDC (10-30VDC)	100-240VAC (85-264VAC)
Current consumption/ Leakage current		Max. 10mA	Max. 2.5mA
Response frequency※1		200Hz	20Hz
Residual voltage		Max. 1.5V	Max. 10V
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃	
Control output		Max. 200mA	5 to 150mA
Insulation resistance		Over 50MΩ (at 500VDC megger)	
Dielectric strength		1,500VAC 50/60Hz for 1 minute	2,500VAC 50/60Hz for 1 minute
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Indicator		Operation indicator: Red LED	
Environ-ment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃	
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH	
Protection circuit		Surge protection circuit, Reverse polarity protection circuit, Over-current protection circuit	Surge protection circuit
Cable		Ø4mm, 3-wire, 2m	Ø4mm, 2-wire, 2m
		AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25	
Material		Case: PPS, Standard cable (black): Polyvinyl chloride (PVC)	
Protection structure		IP67 (IEC standard)	
Approval		CE	
Unit weight		Approx. 70g	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.

※Environment resistance is rated at no freezing or condensation.

■ Dimensions

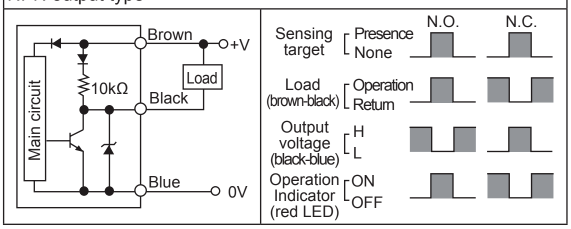
(unit: mm)



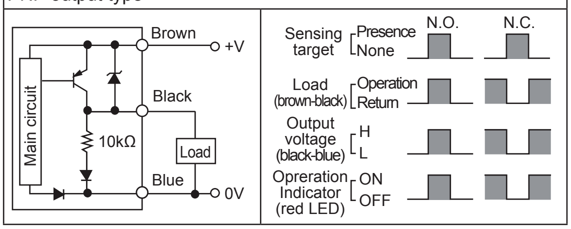
■ Control Output Diagram And Load Operation

◎ DC 3-wire type

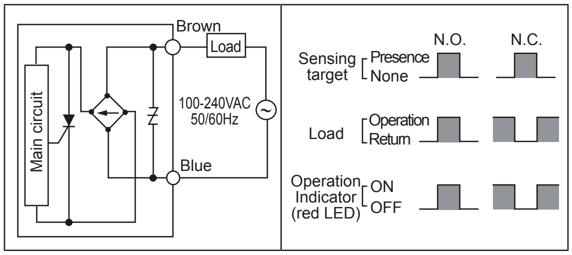
NPN output type



PNP output type



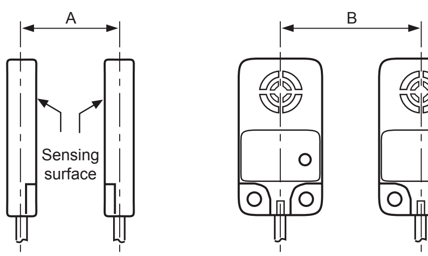
◎ AC 2-wire type



■ Proper Usage

◎ Mutual-interference

When several proximity sensors are mounted close to one another a malfunction of the sensor may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.



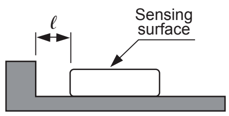
(Face to Face) (Parallel)

(unit: mm)

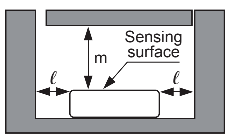
A	100
B	80

◎ Influence by surrounding metals

When sensors are mounted on metallic panel, you must prevent the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



When the height between the proximity sensor and surrounding metals is same.



When the height between the proximity sensor and surrounding metals is different.

(unit: mm)

ℓ	5
m	15

Rectangular, Long Sensing Distance Type Proximity Sensor

■ Features

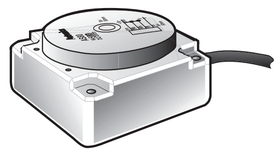
- Sensing up to as 50mm
- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit,
  surge protection circuit, over-current protection circuit
- Wide range of power supply: 12-48VDC
  (voltage range: 10-65VDC)
- Simultaneous output of Normal Open+Normal Close
- Built-in power indicator and operation indicator
- IP67 protection structure (IEC standard)

Please read "Caution for your safety" in operation manual before using.

CE

■ Type

◎ DC 4-wire long distance type

Appearance	Model
	**AS80-50DN3**
	AS80-50DP3

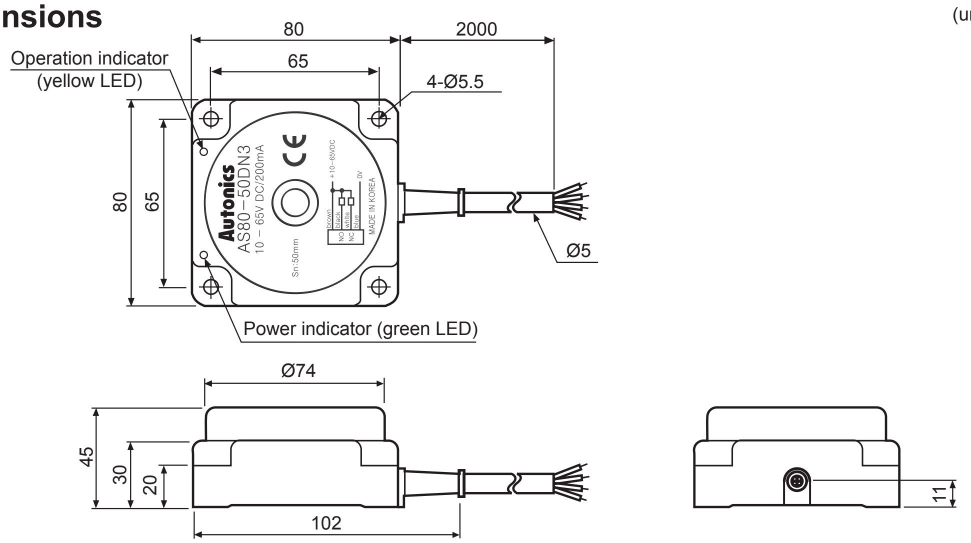
■ Specification

Model	**AS80-50DN3**	**AS80-50DP3**
Sensing type	NPN Normally Open + Normally Closed	PNP Normally Open + Normally Closed
Sensing distance	50mm	
Hysteresis	Max. 15% of sensing distance	
Standard sensing target	150×150×1mm (iron)	
Setting distance	0 to 35mm	
Power supply (operating voltage)	12-48VDC (10-65VDC)	
Current consumption	Max. 20mA	
Response frequency※1	30Hz	
Residual voltage	Max. 2V	
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃	
Control output	Max. 200mA	
Insulation resistance	Over 50MΩ (at 500VDC megger)	
Dielectric strength	1,500VAC 50/60Hz for 1 minute	
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock	500m/s² (appox. 50G) in X, Y, Z direction for 3 times	
Indicator	Power indicator: green LED, Operation indicator: yellow LED	
Environment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃	
Environment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH	
Protection circuit	Surge protection circuit, Reverse polarity protection circuit, Over-current protection circuit	
Cable	Ø5mm, 4-wire, 2m (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm)	
Approval	CE	
Protection structure	IP67 (IEC standard)	
Unit weight	Approx. 470g	

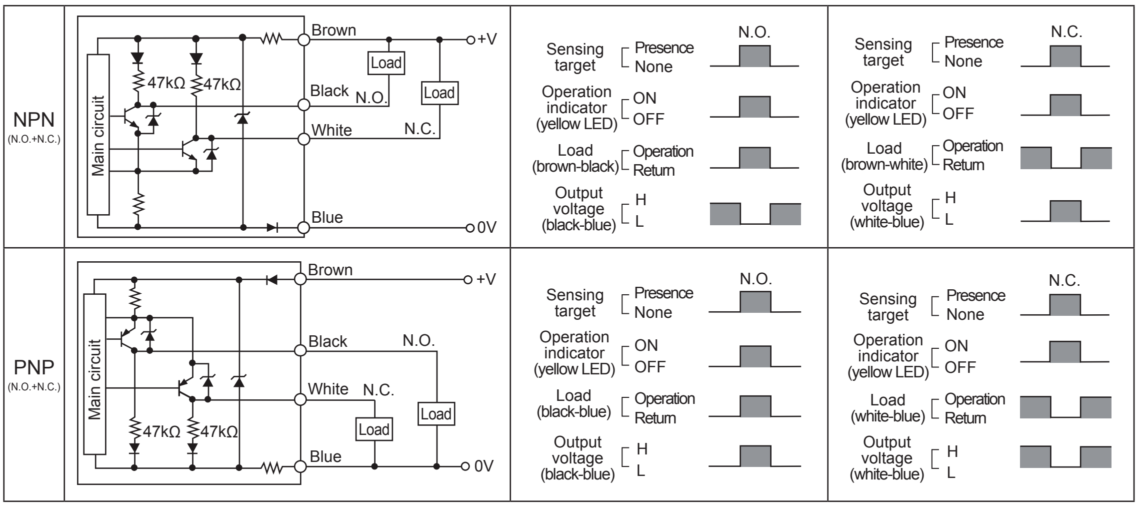
※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※Environment resistance is rated at no freezing or condensation.

■ Dimensions

(unit: mm)



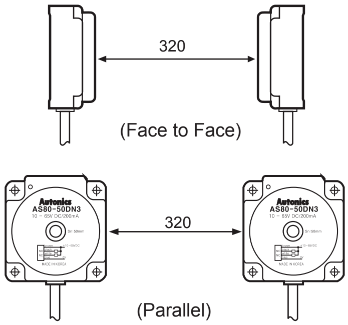
■ Control Output Diagram And Load Operation



■ Mutual-Interference & Influence By Surrounding Metals

◎ Mutual-interference

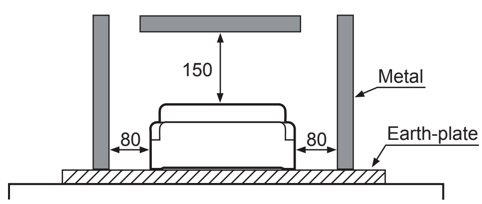
When several proximity sensors are mounted close to one another a malfunction of the sensor may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.



◎ Influence by surrounding metals

When sensors are mounted on metallic panel, you must prevent the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.

(unit: mm)



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

CR Series

Cylindrical, Capacitive type proximity sensor

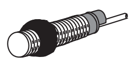
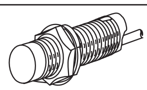
■ Features

- Sensing of iron, metal, plastic, water, stone, wood etc.
- Long life cycle and high reliability
- DC type: Built-in surge protection circuit,
  reverse polarity protection circuit
  AC type: Built-in surge protection circuit
- Easy to adjust of the sensing distance with sensitivity adjuster
- Red LED operation indicator
- Easy to control of level and position

⚠ **Please read "Caution for your safety" in operation manual before using.**

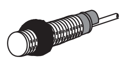
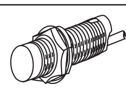
■ Type

◎ DC 3-wire type

Appearances		Model
M18		**CR18-8DN**
		CR18-8DP
		CR18-8DN2 ※
M30		**CR30-15DN**
		CR30-15DP
		CR30-15DM2 ※

※ mark can be customized.

◎ AC 2-wire type

Appearances		Model
M18		**CR18-8AO**
		CR18-8AC
M30		**CR30-15AO**
		CR30-15AC

■ Specifications

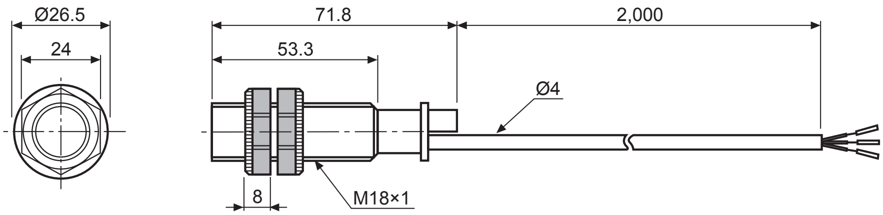
Model		**CR18-8DN** **CR18-3DP** **CR18-8DN2**	**CR30-15DN** **CR30-15DP** **CR30-15DN2**	**CR18-8AO** **CR18-8AC**	**CR30-15AO** **CR30-15AC**
Sensing distance		8mm	15mm	8mm	15mm
Hysteresis		Max. 20% of sensing distance			
Standard sensing target		50×50×1mm (iron)			
Setting distance		0 to 5.6mm	0 to 10.5mm	0 to 5.6mm	0 to 10.5mm
Power supply (operating voltage)		12-24VDC (10-30VDC)		100-240VAC 50/60Hz (85-264VAC)	
Current consumption		Max. 15mA		—	
Leakage current		—		Max. 2.2mA	
Response frequency※1		50Hz		20Hz	
Residual voltage		Max. 1.5V		Max. 20V	
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃			
Control output		Max. 200mA		5 to 200mA	
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,500VAC 50/60Hz for 1minute			
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each of X, Y, Z directions for 2 hours			
Shock		500m/s² (approx. 50G) in each of X, Y, Z directions for 3 times			
Indicator		Operation indicator: Red LED			
Environ-ment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃			
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH			
Protection circuit		Reverse polarity protection circuit, Serge protection circuit		Serge protection circuit	
Protection structure		IP66 (IEC standard)	IP65 (IEC standard)	IP66 (IEC standard)	IP65 (IEC standard)
Cable		Ø4mm, 3-wire, 2m	Ø5mm, 3-wire, 2m	Ø4mm, 2-wire, 2m	Ø5mm, 2-wire, 2m
		AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm			
Material		CR18 - Case/Nut: PA6, Standard cable (black): Polyvinyl chloride (PVC) CR30 - Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC)			
Weight※2		Approx. 88g (approx. 76g)	Approx. 243g (approx. 206g)	Approx. 82g (approx. 70g)	Approx. 237g (approx. 200g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parentheses in for unit only.
※Environment resistance is rated at no freezing or condensation.

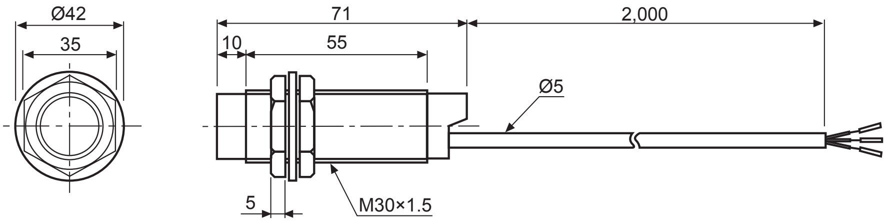
■ Dimensions

(unit: mm)

- **CR18-8□□**



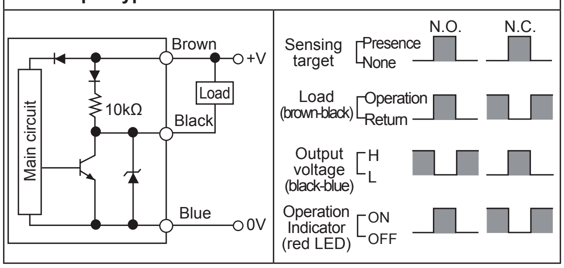
- **CR30-15□□**



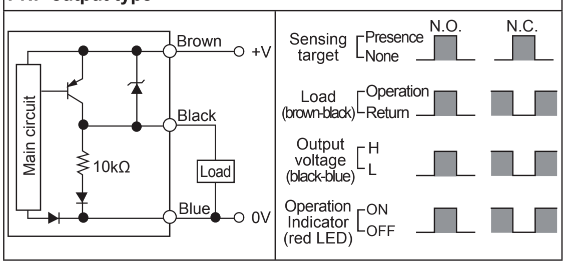
■ Control Output Diagram and Load Operation

◎ DC 3-wire type

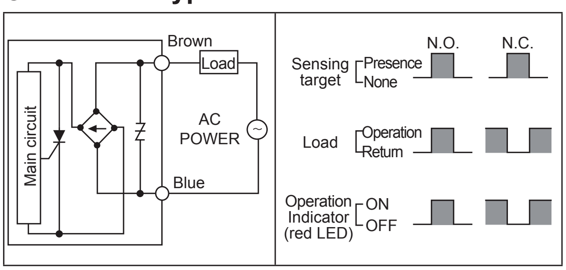
NPN output type



PNP output type

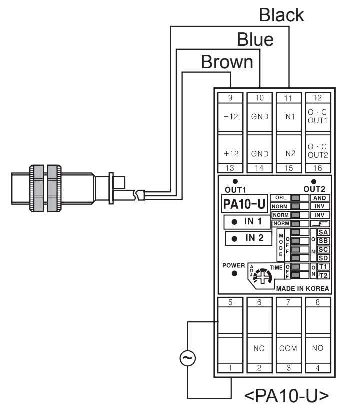


◎ AC 2-wire type

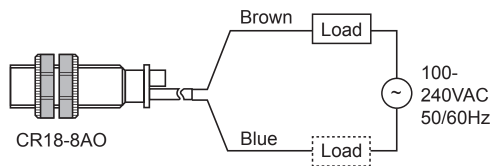


■ Connections

◎ DC 3-wire type



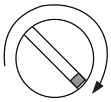
◎ AC 2-wire type



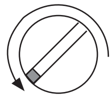
▣ Sensitivity Adjustment

Please turn potention VR to set sensitivity as below procedure.

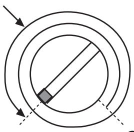
1. Without a sensing object, turn the potention VR to the right and stop at the proximity sensor is ON (OFF).



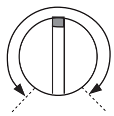
2. Put the object in right sensing position, turn the potention VR to the left and stop at the proximity sensor is OFF (ON).



3. If the difference of the number of potention VR rotation between the ON (OFF) point and the OFF (ON) point is more than 1.5 turns, the sensing operation will be stable.



4. If it is set in sensitivity adjustment position of potention VR at center between **1** and **2**, sensitivity setting will be completed.



※When there is distance fluctuation between proximity sensor and the target, please adjust **2** at the farthest distance from this unit.
※Turning potention VR toward clockwise, it will be max., or turning toward counter clockwise, it will be min. The number of adjustment should be 15±3 revolution and if it is turned to the right or left excessively, it will not stop, but it idles without breakdown.
※(   ) is for Normally closed type.

▣ Grounding

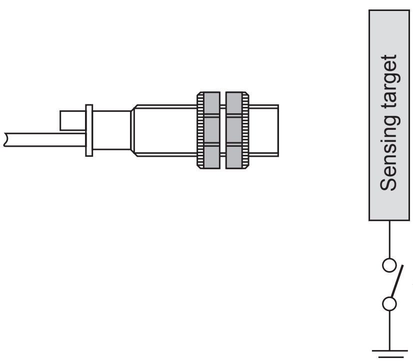
The sensing distance will be changed by grounding status of capacitive proximity sensor and the target[50×50×1mm(Iron)]. Please check the material when installing the sensor and selecting the target.

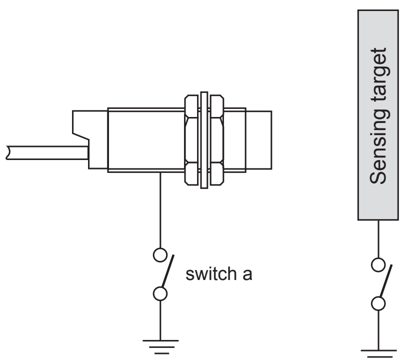
● CR18 type

Ground condition (switch b)	ON	OFF
Operating distance (mm)	8	4

● CR30 type

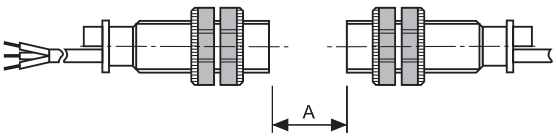
Ground condition	Switch a	ON	OFF	ON	OFF
	Switch b	ON	ON	OFF	OFF
Operating distance (mm)		15	18	6	6



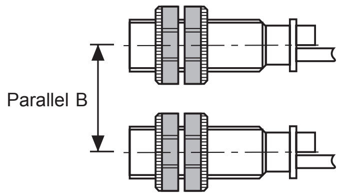


■ Mutual-Interference & Influence By Surrounding Metals

When several proximity sensors are mounted closely, malfunction of sensor may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below charts.



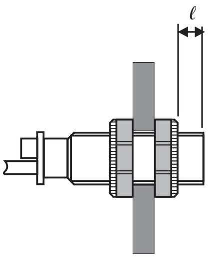
Face to Face

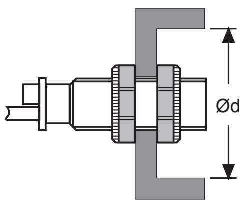


(unit: mm)

Model / Item	CR18	CR30
A	48	90
B	54	90

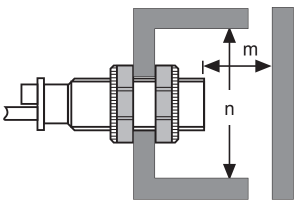
When sensors are mounted on metallic panel, you must prevent the sensors from malfunction by any metallic object. Therefore, be sure to keep a minimum distance as below charts.





(unit: mm)

Model / Item	CR18	CR30
ℓ	20	10
Ød	54	90
m	24	45
n	54	90



■ Materials

◎ Materials of sensing targets

Sensing distance may be different by electrical characteristic of sensing target (conductivity, non dielectric constant) and status of water absorption, size etc.

◎ Effect by high frequency electrical field

It may cause malfunction by machinery which generate high frequency of electrical field such as a washing machine etc.

◎ Surrounding environment

There is water or oil on surface of sensing part, it may cause malfunction.
If the bottle for sensing of level is coated by oil etc., it may cause malfunction.
Especially, 15mm type has high sensitivity for induced objects, please be careful of waterdrops.

◎ Organic solvents

Do not let the oil or oil liquid is flowed into the sensor because the case is made by plastic.

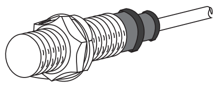
Tranmission coupler

■ Features

- Loop powered type
  The signal is transmitted by magnetic coupling of coils.
- Superior with environmental resistance
  Non-malfunction for oil or dust on transmission part
- Applications
  Drilling, Machine table, Robot arm, Conveyor belt and Various revolution axis.

Please read "Caution for your safety" in operation manual before using.

■ Type

Appearances		Model
M18		**PET18-5**

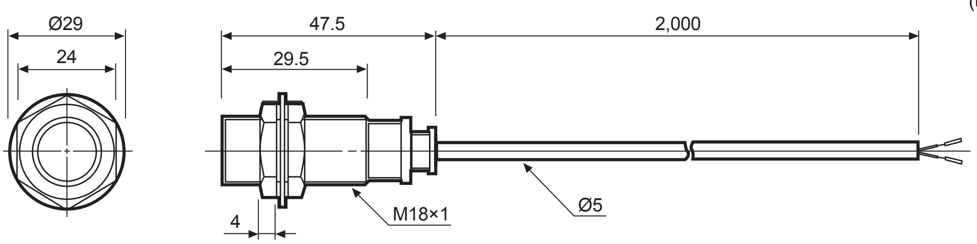
■ Specifications

Model		**PET18-5**
Transmitting distance		5mm
Set transmitting distance		1 to 4.5mm
Responce time		Max. 1ms
Insulation resistance		Over 50MΩ (at 500VDC megger)
Dielectric strength		1,500VAC 50/60Hz for 1minute
Vibration		1mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z direction for 2 hours
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times
Environ-ment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH
Protection structure		IP67 (IEC standards)
Cable		Ø5mm, 2-wire, 2m (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm)
Material		Case and nut: Nickel-plated brass, Washer: Nickel-plated steel, Sensing part: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC)
Weight※1		Approx. 133g (approx. 121g)
Application of proximity sensor		PR18-5DN PRW18-5DN PRCM18-5DN PRWL18-5DN PRL18-5DN PRCML18-5DN PRT18-5DO PR18-5DP PRW18-5DP PRCM18-5DP PRWL18-5DP PRL18-5DP PRCML18-5DP PRT18-5DC PR18-5DN2 PRW18-5DN2 PRCM18-5DN2 PRWL18-5DN2 PRL18-5DN2 PRCML18-5DN2 PRCMT18-5DO PR18-5DP2 PRW18-5DP2 PRCM18-5DP2 PRWL18-5DP2 PRL18-5DP2 PRCML18-5DP2 PRCMT18-5DC

※1: The weight includes packaging. The weight in parentheses in for unit only.
※Environment resistance is rated at no freezing or condensation.

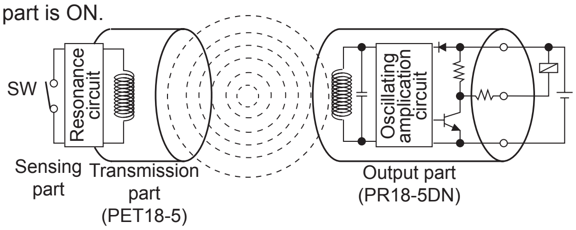
■ Dimensions

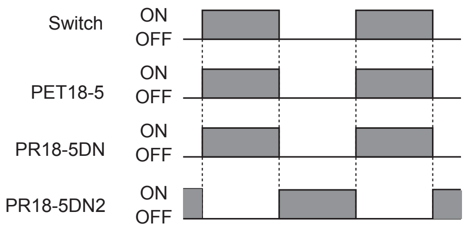
(unit: mm)



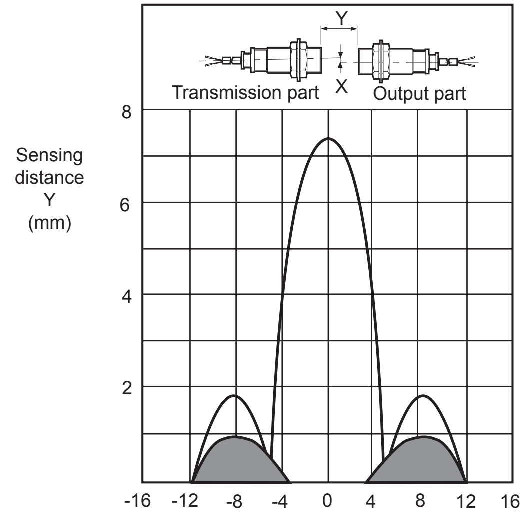
■ Operation Mechanism

It transmits ON/OFF signal with a magnetic coupling of coils.
The coil of transmission part and proximity sensor is coupled electronically, the induced current is generated at closed-loop of transmission part influenced by a magnetic field from proximity sensor coil when the switch of sensing part is ON.



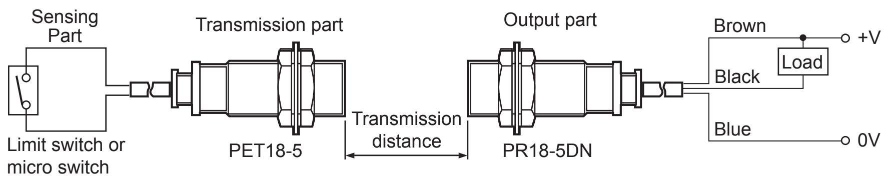


■ Feature Data



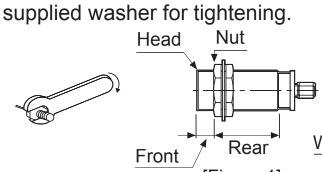
Please note the proximity sensor detects the surrounding cover of the sensing side of transmission coupler even the connection switch is OFF in sensing part of ▒ part.

■ Connections

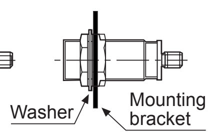


■ Proper Usage

1. This equipment shall not be used outdoors or beyond specified temperature range.
2. Do not apply over tensile strength of cord. (Ø5: Max. 50N)
3. Do not use the same conduit with cord of this unit and electric power line or power line.
4. Do not put overload to tighten nut, please use the supplied washer for tightening.



[Figure 1]



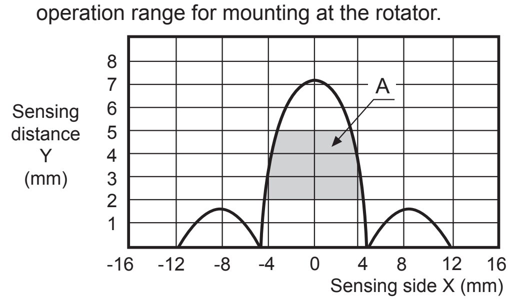
[Figure 2]

[Table 1]

Model \ Strength		Front Size	Front Torque	Rear Torque
PET18-5	Flush	—	150kgf·cm (14.7N·m)	
	Non-Flush	—		

Note1) Allowable tightening torque of a nut may be different by the distance from the head. For allowable tightening torque and the range of front and rear parts, refer to [Table 1] and above[Figure 1] respectively. The rear part includes a nut on the head side(as the [Figure 1]). Please apply a tightening torque of the front part when the nut on the front is located in the front part.
Note2) The allowable tightening torque denotes a torque value when using a provided washer as above [Figure 2].

5. Please shorten the wiring to avoid noise.
6. Please use the cable written on the specification of the product. If the other cable or a crooked cable is used, the waterproof cannot be maintained.
7. $0.3mm^2$ or larger cable can be extended up to 5m.
8. When the transceiver is attached to the proximity sensor or close to the wires, it may cause a malfunction.
9. The contact switch in the sensing part should not have leakage current when it is OFF.
10. The contact resistance is under 300mΩ, open resistance is more than 10MΩ to satisfy the specification of contact switch. (limit switch or micro switch)
11. The inductive proximity sensor used in output part may cause a malfunction, if metal particles attach to sensing area.
12. It is able to transmit signal through the plastic or mirror.
13. Please set sensing distance within part A of the below operation range for mounting at the rotator.

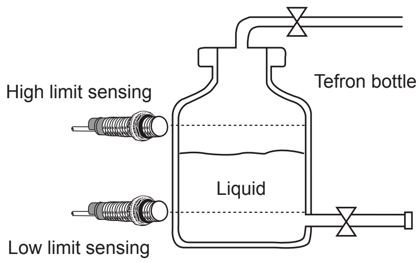


(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Applications

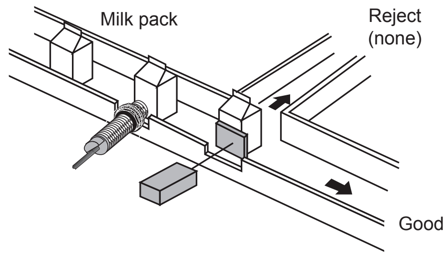
Sensing liquid level (capacitive type)

It is able to detect the level of liquid inside of bottle from outside.

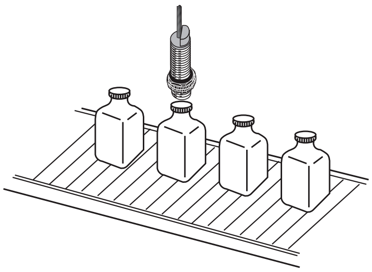


Sensing milk in paper pack (capacitive type)

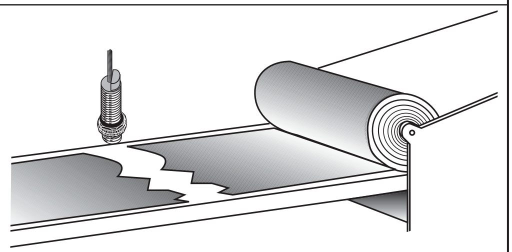
It is able to detect milk in side of pack by capacitive proximity sensor.



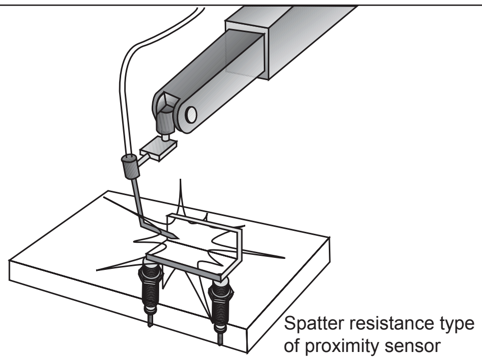
Sensing caps of bottles (capacitive type)



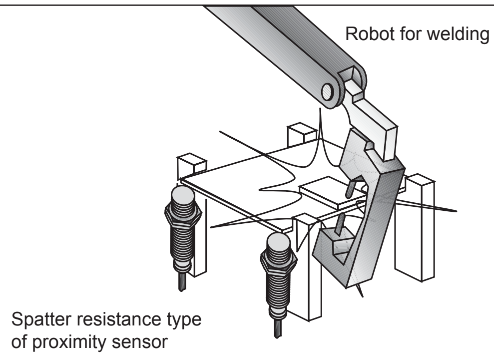
Sensing band defective (capacitive type)



Fixing the point to be welded (arc)

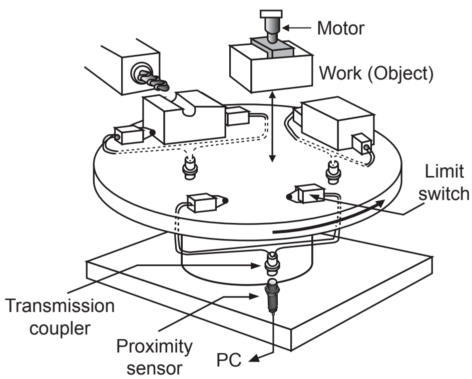


Checking the position for spot welding



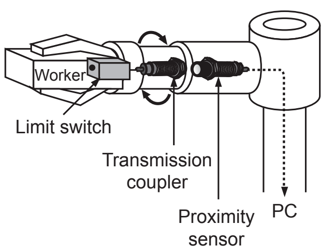
Turning table (transmission coupler)

It detects the work is set on turning table and send a signal.



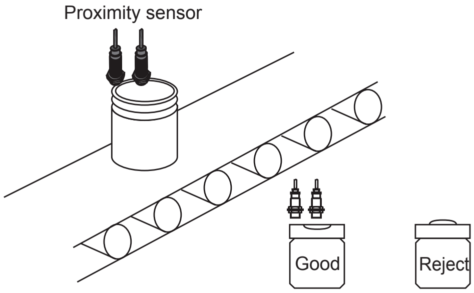
Transmitting the signal of checking (transmission coupler)

It detects if the robot arm is holding the work and send a signal.



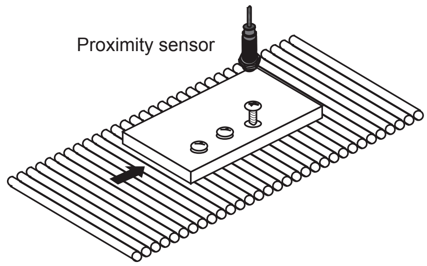
■ Applications

Sensing condition of cans



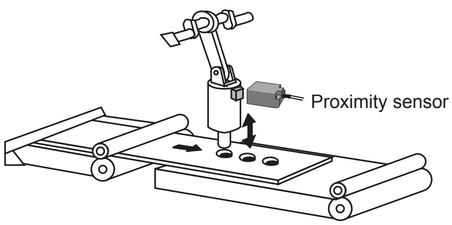
Measuring the height of screws

Sensing the status of screw



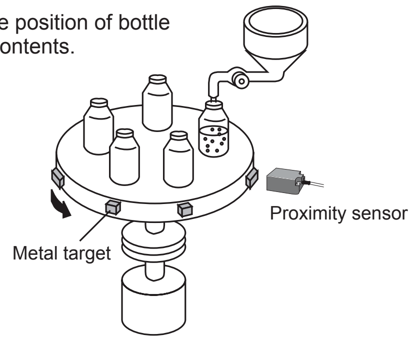
Controlling a press

Making a hole on panel by constant distance



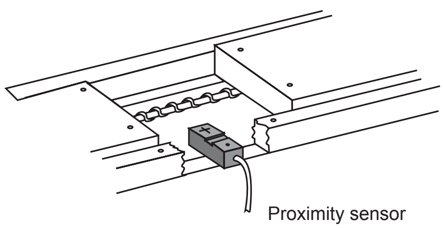
Positioning control

Sensing the position of bottle
for fill the contents.

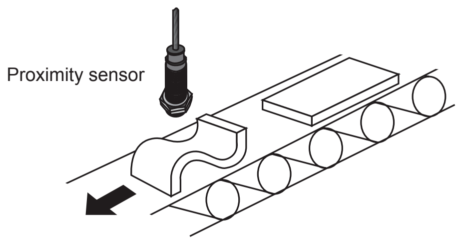


Sensing position of target

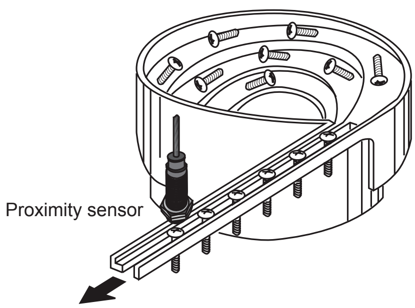
Automatic assembly conveyor line



Sensing incorrect shape of target

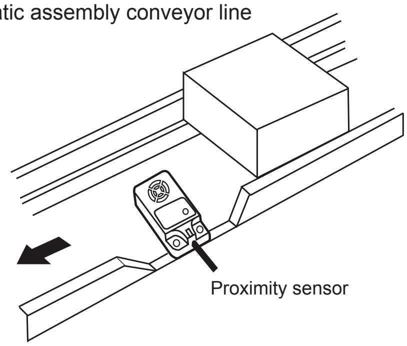


Counting screws



Sensing position of target (PFI 25)

Automatic assembly conveyor line



Technical Description

▣ Overview

Proximity sensor is the non contact detector (sensor) which detects the sensing target when it comes close, not same as the micro switch or the limit switch using the mechanical contact sensing method.

▣ Principle And Feature

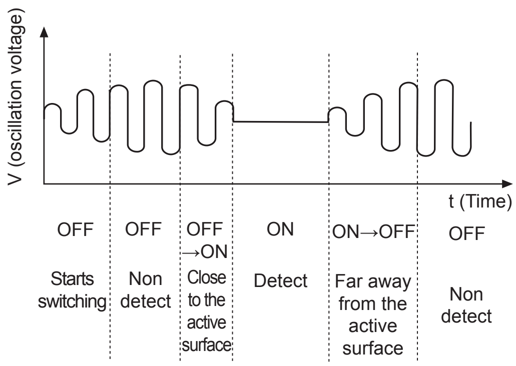
◎ Inductive proximity sensor

● Principle

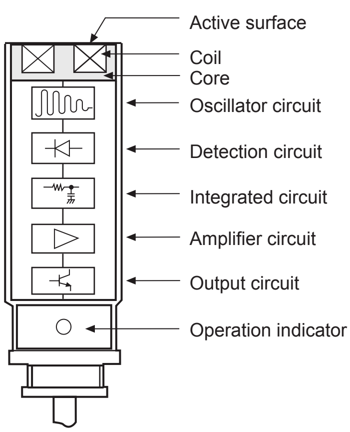
When the object (metallic) approaches the high-frequency magnetic field which is produced at the detection coil, induced currents flow in the metal,causing thermal loss and resulting in the reduction or stopping of oscillations. This change in state is detected by an oscillation state sensing circuit which then operates the output circuit.

● Principles of operation

When the proximity sensor is on, the oscillation of the current within 60ms will be increased to certain frequency, and electric field is formed. After that, if the object approaches, the induced current surrounding the sensing object will be increased, and the oscillation of the current will be decreased. When the object is detected completely, the current will be close to 0V. This very little oscillation of the current will be amplified, and will operate the output section.



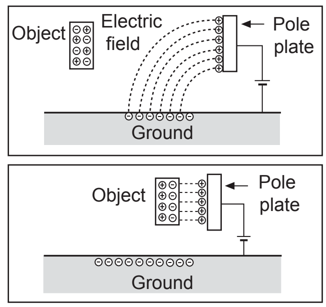
● Configuration



◎ Capacitive proximity sensor

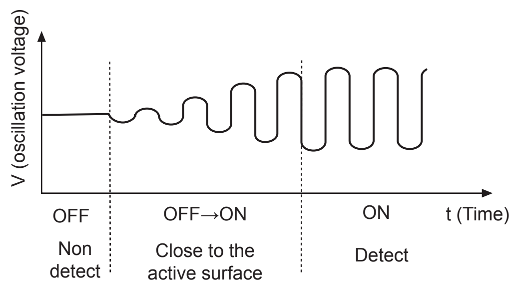
● Principle

As shown below figure, when + current is applied on the pole plate, + charge will be on the pole plate, - charge will be on the ground, and the electric field will be occurred between the pole plate and the ground. When the object approaches to the pole plate, the charges in the object move by the electrostatic induction. - charge will move to the pole plate side, and + charge will move to the other side. This state is called polarization. The object is detected by the strength of the polarization which is strong when the object moves to the pole plate side, and is weak when the object moves far away from the pole plate.

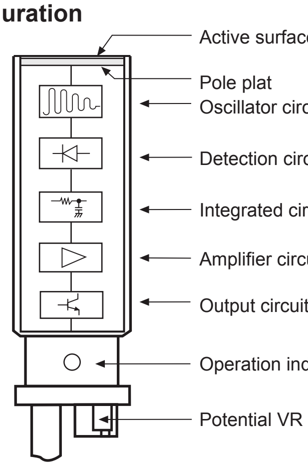


● Principle of operation

Capacitive proximity sensor works contrary method to the inductive proximity sensor. When the sensor power is on, the oscillation of the current is close to 0V. When the object approaches to the sensor, the capacitance will be increased and the oscillation of the current is increased. This output section will be operated by increasing the oscillation.



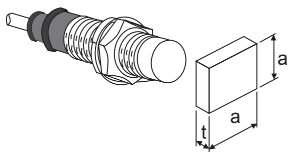
● Configuration



▣ Glossary

◎ Standard sensing target

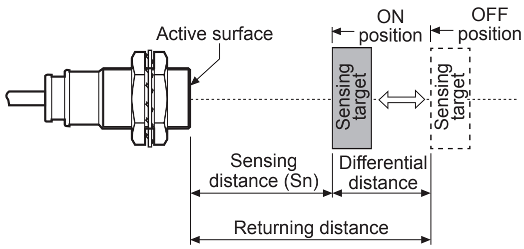
It is the standard of shape, size, and material for each model to measure the standard performance.



t : Thickness of the Target (mm)
a : Length of the one side of the Target (mm)

◎ Sensing distance (Sn)

It is the distance between the active surface and the surface of the sensing target, when the output works by approaching the sensing target to the active surface. The specification of sensing distance (Sn) for each series is measured by standard sensing target.

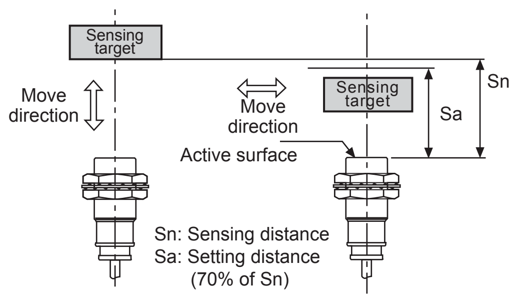


◎ Differential distance (Hysteresis)

The hysteresis is the difference between the operation distance, when the sensor first operates with the standard sensing target approaching from the active surface direction, and the returning distance, when the sensor first stops operating with the standard sensing target receding. This hysteresis prevents chattering of the output due to vibration, etc., of the sensing target.

◎ Setting distance

It is the sensing range for which the sensor can stably detect the standard sensing target even if there is an ambient temperature drift and/or supply voltage fluctuation. Normally, it is 70% of the maximum operation distance.

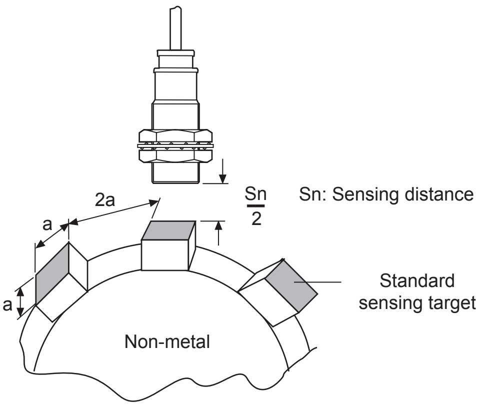


<Figure a> <Figure b>

- After verifying the sensing distance like <Figure a>, please move the target within the stable sensing range like <Figure b>.

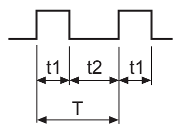
◎ Response frequency

The number of times per second at which sensing can be done without malfunction, when approach the standard sensing target to the sensor. It shows Hz.



< Response frequency measurement method >

Response frequency (f) = $\frac{1}{T}$ [Hz]



◎ Relative dielectric constant

It is the ratio of between the dielectric constant of the material (ε) and the dielectric constant of vacuum (ε_o).

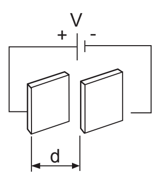
$$\varepsilon_s = \frac{\varepsilon}{\varepsilon_o}$$

As the relative dielectric constant is big, the sensing distance is long. And each material has its own value of the relative dielectric constant. The value of the relative dielectric constant for solid is bigger than liquid. There are the relative dielectric constants for typical materials.

Air	1	Polystyrene	1.2
Paper	2.3	PVC	3
Wood	6 to 8	Glass	5
Alcohol	25.8	Water	80

◎ Capacitance

It is the amount of the accumulated charge (Q), when apply voltage at the insulated conductors. As the accumulated charge (Q) is big, the sensing distance becomes long.



Capacitance (C) = $\frac{Q}{V} = \frac{\varepsilon A}{d}$

- A : The area of the pole plate
- d : The distance between two pole plate
- Q : Charge
- ε : Dielectric constant

As shown above formula, the capacitance (C) will be increased as the amount of charge (Q) is increased. There are the methods to increase the capacitance, increase the area of the pole plate, use the material that the relative dielectric constant is big or narrow the distance between two pole plates.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
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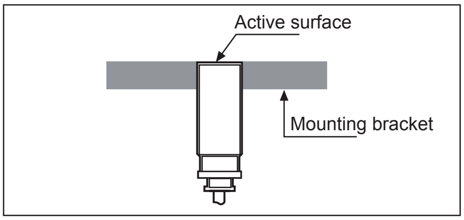
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Mount Sensor

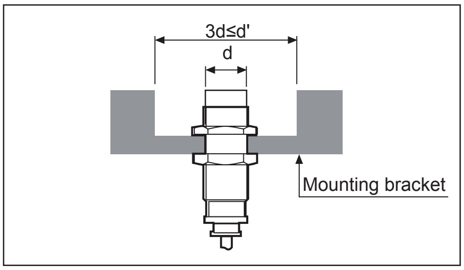
◎ Flush type mounting (shield type)

The most area of the proximity sensor is surrounded by metal except the active surface to prevent the effect of the approaching metal from side. Even though the sensing distance is shorter than non-flush type, the active surface of the sensor can be mounted at the same level of the metal enclosure like below figure.



◎ Non-flush type mounting (non-shield type)

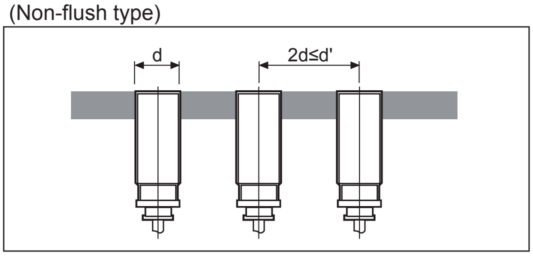
The sensor is affected easily by approaching metal from side because the side of the active surface was not shield by metal. The sensing distance is longer than the flush type, but when mount the sensor, please mount on the concave side, and keep the distance three times longer than the diameter of the sensor like below figure.



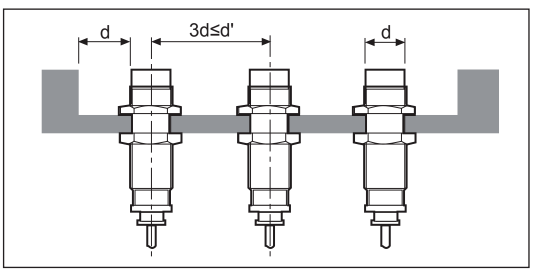
◎ Parallel mounting

When several proximity sensors are mounted close together, there is the effect of mutual interference. Therefore please keep the distance which is two times longer than the diameter of the sensor for flush type, and three times longer than the diameter of the sensor for the non-flush type.

(Non-flush type)

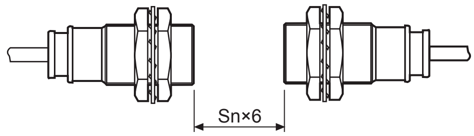


(Flush type)



◎ Face to face mounting

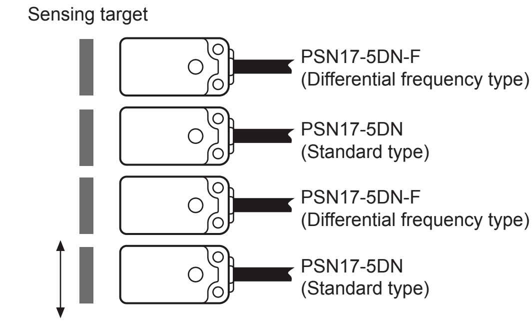
When proximity sensors are mounted in face to face, malfunction of sensor may be caused due to mutual interference. Therefore, please keep the distance which is six times longer than the sensing distance.



※Sn: Sensing distance

◎ Tightly mounting

When proximity sensors are mounted tightly, malfunction of sensor may be caused due to mutual interference. Therefore, please use differential frequency for the application like below picture. Differential frequency type is only for PSN17 series.

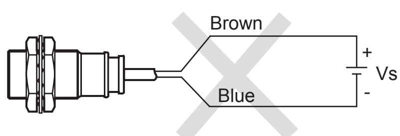


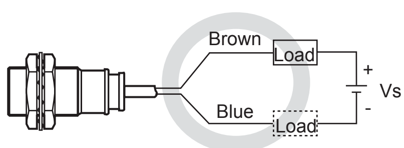
▣ Connection For DC Type

◎ DC 2-wire type

● Load connection

If DC 2-wire type is connected without load, the inner device of DC 2-wire type can get damage. Please connect the load before apply power. The load can be connected any power line.





● To connect DC 2-wire type sensor with PLC (Programmable Logic Controller)

DC 2-wire type of proximity sensor can be connected with PLC when input specification of PLC and proximity sensor specification comply with the conditions shown below.

1)When ON voltage of PLC and residual voltage of sensor meet following formula.

$Von \leq V_S - V_R$

2)When OFF voltage of PLC and a leakage current of sensor meet following formula.

$Ioff \geq IL$

3)When ON current of PLC and control output current of sensor meet following formula.

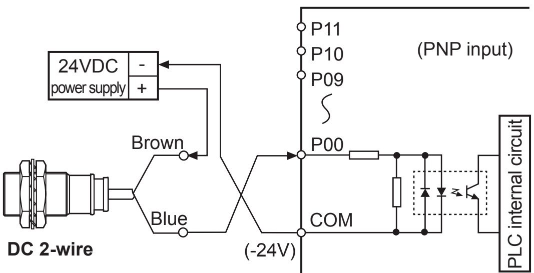
$Iout\ (min) \leq Ion$

[Note]

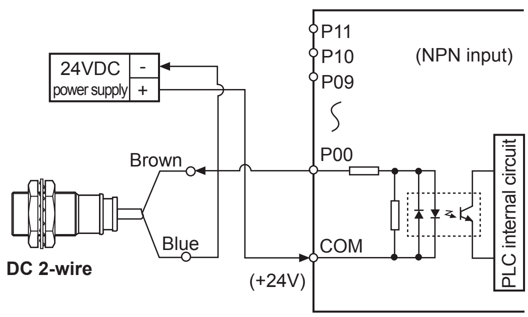
Von : ON voltage of PLC
V_S : Source voltage
V_R : Residual voltage of proximity sensor
Ioff : OFF current of PLC
IL : A leakage current of proximity sensor
Iout (min) : The min. value of proximity sensor's control output
Ion : ON current of PLC

E.g.) PLC input specification - ON voltage: over 15VDC
ON current: over 4.3mA
OFF current: under 1.5mA
Proximity sensor - PRT18-5DO, source voltage is 24VDC
1) Von (15V) ≤ V_S (24V) - V_R (3.5V) = 20.5V : OK
2) Ioff (1.5mA) ≥ IL (0.6mA) : OK
3) Iout (min) (2mA) ≤ Ion (4.3mA) : OK

● Connect DC 2-wire type sensor with PLC (Programmable Logic Controller)



< PLC's Common terminal is "-24V" >



< PLC's Common terminal is "-24V" >

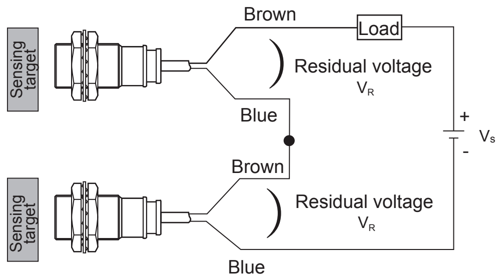
● AND (series) connection

When it is connected in series, all proximity sensors have to be in working to make loads operated. The residual voltage which is related with the number of the sensor should not influence both operating voltage of proximity sensors and driving voltage of a load, and which condition should be considered to choose how many sensors to be connected in series.

To connect sensors in series, choose the number of proximity sensors within the amount that meets formula below.

$V_S - (n \times V_R) \geq$ Operating voltage of load.

[V_S : Source voltage V_R : Residual voltage
n : The number of connected sensors]



● OR (parallel) connection

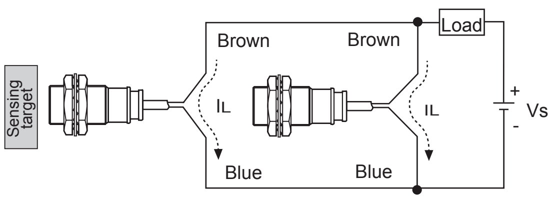
When it is connected in parallel, it works even only one sensor is on operation. A little current flows as a leakage current because proximity sensor operates internal circuit even when it is OFF. Because a number of sensors connected in parallel increase the amount of leakage current, load could run when proximity sensor is in OFF status.

Thus, the leakage current which is related with the number of the sensor should not influence the returning current of load, and which condition should be considered to choose how many sensors to be connected in parallel.

To connect several sensors in parallel, choose the number of proximity sensors within the amount that meets the formula below.

$n \times IL \leq$ The returning current of load

[n : The number of connected sensors
IL : The leakage current of sensor]



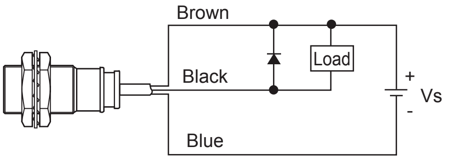
E.g.) When load is relay (24VDC), and connecting PRT18-5DO in parallel,
•The returning current of load : Max. 3.7mA
•The leakage current of PRT18-5DO : Max. 0.6mA
Six sensors can be connected in parallel in Max.

◎ DC 3-wire type

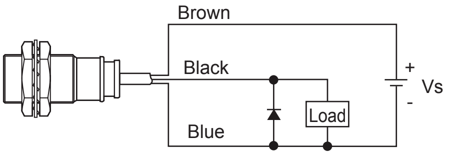
● Load connection

In DC 3-wire type of proximity sensor, there are two types of output, NPN and PNP, and they can either open or close power relay, solenoid, electric counter, PLC, etc.

※In case of using inductive load (relay, motor, magnet, etc.), connect surge absorber diode in parallel with load. Use diode, of which withstand voltage is threefold over power supply.)



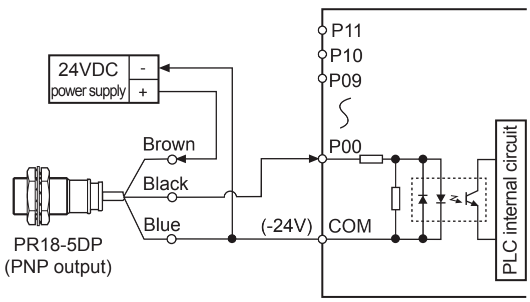
(A circuit using NPN type sensor)



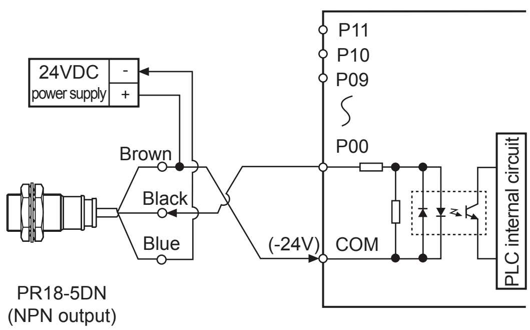
(A circuit using PNP type sensor)

● Connection with PLC (Programmable Logic Controller)

When connecting DC 3-wire type of proximity sensor with PLC, applicable sensor is chosen differently depend on common terminal status.



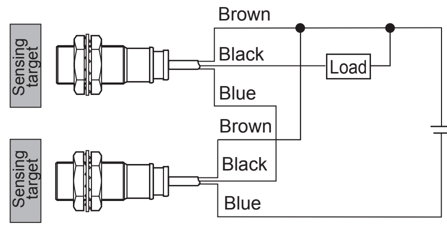
< PLC's Common terminal is "-24V" >



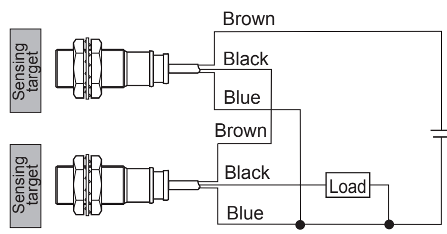
< PLC's Common terminal is "+24V" >

● AND (series) connection

When it is connected in series, all proximity sensors have to be in working to make loads operated. The residual voltage which is related with the number of the sensor should not influence both operating voltage of proximity sensors and driving voltage of a load, and which condition should be considered to choose how many sensors to be connected in series. PNP output type sensor and NPN output type sensor cannot be used in a same circuit.



(Series connection of NPN output type sensors)

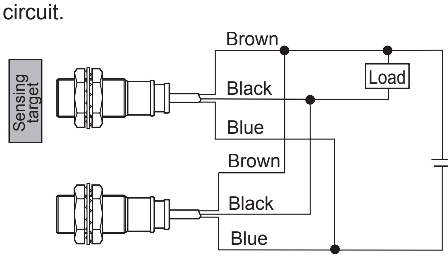


(Series connection of PNP output type sensors)

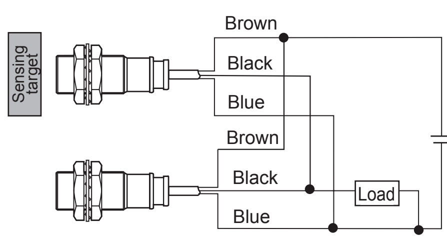
● OR (parallel) connection

When it is connected in parallel, it works even one sensor is on operation.

The leakage current which is related with the number of the sensor should not influence the returning current of load, and which condition should be considered to choose how many sensors to be connected in parallel. PNP output type sensor and NPN output type sensor cannot be used in a same circuit.



(Parallel connection of NPN output type sensors)

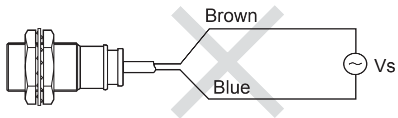


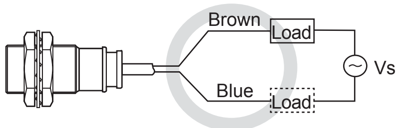
(Parallel connection of PNP output type sensors)

■ How To Connect Ac Type Proximity Sensor

◎ Load connection

When using AC 2-wire type sensor, load have to be wired in circuit, otherwise internal element gets burn when power is supplied. Load could be connected any side of power wire.



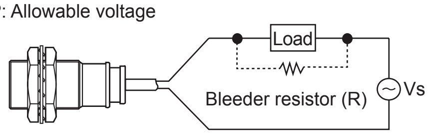


● When operating current of load is not enough

When operating current of load is under 5mA, use bleeder resistance so that current flowing through load can be increased to over 5mA.
Use the formula below to calculate the value of bleeder resistance and allowable current.

$$R \le \frac{Vs}{I}(\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

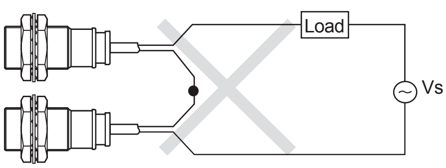
* I : Operating current of load   R: Bleeder resistance
P: Allowable voltage



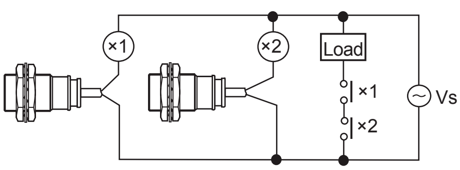
Use load of over 20kΩ 3W for 110VAC power, over 39kΩ 10W for 220VAC.
※When having thermogenic problem, use load that has larger value of watt.

◎ AND (series) connection

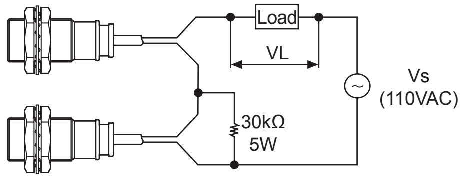
In principle AC type of proximity sensor cannot be used in series connection. To use it in series connection, put relay or bleeder resistance in circuit.



(Figure 1) The wrong way of series connection



(Figure 2) The right way of series connection



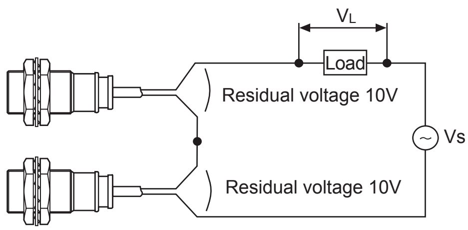
(Figure 3) Bleeder resistance connection method

※Bleeder resistance is not needed when power voltage is 220VAC.

● Load power voltage check

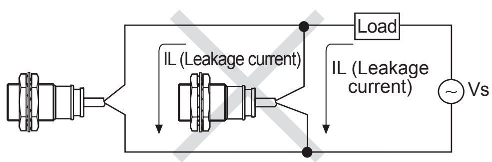
When connecting in series, operating voltage, V_L,is calculated as subtraction of power source voltage and residual voltage of proximity sensor. Thus, it would follow a formula ; V_L=power source voltage- (residual voltage of proximity sensor× the number of sensor)

E.g.) V_S = 110VAC, operating voltage of load
V_L = 110 - (10×2) = 90V, so load that works with 90VAC must be used.

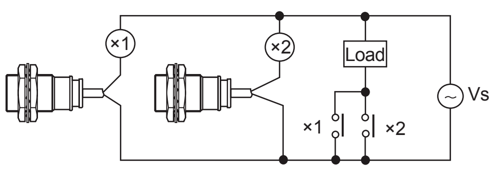


◎ OR (parallel) connection

More than two sensors cannot be connected in a same circuit to operate load. Even though parallel connection is possible when those sensors are not being operated at a same time, because leaking current is increased by n times, returning faulty of load can occur. (n: the number of connected sensors)
Thus, connect relay in parallel so that load can work properly.



(Figure 4) The wrong way of parallel connection



(Figure 5) The right way of parallel connection

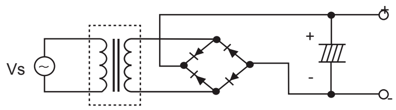
▣ Proper Usage

To using proximity sensors, please refer to the below instructions.

◎ Power supply

● DC type proximity sensor

Power of DC type proximity sensor should be used the rectified power by insulation transformer and ripple should be within 10%.



Insulation transformer

● AC type proximity sensor

Supply power should be sine wave. Square wave of AC power may cause return error, etc.

◎ Load

When wiring proximity sensor, be sure that the load should not be short by wrong connection of power, wrong wiring.

- DC 2-wire has polarity and be sure that the power polarity is properly connected.
  Load connection can be connected to any direction.
  Do not supply the power without loads, or inner element is damaged.
- DC 3-wire has built-in load short protection circuit but this protection circuit operates only for normal operation.
  Be sure that shorted output line with + power line or unproper polarity.
- AC 2-wire power is AC and there is no polarity.
  Load connection method is same as DC 2-wire method.
  Do not supply the power without loads, or inner element is damaged.

◎ Wiring

Do not use the same conduit with cord of proximity sensor and electric power line or power line. Also avoid the same conduction, or it may cause malfunction.
It is possible to extend cable with over 0.3mm^2 and max. 200m.
If fast response is required and using extended cable, it may cause distortion phenomenon of output wave and it does not operate properly.

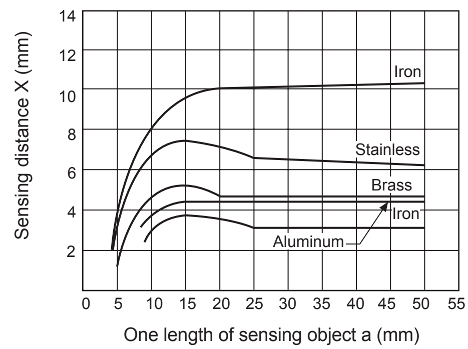
◎ Sensing distance by material of sensing object

Material of the standard sensing object is magnetic metal (iron). Be sure that sensing distance of nonmagnetic metal (aluminum, etc) for a sensing object is shorten extremely.

Material	Sensing distance
Iron	100%
Stainless	Approx. 65%
Brass	Approx. 40%
Aluminum	Approx. 30%
Copper	Approx. 28%

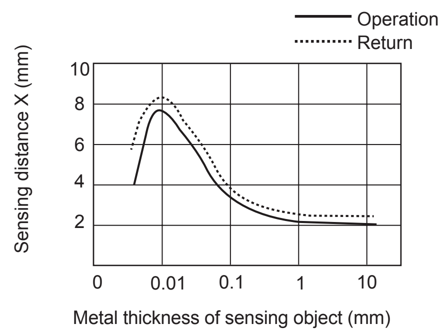
◎ Sensing distance by size of sensing object

If a sensing object is smaller than the standard sensing object, the sensing distance is shorten. If a sensing object is bigger than the standard sensing object, the sensing distance is constant. The below figure is characteristics data by changing one side of sensing distance per a (mm) based on 1mm thickness of square metal plate as a sensing object.
E.g.) For PR30-10DN



◎ Sensing distance of thickness of sensing object

Thickness of standard sensing object is 1mm. If the thickness is over 1mm and sensing distance does not have any variation.
Even though material of a sensing object is nonmagnetic metal (aluminum, copper, etc) and the thickness is around 0.01mm, the sensing object has the same sensing distance as magnetic metal's. If a sensing object which is ultra thin by film, etc or has no conductive cannot be detected.
E.g.) Proximity sensor: PR18-8DN, Sensing object: Aluminum



◎ Sensing distance by plate of sensing object

Refer to the below table for changing sensing distance by the plate of sensing objects.

● Effect by plate (examples of standards) (unit: %)

Applied metal / Thickness of plated type	Iron	Brass
Not plated	100	100
Zn 5 to 15㎛	90 to 120	95 to 105
Cd5 to 15㎛	100 to 110	95 to 100
Ag 5 to 15㎛	60 to 90	85 to 100
Cu 10 to 20㎛	70 to 95	95 to 105
Cu 5 to 15㎛	—	95 to 105
Cu 5 to 10㎛ + Ni (10 to 20㎛)	70 to 95	—
Cu (5 to 15㎛) + Ni (10µ)+Cr (0.3㎛)	75 to 95	—

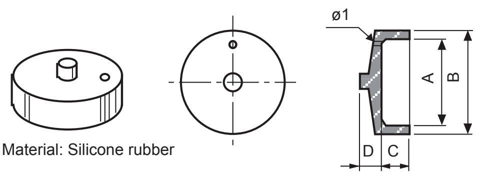
※ Reference: % of not plated sensing object

◎ The characteristic of spatter-resistance type

The hot arc from arc welding machine is adhesive even with metals or plastics. Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with teflon against thermal resistance. Also, the protection cover sold optionally has the same function.

◎ Protection cover

If a proximity sensor is installed at the place where there are lots of arc when welding arc, use the protection cover to prevent a proximity sensor.



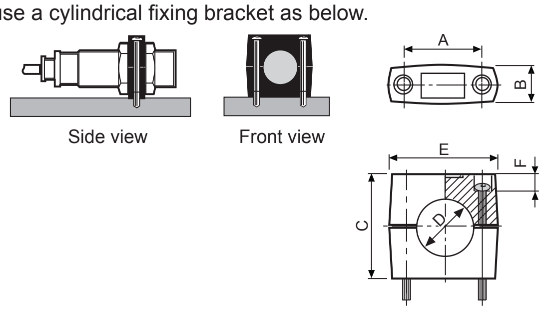
Material: Silicone rubber

Item \ Model	P90-M12	P90-M18	P90-M30
A	ø11	ø17	ø28.5
B	ø14	ø21	ø33
C	5.0	6 0	8.0
D	1.0	3 0	6.0
Applied sensor	M12	M18	M30

※Only for Flush (shield) type

◎ Fixing bracket for cylindrical proximity sensor

If fixing holes are not made for cylindrical proximity sensor, use a cylindrical fixing bracket as below.



Side view Front view

Item \ Model	P90-R12	P90-R18	P90-R30
A	24±0.2	32±0.2	45±0.2
B	Max. 11.5	Max. 16	Max. 16
C	20	30	50
D	ø12	ø18	ø30
E	Max. 34.4	Max. 47	Max. 60
F	6.0	10	10
Fixing bolt	M4×20	M5×30	M5×50
Applied sensor	M12	M18	M30

※For Non-flush (non-shield) type, be sure effect by ambient material.

◎ Other causes

● When AC 2-wire proximity sensor is supplied to the power with noise, the inner circuit may be broken.

● Surge protection (AC 2-wire)

If there are machines (motor, welding, etc), which occurs big surge around this unit, please install Varistor or absorber to source of surge, even though there is built-in surge absorber in this unit.

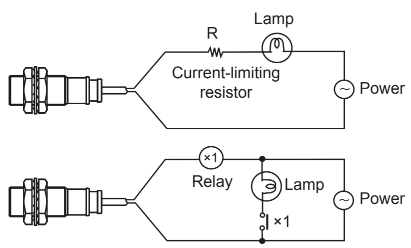
● Effect by leakage current (residual voltage)

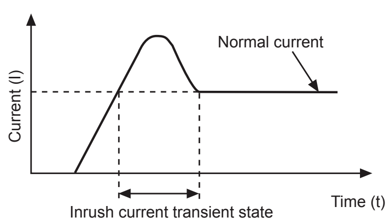
DC 2-wire and AC 2-wire proximity sensor consumes a few of current to operate the circuit even thought the power is OFF. This is called as leakage current. It may cause return error of load because there is small voltage (load residual voltage) at load. Please check that this voltage is below the return voltage of load (leakage current is below than return current of load)

-Refer to "● When operating current of load is not enough" of page D-69.

● Load with large inrush current (DC 2-wire, AC 2-wire)

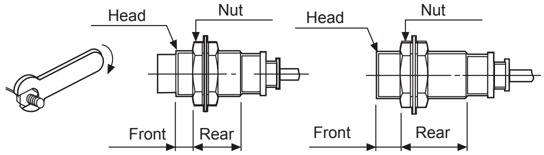
When using load with big inrush current (lamp, motor, etc.), large inrush current flows due to low initial resistance value and it returns to steady state current by high resistance value after certain time. In this case, too large current flows at initial power and it may cause damage to inner circuit of proximity sensor. Use additional relay or current-limit resistance (R) to protect proximity sensor.



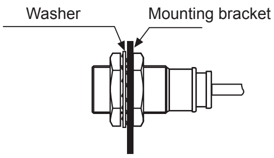


Proper Usage

● Do not put overload to tighten nuts.
Please use the washer for tightening.



<Figure 1>



<Figure 2>

※Allowable tightening torque of nuts may be different by the distance from the head. For allowable tightening torque and the range of front and rear parts, refer to the below table. (front part is the range from head to size of the below table and rear part is including the nuts as the <Figure 1>. please apply the tightening torque of the front part when the nut on the front is located in the front part.)
※Allowable strength tightening (torque) denotes a torque value when using a provided washer as the <Figure 2>.

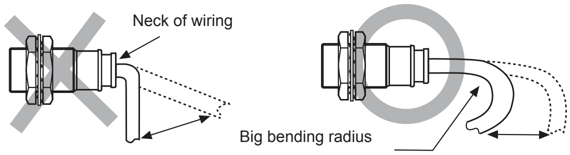
<Allowable strength tightening for nut>

Model \ Strength		Front part		Rear part
		Size	Torque	Torque
PR08 Series	Flush	7mm	40kgf·cm (3.92N·m)	90kgf·cm (8.82N·m)
	Non-flush	5mm		
PR12/ PRD12 Series	Flush	13mm	65kgf·cm (6.37N·m)	120kgf·cm (11.76N·m)
	Non-flush	7mm		
PR18 / PRD18 Series	Flush	—	150kgf·cm (14.7N·m)	
	Non-flush	—		
PR30 / PRD30 Series	Flush	26mm	500kgf·cm (49N·m)	800kgf·cm (78.4N·m)
	Non-flush	12mm		

※ (1kgf·cm = 0.098N·m)

● Wrong wiring damages inner circuit. Check the wiring connection before supplying the power.
● Check the voltage range due not over the rated specifications for power input.
● Do not operate proximity sensor when supplying the power after 60ms, muting time of proximity sensor, or it may cause malfunction.
● Do not connect capacitive load directly to the unit which does not built-in short protection circuit for output.
If it is over the rated load current, short protection circuit operates and if it is below the rated load current, it is cleared automatically.
● Turn OFF the power for wiring.
● Wire must be as short as possible in order to avoid noise.
● Be sure that for the plated sensing object, the sensing distance is varied by plating materials.
● If material dust sticks at the sensing part, it may cause malfunction.

● If the neck of wiring is move during operation, it may cause damage to wire.
Make big bending radius.

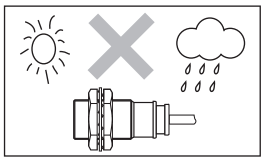


◎ Maintenance

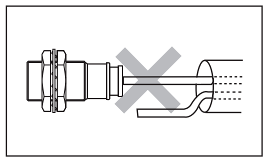
For long-term using proximity sensor, check the below items.
● Installation environment for sensing target and proximity sensor, untightening of nut and distortion
● Untightening of wiring and connection, wrong connection, and disconnection
● Attached or accumulated metal dust at sensing part
● Setting distance
● Ambient environment and temperature

◎ Environment

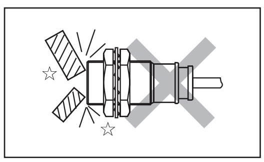
To maintain stable operation, reliability and long life cycle, do not use this unit out of the rated temperature or outside. Proximity sensor has IP67 protection structure but use the cover not to touch water or cutting oil, etc. Do not use this unit at the place where there is chemicals such as acetic acid, strong alkaline, or chromate, etc.



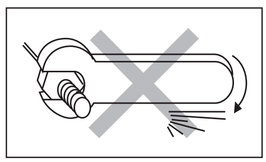
Do not use this unit outdoors.



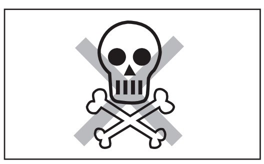
Do not use the same conduit with electric power line or power line, or it may cause malfunction.



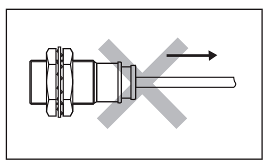
Sensing target should not hit the sensing side of proximity sensor.



Do not put overload to tighten a nut.



Be sure to the strong chemicals such as acid or alkaline.



Do not pull over the cable with excessive load.

■ Protection Structure

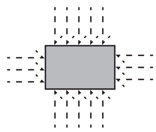
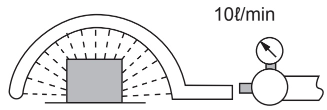
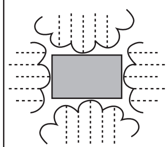
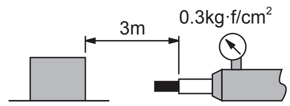
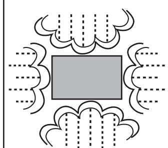
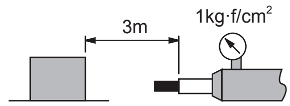
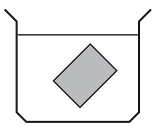
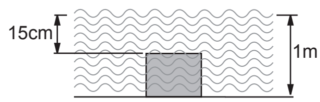
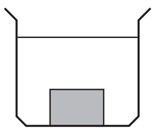
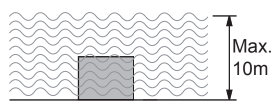
● IEC (International Electrotechnical Commission)

IP 6 □

- IP: International Protection
- 6: Protection against solid object
- □: Protection against ingress of water

IEC (International Electrotechnical Commission) Standard (IEC 60529)

■ Protection against ingress of water.

Code	Level of protection		Test method outline
4		No harmful effect of water spray from all direction	Splashing water from all direction for 10 min 
5		No harmful effect of water splash from all direction	Splashing water from all direction for 3 min  Diameter of discharging nozzle: Ø6.3
6		No harmful effect of strong water jets from all direction	Splashing water from all direction for 3 min  Diameter of discharging nozzle: Ø12.5
7		No harmful effect of water dip in certain level of pressure and length of time	Dip into 1m depth water for 30 min 
8		No harmful effect against water sink	Dip into 10m depth water continually 

■ Protection against solid object

Code	Level of protection	
6	Dust tight	No ingress of dust; complete protection against contact

International Protection

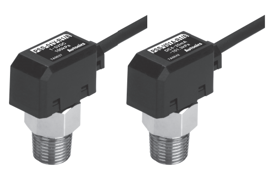
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

(E) Pressure Sensors

Compact Digital Type
PSAN Series

Compact Digital Type
PSA/PSB Series

Compact Type
PSS Series



Product Overview

▣ Compact, Digital Display Pressure Sensor [PSAN Series]

Pressure type			Gauge pressure (In case of fluid type, negative pressure, compound pressure, 1,000kPa/standard pressure are sealed gauge pressure※4)			
			Negative pressure	Standard pressure		Compound pressure
Model※1	Voltage output	Connector	**PSAN-(L)V01C(P)V-□**	**PSAN-(L)01C(P)V-□**	**PSAN-(L)1C(P)V-□**	**PSAN-(L)C01C(P)V-□**
		Cable	—	—	**PSAN-B1(P)V-□**	**PSAN-BC01(P)V-□**
	Current output	Connector	**PSAN-(L)V01C(P)A-□**	**PSAN-(L)01C(P)A-□**	**PSAN-(L)1C(P)A-□**	**PSAN-(L)C01C(P)A-□**
	Hold/Auto shift input	Connector	**PSAN-(L)V01C(P)H-□**	**PSAN-(L)01C(P)H-□**	**PSAN-(L)1C(P)H-□**	**PSAN-(L)C01C(P)H-□**
		Cable	—	—	**PSAN-B1(P)H-□**	**PSAN-BC01(P)H-□**
Appearances & Dimensions			CE **Pneumatic type**  [W30×H30×L30.7mm]	(Connector type) **Fluid type**  [W30×H30×L32mm]	(Cable type)	[W30×H30×L42.3mm]
Rated pressure range			0.0 to -101.3kPa	0.0 to 100.0kPa	0 to 1,000kPa	-101.3 to 100.0kPa
Display and set pressure range			5.0 to -101.3kPa	-5.0 to 110.0kPa	-101.3 to 1,100kPa	-101.3 to 110.0kPa
Min. display unit			0.1kPa	0.1kPa	1kPa	0.1kPa
Max. pressure range			2 times of rated pressure		1.5 times of rated pressure	2 times of rated pressure
Applied vapor			**Pneumatic type** - Air, Non-corrosive gas			
Applied fluid			**Fluid type** - Air, Non-corrosive gas and fluid that do not corrode stainless steel 316L			
Power supply			12V-24VDC ±10% (ripple P-P: Max. 10%)			
Current consumption			Max. 50mA (analog current output type: Max. 75mA)			
Control output			NPN or PNP open collector output • Load voltage: Max. 30VDC • Load current: Max. 100mA • Residual voltage - NPN: Max. 1V, PNP: Max. 2V			
	Hysteresis※2		Min. display interval			
	Repeat error		±0.2% F.S. ± Min. display interval			
	Response time		Selectable 2.5ms, 5ms, 100ms, 500ms, 1000ms			
	Short circuit protection		Built-in			
Analog output※3	Voltage output		• Output voltage: 1-5VDC ±2% F.S. • Linear: Within ±1% F.S. • Output impedance: 1kΩ • Zero point: Max. 1VDC ±2% F.S. • Span: Max. 4VDC ±2% F.S. • Response time: 50ms • Resolution: Automatically changed to 1/1000 or 1/2000 by display unit			
	Current output		• Output current: DC4-20mA ±2% F.S. • Linear: Max. ±1% F.S. • Zero-point: Max. DC4mA ±2% F.S. • Response time:70ms • Span: Max. DC16mA ±2% F.S. • Resolution: Automatically changed to 1/1000 or 1/2000 by display unit			
Display digit			4½ -digit			
Display method			7 segment LED display			
Reference			**E-04 to 16**			

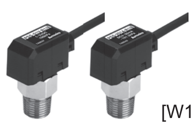
※1: For ' (L)', ' (P)', ' □ ' of model name, please refer to '▣ Ordering Information'.
※2: In hysteresis output mode, detection difference is variable.
※3: It is allowed to select one analog output type only.
※4: The unit is sealed structure. It is based on atmospheric pressure 101.3kPa.
※F.S. : Rated pressure.

■ Compact, Digital Display Pressure Sensor [PSA/PSB Series]

Pressure type		Gauge pressure			
		Negative pressure	Standard pressure		Compound pressure
Model※1	NPN open collector output	**PSA-V01-□** **PSB-V01-□** **PSB-V01C-□**	**PSA-01-□** **PSB-01-□** **PSB-01C-□**	**PSA-1-□** **PSB-1-□** **PSB-1C-□**	**PSA-C01-□** **PSB-C01-□** **PSB-C01C-□**
	PNP open collector output	**PSA-V01P-□** **PSB-V01P-□** **PSB-V01CP-□**	**PSA-01P-□** **PSB-01P-□** **PSB-01CP-□**	**PSA-1P-□** **PSB-1P-□** **PSB-1CP-□**	**PSA-C01P-□** **PSB-C01P-□** **PSB-C01CP-□**
Appearances & Dimensions		CE  **PSA Series** [W30×H30×L38.5mm]	 (Cable type) [W54.2×H10.4×L25mm]	**PSB Series** 	(Connector type) [W52×H10×L25.5mm]
Rated pressure range		0.0 to -101.3kPa	0.0 to 100.0kPa	0.0 to 1,000kPa	-100.0 to 100.0kPa
Display and set pressure range		5.0 to -101.3kPa	-5.0 to 110.0kPa	-50 to 1,100kPa	-101.2 to 110.0kPa
Max. pressure range		2 times of rated pressure		1.5 times of rated pressure	2 times of rated pressure
Applied fluid		Air, Non-corrosive gas			
Power supply		12-24VDC ±10% (ripple P-P: Max. 10%)			
Current consumption		Max. 50mA			
Control output		NPN or PNP open collector output • Load voltage: Max. 30VDC • Load current: Max. 100mA • Residual voltage - NPN: Max. 1V, PNP: Max. 2V			
	Hysteresis※2	1-digit fixed (2-digit for psi unit)			2-digit fixed
	Repeat error	±0.2% F.S. ±1-digit			±0.2% F.S. ±2-digit
	Response time	Selectable 2.5ms, 5ms, 100ms, 500ms			
	Short circuit protection	Built-in			
Analog output		• Output voltage: 1-5VDC ±2% F.S. • Zero-point: Within 1VDC ±2% F.S. • Span: Within 4VDC ±2% F.S. • Linear: Within ±2% F.S. • Resolution: Approx. 1/200 • Output impedance: 1kΩ			
Display digit		3½ -digit			
Display method		7 segment LED display			
Reference		**E-17 to 25**			

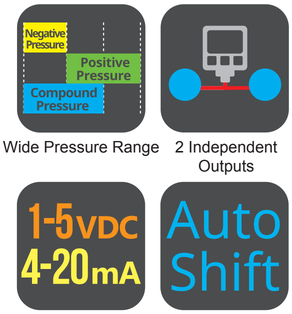
※1: '□' is pressure port type. Please refer to '■ Ordering Information'.
※2: In hysteresis output mode, detection difference is variable.
※F.S. : Rated pressure.

■ Compact, Non-indicating Pressure Sensor [PSS Series]

Pressure type		Gauge pressure			
		Negative pressure	Standard pressure		Compound pressure
Model	Voltage output	**PSS-V01V-R1/8**	**PSS-01V-R1/8**	**PSS-1V-R1/8**	**PSS-C01V-R1/8**
	Current output	**PSS-V01A-R1/8**	**PSS-01A-R1/8**	**PSS-1A-R1/8**	**PSS-C01A-R1/8**
Appearances & Dimensions		CE  [W11.8×H29.3×L24.8mm]			
Rated pressure range		0.0 to -101.3kPa	0.0 to 100.0kPa	0 to 1,000kPa	-101.3 to 100.0kPa
Analog output range		5.0 to -101.3kPa	-5.0 to 110.0kPa	-50 to 1,100kPa	-101.3 to 110.0kPa
Max. pressure range		2 times of rated pressure		1.5 times of rated pressure	2 times of rated pressure
Applied fluid		Air, non-corrosive gas			
Power supply		12-24VDC ±10% (ripple P-P: Max. 10%)			
Current consumption		Voltage output type: Max. 15mA, Current output type: —			
Effect by power supply		Max. ±0.3% F.S.			
Protection circuit		Reverse polarity protection circuit			
Analog output	Voltage output	•Output voltage: 1-5VDC ±2% F.S. •Linear: Max. ±1% F.S. •Output impedance: 1kΩ			
	Current output	•Output current: DC4-20mA ±2% F.S. •Linear: Max. ±1% F.S.			
Reference		**E-26 to 27**			

※F.S. : Rated pressure.

Compact Digital Pressure Sensors



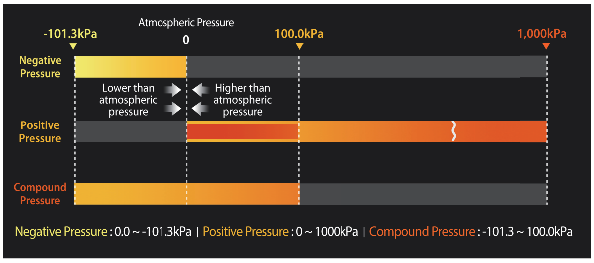
Wide Pressure Range | 2 Independent Outputs

Analog Output | Stable Output

▣ Features

● Pressure Measurement Range (Negative, Standard, Compound)

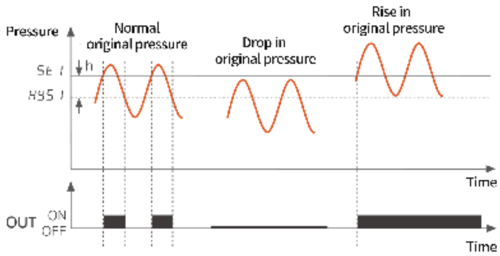
Pressure Measurement Range



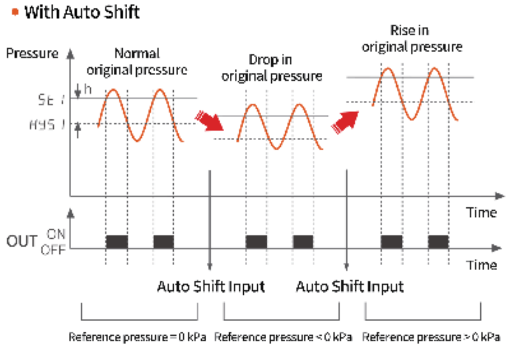
● Auto Shift Function

With change in the original pressure, the external input adjusts the determined level to match the change in pressure. (only available in models with auto shift/hold function)

- Without Auto Shift



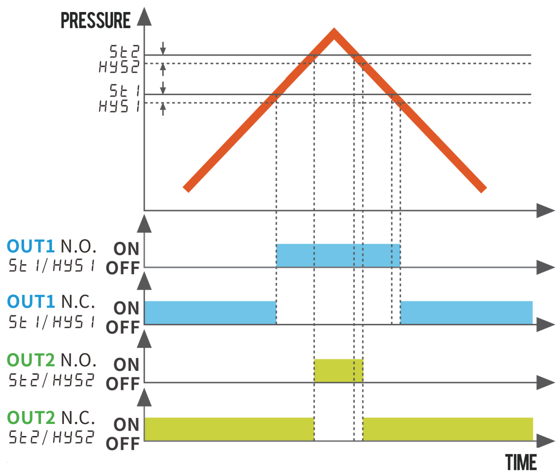
- With Auto Shift



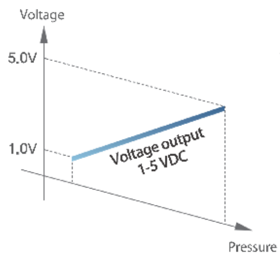
Correction set value [St 1]' = [St 1] + [SHI n]
Correction set value [HYS 1]' = [HYS 1] + [SHI n]
※ [SHI n] is the reference pressure set by Auto Shift input

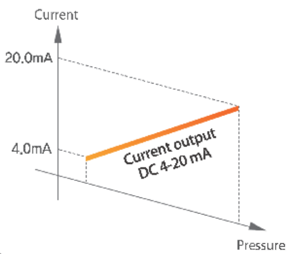
● 2 Independent Outputs

Two independent outputs are available (OUT1, OUT2) for precise and detailed control.

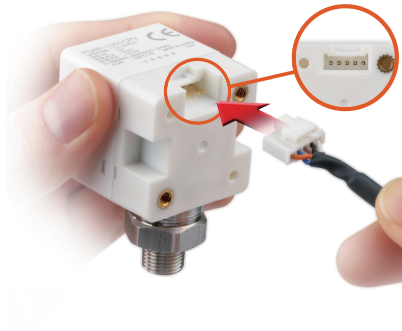


- **Analog Outputs**
  The series is available in DC4-20mA current output and 1-5VDC voltage output models.

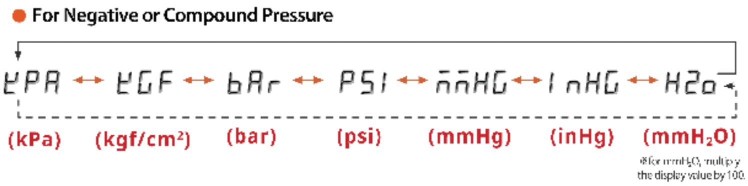


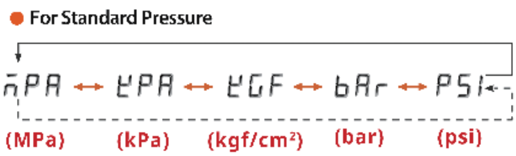


- **One-Touch Connector Wiring**
  The one-touch, push-to-connect wiring allows easier connection and maintenance (connector types only)



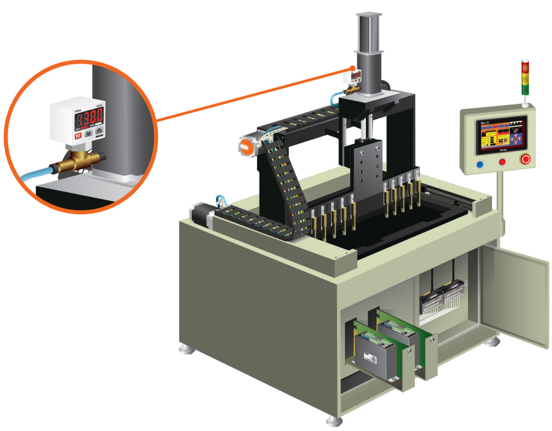
- **Supports 8 Types of Pressure Units**
  The sensors support 8 types of pressure units including MPa, kPa, kgf/cm^2, bar, psi, mmHg, inHg, and mmH_2O.





Application

Digital pressure sensors used to measure pressure of pressure cylinders. (connector type)



Compact, Digital Display Pressure Sensors

■ Features

Pneumatic type

- Pressure measurement of any gas, liquid or oil
  (※except substances which may corrode stainless steel 316L)
- Auto shift function
  : with change in the original pressure, the external input adjusts the determined level to match the change in pressure
  (only available in models with auto shift/hold function)
- High display resolutions - negative pressure: 0.1kPa
  - standard pressure: 0.1kPa, 1kPa
  - compound pressure: 0.1kPa
- Two independent outputs (N.O./N.C. output selectable)
- Hold function: hold current display value or control output
- Forced output control mode for device testing and maintenance
- One-touch connector type for easy wiring and maintenance
- Analog output: voltage (1-5VDC), current (DC4-20mA)
- Zero-point adjustment function,
  peak value monitoring function, chattering prevention function

(connector type) (cable type)

Fluid type

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ Ordering Information

PS | AN – ☐ | V | 01 | C | P | V – Rc1/8

Item	Code	Description
Pressure port※1	R1/8	Standard (fluid type), Option (pneumatic type)
	Rc1/8	Standard (pneumatic type)
	NPT1/8	Option
	7/16-20UNF	Option (fluid type)
	9/16-18UNF	Option (fluid type)
Option input/output	V	Voltage (1-5VDC) output
	A	Current (DC4-20mA) output
	H	Hold/Auto shift input
Control output	No mark	NPN open collector output
	P	PNP open collector output
Cable	C	Connector type
	No mark	Cable type
Pressure range	01	100kPa
	1	1,000kPa
Pressure type	No mark	Standard pressure
	V	Negative pressure
	C	Compound pressure
Applicable fluid	No mark	Pneumatic type (gas)/rear port fitting
	L	Fluid type (gas, liquid, oil)/bottom port fitting
	B	Fluid type (gas, liquid, oil)/rear port fitting
Appearance	AN	Regular square New type (30×30mm)
Item	PS	Pressure Sensor

※1: In case of using M5 port, use PSO-Z01 (M5 Gender) together.

■ Pressure And Max. Pressure Display Range

Type	MPa	kPa	kgf/cm²	bar	psi	mmHg	inHg	mmH₂O
Negative pressure	—	**0.0 to -101.3** (5.0 to -101.3)	**0.000 to -1.033** (0.051 to -1.033)	**0.000 to -1.013** (0.050 to -1.013)	**0.00 to -14.70** (0.74 to -14.70)	**0 to -760** (38.0 to -760.0)	**0.0 to -29.9** (1.50 to -29.90)	**0.0 to -103.3** (5.1 to -103.3)
Standard pressure	**0 to 0.100** (-0.005 to 0.110)	**0.0 to 100.0** (-5.0 to 110.0)	**0.000 to 1.020** (-0.051 to 1.122)	**0.000 to 1.000** (-0.050 to 1.100)	**0.00 to 14.50** (-0.72 to 15.96)	—	—	—
	0 to 1.000 (-0.050 to 1.100)	**0 to 1000** (-101.3 to 1100)	**0.00 to 10.20** (-0.51 to 11.22)	**0.00 to 10.00** (-0.50 to 11.00)	**0.0 to 145.0** (-7.2 to 159.6)	—	—	—
Compound pressure	—	**-101.3 to 100.0** (-101.3 to 110.0)	**-1.034 to 1.020** (-1.034 to 1.122)	**-1.013 to 1.000** (-1.013 to 1.100)	**-14.70 to 14.50** (-14.70 to 15.96)	**-760 to 750** (-760.0 to 824.0)	**-29.9 to 29.5** (-29.88 to 32.58)	**-103.4 to 102.0** (-103.4 to 112.2)

※ ( ) is max. pressure display range.
※For using a unit mmH₂O, multiply display value by 100.

■ Pressure Conversion Chart

from \ to	Pa	kPa	MPa	kgf/cm^2	mmHg	mmH$_2$O	psi	bar	inHg
1Pa	1	0.001	0.000001	0.000010197	0.007501	0.101972	0.000145038	0.00001	0.0002953
1kPa	1000	1	0.001	0.010197	7.500617	101.971626	0.145038	0.01	0.2953
1MPa	1000000	1000	1	10.197162	7500.61683	101971.626	145.038243	10	295.299875
1kgf/cm^2	98066.5	98.0665	0.098067	1	735.55924	10000.0005	14.223393	0.980665	28.959025
1mmHg	133.322368	0.133322	0.000133	0.001359	1	13.595099	0.019337	0.001333	0.039370
1mmH$_2$O	9.80665	0.009807		0.000099	0.073556	1	0.00142	0.000098	0.002896
1psi	6894.733	6.89473	0.006895	0.070307	51.714752	703.0167161	1	0.068947	2.036014
1bar	100000	100	0.100000	1.019716	750.062	10197.1626	14.503824	1	29.529988
1inHg	3386.388	3.386388	0.003386	0.034532	25.40022	345.315507	0.491156	0.033864	1

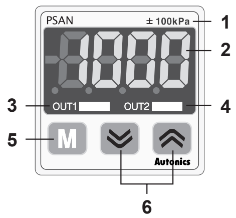
E.g.) For calculating 760mmHg to kPa
: According to above chart, 1mmHg is 0.133322kPa, therefore 760mmHg will be 760×0.133322kPa=101.32472kPa.

■ Specifications

Pressure type			**Gauge pressure(In case of fluid type, negative pressure, compound pressure, 1,000kPa/standard pressure are sealed gauge pressure※5)**			
			Negative pressure	**Standard pressure**		**Compound pressure**
Model※1	Voltage output	Connector	**PSAN-(L)V01C(P)V-□**	**PSAN-(L)01C(P)V-□**	**PSAN-(L)1C(P)V-□**	**PSAN-(L)C01C(P)V-□**
		Cable	—	—	**PSAN-B1(P)V-□**	**PSAN-BC01(P)V-□**
	Current output	Connector	**PSAN-(L)V01C(P)A-□**	**PSAN-(L)01C(P)A-□**	**PSAN-(L)1C(P)A-□**	**PSAN-(L)C01C(P)A-□**
	Hold/Auto shift input	Connector	**PSAN-(L)V01C(P)H-□**	**PSAN-(L)01C(P)H-□**	**PSAN-(L)1C(P)H-□**	**PSAN-(L)C01C(P)H-□**
		Cable	—	—	**PSAN-B1(P)H-□**	**PSAN-BC01 (P)H-□**
Rated pressure range			0.0 to -101.3kPa	0.0 to 100.0kPa	0 to 1,000kPa	-101.3 to 100.0kPa
Display pressure range			5.0 to -101.3kPa	-5.0 to 110.0kPa	-101.3 to 1,100kPa	-101.3 to 110.0kPa
Min. display unit			0.1kPa	0.1kPa	1kPa	0.1kPa
Max. pressure range			2 times of rated pressure		1.5 times of rated pressure	2 times of rated pressure
Applied vapor			• **Pneumatic type** - Air, Non-corrosive gas			
Applied fluid			• **Fluid type** - Air, Non-corrosive gas and fluid that do not corrode Stainless steel 316L			
Power supply			12V-24VDC ±10% (ripple P-P: Max. 10%)			
Current consumption			Max. 50mA (analog current output type: max. 75mA)			
Control output			NPN or PNP open collector output • Load voltage: max. 30VDC • Load current: max. 100mA • Residual voltage - NPN: max. 1V, PNP: max. 2V			
	Hysteresis ※2		Min. display interval			
	Repeat error		±0.2%F.S. ± Min. display interval			
	Response time		Selectable 2.5ms, 5ms, 100ms, 500ms, 1000ms			
	Short circuit protection		Built-in			
Analog output ※3	Voltage output		• Output voltage: 1-5VDC ±2% F.S. • Linear: Within ±1% F.S. • Output impedance: 1kΩ • Zero point: Max. 1VDC ±2% F.S. • Span: Max. 4VDC ±2% F.S. • Response time: 50ms • Resolution: Automatically changed to 1/1000 or 1/2000 by display unit			
	Current output		• Output current: DC4-20mA ±2% • Linear: Max. ±1% F.S. • Zero-point: Max. DC4mA ±2% F.S. • Span: Max. DC16mA ±2% F.S. • Response time: 70ms • Resolution: Automatically changed to 1/1000 or 1/2000 by display unit			
Display digit			4½-digit			
Display method			7 segment LED Display			
Min. display interval	MPa		—	0.001	0.001	—
	kPa		0.1	0.1	1	0.1
	kgf/cm^2		0.001	0.001	0.01	0.001
	bar		0.001	0.001	0.01	0.001
	psi		0.01	0.01	0.1	0.02
	mmHg		0.4	—		0.8
	inHg		0.02			0.03
	mmH$_2$O		0.1			0.1
Display accuracy			0 to 50℃: max. ±0.5% F.S., -10 to 0℃: max. ±1% F.S.			
Insulation resistance			Over 50MΩ (at 500VDC megger)			
Dielectric strenght			1000VAC 50/60Hz for 1 minute			
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Environment	Ambient temp.		-10 to 50℃, storage: -20 to 60℃			
	Ambient humi.		30 to 80%RH, storage: 30 to 80%RH			
Protection structure			Connector type: IP40 (IEC standard), Cable type: IP65 (IEC standard)			
Material			• **Pneumatic type** - Front, Rear case: Polycarbonate, Pressure port: Nickel Plated Brass • **Fluid type** - Front case: Polycarbonate, Rear case: Polyamide 6, Pressure port: Stainless steel 316L			
Cable			Ø4mm, 5-wire, 2m (connector type), 3m (cable type), AWG24, Core diameter: 0.08mm, Number of cores: 40, Insulator out diameter: Ø1mm			
Approval			CE			
Weight※4			• **Pneumatic type**: Approx. 165g (approx. 80g) • **Fluid type - Connector type**: Approx. 173g (approx. 88g) • **Fluid type - Cable type**: Approx. 167g (approx. 90g)			

※1: For ' (L)', ' (P)', ' □ ' of model name, please refer to '■ Ordering Information'.
※2: In hysteresis output mode, detection difference is variable.
※3: It is allowed to select one analog output type only.
※4: The weight includes packaging. The weight in parenthesis in for unit only.
※5: The unit is sealed structure. It is based on atmospheric pressure 101.3kPa.
※F.S.: Rated pressure.
※There may be ±1-digit error in hysteresis by pressure unit calculation error.
※Environment resistance is rated at no freezing or condensation.

▣ Unit Description

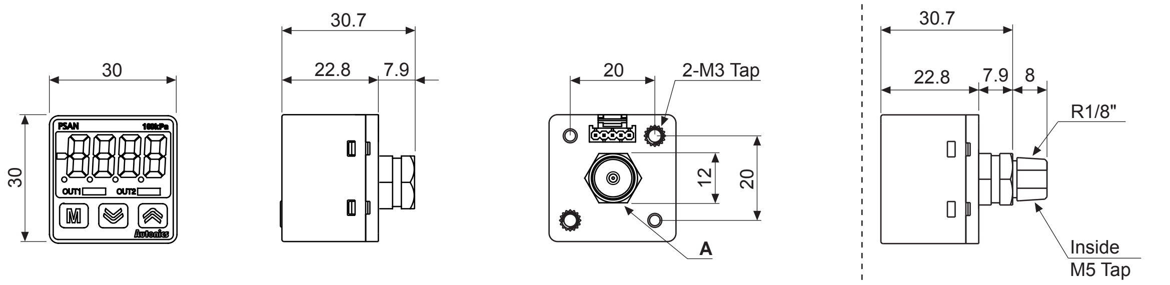


1. Range of rated pressure
: It is possible to change the pressure unit in Pressure sensor.
Please attach component label which is fit for specific indication unit.
2. 4-digit LED display (Red)
: Used to indicate measured pressure value, setting value and error message.
3. Output1 indicator (Red): Output1 is ON, LED will be ON.
4. Output2 indicator (Green): Output2 is ON, LED will be ON.
5. M key: Used to enter into Preset/Parameter setting mode and to save Setting mode.
6. ▽, △ key: Used to set parameter and preset, peak value check mode, function setting or output operation mode.
▽+△ **key** : Used for zero point adjustment function by pressing ▽+△ keys over 1 sec simultaneously in RUN mode.

▣ Dimensions

◎ Pneumatic type

(unit: mm)

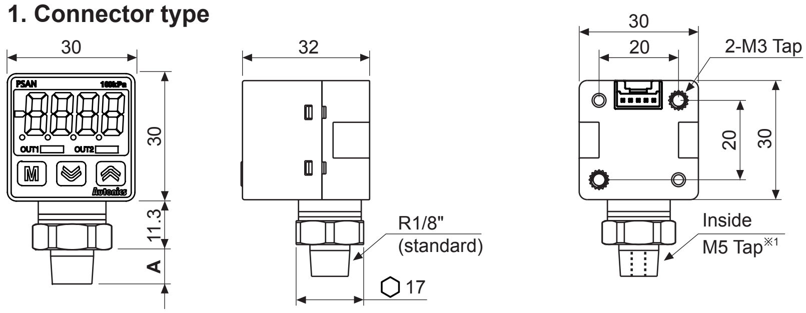


※A

Rc1/8" model (standard)	8
NPT1/8" model	

◎ Fluid type

1. Connector type

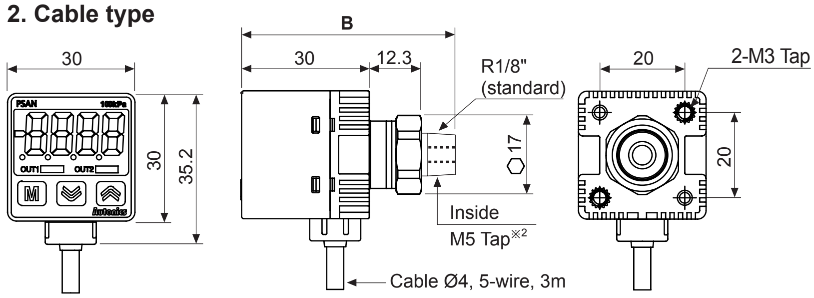


※A

R1/8" model (standard)	8
NPT1/8" model	
7/16"-20UNF model	11

※1: Only for R1/8" model, NPT1/8" model.

2. Cable type



※B

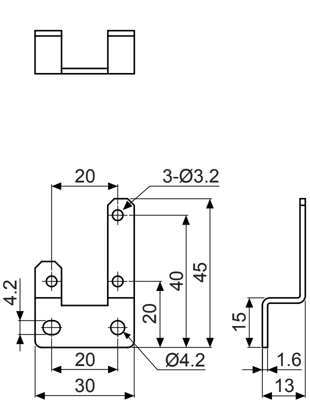
R1/8" model (standard)	50.3
9/16"-18UNF model (metal gasket sealing method)	57.7

※2: Only for R1/8" model

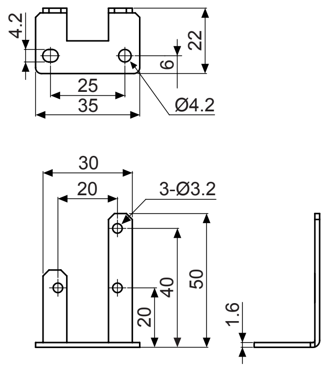
◎ Accessory

(unit: mm)

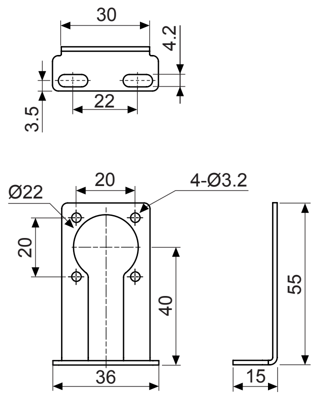
●Bracket A



●Bracket B



●Bracket C



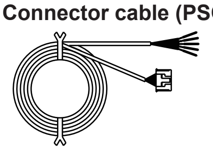
※Bracket A, B: Pneumatic type, Fluid type (connector type)
Bracket C: Fluid type (cable type)

● Pressure unit label

±100kPa	-101.3kPa	2kPa	10kPa	100kPa	1MPa
±1.020kgf/cm²	-1.034kgf/cm²	2.040kgf/cm²	10.20kgf/cm²	1.020kgf/cm²	10.20kgf/cm²
±14.50psi	-14.70psi	29.00psi	145.0psi	14.50psi	145.0psi
±1.000bar	-1.013bar	2.000bar	10.00bar	1.000bar	10.00bar
±750mmHg	-760mmHg				
±29.5inHg	-29.9inHg			/100	/100
±102.0mmH₂O	-103.4mmH₂O	2.040mmH₂O	10.20mmH₂O	X100	X100

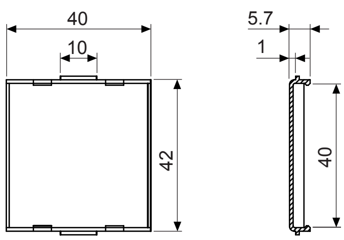
DISPLAY UNIT LABEL

● Connector cable (PSO-C01, 2m)

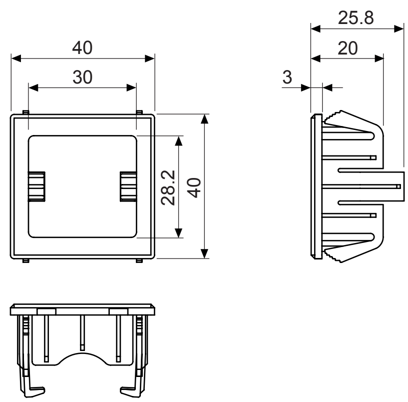


◎ Sold separately

● Front cover (PSO-P01)

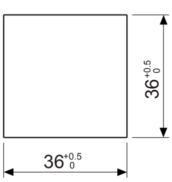


● Panel bracket (PSO-B02/B03)



※PSO-B02 (white): Pneumatic type, Fluid type (connector type)
PSO-B03 (black): Fluid type (cable type)

● Panel cut-out

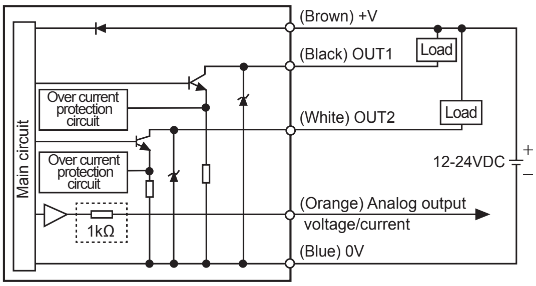


(panel thickness: 0.8 to 3.5mm)

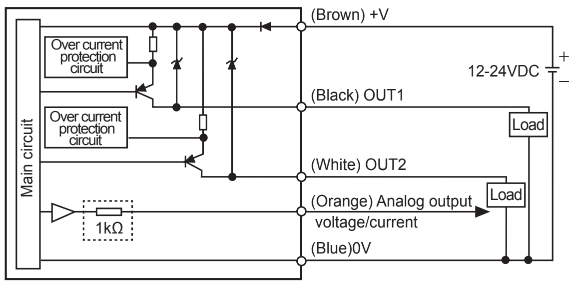
■ Control Output Diagram

◎ Voltage (1-5VDC) output type (PSAN-□□□□□V-□) Current (DC4-20mA) output type (PSAN-□□□□□A-□)

● NPN open collector output type



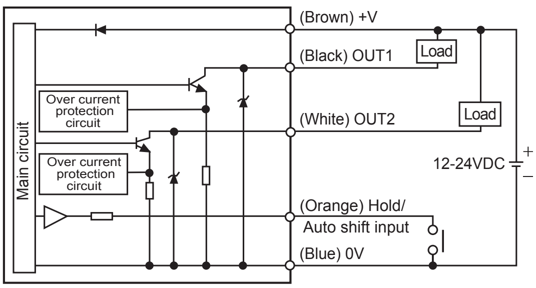
● PNP open collector output type



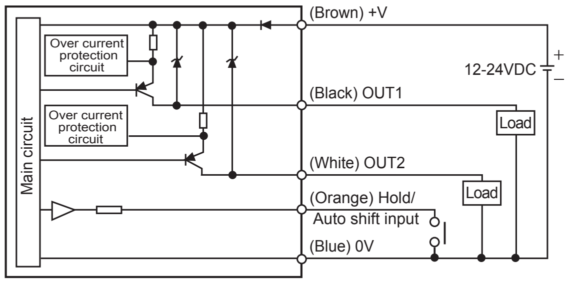
※In case of analog voltage output type models short-circuit protection is not embodied. (⬚ : For voltage output type only.) Do not connect of power source or capacitive load directly.
※Be careful with input impedance of connecting devices when using analog voltage output type models.
※Be careful with voltage drop due to cable resistance when extending sensor cable.

◎ Hold/Auto shift input (PSAN-□□□□□H-□)

● NPN open collector output type



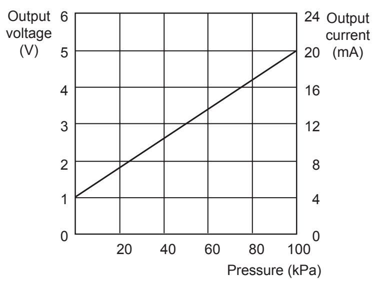
● PNP open collector output type



■ Analog Output Characteristic

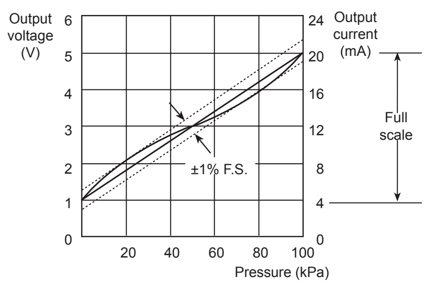
● Analog output voltage and current - Pressure characteristic

PSAN-01



● Analog output voltage and current - Linear characteristic

PSAN-01



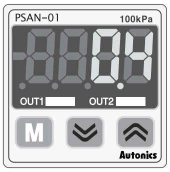
■ Setting

RUN mode

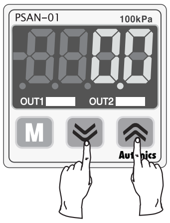
- Press M key over 3sec → **Parameter setting**: Pressure unit setting ▶ Output operation mode setting ▶ Output type setting ▶ Response time setting ▶ Analog output scale and Hold/Auto Shift input setting ▶ Key lock setting
- M → **Preset value setting**: Detection level 1 setting (out1) ▶ Detection level 2 setting (out2)
- **Forced output control mode setting**: The forced output control mode is applied by pressing M key after selecting forced output control mode [F.oUt] in output operation mode [oUt.n] parameter. For more detailed information, refer to '● Forced output control mode' '■ Output operation mode'
- Press ⌃ key over 3sec → **Peak hold**: High peak value check ▶ Low peak value check ▶ Auto shift input setting (In case of Hold/Auto shift input type model)
- Press ⌄+⌃ keys over 1sec → **Zero-point adjustment**: Zero-point adjustment

■ Zero Point Adjustment

1



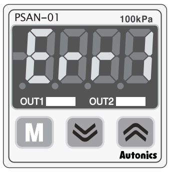
2



Press over 1sec

1. In state of atmospheric pressure during RUN mode, press [▽] key and [△] key at the same time for over 1sec
2. When the zero-point adjustment is complet, it will display 0.0 and return to RUN mode automatically.

※Please execute zero-point adjustment regularly.



※ Err 1 will flash while you execute zero point adjustment in the condition that external pressure exists.
Please execute zero-point adjustment again in state of atmospheric pressure without external pressure.

■ Parameter Setting

1. It is able to set pressure unit, display resolution, output operation mode, output type, Response time, analog output scale, Hold/Auto shift and key lock setting in parameter setting mode.
2. If the key lock is set (lock1 or lock2), unlock the key lock before setting parameters. (Refer to Key Lock setting below.)

RUN mode

Press [M] key over 3sec

Press [M] key over 3sec

Unit **Pressure unit setting**

Unit and previously set unit will flash in turn every 0.5 sec
Press [▽] or [△] key to select the unit.
(Press [M] key for 1 sec to save selected unit and move to next mode.)

- **Negative pressure, compound pressure:**

kPA ↔ kGF ↔ bAr ↔ PSI ↔ mmHG ↔ InHG ↔ H2o

(kPa) (kgf/cm²) (bar) (psi) (mmHg) (inHg) (mmH$_2$O)

※For using mmH$_2$O unit, multiply display value by 100.

- **Standard pressure:**

mPA ↔ kPA ↔ kGF ↔ bAr ↔ PSI

(MPa) (kPa) (kgf/cm²) (bar) (psi)

[M]

oUt.m **Output operation mode setting**

oUt.m and previously set output operation mode will flash in turn every 0.5 sec
Press [▽] or [△] key to select output operation mode.
(Press [M] key for 1 sec to save selected output operation mode and move to next mode.)

HYS.m ↔ WIn ↔ HY-W ↔ AUto ↔ F.oUt

[M]

no.nC **Output setting**

no.nC and previously set output operation mode will flash in turn every 0.5 sec
Press [▽] or [△] key to select output type.
(Press [M] key for 1 sec to save selected output type and move to next mode.)

1o2o ↔ 1o2C ↔ 1C2o ↔ 1C2C

※Refer to page E-14.

[M]

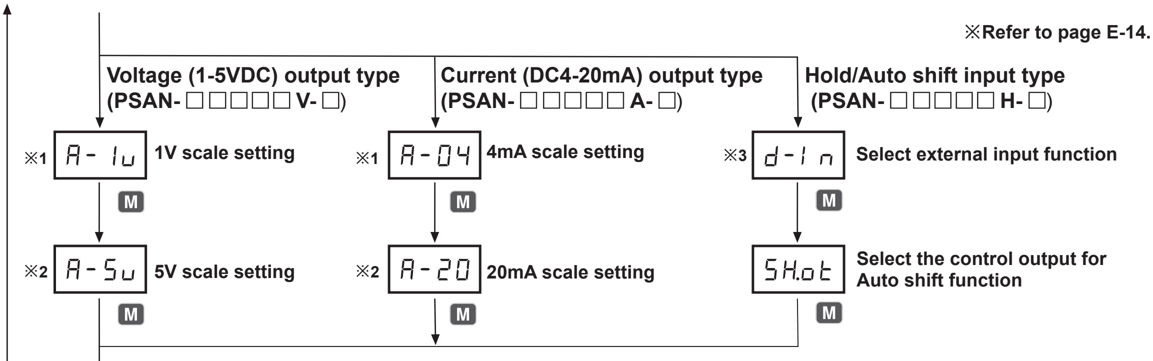
SPd **Response time setting**

SPd and previously set output operation mode will flash in turn every 0.5 sec
Press [▽] or [△] key to select Response time.
(Press [M] key for 1 sec to save selected Response time and move to next mode.)

2.5 ↔ 5.0 ↔ 100 ↔ 500 ↔ 1000 (unit: ms)

[M]

※Refer to page E-14.

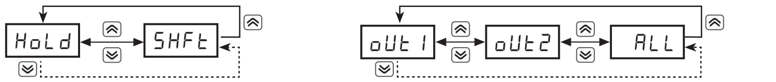


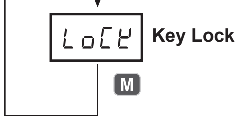
※1: A- 1u (voltage output)/ A-04 (current output)and previously set pressure value will flash in turn every 0.5 sec
Press ⌄ or ⌃ key to set analog output scale value for 1V and 4mA.
Setting range: Min. rated pressure ≤ [A- 1u, A-04] ≤ 90% of rated pressure
(Press M key for 1 sec to save selected pressure value as a scale value for 1V and 4mA and move to next mode.)

※2: A-5u (voltage output)/ A-20 (current output) and previously set pressure value will flash in turn every 0.5 sec
Press ⌄, ⌃ Key to set analog output scale value for 5V and 20mA.
Setting range:[A- 1u, A-04]+10% of rated pressure ≤ [A-5u, A-20] ≤ Max. rated pressure
(Press M key for 1 sec to save selected pressure value as a scale value for 5V and 20mA and move to next mode.)

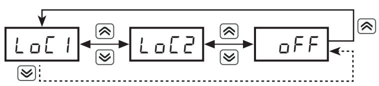
※3: d-In and previously set control function will flash in turn every 0.5 sec Press ⌃, ⌄ key to select external function.
(Press M key for 1 sec to save selected function and move to next mode.)

- **Select external input function**
- **Select the control output for Auto shift function**





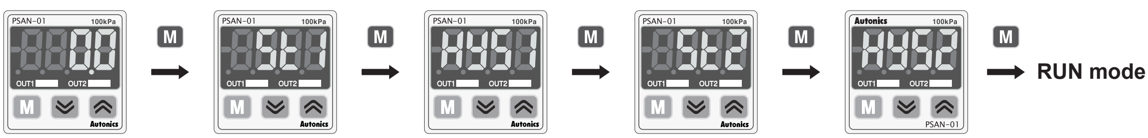
LoCK will flash in turn with previous setting parameter. Press ⌄, ⌃ key to select key lock setting.
(Press M key for 1 sec to save selected lock setting. Then, it will return to pressure unit setting mode.)



※When pressing M key for 3 sec in the middle of parameter setting, current setting value will be saved and it will return to RUN mode. If there is no additional key operation within 60 sec while setting, current set value is not valid and previous set value will remain.
※All settings are saved regardless of power failure. Make sure that this unit has a limited write life cycle (100,000 times).

▣ Preset Setting

◎ Hysteresis mode [HYS.n]



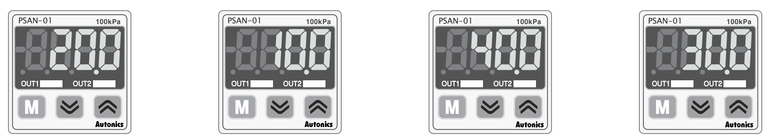
RUN mode

St1 and previously set value will flash in turn every 0.5 sec

HYS1 and previously set value will flash in turn every 0.5 sec

St2 and previously set value will flash in turn every 0.5 sec

HYS2 and previously set value will flash in turn every 0.5 sec



Press ⌄ or ⌃ Key to select St1 setting value.

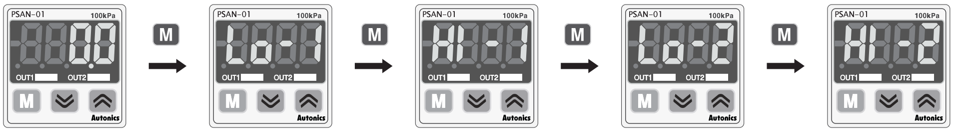
Press ⌄ or ⌃ key to select HYS1 setting value.

Press ⌄ or ⌃ key to select St2 setting value.

Press ⌄ or ⌃ key to select HYS2 setting value.

※St1 setting range : Min. display pressure < St1 ≤ Max. display pressure
※HYS1 setting range : Min. display pressure ≤ HYS1 < St1
※St2 setting range : Min. display pressure < St2 ≤ Max. display pressure
※HYS2 setting range : Min. display pressure ≤ HYS2 < St2

◎ Window comparison output mode [Win]



RUN mode

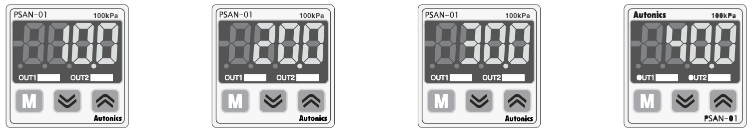
RUN mode

Lo-1 and previously set value will flash in turn every 0.5 sec

HI-1 and previously set value will flash in turn every 0.5 sec

Lo-2 and previously set value will flash in turn every 0.5 sec

HI-2 and previously set value will flash in turn every 0.5 sec



Press ⊻ or ⊼ Key to select Lo-1 setting value.

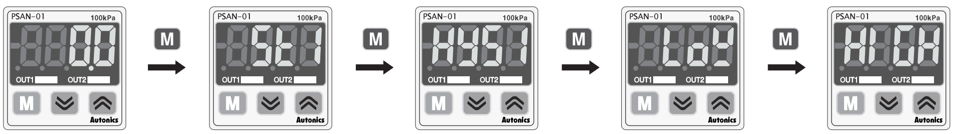
Press ⊻ or ⊼ Key to select HI-1 setting value.

Press ⊻ or ⊼ Key to select Lo-2 setting value.

Press ⊻ or ⊼ Key to select HI-2 setting value.

※Lo-1 setting range: Min. display pressure ≤ Lo-1 ≤ Max. display pressure- (3×min. display interval)
※HI-1 setting range: Lo-1+ (3×min. display interval) ≤ HI-1 ≤ Max. display pressure
※Lo-2 setting range: Min. display pressure ≤ Lo-2 ≤ Max. display pressure- (3×min. display interval)
※HI-2 setting range: Lo-2+ (3×min. display interval) ≤ HI-2 ≤ Max. display pressure
※The minimum display interval for hysteresis is fixed to 1.

◎ Hysteresis-Window comparison output mode [HY-W]



RUN mode

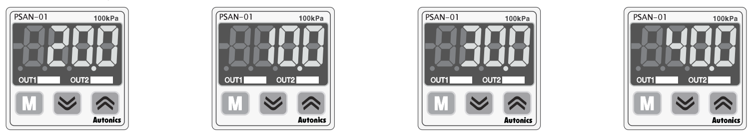
RUN mode

St1 and previously set value will flash in turn every 0.5 sec

HYS1 and previously set value will flash in turn every 0.5 sec

LoW and previously set value will flash in turn every 0.5 sec

HIGH and previously set value will flash in turn every 0.5 sec



Press ⊻ or ⊼ Key to select St1 setting value.

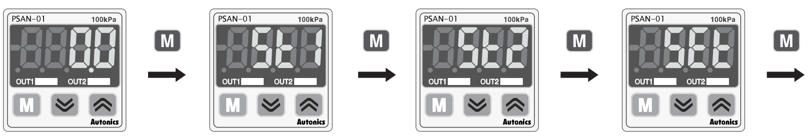
Press ⊻ or ⊼ Key to select HYS1 setting value.

Press ⊻ or ⊼ Key to select LoW setting value.

Press ⊻ or ⊼ Key to select HIGH setting value.

※St1 setting range : Min. display pressure < St1 ≤ Max. display pressure
※HYS1 setting range : Min. display pressure ≤ HYS1 < St1
※LoW setting range : Min. display pressure ≤ LoW ≤ Max. display pressure - (3×min. display interval)
※HIGH setting range : Low value + (3×min. display interval) ≤ HIGH ≤ Max. display pressure
※In case HYS1 and St1 have the same setting values, it will have the minimum display unit as a hysteresis.

◎ Automatic sensitivity setting mode [AUto]



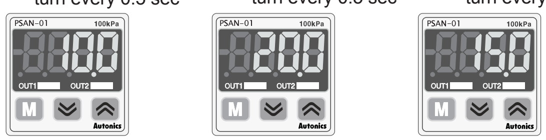
RUN mode

RUN mode

St1 and previously set value will flash in turn every 0.5 sec

St2 and previously set value will flash in turn every 0.5 sec

SEt and previously set value will flash in turn every 0.5 sec



Press ⊻ or ⊼ Key to select St1 setting value.

Press ⊻ or ⊼ Key to select St2 setting value.

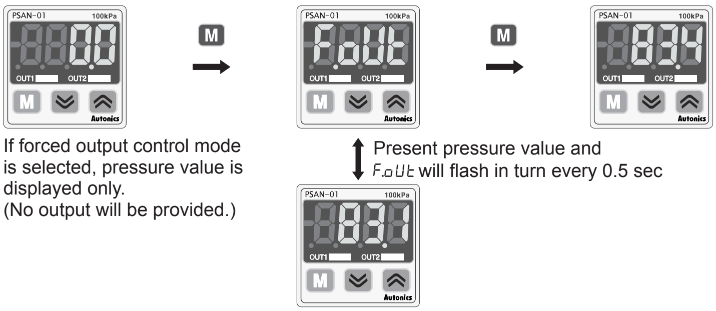
Press ⊻ or ⊼ Key to select SEt setting value.

Sensitivity will be automatically SEt. Press ⊻ or ⊼ key to fine-adjust the setting value between St1 and St2.

$$\text{SEt} = \frac{\text{St1} + \text{St2}}{2}$$

※St1 setting range : Min. display pressure < St1 ≤ Max. display pressure - 1% of rated pressure
※St2 setting range : St1 + 1% of rated pressure < St2 ≤ Max. display pressure
※If certain detection level difference is not ensured, or setting conditions are not met, Err3 message will flash three times and return to St2 setting mode. Check all setting conditions and set proper setting values.

◎ **Forced output control mode [F.oUt]**



If forced output control mode is selected, pressure value is displayed only.
(No output will be provided.)

Control output 1 ON ⇄ Control output 1 OFF

Control output 2 ON ⇄ Control output 2 OFF

※When there is no additional key operation within 60 sec while setting, it returns to Run mode (Except for force output mode). Previously set values remain.

※In case of changing output operation mode, no preset values will be initialized. Instead, previous output operation settings will become the preset values.

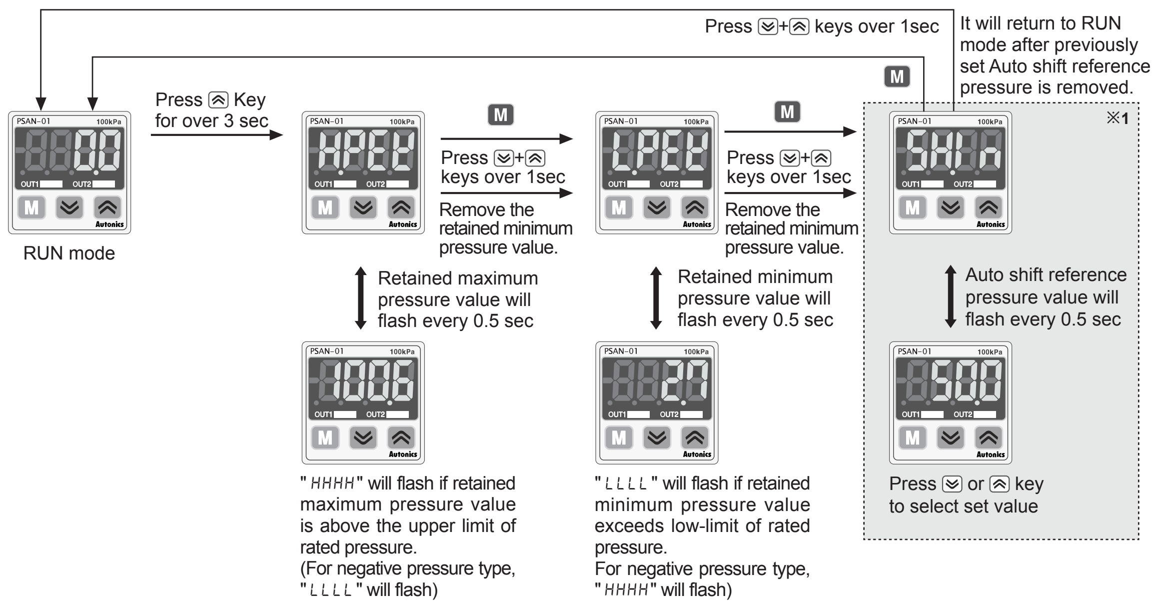
※When using the forced output function, Hold/Auto shift function is not available to use in Hold/Auto shift model.

※When changing pressure display unit, resolution, and Hold Auto shift input function, preset values will be initialized as shown on the next table. (When changing pressure display unit, preset value will be automatically switched to changed pressure unit.)

● **Factory default** (unit: kPa)

Output mode	Negative pressure 0.0 to -101.3	Standard pressure 0.0 to 100.0	Standard pressure 0 to 1,000	Compound pressure -101.3 to 100.0
HYS.m	St 1:-50.0 HYS 1:0.0 St2:-50.0 HYS2:0.0	St 1:50.0 HYS 1:0.0 St2:50.0 HYS2:0.0	St 1:500 HYS 1:0 St2:500 HYS2:0	St 1:50.0 HYS 1:-50.0 St2:50.0 HYS2:-50.0
Win	Lo- 1:0.0 HI - 1:-50.0 Lo-2:0.0 HI -2:-50.0	Lo- 1:0.0 HI - 1:50.0 Lo-2:0.0 HI -2:50.0	Lo- 1:0 HI - 1:500 Lo-2:0 HI -2:500	Lo- 1:-50.0 HI - 1:50.0 Lo-2:-50.0 HI -2:50.0
HY-W	St 1:-50.0 HYS 1:0.0 LoW:0.0 HIGH:-50.0	St 1:50.0 HYS 1:0.0 LoW:0.0 HIGH:50.0	St 1:500 HYS 1:0 LoW:500 HIGH:0	St 1:50.0 HYS 1:-50.0 LoW:-50.0 HIGH:50.0
AUto	St 1:0.0 St2:-50.0 SEt:-25.0	St 1:0.0 St2:50.0 SEt:25.0	St 1:0 St2:500 SEt:250	St 1:-50.0 St2:50.0 SEt:0.0

▣ High Peak/Low Peak Function And Auto Shift Reference Pressure Check/Change



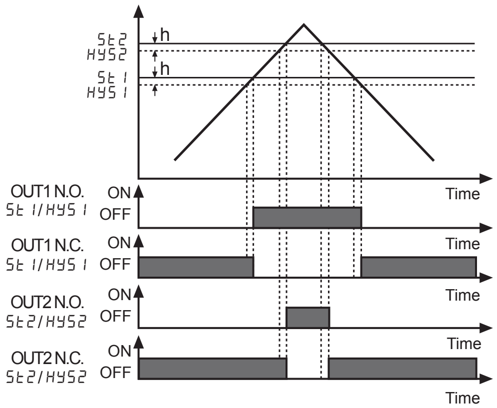
※1: Displayed only when d-In is set to SHFt (PSAN-□□□□□H-□ models only)

※If there is no Auto shift input, "0" will be displayed. (Refer to page E-15 for more details.)

■ Output Operation Mode

1. Hysteresis mode [HYS.n]

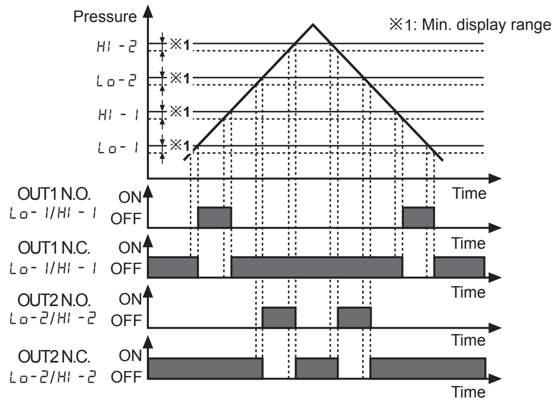
It is able to set certain value for pressure detection level [St1, St2] and hysteresis [HYS1, HYS2].



2. Window comparison output mode [Win]

① It is able to set the range for high [HI-1, HI-2], low [Lo-1, Lo-2] limit of pressure detection level when it is required to detect pressure at a certain range.

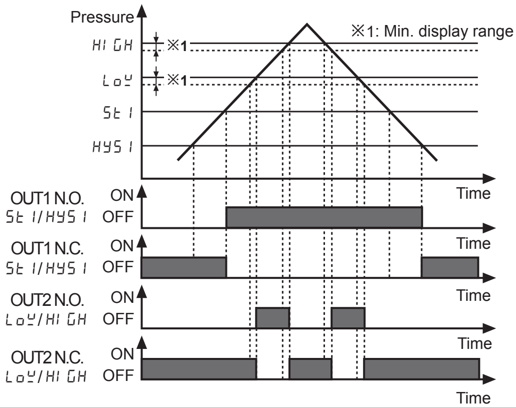
② Detection hysteresis is fixed to min. display range.



3. Hysteresis-window comparison output mode [HY-W]

① It is available to set hysteresis mode and window comparison output mode when both hysteresis mode [St1, St2] and window comparison output mode [LoW, HIGH] are necessary.

② Detection hysteresis is fixed to min. display range.



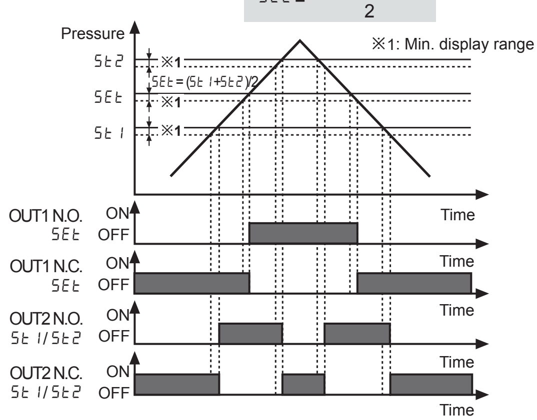
4. Automatic sensitivity setting mode [AUto]

① This function is to set pressure detection level to the proper position automatically. It is set by applied pressure from two positions [St1, St2].

② Detection hysteresis is fixed to min. display range.

③ The pressure detection level[SEt] is shown in the following calculation.

$$SEt = \frac{(St1+St2)}{2}$$

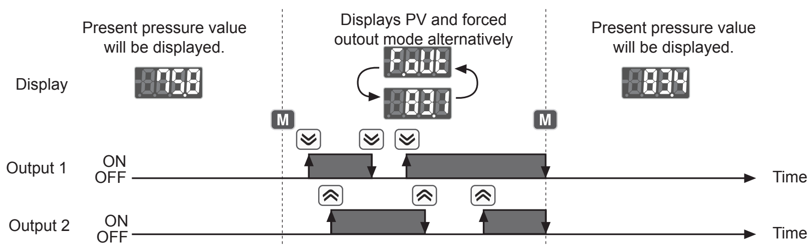


5. Forced output control mode [F.oUt]

① Used to display pressure with forcibly holding comparing output OFF regardless of setting value.

② In parameter setting, if output operation mode setting 'oUt.n' is changed to 'F.oUt', forced output control mode is operated.

③ Output 1, 2 can be ON/OFF manually by pressing ⩔, ⩓ key while the forced output control mode is applied.



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Functions

◎ Pressure unit change

PSAN-V01C (P) and PSAN-C01C (P) has 7 kinds of pressure unit, PSAN-01C (P) and PSAN-1C (P) has 5 kinds of pressure unit. Please select the proper unit for application.

- PSAN-V01C (P), PSAN-C01C (P)
  : kPa, kgf/cm², bar, psi, mmHg, inHg, mmH_2O
- PSAN-01C (P), PSAN-1C (P) : MPa, kPa, kgf/cm², bar, psi

※When using mmH_2O unit, multiply display value by 100.

◎ Output mode change

There are 5 kinds of control output mode in order to realize the various pressure detection.

• Hysteresis mode [HYS.m]
When needed to change hysteresis for detecting pressure.

• Window comparison output mode [WIn]
When needed to detect pressure in certain area.

• Hysteresis - Window comparison output mode [HY-W]
When both hysteresis mode and window comparison output mode are required.

• Automatic sensitivity setting mode [AUTo]
When needed to set detection sensitivity automatically at proper position.

• Forced output control mode [F.oUT]
When needed to display pressure with remaining comparison output OFF regardless of setting value.

◎ Control output change

Type of control output for Out1 and Out2 can be able to set Normally Open or Normally Closed.
※Note that Normally Open and Normally Closed provide opposite output.

OUT1 output	OUT2 output	Parameter setting value
Normally Open	Normally Open	1o2o
Normally Open	Normally Closed	1o2C
Normally Closed	Normally Open	1C2o
Normally Closed	Normally Closed	1C2C

◎ Response time change (chattering prevention)

It can prevent chattering of control output by changing Response time. It is able to set 5 kinds of Response time (2.5ms, 5ms, 100ms, 500ms, 1000ms) and if the Response time is getting longer, the detection will be more stable by increasing the number.

◎ Analog output scale setting

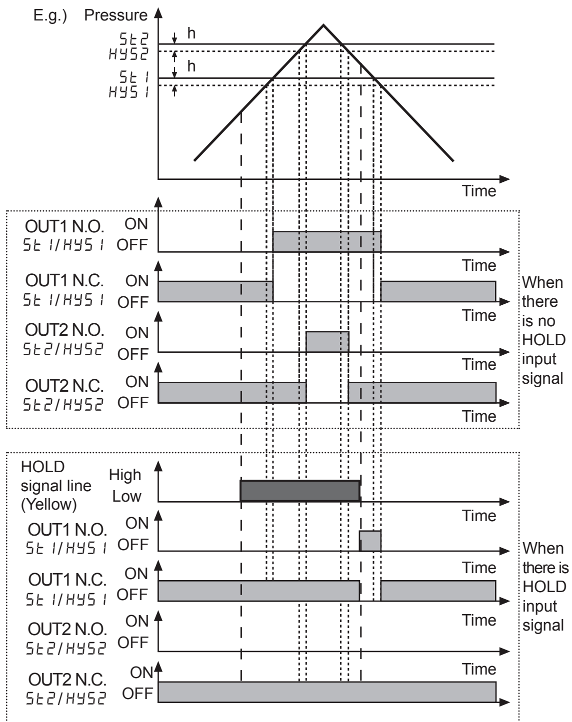
• Analog voltage output scale setting
The scale function for analog output voltage (1-5VDC) is not fixed to the rated pressure range. It can be changed for User's application. Analog output voltage range will be fixed to 1-5VDC within the pressure range from pressure point of 1VDC output [A-1V] to pressure point of 5VDC output [A-5V].

• Analog current output scale setting
The scale for analog output Current (DC4-20mA) is not fixed to the rated pressure range. It can be changed for User's application. Analog output voltage will be fixed to DC4-20mA within the rated pressure range from pressure point of 4mA output [A-04] to pressure point of 20mA output [A-20].

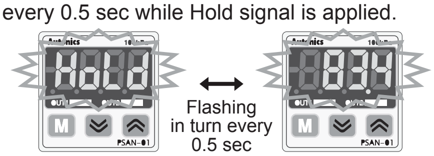
◎ Hold/Auto shift input setting

• Hold
A function to hold present pressure value and control output at the time of hold signal input.
※Present pressure value and Hold message will flash in turn every 0.5 sec while Hold function is set. Make sure that Hold function is not able to execute while forced output mode is executed.

▸ Control output timing chart
When Hold signal is applied in Hysteresis mode, refer to '▣ Control output diagram' of page E-9.



※[HoLd] and present pressure value will flash in turn every 0.5 sec while Hold signal is applied.

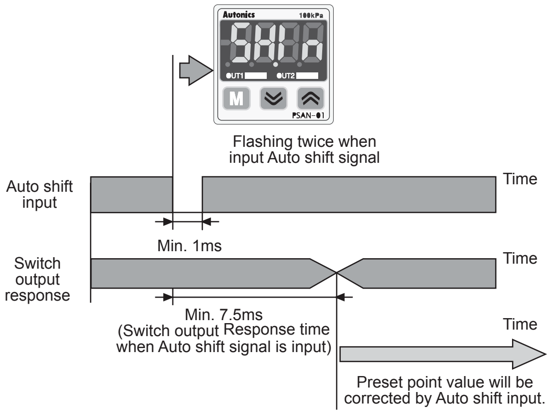


• Auto shift
A function to use the measured pressure at the moment of auto shift input as a reference pressure in order to correct the set point values of control output when initial pressure changes.
※Reference pressure is fixed to atmospheric pressure (0.0kPa) when Auto shift function is not used.
※SH.In (Auto shift compensation value) will be reset to 0 when changing control output or preset values.
※Auto shift function will not be executed if "HHHH" or "LLLL" error occurs or if forced output mode is set.

- SH.oT : Reference pressure change through setting.
- oUT1 : Changed reference will be applied to control output 1 only.
- oUT2 : Changed reference will be applied to control output 2 only.
- ALL : Changed reference will be applied to both control output 1 and control output 2.

▸ **When Auto shift is used**

When Auto shift input signal remains at low level more than 1ms, the measured pressure at this point will be saved as a reference value to make correct judgment regardless of pressure changes. Corrected preset pressure value will be applied after 7.5ms.
Measured reference pressure value will be saved in [SHIn].



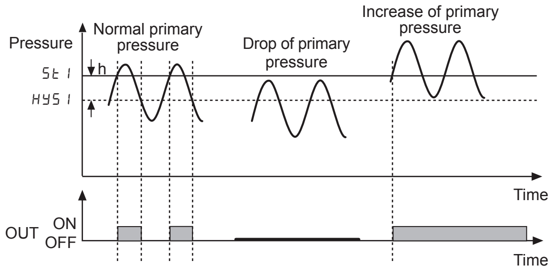
※When Auto shift function is used, the possible set pressure range will be wider than rated set pressure range.
※The possible set pressure range for Auto shift type models.

Pressure type	Set pressure range	Possible set pressure range for Auto shift type models
Vacuum pressure	-101.3kPa to 5.0kPa	-101.3kPa to 101.3kPa
Vacuum pressure	-5.0kPa to 110.0kPa	-110.0kPa to 110.0kPa
	-50.0kPa to 1100kPa	-1100kPa to 1100kPa
Compound pressure	-101.3kPa to 110.0kPa	-101.3kPa to 110.0kPa

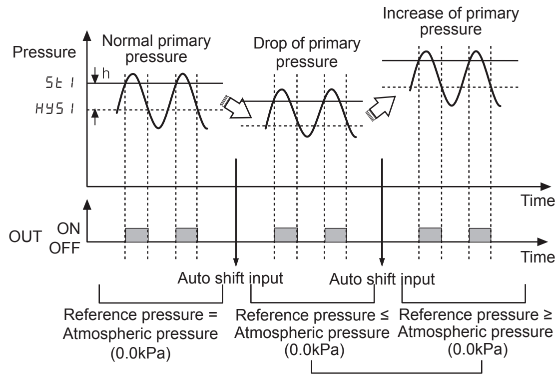
※If the set point value corrected by auto shift input exceeds set pressure range,an error message will flash three times and corrected value is not saved.
→[-HH-] displayed when the set point value corrected by Auto shift input is above the upper limit of set pressure range.
→ [-LL-] displayed when the set point value corrected by Auto shift input is below the lower limit of set pressure range.

▸ **Example of Auto shift**

< When Auto shift is not used >



< When Auto shift is used >



Correction set value: St1 = St1+SHIn
Correction set value: HYS1 = HYS1 + SHIn
※ SHIn is the reference pressure set by Auto shift input.

◎ Key lock

The key lock function prevents key operations so that conditions set in each mode.

- LoC1: All keys are locked; therefore it is not available to change parameter settings, preset value, zero adjustment, High/Low peak check, and SHIn data initialization. (Lock setting change is available)
- LoC2: Partially locked status; therefore it is not available to change parameter settings only (Lock setting change is available). Other settings are still available.
- oFF: All of the setting is available, all keys are unlocked. to set detection sensitivity automatically at proper position.

◎ Zero-point adjustment

The key lock function prevents key operations so that conditions set in each mode.
The zero-point adjustment function forcibly sets the pressure value to "zero" when the pressure port is opened to atmospheric pressure. When the zero adjustment is applied, analog output [Voltage or Current] is changed by this function.
(Press [▽] + [△] keys over 1 sec in RUN mode.)

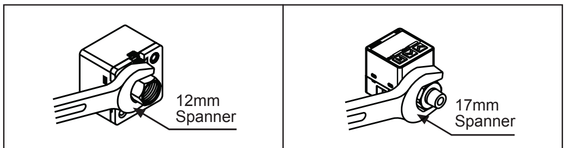
◎ High Peak / Low Peak Hold

This function is to diagnosis malfunction of the system caused by parasitic pressure or to check through memorizing the max./min. pressure occurred from the system.

Error display	Description	Troubleshooting
Err1	When external pressure is input while adjusting zero point	Try again after removing external pressure
Err2	When overload is applied on control output	Remove overload
Err3	When setting condition is not met in Auto sensitivity setting mode	Check setting conditions and set proper setting values
LLLL	When applied pressure exceeds Low-limit of display pressure range	Apply pressure within display pressure range
HHHH	When applied pressure exceeds High-limit of display pressure range	
-HH- -LL- -Ho-	Auto shift correction error	Set the corrected setting value within setting pressure range.

▣ Installation

1. Pressure port is divided as standard and option specification. Therefore, be sure that to use commercially available one touch fitting.
   - ●Standard
     Pneumatic type: Rc1/8", Fluid type: R1/8"
   - ●Option
     Pneumatic type: NPT1/8", R1/8"
     Fluid type: Connector type-NPT1/8", 7/16"-20UNF
     Cable type-9/16"-18UNF
2. Please connect it by using spanner (pneumatic type 12mm, fluid type 17mm) at the metal part in order not to overload on the body when connecting one touch fitting.

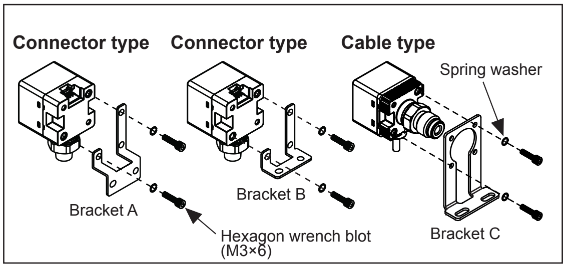


<Pneumatic type> **<Fluid type>**

⚠Caution

The tightening torque of one touch fitting should be max.10N·m. If not, it may cause mechanical problem.

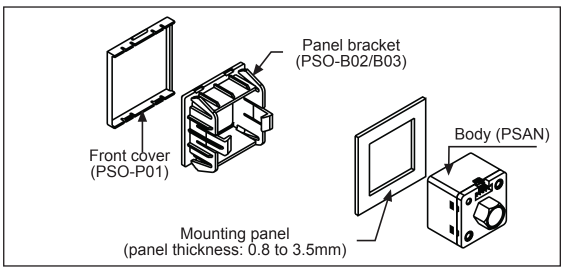
3. Two different brackets are provided for pneumatic type and three different brackets are provided for fluid type. Select proper one with considering your application environments.
4. At first, please unscrew hexagon wrench bolt and assemble the bracket on this unit by fixing hexagon the wrench bolt.



⚠Caution

In this case, tightening torque of hexagon wrench should be max. 3N·m. If not, it may cause mechanical problem.

5. Panel bracket (PSO-B02/B03) and front cover (PSO-P01) are sold separately. Please see the pictures for installation.

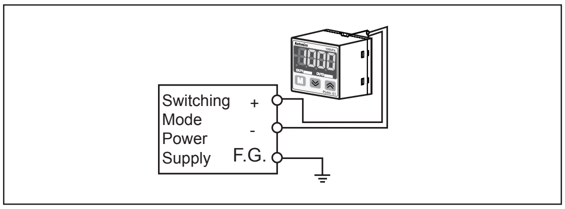


▣ Proper Usage

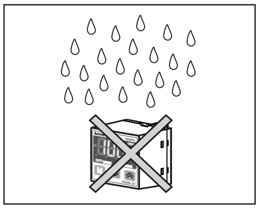
⚠Caution

PSAN Series is for sensing of non corrosive gas.
Do not use this product at corrosive gas or flammable gas, etc.

- Please using this unit within the range of specification, if applying pressure is larger than specification, it may not be working properly due to damage.
- After supplying power, it takes 3 sec to work.
- When using switching mode power supply, frame ground (F.G.) terminal of power supply should be grounded.



- It may cause malfunction by noise, when wiring with power line or high voltage line.
- Do not insert any sharp or pointed object into pressure port. It may cause mechanical problem due to sensor damage.
- Do not use this unit with flammable gas, because this is not an explosion proof structure.
- Be sure that this unit should not be contacted directly with water, oil, thinner, etc.



- Wiring must be done with power off.

Compact, Digital Display Pressure Sensors

■ Features

- High brightness red LED (LED height : 9.5mm)
- Min. display interval-Negative pressure: 0.1kPa
  -Standard pressure: 0.1kPa, 1kPa
  -Compound pressure: 0.2kPa
- Convertible pressure unit
  - Negative, Compound pressure : kPa, kgf/cm^2, bar, psi, mmHg, mmH$_2$O, inHg
  - Standard pressure : kPa, kgf/cm^2, bar, psi
- Various output modes : Hysteresis mode, Automatic sensitivity setting mode, Independent 2 output mode, Window comparative output mode
- Chattering prevention for output (selectable response time : 2.5ms, 5ms, 100ms, 500ms)
- One-touch connector type for easy wiring and maintenance
- Analog output: voltage (1-5VDC)
- Reverse power polarity and overcurrent protection circuit
- Zero-point adjustment function, peak value monitoring function, bottom hold display

PSA Series

PSB Series

PSB Series
Connector type

Please read "Caution for your safety" in operation manual before using.

CE

■ Ordering Information

PS | A – V | 01 | C | P – Rc1/8

Code position	Code	Description
Pressure port	Rc1/8	Standard (PSA Series)
	NPT1/8	Option (PSA Series)
	M5	Standard (PSB Series)
Output type	No mark	NPN open collector output
	P	PNP open collector output
Cable※1	No mark	Cable type
	C	Connector type
Pressure range	01	100kPa
	1	1,000kPa
Pressure type	No mark	Standard pressure
	V	Negative pressure
	C	Compound pressure
Appearance	A	Regular square (30mm×30mm)
	B	Rectangular (cable type: 10.4mm×54.2mm) (connector type: 10mm×52mm)
Item	PS	Pressure Sensor

※1: It is only applied to PSB Series.

■ Pressure And Max. Pressure Display Range

Type	kPa	kgf/cm^2	bar	psi	mmHg	inHg	mmH$_2$O
Negative pressure	**0.0 to -101.3** (5.0 to -101.3)	**0.000 to -1.033** (0.051 to -1.033)	**0.000 to -1.013** (0.05 to -1.013)	**0.00 to -14.70** (0.74 to -14.70)	**0 to -760** (38 to -760)	**0.0 to -29.9** (1.5 to -29.9)	**0.0 to -103.3** (5.2 to -103.3)
Standard pressure	**0.0 to 100.0** (-5.0 to 110.0)	**0.000 to 1.020** (-0.051 to 1.122)	**0.000 to 1.000** (-0.050 to 1.100)	**0.00 to 14.50** (-0.72 to 15.96)	—	—	—
	0 to 1000 (-50 to 1100)	**0.00 to 10.20** (-0.51 to 11.22)	**0.00 to 10.00** (-0.50 to 11.00)	**0.0 to 145.0** (-7.2 to 159.6)	—	—	—
Compound pressure	**-100.0 to 100.0** (-101.2 to 110.0)	**-1.020 to 1.020** (-1.034 to 1.122)	**-1.000 to 1.000** (-1.012 to 1.100)	**-14.50 to 14.50** (-14.70 to 15.96)	**-750 to 750** (-760 to 824)	**-29.5 to 29.5** (-29.8 to 32.6)	**-102.0 to 102.0** (-103.4 to 112.2)

※( ) is Max. pressure display range.
※For using a unit mmH$_2$O, multiply display value by 100.

■ Pressure Conversion Chart

from \ to	Pa	kPa	MPa	kgf/cm^2	mmHg	mmH$_2$O	psi	bar	inHg
1Pa	1	0.001	0.000001	0.000010197	0.007501	0.101972	0.000145038	0.00001	0.0002953
1kPa	1000	1	0.001	0.010197	7.500617	101.971626	0.145038	0.01	0.2953
1MPa	1000000	1000	1	10.197162	7500.61683	101971.626	145.038243	10	295.299875
1kgf/cm^2	98066.5	98.0665	0.098067	1	735.55924	10000.0005	14.223393	0.980665	28.959025
1mmHg	133.322368	0.133322	0.000133	0.001359	1	13.595099	0.019337	0.001333	0.039370
1mmH$_2$O	9.80665	0.009807	—	0.000099	0.073556	1	0.00142	0.000098	0.002896
1psi	6894.733	6.89473	0.006895	0.070307	51.714752	703.016716	1	0.068947	2.036014
1bar	100000	100	0.100000	1.019716	750.062	10197.1626	14.503824	1	29.529988
1inHg	3386.388	3.386388	0.003386	0.034532	25.40022	345.315507	0.491156	0.033864	1

E.g.) For calculating 760mmHg as kPa : According to above chart, 1mmHg is 0.133322kPa, therefore 760mmHg will be 760×0.133322kPa=101.32472kPa.

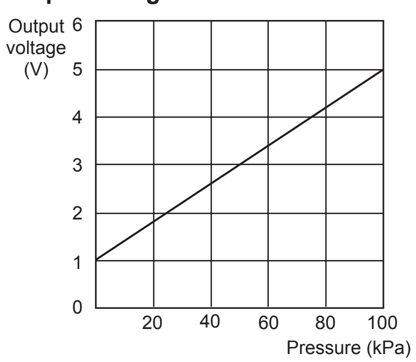
■ Specifications

Pressure type		Gauge pressure			
		Negative pressure	Standard pressure		Compound pressure
Model※1	NPN open collector output	**PSA-V01-□** **PSB-V01-□** **PSB-V01C-□**	**PSA-01-□** **PSB-01-□** **PSB-01C-□**	**PSA-1-□** **PSB-1-□** **PSB-1C-□**	**PSA-C01-□** **PSB-C01-□** **PSB-C01C-□**
	PNP open collector output	**PSA-V01P-□** **PSB-V01P-□** **PSB-V01CP-□**	**PSA-01P-□** **PSB-01P-□** **PSB-01CP-□**	**PSA-1P-□** **PSB-1P-□** **PSB-1CP-□**	**PSA-C01P-□** **PSB-C01P-□** **PSB-C01CP-□**
Rated pressure range		0.0 to -101.3kPa	0.0 to 100.0kPa	0.0 to 1,000kPa	-100.0 to 100.0kPa
Display and set pressure range		5.0 to -101.3kPa	-5.0 to 110.0kPa	-50 to 1,100kPa	-101.2 to 110.0kPa
Max. pressure range		2 times of rated pressure		1.5 times of rated pressure	2 times of rated pressure
Applied fluid		Air, Non-corrosive gas			
Power supply		12-24VDC ±10% (ripple P-P : Max. 10%)			
Current consumption		Max. 50mA			
Control output		NPN or PNP open collector output • Load voltage: Max. 30VDC • Load current: Max. 100mA • Residual voltage - NPN: Max. 1V, PNP: Max. 2V			
	Hysteresis※2	1-digit fixed (2-digit for psi unit)			2-digit fixed
	Repeat error	±0.2% F.S. ±1-digit			±0.2% F.S. ±2-digit
	Response time	Selectable 2.5ms, 5ms, 100ms, 500ms			
	Short circuit protection	Built-in			
Analog output		• Output voltage: 1-5VDC ±2% F.S. • Zero-point: Within 1VDC ±2% F.S. • Span: Within 4VDC ±2% F.S. • Linear: Within ±2% F.S. • Resolution: Approx. 1/200 • Output impedance: 1kΩ			
Display digit		3½ -digit			
Display method		7 segment LED			
Min. display interval		1-digit (psi unit: 2-digit are fixed)			2-digit
Pressure unit		kPa, kgf/cm², bar, psi, mmHg, mmH₂O, inHg	kPa, kgf/cm², bar, psi		kPa, kgf/cm², bar, psi, mmHg, mmH₂O, inHg
Display accuracy		0 to 50℃: Max. ±1% F.S., -10 to 0℃ : Max. ±2% F.S.			
Environment	Ambient temp.	-10 to 50℃, storage: -20 to 60℃			
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Material		• PSA - Front, Rear case: Polycarbonate (insert glass), Pressure port: die-cast (Zn) • PSB - Case, Pressure port, Cover: IXEF • PSB-C - Case, Pressure port, Cover: IXEF			
Protection structure		IP40 (IEC standard)			
Cable	Cable type	Ø4mm, 5-wire, 2m (AWG24, Core diameter: 0.08mm, Number of cores: 40, Insulation out diameter: Ø1mm)			
	Connector type	5-wire, 3m (AWG24, Insulation out diameter: Ø1mm)			
Approval		CE			
Weight※3		• **PSA:** Approx. 200g (approx. 120g) • **PSB:** Approx. 160g (approx. 70g) • **PSB-C:** Approx. 160g (approx. 70g)			

※1: '□' is pressure port type. Please refer to the '■ Ordering Information'.
※2: In hysteresis output mode, detection difference is variable.
※3: The weight includes packaging. The weight in parenthesis in for unit only.
※F.S.: Rated pressure.
※There may be ±1-digit error in hysteresis by pressure unit calculation error.
※The specification of pressure port is marked on the upper part of the case.
※Environment resistance is rated at no freezing or condensation.

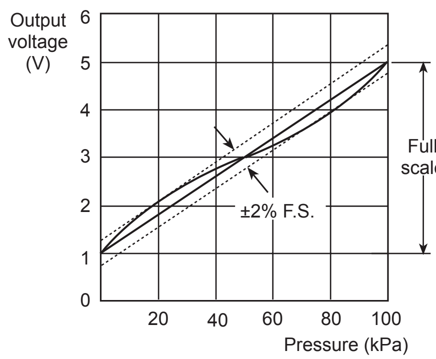
● Analog output voltage-Pressure characteristic

PSA-01



● Analog output voltage-Linear characteristic

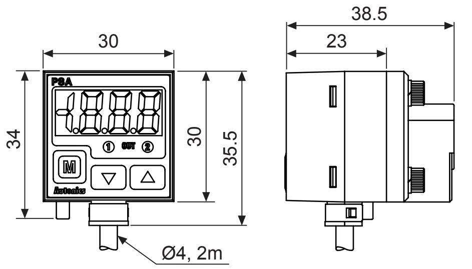
PSA-01



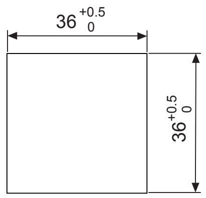
■ Dimensions

(unit: mm)

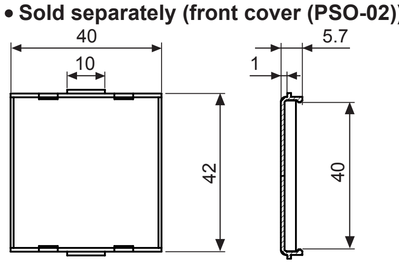
● PSA Series

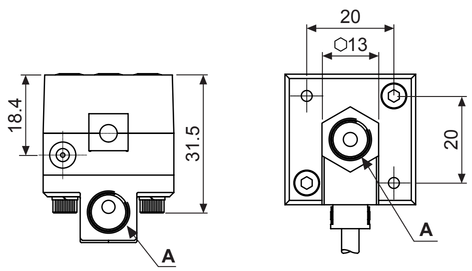


● Panel cut-out



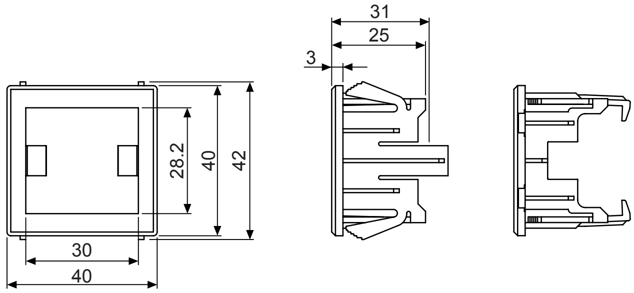
● Sold separately (front cover (PSO-02))



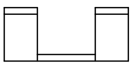


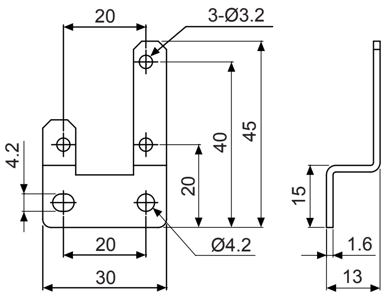
※**A**: Rc1/8" (standard), NPT1/8" (option)

● Sold separately (panel bracket (PSO-01))

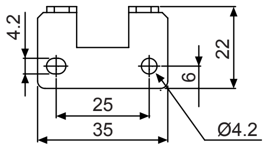


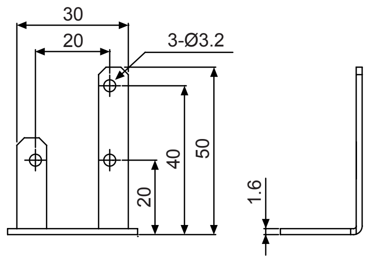
● **Bracket A**





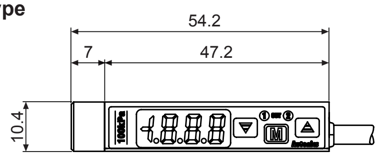
● **Bracket B**

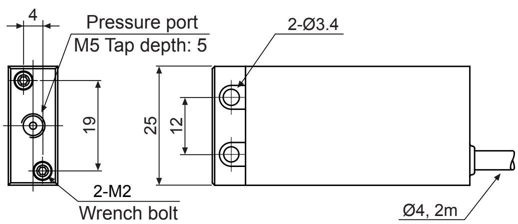




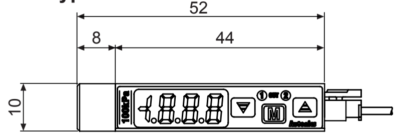
● PSB Series

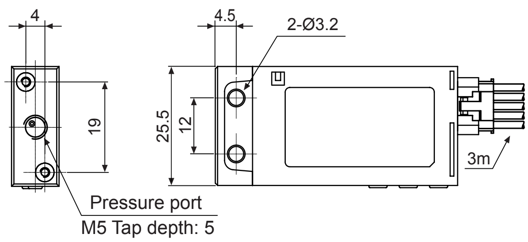
● Cable type





● Connector type

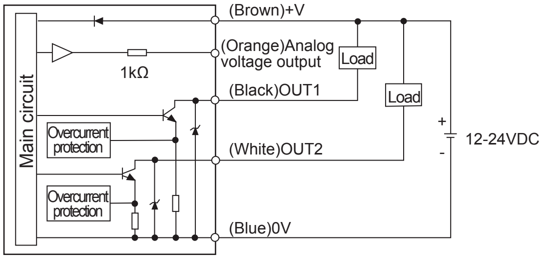




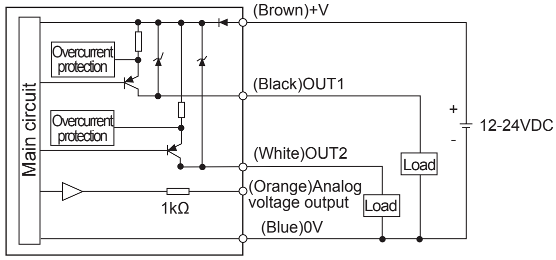
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Control Output Diagram (PSA/PSB)

● NPN open collector output type



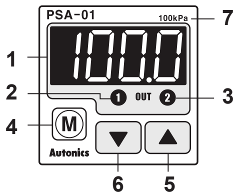
● PNP open collector output type



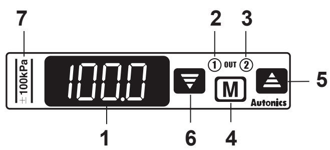
※There is no short-circuit protection in analog voltage output. Do not connect this output to power supply or capacitive load directly.
※Please observe input impedance of connected equipment when use analog voltage output.
And be sure to check voltage drop caused by resistance of extended wire.

■ Unit Description

(PSA Series)



(PSB Series)

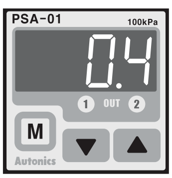


1. 3½digit LED display (red)
: Display sensing pressure, every setting value and display error.
2. 1 output indicator (red) : Output 1 is ON, LED will be ON.
3. 2 output indicator (PSA: red, PSB: green)
: Output 2 is ON,LED will be ON.
4. Mode key
: Parameter setting mode or preset setting mode, save setting value.
5. Up key
: Set the setting value to lower step in preset setting or pressure unit, output mode, response time, analog output scale, key lock, peak hold value, bottom hold value display in parameter setting.
6. Down key
: Set setting value to upper step in preset setting or pressure unit, output mode, response time, analog output scale, key lock, peak hold, bottom hold display in parameter setting.
7. Range of rated pressure
: It is possible to change the pressure unit in PSA Series. Please use different unit as label for your application.

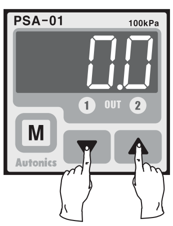
■ Setting (PSA/PSB)

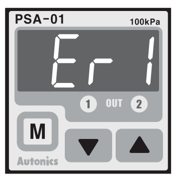
RUN mode	Mode	Settings
Press [M] key over 3sec.	Parameter setting	Display unit setting ▶ Output operation mode setting ▶ Response time setting ▶ Analog output scale setting (1VDC) ▶ Analog output scale setting (5VDC) ▶ Key lock setting
[M]	Preset value setting	Sensing level 1 setting [St1, Lo] ▶ Sensing level 2 setting [St2, Lo]
Press [▲] key over 3sec.	Peak hold	Peak hold ▶ Bottom hold
Press [▼]+[▲] key over 1sec.	Zero-point adjustment	Zero-point adjustment

■ Zero Point Adjustment (PSA/PSB)

1


➡

2




1. In state of atmospheric pressure during RUN mode, press [▼] key and [▲] key at the same time for over 1sec.
2. When the zero point adjustment is completed, it will display 0.0 and return to RUN mode automatically.

※Please execute zero point adjustment regularly.

※If executing zero point adjustment when external pressure has been applied, Er1 will be flashing. Please execute zero point again in state of atmospheric pressure.

■ Parameter Setting (PSA/PSB)

RUN mode

Press [M] Key over 3sec.

Unt — Display unit setting

Unt and previously set unit will flash in turn every 0.5 sec.
Press [▼] or [▲] key to select the unit.
(Press [M] key momentarily, the unit will be saved, then move to the next mode.)

● **Negative pressure, compound pressure:**

PA (kPa) ↔ kgF (kgf/cm^2) ↔ bAr (bar) ↔ PSI (psi) ↔ mmH (mmHg) ↔ InH (inHg) ↔ H2o (mmH$_2$O)

● **Standard pressure:**

PA (kPa) ↔ kgF (kgf/cm^2) ↔ bAr (bar) ↔ PSI (psi)

※For using mmH$_2$O unit, multiply display value by 100.

[M]

oUt — Output operation mode setting

oUt and previous output operation mode will flash by turning on. (0.5sec.)
Select the output operation mode with [▼], [▲] Key.
(Press [M] key momentarily, the response time will be saved, then move to the next mode.)

F-1 ↔ F-2 ↔ F-3 ↔ F-4 ↔ F-5 ↔ F-6

[M]

SPd — Response time setting

SPd and the previous response time will flash by turning on. (0.5sec.)
Select the output operation mode with [▼], [▲] Key.
(Press [M] key momentarily, the response time will be saved, then move to the next mode.)

2.5 ↔ 5.0 ↔ 100 ↔ 500 (unit : ms)

[M]

A-1 — Analog output scale setting (1VDC)

A-1 and the previous pressure will flash by turning on. (0.5sec.)
Set the pressure which will output 1VDC with [▼], [▲] Key.
• Allowable setting range : Min. value of rated pressure ≤ [A-1] ≤ 90% of rated pressure
(Press [M] key momentarily, the selected pressure is set as 1VDC scales, then move to the next mode.)

[M]

A-5 — Analog output scale setting (5VDC)

A-5 and the previous pressure will flash by turning on. (0.5sec.)
Set the pressure which will output 5VDC by [▼], [▲] Key.
• Allowable setting range : [A-1] +10% of rated pressure ≤ [A-5] < Max. value of rated pressure
(Press [M] key momentarily, the selected pressure is set as 5VDC scales, then move to the next mode.)

[M]

KEY — Key Lock

KEY and the previous key lock will flash by turning on (0.5sec.)
Select key lock with [▼], [▲] Key.
(Press [M] key momentarily, key lock is set, then move to the display unit setting mode.)

LoC ↔ PA.L ↔ UnL

[M]

※Key lock functions
- LoC : Disable to change preset value and parameter value (Enable to change KEY mode only)
- PA.L : Disable to change parameter setting/preset, zero point adjustment (Enable to check peak hold and bottom hold, and to change KEY mode)
- UnL : Enable to change preset value and parameter value (Lock off)

※When advance to parameter setting mode and preset setting mode, it displays "Setting item" and "Previous setting value" by 0.5 sec. turn. This display will stop by pressing [▼] or [▲] key (Display setting value), if any key is untouched for over 1 sec., it will display old value by 0.5sec. turn again.
※When [M] key is pressed for 3sec. during setting, it will return to RUN mode with memorizing on EEPROM. However, when there is any key is untouched for 60sec., it turns to RUN mode with keeping the previous setting value not current setting value.
※There is memory protection by EEPROM, but life cycle of EEPROM is 100,000 times.

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(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
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(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
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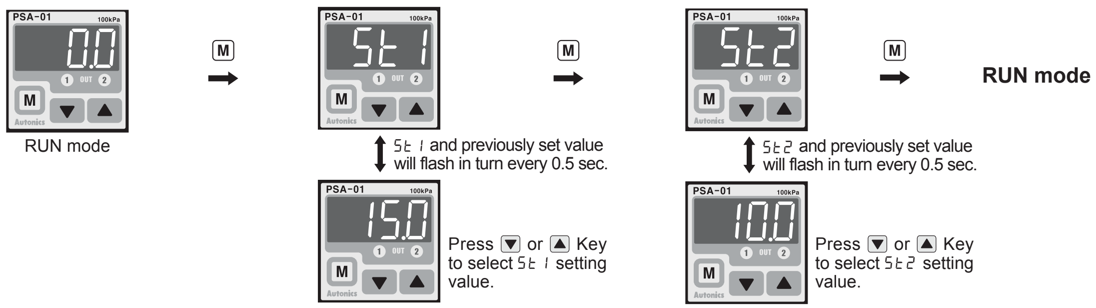
(S) Field Network Devices
(T) Software

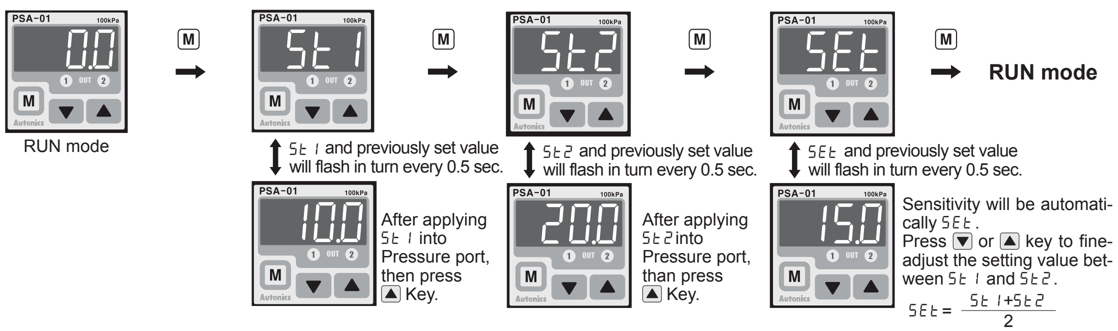
▣ Preset Value Setting (PSA/PSB)

◎ Hysteresis mode[F-1] and independent 2 output mode[F-3, F-4, F-5]



※St1 setting range : Min. display pressure < St1 ≤ Max. display pressure
※St2 setting range : - Hysteresis mode: Min. display pressure ≤ St2 < St1
- 2 independent output mode: Min. display pressure < St2 ≤ Max. display pressure

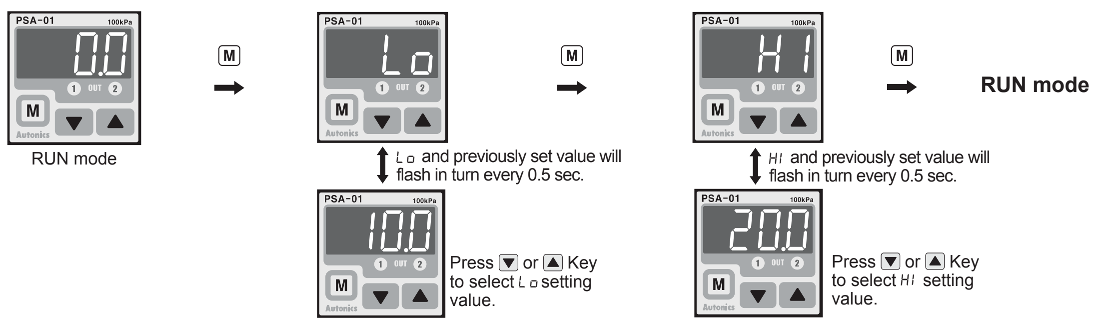
◎ Automatic sensitivity setting mode[F-2]



※St1 setting range : Min. display pressure < St1 ≤ Max. display pressure – 1% of rated pressure
※St2 setting range : St1 + 1% of rated pressure < St2 ≤ Max. display pressure

Adjustable range of set value: Between St1 and St2.

◎ Window comparison output mode[F-6]



※Low value setting range : Min. display pressure ≤ Lo ≤ Max. display pressure
※High value setting range : Lo ≤ HI < Max. display pressure

- If no key is touched for 60sec., it will return to RUN mode. [Automatic sensitivity setting mode[F-2] is exception]
- When changing the display unit, preset value will be calculated according to the display unit.
- Whenever key touched one time, it is increased (decreased) as 1 digit (2 digits for psi unit and compound pressure) but it will be continuously increasing (decreasing) by pressing ▼, ▲ key constantly.

▣ Peak Hold And Bottom Hold Check

1. Press ▲ key for over 3sec. in RUN mode.
2. PE.H and memorized max. pressure (Negative pressure type is for max. negative pressure) will flash by turning on (0.5sec.) then display peak hold value.
3. bo.H and memorized min. pressure (Negative pressure type is for min. negative pressure) will flash by turning on (0.5sec.) then display bottom hold value.
4. If pressing ▲ key one time shortly, memorized peak hold and bottom hold value will be removed then return to RUN mode.

※When the peak hold and bottom hold value is over the max. display pressure value, it displays HHH, On the opposite, it displays LLL. Please remove peak hold and bottom hold value by using ▲ key.

■ Output Operation Mode (PSA/PSB)

1. Hysteresis mode [F- 1]

※It can be set for pressure sensing level[St 1] and sensing difference[St2].

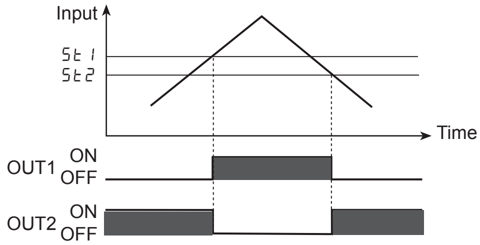
※St 1 setting range

: Min. display pressure < St 1 ≤ Max. display pressure

St2 setting range

: Min. display pressure ≤ St2 < St 1

- OUT 1: When applying pressure is larger than St 1, it wil be ON.
- OUT 2: When applying pressure is lower than St2, it will be ON.



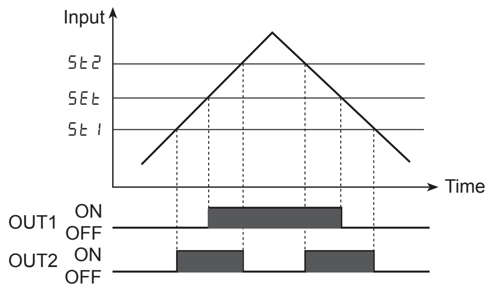
2. Automatic sensitivity setting mode [F-2]

※This function is to set pressure sensing level to the proper position automatically, it is set by received pressure from two positions [St 1, St2].

※The sensing hysteresis fixed to 1 digit (2 digits for psi unit and compound type)

※The pressure sensing level [SEt] is shown in the following calculation. $SEt = \frac{(St1 + St2)}{2}$

- OUT 1 : When applying pressure is larger than SEt value, it will be ON.
- OUT 2 : When applying pressure is between St 1 and St2, it will be ON.



Note1) If it is not enough for difference of sensing level between St 1 and St2, Er3 will be displayed. Please set again after applying enough pressure.

Note2) St 1 setting range: Min. display pressure ≤ St 1 ≤ Max. display pressure -1% of rated pressure
St2 setting range: St 1 +1% of rated pressure ≤ St2 ≤ Max. display pressure

Note3) If fine adjustment for sensing level is required, adjust sensing level by ▼, ▲ key.
(Adjustment range : Between St 1 and St2)

3. Independent 2 output mode [F-3, F-4, F-5]

※St 1 and St2 can be set independently within display pressure range. One is for control, the other is for alarm or optional control.

※The sensing hysteresis fixed to 1 digit (2 digits for psi unit and compound type)

※St 1 setting range

: Min. display pressure ≤ St 1 ≤ Max. display pressure

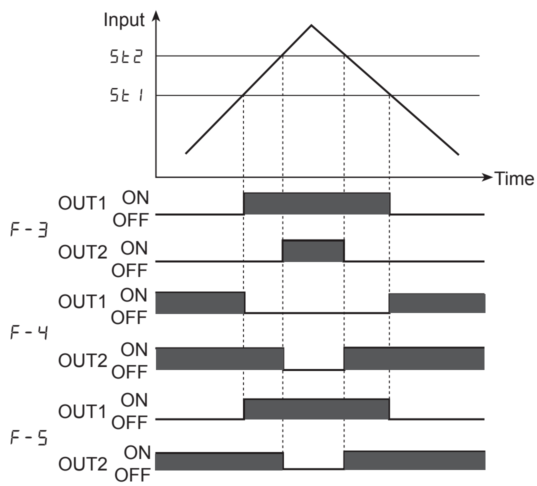
St2 setting range

: Min. display pressure ≤ St2 ≤ Max. display pressure

● Independent 2 output mode [F-3]
- OUT 1 : It will be ON, when it is over St 1.
- OUT 2 : It will be ON, when it is over St2.

● Independent 2 opposite mode [F-4]
- OUT 1 : It will be OFF when it is over St 1.
- OUT 2 : It will be OFF, when it is over St2.

● Independent 2 cross mode [F-5]
- OUT 1 : It will be OFF when it is under St 1.
- OUT 2 : It will be ON, when it is under St2.



4. Window comparison output mode [F-6]

※It is able to set High limit value [HI], Low limit value [Lo] of pressure sensing level in this mode.

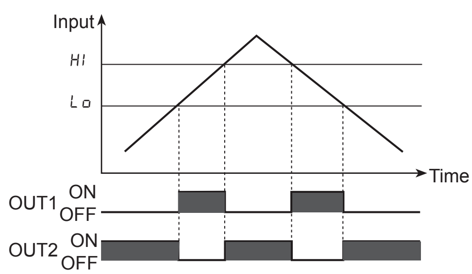
※The sensing hysteresis fixed to 1 digit (psi unit and compound type 2 digits)

※Lo setting range

: Min. display pressure ≤ Lo < Max. display pressure

HI setting range : Lo ≤ HI < Max. display pressure

- OUT 1 : It will be ON between high limit value[HI] and low limit value[Lo]
- OUT 2 :It will be ON when it is over high limit value[HI] and low limit value[Lo].



▣ Functions (PSA/PSB)

◎ Pressure unit change

PS□-V01 (C) (P)/PS□-C01 (C) (P) has 7 kinds of pressure unit and PS□-01 (C) (P)/PS□-1 (C) (P) has 4 kinds of pressure unit.
Please select the proper unit for application.

- PS□-V01 (C) (P), PS□-C01 (C) (P) :
  kPa, kgf/cm², bar, psi, mmHg, inHg, mmH_2O
- PS□-01 (C) (P), PS□-1 (C) (P) : kPa, kgf/cm², bar, psi

※When using mmH_2O multiply the display value by 100.

◎ Output mode change

There are 6 kinds of control output modes in order to provide the various detection. Select a mode for your proper application.

• Hysteresis mode [F- 1]
When variable hysteresis is required for pressure detection.

• Automatic sensitivity setting mode [F-2]
When it is required to set detecting sensitivity automatically at proper position.

• Independent 2 output mode [F-3, F-4, F-5]
When it is required to detect pressure from two position with one product.

• Window comparison output mode [F-6]
When is required to detect pressure in a certain range.

◎ Response time change (chattering prevention)

It can prevent chattering of control output by changing response time. It is able to set 4 kinds of response time (2.5, 5, 100, 500ms) and if the response is getting longer, the sensing will be more stable by increasing the number of digital filter.

◎ Analog output scale setting

It is not fixed the analog output (1-5VDC) scale as the rated pressure range but this is a function to change properly for user's application. When the position[A- 1] for 1VDC output and the position [A-5] for 5VDC output are set, the pressure range of A- 1 to A-5 is to 1-5VDC analog output.

◎ Key lock

This unit has 2 kinds of key lock function in order to prevent wrong operation.

- LoC : All keys are locked, it is impossible to change any parameter setting/preset, zero point adjustment, peak hold and bottom hold. (Enable to change KEY mode only).
- PAL : It is impossible to change parameter setting/preset, zero point adjustment. (Enable to check peak hold and bottom hold, and to change KEY mode).
- UnL : All keys are unlocked.

◎ Zero-point adjustment

This function is to set the display value of pressure at zero when port is opened to atmospheric pressure.

◎ Peak hold and bottom hold

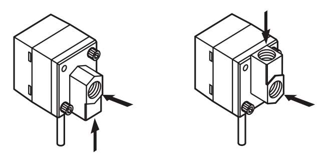
This function is diagnosis malfunction of the system caused by parasitic pressure or to check through memorizing the max./min. pressure that occurred in the system.

◎ Error display

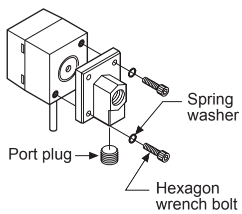
Error display	Description	Troubleshooting
Er 1	When external pressure is input while adjusting zero point	Try again after removing external pressure
Er2	When overload is applied on control output	Remove overload
Er3	When the setting value is not matched with setting condition	Check setting conditions and set proper setting values
HHH	When applied pressure exceeds High-limit of display pressure range	Apply pressure within display pressure range
LLL	When applied pressure exceeds Low-limit of display pressure range	

▣ Installation (PSA Series)

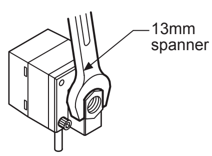
1. When installing pressure port, it is able to bring pressure from 3 directions by changing the mounting direction of the pressure port.
2. Basic spec of pressure port is Rc (PT) 1/8"and option pressure port is NPT1/8". Use general one-touch fitting.



3. Please use seal tape at port plug in order to prevent pressure leak.
4. Please block another two pressure ports not used with port plug.



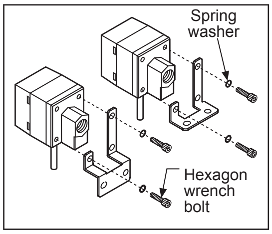
5. Please connect it by using spanner (13mm) at the metal part in order not to overload on the body when connecting one touch fitting.



⚠Caution

The tightening torque of one touch fitting should be max. 10N·m. If not, it may cause mechanical problem.

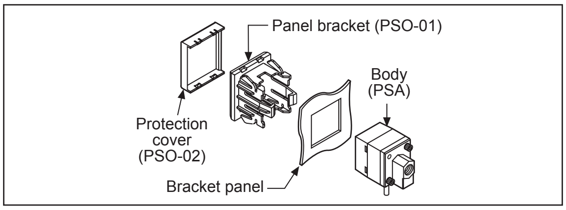
6. PSA Series has 2 kinds of brackets so it is able to install it in two different ways.
7. At first, please unscrew hexagon wrench bolt and assemble the bracket on this unit by fixing the hexagon wrench bolt.



⚠Caution

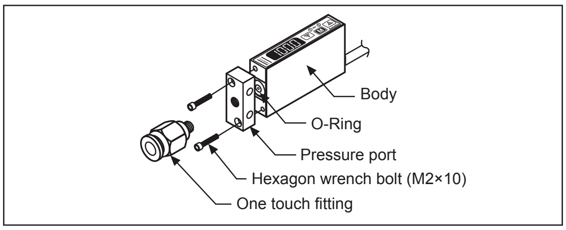
In this case, tightening torque of hexagon wrench should be max. 3N·m. If not, it may cause mechanical problem.

8. Bracket (PSO-01) and front protection cover (PSO-02) are sold separately. Please see the pictures for installation.

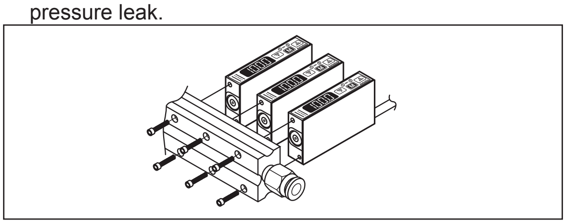


▣ Installation (PSB Series)

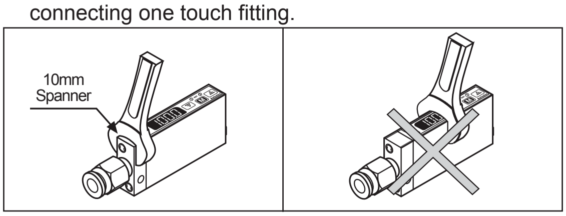
1. Pressure port is M5. Use general one touch fitting.



2. It is able to use it without the pressure port according to environment. In this case O-Ring between pressure port and its body should not be taken out in order to prevent pressure leak.



3. Please connect it by using spanner (10mm) at pressure port in order not to overload on the body when connecting one touch fitting.



⚠Caution

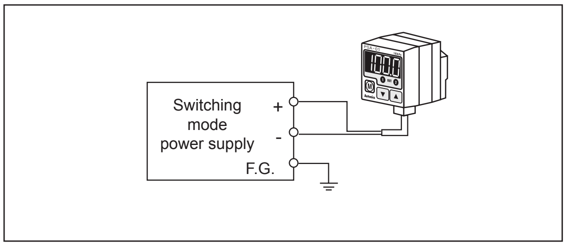
The tightening torque of one touch fitting and hexagon wrench should be Max. 5N·m and 2N·m. It may cause mechanical trouble. Please do not use spanner to install as it may cause mechanical trouble.

▣ Proper Usage

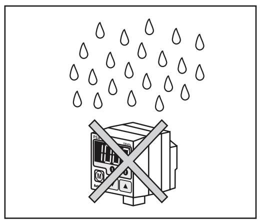
⚠Caution

PSA, PSB Series is for sensing of non corrosive gas. Do not use this product at corrosive gas or flammable gas, etc.

- Please using this unit within the range of specification, if applying pressure is larger than specification, it may not be working properly due to damage.
- After supplying power, it takes 3 sec. to work.
- When using switching mode power supply, frame ground (F.G.) terminal of power supply should be grounded.



- It may cause malfunction by noise, when wiring with power line or high voltage line.
- Do not insert any sharp or pointed object into pressure port. It may cause mechanical problem due to sensor damage.
- Do not use this unit with flammable gas, because this is not an explosion proof structure.
- Be sure that this unit should not be contacted directly with water, oil, thinner, etc.



- Wiring must be done with power off.

▣ Accessory

● PSA/PSB

- Pressure unit label

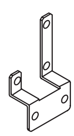
±100kPa	±101.3kPa	100kPa	1MPa
±1.020kgf/㎠	-1.034kgf/㎠	1.020kgf/㎠	10.20kgf/㎠
±14.50psi	-14.70psi	14.50psi	145.0psi
±1.000bar	-1.013bar	1.000bar	10.00bar
±750㎜hg	-760㎜hg	×10	×10
±29.5inHg	-29.9inHg	×100	×100
±102.0㎜H_2O	-103.4㎜H_2O	×1000	×1000

DISPLAY UNIT LABEL

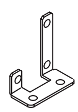
● Only for PSA Series

- Port plug

- Bracket A



- Bracket B



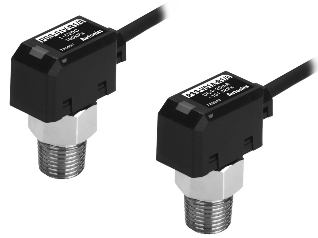
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

PSS Series

Compact, Non-indicating Pressure Sensors

▣ Features

- Rated pressure
  : negative pressure (-101.3 to 0.0kPa)
  standard pressure (0 to 100.0kPa, 0 to 1,000kPa)
  compound pressure (-101.3 to 100.0kPa)
- Compact design: W11.8×H29.3×L24.8mm (including pressure port)
- Analog output: Voltage (1-5VDC), current (DC4-20mA)
- Power supply: 12-24VDC ±10%



⚠ Please read "Caution for your safety" in operation manual before using.

CE

▣ Ordering Information

PS **S** – **V** **01** **V** – **R1/8**

Pressure port	R1/8	Standard
Output	V	Voltage (1-5VDC) output
	A	Current (DC4-20mA) output
Pressure range	01	100kPa
	1	1,000kPa
Pressure type	No-mark	Standard pressure type
	V	Negative pressure type
	C	Compound pressure type
Size	S	Small (W11.8×H29.3×L24.8mm)
Item	PS	Pressure Sensor

▣ Specifications

Pressure type		Gauge pressure			
		Negative pressure	Standard pressure		Compound pressure
Model	Voltage output	**PSS-V01V-R1/8**	**PSS-01V-R1/8**	**PSS-1V-R1/8**	**PSS-C01V-R1/8**
	Current output	**PSS-V01A-R1/8**	**PSS-01A-R1/8**	**PSS-1A-R1/8**	**PSS-C01A-R1/8**
Rated pressure range		0.0 to -101.3kPa	0.0 to 100.0kPa	0 to 1,000kPa	-101.3 to 100.0kPa
Analog output range		5.0 to -101.3kPa	-5.0 to 110.0kPa	-50 to 1,100kPa	-101.3 to 110.0kPa
Max. pressure range		2 times of rated pressure	2 times of rated pressure	1.5 times of rated pressure	2 times of rated pressure
Applied fluid		Air, non-corrosive gas			
Power supply		12-24VDC ±10% (ripple P-P: Max. 10%)			
Current consumption		Voltage output type: Max. 15mA, Current output type: —			
Effect by power supply		Max. ±0.3% F.S.			
Protection circuit		Reverse polarity protection circuit			
Analog output	Voltage output	•Output voltage: 1-5VDC ±2% F.S. •Linear: Max. ±1% F.S. •Output impedance: 1kΩ			
	Current output	•Output current: DC4-20mA ±2% F.S. •Linear: Max. ±1% F.S.			
Temp. characteristics of analog output		Max. ±2% F.S. of output voltage/current at 25℃ within temperature range 0 to 50℃			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		2000VAC 50/60Hz for 1 minute			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 2 hours			
Environment	Ambient temp.	0 to 50℃, storage: -10 to 60℃			
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP40 (IEC standard)			
Material		Front, Rear case: Polycarbonate, Pressure port: Nickel plated brass			
Cable		Ø3, 4-wire, 3m (AWG28, Core diameter: 0.08mm, Number of cores: 19, Insulator out diameter: Ø0.88mm)			
Sold separately		Sensor connector wire mount plug (CNE-P04-YG)※1			
Approval		CE			
Weight※2		Approx. 60g (approx. 26g)			

※1: For more information about sensor connector wire mount plug, refer to '(G) Connector/Socket'.
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※F.S.: Rated pressure.
※Environment resistance is rated at no freezing or condensation.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
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(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
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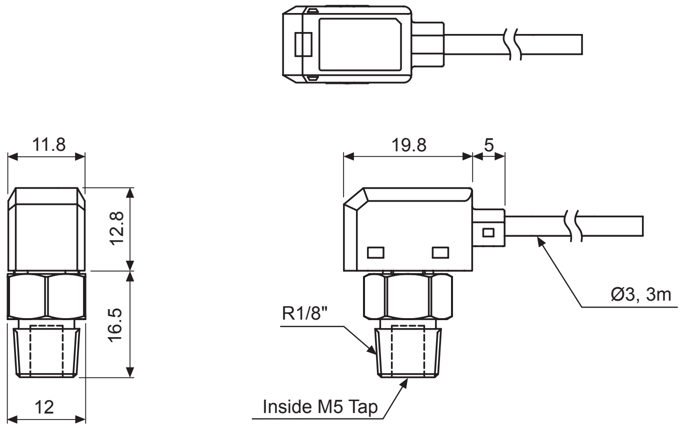
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

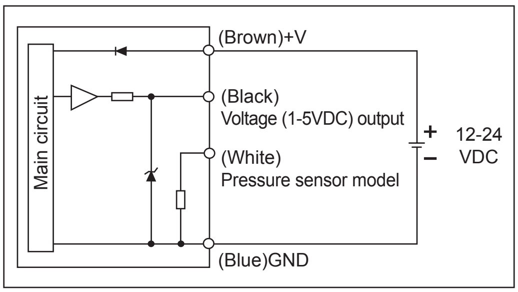
■ Dimensions

(unit : mm)

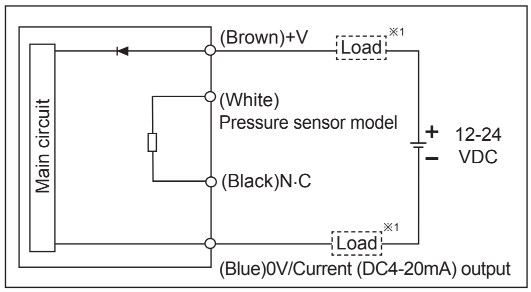


■ Connections

● **Voltage (1-5VDC) output type**



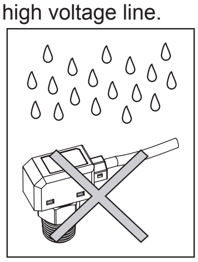
● **Current (DC4-20mA) output type**

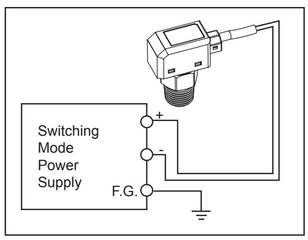


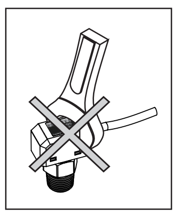
※1 : Load can be connected any directions.
※Allowable load impedance: Max. 100Ω for 12VDC power
Max. 500Ω for 24VDC power

■ Proper Usage

- Do not insert any sharp or pointed object into pressure port.
  Failure to follow this instruction may result in malfunction and damage the sensor.
- Be sure that this unit must avoid direct touch with water, oil, thinner etc.
- It is ready to operate 3 sec after it is turned ON. Be sure not to use the product within 3 sec.
- When using switching mode power supply, frame ground (F.G.) terminal of power supply should be grounded.
- To avoid inductive noise, keep the wiring away from power line, high voltage line.
  Failure to follow this instruction may result in malfunction.
- When moving this unit from warm place to cold place, please remove the humidity on the cover then use it.
- Do not use spanner to mounting this unit.
  Tightening torque for one touch fitting should be below 10N·m.
- Do not apply a tensile strength in excess of 30N to the cables or connector.
- Allowable installation environment
  - Indoor
  - Altitude max. 2,000m
  - Pollution degree 3
  - Installation Category II







(F) Rotary Encoders

NEW

Absolute type (Single-turn)
Ø50mm Shaft Type,
Magnetic
MGA50S Series

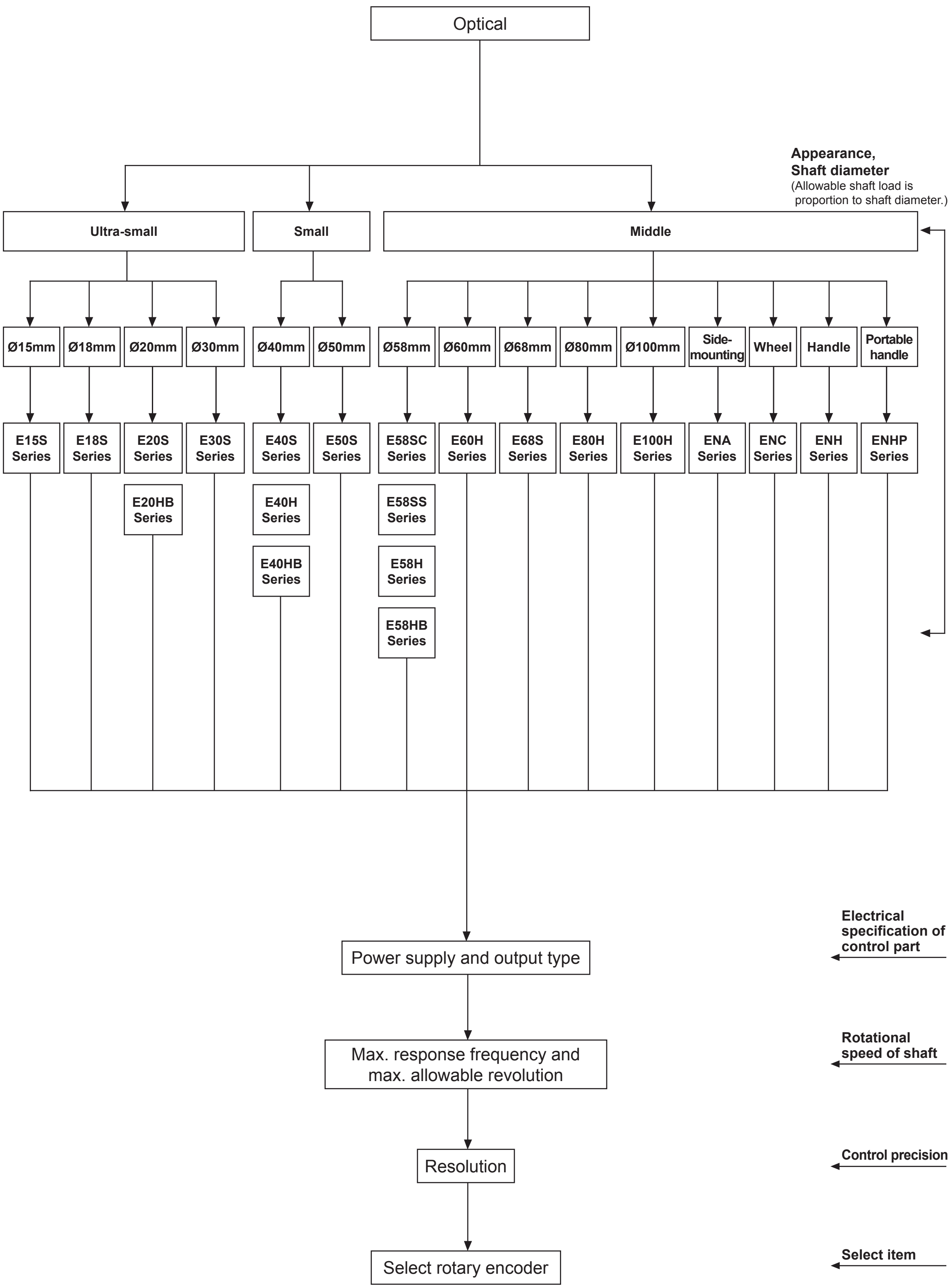
NEW

Absolute type (Multi-turn)
Ø50mm Shaft Type,
Magnetic
MGAM50S Series

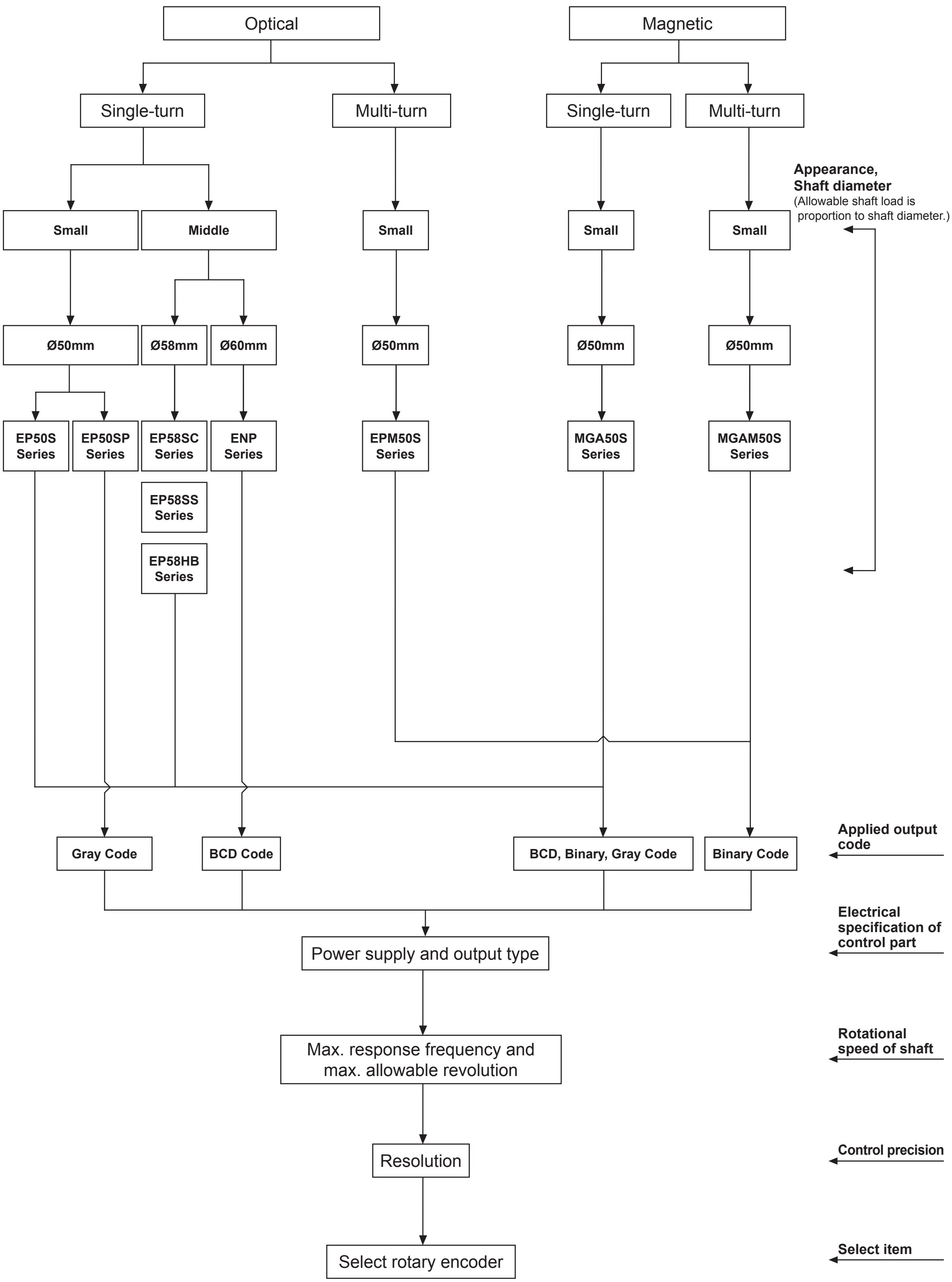
Flexible Coupling
ERB Series

Rotary Encoder Selection

■ Incremental Type Rotary Encoder Selection



■ Absolute Type Rotary Encoder Selection



Product Overview

■ Incremental Type

E15S | 2 | — | Resolution | — | 2 | — | N | — | 5 | — | ☐

- 2: External or inner diameter of shaft
- 2: Output phase
- Cable: No-mark: Cable type; C: Cable connector type

<table>
<tr><th>Appearance</th><th>Model</th><th>Resolution※1</th><th>Control output</th><th>Power supply</th><th>Reference</th></tr>
<tr><td>Ø15mm Shaft type
</td><td>E15S2- Resolution -2-N-5</td><td>36PPR</td><td rowspan="8">T (1):
Totem pole output

N (2):
NPN open collector output

V (3):
Voltage output

L:
Line driver output
(except CE certification)

※The number of ( ) is former name.</td><td rowspan="8">5:
5VDC ±5%

12:
12VDC ±5%

24:
12-24VDC ±5%</td><td>F-10 to 11</td></tr>
<tr><td>Ø18mm Shaft type
CE cULus
</td><td>E18S2 - Resolution -1-N-5
E18S2.5 V</td><td>100PPR
200PPR
300PPR
400PPR</td><td>F-12 to 13</td></tr>
<tr><td>Ø20mm Shaft type
CE
</td><td>E20S2 - Resolution -3-N-5, 12
V
-6-L-5

※Cable
R: Axial cable type
S: Radial cable type</td><td rowspan="2">100PPR
200PPR
320PPR
360PPR</td><td rowspan="2">F-14 to 15</td></tr>
<tr><td>Ø20mm Blind hollow shaft type
CE
</td><td>E20HB2 - Resolution -3-N-5, 12
E20HB2.5 V
E20HB3 -6-L-5

※Cable
R: Axial cable type
S: Radial cable type</td></tr>
<tr><td>Ø30mm Shaft type
CE
</td><td>E30S4 - Resolution -3-T-5, 24
N
V
-6-L-5</td><td>100PPR 1000PPR
200PPR 1024PPR
360PPR 3000PPR
500PPR</td><td>F-16 to 17</td></tr>
<tr><td>Ø40mm Shaft type
CE
</td><td>E40S6 - Resolution -2-T-5, 24
(standard item) N
E40S8 V
(option) -3-T-5, 24
N
V
-4-L-5
6</td><td rowspan="3">*1PPR
*2PPR
*5PPR
10PPR
*12PPR
15PPR
20PPR
23PPR
25PPR
30PPR
35PPR
40PPR
45PPR
50PPR
60PPR
75PPR
100PPR
120PPR
125PPR
150PPR
192PPR
200PPR
240PPR
250PPR
256PPR
300PPR
360PPR
400PPR
500PPR
512PPR
600PPR
800PPR
1000PPR
1024PPR
1200PPR
1500PPR
1800PPR
2000PPR
2048PPR
2500PPR
3000PPR
3600PPR
5000PPR</td><td rowspan="3">F-18 to 20</td></tr>
<tr><td>Ø40mm Hollow shaft type
CE
</td><td>E40H8 - Resolution -2-T-5, 24
(standard item) N
E40H6 V
E40H10 -3-T-5, 24
E40H12 N
(option) V
-4-L-5
6</td></tr>
<tr><td>Ø40mm Blind hollow shaft type
CE
</td><td>E40HB8 - Resolution -2-T-5, 24
(standard item) N
E40HB6 V
E40HB10 -3-T-5, 24
E40HB12 N
(option) V
-4-L-5
6</td></tr>
</table>

※1: Not indicated resolutions are customizable.
※The '*' marked pulse is only for A, B phase in resolution. (line driver output is for A, $\overline{A}$, B, $\overline{B}$ phase.)

E50S | 8 | — | Resolution | — | 2 | — | T | — | 5 | — | ☐

External or inner diameter of shaft

Output phase

Cable
No-mark: Cable type
C: Cable connector type

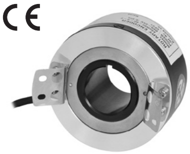
Appearance	Model	Resolution※1	Control output	Power supply	Reference
Ø50mm Shaft type CE 	**E50S8 - Resolution -2-T-5, 24** **N** **V** **-3-T-5, 24** **N** **V** **-4-L-5** **6** ※Cable CR: Axial connector type CS: Radial connector type	*1PPR, *2PPR, *5PPR, 10PPR, 12PPR, 15PPR, 20PPR, 23PPR, 25PPR, 30PPR, 35PPR, 40PPR, 45PPR, 50PPR, 60PPR, 75PPR, 100PPR, 120PPR, 125PPR, 150PPR, 192PPR, 200PPR, 240PPR, 250PPR, 256PPR, 300PPR, 360PPR, 400PPR, 500PPR, 512PPR, 600PPR, 800PPR, 1000PPR, 1024PPR, 1200PPR, 1500PPR, 1800PPR, 2000PPR, 2048PPR, 2500PPR, 3000PPR, 3600PPR, 4000PPR, 5000PPR, 6000PPR, 8000PPR	**T (1):** **Totem pole output**		**F-21 to 23**
Ø58mm Shaft type CE 	**E58SC10 - Resolution -2-T-5, 24** **(shaft clamping) N** **E58SS6 V** **(shaft synchro) -3-T-5, 24** **N** **V** **-4-L-5** **6** ※Cable CR: Axial connector type CS: Radial connector type		**N (2):** **NPN open collector output**		
Ø58mm Hollow shaft type CE 	**E58H12 - Resolution -2-T-5, 24** **N** **V** **-3-T-5, 24** **N** **V** **-4-L-5** **6**	*1PPR, *2PPR, *5PPR, 10PPR, *12PPR, 15PPR, 20PPR, 23PPR, 25PPR, 30PPR, 35PPR, 40PPR, 45PPR, 50PPR, 60PPR, 75PPR, 100PPR, 120PPR, 125PPR, 150PPR, 192PPR, 200PPR, 240PPR, 250PPR, 256PPR, 300PPR, 360PPR, 400PPR, 500PPR, 512PPR, 600PPR, 800PPR, 1000PPR, 1024PPR, 1200PPR, 1500PPR, 1800PPR, 2000PPR, 2048PPR, 2500PPR, 3000PPR, 3600PPR, 5000PPR, 6000PPR, 8000PPR	**V (3):** **Voltage output**	**5**: 5VDC ±5%	**F-24 to 27**
Ø58mm Blind hollow shaft type CE 	**E58HB12 - Resolution -2-T-5, 24** **N** **V** **-3-T-5, 24** **N** **V** **-4-L-5** **6** ※Cable CR: Axial connector type CS: Radial connector type		**L:** **Line driver output** (except CE certification)	**24**: 12-24VDC ±5%	
Ø60mm Hollow shaft type CE 	**E60H20 - Resolution -3-T-5, 24** **N** **V** **-6-L-5**	100PPR, 1024PPR, 5000PPR, 8192PPR	※The number of ( ) is former name.		**F-28 to 30**
Ø68mm Shaft type 	**E68S15 - Resolution -6-L-5**	500PPR, 600PPR, 1024PPR			**F-31 to 32**

※1: Not indicated resolutions are customizable.
※The '*' marked pulse is only for A, B phase in resolution. (line driver output is for A, $\overline{A}$, B, $\overline{B}$ phase.)

Product Overview

E80H | 30 | — | Resolution | — | 3 | — | T | — | 5 | — | □

- E80H → Appearance
- 30: External or inner diameter of shaft
- Resolution → Resolution
- 3: Output phase. It is clickstopper position for handle type.
- T → Control output
- 5 → Power supply
- □: Cable. No-mark: Cable type. C: Cable connector type

Appearance	Model	Resolution※1	Control output	Power supply	Reference
Ø80mm Hollow shaft type CE 	**E80H30 - Resolution -3-T-5, 24** **(standard item) N** **E80H32 V** **(option) -6-L-5**	60PPR 100PPR 360PPR 500PPR 512PPR 1024PPR 3200PPR	**T (1):** **Totem pole output** **N (2):** **NPN open collector output** **V (3):** **Voltage output** **L:** **Line driver output** (except CE certification) ※The number of ( ) is former name.	**5**: 5VDC ±5% **24**: 12-24VDC ±5%	**F-33 to 35**
Ø100mm Hollow shaft type CE 	**E100H35 - Resolution -3-T-5, 24** **N** **V** **-6-L-5**	512PPR 1024PPR 10000PPR			**F-36 to 38**
Side-mounting type CE 	**ENA - Resolution -2-T-5, 24** **N** **V** **-3-T-5, 24** **N** **V** ※**ENA - Resolution -2- □ - □** **: Output the A, B phase** ※**ENA - Resolution -3- □ - □** **: Output the A, B, Z phase**	*1PPR 60PPR 512PPR *2PPR 75PPR 600PPR *5PPR 100PPR 800PPR 10PPR 120PPR 1000PPR 12PPR 150PPR 1024PPR 15PPR 192PPR 1200PPR 20PPR 200PPR 1500PPR 23PPR 240PPR 1800PPR 25PPR 250PPR 2000PPR 30PPR 256PPR 2048PPR 35PPR 300PPR 2500PPR 40PPR 360PPR 3000PPR 45PPR 400PPR 3600PPR 50PPR 500PPR 5000PPR			**F-39 to 41**
Measuring wheel type CE 	**ENC-1- Resolution -T-5, 24** **N** **V** **(**output phase: A, B**)**	**1:** 1mm/1Pulse **2:** 1cm/1Pulse **3:** 1m/1Pulse **4:** 0.01yd/1Pulse **5:** 0.1yd/1Pulse **6:** 1yd/1Pulse			**F-42 to 43**
Manual handle type 	**ENH - Resolution -1-T-5, 24** **2** **-1-V-5, 24** **2** **-1-L-5** **2**	25PPR 100PPR			**F-44 to 45**
Portable encoder with handle 	**ENHP - Resolution -1-T-5, 24** **2** **-1-L-5** **2**	100PPR			**F-46 to 47**

※1: Not indicated resolutions are customizable.
※The '*' marked pulse is only for A, B phase in resolution. (line driver output is for A, $\overline{A}$, B, $\overline{B}$ phase.)

■ Absolute Type (Single-turn)

EP50S | 8 | — | Resolution | — | 1 | R | — | P | — | 5

8: External or inner diameter of shaft
R: Revolution direction※1

Appearance	Model	Resolution (-division)	Output code	Control output	Power supply	Reference
Ø50mm Shaft type CE 	**EP50S8 - Resolution -1R-N (P)-5, 24** **2R** **3R** **1F** **2F** **3F**	6, 8, 10, 12, 16, 20, 24, 32, 40, 45, 48, 64, 90, 128, 180, 256, 360, 512, 720, 1024	**1: BCD code** **2: Binary code** **3: Gray code (customi-zable)**	**P (1): PNP open collector output** **N (2): NPN open collector output** ※The number of ( ) is former name.	**5**: 5VDC ±5% **24**: 12-24VDC ±5%	**F-48 to 52**
Ø50mm Shaft type 	**EP50SP- Resolution -3F-N-5, 24** **R**	180 360				**F-53 to 55**
Ø58mm Shaft type CE  	**EP58SC10 - Resolution -1R-N (P)-5, 24** **(shaft clamping) 2R** **EP58SS6 3R** **(shaft synchro) 1F** **2F** **3F**	45, 64, 90, 128, 180, 256, 360, 512, 720, 1024				**F-62 to 65**
Ø58mm Blind hollow shaft type CE 	**EP58HB8 - Resolution -1R-N (P)-5, 24** **2R** **3R** **1F** **2F** **3F**					

※1: **R**-CCW as from the shaft, **F**-CW as from the shaft.

ENP | — | 1 | 1 | 1 | R | — | Resolution | — | P

1: Output※1
R: Revolution direction※2

Appearance	Model	Output code	Power supply	Resolution (-division)	Control output※3	Reference
Ø60mm Shaft type 	**ENP-111R- Resolution -P** **111F**	**1: BCD code**	**1:** 12-24VDC ±5%	6 8 12 16 24	**P (1): PNP open collector output**	**F-66 to 69**
	ENP-101R- Resolution -N **101F**				**N (2): NPN open collector output**	
	ENP-110R-360-P **110F**		**0:** 5VDC ±5% ※only for 360-division of resolution. **1:** 12-24VDC ±5%	360	**P (1): PNP open collector output**	
	ENP-111R-360-P **111F**					
	ENP-100R-360-N **100F**				**N (2): NPN open collector output**	
	ENP-101R-360-N **101F**					

※1: **0**-Negative logic, **1**-Positive logic
※2: **R**-CCW as from the shaft, **F**-CW as from the shaft.
※3: The number of ( ) is former name.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Product Overview

■ Absolute Type (Multi-turn)

EPM50S 8 — 10 13 — B — PN — 24 — □

External diameter of shaft

Cable
No-mark: Axial cable type
C : Radial cable type

Appearance	Single-turn	Multi-turn	Output code	Control output	Power supply	Reference
Ø50mm Shaft type CE 	10bit (1024-division)	13bit (8192-revolution)	**Binary code**	**PN: Parallel NPN open collector output** **S: SSI**	12-24VDC ±5%	**F-70 to 74**

■ Absolute Type (Magnetic, Single-turn)

MGA50S 8 — 1024 — 1 R — N — 5

External diameter of shaft

Appearance	Resolution (-division)	Output code	Revolution direction	Control output	Power supply	Reference
Ø50mm Shaft type NEW 	32 128 40 180 45 256 48 360 64 512 90 720 1024	**1: BCD code** **2: Binary code** **3: Gray code**	**F: Output value increases at CW direciton** **R: Output value increases at CCW direction**	**N: NPN open collector output**	**5:** 5VDC ±5% **24:** 12-24VDC ±5%	**F-56 to 61**

■ Absolute Type (Magnetic, Multi-turn)

MGAM50S 8 — 10 10 — B F — PN — 24

External diameter of shaft

Appearance	Single-turn	Multi-turn	Output code	Revolution direction	Control output	Power supply	Reference
Ø50mm Shaft type NEW 	10bit (1024-division)	13bit (8192-revolution)	**Binary code**	**F: Output value increases at CW direciton** **R: Output value increases at CCW direction**	**PN: Parallel NPN open collector output** **S: SSI Line driver output**	12-24VDC ±5%	**F-75 to 79**

■ Flexible Coupling

Model		ERB-F-19C-□	ERB-F-19S-□	ERB-F-26C-□	ERB-F-26S-□
Appearance					
Connection type		Clamp	Set screw	Clamp	Set screw
Max. revolutions		8000rpm	20000rpm	6000rpm	15000rpm
Max. torque		1.2 N·m (12.17kgf·cm)		3.0 N·m (30.42 kgf·cm)	
Rated torque		0.6 N·m (6.08kgf·cm)		1.5 N·m (15.21 kgf·cm)	
Max. allowable misalignment	Angular misalignment	2.5°			
	Parallel misalignment	0.15mm		0.2mm	
	End-play	±0.3mm		±0.4mm	
Standard bore diameter (tolerance h7)		Ø4, Ø5, Ø6mm		Ø6, Ø8mm	
Material		Aluminum (AL 7075-T6), Alumite surface			
Reference		**F-80 to 81**			

E15S2-36-2-N-5-R

Shaft Type Ø15mm Incremental Rotary Encoder

Ultra Lightweight

Ultra Compact

▣ Features

● Ultra-Compact (Ø15mm) and Ultra-Lightweight (14g)

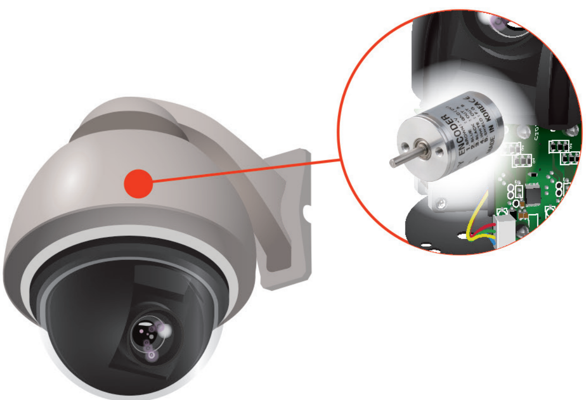
The ultra-compact (Ø15mm), ultra-lightweight (14g) encoders are ideal for installation in small machinery and compact applications.

15 mm Diameter

Weights Only 14 g

▣ Application

Application PTZ cameras requiring precise directional and zoom movement



Shaft Type Ø15mm Incremental Rotary Encoder

■ Features

- **Ultra-compact (Ø15mm) and ultra-lightweight (14g)**
- Easy installation in tight or limited spaces
- Low moment of inertia
- Power supply: 5VDC ±5%

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

Item		Shaft Type Ø15mm Incremental Rotary Encoder
Model		E15S2-36-2-N-5-R
Resolution (PPR)※1		36
Electrical specification	Output phase	A, B phase
	Phase difference of output	Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	NPN open collector output - Load current: Max. 30mA, Residual voltage: Max. 0.4VDC
	Response time (rise/fall)	Max. 1μs (cable length: 1m, I sink=20mA)
	Max. response frequency	10kHz
	Power supply	5VDC ±5% (ripple P-P: Max. 5%)
	Current consumption	Max. 50mA (disconnection of the load)
	Insulation resistance	Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength	500VAC 50/60Hz for 1 min (between all terminals and case)
	Connection	Axial cable type
Mechanical specification	Starting torque	Max. 10gf·cm (9.8×10^{-4}N·m)
	Moment of inertia	Max. 0.5g·cm² (5×10^{-8}kg·m^2)
	Shaft loading	Radial: 200gf, Thrust: 200gf
	Max. allowable revolution※2	3,000rpm
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock		Approx. max. 50G
Environment	Ambient temperature	-10 to 70℃, storage: -20 to 80℃
	Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure		IP50 (IEC standard)
Cable		Ø3mm, 4-wire, 500mm, Flexible PVC insulation shielded cable (AWG30, core diameter: 0.102mm, number of cores: 7, insulator diameter: Ø0.71mm)
Accessory		Ø2mm coupling
Weight※3		Approx. 37g (approx. 14g)

※1: Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

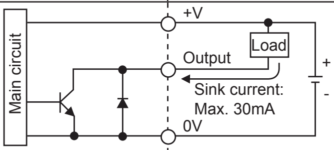
※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

E15S2-36-2-N-5-R

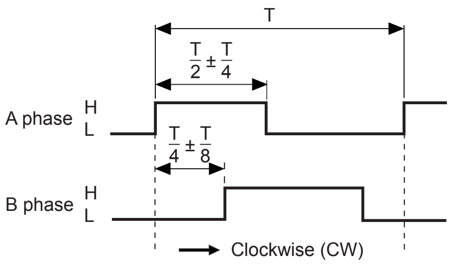
■ Control Output Diagram

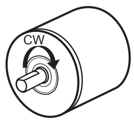
NPN open collector output

Rotary encoder circuit	Load connection

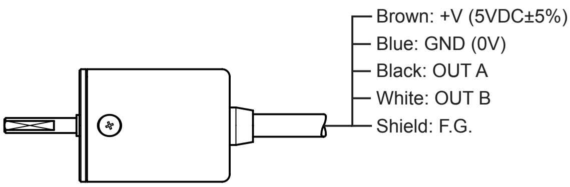


■ Output Waveform





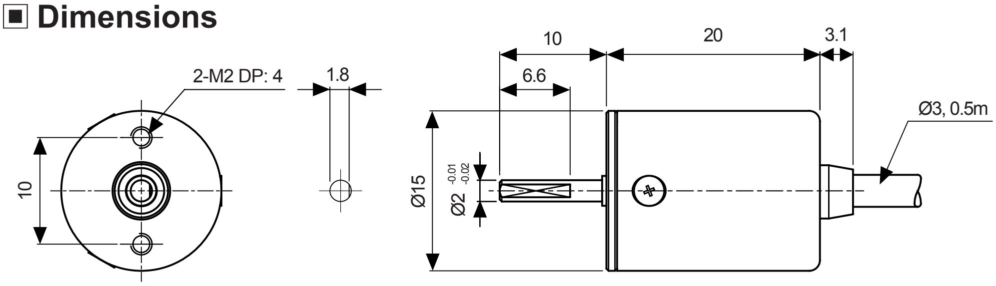
■ Connections



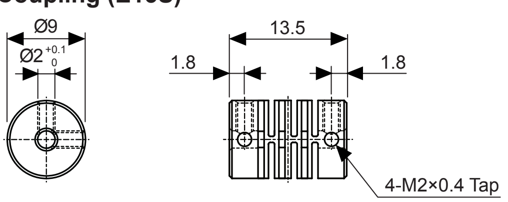
※Unused wires must be insulated.
※The metal case and shield cable should be grounded (F.G.).

■ Dimensions

(unit: mm)



● Coupling (E15S)



- Parallel misalignment: Max. 0.15mm
- Angular misalignment: Max. 2°
- End-play: Max. 0.5mm

※When mounting the coupling to the encoder shaft, if there is combined misalignment (parallel, angular misalignment) between rotating encoder shaft and mate shaft, it may cause encoder and coupling's life cycle to shorten.
※Do not load overweight on the shaft.
※For parallel misalignment, angular misalignment, end-play terms, refer to page F-87.
※For flexible coupling (ERB series) information, refer to page F-80.

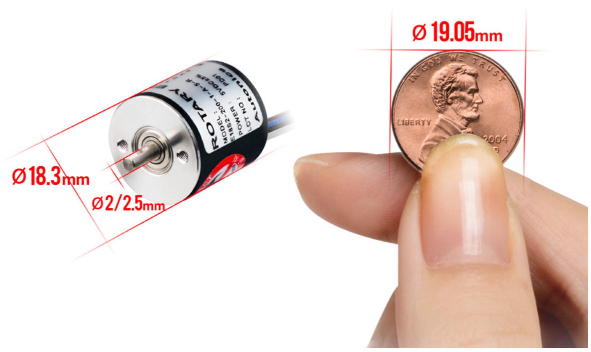
Shaft Type Ø18mm Incremental Rotary Encoder

Ultra Lightweight Ultra Compact

■ Features

● **Ultra-Compact (Ø18mm) and Ultra-Lightweight (12g)**

The ultra-compact (Ø18mm), ultra-lightweight (12g) encoders are ideal for installation in small machinery and compact applications.

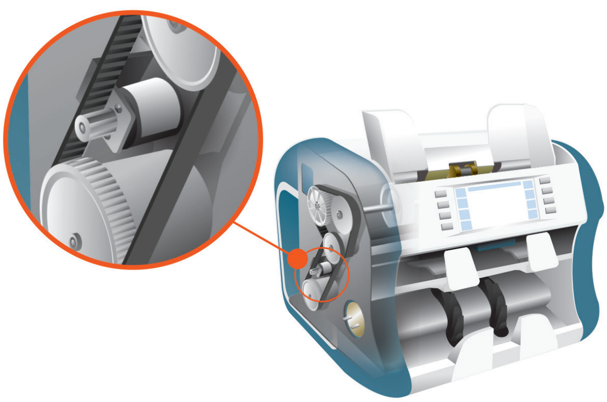


18 mm Diameter

Weights Only 12 g

■ Application

Application in automatic bill counting machines.



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Shaft Type Ø18mm Incremental Rotary Encoder

■ Features

- **Ultra-compact (Ø18mm) and ultra-lightweight (12g)**
- Easy installation in tight or limited spaces
- Low moment of inertia
- Power supply: 5VDC ±5%

[Axial cable type]

[Radial cable type]

■ Applications

- Suitable for office machine such as ATMs, bill counting machines, copy machines

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

E18S	2.5	200	1	N	5	R
Series	Shaft diameter	Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø18mm, shaft type	2: Ø2mm 2.5: Ø2.5mm	100, 200, 300, 400	1: A	N: NPN open collector output V: Voltage output	5: 5VDC ±5%	R: Axial cable type S: Radial cable type

■ Specifications

Item			Shaft Type Ø18mm Incremental Rotary Encoder
Resolution (PPR)※1			100, 200, 300, 400
Electrical specification	Output phase		A phase
	Control output	NPN open collector output	Load current: Max. 30mA, Residual voltage: Max. 0.4VDC
		Voltage output	Load current: Max. 10mA, Residual voltage: Max. 0.4VDC
	Response time (rise/fall)	NPN open collector output	Max. 1μs (cable length: 1m, I sink=20mA)
		Voltage output	
	Max. response frequency		25kHz
	Power supply		5VDC ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		500VAC 50/60Hz for 1 min (between all terminals and case)
	Connection		Axial/Radial cable type
Mechanical specification	Starting torque		Max. 10gf·cm (9.8×10^{-4} N·m)
	Moment of inertia		Max. 0.5g·cm^2 (5×10^{-8} kg·m^2)
	Shaft loading		Radial: 200gf, Thrust: 200gf
	Max. allowable revolution※2		6,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment	Ambient temperature		-10 to 70℃, storage: -20 to 80℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø0.98mm, 4-wire, 150mm, Flat ribbon cable (AWG26, core diameter: 0.16mm, number of cores: 7, insulator out diameter: Ø0.98mm)
Accessory			Ø2mm coupling (supplied only for Ø2mm shaft diameter model)
Approval			CE, cULus
Weight※3			Ø2mm Shaft diameter model: Approx. 35.4g (approx. 12g) Ø2.5mm Shaft diameter model: Approx. 34.2g (approx. 12g)

※1: Not indicated resolutions are customizable.

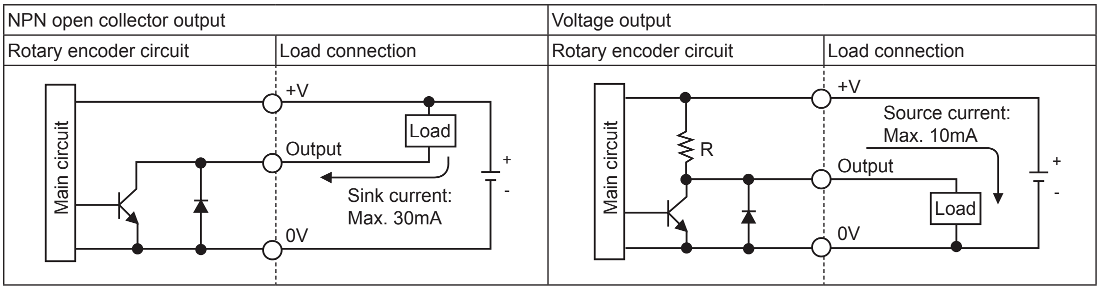
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60\text{ sec}]$$

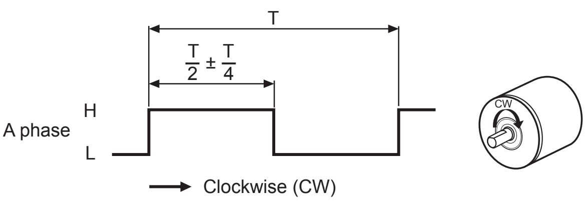
※3: The weight includes packaging. The weight in parenthesis is for unit only.

※Environment resistance is rated at no freezing or condensation.

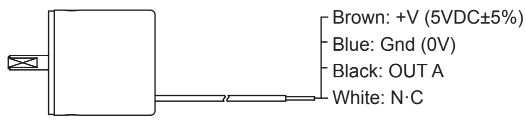
■ Control Output Diagram



■ Output Waveform



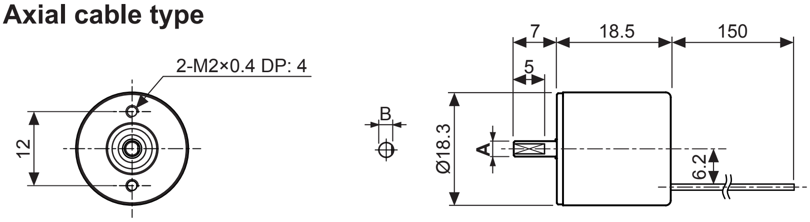
■ Connections



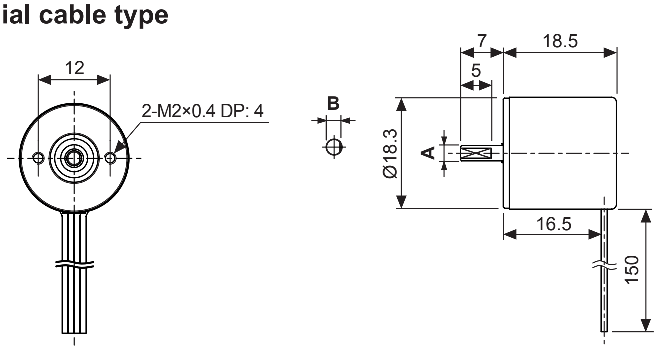
■ Dimensions

◎ Axial cable type

(unit: mm)

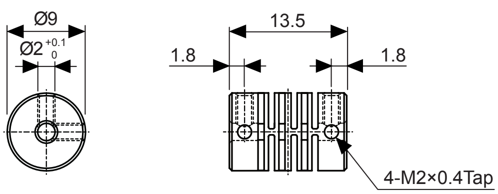


◎ Radial cable type



Model	A	B
E18S2	Ø2.0 $^{-0.004}_{-0.02}$	1.7 $^{0}_{-0.1}$
E18S2.5	Ø2.5 $^{-0.004}_{-0.02}$	2.2 $^{0}_{-0.1}$

● Coupling (E18S)



- Parallel misalignment: Max. 0.15mm
- Angular misalignment: Max. 2°
- End-play: Max. 0.5mm

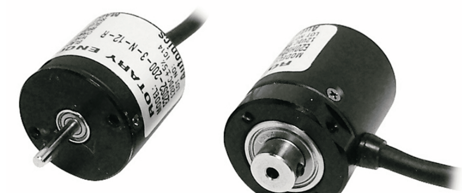
※When mounting the coupling to the encoder shaft, if there is combined misalignment (parallel, angular misalignment) between rotating encoder shaft and mate shaft, it may cause encoder and coupling's life cycle to shorten.
※Do not load overweight on the shaft.
※For parallel misalignment, angular misalignment, end-play terms, refer to page F-87.
※For flexible coupling (ERB series) information, refer to page F-80.

Shaft Type/Blind Hollow Shaft Type Ø20mm Incremental Rotary Encoder

■ Features

- **Ø20mm of miniature rotary encoder**
- Easy installation at narrow space
- Low moment of inertia
- Power supply: 5VDC, 12VDC ±5%
- Various output types

⚠ Please read "Caution for your safety" in operation manual before using.



E20S Series

E20HB Series

■ Ordering Information

E20S — 2 — 360 — 3 — N — 12 — R

Series	Shaft type	Hollow type	Pulses/revolution	Output phase	Control output	Power supply	Cable
	External	Inner					
Ø20mm, S: Shaft type HB: Blind hollow shaft type	2: Ø2mm	2: Ø2mm 2.5: Ø2.5mm 3: Ø3mm	100, 200, 320, 360	3: A, B, Z 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	N: NPN open collector output V: Voltage output L: Line driver output (※)	5: 5VDC ±5% 12: 12VDC ±5%	R: Axial cable type S: Radial cable type

※The power of Line driver is only for 5VDC.

■ Specifications

Item			Shaft Type/Blind Hollow Shaft Type Ø20mm Incremental Rotary Encoder
Resolution (PPR)※1			100, 200, 320, 360
Electrical specification	Output phase		A, B, Z phase (line driver output A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	NPN open collector output	Load current: Max. 30mA, Residual voltage: Max. 0.4VDC
		Voltage output	Load current: Max. 10mA, Residual voltage: Max. 0.4VDC
		Line driver output	• [Low] - Load current: Max. 20mA, Residual voltage: Max. 0.5VDC • [High] - Load current: Max. -20mA, Output voltage: Min. 2.5VDC
	Response time (rise/fall)	NPN open collector output	Max. 1µs (cable length: 1m, I sink = 20mA)
		Voltage output	
		Line driver output	Max. 0.5µs (cable length: 1m, I sink = 20mA)
	Max. response frequency		100kHz
	Power supply		• 5VDC ±5% (ripple P-P: Max. 5%) • 12VDC ±5% (ripple P-P: Max. 5%)
	Current consumption		Max. 60mA (disconnection of the load), Line driver output: Max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		500VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Axial/Radial cable type
Mechanical specification	Starting torque		Max. 5gf·cm ($5\times9.8\times10^{-4}$ N·m)
	Moment of inertia		Max. 0.5g·cm² (5×10^{-8} kg·m²)
	Shaft loading		Radial: 200gf, Thrust: 200gf
	Max. allowable revolution ※2		6,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment	Ambient temperature		-10 to 70℃, storage: -20 to 80℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø3mm, 5-wire (line driver output: 8-wire), 1m, Shield cable
Accessory			Ø2mm Coupling (shaft type), Bracket (blind hollow shaft type)
Approval			CE (except line driver output)
Unit weight			Approx. 35g

※1: Not indicated resolutions are customizable. ※Environment resistance is rated at no freezing or condensation.

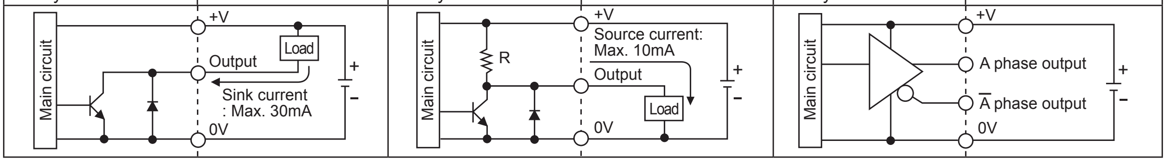
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60\ \text{sec}]$$

Incremental Ø20mm Shaft/Blind Hollow Shaft type

■ Control Output Diagram

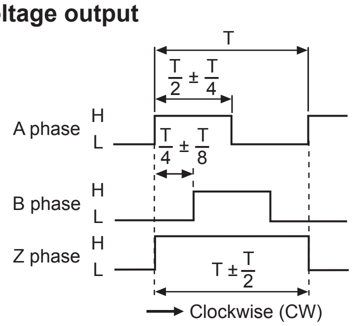
NPN open collector output		Voltage output		Line driver output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection



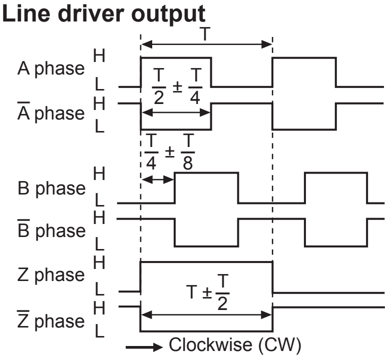
● The output circuit of A, B, Z phase are same. (line driver output is A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$)

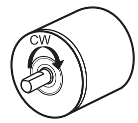
■ Output Waveform

● NPN open collector output / Voltage output



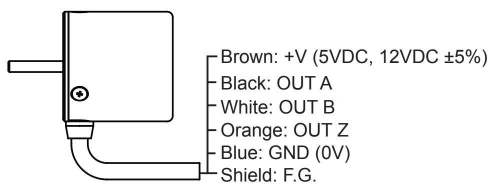
● Line driver output



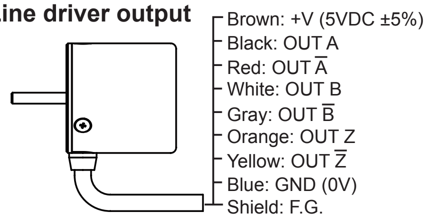


■ Connections

● NPN open collector output / Voltage output



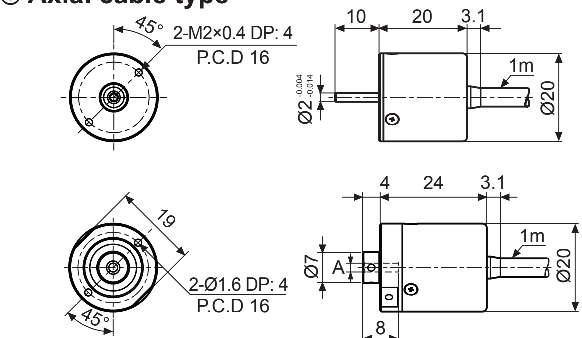
● Line driver output



■ Dimensions

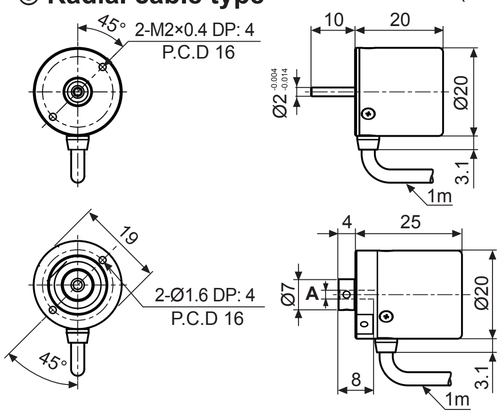
(unit: mm)

◎ Axial cable type

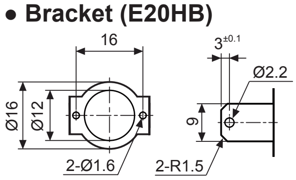


A	Ø2	Ø2.5	Ø3
Tolerance	+0.014 +0.004		

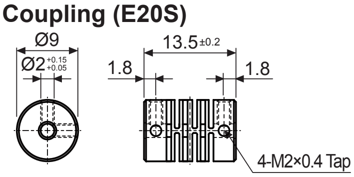
◎ Radial cable type



● Bracket (E20HB)



● Coupling (E20S)



- Parallel misalignment: Max. 0.15mm
- Angular misalignment: Max. 2°
- End-play: Max. 0.5mm

※Do not load overweight on the shaft.
※For parallel misalignment, angular misalignment, end-play terms, refer to page F-87.
※For flexible coupling (ERB series) information, refer to page F-80.

※When mounting the coupling to the encoder shaft, if there is combined misalignment (parallel, angular misalignment) between rotating encoder shaft and mate shaft, it may cause encoder and coupling's life cycle to shorten.

Shaft Type Ø30mm Incremental Rotary Encoder

■ Features

- Ø30mm of miniature shaft type rotary encoder
- Easy installation at narrow space
- Low moment of inertia
- Power supply: 5VDC, 12-24VDC ±5%
- Various output types

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ Ordering Information

E30S — 4 — 3000 — 3 — N — 24 — [ ]

Series	Shaft diameter	Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø30mm, shaft type	Ø4mm	Refer to resolution	3: A, B, Z 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output (※)	5 : 5VDC ±5% 24: 12-24VDC ±5%	No mark: Axial cable type C: Axial cable connector type

※The power of Line driver is only for 5VDC.

■ Specifications

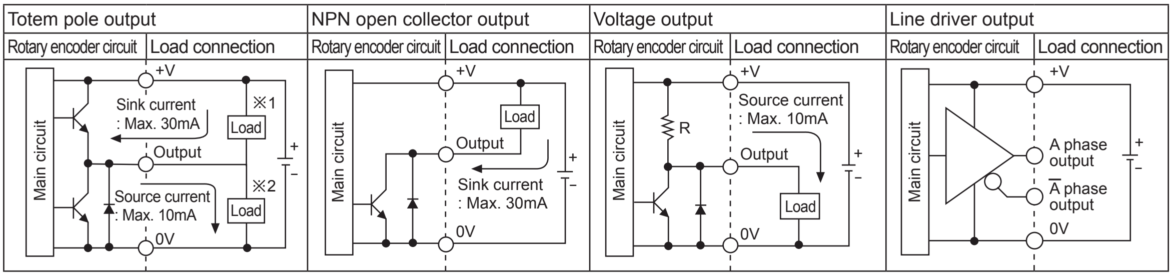
Item			Shaft type Ø30mm Incremental Rotary Encoder
Resolution (PPR)※1			100, 200, 360, 500, 1000, 1024, 3000
Electrical specification	Output phase		A, B, Z phase (line driver: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: Max. 30mA, Residual voltage: Max. 0.4VDC • [High] - Load current: Max. 10mA, Output voltage (power voltage 5VDC): Min. (power voltage-2.0)VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
		NPN open collector output	Load current: Max. 30mA, Residual voltage: Max. 0.4VDC
		Voltage output	Load current: Max. 10mA, Residual voltage: Max. 0.4VDC
		Line driver output	• [Low] - Load current: Max. 20mA, Residual voltage: Max. 0.5VDC • [High] - Load current: Max. -20mA, Output voltage: Min. 2.5VDC
	Response time (rise/fall)	Totem pole output	Max. 1µs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	Max. 1µs (5VDC: output resistance 820Ω), Max. 2µs (12-24VDC: output resistance 4.7kΩ) (cable length: 2m, I sink = 20mA)
		Line driver output	Max. 0.5µs (cable length: 2m, I sink = 20mA)
	Max. Response frequency		300kHz
	Power supply		• 5VDC ±5% (ripple P-P: Max. 5%) • 12-24VDC ±5% (ripple P-P: Max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: Max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Axial cable type, Axial cable connector type
Mechanical specification	Starting torque		Max. 20gf·cm (0.002N·m)
	Moment of inertia		Max. 20g·cm^2 (2×10^{-6} kg·m^2)
	Shaft loading		Radial: Max. 2kgf, Thrust: Max. 1kgf
	Max. allowable revolution※2		5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. Max. 50G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver: Ø5mm, 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Ø4mm coupling
Approval			CE (except line driver output)
Unit weight			Approx. 80g

※1: Not indicated resolutions are customizable. ※Environment resistance is rated at no freezing or condensation.

※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

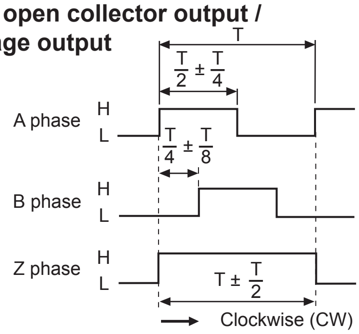
■ Control Output Diagram



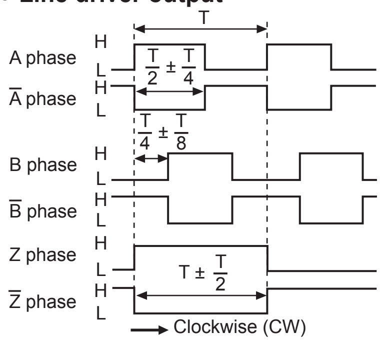
- Totem pole output type can be used for NPN open collector output type (※1) or Voltage output type (※2).
- All output circuits of A, B, Z phase are same. (line driver output is for A, Ā, B, B̄, Z, Z̄)

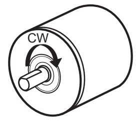
■ Output Waveform

- **Totem pole output / NPN open collector output / Voltage output**



- **Line driver output**

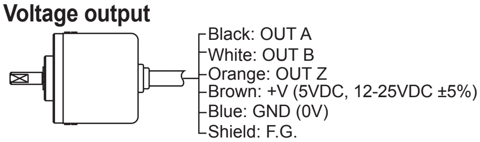




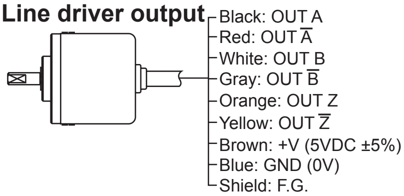
■ Connections

◎ Cable type

- **Totem pole output / NPN open collector output / Voltage output**



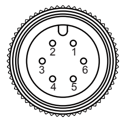
- **Line driver output**



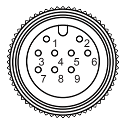
※Unused wires must be insulated.
※The metal case and shield wire of encoder should be grounded (F.G.).

◎ Connector cable type

- **Totem pole output / NPN open collector output / Voltage output**



- **Line driver output**



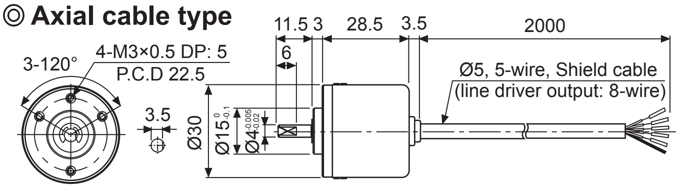
Totem pole output NPN open collector output Voltage output			Line driver output		
Pin No	Function	Cable color	Pin No	Function	Cable color
①	OUT A	Black	①	OUT A	Black
②	OUT B	White	②	OUT Ā	Red
③	OUT Z	Orange	③	+V	Brown
④	+V	Brown	④	GND	Blue
⑤	GND	Blue	⑤	OUT B	White
⑥	F.G.	Shield	⑥	OUT B̄	Gray
—			⑦	OUT Z	Orange
			⑧	OUT Z̄	Yellow
			⑨	F.G.	Shield

※F.G. (field ground): It should be grounded separately.

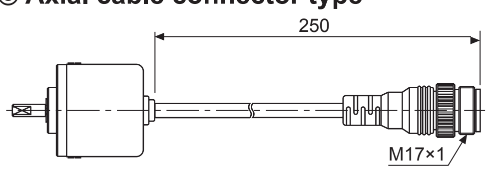
■ Dimensions

(unit: mm)

◎ Axial cable type

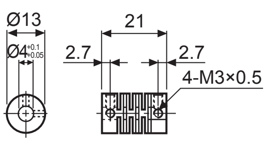


◎ Axial cable connector type



※Connector cable is sold separately and refer to page G-10 for specifications.

- **Coupling (E30S)**



- Parallel misalignment: Max. 0.25mm
- Angular misalignment: Max. 5°
- End-play: Max. 0.5mm

※Do not load overweight on the shaft.
※For parallel misalignment, angular misalignment, end-play terms, refer to page F-87.
※For flexible coupling (ERB series) information, refer to page F-80.
※When mounting the coupling to the encoder shaft, if there is combined misalignment (parallel, angular misalignment) between rotating encoder shaft and mate shaft, it may cause encoder and coupling's life cycle to shorten.

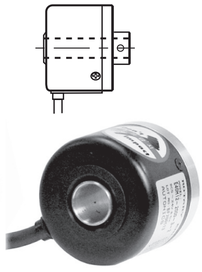
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

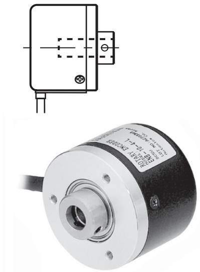
Shaft Type/Hollow Shaft Type/Blind Hollow Shaft Type Ø40mm Incremental Rotary Encoder

■ Features

- Easy installation at narrow space
- Low moment of inertia
- Power supply: 5VDC, 12-24VDC ±5%
- Various output types


E40S Series


E40H Series


E40HB Series

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

E40H — 8 — 5000 — 3 — N — 24 — [ ]

Series	Shaft type	Hollow type	Pulses/revolution	Output phase	Control output	Power supply	Cable
	External	Inner					
Ø40mm S: Shaft type H: Hollow shaft type HB: Blind hollow shaft type	6: Ø6mm 8: Ø8mm	6: Ø6mm 8: Ø8mm 10: Ø10mm 12: Ø12mm	Refer to resolution	2: A, B 3: A, B, Z 4: A, $\overline{A}$, B, $\overline{B}$ 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5 : 5VDC ±5% 24: 12-24VDC ±5%	No mark: Radial cable type C: Radial cable connector type

■ Specifications

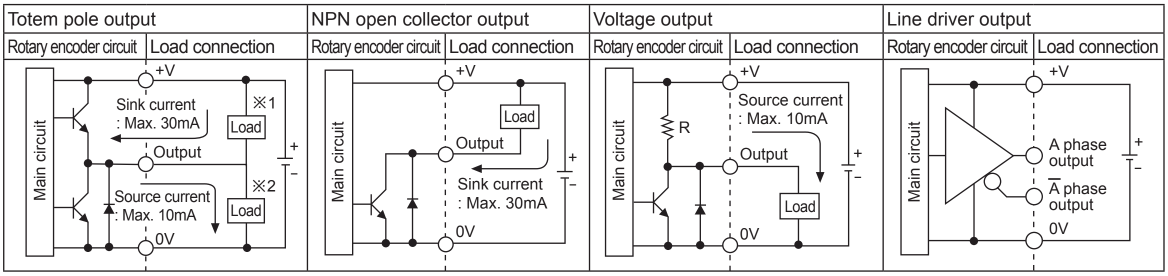
Item			Shaft Type/Hollow Shaft Type/Blind Hollow Shaft Type Ø40mm Incremental Rotary Encoder
Resolution (PPR)※1			*1, *2 ,*5, 10, *12, 15, 20, 23, 25, 30, 35, 40, 45, 50, 60, 75, 100, 120, 150, 192, 200, 240, 250, 256, 300, 360, 400, 500, 512, 600, 800, 1000, 1024, 1200, 1500, 1800, 2000, 2048, 2500, 3000, 3600, 5000
Electrical specification	Output phase		A, B, Z phase (line driver A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: Max. 30mA, Residual voltage: Max. 0.4VDC • [High] - Load current: Max. 10mA, Output voltage (power voltage 5VDC): Min. (power voltage-2.0)VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
		NPN open collector output	Load current: Max. 30mA, Residual voltage: Max. 0.4VDC
		Voltage output	Load current: Max. 10mA, Residual voltage: Max. 0.4VDC
		Line driver output	• [Low] - Load current: Max. 20mA, Residual voltage: Max. 0.5VDC • [High] - Load current: Max. -20mA, Output voltage (power voltage 5VDC): Min. 2.5VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency		300kHz
	Power supply		• 5VDC ±5% (ripple P-P: Max. 5%) • 12-24VDC ±5% (ripple P-P: Max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: Max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Radial cable type, Radial cable connector type
Mechanical specification	Starting torque		S type: max. 40gf·cm (0.004N·m), H/HB type: max. 50gf·cm (0.005N·m)
	Moment of inertia		Max. 40g·cm² (4×10^{-6} kg·m²)
	Shaft loading		Radial: max. 2kgf, Thrust: max. 1kgf
	Max. allowable revolution ※2		5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			• S: Ø6mm coupling standard, Ø8mm coupling (sold separately) • H/HB type: Bracket
Approval			CE (except line driver output)
Unit weight			Approx. 120g

※1: '*' pulse is only for A, B phase (line driver output is for A, $\overline{A}$, B, $\overline{B}$ phase). Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60\ \text{sec}]$$

※Environment resistance is rated at no freezing or condensation.

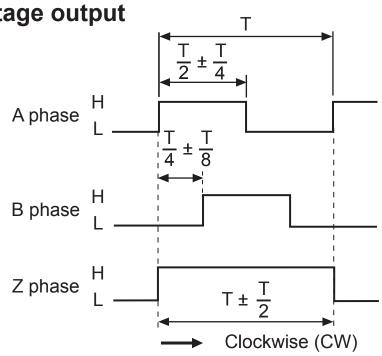
■ Control Output Diagram



- Totem pole output type can be used for NPN open collector output type (※1) or Voltage output type (※2).
- All output circuits of A, B, Z phase are same. (line driver output is A, Ā, B, B̄, Z, Z̄)

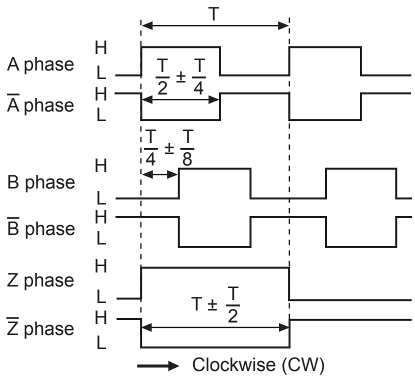
■ Output Waveform

- **Totem pole output / NPN open collector output / Voltage output**



※Z reverse phase output is optional.

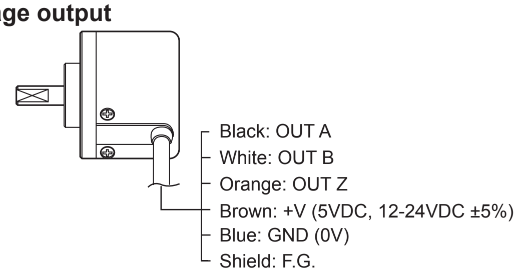
- **Line driver output**



■ Connections

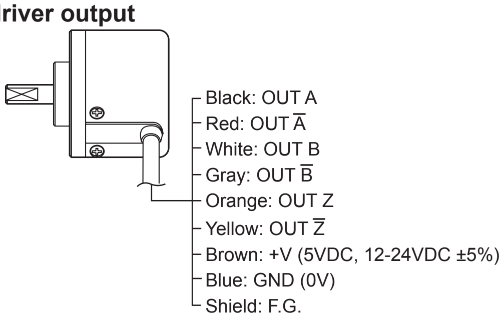
◎ Radial cable type

- **Totem pole output / NPN open collector output / Voltage output**



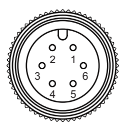
※Unused wires must be insulated.
※The metal case and shield wire of encoder should be grounded (F.G.).

- **Line driver output**

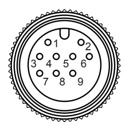


◎ Radial cable connector type

- **Totem pole output / NPN open collector output / Voltage output**



- **Line driver output**



Totem pole output/ NPN open collector output/ Voltage output			Line driver output		
Pin No	Function	Cable color	Pin No	Function	Cable color
①	OUT A	Black	①	OUT A	Black
②	OUT B	White	②	OUT Ā	Red
③	OUT Z	Orange	③	+V	Brown
④	+V	Brown	④	GND	Blue
⑤	GND	Blue	⑤	OUT B	White
⑥	F.G.	Shield	⑥	OUT B̄	Gray
—			⑦	OUT Z	Orange
			⑧	OUT Z̄	Yellow
			⑨	F.G.	Shield

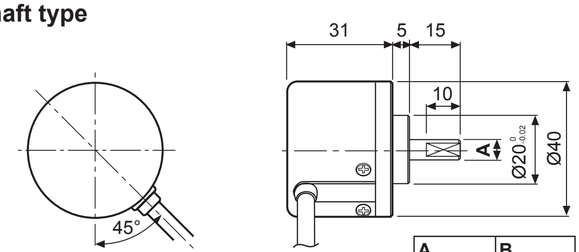
※F.G. (field ground): It should be grounded separately.

▣ Dimensions

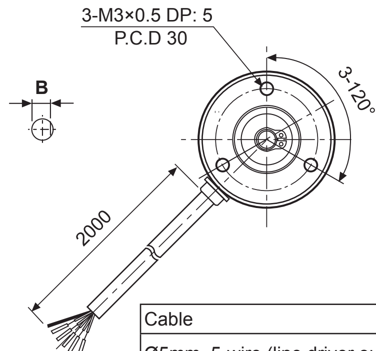
(unit: mm)

◎ Radial cable type

● Shaft type

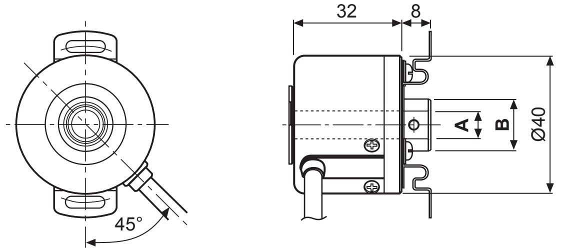


A	B
$Ø6^{-0.01}_{-0.015}$	5
$Ø8^{-0.01}_{-0.02}$	7

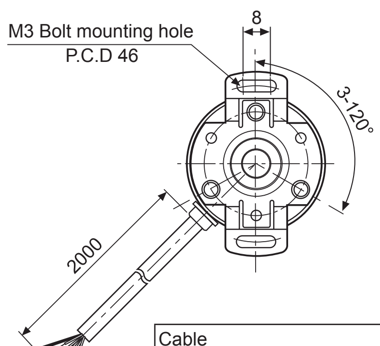


Cable
Ø5mm, 5-wire (line driver output: 8-wire), 2000mm, Shield cable

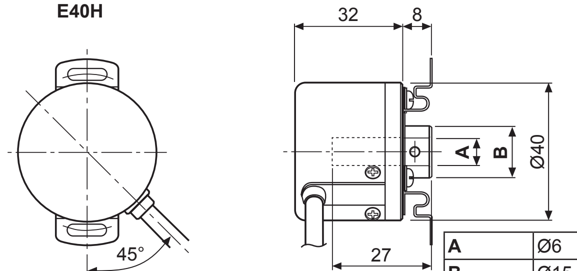
● Hollow shaft / Blind hollow shaft type



E40H



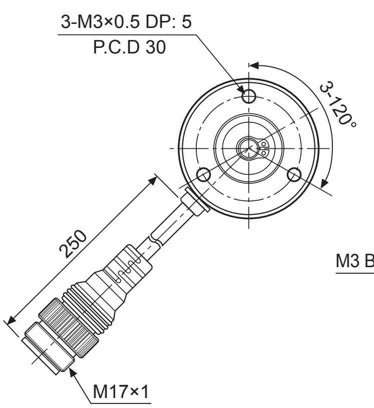
Cable
Ø5mm, 5-wire (line driver output: 8-wire), 2000mm, Shield cable



E40HB

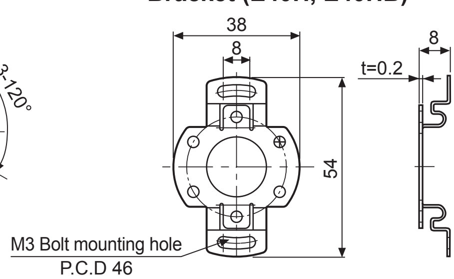
A	Ø6	Ø8	Ø10	Ø12
B	Ø15		Ø17	
Tolerance	$^{+0.015}_{0}$			

◎ Radial cable connector type



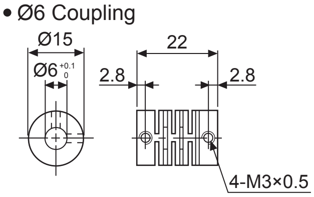
※Connector cable is sold separately and refer to page G-10 for specifications.

● Bracket (E40H, E40HB)

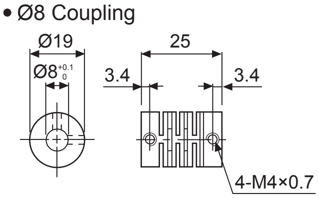


● Coupling (E40S)

• Ø6 Coupling



• Ø8 Coupling



- Parallel misalignment: Max. 0.25mm
- Angular misalignment: Max. 5°
- End-play: Max. 0.5mm

※Do not load overweight on the shaft.
※When mounting the coupling to the encoder shaft, if there is combined misalignment (parallel, angular misalignment) between rotating encoder shaft and mate shaft, it may cause encoder and coupling's life cycle to shorten.
※For parallel misalignment, angular misalignment, end-play terms, refer to page F-87.
※For flexible coupling (ERB Series) information, refer to page F-80.

Shaft Type Ø50mm Incremental Rotary Encoder

■ Features

- **12-24VDC power supply of line driver output (line-up)**
- Suitable for measuring angle, position, revolution, speed, acceleration and distance
- Power supply: 5VDC, 12-24VDC ±5%

■ Applications

- Various tooling machinery, packing machine and general industrial machinery, etc.

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information (former name: ENB)

E50S | 8 — 8000 — 3 — N — 24 — [ ]

Series	Shaft diameter	Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø50mm, shaft type	Ø8mm	Refer to resolution	2: A, B 3: A, B, Z 4: A, $\overline{A}$, B, $\overline{B}$ 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%	No mark: Axial cable type C: Axial cable connector type CR: Axial connector type CS: Radial connector type

■ Specifications

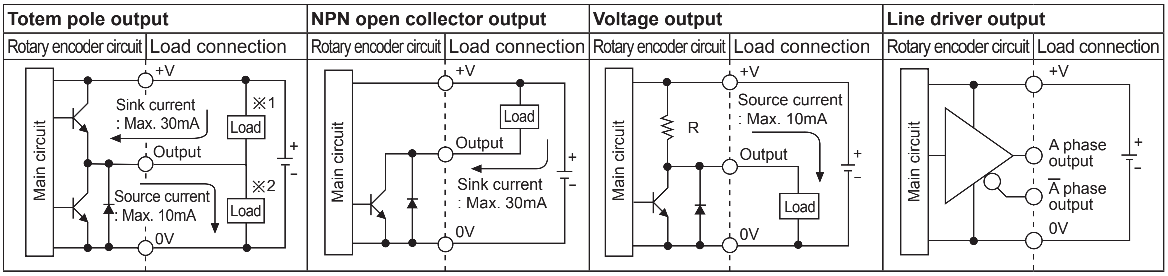
Item			Shaft Type Ø50mm Incremental Rotary Encoder
Resolution (PPR)※1			*1, *2, *5, 10, 12, 15, 20, 23, 25, 30, 35, 40, 45, 50, 60, 75, 100, 120, 125, 150, 192, 200, 240, 250, 256, 300, 360, 400, 500, 512, 600, 800, 1000, 1024, 1200, 1500, 1800, 2000, 2048, 2500, 3000, 3600, 4000, 5000, 6000, 8000
Electrical specification	Output phase		A, B, Z phase (line driver: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Output between A and B phase: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: Max. 30mA, Residual voltage: Max. 0.4VDC • [High] - Load current: Max. 10mA, Output voltage (power voltage 5VDC): Min. (power voltage-2.0)VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
		NPN open collector output	Load current: Max. 30mA, Residual voltage: Max. 0.4VDC
		Voltage output	Load current: Max. 10mA, Residual voltage: Max. 0.4VDC
		Line driver output	• [Low] - Load current: Max. 20mA, Residual: Max. 0.5VDC • [High] - Load current: Max. -20mA, Output voltage (power voltage 5VDC): Min.2.5VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency		300kHz
	Power supply		• 5VDC ±5% (ripple P-P: Max. 5%) • 12-24VDC ±5% (ripple P-P: Max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: Max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Axial cable type, Axial cable connector type, Axial/Radial connector type
Mechanical specification	Starting torque		Max. 70gf·cm (0.007N·m)※2, Max. 800gf·cm (0.078N·m)※3
	Moment of inertia		Max. 80g·cm^2 (8×10^{-6} kg·m^2)※2, Max. 400g·cm^2 (4×10^{-5} kg·m^2)※3
	Shaft loading		Radial: Max. 10kgf, Thrust: Max. 2.5kgf
	Max. allowable revolution※4		5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment	Ambient temperature		-10 to 70℃, Storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, Storage: 35 to 90%RH
Protection structure			Axial cable type, Axial cable connector type: IP50 (IEC standard)※5, Axial/Radial connector type: IP65 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG 24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Ø8mm coupling, Bracket
Approval			CE (except for line driver output)
Weight※6			Approx. 363g (approx. 275g), Axial/Radial connector type: Approx. 268g (approx. 180g)

※1: '*' pulse is only for A, B phase (line driver output is for A, $\overline{A}$, B, $\overline{B}$ phase). Not indicated resolutions are customizable.
※2: This value is for Axial cable type, Axial cable connector type (protection structure: IP50).
※3: This value is for Axial cable type, Axial cable connector type (protection structure: IP64), Axial/Radial connector type (protection structure: IP65).
※4: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

【Max. response resolution (rpm) = $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec】

※5: In case of axial cable type, axial cable connector type, they are available to order the option protection structure IP64.
※6: The weight includes packaging. The weight in parenthesis is for unit only. ※Environment resistance is rated at no freezing or condensation.

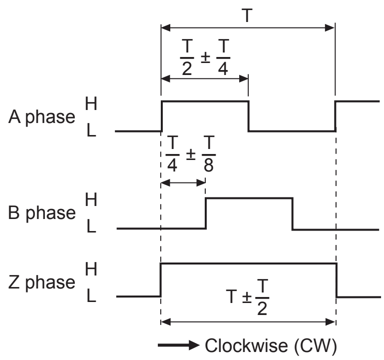
Control Output Diagram



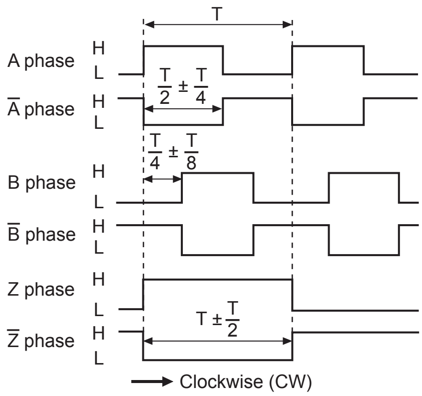
- All output circuits of A, B, Z phase are same. (line driver output is A, Ā, B, B̄, Z, Z̄)
- Totem pole output type can be used for NPN open collector type(※1) or voltage output type(※2).

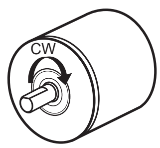
Output Waveforms

- **Totem pole output / NPN open collector output / Voltage output**



- **Line driver output**

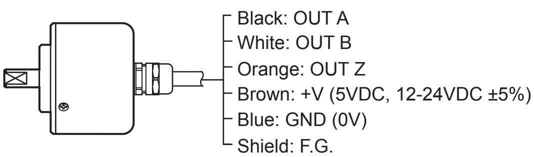




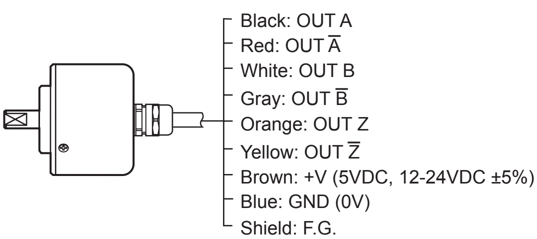
Connections

◎ Axial cable type

- **Totem pole output / NPN open collector output / Voltage output**



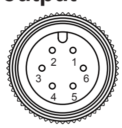
- **Line driver output**



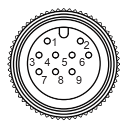
※Unused wires must be insulated.
※The metal case and shield cable of encoder should be grounded (F.G.).

◎ Axial cable connector type / Axial/Radial connector type

- **Totem pole output NPN open collector output Voltage output**



- **Line driver output**



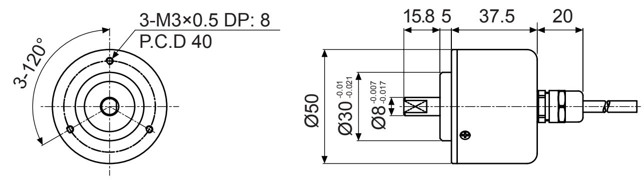
• Totem pole output • NPN open collector output • Voltage output			• Line driver output		
Pin No.	Function	Cable color	Pin No.	Function	Cable color
1	OUT A	Black	1	OUT A	Black
2	OUT B	White	2	OUT Ā	Red
3	OUT Z	Orange	3	+V	Brown
4	+V	Brown	4	GND	Blue
5	GND	Blue	5	OUT B	White
6	F.G.	Shield	6	OUT B̄	Gray
—			7	OUT Z	Orange
			8	OUT Z̄	Yellow
			9	F.G.	Shield

※F.G. (field ground): It should be grounded separately.

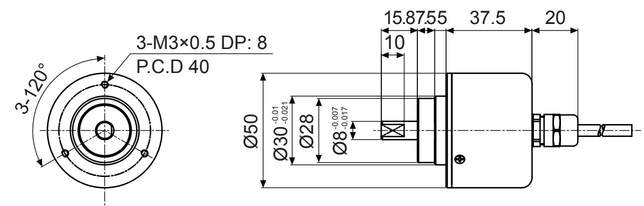
▣ Dimensions

(unit: mm)

◎ Axial cable type, Axial cable connector type (IP50)



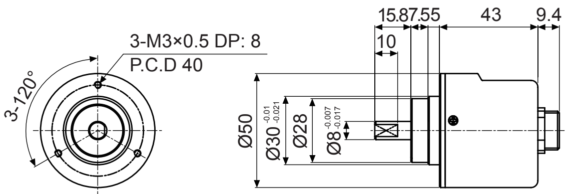
◎ Axial cable type, Axial cable connector type (IP64) (option)



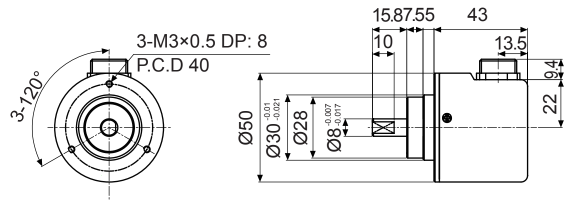
Cable for Axial cable type
Ø5mm, 5-wire (line driver output: 8-wire), 2000mm, Shield cable
Cable for Axial cable connector type
Ø5mm, 5-wire (line driver output: 8-wire), 250mm, Shield cable

※Connector cable is sold separately and refer to page G-10 for specifications.

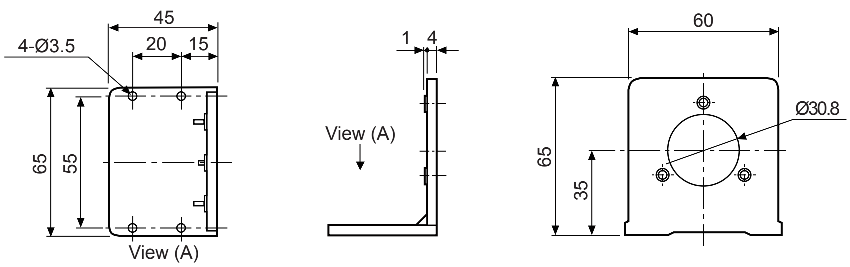
◎ Axial connector type



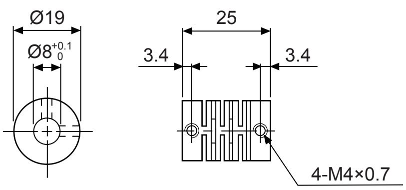
◎ Radial connector type



● **Bracket**



● **Coupling (E50S)**



- Parallel misalignment: Max. 0.25mm
- Angular misalignment: Max. 5°
- End-play: Max. 0.5mm

※When mounting the coupling to the encoder shaft, if there is combined misalignment (parallel, angular misalignment) between rotating encoder shaft and mate shaft, it may cause encoder and coupling's life cycle to shorten.
※Do not load overweight on the shaft.
※For parallel misalignment, angular misalignment, end-play terms, refer to page F-87.
※For flexible coupling (ERB series) information, refer to page F-80.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Shaft Type/Hollow Shaft Type/Blind Hollow Shaft Type Ø58mm Incremental Rotary Encoder

■ Features

- Ø58mm flange type
- Suitable for measuring angle, position, revolution, speed, acceleration and distance
- Power supply: 5VDC, 12-24VDC ±5%

■ Applications

- Various tooling machinery, packing machine and general industrial machinery, etc.

Please read "Caution for your safety" in operation manual before using.

CE

■ Ordering Information

E58SC – 10 – 8000 – 3 – N – 24 –

Series (Ø58mm)	Shaft diameter			Pulses/ revolution	Output phase	Control output	Power supply	Cable
SC: Shaft Clamping	External	10	Ø10mm	Refer to resolution	2: A, B 3: A, B, Z 4: A, $\overline{A}$, B, $\overline{B}$ 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%	No mark※1: Axial cable type C※1: Axial cable connector type CR: Axial connector type CS: Radial connector type
SS: Shaft Synchro		6	Ø6mm					
H: Hollow shaft	Inner	12	Ø12mm					
HB: Blind hollow shaft								

※1: E58H (hollow shaft) has only radial cable type, radial cable connector type.

■ Specifications

Item			Shaft Type/Hollow Shaft Type/Blind Hollow Shaft Type Ø58mm Incremental Rotary Encoder
Resolution (PPR)※1			*1, *2, *5, 10, *12, 15, 20, 23, 25, 30, 35, 40, 45, 50, 60, 75, 100, 120, 125, 150, 192, 200, 240, 250, 256, 300, 360, 400, 500, 512, 600, 800, 1000, 1024, 1200, 1500, 1800, 2000, 2048, 2500, 3000, 3600, 5000, 6000, 8000
Electrical specification	Output phase		A, B, Z phase (line driver output: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Output between A and B phase: $\frac{T}{4} \pm \frac{T}{8}$(T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: Max. 30mA, Residual voltage: Max. 0.4VDC • [High] - Load current: Max. 10mA, Output voltage (power voltage 5VDC): Min. (power voltage-2.0)VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
		NPN open collector output	Load current: Max. 30mA, Residual voltage: Max. 0.4VDC
		Voltage output	Load current: Max. 10mA, Residual voltage: Max. 0.4VDC
		Line driver output	• [Low] - Load current: Max. 20mA, Residual voltage: Max. 0.5VDC • [High] - Load current: Max. -20mA, Output voltage (power voltage 5VDC): Min. 2.5VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
	Response time (rise, fall)	Totem pole output	Max. 1㎲ (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5㎲ (cable length: 2m, I sink = 20mA)
	Max. response frequency		300kHz
	Power supply		• 5VDC ±5% (ripple P-P: Max. 5%) • 12-24VDC ±5% (ripple P-P: Max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: Max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 min (between all terminals and case)
	Connection		Axial cable type, Axial cable connector type, Axial/Radial connector type
Mechanical specification	Starting torque		• SC/SS type: Max. 40gf·cm (0.004N·m) • H/HB type: Max. 90gf·cm (0.009N·m)
	Moment of inertia		• SC/SS type: Max. 15g·cm^2 (1.5×10^{-6} kg·m^2) • H/HB type: Max. 20g·cm^2 (2×10^{-6} kg·m^2)
	Shaft loading		• SC/SS type-Radial: Max. 10kgf, Thrust: Max. 2.5kgf • H/HB type-Radial: Max. 2kgf, Thrust: Max. 1kgf
	Max. allowable revolution※2		5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Coupling (SC type: Ø10mm, SS type: Ø6mm), Bracket
Approval			CE (except for line driver output)
Weight※3	Cable type, Cable connector type		• SC type: Approx. 420g (approx. 310g), SS type: Approx. 395g (approx. 285g), H type: Approx. 380g (approx. 270g), HB type: Approx. 380g (approx. 270)g
	Connector type		• SC type: Approx. 340g (approx. 230g), SS type: Approx. 315g (approx. 205g), HB type: Approx. 310g (approx. 200g)

※1: '*' pulse is only for A, B phase. (line driver output is for A, $\overline{A}$, B, $\overline{B}$ phase) [In case of hollow shaft type, 6000, 8000 PPR excluded] Not indicated resolutions are customizable.

※3: The weight includes packaging. The weight in parenthesis is for unit only.

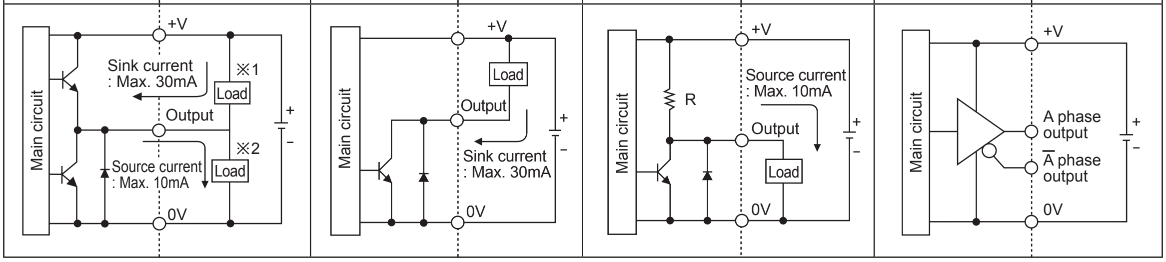
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※Environment resistance is rated at no freezing or condensation.

▣ Control Output Diagram

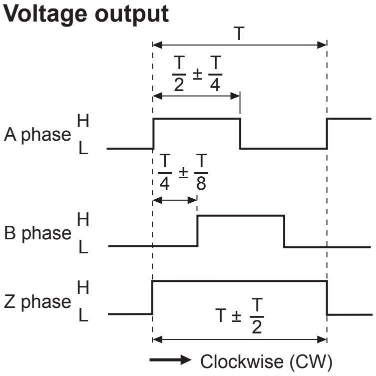
Totem pole output		NPN open collector output		Voltage output		Line driver output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection



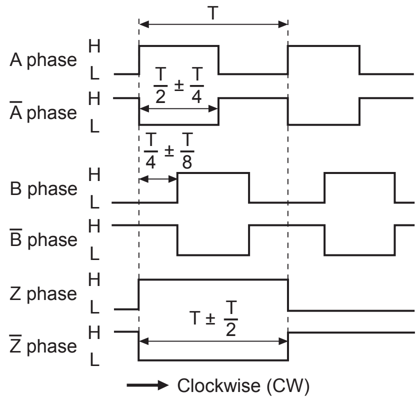
- All output circuits of A, B, Z phase are same. (line driver output is A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$)
- Totem pole output type can be used for NPN open collector type (※1) or voltage output type (※2).

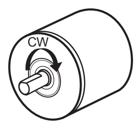
▣ Output Waveforms

- **Totem pole output / NPN open collector output / Voltage output**



- **Line driver output**

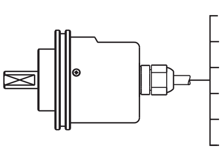




▣ Connections

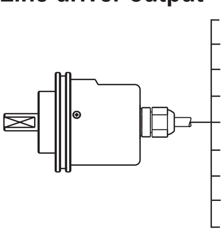
◎ Cable type

- **Totem pole output / NPN open collector output / Voltage output**



Black: OUT A
White: OUT B
Orange: OUT Z
Brown: +V (5VDC, 12-24VDC ±5%)
Blue: GND (0V)
Shield: F.G.

- **Line driver output**

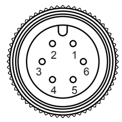


Black: OUT A
Red: OUT $\overline{A}$
White: OUT B
Gray: OUT $\overline{B}$
Orange: OUT Z
Yellow: OUT $\overline{Z}$
Brown: +V (5VDC, 12-24VDC ±5%)
Blue: GND (0V)
Shield: F.G.

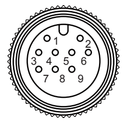
※Unused wires must be insulated.
※The metal cable and shield cable of encoder should be grounded (F.G.)

◎ Cable connector type / Connector type

- **Totem pole output / NPN open collector output / Voltage output**



- **Line driver output**



• Totem pole output • NPN open collector output • Voltage output			• Line driver output		
Pin No.	Function	Cable color	Pin No.	Function	Cable color
1	OUT A	Black	1	OUT A	Black
2	OUT B	White	2	OUT $\overline{A}$	Red
3	OUT Z	Orange	3	+V	Brown
4	+V	Brown	4	GND	Blue
5	GND	Blue	5	OUT B	White
6	F.G.	Shield	6	OUT $\overline{B}$	Gray
—			7	OUT Z	Orange
			8	OUT $\overline{Z}$	Yellow
			9	F.G.	Shield

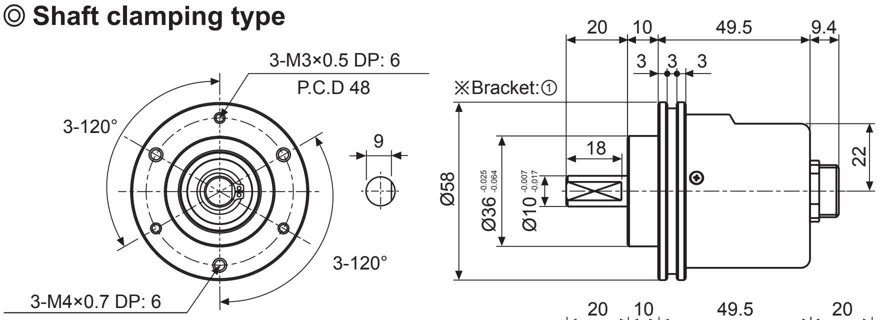
※F.G. (field ground): It should be grounded separately.

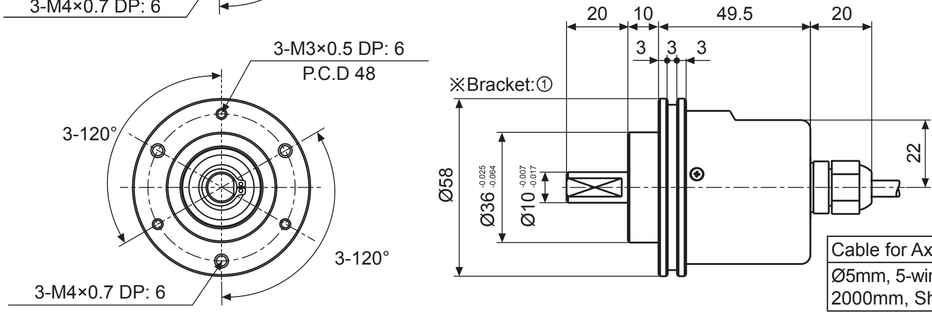
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Dimensions

◎ Shaft clamping type

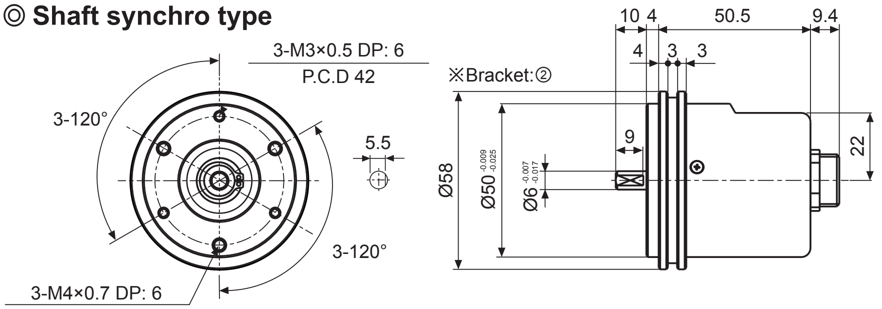
(unit: mm)

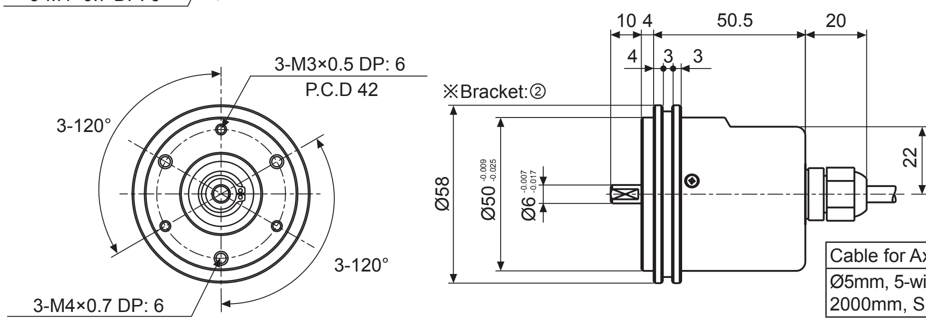




Cable for Axial cable type
Ø5mm, 5-wire (line driver output: 8-wire), 2000mm, Shield cable

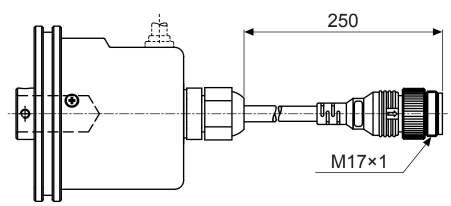
◎ Shaft synchro type





Cable for Axial cable type
Ø5mm, 5-wire (line driver output: 8-wire), 2000mm, Shield cable

● Cable connector type



Cable for Connector type
Ø5mm, 5-wire (line driver output: 8-wire), 250mm, Shield cable

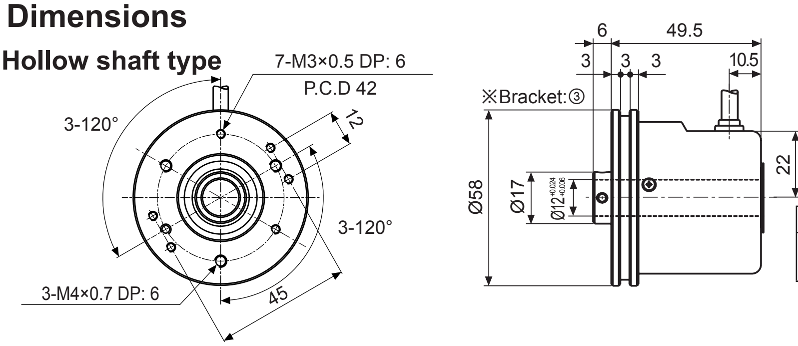
※Connector cable is sold separately and refer to page G-10 for specifications.

Incremental Ø58mm Shaft/Hollow Shaft/Blind Hollow Shaft Type

■ Dimensions

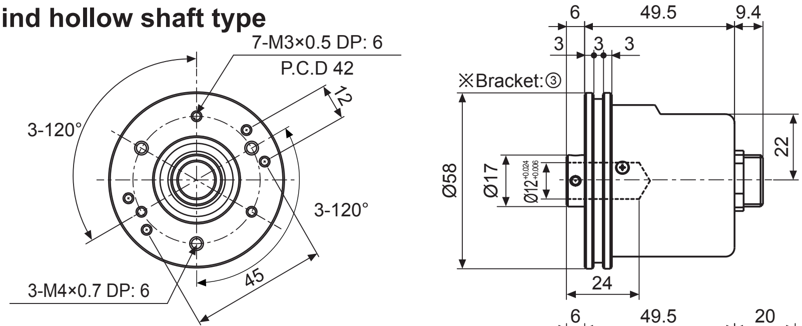
(unit: mm)

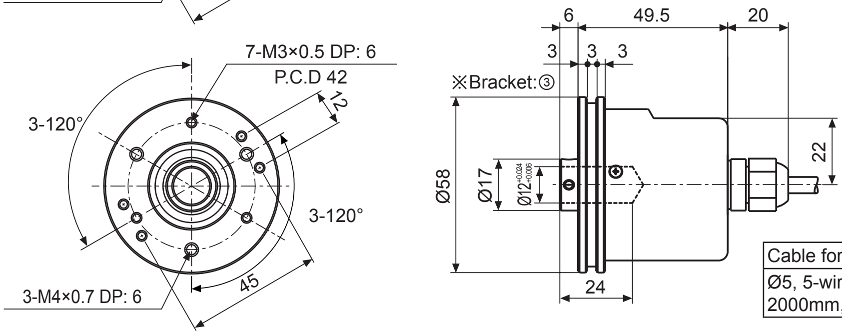
◎ Hollow shaft type



Cable for Radial cable type
Ø5mm, 5-wire (line driver output: 8-wire), 2000mm, Shield cable

◎ Blind hollow shaft type

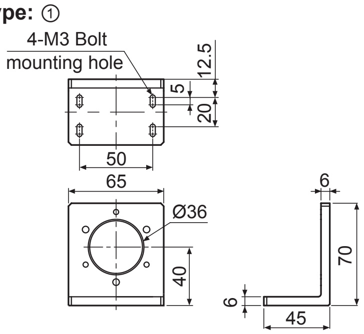




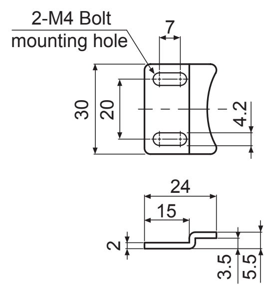
Cable for Axial cable type
Ø5, 5-wire (line driver output: 8-wire), 2000mm, Shield cable

● **Bracket**

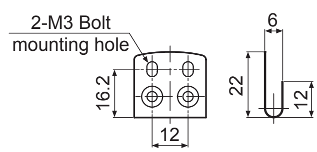
※**SC type:** ①



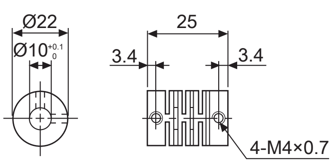
※**SS type:** ②



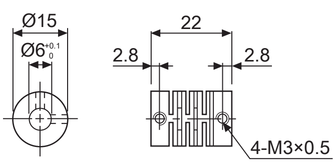
※**H/HB type:** ③



• Ø10mm Coupling (E58SC10 Series)



• Ø6mm Coupling (E58SS6 Series)



- Parallel misalignment: Max. 0.25mm
- Angular misalignment: Max. 5°
- End-play: Max. 0.5mm

※When mounting the coupling to the encoder shaft, if there is combined misalignment (parallel, angular misalignment) between rotating encoder shaft and mate shaft, it may cause encoder and coupling's life cycle to shorten.

※Do not load overweight on the shaft.

※For parallel misalignment, angular misalignment, end-play terms, refer to page F-87.

※For flexible coupling (ERB series) information, refer to page F-80.

Hollow Shaft Type Ø60mm Incremental Rotary Encoder

■ Features

- Ø60mm, Inner diameter of shaft Ø20mm
- Easy installation at narrow space
- Suitable for measuring angle, position, revolution, speed, acceleration and distance
- Power supply: 5VDC, 12-24VDC ±5%
- Various output types

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ Ordering Information

E60H | 20 – 8192 – 3 – N – 24 –

Series	Shaft inner diameter	Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø60mm, hollow shaft type	Ø20mm	100, 1024, 5000, 8192	3: A, B, Z 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%	No mark: Radial cable type C: Radial cable connector type

■ Specifications

Item			Hollow Shaft Type Ø60mm Incremental Rotary Encoder
Resolution (PPR)※1			100, 1024, 5000, 8192
Electrical specification	Output phase		A, B, Z phase (line driver output: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Output between A and B phase: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: Max. 30mA, Residual voltage: Max. 0.4VDC • [High] - Load current: Max. 10mA, Output voltage (power voltage 5VDC): Min. (power voltage-2.0)VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
		NPN open collector output	Load current: Max. 30mA, Residual voltage: Max. 0.4VDC
		Voltage output	Load current: Max. 10mA, Residual voltage: Max. 0.4VDC
		Line driver output	• [Low] - Load current: Max. 20mA, Residual voltage: Max. 0.5VDC • [High] - Load current: Max. -20mA, Output voltage (power voltage 5VDC): Min. 2.5VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency		300kHz
	Power supply		• 5VDC ±5% (ripple P-P: Max. 5%) • 12-24VDC ±5% (ripple P-P: Max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: Max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Radial cable type, Radial cable connector type
Mechanical specification	Starting torque		Max. 150gf·cm (0.0147 N·m)
	Moment of inertia		Max. 110g·cm² (11×10^{-6} kg·m²)
	Shaft loading		Radial: Max. 5kgf, Thrust: Max. 2.5kgf
	Max. allowable revolution※2		6,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 100G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Bracket: 2
Approval			CE (except line driver output)
Weight※3			Approx. 391g (approx. 330g)

※1: Not indicated resolutions are customizable.

※3: The weight includes packaging. The weight in parenthesis is for unit only.

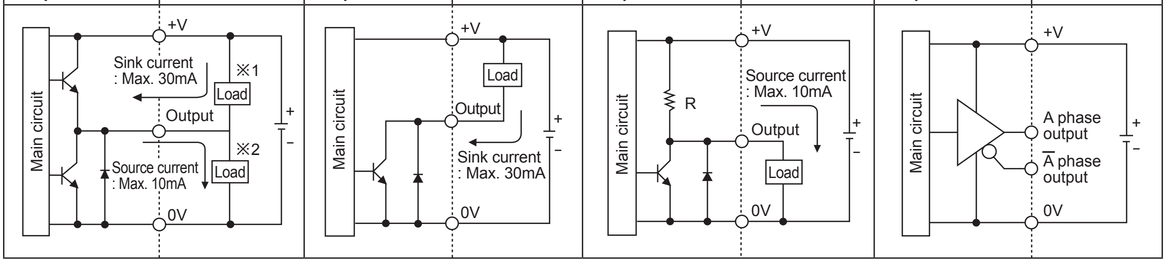
※Environment resistance is rated at no freezing or condensation.

※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

■ Control Output Diagram

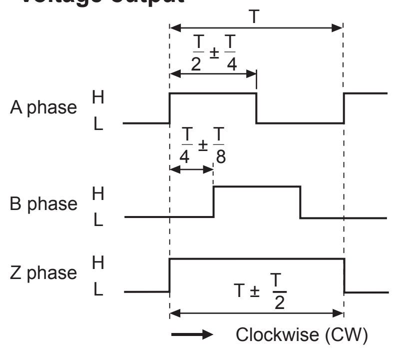
Totem pole output		NPN open collector output		Voltage output		Line driver output	
Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection



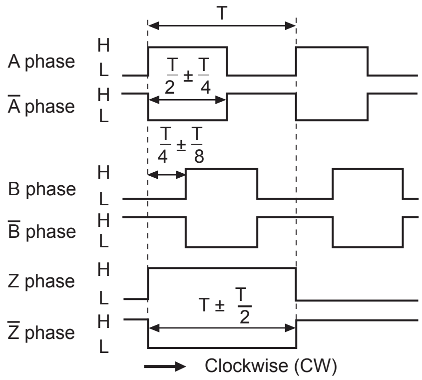
- All output circuits of A, B, Z phase are same. (line driver output is A, Ā, B, B̄, Z, Z̄)
- Totem pole output type can be used for NPN open collector type (※1) or voltage output type (※2).

■ Output Waveforms

● **Totem pole output / NPN open collector output / Voltage output**



● **Line driver output**

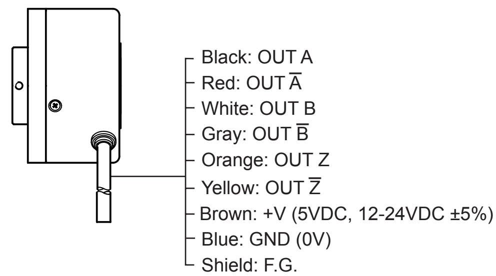


■ Connections

◎ Radial cable type

● **Totem pole output / NPN open collector output / Voltage output**

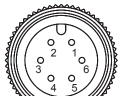
● **Line driver output**



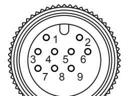
※Unused wires must be insulated.
※The metal case and shield cable of encoder should be grounded (F.G.).

◎ Radial cable connector type

● **Totem pole output / NPN open collector output / Voltage output**



● **Line driver output**



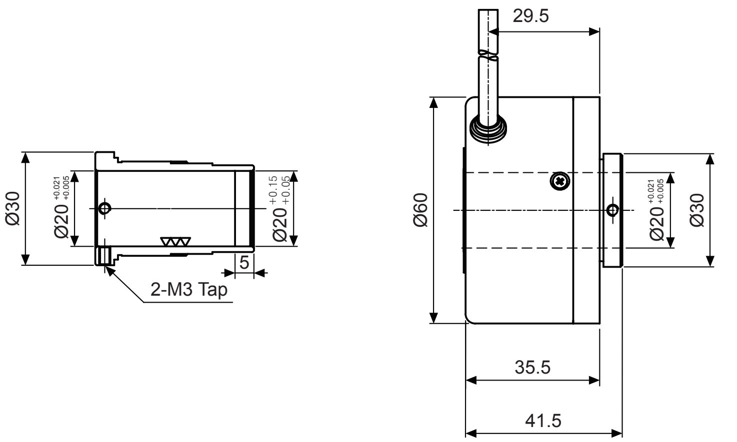
• Totem pole output • NPN open collector output • Voltage output			• Line driver output		
Pin No.	Function	Cable color	Pin No.	Function	Cable color
1	OUT A	Black	1	OUT A	Black
2	OUT B	White	2	OUT Ā	Red
3	OUT Z	Orange	3	+V	Brown
4	+V	Brown	4	GND	Blue
5	GND	Blue	5	OUT B	White
6	F.G.	Shield	6	OUT B̄	Gray
—			7	OUT Z	Orange
			8	OUT Z̄	Yellow
			9	F.G.	Shield

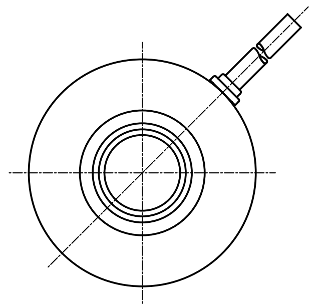
※F.G. (field ground): It should be grounded separately.

▣ Dimensions

◎ Radial cable type

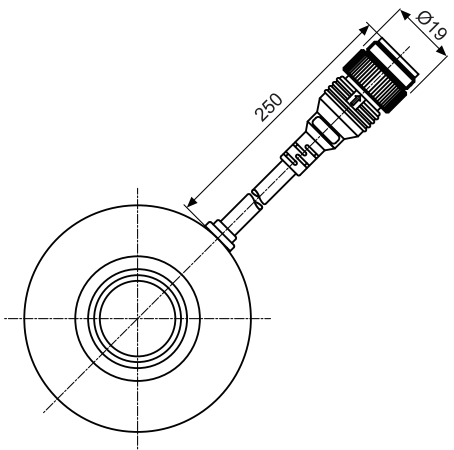
(unit: mm)



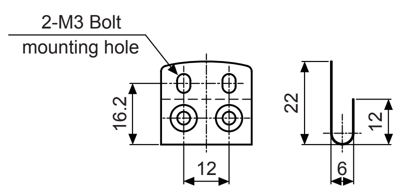


Cable for Radial cable type
Ø5mm, 5-wire (line driver output: 8-wire), 2,000mm, Shield cable

◎ Radial cable connector type



● **Bracket**



Cable for Radial cable connector type
Ø5mm, 5-wire (line driver output: 8-wire), 250mm, Shield cable

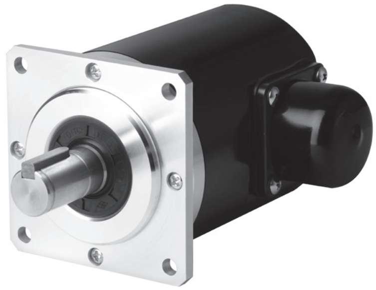
※Connector cable is sold separately and refer to page G-10 for specifications.

Shaft Type Ø68mm Incremental Rotary Encoder

■ Features

- Ø68mm, shaft diameter: Ø15mm
- High speed response frequency: 180kHz
- Radial connector type
- Suitable for tooling machinery
- Protection structure IP65 (IEC standard) (tentative water-proof/oil)
- High shaft loading capabilities (allowable load weight is 10kgf)

⚠ **Please read "Caution for your safety" in operation manual before using.**



■ Ordering Information

E68S - 15 - 1024 - 6 - L - 5

Series	Shaft diameter	Pulses/revolution	Output phase	Control output	Power supply
E68S	15	1024	6	L	5
Ø68mm, shaft type	Ø15mm	500, 600, 1024	6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	L: Line driver output	5VDC ±5%

※Connector standard: MS3102A20-29P

■ Specifications

Item		Shaft Type Ø68mm Incremental Rotary Encoder
Resolution (PPR)※1		500, 600, 1024
Electrical specification	Output phase	A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase
	Phase difference of output	Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	• [Low] - Load current: Max. 20mA, Residual voltage: Max. 0.5VDC • [High] - Load current: Max. -20mA, Output voltage: Min. 2.5VDC
	Response time (rise/fall)	Max. 0.5µs (cable: 1m, I sink = 20mA)
	Power supply	5VDC ± 5% (ripple P-P: max. 5%)
	Max. response frequency	180kHz
	Current consumption	Max. 50mA (disconnection of the load)
	Insulation resistance	Over 100MΩ (at 500VDC megger) (between all terminals and case)
	Dielectric strength	750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection	Radial connector type (MS3102A20-29P)
Mechanical specification	Starting torque	Max. 1.5kgf·cm (0.15N·m)
	Shaft loading	Radial: 20kgf, Thrust: 10kgf
	Max. allowable revolution※2	6,500rpm
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock		Approx. max. 50G
Environ-ment	Ambient temperature	-10 to 70℃, storage: -25 to 85℃
	Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure		IP65 (IEC standard)
Unit weight		Approx. 550g

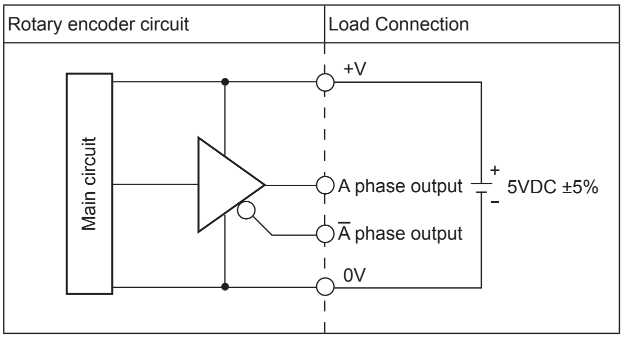
※1: Not indicated resolutions are available customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※Environment resistance is rated at no freezing or condensation.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

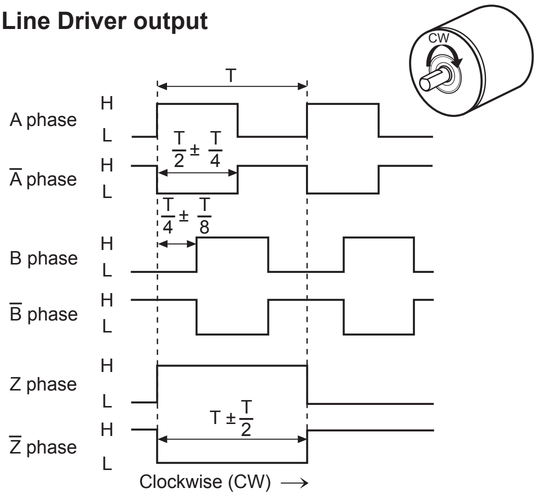
Control Output Diagram



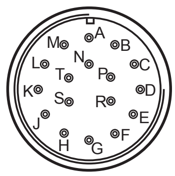
※All output circuits of A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase are same.

Output Waveform

● **Line Driver output**



Connections

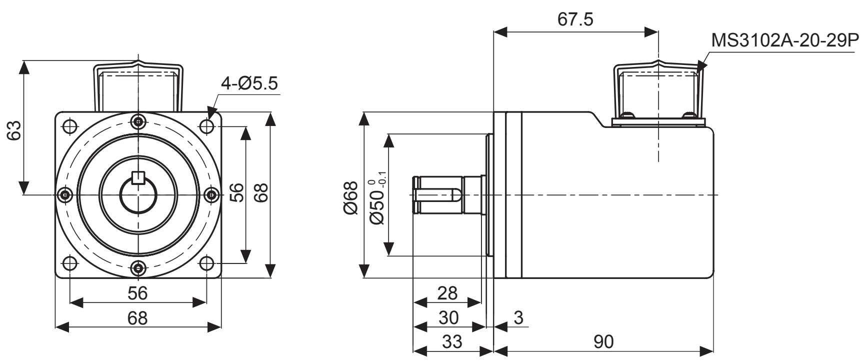


Pin No.	Connection	Pin No.	Connection
A	A phase	K	0V
B	Z phase	L	N·C
C	B phase	M	0V
D	N·C	N	$\overline{A}$ phase
E	5VDC	P	$\overline{Z}$ phase
F	N·C	R	$\overline{B}$ phase
G	N·C	S	N·C
H	5VDC	T	Shield (F.G.)
J	N·C	—	—

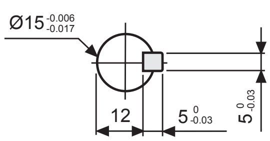
※N·C: Not Connected.
※E and H terminals, K and M terminals are connected internally.

Dimensions

(unit: mm)



● **Shaft dimension**



Hollow Shaft Type Ø80mm Incremental Rotary Encoder

■ Features

- Ø80mm, Inner diameter of shaft Ø30mm, Ø32mm
- No coupling needed with direct installation at motor or rotation shaft of machine
- Power supply: 5VDC, 12-24VDC ±5%
- Various output types

⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Ordering Information

E80H — 30 — 3200 — 3 — N — 24 — [ ]

Series	Shaft diameter	Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø80mm, hollow shaft type	30: Ø30mm 32: Ø32mm	60, 100, 360, 500, 512, 1024, 3200	3: A, B, Z 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%	No mark: Radial cable type C: Radial cable connector type

■ Specifications

Item			Hollow Shaft Type Ø80mm Incremental Rotary Encoder
Resolution (PPR)※1			60, 100, 360, 500, 512, 1024, 3200
Electrical specification	Output phase		A, B, Z phase (line driver output A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Output between A and B phase: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: Max. 30mA, Residual voltage: Max. 0.4VDC • [High] - Load current: Max. 10mA, Output voltage (power voltage 5VDC): Min. (power voltage-2.0)VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
		NPN open collector output	Load current: Max. 30mA, Residual voltage: Max. 0.4VDC
		Voltage output	Load current: Max. 10mA, Residual voltage: Max. 0.4VDC
		Line driver output	• [Low] - Load current: Max. 20mA, Residual voltage: Max. 0.5VDC • [High] - Load current: Max. -20mA, Output voltage (power voltage 5VDC): Min. 2.5VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
	Response time (rise, fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency		200kHz
	Power supply		• 5VDC ±5% (ripple P-P: Max. 5%) • 12-24VDC ±5% (ripple P-P: Max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: Max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Radial cable type, Radial cable connector type
Mechanical specification	Starting torque		Max. 200gf·cm (0.0196N·m)
	Moment of inertia		Max. 800g·cm² (8×10^{-5} kg·m²)
	Shaft loading		Radial: Max. 5kgf, Thrust: Max. 2.5kgf
	Max. allowable revolution※2		3,600rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Spring bracket
Approval			CE (except for line driver output)
Unit weight			Approx. 560g

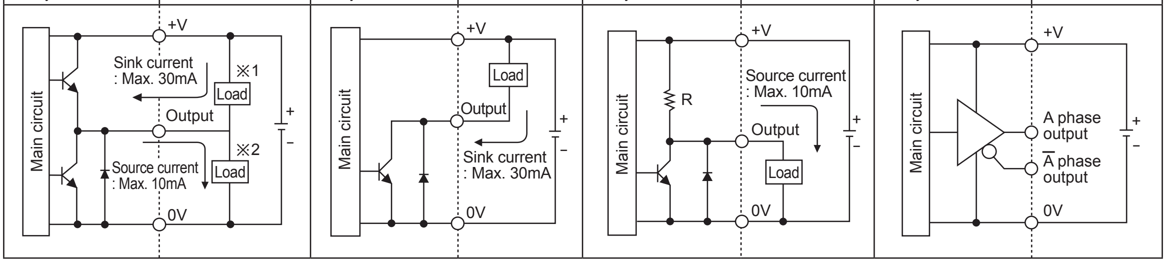
※1: Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※Environment resistance is rated at no freezing or condensation.

■ Control Output Diagram

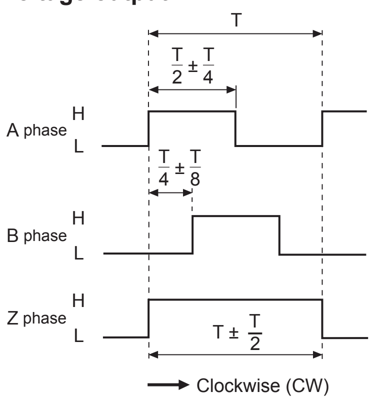
Totem pole output		NPN open collector output		Voltage output		Line driver output	
Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection



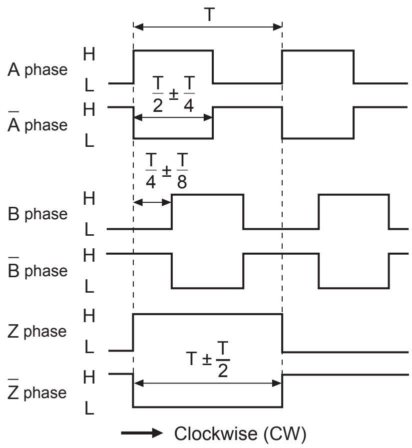
● All output circuits of A, B, Z phase are same. (line driver output is A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$)
● Totem pole output type can be used for NPN open collector type (※1) or voltage output type (※2).

■ Output Waveforms

● Totem pole output / NPN open collector output / Voltage output



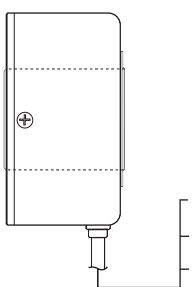
● Line driver output



■ Connections

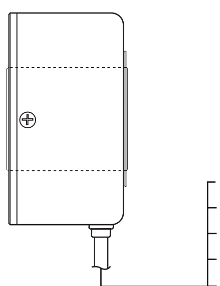
◎ Radial cable type

● Totem pole output / NPN open collector output / Voltage output



- Black: OUT A
- White: OUT B
- Orange: OUT Z
- Brown: +V (5VDC, 12-24VDC ±5%)
- Blue: GND (0V)
- Shield: F.G.

● Line driver output



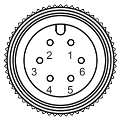
- Black: OUT A
- Red: OUT $\overline{A}$
- White: OUT B
- Gray: OUT $\overline{B}$
- Orange: OUT Z
- Yellow: OUT $\overline{Z}$
- Brown: +V (5VDC, 12-24VDC ±5%)
- Blue: GND (0V)
- Shield: F.G.

※Unused wires must be insulated.
※The metal case and shield cable of encoder should be grounded (F.G.).

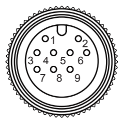
▣ Connections

◎ Radial cable connector type

● Totem pole output / NPN open collector output / Voltage output



● Line driver output



• Totem pole output • NPN open collector output • Voltage output			• Line driver output		
Pin No.	Function	Cable color	Pin No.	Function	Cable color
1	OUT A	Black	1	OUT A	Black
2	OUT B	White	2	OUT $\overline{A}$	Red
3	OUT Z	Orange	3	+V	Brown
4	+V	Brown	4	GND	Blue
5	GND	Blue	5	OUT B	White
6	F.G.	Shield	6	OUT $\overline{B}$	Gray
—			7	OUT Z	Orange
			8	OUT $\overline{Z}$	Yellow
			9	F.G.	Shield

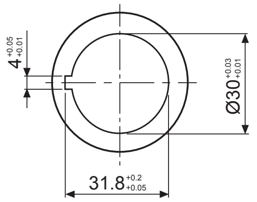
※F.G. (field ground): It should be grounded separately.

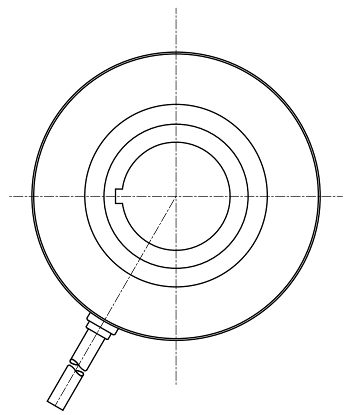
▣ Dimensions

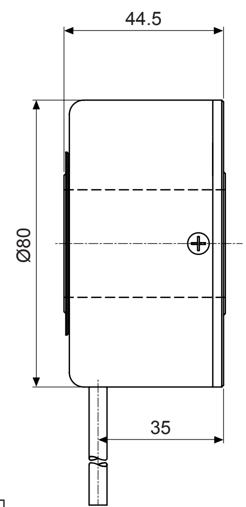
◎ Radial cable type

(unit: mm)

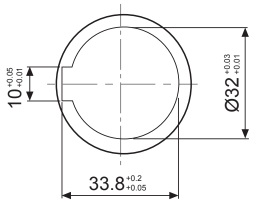
● Shaft inner diameter = Ø30mm





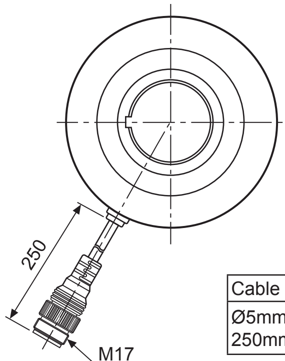


● Shaft inner diameter = Ø32mm

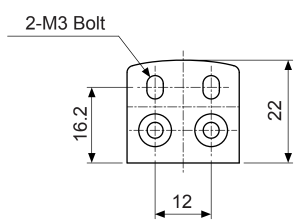


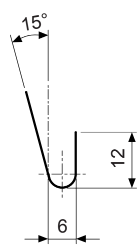
Cable for Radial cable type
Ø5mm, 5-wire (line driver output: 8-wire), 2000mm, Shield cable

◎ Radial cable connector type



● Bracket





Cable for Radial cable connector type
Ø5mm, 5-wire (line driver output: 8-wire), 250mm, Shield cable

※Connector cable is sold separately and refer to page G-10 for specifications.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Hollow Shaft Type Ø100mm Incremental Rotary Encoder

■ Features

- Great environmental resistance
- High stability of output
- Exclusive for Elevator

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ Ordering Information

E100H | 35 — 10000 — 6 — L — 5

Series	Shaft diameter	Pulses/revolution	Output phase	Control output	Power supply
Ø100mm, hollow shaft type	Ø35mm	512, 1024, 10000	3: A, B, Z 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%

■ Specifications

Item			Hollow Shaft Type Ø100mm Incremental Rotary Encoder
Resolution (PPR)※1			512, 1024, 10000
Electrical specification	Output phase		A, B, Z phase (line driver output A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: Max. 30mA, Residual voltage: Max. 0.4VDC • [High] - Load current: Max. 10mA, Output voltage (power voltage 5VDC): Min. (power voltage-2.0)VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
		NPN open collector output	Load current: Max. 30mA, Residual voltage: Max. 0.4VDC
		Voltage output	Load current: Max. 10mA, Residual voltage: Max. 0.4VDC
		Line driver output	• [Low] - Load current: Max. 20mA, Residual voltage: Max. 0.5VDC • [High] - Load current: Max. -20mA, Output voltage (power voltage 5VDC): Min. 2.5VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
	Response time (rise/fall)	Totem pole output	Max. 1µs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5µs (cable length: 2m, I sink = 20mA)
	Max. response frequency		300kHz
	Power supply		• 5VDC ±5% (ripple P-P: Max. 5%) • 12-24VDC ±5% (ripple P-P: Max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: Max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Radial connector type
Mechanical specification	Starting torque		Max. 300gf·cm (0.03N·m)
	Moment of inertia		Max. 800g·cm² (8×10^{-5} kg·m²)
	Shaft loading		Radial: 5kgf, Thrust: 2.5kgf
	Max. allowable revolution※2		3,600rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Bracket: 2, Connector cable
Approval			CE (except for line driver output)
Weight※3			Approx. 1400g (approx. 1130g)

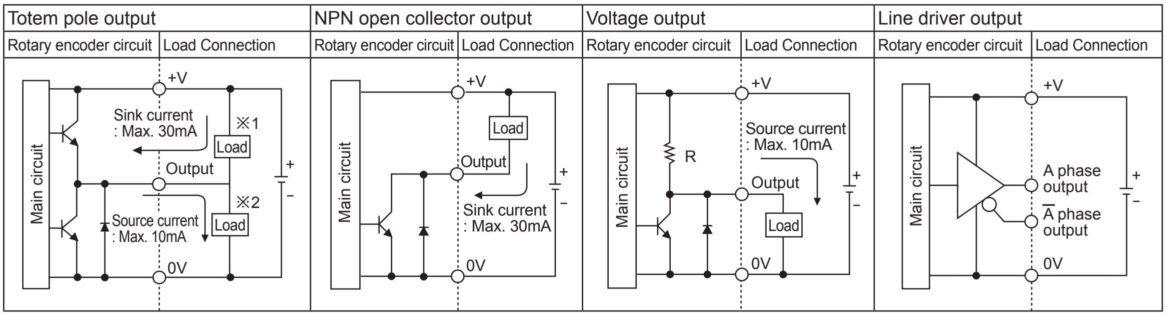
※1: Not indicated resolutions are customizable.

※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

※3: The weight includes packaging. The weight in parenthesis is for unit only. ※Environment resistance is rated at no freezing or condensation.

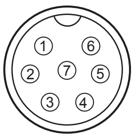
■ Control Output Diagram



- Totem pole output type can be used for NPN open collector output type (※1) or Voltage output type (※2).
- All output circuits of A, B, Z phase are same. (line driver output is A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$)

■ Connections

● Totem pole output / NPN open collector output / Voltage output

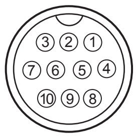


SCN-16-7P

Pin No.	Function	Cable color
①	+V	Brown
②	GND	Blue
③	OUT A	Black
④	OUT B	White
⑤	OUT Z	Orange
⑥	F.G.	Shield
⑦	N·C	N.C

※Unused wires must be insulated.
※The metal case and shield cable should be grounded (F.G.).

● Line driver output



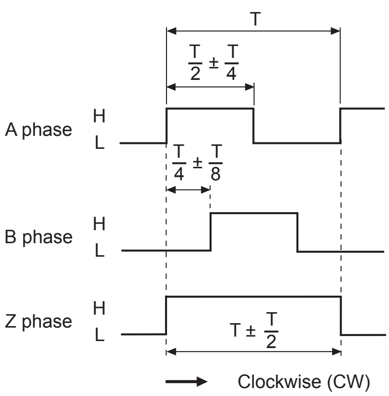
SCN-20-10P

Pin No.	Function	Cable color
①	+V	Brown
②	GND	Blue
③	OUT A	Black
④	OUT $\overline{A}$	Red
⑤	F.G.	Shield
⑥	OUT B	White
⑦	OUT $\overline{B}$	Gray
⑧	OUT Z	Orange
⑨	OUT $\overline{Z}$	Yellow
⑩	N·C	N·C

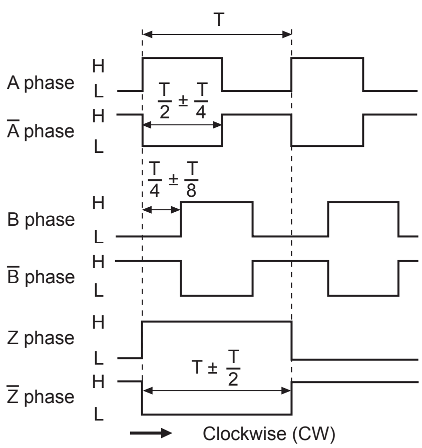
※N·C (not connected)

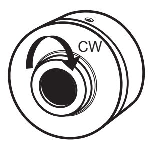
■ Output Waveform

● Totem pole output / NPN open collector output / Voltage output



● Line driver output





(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
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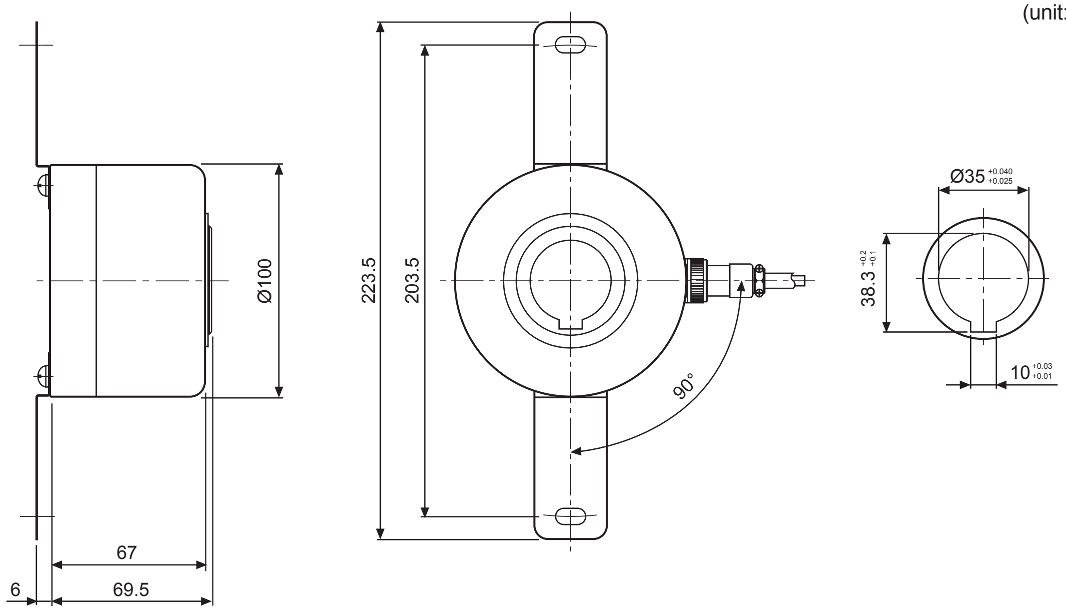
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

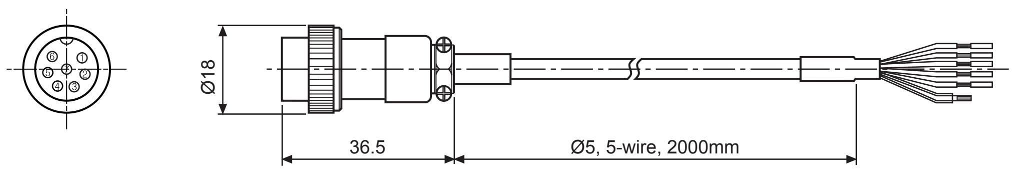
■ Dimensions

(unit: mm)

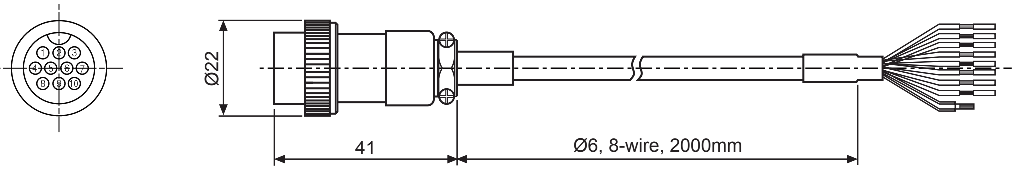


◎ Connector cable

- **Totem pole output / NPN open collector output / Voltage output**

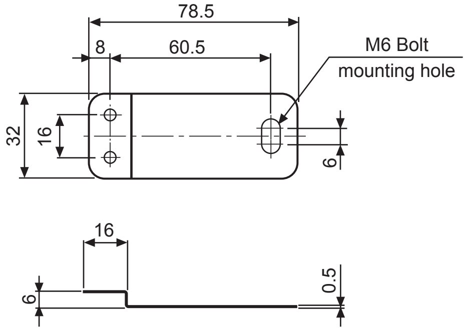


- **Line driver output**



※10m connector cable is customizable.
※Cable type is customizable.

- **Bracket**



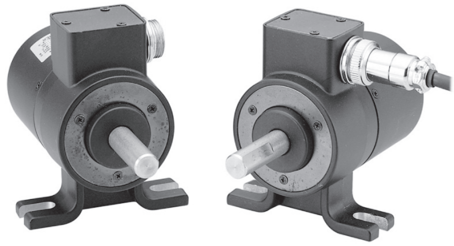
Side-Mounting Shaft Type Incremental Rotary Encoder

■ Features

- Strong die cast structure against external impact
- Convenient structure for direct mounting on the frame
- Connector type
- Power supply: 5VDC, 12-24VDC ±5%

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE



■ Ordering Information

ENA — 5000 — 3 — N — 24

Series	Pulses/revolution	Output phase	Control output	Power supply
Side-mounting shaft type (external diameter of shaft: Ø10mm)	Refer to resolution	2: A, B 3: A, B, Z	T: Totem pole output N: NPN open collector output V: Voltage output	5 : 5VDC ±5% 24: 12-24VDC ±5%

■ Specifications

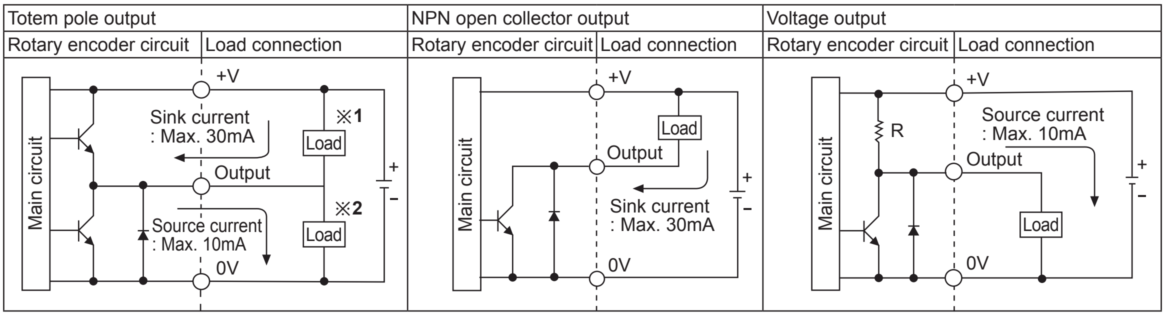
Item			Side-mounting Shaft Type Incremental Rotary Encoder
Resolution (PPR)※1			*1, *2, *5, 10, 12, 15, 20, 23, 25, 30, 35, 40, 45, 50, 60, 75, 100, 120, 150, 192, 200, 240, 250, 256, 300, 360, 400, 500, 512, 600, 800, 1000, 1024, 1200,1500, 1800, 2000, 2048, 2500. 3000, 3600, 5000
Electrical specification	Output phase		•ENA-□-2-□-□: A, B phase •ENA-□-3-□-□: A, B, Z phase
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current:Max. 30mA, Residual voltage: Max. 0.4VDC • [High] - Load current:Max. 10mA, Output voltage (power voltage 5VDC):Min. (power voltage-2.0)VDC, Output voltage (power voltage 12-24VDC):Min. (power voltage-3.0)VDC
		NPN open collector output	Load current: Max. 30mA, Residual voltage: Max. 0.4VDC
		Voltage output	Load current: Max. 10mA, Residual voltage: Max. 0.4VDC
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
	Max. response frequency		300kHz
	Power supply		• 5VDC ±5% (ripple P-P: Max. 5%) • 12-24VDC ±5% (ripple P-P: Max. 5%)
	Current consumption		Max. 80mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Radial connector type
Mechanical specification	Starting torque		Max. 70gf·cm (0.007N·m)
	Moment of inertia		Max. 80g·cm² (8×10^{-6} kg·m²)
	Shaft loading		Radial: 10kgf, Thrust: 2.5kgf
	Max. allowable revolution※2		5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable	ENA-□-2-□-□		Ø5mm, 4-wire, 2m, Shield cable (AWG 24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
	ENA-□-3-□-□		Ø5mm, 5-wire, 2m, Shield cable (AWG 24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Ø10mm coupling, Connector cable
Approval			CE
Unit weight			Approx. 345g

※1: '*' pulse is only for A, B phase. Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※Environment resistance is rated at no freezing or condensation.

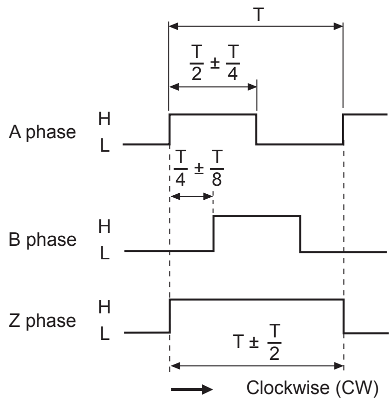
■ Control Output Diagram

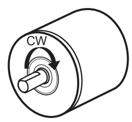


- The output circuits of A, B, Z phase are same.
- Totem pole output type can be used for NPN open collector type (※1) or voltage output type (※2).

■ Output Waveform

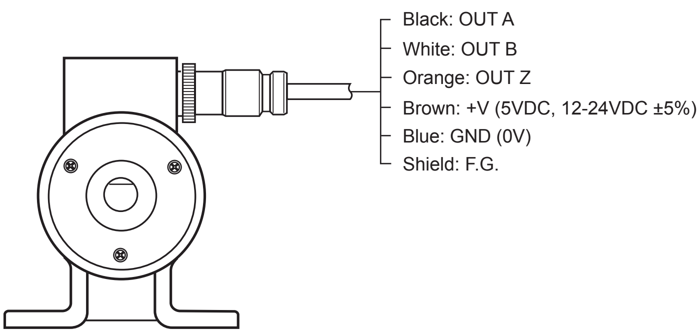
● Totem pole output / NPN open collector output / Voltage output

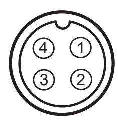
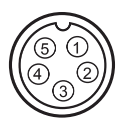




※In case of ENA-□-3-□-□ model, Z phase is output.

■ Connections

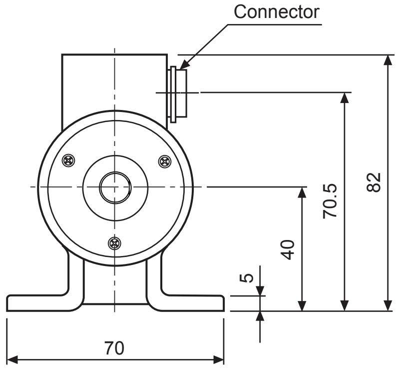


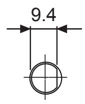
	Pin No	Cable color	Function
	①	Black	OUT A
	②	White	OUT B
	③	Brown	+V
	④	Blue	GND
	①	Black	OUT A
	②	White	OUT B
	③	Orange	OUT Z
	④	Brown	+V
	⑤	Blue	GND

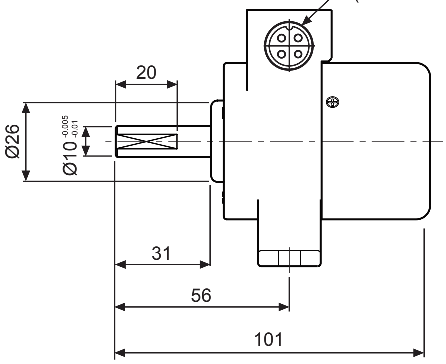
※In case of ENA-□-3-□-□ model, Z phase is output.
※Unused wires must be insulated.
※The metal case and shield cable of encoder must be grounded (F.G.).

■ Dimensions

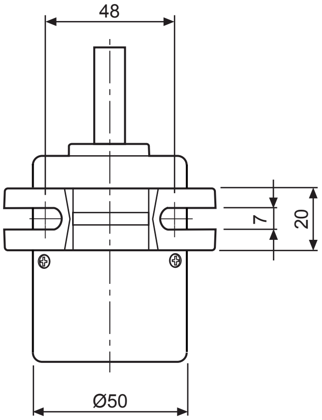
(unit: mm)





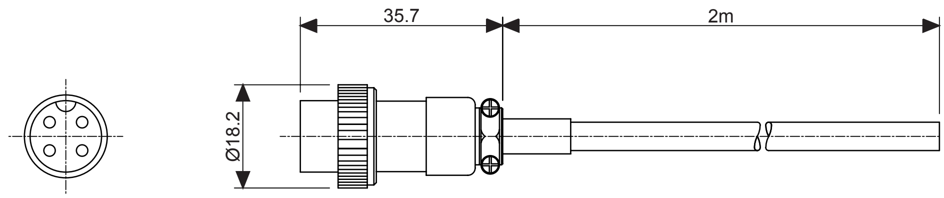


※ENA-□-3-□-□
: 5 holes connector (SCN-16-5P)

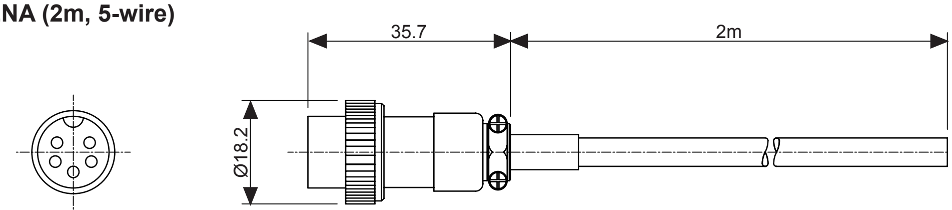


◎ Connector cable (accessory)

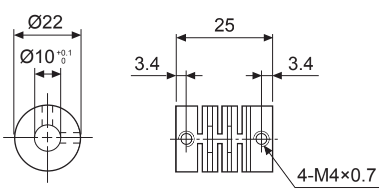
● ENA (2m, 4-wire)



● ENA (2m, 5-wire)



◎ Coupling (ENA)



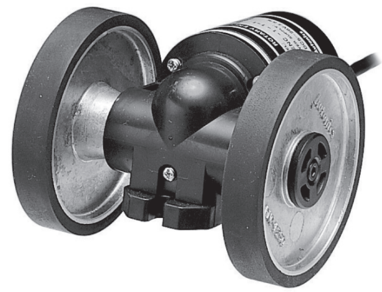
- Parallel misalignment: Max. 0.25mm
- Angular misalignment: Max. 5°
- End-play: Max. 0.5mm

※For parallel misalignment, angular misalignment, end-play terms, refer to page F-87.

Wheel Type Incremental Rotary Encoder

■ Features

- Suitable for measuring the length or speed of target moving successively by wheel type
- The output waveform according to measuring distance is proportional to the unit of International Measurement type (meter or inch)
- Power supply: 5VDC, 12-24VDC ±5%



■ Applications

- Various packing machine, sheet manufacturing, textile machinery, and general industrial machinery etc.

Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

ENC – 1 – 1 – N – 24 –

Series	Output phase	Min. measuring unit	Control output	Power supply	Cable
Wheel type	1: A, B	1: 1mm 4: 0.01yd 2: 1cm 5: 0.1yd 3: 1m 6: 1yd	T: Totem pole output N: NPN open collector output V: Voltage output	5: 5VDC ±5% 24: 12-24VDC ±5%	No mark: Axial cable type C: Axial cable connector type

■ Specifications

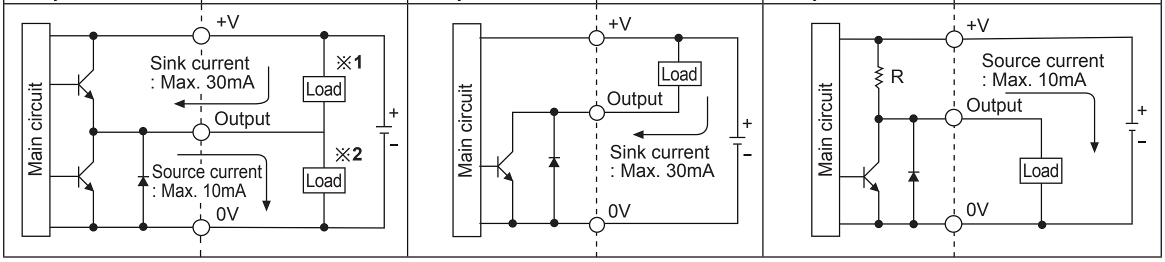
Item			Wheel Type Incremental Rotary Encoder
Resolution (PPR)※1			Refer to resolution (next page)
Electrical specification	Output phase		A, B phase
	Phase difference of output		Phase difference between A and B : $\frac{T}{4} \pm \frac{T}{8}$ (T=1cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: Max. 30mA, Residual voltage: Max. 0.4VDC • [High] - Load current: Max. 10mA, Output voltage (power voltage 5VDC): Min. (power voltage-2.0)VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
		NPN open collector output	Load current: Max. 30mA, Residual voltage: Max. 0.4VDC
		Voltage output	Load current: Max. 10mA, Residual voltage: Max. 0.4VDC
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
	Max. response frequency		180kHz
	Power supply		• 5VDC ±5% (ripple P-P: Max. 5%) • 12-24VDC ±5% (ripple P-P: Max. 5%)
	Current consumption		Max. 80mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Axial cable type, Axial cable connector type
Mechanical specification	Starting torque		Depend on coefficient of friction
	Max. allowable revolution※2		5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment	Ambient temperature		-10 to 70℃ (at non-freezing status), storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Cable	Axial cable type		Ø5mm, 4-wire, 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
	Axial cable connector type		Ø5mm, 5-wire, 250mm, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Protection structure			IP50 (IEC standard)
Approval			CE
Unit weight			Approx. 494g

※1: Not indicated resolutions are customizable.
※Environment resistance is rated at no freezing or condensation.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

■ Control Output Diagram

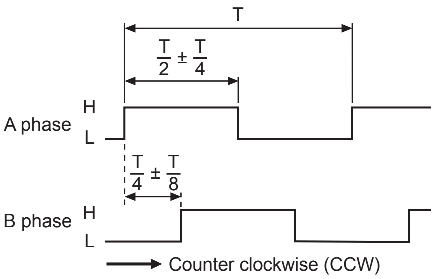
Totem pole output		NPN open collector output		Voltage output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection

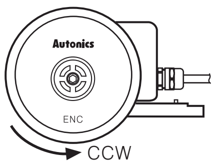


- The output circuits of A, B phase are same.
- Totem pole output type can be used for NPN open collector type (※1) or voltage output type (※2).

■ Output Waveform

- **Totem pole output / NPN open collector output / Voltage output**



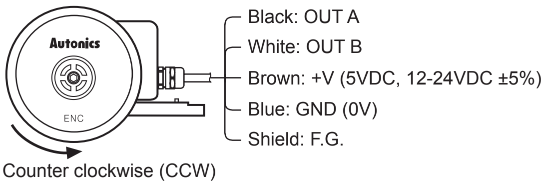


■ Resolution

No	The number of encoder pulse	Gear ratio	Wheel circumference	Moving distance per 1pulse
1	250Pulse	1:1	250mm	1mm/1Pulse
2	100Pulse	4:1	250mm	1cm/1Pulse
3	1Pulse	4:1	250mm	1m/1Pulse
4	100Pulse	4:1	228.6mm (0.25/yd)	0.01yd/1Pulse
5	10Pulse	4:1	228.6mm (0.25/yd)	0.1yd/1Pulse
6	1Pulse	4:1	228.6mm (0.25/yd)	1yd/1Pulse

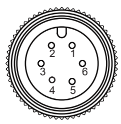
■ Connections

◎ Axial cable type



※Unused wires must be insulated.
※The metal case and shield wire of encoder must be grounded (F.G.)

◎ Axial cable connector type



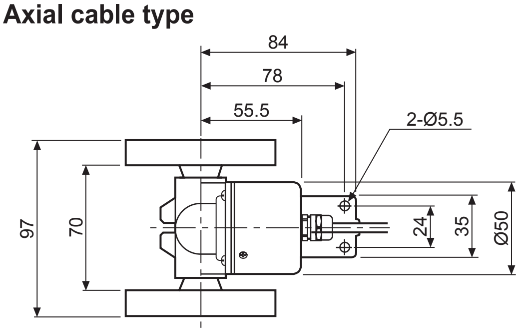
Pin No	Cable color	Function
①	Black	OUT A
②	White	OUT B
③	Orange	N·C
④	Brown	+V
⑤	Blue	GND
⑥	Shield	F.G.

※F.G. (field ground): It must be grounded separately.

■ Dimensions

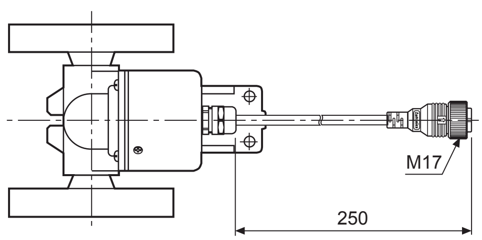
(unit: mm)

◎ Axial cable type



※The wheel circumference(Ø) is changed according to model, please refer to resolution chart.
※Connector cable is sold separately and refer to page G-10 for specifications.

◎ Axial cable connector type



Cable for axial cable type	Cable for axial cable connector type
Ø5mm, 4-wire, 2000mm, Shield cable	Ø5mm, 5-wire, 250mm, Shield cable

Manual Handle Type Incremental Rotary Encoder

■ Features

- Suitable for manual pulse input type such as numerically controlled or milling machinery
- Terminal connection type
- Power supply: 5VDC ±5%, 12-24VDC ±5%

■ Applications

- Industrial tooling machinery

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

ENH – 100 – 1 – T – 24

Series	Pulses/revolution	Clickstopper position	Control output	Power supply
Handle type	25, 100	1: Normal "H" 2: Normal "L"	T: Totem pole output V: Voltage output L: Line driver output (※)	5: 5VDC ±5% 24: 12-24VDC ±5%

※The power of Line driver is only for 5VDC.

■ Specifications

Item			Manual Handle Type Incremental Rotary Encoder
Resolution (PPR)※1			25,100
Electrical specification	Output phase		A, B phase (line driver output A, $\bar{A}$, B, $\bar{B}$ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T= 1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: Max. 30mA, Residual voltage: Max. 0.4VDC • [High] - Load current: Max. 10mA Output voltage (power voltage 5VDC): Min. (power voltage-2.0)VDC, Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0) VDC
		Voltage output	Load current: Max. 10mA, Residual voltage: Max. 0.4VDC
		Line driver output	• [Low] - Load current: Max. 20mA, Residual voltage: Max. 0.5VDC • [High] - Load current: Max. -20mA, Output voltage: Min. 2.5VDC
	Response time (rise/fall)	Totem pole output	Max. 1µs (cable length: 1m, I sink = 20mA)
		Voltage output	
		Line driver output	Max. 0.2µs (cable length: 1m, I sink = 20mA)
	Power supply		• 5VDC ±5% (ripple P-P: max.5%) • 12-24VDC ±5% (ripple P-P: max.5%)
	Current consumption		Max. 40mA (disconnection of the load), Line driver output: Max. 50mA (disconnection of the load)
	Max. response frequency		10kHz
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Terminal block type
Mechanical specification	Starting torque		Max. 1kgf·cm (0.098N·m)
	Shaft loading		Radial: 2kgf, Thrust: 1kgf
	Max. allowable revolution※2		Max. 200rpm (normal), 600rpm (peak)
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90℃
Protection structure			IP50 (IEC standard)
Weight※3			Approx. 330g (approx. 260g)

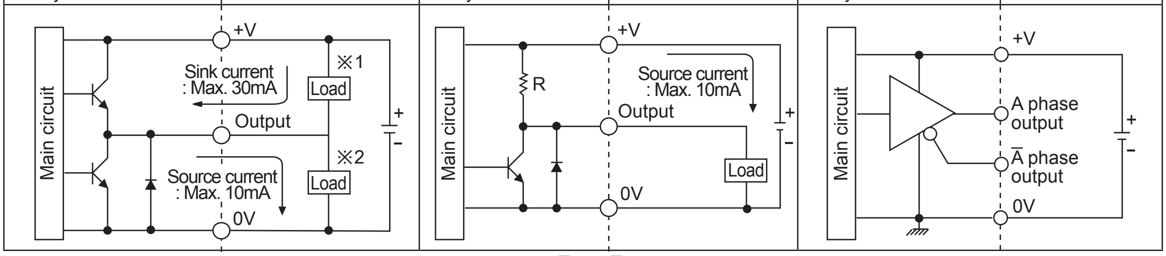
※1: Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Control Output Diagram

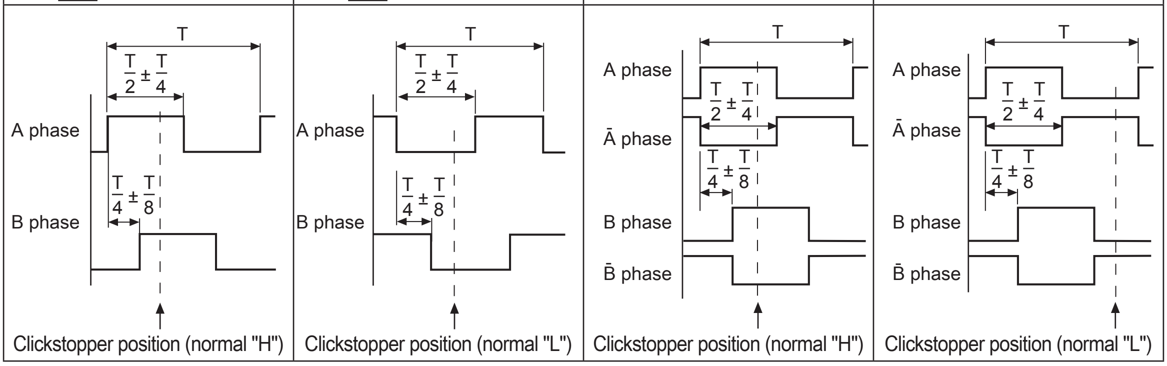
Totem pole output		Voltage output		Line driver output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection



● The output circuits for A, B phase (line driver output is A, Ā, B, B̄ phase) are same.
● Totem pole output can be used for NPN open collector type (※1) or voltage output type (※2).

■ Output Waveform

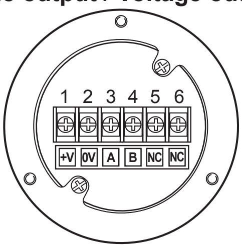
ENH-☐-1-T-5, 24 ENH-☐-1-V-5, 24	ENH-☐-2-T-5, 24 ENH-☐-2-V-5, 24	ENH-☐-1-L-5	ENH-☐-2-L-5



※Clickstopper position Normal "H" or Normal "L": It shows the waveform when the handle is stopped.

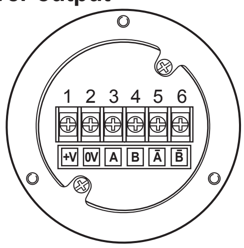
■ Connections

●Totem pole output / Voltage output



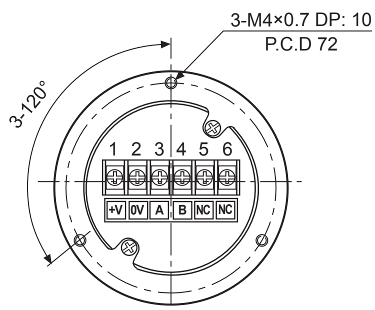
※Do not use terminal No. 5, 6.

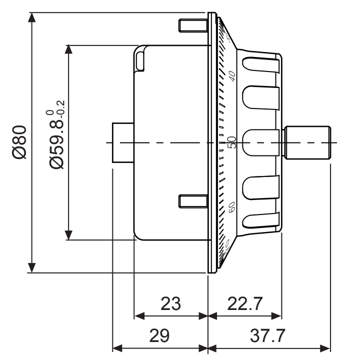
●Line driver output

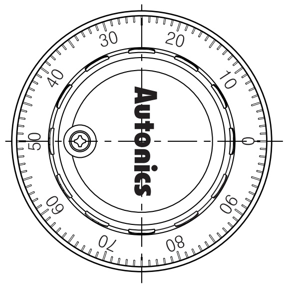


■ Dimensions

(unit: mm)







※Ø70mm PCD mounting hole type is customizable.

Portable, Handle Type Incremental Rotary Encoder

■ Features

- Suitable for manual pulse input type such as numerically controlled or milling machinery
- Emergency stop switch, enable switch is available
- 6-axis, 4-rate select switches

■ Application

- Industrial tooling machinery

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

ENHP — **100** — **1** — **L** — **5**

Series	Pulses/revolution	Clickstopper position	Control output	Power supply
Portable handle type	100	1: Normal "H" 2: Normal "L"	T: Totem pole output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%

※Line driver power is only 5VDC.

■ Specifications

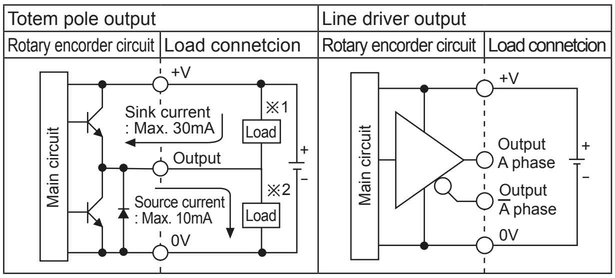
Item			Portable, Handle Type Incremental Rotary Encoder
Resolution (PPR)※1			100
Electrical specification	Output phase		A, B phase (line driver output A, $\overline{A}$, B, $\overline{B}$ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Rotary switch output		BCD Code output • Axis select switch (OFF, X, Y, Z, A, B) • Rate select switch (R1, R2, R3, R4)
	Control output	Totem pole output	• [Low] - Load current: Max. 30mA, Residual voltage: Max. 0.4VDC • [High] - Load current: Max. 10mA, Output voltage (power voltage 5VDC): Min. (power voltage-2.0)VDC Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
		Line driver output	• [Low] - Load current: Max. 20mA, Residual voltage: Max. 0.5VDC • [High] - Load current: Max. -20mA, Output voltage: Min. 2.5VDC
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 1m, I sink = 20mA)
		Line driver output	Max. 0.5μs (cable length: 1m, I sink = 20mA)
	Power supply		• 5VDC ±5% (ripple P-P: max. 5%) • 12-24VDC ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 40mA (disconnection of the load), Line driver output: Max. 50mA (disconnection of the load)
	Max. response frequency		10kHz
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		25Pin D-SUB of connector type
Mechanical specification	Starting torque		Max. 1kgf·cm (0.098N·m)
	Shaft loading		Radial: 2kgf, Thrust: 1kgf
	Max. allowable revolution ※2		Max. 200rpm (normal), 600rpm (peak)
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure※3			IP67 (IEC standard) for Box
Cable			Ø5mm, 18-wire, 8m, Spring code cable (AWG28, core diameter: 0.08mm, number of cores: 18, insulator out diameter: Ø0.7mm)
Unit weight			Approx. 730g

※1: Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

※3: It is protection for the rear case and the wiring part.
※Environment resistance is rated at no freezing or condensation.

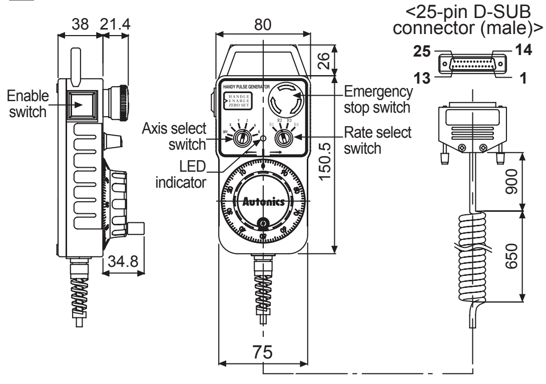
■ Control Output Diagram



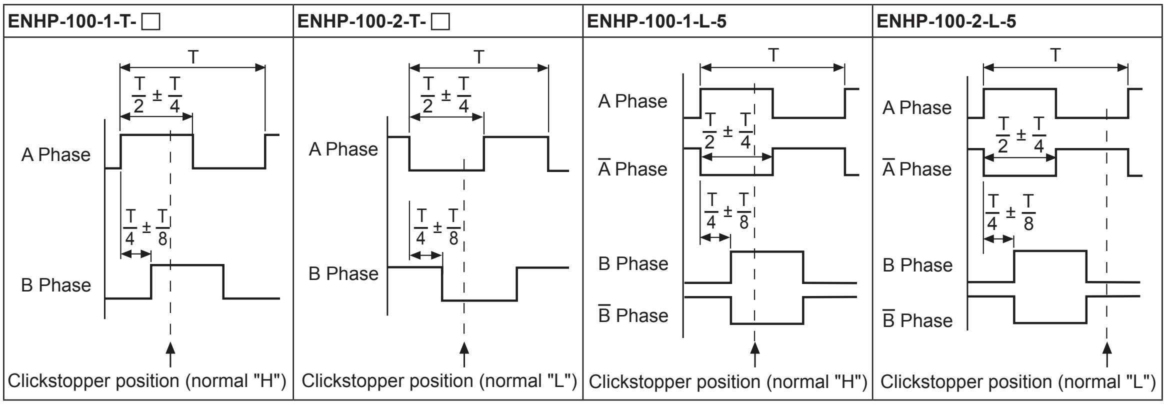
※The output circuits of A, B phase (line driver output A, Ā, B, B̄ phase) are same.
※Totem pole output type can be used for NPN open collector output type (**※1**) or voltage output type (**※2**).

■ Dimensions

(unit: mm)

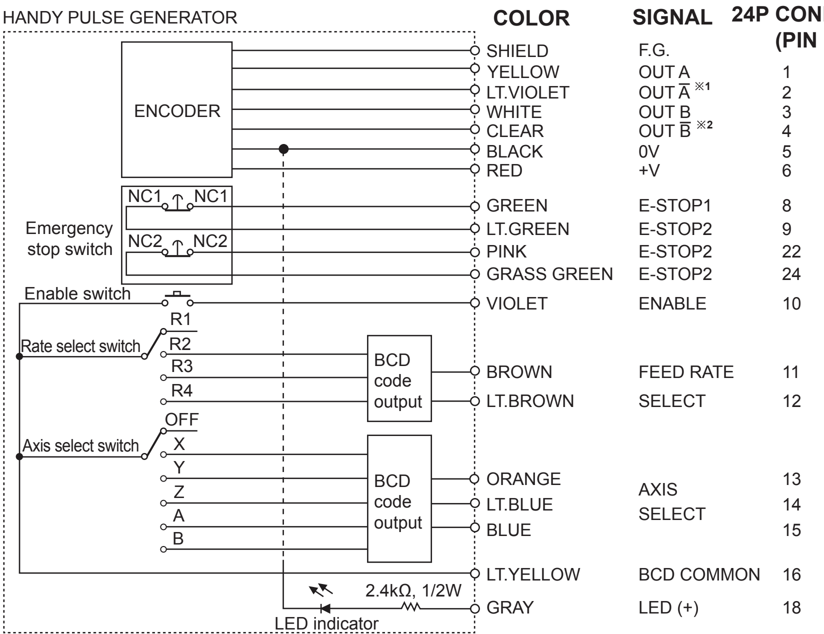


■ Output Waveform



※Clickstopper position Normal "H" or Normal "L": It shows the waveform when the handles is stopped.
※Encoder revolution direction: It is clockwise (CW) from the dial.

■ Connections



● AXIS SELECT

Axis	BCD code output		
	Pin No.15	Pin No.14	Pin No.13
OFF	0	0	0
X axis	0	0	1
Y axis	0	1	0
Z axis	0	1	1
A axis	1	0	0
B axis	1	0	1

● RATE SELECT

Rate	BCD code output	
	Pin No.12	Pin No.11
R1	0	0
R2	0	1
R3	1	0
R4	1	1

※1: Totem pole output does not have Ā, B̄ output signal.
※COMMON terminal (pin no. 16) of Axis select switch and Rate select switch are common.

EP50S Series

Shaft Type Ø50mm Absolute Rotary Encoder

■ Features

- Compact size of external diameter: Ø50mm
- Various output code: BCD, Binary, Gray code
- Various and high resolution (720, 1024-division)
- Protection structure IP64 (dust-proof, oil-proof)

■ Applications

- Precision machine tool, Fabric machinery, Robot, Parking system

⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Ordering Information

EP50S | 8 – 1024 – 1 | R – P – 24

Series	Shaft diameter	Steps/revolution	Output code	Revolution direction	Control output	Power supply
EP50S	8	1024	1	R	P	24
Ø50mm shaft type	Ø8mm	Refer to resolution	1: BCD code 2: Binary code 3: Gray code	F: Output value increase at CW direction R: Output value increase at CCW direction	P: PNP open collector output N: NPN open collector output	5 : 5VDC ±5% 24: 12-24VDC ±5%

■ Specifications

Item	Shaft Type Ø50mm Absolute Rotary Encoder
Resolution	6, 8, 10, 12, 16, 20, 24, 32, 40, 45, 48, 64, 90, 128, 180, 256, 360, 512, 720, 1024-division

Electrical specification — Output code / Output phase / Output angle※1

Output phase / Output angle※1	BCD code	Binary code	Gray code
1024-division	TS: 0.3515°±15' (13-bit)	TS: 0.3515°±15' (10-bit)	TS: 0.703°±15' (10-bit)
720-division	TS: 0.5°±25' (11-bit)	TS: 0.5°±25' (10-bit)	TS: 1°±25' (10-bit)
512-division	TS: 0.703°±15' (11-bit)	TS: 0.703°±15' (9-bit)	TS: 1.406°±15' (9-bit)
360-division	TS: 1°±25' (10-bit)	TS: 1°±25' (9-bit)	TS: 2°±25' (9-bit)
256-division	TS: 1.406°±15' (10-bit)	TS: 1.406°±15' (8-bit)	TS: 2.8125°±15' (8-bit)
180-division	TS: 2°±25' (9-bit)	TS: 2°±25' (8-bit)	TS: 4°±25' (8-bit)
128-division	TS: 2.8125°±15' (9-bit)	TS: 2.8125°±15' (7-bit)	TS: 5.625°±15' (7-bit)
90-division	TS: 4°±25' (8-bit)	TS: 4°±25' (7-bit)	TS: 8°±25' (7-bit)
64-division	TS: 5.625°±15' (7-bit)	TS: 5.625°±15' (6-bit)	TS: 11.25°±15' (6-bit)
48-division	TS: 7.5°±25' (7-bit)	TS: 7.5°±25' (6-bit)	TS: 15°±25' (6-bit)
45-division	TS: 8°±25' (7-bit)	TS: 8°±25' (6-bit)	TS: 16°±25' (6-bit)
40-division	TP1: 5°±60' (1-bit) TP2: 2°±60' (1-bit) TS: 9°±60' (6-bit) EP: 9°±60' (1-bit)	TP1: 5°±60' (1-bit) TP2: 2°±60' (1-bit) TS: 9°±60' (6-bit) EP: 9°±60' (1-bit)	TP1: 5°±60' (1-bit) TP2: 2°±60' (1-bit) TS: 18°±60' (6-bit) EP: 9°±60' (1-bit)
32-division	TP1: 7°±60' (1-bit) TP2: 2°±60' (1-bit) TS: 11.25°±60' (6-bit) EP: 11.25°±60' (1-bit)	TP1: 7°±60' (1-bit) TP2: 2°±60' (1-bit) TS: 11.25°±60' (5-bit) EP: 11.25°±60' (1-bit)	TP1: 7°±60' (1-bit) TP2: 2°±60' (1-bit) TS: 22.5°±60' (5-bit) EP: 11.25°±60' (1-bit)
24-division	TP1: 8°±60' (1-bit) TP2: 3°±60' (1-bit) TS: 15°±60' (6-bit) EP: 15°±60' (1-bit)	TP1: 8°±60' (1-bit) TP2: 3°±60' (1-bit) TS: 15°±60' (5-bit) EP: 15°±60' (1-bit)	TP1: 8°±60' (1-bit) TP2: 3°±60' (1-bit) TS: 30°±60' (5-bit) EP: 15°±60' (1-bit)

Output phase / Output angle※1	BCD code	Binary code	Gray code
20-division	TP1: 12°±60' (1-bit) TP2: 2°±60' (1-bit) TS: 18°±60' (5-bit) EP: 18°±60' (1-bit)	TP1: 12°±60' (1-bit) TP2: 2°±60' (1-bit) TS: 18°±60' (5-bit) EP: 18°±60' (1-bit)	TP1: 12°±60' (1-bit) TP2: 2°±60' (1-bit) TS: 36°±60' (5-bit) EP: 18°±60' (1-bit)
16-division	TP1: 15°±60' (1-bit) TP2: 2°±60' (1-bit) TS: 22.5°±60' (5-bit) EP: 22.5°±60' (1-bit)	TP1: 15°±60' (1-bit) TP2: 2°±60' (1-bit) TS: 22.5°±60' (4-bit) EP: 22.5°±60' (1-bit)	TP1: 15°±60' (1-bit) TP2: 2°±60' (1-bit) TS: 45°±60' (4-bit) EP: 22.5°±60' (1-bit)
12-division		TP1: 15°±60' (1-bit) TP2: 3°±60' (1-bit) TS: 30°±60' (4-bit) EP: 30°±60' (1-bit)	TP1: 15°±60' (1-bit) TP2: 3°±60' (1-bit) TS: 60°±60' (4-bit) EP: 30°±60' (1-bit)
10-division	TP1: 30°±60' (1-bit) TP2: 12°±60' (1-bit) TS: 36°±60' (4-bit) EP: 36°±60' (1-bit)	TP1: 30°±60' (1-bit) TP2: 12°±60' (1-bit) TS: 36°±60' (4-bit) EP: 36°±60' (1-bit)	TP1: 30°±60' (1-bit) TP2: 12°±60' (1-bit) TS: 72°±60' (4-bit) EP: 36°±60' (1-bit)
8-division	TP1: 39°±60' (1-bit) TP2: 15°±60' (1-bit) TS: 45°±60' (3-bit) EP: 45°±60' (1-bit)	TP1: 39°±60' (1-bit) TP2: 15°±60' (1-bit) TS: 45°±60' (3-bit) EP: 45°±60' (1-bit)	TP1: 39°±60' (1-bit) TP2: 15°±60' (1-bit) TS: 90°±60' (3-bit) EP: 45°±60' (1-bit)
6-division	TP1: 53°±60' (1-bit) TP2: 15°±60' (1-bit) TS: 60°±60' (3-bit) EP: 60°±60' (1-bit)	TP1: 53°±60' (1-bit) TP2: 15°±60' (1-bit) TS: 60°±60' (3-bit) EP: 60°±60' (1-bit)	TP1: 53°±60' (1-bit) TP2: 15°±60' (1-bit) TS: 120°±60' (3-bit) EP: 60°±60' (1-bit)

Item		Specification
Control output	PNP open collector output	Output voltage: Min. (power supply-1.5)VDC, Load current: Max. 32mA
	NPN open collector output	Load current: Max. 32mA, Residual voltage: Max. 1VDC
Response time (rise/fall)		Ton=800nsec, Toff=Max. 800nsec (cable length: 2m, I sink = 32mA)
Max. response frequency		35kHz
Power supply		• 5VDC ±5% (ripple P-P: max. 5%) • 12-24VDC ±5% (ripple P-P: max. 5%)
Current consumption		Max. 100mA (disconnection of the load)
Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
Connection		Axial cable type (cable gland)

※1: TS=Signal Pulse, TP=Timing Pulse, EP=Even Parity

■ Specifications

Item		Shaft Type Ø50mm Absolute Rotary Encoder
Mechanical specification	Starting torque	Max. 40gf·cm (0.004N·m)
	Moment of inertia	Max. 40g·cm² (4×10^{-6}kg·m²)
	Shaft loading	Radial: 10kgf, Thrust: 2.5kgf
	Max. allowable revolution※2	3,000rpm
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock		Approx. max. 50G
Environ-ment	Ambient temperature	-10 to 70℃, storage: -25 to 85℃
	Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure		IP64 (IEC standard)
Cable		Ø7mm, 15-wire, 2m, Shield cable (AWG28, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø0.8mm)
Accessory		Fixing bracket, Coupling
Approval		CE
Unit weight		Approx. 380g

※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

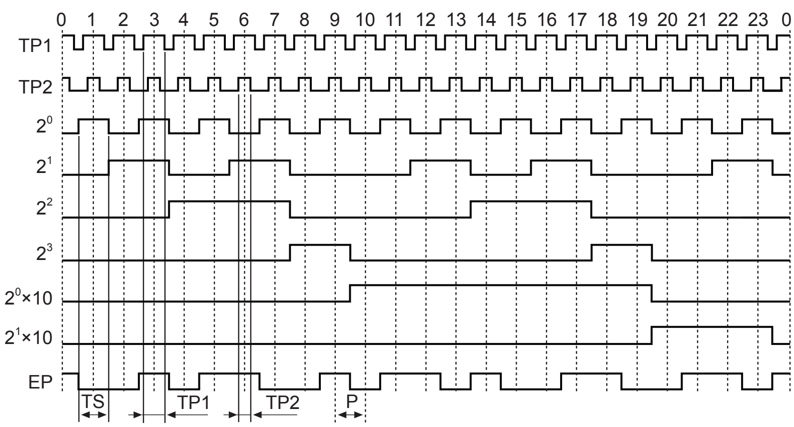
$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60\ \text{sec}]$$

※Environment resistance is rated at no freezing or condensation.

■ Output Waveform

● 24-division (BCD code output)

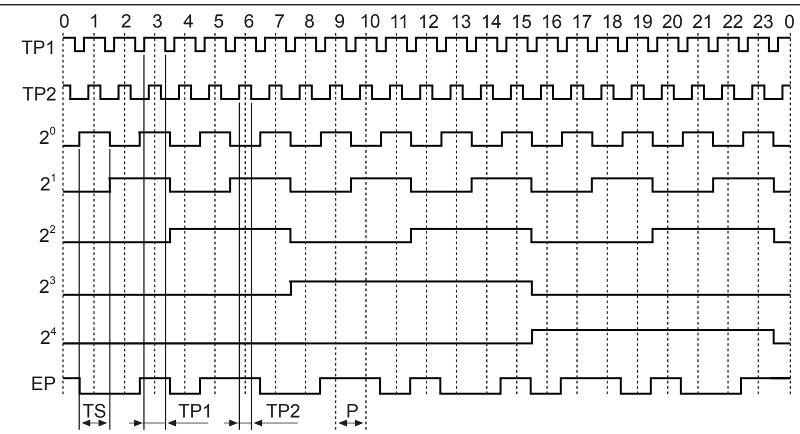
Model	**EP50S8-24-1□-□-□**



※TP1=8°±60', TP2=3°±60', TS=15°±60', P=15°±60'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)

● 24-division (Binary code output)

Model	**EP50S8-24-2□-□-□**

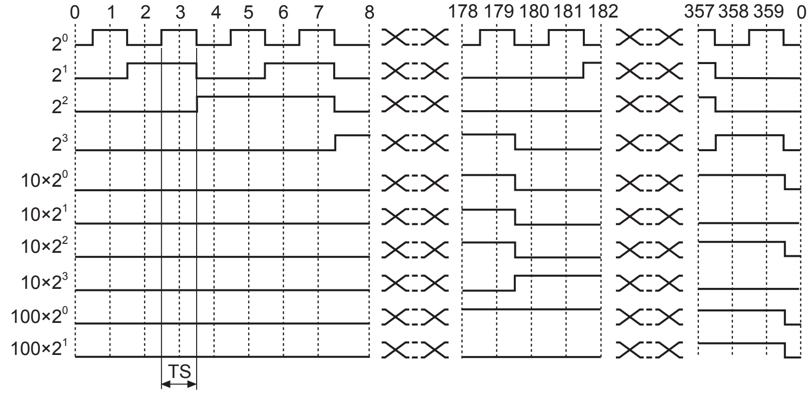


※TP1=8°±60', TP2=3°±60', TS=15°±60', P=15°±60'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)

▣ Output Waveform

● 360-division (BCD code output)

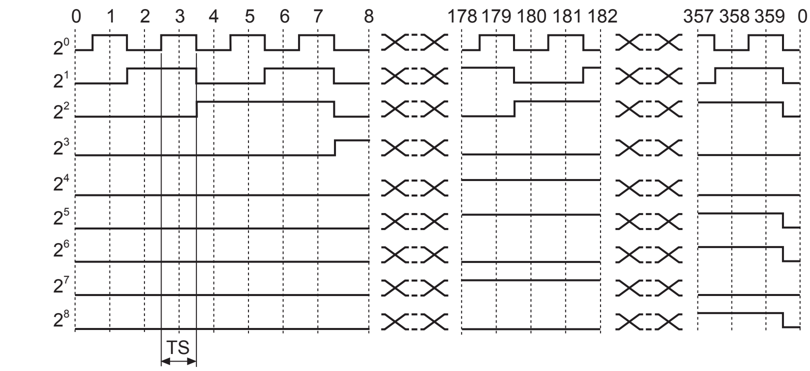
Model	EP50S8-360-1□-P-□



※TS=1°±25'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

● 360-division (Binary code output)

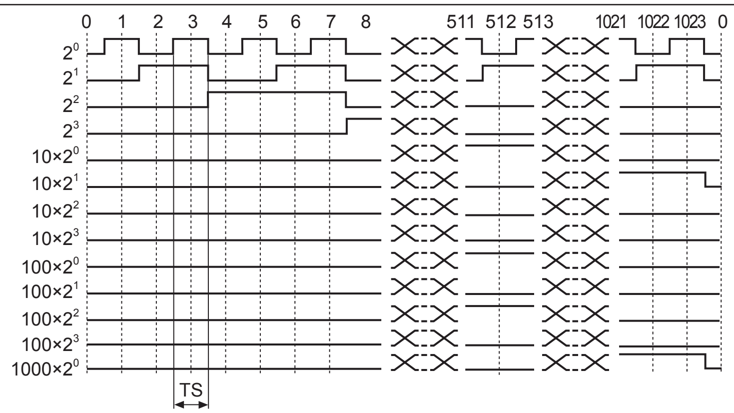
Model	EP50S8-360-2□-P-□



※TS=1°±25'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

● 1024-division (BCD code output)

Model	EP50S8-1024-1□-□-□

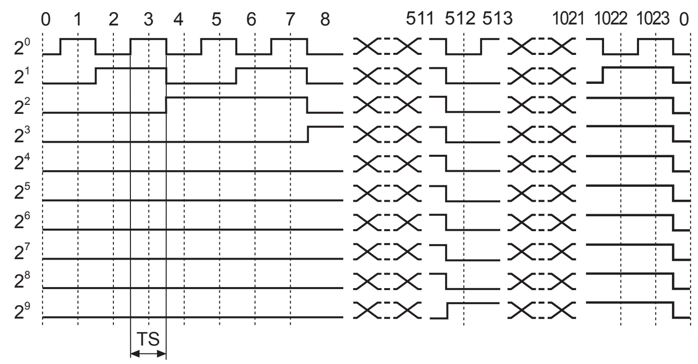


※TS=0.3515°±15'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

■ Output Waveform

● 1024-division (Binary code output)

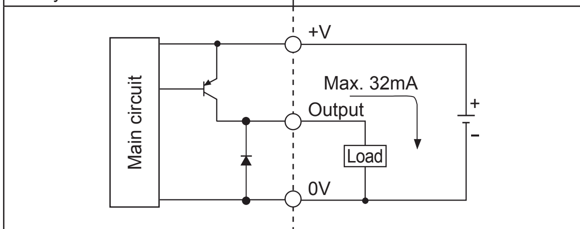
Model	EP50S8-1024-2□-P-□

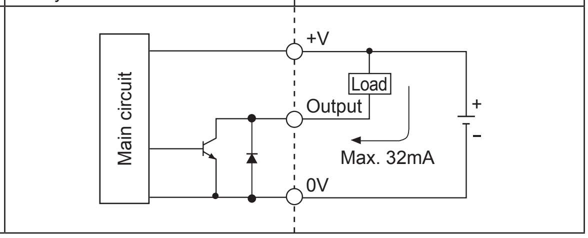


※TS=0.3515°±15'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

■ Control Output Diagram

PNP open collector output		NPN open collector output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection





※Output circuits of all phases are same.

■ Connections

● BCD Code

	Color \ Resolution	6-division	8-division	10-division	12-division	16-division	20-division	24-division	32-division	40-division	45-division	48-division	64-division	90-division	128-division	180-division	256-division	360-division	512-division	720-division	1024-division
Power	White	+V																			
	Boack	0V																			
Output wire	Brown	2^0																			
	Red	2^1																			
	Orange	2^2																			
	Yellow	N·C		2^3																	
	Blue	N·C			2^0×10																
	Purple	N·C						2^1×10													
	Gray	N·C									2^2×10										
	White/Brown	TP1									N·C			2^3×10							
	White/Red	TP2									N·C				2^0×10						
	White/Orange	EP									N·C						2^1×100				
	White/Yellow	N·C																	2^2×100		
	White/Blue	N·C																			2^3×100
	White/Purple	N·C																			2^0×1000
	Shield wire	F.G.																			

※Unused wires must be insulated.
※Encoder case and shield wire must be grounded (F.G.).
※N·C: Not Connected.
※Each output cable must not be short-circuited, because Driver IC is used in output circuit.

■ Connections

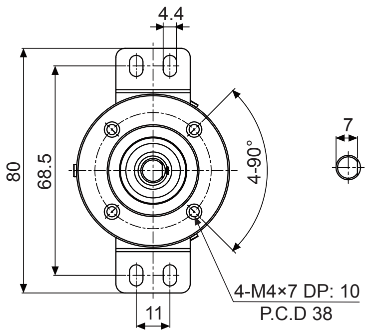
● Binary code/Gray code

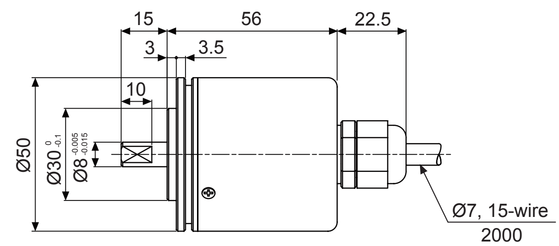
Resolution / Color		6-division	8-division	10-division	12-division	16-division	20-division	24-division	32-division	40-division	45-division	48-division	64-division	90-division	128-division	180-division	256-division	360-division	512-division	720-division	1024-division
Power	White	+V																			
	Black	0V																			
Output wire	Brown	2^0																			
	Red	2^1																			
	Orange	2^2																			
	Yellow	N·C		2^3																	
	Blue	N·C					2^4														
	Purple	N·C								2^5											
	Gray	N·C												2^6							
	White/Brown	TP1									N·C					2^7					
	White/Red	TP2									N·C							2^8			
	White/Orange	EP									N·C									2^9	
	Shield wire	F.G.																			

※Unused wires must be insulated.
※Encoder metal case and shield wire must be grounded (F.G.).
※N·C: Not Connected.
※Each output cable must not be short-circuited, because Driver IC is used in output circuit.

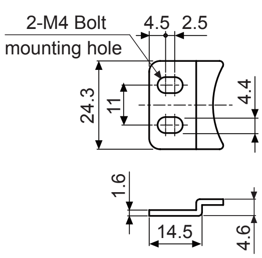
■ Dimensions

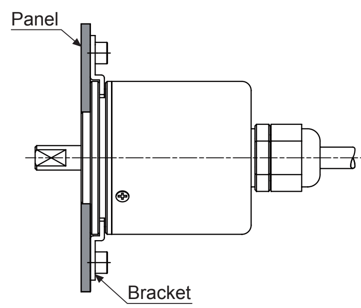
(unit: mm)



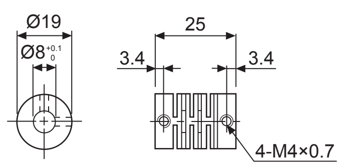


● Bracket





● Coupling (EP50S)



- Parallel misalignment: Max. 0.25mm
- Angular misalignment: Max. 5°
- End-play: Max. 0.5mm

※For parallel misalignment, angular misalignment, end-play terms, refer to page F-87.
※For flexible coupling (ERB series) information, refer to page F-80.

Shaft Type Ø50mm Absolute Rotary Encoder

■ Features

- Light as plastic structure
- Power supply: 5VDC, 12-24VDC ±5%
- Shift gray code output

■ Applications

- Precision machine tool, Fabric machinery, Robot, Parking system

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

EP50S | 6 | P – 360 – 3 | F – N – 24

Series	Shaft diameter	Outer meterial	Steps/revolution	Output code	Revolution direction	Control output	Power supply
Ø50mm shaft type	6: Ø6mm 8: Ø8mm	Plastic	180, 360	3: Shift gray code	F: Output value increases at CW direction R: Output value increase at CCW direction	N: NPN open collector output	5: 5VDC ±5% 24: 12-24VDC ±5%

■ Specifications

Item		Shaft Type Ø50mm Absolute Rotary Encoder
Resolution		180, 360-division
Electrical specification	Output code	Gray code (shift gray code)
	Output phase / Output angle	TS: Signal Pulse (9-bit), TS: 2°±25'
	Control output	NPN open collector output - Load current: Max. 15mA, Residual voltage: Max. 1VDC
	Response time (rise/fall)	Ton=Max. 1µs, Toff=Max. 1µs (cable length: 2m, I sink = 15mA)
	Max. response frequency	20kHz
	Power supply	• 5VDC ±5% (ripple P-P: max. 5%) • 12-24VDC ±5% (ripple P-P: max. 5%)
	Current consumption	Max. 80mA (disconnection of the load)
	Connection	Axial cable type (cable gland)
Mechanical specification	Starting torque	Max. 40gf·cm (0.004N·m)
	Moment of inertia	Max. 50g·cm² (5×10⁻⁶kg·m²)
	Shaft loading	Radial: 2kgf, Thrust: 1kgf
	Max. allowable revolution※1	3,000rpm
Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock		Approx. max. 50G
Environment	Ambient temperature	-10 to 55℃, storage: -25 to 85℃
	Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure		IP50 (IEC standard)
Cable		Ø6mm, 12-wire, 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory		Fixing bracket, Coupling
Weight※2		Approx. 308g (approx. 280g)

※1: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

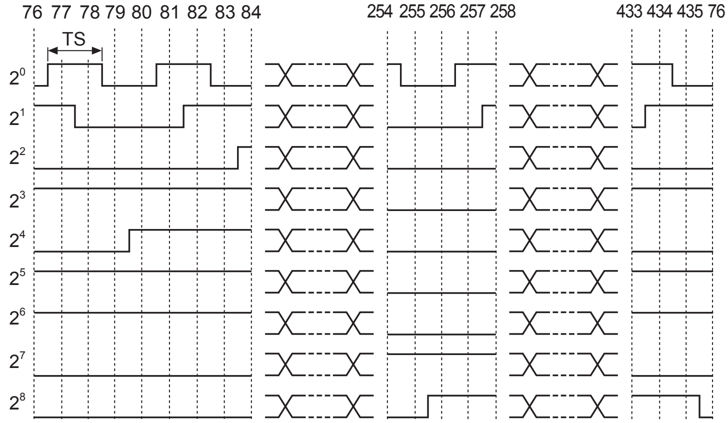
$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Output Waveform

● 360-division (shift gray code output)

Model	EP50S□P-360-3F-N

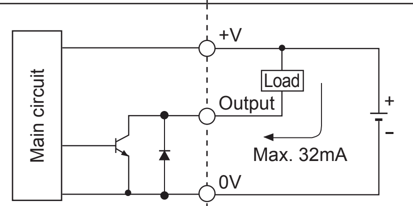


※TS=2°±25'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

■ Control Output Diagram

NPN open collector output

Rotary encoder circuit	Load connection



※Be sure that if overload or short-circuit to output terminal, output circuit is damaged.

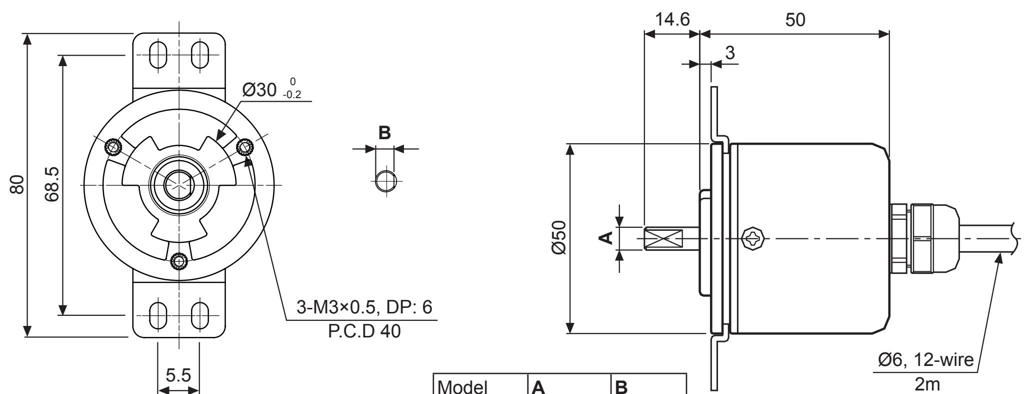
■ Connections

● Shift gray code

	Color \ Resolution	360-division
Power	White	+V (5VDC, 12-24VDC)
	Boack	0V (GND)
Output wire	Brown	2^0
	Red	2^1
	Orange	2^2
	Yellow	2^3
	Blue	2^4
	Purple	2^5
	Gray	2^6
	White/Brown	2^7
	White/Red	2^8
	White/Orange	N·C
	Shield wire	F.G.

■ Dimensions

(unit: mm)

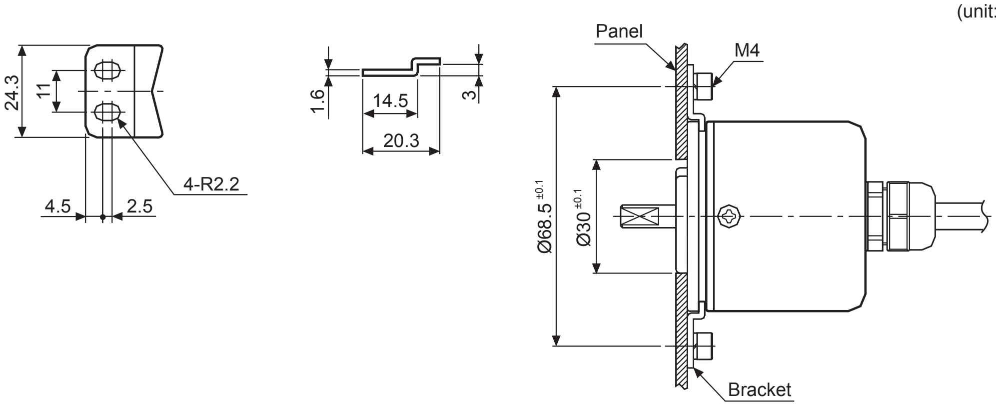


Model	A	B
E50S6P	Ø6 $^{-0.013}_{-0.007}$	5
E50S8P	Ø8 $^{-0.015}_{-0.01}$	7

■ Dimensions

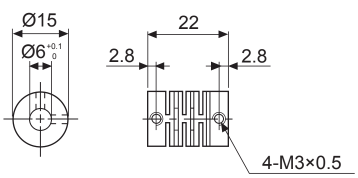
● Bracket

(unit: mm)

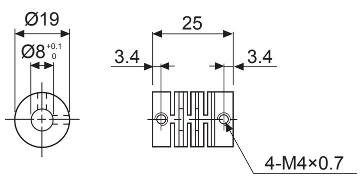


● Coupling

● Ø6mm coupling



● Ø8mm coupling



- Parallel misalignment: Max. 0.25mm
- Angular misalignment: Max. 5°
- End-play: Max. 0.5mm

※For parallel misalignment, angular misalignment, end-play terms, refer to page F-87.
※For flexible coupling (ERB series) information, refer to page F-80.

Shaft type Ø50mm Magnetic Absolute Rotary Encoder

NEW

■ Features

- **Higher resistant to vibration and impact by magnetic elements than optical encoder**
- Various output code: BCD, Binary, Gray code
- Various and high resolution (32, 40, 45, 48, 64, 90, 128, 180, 256, 360, 512, 720, 1024-division)
- Power supply: 5VDC ±5%, 12-24VDC ±5%
- Protection structure IP50 (IEC standard)

⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Ordering Information

MGA50S | 8 — 1024 — 1 | R — N — 5

Series	Shaft diameter	Steps/revolution	Output code	Revolution direction	Control output	Power supply
MGA50S	8	1024	1	R	N	5
Ø50mm shaft type	Ø8mm	Refer to resolution	1: BCD code 2: Binary code 3: Gray code	F: Output value increase at CW direction R: Output value increase at CCW direction	N: NPN open collector output	5: 5VDC ±5% 24: 12-24VDC ±5%

■ Specifications

Type			**Shaft Type Ø50mm Magnetic Absolute Rotary Encoder**			
Model			MGA50S8-□-□□-N-□			
Resolution			32, 40, 45, 48, 64, 90, 128, 180, 256, 360, 512, 720, 1024-division			
Electrical specification	Output	Hysteresis	±0.1°			
		Positioning error※1	±1-bit (LSB: Least Significant Bit)			
		Output code		BCD code	Binary code	Gray code
		Output phase/ Output angle※2	1024-division	TS: 0.3515°±15' (13-bit)	TS: 0.3515°±15' (10-bit)	TS: 0.703°±15' (10-bit)
			720-division	TS: 0.5°±25' (11-bit)	TS: 0.5°±25' (10-bit)	TS: 1°±25' (10-bit)
			512-division	TS: 0.703°±25' (11-bit)	TS: 0.703°±25' (9-bit)	TS: 1.406°±25' (9-bit)
			360-division	TS: 1°±25' (10-bit)	TS: 1°±25' (9-bit)	TS: 2°±25' (9-bit)
			256-division	TS: 1.406°±25' (10-bit)	TS: 1.406°±25' (8-bit)	TS: 2.8125°±25' (8-bit)
			180-division	TS: 2°±25' (9-bit)	TS: 2°±25' (8-bit)	TS: 4°±25' (8-bit)
			128-division	TS: 2.8125°±25' (9-bit)	TS: 2.8125°±25' (7-bit)	TS: 5.625°±25' (7-bit)
			90-division	TS: 4°±25' (8-bit)	TS: 4°±25' (7-bit)	TS: 8°±25' (7-bit)
			64-division	TP1: 4.5°±60' (1-bit) TP2: 1.125°±60' (1-bit) TS: 5.625°±60' (7-bit) EP: 5.625°±60' (1-bit)	TP1: 4.5°±60' (1-bit) TP2: 1.125°±60' (1-bit) TS: 5.625°±60' (6-bit) EP: 5.625°±60' (1-bit)	TP1: 4.5°±60' (1-bit) TP2: 1.125°±60' (1-bit) TS: 11.25°±60' (6-bit) EP: 5.625°±60' (1-bit)
			48-division	TP1: 6°±60' (1-bit) TP2: 1.5°±60' (1-bit) TS: 7.5°±60' (7-bit) EP: 7.5°±60' (1-bit)	TP1: 6°±60' (1-bit) TP2: 1.5°±60' (1-bit) TS: 7.5°±60' (6-bit) EP: 7.5°±60' (1-bit)	TP1: 6°±60' (1-bit) TP2: 15°±60' (1-bit) TS: 1.5°±60' (6-bit) EP: 7.5°±60' (1-bit)
			45-division	TP1: 6.4°±60' (1-bit) TP2: 1.6°±60' (1-bit) TS: 8°±60' (7-bit) EP: 8°±60' (1-bit)	TP1: 6.4°±60' (1-bit) TP2: 1.6°±60' (1-bit) TS: 8°±60' (6-bit) EP: 8°±60' (1-bit)	TP1: 6.4°±60' (1-bit) TP2: 1.6°±60' (1-bit) TS: 16°±60' (6-bit) EP: 8°±60' (1-bit)
			40-division	TP1: 7.2°±60' (1-bit) TP2: 1.8°±60' (1-bit) TS: 9°±60' (6-bit) EP: 9°±60' (1-bit)	TP1: 7.2°±60' (1-bit) TP2: 1.8°±60' (1-bit) TS: 9°±60' (6-bit) EP: 9°±60' (1-bit)	TP1: 7.2°±60' (1-bit) TP2: 1.8°±60' (1-bit) TS: 18°±60' (6-bit) EP: 9°±60' (1-bit)
			32-division	TP1: 9°±60' (1-bit) TP2: 2.25°±60' (1-bit) TS: 11.25°±60' (6-bit) EP: 11.25°±60' (1-bit)	TP1: 9°±60' (1-bit) TP2: 2.25°±60' (1-bit) TS: 11.25°±60' (5-bit) EP: 11.25°±60' (1-bit)	TP1: 9°±60' (1-bit) TP2: 2.25°±60' (1-bit) TS: 22.5°±60' (5-bit) EP: 11.25°±60' (1-bit)

※1: When turning ON/OFF the unit, there may be ±1-bit (LSB) error at present position by hysteresis.
※2: TP1, TP2 other output angles are available as option.

■ Specifications

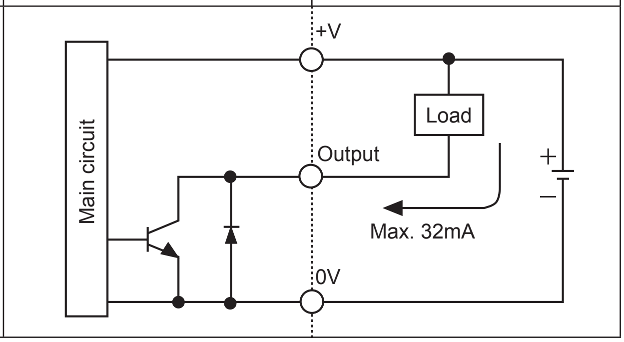
Electrical specification	Output	Output type	NPN open collector output
		Output capacity	Load current max. 32mA, Residual voltage max. 1VDC
		Output logic	Negative logic output
		Response time (rise/fall)	Max. 1µs (cable length: 2m, I sink=32mA)
	Max. response frequency		30kHz
	Power supply		5VDC±5% (ripple P-P: max. 5%), 12-24VDC±5% (ripple P-P: max. 5%)
	Current consumption		Max. 60mA (disconnection of load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 min (between all terminals and case)
	Connection		Axial cable type (cable gland)
Mechanical specification	Starting torque		Max. 70gf·cm (0.007N·m)
	Moment of inertia		Max. 80g·cm^2 (8×10^{-6}kg·m^2)
	Shaft loading		Radial: 10kgf, Thrust: 2.5kgf
	Max. allowable revolution※3		3,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environ-ment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø6mm, 17-wire, 2m, Shield cable (AWG 28, core diameter: 0.08mm, number of cores: 17, insulator diameter: Ø0.8mm)
Accessory			Bracket, Coupling
Approval			CE
Weight※4			Approx. 400g (approx. 270g)

※3: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

【Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec】

※4: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Control Output Circuit

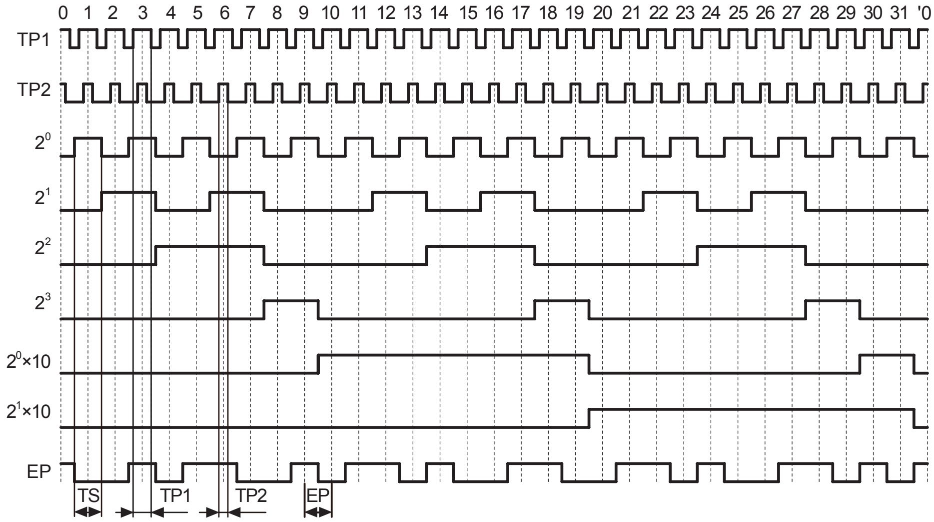
Output type	NPN open collector output	
Type	Rotary encoder	Load connection
Output circuit		

※The output of each bit is same circuit.
※Be sure that when applying excessive load or being short, the circuit may be damaged.

▣ Output Waveform

● 32-division Output Waveform (BCD code output)

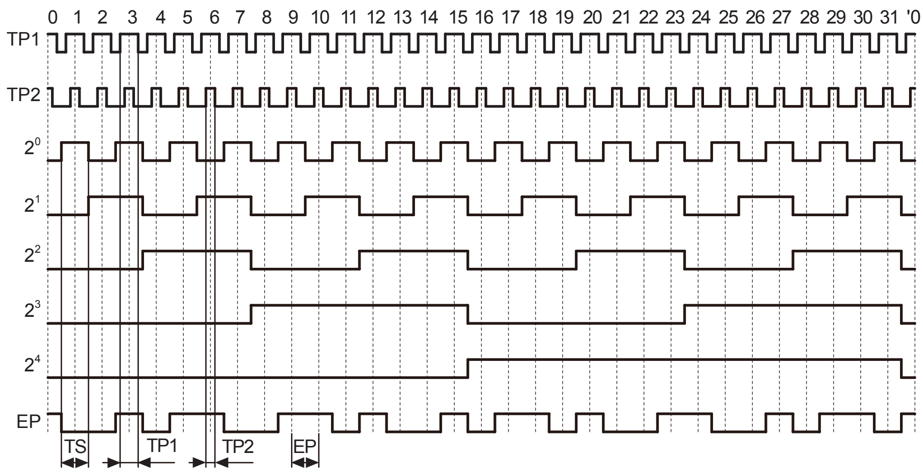
Model	MGA50S8-32-1□-N-□



※TP1=9°±60', TP2=2.25°±60', TS=11.25°±60', EP=11.25°±60'
※The above waveform is based on the positive logic. (the output waveform of negative logic is opposed.)

● 32-division Output Waveform (Binary code output)

Model	MGA50S8-32-2□-N-□

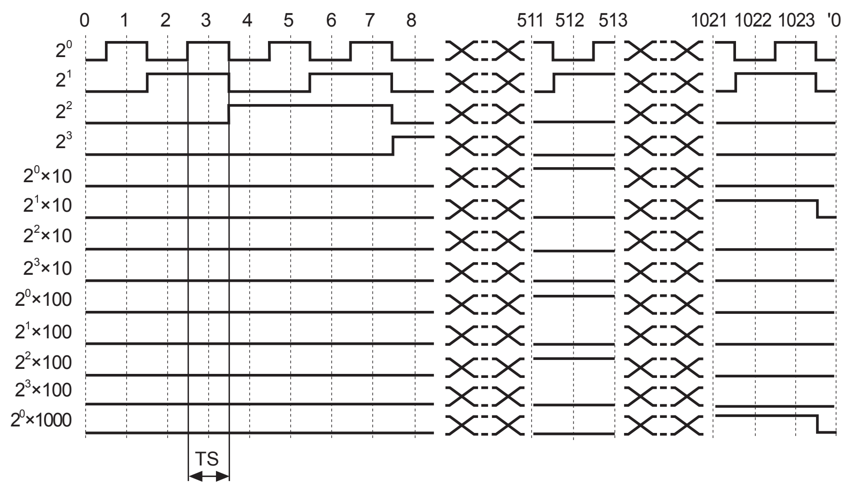


※TP1=9°±60', TP2=2.25°±60', TS=11.25°±60', EP=11.25°±60'
※The above waveform is based on the positive logic. (the output waveform of negative logic is opposed.)

▣ Output Waveform

● 1024-division Output Waveform (BCD code output)

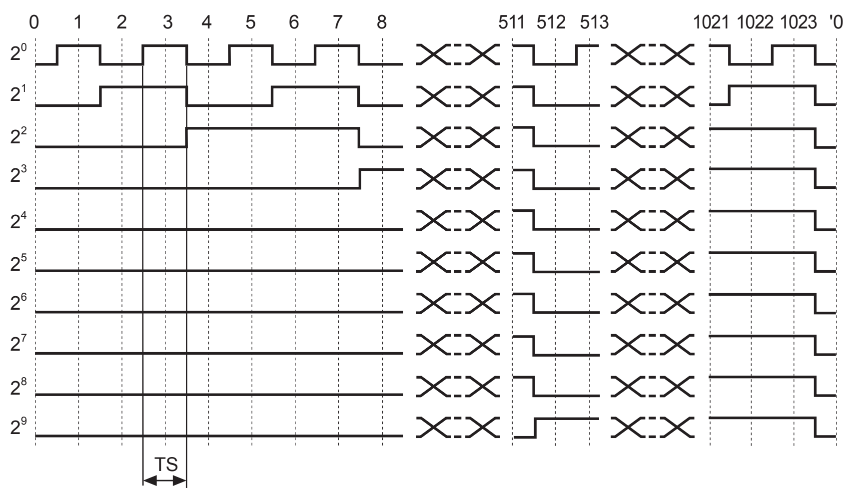
Model	MGA50S8-1024-1□-N-□



※TS=0.3515°±15'
※The above waveform is based on the positive logic. (the output waveform of negative logic is opposed.)

● 1024-division Output Waveform (Binary code output)

Model	MGA50S8-1024-2□-N-□



※TS=0.3515°±15'
※The above waveform is based on the positive logic. (the output waveform of negative logic is opposed.)

■ Connection

● BCD code

<table>
<tr><th colspan="2">Resolution
Color</th><th>32
-division</th><th>40
-division</th><th>45
-division</th><th>48
-division</th><th>64
-division</th><th>90
-division</th><th>128
-division</th><th>180
-division</th><th>256
-division</th><th>360
-division</th><th>512
-division</th><th>720
-division</th><th>1024
-division</th></tr>
<tr><td rowspan="2">Power</td><td>White</td><td colspan="13">+V</td></tr>
<tr><td>Black</td><td colspan="13">0V</td></tr>
<tr><td rowspan="16">Output cable</td><td>Brown</td><td colspan="13">2^0</td></tr>
<tr><td>Red</td><td colspan="13">2^1</td></tr>
<tr><td>Orange</td><td colspan="13">2^2</td></tr>
<tr><td>Yellow</td><td colspan="13">2^3</td></tr>
<tr><td>Green</td><td colspan="13">$2^0 \times 10$</td></tr>
<tr><td>Blue</td><td colspan="13">$2^1 \times 10$</td></tr>
<tr><td>Purple</td><td colspan="2">N·C</td><td colspan="11">$2^2 \times 10$</td></tr>
<tr><td>Gray</td><td colspan="5">TP1</td><td colspan="8">$2^3 \times 10$</td></tr>
<tr><td>Pink</td><td colspan="5">TP2</td><td>N·C</td><td colspan="7">$2^0 \times 100$</td></tr>
<tr><td>Transparent</td><td colspan="5">EP</td><td colspan="3">N·C</td><td colspan="5">$2^1 \times 100$</td></tr>
<tr><td>Light Brown</td><td colspan="10">N·C</td><td colspan="3">$2^2 \times 100$</td></tr>
<tr><td>Light Yellow</td><td colspan="12">N·C</td><td>$2^3 \times 100$</td></tr>
<tr><td>Light Green</td><td colspan="12">N·C</td><td>$2^0 \times 1000$</td></tr>
<tr><td>Light Blue</td><td colspan="13">N·C</td></tr>
<tr><td>Light Purple</td><td colspan="13">N·C</td></tr>
<tr><td>Shield cable</td><td colspan="13">Signal shield cable (F.G.)</td></tr>
</table>

● Binary Code/Gray code

<table>
<tr><th colspan="2">Resolution
Color</th><th>32
-division</th><th>40
-division</th><th>45
-division</th><th>48
-division</th><th>64
-division</th><th>90
-division</th><th>128
-division</th><th>180
-division</th><th>256
-division</th><th>360
-division</th><th>512
-division</th><th>720
-division</th><th>1024
-division</th></tr>
<tr><td rowspan="2">Power</td><td>White</td><td colspan="13">+V</td></tr>
<tr><td>Black</td><td colspan="13">0V</td></tr>
<tr><td rowspan="16">Output cable</td><td>Brown</td><td colspan="13">2^0</td></tr>
<tr><td>Red</td><td colspan="13">2^1</td></tr>
<tr><td>Orange</td><td colspan="13">2^2</td></tr>
<tr><td>Yellow</td><td colspan="13">2^3</td></tr>
<tr><td>Green</td><td colspan="13">2^4</td></tr>
<tr><td>Blue</td><td>N·C</td><td colspan="12">2^5</td></tr>
<tr><td>Purple</td><td colspan="5">N·C</td><td colspan="8">2^6</td></tr>
<tr><td>Gray</td><td colspan="5">TP1</td><td colspan="2">N·C</td><td colspan="6">2^7</td></tr>
<tr><td>Pink</td><td colspan="5">TP2</td><td colspan="4">N·C</td><td colspan="4">2^8</td></tr>
<tr><td>Transparent</td><td colspan="5">EP</td><td colspan="6">N·C</td><td colspan="2">2^9</td></tr>
<tr><td>Light Brown</td><td colspan="13">N·C</td></tr>
<tr><td>Light Yellow</td><td colspan="13">N·C</td></tr>
<tr><td>Light Green</td><td colspan="13">N·C</td></tr>
<tr><td>Light Blue</td><td colspan="13">N·C</td></tr>
<tr><td>Light Purple</td><td colspan="13">N·C</td></tr>
<tr><td>Shield cable</td><td colspan="13">Signal shield cable (F.G.)</td></tr>
</table>

※Non-using wires must be insulated.

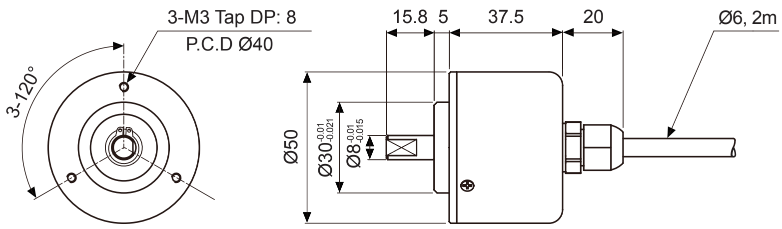
※Encoder case and shield cable must be grounded.

※N·C (not connected): Not using.

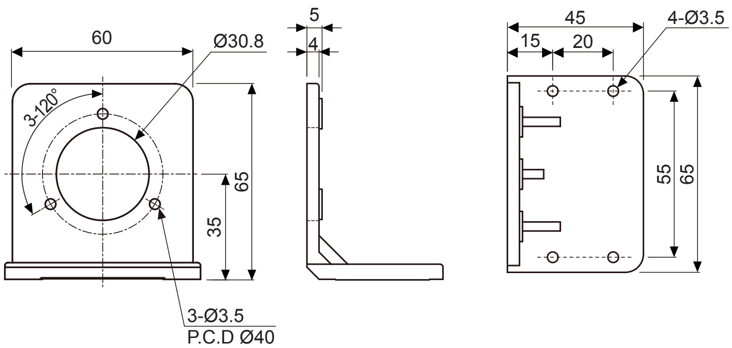
※Please make sure not to short when wiring output cables because the dedicated driver IC is used at output circuit.

■ Dimensions

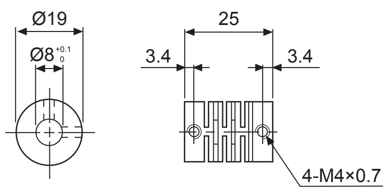
(unit: mm)



- **Bracket**



- **Coupling (MGA50S)**



- Parallel misalignment: Max. 0.25mm
- Angular misalignment: Max. 5°
- End-play: Max. 0.5mm

※When mounting the coupling to the encoder shaft, if there is combined misalignment (parallel, angular misalignment) between rotating encoder shaft and mate shaft, it may cause encoder and coupling's life cycle to shorten.
※Do not load overweight on the shaft.
※For parallel misalignment, angular misalignment, end-play terms, refer to page F-87.
※For flexible coupling (ERB series) information, refer to page F-80.

EP58 Series

Shaft Type/Blind Hollow Shaft Type Ø58mm Absolute Rotary Encoder

■ Features

● Ø58mm flange type
● Applicable to various mounting environments
● Various output code: BCD, Binary, Gray code (customizable)
● Various and high resolution (720, 1024-division)

■ Applications

● Precision machine tool, Fabric machinery, Robot, Parking system

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ Ordering Information

EP58SC | **10** – **1024** – **1** | **R** – **P** – **24**

Series Ø58mm	Shaft diameter			Steps/revolution	Output code	Rotating direction	Control output	Power supply
SC: Shaft clamping	External	10	Ø10mm	Refer to resolution	1: BCD code 2: Binary code 3: Gray code	F: Output value increases at CW direction R: Output value increases at CCW direction	P: PNP open collector output N: NPN open collector output	5: 5VDC ±5% 24: 12-24VDC ±5%
SS: Shaft synchro		6	Ø6mm					
HB: Blind hollow shaft	Inner	8	Ø8mm					

■ Specifications

Type		Shaft Type/Blind Hollow Shaft Type Ø58mm Absolute Rotary Encoder	
Resolution		720, 360, 180, 90, 45-division	1024, 512, 256, 128, 64-division

Electrical specification — Output code / Output phase/Output angle:

Output code	BCD code	Binary code	Gray code	Output code	BCD code	Binary code	Gray code
720-division	TS: Signal Pulse (11-bit) TS: 0.5°±25'	TS: Signal Pulse (10-bit) TS: 0.5°±25'	TS: Signal Pulse (10-bit) TS: 1°±25'	1024-division	TS: Signal Pulse (13-bit) TS: 0.3515°±15'	TS: Signal Pulse (10-bit) TS: 0.3515°±15'	TS: Signal Pulse (10-bit) TS: 0.703°±15'
360-division	TS: Signal Pulse (10-bit) TS: 1°±25'	TS: Signal Pulse (9-bit) TS: 1°±25'	TS: Signal Pulse (9-bit) TS: 2°±25'	512-division	TS: Signal Pulse (11-bit) TS: 0.703°±15'	TS: Signal Pulse] (9-bit) TS: 0.703°±15'	TS: Signal Pulse (9-bit) TS: 1.406°±15'
180-division	TS: Signal Pulse (9-bit) TS: 2°±25'	TS: Signal Pulse (8-bit) TS: 2°±25'	TS: Signal Pulse (8-bit) TS: 4°±25'	256-division	TS: Signal Pulse (10-bit) TS: 1.406°±15'	TS: Signal Pulse (8-bit) TS: 1.406°±15'	TS: Signal Pulse (8-bit) TS: 2.8125°±15'
90-division	TS: Signal Pulse (8-bit) TS: 4°±25'	TS: Signal Pulse (7-bit) TS: 4°±25'	TS: Signal Pulse (7-bit) TS: 8°±25'	128-division	TS: Signal Pulse (9-bit) TS: 2.8125°±15'	TS: Signal Pulse (7-bit) TS: 2.8125°±15'	TS: Signal Pulse (7-bit) TS: 5.625°±15'
45-division	TS: Signal Pulse (7-bit) TS: 8°±25'	TS: Signal Pulse (6-bit) TS: 8°±25'	TS: Signal Pulse (6-bit) TS: 16°±25'	64-division	TS: Signal Pulse (7-bit) TS: 5.625°±15'	TS: Signal Pulse (6-bit) TS: 5.625°±15'	TS: Signal Pulse (6-bit) TS: 11.25°±15'

Electrical specification	Control output	PNP open collector output	Output voltage: Min. (power supply-1.5VDC), Load current: Max. 32mA
		NPN open collector output	Load current: Max. 32mA, Residual voltage: Max. 1VDC
	Response time (rise/fall)		Ton=800nsec, Toff=Max. 800nsec (cable: 2m, I sink = 32mA)
	Max. response frequency		35kHz
	Power supply		• 5VDC ±5% (ripple P-P: max. 5%) • 12-24VDC ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 100mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Axial cable type (cable gland)
Mechanical specification	Starting torque		• SC/SS type: Max. 40gf·cm (0.004N·m) • HB type: Max. 90gf·cm (0.009N·m)
	Moment of inertia		• SC/SS type: Max. 15g·cm² (1.5×10^{-6}kg·m²) • HB type: Max. 20g·cm² (2.0×10^{-6}kg·m²)
	Shaft loading		• SC/SS type: Radial: 10kgf, Thrust: 2.5kgf • HB type: Radial: 2kgf, Thrust: 1kgf
	Max. allowable revolution※1		3,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø7mm, 15-wire, 2m, Shield cable
Accessories			Ø10mm (SC type)/Ø6mm (SS type) coupling, Fixing bracket
Approval			CE
Unit weight			• SC type: Approx. 435g • SS type: Approx. 415g • HB type: Approx. 410g

※1: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

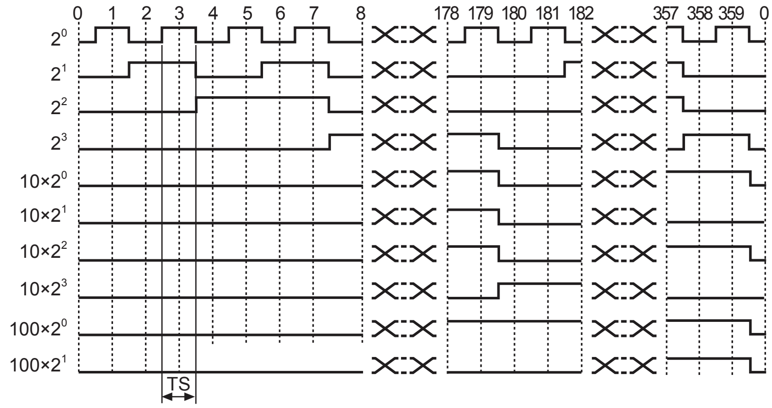
$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※Environment resistance is rated at no freezing or condensation.

■ Output Waveform

● 360-division (BCD code output)

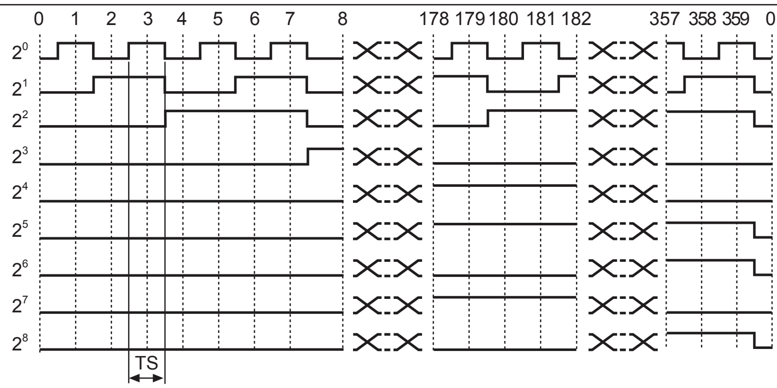
Model	EP58□□-360-1□-P-□



※TS=1°±25'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

● 360-division (Binary code output)

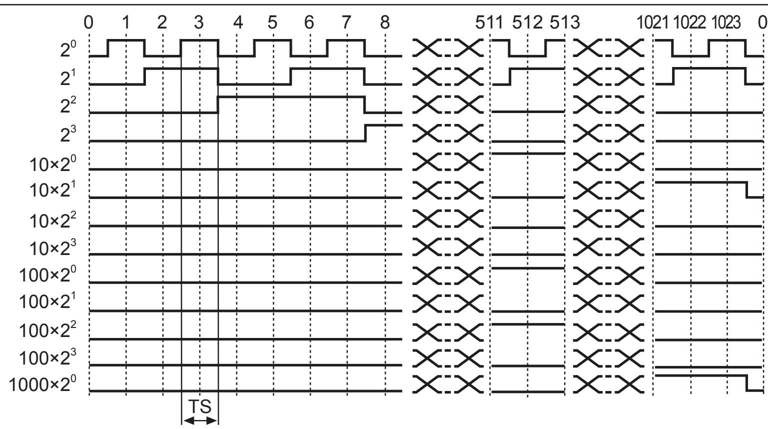
Model	EP58□□-360-2□-P-□



※TS=1°±25'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

● 1024-division (BCD code output)

Model	EP58□□-1024-1□-P-□



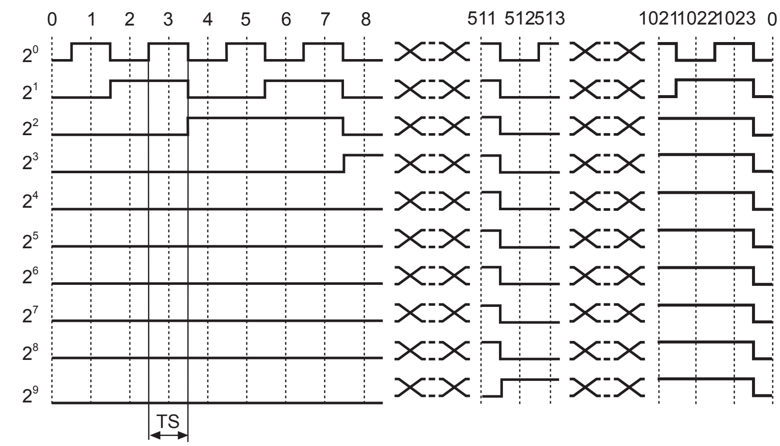
※TS=0.3515°±15'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Output Waveform

● **1024-division (Binary code output)**

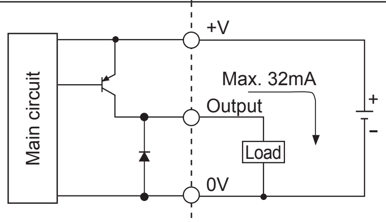
Model	**EP58□□-1024-2□-P-□**

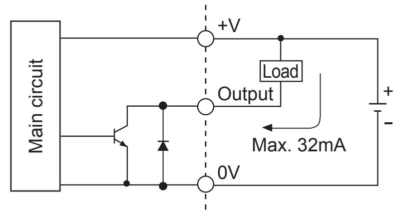


※TS=0.3515°±15'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

■ Control Output Diagram

PNP open collector output		NPN open collector output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection





※In case of overload or short on output terminal, it may cause output circuit break.

■ Connections

● **BCD code**

Color		Resolution: 45-division	48-division	64-division	90-division	128-division	180-division	256-division	360-division	512-division	720-division	1024-division
Power	White	+V										
	Black	GND (0V)										
Output wire	Brown	2^0										
	Red	2^1										
	Orange	2^2										
	Yellow	2^3										
	Blue	(2^0×10)										
	Purple	(2^1×10)										
	Gray	(2^2×10)										
	White/Brown	N·C			2^3×10							
	White/Red	N·C				2^0×100						
	White/Orange	N·C						2^1×100				
	White/Yellow	N·C								2^2×100		
	White/Blue	N·C										2^3×100
	White/Purple	N·C										2^0×1000
	Shield wire	F.G.										

● **Binary code / Gray code**

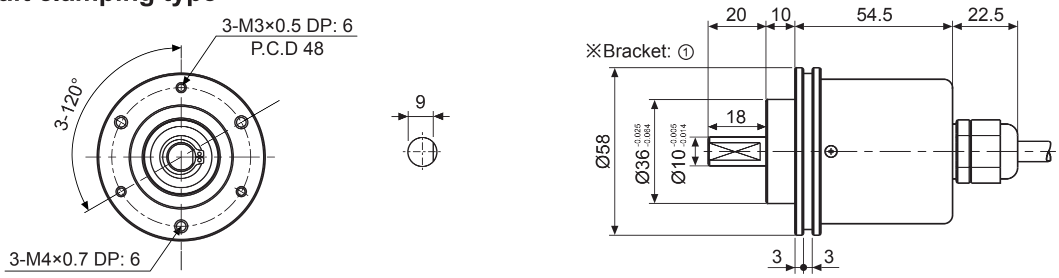
Color		Resolution: 45-division	48-division	64-division	90-division	128-division	180-division	256-division	360-division	512-division	720-division	1024-division
Power	White	+V										
	Black	GND (0V)										
Output wire	Brown	2^0										
	Red	2^1										
	Orange	2^2										
	Yellow	2^3										
	Blue	2^4										
	Purple	2^5										
	Gray	N·C		2^6								
	White/Brown	N·C					2^7					
	White/Red	N·C							2^8			
	White/Orange	N·C									2^9	
	White/Yellow	N·C										
	White/Blue	N·C										
	White/Purple	N·C										
	Shield wire	F.G.										

※Unused wires must be insulated.
※Encoder metal case and shield wire must be grounded (F.G.).
※N·C: Not connected.
※Output cable must not be short-circuited, because Driver IC is used in output circuit.

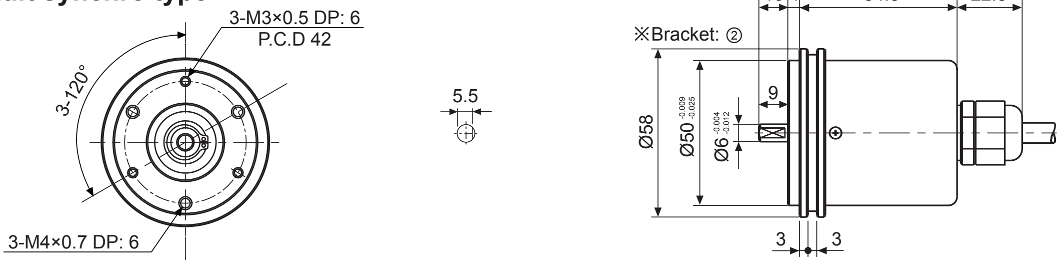
▣ Dimensions

(unit: mm)

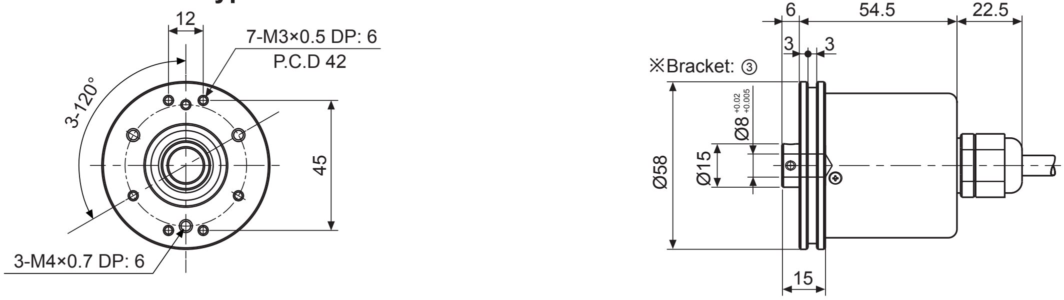
◎ Shaft clamping type



◎ Shaft synchro type

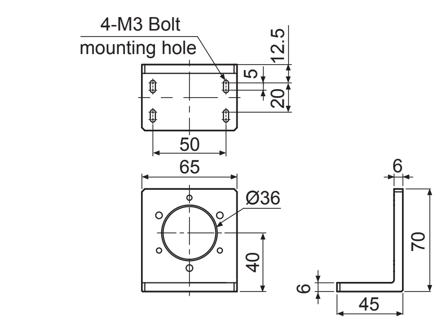


◎ Blind hollow shaft type

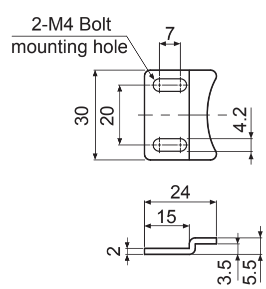


● **Bracket**

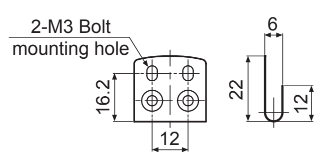
※**SC type:** ①



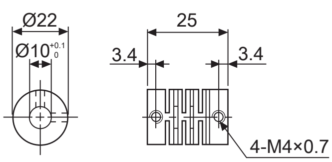
※**SS type:** ②



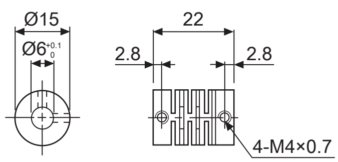
※**HB/H type:** ③



• Ø10 Coupling (EP58SC10 series)



• Ø6 Coupling (EP58SS6 series)



- Parallel misalignment: Max. 0.25mm
- Angular misalignment: Max. 5°
- End-play: Max. 0.5mm

※ For parallel misalignment, angular misalignment, End-play terms, refer to page F-87.
※ For flexible coupling (ERB series) information, refer to page F-80.

Shaft Type Ø60mm Absolute Rotary Encoder

■ Features

- Allows to measure absolute variable angle with BCD code
- Strong against external impact
- Memorizing the absolute position when power is cut off

■ Applications

Precision numerical control machine for industrial plant

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

ENP – 1 1 1 – R – 360 – P

Series	Output code	Output	Power supply	Revolution direction	Steps/revolution	Control output
Ø60mm shaft type (external shaft diameter: Ø10mm)	1: BCD code	0: Negative logic 1: Positive logic	0: 5VDC ±5% 1: 12-24VDC ±5%	F: Output value increase at CW direction R: Output value increase at CCW direction	006: 6-divison 016:16-divison 008: 8-divison 024: 24-divison 012: 12-divison 360: 360-divison	P: PNP open collector output N: NPN open collector output

■ Specifications

Item			Shaft Type Ø60mm Absolute Rotary Encoder					
Model	PNP open collector		**ENP-111□-006-P**	**ENP-111□-008-P**	**ENP-111□-012-P**	**ENP-111□-016-P**	**ENP-111□-024-P**	**ENP-11□□-360-P**
	NPN open collector		**ENP-101□-006-N**	**ENP-101□-008-N**	**ENP-101□-012-N**	**ENP-101□-016-N**	**ENP-101□-024-N**	**ENP-10□□-360-N**
Resolution			6-division	8-division	12-division	16-division	24-division	360-division
Electrical specification	Output phase		TP (timing pulse): 2-bit TS (signal pulse): 4-bit (BCD, EP)	TP (timing pulse): 2-bit TS (signal pulse): 5-bit (BCD, EP)	TP (timing pulse): 2-bit TS (signal pulse): 6-bit (BCD, EP)	TP (timing pulse): 2-bit TS (signal pulse): 6-bit (BCD, EP)	TP (timing pulse): 2-bit TS (signal pulse): 7-bit (BCD, EP)	TS (signal pulse): 10-bit (BCD)
	Output of phase differences		TP1: 53° ±30' TP2: 15° ±30' P: 60° ±30' TS: 56° ±30'	TP1: 39° ±30' TP2: 15° ±30' P: 45° ±30' TS: 42° ±30'	TP1: 3° ±30' TP2: 15° ±30' P: 30° ±30' TS: 26° ±30'	TP1: 2° ±30' TP2: 11.25° ±30' P: 22.5° ±30' TS: 19.5° ±30'	TP1: 8° ±30' TP2: 3° ±30' P: 15° ±30' TS: 11° ±30'	TS: 1° ±30'
	Control output	PNP open collector output	Output voltage: Min. (power supply-1.5V)VDC, Load current: Max. 32mA					
		NPN open collector output	Load current: Max. 32mA, Residual voltage: Max. 1VDC					
	Response time (rise/fall)	PNP open collector output	Ton=800ns, Toff=Max. 800ns (cable length: 1m, I sink=32mA)					
		NPN open collector output	Ton=800ns, Toff=Max. 800ns (cable length: 1m, I sink=32mA)					
	Max. response frequency		20kHz					
	Power supply		• 5VDC ±5% (ripple P-P: max. 5%) • 12-24VDC ±5% (ripple P-P: max. 5%)					
	Current consumption		Max. 100mA (disconnection of the load)					
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)					
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)					
	Connection		Axial cable type					
Mechanical specification	Starting toque		Max. 500gf·cm (0.05N·m)					
	Moment of inertia		Max. 300g·cm² (3×10^{-5}kg·m²)					
	Shaft loading		Radial: 10kgf, Thrust: 2.5kgf					
	Mechanical revolution※1		3,600rpm					
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock			Approx. max. 75G					
Environ-ment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃					
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH					
Protection structure			IP50 (IEC standard)					
Cable			Ø8mm, 12-wire, 1m, Double shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator diameter: Ø1mm)					
Accessory			Mounting bracket, coupling					
Weight※2			Approx. 478g (approx. 400g)					

※1: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※2: The weight includes packaging. The weight in parenthesis is for unit only.

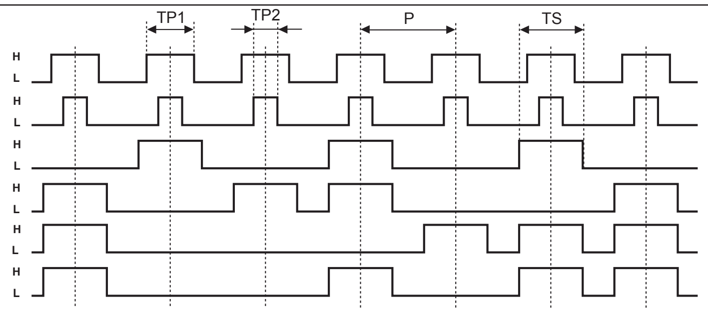
※Environment resistance is rated at no freezing or condensation.

■ Output Waveform

● 6-division

Model	ENP-111□-006-P						
Shaft revolution angle (°)	0°	60°	120°	180°	240°	300°	360°
Output value	6	1	2	3	4	5	6

Wire color	Wire function
Black	TP1
Gray	TP2
Brown	BCD (2^0)
Red	BCD (2^1)
Orange	BCD (2^2)
White	EP (PARITY)

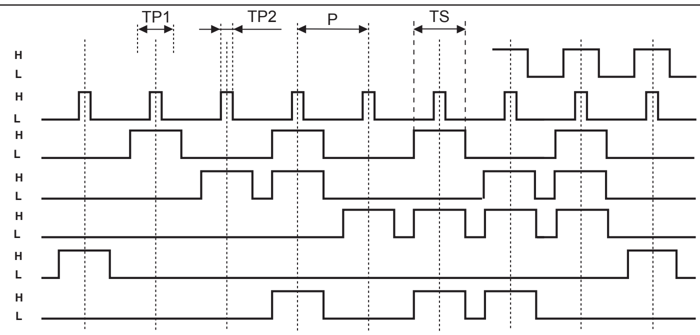


※TP1=53°±30', TP2=15°±30' ※P > TS (56°) > TP1 ※P=60°±30'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)

● 8-division

Model	ENP-111□-008-P								
Shaft revolution angle (°)	0°	45°	90°	135°	180°	225°	270°	315°	360°
Output value	8	1	2	3	4	5	6	7	8

Wire color	Wire function
Black	TP1
Gray	TP2
Brown	BCD (2^0)
Red	BCD (2^1)
Orange	BCD (2^2)
Yellow	BCD (2^3)
White	EP (PARITY)

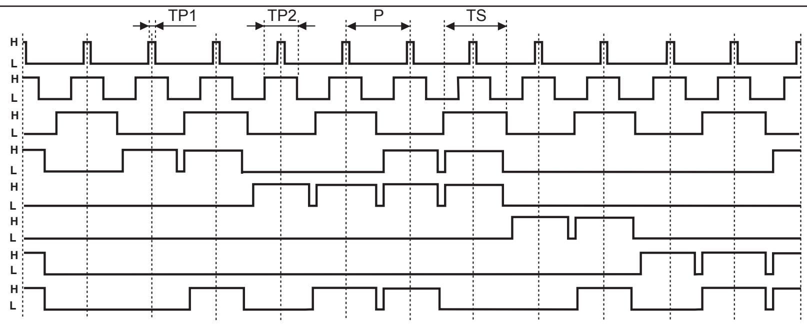


※TP1=39°±30', TP2=15°±30' ※P > TS (42°) > TP1 ※P=45°±30'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)

● 12-division

Model	ENP-111□-012-P												
Shaft revolution angle (°)	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
Output value	12	1	2	3	4	5	6	7	8	9	10	11	12

Wire color	Wire function
Black	TP1
Gray	TP2
Brown	BCD (2^0)
Red	BCD (2^1)
Orange	BCD (2^2)
Yellow	BCD (2^3)
Green	BCD (2×10^0)
White	EP (PARITY)

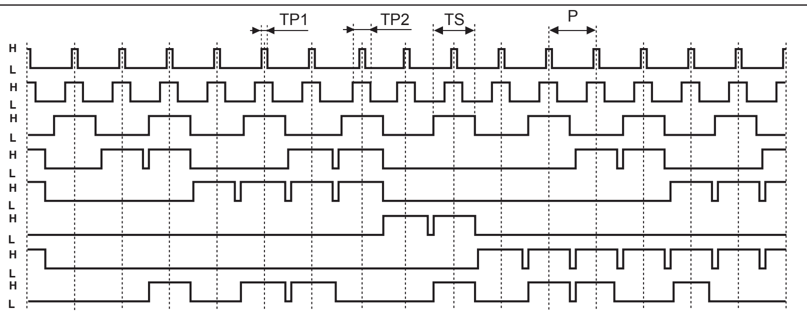


※TP1=3°±30', TP2=15°±30' ※P > TS (26°) > TP1 ※P=30°±30'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)
※The option model for TS (signal pulse) signal with 5-bit (BCD, EP) is available.

■ Output Waveform

● 16-division

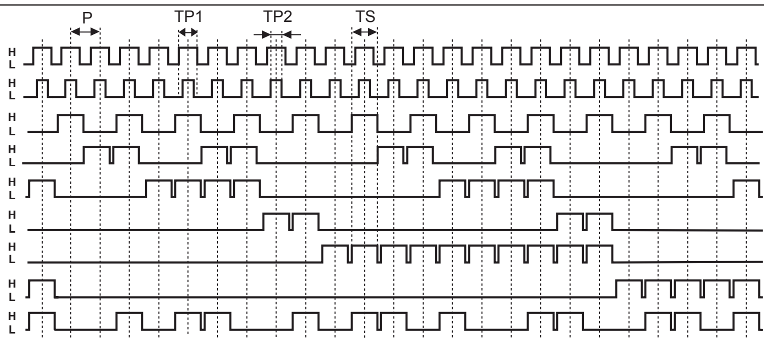
Model		ENP-111□-016-P
Shaft revolution angle (°)		0° 22.5° 45° 67.5° 90° 112.5° 135° 157.5° 180° 202.5° 225° 247.5° 270° 292.5° 315° 337.5° 360°
Output value		16 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Wire color	Wire function	
Black	TP1	
Gray	TP2	
Brown	BCD (2^0)	
Red	BCD (2^1)	
Orange	BCD (2^2)	
Yellow	BCD (2^3)	
Green	BCD (2×10^0)	
White	EP (PARITY)	



※TP1=2°±30', TP2=11.25°±30' ※P > TS (19.5°) > TP1 ※P=22.5°±30'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)
※The option model for TS (signal pulse) signal with 5-bit (BCD, EP) is available.

● 24-division

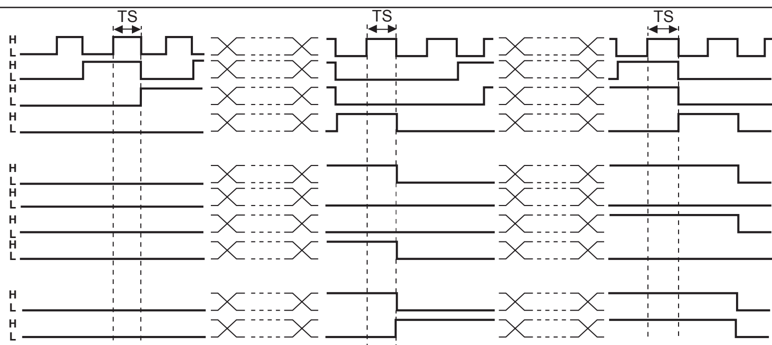
Model		ENP-111□-024-P
Shaft revolution angle (°)		0° 15° 30° 45° 60° 75° 90° 105° 120° 135° 150° 165° 180° 195° 210° 225° 240° 255° 270° 285° 300° 315° 330° 345° 360°
Output value		24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Wire color	Wire function	
Black	TP1	
Gray	TP2	
Brown	BCD (2^0)	
Red	BCD (2^1)	
Orange	BCD (2^2)	
Yellow	BCD (2^3)	
Green	BCD ($2^0\times10$)	
Blue	BCD ($2^1\times10$)	
White	EP (PARITY)	



※TP1=8°±30', TP2=3°±30' ※P > TS (11°) > TP1 ※P=15°±30'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)

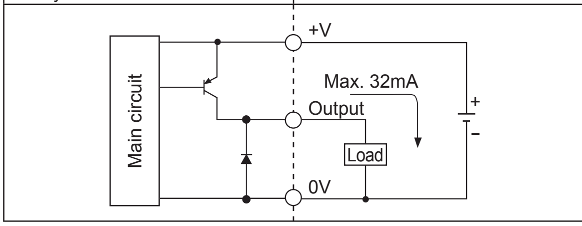
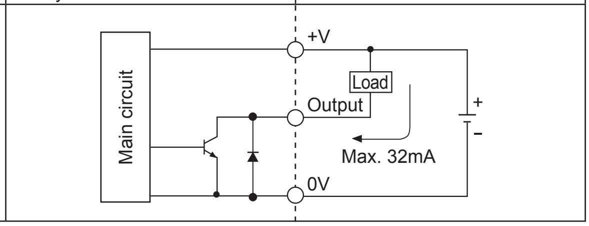
● 360-division

Model		ENP-11□ □-360-P
Shaft revolution angle (°)		0° 1° 2° 3° 4° 5° ··········· 198° 199° 200° 201° 202° ··········· 356° 357° 358° 359° 360°
Output value		0 1 2 3 4 5 ··········· 198 199 200 201 200 ··········· 356 357 358 359 0
Wire color	Wire function	
Black	BCD (2^0)	
Brown	BCD (2^1)	
Red	BCD (2^2)	
Orange	BCD (2^3)	
Yellow	BCD ($2^0\times10$)	
Green	BCD ($2^1\times10$)	
Blue	BCD ($2^2\times10$)	
Violeet	BCD ($2^3\times10$)	
Gray	BCD ($2^0\times100$)	
White	BCD ($2^1\times100$)	



※TS=1°±30'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)

■ Control Output Diagram

PNP open collector output		NPN open collector output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection
			

※Output circuit of each output signal is same.

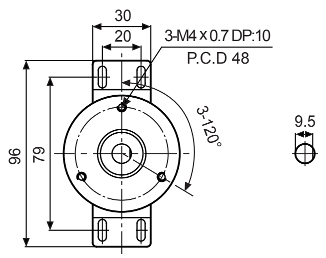
■ Connections

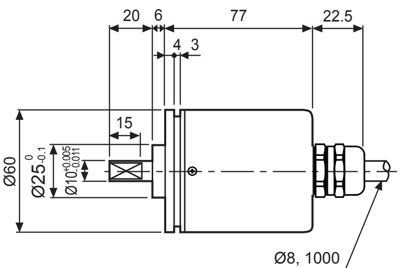
Wire color \ Resolution		6-division	8-division	12-division	16-division	24-division	360-division
Power wire	White ※1	+V					
	Black ※1	GND (0V)					
	Shield wire	F.G.					
Output wire	Black	TP1 ※2					2^0
	Brown	2^0	2^0	2^0	2^0	2^0	2^1
	Red	2^1	2^1	2^1	2^1	2^1	2^2
	Orange	2^2	2^2	2^2	2^2	2^2	2^3
	Yellow	N·C	2^3	2^3	2^3	2^3	2^0×10
	Green	N·C	N·C	2^0×10	2^0×10	2^0×10	2^1×10
	Blue	N·C	N·C	N·C	N·C	2^1×10	2^2×10
	Purple	N·C					2^3×10
	Gray	TP2 ※2					2^0×100
	White	EP (PARITY) ※3					2^1×100
	Shield wire	F.G.					

※1: Insulator external diameter is Ø1.5mm.
※2: TP1/TP2: Because low resolution model has long output signal period, this signal for enable is easy to determine signal recognization point about output.
※3: EP: Parity signal. It outputs odd parity.
※Unused wire must be insulated.
※Encoder case and shield wire must be grounded.
※N·C: Not connected.
※Output cable must not be short-circuited, because Driver IC is used in output circuit.

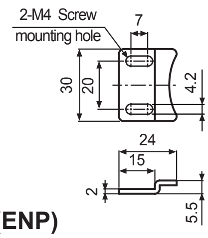
■ Dimensions

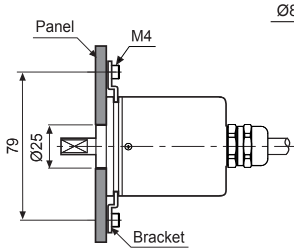
(unit: mm)





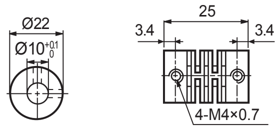
● **Bracket**





※When mounting the coupling to encoder shaft,if there is big eccentricity or declination between rotating encoder shaft and mate shaft, it may shorten life cycle of the encoder or the coupling.
※Do not load overweight on the shaft.

● **Coupling (ENP)**



- Parallel misalignment: Max. 0.25mm
- Angular misalignment: Max. 5°
- End-play: Max. 0.5mm

※For parallel misalignment, angular misalignment, end-play terms, refer to page F-87.

Shaft Type Ø50mm Multi-Turn Absolute Rotary Encoder

■ Features

- **Total 23-bit resolution (8388608-division) of 10-bit single-turn (1024-division) and 13-bit multi-turn (8192-revolution)**
- Compact size of Ø50mm
- Parallel data/SSI data transmission type
- Easy zero adjustment using single-turn/multi-turn data separated reset function
- Memorizing revolution data up to ±90° after blackout without memory back up function
- Possible CW/CCW direction setting with direction function
- Maximizing users convenience with clear, over flow alarm (OVF) function
- Protection structure IP64 (IEC standard) (dust-proof, oil-proof)
- Provides Latch function (parallel output model only)

Radial cable type

Axial cable type

■ Applications

- Precision machine tool, Fabric machinery, Robot, Parking system

Please read "Caution for your safety" in operation manual before using.

CE

■ Ordering Information

EPM50S	8	– 10	13	– B	– PN	– 24	–
Series	Shaft diameter	Single-turn	Multi-turn	Output code	Control output	Power supply	Cable
Ø50mm Shaft type	Ø8mm	10-bit (1024-division)	13-bit (8192-revolution)	Binary code	PN: Parallel NPN open collector output S: SSI Line driver output	12-24VDC±5%	No mark: Axial cable type S: Radial cable type

■ Specifications

Type				**Shaft Type Ø50mm Multi-Turn Absolute Rotary Encoder**	
Model				**EPM50S8-1013-B-S-24**	**EPM50S8-1013-B-PN-24**
Resolution		Single-turn		1024-division (10-bit)	
		Multi-turn		8192-revolution (13-bit)	
Rotation limit when power off ※1				±90°	
Electrical specification	Output	Output code		24-bit, Binary 2 code	Binary 2 code
		Control output		SSI (Synchronous Serial Interface) Line driver [Low] - Sink current: Max. 20mA, Residual voltage: Max. 0.5VDC [High] - Sink current: Max. -20mA, Output voltage: Min. 2.5VDC	Parallel NPN open collector output Sink current: Max. 32mA, Residual voltage: Max. 1VDC
		Output signal		Single-turn data, Multi-turn count, Over flow alarm (OVF)※2	
		Output logic		—	Negative logic output
		Response time (rise, fall)		—	Max. 1μs (cable: 2m, I sink = 32mA)
	Input	Input signal		Single-turn data reset ※3, Multi-turn count reset ※4, Direction, Clear	
				—	Latch
		Input level		0-1VDC (high active: 5-24VDC)	
		Input logic		Low Active※5, Open or High for common use	
		Input time		Single-turn data reset※3, Multi-turn count reset※4, Direction, Clear: Approx. Over 100ms	
				—	Latch: Approx. Over 500μs
		SSI clock input	Input level	5VDC±5%	—
			Input frequency	100kHz to 1MHz	
	Max. response frequency			—	50kHz
	Power supply			12-24VDC ±5% (ripple P-P: max. 5%)	
	Current consumption			Max. 150mA (disconnection of the load)	Max. 100mA (disconnection of the load)
	Insulation resistance			Over 100MΩ (at 500VDC megger between all terminals and case)	
	Dielectric strength			750VAC 50/60Hz for 1 minute (between all terminals and case)	
	Connection			Axial/Radial cabel type (cable gland)	

※1: It calibrates the multi-turn counts by comparing single-turn data before/after power off without counting multi-turn counts when power is off. It shall be used on the condition that no overrated revolution occurred since proper multi-turn data may not be available if any revolutions occurred over ±90° from the position when power is off.
※2: OVF alarm is ON when multi-turn count is out of counting range (0 to 8191 revolutions).
※3: Single-turn data will be reset as「0」when single-turn data reset is input.
※4: Multi-turn count will be reset as「0 revolution」when multi-turn count reset is input.
※5: High Active is optional.

■ Specifications

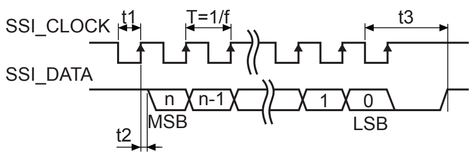
Type		Shaft Type Ø50mm Multi-Turn Absolute Rotary Encoder	
Model		**EPM50S8-1013-B-S-24**	**EPM50S8-1013-B-PN-24**
Mechanical specification	Starting torque	Max. 40gf·cm (0.004N·m)	
	Moment of inertia	Max. 40g·cm² (4×10^{-6}kg·m²)	
	Shaft loading	Radial: Max. 10kgf, Thrust: Max. 2.5kgf	
	Max. allowable revolution※6	3,000rpm	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		Approx. max. 50G	
Environment	Ambient temp.	-10 to 70℃, storage: -25 to 85℃	
	Ambient humi.	35 to 85%RH, storage: 35 to 90%RH	
Protection structure		Axial cabel type: IP64 (IEC standard), Radial cabel type: IP50 (IEC standard)	
Cable		Ø6mm, 10-wire, 2m, Shield cable (AWG28, core diameter: 0.08mm, number of cores: 19, insulation out diameter: Ø0.8mm)	Ø6mm, 17-wire×2, 2m, Shield cable (AWG28, core diameter: 0.08mm, number of cores: 17, insulation out diameter: Ø0.8mm)
Accessory		Bracket, coupling	
Approval		CE	
Weight※7		Approx. 409g (approx. 324g)	Approx. 560g (approx. 475g)

※6: In case of Parallel type model, Make sure that Max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

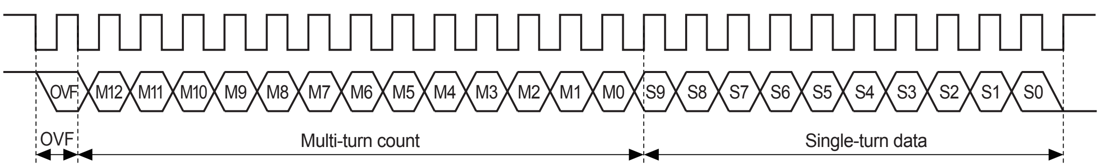
※7: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Synchronous Serial Interface (SSI) Output Timing Diagram



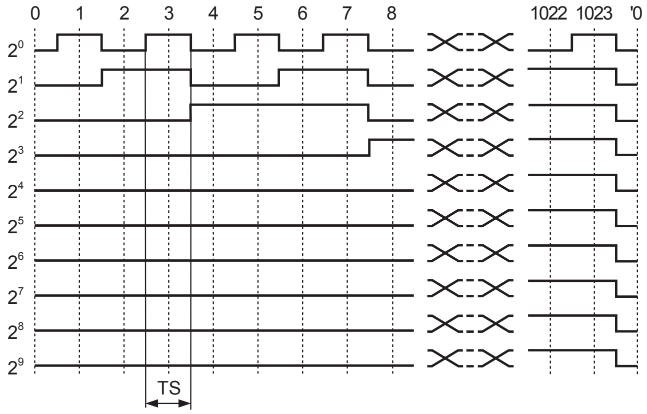
Clock Frequency f	100kHz to 1MHz
T	T: 1 to 10µs
	0.5µs < t1 < 5µs
Time lag t2	t2 < 0.3µs
Monoflop Time t3	15µs < t3 < 30µs

■ Synchronous Serial Interface (SSI) Data Output



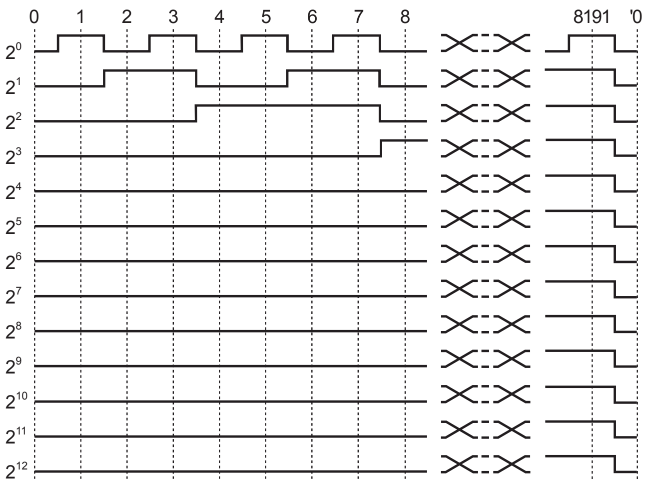
Clock input bit	Data output name	Data output bit	Clock input bit	Data output name	Data output bit
1	Over flow alarm bit	0-bit	15	Single-turn data	9-bit (MSB)
2	Multi-turn count	12-bit (MSB)	16		8-bit
3		11-bit	17		7-bit
4		10-bit	18		6-bit
5		9-bit	19		5-bit
6		8-bit	20		4-bit
7		7-bit	21		3-bit
8		6-bit	22		2-bit
9		5-bit	23		1-bit
10		4-bit	24		0-bit (LSB)
11		3-bit			
12		2-bit			
13		1-bit			
14		0-bit (LSB)			

■ Parallel Interface 1024-Division Single-Turn Data Output Waveform (Binary code)



※TS=0.3515625°±15'
※Above waveform is based on the positive logic. (the output waveform of negative logic is in reverse.)

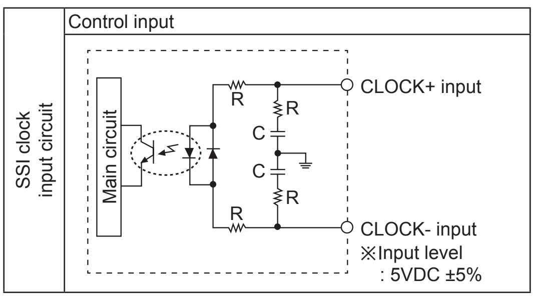
■ Parallel Interface 8192-Revolution Multi-Turn Count Data Output Waveform (Binary code)

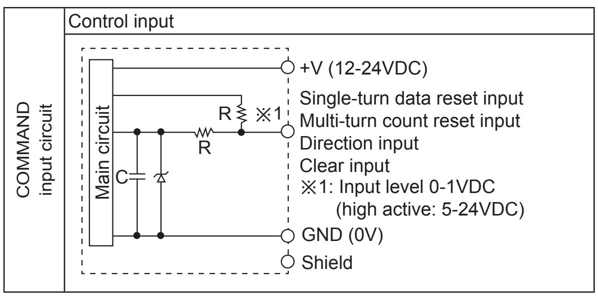


※Above waveform is based on the positive logic. (the output waveform of negative logic is in reverse.)

■ Control Output I/O Circuit

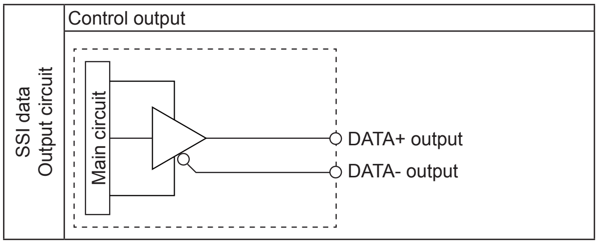
● **SSI input**



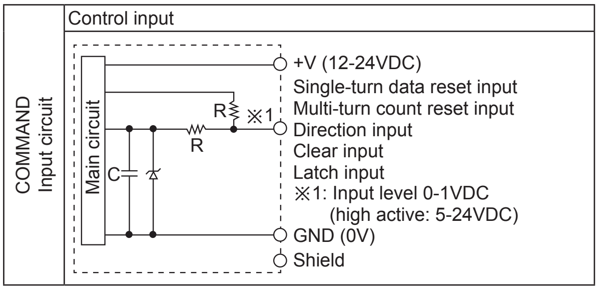


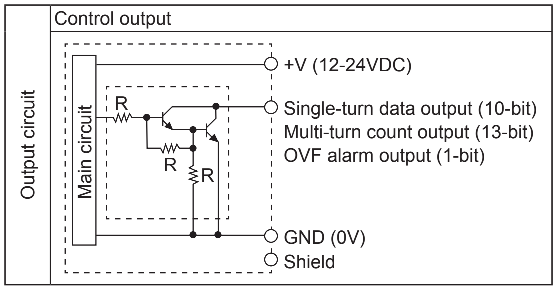
■ Control Output I/O Circuit

● SSI output



● Parallel input/output





※Output of each bit is the same circuit.
※Be sure that overload or short may cause circuit break.

■ Connections

● SSI Line driver output type

Cable					
Cable color	Description		Cable color	Description	
Brown	SSI	CLOCK+	Gray	COMMAND	Single-turn data reset
Red		CLOCK-	Blue		Multi-turn count reset
Orange		DATA+	Green		Direction
Yellow		DATA-	Purple		Clear
White	+V (12-24VDC)		Shield	Signal shield cable (F.G.)	
Black	GND (0V)		—		

● Parallel NPN open collector output type

Multi-turn count cable (sheath color: black)		
Cable color	Description	
Brown	Multi-turn count	2^0
Red		2^1
Orange		2^2
Yellow		2^3
Green		2^4
Blue		2^5
Purple		2^6
Gray		2^7
Pink		2^8
Clear		2^9
Light brown		2^{10}
Light yellow		2^{11}
Light green		2^{12}
Light blue	OVF	
Light purple	Multi-turn count reset	
White	+V (12-24VDC)	
Black	GND (0V)	
Shield	Signal shield cable (F.G.)	

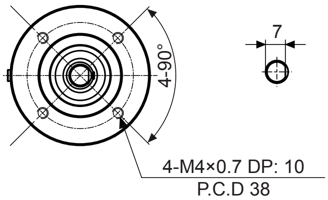
Single-turn data cable (sheath color: gray)		
Cable color	Description	
Brown	Single-turn data	2^0
Red		2^1
Orange		2^2
Yellow		2^3
Green		2^4
Blue		2^5
Purple		2^6
Gray		2^7
Pink		2^8
Clear		2^9
Light brown	N.C.	
Light yellow	Direction	
Light green	Latch	
Light blue	Clear	
Light purple	Single-turn data reset	
White	+V (12-24VDC)	
Black	GND (0V)	
Shield	Signal shield cable (F.G.)	

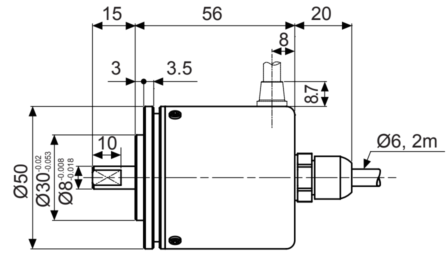
※Not used cables should be insulated.
※Do the wiring properly.
※Encoder's metal case and shield cable must be grounded (F.G.).
※Do the wiring with care for short since dedicated Driver IC is used for I/O circuit.
※As for Parallel output, it is recommended to connect +V and GND of both multi-turn count cable and single-turn data cable.

▣ Dimensions

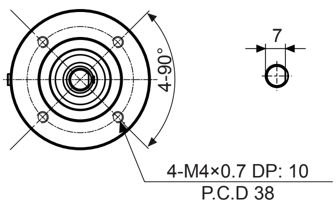
(unit: mm)

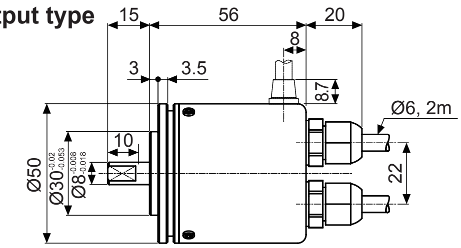
● **SSI Line driver output type**



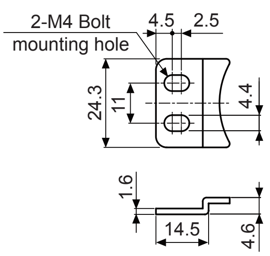


● **Parallel NPN open collector output type**

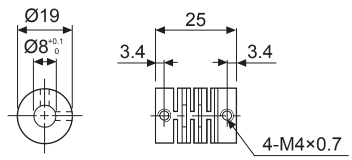




● **Bracket**



● **Coupling (EPM50S)**



- Parallel misalignment: Max. 0.25mm
- Angular misalignment: Max. 5°
- End-play: Max. 0.5mm

※When mounting the coupling to encoder shaft, if there is combined misalignment (parallel, angular misalignment) between rotating encoder shaft and mate shaft, it may cause encoder and coupling's life cycle to be

※Do not load overweight on the shaft.

※For parallel misalignment, angular misalignment, end-play terms, refer to the F-87.

※For flexible coupling (ERB series) information, refer to the F-80.

▣ Functions

◎ Single-turn data reset

Single-turn data will be reset as「0」when single-turn data reset cable is inputted 0 to 1V (over 100ms). In case of not using single-turn data reset cable, connect the line to OPEN or + V.

◎ Multi-turn count reset

Multi-turn data will be reset as「0 revolution」when multi-turn count reset cable is inputted 0 to 1V (over 100ms). In case of not using multi-turn count reset cable, connect the line to OPEN or + V.
OVF alarm will be reset with muli-turn count reset input.

◎ Direction

Connect the direction cable to OPEN or +V and turn on the power. Output will increase when rotation direction is CW from shaft axis. In case of connecting 0 to 1 V (over 100ms), output will increase when rotation direction is CCW. If direction setting is reset, single-turn data, multi-turn count and OVF will be reset together since direction setting is initial setting which is set with Power ON.

◎ Clear

Single-turn data will be reset as「0」and multi-count will be also reset as「0 revolution」when clear cable is inputted 0 to 1V (over 100ms). In case of not using clear cable, connect the cable to OPEN or + V. OVF alarm will be reset with clear input.

◎ Latch (parallel output model only)

When the latch cable is inputted 0 to 1V (over 500µs), outputs for single-turn data, multi-turn count and OVF at latch point will be remained. When latch cable is connected to OPEN or +V, output will be returned to operating mode output.

◎ Over flow alarm (OVF)

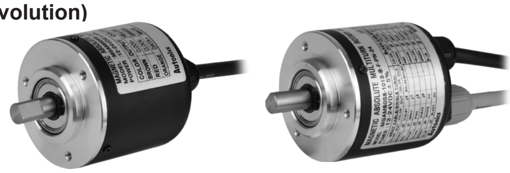
It is an alarm function when multi-turn count is out of rotation ranges (0 to 8191 revolutions).
Over flow alarm is also reset with multi-turn count value when multi-turn count reset signal is inputted.

Shaft Type Ø50mm Magnetic Multi-Turn Absolute Rotary Encoder

■ Features

- **Higher resistant to vibration and impact by magnetic elements than optical encoder**
- **Total 23-bit resolution (8388608-division) of 10-bit single-turn (1024-division) and 13-bit multi-turn (8192-revolution)**
- Compact size of Ø50mm
- Parallel data/SSI data transmission type
- Maximizing users convenience with over flow alarm (OVF) function
- Power supply: 12-24VDC ±5%
- Protection structure IP50 (IEC standard)

NEW



■ Applications

- Precision machine tool, Fabric machinery, Robot, Parking system

⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Ordering Information

MGAM50S	8	10	13	B	F	PN	24
Series	Shaft diameter	Single-turn	Multi-turn	Output code	Rotation direction	Control output	Power supply
Ø50mm Shaft type	Ø8mm	10-bit (1024-division)	13-bit (8192-revolution)	Binary Code	F: Output increases by CW rotation direction at the shaft R: Output increases by CCW rotation direction at the shaft	PN: Parallel NPN open collector output S: SSI Line driver output	12-24VDC±5%

■ Specifications

Type			Shaft Type Ø50mm Magnetic Multi-Turn Absolute Rotary Encoder	
Model			**MGAM50S8-1013-B-F-S-24**	**MGAM50S8-1013-B-F-PN-24**
Resolution		Single-turn	1024-division (10-bit)	
		Multi-turn	8192-revolution (13-bit)	
Rotation limit when power off ※1			±90°	
Electrical specification	Output	Hysteresis	±0.1°	
		Positioning error※2	±1-bit (LSB: Least Significant Bit)	
		Output code	24-bit, Binary 2 code	Binary 2 code
		Control output	SSI (Synchronous Serial Interface) Line driver output [Low] - Sink current: Max. 20mA, Residual voltage: Max. 0.5VDC [High] - Sink current: Max. -20mA, Output voltage: Min. 2.5VDC	Parallel NPN open collector output Sink current: Max. 20mA, Residual voltage: Max. 1VDC
		Output signal	Single-turn data, Multi-turn count, Over flow alarm (OVF)※3	
		Output logic	—	Negative logic output
		Response time (rise, fall)	—	Max. 1μs (cable: 2m, I sink = 20mA)
	Multi-turn count reset input※4	Input level	0-1VDC	
		Input logic	Low Active, Open for common use	
		Input time	Over 100ms	
	SSI clock input	Input level	5VDC±5%	—
		Input frequency	100kHz to 1MHz	
	Max. response frequency		—	30kHz
	Power supply		12-24VDC ±5% (ripple P-P: max. 5%)	
	Current consumption		Max. 150mA (disconnection of the load)	Max. 100mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)	
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)	
	Connection		Axial cable type (cable gland)	

※1: It calibrates the multi-turn counts by comparing single-turn data before/after power off without counting multi-turn counts when power is off. It shall be used on the condition that no overrated revolution occurred since proper multi-turn counts may not be available if any revolutions occurred over ±90°from the position when power is off.
※2: When turning ON/OFF the unit, there may be ±1-bit (LSB) error at present position by hysteresis.
※3: OVF alarm is ON when multi-turn count is out of counting range (0 to 8191 revolutions).
※4: Multi-turn count shall be initialized as「0 revolution」when multi-turn count reset is input.

Specifications

Type		Shaft Type Ø50mm Magnetic Multi-Turn Absolute Rotary Encoder	
Model		**MGAM50S8-1013-B-F-S-24**	**MGAM50S8-1013-B-F-PN-24**
Mechanical specification	Starting torque	Max. 70gf·cm (0.007N·m)	
	Moment of inertia	Max. 80g·cm² (8×10^{-6}kg·m²)	
	Shaft loading	Radial: Max. 10kgf, Thrust: Max. 2.5kgf	
	Max. allowable revolution※5	3,000rpm	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		Approx. max. 50G	
Environment	Ambient temp.	-10 to 70℃, storage: -25 to 85℃	
	Ambient humid.	35 to 85%RH, storage: 35 to 90%RH	
Protection structure		IP50 (IEC standard)	
Cable		Ø6mm, 10-wire, 2m, Shield cable (AWG 28, core diameter: 0.08mm, number of cores: 19, insulator out diameter: Ø0.8mm)	Ø6mm, 17-wire×2, 2m, Shield cable (AWG 28, core diameter: 0.08mm, number of cores: 17, insulator out diameter: Ø0.8mm)
Accessories		Bracket, coupling	
Approval		CE	
Weight※6		Approx. 391g (approx. 261g)	Approx. 523g (approx. 393g)

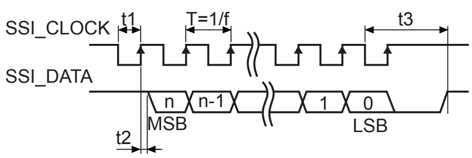
※5: In case of Parallel type model, Make sure that Max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

【Max. response revolution (rpm) = $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec】

※6: The weight includes packaging. The weight in parenthesis is for unit only.

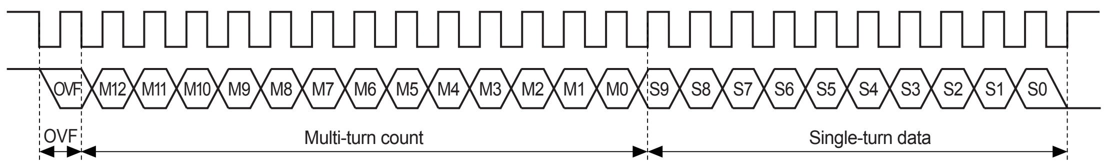
※Environment resistance is rated at no freezing or condensation.

Synchronous Serial Interface (SSI) Output Timing Diagram



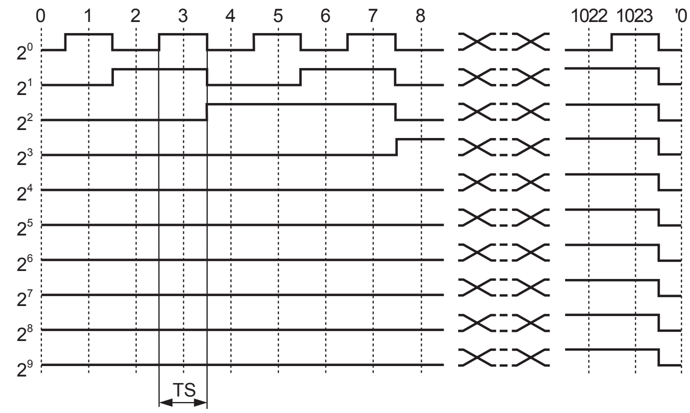
Clock Frequency f	100kHz to 1MHz
T	T: 1 to 10µs
	0.5µs < t1 < 5µs
Time lag t2	t2 < 0.3µs
Monoflop Time t3	15µs < t3 < 30µs

Synchronous Serial Interface (SSI) Data Output



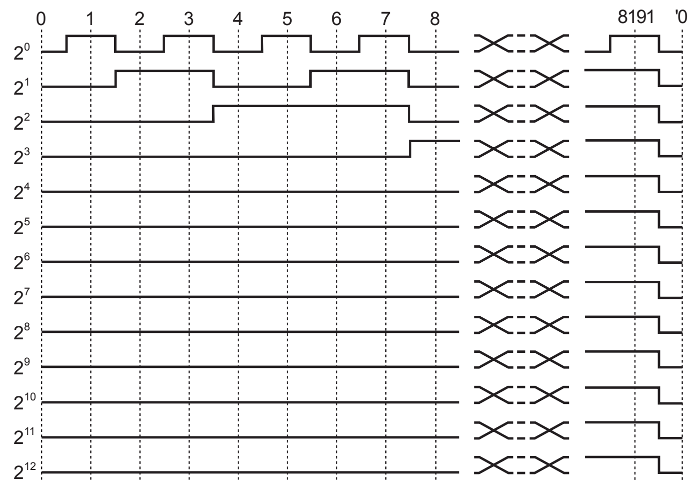
Clock input bit	Data output name	Data output bit	Clock input bit	Data output name	Data output bit
1	Over flow alarm bit	0-bit	15	Single-turn data	9-bit (MSB)
2	Multi-turn count	12-bit (MSB)	16		8-bit
3		11-bit	17		7-bit
4		10-bit	18		6-bit
5		9-bit	19		5-bit
6		8-bit	20		4-bit
7		7-bit	21		3-bit
8		6-bit	22		2-bit
9		5-bit	23		1-bit
10		4-bit	24		0-bit (LSB)
11		3-bit			
12		2-bit			
13		1-bit			
14		0-bit (LSB)			

■ Parallel Interface 1024-Division Single-Turn Data Output Waveform (Binary code)



※TS=0.3515625°±15'
※Above waveform is based on the positive logic. (The output waveform of negative logic is in reverse.)

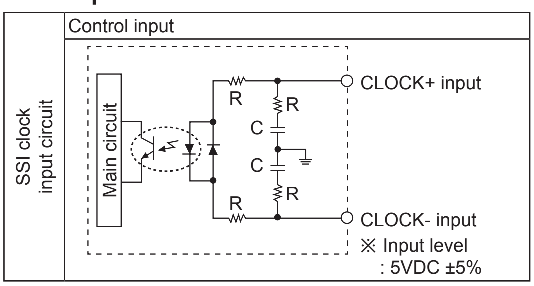
■ Parallel Interface 8192-Revolution Multi-Turn Count Data Output Waveform (Binary code)

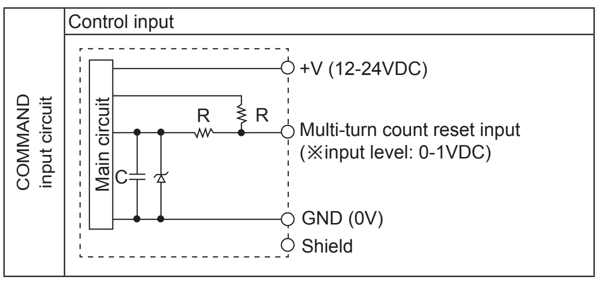


※Above waveform is based on the positive logic. (The output waveform of negative logic is in reverse.)

■ Control Output I/O Circuit

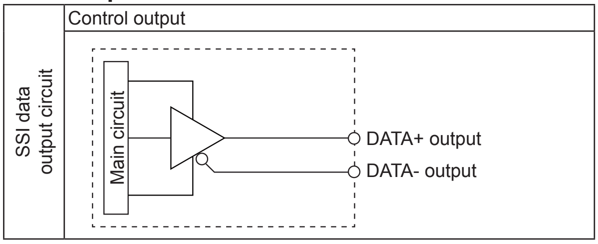
● **SSI input**



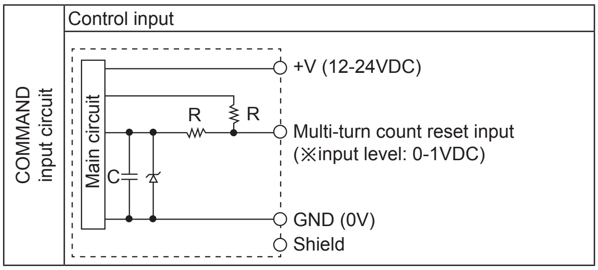


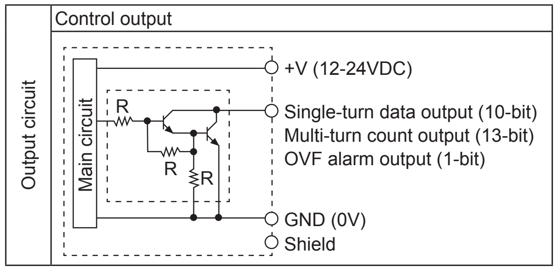
Control Output I/O Circuit

● SSI output



● Parallel input/output





※Output of each bit is the same circuit.
※Be sure that overload or short may cause circuit break.

Connections

● SSI Line driver output type

Cable					
Cable color	Description		Cable color	Description	
Brown	SSI	CLOCK+	Green	COMMAND	Multi-turn count reset
Red		CLOCK-	Blue		N.C.
Orange		DATA+	Purple		N.C.
Yellow		DATA-	Gray		N.C.
White	+V (12-24VDC)		Shield	Signal shield cable (F.G.)	
Black	GND (0V)		—		

● Parallel NPN open collector output type

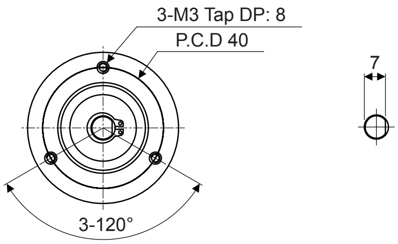
Multi-turn count cable (sheath color: black)		
Cable color	Description	
Brown	Multi-turn count	2^0
Red		2^1
Orange		2^2
Yellow		2^3
Green		2^4
Blue		2^5
Purple		2^6
Gray		2^7
Pink		2^8
Clear		2^9
Light brown		2^{10}
Light yellow		2^{11}
Light green		2^{12}
Light blue	OVF	
Light purple	Multi-turn count reset	
White	N.C.	
Black	N.C.	
Shield	Signal shield cable (F.G.)	

Single-turn data cable (sheath color: gray)		
Cable color	Description	
Brown	Single-turn data	2^0
Red		2^1
Orange		2^2
Yellow		2^3
Green		2^4
Blue		2^5
Purple		2^6
Gray		2^7
Pink		2^8
Clear		2^9
Light brown	N.C.	
Light yellow	N.C.	
Light green	N.C.	
Light blue	N.C.	
Light purple	N.C.	
White	+V (12-24VDC)	
Black	GND (0V)	
Shield	Signal shield cable (F.G.)	

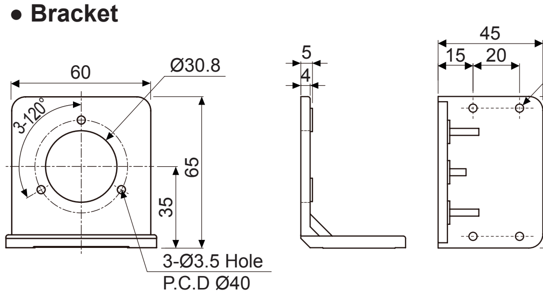
※Not used cables should be insulated.
※Do the wiring properly.
※Encoder's metal case and shield cable must be grounded (F.G.).
※Do the wiring with care for short since dedicated Driver IC is used for I/O circuit.

▣ Dimensions

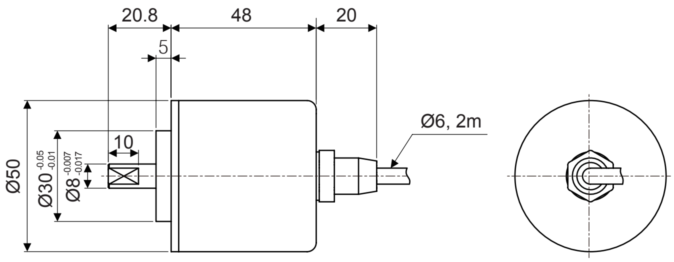
(unit: mm)



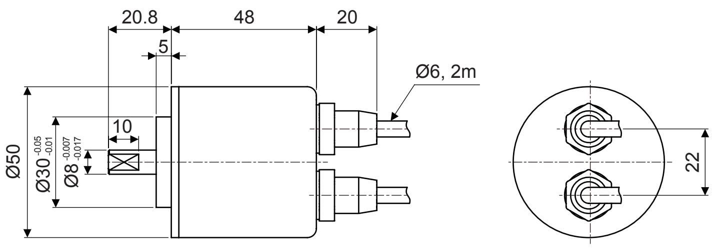
● **Bracket**



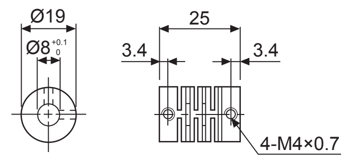
● **SSI Line driver output type**



● **Parallel NPN open collector output type**



● **Coupling (MGAM50S)**



- Parallel misalignment: Max. 0.25mm
- Angular misalignment: Max. 5°
- End-play: Max. 0.5mm

※When mounting the coupling to encoder shaft, if there is combined misalignment (parallel, angular misalignment) between rotating encoder shaft and mate shaft, it may cause encoder and coupling's life cycle to be shorten.

※Do not load overweight on the shaft.

※For flexible coupling (ERB series) information, refer to the F-80.

※For parallel misalignment, angular misalignment, end-play terms, refer to the F-87.

▣ Functions

◎ Multi-turn count reset

Multi-turn data will be reset as「0 revolution」when multi-turn count reset cable (light purple) is inputted 0 to 1V (over 100ms).

◎ Over flow alarm (OVF)

It is an alarm function when multi-turn count is out of rotation ranges (0 to 8191 revolutions).
Over flow alarm is also reset with multi-turn count value when multi-turn count reset signal is inputted.

Flexible coupling

Features

- Zero (0) Backlash
- High torsional stiffness by high strength aluminum alloy AL 7075-T6
- High corrosion resistance with alumite treated surface
- Two connection types (clamp type, set screw type)

⚠ **Please read "Caution for your safety" in operation manual before using.**

Applications

- Stepper motor, Servo motor, Precision motor, high-precision encoder, dynamometer driver, high speed/precision position control system

Ordering Information

ERB **A** - **19** **C** - **d_1/d_2**

Bore diameters	Number/Number	Bore diameters
Connection type	S	Set screw
	C	Clamp
External diameter	Number	External diameter (mm)
Type	A	Double beam (normal type)
Item	ERB	Radial beam type coupling

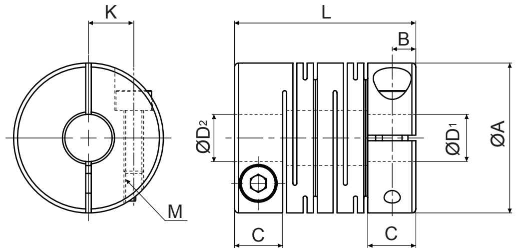
Specifications

Model		ERB-A-19C-□	ERB-A-19S-□	ERB-A-26C-□	ERB-A-26S-□
Connection type		Clamp	Set screw	Clamp	Set screw
Max. revolutions		8000rpm	20000rpm	6000rpm	15000 rpm
Max. torque		1.2 N·m (12.17 kgf·cm)		3.0 N·m (30.42 kgf·cm)	
Rated torque		0.6 N·m (6.08 kgf·cm)		1.5 N·m (15.21 kgf·cm)	
Mounting bolt (mounting torque)		M2.5 (1N·m)	M3 (0.7N·m)	M3 (0.7N·m)	M4 (1.7N·m)
Torsional stiffness		140 N·m/rad		240 N·m/rad	
Moment of inertia		6.4×10^{-7} kg·m^2		3.4×10^{-6} kg·m^2	
Max. allowable misalign-ment	Angular misalignment	2.5°			
	Parallel misalignment	0.15mm		0.2mm	
	End-play	±0.3mm		±0.4mm	
Standard bore diameter (tolerance h7)		Ø4, Ø5, Ø6mm		Ø6, Ø8mm	
Min. allowable bore diameter		Ø4mm		Ø5mm	
Max. allowable bore diameter		Ø8mm		Ø12mm	
Material		Aluminum (AL 7075-T6), Alumite surface			
Weight		Approx. 14.9g (approx. 14.4g)		Approx. 37.3g (approx. 36.7g)	

■ Dimensions

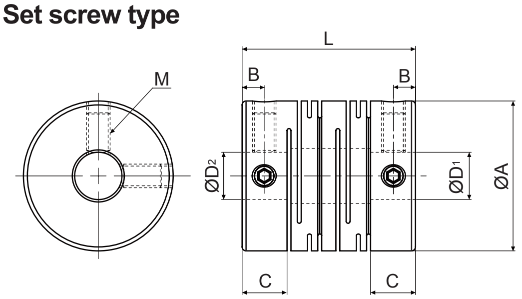
(unit: mm)

◎ Clamp type



Model	ØA	L	ØD1	ØD2	M	C	B	K
ERB-A-19C-04/04	19	23	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	M2.5	6.1	3	5.75
ERB-A-19C-04/05				$5^{+0.018}_{0}$				
ERB-A-19C-04/06				$6^{+0.018}_{0}$				
ERB-A-19C-05/05			$5^{+0.018}_{0}$	$5^{+0.018}_{0}$				
ERB-A-19C-05/06				$6^{+0.018}_{0}$				
ERB-A-19C-06/06			$6^{+0.018}_{0}$					
ERB-A-26C-06/06	26	31.4	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	M3	7.4	3.7	8.55
ERB-A-26C-06/08				$8^{+0.018}_{0}$				
ERB-A-26C-08/08			$8^{+0.018}_{0}$					

◎ Set screw type



Model	ØA	L	ØD1	ØD2	M	C	B
ERB-A-19S-04/04	19	22	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	M3	5.7	2.8
ERB-A-19S-04/05				$5^{+0.018}_{0}$			
ERB-A-19S-04/06				$6^{+0.018}_{0}$			
ERB-A-19S-05/05			$5^{+0.018}_{0}$	$5^{+0.018}_{0}$			
ERB-A-19S-05/06				$6^{+0.018}_{0}$			
ERB-A-19S-06/06			$6^{+0.018}_{0}$				
ERB-A-26S-06/06	26	30	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	M4	6.8	3.4
ERB-A-26S-06/08				$8^{+0.018}_{0}$			
ERB-A-26S-08/08			$8^{+0.018}_{0}$				

■ Proper Usage

The flexible coupling is available in the places where vibration or misalignment occurs. It must be used within the rated allowable misalignment range.
When using the flexible coupling over the rated misalignment range, it may cause vibration or shorten the life cycle.
When there are more than two misalignments, each allowable value is 50%.
It is recommended to use the flexible coupling below 1/3 of the allowable misalignment value to extend the life of the coupling and the applied equipment.

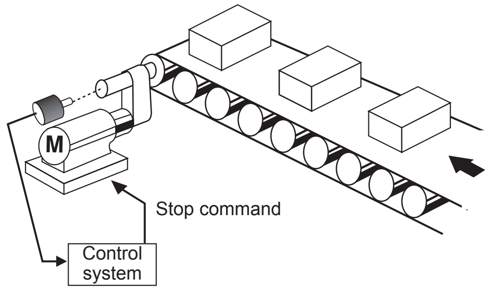
◎ Caution for using

- Couplings are for transferring rotation angle and power between shafts. Before using this, make sure to check the purpose and appropriacy.
- This product uses high strength aluminum alloy and has spring power as Radial beam type. However, if the coupling is dropped, hit or applied excessive power, it may be damaged or transformed.
- If the coupling is applied over the rated misalignment, or the tolerance of the shaft is over the allowable value, it may cause plastic deformation, damage of the product or shorten the life cycle.
- When it occurs abnormal sound during operating the equipment with this coupling, stop the operation and remove the cause such as misalignment, unscrewing, or rotation hazard.
- If this coupling is applied to the equipment which has big fluctuation of load, shaft may be loose by unscrewing. Tighten the screw securely and prevent from unscrewing.
- This product is for transferring rotation power. If there is a risk of human contact, attach the caution label or install a safety cover in a prominent position.
- Rated torque is available to transfer the power continuously. Check the rated capacity before using this product.
- Max. torque is available to transfer the power in a moment. Check the rated capacity before using this product.

■ Applications

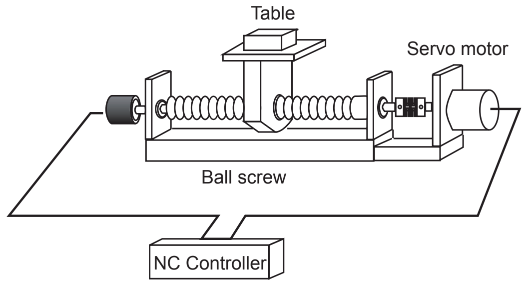
Stopping the motor at right position

※Incremental encoder



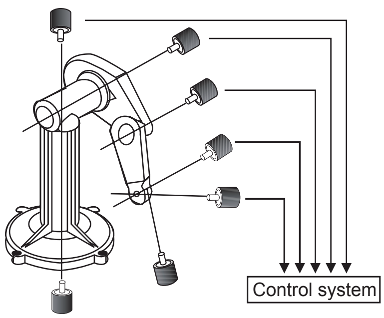
X, Y table positioning of NC tooling machine

※Incremental encoder



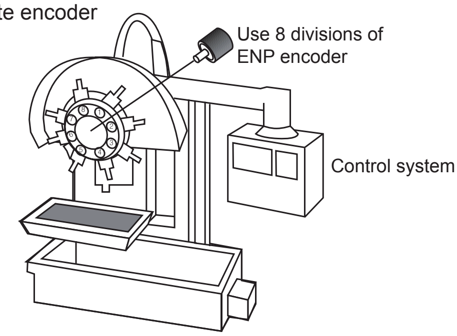
Measuring of Robot arm angle and position

※Incremental encoder



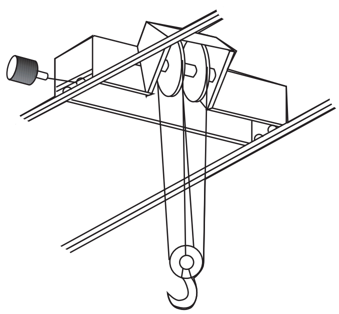
Controlling drill position of NC machine

※Absolute encoder



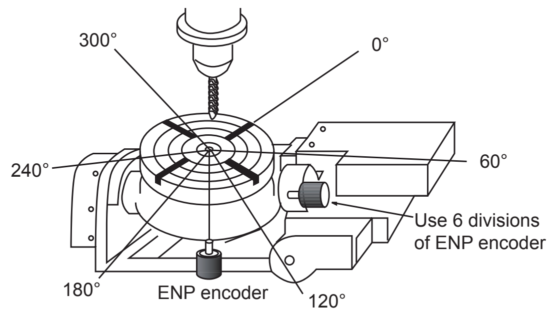
Controlling position of moving crane

※ Incremental encoder



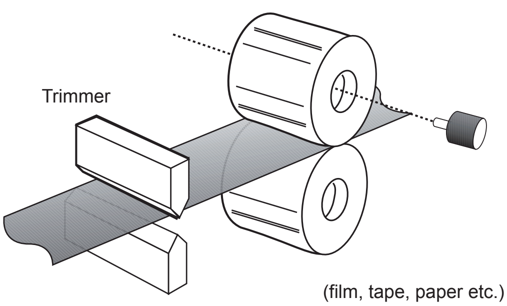
Controlling table angle of NC machine

※Absolute encoder



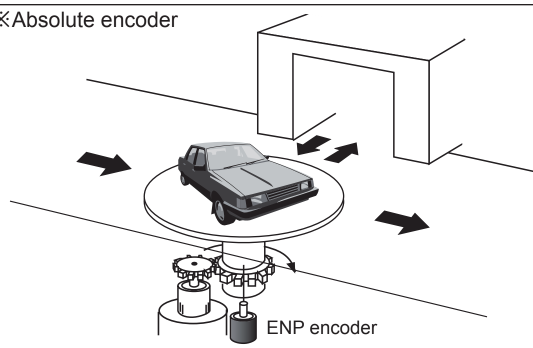
Measuring the length of sheet

※Incremental encoder



Controlling entrance and exit of car

※Absolute encoder



▣ Overview

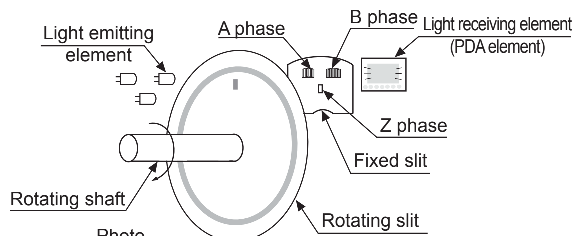
It is being digitalized and accelerated with built-in micro processor because of development of computer.
It is widely used in industrial NC, ROBOT, servo motors and OA equipment in order to detect accurate location and operating speed and to provide some feedback.
Rotary encoder is a device that converts shaft's rotation angle into electrical signals (pulse) and provides an output.
In case of incremental type, rotation direction is detected by A, B phase output timing.
In case of absolute type, rotation direction is detected by increment/decrement of output code.
The absolute type does not need zero point return due to the code for rotation angle output.

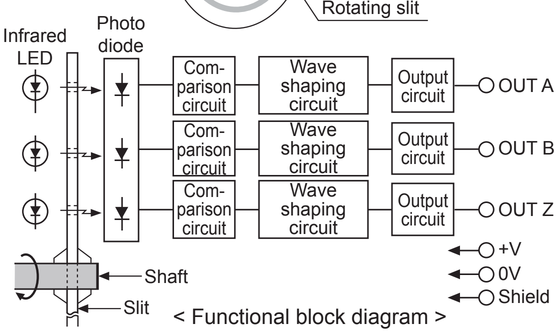
▣ Principle Of Operation

◎ Optical rotary encoder

● Incremental rotary encoder

Incremental rotary encoder consists of a rotating slit which is painted black pattern and a fixed slit between light emitting elements and light receiving elements. By rotating encoder's shaft, light from the light emitting elements passes through these silts, or is blocked. The passing light is converted as current signal by light receiving element. This current signal outputs square wave pulse through a wave shaping circuit and an output circuit. Incremental output phases are A phase, B phase which have phase difference at 90°, and Z phase, zero-reference phase.

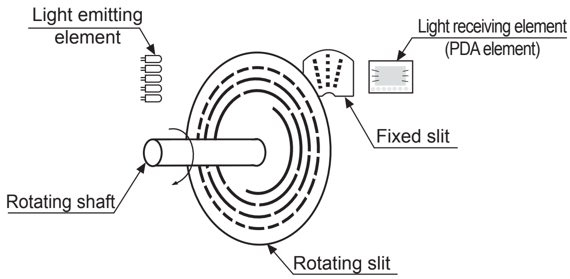




< Functional block diagram >

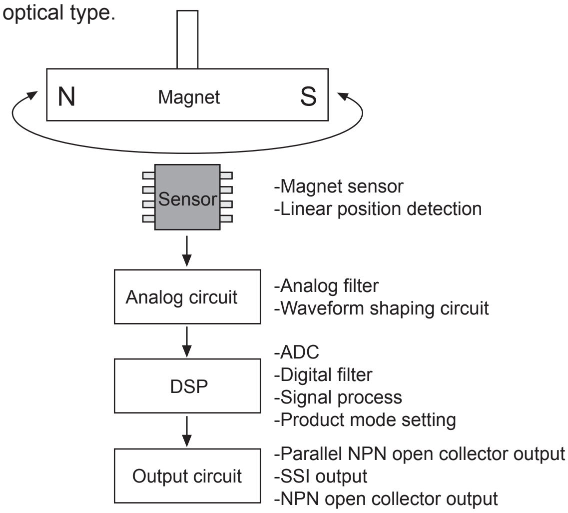
● Absolute rotary encoder

The absolute rotary encoder divides from 0° to 360° as certain rate and specifies electrical digital code (BCD, Binary, Gray code) to the each divided angle position.
The absolute rotary encoder as the absolute angle sensor outputs the specified digital code according to the rotational shaft position. Due to no impact on the electric characteristics, this encoder does not need memory retention circuit against power failure and has high noise immunity.



◎ Magnetic rotary encoder

Magnetic rotary encoder is operated by processing signal of magnetic field change from rotated magnet.
Autonics magnetic rotary encoder is absolute type.
The absolute rotary encoder divides from 0° to 360° as certain rate and specifies electrical digital code (BCD, Binary, Gray code) to the each divided angle position.
The absolute rotary encoder as the absolute angle sensor outputs the specified digital code according to the rotational shaft position.
Magnetic rotary encoder does not have slit. This is strong vibration and shock and the life expectancy is longer than optical type.



▣ Characteristics by Operation Principle

	Optical	Magnetic
Vibration, Shock	Weak	Stronger than optical type (∵ no slit)
Life expectation	Short	Longer than optical type
Accuracy	High	Lower than optical type

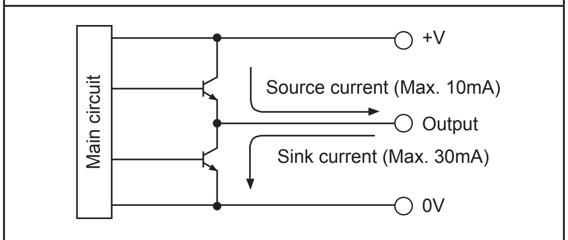
Technical Description

▣ Connection Example And Output Types Of Rotary Encoder

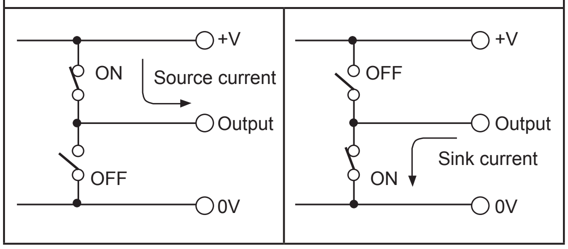
◎ Totem pole output

A totem pole output is a type of electronic circuit that consist of two transistors between +V and 0V as shown in the figure below. When output signal is "H", upper transistor will be ON and lower transistor will be OFF. When output signal is "L", upper transistor will be OFF and lower transistor will be ON. Totem pole output features low output impedance because the circuit is designed to be capable of flowing current in both directions. In addition, it has little influence of waveform distortion and noise, and is used for longer encoder line.

Totem pole output circuit

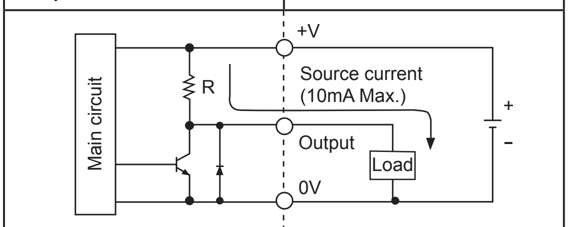


Equivalent circuit



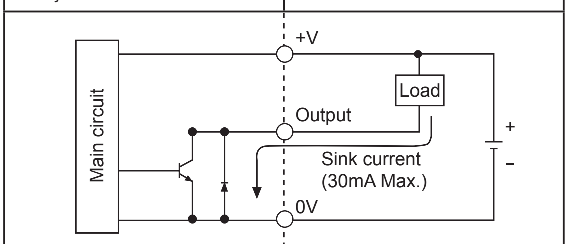
● In case of voltage output type

Rotary encoder circuit	Load connection



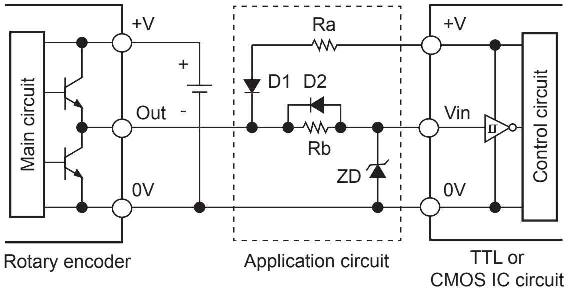
● In case of NPN open collector output type

Rotary encoder circuit	Load connection



● Connection example totem pole output type and IC circuit

If certain deviation occurs between encoder's max. output signal voltage (Vout) and max. allowable input voltage of logic IC (Vin), it is required to adjust circuit's voltage level as shown in the figure below.

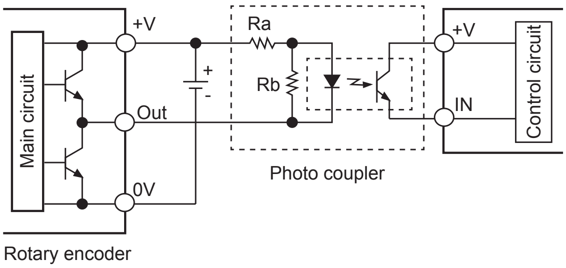


※If input voltage of control circuit is lower than applied voltage of encoder,

1) Make sure that zener voltage on ZD should be the same with max. allowable input voltage (Vin) of logic IC circuit.
2) Make sure that Ra and Rb should be adjusted to stable input signal level when designing application circuit.
3) In case cable length between encoders and control circuit is short, it is fine to design the circuit without Ra and D1.

● Connection example totem pole output type and Coupler

Encoder's output circuit can be isolated by using photo coupler as shown in the figure below.



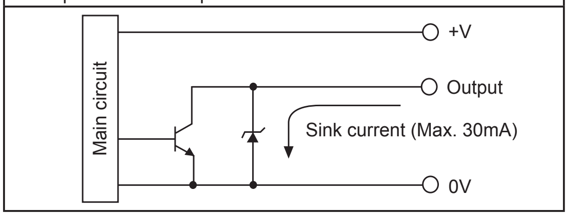
Note 1) All components applied to application circuits shall be connected adjacent to photo coupler.

Note 2) Make sure to select the photo coupler having higher response speed than encoder's max. response frequency.

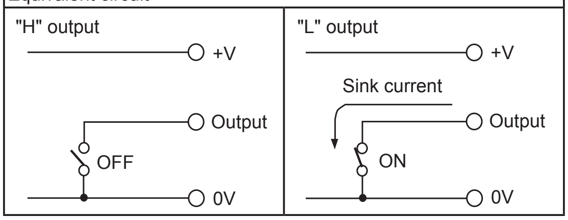
◎ NPN open collector output

As shown below, it is one of various output types using NPN transistor to connect emitter with "0V" terminal, and to open "+V" terminal with collector so that collector terminal can be used as an output terminal.
It is useful when encoder's power voltage and controller's power voltage are not matched.

NPN open collector output circuit

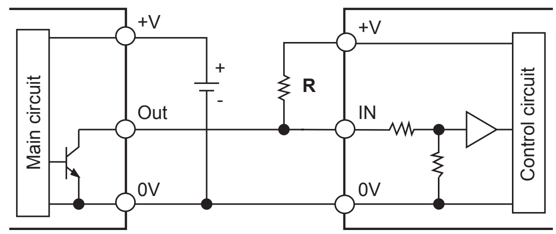


Equivalent circuit



● Connection example of NPN open collector output type collector and counter.

When connect to a counter which is voltage input type, please connect to pull-up resistance between +V and output (transistor's collector) from external.



Rotary encoder
Voltage input type counter

Note) Make the value of pull up resistance under 1/5 of input impedance of a counter.

● Connection example of NPN open collector output type and photo coupler

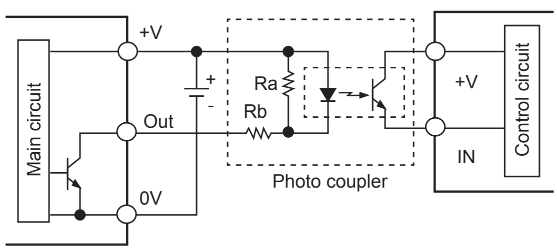


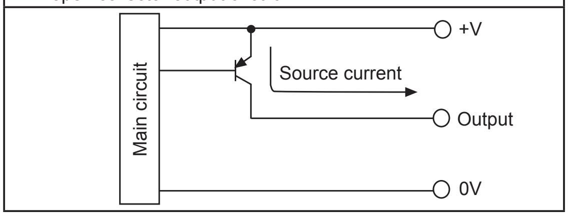
Photo coupler
Rotary encoder

Note 1) Ra value should be a high resistance within the stable operating range of photo coupler.
Note 2) Rb value should be within the stable operating range of photo coupler. This value is not exceeded the rated load current of rotary encoder.

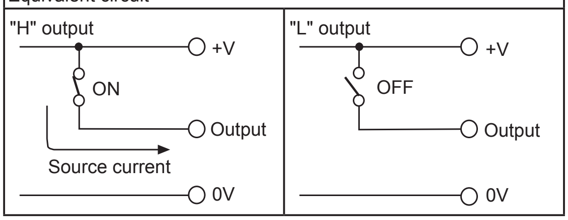
◎ PNP open collector output (Only for absolute type)

As shown below, it is one of various output types using PNP transistor to connect emitter with "+V" terminal, and to open "0V" terminal with collector so that collector terminal can be used as an output terminal.
It is useful when encoder's power voltage and controller's power voltage are not matched.

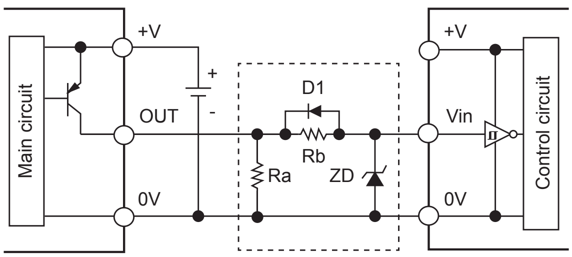
PNP open collector output circuit



Equivalent circuit



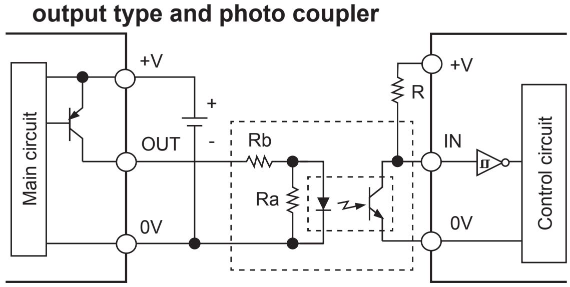
● Connection example of PNP open collector output type and external application circuit



Rotary encoder
Application circuit
TTL or CMOS IC circuit

Note 1) Please use low resistance that does not exceed the rated load current of rotary encoder.
Note 2) Select components that make zener voltage of ZD the same as maximum allowable input voltage of logic IC.

● Connection example of PNP open collector output type and photo coupler



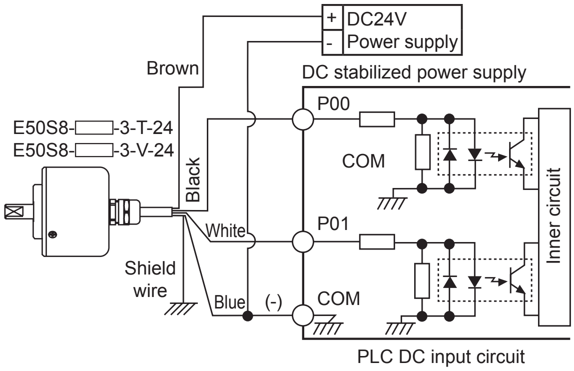
Rotary encoder
Photo coupler

Note) Ra and Rb values should be within the stable operating range of photo coupler. These values are not exceeded the rated load current of rotary encoder.
※Only absolute rotary encoder has PNP open collector output type.

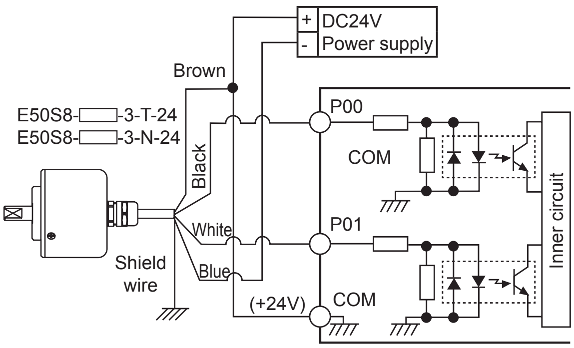
◎ Connection example of rotary encoder and PLC

Rotary encoder output is able to connect PLC which is DC type input module. Be sure to set the output pulse of rotary encoder longer enough (more than 10 times) than scan time of PLC. (Either make rpm lower or use a low pulse encoder.).
Because DC power of PLC is not stabilized, please supply stable power to rotary encoder.

● **Common terminal is "0V"**

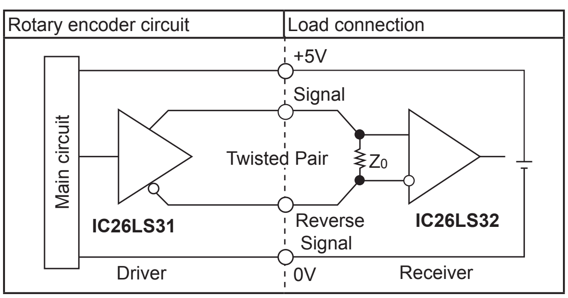


● **Common terminal is "+24V"**



◎ Line driver output

Line Drive output uses Line Drive exclusive IC (26LS31) on output circuit as shown below. That exclusive IC has high speed response. So, it is proper for long-distance transmission and is strong on noise.
However, use IC (26LS32) corresponded to RS422A on response side.
Also, in case of extending wiring length, use twisted pair line. If make output line, it is able to get a characteristic to eliminate normal mode noises as offsetting electromotive force occurred in line.
(Terminating resistance of receiver (Zo): Approx. 200Ω)



▣ Glossary

● **Resolution**

Resolution is number of output pulse while rotary encoder shaft revolves once.
For incremental rotary encoder, resolution means number of graduations on a silt, and for absolute rotary encoder, resolution means number of divisions.

● **Starting torque**

The torque needed to rotate the shaft of the rotary encoder at startup. The torque during rotation is normally lower than the starting torque.

● **Maximum response frequency**

The max. number of pulses that rotary encoder could respond electronically in a sec. And it also can be the shaft speed when the device in which the encoder is used is in operation.

$$\text{Max. response frequency} = \frac{\text{Revolutions}}{60} \times \text{Resolution}$$

Note)Max. revolutions should be within max. allowable revolutions. Resolution should not be exceeded max. response frequency.

● **Maximum allowable revolution (rpm)-Mechanical specification**

It means the mechanical maximum allowable revolution of rotary encoder, and has an impact on the lifetime of the encoder.
So, please do not exceed the rated values listed in.

● **Maximum response revolution (rpm)-Electronic specification**

The maximum revolution speed for rotary encoder to output electric signal ordinarily. It is decided by max. response frequency and resolution.

$$\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60$$

Set resolution that makes max. response revolution not to exceed max. allowable revolution.

● **CW (Clock wise)**

The clockwise direction of rotation from the shaft, the shaft. (A phase precedes B phase at 90° in our company's standard feature.)

● **CCW (Counter clock wise)**

The counterclockwise direction of rotation from encoder's shaft. (B phase precedes A phase at 90° in our company's standard feature.)

● **A, B phase**

Digital signals of which phase difference is 90°, and that is to determine the direction of rotation.

● **Z phase**

Signal that is generated once a revolution and is called zero-reference phase.

● **BCD Code (Binary-Coded Decimal code)**

It is a binary-coded decimal system.
Because it is easy to change a decimal code to binary code with the '8 4 2 1' that indicates the weight of each bit, it is widely used with controllers and counters.
E.g.)In case of converting decimal digit 23 to binary-coded decimal code, it would be;

$$23 = \overbrace{0\ 0\ 1\ 0}^{2}\quad \overbrace{0\ 0\ 1\ 1}^{3}$$

	Tens position	Ones position	
23 =	0 0 1 0	0 0 1 1	
	8 4 2 1	8 4 2 1	← The weight of each bit

- **Binary code**

The most basic code expressed in combination of 0 and 1.
E.g.) In case of converting decimal digit 27 to binary code, it would be 11011.

```
2 | 27
2 | 13 --1
2 |  6 --1
2 |  3 --0
     1 --1
```

Write down in the direction of arrow.

- **Gray code**

Gray code is made to complement the defects of binary code. Only one bit changes state form one position to another so that it prevents errors occurring.
E.g.) In case of converting decimal digit 12 (1100 in binary code) to gray code, it would be 1010.

Binary code 1 1 0 0

Gray code 1 0 1 0

It becomes 1 if third bit and fourth bit of binary code are different from each other, and becomes 0 when they are equal to each other.

It becomes 1 if second bit and third bit of binary code are different from each other, and becomes 0 when they are equal to each other.

It becomes 1 if the first bit and the second one of binary code are different from each other, and becomes 0 when they are equal to each other.

The first bit of binary code (called MSB) remains the same as the first bit of gray code.

< Absolute code table >

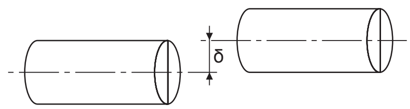
Decimal	Gray Code					Binary Code					BCD Code ×10				BCD Code ×1			
	2^4	2^3	2^2	2^1	2^0	2^4	2^3	2^2	2^1	2^0	2^3	2^2	2^1	2^0	2^3	2^2	2^1	2^0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1
2	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0
3	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	1
4	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0
5	0	0	1	1	1	0	0	1	0	1	0	0	0	0	0	1	0	1
6	0	0	1	0	1	0	0	1	1	0	0	0	0	0	0	1	1	0
7	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	1	1	1
8	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
9	0	1	1	0	1	0	1	0	0	1	0	0	0	0	1	0	0	1
10	0	1	1	1	1	0	1	0	1	0	0	0	0	1	0	0	0	0
11	0	1	1	1	0	0	1	0	1	1	0	0	0	1	0	0	0	1
12	0	1	0	1	0	0	1	1	0	0	0	0	0	1	0	0	1	0
13	0	1	0	1	1	0	1	1	0	1	0	0	0	1	0	0	1	1
14	0	1	0	0	1	0	1	1	1	0	0	0	0	1	0	1	0	0
15	0	1	0	0	0	0	1	1	1	1	0	0	0	1	0	1	0	1
16	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0
17	1	1	0	0	1	1	0	0	0	1	0	0	0	1	0	1	1	1
18	1	1	0	1	1	1	0	0	1	0	0	0	0	1	1	0	0	0
19	1	1	0	1	0	1	0	0	1	1	0	0	0	1	1	0	0	1
20	1	1	1	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0
21	1	1	1	1	1	1	0	1	0	1	0	0	1	0	0	0	0	1
22	1	1	1	0	1	1	0	1	1	0	0	0	1	0	0	0	1	0
23	1	1	1	0	0	1	0	1	1	1	0	0	1	0	0	0	1	1
24	1	0	1	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0
25	1	0	1	0	1	1	1	0	0	1	0	0	1	0	0	1	0	1

▣ Glossary (Coupling)

◎ Misalignment

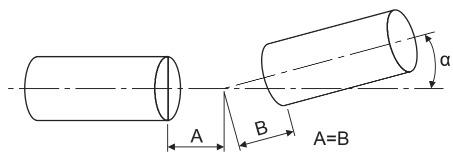
- **Parallel misalignment**

It rotates with parallel misalignment by δ when the centers of two axes connected by a coupling are not symmetrical.
E.g.)In case of converting decimal digit 23 to binary-coded decimal code, it would be;



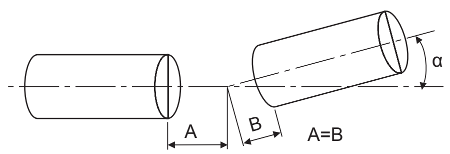
- **Angular misalignment (Symmetrical)**

It rotates with angular misalignment by α when the center distances of two axes connected by a coupling are equal.



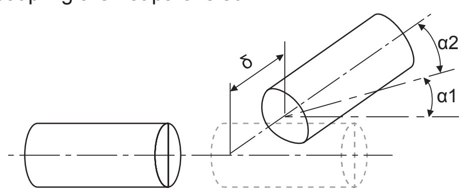
- **Angular misalignment (Non-symmetrical)**

It rotates with angular misalignment by α when the center distances of two axes connected by a coupling are not equal.



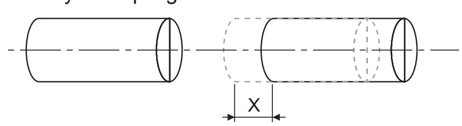
- **Combined parallel and angular misalignment**

It rotates with parallel misalignment by δ and angular misalignment by α when the centers of two axes connected by a coupling are not paralleled.



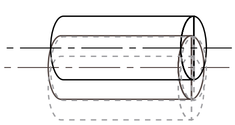
- **End-play**

It rotates with End-play by X from one of two shafts connected by a coupling.



- **Run out**

It rotates with vibration in a radial direction.



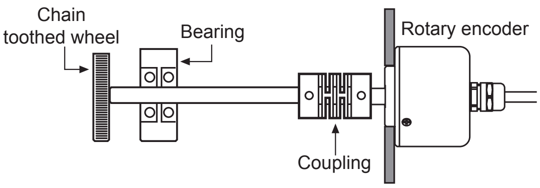
Technical Description

▣ Proper Usage

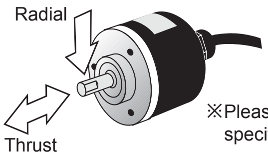
◎ Caution for using

Because rotary encoder consist of precision parts, excessive force can cause internal slit damaged.
So, please be careful when using it.

- When combine to chains, timing belts, toothed wheels, use the coupling so that the axis of encoder is not impacted by an excessive force.

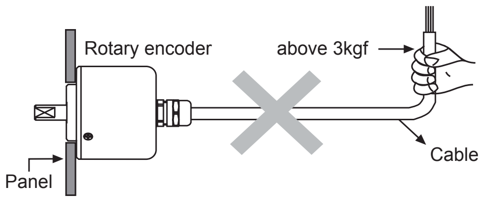


- Do not apply excessive loads to the axis of rotation.

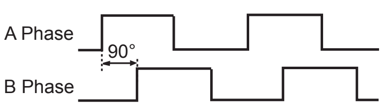
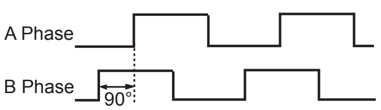


※Please refer to mechanical specifications.

- Be sure not to inflict more than 3kgf of the tensile on Rotary encoder wiring.

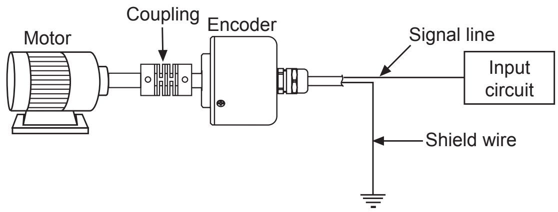


- Do not drop water or oil on the rotary encoder. Otherwise, it may cause malfunction.
- Do not hammer when combining either hollow shaft or built-in type encoder with a body of revolution. Especially be careful with high-pulse encoder that has fragile glass slit.
- Pulse phase of encoder varies depending on the direction of rotation. If the shaft rotates right when see it from the end of the shaft, it is Clockwise (CW). And if it rotates left, it is Counterclockwise (CCW).
  A phase precedes B phase when it is on CW.

Clock wise (CW)	A phase precedes at 90° 
Counter clock wise (CCW)	B phase precedes at 90° 

◎ Cautions when connecting wiring

- Cable shield line of rotary encoder is directly connected to the case, so please ground the metal parts of encoder case to prevent malfunction from being caused by external noises. Also make sure shield line of encoder cable to be grounded, not to be opened.



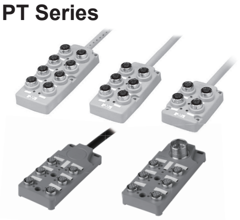
- Work on the wiring when power is turned off. And wrap it with pipe separately from other wires like power line, otherwise malfunction or internal circuit failure can be caused.
- It is better to shorten the wire length otherwise, the fall and rise time of wave form gets as long as the wire extended. Because which make it impossible to get an wanted output wave, please use it after standardizing the wave form using Schmidt trigger circuit.

◎ Vibration

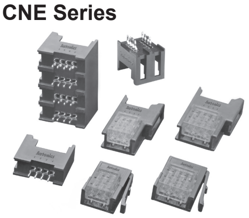
- If vibration is inflicted to rotary encoder, pulses can be caused in wrong way. Thus, please place it in vibration-less area.
- The more pulses in one revolution, the narrower the gradations on resolution curve, and in which condition, operation vibration can be transmitted and that may cause uncommon pulses.

(G) Connectors / Connector Cables / Sensor Distriction Boxes / Sockets

Sensor Distribution Box
PT Series



Sensor Connector
CNE Series



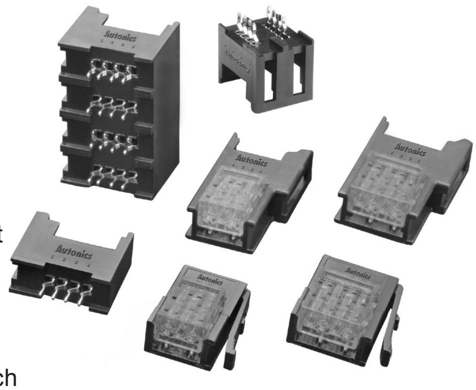
Photoelectric/Proximity Sensor Connector Cable
CID/CLD Series

CNE Series

Sensor Connector

■ Features

■ **Wire mount plug/socket**
● Compact and highly reliable of pressure welding connector
● Enables to connect wires as wire mount plug/socket
● Different 9 colors of cover by wire diameter
● Visible wiring status with translucent cover
■ **Board mount socket**
● Enables to insert 4, 2, or 1 wire mount plugs
● Contact placed in mold against electric shock and short-circuit
● Mountable on board closely
■ **Commons**
● Significantly reduces connection time and effort
● Wide products range for various wires
● Compact and high density installation with 2mm of contact pitch
● Compliance with e-CON
● Max. 3A of current capacity by a pin



■ Ordering Information

CNE – P 03 – WT

Cover color (wire specifications)
※'■ **Cover color and wire specifications'**
(Refer to page G-3)

Field	Code	Description
Pins	03	3-pin
	04	4-pin
Connector type	P	Wire mount plug
	S	Wire mount socket
Item	CNE	Sensor connector

CNE – B 2 03

Field	Code	Description
Pins	03	3-pin
	04	4-pin
Lines	No-mark	1-line
	2	2-line
	4	4-line
Connector type	B	Board mount socket
Item	CNE	Sensor connector

■ Specifications

Type		Wire mount plug	Wire mount socket	Board mount socket
Model		**CNE-P□-□**	**CNE-S□-□**	**CNE-B□□**
Application	Connector	Board mount socket/Wire mount socket	Wire mount plug	Wire mount plug
	Cable	AWG30-20 (Ø0.6mm to Ø2.0mm)		—
	PCB	—		Fender plated-through hole, Hole dia.: 1.0mm, PCB thickness: 1.0 to 2.2mm
Rated voltage		Max. 250VAC/DC		
Rated current		Max. 3.0A		
Environ-ment	Ambient temp.	-20 to 85℃ (applying 1A), -20 to 75℃ (applying 2A), -20 to 60℃ (applying 3A)		
	Ambient humi.	40 to 80%RH		
Terminal retention		Min. 1.4kgf		
Pressure strength		● AWG30: Min. 0.5kgf ● AWG24: Min. 0.8kgf ● AWG20: Min. 1.0kgf		
Extraction		Min. 0.49N (50gf)/pin		
Insertion		Max. 1.96N (200gf)/pin		
Dielectric strength		1,000VAC for 1min (between terminals)		
Insulated resistance		Over 1,000MΩ (between terminals)		
Contact resistance		Max. 0.05Ω (short-current: 1mA, max. open voltage: 20mV)		
Material		Body: PC/ABS (UL94V-0), Terminal: C5210 (gold 0.2μm), Case: PC (UL94-V0)		Body: PC/ABS (UL94-V0), Terminal: C5210 (gold 0.2μm)

■ Cover Color And Wire Specifications

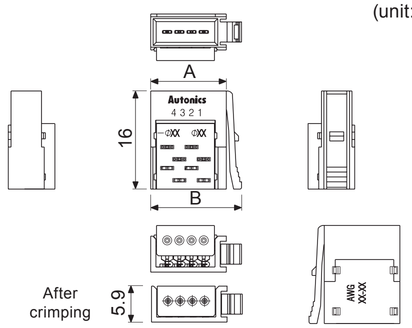
Cover color	3-pin	4-pin	Applied wire specifications	
			Nominal cross section area (mm²)	Cover diameter (mm)
Transparent (WT)	CNE-□03-WT	CNE-□04-WT	0.05 to 0.08 (AWG30 to 28)	Ø0.6 to 0.8
Yellow-Green (YG)	CNE-□03-YG	CNE-□04-YG		Ø0.8 to 1.0
Violet (VT)	CNE-□03-VT	CNE-□04-VT		Ø1.0 to 1.2
Red (RE)	CNE-□03-RE	CNE-□04-RE	0.13 to 0.21 (AWG26 to 24)	Ø0.8 to 1.0
Yellow (YW)	CNE-□03-YW	CNE-□04-YW		Ø1.0 to 1.2
Orange (OG)	CNE-□03-OG	CNE-□04-OG		Ø1.2 to 1.6
Green (GN)	CNE-□03-GN	CNE-□04-GN	0.32 to 0.5 (AWG22 to 20)	Ø1.0 to 1.2
Blue (BL)	CNE-□03-BL	CNE-□04-BL		Ø1.2 to 1.6
Gray (GY)	CNE-□03-GY	CNE-□04-GY		Ø1.6 to 2.0

※□: P (wire mount plug), S (wire mount socket)

■ Dimensions

◎ Wire mount plug

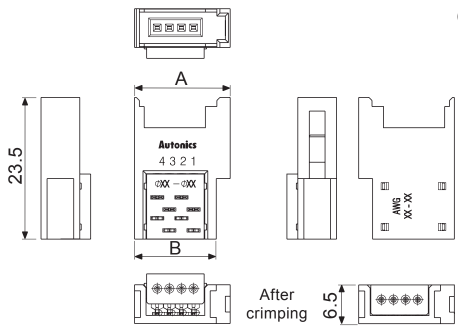
(unit: mm)



Pins	Model	A	B
3	CNE-P03-□	10.5	14.5
4	CNE-P04-□	12.5	16.5

◎ Wire mount socket

(unit: mm)

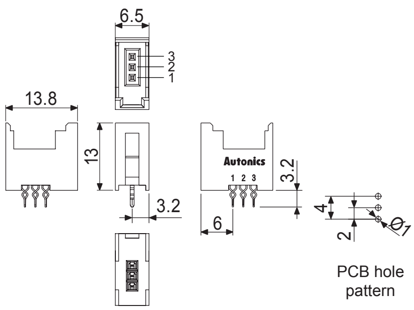


Pins	Model	A	B
3	CNE-S03-□	13.8	11.5
4	CNE-S04-□	15.8	13.5

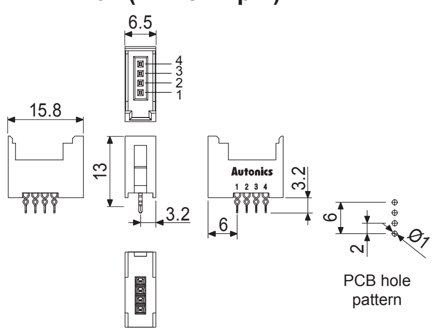
◎ Board mount socket

(unit: mm)

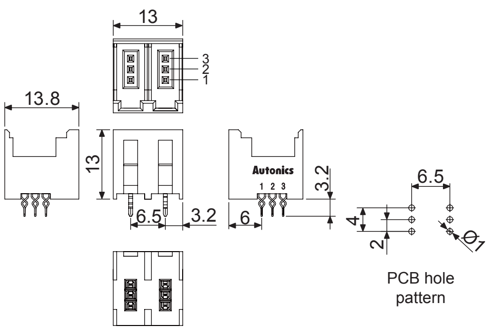
● **CNE-B03 (1-line×3-pin)**



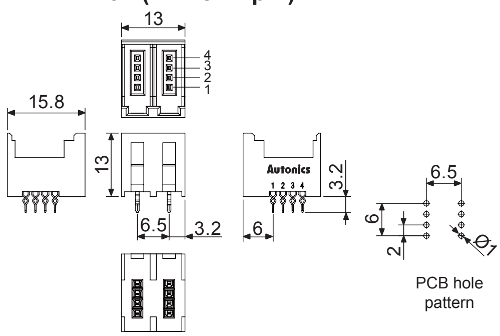
● **CNE-B04 (1-line×4-pin)**



● **CNE-B203 (2-line×3-pin)**



● **CNE-B204 (2-line×4-pin)**

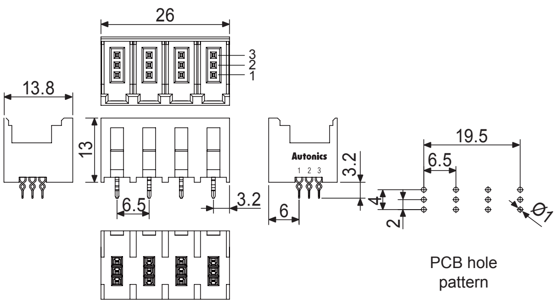


▣ Dimensions

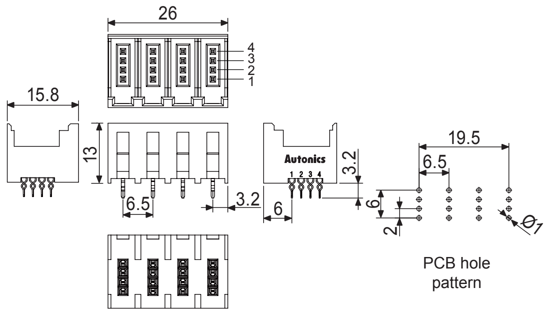
◎ Board mount socket

(unit: mm)

● **CNE-B403 (4-line×3-pin)**



● **CNE-B404 (4-line×4-pin)**



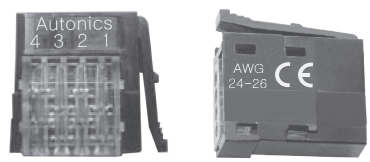
▣ Wiring Sensor Connector

1) Select connector

- Check the wire specifications (conductor section, cover diameter).
- Select the proper color of sensor connector (model) by referring to the below table.

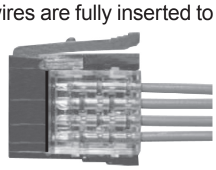
Cover color	Wire mount plug	Wire mount socket	Applied wire specifications	
			Nominal cross section area (mm²)	Cover diameter (mm)
Transparent (WT)	CNE-P□-WT	CNE-S□-WT	0.05 to 0.08 (AWG30 to 28)	Ø0.6 to 0.8
Yellow-Green (YG)	CNE-P□-YG	CNE-S□-YG		Ø0.8 to 1.0
Violet (VT)	CNE-P□-VT	CNE-S□-VT		Ø1.0 to 1.2
Red (RE)	CNE-P□-RE	CNE-S□-RE	0.13 to 0.21 (AWG26 to 24)	Ø0.8 to 1.0
Yellow (YW)	CNE-P□-YW	CNE-S□-YW		Ø1.0 to 1.2
Orange (OG)	CNE-P□-OG	CNE-S□-OG		Ø1.2 to 1.6
Green (GN)	CNE-P□-GN	CNE-S□-GN	0.32 to 0.5 (AWG22 to 20)	Ø1.0 to 1.2
Blue (BL)	CNE-P□-BL	CNE-S□-BL		Ø1.2 to 1.6
Gray (GY)	CNE-P□-GY	CNE-S□-GY		Ø1.6 to 2.0

※□: Number of pins (03: 3-pin, 04: 4-pin)
※The proper sensor connector may be different by conductor of wire.
※Cover diameter of applied wire at connector (at translucent part) and AWG number of body backside are marked.



2) Insert the wires

- Check the pin numbers and insert the wires into the according holes.
- Check that the wires are fully inserted to the end of the cover.



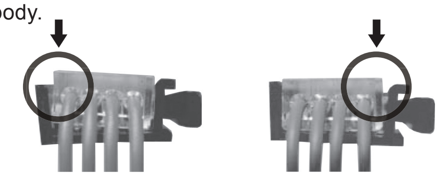
3) Crimping

- Insert the cover into the body with a jig (press fitting tool, etc).

※Apply pressure with the jig from the side, as shown in the figure below.

4) Check the cover

- Check to make sure that the cover is level with the body and that there is no space between the cover and the body.



Wrong (1)
Not enough cover insertion.

Wrong (2)
Not enough cover insertion.

※Press the part of arrows again.

■ Ordering Information

◎ Connector cable

C I D [ ] 2 [ ] – 2 [ ] – [ ]

Item	Code	Description
Standard	No-mark	Standard type
	I※1	IEC standard
Connection	No-mark	Socket type
	P	Plug type
Cable length	1	1m
	2	2m
	3	3m
	5	5m
	7	7m
Connector dimension	No-mark	M12
	08	M8
Cable wire	2	2-wire type
	3	3-wire type
	4	4-wire type
Cable material	No-mark	General type
	H	Oil resistant PVC
Power supply	D	DC type
	A	AC type
Shape	I	Standard type
	L	L type
Item	C	Connector

※1: This is IEC standard and it can be customized.

◎ Connector connection cable

C 1 D [ ] 4 – 2 [ ]

Item	Code	Description
Connection type	No-mark	Socket-Plug type
	P	Plug-Plug type
Cable length	1	1m
	2	2m
	3	3m
	5	5m
	7	7m
Number of connector pins	4	4-pin
Cable material	No-mark	General type
	H	Oil resistant PVC
Power supply	D	DC type
	A	AC type
Shape	1	Standard type
	2	L type-L type
	3	Standard type-L type
	4	L type-Standard type
Item	C	Connector

■ Connector Cable

◎ M12 Connector

Appearance			Model	Length	Cable material
DC 2-wire type	Socket type		CID2-2	2m	PVC
			CID2-2-I ※1		
			CID2-5	5m	
			CID2-5-I ※1		
			CLD2-2	2m	
			CLD2-2-I ※1		
			CLD2-5	5m	
			CLD2-5-I ※1		
	Plug type		CID2-2P	2m	
			CID2-5P	5m	
			CLD2-2P	2m	
			CLD2-5P	5m	
DC 3-wire type	Socket type		CID3-2	2m	
			CID3-5	5m	
			CLD3-2	2m	
			CLD3-5	5m	
	Plug type		CID3-2P	2m	
			CLD3-2P	2m	
DC 4-wire type	Socket type		CIDH4-2	2m	
			CIDH4-3	3m	
			CIDH4-5	5m	
			CIDH4-7	7m	
			CLDH4-2	2m	
			CLDH4-3	3m	
			CLDH4-5	5m	
			CLDH4-7	7m	
	Plug type		CIDH4-2P	2m	
			CIDH4-3P	3m	
			CIDH4-5P	5m	
			CIDH4-7P	7m	
			CLDH4-2P	2m	
			CLDH4-3P	3m	
			CLDH4-5P	5m	
			CLDH4-7P	7m	
AC 2-wire type	Socket type		CIA2-2	2m	
			CIA2-5	5m	
			CIAH2-2	2m	
			CIAH2-5	5m	
			CLA2-2	2m	
			CLA2-5	5m	
			CLAH2-2	2m	
			CLAH2-5	5m	
	Plug type		CIA2-2P	2m	
			CIA2-5P	5m	
			CIAH2-2P	2m	
			CIAH2-5P	5m	
			CLA2-2P	2m	
			CLA2-5P	5m	
			CLAH2-2P	2m	
			CLAH2-5P	5m	

※1: This is IEC standard and it can be customized.
※Be careful of connection, because color is different when DC 4-wire connector cable is used for DC 2-wire sensor.

■ Connector Connection Cable

◎ M12 Connector

Appearance			Model	Length	Cable material
Socket - Plug type		DC type	C1D4-2	2m	PVC
			C1D4-5	5m	
			C1DH4-1	1m	
			C1DH4-3	3m	
			C1DH4-5	5m	
			C1DH4-7	7m	
		AC type	C1A4-2	2m	
			C1A4-5	5m	
		DC type	C2D4-2	2m	
			C2D4-5	5m	
			C2DH4-1	1m	
			C2DH4-3	3m	
			C2DH4-5	5m	
			C2DH4-7	7m	
		AC type	C2A4-2	2m	
			C2A4-5	5m	
		DC type	C3D4-2	2m	
			C3D4-5	5m	
			C3DH4-1	1m	
			C3DH4-3	3m	
			C3DH4-5	5m	
			C3DH4-7	7m	
		AC type	C3A4-2	2m	
			C3A4-5	5m	
		DC type	C4D4-2	2m	
			C4D4-5	5m	
			C4DH4-1	1m	
			C4DH4-3	3m	
			C4DH4-5	5m	
			C4DH4-7	7m	
		AC type	C4A4-2	2m	
			C4A4-5	5m	
Plug - Plug type		DC type	C1D4-2P	2m	
			C1D4-5P	5m	
		AC type	C1A4-2P	2m	
			C1A4-5P	5m	

◎ M8 Connector (connector connection cable)

Appearance			Model	Length	Cable material
DC 4-wire type	Socket type		CID408-2	2m	PVC
			CID408-5	5m	
			CLD408-2	2m	
			CLD408-5	5m	

■ Specifications Of Connector Cable

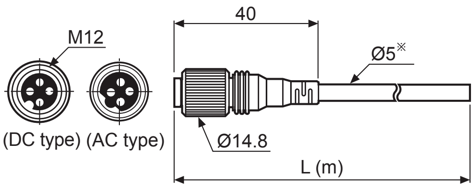
Ø5, 2/3/4-wire, 2m/3m/5m/7m (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.3mm)
For, CIDH4/CLDH4, Ø6, 4-wire, 3m/5m (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.65mm)

▣ Dimensions

◎ Connector cable (Socket type)

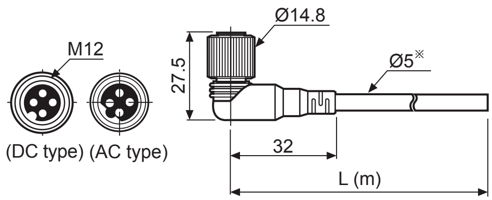
(unit: mm)

● CID2-□, CID2-□-I ● CID3-□ ● CIDH4-□
● CIA2-□, CIAH2-□



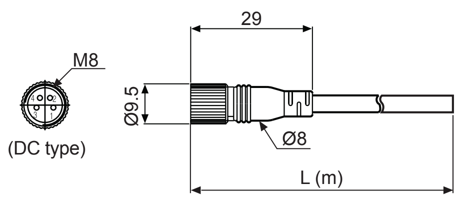
※Cable diameter of CIDH4-□, CIAH2-□ is Ø6.

● CLD2-□, CLD2-□-I ● CLD3-□ ● CLDH4-□
● CLA2-□, CLAH2-□

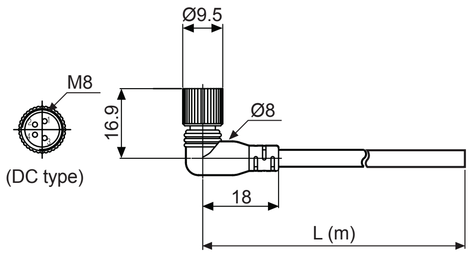


※Cable diameter of CLDH4-□, CLAH2-□ is Ø6.

● CID408-2, CID408-5



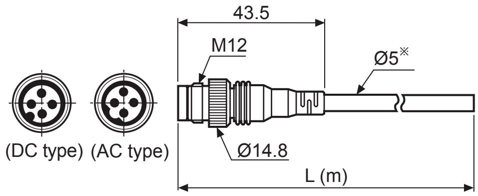
● CLD408-2, CLD408-5



◎ Connector cable (Plug type)

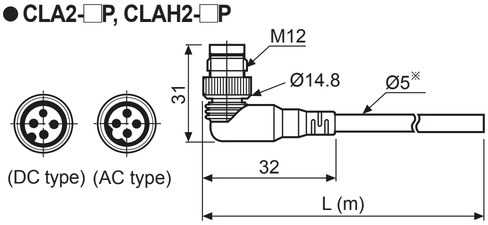
(unit: mm)

● CID2-□P ● CID3-2P ● CIDH4-□P
● CIA2-□P, CIAH2-□P



※Cable diameter of CIDH4-□P, CIAH2-□P is Ø6.

● CLD2-□P ● CLD3-2P ● CLDH4-□P
● CLA2-□P, CLAH2-□P

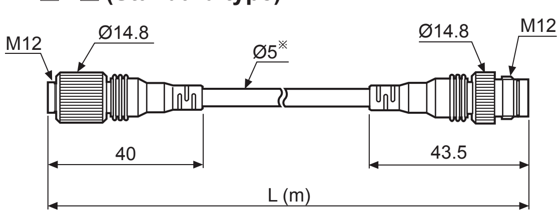


※Cable diameter of CLDH4-□P, CLAH2-□P is Ø6.

◎ Connector connection cable (Socket-Plug type)

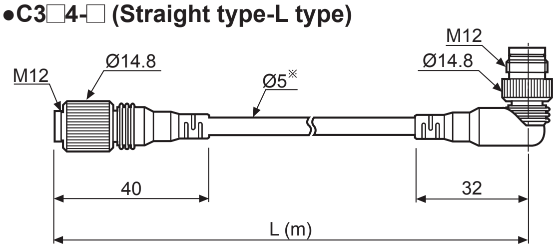
(unit: mm)

●C1□4-□ (Standard type)



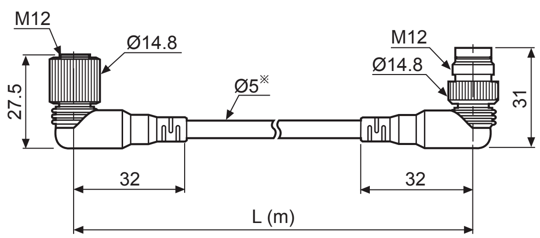
※Cable diameter of C1DH4-□ is Ø6.

●C3□4-□ (Straight type-L type)



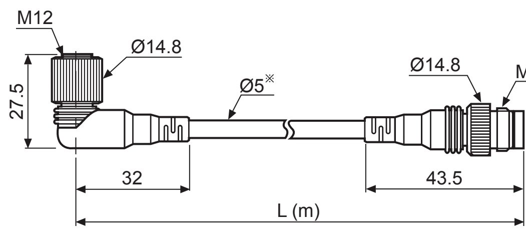
※Cable diameter of C3DH4-□ is Ø6.

●C2□4-□ (L type-L type)



※Cable diameter of C2DH4-□ is Ø6.

●C4□4-□ (L type-Straight type)

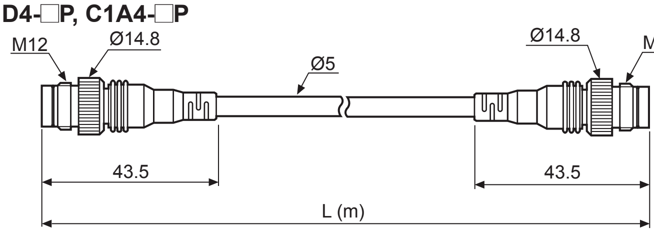


※Cable diameter of C4DH4-□ is Ø6.

◎ Connector connection cable (Plug-Plug type)

(unit:mm)

● **C1D4-□P, C1A4-□P**

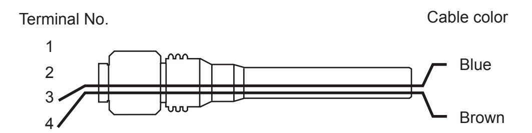


■ Connections

◎ Connector cable

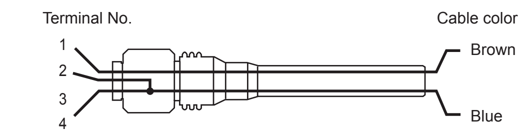
DC 2-wire type

● **CID2-□** ● **CLD2-□** ● **CID2-□P** ● **CLD2-□P**



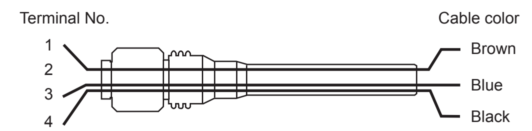
DC 2-wire type (IEC standard type)

● **CID2-□-I** ● **CLD2-□-I**



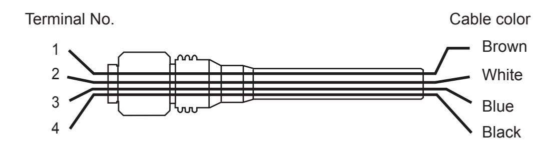
DC 3-wire type

● **CID3-□** ● **CLD3-□** ● **CID3-□P** ● **CLD3-□P**



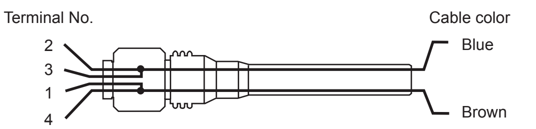
DC 4-wire type (oil resistant PVC)

● **CIDH4-□** ● **CLDH4-□** ● **CIDH4-□P** ● **CLDH4-□P**



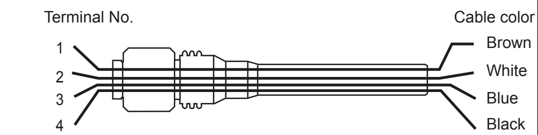
AC 2-wire type

● **CIA2-□** ● **CLA2-□** ● **CIA2-□P** ● **CLA2-□P**
● **CIAH2-□** ● **CLAH2-□** ● **CIAH2-□P** ● **CLAH2-□P**



DC 4-wire type

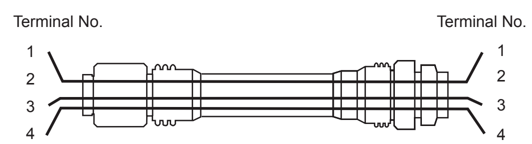
● **CID408-□** ● **CLD408-□**



◎ Connector connection cable

DC type

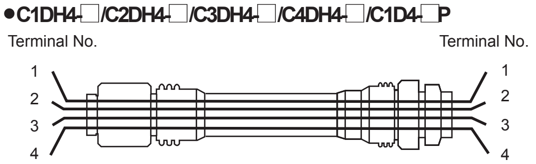
● **C1D4-□ / C2D4-□ / C3D4-□ / C4D4-□**



※Pin 2 is N·C (Not Connected).

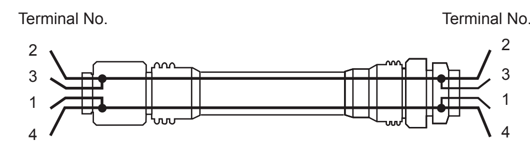
DC type

● **C1DH4-□/C2DH4-□/C3DH4-□/C4DH4-□/C1D4-□P**



AC type

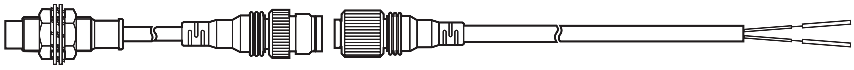
● **C1A4-□/C2A4-□/C3A4-□/C4A4-□** ● **C1A4-□P**



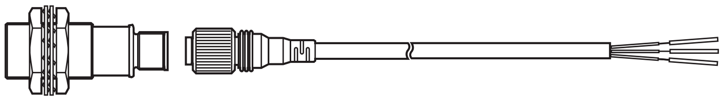
※Pin 2 / 3, 1 / 4 are connected inside.

■ Connector Cable Connections

● Connector cable (Socket type)

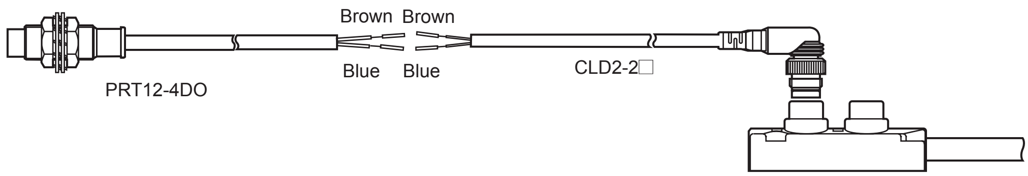


PRWT12-4DO CID2-□



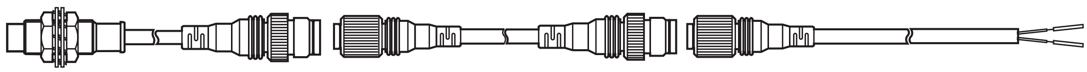
PRCM18-5DN CID3-□

● Connector cable (Plug type)

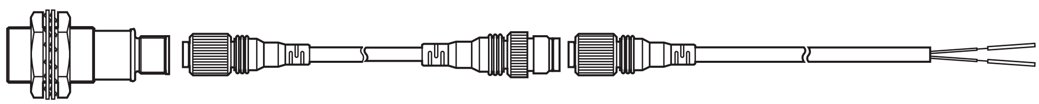


Sensor Distribution Box (PT4-2D)

● Connector connection cable (Socket-Plug type)



PRWT12-4DO C1D4-□ CID2-□



PRCMT18-5DO C1D4-□ CID2-□

Encoder Connector Cable / Connector Connection Cable

■ Ordering Information

◎ Connector cable (Socket type)

C I D 6 S – 2

Field	Code	Description
Cable length※	2	2m
	5	5m
	10	10m
Connection	S	Socket type
Number of connector pins	6	6-pin
Power supply	D	DC type
Shape	I	Standard type
Item	C	Connector

※Cable length is customizable.

◎ Connector connection cable (Socket-Plug type)

C I D 13 P – 2 – S I

Field	Code	Description
Shape	I	Standard type
Connection	S	Socket type
Cable length※	2	2m
	5	5m
	10	10m
Cable shape	P	Plug type
Number of connector pins	13	13-pin
Power supply	D	DC type
Shape	1	Standard type
Item	C	Connector

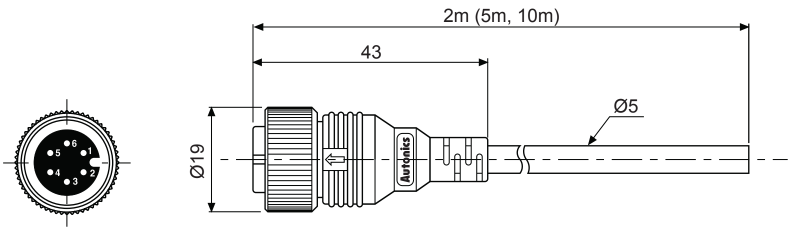
※Cable length is customizable.

▣ Dimensions

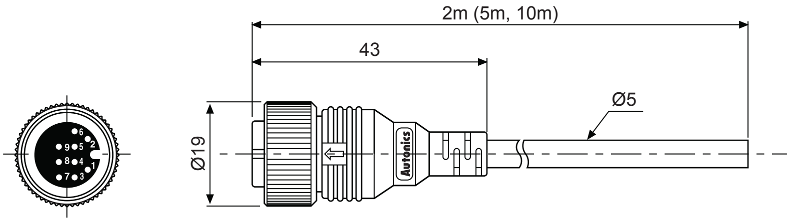
◎ Connector cable (Socket type)

(unit: mm)

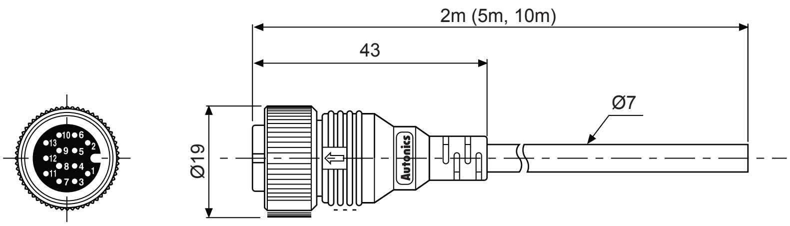
● CID6S-2, CID6S-5, CID6S-10 (totem pole output / NPN open collector output / voltage output)



● CID9S-2, CID9S-5, CID9S-10 (line driver output)

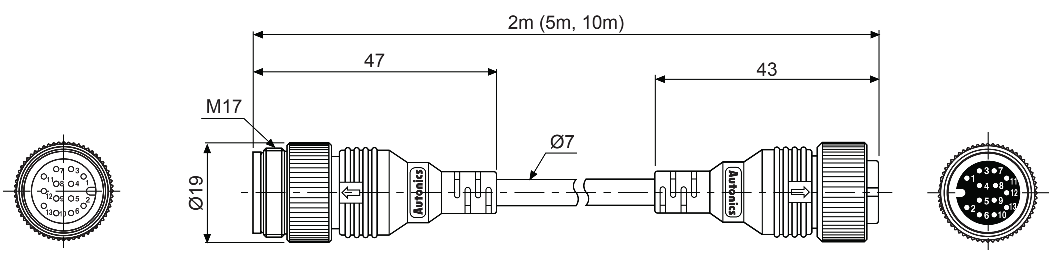


● CID13S-2, CID13S-5, CID13S-10



◎ Connector connection cable (Socket-Plug type)

● CID13P-2-SI, CID13P-5-SI, CID13P-10-SI



Sensor Distribution Box (M12 4-Pin/5-Pin Connector Type)

■ Features

- Easy check operation by operation indicator (red, green)
- Single power operates several sensors
- Convenient wiring and power line
- IP67 protection structure with water-proof cover
  (IP52 protection structure with protection cover)
- Supports 1-signal, 2-signal (DC 4-wire)

⚠ Please read "Caution for your safety" in operation manual before using.

CE

M12 4-pin connector type

Cable type

M12 5-pin connector type

Cable type **Connector type**

■ Ordering Information

PT 4 — ☐ 3D N 5 — 5

Cable length※2		
M12 4-pin connector type	No-mark	5m
M12 5-pin connector type	5	5m
	10	10m

Number of M12 connector pins	
No-mark	4-pin
5	5-pin

Input logic※1	
N	NPN type
P	PNP type

Output type	
2D	DC 2-wire (1-signal)
3D	DC 3-wire (1-signal)
4D	DC 4-wire (1-signal, 2-signal)

Connection method for external signal	
No-mark	Cable type
C	Connector type

Number of ports	
4	4
6	6
8	8

Item	
PT	Sensor distribution box

※1: It is not applied for DC 2-wire (1-signal) type of output.
※2: Cable length is only for Cable type models.

■ Specifications

Type		M12 4-pin connector type			M12 5-pin connector type					
Model	Cable type	**PT4-2D☐** **PT4-3D☐**	**PT6-2D☐** **PT6-3D☐**	**PT8-2D☐** **PT8-3D☐**	**PT4-3D☐5-☐**	**PT4-4D☐5-☐**	**PT6-3D☐5-☐**	**PT6-4D☐5-☐**	**PT8-3D☐5-☐**	**PT8-4D☐5-☐**
	Connector type	—			**PT4-C3D☐5**	**PT4-C4D☐5**	**PT6-C3D☐5**	**PT6-C4D☐5**	**PT8-C3D☐5**	**PT8-C4D☐5**
Port		4	6	8	4		6		8EA	
Output type※1		2-wire (1-signal), 3-wire (1-signal)			3-wire (1-signal)	4-wire (2-signal)	3-wire (1-signal)	4-wire (2-signal)	3-wire (1-signal)	4-wire (2-signal)
Power supply		12-24VDC (10-30VDC)								
Rated current		2A (per signal), 4A (per port), 10A (total)								
Leakage current		Max. 0.5mA								
Connection life cycle		Min. 200 operations								
Cable tensile strength		10kgf (98N)/15S								
Insulation resistance		Over 50MΩ (at 500VDC megger)								
Dielectric strength		1,500VAC 50/60Hz for 1minute								
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours								
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times								
Indicator		Power indicator: Green, Operation indicator: Red			Power indicator: Red, Operation indicator: Green					
Environment	Ambient temp.	-25 to 75, storage: -30 to 80								
	Ambient humi.	35 to 95%RH, storage: 35 to 95%RH			35 to 85%RH, storage: 35 to 85%RH					
Protection structure※2		IP67 (IEC standards/when mounting connector, waterproof cover) or IP52 (IEC standards/when mounting protection cover)								
Material		Case: PBT (G15%), General cable (gray): Polyvinyl chloride (PVC)			Case: PBT (G15%), Name plate: PC, General cable (black): Polyvinyl chloride (PVC)					
Approval		CE								
Weight※3	Cable type※4	Approx. 700g (approx. 660g)	Approx. 720g (approx. 680g)	Approx. 820g (approx. 780g)	Approx. 1100g (approx. 900g)	Approx. 1400g (approx. 1200g)	Approx. 1130g (approx. 930g)	Approx. 1430g (approx. 1230g)	Approx. 1160g (approx. 960g)	Approx. 1460g (approx. 1260g)
	Connector type	—			Approx. 230g (approx. 120g)	Approx. 235g (approx. 125g)	Approx. 260g (approx. 150g)	Approx. 265g (approx. 155g)	Approx. 290g (approx. 180g)	Approx. 295g (approx. 185g)

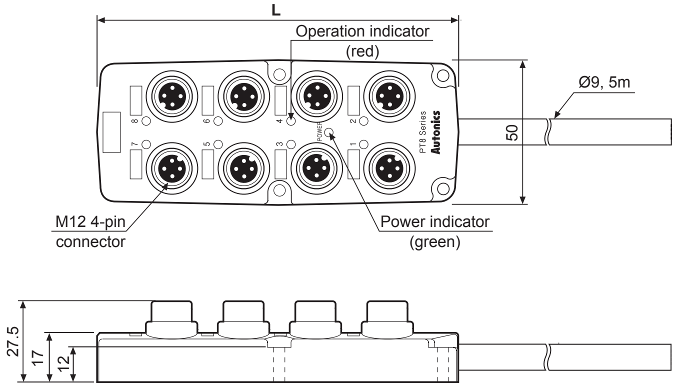
※1: Connect the sensor to the proper output type. ※2: This is not applicable when connectors and protection/waterproof covers are not mounted.
※3: The weight includes packaging. The weight in parentheses is for unit only. ※4: The weights are for 5m cable.
※Environment resistance is rated at no freezing or condensation.

▣ Dimensions

(unit: mm)

※The below dimensions are based on 8-port.

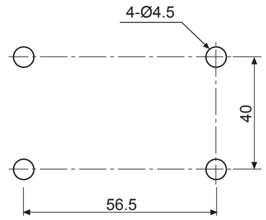
● M12 4-pin connector type



Model	L
PT4-□□	73
PT6-□□	98
PT8-□□	123

※Cable specification: Ø9, 10-wire (conductor cross section: 0.3mm², insulator diameter: Ø1.67)

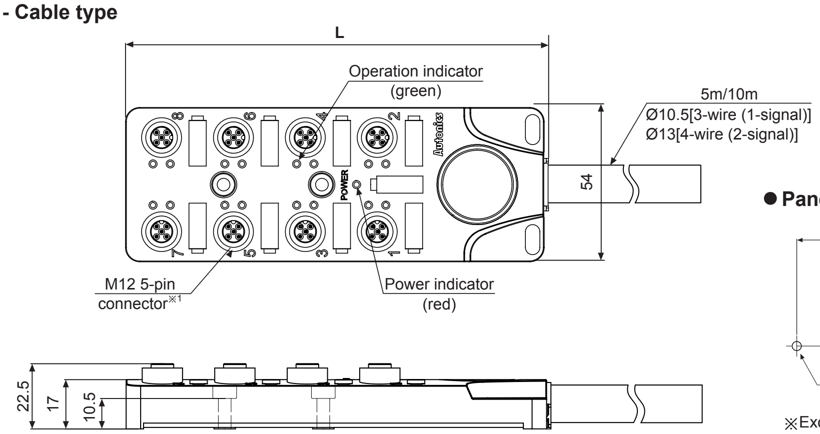
● Panel cut-out



※Mounting holes are same as 4, 6, 8-port.

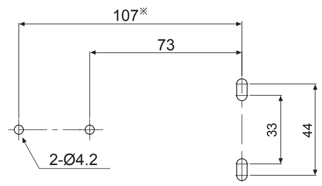
● M12 5-pin connector type

- Cable type



Model	L
PT4-□□□□-□	95
PT6-□□□□-□	120
PT8-□□□□-□	145

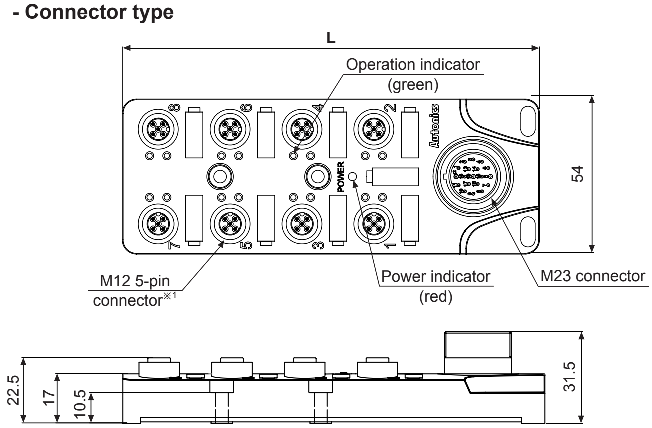
● Panel cut-out



※Except 4-port model.

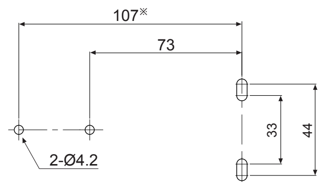
※1: When connecting L type connectors, connection direction may be different by the manufacturers of the connector.

- Connector type



Model	L
PT4-C□□□□	95
PT6-C□□□□	120
PT8-C□□□□	145

● Panel cut-out



※Except 4-port model.

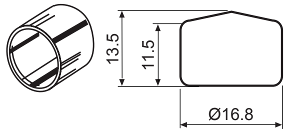
※1: When connecting L type connectors, connection direction may be different by the manufacturers of the connector.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Sold Separately

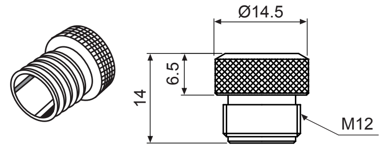
(unit: mm)

- Protection cover (CAP-PT)



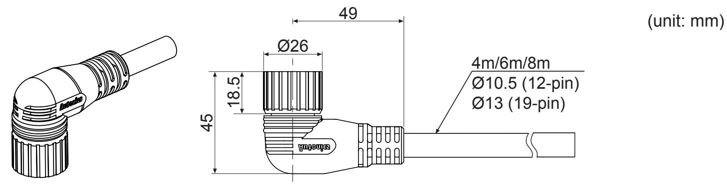
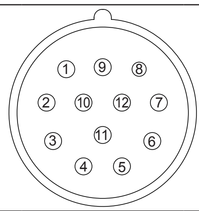
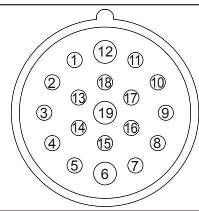
※This protection cover is used for protecting connection holes from dust or particle, etc. Please push it into hole.
※If using protection covers, protection structure of the sensor distribution box is IP52.

- Waterproof cover (P96-M12-1)



※This waterproof cover is used for protecting unused connection hole from water or oil, etc. Please tighten it when applying to the ports.
※If using waterproof covers, protection structure of the sensor distribution box is IP67.

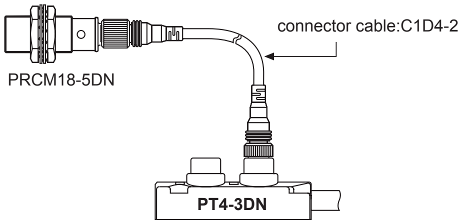
- M23 connector cable (only for M12 5-pin connector type)

	12-pin [3-wire (1-signal)]			19-pin [4-wire (2-signal)]		
Model	**CLDH12C -040**	**CLDH12C -060**	**CLDH12C -080**	**CLDH19C -040**	**CLDH19C -060**	**CLDH19C -080**
Dimensions	 (unit: mm)					
Pin arrangement						
Cable length※1	4m	6m	8m	4m	6m	8m
Applied model	**PT4-C3DN5, PT4-C3DP5, PT6-C3DN5, PT6-C3DP5 PT8-C3DN5, PT8-C3DP5**			**PT4-C4DN5, PT4-C4DP5, PT6-C4DN5, PT6-C4DP5 PT8-C4DN5, PT8-C4DP5**		
Connection cable	Pin no.	Cable color	AWG	Pin no.	Cable color	AWG
	1	White	AWG22	1	Purple	AWG22
	2	Green		2	Red	
	3	Yellow		3	Gray	
	4	Gray		4	Red/Blue	
	5	Pink		5	Green	
	6	Red		6	Blue	AWG17
	7	Black		7	Gray/Pink	AWG22
	8	Purple		8	White/Green	
	9	Blue	AWG17	9	White/Yellow	
	10	—		10	White/Gray	
	11	Brown		11	Black	
	12	Green/Yellow		12	Green/Yellow	AWG17
				13	Yellow/Brown	AWG22
				14	Brown/Green	
				15	White	
				16	Yellow	
				17	Pink	
				18	Gray/Brown	
				19	Brown	AWG17

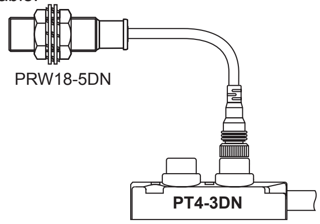
※1: Cable length can be customized.

▣ Example of Connections

● Connection with connector type sensor
When connecting a connector type proximity sensor (PRCM Series) with a sensor distribution box, use only connector cable.



● Connection with cable type sensor
It is available to connect a cable type sensor proximity sensor (PRW Series) with a sensor distribution box directly. When installation distance is longer, use a connector cable.



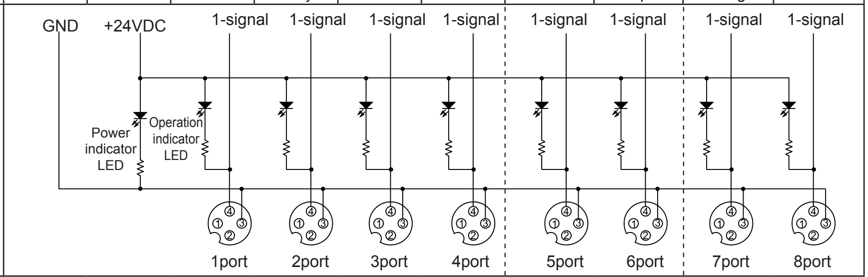
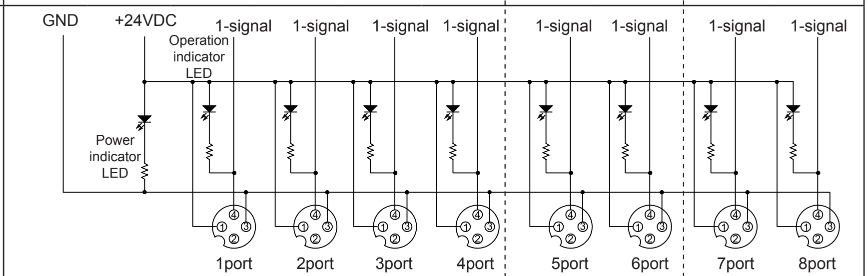
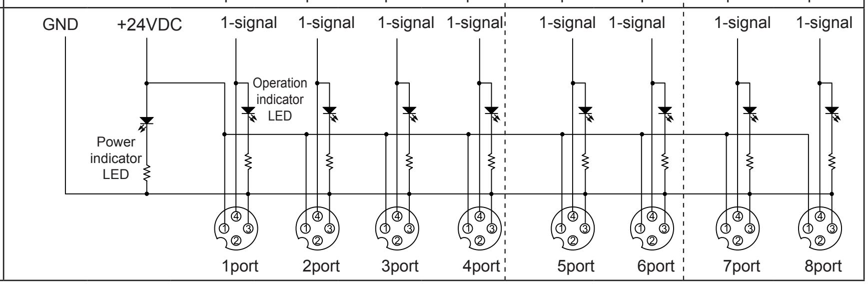
▣ Connectable Autonics Proximity Sensors, Photoelectirc Sensors, Door/Area Sensors

Sensor distribution box	Input logic	Proximity sensor		Photoelectric sensor	Door/Area sensor	Connection method
PT□-2D	DC 2-wire	PRCMT12-2/4DO, DC PRCMT18-5/8DO, DC PRCMT30-10/15DO, DC	PRDCMT12-4/8DO,DC PRDCMT18-7/14DO,DC PRDCMT30-15/25DO,DC	—		Use connector cable
		PRWT12-2/4DO, DC PRWT18-5/8DO, DC PRWT30-10/15DO, DC	PRDWT12-4/8DO,DC PRDWT18-7/14DO,DC PRDWT30-15/25DO,DC			Connect directly, Use connector cable
PT□-3DN PT□-3DN5-□ PT□-□3DN5	DC 3-wire NPN output type	PRCM12-2/4DN, DN2 PRCM18-5/8DN, DN2 PRCM30-10/15DN, DN2 PRCML18-5/8DN, DN2 PRCML30-10/15DN, DN2	PRDCM12-4/8DN,DN2 PRDCM18-7/14DN,DN2 PRDCM30-15/25DN,DN2 PRDCML12-4/8DN,DN2 PRDCML18-7/14DN,DN2 PRDCML30-15/25DN,DN2	BRP3M-MDT-C BR3M-MDT-C	—	Use connector cable
		PRW12-2/4DN, DN2 PRW18-5/8DN, DN2 PRW30-10/15DN, DN2 PRWL18-5/8DN, DN2 PRWL30-10/15DN, DN2	PRDW12-4/8DN,DN2 PRDW18-7/14DN,DN2 PRDW30-15/25DN,DN2 PRDWL12-4/8DN,DN2 PRDWL18-7/14DN,DN2 PRDWL30-15/25DN,DN2	—		Connect directly, Use connector cable
PT□-3DP PT□-3DP5-□ PT□-□3DP5	DC 3-wire PNP output type	PRCM12-2/4DP, DP2 PRCM18-5/8DP, DP2 PRCM30-10/15DP, DP2 PRCML18-5/8DP, DP2 PRCML30-10/15DP, DP2	PRDCM12-4/8DP,DP2 PRDCM18-7/14DP,DP2 PRDCM30-15/25DP,DP2 PRDCML12-4/8DP,DP2 PRDCML18-7/14DP,DP2 PRDCML30-15/25DP,DP2	BRP3M-MDT-C-P BR3M-MDT-C-P	—	Use connector cable
		PRW12-2/4DP, DP2 PRW18-5/8DP, DP2 PRW30-10/15DP, DP2 PRWL18-5/8DP, DP2 PRWL30-10/15DP, DP2	PRDW12-4/8DP,DP2 PRDW18-7/14DP,DP2 PRDW30-15/25DP,DP2 PRDWL12-4/8DP,DP2 PRDWL18-7/14DP,DP2 PRDWL30-15/25DP,DP2	—		Connect directly, Use connector cable
PT□-4DN5-□ PT□-□4DN5	DC 4-wire NPN output type	—		BRP100-DDT-C BR100DDT-C BRP400DDT-C BR400DDT-C BRP200DDTN-C BR200DDTN-C	BWC40-□H, HD BWC80-□H, HD BW20-□ BW40-□	Connect directly, Use connector cable
PT□-4DP5-□ PT□-□4DP5	DC 4-wire PNP output type			BRP100-DDT-C-P BR100-DDT-C-P BRP400DDT-C-P BR400DDT-C-P BRP200DDTN-C-P BR200DDTN-C-P	BW20-□P BW40-□P	Connect directly, Use connector cable

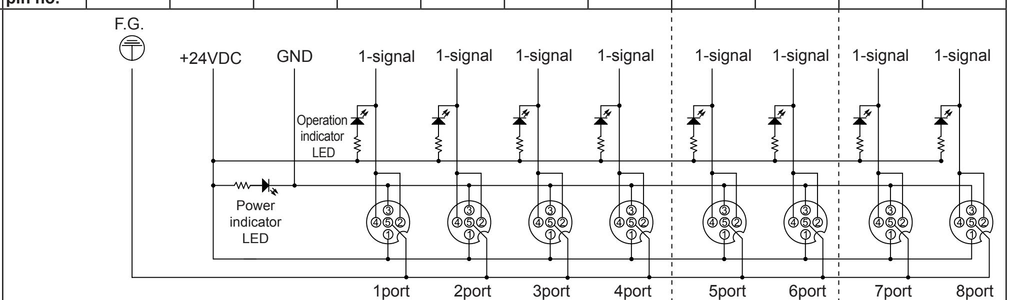
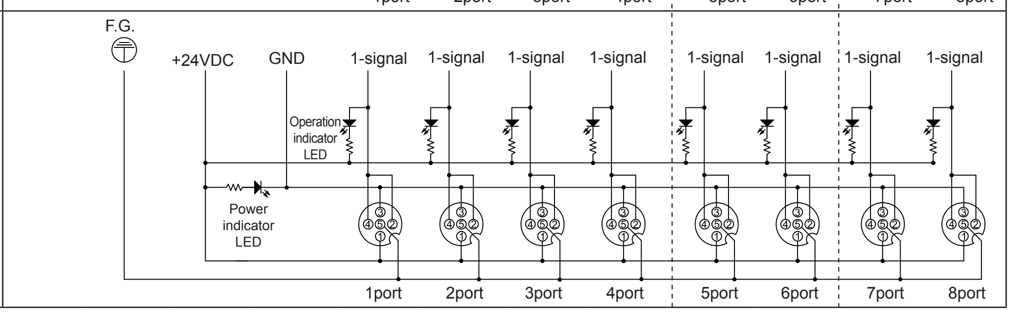
※Standard cable type sensors can also connect a sensor distribution box by using plug type connector cable.

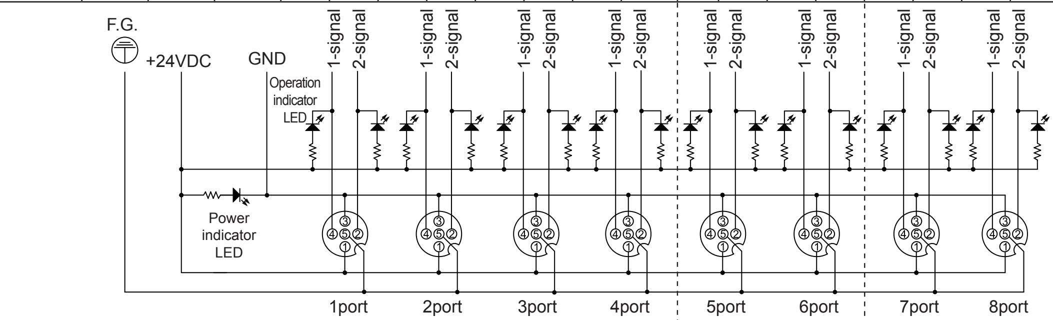
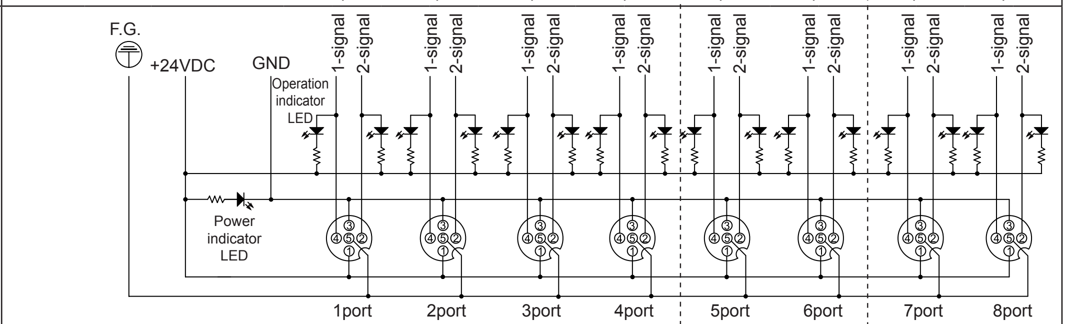
■ Connections

● M12 4-pin connector type

Cable color	Blue	Brown	White	Gray	Pink	Red	Black	Purple	Orange	Yellow
DC 2-wire										
DC 3-wire NPN										
DC 3-wire PNP										

● M12 5-pin connector type

Cable type	Cable color	Green/ Yellow	Brown	Blue	White	Green	Yellow	Gray	Pink	Red	Black	Purple
Connector type	M23 plug pin no.	12	11	9, 10	1	2	3	4	5	6	7	8
DC 3-wire NPN												
DC 3-wire PNP												

Cable type	Cable color	Green /Yellow	Brown	Blue	White	Gray/ Pink	Green	Red/ Blue	Yellow	White/ Green	Gray	Brown/ Green	Pink	White/ Yellow	Red	Yellow/ Brown	Black	White/ Gray	Purple	Gray/ Brown
Connector type	M23 plug pin no.	12	19	6	15	7	5	4	16	8	3	14	17	9	2	13	11	10	1	18
DC 4-wire NPN																				
DC 4-wire PNP																				

■ Cautions During Use

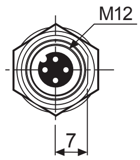
1. This connection box is only for DC. Do not use this unit for AC.
2. Use DC 2-wire, DC 3-wire, DC 4-wire separately.
   DC 3-wire, DC 4-wire are separated by NPN type and PNP type.
3. Do not use the same conduit with cord of this unit and electric power line and power line. Also avoid the same connection.
4. Be sure that wire power cable (blue: -, brown: +) properly.
5. Check the voltage variation range of power not to over the rated specifications for power input.
6. In case of M12 5-pin connector type, Tighten the screws and connector with the proper tightening strength.
   (M4 mounting screw: max. 1.2N·m / M12 Connector: 0.6 to 0.7N·m/ M23 Connector: 2.0 to 2.5N·m)
   When tightening is bad, protection is not effective and it may loose by vibration.
7. In case of M12 4-pin connector type, the power indicator (green LED) does not operate when polarity is not correctly connected.
8. If transceiver is close to wire connections, it may cause malfunction.
9. When take out the connector from the box, cut off the power.
10. It might cause malfunction, if particle of metal etc. inflow in to engaging.
11. Do not use this unit when external force loaded on contact block and connection of cover. It may cause loss of efficiency of protection.
12. Follow the connections when wiring the signals. After connecting loads, operate proximity sensors.
13. Check the operation indicator when operating the sensors.
14. Please use protection cover (CAP-PT, sold separately) or water-proof cover (P96-M12-1, sold separately) for not using connector (M12 socket).
15. Do not use in place there are water or oil etc.
16. Main body is made by plastic, therefore do not put heavy load on this product.
17. Please avoid below environment for long-term storage.
    ① Lots of dust or high humidity
    ② Ammonia or sulfide gas

■ Connector For Panel Mounting

(unit: mm)

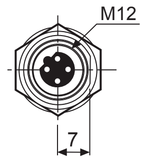
◎ Connector for panel mounting (non-flush)

● PT1-D

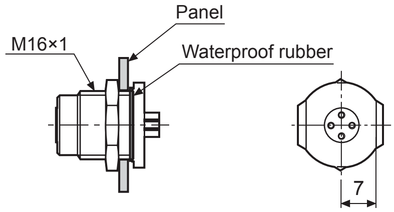


(DC type)

● PT1-A

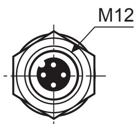


(AC type)



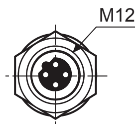
◎ Connector for panel mounting (flush)

● PT2-D

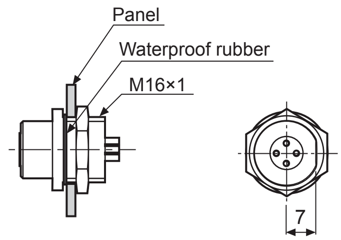


(DC type)

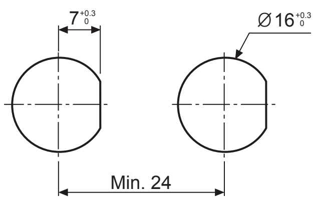
● PT2-A



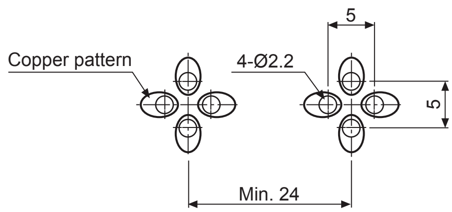
(AC type)



◎ Panel cut-out

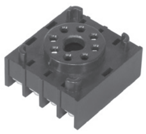
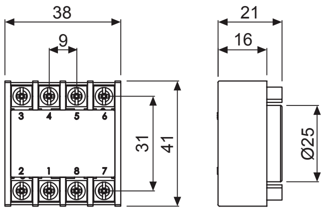


◎ Printed circuit board (PCB) cut-out



■ Controller Socket (8-pin, 11-pin)

(unit: mm)

<table>
<tr><td rowspan="2">Model</td><td colspan="2">Standard socket</td></tr>
<tr><td>PG-08</td><td>PG-11</td></tr>
<tr><td>Appearances & Dimensions</td>
<td>


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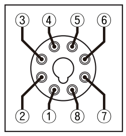
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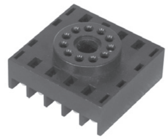
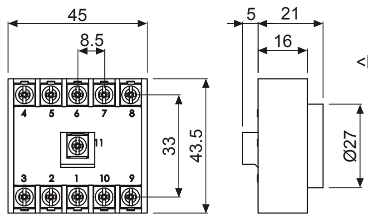
<td>


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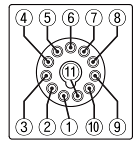
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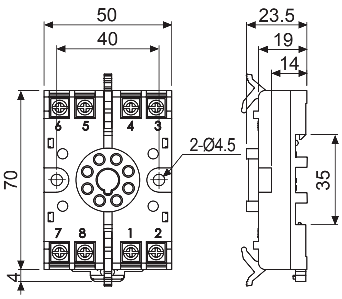
<table>
<tr><td rowspan="2">Model</td><td colspan="2">DIN rail and panel mounting socket</td></tr>
<tr><td>PS-08(N)</td><td>PS-11(N)</td></tr>
<tr><td>Appearances & Dimensions</td>
<td>


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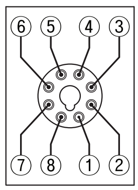
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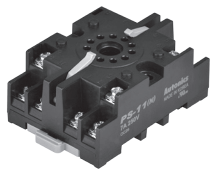
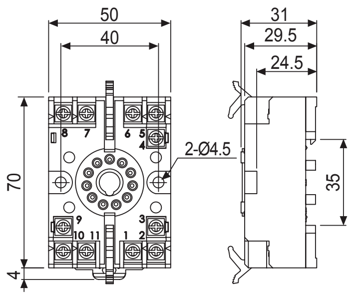
<td>


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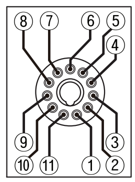
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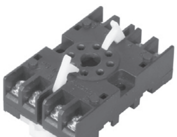
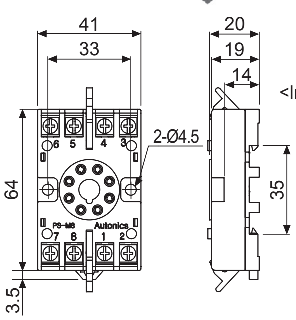
<table>
<tr><td rowspan="3">Model</td><td rowspan="2">DIN rail and panel mounting socket</td><td colspan="2">Adaptor</td><td rowspan="2">Bracket</td></tr>
<tr><td>Beige</td><td>Black</td></tr>
<tr><td>PS-M8</td><td>FGB48-GR</td><td>FGB48-BL</td><td>PGB48-W</td></tr>
<tr><td>Appearances & Dimensions</td>
<td>


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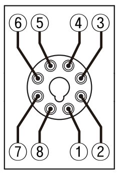

※ Only for ATS8 Series socket.</td>
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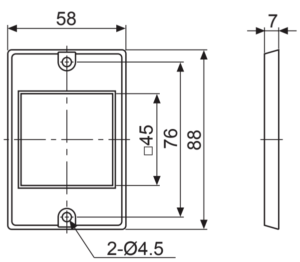
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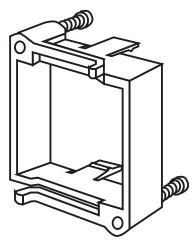
<td>
※ ATE Series Bracket is sold separately.</td></tr>
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(H) Temperature Controllers

NEW

LCD Display PID Control Temperature Controller TX Series

NEW

2-CH USB Temperature Data Logger SCM-USU2I

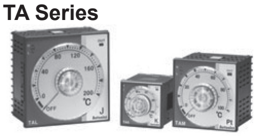
2/4-CH Modular Type, PID Control Temperature Controller TM Series

Line-up

High Performance, General-Purpose, PID Control Temperature Controller TK Series

Dual Display, PID Control Temperature Controller TCN Series

Analog, Non-Display, PID Control Temperature Controller TA Series



Product Overview

LCD Display PID Control Temperature Controller [TX Series]

Series		**TX4S**
Appearances & Dimensions		 NEW [W48×H48×L45mm]
Power supply		100-240VAC 50/60Hz
Allowable voltage range		90 to 110% of rated voltage
Power consumption		Max. 8VA
Display method		11-segment (PV: white, SV: green), other display (yellow) with LCD method※1
Character size	PV(W×H)	6.9×15.3mm
	SV(W×H)	4.1×9.2mm
Input type	RTD	DPt100Ω, Cu50Ω (permissible line resistance max. 5Ω)
	TC	K(CA), J(IC), L(IC), T(CC), R(PR), S(PR)
Display accuracy	RTD	●At room temperature (23℃±5℃): (PV ±0.3% or ±1℃, select the higher one) ±1-digit ●Out of room temperature: (PV ±0.5% or ±2℃, select the higher one) ±1-digit (for more information, refer to the ■ **Specification**)
	TC	
Control output	Relay	250VAC 3A 1a
	SSR	Max. 12VDC ± 2V 20mA
	Current	DC4-20mA or DC0-20mA (load resistance max. 500Ω)
Option output	Alarm output	AL1, AL2 Relay: 250VAC 3A 1a
	Trans. output	DC4-20mA (load resistance max. 500Ω, output accuracy: ±0.3%F.S.)
	Com. output	RS485 Communication output (Modbus RTU method)
Sampling period		50ms
Control method		ON/OFF P PI PD PID
Reference		**H-11 to 25**

※1. When using the unit at low temperature (below 0℃), display cycle is slow. Control output operates normally.

2/4-CH Modular Type, PID Control Temperature Controller [TM Series]

Series		**TM2**	**TM4**
Appearances & Dimensions		 [W30×H100×L84.8mm]	
No. of channels		2 CH (insulated each channel-dielectric strength 1,000VAC)	4 CH (insulated each channel-dielectric strength 1,000VAC)
Power supply		24VDC	
Permissible voltage range		90 to 110% of rated voltage	
Power consumption		Max. 5W (for max. load)	
Display method		None- parameter setting and monitoring is available at external devices (PC, PLC, etc.)	
Input type	Thermocouple	K(CA), J(IC), E(CR), T(CC), B(PR), R(PR), S(PR), N(NN), C(TT), G, (TT), L(IC), U(CC), Platinel II	
	RTD	JPt100Ω, DPt100Ω (permissible line resistance max. 5Ω)	
Sampling period		50ms (2CH synchronous sampling)	100ms (4CH synchronous sampling)
Measured accuracy	Thermocouple	(PV ±0.5% or ±1℃, select the higher one) ±1-digit max. (for more information, refer to the ■ **Specification**)	
	RTD		
	CT input	±5% F.S. ±1-digit max.	—
	Current output	±1.5% F.S. ±1-digit max.	—
Control output	Relay	250VAC 3A 1a	
	SSR	Max. 12VDC ±3V 30mA	Max. 22VDC ±3V 30mA
	Current	Selectable DC 4-20mA or DC 0-20mA (load resistance max. 500Ω)	—
Option output	Alarm	250VAC 3A 1a	—
	Communication	RS485 communication output (Modbus RTU method)	
Option input	CT input	0.0-50.0A (primary current measurement range) ※CT ratio=1/1000	—
	Digital input	· Contact input: ON max. 1kΩ, OFF min. 100kΩ · Solid-state input: ON residual voltage max. 1.5V, OFF leakage current max. 0.1mA · Outflow current: Approx. 0.5mA per input	—
Control method	Heating, Cooling	ON/OFF P PI PD PID	
	Heating&Cooling		
Reference		**H-26 to 34**	

High Performance, General-Purpose, PID Control Temperature Controller [TK Series]

Series		TK4N	TK4S	TK4SP	TK4M	TK4W	TK4H	TK4L
Appearances & Dimensions		 [W48×H24×L91.8mm]	Line-up  [W48×H48×L64.5mm]	Line-up  [W48×H48×L72.2mm]	Line-up  [W72×H72×L64.5mm]	Line-up  [W96×H48×L64.5mm]	Line-up  [W48×H96×L64.5mm]	Line-up  [W96×H96×L64.5mm]
Power supply	AC power	100-240VAC 50/60Hz						
	AC/DC power	—	24VAC 50/60Hz, 24-48VDC					
Allowable voltage range		90 to 110% of rated voltage						
Power consumption	AC power	Max. 6VA	Max. 8VA					
	AC/DC power	—	Max. 8VA (24VAC 50/60Hz), Max. 5W (24-48VDC)					
Display method		7 Segment (PV: red, SV: green), Other display part (green, yellow, red) LED method						
Character size	PV (W×H)	4.5×7.2mm	7.0×14.0mm		7.0×14.6mm	9.5×20.0mm	8.5×17.0mm	11.0×22.0mm
	SV (W×H)	3.5×5.8mm	5.0×10.0mm		6.0×12.0mm	7.5×15.0mm	6.0×12.0mm	7.0×14.0mm
Input type	RTD	JPt100Ω, DPt100Ω, DPt50Ω, Cu100Ω, Cu50Ω, Nikel120Ω (6 types)						
	Thermocouple	K(CA), J(IC), E(CR), T(CC), B(PR), R(PR), S(PR), N(NN), C(TT), G(TT), L(IC), U(CC), Platinel II (13 types)						
	Analog	Voltage: 0-100mV, 0-5V, 1-5V, 0-10V (4 types) / Current: 0-20mA, 4-20mA (2 types)						
Display accuracy	RTD / Thermocouple	• At room temperature (23℃±5℃): (PV ±0.3% or ±1℃, select the higher one) ±1-digit • Out of room temperature range: (PV ±0.5% or ±2℃, select the higher one) ±1-digit ※In case of TK4SP Series, ±1℃ will be added. (for more information, refer to the ■ **Specification**)						
	Analog	• At room temperature (23℃±5℃): ±0.3% F.S. ±1-digit, • Out of room temperature range: ±0.5% F.S. ±1-digit						
	CT input	±5% F.S. ±1-digit						
Control output	Relay	OUT1, OUT2: 250VAC 3A 1a						
	SSR	Max. 11VDC ±2V 20mA						
	Current	Selectable DC4-20mA or DC0-20mA (resistive load max. 500Ω)						
Sub output	PV transmission	DC4-20mA (resistive load 500Ω max., accuracy: ±0.3% F.S.)						
	Communication	RS485 communication output (Modbus RTU)						
Alarm output		AL1, AL2 Relay: 250VAC 3A 1a (※TK4N AL2: 250VAC 0.5A 1a (max. 125VA), TK4SP: AL1 only)						
Sampling period		50ms						
Control method	Heating, cooling / Heating&cooling	ON/OFF, P, PI, PD, PID						
Reference		**H-35 to 58**						

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Product Overview

Dual Display, PID Control Temperature Controller [TCN Series]

Series		TCN4S	TCN4M	TCN4H	TCN4L
Appearances & Dimensions		 [W48×H48×L64.5mm]	 [W72×H72×L64.5mm]	 [W48×H96×L64.5mm]	 [W96×H96×L64.5mm]
Power supply	AC power	100-240VAC 50/60Hz			
	AC/DC power	24-48VDC, 24VAC 50/60Hz			
Allowable voltage range		90 to 110% of rated voltage			
Power consumption	AC power	Max. 5VA (100-240VAC 50/60Hz)			
	AC/DC power	Max. 5VA (24VAC 50/60Hz), Max. 3W (24-48VDC)			
Display method		7 Segment (PV: red, SV: green), Other display part (green,red) LED method			
Character size	PV (W×H)	W7.0×H15.0mm	W9.5×H20.0mm	W7.0×H14.6mm	W11.0×H22.0mm
	SV (W×H)	W5.0×H9.5mm	W7.5×H15.0mm	W6.0×H12.0mm	W7.0×H14.0mm
Input type	RTD	DPt100Ω, Cu50Ω (allowable line resistance max. 5Ω per a wire)			
	Thermocouple	K(CA), J(IC), L(IC), T(CC), R(PR), S(PR)			
Display accuracy	RTD	• At room temperature (23℃±5℃): (PV ±0.5% or ±1℃, select the higher one) ±1-digit • Out of room temperature range: (PV ±0.5% or ±2℃, select the higher one) ±1-digit ※For TCN4S-□-P, add ±1℃ by accuracy standard. (for more information, refer to the ◼ **Specification**)			
	Thermocouple				
Control output	Relay	250VAC 3A 1a			
	SSR	Max.12VDC ±2V 20mA			
Alarm output		AL1, AL2 Relay: 250VAC 1A 1a			
Sampling period		100ms			
Control method		ON/OFF P PI PD PID			
Reference		**H-59 to 71**			

Single Display, PID Control Temperature Controller [TC Series]

Series		TC4S	TC4SP	TC4Y	TC4M	TC4W	TC4H	TC4L
Appearances & Dimensions		 [W48×H48×L64.5mm]	 [W48×H48×L72.2mm]	 [W72×H36×L77mm]	 [W72×H72×L64.5mm]	 [W96×H48×L64.5mm]	 [W48×H96×L64.5mm]	 [W96×H96×L64.5mm]
Power supply	AC power	100-240VAC 50/60Hz						
	AC/DC power	24-48VDC, 24VAC 50/60Hz						
Allowable voltage range		90 to 110% of rated voltage						
Power consumption	AC power	Max. 5VA (100-240VAC 50/60Hz)						
	AC/DC power	Max. 5VA (24VAC 50/60Hz), Max. 3W (24-48VDC)						
Display method		7 Segment (red), Other display part (green, yellow, red) LED method						
Character size (W×H)		7.0×15.0mm		7.4×15.0mm	9.5×20.0mm	9.5×20.0mm	7.0×14.6mm	11.0×22.0mm
Input type	RTD	DPt100Ω, Cu50Ω (allowable line resistance max. 5Ω per a wire)						
	Thermocouple	K(CA), J(IC), L(IC)						
Display accuracy	RTD	• At room temperature (23℃±5℃): (PV ±0.5% or ±1℃, select the higher one) ±1-digit • Out of room temperature range: (PV ±0.5% or ±2℃, select the higher one) ±1-digit ※In case of TC4SP Series, ±1℃ will be added. (for more information, refer to the ◼ **Specification**)						
	Thermocouple							
Control output	Relay	250VAC 3A 1a						
	SSR	Max. 12VDC ±2V 20mA						
Alarm output		AL1, AL2 Relay: 250VAC 1A 1a (※TC4SP, TC4Y have AL1 only.)						
Sampling period		100ms						
Control method		ON/OFF P PI PD PID						
Reference		**H-72 to 85**						

Dual PID Control Temperature Controller [TZN Series]

Series		TZN4S	TZN4M	TZN4W	TZN4H	TZN4L
Appearances & Dimensions		 [W48×H48×L90mm]	 [W72×H72×L73mm]	 [W96×H48×L100mm]	 [W48×H96×L100mm]	 [W96×H96×L100mm]
Power supply	AC power	100-240VAC 50/60Hz				
	AC/DC power	—	24VAC 50/60Hz / 24-48VDC (only for TZN4M Series)			
Allowable voltage range		90 to 110% of rated voltage				
Power consumption	AC power	Max. 5VA (100-240VAC 50/60Hz)	Max. 6VA (100-240VAC 50/60Hz)			
	AC/DC power	—	Max. 8VA (24VAC 50/60Hz), Max. 7W (24-48VDC) (only for TZN4M Series)			
Display method		7 Segment (PV: red, SV: green) LED method				
Character size	PV (W×H)	7.8×11.0mm	8.0×13.0mm	8.0×10.0mm	7.8×11.0mm	9.8×14.2mm
	SV (W×H)	5.8×8.0mm	5.0×9.0mm	8.0×10.0mm	5.8×8.0mm	8.0×10.0mm
Input type	RTD	DPt100Ω, JPt100Ω, 3wire (allowable line resistance max. 5Ω per a wire)				
	Thermocouple	K(CA), J(IC), R(PR), E(CR), T(CC), S(PR), N(NN), W(TT) (allowable line resistance max. 100Ω)				
	Analog	1-5VDC, 0-10VDC, DC4-20mA				
Display accuracy		F.S. ±0.3% or 3℃, select the higher one				
Control output	Relay	250VAC 3A 1c				
	SSR	Max. 12VDC ±3V 30mA				
	Current	DC4-20mA (max. load 600Ω)				
Sub output	PV transmission	—	DC4-20mA (max. load 600Ω)			
	EVENT1	250VAC 1A 1a				
	EVENT2	—	250VAC 1A 1a			
	Communication	—	RS485 (PV transmission, SV setting)			
Sampling period		0.5 sec				
Control method		ON/OFF, P, PI, PD, PIDF, PIDS				
Reference		**H-91 to 106**				

※ AC/DC voltage type is except UL certification.

Dual PID Control Temperature Controller [TZ Series]

Series		TZ4SP	TZ4ST	TZ4M	TZ4W	TZ4H	TZ4L
Appearances & Dimensions		 [W48×H48×L97.3mm]	 [W48×H48×L98.8mm]	 [W72×H72×L100mm]	 [W96×H48×L100mm]	 [W48×H96×L100mm]	 [W96×H96×L100mm]
Power supply	AC power	100-240VAC 50/60Hz					
	AC/DC power	24VAC 50/60Hz / 24-48VDC (only for TZ4SP, TZ4ST, TZ4L)					
Allowable voltage range		90 to 110% of rated voltage					
Power consumption	AC power	Max. 5VA (100-240VAC 50/60Hz)		Max. 6VA (100-240VAC 50/60Hz)			
	AC/DC power	Max. 7VA (24VAC 50/60Hz), Max. 6W (24-48VDC)		—			Max. 8VA (24VAC 50/60Hz), Max. 7W (24-48VDC)
Display method		7 Segment (PV: red, SV: green) LED method					
Character size	PV (W×H)	4.8×7.8mm		9.8×14.2mm	8.0×10.0mm	3.8×7.6mm	9.8×14.2mm
	SV (W×H)	4.8×7.8mm		8.0×10.0mm	8.0×10.0mm	3.8×7.6mm	8.0×10.0mm
Input type	RTD	DPt100Ω, JPt100Ω, 3wire (allowable line resistance max. 5Ω per a wire)					
	Thermocouple	K(CA), J(IC), R(PR), E(CR), T(CC), S(PR), N(NN), W(TT) (allowable line resistance max. 100Ω)					
	Analog	1-5VDC, 0-10VDC, DC4-20mA					
Display accuracy		F.S. ±0.3% or 3℃, select the higher one					
Control output	Relay	250VAC 3A 1c					
	SSR	Max. 12VDC ±3V 30mA					
	Current	DC4-20mA (max. load 600Ω)					
Sub output	PV transmission	—	DC4-20mA (max. load 600Ω)				
	EVENT1	250VAC 1A 1a					
	EVENT2	—	250VAC 1A 1a				
	Communication	—	—	RS485 communication			
Control type		ON/OFF, P, PI, PD, PIDF, PIDS					
Sampling period		0.5 sec					
Reference		**H-91 to 106**					

※ AC/DC voltage type is except UL certification.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Product Overview

Thumwheel Switch Setting Type Temperature Controller [T3/T4 Series]

Series		T3S	T3H	T3HA	T3HS	T4M	T4MA	T4L	T4LA	T4LP
Appearances & Dimensions		 [W48×H48×L77.8mm]	 [W48×H96×L70mm]			 [W72×H72×L75mm]		 [W96×H96×L70mm]		
Power supply		100-240VAC 50/60Hz								
Allowable voltage range		90 to 110% of rated voltage								
Power consumption		Max. 5VA								
Display method		7-segment (red) LED method								
Character size (W×H)		3.8×7.6mm	6.0×10.0mm					8.0×14.2mm		
Input type	RTD	DPt100Ω (Allowable line resistance max.5Ω per a wire)								
	TC	K(CA), J(IC)				K(CA), J(IC), R (PR)				
Display accuracy※1	RTD	●At room temperature (23ºC ± 5ºC): (PV ± 0.5% or ±1ºC, select the higher one) ±1-digit								
	TC	●Out of room temperature range: (PV± 0.5% or ±2ºC, select the higher one) ±1-digit								
Control output	Relay	OUT1: 250VAC 5A 1c, OUT2: 250VAC 2A 1c※2								
	SSR	Max. 12VDC±2V 20mA								
	Current	DC4-20mA (resistive load max. 500Ω)								
Alarm/Sub/Dual setting output		—		250VAC 2A 1c		—	250VAC 2A 1a	—	250VAC 2A 1c	
Sampling period		100ms								
Control method		ON/OFF P								
Hysteresis		F.S. 0.5%	F.S. 0.2 to 3% variable							
Proportional band		F.S. 3%	F.S. 1 to 10% variable							
Proportional cycle		20 sec								
RESET range		F.S. -3 to 3% variable								
Reference		**H-107 to 115**								

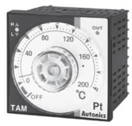
※1: In case of the T3S Series and the decimal point display models
At room temperature (23ºC±5ºC): (PV ±0.5% or ±2℃, select the higher one) ±1-digit
Out of room temperature range: (PV ±0.5% or ±3℃, select the higher one) ±1-digit
※2: Dual output of the T4LP is fixed as relay output and, it is also available as alarm output.

Temperature Indicator [T3/T4 Series]

Series		T3NI	T4YI	T4WI	T3SI	T3HI	T4MI	T4LI
Appearances & Dimensions		 [W48×H24×L48mm]	 [W72×H36×L93mm]	 [W96×H36×L100mm]	 [W48×H48×L77.8mm]	 [W48×H96×L70mm]	 [W72×H72×L75mm]	 [W96×H96×L70mm]
Power supply		12-24VDC	100-240VAC 50/60Hz					
Allowable voltage range		90 to 110% of rated voltage						
Power consumption		Max. 1W	Max. 3VA					
Display method		7-segment (red) LED method						
Character size (W×H)		3.8×7.6mm	8.0×14.2mm		3.8×7.6mm	6.0×10.0mm		8.0×14.2mm
Input type	RTD	DPt100Ω (Allowable line resistance max.5Ω per a wire)						
	TC	K(CA), J(IC)					K(CA), J(IC), R (PR)	
Display accuracy※1	RTD	●At room temperature (23ºC ± 5ºC): (PV ± 0.5% or ±1ºC, select the higher one) ±1-digit						
	TC	●Out of room temperature range: (PV± 0.5% or ±2ºC, select the higher one) ±1-digit						
Sampling period		100ms						
Reference		**H-116 to 121**						

※1: In case of the T3NI, T3SI Series and the decimal point display models
At room temperature (23ºC±5ºC): (PV ±0.5% or ±2℃, select the higher one) ±1-digit
Out of room temperature range: (PV ±0.5% or ±3℃, select the higher one) ±1-digit

Analog, Non-Display, PID Control Temperature Controller [TA Series]

Series		TAS	TAM	TAL
Appearances & Dimensions		CE cULus  [W48×H48×L66.7mm]	CE cULus  [W72×H72×L64.5mm]	CE cULus  [W96×H96×L64.5mm]
Power supply		100-240VAC 50/60Hz		
Allowable voltage range		90 to 110% of rated voltage		
Power consumption		Max. 4VA		
Display method		Deviation LED (red, green), Output LED (red) method		
Setting type		Dial setting		
Setting accuracy※1		F.S. ±2% (room temperature 23℃±5℃)		
Input type	RTD	DPt100Ω (allowable line resistance max. 5Ω per a wire)		
	Thermocouple	K(CA), J(IC)		
Control output	Relay	250VAC 3A 1c		
	SSR	Max. 12VDC ±2V 20mA		
Control method		ON/OFF PID		
Sampling period		100ms		
Reference		**H-86 to 90**		

※1: Out of room temperature range: Below 100℃ model is F.S. ±4%, over 100℃ model is F.S. ±3%

Analog, Non-Display Type Temperature Controller [TOS/TOM/TOL Series]

Series		TOS	TOM	TOL
Appearances & Dimensions		cULus  [W48×H48×L79mm]	 [W72×H72×L112mm]	 [W96×H96×L100mm]
Power supply		100-240VAC 50/60Hz	110/220VAC 50/60Hz	
Allowable voltage range		90 to 110% of rated voltage		
Power consumption		Max. 2.2VA	Max. 3VA	
Setting type		Dial setting		
Setting accuracy		F.S. ±2%		
Display method		LED ON	LED ON/OFF	
Input type	RTD	DPt100Ω		
	Thermocouple	K(CA), J(IC)		
Control output	Relay	250VAC 2A 1c	250VAC 3A 1c	
	SSR	Max. 12VDC ±3V 20mA		
Control type		ON/OFF P		
Reference		**H-122 to 125**		

Product Overview

Refrigeration Temperature Controller [TC3YF Series]

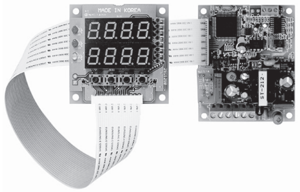
Model		TC3YF-1□R	TC3YF-2□R	TC3YF-3□R
Appearances & Dimensions		c UL us (only for AC voltage type)  [W72×H36×L77mm]		
Power supply	AC power	100-240VAC 50/60Hz		
	DC power	12-24VDC		
Allowable voltage range		90 to 110% of rated voltage		
Power consumption	AC power	Max. 4VA (100-240VAC 50/60Hz)		
	DC power	Max. 8W (12-24VDC)		
Display method		7 Segment LED method (red)		
Character size (W×H)		7.4×15.0mm		
Input type		NTC: 5kΩ, RTD※1: DPt 100Ω		
Sampling period		500ms		
Display accuracy		• At room temp. (23 ±5℃): (PV ±0.5% or 1℃, select the higher one) rdg ±1digit • Out of room temp. range: (PV ±0.5% or 1℃, select the higher one) rdg ±1℃		
Control output	Compressor (COMP)	250VAC 5A 1a		
	Defrost (DEF)	—	250VAC 10A 1a	
	Evaporator-fan (FAN)	—	—	250VAC 5A 1a
Control method		ON/OFF		
Reference		**H-126 to 131**		

※1: RTD input type is option.

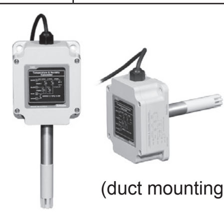
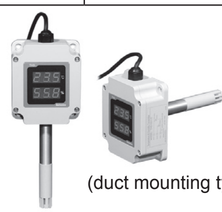
Simple Operation Type Temperature Controller [TC3YT Series]

Model	TC3YT-B4R	TC3YT-B4R16
Appearances & Dimensions	c UL us  [W72×H36×L77mm]	
Power supply	100-240VAC 50/60Hz	
Allowable voltage range	90 to 110% of rated voltage	
Power consumption	Approx. 4VA	
Display method	7 Segment(red) LED method [Deviation "■" signal(Green), unit display(Yellow)]	
Character size (W×H)	7.4×15.0mm	
Input type	TC: K(CA), J(IC), RTD: DPt100Ω (DIN)	
Control period	1 to 120 sec	
Control output	Relay output 250VAC 3A 1c	Relay output 250VAC 16A 1c
Sampling period	500ms	
Control method	ON/OFF P	
Reference	**H-132 to 137**	

Board Type, Dual PID Control Temperature Controller [TB42 Series]

Model		TB42-14R	TB42-14S	TB42-14C	TB42-14N
Appearances & Dimensions		 [Display part: W60×H60mm] [Controller part: W65×H78mm]			
Power supply		100-240VAC 50/60Hz			
Allowable voltage range		90 to 110% of rated voltage			
Power consumption		Max. 5VA			
Display method		7 Segment (PV: green, SV: red) LED method			
Character size (W×H)		8.0×10.0mm			
Input type	RTD	DPt100Ω, JPt100Ω (allowable line resistance max. 5Ω per a wire)			
	Thermocouple	K(CA), J(IC) (tolerance of outer resistance is max. 100Ω)			
Display accuracy		F.S. ±0.5% or 3℃, select the higher one			
Output	Relay	250VAC 3A 1a	—	—	—
	SSR drive	—	Max. 12VDC ±3V 30mA	—	—
	Current	—	—	DC4-20mA (max. load 600Ω)	—
	Transmission	—	—	—	DC4-20mA (max. load 600Ω)
Sub output	Event1	Relay output (250VAC 0.5A 1a)			
	Event2	OK monitoring display by LED			
Sampling period		0.5 sec			
Control method		ON/OFF P PI PD PIDF PIDS			
Reference		**H-138 to 146**			

Temperature/Humidity Transducer [THD Series]

Series		THD-R-T	THD-R-PT/C	THD-R-C THD-R-V THD-R-T	THD-D□-□ THD-W□-□	THD-DD□-□ THD-WD□-□
Appearances & Dimensions		(only for THD-□-T)  (room type) [W60×H80×L30.5mm]		 (wall mounting type) (duct mounting type) [W72×H85×L34.5mm]		 (wall mounting type) (duct mounting type) [W72×H85×L34.5mm]
Power supply		—	24VDC			
Allowable voltage range		—	90 to 110% of rated voltage			
Power consumption		—	Max. 2.4W			
Display method		—	Non-display type			7 Segment LED display
Character size (W×H)		—	—			6.2×10.0mm
Sensor type		Temperature sensor	Temperature/Humidity sensor			
Accuracy※1	Temp.	Max. ±0.8℃	±1.0℃ (at room temperature)			
	Humidity	—	±3%RH (30 to 70%RH, at room temp.), ±4%RH (10 to 90%RH)		±2%RH (10 to 90%RH, at room temp.)	
Output	Temp.	DPt100Ω resistance value (TCR: 3850ppm/℃)		DC4-20mA (allowable impedance: max. 600Ω), 1-5VDC, RS485 communication (Modbus RTU)		
	Humidity	—	DC4-20mA (allowable impedance: max. 600Ω)			
Resolution		—	1/1000			
Sampling period		—	0.5 sec			
Reference		**H-147 to 153**				

※1: • Room temperature is 23℃±5℃.
- It may cause degree of degradation when this unit is exposed to organic chemicals such as alcohol gas or sulfuric acid.
- It may cause degree of degradation for humidity when using this unit at high temperature/humidity environment for a long time.
- It may cause error of humidity value when this unit is exposed to high humidity environment (over 80%RH) for a long time.

Product Overview

5-CH Temperature Indicator [T4WM Series]

Series	**T4WM**
Appearances & Dimensions	 [W96×H48×L100mm]
Power supply	110/220VAC 50/60Hz
Allowable voltage range	90 to 110% of rated voltage
Power consumption	Max. 3VA
Display method	7 Segment (red) LED method
Character size (W×H)	9.8×14.2mm
Input type	Thermocouple: K(CA), J(IC) / RTD: DPt100Ω
Display accuracy	F.S. ±0.5% rdg ±1-digit
Input line resistance	Thermocouple: Max. 100Ω / RTD: Allowable line resistance max. 5Ω per a wire
Connectable sensors	5 (thermocouple, RTD are not used as mixed)
Switching CH	Selectable manual/auto
Auto switching time	1 to 10 sec variable (includes adjuster)
Reference	**H-154 to 156**

2-CH USB Temperature Data Logger [SCM-USU2I]

Model		**SCM-USU2I**
Appearances & Dimensions		NEW  [W45×H25.3×L80mm]
Power supply		USB bus power(5VDC)
Permissible voltage range		90 to 110% of rated voltage
Communication method		USB
Protocol		Modbus RTU
Display method		Check via PC Software (DAQMaster)
Input type	RTD	DPt100Ω, DPt50Ω, JPt100Ω, Cu100Ω, Cu50Ω, Nickel120Ω
	Thermocouple	K(CA), J(IC), E(CR), T(CC), B(PR), R(PR), S(PR), N(NN), C(TT), G(TT), L(IC), U(CC), Platinel II
	Analog	Voltage: -60-60mV, 0-200mV, 0-1V, 1-5V, 0-5V, 0-10V Current: 0-20mA, 4-20mA
Display accuracy※1	RTD, Thermocouple	●At room temperature range (23℃±5℃) : (PV ±0.3% or ±1℃, select the higher one) ±1-digit ●Out of room temperature range : (PV ±0.5% or ±2℃, select the higher one) ±1-digit
	Analog	●At room temperature range (23℃±5℃): ±0.3% F.S. ±1-digit ●Out of room temperature range: ±0.5% F.S. ±1-digit
Sampling period		50ms (2-CH simultaneous sampling)
Reference		**H-157 to 165**

※1: ◎ At room temperature range (23℃±5℃)
- Below -100℃ of thermocouple K, J, T, N, E, and L, U, PLII, RTD Cu50Ω, DPt50Ω
  : (PV ±0.3% or ±2℃, select the higher one) ±1-digit
- Below 200℃ of thermocouple C, G and R, S
  : (PV ±0.3% or ±3℃, select the higher one) ±1-digit
- Below 400℃ of thermocouple B does not have accuracy standard.

◎ Out of room temperature range
- RTD Cu50Ω, DPt50Ω: (PV 0.5% or ±3℃, select the higher one) ±1-digit
- Thermocouple R, S, B, C, G, L, U: (PV ±0.5% or ±5℃, select the higher one) ±1-digit
- Below -100℃ of other sensors: within ±5℃

LCD Display PID Control Temperature Controller

NEW

■ Features

- Super high-speed sampling with 50ms
- Improved visibility with LCD display
- Communication function supported: RS485 (Modbus RTU)
- **Convenient parameter setting** (RS485 communication)
  : Free download the comprehensive device management program (DAQMaster)
- SSR drive output / Current output selectable
- SSRP output (standard/phase/cycle control selectable
- Mounting space saving with compact design
  : downsized by approx. 30% in depth compared with same size of other Series (panel back length: 60mm)

※Terminal cover, sold separately: RSA-COVER

⚠ Please read "Caution for your safety" in operation manual before using.

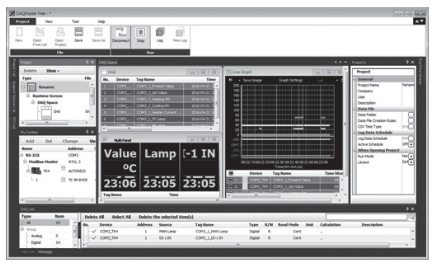
■ Comprehensive Device Management Program (DAQMaster)

- DAQMaster is comprehensive device management program. It is available for parameter setting, monitoring.
- Visit our website (www.autonics.com) to download user manual and comprehensive device management program.

< Computer specification for using software >

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operating system	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB or more
Hard disk	More than 1GB of free hard disk space
VGA	1024×768 or higher resolution display
Others	RS-232 serial port (9-pin), USB port

< DAQMaster screen >



■ Ordering Information

TX 4 S - 1 4 R

Position	Code	Description
Control output	R	Relay output
	S	SSR drive output
	C	Selectable current output or SSR drive output
Power supply	4	100-240VAC 50/60Hz
Option output	1	Alarm output 1
	2	Alarm output 1+Alarm output 2
	A	Alarm output 1+Alarm output 2+Trans. output
	B	Alarm output 1+Alarm output 2+RS485 com. output
Size	S	DIN W48×H48mm
Digit	4	9999 (4-digit)
Item	TX	LCD display standard PID temperature controller

■ Specifications

Series		**TX4S**
Power supply		100-240VAC 50/60Hz
Allowable voltage range		90 to 110% of rated voltage
Power consumption		Max. 8VA
Display method		11-segment (PV: white, SV: green), other display (yellow) with LCD method※1
Character size	PV(W×H)	6.9×15.3mm
	SV(W×H)	4.1×9.2mm
Input type	RTD	DPt100Ω, Cu50Ω (permissible line resistance max. 5Ω)
	TC	K(CA), J(IC), L(IC), T(CC), R(PR), S(PR)
Display accuracy※2	RTD TC	●At room temperature (23℃±5℃): (PV ±0.3% or ±1℃, select the higher one) ±1-digit ●Out of room temperature: (PV ±0.5% or ±2℃, select the higher one) ±1-digit
Control output	Relay	250VAC 3A 1a
	SSR	Max. 12VDC ± 2V 20mA
	Current	DC4-20mA or DC0-20mA (load resistance max. 500Ω)
Option output	Alarm output	AL1, AL2 Relay: 250VAC 3A 1a
	Trans. output	DC4-20mA (load resistance max. 500Ω, output accuracy: ±0.3%F.S.)
	Com. output	RS485 Communication output (Modbus RTU method)
Control method		ON/OFF control, P, PI, PD, PID control
Hysteresis		1 to 100℃/℉ (0.1 to 50.0℃/℉) variable
Proportional band(P)		0.1 to 999.9℃/℉
Integral time(I)		0 to 9999 sec
Derivative time(D)		0 to 9999 sec
Control period(T)		0.5 to 120.0 sec
Manual reset		0.0 to 100.0%
Sampling period		50ms
Dielectric strength		3,000VAC 50/60Hz for 1 min (between all terminals and case)
Vibration		0.75mm amplitude at frequency 5 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Relay life cycle	Mechanical	OUT, AL1/2: Min. 5,000,000 operations
	Electrical	OUT, AL1/2: Min. 200,000 (250VAC 3A resistance load)
Insulation resistance		Over 100MΩ (at 500VDC megger)
Noise immunity		Square shaped noise by noise simulator (pulse width 1μs) ±2kV R-phase, S-phase
Memory retention		Approx. 10 years (non-volatile semiconductor memory type)
Environ-ment	Ambient temp.	-10 to 50℃, storage: -20 to 60℃
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH
Protection structure		IP50 (front panel, IEC standards)
Insulation type		Double insulation or reinforced insulation(mark: ▣, dielectric strength between all terminals and case: 3kV)
Approval		CE c UL us
Weight※3		Approx. 135.2g (approx. 85.2g)

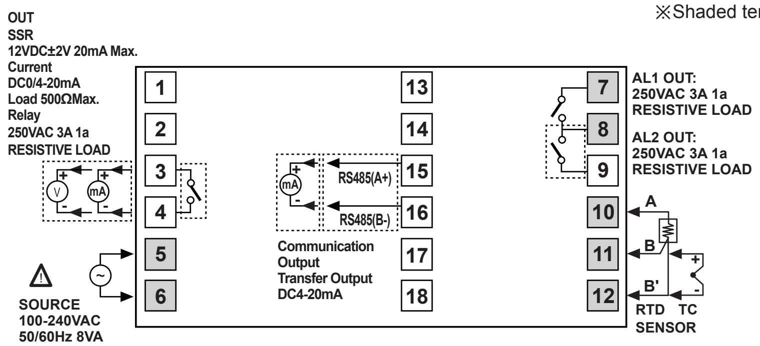
※1: When using the unit at low temperature (below 0℃), display cycle is slow.
Control output operates normally.
※2: ◎At room temperature(23℃±5℃)
- TC R(PR), S(PR), below 200℃: (PV ±0.5% or ±3℃, select the higher one) ±1-digit
  , over 200℃: (PV ±0.5% or ±2℃, select the higher one) ±1-digit
- TC L(IC), RTD Cu50Ω: (PV ±0.5% or ±2℃, select the higher one) ±1-digit

◎ Out of room temperature range
- TC R(PR), S(PR): (PV ±1.0% or ±5℃, select the higher one) ±1-digit
- TC L(IC), RTD Cu50Ω: (PV ±0.5% or ±3℃, select the higher one) ±1-digit

※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

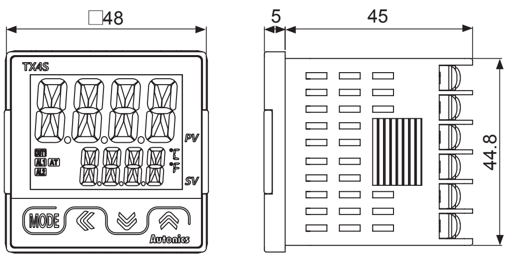
■ Connections

※Shaded terminals are standard model.

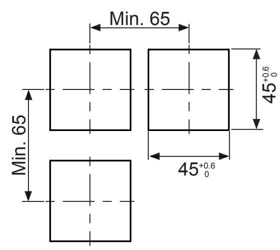


■ Dimensions

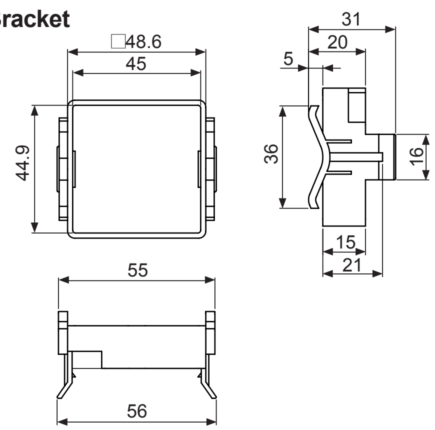
(unit: mm)



●Panel cut-out



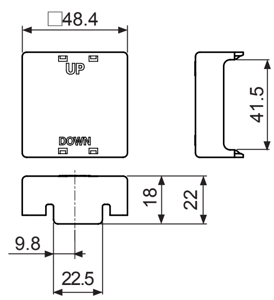
● Bracket



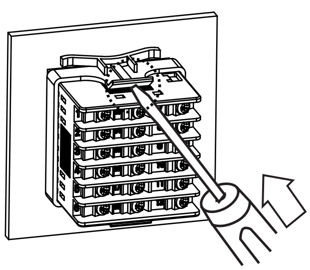
● Terminal cover (sold separately)

●RSA Cover(48×48mm)

(unit: mm)



■ Product Mounting



Mount the unit on the panel. Push the bracket with tools to fix the unit as the figure.

▣ Sold Separately

◎ Communication converter

- **SCM-38I**
  (RS232C to RS485 converter)

- **SCM-US48I**
  (USB to RS485 converter)

- **SCM-US**
  (USB to Serial converter)

- **EXT-US**
  (converter cable)

◎ Display units (DS/DA-T Series)

- **DS/DA-T Series**
  (RS485 communication input type display unit)

DS16-□T

DS22/DA22-□T

DS40/DA40-□T

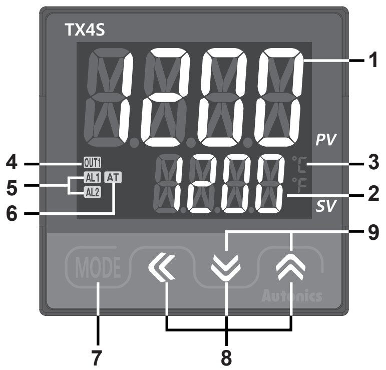
DS60/DA60-□T

※Connect RS485 communication input type display unit (DS/DA-T Series) and RS485 communication output model of TX Series, the display unit displays present value of the device without PC/PLC.

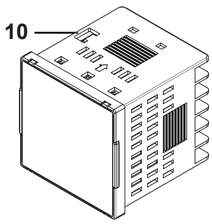
▣ Input Type And Range

Input type		Decimal point	Display	Input range(℃)	Input range(℉)
Thermocouple	K(CA)	1	KCA.H	-50 to 1200	-58 to 2192
		0.1	KCA.L	-50.0 to 999.9	-58.0 to 999.9
	J(IC)	1	JIC.H	-30 to 800	-22 to 1472
		0.1	JIC.L	-30.0 to 800.0	-22.0 to 999.9
	L(IC)	1	LIC.H	-40 to 800	-40 to 1472
		0.1	LIC.L	-40.0 to 800.0	-40.0 to 999.9
	T(CC)	1	tCC.H	-50 to 400	-58 to 752
		0.1	tCC.L	-50.0 to 400.0	-58.0 to 752.0
	R(PR)	1	RPR	0 to 1700	32 to 3092
	S(PR)	1	SPR	0 to 1700	32 to 3092
RTD	DPt 100Ω	1	dPt.H	-100 to 400	-148 to 752
		0.1	dPt.L	-100.0 to 400.0	-148.0 to 752.0
	Cu50Ω	1	CU5.H	-50 to 200	-58 to 392
		0.1	CU5.L	-50.0 to 200.0	-58.0 to 392.0

Unit Description

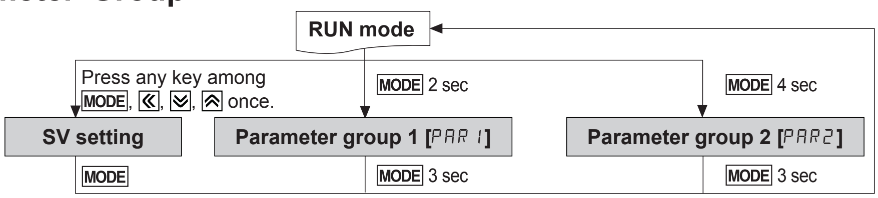


1. **Measured value (PV) component:**
   RUN mode: Displays current measured value (PV).
   SETTING mode: Displays parameters.
2. **Setting value (SV) display component:**
   RUN mode: Displays setting value(SV).
   SETTING mode: Displays setting value of parameter.
3. **Temperature unit(℃/℉) indicator:**
   Displays the set temperature unit as temperature unit [UNIT] of parameter group 2.
4. **Control output (OUT1) indicator:**
   Turns ON while control output is ON.
   ※Turns ON when MV is over 3.0% at cycle/phase control of SSR drive output method.
5. **Alarm output (AL1, AL2) indicator:**
   Turns ON when the corresponding alarm output turns ON.
6. **Auto-tuning indicator:**
   Flashes during auto-tuning every 1 sec.



7. MODE **key:** Enters parameter group, returns to RUN mode, moves parameters, and saves the setting value.
8. **Setting value adjustment key:** Enters SV setting mode and move digits.
9. **Digital input key:**
   Press the ▽+△ keys for 3 sec to execute the digital input key functions which is set at digital input key [dI-K]of parameter group 2 (RUN/STOP, clear alarm output, auto-tuning).
10. **PC loader port:**
   It is for serial communication to set parameter and monitoring by DAQMaster installed in PC. Use this for connection EXT-US (converter cable, sold separately) + SCM-US (USB to Serial converter, sold separately).

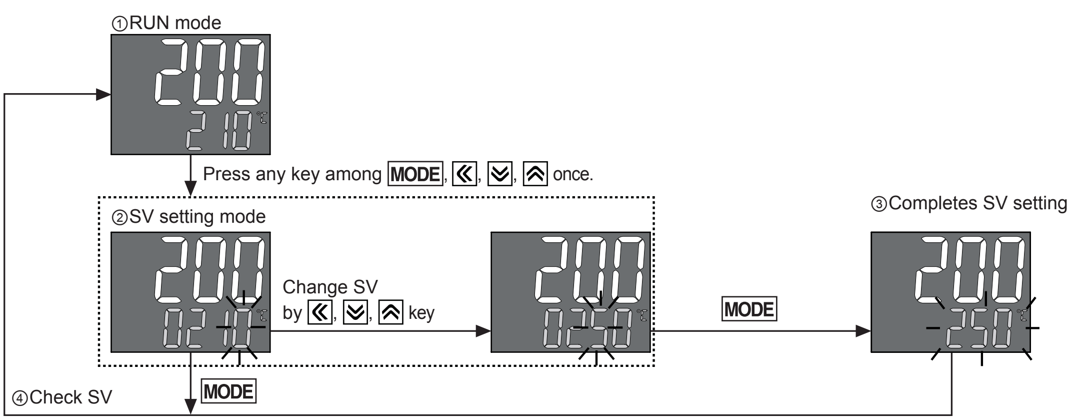
Parameter Group



※Order of parameter setup Parameter group 2 → Parameter group 1 → SV setting
●All parameters are related one another. Set the parameters as above order.
※If there is no key input for 30 sec while setting SV or the parameters, the new settings are ignored, and the unit will return to RUN mode with previous settings.
※When returning to RUN mode by holding the MODE key for over 3 sec, press the MODE key within 1 sec to re-enter the first parameter of previous parameter group.
※Hold the ≪+▽+△ keys for 5 sec in RUN mode, to enter re-set parameter menu. Select 'YES' and all parameters are reset as factory default.

● SV setting

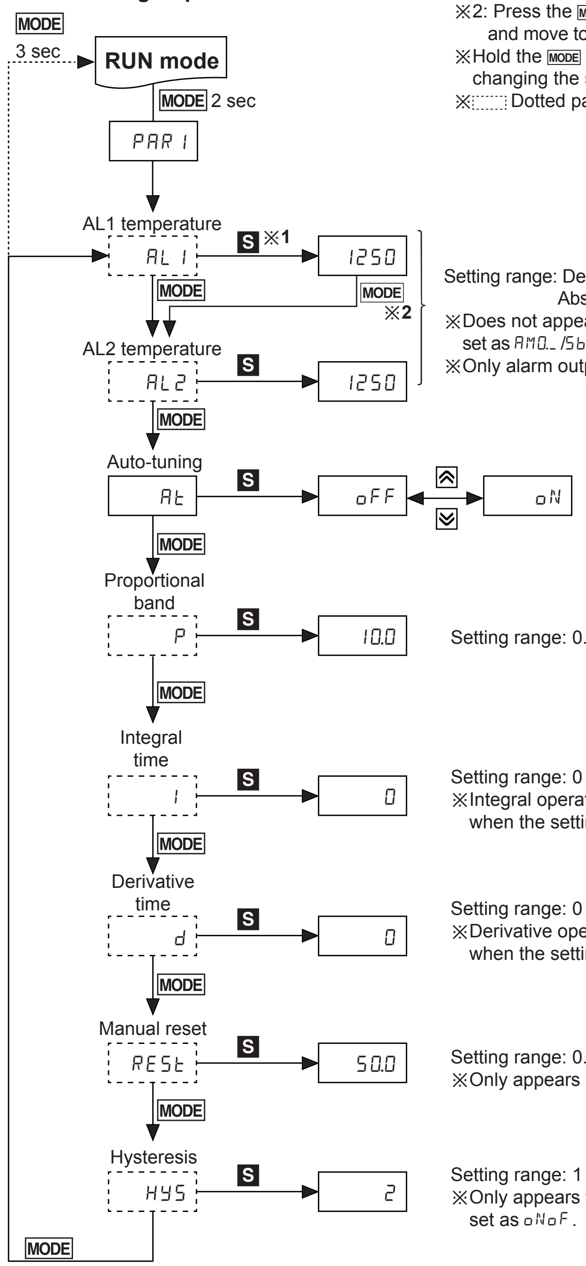
※To change set temperature from 210℃ to 250℃



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

● **Parameter group 1**

※1: S: Press any key among ≪, ≫, ≪.
※2: Press the MODE key once after changing the setting value, to save the setting value and move to the next parameter
※Hold the MODE key for 3 sec to save the setting value and return to RUN mode after changing the setting value.
※ Dotted parameters may not appear by model type or other parameter settings.



Setting range: Deviation alarm(- [F.S] to [F.S]),
Absolute value alarm(temperature range)
※Does not appear when AL1/AL2 alarm operation [AL - 1, AL - 2] of parameter group 2 is set as AM0._ /SbA.□/LbA.□.
※Only alarm output 2 models have [AL2].

※When setting as oN, the unit starts auto-tuning. After completing, oFF is automatically set.
※During auto-tuning, the auto-tuning indicator flashes (every 1 sec).

Setting range: 0.1 to 999.9°C/°F

Setting range: 0 to 9999 sec
※Integral operation will be OFF when the setting value is '0'.

Setting range: 0 to 9999 sec
※Derivative operation will be OFF when the setting value is '0'.

Setting range: 0.0 to 100.0%
※Only appears in P, PD control.

※Only appears when control method [C-Md] of parameter group 2 is set as PId.

Setting range: 1 to 100°C/°F (0.1 to 50.0°C/°F)
※Only appears when control method [C-Md] of parameter group 2 is set as oNoF.

● **Parameter group 2**

※1: S: Press any key among ◁, ▽, △.
※2: Press the MODE key once after changing the setting value, to save the setting value and move to the next parameter
※Hold the MODE key for 3 sec to save the setting value and return to RUN mode after changing the setting value.
※ Dotted parameters may not appear by model type or other parameter settings.

RUN mode → MODE 4 sec → PAR2 (MODE 3 sec → RUN mode)

Parameter	Display	Setting value (S ※1)	Description
Input sensor	IN-t	KCA.H (MODE ※2)	Setting range: Refer to '■ Input Type And Range'. ※When changing the setting value, SV, [IN-b, H-SV/L-SV, AL1, AL2, LbA.b, AHYS] parameters of parameter group 2 are reset.
Temperature unit	UNIt	°C ↔ °F	※When changing the setting value, SV, [IN-b, H-SV/L-SV, AL1, AL2, LbA.b, AHYS] parameters of parameter group 2 are reset.
Input correction	IN-b	0	Setting range: -999 to 999°C/°F(-199.9 to 999.9°C/°F)
Input digital filter	MAV.F	0.1	Setting range: 0.1 to 120.0 sec
SV low-limit value	L-SV	-50	Setting range: Within temperature range of each sensor [L-SV ≤(H-SV -1-digit)] ※When changing the setting value, and SV < L-SV, SV is reset as L-SV.
SV high-limit value	H-SV	1200	Setting range: Within temperature range of each sensor [H-SV ≥(L-SV +1-digit)] ※When changing the setting value, and SV > H-SV, SV is reset as H-SV.
Control output mode	o-Ft	HEAt ↔ CooL	
Control method	C-Md	PId ↔ oNoF	※When changing the setting value, [ER.MV] is reset as 0.0, [dI -K] is reset as oFF.
Control output selection	oUt	CURR ↔ SSR	※Appears only in selectable current output or SSR drive output model(TX4S-□4C).
SSR drive output method	SSR.M	StNd ↔ CYCL ↔ PHAS	※Appears only in SSR drive output model (TX4S-□4S).
Current output range	o.MA	4-20 ↔ 0-20	※Appears only when control output [oUt] is set as CURR.
Control cycle	t	20.0	Setting range: 0.5 to 120.0 sec ※Appears only when control method [C-Md] is PId. ※Does not appear when SSR drive output is set as CYCL, or PHAS.
AL1 operation	AL-1	※Alarm operation: AM1.A ↔ LbA.A; ※ Alarm option: AM1.A ↔ AM1.b	※Press the ◁ key to switch 'Alarm operation' ⇔ 'Alarm option' setting. ※When changing the setting value, [AL1, AL2] parameter of parameter group 1 is reset.
AL2 operation	AL-2	AM2.A	※Set method is same as AL1 alarm operation [AL-1]. ※Appears only in alarm output 2 models. ※When changing the setting value, [AL1, AL2] parameter of parameter group 1 is reset.
Alarm output hysteresis	AHYS	1	Setting range: 1 to 100°C/°F(0.1 to 100.0°C/°F) ※Does not appear when AL1/AL2 alarm operation [AL-1, AL-2] is set as AM0._ /SbA.□/LbA.□.

Each parameter advances to the next with MODE; after AHYS, MODE returns to PAR2.

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(S) Field Network Devices
(T) Software

- **LBA monitoring time** [LbA.t] → S → 0
  Setting range: 0 to 9999 sec (automatically set during auto-tuning)
  ※Appears only when alarm operation [AL-1, AL-2] is set as LbA□.
- **LBA detection band** [LbA.b] → S → 2
  Setting range: 0 to 999℃/℉ (0.0 to 999.9℃/℉)
  (automatically set during auto-tuning)
  ※Appears only when alarm operation [AL-1, AL-2] is set as LbA□ and [LbA.t] is not set as 0.
- **Trans. output low-limit value** [FS-L] → S → -50
- **Trans. output high-limit value** [FS-H] → S → 1200
  Setting range: Refer to '■ Input Type And Range'.
  ※Appears only in transmission output model(TX4S-A4□).
- **Comm. address** [AdRS] → S → 1
  Setting range: 1 to 127
- **Comm. speed** [bPS] → S → 96
  Setting range: 24, 48, 96, 192, 384 bps
  Multiply 100 to read the setting value.
- **Comm. parity-bit** [PRty] → S → NoNE ⇄ EVEN ⇄ odd
- **Comm. stop-bit** [StP] → S → 2 ⇄ 1
- **Comm. response waiting time** [RSW.t] → S → 20
  Setting range: 5 to 99ms
- **Comm. write** [CoMW] → S → EN.A ⇄ dI S.A
  ※Appears in RS485 communication output model(TX4S-B4□).
- **Digital input key** [dI-K] → S → StoP ⇄ AL.RE ⇄ At ⇄ oFF
  ※ At does not appear when control method [C-Md] is set as oNoF.
- **Control output MV for input break** [ER.MV] → S → 0.0
  Setting range: 0.0 to 100.0%
  ※Only 0.0 (OFF)/ 100.0 (ON) appear when control method [C-Md] is set as oNoF.
  ※When control method [C-Md] is changing PI d↔oNoF and the setting value is below 100.0, it is reset as 0.0.
- **Lock** [LoC] → S → oFF ⇄ LoC1 ⇄ LoC2 ⇄ LoC3

MODE

Setting range:

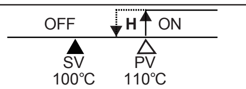
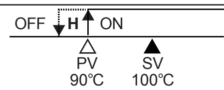
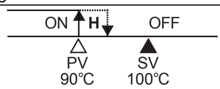
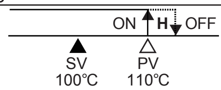
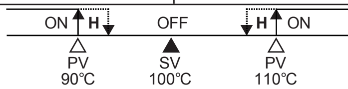
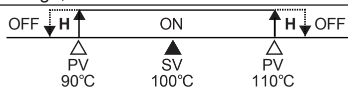
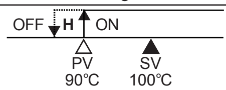
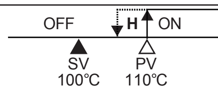
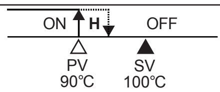
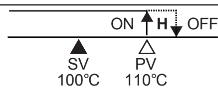
oFF	Unlock
LoC1	Parameter group 2 lock
LoC2	Parameter 1,2 group lock
LoC3	Parameter 1,2 group, SV setting lock

■ Alarm

AM1.A
Alarm operation — Alarm option

Set both alarm operation and alarm option by combining.
Each alarm operates individually in two alarm output models.
When the current temperature is out of alarm range, alarm clears automatically. If alarm option is alarm latch or alarm latch and standby sequence 1/2, press digital input key(▽+△) 3 sec, digital input key [dI-K] of parameter group 2 set as AL.RE), or turn OFF the power and turn ON to clear alarm.

◎ Alarm operation

Mode	Name	Alarm operation		Description
AM0._	-	-		No alarm output
AM1.□	Deviation high-limit alarm	 High-limit deviation: Set as 10℃	 High-limit deviation: Set as -10℃	If deviation between PV and SV as high-limit is higher than set value of deviation temperature, the alarm output will be ON.
AM2.□	Deviation low-limit alarm	 Low-limit deviation: Set as 10℃	 Low-limit deviation: Set as -10℃	If deviation between PV and SV as low-limit is higher than set value of deviation temperature, the alarm output will be ON.
AM3.□	Deviation high/low-limit alarm	 High, Low-limit deviation: Set as 10℃		If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be ON.
AM4.□	Deviation high/low-limit reserve alarm	 High, Low-limit deviation: Set as 10℃		If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be OFF.
AM5.□	Absolute value high limit alarm	 Alarm absolute-value: Set as 90℃	 Alarm absolute-value: Set as 110℃	If PV is higher than the absolute value, the output will be ON.
AM6.□	Absolute value low limit alarm	 Alarm absolute-value: Set as 90℃	 Alarm absolute-value: Set as 110℃	If PV is lower than the absolute value, the output will be ON.
SbA.□	Sensor break alarm	-		It will be ON when it detects sensor disconnection.
LbA.□	Loop break alarm	-		It will be ON when it detects loop break.

※ H: Alarm output hysteresis [AHYS]

◎ Alarm option

Option	Name	Description
AM□.A	Standard alarm	If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.
AM□.b	Alarm latch	If it is an alarm condition, alarm output is ON and maintains ON status. (Alarm output HOLD)
AM□.C	Standby sequence 1	First alarm condition is ignored and from second alarm condition, standard alarm operates. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, standard alarm operates.
AM□.d	Alarm latch and standby sequence 1	If it is an alarm condition, it operates both alarm latch and standby sequence. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, alarm latch operates.
AM□.E	Standby sequence 2	First alarm condition is ignored and from second alarm condition, standard alarm operates. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, standard alarm operates.
AM□.F	Alarm latch and standby sequence 2	Basic operation is same as alarm latch and standby sequence1. It operates not only by power ON/OFF, but also alarm setting value, or alarm option changing. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, alarm latch operates.

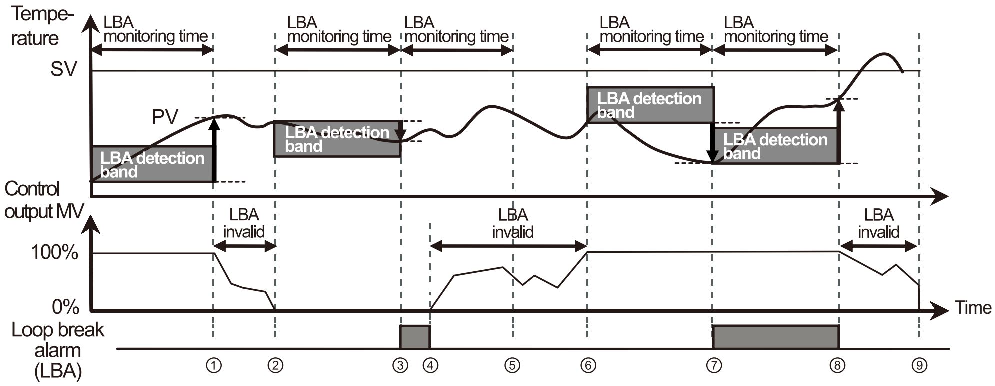
※Condition of re-applied standby sequence for standby sequence 1, alarm latch and standby sequence 1: Power ON
Condition of re-applied standby sequence for standby sequence 2, alarm latch and standby sequence 2: Power ON, changing set temperature, alarm temperature [AL1, AL2] or alarm operation [AL-1, AL-2], switching STOP mode to RUN mode.

●Sensor break alarm

The function that alarm output will be ON when sensor is not connected or when sensor's disconnection is detected during temperature controlling. You can check whether the sensor is connected with buzzer or other units using alarm output contact. It is selectable between standard alarm [SbA.A] or alarm latch [SbA.b].

● Loop break alarm(LBA)

It checks control loop and outputs alarm by temperature change of the subject. For heating control(cooling control), when control output MV is 100%(0% for cooling control) and PV is not increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], or when control output MV is 0%(100% for cooling control) and PV is not decreased below than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], alarm output turns ON.



Start control to ①	When control output MV is 100%, PV is increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t].
① to ②	The status of changing control output MV (LBA monitoring time is reset.)
② to ③	When control output MV is 0% and PV is not decreased below than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], loop break alarm (LBA) turns ON after LBA monitoring time.
③ to ④	Control output MV is 0% and loop break alarm (LBA) turns and maintains ON.
④ to ⑥	The status of changing control output MV (LBA monitoring time is reset.)
⑥ to ⑦	When control output MV is 100% and PV is not increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], loop break alarm (LBA) turns ON after LBA monitoring time.
⑦ to ⑧	When control output MV is 100% and PV is increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], loop break alarm (LBA) turns OFF after LBA monitoring time.
⑧ to ⑨	The status of changing control output MV (LBA monitoring time is reset.)

※When executing auto-tuning, LBA detection band [LbA.b] and LBA monitoring time are automatically set based on auto tuning value. When alarm operation mode [AL-1, AL-2] is set as loop break alarm(LBA) [LbA.□], LBA detection band [LbA.b] and LBA monitoring time [LbA.t] parameter is displayed.

▣ Functions

1. Input correction [IN-b]

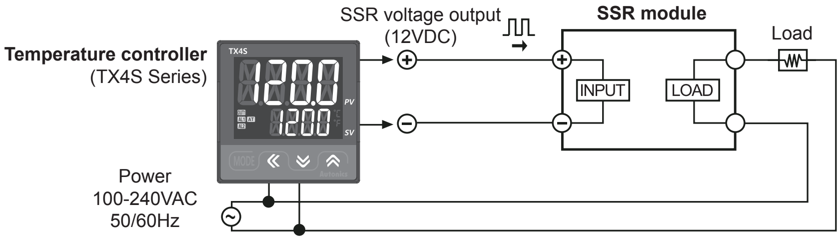
Controller itself does not have errors but there may be error by external input temperature sensor. This function is for correcting this error.
E.g.) If actual temperature is 80℃ but controller displays 78℃, set input correction value [IN-b] as '2' and controller displays 80℃.
※As the result of input correction, if current temperature value (PV) is over each temperature range of input sensor, it displays HHHH or LLLL.

2. Input digital filter [MAV.F]

If current temperature (PV) is fluctuating repeatedly by rapid change of input signal, it reflects to MV and stable control is impossible. Therefore, digital filter function stabilizes current temperature value.
For example, set input digital filter value as 0.4 sec, and it applies digital filter to input values during 0.4 sec and displays these values. Current temperature may be different by actual input value.

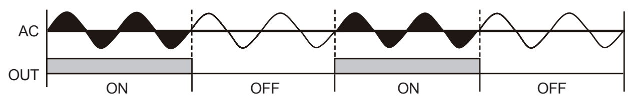
3. SSR drive output method (SSRP function) [SSR.M]

- SSRP function is selectable one of standard ON/OFF control, cycle control, phase control by utilizing standard SSR drive output.
- This function parameter appears only in SSR drive output model (TX4S-□4S).
- Realizing high accuracy and cost effective temperature control with both current output (4-20mA) and linear output(cycle control and phase control)
- Select one of standard ON/OFF control [StNd], cycle control [CYCL] , phase control [PHAS] at SSR.M parameter of parameter group 2. For cycle control, connect a zero cross turn-on SSR or random turn-on SSR. For phase control, connect random turn-on SSR.

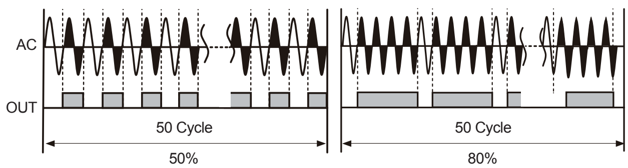


※When selecting cycle or phase control mode, **the power supply for a load and a temperature controller must be the same.**
※Control cycle [t] is able to set only when control method [C-Md]of parameter group 2 is set as PId and SSR drive output method [SSR.M] is set as StNd.
※In case of selectable current output or SSR drive output model(TX4S-□4C), this parameter does not appear. Standard ON/OFF control by SSR is only available.

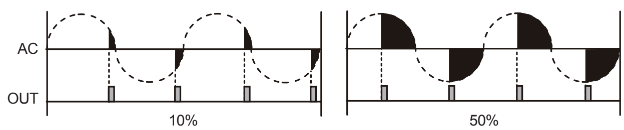
1)Standard ON/OFF control [StNd]
Controls ON (100% output)/OFF (0% output) as same as standard relay output.



2)Cycle control [CYCL]
Controls the load by repeating output ON / OFF according to the rate of output within setting cycle based on certain period (50-cycle).
Control accuracy is almost the same with phase control's.
This control has improved ON/OFF noise than phase control's due to zero cross type which turns ON/OFF at zero point of AC.



3)Phase control [PHAS]
Controls the load by controlling the phase within AC half cycle. Serial control is available.
Must use random turn-on SSR for this mode.



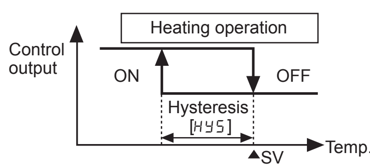
4. Current output range [o.MA]

In case of selectable current output or SSR drive output model(TX4S-□4C), when control output [oUt] parameter group 2 is set as [CURR], you can select high/low-limit range, 4-20mA [4-20] or 0-20mA [0-20] of current output.

5. Hysteresis [HYS]

Set interval between ON and OFF of control output for ON/OFF control.

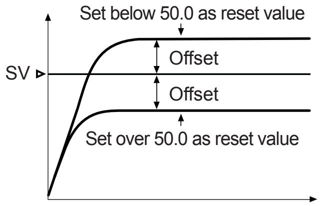
- If hysteresis is too narrow, hunting(oscillation, chattering) could occur due to external noise.
- In case of ON / OFF control mode, even if PV reaches stable status, there still occurs hunting. It could be due to hysteresis [HYS] setting value, load's response characteristics or sensor's location. In order to reduce hunting to a minimum, it is required to take into following factors consideration when designing temp. controlling; proper Hysteresis [HYS], heater's capacity, thermal characteristics, sensor's response and location.



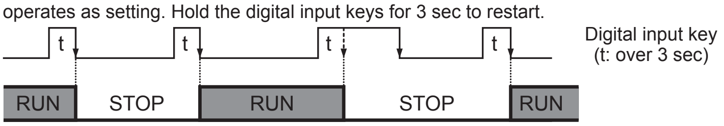
6. Manual reset [rESt]

When selecting P/PD control mode, certain temperature difference exists even after PV reaches stable status because heater's rising and falling time is inconsistent due to thermal characteristics of controlled objects, such as heat capacity, heater capacity. This temperature difference is called offset and manual reset [rESt] function is to set/correct offset.
When PV and SV are equal, reset value is 50.0%. After control is stable, PV is lower than SV, reset value is over 50.0% or PV is higher than SV, reset value is below 50.0%.

●Manual reset [rESt] by control result



7. Digital input key(▽ + △ 3 sec) [dI-K]

Parameter		Operation
OFF	oFF	It does not use digital input key function.
RUN/STOP	StoP	Pauses control output. Auxiliary output (except loop break alarm, sensor break alarm)except Control output operates as setting. Hold the digital input keys for 3 sec to restart. 
Clear alarm	AL.rE	Clears alarm output by force. (only when alarm option is alarm latch, or alarm latch and standby sequence 1/2 .) This function is applied when present value is out of alarm operation range but alarm output is ON. Alarm operates normally right after clearing alarm.
Auto-tuning	At	Starts/Stops auto-tuning. This function is same as auto-tuning [At] of parameter group 1. (You can start auto-tuning [At] of parameter group 1 and stop it by digital input key.) ※This parameter At appears only when control method [C-Md] parameter group 2 is set as PId. When control method [C-Md] parameter group 2 is set as oNoF, this parameter is changed as oFF.

8. Control output MV for input break [Er.MV]

When input sensor is break, set control output MV.
When control method [C-Md] of parameter group 2 is set as oNoF, set control output MV as 0.0 (OFF) or 100.0 (ON). When control method [C-Md] is set as PId, setting range for control output MV is 0.0 to 100.0.

▣ RS485 Communication Output

Applicable for models with RS485 communication output through option output(TX4S-B4□).
Please refer to '▣Ordering Information'.

1. Communication Specifications

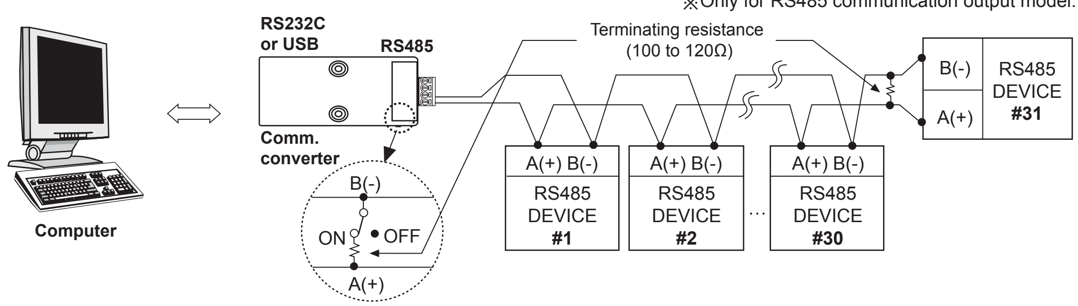
1-1. Interface

Com. protocol	Modbus RTU	Com. speed	2400, 4800, 9600, 19200, 38400 bps
Applied standard	EIA RS485		
Max. connections	31 units(address: 1 to 99)	Start-bit	1-bit fixed
Com. method	2-wire half duplex	Data-bit	8-bit fixed
Synchronization method	Asynchronous	Parity-bit	None, Even, Odd
Com. distance	Within 800m	Stop-bit	1, 2Bit
Com. response time	5 to 99ms		

※It is not allowed to set overlapping communication address at the same communication line.
Use twisted pair wire for RS485 communication.

1-2. Application of system organization

※Only for RS485 communication output model.



※It is recommended to use Autonics communication converter; SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately), SCM-US (USB to Serial converter, sold separately).
Please use twisted pair wire for RS485 communication.

2. Modbus Mapping Table

2-1. Read Coil Status (Func 01) / Force Single Coil (Func 05) [Func: 01/05, R/W: R/W]

No.(Address)	Type		Description	Setting/Display range	Unit	Default
000001(0000)	RUN/STOP	Related coil, variable	Control output run/stop	0: RUN 1: StoP	-	StoP
000002(0001)	AT		Auto-tuning run/stop	0: oFF 1: oN	-	oFF
000003(0003)	Alarm Reset		Alarm output clear	0: oFF 1: oN	-	oFF
000004 to 000050	Reserved					

2-2. Read Discrete Inputs(Func 02) [Func: 02, R/W: R]

No.(Address)	Type		Description	Setting/Display range	Unit	Default
100001(0000)	℃ indicator	Front indicator	Unit indicator	0: OFF 1: ON	-	-
100002(0001)	℉ indicator		Unit indicator	0: OFF 1: ON	-	-
100003(0002)	OUT indicator		Control output indicator	0: OFF 1: ON	-	-
100004(0003)	AT indicator		Auto-tuning indicator	0: OFF 1: ON	-	-
100005(0004)	AL1 indicator		Alarm output 1 indicator	0: OFF 1: ON	-	-
100006(0005)	AL2 indicator		Alarm output 2 indicator	0: OFF 1: ON	-	-
100006 to 100050	Reserved					

2-3. Read Input Registers (Func 04) [Func:02, R/W : R]

No.(Address)	Type		Description	Setting/Display range	Unit	Default
300001 to 300100	Reserved					
300101(0064)	-		Product number H	-	-	Dedicated model number
300102(0065)	-		Product number L	-	-	
300103(0066)	-		Hardware version	-	-	□
300104(0067)	-		Software version	-	-	□
300105(0068)	-		Model 1	-	-	"TX"
300106(0069)	-		Model 2	-	-	" 4"
300107(006A)	-		Model 3	-	-	"S "
300108(006B)	-		Model 4	-	-	"14"
300109(006C)	-		Model 5	-	-	"R "
300110(006D)	-		Model 6	-	-	" "
300111(006E)	-		Model 7	-	-	" "
300112(006F)	-		Model 8	-	-	" "
300113(0070)	-		Model 9	-	-	" "
300114(0071)	-		Model 10	-	-	" "
300115(0072)	-		Reserved	-	-	-
300116(0073)	-		Reserved	-	-	-
300117(0074)	-		Reserved	-	-	-
300118(0075)	-		Coil status start address	-	-	0000
300119(0076)	-		Coil status quantity	-	-	0
300120(0077)	-		Input status start address	-	-	0000
300121(0078)	-		Input status quantity	-	-	0
300122(0079)	-		Holding register start address	-	-	0000
300123(007A)	-		Holding register quantity	-	-	0
300124(007B)	-		Input register start address	-	-	0000
300125(007C)	-		Input register quantity	-	-	0
300127 to 300200	Reserved					
301001(03E8)	PV		Present value	-1999 to 9999	℃/℉	-
301002(03E9)	DOT		Decimal point location	0:0, 1:0.0, 2:0.00, 3:0.000	-	-
301003(03EA)	UNIT		Display unit	0: °C, 1: °F	-	-
301004(03EB)	SV		Setting value	Within L-SV to H-SV	℃/℉	0
301005(03EC)	℃ indicator	Front indicator	Unit indicator	0: OFF 1: ON	-	-
	℉ indicator		Unit indicator	0: OFF 1: ON	-	-
	OUT indicator		Control output indicator	0: OFF 1: ON	-	-
	AT indicator		Auto-tuning indicator	0: OFF 1: ON	-	-
	AL1 indicator		Alarm output 1 indicator	0: OFF 1: ON	-	-
	AL2 indicator		Alarm output 2 indicator	0: OFF 1: ON	-	-
310006 to 310050	Reserved					

2-4. Read Holding Register (Func 03)/Preset Single Register (Func 06)/ Preset Multiple Registers (Func 16) [Func:03/06/16, R/W : R/W]

2-4-1. SV setting

No.(Address)	Parameter	Description	Setting/Display range	Unit	Default
400001(0000)	Set value	SV setting value	Within L-SV to H-SV	℃/℉	0
400002 to 400050	Reserved				

2-4-2. Parameter group 1 [PAR1]

No.(Address)	Parameter	Description	Setting/Display range	Unit	Default
400051(0032)	AL1	AL1 temperature	Deviation temperature: -F.S. to F.S. Absolute value alarm: Temperature range	℃/℉	1250
400052(0033)	AL2	AL2 temperature			
400053(0034)	AT	Auto-tuning	0: oFF 1: oN	-	oFF
400054(0035)	P	Proportional band	1 to 9999: 0.1 to 999.9	℃/℉	10.0
400055(0036)	I	Integral time	0 to 9999: 0 to 9999	Sec	0
400056(0037)	d	Derivative time	0 to 9999: 0 to 9999	Sec	0
400057(0038)	REST	Manual reset	0 to 1000: 0.0 to 100.0	%	50.0
400058(0039)	HYS	Hysteresis	1 to 100(1 to 500): 1 to 100(0.1 to 50.0)	-	2
400059 to 400100	Reserved				

2-4-3. Parameter group 2 [PAR2]

No.(Address)	Parameter	Description	Setting/Display range	Unit	Default
400101(0064)	IN-T	Input sensor	Refer to '■ Input Type And Range'	-	KCA.H
400102(0065)	UNIT	Temperature unit	0: ℃, 1: ℉	-	℃
400103(0066)	IN-b	Input correction	-999 to 999(-1999 to 9999): -999 to 999(-199.9 to 999.9)	-	0
400104(0067)	MAV.F	Input digital filter	1 to 1200: 0.1 to 120.0	Sec	0.1
400105(0068)	L-SV	SV low-limit value	Refer to '■ Input Type And Range'	℃/℉	-50
400106(0069)	H-SV	SV high-limit value			1200
400107(006A)	o-FT	Control output mode	0: HEAT, 1: CooL	-	HEAT
400108(006B)	C-Md	control method	0: PId, 1: oNoF	-	PId
400109(006C)	oUT	Control output selection	0: SSR, 1: CURR	-	CURR
400110(006D)	SSR.M	SSR drive output method	0: STNd, 1: CYCL, 2: PHAS	-	STNd
400111(006E)	o.MA	Current output range	0: 4-20, 1: 0-20	-	4-20
400112(006F)	T	Control cycle	5 to 1200: 0.5 to 120.0	Sec	20.0 2.0
400113(0070)	AL-1	AL1 operation	00: AM0._, 10 to 15: AM1.A to AM1.F, ... 60 to 65: AM6.A to AM6.F, 70: SbA.A, 71: SbA.b, 80: LbA.A, 81: LbA.b	-	AM1.A
400114(0071)	AL-2	AL2 operation			AM2.A
400115(0072)	AHYS	Alarm output hysteresis	1 to 100(1 to 500): 1 to 100(0.1 to 50.0)	-	1
400116(0073)	LbA.T	LBA detection time	0 to 9999: 0 to 9999	Sec	0
400117(0074)	LbA.b	LBA detection band	0 to 999(0 to 9999): 0 to 999(0.0 to 999.9)	℃/℉	2
400118(0075)	FS-L	Trans. output low-limit value	Refer to '■ Input Type And Range'.	-	-50
400119(0076)	FS-H	Trans. output high-limit value		-	1200
400120(0077)	AdRS	Com. address	1 to 127: 1 to 127	-	1
400121(0078)	bPS	Com. speed	0: 24, 1: 48, 2: 96, 3: 192, 4: 384	-	96
400122(0079)	PRTY	Com. parity bit	0: NoNE, 1: EVEN, 2: odd	-	NoNE
400123(007A)	STP	Com. stop bit	0: 1, 1: 2	-	2
400124(007B)	RSW.T	Com. response waiting time	5 to 99: 5 to 99	ms	20
400125(007C)	CoMW	Com. write	0: EN.A, 1: dIS.A	-	EN.A
400126(007D)	dI-K	Digital input key	0: oFF, 1: SToP, 2: AL.RE, 3: AT	-	SToP
400127(007E)	ER.MV	Control output MV for input break	0 to 1000: 0.0(OFF) to 100.0(ON)	%	0.0
400128(007F)	LoC	Lock	0: oFF, 1: LoC1, 2: LoC2, 3: LoC3	-	oFF
400129 to 400150	Reserved				

Factory Default

SV setting

Parameter	Factory default
-	0

Parameter group 1

Parameter	Factory default
AL1	1250
AL2	
At	oFF
P	10.0
I	0
d	
RESt	50.0
HYS	2

Parameter group 2

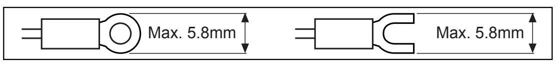
Parameter	Factory default	Parameter	Factory default
IN-t	KCA.H	AHYS	1
UNIt	°C	LbA.t	0
IN-b	0	LbA.b	2
MAV.F	0.1	FS-L	-50
L-SV	-50	FS-H	1200
H-SV	1200	AdRS	1
o-Ft	HEAt	bPS	96
C-Md	PId	PRtY	NoNE
oUt	CURR	StP	2
SSR.M	StNd	RSW.t	20
o.MA	4-20	CoMW	EN.A
t	20.0 (Relay)	dI-K	StoP
	2.0 (SSR drive)	ER.MV	0.0
AL-1	AM1.A	LoC	oFF
AL-2	AM2.A		

Error

Display	Description	Troubleshooting
oPEN	Flashes when input sensor is disconnected or sensor is not connected.	Check input sensor status.
HHHH	Flashes when measured value is higher than input range.	When input is within the rated input range, this display disappears.
LLLL	Flashes when measured value is lower than input range.	

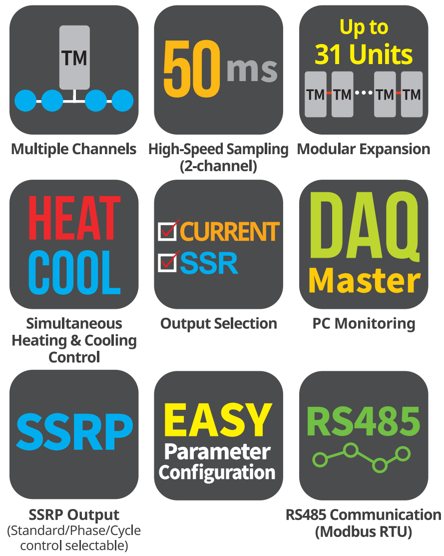
Proper Usage

1. Please separate the unit wiring from high voltage lines or power lines to prevent inductive noise.
2. For crimp terminal, select following shaped terminal (M3).



3. Install a power switch or circuit breaker to control the power supply.
4. The power switch or circuit breaker should be installed where it is easily accessible by the user.
5. The unit is for temperature controller. Do not use the unit as volt-meter or ampere-meter.
6. When using RTD temperature sensor, must wire it as 3-wire type. If cable is extended, use 3 wires which are same thickness as the line. It might cause the deviation of temperature when line resistance is different.
7. If power line and input signal line are close each other, install line filter for noise protection at power line and use shielded input signal line.
8. Keep away from the high frequency instruments.(High frequency welding machine & sewing machine, large capacity SCR controller).
9. When supplying the measured input, the unit displays HHHH or LLLL, the measured input may have problem. Turn OFF the power to the unit and check the line. .
10. This unit may be used in the following environments.
    ①It shall be used indoor. ②Altitude up to 2,000m.
    ③Pollution degree 2. ④Installation category II.

Modular Multi-Channel PID Temperature Controllers



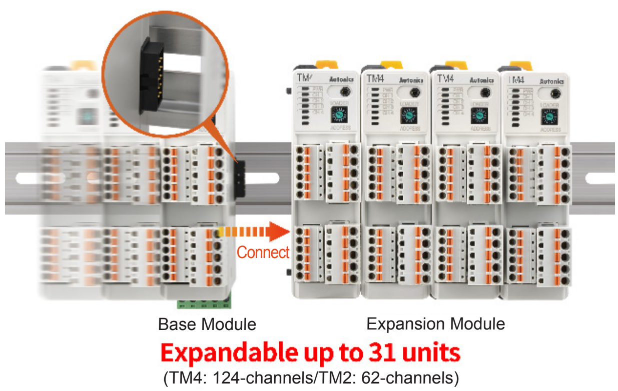
▣ Features

● Multi-Channel Input and Output Control (2-Channels/4-Channels)

The TM series temperature controllers are capable of controlling 2-channels or 4-channels of input and outputs, capable of performing as 4 separate temperature controllers.

● Modular Expansion Up to 31 Units

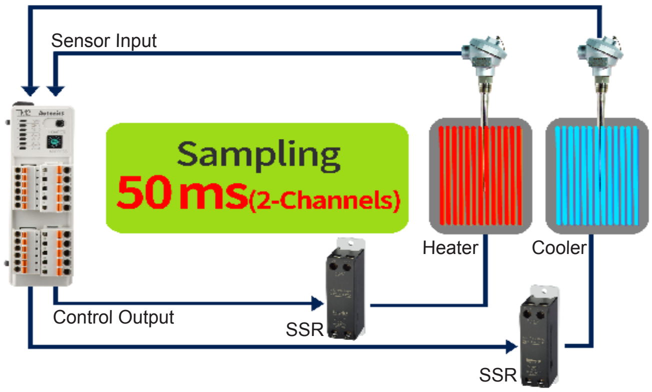
Up to 31 units can be connected with the side expansion connectors (124-channels / 62-channels). Individual power supply is not required, and communication is supported between modules.



● **50 ms High-Speed Sampling Rate**

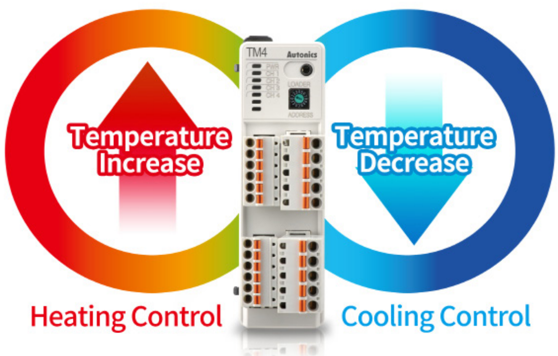
The TM2 models are capable of high-speed sampling rate of 50 ms, providing ideal control in applications requiring high-speed response rates. (Simultaneous 2-channel control)

※TM4 Series sampling speed: 100ms



● **Simultaneous Heating & Cooling Control**

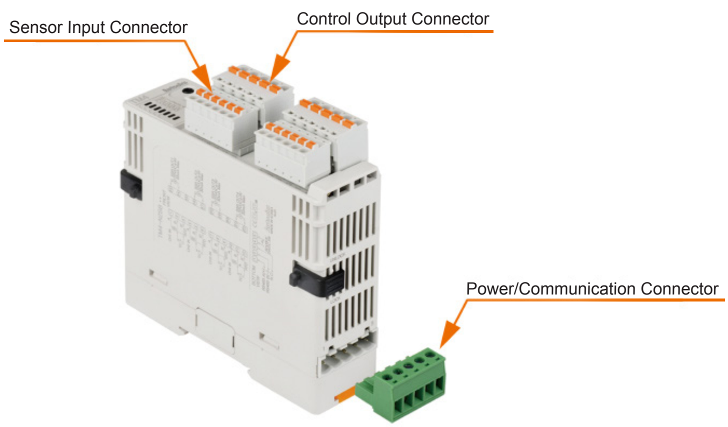
The controllers can simultaneously control heating and cooling elements, providing efficient temperature control.



● **Connector Wiring**

Easy wiring and maintenance with various connectors: sensor input connectors, control output connectors, power/communication connectors.

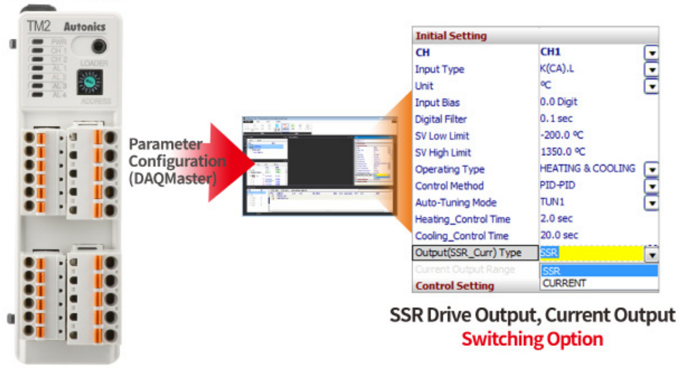
※Power/communication connectors can only be connected to base units. (TM□-□□□B models)



● **Switch Between Current Output and SSR Drive Output**

Depending on the application, users can select between current output and SSR drive output by parameter configuration through DAQMaster.

Control Output

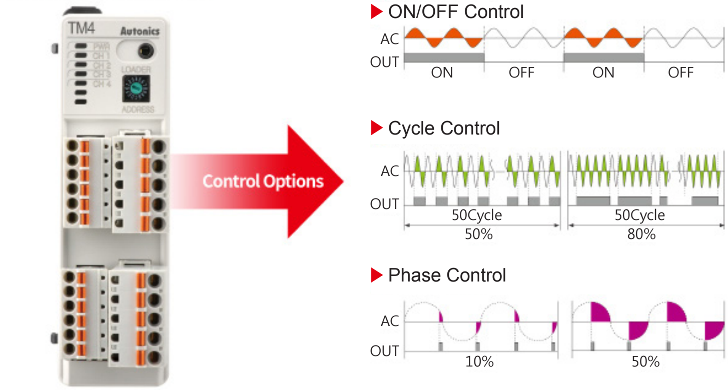


(TM2-□2C□models)

● **SSR Drive Output (SSRP Function) Control Options**

Users can select from ON/OFF control, cycle control, and phase control using standard SSR drive output option. Precise and accurate control is possible at low costs.

SSR Drive Output Method



▣ Application

Modular multi-channel temperature controllers used to control various temperature components in a stick packaging machine.

2/4-CH Modular Type, PID Control Temperature Controller

■ Features

- Multi-channel (4-channel: TM4 / 2-channel: TM2) input and output control
- High-speed sampling cycle (4-channel: 100 ms / 2-channel: 50 ms)
- **Module connection and expansion with expansion connectors**
  - Communication between modules
  - No additional power supply wiring
  - Expandable up to 31 units (124-channel / 62-channel)
- Simultaneous heating and cooling control function
- Isolated input channels (dielectric strength: 1000 VAC)
- Switch between current output and SSR drive output (TM2-□2C□ models)
- SSR drive output (SSRP function) control options: ON/OFF control, cycle control, phase control
- Parameter configuration via PC (USB and RS485 communication)
  - DAQMaster software included (comprehensive device management software)
  - Communication converter sold separately: SCM-US (USB to serial converter), SCM-38I (RS-232C to RS485 converter), SCM-US48I (USB to RS485 converter)
- Easy wiring and maintenance with various connectors:
  sensor input connector, control output connector, power/communication connector
- Heater disconnect alarm function (CT input)
  - Current transformer (CT) sold separately: CSTC-E80LN, CSTC-E200LN
- Various input types and temperature ranges

Please read "Caution for your safety" in operation manual before using.

■ Manual

- Visit our website (www.autonics.com) to download user manual and communication manual.
- User manual describes for specifications and function, and communication manual describes for RS485 communication (Modbus RTU protocol) and parameter address map data.

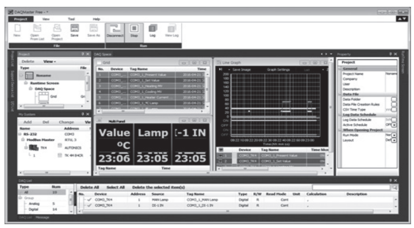
■ Comprehensive Device Management Program (DAQMaster)

- DAQMaster is comprehensive device management program for convenient management of parameters and multiple device data monitoring.
- Visit our website (www.autonics.com) to download user manual and comprehensive device management program.

< Computer specification for using software >

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS-232 serial port (9-pin), USB port

< DAQMaster screen >



■ Ordering Information

TM 4 – N 2 R B

Module type	B		Basic module
	E		Expansion module ※1
Control output	2CH	R	Relay output
		C	Current or SSR drive output selectable
	4CH	R	Relay output
		S	SSR drive output
Power supply	2		24VDC
Option I/O	2CH	2	CT input, Digital input (DI-1, DI-2), Alarm output 1+2, RS485 comm. output
		4	CT input, Digital input (DI-1, DI-2), Alarm output 1+2+3+4, RS485 comm. output
	4CH	N	RS485 comm. output
Channels	2		2-channel
	4		4-channel
Item	TM		Multi-channel modular temperature controller

※The expansion module does not supply power/comm. terminal. Order it with the basic module.

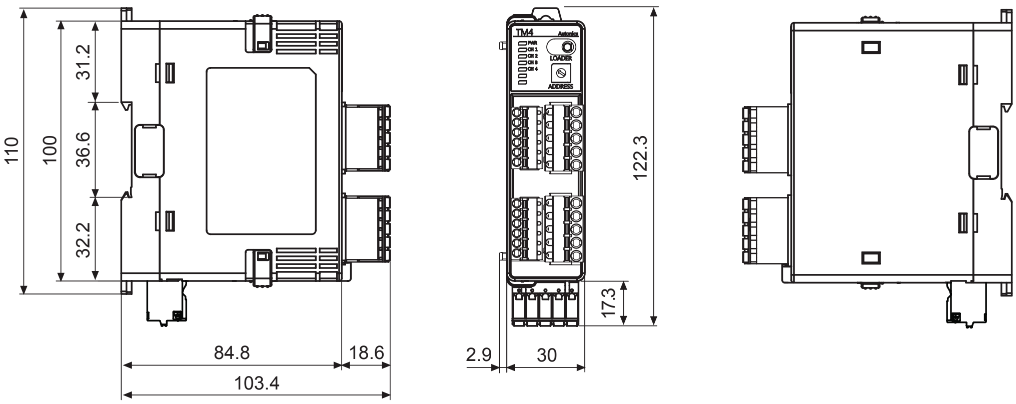
■ Specifications

Series		TM2	TM4
No. of channels		2-channel (insulated each channel-dielectric strength 1,000VAC)	4-channel (insulated each channel-dielectric strength 1,000VAC)
Power supply		24VDC	
Permissible voltage range		90 to 110% of rated voltage	
Power consumption		Max. 5W (for max. load)	
Display method		None- parameter setting and monitoring is available at external devices (PC, PLC, etc.)	
Input type	Thermocouple	K(CA), J(IC), E(CR), T(CC), B(PR), R(PR), S(PR), N(NN), C(TT), G, (TT), L(IC), U(CC), Platinel II	
	RTD	JPt100Ω, DPt100Ω (permissible line resistance max. 5Ω)	
Sampling period		50ms (2CH synchronous sampling)	100ms (4CH synchronous sampling)
Measured accuracy	Thermocouple※1	(PV ±0.5% or ±1℃, select the highter one) ±1-digit max.	
	RTD		
	CT input	±5% F.S. ±1-digit max.	—
	Current output	±1.5% F.S. ±1-digit max.	—
Influence of temp.※2	Thermocouple	(PV ±0.5% or ±2℃, select the highter one) ±1-digit max. (TC input max. -100℃ is within ±5℃) • TC B, R, S, C, G, L, U: (PV ±0.5% or ±5℃, select the highter one) ±1-digit max.	
	RTD		
Control output	Relay	250VAC 3A 1a	
	SSR	Max. 12VDC ±3V 30mA	Max. 22VDC ±3V 30mA
	Current	Selectable DC 4-20mA or DC 0-20mA (load resistance max. 500Ω)	—
Control method	Heating, Cooling	ON/OFF control, P, PI, PD, PID control	
	Heating&Cooling		
Option output	Alarm	250VAC 3A 1a	—
	Communication	RS485 communication output (Modbus RTU method)	
Option input	CT input	0.0-50.0A (primary current measurement range) ※CT ratio=1/1000	—
	Digital input	• Contact input: ON max. 1kΩ, OFF min. 100kΩ • Solid-state input: ON residual voltage max. 1.5V, OFF leakage current max. 0.1mA • Outflow current: Approx. 0.5mA per input	—
Hysteresis		1 to 100℃/℉ (0.1 to 100℃/℉) variable	
Proportional band (P)		0.1 to 999.9℃/℉	
Integral time (I)		0 to 9999 sec	
Derivative time (D)		0 to 9999 sec	
Control period (T)		0.1 to 120.0 sec (only for relay output, SSR drive output)	
Manual reset		0.0 to 100.0%	
Relay life cycle	Mechanical	Min. 10,000,000 operations	
	Electrical	Min. 100,000 operations (250VAC 3A resistance load)	
Insulation resistance		Over 100MΩ (at 500VDC megger)	
Insulation type		Double insulation or reinforced insulation (mark: ⧈, dielectric strength between the measuring input part and the power part: 1kV)	
Dielectric strength		1,000VAC 50/60Hz for 1 min (between input terminals and power terminals)	
Vibration		0.75mm amplitude at frequency of 5 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Noise immunity		±0.5kV the square wave noise (pulse width: 1μs) by the noise simulator	
Environ-ment	Ambient temp.	-10 to 50℃, storage: -20 to 60℃	
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH	
Accessories		Expansion connector: 1, Power/Comm. connector: 1 (only for basic module)	
Approval		CE c UL us KC	
Weight※3	Basic module	Approx. 217g (Approx. 152g)	Approx. 239g (Approx. 174g)
	Expansion module	Approx. 208g (Approx. 143g)	Approx. 231g (Approx. 166g)

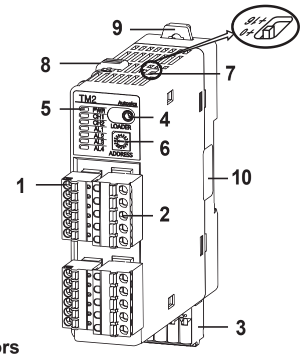
※1: In case of thermocouple K, J, E, T, N, it is below -100℃ and L, U, Platinel II, it is below ±2℃ ±1-digit.
In case of thermocouple B, display accuracy cannot be ensured under 400℃.
In case of thermocouple R, S, it is below 200℃ and C, G, it is max. 3℃ ±1-digit.
※2: Applied when it is for out of room temperature (23±5℃) range.
※3: The weight includes packaging. The weight in parentheses is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Dimensions

(unit: mm)



■ Unit Description



1. Sensor input connector

2. Control output connector

3. Power/Comm. terminal

[only for basic module (TM□-□2□B)]

Suppling power to basic/expansion modules and communicating with over 1 module(s).

4. PC loader port

It is the PC loader port for serial communication between one module and PC to set parameter and monitoring by DAQMaster. Use this for connecting SCM-US (USB to serial converter, sold separately).

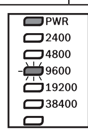
※When using PC loader port (connecting SCM-US), communication via power/comm. terminal is blocked and monitoring is not available.

5. Indicators

●TM2 Series

Indicator \ Status	Initial power ON※1	Control output	Alarm output				Auto-tuning※2
			N.O. (Normally Open)		N.C. (Normally Closed)		
			OFF (OPEN)	ON (CLOSE)	OFF (CLOSE)	ON (OPEN)	
PWR (green)※3	ON	ON	—	—	—	—	ON
CH1 (red)	Flash (2,400bps)	ON	—	—	—	—	Flash
CH2 (red)	Flash (4,800bps)	ON	—	—	—	—	Flash
AL1 (yellow)	Flash (9,600bps)	ON※4	OFF	ON	OFF	ON	OFF
AL2 (yellow)	Flash (19,200bps)	ON※5	OFF	ON	OFF	ON	OFF
AL3	Flash (38,400bps)	—	OFF	ON	OFF	ON	OFF
AL4	—	—	OFF	ON	OFF	ON	OFF

※1: When power is supplied initially, the set communication speed LED flashes for 5 sec.



●TM4 Series

Indicator \ Status	Initial power ON※1	Control output	Auto-tuning※2
PWR (green)※3	ON	ON	ON
CH1 (red)	Flash (2,400bps)	ON	Flash
CH2 (red)	Flash (4,800bps)	ON	Flash
CH3 (red)	Flash (9,600bps)	ON	Flash
CH4 (red)	Flash (19,200bps)	ON	Flash
	Flash (38,400bps)	—	—

※2: The auto-tuning CH LED flashes for 1 sec in turn.

※3: The PWR LED flashes during communication for 1 sec in turn.

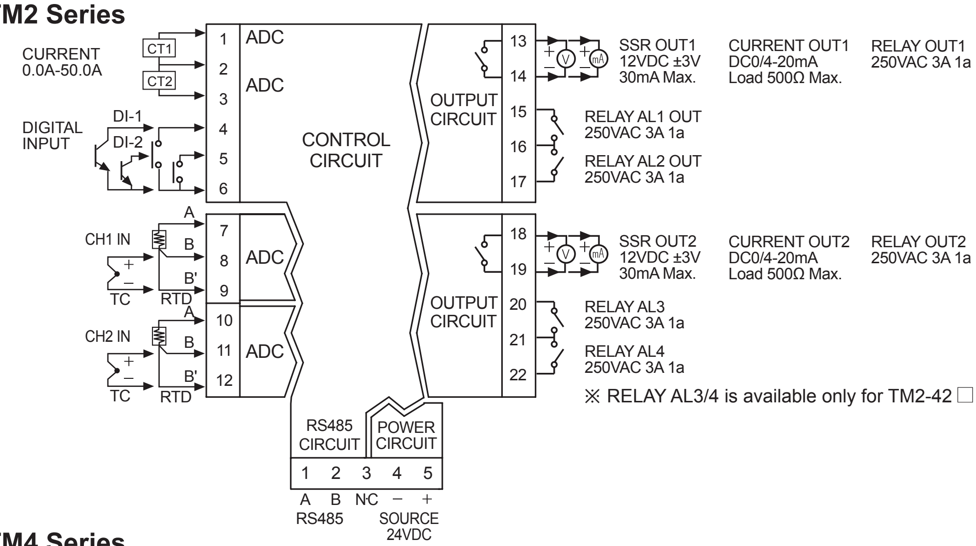
※4: Turns ON when CH1 control method is heating & cooling control and cooling output occurs.
(disable AL1 setting)

※5: Turns ON when CH2 control method is heating & cooling control and cooling output occurs.
(disable AL2 setting)

6. Communication address setting switch (SW1): Set the communication address.
7. Communication address group switch (SW2): When setting the communication address over 16, select +16.
8. Lock switch: Used for fixing modules at top and bottom.
9. Rail Lock: Used for installing at DIN rail or using bolts.
10. END cover: Remove it when connecting each module to connect an expansion connector.

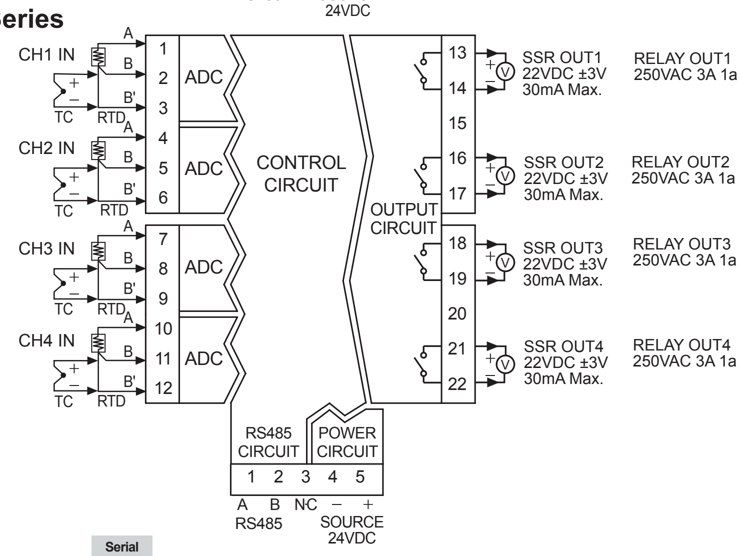
▣ Connections And Block Diagram

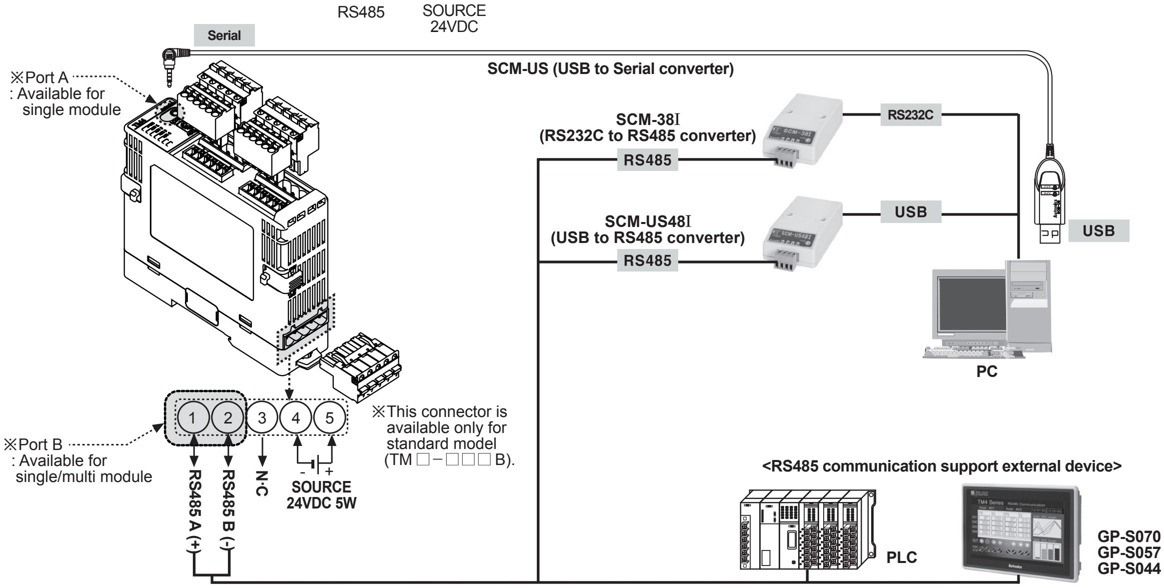
● TM2 Series



※ RELAY AL3/4 is available only for TM2-42□□ model.

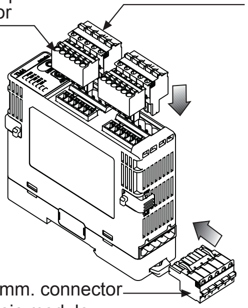
● TM4 Series



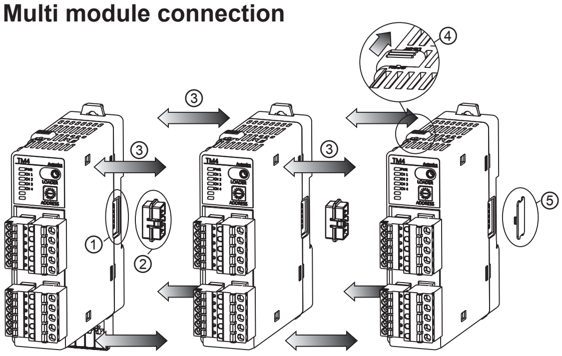


■ Installation

● Connector connection



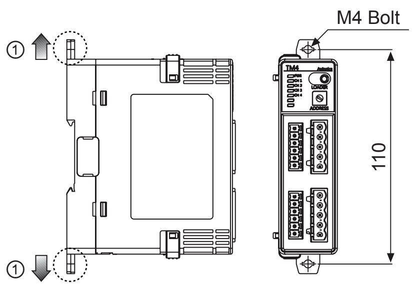
● Multi module connection



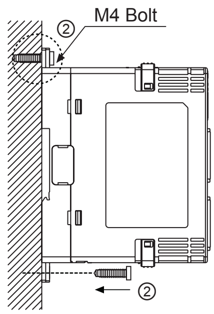
TM□-□2□B (basic module) TM□-□2□E (expansion module) TM□-□2□E (expansion module)

①Remove each module's END covers.
(do not remove at the ends of END covers)
②Connect expansion connectors between modules.
③Push each modules. (max. 30 units)
④Push the lock switch to lock direction.
※Supply adequate power for power input specifications and overall capacity.
(Max. power when connecting 31 modules:
31 units×5W=155W)

● Bolt Inserting



① Pull each Rail Lock switch up and down.

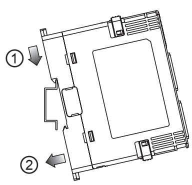


② Insert the bolts to fix.
(Tightening torque is 0.5N·m to 0.9N·m.)

● DIN Rail Installation

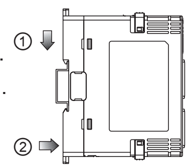
[Installation method]

① Put the top edge of the rail Lock on the top edge or the DIN rail.
② Push the module body in while pressing down.

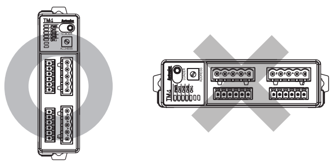


[Removal method]

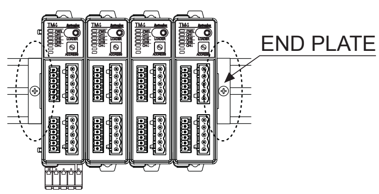
① Press down the module body.
② Pull the module body forward.



※Install the units vertically.



※Use end plates (sold separately, not available from Autonics) to fix firmly.



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Input Sensor Type And Temperature Range

Input sensor		No.	Dot	Display	Input range (℃)	Input range (℉)
Thermocouple	K(CA)	0	1	K(CA).H	-200 to 1350	-328 to 2462
		1	0.1	K(CA).L	-200.0 to 1350.0	-328.0 to 2462.0
	J(IC)	2	1	J(IC).H	-200 to 800	-328 to 1472
		3	0.1	J(IC).L	-200.0 to 800.0	-328.0 to 1472.0
	E(CR)	4	1	E(CR).H	-200 to 800	-328.0 to 1472
		5	0.1	E(CR).L	-200.0 to 800.0	-328.0 to 1472.0
	T(CC)	6	1	T(CC).H	-200 to 400	-328 to 752
		7	0.1	T(CC).L	-200.0 to 400.0	-328.0 to 752.0
	B(PR)	8	1	B(PR)	0 to 1800	32 to 3272
	R(PR)	9	1	R(PR)	0 to 1750	32 to 3182
	S(PR)	10	1	S(PR)	0 to 1750	32 to 3182
	N(NN)	11	1	N(NN)	-200 to 1300	-328 to 2372
	C(TT)※1	12	1	C(TT)	0 to 2300	32 to 4172
	G(TT)※2	13	1	G(TT)	0 to 2300	32 to 4172
	L(IC)	14	1	L(IC).H	-200 to 900	-328 to 1652
		15	0.1	L(IC).L	-200.0 to 900.0	-328.0 to 1652.0
	U(CC)	16	1	U(CC).H	-200 to 400	-328 to 752
		17	0.1	U(CC).L	-200.0 to 400.0	-328.0 to 752.0
	Platinel II	18	1	PLII	0 to 1400	32 to 2552
RTD	JPt 100Ω	19	1	JPt100.H	-200 to 600	-328 to 1112
		20	0.1	JPt100.L	-200.0 to 600.0	-328.0 to 1112.0
	DPt 100Ω	21	1	DPt100.H	-200 to 600	-328 to 1112
		22	0.1	DPt100.L	-200.0 to 600.0	-328.0 to 1112.0

※1: C(TT): Same as existing W5(TT).
※2: G(TT): Same as existing W(TT).
※Default: K(CA).H

■ Error Display

Indicators \ Status	Disconnected input sensors	Out of temperature range
PWR (red)	ON	
CH□ (red)※1	Flash (for 0.5 sec in turn)	
Comm. output (decimal)	Outputs '31000'	Outputs '30000 (high-limit)', '-30000 (low-limit)'
DAQMaster	Displays 'OPEN'	Displays 'HHHH (high-limit)', 'LLLL (low-limit)'

※1: The applied CH LED indicator flashes.

■ Communication Setting

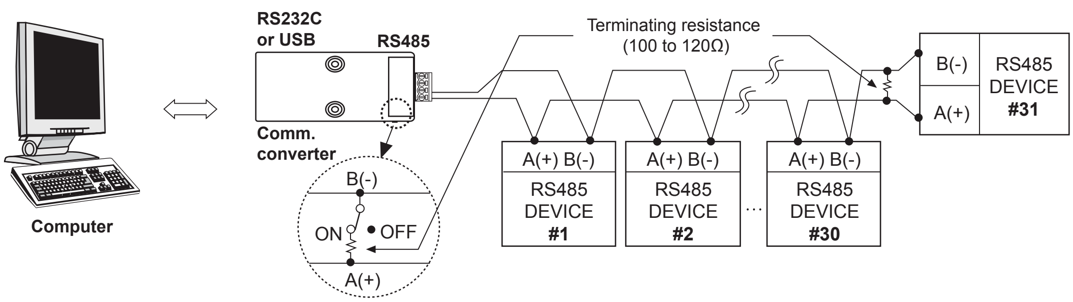
It is for parameter setting and monitoring via external devices (PC, PLC, etc.).

• Interface

Comm. protocol	Modbus RTU	Comm. distance	Max. 800m
Connection type	RS485	Comm. speed	2400, 4800, 9600 (default), 19200, 38400 bps
Application standard	Compliance with EIA RS485	Start bit	1-bit (fixed)
Max. connection	31 units (address: 01 to 31)	Data bit	8-bit (fixed)
Synchronous method	Asynchronous	Parity bit	None (default), Odd, Even
Comm. method	Two-wire half duplex	Stop bit	1-bit, 2-bit (default)

※It is not allowed to set overlapping communication address at the same communication line.
Use twisted pair wire for RS485 communication.

• Application of system organization



※It is recommended to use Autonics communication converter; SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately), SCM-US (USB to Serial converter, sold separately).
Please use twisted pair wire for RS485 communication.

• Communication Address Setting

Set the communication address by the communication address setting switch (SW1) and Communication address group switch (SW2).
When setting as 0, it does not operate communication.
(setting range: 01 to 31, factory default: [SW1] 1, [SW2] +0)

SW1 / SW2																
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
+0 +16	~~00~~	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
+0 +16	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

• Caution for Communication Address Setting

When changing communication address via the Power/Comm. terminal, resupply the power.

▣ Sold Separately

◎ Communication converter

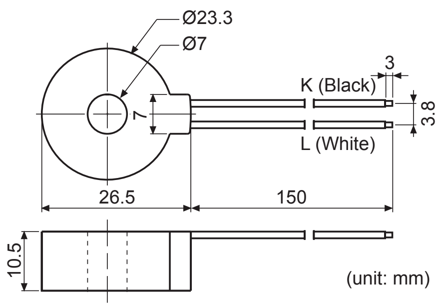
- **SCM-38I**
  (RS232C to RS485 converter)

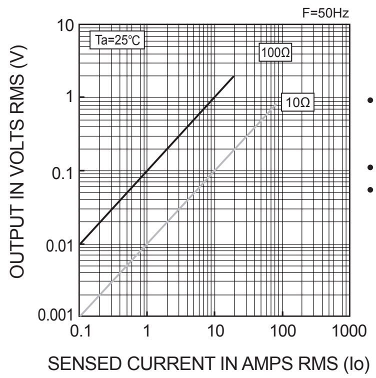
- **SCM-US48I**
  (USB to RS485 converter)

- **SCM-US**
  (USB to Serial converter)

◎ Current transformer (CT)

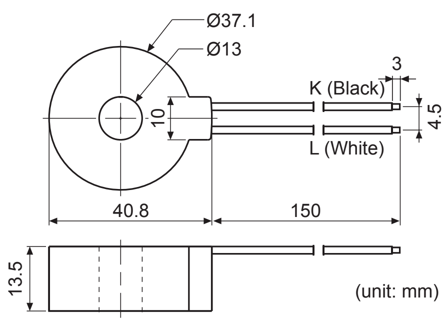
- **CSTC-E80LN**

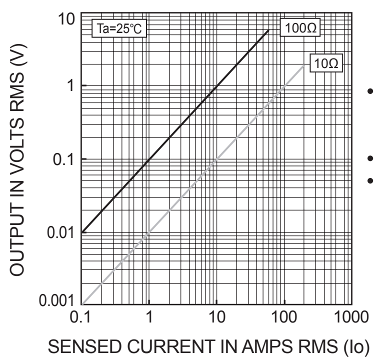




- Max. load current: 80A (50/60Hz)
  ※Max. load current for TM Series is 50A.
- Current ratio: 1/1000
- Wire wounded resistance: 31Ω±10%

- **CSTC-E200LN**





- Max. load current: 200A (50/60Hz)
  ※Max. load current for TM Series is 50A.
- Current ratio: 1/1000
- Wire wounded resistance: 20Ω±10%

※Do not supply primary current in case that CT output is open. High voltage will be generated in CT output.
※The current for above two CTs is 50A same but inner hole sizes are different. Please use this your environment.

◎ Display units (DS/DA-T Series)

- **DS/DA-T Series**
  (RS485 communication input type display unit)

DS16-□T

DS22/DA22-□T

DS40/DA40-□T

DS60/DA60-□T

※Connect RS485 communication input type display unit (DS/DA-T Series) and TM Series, the display unit displays present value of the device without PC/PLC.

▣ Proper Usage

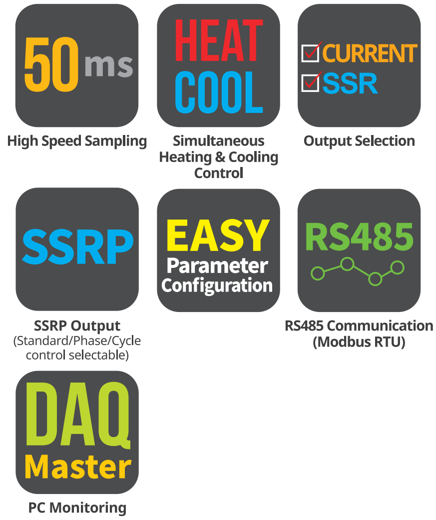
◎ Simple failure diagnosis

- **LED indicators flash (for 0.5 sec in turn), or external device displays OPEN.**
  - Check input sensor setting.
  - Disconnect the power and check the input connection.
  - If input is connected, disconnect the input wiring from the temperature controller and short the + and - terminals. Power the temperature controller and check if the external device displays the room temperature. If it does not display the room temperature and continues to display HHHH or LLLL, the controller is broken. Please contact our technical support. (input type is thermocouple)
- **Output does not operate normally.**
  - Check that CH indicators for control output operates normally.
  - If CH indicators for control output does not operates, check the parameter settings.
  - If CH indicators for control output operates, remove the control output connector and check the output.
- **External device receives no-response or abnormal data.**
  - Check the communication converter (SCM-38I or SCM-US, sold separately).
  - Do not install communication converter line and AC power supply lines.
  - Use different communication converter power and temperature controller power.
  - Indicates damage to internal chip by strong noise. Please contact our technical support. Locate the source of the noise device countermeasures.
- **Communication does not work between TM and external device**
  - Check the communication converter power and connections.
  - Check the communication settings.
  - Check the temperature controller and external device connections.

◎ Caution during use

- Use DC power only.
- Must use DC power.
- After connecting input sensors and supplying the power, use the controller 20 minutes later.
- If measurement accuracy is low, check the Input Bias parameter setting.
- Install a power switch or circuit breaker to control the power supply.
- The power switch or circuit breaker should be installed where it is easily accessible by the user.
- The unit is for temperature controller. Do not use the unit as volt-meter or ampere-meter.
- When line extension between thermocouple and temperature controller is required, use the specified compensation line. If using the general line, temperature difference at the joint part between thermocouple and extension lines.
- When using RTD temperature sensor, must wire it as 3-wire type. If cable is extended, use 3 wires which are same thickness as the line. It might cause the deviation of temperature when line resistance is different.
- Please separate the unit wiring from high voltage lines or power lines to prevent inductive noise.
- If power line and input signal line are close each other, install line filter for noise protection at power line and use shielded input signal line.
- Keep away from the high frequency instruments (High frequency welding machine & sewing machine, large capacity SCR controller) or the devices (radio, television, wireless machines) which causes high frequency interference.
- Before changing the input sensor, turn OFF the power. Connect the input sensor and re-supply the power, change parameter settings via communication.
- If changing the communication address by setting switch, use the flat head driver which is 2mm size or plastic driver. If not, it may cause product damage.
- Use twisted pair wire for RS485 communication. Connect ferrite bead at each end of line to reduce the effect of external noise.
- Do not overlapping communication line and AC power line.
- Install the unit at well ventilation place. If not, take the ventilation countermeasures.
- This unit may be used in the following environments.
  - Indoor
  - Altitude: Under 2,000m
  - Pollution degree 2
  - Installation category II

Standard High Accuracy PID Temperature Controllers



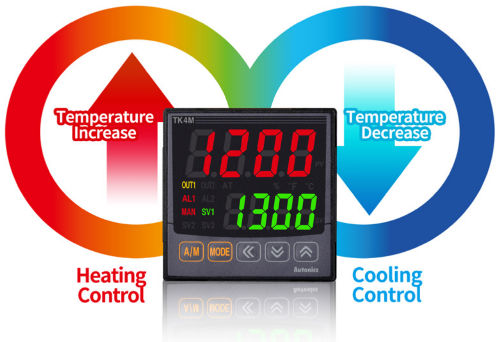
▣ Features

● 50 ms High-Speed Sampling Rate

The 50 ms sampling cycle rate allows ideal temperature control in applications requiring high-speed response rates.

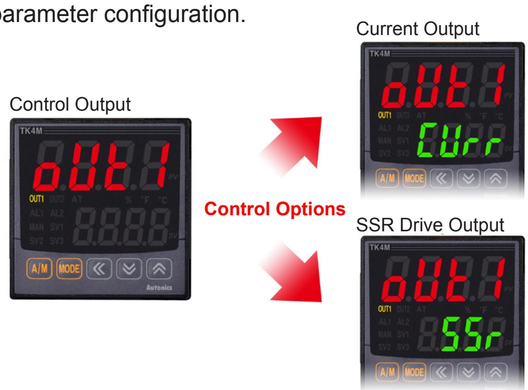
● Simultaneous Heating & Cooling Control

The controllers can simultaneously control heating and cooling elements, providing efficient temperature control.



● Switch Between Current Output and SSR Drive Output

Depending on the application, users can select between current output and SSR drive output through parameter configuration.



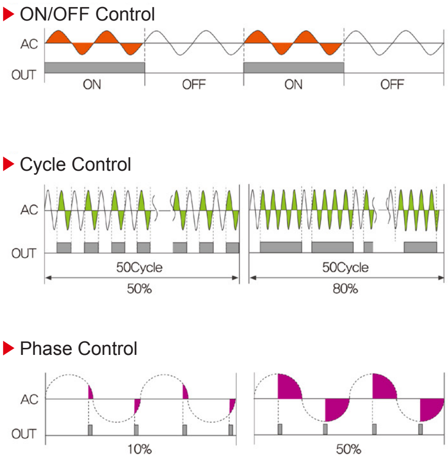
● Terminal Protection Cover (TK4N)

The TK4N models feature terminal protection covers to prevent electric shock and short-circuiting.

● SSR Drive Output (SSRP Function) Control Options

Users can select from ON/OFF control, cycle control, and phase control using standard SSR drive output option. Precise and accurate control is possible at low costs.

SSR Drive Output Method



● User-Friendly Parameter Configuration

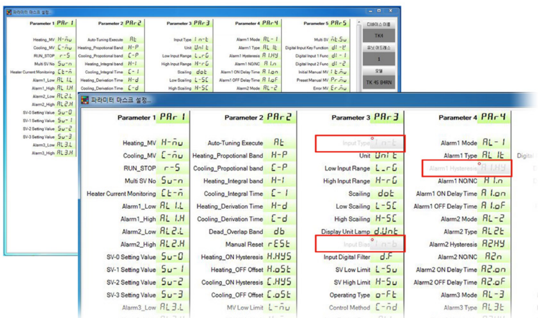
Parameter configuration is easier with user-friendly features including parameter mask function and user parameter group function.

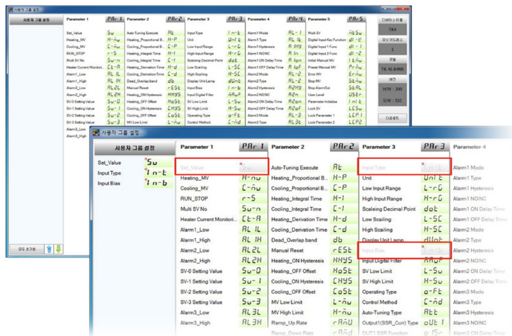
· Parameter Mask Function

Hide unnecessary or seldom used parameters.

· User Parameter Group Function

Group frequently used parameters for easy access and configuration.



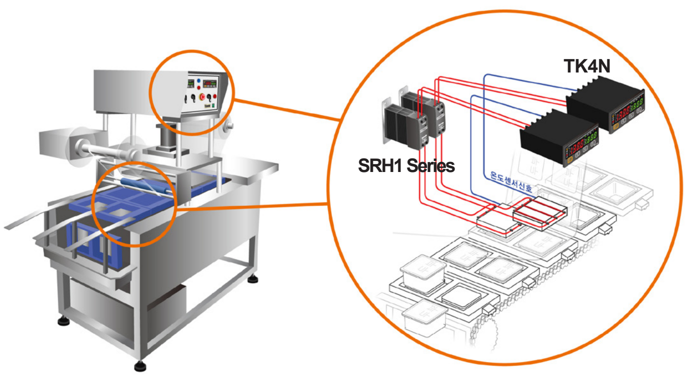


Befor Parameter mask ▶ PAr3 ▶ In-t ▶ Unit ▶ L-rG ▶ H-rG ▶ dot ▶ L-SC ▶ H-SC ▶ d.Unt ▶ In-b ▶ d.F ▶ ···

After Parameter mask ▶ PAr3 ▶ Unit ▶ L-rG ▶ H-rG ▶ dot ▶ L-SC ▶ H-SC ▶ d.Unt ▶ d.F ▶ ···

▣ Applications

Temperature controllers used for high precision temperature control of cup sealing/packaging machines.



High Performance, General-Purpose, PID Control Temperature Controller

Line-up

AC/DC voltage type

■ Features

- 50 ms high-speed sampling rate and ±0.3% display accuracy
- Simultaneous heating and cooling control function
- Automatic/manual control option
- Switch between current output and SSR drive output
- SSR drive output (SSRP function) control options: ON/OFF control, cycle control, phase control
- Communication output models available: RS485 (Modbus RTU)
- Parameter configuration via PC (RS485 communication)
  - DAQMaster software included (comprehensive device management software)
  - Communication converter sold separately: SCM-US (USB to serial converter), SCM-38I (RS-232C to RS485 converter), SCM-US48I (USB to RS485 converter)
- User-friendly parameter features (via DAQMaster)
- SV preset function (up to 4 set values) using digital input terminals
- Heater disconnect alarm function (CT input)
  - Current transformer (CT) sold separately: CSTC-E80LN, CSTC-E200LN
- Various input types and temperature ranges

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Manual

- Visit our website (www.autonics.com) to download user manual and communication manual.
- User manual describes for specifications and function, and communication manual describes for RS485 communication (Modbus RTU protocol) and parameter address map data.

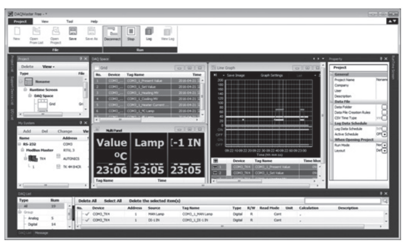
■ Comprehensive Device Management Program (DAQMaster)

- DAQMaster is comprehensive device management program. It is available for parameter setting, monitoring, and user parameter group setting, parameter mask setting for only TK4 Series.
- Visit our website (www.autonics.com) to download user manual and comprehensive device management program.

< Computer specification for using software >

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operating system	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB or more
Hard disk	More than 1GB of free hard disk space
VGA	1024×768 or higher resolution display
Others	RS-232 serial port (9-pin), USB port

< DAQMaster screen >



■ Ordering Information

TK | 4 | S — 1 | 4 | R | R

OUT 2 control output※3

Standard	N	None ※Select in case of standard control (Heating or Cooling)
Heating & Cooling	R	Relay output
	C	Current output or SSR drive output selectable

OUT 1 control output※2

R	Relay output
S※4	SSR drive output (standard ON/OFF control, phase control, cycle control)
C	Current output or SSR drive output selectable

Power supply

2※5	24VAC 50/60Hz, 24-48VDC
4	100-240VAC 50/60Hz

Option input/output ※1

N	1	Standard	Alarm output 1+CT input※6
		Heating&Cooling	Alarm output 2※7
	2	Standard	Alarm output 1+Alarm output 2
	D	Standard	Alarm output 1+Digital input (DI-1, DI-2)
		Heating&Cooling	Digital input (DI-1, DI-2)
	R	Standard	Alarm output 1+Transmission output
		Heating&Cooling	Transmission output
	T	Standard	Alarm output 1+RS485 communication output
		Heating&Cooling	RS485 communication output
SP	1	Alarm output 1	
S M W H L	1	Alarm output 1	
	2	Alarm output 1+Alarm output 2	
	R	Alarm output 1+Transmission output	
	T	Alarm output 1+RS485 communication output	
	A	Alarm output 1+Alarm output 2+Transmission output	
	B	Alarm output 1+Alarm output 2+RS485 communication output	
	D	Alarm output 1+Alarm output 2+Digital input (DI-1, DI-2)※8	

Size

N	DIN W48×H24mm
SP	DIN W48×H48mm (11-pin plug type)※9
S	DIN W48×H48mm (Terminal block type)
M	DIN W72×H72mm
W	DIN W96×H48mm
H	DIN W48×H96mm
L	DIN W96×H96mm

Digit

4	9999 (4-digit)

Item

TK	Temperature / Process Controller

※1: In case of TK4N, TK4SP, option output may be limited due to number of terminals.

※2: “S” represents SSR drive output support models which SSRP function (standard ON/OFF control, cycle control, phase control) are available. “C” represents selectable current and SSR drive output support models.

※3: Select "R" or "C" type in case of using heating&cooling control and "N" type in case of using standard control.

※4: Does not support in AC/DC voltage type model.

※5: Does not support in TK4N.

※6: CT input of TK4N is available only for the standard model which has alarm output 1.

※7: The heating&cooling model of TK4N-1□□□ has only alarm output 2.

※8: Only for TK4S-D□□□, OUT 2 output terminal is used as DI-2 input terminal.

※9: Sockets for TK4SP (PG-11, PS-11(N)) are sold separately.

■ Specifications

Series		TK4N	TK4SP	TK4S	TK4M	TK4W	TK4H	TK4L
Power supply	AC voltage	100-240VAC 50/60Hz						
	AC/DC voltage	—	24VAC 50/60Hz, 24-48VDC					
Allowable voltage range		90 to 110% of rated voltage						
Power consumption	AC voltage	Max. 6VA	Max. 8VA					
	AC/DC voltage	—	Max. 8VA(24VAC 50/60Hz), Max. 5W(24-48VDC)					
Display method		7-segment (PV: red, SV: green), Other display part (green, yellow, red) LED method						
Character size	PV (W×H)	4.5×7.2mm	7.0×14.0mm		9.5×20.0mm	8.5×17.0mm	7.0×14.6mm	11.0×22.0mm
	SV (W×H)	3.5×5.8mm	5.0×10.0mm		7.5×15.0mm	6.0×12.0mm	6.0×12.0mm	7.0×14.0mm
Input type	RTD	JPt100Ω, DPt100Ω, DPt50Ω, Cu100Ω, Cu50Ω, Nikel 120Ω (6 types)						
	Thermocouple	K(CA), J(IC), E(CR), T(CC), B(PR), R(PR), S(PR), N(NN), C(TT), G(TT), L(IC), U(CC), Platinel II (13 types)						
	Analog	Voltage: 0-100mV, 0-5V, 1-5V, 0-10V (4 types) / Current: 0-20mA, 4-20mA (2 types)						
Display accuracy	RTD Thermocouple	• At room temperature (23℃±5℃): (PV ±0.3% or ±1℃, select the higher one) ±1-digit ※1 • Out of room temperature range: (PV ±0.5% or ±2℃, select the higher one) ±1-digit ※In case of TK4SP Series, ±1℃ will be added.						
	Analog	• At room temperature (23℃±5℃): ±0.3% F.S. ±1-digit • Out of range of room temperature: ±0.5℃% F.S. ±1-digit						
	CT input	±5% F.S. ±1-digit						
Control output	Relay	OUT1, OUT2: 250VAC 3A 1a						
	SSR	11VDC±2V 20mA Max.						
	Current	DC4-20mA or DC0-20mA selectable (load 500Ω Max.)						
Alarm output	Relay	AL1, AL2 Relay: 250VAC 3A 1a ※TK4N AL2: 250VAC 0.5A 1a (Max.125VA), TK4SP has only AL1.						
Option output	Transmission	DC4-20mA (load 500Ω Max., Accuracy: ±0.3% F.S.)						
	Communication	RS485 communication output (Modbus RTU)						
Option input	CT input	0.0-50.0A (primary heater current value measuring range) ※CT ratio = 1/1000 (except TK4SP)						
	Digital input	• Contact Input: ON - Max. 2kΩ, OFF - Min. 90kΩ • Non-contact Input: ON - Residual votage max. 1.0V, OFF - Leakage current max. 0.1mA • Outflow current: Approx. 0.5mA ※TK4S/M: 1 (TK4S-D□□□: 2, TK4SP: None), TK4N/H/W/L: 2						
Control type	Heating, cooling Heating&cooling	ON/OFF, P, PI, PD, PID control						
Hysteresis		• Thermocouples / RTD: 1 to 100℃/℉ (0.1 to 100.0℃/℉) variable • Analog: 1 to 100-digit						
Proportional band (P)		0.1 to 999.9℃/℉ (0.1 to 999.9%)						
Integral time (I)		0 to 9999 sec						
Derivative time (D)		0 to 9999 sec						
Control period (T)		Relay output, SSR drive output: 0.1 to 120.0 sec, Current output or SSR drive output selectable: 1.0 to 120.0 sec						
Manual reset value		0.0 to 100.0%						
Sampling period		50ms						
Dielectric strength		2,000VAC 50/60Hz for 1 min (between power source terminal and input terminal)						
Vibration		0.75mm amplitude at frequency of 5 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours						
Relay life cycle	Mechanical	OUT1/2: Over 5,000,000 times, AL1/2: Over 20,000,000 times (TK4H/W/L: Over 5,000,000 times)						
	Electrical	OUT1/2: Over 200,000 times, AL1/2: Over 100,000 times (TK4H/W/L: Over 200,000 times)						
Insulation resistance		Over 100MΩ (at 500VDC megger)						
Noise immunity		±2kV R-phase, S-phase the square wave noise (pulse width: 1us) by the noise simulator						
Memory retention		Approx. 10 years (when using non-volatile semiconductor memory type)						
Environ-ment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃						
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH						
Protection structure		IP65 (Front panel) ※TK4SP: IP50 (Front panel)						
Insulation type		Double insulation or reinforced insulation (Mark: ⧈, Dielectric strength between the measuring input part and the power part: 2kV)						
Approval		CE cULus						
Weight※2		Approx. 140g (approx. 70g)	Approx. 130g (approx. 85g)	Approx. 150g (approx. 105g)	Approx. 210g (approx. 140g)	Approx. 211g (approx. 141g)		Approx. 294g (Approx. 198g)

※1: ◎ At room temperature (23℃±5℃)
- Thermocouple K, J, T, N, E type, below -100℃ / Thermocouple L, U, PLII type, RTD Cu50Ω, DPt50Ω : (PV ±0.3% or ±2℃, select the higher one) ±1-digit
- Thermocouple C, G, R, S type, below 200℃: (PV ±0.3% or ±3℃, select the higher one) ±1-digit
- Thermocouple B type, below 400℃: There is no accuracy standards.

◎ Out of room temperature range
- RTD Cu50Ω, DPt50Ω: (PV ±0.5% or ±3℃, select the higher one) ±1-digit
- Thermocouple R, S, B, C, G type: (PV ±0.5% or ±5℃, select the higher one) ±1-digit
- Others, Below -100℃: Within ±5℃

In case of TK4SP Series, ±1℃ will be added to the degree standard.

※2: The weight includes packaging. The weight in parenthesis is for unit only.

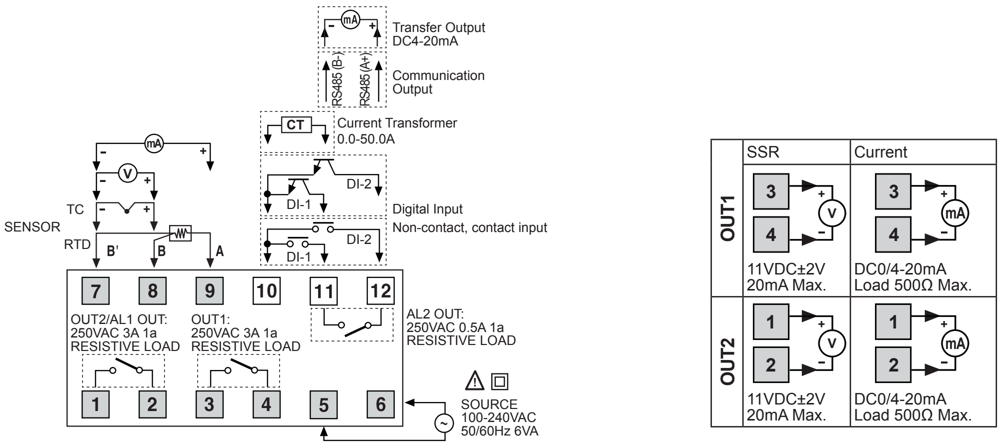
※Environment resistance is rated at no freezing or condensation.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

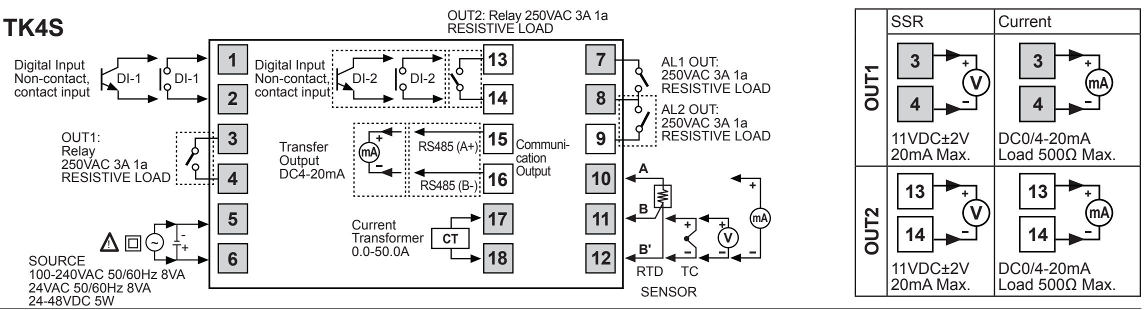
▣ Connections

※Please check the polarity when connecting temperature sensor or analog input.
※Standard model has shaded terminals only.
※Operation mode of heating&cooling OUT 2 relay output model is heating or cooling, OUT 2 is available as alarm output 3. (except TK4N Series).
※Operation mode of heating&cooling OUT 2 current output model is heating or cooling, OUT 2 is available as transmission output 2.

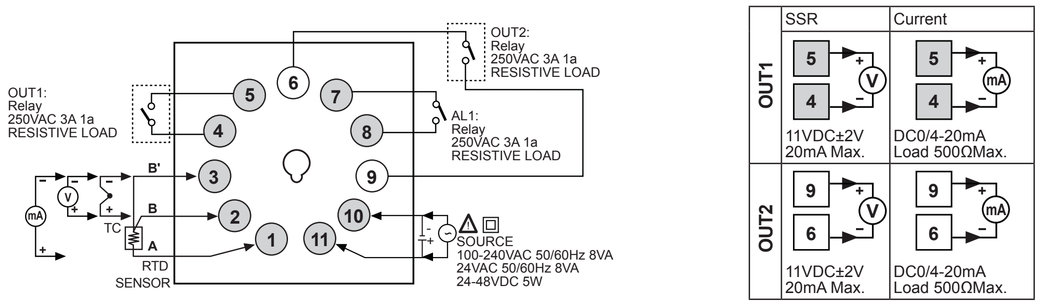
● TK4N



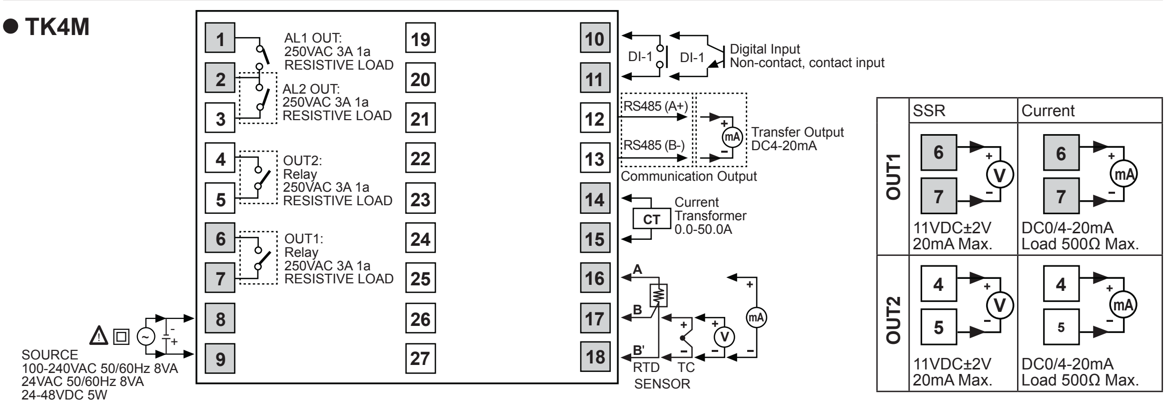
● TK4S



● TK4SP



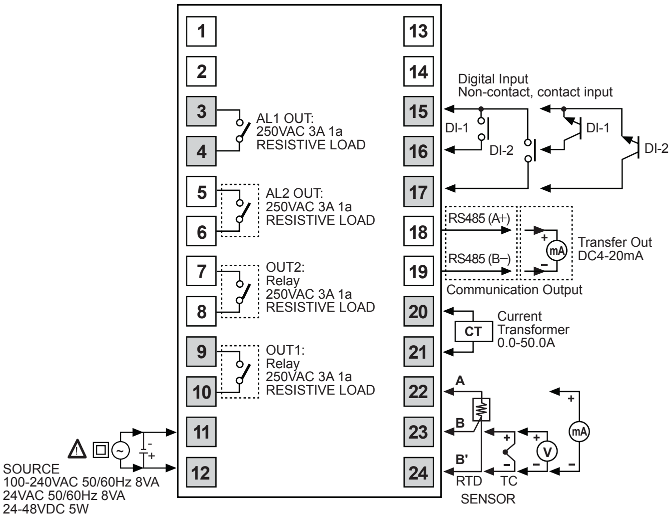
● TK4M



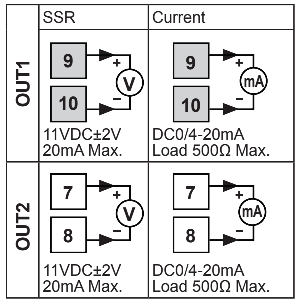
Connections

※Please check the polarity when connecting temperature sensor or analog input.
※Standard model has shaded terminals only.
※Operation mode of heating&cooling OUT2 relay output model is heating or cooling, OUT2 is available as alarm output 3. (except TK4N Series).
※Operation mode of heating&cooling OUT2 current output model is heating or cooling, OUT2 is available as transmission output 2.

● TK4H / TK4W / TK4L



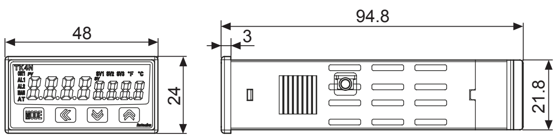
※Digital input is not electrically insulated from internal circuits, so it should be insulated when connecting other circuits. (Photocoupler, Relay, Independent switch)



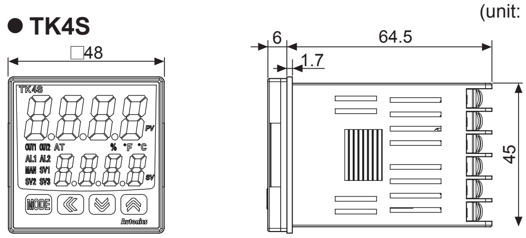
Dimensions

(unit: mm)

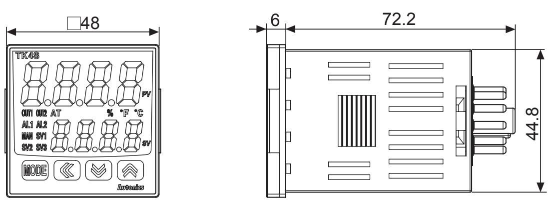
● TK4N



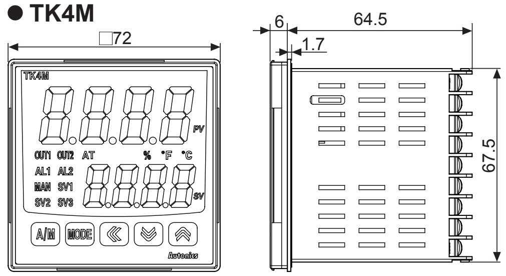
● TK4S



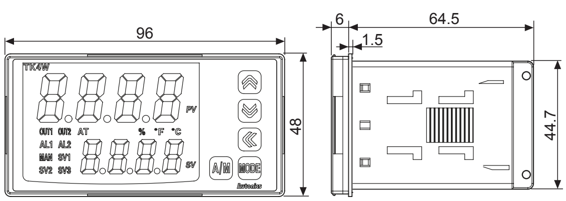
● TK4SP



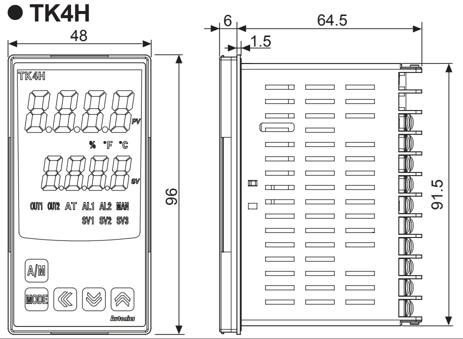
● TK4M



● TK4W

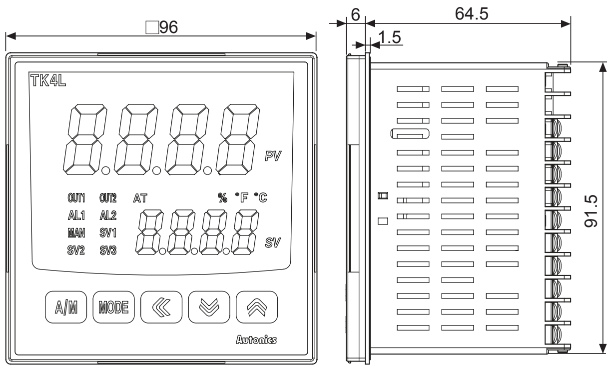


● TK4H

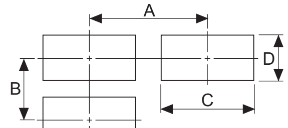


■ Dimensions

● TK4L



●Panel cut-out

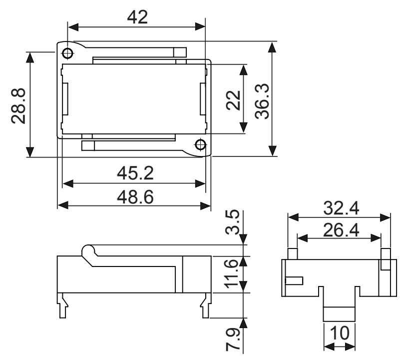


(unit: mm)

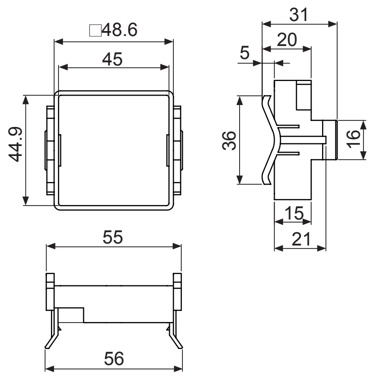
Model \ Size	A	B	C	D
TK4N	Min. 55	Min. 37	$45^{+0.6}_{0}$	$22.2^{+0.3}_{0}$
TK4S	Min. 65	Min. 65	$45^{+0.6}_{0}$	$45^{+0.6}_{0}$
TK4SP	Min. 65	Min. 65	$45^{+0.6}_{0}$	$45^{+0.6}_{0}$
TK4M	Min. 90	Min. 90	$68^{+0.7}_{0}$	$68^{+0.7}_{0}$
TK4H	Min. 65	Min. 115	$45^{+0.6}_{0}$	$92^{+0.8}_{0}$
TK4W	Min. 115	Min. 65	$92^{+0.8}_{0}$	$45^{+0.6}_{0}$
TK4L	Min. 115	Min. 115	$92^{+0.8}_{0}$	$92^{+0.8}_{0}$

● Bracket

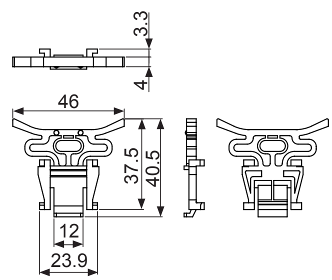
●TK4N Series



●TK4S, TK4SP Series

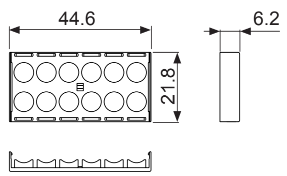


●TK4M/W/H/L Series



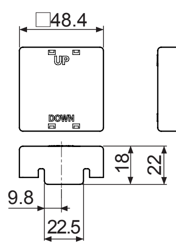
● Terminal cover (sold separately)

●TK4N Cover (48×24mm)

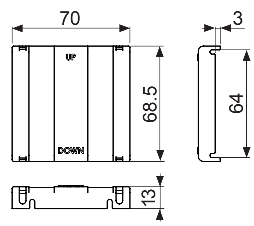


※TK4N COVER is accessory.

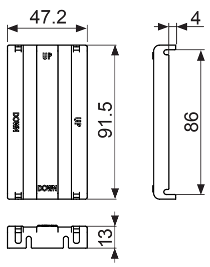
●RSA Cover (48×48mm)



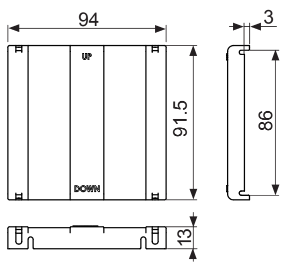
●RMA Cover (72×72mm)



●RHA Cover (48×96mm, 96×48mm)

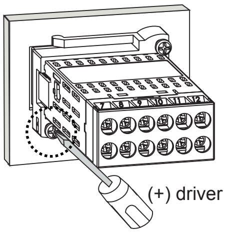


●RLA Cover (96×96mm)



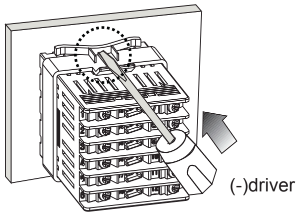
▣ Product Mounting

● TK4N (48×24mm) Series



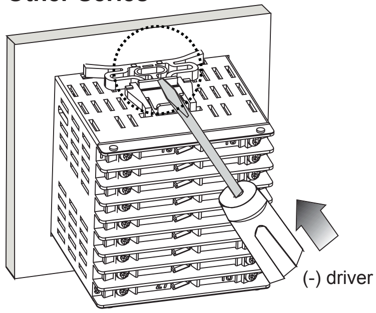
※Insert the unit into a panel, fasten the bolt with a (+) driver.

● TK4S/SP (48×48mm) Series

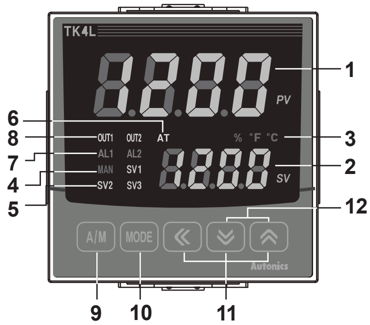


※Insert the unit into a panel, fasten the bracket by pushing with tools with a (-) driver.

● Other Series

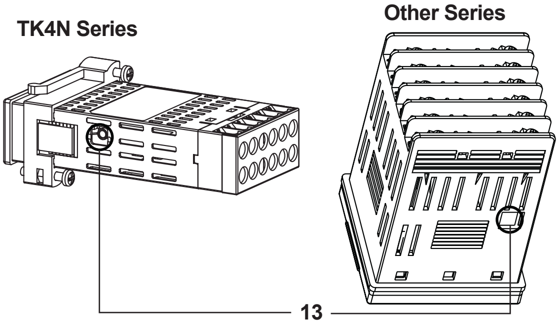


▣ Unit Description



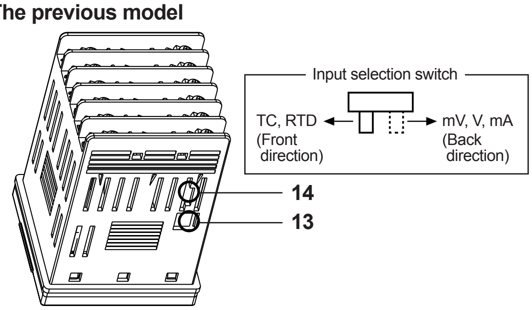
TK4N Series

Other Series



※The input selection switch (TC, RTD/mV, V, mA) switch disappears. Select input type [In-t] in parameter 3 group.

The previous model



1. **Measured value (PV) display part:**
   - RUN mode: It displays currently measured value (PV).
   - Setting mode: It displays the parameter.
2. **Set value (SV) display part:**
   - RUN mode: It displays the set value (SV).
   - Setting mode: It displays the set value of the parameter.
3. **Unit (℃ / ℉ / %) indicator:** It displays the unit set at display unit [Unt] in parameter 3 group. (In case of TK4N, % is not supported)
4. **Manual control indicator:** It turns ON during manual controlling.
5. **Multi SV indicator:** One of SV1 to 3 indicators will be ON in case of selecting multi SV function.
6. **Auto tuning indicator:** It flashes by 1 sec when executing auto tuning.
7. **Alarm output (AL 1, AL 2) indicator:** It turns ON when the alarm output is ON.
8. **Control output (OUT 1, OUT 2) indicator:** It turns ON when the control output is ON.
   ※During cycle/phase controlling in SSRP function model (TK4□-□4S□) when MV is over 5.0%, it turns ON.
   ※To use current output, when MV is 0.0% in manual control, it turns OFF. Otherwise, it always turns ON. When MV is over 3.0% in auto control, it turns ON and when MV is below 2.0%, it turns OFF.
9. **[A/M] key:** It is used when switching auto control to manual control.
   ※TK4N/S/SP do not have [A/M] key. [MODE] key operates switching simultaneously.
10. **[MODE] key:** It is used when entering parameter setting group, returning to RUN mode, moving parameter, saving the set value.
11. **[《], [︾], [︽] key:** It is used when entering the set value changing mode and moving or changing up/down digit.
12. **Digital input key:** When pressing [︾] + [︽] keys for 3 sec at the same time, it operates the function (RUN/STOP, alarm clear, auto tuning) set at digital input key [dI-K] in parameter 5 group.
13. **PC loader port:** It is the PC loader port for serial communication to set parameter and monitoring by DAQMaster installed in PC. Use this for connecting SCM-US (USB to Serial converter, sold separately).
14. **Input selection switch:** Used when switching sensor (TC, RTD) input ↔ analog input (mV, V, mA). (only the previous model)

■ Sold Separately

◎ Communication converter

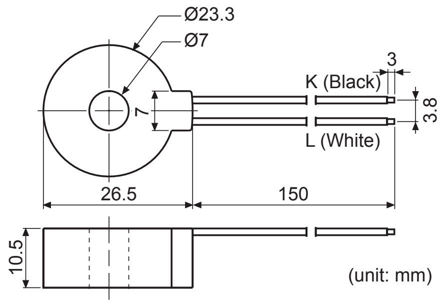
- **SCM-38I**
  (RS232C to RS485 converter)

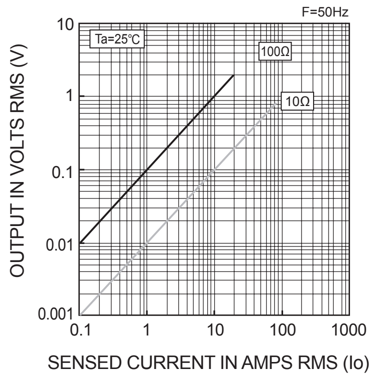
- **SCM-US48I**
  (USB to RS485 converter)

- **SCM-US**
  (USB to Serial converter)

◎ Current transformer (CT)

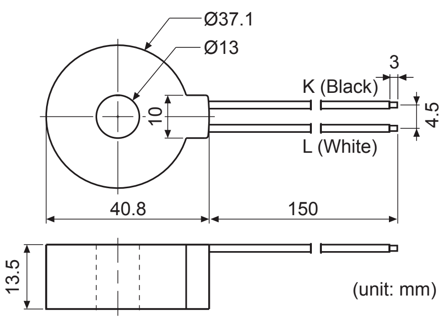
- **CSTC-E80LN**

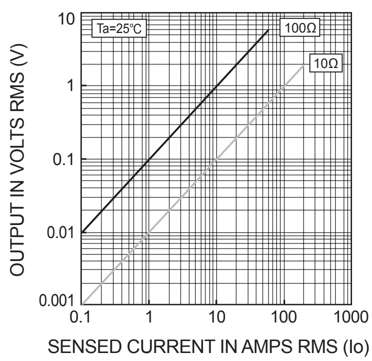




- Max. load current: 80A (50/60Hz)
  ※Max. load current for TK4 Series is 50A.
- Current ratio: 1/1000
- Wire wounded resistance: 31Ω±10%

- **CSTC-E200LN**





- Max. load current: 200A (50/60Hz)
  ※Max. load current for TK4 Series is 50A.
- Current ratio: 1/1000
- Wire wounded resistance: 20Ω±10%

※Do not supply primary current in case that CT output is open. High voltage will be generated in CT output.
※The current for above two CTs is 50A same but inner hole sizes are different. Please use this for your environment.

◎ Display units (DS/DA-T Series)

- **DS/DA-T Series**
  (RS485 communication input type display unit)

DS16-□T

DS22/DA22-□T

DS40/DA40-□T

DS60/DA60-□T

※Connect RS485 communication input type display unit (DS/DA-T Series) and RS485 communication output model of TK Series, the display unit displays present value of the device without PC/PLC.

■ Input Type And Range

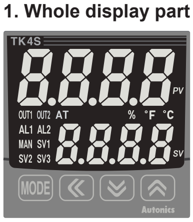
Input type			Decimal point	Display	Input range (℃)	Input range (℉)
Thermocouple	K(CA)		1	KCA.H	-200 to 1350	-328 to 2463
			0.1	KCA.L	-199.9 to 999.9	-199.9 to 999.9
	J(IC)		1	JIC.H	-200 to 800	-328 to 1472
			0.1	JIC.L	-199.9 to 800.0	-199.9 to 999.9
	E(CR)		1	ECr.H	-200 to 800	-328 to 1472
			0.1	ECr.L	-199.9 to 800.0	-199.9 to 999.9
	T(CC)		1	tCC.H	-200 to 400	-328 to 752
			0.1	tCC.L	-199.9 to 400.0	-199.9 to 752.0
	B(PR)		1	b Pr	0 to 1800	32 to 3272
	R(PR)		1	r Pr	0 to 1750	32 to 3182
	S(PR)		1	S Pr	0 to 1750	32 to 3182
	N(NN)		1	n nn	-200 to 1300	-328 to 2372
	C(TT)※1		1	C tt	0 to 2300	32 to 4172
	G(TT)※2		1	G tt	0 to 2300	32 to 4172
	L(IC)		1	LIC.H	-200 to 900	-328 to 1652
			0.1	LIC.L	-199.9 to 900.0	-199.9 to 999.9
	U(CC)		1	UCC.H	-200 to 400	-328 to 752
			0.1	UCC.L	-199.9 to 400.0	-199.9 to 752.0
	Platinel II		1	PLII	0 to 1390	32 to 2534
RTD	Cu 50Ω		0.1	CU 5	-199.9 to 200.0	-199.9 to 392.0
	Cu 100Ω		0.1	CU 10	-199.9 to 200.0	-199.9 to 392.0
	JPt 100Ω		1	JPt.H	-200 to 650	-328 to 1202
			0.1	JPt.L	-199.9 to 650.0	-199.9 to 999.9
	DPt 50Ω		0.1	dPt5	-199.9 to 600.0	-199.9 to 999.9
	DPt 100Ω		1	dtt.H	-200 to 650	-328 to 1202
			0.1	dPt.L	-199.9 to 650.0	-199.9 to 999.9
	Nickel 120Ω		1	nI 12	-80 to 200	-112 to 392
Analog	Voltage	0-10V		Au 1	-1999 to 9999 (Display point will be changed according to decimal point position)	
		0-5V		Au 2		
		1-5V		Au 3		
		0-100mV		Amu 1		
	Current	0-20mA		AmA 1		
		4-20mA		AmA 2		

※1: C (TT): Same as existing W5 (TT) type sensor
※2: G (TT): Same as existing W (TT) type sensor

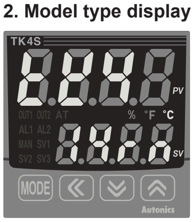
■ Front Panel Display When Power Is On

When power is supplied, display will flash for 1 sec. Afterwards, model name and input sensor type will flash twice and then enter into RUN mode.

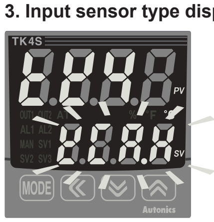
1. Whole display part



2. Model type display

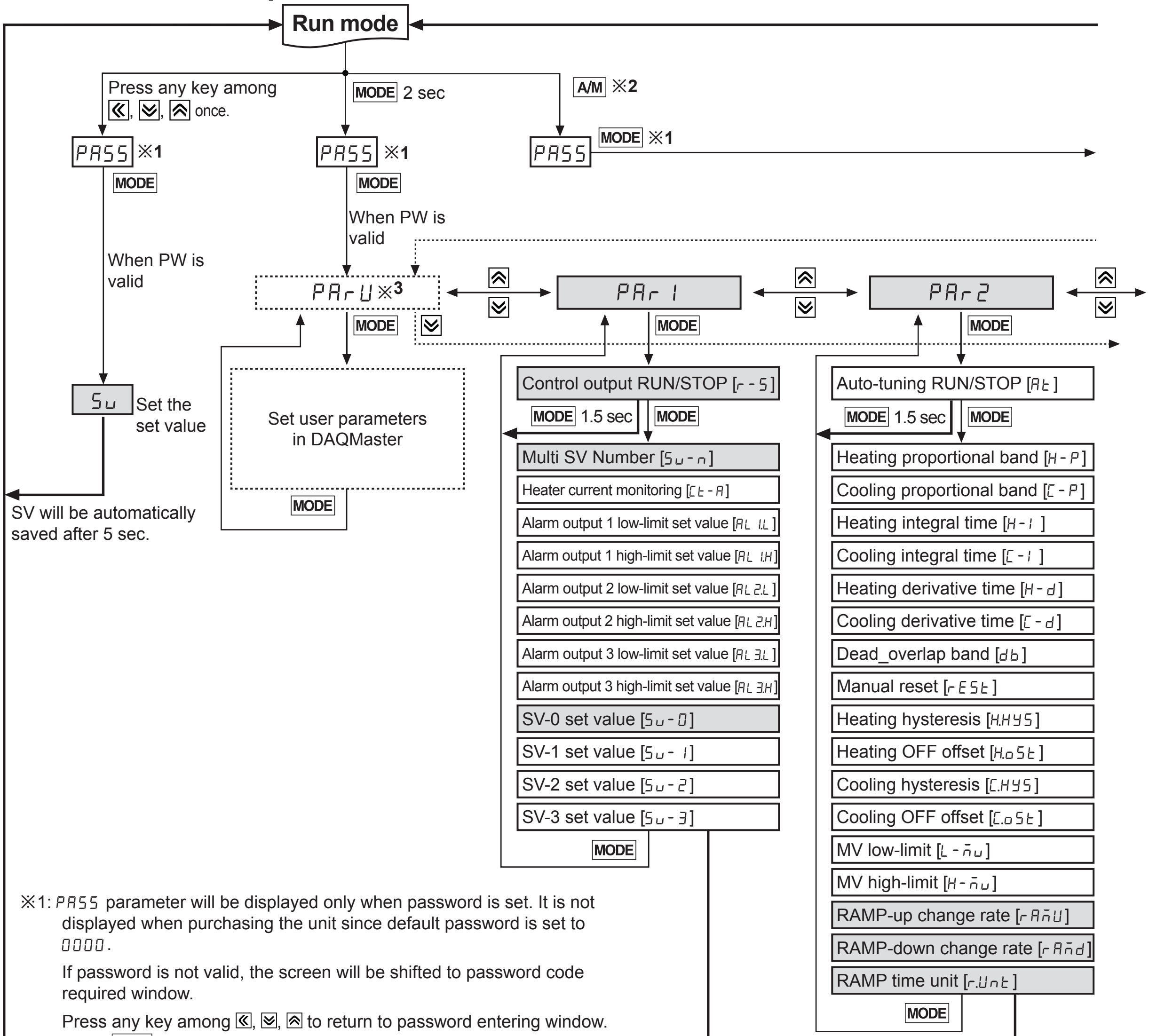


3. Input sensor type display



4. Run mode

■ Parameter Group



※1: PASS parameter will be displayed only when password is set. It is not displayed when purchasing the unit since default password is set to 0000.

If password is not valid, the screen will be shifted to password code required window.

Press any key among ⟪, ⩔, ⩓ to return to password entering window. Press MODE key to return to RUN mode.

In case you forget password, contact Autonics after checking password code.

※2: TK4N/4S/4SP do not have A/M key. MODE key replaces A/M key.

※3: It is displayed when setting user parameter group in the comprehensive device management program (DAQMaster).

※Hold the MODE key over 2 sec in RUN mode to enter into setting mode.

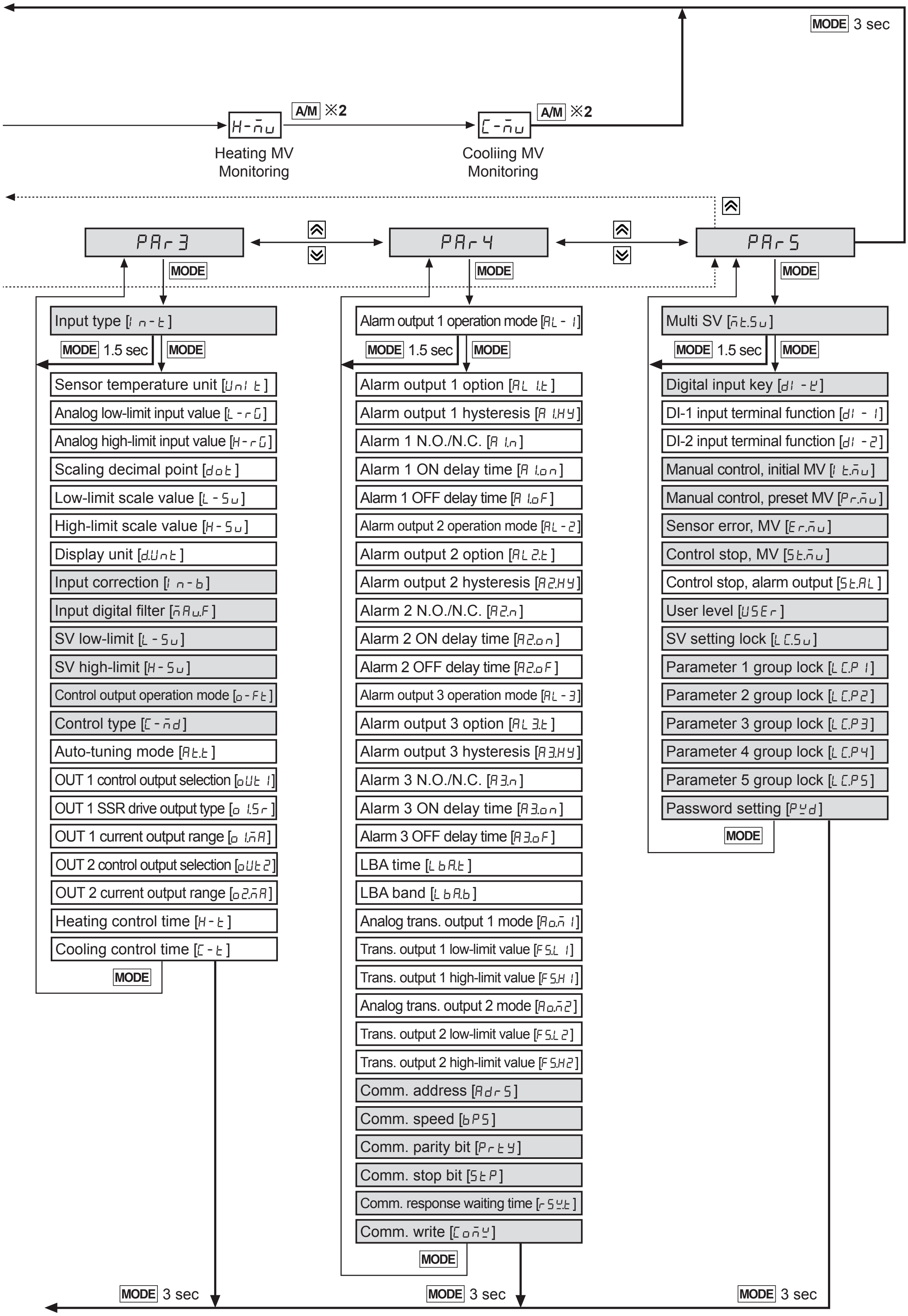
※Hold the MODE key for 1.5 sec while in setting mode to move to other parameter group.

※Hold the MODE key over 3 sec while in setting mode to return to RUN mode.

※Press MODE key at the last parameter of each parameter, it moves to that parameter name. You can move to other groups.

※If there is no additional key operation within 30 sec after entering into setting mode, it will be automatically returned to RUN mode and previous set value will be remained.

※ The shaded parameters ( ) are displayed in common. The others may not be displayed by the specifications of the product, other parameter's setting, or parameter mask setting.



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Parameter 1 Group

※1: S : Press any key among ≪, ⩔, ⩓

※After entering setting mode, press MODE key anytime for 3 sec to return to Run mode.

※After entering setting mode, press MODE key anytime for 1.5 sec to go to the concerned group name.

※If you press the MODE key after changing the set value of the parameter the set value will be stored.

※ Shaded parameters are for standard-level users, the others are for high-level users.
(You can set the user level in parameter 5 group)

※ This parameter might not be displayed depending on other parameter settings.

MODE 3 sec → Run mode

MODE 2 sec

PASS — S ※1 — Output code when PW value is unequal in SV display

Password entry: PASS — S → 0001

MODE — When PW is unequal

MODE — When PW is valid.

Parameter 1 group: PAr1 ⟷ Parameter 2 group: PAr2 ⟷ Parameter 3 group: PAr3

Control Output RUN/STOP: r-S — S → rUn ⟷ StoP

Multi SV number: SV-n — S → SV-0 ⟷ SV-1 ⟷ SV-2 ⟷ SV-3

※Display SV0 through SV3, depending on the preset number of multi SVs [MT.SV]

Heater current monitoring: CT-A — S → 0.0

Setting range: 00.0 to 50.0A

※Displayed only with current transformer (CT) input models (Expect for TK4SP)

Alarm output 1 low-limit set value: AL1.L — S → 1550

Setting range: Deviation alarm (-F.S. to F.S.),
Absolute alarm (within display range), Unit (℃/℉)

※Displayed only when alarm output 1's operation mode [AL-1] is set to low-limit alarm for offset/absolute value or high/low-limit alarm/reverse alarm for offset value.

※Sets the heater burnout SV for a current transformer (with option inputs) when Alarm output 1 operation mode [AL-1] is in heater burnout alarm [HBA].

※It does not display if alarm output 1's operation mode [AL-1] is set to oFF, SbA or LbA.

Alarm output 1 high-limit set value: AL1.H — S → 1550

※Displayed only when alarm output 1's operation mode [AL-1] is set to high-limit alarm for offset/absolute value or high-limit alarm/reserve alarm for offset value.

※It does not display if alarm output 1's operation mode [AL-1] is set to oFF, SbA, LbA or HbA.

Alarm output 2 low-limit set value: AL2.L — S → 1550

Alarm output 2 high-limit set value: AL2.H — S → 1550

Setting range: Deviation alarm (-F.S. to F.S.),
Absolute alarm (within display range), Unit (℃/℉)

※Displayed only with option output models that support alarm output 2.
(Active/inactive conditions and the same as alarm output 1 with the exception for HBA)

Alarm output 3 low-limit set value: AL3.L — S → 1550

Alarm output 3 high-limit set value: AL3.H — S → 1550

Setting range: Deviation alarm (-F.S. to F.S.),
Absolute alarm (within display range), Unit (℃/℉)

※Displayed only with option output models that support alarm output 3.
(Active/inactive conditions ard the same as alarm output 1 with the exception for HBA)

SV-0 set value: SV-0 — S → 0000

SV-1 set value: SV-1 — S → 0000

SV-2 set value: SV-2 — S → 0000

SV-3 set value: SV-3 — S → 0000

Setting range: L-SV to H-SV, unit (℃/℉)

※The number of multi SVs [SV0 to SV3] set at Multi SV [MT.SV] are displayed.

▣ Parameter 2 Group

※1: S : Press any key among ≪, ≫, ≪≫
※After entering setting mode, press MODE key anytime for 3 sec to return to Run mode.
※After entering setting mode, press MODE key anytime for 1.5 sec to go to the concerned group name.
※If you press the MODE key after changing the set value of the parameter the set value will be stored.
※ Shaded parameters are for standard-level users, the others are for high-level users.
(You can set the user level in parameter 5 group)
※ This parameter might not be displayed depending on other parameter settings.

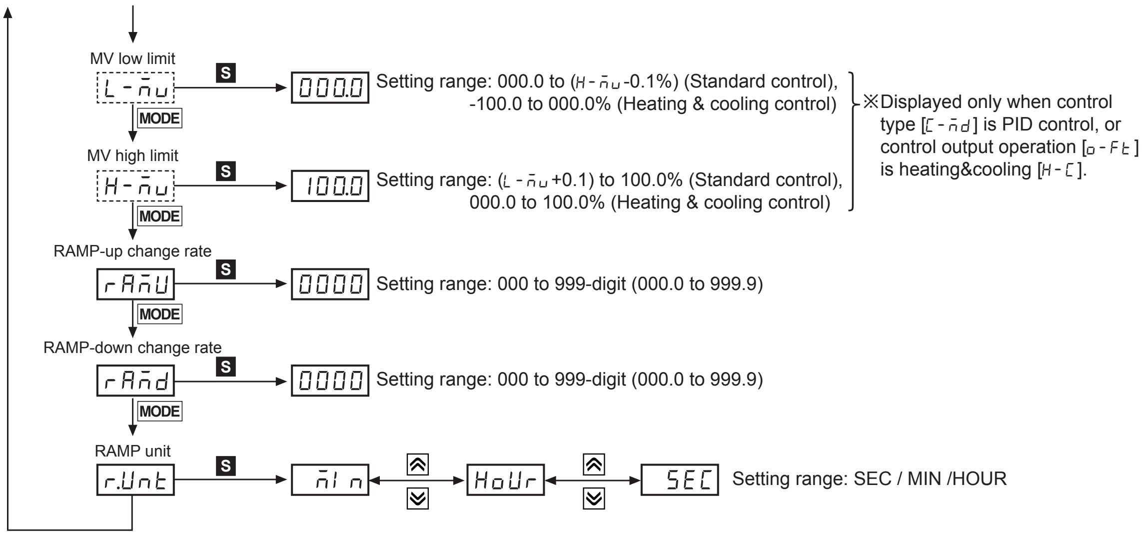
Parameter 2 group [PAr2] ↔ Parameter 3 group [PAr3] ↔ Parameter 4 group [PAr4]

Parameter	Display	Setting	Description
Auto-tuning RUN/STOP	At	oFF ↔ on	※Displayed only when temperature control type [C-ñd] is set to PID control. (applies from Auto-tuning to Cooling derivative time)
Heating proportional band	H-P	010.0	Setting range: 000.1 to 999.9℃ / ℉, % ※Displayed only when control output operation mode [o-Ft] is set to heating [HEAt] or heating and cooling [H-C].
Cooling proportional band	C-P	010.0	Setting range: 000.1 to 999.9℃ / ℉, % ※Displayed only when control output operation mode [o-Ft] is set to cooling [CooL] or heating and cooling [H-C].
Heating integral time	H-I	0000	Setting range: 0001 to 9999 sec ※Displayed only when control output operation mode [o-Ft] is set to heating [HEAt] or heating and cooling [H-C].
Cooling integral time	C-I	0000	Setting range: 0001 to 9999 sec ※Displayed only when control output operation mode [o-Ft]is set to cooling [CooL] or heating and cooling [H-C].
Heating derivative time	H-d	0000	Setting range: 0001 to 9999 sec ※Displayed only when control output operation mode [o-Ft]is set to heating [HEAt] or heating and cooling [H-C].
Cooling derivative time	C-d	0000	Setting range: 0001 to 9999 sec ※Displayed only when control output operation mode [o-Ft]is set to cooling [CooL] or heating and cooling [H-C].
Dead_overlap band	db	0000	Setting range: • P/P, P/ONOFF, ONOFF/P control: -significant proportion to 0.0 to + significant proportion • ONOFF/ONOFF control: -999 to 999-digit (Temp. H), -199.9 to 999.9-digit (Temp. L), -99.9 to 99.9% F.S. (Analog) ※Displayed only when control output operation mode [o-Ft] is set to heating and cooling [H-C].
Manual reset	rESt	050.0	Setting range: 000.0 to 100.0% ※Displayed only under proportional control. ※Does not display if control output operation mode [o-Ft] is set to heating and cooling [H-C]).
Heating hysteresis	H.HYS	002	Setting range: 001 to 100-digit (000.1 to 100.0)
Heating OFF offset	H.oSt	000	Setting range: 000 to 100-digit (000.0 to 100.0)
Cooling hysteresis	C.HYS	002	Setting range: 001 to 100-digit (000.1 to 100.0)
Cooling OFF offset	C.oSt	000	Setting range: 000 to 100-digit (000.0 to 100.0)

Heating hysteresis / Heating OFF offset: ※Displayed only when control output operation mode [o-Ft] is set to heating [HEAt] or heating and cooling [H-C].

Heating hysteresis to Cooling OFF offset: ※Displayed only when temperature control type [C-ñd] is set to onoF or on.on control.

Cooling hysteresis / Cooling OFF offset: ※Displayed only when control output operation mode [o-Ft] is set to cooling [CooL] or heating and cooling [H-C].



▣ Parameter 3 Group

※1: S : Press any key among ≪, ∨, ∧

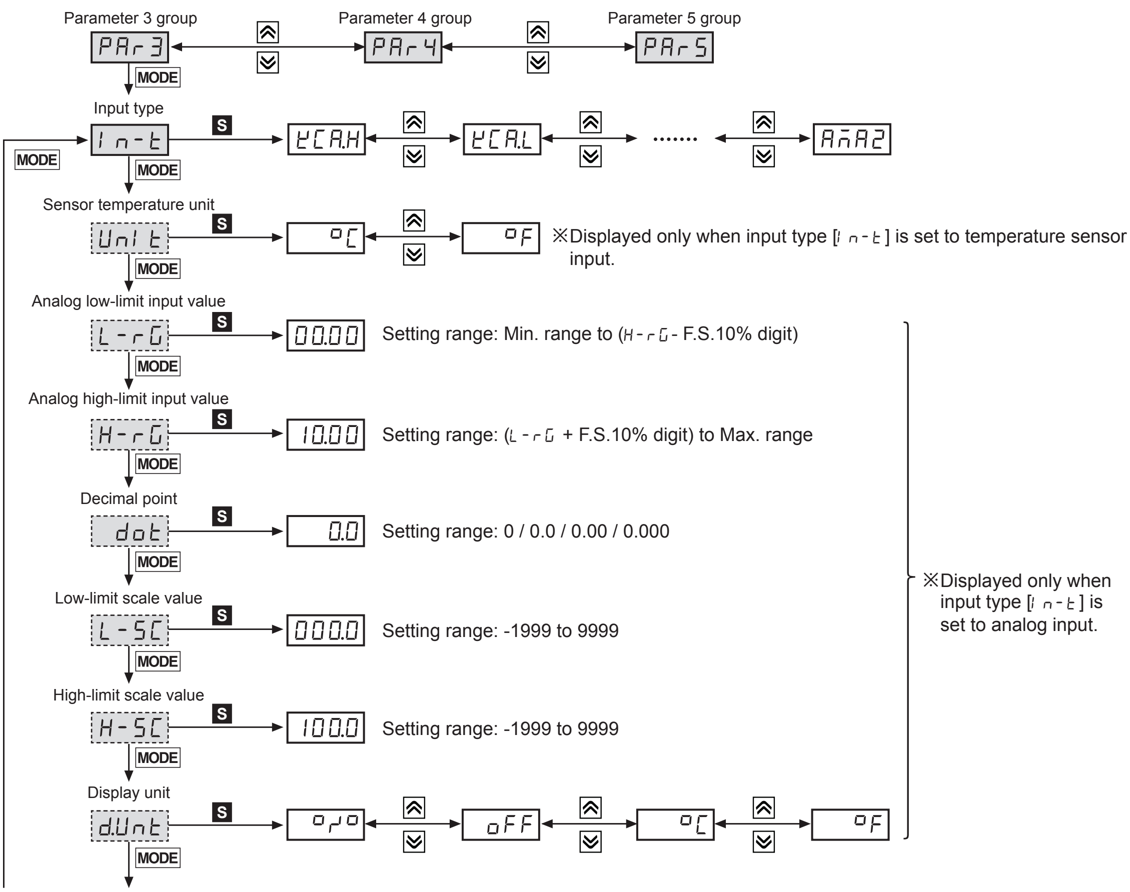
※After entering setting mode, press MODE key anytime for 3 sec to return to Run mode.

※After entering setting mode, press MODE key anytime for 1.5 sec to go to the concerned group name.

※If you press the MODE key after changing the setting value of the parameter the setting value will be stored.

※ Shaded parameters are for standard-level users, the others are for high-level users.
(You can set the user level in parameter 5 group)

※ This parameter might not be displayed depending on other parameter settings.



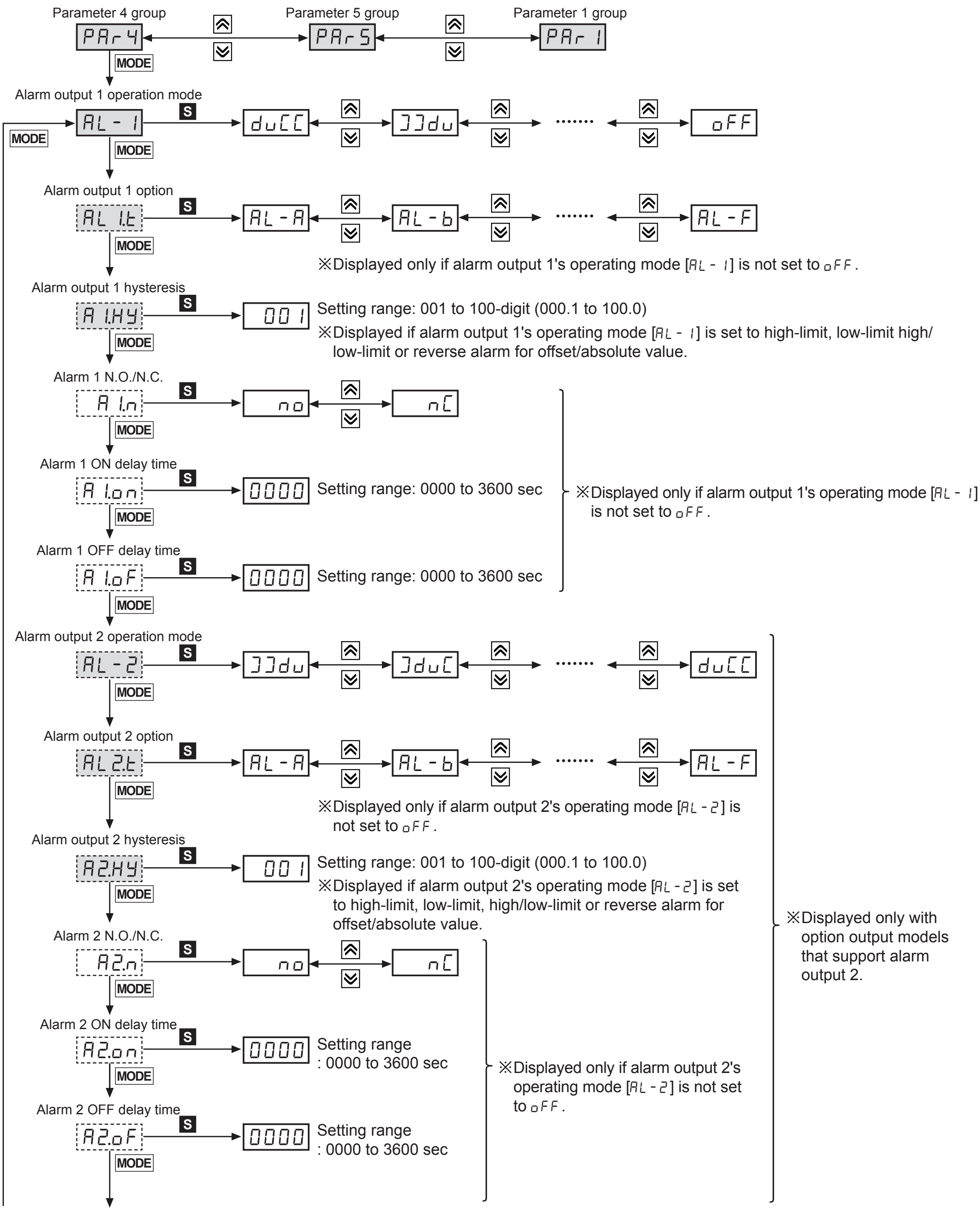
- Input correction: In-b → S → 000 — Setting range: -999 to 0999-digit (-199.9 to 999.9)
  - MODE
- Input digital filter: mAv.F → S → 000.1 — Setting range: 000.1 to 120.0 sec
  - MODE
- SV low-limit: L-Sv → S → -200 — Setting range: Low limit input [L-SC] to H-Sv-1-digit ℃ / ℉ / %
  - MODE
- SV high-limit: H-Sv → S → 1350 — Setting range: L-Sv+1-digit to High limit input [H-SC] ℃ / ℉ / %
  - MODE
- Control output operation mode: o-Ft → S → HEAt / H-C ↔ (▲/▼) CooL / HEAt ↔ (▲/▼) CooL
  - ※Standard type
  - ※Heating & cooling control model.
  - MODE
- Control type: C-md → S → PId / P.P ↔ (▲/▼) onoF / P.on ↔ (▲/▼) on.P ↔ (▲/▼) on.on
  - ※Standard control
  - ※Heating & cooling control
  - MODE
- Auto-tuning mode: At.t → S → tUn1 ↔ (▲/▼) tUn2 — ※Displayed only when temperature control type [C-md] is set to PID control.
  - MODE
- OUT 1 control output selection: oUt1 → S → CUrr ↔ (▲/▼) SSr — ※Displayed only when OUT1 control output of model is current output.
  - MODE
- OUT 1 SSR drive output type: o1.Sr → S → Stnd ↔ (▲/▼) CYCL ↔ (▲/▼) PHAS — ※Displayed only when OUT1 control output of model is SSR drive output of SSRP function.
  - MODE
- OUT 1 current output range: o1.mA → S → 4-20 ↔ (▲/▼) 0-20 — ※Displayed only when OUT1 control output of model is current output and is set to CUrr in oUt1 mode.
  - MODE
- OUT 2 control output selection: oUt2 → S → CUrr ↔ (▲/▼) SSr — ※Displayed only when OUT2 control output of model is current output.
  - MODE
- OUT 2 current output range: o2.mA → S → 4-20 ↔ (▲/▼) 0-20 — ※Displayed only when OUT2 control output of model is current output and is set to CUrr in oUt2 mode.
  - MODE
- Heating control time: H-t → S → 020.0
  - MODE
- Cooling control time: C-t → S → 020.0

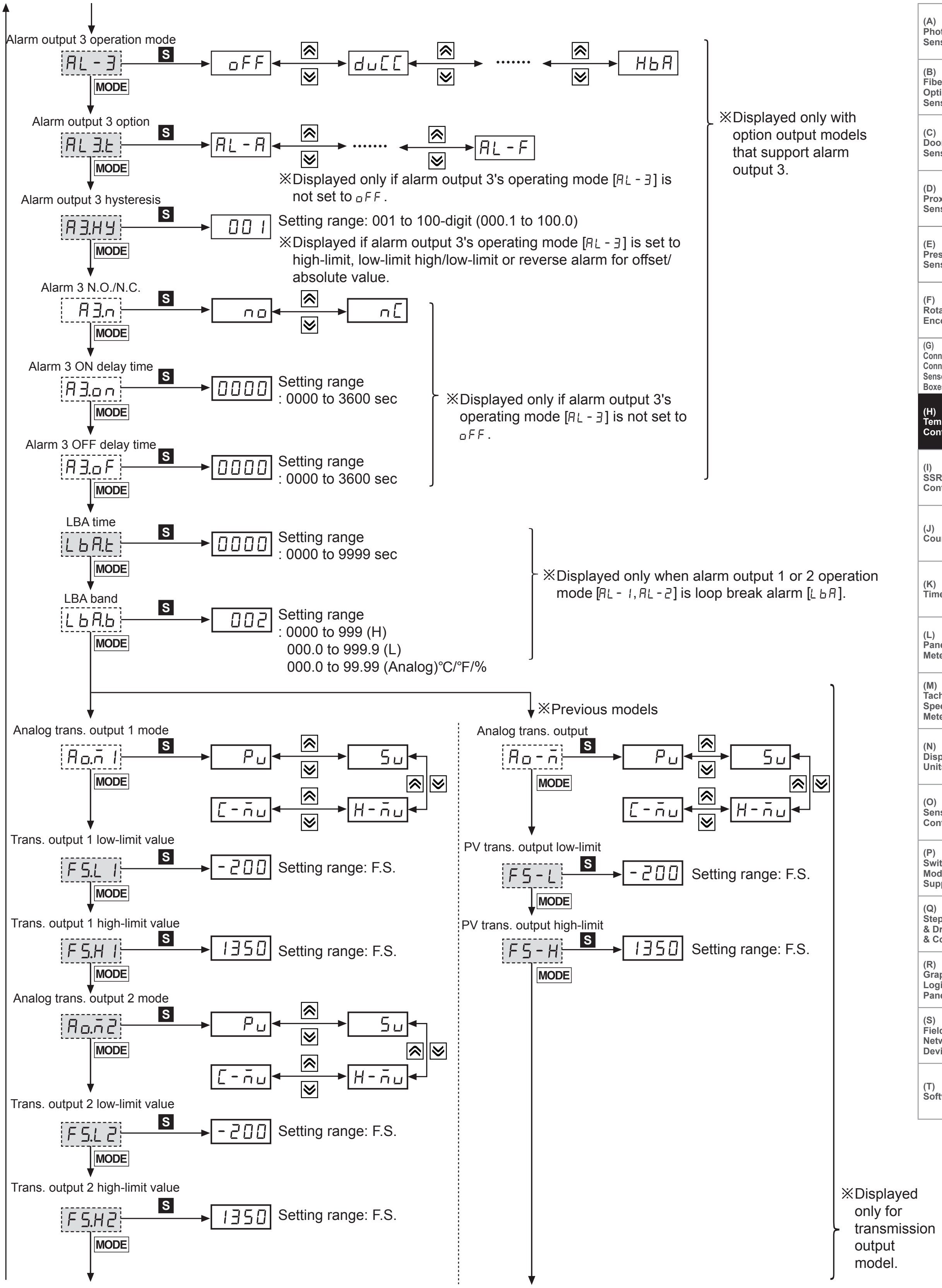
Setting range: 000.1 to 120.0 sec
※Displayed only when temperature control method [C-md] is set to PID control.
※Not Displayed when output method is set to CYCL, PHAS.

※OUT1, OUT2 output:
- In case that OUT1,OUT2 output is relay output type , oUt1, o1.Sr, o1.mA, oUt2, o2.Sr, o2.mA parameter are not displayed.
- In case that OUT1,OUT2 output is current + SSR drive output type, when OUT1,OUT2 output is set to SSr.
  - Output method of o1.Sr, o2.Sr is held in Stnd and parameter is not displayed.
- In case that OUT1, output is SSR drive output model of SSRP function and OUT2 output is current + SSR drive output
  - oUt1, o1.mA are not displayed.
  - o1.Sr can set to Stnd, CYCL, PHAS
  - When o2.Sr is set to SSr it is held in Stnd and parameter is not displayed.

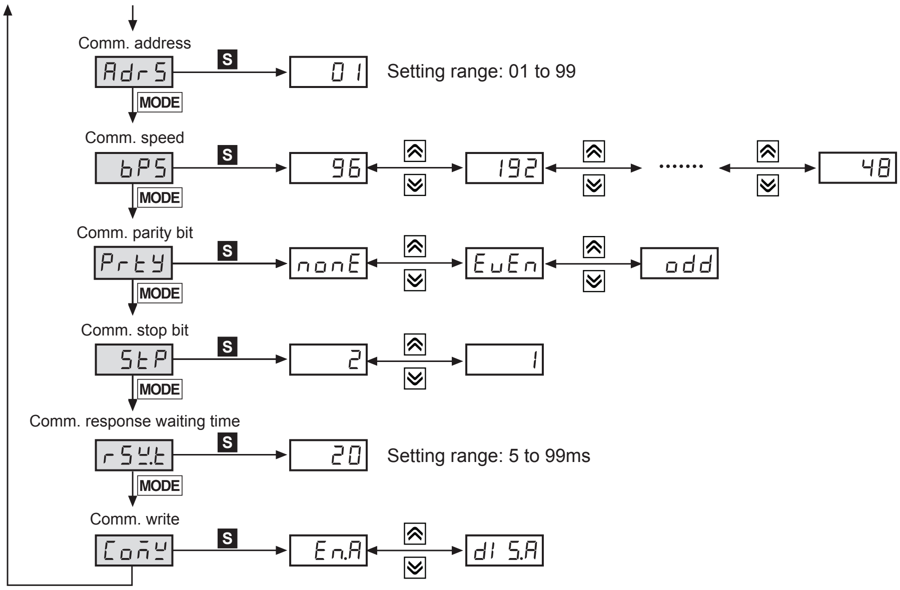
■ Parameter 4 Group

※1: S : Press any key among ≪, ⩔, ⩓
※After entering setting mode, press MODE key anytime for 3 sec to return to Run mode.
※After entering setting mode, press MODE key anytime for 1.5 sec to go to the concerned group name.
※If you press the MODE key after changing the set value of the parameter the set value will be stored.
※ Shaded parameters are for standard-level users, the others are for high-level users.
(You can set the user level in parameter 5 group)
※ This parameter might not be displayed depending on other parameter settings.



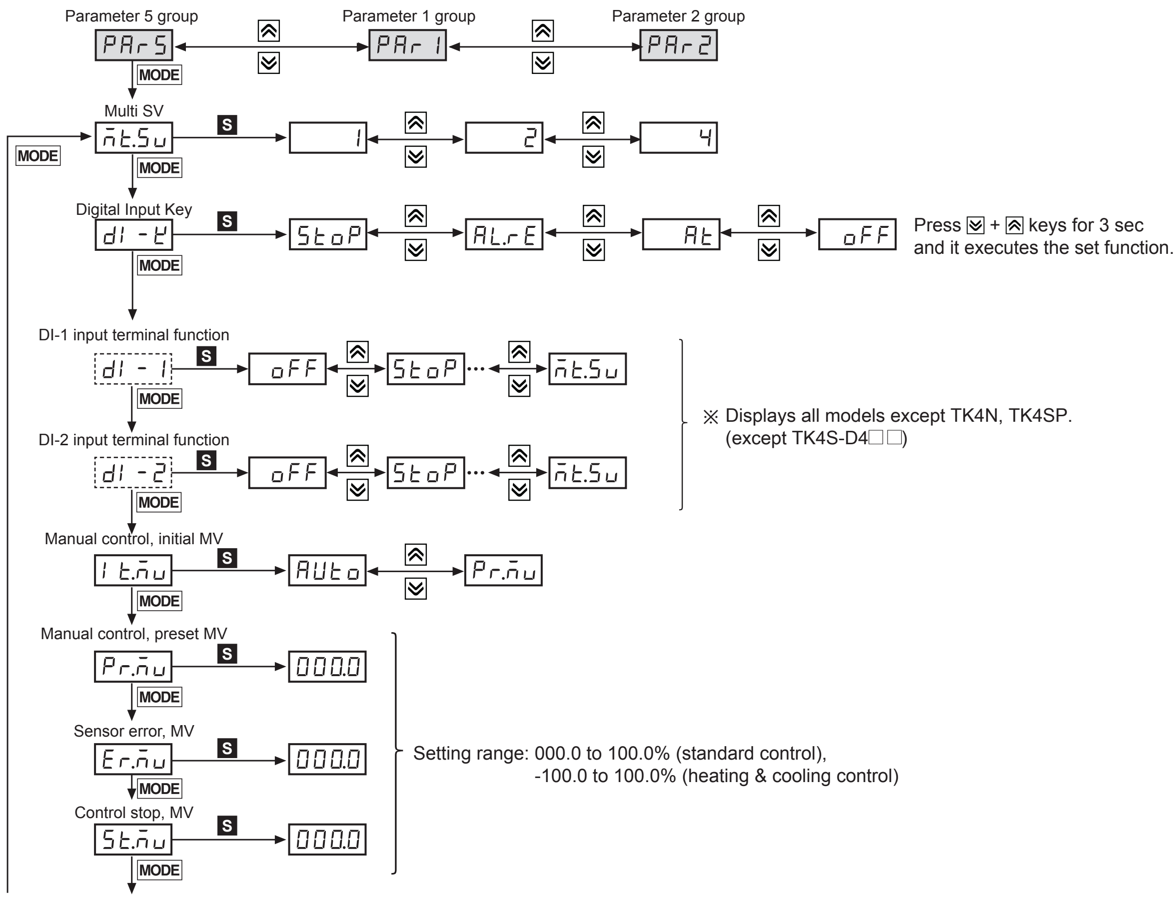


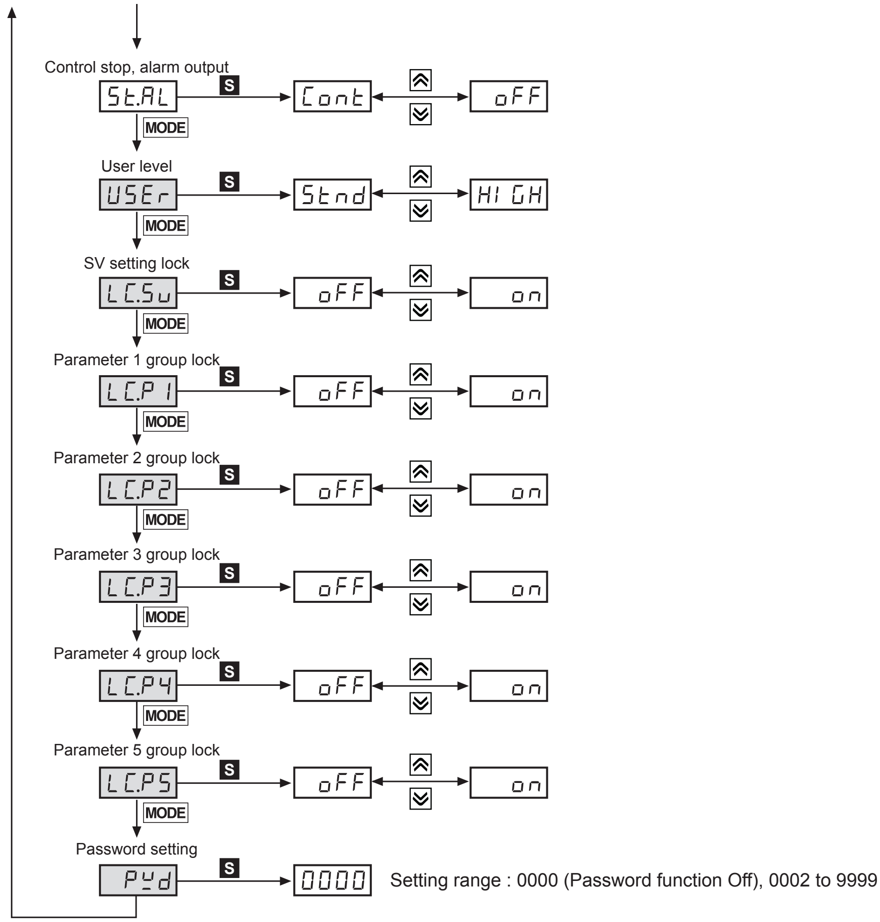
Alarm output 3 operation mode
AL-3
S
MODE
oFF
duCC
HbA
Alarm output 3 option
AL3.t
AL-A
AL-F
※Displayed only if alarm output 3's operating mode [AL-3] is not set to oFF.
Alarm output 3 hysteresis
A3.HY
001
Setting range: 001 to 100-digit (000.1 to 100.0)
※Displayed if alarm output 3's operating mode [AL-3] is set to high-limit, low-limit high/low-limit or reverse alarm for offset/ absolute value.
※Displayed only with option output models that support alarm output 3.
Alarm 3 N.O./N.C.
A3.n
no
nC
Alarm 3 ON delay time
A3.on
0000
Setting range
: 0000 to 3600 sec
※Displayed only if alarm output 3's operating mode [AL-3] is not set to oFF.
Alarm 3 OFF delay time
A3.oF
0000
Setting range
: 0000 to 3600 sec
LBA time
LbA.t
0000
Setting range
: 0000 to 9999 sec
※Displayed only when alarm output 1 or 2 operation mode [AL-1, AL-2] is loop break alarm [LbA].
LBA band
LbA.b
002
Setting range
: 0000 to 999 (H)
000.0 to 999.9 (L)
000.0 to 99.99 (Analog)℃/℉/%
※Previous models
Analog trans. output 1 mode
Ao.m1
Pu
Su
C-mu
H-mu
Analog trans. output
Ao-m
Trans. output 1 low-limit value
FS.L1
-200
Setting range: F.S.
PV trans. output low-limit
FS-L
-200
Setting range: F.S.
Trans. output 1 high-limit value
FS.H1
1350
Setting range: F.S.
PV trans. output high-limit
FS-H
1350
Setting range: F.S.
Analog trans. output 2 mode
Ao.m2
Pu
Su
C-mu
H-mu
Trans. output 2 low-limit value
FS.L2
-200
Setting range: F.S.
Trans. output 2 high-limit value
FS.H2
1350
Setting range: F.S.
※Displayed only for transmission output model.



■ Parameter 5 Group

※1: S : Press any key among ◁, ▽, △
※After entering setting mode, press MODE key anytime for 3 sec to return to Run mode.
※After entering setting mode, press MODE key anytime for 1.5 sec to go to the concerned group name.
※If you press the MODE key after changing the setting value of the parameter the setting value will be stored.
※ Shaded parameters are for standard-level users, the others are for high-level users.
(You can set the user level in parameter 5 group)
※ This parameter might not be displayed depending on other parameter settings.



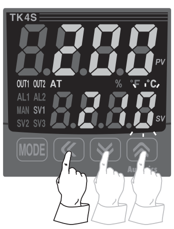


■ SV Setting

You can set the temperature to control with «, ∨, ∧ keys.
Setting range is within SV low-limit value [L-Su] to SV high-limit value [H-Su].

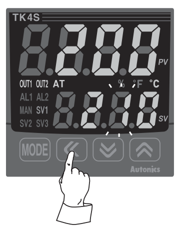
E.g.) In case of changing set temperature from 210ºC to 250ºC

1



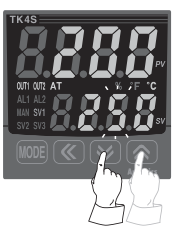
Press any key among «, ∨, ∧ key in RUN mode, the right digit at SV display flashes and it enters to SV setting.

2



Press « key to move the desired digit.
(10^0→10^1→10^2→10^3→10^0)

3



Press ∨ or ∧ key to move the desired number (1 → 5).

4

Press MODE key to save the value and it controls with this set value.
(even though there is no key input for over 3 sec, it saves automatically.)

■ Parameter Reset

Press «, ∨, ∧ to reset all parameters in memory to default value.
Set InIt parameter to YES to reset all parameters.
In case password function is on, it is required to enter valid password to reset parameters.
Password is also reset.

■ Factory Default

● SV setting [SV]

Parameter	Factory default
SV	0

● Password input parameter

Parameter	Factory default
PASS	0001

● Parameter 1 group [PAr1]

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
r-S	rUn	AL1.H	1550	AL3.H	1550	SV-3	0000
SV-n	SV-0	AL2.L	1550	SV-0	0000		
Ct-A	0.0	AL2.H	1550	SV-1	0000		
AL1.L	1550	AL3.L	1550	SV-2	0000		

● Parameter 2 group [PAr2]

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
At	oFF	H-d	0000	H.oSt	000	rAMU	000
H-P	010.0	C-d	0000	C.HYS	002	rAMd	000
C-P	010.0	db	0000	C.oSt	000	r.Unt	MIn
H-I	0000	rESt	050.0	L-MV	-100.0		
C-I	0000	H.HYS	002	H-MV	100.0		

● Parameter 3 group [PAr3]

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
In-t	KCA.H	H-SC	100.0	o-Ft	HEAt (standard)	o1.Sr	Stnd
UnIt	°C	d.Unt	%		H-C (heating & cooling)	o1.MA	4-20
L-rG	00.00	In-b	0000	C-Md	PId (standard)	oUt2	CUrr
H-rG	10.00	MAV.F	000.1		P.P (heating & cooling)	o2.MA	4-20
dot	0.0	L-SV	-200	At.t	tUn1	H-t	020.0 (relay) 002.0 (SSR)
L-SC	000.0	H-SV	1350	oUt1	CUrr	C-t	

● Parameter 4 group [PAr4]

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
AL-1	dVCC	A2.n	no	LbA.t	0000	bPS	96
AL1.t	AL-A	A2.on	0000	LbA.b	002 (003※1)	PrtY	nonE
A1.HY	001	A2.oF	0000	Ao.M1 (Ao-M※1)	PV	StP	2
A1.n	no	AL-3	oFF	FS.L1 (FS-L※1)	-200	rSWt	20
A1.on	0000	AL3.t	AL-A	FS.H1 (FS-H※1)	1350	CoMW	EnA
A1.oF	0000	A3.HY	001	Ao.M2	PV		
AL-2	JJdu	A3.n	no	FS.L2	-200		
AL2.t	AL-A	A3.on	0000	FS.H2	1350		
A2.HY	001	A3.oF	0000	AdrS	01		

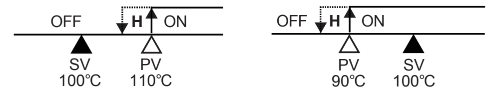
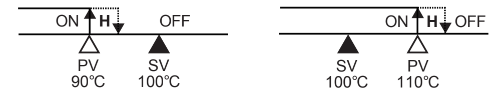
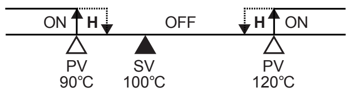
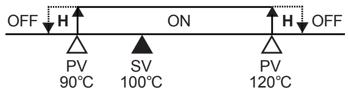
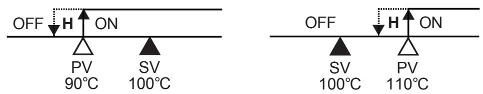
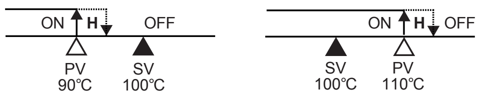
● Parameter 5 group [PAr5]

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
MtSV	1	Pr.MV	000.0	LC.SV	oFF	LC.PS	oFF
dI-K	StoP	Er.MV	000.0	LC.P1	oFF	PWd	0000
dI-1	oFF	St.MV	000.0	LC.P2	oFF		
dI-2	oFF	St.AL	Cont	LC.P3	oFF		
It.MV	AUto	USEr	Stnd	LC.P4	oFF		

※ shaded parameters are only for the new model.
※1: This parameter is for previous models.

■ Alarm

◎ Alarm operation

Mode	Name	Alarm operation	Description
oFF	—	—	No alarm output
duCC	Deviation high-limit alarm	 High deviation: Set as 10℃ High deviation: Set as -10℃	If deviation between PV and SV as high-limit is higher than set value of deviation temperature, the alarm output will be ON.
]]du	Deviation low-limit alarm	 Lower deviation: Set as 10℃ Lower deviation: Set as -10℃	If deviation between PV and SV as low-limit is higher than set value of deviation temperature, the alarm output will be ON.
]du [	Deviation high/low-limit alarm	 Lower deviation: Set as 10℃, High deviation: Set as 20℃	If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be ON.
[du]	Deviation high/low-limit reserve alarm	 Lower deviation: Set as 10℃, High deviation: Set as 20℃	If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be OFF.
PuCC	Absolute value high limit alarm	 Absolute-value Alarm: Set as 90℃ Absolute-value Alarm: Set as 110℃	If PV is higher than the absolute value, the output will be ON.
]]Pu	Absolute value low limit alarm	 Absolute-value Alarm: Set as 90℃ Absolute-value Alarm: Set as 110℃	If PV is lower than the absolute value, the output will be ON.
LbA	Loop break Alarm	—	It will be ON when it detects loop break.
SbA	Sensor break Alarm	—	It will be ON when it detects sensor disconnection.
HbA	Heater break alarm	—	It will be ON when CT detects heater break.

※ H: Alarm □ output hysteresis [A□.HY]

◎ Alarm option

Mode	Name	Description
AL-A	Standard alarm	If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.
AL-b	Alarm latch	If it is an alarm condition, alarm output is ON and maintains ON status.
AL-C	Standby sequence 1	First alarm condition is ignored and from second alarm condition, standard alarm operates. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, standard alarm operates.
AL-d	Alarm latch and standby sequence 1	If it is an alarm condition, it operates both alarm latch and standby sequence. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, alarm latch operates.
AL-E	Standby sequence 2	First alarm condition is ignored and from second alarm condition, standard alarm operates. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, standard alarm operates.
AL-F	Alarm latch and standby sequence 2	Basic operation is same as alarm latch and standby sequence 1. It operates not only by power ON/OFF, but also alarm set value, or alarm option changing. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, alarm latch operates.

※Condition of re-applied standby sequence for standby sequence 1, alarm latch and standby sequence 1: Power ON
Condition of re-applied standby sequence for standby sequence 2, alarm latch and standby sequence 2: Power ON, changing set temperature, alarm temperature [AL1, AL2] or alarm operation [AL-1, AL-2], switching STOP mode to RUN mode.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Functions

◎ Parameter mask

- This function is able to hide unnecessary parameters to user environment or less frequently used parameters in parameter setting group. You can set this in the comprehensive device management program (DAQMaster).
- Though masked parameters are not displayed in parameter setting group, the parameter set values are applied. For more information, refer to the DAQMaster user manual.
- Visit our web site (www.autonics.com) to download the DAQMaster program and the user manual.

※E.g.)The above is masking auto tuning [At], cooling proportional band [C-P], cooling integral time [C-I], cooling derivative time [C-d] parameters in parameter 2 group.

Before applying mask [PAr2] → [At] → [H-P] → [C-P] → [H-I] → [C-I] → [H-d] → [C-d] •••

After applying mask [PAr2] → [H-P] → [H-I] → [H-d] •••

※This function is for new model.

◎ User parameter group [PArU] setting

- This function is able to set the frequently used parameters to the user parameter group. You can quickly and easily set parameter settings.
- User parameter group can have up to 30 parameters in the comprehensive device management program (DAQMaster). For more information, refer to the DAQMaster user manual.
- Visit our website (www.autonics.com) to download the DAQMaster program and the user manual.

※E.g.)The above is setting user parameter group in the DAQMaster with alarm output 1 low-limit value [AL1.L], alarm output 1 high-limit value [AL1.H], SV-0 set value [Su-0] parameter of parameter 1 group, heating hysteresis [H.HYS], cooling hysteresis [C.HYS] parameters of parameter 2 group, input correction [In-b] parameter of parameter 3 group, alarm output 1 hysteresis [A1.HY], alarm output 2 hysteresis [A2.HY] parameters of parameter 4 group.

RUN

↓

[PArU] → [PAr1] ••• [PAr5]

↓

[AL1.L] → [AL1.H] → [Su-0] → [H.HYS] → [C.HYS] → [In-b] → [A1.HY] → [A2.HY]

※This function is for new model.

◎ Auto tuning [At]

In PID control, auto-tuning determines the control subject's thermal characteristics and thermal response rate, and then determines the necessary PID time constant. Application of the PID time constant realizes fast response and high precision temperature control.

- Auto-tuning automatically stores PID time constants upon termination. These PID time constants can then be modified by the user to suit their usage environment.
- When auto-tuning is in progress, the AT indicator located on the front of the controller flashes in 1 second intervals. When auto-tuning finishes, the AT indicator automatically goes off and the auto-tuning parameter will return to OFF.

Set value	Descriptions
oFF	Auto tuning end
on	Auto tuning run

Setting group	Parameter	Setting range	Factory default	Unit
PAr2	At	oFF/on	oFF	-

※Manual interruption or a sensor disconnection error when auto-tuning is in progress restores the PID time constant to the value used prior to the auto-tuning session.

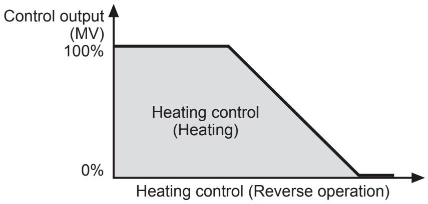
※Auto-tuning continues to run even if the temperature reading exceeds or falls below the input range.

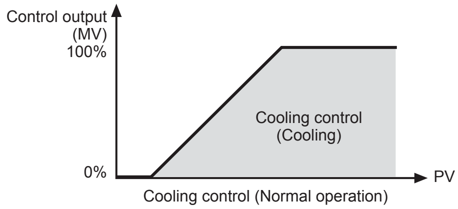
※When auto-turning is in progress, parameters can only be referenced and not altered.

※Auto-tuning is not available in manual control.

◎ Control output operation mode [o-Ft]

- Control output modes for general temperature control include heating, cooling, and heating and cooling.
- Heating control and cooling control are mutually opposing operations with inverse outputs.
- The PID time constant varies based on the controlled objects during PID control.





Setting group	Parameter	Setting range	Factory default	Unit
PAr3	o-Ft	Standard model HEAt/CooL	HEAt	—
		Heating & Cooling model HEAt/CooL/H-C	H-C	—

● Heating control [HEAt]

Heating control mode: the output will be provided in order to supply power to the load (heater) if PV (Present Value) falls below SV (Set value).

● Cooling control [CooL]

Cooling control mode: the output will be provided in order to supply power to the load (cooler) if PV (Present Value) rises above SV (Set value).

● Heating and cooling control [H-C]

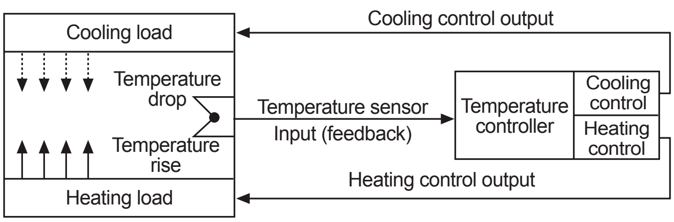
Heating and cooling control mode: heating and cooling with a single temperature controller when it is difficult to control subject temperature with only heating or cooling.

Heating and cooling control mode controls the object using different PID time constants for each heating and cooling.

It is also possible to set heating and cooling control in both PID control or ON/OFF control mode.

Heating/cooling output can be selected among Relay output, SSR drive output and current output depending on model types chosen according to your application environment.

(Note that only standard SSR control is available for SSR drive output in OUT2.)



※For heating and cooling control, OUT1 control output is dedicated to heating control and OUT2 control output to cooling control.

◎ Control output (OUT1/OUT2) selection [oUt1/oUt2]

- In case of selecting the Models with current control output, both current and SSR drive outputs are available. You can therefore choose the right output type depending on application environments.
  - OUT1: Selects OUT1 control output.
  - OUT2: Selects OUT2 control output.

Setting group	Parameter	Setting range	Factory default	Unit
PAr3	oUt1 oUt2	SSr/CUrr	SSr	—

◎ Communication output

It is for parameter setting and monitoring via external devices (PC, PLC, etc.).

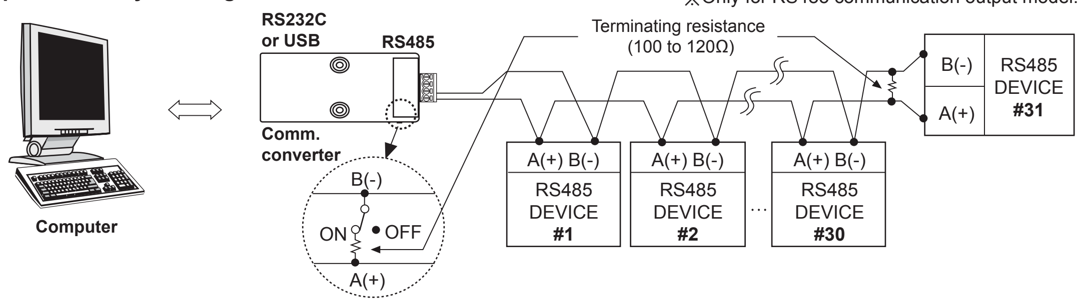
- **Interface**

Comm. protocol	Modbus RTU (character = 11-bit fixed)	Comm. speed	2400, 4800, 9600, 19200, 38400 bps
Connection type	RS485	Comm. response wait time	5 to 99 ms
Application standard	Compliance with EIA RS485	Start bit	1-bit (fixed)
Max. connection	31 units (address: 01 to 99)	Data bit	8-bit (fixed)
Synchronous method	Asynchronous	Parity bit	None, Odd, Even
Comm. method	Two-wire half duplex	Stop bit	1-bit, 2-bit
Comm. distance	Max. 800m		

※It is not allowed to set overlapping communication address at the same communication line.
Use twisted pair wire for RS485 communication.

- **Application of system organization**

※Only for RS485 communication output model.



※It is recommended to use Autonics communication converter; SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately), SCM-US (USB to Serial converter, sold separately).
Please use twisted pair wire for RS485 communication.

◎ For more information, refer to the user manual.

▣ Proper Usage

◎ Simple "Error" diagnosis

● When the load (Heater etc) is not operated

Please check operation of the OUT indicator located in front panel of the unit.

If the OUT indicator does not operate, please check the parameter of all programmed mode.
If OUT indicator is operating, please check the output (Relay, SSR drive voltage) after separating output line from the unit.

● When it displays oPEn during operation

This is a warning that external sensor is open.
Please turn off the power and check the wire state of the sensor. If sensor is not open disconnect sensor line from the unit and short the input +, - terminal. Turn on the power of the unit and check the controller displays room temperature.

If this unit cannot display room temperature, this unit is broken. Please remove this unit and contact our service center. (When the input mode is thermocouple, it is available to display room temperature.)

● In case of indicating "Error" in display

This Error message is indicated in case of damaging inner chip program data by outer strong noise.

In this case, please send the unit to our after service center after removing the unit from system.

Noise protection is designed in this unit, but it does not stand up strong noise continuously. If bigger noise than specified (Max. 2kV) flows in the unit, it can be damaged.

◎ Caution during use

- Please use separated line from high voltage line or power line in order to avoid inductive noise.
- Please install power switch or circuit-breaker in order to cut power supply off.
- The switch or circuit-breaker should be installed near by users.
- This unit is designed for temperature controlling only. Do not apply this unit as a voltage meter or a current meter.
- In case of using RTD sensor, 3-wire type must be used. If you need to extend the line, 3-wire must be used with the same thickness as the line. It might cause temperature difference if the resistance of line is different.
- In case of making power line and input signal line close, line filter for noise protection should be installed at power line and input signal line should be shielded.
- Keep away from the high frequency instruments. (High frequency welding machine & sewing machine, big capacitive SCR controller)
- This unit may be used in the following environments.
  - Indoor
  - Altitude: Under 2,000m
  - Pollution degree 2
  - Installation category II

Dual Display, PID Control Temperature Controller

■ Features

- Realizes ideal temp. controlling with newly developed PID control algorithm and 100ms high speed sampling
- **Built-in relay output or SSR drive output selectable : Enables to phase control and cycle control with SSR drive output (SSRP function)**
- Dramatically increased visibility using wide display part
- Enhanced convenience of wiring and maintenance by connector plug type (TCN4S-□-P)
- Mounting space saving with compact design : Approx. 38% reduced size compared with existing model (depth-based)

Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

T | CN | 4 | S – 2 | 4 | R – P

Item	Code	Description
Wiring method	No-mark	Bolt wiring method
	P	Connector plug connection method※1
Control output	R	Relay contact output+SSR drive output※2
Power supply	2	24VAC 50/60Hz, 24-48VDC
	4	100-240VAC 50/60Hz
Auxiliary output	2	Alarm1+Alarm2 output
Size	S	DIN W48×H48mm
	M	DIN W72×H72mm
	H	DIN W48×H96mm
	L	DIN W96×H96mm
Digit	4	9999 (4-digit)
Setting type	CN	Dual display type, set by touch switch
Item	T	Temperature controller

※1: Only for TCN4S model.
※2: In case of the AC voltage model, SSR drive output method (standard ON/OFF control, cycle control, phase control) is available to select.

■ Specifications

Series		TCN4S	TCN4M	TCN4H	TCN4L
Power supply	AC power	100-240VAC 50/60Hz			
	AC/DC power	24VAC 50/60Hz, 24-48VDC			
Allowable voltage range		90 to 110% of rated voltage			
Power consumption	AC power	Max. 5VA (100-240VAC 50/60Hz)			
	AC/DC power	Max. 5VA (24VAC 50/60Hz), Max. 3W (24-48VDC)			
Display method		7-segment (PV: red, SV: green), Other display (green, red) LED			
Character size	PV (W×H)	7.0×15.0mm	9.5×20.0mm	7.0×14.6mm	11.0×22.0mm
	SV (W×H)	5.0×9.5mm	7.5×15.0mm	6.0×12.0mm	7.0×14.0mm
Input type	RTD	DPt100Ω, Cu50Ω (allowable line resistance max. 5Ω per a wire)			
	Thermocouple	K(CA), J(IC), L(IC), T(CC), R(PR), S(PR)			
Display accuracy※1	RTD	• At room temperature (23℃ ±5℃): (PV ±0.5% or ±1℃, select the higher one) ±1-digit • Out of room temperature range: (PV ±0.5% or ±2℃, select the higher one) ±1-digit For TCN4S-□-P, add ±1℃ by accuracy standard.			
	Thermocouple				
Control output	Relay	250VAC 3A 1a			
	SSR	12VDC ±2V 20mA Max.			
Alarm output		AL1, AL2 Relay output: 250VAC 1A 1a			
Control method		ON/OFF control, P, PI, PD, PID control			
Hysteresis		1 to 100℃/℉ (0.1 to 50.0℃/℉) variable			

※1: ◎ At room temperature (23℃ ±5℃)
- Thermocouple R (PR), S (PR), below 200℃: (PV ±0.5% or ±3℃, select the higher one) ±1-digit
- Thermocouple R (PR), S (PR), over 200℃: (PV ±0.5% or ±2℃, select the higher one) ±1-digit
- Thermocouple L (IC), RTD Cu50Ω: (PV ±0.5% or ±2℃, select the higher one) ±1-digit

◎ Out of room temperature range
- Thermocouple R (PR), S (PR), below 200℃: (PV ±1.0% or ±6℃, select the higher one) ±1-digit
- Thermocouple R (PR), S (PR), over 200℃: (PV ±0.5% or ±5℃, select the higher one ±1-digit
- Thermocouple L (IC), RTD Cu50Ω: (PV ±0.5% or ±3℃, select the higher one) ±1-digit

For TCN4S-□-P, add ±1℃ by accuracy standard.

■ Specifications

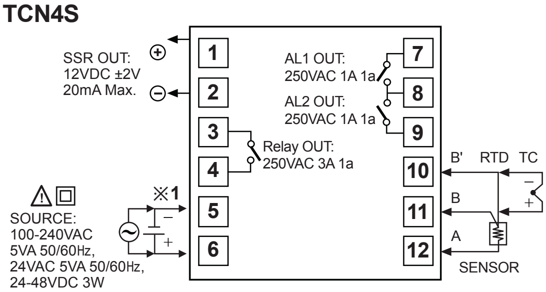
Series		TCN4S	TCN4M	TCN4H	TCN4L
Proportional band (P)		0.1 to 999.9℃/℉			
Integral time (I)		0 to 9999 sec			
Derivative time (D)		0 to 9999 sec			
Control period (T)		0.5 to 120.0 sec			
Manual reset		0.0 to 100.0%			
Sampling period		100ms			
Dielectric strength	AC Power	2,000VAC 50/60Hz for 1 min (between input terminal and power terminal)			
	AC/DC power	1,000VAC 50/60Hz for 1 min (between input terminal and power terminal)			
Vibration		0.75mm amplitude at frequency of 5 to 55Hz in each X, Y, Z direction for 2 hours			
Relay life cycle	Mechanical	OUT: Over 5,000,000 times, AL1/2: Over 5,000,000 times			
	Electrical	OUT: Over 200,000 times (250VAC 3A resistive load) AL1/2: Over 300,000 times (250VAC 1A resistive load)			
Insulation resistance		Over 100MΩ (at 500VDC megger)			
Noise immunity		±2kV R-phase, S-phase the square wave noise (pulse width: 1us) by the noise simulator			
Memory retention		Approx. 10 years (when using non-volatile semiconductor memory type)			
Environ-ment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Insulation type		Double insulation or reinforced insulation (mark: ⧈, dielectric strength between the measuring input part and the power part: AC power 2kV, AC/DC Power 1kV)			
Approval		CE cULus			
Weight※2		Approx. 147g (approx. 100g)	Approx. 203g (approx. 133g)	Approx. 194g (approx. 124g)	Approx. 275g (approx. 179g)

※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

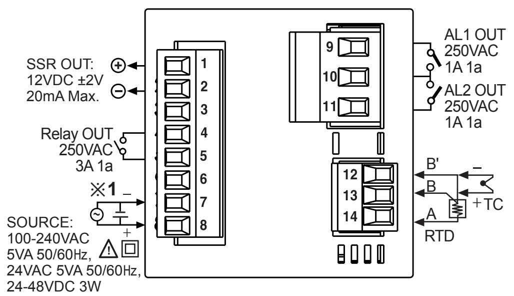
■ Connections

※TCN4 Series has selectable control output; Relay output, and SSR drive output. AC/DC voltage type does not have SSRP function.

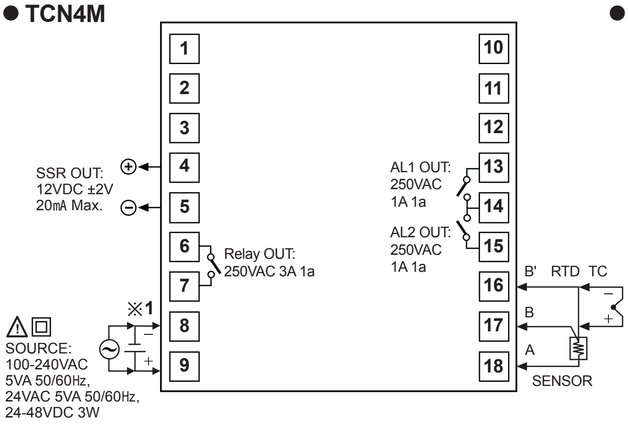
● TCN4S



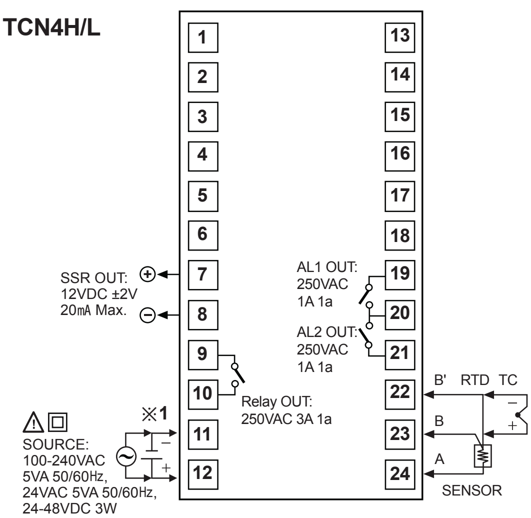
● TCN4S-□-P



● TCN4M



● TCN4H/L

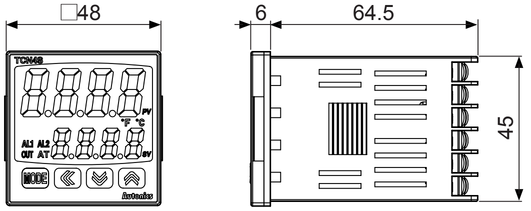


※1: Power supply
- AC power: 100-240VAC 5VA 50/60Hz
- AC/DC power: 24VAC 5VA 50/60Hz, 24-48VDC 3W

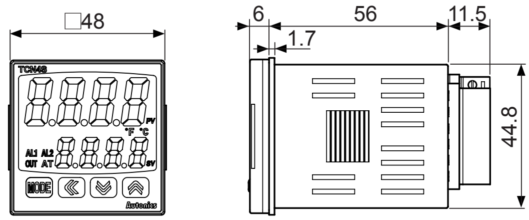
■ Dimensions

(unit: mm)

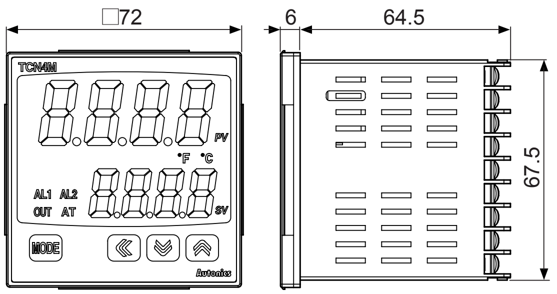
● **TCN4S**



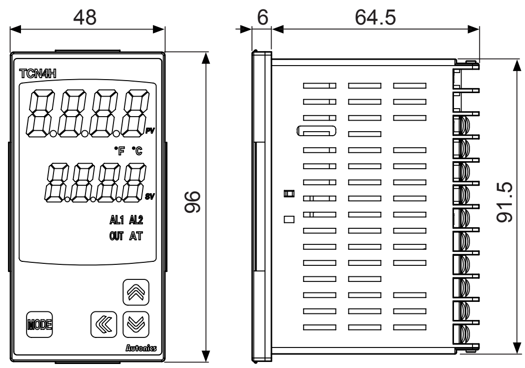
● **TCN4S-□-P**



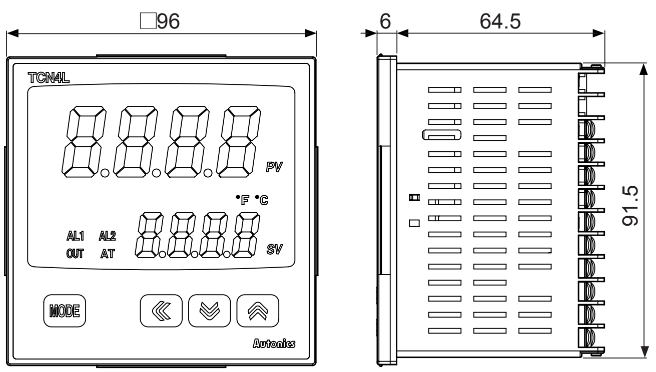
● **TCN4M**



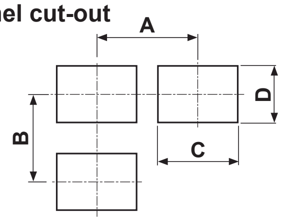
● **TCN4H**



● **TCN4L**



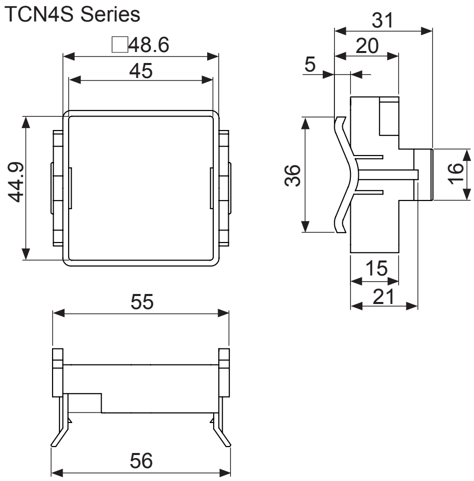
● **Panel cut-out**



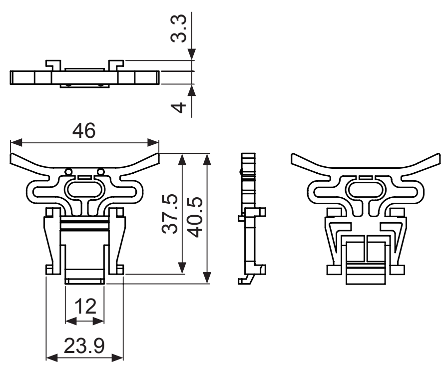
Series \ Size	A	B	C	D
TCN4S	Min. 65	Min. 65	$45^{+0.6}_{0}$	$45^{+0.6}_{0}$
TCN4M	Min. 90	Min. 90	$68^{+0.7}_{0}$	$68^{+0.7}_{0}$
TCN4H	Min. 65	Min. 115	$45^{+0.6}_{0}$	$92^{+0.8}_{0}$
TCN4L	Min. 115	Min. 115	$92^{+0.8}_{0}$	$92^{+0.8}_{0}$

● **Bracket**

- TCN4S Series



- TCN4M, TCN4H, TCN4L Series



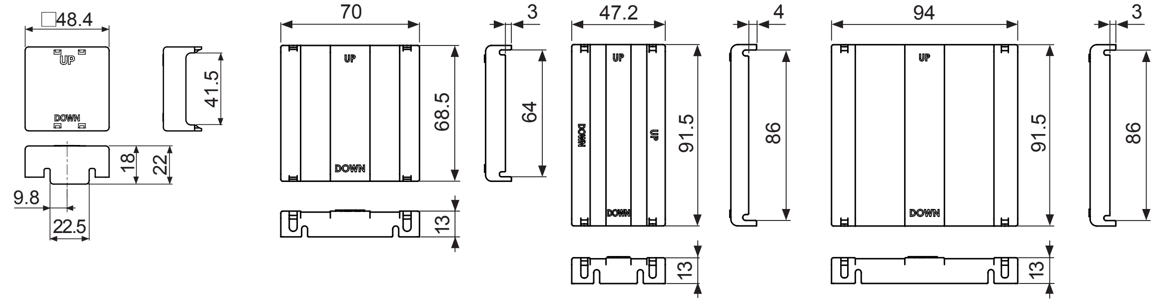
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Dimensions

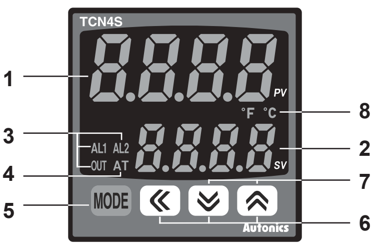
(unit: mm)

● **Terminal cover (sold separately)**

● RSA-COVER (48×48mm) ● RMA-COVER (72×72mm) ● RHA-COVER (48×96mm) ● RLA-COVER (96×96mm)



▣ Unit Description



1. Present temperature (PV) display (red)
- RUN mode: Present temperature (PV) display.
- Parameter setting mode: Parameter display.

2. Set temperature (SV) display (green)
- RUN mode: Set temperature (SV) display.
- Parameter setting mode: Parameter setting value display.

3. Control/Alarm output display indicator
- OUT: It turns ON when the control output is ON.
  ※During SSR drive output type in CYCLE/PHASE control, this indicator turns ON when MV is over 3.0%. (only AC voltage type)
- AL1/AL2: It turns ON when the alarm output is ON.

4. Auto tuning indicator: AT indicator flashes by every 1 sec during operating auto tuning.

5. MODE key: Used when entering into parameter setting group, returning to RUN mode, moving parameter, and saving setting values.

6. Adjustment: Used when entering into set value change mode, digit moving and digit up/down.

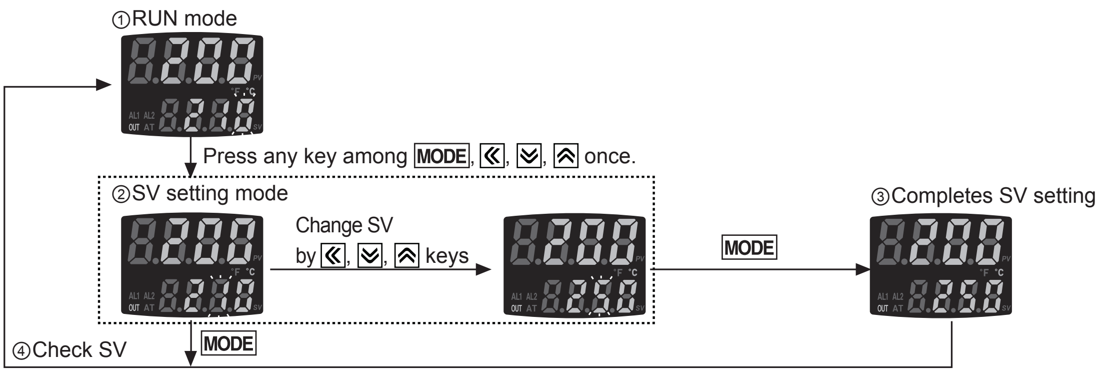
7. Digital input key: Press ⩔ + ⩓ keys for 3 sec to operate the set function (RUN/STOP, alarm output reset, auto tuning) in digital input key [di -t].

8. Temperature unit (℃/℉) indicator: It shows current temperature unit.

▣ SV Setting

You can set the temperature to control with MODE, «, ⩔, ⩓ keys.
Setting range is within SV lower limit value [L-Sv] to SV higher limit value [H-Sv].

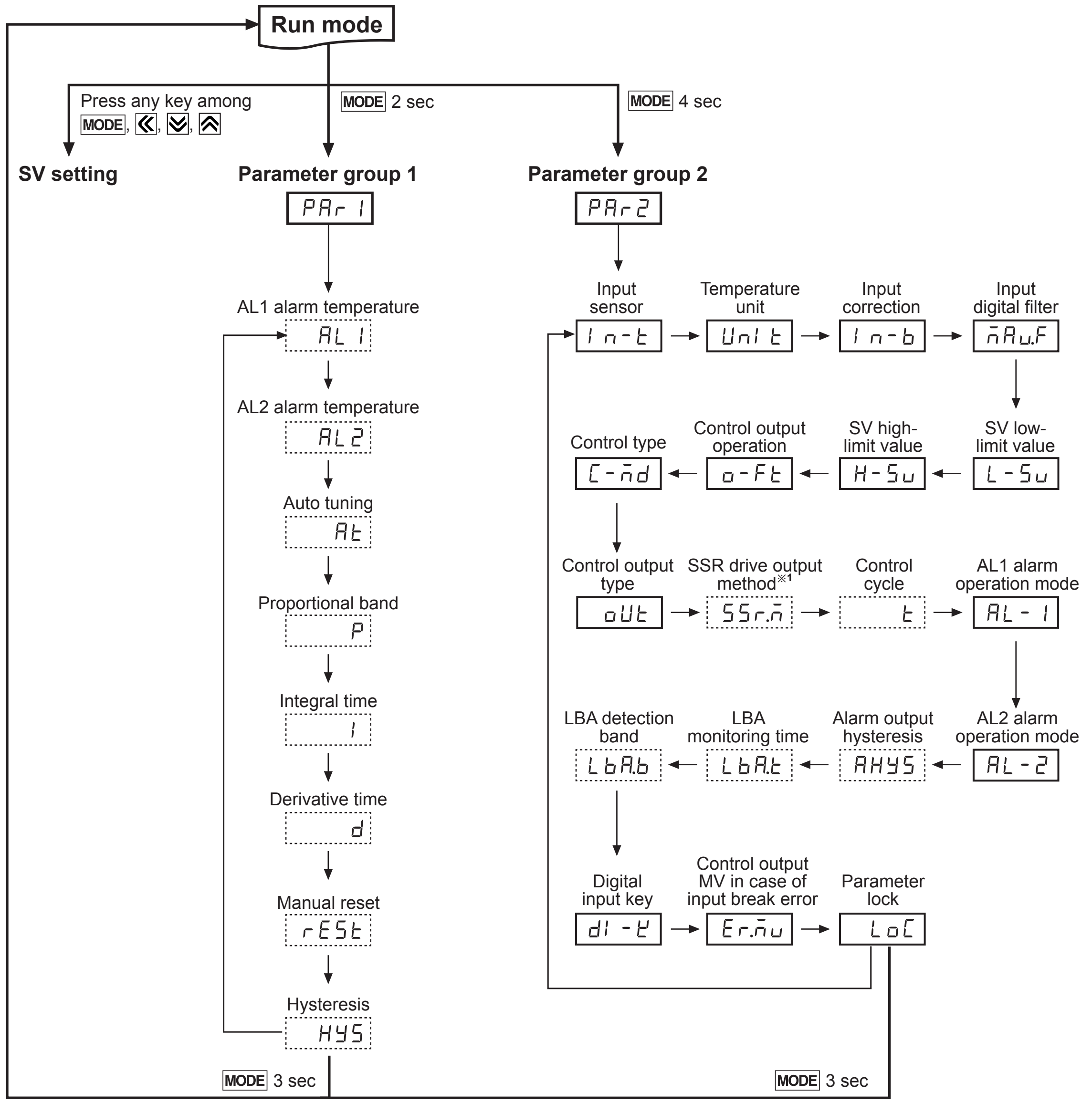
E.g.) In case of changing set temperature from 210ºC to 250ºC



▣ Parameter Reset

Reset all parameters as factory default. Hold the front «+⩔+⩓ keys for 5 sec, to enter parameter reset [Init] parameter. Select 'YES' and all parameters are reset as factory default. Select 'no' and previous settings are maintained. If setting parameter lock [LoC] or processing auto-tuning, parameter reset is unavailable.

■ Parameter Group



※Press MODE key over 3 sec in any setting group, it saves the set value and returns to RUN mode.
(Press MODE key once in SV setting, it returns to RUN mode).

※If no key entered for 30 sec, it returns to RUN mode automatically and the set value of parameter is not be saved.

※Press MODE key again within 1 sec after returning to RUN mode, it advances of the first parameter of previous setting group.

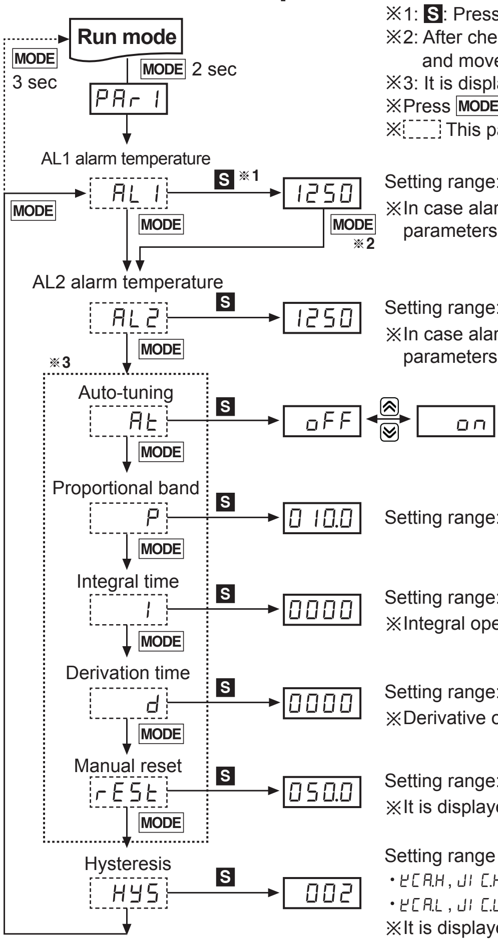
※Press MODE key to move next parameter.

※[ ] This parameter might not be displayed depending on other parameter settings.

※Set parameter as 'Parameter group 2 → Parameter group 1 → Setting of set value' order considering parameter relation of each setting group.

※1: It is not displayed for AC/DC power model (TCN4□-22R).

■ Parameter Group 1



※1: S: Press any key among ⊗, ⊗, ⊗.
※2: After checking or changing setting value in each parameter, press MODE key to save and move to next parameter setting.
※3: It is displayed when control type parameter [C-ṅd] of parameter group 2 is set PId.
※Press MODE key for 3 sec to return RUN mode at any parameter.
※[ ] This parameter might not be displayed depending on other parameter settings.

Setting range: Deviation alarm (-F.S to F.S), Absolute value alarm (temperature range)
※In case alarm operation mode [AL-1] of Parameter group 2 is AṅO.□/SbA.□/bA□, no parameters is displayed.

Setting range: Deviation alarm (-F.S to F.S), Absolute value alarm (temperature range)
※In case alarm operation mode [AL-2] of Parameter group 2 is AṅO.□/SbA.□/bA□, no parameters is displayed.

※Front AT indicator flashes during auto tuning operation.

Setting range: 0.1 to 999.9 ℃/℉

Setting range: 0 to 9999 sec
※Integral operation is OFF when set value is "0".

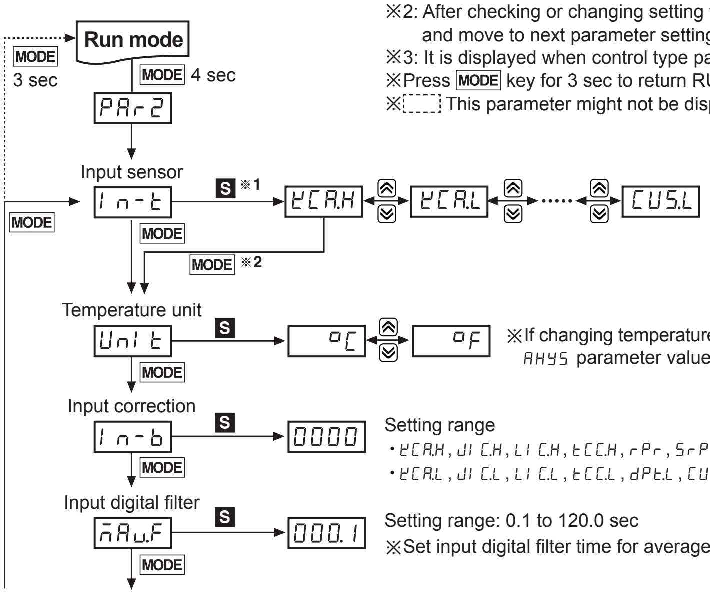
Setting range: 0 to 9999 sec
※Derivative operation is OFF when set value is "0".

Setting range: 0.0 to 100.0%
※It is displayed in P, PD control.

Setting range
- KCA.H, JIC.H, LIC.H, TCC.H, rPr, SrP, dPt.H, CUS.H: 1 to 100℃/℉
- KCA.L, JIC.L, LIC.L, TCC.L, dPt.L, CUS.L: 0.1 to 50.0℃/℉

※It is displayed when control type [C-ṅd] of parameter group 2 is set onoF.

■ Parameter Group 2



※1: S: Press any key among ⊗, ⊗, ⊗.
※2: After checking or changing setting value in each parameter, press MODE key to save and move to next parameter setting.
※3: It is displayed when control type parameter [C-ṅd] of parameter group 2 is set PId.
※Press MODE key for 3 sec to return RUN mode at any parameter.
※[ ] This parameter might not be displayed depending on other parameter settings.

Setting range: Refer to 'Input sensor and temperature range'.
※If changing input sensor, SV, In-b, H-Su, L-Su, AL1, AL2, LbA.t, LbA.b, AHYS parameter values are initialized.

※If changing temperature unit, SV, In-b, H-Su, L-Su, AL1, AL2, LbA.t, LbA.b, AHYS parameter values are initialized.

Setting range
- KCA.H, JIC.H, LIC.H, TCC.H, rPr, SrP, dPt.H, CUS.H: -999 to 999℃/℉
- KCA.L, JIC.L, LIC.L, TCC.L, dPt.L, CUS.L: -199.9 to 999.9℃/℉

Setting range: 0.1 to 120.0 sec
※Set input digital filter time for average input value affected control, and display value.

SV low-limit value [L-Su] —S→ [-050]

MODE ↓

Setting range: Within the rated temperature range by input sensor [L-Su ≤ (H-Su-1-digit)]
※ When changing SV low-limit value, if SV<L-Su, SV is initialized as L-Su.
※In case of changing input sensor type [In-t], it changes automatically as min. value of the changed input sensor.

SV high-limit value [H-Su] —S→ [1200]

MODE ↓

Setting range: Within the rated temperature range by input sensor [H-Su ≥ (L-Su+1-digit)]
※ When changing SV high-limit value, if SV>H-Su, SV is initialized as H-Su.
※In case of changing input sensor type [In-t], it changes automatically as max. value of the changed input sensor.

Control output operation [o-Ft] —S→ [HEAt] ⇔ [CooL]

MODE ↓

※When changing control output operation, Er.mu is initialized.

Control type [C-md] —S→ [PId] ⇔ [onoF]

MODE ↓

※When changing control type, Er.mu is initialized (control output MV is below 100%) and dI-t turns OFF automatically.

Control output type [oUt] —S→ [rLY] ⇔ [SSr]

MODE ↓

SSR drive output method [SSr.m] —S→ [Stnd] ⇔ [CYCL] ⇔ [PHAS]

MODE ↓

※It is displayed when selecting control output [oUt] as SSr.
It is not displayed for AC/DC power model (TCN4□-22R).

Control cycle [t] —S→ [020.0]

MODE ↓

Setting range: 0.5 to 120.0 sec
In case of Relay output [rLY] of control output [oUt] it is set as 20.0 sec
In case of SSR drive output [SSr] of that, it is set as 2.0 sec
※t is not displayed when SSR drive output [SSr.m] method is set as CYCL, PHAS.

AL1 alarm operation mode [AL-1] —S→ [Am1.A]

MODE ↓

[Am0.] ⇔ [Am1.A] ⇔ [Am2.A] ⇔ [Am6.A] ⇔ [SbA.A] ⇔ [LbA.A]

[SbA.b] ⇔ [SbA.A] [LbA.b] ⇔ [LbA.A]

AL2 alarm operation mode [AL-2] —S→ [Am2.A]

MODE ↓

[Am1.A] ⇔ [Am1.b] ⇔ [Am1.C] ⇔ [Am1.d] ⇔ [Am1.E] ⇔ [Am1.F]

For more details refer to ▣ Functions '◎ Alarm'.
※Black: Flashes, Gray: Fixed
※When changing AL1, AL2 alarm operation mode, AL1, AL2 alarm temperature value are initialized.

Alarm output hysteresis [AHYS] —S→ [001]

MODE ↓

Refer to ▣ Functions '◎Alarm output hysteresis'.
※AHYS is not displayed when AL1, AL2 alarm operation mode [AL-1, AL-2] is set as Am0._, SbA.□, LbA.□.

LBA monitoring time [LbA.t] —S→ [0000]

MODE ↓

Setting range: 0 to 9999 sec
※'0' is set, loop break alarm function is OFF.
※LbA.t is displayed when AL1, AL2 alarm operation mode [AL-1, AL-2] is set as LbA..

LBA detection band [LbA.b] —S→ [0002]

MODE ↓

Setting range: 0 to 999 (0.0 to 999.9)℃/℉
※'0' is set, loop break alarm function is OFF.
※LbA.b is displayed when AL1, AL2 alarm operation mode [AL-1, AL-2] is set as LbA.□ and LbA.t is not '0'.

Digital input key [dI-K] —S→ [StoP] ⇔ [AL.rE] ⇔ [At] ⇔ [oFF]

MODE ↓

Press ⊗ + ⊗ keys for 3 sec and it executes the set function. For more information, refer to ▣ Functions '◎Digital input key'.
※When control type [C-md] is onoF, At is not displayed.

Control output MV in case of input break error [Er.mu] —S→ [000.0]

MODE ↓

Setting range: 0.0 to 100.0%
※Only 0.0, 100% are displayed when control type [C-md] is set as onoF.
※When changing PID control to ON/OFF control, if MV is below 100.0%, it is initialized as 0.0%.

Parameter lock [LoC] —S→ [oFF] ⇔ [LoC1] ⇔ [LoC2] ⇔ [LoC3]

MODE ↓

LoC1: Locks parameter group 2
LoC2: Locks parameter 1, 2 group
LoC3: Locks parameter 1, 2 group and SV setting
※Parameter setting values are still possible to check when parameter lock is set.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Input Sensor And Temperature Range

Input sensor		Display	Temperature range (℃)	Temperature range (℉)
Thermocouple	K(CA)	KCA.H	-50 to 1200	-58 to 2192
		KCA.L	-50.0 to 999.9	-58.0 to 999.9
	J(IC)	JIC.H	-30 to 800	-22 to 1472
		JIC.L	-30.0 to 800.0	-22.0 to 999.9
	L(IC)	LIC.H	-40 to 800	-40 to 1472
		LIC.L	-40.0 to 800.0	-40 to 999.9
	T(CC)	tCC.H	-50 to 400	-58 to 752
		tCC.L	-50.0 to 400.0	-58.0 to 752.0
	R(PR)	r Pr	0 to 1700	32 to 3092
	S(PR)	S Pr	0 to 1700	32 to 3092
RTD	DPt100Ω	dPt.H	-100 to 400	-148 to 752
		dPt.L	-100.0 to 400.0	-148.0 to 752.0
	Cu50Ω	CUS.H	-50 to 200	-58 to 392
		CUS.L	-50.0 to 200.0	-58.0 to 392.0

■ Factory Default

● SV setting

Parameter	Factory default
—	0

● Parameter group 1

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
AL1	1250	At	oFF	I	0000	rESt	050.0
AL2	1250	P	010.0	d	0000	HYS	002

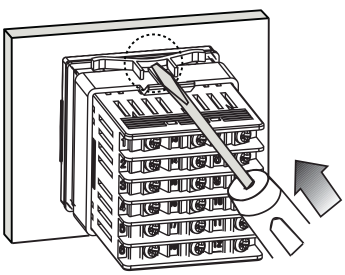
● Parameter group 2

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
In-t	KCA.H	H-Su	1200	t	020.0	LbA.b	0002
UnIt	℃	o-Ft	HEAt	AL-1	AM1.A	dI-K	StoP
In-b	0000	C-Md	PId	LA-2	AM2.A	Er.Mu	000.0
MAu.F	000.1	oUt	rLY	AHYS	001	LoC	oFF
L-Su	-050	SSr.M	Stnd	LbA.t	0000		

※The AC/DC voltage models do not have SSR drive output method [SSr.M]. In case of control output [oUt], if set as SSr , it supports only ON/OFF output.

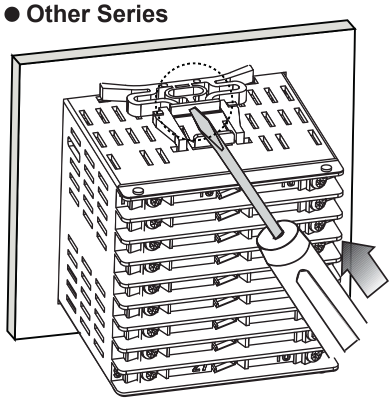
■ Mounting

● TCN4S (48×48mm) Series



※Mount the product on the panel, fasten bracket by pushing with tools as shown above.

● Other Series



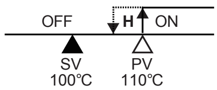
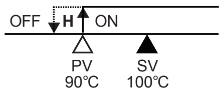
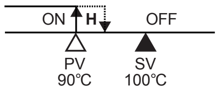
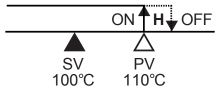
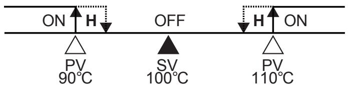
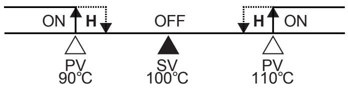
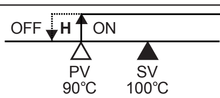
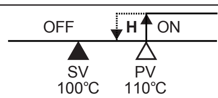
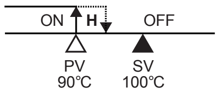
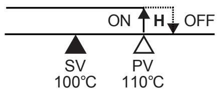
■ Functions

◎ Alarm [AL-1 / AL-2]

AM1.A
Alarm operation — Alarm option

Set both alarm operation and alarm option by combining.
Alarm outputs are two and each one operates individually.
When the current temperature is out of alarm range, alarm clears automatically. If alarm option is alarm latch or alarm latch and standby sequence 1/2, press digital input key(▽+△ 3 sec, digital input key[di-K] of parameter group 2 set as AL.rE), or turn OFF the power and turn ON to clear alarm.

● Alarm operation

Mode	Name	Alarm operation	Description
AM0._	—	—	No alarm output
AM1.□	Deviation high-limit alarm	 High deviation: Set as 10℃  High deviation: Set as -10℃	If deviation between PV and SV as high-limit is higher than set value of deviation temperature, the alarm output will be ON.
AM2.□	Deviation low-limit alarm	 Lower deviation: Set as 10℃  Lower deviation: Set as -10℃	If deviation between PV and SV as low-limit is higher than set value of deviation temperature, the alarm output will be ON.
AM3.□	Deviation high/low-limit alarm	 High/Lower deviation: Set as 10℃	If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be ON.
AM4.□	Deviation high/low-limit reverse alarm	 High/Lower deviation: Set as 10℃	If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be OFF.
AM5.□	Absolute value high limit alarm	 Absolute-value Alarm: Set as 90℃  Absolute-value Alarm: Set as 110℃	If PV is higher than the absolute value, the output will be ON.
AM6.□	Absolute value low limit alarm	 Absolute-value Alarm: Set as 90℃  Absolute-value Alarm: Set as 110℃	If PV is lower than the absolute value, the output will be ON.
SbA.□	Sensor break Alarm	—	It will be ON when it detects sensor disconnection.
LbA.□	Loop break Alarm	—	It will be ON when it detects loop break.

※ H: Alarm output hysteresis [AHYS]

● Alarm option

Mode	Name	Description
AM□.A	Standard alarm	If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.
AM□.b	Alarm latch	If it is an alarm condition, alarm output is ON and maintains ON status.
AM□.C	Standby sequence 1	First alarm condition is ignored and from second alarm condition, standard alarm operates. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, standard alarm operates.
AM□.d	Alarm latch and standby sequence 1	If it is an alarm condition, it operates both alarm latch and standby sequence. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, alarm latch operates.
AM□.E	Standby sequence 2	First alarm condition is ignored and from second alarm condition, standard alarm operates. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, standard alarm operates.
AM□.F	Alarm latch and standby sequence 2	Basic operation is same as alarm latch and standby sequence 1. It operates not only by power ON/OFF, but also alarm setting value, or alarm option changing. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, alarm latch operates.

※Condition of re-applied standby sequence for standby sequence 1, alarm latch and standby sequence 1: Power ON
Condition of re-applied standby sequence for standby sequence 2, alarm latch and standby sequence 2: Power ON, changing set temperature, alarm temperature [AL1, AL2] or alarm operation [AL-1, AL-2], switching STOP mode to RUN mode.

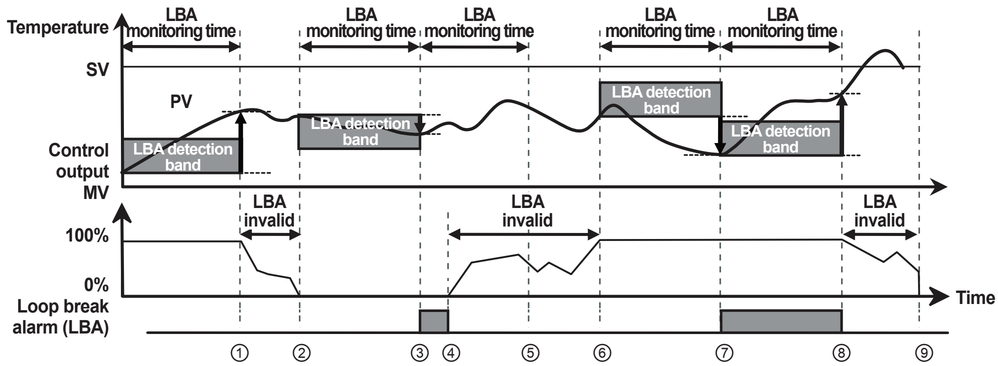
◎ Sensor break alarm

The function that alarm output will be ON when sensor is not connected or when sensor's disconnection is detected during temperature controlling. You can check whether the sensor is connected with buzzer or other units using alarm output contact. It is selectable between standard alarm [SbA.A], or alarm latch [SbA.b].

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

◎ Loop break alarm (LBA)

It checks control loop and outputs alarm by temperature change of the subject. For heating control (cooling control), when control output MV is 100% (0% for cooling control) and PV is not increased over than LBAdetection band [LbA.b] during LBA monitoring time [LbA.t], or when control output MV is 0% (100% for cooling control) and PV is not decreased below than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], alarm output turns ON.

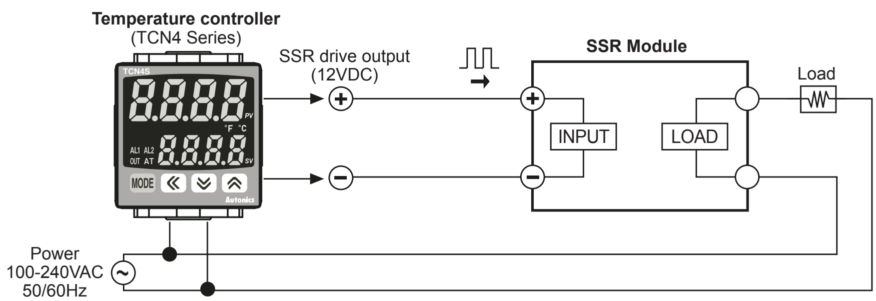


Start control to ①	When control output MV is 0% and PV is not decreased below than LBA detection band [LbA.b] during LBA monitoring time [LbA.t]
① to ②	The status of changing control output MV (LBA monitoring time is reset.)
② to ③	When control output MV is 0% and PV is not decreased below than LBA detection band [LbA.b] during LBA monitoring time [LbA.] loop break alarm (LBA) turns ON after LBA monitoring time.
③ to ④	Control output MV is 0% and loop break alarm (LBA) turns and maintains ON.
④ to ⑥	The status of changing control output MV (LBA monitoring time is reset.)
⑥ to ⑦	When control output MV is 100% and PV is not increased over than LBA detection band [LbA.t] during LBA monitoring time [LbA.t], loop break alarm (LBA) turns ON after LBA monitoring time.
⑦ to ⑧	When control output MV is 100% and PV is increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t] loop break alarm (LBA) turns OFF after LBA monitoring time.
⑧ to ⑨	The status of changing control output MV (LBA monitoring time is reset.)

※When executing auto-tuning, LBA detection band [LbA.b] and LBA monitoring time are automatically set based on auto tuning value. When AL1, AL2 alarm operation [AL-1, AL-2] is set as loop break alarm (LBA) [LbA□], LBA detection band [LbA.b] and LBA monitoring time [LbA.t] parameter is displayed.

◎ SSR drive output function (SSRP function) [SSr.m]

- SSRP function is selectable one of standard ON/OFF control, cycle control, phase control by utilizing standard SSR drive output.
- Realizing high accuracy and cost effective temperature control as linear output(cycle control and phase control).
- Select one of standard ON/OFF control [Stnd], cycle control [CYCL], phase control [PHAS] at [SSr.m] parameter of parameter group 2. For cycle control, connect zero cross turn-on SSR or random turn-on SSR. For phase control, connect random turn-on SSR.



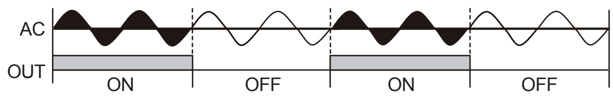
※When selecting phase or cycle control mode, **the power supply for load and temperature controller must be the same.**

※In case of selecting PID control type and phase [PHAS] / cycle [CYCL] control output modes, control cycle [t] is not allowed to set.

※For AC/DC power model (TCN4 □ -22R), this parameter is not displayed and it is available only standard control by relay or SSR.

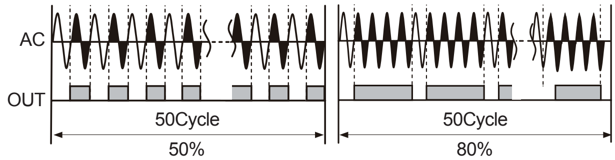
● **Standard ON/OFF control mode [StNd]**

A mode to control the load in the same way as Relay output type.
(ON: output level 100%, OFF: output level 0%)



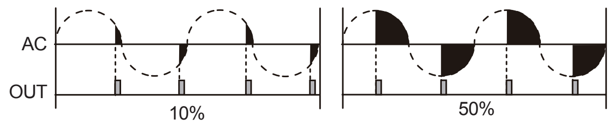
● **Cycle control mode [CYCL]**

A mode to control the load by repeating output ON / OFF according to the rate of output within setting cycle. Having improved ON / OFF noise feature by Zero Cross type.



● **Phase control mode [PHAS]**

A mode to control the load by controlling the phase within AC half cycle. Serial control is available.
RANDOM Turn-on type SSR must be used for this mode.



◎ Auto tuning [AT]

- Auto tuning measures the control subject's thermal characteristics and thermal response rate, and then determines the necessary PID time constant. (When control type [C-MD] is set as PID, it is displayed.)
- If error [OPEN] occurs during auto tuning, it stops this operation automatically.
- To stop auto tuning, change the set as OFF. (It maintains P, I, D values of before auto tuning.)

◎ Input correction [IN-B]

Controller itself does not have errors but there may be error by external input temperature sensor.

E.g.) If actual temperature is 80℃ but controller displays 78℃, set input correction value [IN-B] as 002 and controller displays 80℃.

※As the result of input correction, if current temperature value (PV) is over each temperature range of input sensor, it displays HHHH or LLLL.

◎ Input digital filter [MAV.F]

If current temperature (PV) is fluctuating repeatedly by rapid change of input signal, it reflects to MV and stable control is impossible. Therefore, digital filter function stabilizes current temperature value.

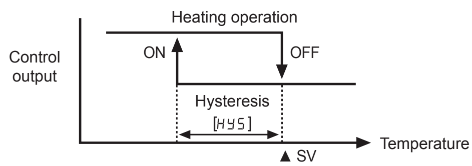
- For example, set input digital filter value as 0.4 sec, and it applies digital filter to input values during 0.4 sec and displays this values. Current temperature may be different by actual input value.

◎ SV High/Low limit [H-SV/L-SV]

- It sets SV high/low limit Limit range of using temperature within temperature range for each sensor, user can set/ change set temperature (SV) within SV high limit [H-SV] to SV low limit [L-SV]. (※L-SV > H-SV cannot be set.)
- When changing input type [IN-T], SV high limit [H-SV] and SV low limit [L-SV] of using temperature will be initialized as max./min.value of sensor temperature range automatically.

◎ Hysteresis [HYS]

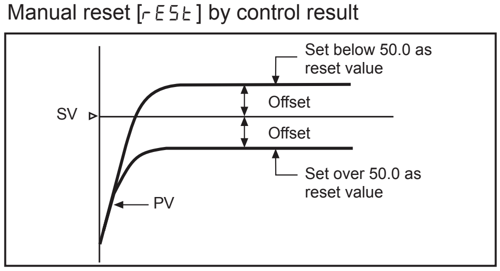
- In case of ON/OFF control, set between ON and OFF intervals as hysteresis. (When control type [C-MD] is set as ONOF, it is displayed.)
- If hysteresis is too small, it may cause control output hunting (take off, chattering) by external noise, etc.



◎ Manual reset [REST]

When selecting P/PD control mode, certain temperature difference exists even after PV reaches stable status because heater's rising and falling time is inconsistent due to thermal characteristics of controlled objects, such as heat capacity, heater capacity. This temperature difference is called offset and manual reset [REST] function is to set/ correct offset.

- When PV and SV are equal, reset value is 50.0%. After control is stable, PV is lower than SV, reset value is over 50.0% or PV is higher than SV, reset value is below 50.0%.
- Manual reset [REST] by control result



※Manual reset function is applicable only to P / PD control mode.

◎ Temperature unit selection [UNIT]

- A function to select display temperature unit.
- Unit display indicator will be ON when converting temperature unit.

◎ Cool / Heat function [o-Ft]

Generally there are two ways to control temperature, one (heat-function) is to heat when PV is getting down (heater). The other (cool-function) is to cool when PV is getting higher (freezer).

These functions are operating oppositely when it is ON/OFF control or proportional control. But in this case PID time constant will be different due to PID time constant will be decided according to control system when it is PID control.

- Cool-function [CooL] and heat-function [HEAt] must be set correctly according to the application, if set as opposite function, it may cause a fire. (If set cool-function [CooL] at heater, it will be maintained ON and it may cause a fire.)
- Avoid changing heat-function to cool-function or cool-function to heat-function when the unit is operating.
- It is impossible to operate both function at once in this unit. Therefore, only one function should be selected only.

◎ Control method selection [C-Md]

It is selectable PID, ON/OFF control.

- In case of ON/OFF [onoF] mode, Hysteresis [HYS] parameter is displayed.
- In case of PID [PId] mode, Proportional band [P], Integral time [I], and Derivative time [d] parameters are displayed.

◎ Control output type selection [oUt]

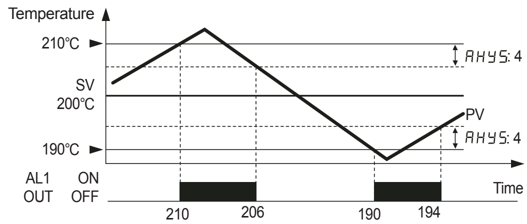
It is selectable output type ; relay output [rLY], SSR drive output [SSr].

◎ Alarm output hysteresis [AHYS]

It displays alarm output ON and OFF interval and hysteresis is applied to both AL1 OUT and AL2 OUT.

- UCA.H, UI C.H, LI C.H, tCC.H, rPr, SPr, dPt.H, CUS.H : 1 to 100
- UCA.L, UI C.L, LI C.L, tCC.L, dPt.L, CUS.L : 0.1 to 50.0

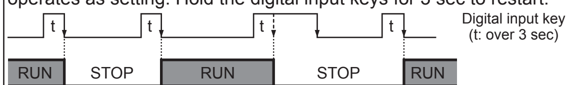
E.g.) AL1 alarm operation [AL-1]: AM3.A,
AL1 alarm operation [AL1]: 10℃,
Alarm output hysteresis [AHYS]: 4



◎ Control output MV when input sensor line is broken [Er.Mu]

When input sensor line is broken or setting value error occurs, this function is to set control output. You can set ON/OFF setting for ON/OFF control, MV setting for PID control.

◎ Digital input key (⋎ + ⋏ 3 sec) [dI-K]

Parameter		Operation
OFF	oFF	It does not use digital input key function.
RUN/STOP	StoP	Pauses control output. Auxiliary output (except loop break alarm, sensor break alarm)except Control output operates as setting. Hold the digital input keys for 3 sec to restart. 
Clear alarm	AL.rE	Clears alarm output by force. (only when alarm option is alarm latch, or alarm latch and standby sequence 1/2 .) This function is applied when present value is out of alarm operation range but alarm output is ON. Alarm operates normally right after clearing alarm.
Auto-tuning	At	Starts/Stops auto-tuning. This function is same as auto-tuning[At] of parameter group 1. (You can start auto-tuning [At] of parameter group 1 and stop it by digital input key.) ※This parameter At appears only when control method [C-Md] parameter group 2 is set as PId. When control method [C-Md] parameter group 2 is set as onoF, this parameter is changed as oFF.

◎ Parameter lock [LoC]

A function to prevent changing SV and parameters of each setting group. Parameter setting values are still possible to check when parameter lock is set.

Display	Description
oFF	Lock off
LoC1	Lock parameter group 2
LoC2	Lock parameter group 1, 2
LoC3	Lock parameter group 1, 2, SV setting

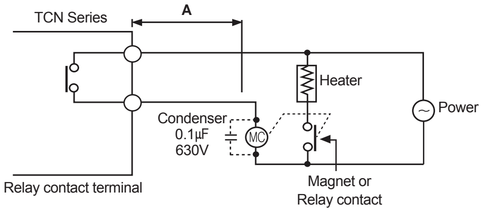
◎ Error

Display	Description	Troubleshooting
oPEn	Flashes if input sensor is disconnected or sensor is not connected.	Check input sensor state.
HHHH	Flashes if measured sensor input is higher than temperature range.	When input is within the rated temperature range, this display disappears.
LLLL	Flashes if measured sensor input is lower than temperature range.	

◎ Output connections

Refer to page H-170 for output.

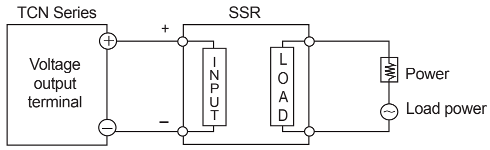
● Application of relay output type



Keep **A** length as long as possible when wiring the temperature controller and the load. If wire length of **A** is short, counter electromotive force which occurs from a coil of magnet switch & power relay may flow in power line of the unit, and it may cause malfunction.

If wire length of **A** is short, please connect mylar condensers 104 (630V) on the both ends of "Ⓜ" (magnet coil) to protect electromotive force.

● Application of SSR drive output method



※SSR should be selected by the capacity of load, otherwise, it may short-circuit and result in a fire. Indirect heated should be used with SSR for efficient working.

※Please use a cooling plate or it may cause the capability deterioration, breakdown of SSR for a long usage.

※Refer to page H-69 for phase/cycle control connections.

▣ Proper Usage

◎ Simple "error" diagnosis

● When the load (Heater etc) is not operated

Please check operation of the OUT indicator located in front panel of the unit.

If the OUT indicator does not operate, please check the parameter of all programmed mode.
If indicator is operating, please check the output (Relay, SSR drive voltage) after separating output line from the unit.

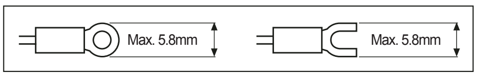
● When it displays oPEn during operation

This is a warning that external sensor is open.
Please turn off the power and check the wire state of the sensor. If sensor is not open disconnect sensor line from the unit and short the input +, - terminal. Turn on the power of the unit and check the controller displays room temperature.

If this unit cannot display room temperature, this unit is broken. Please remove this unit and contact our service center. (When the input mode is thermocouple, it is available to display room temperature.)

◎ Caution during use

- The connection wire of this unit should be separated from the power line and high voltage line in order to prevent from inductive noise.
- For crimp terminal, select following shaped terminal (M3)



- Please install power switch or circuit-breaker in order to cut power supply off.
- The switch or circuit-breaker should be installed near by users.
- This unit is designed for temperature controlling only. Do not apply this unit as a voltage meter or a current meter.
- In case of using RTD sensor, 3-wire type must be used. If you need to extend the line, 3-wire must be used with the same thickness as the line. It might cause temperature difference if the resistance of line is different.
- In case of making power line and input signal line close, line filter for noise protection should be installed at power line and input signal line should be shielded.
- Keep away from the high frequency instruments. (High frequency welding machine & sewing machine, big capacitive SCR controller)
- When supplying measured input, if HHHH or LLLL is displayed, measured input may have problem. Turn off the power and check the line.
- This unit may be used in the following environments.
  - Indoor
  - Altitude: Under 2,000m
  - Pollution degree 2
  - Installation category II

Single Display, PID Control Temperature Controller

■ Features

- Realizes ideal temp. controlling with newly developed PID control algorithm and 100ms high speed sampling
- **Built-in relay output or SSR output selectable**
  : Enables to phase control and cycle control with SSR drive output (SSRP function)
- Dramatically increased visibility using wide display part
- Mounting space saving with compact design
  : Approx. 38% reduced size compared with existing model (depth-based)
- SV/PV deviation indicatable

Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

T C 4 S — 1 4 R

Code position	Item	Code	Description
R	Control output	N	Indicator - Without control output
		R	Relay output + SSR drive output※1
4	Power supply	2	24VAC 50/60Hz, 24-48VDC
		4	100-240VAC 50/60Hz
1	Alarm output	N	No alarm output
		1	Alarm 1 output
		2	Alarm 1 output + Alarm 2 output※2
S	Size	S	DIN W48×H48mm (terminal block type)
		SP	DIN W48×H48mm (11-pin plug type)※3
		Y	DIN W72×H36mm
		M	DIN W72×H72mm
		H	DIN W48×H96mm
		W	DIN W96×H48mm
		L	DIN W96×H96mm
4	Digit	4	9999 (4-digit)
C	Setting type	C	Set by touch switch
T	Item	T	Temperature controller

※1: In case of the AC voltage model, SSR drive output method (standard ON/OFF control, cycle, control, phase control) is available to select.
※2: It is unavailable for TC4SP, TC4Y.
※3: 11-pin socket (PG-11, PS-11(N)) for TC4SP: sold separately.

■ Specifications

Series		TC4S	TC4SP	TC4Y	TC4M	TC4W	TC4H	TC4L
Power supply	AC power	100-240VAC 50/60Hz						
	AC/DC power	24VAC 50/60Hz, 24-48VDC						
Allowable voltage range		90 to 110% of rated voltage						
Power consumption	AC power	Max. 5VA (100-240VAC 50/60Hz)						
	AC/DC power	Max. 5VA (24VAC 50/60Hz), Max. 3W (24-48VDC)						
Display method		7-segment (red), Other display (green, yellow, red) LED						
Character size (W×H)		7.0×15.0mm		7.4×15.0mm	9.5×20.0mm	9.5×20.0mm	7.0×14.6mm	11.0×22.0mm
Input type	RTD	DPt100Ω, Cu50Ω (allowable line resistance max. 5Ω per a wire)						
	Thermocouple	K(CA), J(IC), L(IC)						
Display accuracy※1	RTD	• At room temperature (23℃±5℃): (PV ±0.5% or ±1℃, select the higher one) ±1-digit • Out of room temperature range: (PV ±0.5% or ±2℃, select the higher one) ±1-digit ※For TC4SP, add ±1℃ by accuracy standard.						
	Thermocouple							

※1: Thermocouple L(IC) type, RTD Cu50Ω
- At room temperature (23℃ ±5℃): (PV ±0.5% or ±2℃, select the higher one) ±1-digit
- Out of room temperature range: (PV ±0.5% or ±3℃, select the higher one) ±1digit

In case of TC4SP Series, ±1℃ will be added.

Specifications

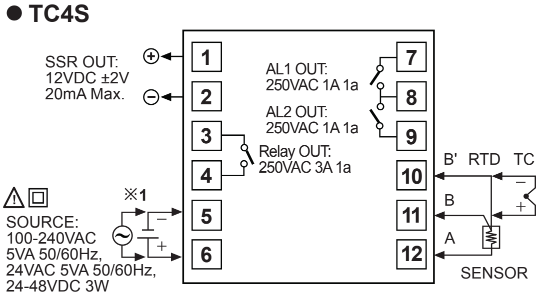
Series		TC4S	TC4SP	TC4Y	TC4M	TC4W	TC4H	TC4L
Control output	Relay	250VAC 3A 1a						
	SSR	12VDC ±2V 20mA Max.						
Alarm output		AL1, AL2 Relay: 250VAC 1A 1a (※TC4SP, TC4Y have AL1 only.)						
Control method		ON/OFF and P, PI, PD, PID control						
Hysteresis		1 to 100℃/℉ (0.1 to 50.0℃/℉) variable						
Proportional band (P)		0.1 to 999.9℃/℉						
Integral time (I)		0 to 9999 sec						
Derivative time (D)		0 to 9999 sec						
Control period (T)		0.5 to 120.0 sec						
Manual reset		0.0 to 100.0%						
Sampling period		100ms						
Dielectric strength	AC power	2,000VAC 50/60Hz for 1 min (between input terminal and power terminal)						
	AC/DC power	1,000VAC 50/60Hz for 1 min (between input terminal and power terminal)						
Vibration		0.75mm amplitude at frequency of 5 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours						
Relay life cycle	Mechanical	OUT: Over 5,000,000 operations, AL1/2: Over 5,000,000 operations						
	Electrical	OUT: Over 200,000 operations (250VAC 3A resistive load) AL1/2: Over 300,000 operations (250VAC 1A resistive load)						
Insulation resistance		Over 100MΩ (at 500VDC megger)						
Noise immunity		Square-wave noise by noise simulator (pulse width 1us) ±2kV R-phase and S-phase						
Memory retention		Approx. 10 years (when using non-volatile semiconductor memory type)						
Environ-ment	Ambient temperature	-10 to 50℃, Storage: -20 to 60℃						
	Ambient humidity	35 to 85%RH, Storage: 35 to 85%RH						
Insulation type		Double insulation or reinforced insulation (mark: ⧈, Dielectric strength between the measuring input part and the power part: AC power 2kV, AC/DC Power 1kV)						
Approval		CE cULus						
Weight※2		Approx. 141g (approx. 94g)	Approx. 123g (approx. 76g)	Approx. 174g (approx. 85g)	Approx. 204g (approx. 133g)	Approx. 194g (approx. 122g)	Approx. 194g (approx. 122g)	Approx. 254g (approx. 155g)

※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

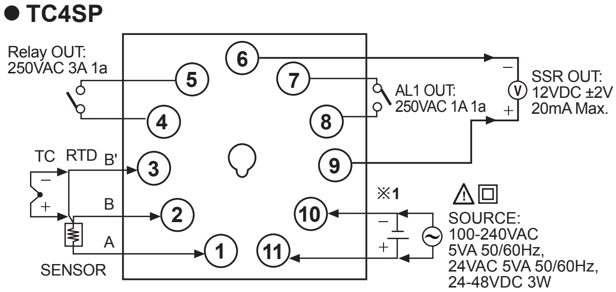
Connections

※TC4 Series has selectable control output; Relay output, and SSR drive output. AC/DC power type does not have SSRP function.

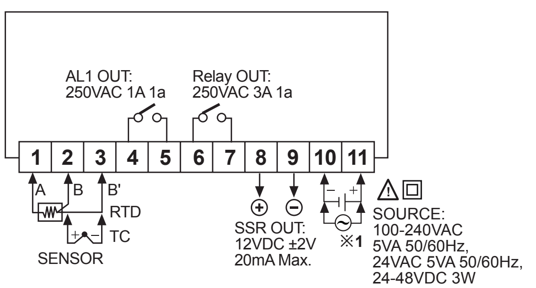
● TC4S



● TC4SP

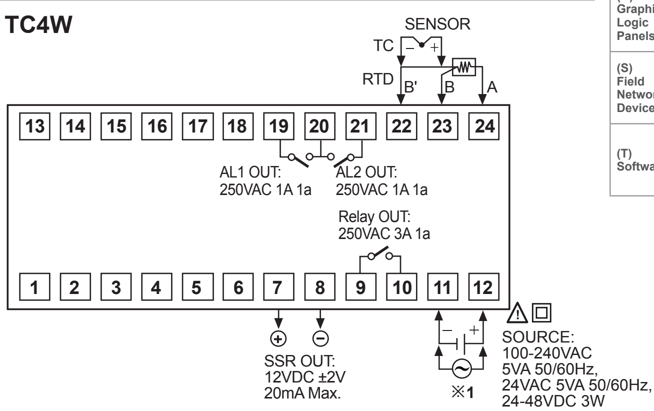


● TC4Y

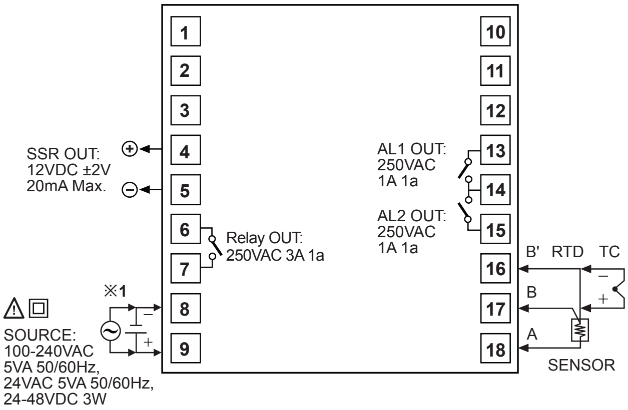


※1: AC power: 100-240VAC 5VA 50/60Hz
AC/DC power: 24VAC 5VA 50/60Hz, 24-48VDC 3W

● TC4W

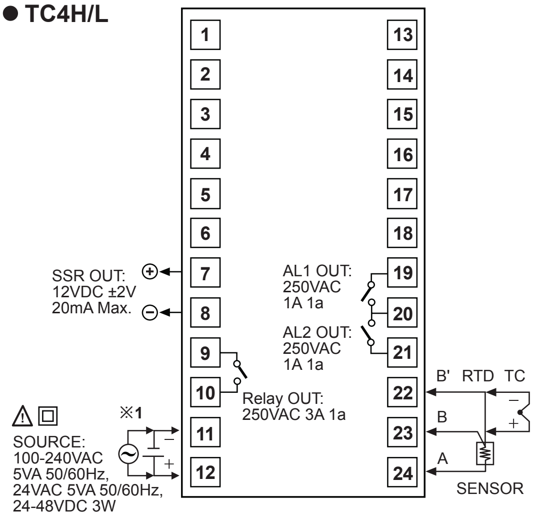


● TC4M



※1: AC power: 100-240VAC 5VA 50/60Hz
AC/DC power: 24VAC 5VA 50/60Hz, 24-48VDC 3W

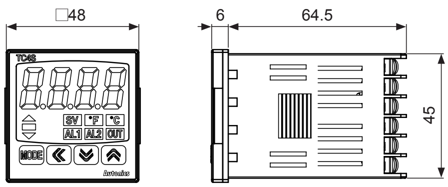
● TC4H/L



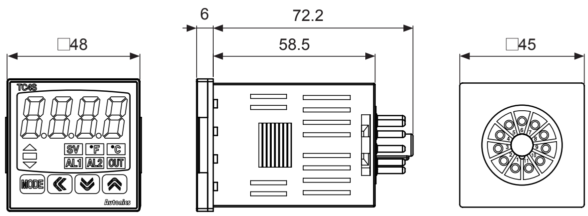
▣ Dimensions

(unit: mm)

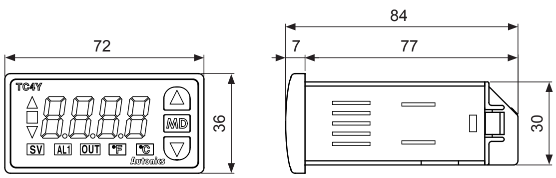
● TC4S



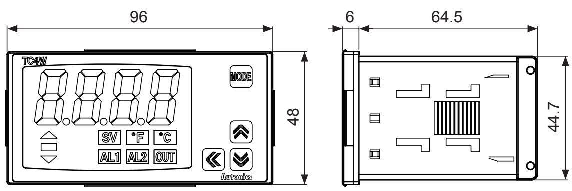
● TC4SP



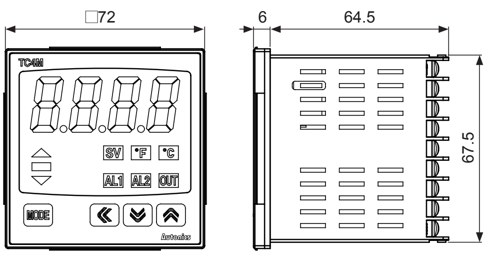
● TC4Y



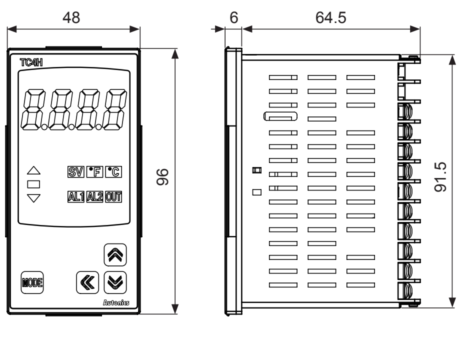
● TC4W



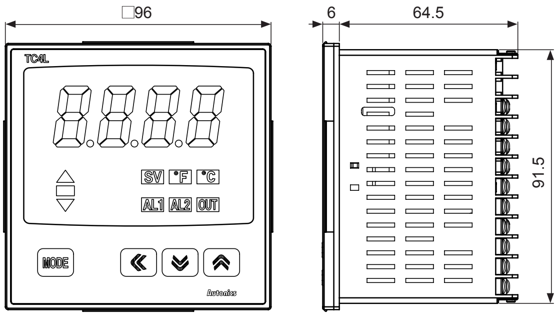
● TC4M



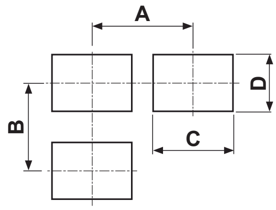
● TC4H



TC4L



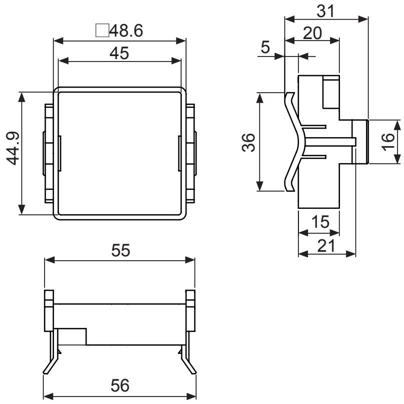
Panel cut-out



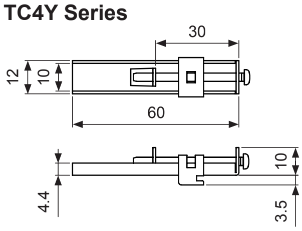
Size / Model	A	B	C	D
TC4S	Min. 65	Min. 65	$45^{+0.6}_{0}$	$45^{+0.6}_{0}$
TC4SP	Min. 65	Min. 65	$45^{+0.6}_{0}$	$45^{+0.6}_{0}$
TC4Y	Min. 91	Min. 40	$68^{+0.7}_{0}$	$31.5^{+0.5}_{0}$
TC4M	Min. 90	Min. 90	$68^{+0.7}_{0}$	$68^{+0.7}_{0}$
TC4H	Min. 65	Min. 115	$45^{+0.6}_{0}$	$92^{+0.8}_{0}$
TC4W	Min. 115	Min. 65	$92^{+0.8}_{0}$	$45^{+0.6}_{0}$
TC4L	Min. 115	Min. 115	$92^{+0.8}_{0}$	$92^{+0.8}_{0}$

Bracket

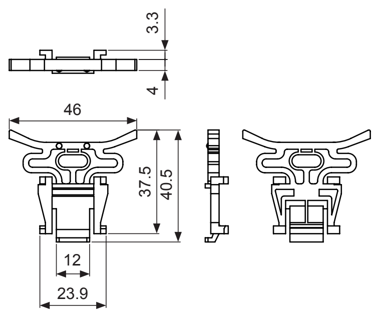
TC4S/TC4SP Series



TC4Y Series

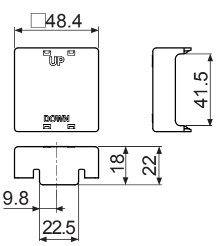


TC4M, TC4W, TC4H, TC4L Series

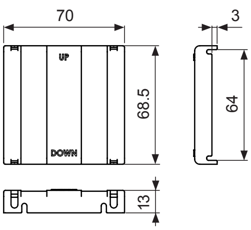


Terminal cover (sold separately)

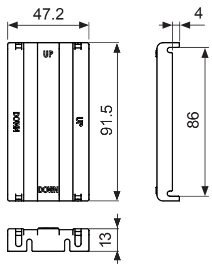
RSA-COVER
(48×48mm)



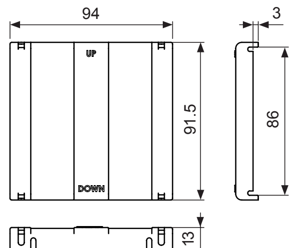
RMA-COVER
(72×72mm)



RHA-COVER
(48×96mm)

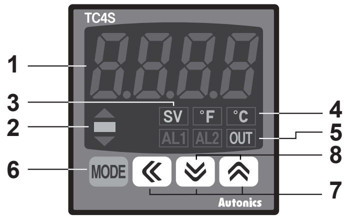


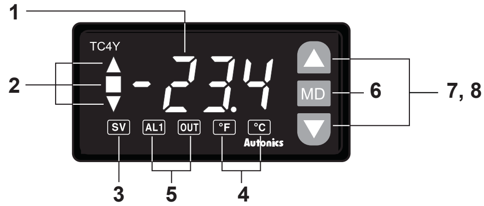
RLA-COVER
(96×96mm)



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Unit Description





1. Present temperature (PV) display
- RUN mode: Present temperature (PV) display.
- Parameter setting mode: Parameter or parameter setting value display.

2. Deviation indicator, Auto-tuning indicator
It shows current temperature (PV) deviation based on set temperature (SV) by LED.

No.	PV deviation temp.	Deviation display
1	Over 2℃	▲ indicator ON
2	Below ±2℃	▬ indicator ON
3	Under -2℃	▼ indicator ON

The deviation indicators (▲, ▬, ▼) flash by every 1 sec when operating auto tuning.

3. Set temperature (SV) indicator
Press any front key once to check or change current set temperature (SV), the set temperature (SV) indicator is ON and preset set value is flashed.

4. Temperature unit (℃/℉) **indicator**
It shows current temperature unit.

5. Control/alarm output indicator
- OUT: It will turn ON when control output (Main Control Output) is ON.

※In case of CYCLE/PHASE control of SSR drive output, it will turn ON when MV is over 3.0%. (only for AC voltage type)

- AL1/AL2: It will light up when alarm output Alarm 1/ Alarm 2 are on.

6. [MODE] key
Used when entering into parameter group, returning to RUN mode, moving parameter, and saving setting values.

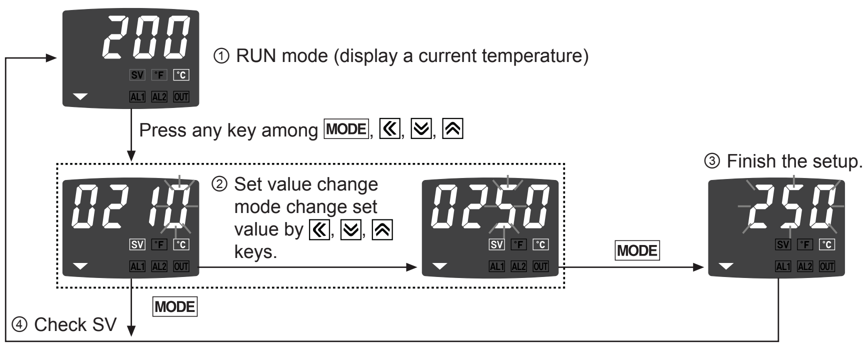
7. Adjustment
Used when entering into set value change mode, digit moving and digit up/down.

8. FUNCTION key
Press [⩔]+[⩓] keys for 3 sec to operate function (RUN/ STOP, alarm output cancel, auto-tuning) set in inner parameter [dI-K].

※Press [⩔]+[⩓] keys at the same time in set value operation to move digit.

▣ SV Setting

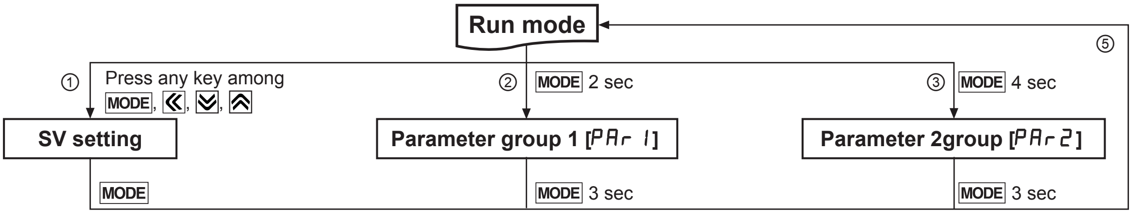
※In case of changing set temperature from 210℃ to 250℃.



▣ Parameter Reset

Reset all parameters as factory default. Hold the front [≪]+[⩔]+[⩓] keys for 5 sec, to enter parameter reset [InIt] parameter. Select 'YES' and all parameters are reset as factory default. Select 'no' and previous settings are maintained. If setting parameter lock [LoC] or processing auto-tuning, parameter reset is unavailable.

■ Parameter Group



④

AL1	AL1 alarm temperature
AL2	AL2 alarm temperature
At	Auto tuning
P	Proportional band
I	Integral time
d	Derivative time
rSEt	Manual reset (Normal deviation correction)
HYS	ON/OFF control hysteresis

In-t	Input type
UnIt	Temperature unit
In-b	Input correction
MAv.F	Input digital filter
L-Sv	SV low-limit value
H-Sv	SV high-limit value
o-Ft	Control output operation
C-Md	Control type
oUt	Control output
SSr.M	SSR drive output method※1
t	Control cycle
AL-1	AL1 alarm operation mode
AL-2	AL2 alarm operation mode
AHYS	Alarm output hysteresis
LbA.t	LBA monitoring time
LbA.b	LBA detection range
dI-K	Digital input key
Er.Mv	Control output MV in case of input break error
LoC	Parameter lock

※1: It is not displayed for AC/DC power model (TC4□-□2R).
※If no key entered for 30 sec, it returns to RUN mode automatically and the set value of parameter is not be saved.
※[dashed box] This parameter might not be displayed depending on other parameter settings.

① Press any key once in RUN mode, it advances to set value setting group.
② Press MODE key over 2 sec in RUN mode, it advances to parameter group 1.
③ Press MODE key over 4 sec in RUN mode, it advances to parameter group 2.
④ First parameter will be displayed on viewer when it advances to the setting group.
⑤ Press MODE key over 3 sec in the setting group, it returns to RUN mode.
※Exception: Press MODE key once in SV setting group it returns to RUN mode.

※Press MODE key again within a sec after return to RUN mode by press MODE key over 3 sec, it advances to the first parameter of previous setting group.

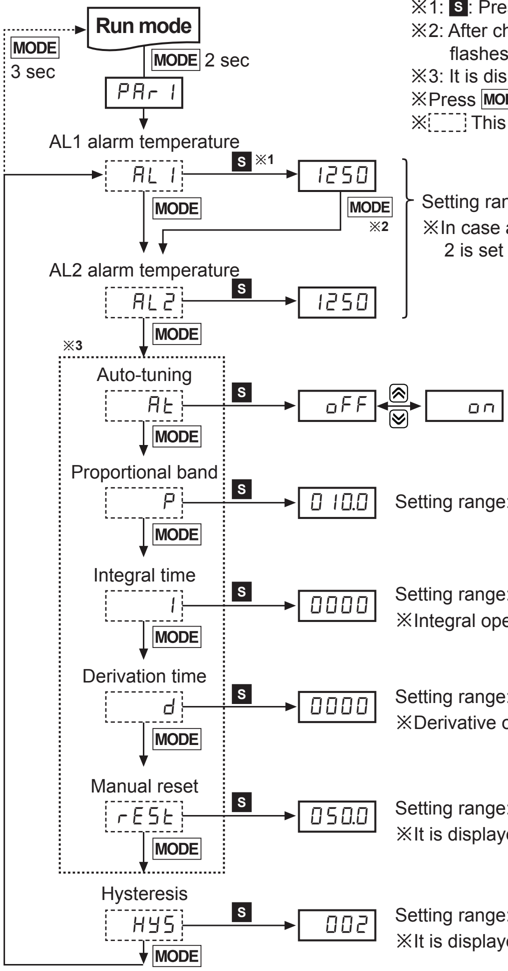
※Parameter setup

Parameter group 2 → **Parameter group 1** → **SV setting**

- Set parameter as the above considering parameter relation of each setting group.
- Check parameter set value after change parameter of setting group 2.

※Indicator model (TC4□-N□N)displays shaded parameter ( ) of parameter group 2.
※Alarm operation mode [AL-1, AL-2] parameter of parameter group 2 is decided whether to display according by alarm output type.
※If alarm operation mode [AL-1, AL-2] of parameter group 2 is set to AM0._ / SbA.□ / LbA.□, AHYS parameter is not displayed.

■ Parameter Group 1



※1: S: Press any key among ≪, ≫, ≈.
※2: After checking/changing set value at each parameter, and press MODE key, set value flashes twice and it moves to next parameter automatically.
※3: It is displayed when control type parameter [C-ṁd] of parameter 2group is set PId.
※Press MODE key for 3 sec to return RUN mode at any parameter.
※[ ] This parameter might not be displayed depending on other parameter settings.

Setting range: Deviation alarm (- [F.S] to [F.S], Absolute value alarm (temperature range)
※In case alarm operation mode [AL-1, AL-2], Aṁ0._ / SbA.□ / LbA.□ of parameter group 2 is set to [AL-1, AL-2], no parameters is displayed.

※It starts to operate auto-tuning when it is ON and set as OFF automatically after finish the operation.
※**Deviation indicators** (▲, ■, ▼) flash (cycle:1 sec) during auto tuning function.

Setting range: 0.1 to 999.9℃/℉

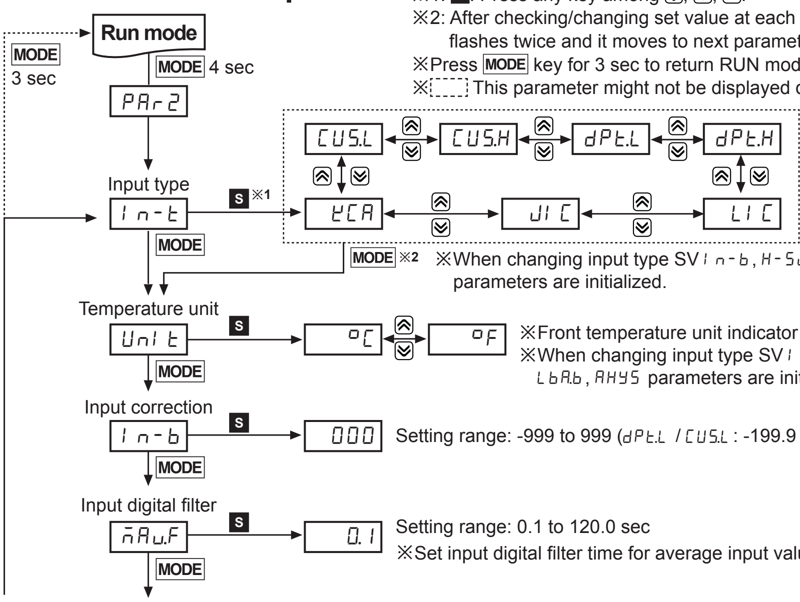
Setting range: 0 to 9999 sec
※Integral operation will be OFF when set value is "0".

Setting range: 0 to 9999 sec
※Derivative operation will be OFF when set value is "0".

Setting range: 0.0 to 100.0%
※It is displayed in P/PD control.

Setting range: 1 to 100℃/℉ (0.1 to 50.0℃/℉)
※It is displayed when control type parameter [C-ṁd] of parameter group 2 is set onoF.

■ Parameter Group 2



※1: S: Press any key among ≪, ≫, ≈.
※2: After checking/changing set value at each parameter, and press MODE key, set value flashes twice and it moves to next parameter automatically.
※Press MODE key for 3 sec to return RUN mode at any parameter.
※[ ] This parameter might not be displayed depending on other parameter settings.

※When changing input type SV In-b, H-Su, L-Su, AL1, AL2, LbA.t, LbA.b, AHYS parameters are initialized.

※Front temperature unit indicator will flash when selecting the unit.
※When changing input type SV In-b, H-Su, L-Su, AL1, AL2, LbA.t, LbA.b, AHYS parameters are initialized.

Setting range: -999 to 999 (dPt.L / CUS.L : -199.9 to 999.9)

Setting range: 0.1 to 120.0 sec
※Set input digital filter time for average input value affected control, and display value.

- **SV low-limit value** [L-SV] —S→ [-050] (MODE)
  - Setting range: Within the rated temperature range by input sensor [L-SV ≤ (H-SV-1-digit)]
  - ※When changing SV low-limit value, if SV<L-SV, SV is initialized as L-SV.
- **SV high-limit value** [H-SV] —S→ [1200] (MODE)
  - Setting range: Within the rated temperature range by input sensor [H-SV ≥ (L-SV+1digit)]
  - ※When changing SV high-limit value, if SV>H-SV, SV is initialized as H-SV.

※In case of changing input sensor type [IN-T], it changes automatically as max./min. value of the changed input sensor.

- **Control output operation** [O-FT] —S→ [HEAT] ⇄ [COOL] (MODE)
  - ※When changing control output operation, ER.MV is initialized.
- **Control type** [C-MD] —S→ [PID] ⇄ [ONOF] (MODE)
  - ※When changing control type, ER.MV is initialized (control output MV is below 100%) and DI-K turns OFF automatically.
- **Control output type** [OUT] —S→ [RLY] ⇄ [SSR] (MODE)
  - ※Operates only selected output between Relay or SSR.
- **SSR dirve output method** [SSR.M] —S→ [STND] ⇄ [CYCL] ⇄ [PHAS] (MODE)
  - ※It is displayed when selecting control output [OUT] as SSR. For AC/DC power type (TC4□-□2R), this parameter [SSR.M] is not displayed.
- **Control cycle** [T] —S→ [020.0] (MODE)
  - Setting range: 0.5 to 120.0 sec
  - ※If control output [OUT] is set as RLY, factory default is 20.0 sec, or set as SSR drive output [SSR], factory default is 2.0 sec.
  - ※This T will not be displayed when SSR drive output method [SSR.M] is set as CYCL, PHAS.
- **AL1 alarm operation** [AL-1] —S→ [AM1.A] ⇄ [LBA.A] (※Alarm operation) ⇄ [AM1.A] ⇄ [AM1.B] (※Alarm option) (MODE)
  - ※Press « key to convert alarm operation mode into alarm option.
  - ※Refer to page H-82.
- **AL2 alarm operation** [AL-2] —S→ [AM2.A] (MODE)
  - ※Same with the above [AL-1].
  - ※When changing alarm operation AL1, AL2 alarm temperature of AL1, AL2 is initialized.
- **Alarm output hysteresis** [AHYS] —S→ [001] (MODE)
  - Setting range: 1 to 100°C/°F (DPT.L / CYS.L : 0.1 to 50.0°C)
  - ※If AL1, AL2 alarm operation [AL-1, AL-2] is set to AM0._, SBA□, LBA□, AHYS parameter is not displayed.
- **LBA monitoring time** [LBA.T] —S→ [0] (MODE)
  - Setting range: 0 to 9999 sec (Automatically setting with Auto-tuning)
  - ※LBA.T parameter is displayed when AL1, AL2 alarm operation [AL-1, AL-2] is set as LBA□.
- **LBA detection band** [LBA.B] —S→ [002] (MODE)
  - Setting range: 0 to 999°C/°F (DPT.L / CUS.: 0.0 to 999.9°C/°F) (automatically setting with auto-tuning)
  - ※When alarm operation mode [AL-1, AL-2] is set as loop break alarm (LBA) [LBA□], and LBA.T parameter does not set as 0, LBA.B parameter is displayed.
- **Digital input key** [DI-K] —S→ [OFF] ⇄ [STOP] ⇄ [AL.RE] ⇄ [AT] (MODE)
  - Press ≫ + ≪ keys for 3 sec and it executes the set function. For more information, refer to ■ Functions '◎Digital input key'.
  - ※AL.RE is not displayed for not alarm output model.
  - ※AT is not displayed when control type parameter [C-MD] is set ONOF.
- **Control output MV in case of input break error** [ER.MV] —S→ [000.0] (MODE)
  - Setting range: 0.0 to 100.0%
  - ※0.0/100.0% is displayed when control type parameter [C-MD] is set ONOF.
  - ※When changing PID control to ON/OFF control, if MV is below 100.0%, it is initialized as 0.0%.
- **Parameter lock** [LOC] —S→ [OFF] ⇄ [LOC1] ⇄ [LOC2] ⇄ [LOC3] (MODE)
  - ※For indicator model (TC4□-N□N), only OFF, LOC1 are available.

■ Input Sensor And Temperature Range [In-t]

Input sensor		Display	Input range (℃)	Input range (℉)
Thermocouple	K(CA)	KCA	-50 to 1200	-58 to 2192
	J(IC)	JIC	-30 to 500	-22 to 932
	L(IC)	LIC	-40 to 800	-40 to 1472
RTD	DPt100Ω	dPt.H	-100 to 400	-148 to 752
		dPt.L	-100.0 to 400.0	-148.0 to 752.0
	Cu50Ω	CUS.H	-50 to 200	-58 to 392
		CUS.L	-50.0 to 200.0	-58.0 to 392.0

■ Factory Default

● SV setting

Parameter	Factory default
–	0

● Parameter group 1

Parameter	Factory default
AL1	1250
AL2	
At	oFF
P	010.0
I	0000
d	
rESt	050.0
HYS	002

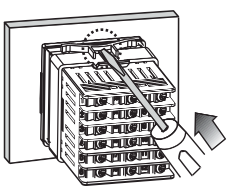
● Parameter group 2

Parameter	Factory default	Parameter	Factory default
In-t	KCA	t	020.0
Unit	°C	AL-1	AM1.A
In-b	0000		
MAu.F	000.1	AL-2	AM2.A
L-Su	-050	AHYS	0001
H-Su	1200	LbA.t	0000
o-Ft	HEAt	LbA.b	002
C-Md	PId	dI-K	StoP
oUt	rLY	Er.Mu	000.0
SSr.M	Stnd	LoC	oFF

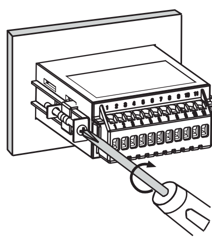
※AC/DC power type has no SSR drive output method [SSr.M] and supports only ON/OFF output when selecting SSr in control output [oUt].

■ Mounting

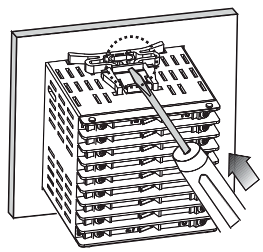
● TC4S/SP (48×48mm) Series



● TC4Y (72×36mm) Series



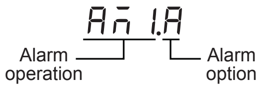
● Other Series



※Mount the product on the panel, fasten bracket by pushing with tools as shown above.
(In case of TC4Y, fasten bolts for bracket.)

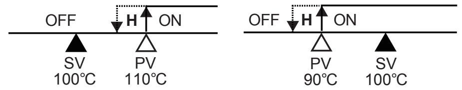
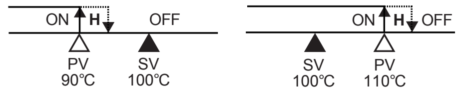
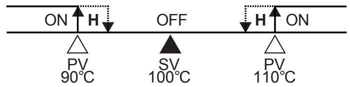
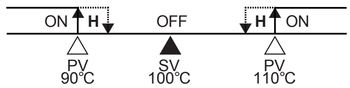
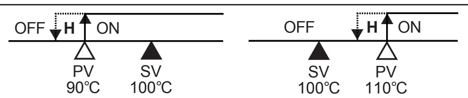
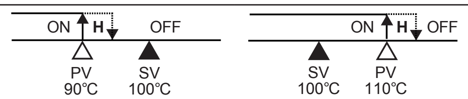
■ Functions

◎ Alarm [AL-1 / AL-2]



Set both alarm operation and alarm option by combining.
Each alarm operates individually in two alarm output models.
When the current temperature is out of alarm range, alarm clears automatically. If alarm option is alarm latch or alarm latch and standby sequence 1/2, press digital input key(▽+△) 3 sec, digital input key[di-K] of Parameter group 2 set as AL.rE), or turn OFF the power and turn ON to clear alarm.

● Alarm operation

Mode	Name	Alarm operation	Description
AM0._	—	—	No alarm output
AM1.□	Deviation high-limit alarm	 High deviation: Set as 10℃ High deviation: Set as -10℃	If deviation between PV and SV as high-limit is higher than set value of deviation temperature, the alarm output will be ON.
AM2.□	Deviation low-limit alarm	 Lower deviation: Set as 10℃ Lower deviation: Set as -10℃	If deviation between PV and SV as low-limit is higher than set value of deviation temperature, the alarm output will be ON.
AM3.□	Deviation high/low-limit alarm	 High/Lower deviation: Set as 10℃	If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be ON.
AM4.□	Deviation high/low-limit reserve alarm	 High/Lower deviation: Set as 10℃	If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be OFF.
AM5.□	Absolute value high limit alarm	 Absolute-value Alarm: Set as 90℃ Absolute-value Alarm: Set as 110℃	If PV is higher than the absolute value, the output will be ON.
AM6.□	Absolute value low limit alarm	 Absolute-value Alarm: Set as 90℃ Absolute-value Alarm: Set as 110℃	If PV is lower than the absolute value, the output will be ON.
SbA.□	Sensor break Alarm	—	It will be ON when it detects sensor disconnection.
LbA.□	Loop break Alarm	—	It will be ON when it detects loop break.

※ H: Alarm output hysteresis [AHYS]

● Alarm option

Mode	Name	Description
AM□.A	Standard alarm	If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.
AM□.b	Alarm latch	If it is an alarm condition, alarm output is ON and maintains ON status. (Alarm output HOLD)
AM□.C	Standby sequence 1	First alarm condition is ignored and from second alarm condition, standard alarm operates. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, standard alarm operates.
AM□.d	Alarm latch and standby sequence 1	If it is an alarm condition, it operates both alarm latch and standby sequence. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, alarm latch operates.
AM□.E	Standby sequence 2	First alarm condition is ignored and from second alarm condition, standard alarm operates. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, standard alarm operates.
AM□.F	Alarm latch and standby sequence 2	Basic operation is same as alarm latch and standby sequence 1. It operates not only by power ON/OFF, but also alarm setting value, or alarm option changing. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, alarm latch operates.

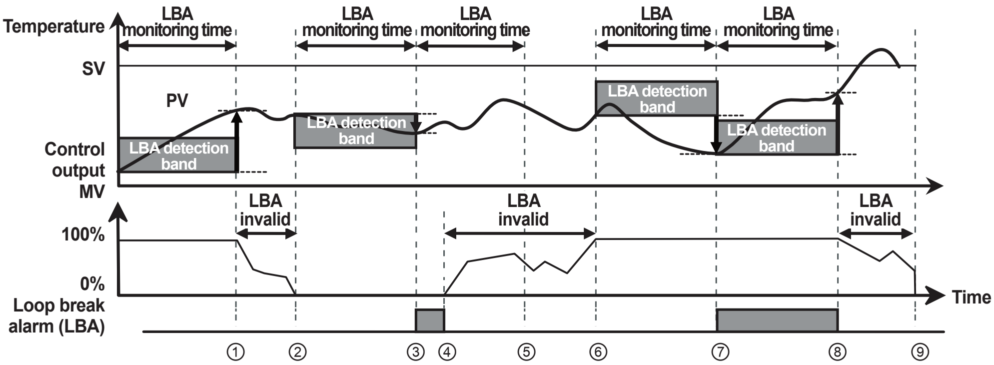
※Condition of re-applied standby sequence for standby sequence 1, alarm latch and standby sequence 1: Power ON
Condition of re-applied standby sequence for standby sequence 2, alarm latch and standby sequence 2: Power ON, changing set temperature, alarm temperature [AL1, AL2] or alarm operation [AL-1, AL-2], switching STOP mode to RUN mode.

◎ Sensor break alarm

The function that alarm output will be ON when sensor is not connected or when sensor's disconnection is detected during temperature controlling. You can check whether the sensor is connected with buzzer or other units using alarm output contact. It is selectable between standard alarm [SbA.A], or alarm latch [SbA.b].

◎ Loop break alarm (LBA)

It checks control loop and outputs alarm by temperature change of the subject. For heating control (cooling control), when control output MV is 100% (0% for cooling control) and PV is not increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], or when control output MV is 0% (100% for cooling control) and PV is not decreased below than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], alarm output turns ON.

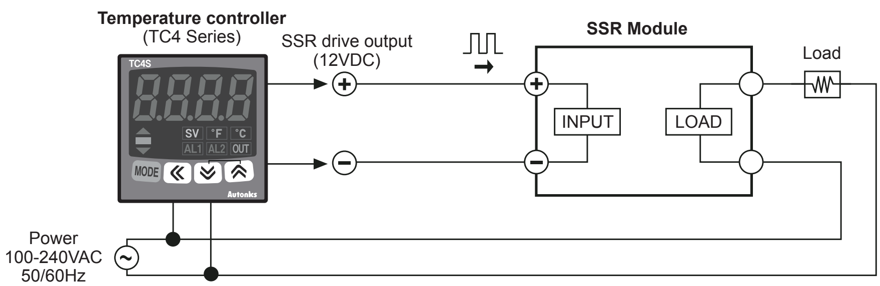


Start control to ①	When control output MV is 0% and PV is not decreased below than LBA detection band [LbA.b] during LBA monitoring time [LbA.t]
① to ②	The status of changing control output MV (LBA monitoring time is reset.)
② to ③	When control output MV is 0% and PV is not decreased below than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], loop break alarm (LBA) turns ON after LBA monitoring time.
③ to ④	Control output MV is 0% and loop break alarm (LBA) turns and maintains ON.
④ to ⑥	The status of changing control output MV (LBA monitoring time is reset.)
⑥ to ⑦	When control output MV is 100% and PV is not increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], loop break alarm (LBA) turns ON after LBA monitoring time.
⑦ to ⑧	When control output MV is 100% and PV is increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t] loop break alarm (LBA) turns OFF after LBA monitoring time.
⑧ to ⑨	The status of changing control output MV (LBA monitoring time is reset.)

※When executing auto-tuning, LBA detection band [LbA.b] and LBA monitoring time are automatically set based on auto tuning value. When AL1, AL2 alarm operation [AL-1, AL-2] is set as loop break alarm (LBA) [LbA.□], LBA detection band [LbA.b] and LBA monitoring time [LbA.t] parameter is displayed.

◎ SSR drive output function (SSRP function) [SSr.m]

- SSRP function is selectable one of standard ON/OFF control, cycle control, phase control by utilizing standard SSR drive output.
- Realizing high accuracy and cost effective temperature control as linear output(cycle control and phase control).
- Select one of standard ON/OFF control [Stnd], cycle control [CYCL] , phase control [PHAS] at [SSr.m] parameter of Parameter group 2. For cycle control, connect zero cross turn-on SSR or random turn-on SSR. For phase control, connect random turn-on SSR.



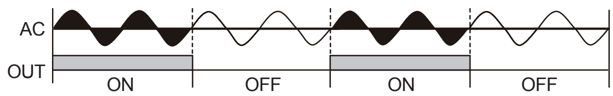
※When selecting cycle or phase control mode, **the power supply for load and temperature controller must be the same.**

※In case of selecting cycle [CYCL] or phase [PHAS] control mode for PID control, control cycle [t] is not allowed to set.

※For AC/DC power model (TC4□-□2R), this parameter [SSr.m] is not displayed and it is available only standard control by relay or SSR.

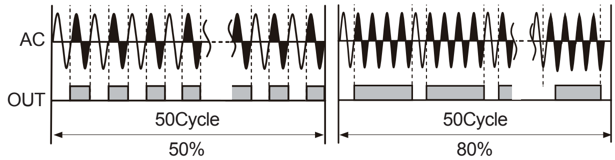
● **Standard ON/OFF control mode [StNd]**

A mode to control the load in the same way as Relay output type.
(ON: output level 100%, OFF: output level 0%)



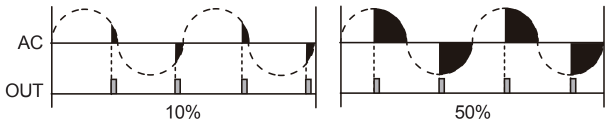
● **Cycle control [CYCL]**

A mode to control the load by repeating output ON / OFF according to the rate of output within setting cycle. Having improved ON / OFF noise feature by Zero Cross type.



● **Phase control [PHAS]**

A mode to control the load by controlling the phase within AC half cycle. Serial control is available.
RANDOM Turn-on type SSR must be used for this mode.



◎ Auto tuning [At]

- When setting At parameter to on, front temperature unit display (℃ or ℉) indicator will be flickering during Auto tuning. After completing auto tuning, temperature unit display indicator returns to normal operation and At parameter automatically becomes [on → oFF].
- Set as oFF to stop auto tuning.
  ※It keeps previous P, I, D set values.
- If SV is changed during auto tuning mode, auto tuning is stopped.
- PID time constants figured out through auto tuning function can be changed.
- If control method [C-Md] is set to onoF, no parameters are displayed.
- Finish auto tuning when [oPEn] error occurs during the operation.

※In case of [oPEn] error, auto tuning operation is not applicable.

◎ Input correction [In-b]

Controller itself does not have errors but there may be error by external input temperature sensor.

E.g.)If actual temperature is 80℃ but controller displays 78℃, set input correction value [In-b] as 002 and controller displays 80℃.

※As the result of input correction, if current temperature value (PV) is over each temperature range of input sensor, it displays HHHH or LLLL.

◎ Input digital filter [MAv.F]

If current temperature (PV) is fluctuating repeatedly by rapid change of input signal, it reflects to MV and stale control is impossible. Therefore, digital filter function stabilizes current temperature value.

- For example, set input digital filter value as 0.4 sec, and it applies digital filter to input values during 0.4 sec and displays this values. Current temperature may be different by actual input value.

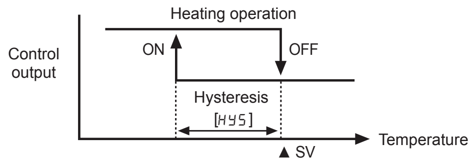
◎ Control method selection [C-Md]

It is selectable PID, ON/OFF control.

- In case of ON/OFF [onoF] mode, Hysteresis [HYS] parameter is displayed.
- In case of PID [PId] mode, Proportional band [P], Integral time [I], and Derivative time [d] parameters are displayed.

◎ Hysteresis [HYS]

- Set control output ON / OFF interval in ON / OFF control mode.



- If Hysteresis is too narrow, hunting (oscillation, chattering) could occur due to external noise.
- In case of ON / OFF control mode, even if PV reaches stable status, there still occurs hunting. It could be due to Hysteresis [HYS] SV, load's response characteristics or sensor's location. In order to reduce hunting to a minimum, it is required to take into following factors consideration when designing temp. controlling; proper Hysteresis [HYS], heater's capacity, thermal characteristics, sensor's response and location.

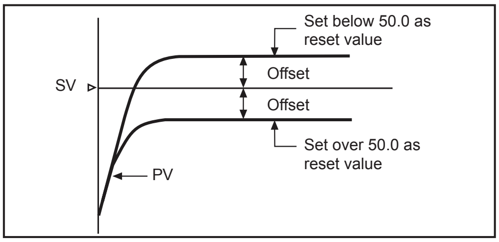
◎ Temperature unit selection [UnIt]

- A function to select display temperature unit
- Unit display indicator will be ON when converting temperature unit.

◎ Manual reset [rESt]

When selecting P/PD control mode, certain temperature difference exists even after PV reaches stable status because heater's rising and falling time is inconsistent due to thermal characteristics of controlled objects, such as heat capacity, heater capacity. This temperature difference is called offset and manual reset [rESt] function is to set/ correct offset.

- When PV and SV are equal, reset value is 50.0%. After control is stable, PV is lower than SV, reset value is over 50.0% or PV is higher than SV, reset value is below 50.0%.
- Manual reset [rESt] by control result



※Manual reset function is applicable only to P / PD control mode.

◎ Control output MV when input sensor line is broken [Er.MV]

The function to set control output MV in case of open error. Users are able to set by ON/OFF setting or MV setting. It executes control output by set MV regardless of ON/OFF or PID control output.

◎ Cool / Heat function [o-Ft]

Generally there are two ways to control temperature, one (Heat-function) is to heat when PV is getting down (Heater). The other (Cool-function) is to cool when PV is getting higher (Freezer).

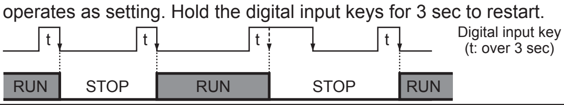
These functions are operating oppositely when it is ON/OFF control or proportional control. But in this case PID time constant will be different due to PID time constant will be decided according to control system when it is PID control.

- Cool-function [CooL] and heat-function [HEAt] must be set correctly according to the application, if set as opposite function, it may cause a fire. (If set cool-function [CooL] at heater, it will be maintained ON and it may cause a fire.)
- Avoid changing heat-function to cool-function or cool-function to heat-function when the unit is operating.
- It is impossible to operate both function at once in this unit. Therefore, only one function should be selected only.

◎ SV High/Low limit [H-SV / L-SV]

- It sets SV high/low limit Limit range of using temperature within temperature range for each sensor, user can set/ change set temperature (SV) within SV high limit [H-SV] to SV low limit [L-SV]. (※ L-SV > H-SV cannot be set.)
- When changing input type [In-t], SV high limit [H-SV] and SV low limit [L-SV] of using temperature will be initialized as max./min. value of sensor temperature range automatically.

◎ Digital input key (⩔ + ⩓ 3 sec) [dI-K]

Parameter		Operation
OFF	oFF	It does not use digital input key function.
RUN/STOP	StoP	Pauses control output. Auxiliary output (except loop break alarm, sensor break alarm)except Control output operates as setting. Hold the digital input keys for 3 sec to restart. 
Clear alarm	AL.rE	Clears alarm output by force. (only when alarm option is alarm latch, or alarm latch and standby sequence 1/2 .) This function is applied when present value is out of alarm operation range but alarm output is ON. Alarm operates normally right after clearing alarm.
Auto-tuning	At	Starts/Stops auto-tuning. This function is same as auto-tuning[At] of parameter group 1. (You can start auto-tuning [At] of parameter group 1 and stop it by digital input key.) ※This parameter At appears only when control method [C-Md] Parameter group 2 is set as PId. When control method [C-Md] Parameter group 2 is set as onoF, this parameter is changed as oFF.

◎ Parameter lock [LoC]

A function to prevent changing SV and parameters of each setting group. Parameter setting values are still possible to check when parameter lock is set.

Display	Description
oFF	Lock off
LoC1	Lock parameter group 2
LoC2	Lock parameter group 1, 2
LoC3	Lock parameter group 1, 2, SV setting

※ oFF, LoC1 are available only for indicator (TC4□-N□N).

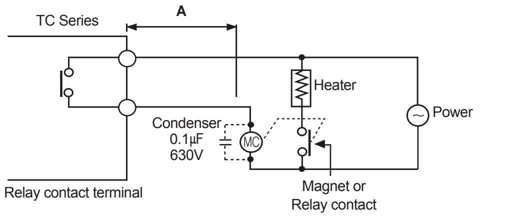
◎ Error

Display	Description	Troubleshooting
oPEn	Flashes if input sensor is disconnected or sensor is not connected.	Check input sensor state.
HHHH	Flashes if measured sensor input is higher than temperature range.	When input is within the rated temperature range, this display disappears.
LLLL	Flashes if measured sensor input is lower than temperature range.	

◎ Output connections

Refer to page H-170 for output.

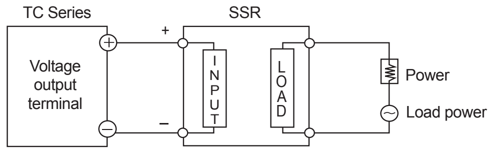
● Application of relay output type



Keep **A** length as long as possible when wiring the temperature controller and the load. If wire length of **A** is short, counter electromotive force which occurs from a coil of magnet switch & power relay may flow in power line of the unit, and it may cause malfunction.

If wire length of **A** is short, please connect mylar condensers 104 (630V) on the both ends of "Ⓜ︎C" (magnet coil) to protect electromotive force.

● Application of SSR drive output method



※SSR should be selected by the capacity of load, otherwise, it may short-circuit and result in a fire. Indirect heated should be used with SSR for efficient working.

※Please use a cooling plate or it may cause the capability deterioration, breakdown of SSR for a long usage.

※Refer to page H-70 for phase/cycle control connections.

▣ Proper Usage

◎ Simple "error" diagnosis

● When the load (Heater etc) is not operated

Please check operation of the OUT indicator located in front panel of the unit.

If the OUT indicator does not operate, please check the parameter of all programmed mode.
If indicator is operating, please check the output (Relay, SSR drive voltage) after separating output line from the unit.

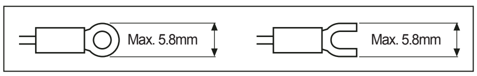
● When it displays oPEn during operation

This is a warning that external sensor is open.
Please turn off the power and check the wire state of the sensor. If sensor is not open disconnect sensor line from the unit and short the input +, - terminal. Turn on the power of the unit and check the controller displays room temperature.

If this unit cannot display room temperature, this unit is broken. Please remove this unit and contact our service center. (When the input mode is thermocouple, it is available to display room temperature.)

◎ Caution during use

- The connection wire of this unit should be separated from the power line and high voltage line in order to prevent from inductive noise.
- For crimp terminal, select following shaped terminal (M3)



- Please install power switch or circuit-breaker in order to cut power supply off.
- The switch or circuit-breaker should be installed near by users.
- This unit is designed for temperature controlling only. Do not apply this unit as a voltage meter or a current meter.
- In case of using RTD sensor, 3-wire type must be used. If you need to extend the line, 3-wire must be used with the same thickness as the line. It might cause temperature difference if the resistance of line is different.
- In case of making power line and input signal line close, line filter for noise protection should be installed at power line and input signal line should be shielded.
- Keep away from the high frequency instruments. (High frequency welding machine & sewing machine, big capacitive SCR controller)
- When supplying measured input, if HHHH or LLLL is displayed, measured input may have problem. Turn off the power and check the line.
- This unit may be used in the following environments.
  - Indoor
  - Altitude: Under 2,000m
  - Pollution degree 2
  - Installation category II

Analog, Non-Display, PID Control Temperature Controller

■ Features

- Improved control performance with built-in microcomputer
- Adopting new Auto-tuning PID control algorithm
  : Selectable ON/OFF, PID control (the external switch)
- Easy to check controlling status with deviation indicators
  : Deviation LED (red, green), output LED (red) indicators
- Dial setting output OFF function
- Sensor broken display function

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

TA | S – B | 4 | R | P | 4 | C

Unit

C	Celsius ℃
F	Fahrenheit ℉

Temperature range for each sensor

	℃	℉	Temperature sensor		
0	-50 to 100	-58 to 212	DPt	–	–
1	0 to 100	32 to 212	DPt	–	K(CA)
2	0 to 200	32 to 392	DPt	J(IC)	K(CA)
3	0 to 300	32 to 572	–	J(IC)	–
4	0 to 400	32 to 752	DPt	J(IC)	K(CA)
6	0 to 600	32 to 1,112	–	–	K(CA)
8	0 to 800	32 to 1,472	–	–	K(CA)
C	0 to 1,200	32 to 2,192	–	–	K(CA)

Sensor input type

P	DPt100Ω
J	J(IC)
K	K(CA)

Control output

R	Relay output
S	SSR drive output

Power supply

4	100-240VAC 50/60Hz

Control method

B	ON/OFF control & PID control combined

Size

S	DIN W48 x H48mm (8-pin plug type)※1
M	DIN W72 x H72mm
L	DIN W96 x H96mm

Item

TA	Analog setting type temperature controller

※1: 8-pin socket (PG-08, PS-08(N)) is sold separately.

■ Specifications

Series		TAS	TAM	TAL
Power supply		100-240VAC 50/60Hz		
Allowable voltage range		90 to 110% of rated voltage		
Power consumption		Max. 4VA		
Size		DIN W48×H48mm	DIN W72×H72mm	DIN W96×H96mm
Display method		Deviation LED (red, green), Output LED (red)		
Setting type		Dial setting		
Setting accuracy ※1		F.S. ±2% (room temperature 23℃±5℃)		
Input type	RTD	DPt100Ω (allowable line resistance max. 5Ω per a wire)		
	Thermocouples	K(CA), J(IC)		
Control	ON/OFF Control	Hysteresis: 2℃ fixed		
	PID Control	Control period: Relay output - 20 sec / SSR drive output - 2 sec		
Control output	Relay	250VAC 3A 1c		
	SSR	12VDC±2V 20mA Max.		

※1: Out of room temperature range: Below 100℃ model is F.S. ±4% , Over 100℃ model is F.S. ±3%

■ Specifications

Series		TAS	TAM	TAL
Functions		PV deviation indicatable, Error indicatable		
Sampling period		100ms		
Dielectric strength		2,000VAC 50/60Hz for 1 min (between input terminal and power terminal)		
Vibration		0.75mm amplitude at frequency of 5 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Relay life cycle	Mechanical	Min. 10,000,000 operations (18,000 operations/hr)		
	Electrical	Min. 100,000 operations (900 operations/hr)		
Insulation resistance		Over 100MΩ (at 500VDC megger)		
Noise immunity		±2kV R-phase, S-phase the square wave noise (pulse width: 1us) by the noise simulator		
Memory retention		Approx. 10 years (when using non-volatile semiconductor memory type)		
Environ-ment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃		
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH		
Insulation type		Double insulation or reinforced insulation (mark: ⧈, dielectric strength between the measuring input part and the power part: 2kV)		
Approval		CE c UL us		
Weight※2		Approx. 112g (approx. 74g)	Approx. 176g (approx. 114g)	Approx. 237g (approx. 152g)

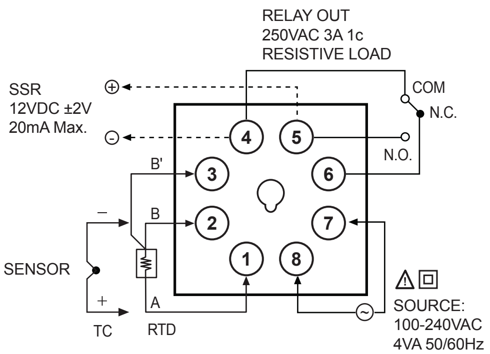
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Connections

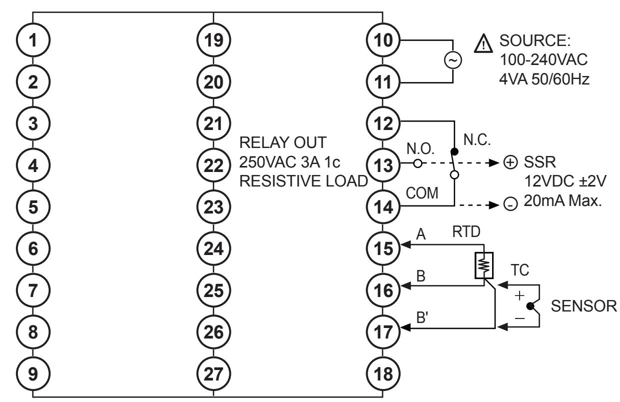
※RTD: DPt100Ω (3-wire type) ※Thermocouple: K(CA), J(IC)

● TAS

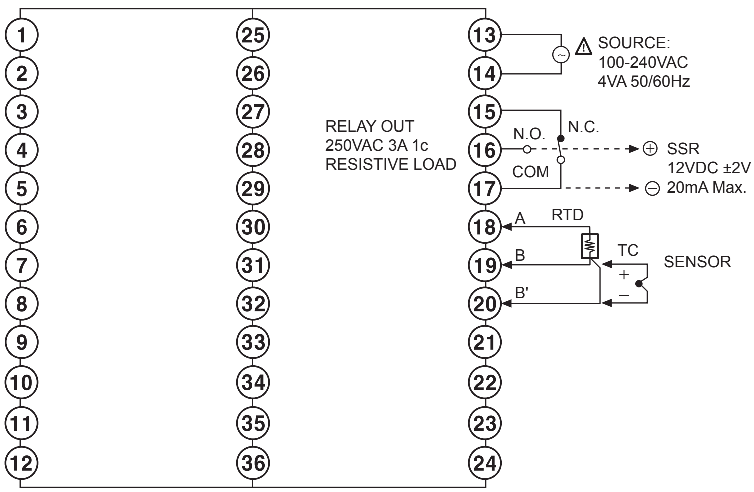
(※Socket (PG-08, PS-08 (N)) is sold separately)



● TAM



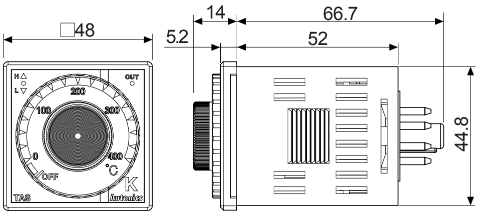
● TAL



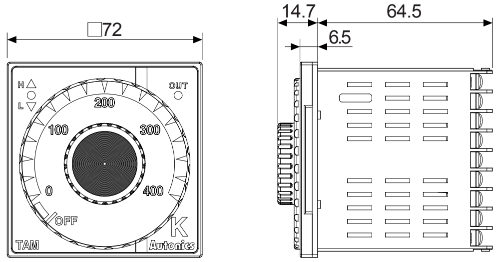
■ Dimensions

(unit: mm)

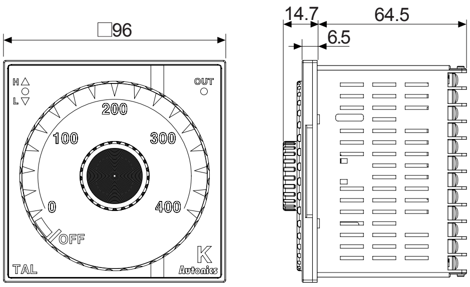
● TAS



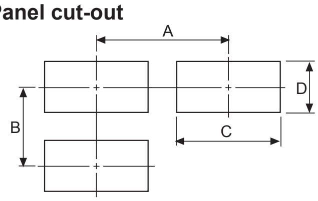
● TAM



● TAL



• Panel cut-out

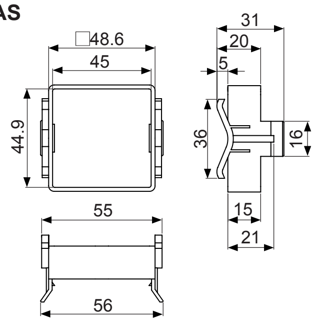


Series \ Size	A	B	C	D
TAS	Min. 65	Min. 65	$45^{+0.6}_{0}$	$45^{+0.6}_{0}$
TAM	Min. 90	Min. 90	$68^{+0.7}_{0}$	$68^{+0.7}_{0}$
TAL	Min. 115	Min. 115	$92^{+0.8}_{0}$	$92^{+0.8}_{0}$

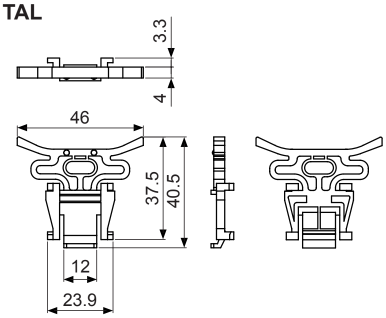
● Bracket

(unit: mm)

• TAS

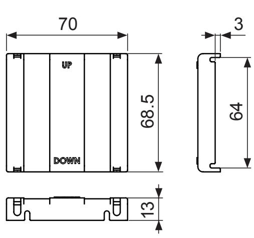


• TAM, TAL

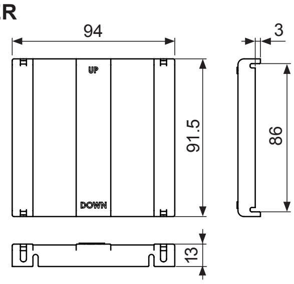


● Terminal cover (sold separately)

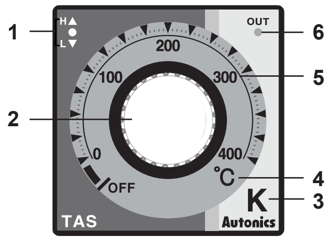
• RMA-COVER
(72×72mm)



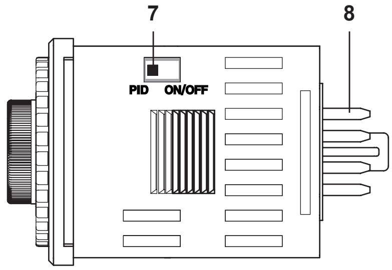
• RLA-COVER
(96×96mm)



▣ Unit Description

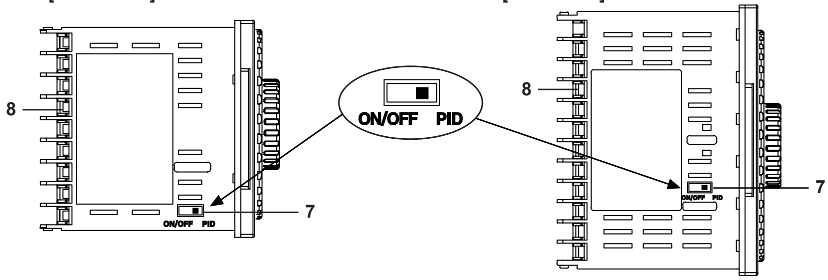


[TAS Series]



[TAM Series]

[TAL Series]



1. Deviation indicator: It shows deviation of present temperature (PV) based on set temperature (SV) by LED.

PV deviation temperature	**Input deviation indicator** [Deviation indicator: ● (green), ▲/▼ (red)]
Input sensor OPEN	▲ + ● + ▼ indicators flash (every 0.5 sec)
Exceed max. input value	▲ indicator flashes (every 0.5 sec)
More than 10℃	▲ indicator turns ON
More than 2℃ to less than or equal to 10℃	▲ + ● indicators turn ON
Less than or equal to ±2℃	● indicator turns ON
More than -2℃ to less than or equal to -10℃	● + ▼ indicators turn ON
More than -10℃	▼ indicator turns ON
Less than min. input value	▼ indicator flashes (every 0.5 sec)

※This is the same as Fahrenheit (℉).
※When power is on, all indicators light for 2 sec, then they turn off and control operation starts.

2. Set temperature (SV) dial:
Dial to change set temperature (SV). When changing set temperature, it is applied after 2 sec for the stable input.

3. Input sensor type:
Indicates sensor type of present value. Input sensor type or input range each product is shown in the below table.

Input sensor		Range No.	Temperature range (℃)	Temperature range (℉)
Thermocouple	K (CA)	1	0 to 100	32 to 212
		2	0 to 200	32 to 392
		4	0 to 400	32 to 752
		6	0 to 600	32 to 1,112
		8	0 to 800	32 to 1,472
		C	0 to 1,200	32 to 2,192
	J (IC)	2	0 to 200	32 to 392
		3	0 to 300	32 to 572
		4	0 to 400	32 to 752
RTD	DPt100Ω	0	-50 to 100	-58 to 212
		1	0 to 100	32 to 212
		2	0 to 200	32 to 392
		4	0 to 400	32 to 752

※Set temperature within input range each sensor.

4. Temperature unit: Indicates temperature unit (℃, ℉) of set temperature (SV) and present value (PV).

5. Temperature range: Indicates temperature range of set temperature (SV).

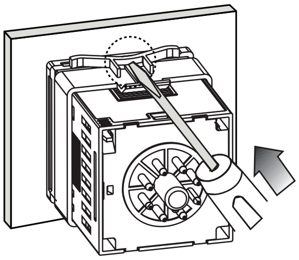
6. Control output indicator: Turns ON when control output (Relay output/SSR drive output).

7. Control mode selector switch: Select PID control (front part) or ON/OFF control (rear part) using switch.

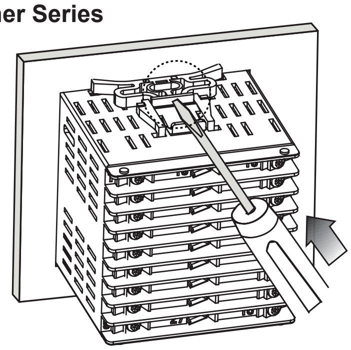
8. Terminal: Terminals for external connections. For detail, refer to ▣ Connections.

▣ Mounting

● **TAS (48×48mm) Series**



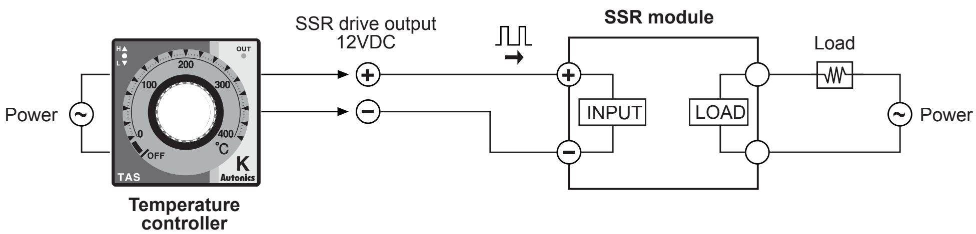
● **Other Series**



※Mount the product on the panel, fasten bracket by pushing with tools as shown above.

▣ Functions

● **SSR drive output**

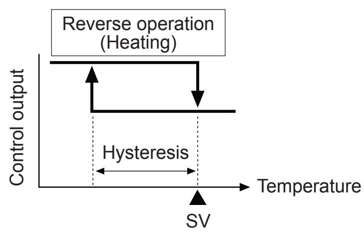


● **ON/OFF control**

ON/OFF control function is for controlling temperature by comparing present temperature (PV) to setting temperature (SV). ON/OFF control is fixed on reverse operation (Heating).

Output turns on to supply power to heater when present temperature (PV) falls lower than setting temperature (SV) and the output turns off to turn off heater when present temperature (PV) is higher then setting temperature (SV).

※Hysteresis is fixed 2℃ during ON/OFF control.



● **PID control**

PID constants are suggested and implemented based on self tuning from supply power until reaching set temperature (SV), then self tuning is over after reaching set temperature (SV).

When power supply, in case that set temperature (SV) dial points at OFF or self tuning can not be started because present temperature (PV) is higher than set temperature (SV) or hunting occurs during self tuning, output control is switched to proportion band (P) because that is considered to error. At that time, proportion band is fixed at 10℃.

※Control cycle of PID control and proportion control is 20 sec in relay output model and 2 sec in SSR drive output model.

● **STOP**

Control output could stop without power off by setting the front setting volume to below min. setting range.
If control output stops by STOP function, Green indicator in deviation indicator (●) will flash every 1 sec.

● **Error**

Error mark will flash (every 1 sec) in PV indicator when error occurs during the control operation.
It will operate normally, if input sensor is connected or returned to normal range.

No	Display		Description
1	▲+●+▼	indicators flash	If input sensor line is broken or sensor is not connected.
2	▲	indicator flashes	If measured sensor input is higher than temperature range.
3	▼	indicator flashes	If measured sensor input is lower than temperature range.

Dual PID Control Temperature Controller

■ Features

- Dual PID auto tuning function:
  High-speed response of PID control to reach to the desired value fast, low-speed of response of PID control to minimize the overshoot even though response is a little bit slow.
- High display accuracy: ±0.3% (by F.S. value of each input)
- 2-step auto tuning control function
- Multi-input function
  (13 kinds of multi-input selection function):
  Temperature sensor, voltage and current selection function.
- Various sub output function:
  Includes in LBA, SBA, 7 kinds of alarm output and 4 kinds of alarm option function, PV transmission output (DC4-20mA), RS485 communication output
- Display the decimal point for analog input

⚠ Please read "Caution for your safety" in operation manual before using.

(except AC/DC voltage type)

■ Ordering Information

TZ | 4 | M — 1 | 4 | R

Item	Model	Code	Description
Control output		R	Relay output
		S	SSR drive output
		C	Current output(DC4-20mA)
Power supply		2	24VAC 50/60Hz, 24-48VDC※1
		4	100-240VAC 50/60Hz
Option output	TZ4SP/TZN4S	1	Event 1 output
	TZ4ST	1	Event 1 output
		2	Event 1 + Event 2 output
		R	Event 1 + PV transmission output(DC4-20mA)
	Others	1	Event 1 output
		2	Event 1 + Event 2 output
		R	Event 1 + PV transmission output(DC4-20mA)
		A	Event 1 + Event 2 + PV transmission output(DC4-20mA)
		T	Event 1 + RS485 communication output
		B	Event 1 + Event 2 + RS485 communication output
Size	TZN4	S	DIN W48×H48mm (terminal block type)
	TZ4	SP	DIN W48×H48mm (plug type)※2
		ST	DIN W48×H48mm (terminal block type)
	TZ4/TZN4	M	DIN W72×H72mm
		W	DIN W96×H48mm
		H	DIN W48×H96mm
		L	DIN W96×H96mm
Digit		4	9999 (4-digit)
Item		TZ	Temperature Controller
		TZN	Temperature Controller

※The unit cannot be configured with any random combination from the above ordering information.
Please refer to ■Specifications for possible configurations.
※1: Only applies to TZ4SP, TZ4ST, TZ4L, and TZN4M.
※2: 11-pin sockets (PG-11, PS-11(N)) are sold separately.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Specifications

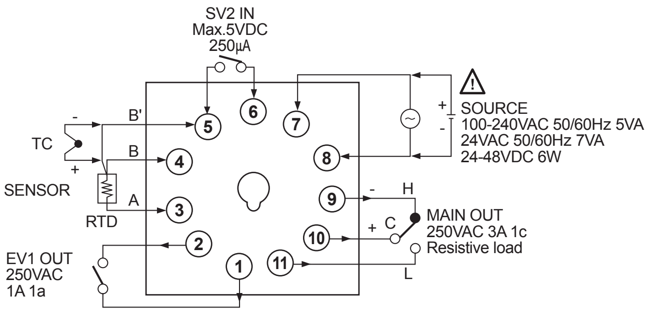
Series		TZ4SP TZN4S	TZ4ST	TZ4M TZN4M	TZ4W TZN4W	TZ4H TZN4H	TZ4L TZN4L
Power supply	AC power	100-240VAC 50/60Hz					
	AC/DC power※1	24VAC 50/60Hz, 24-48VDC					
Allowable voltage range		90 to 110% of rated power voltage					
Power consum-ption	AC power	Max. 5VA (100-240VAC 50/60Hz)		Max. 6VA (100-240VAC 50/60Hz)			
	AC/DC power※1	Max. 7VA (24VAC 50/60Hz), Max. 6W (24-48VDC)		Max. 8VA (24VAC 50/60Hz), Max. 7W (24-48VDC)	—		Max. 8VA(24VAC 50/60Hz), Max. 7W (24-48VDC)
Display method		7-segment LED (PV: red, SV: green)					
Character size	PV (W×H)	**TZ4SP:** 4.8×7.8mm **TZN4S:** 7.8×11.0mm	4.8×7.8mm	**TZ4M:** 9.8×14.2mm **TZN4M:** 8.0×13.0mm	8.0×10.0mm	**TZ4H:** 3.8×7.6mm **TZN4H:** 7.8×11.0mm	9.8×14.2mm
	SV (W×H)	**TZ4SP:** 4.8×7.8mm **TZN4S:** 5.8×8.0mm		**TZ4M:** 8.0×10.0mm **TZN4M:** 5.0×9.0mm		**TZ4H:** 3.8×7.6mm **TZN4H:** 5.8×8.0mm	8.0×10.0mm
Input type	RTD	DPt100Ω, JPt100Ω, 3-wire (allowed resistance: max. 5Ω per line)					
	TC	K(CA), J(IC), R(PR), E(CR), T(CC), S(PR), N(NN), W(TT) (allowed resistance: max. 100Ω per line)					
	Analog	1-5VDC, 0-10VDC, DC4-20mA					
Display accuracy		F.S. ±0.3% or 3℃, greater value					
Control output	Relay	250VAC 3A 1c					
	SSR	Max. 12VDC ±3V 30mA					
	Current	DC4-20mA (load resistance max. 600Ω)					
Option output	EVENT1	250VAC 1A 1a					
	EVENT2	—	250VAC 1A 1a				
	PV transmission	—	DC4-20mA (load resistance max. 600Ω)				
	Communication	—		RS485 communication			
Control method		ON/OFF, P, PI, PD, PIDF, PIDS control					
Alarm output hysteresis		1 to 100℃ (0.1 to 100.0℃) variable					
Proportional band (P)		0.0 to 100.0%					
Integral time (I)		0 to 3,600 sec					
Derivative time (D)		0 to 3,600 sec					
Control period (T)		1 to 120 sec					
Sampling period		0.5 sec					
LBA setting		1 to 999 sec					
Ramp setting		Ramp Up, Ramp Down: 1 to 99 min each					
Dielectric strength		2,000VAC 50/60Hz for 1 min (between input and power terminals)					
Vibration	Mechanical	0.75mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
	Electrical	0.5mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min					
Relay life cycle	Control output	Mechanical: Min. 10,000,000 operations, Electrical: Min. 100,000 operations (250VAC 3A resistance load)					
	Option output	Mechanical: Min. 20,000,000 operations, Electrical: Min. 500,000 operations (250VAC 1A resistance load)					
Insulation resistance		Over 100MΩ (at 500VDC megger)					
Noise immunity	AC power	Square shaped noise by noise simulator (pulse width 1µs) ±2kV R-phase, S-phase					
	AC/DC power※1	Square shaped noise by noise simulator (pulse width 1µs) ±500V R-phase, S-phase		Square shaped noise by noise simulator (pulse width 1µs) ±2kV R-phase, S-phase			
Memory retention		Approx. 10 years (non-volatile semiconductor memory type)					
Environ-ment	Ambient temp.	-10 to 50℃, storage: -20 to 60℃					
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH					
Approval		(except AC/DC power type)					
Weight※2		**TZ4SP:** Approx. 205g (approx. 144g) **TZN4S:** Approx. 226g (approx. 164g)	Approx. 218g (approx. 162g)	**TZ4M:** Approx. 360g (approx. 228g) **TZN4M:** Approx.355g (approx. 246g)	**TZ4W:** Approx. 365g (approx. 246g) **TZN4W:** Approx. 351g (approx. 232g)	**TZ4H:** Approx. 365g (approx. 246g) **TZN4H:** Approx. 351g (approx. 232g)	**TZ4L:** Approx. 474g (approx. 304g) **TZN4L:** Approx. 474g (approx. 303g)

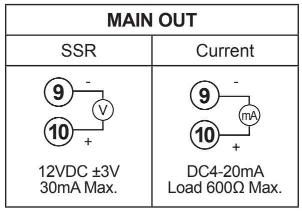
※1: AC/DC power models are only available for TZ4SP, TZ4ST, TZ4L, TZN4M
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Connections

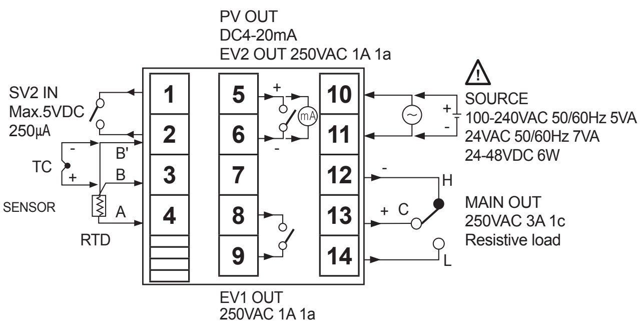
※RTD: DPt100Ω (3-wire type), JPt100Ω (3-wire type)
※TC (Thermocouple): K(CA), J(IC), R(PR), E(CR), T(CC), S(PR), N(NN), W(TT)
※In case of Analog input, please use TC (Thermocouple) terminal and be careful about polarity.

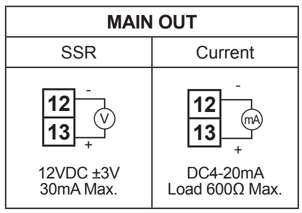
● TZ4SP



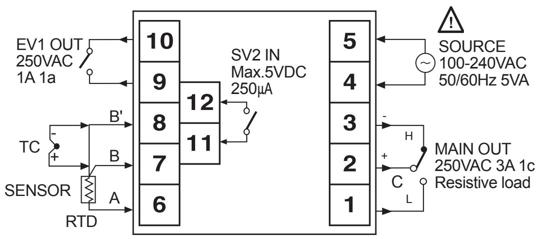


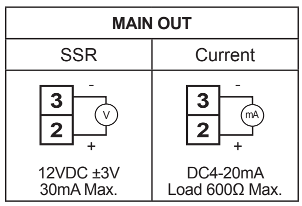
● TZ4ST



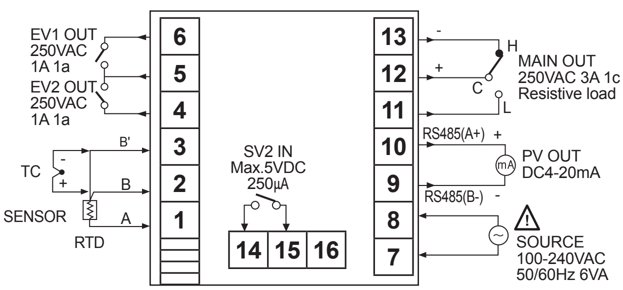


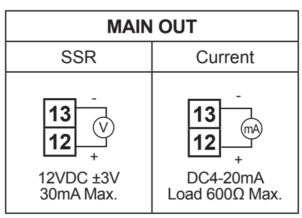
● TZN4S



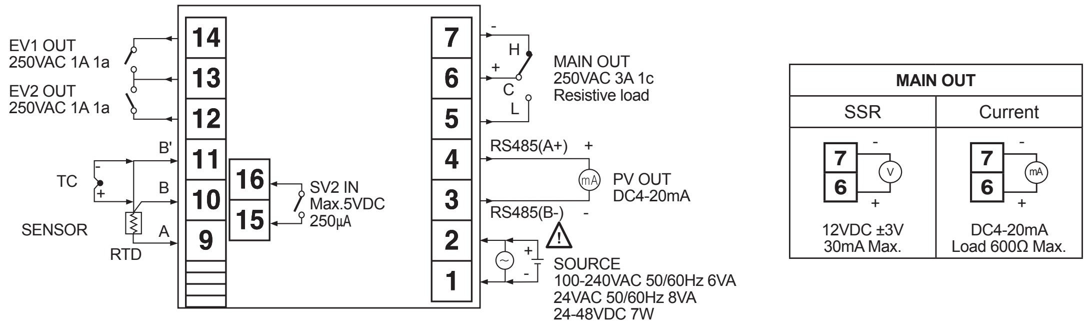


● TZ4M

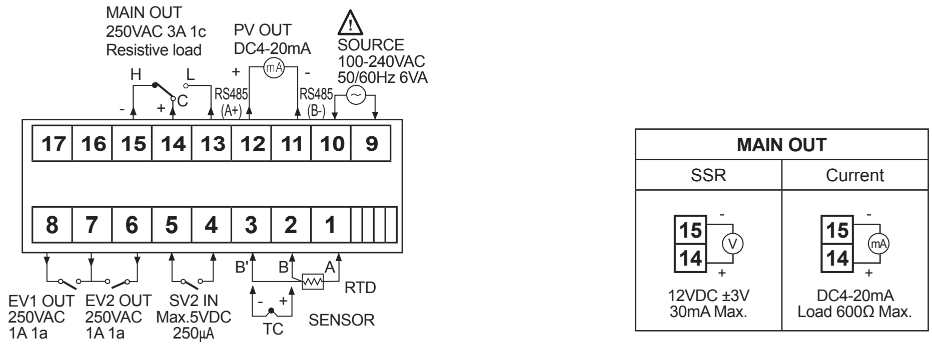




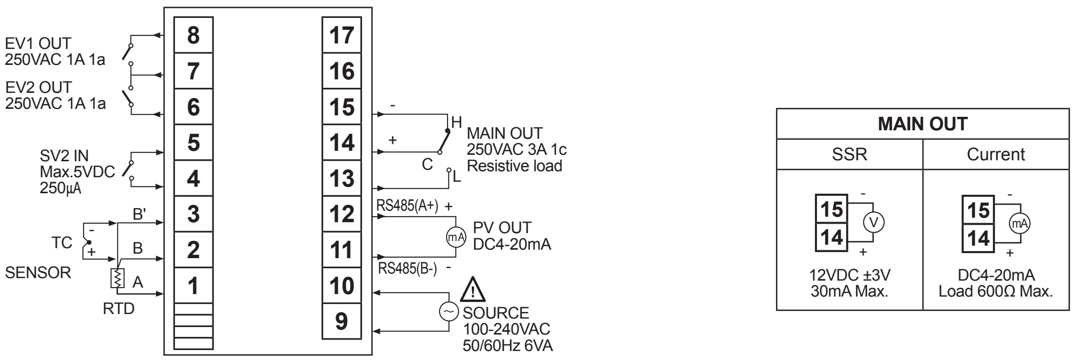
● TZN4M



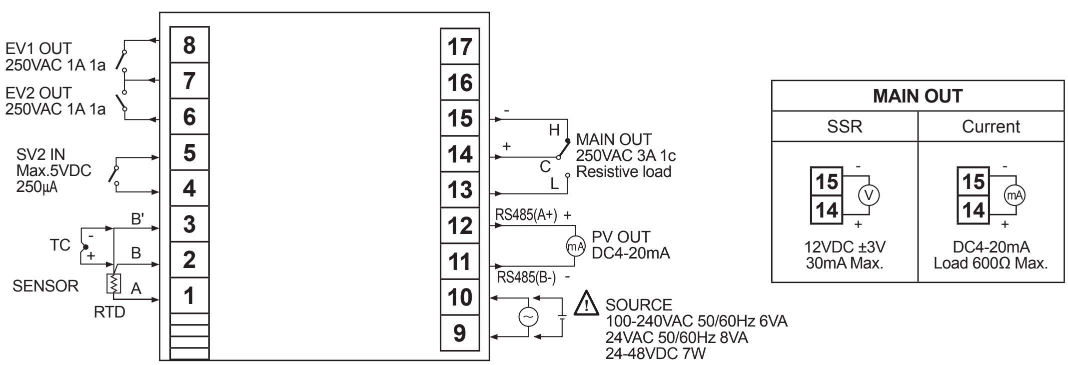
● TZ4W/TZN4W



● TZ4H/TZN4H



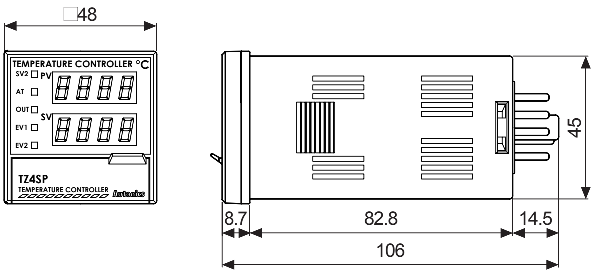
● TZ4L/TZN4L



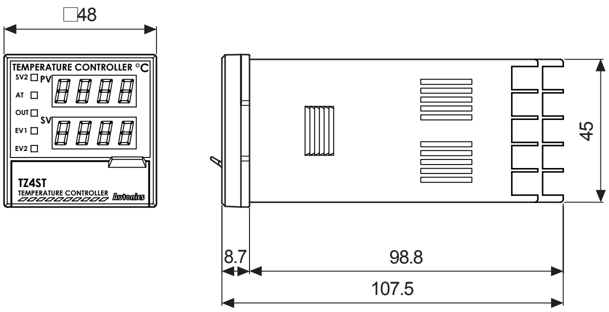
■ Dimensions

(unit: mm)

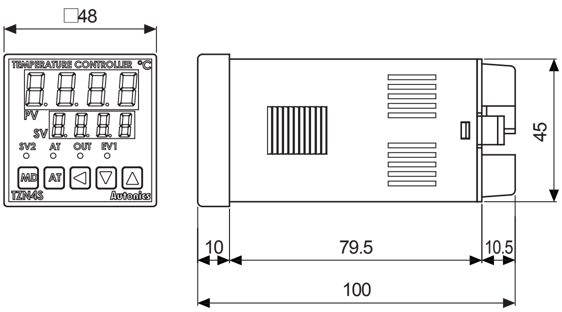
● TZ4SP



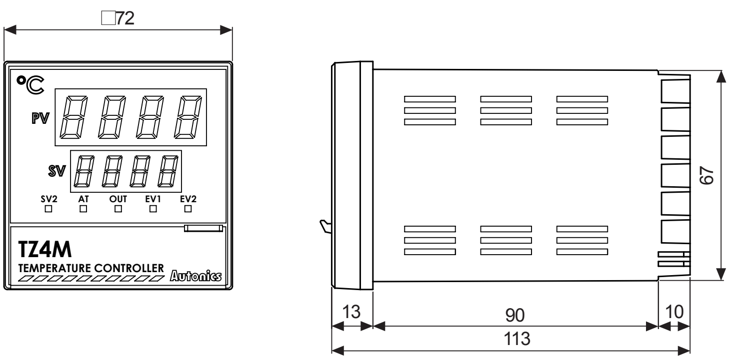
● TZ4ST



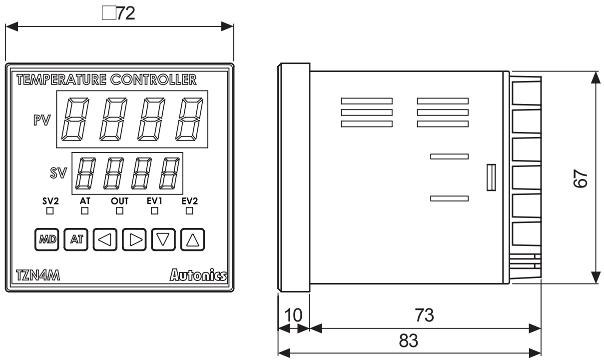
● TZN4S



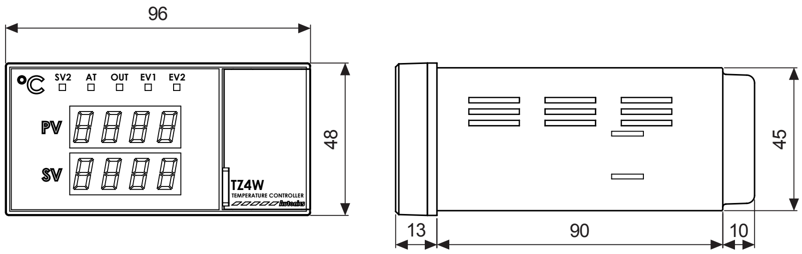
● TZ4M



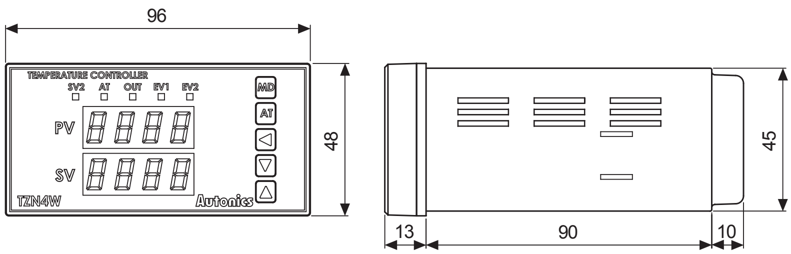
● **TZN4M** (unit: mm)



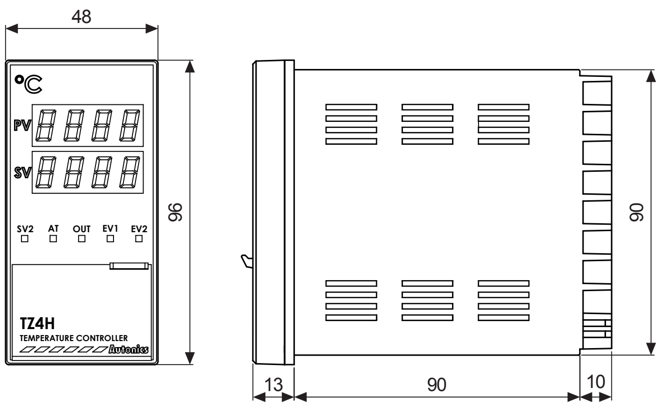
● **TZ4W**



● **TZN4W**

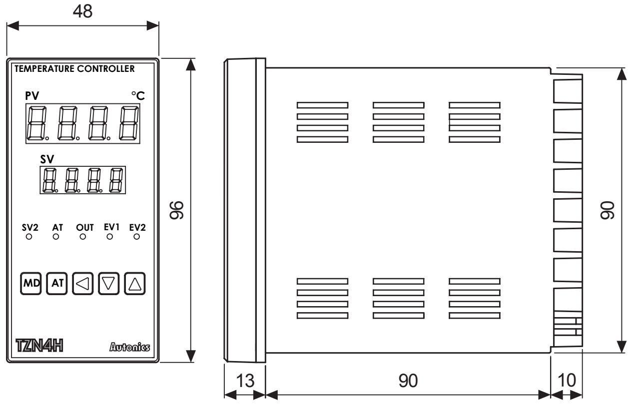


● **TZ4H**

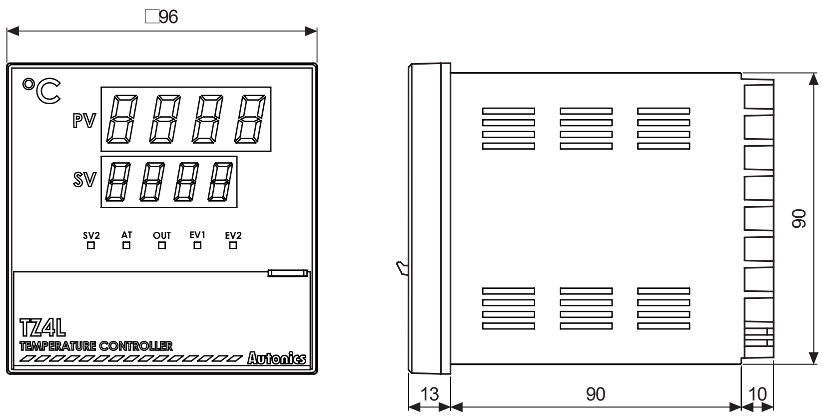


● TZN4H

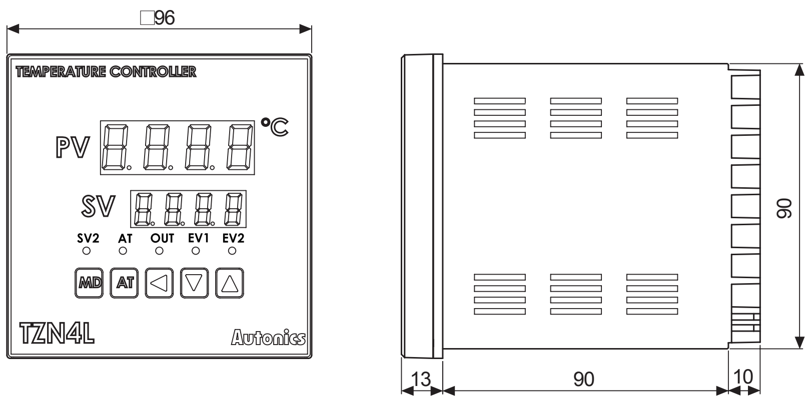
(unit: mm)



● TZ4L

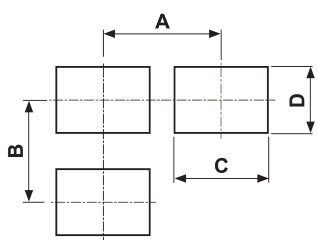


● TZN4L



● Panel cut-out dimensions

(unit: mm)

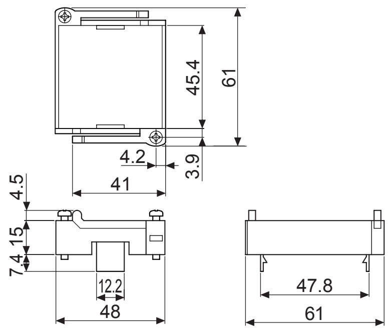


Series \ Size	A	B	C	D
TZ4SP, TZ4ST TZN4S	Min. 55	Min. 62	$45.5^{+0.5}_{0}$	$45.5^{+0.5}_{0}$
TZ4M	Min. 74	Min. 91	$68.5^{+0.5}_{0}$	$68.5^{+0.5}_{0}$
TZN4M	Min. 91	Min. 91	$68^{+0.7}_{0}$	$68^{+0.7}_{0}$
TZ4W, TZN4W	Min. 112	Min. 50	$92^{+0.8}_{0}$	$45.5^{+0.6}_{0}$
TZ4H, TZN4H	Min. 50	Min. 102	$45^{+0.6}_{0}$	$92^{+0.8}_{0}$
TZ4L, TZN4L	Min. 98	Min. 106	$91^{+0.5}_{0}$	$91^{+0.5}_{0}$

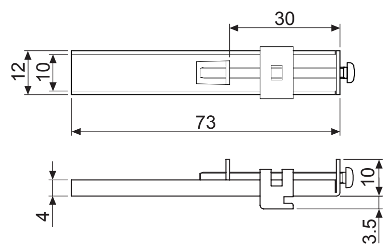
● **Bracket**

(unit: mm)

- TZ4ST, TZ4SP, TZN4S Series



- TZ4L, TZN4L, TZ4M, TZN4M, TZ4H, TZN4H, TZ4W, TZN4W Series



▣ Sold Separately

◎ Communication converter

- **SCM-38I**
  (RS232C to RS485 converter)
  CE

- **SCM-US48I**
  (USB to RS485 converter)
  CE

▣ Input Type And Range

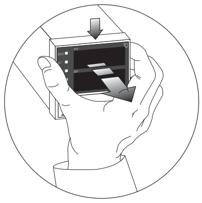
Input type			Decimal point	Display	Temperature range (℃)	Temperature range (℉)
Thermocouple	K(CA)		1	KCA.H	-100 to 1300	-148 to 2372
	K(CA)		0.1	KCA.L	-100.0 to 999.9	Not supported
	J(IC)		1	JIC.H	0 to 800	32 to 1472
	J(IC)		0.1	JIC.L	0.0 to 800.0	Not supported
	R(PR)		1	r Pr	0 to 1700	32 to 3092
	E(CR)		1	ECr.H	0 to 800	32 to 1472
	E(CR)		0.1	ECr.L	0.0 to 800.0	Not supported
	T(CC)		1	tCC.H	-200 to 400	-328 to 752
	T(CC)		0.1	tCC.L	-199.9 to 400.0	Not supported
	S(PR)		1	S Pr	0 to 1700	32 to 3092
	N(NN)		1	N nn	0 to 1300	32 to 2372
	W(TT)		1	W tt	0 to 2300	32 to 4172
RTD	JPt100Ω		1	JPt.H	0 to 500	32 to 932
	JPt100Ω		0.1	JPt.L	-199.9 to 199.9	-199.9 to 391.8
	DPt100Ω		1	dPt.H	0 to 500	32 to 932
	DPt100Ω		0.1	dPt.L	-199.9 to 199.9	-199.9 to 391.8
Analog	Voltage	0-10VDC		A--1	-1999 to 9999 (display range will vary depending on the decimal point.)	
		1-5VDC		A--2		
	Current	DC4-20mA		A--3		

▣ Configuring Input Type

Please configure the internal switches before supplying power. After supplying power, configure the input type [In-t] in parameter group 2 according to the input type.

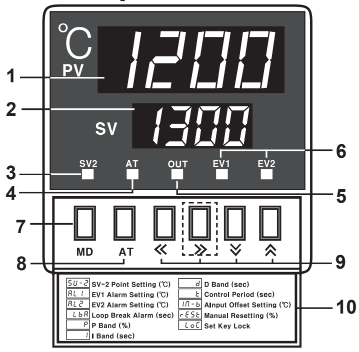
Input type		S/W 1	S/W 2
Thermocouple		1 1	mA V
RTD			
Analog	Voltage (0-10VDC, 1-5VDC)	2 2	mA V
	Current (DC4-20mA)	2 2	mA V

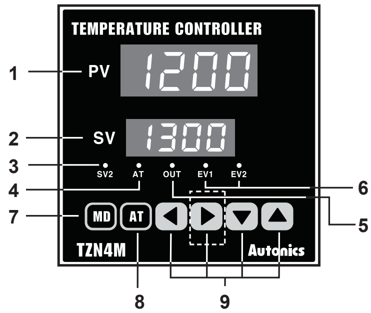
● **Detaching the case**



Press the front case then pull the case to detach the case from the body.
Configure the internal switches as input type.

▣ Unit Description





1. Present value (PV) display (red):
RUN mode: displays the current value (PV)
Setting mode: displays parameters

2. Set value (SV) display (green):
RUN mode: displays the set value (SV)
Setting mode: displays parameter setting values

3. SV2 operation indicator: turns ON when SV2 is operating

4. Auto-tuning indicator: turns ON when auto-tuning

5. Control output operation indicator: turns ON when control output is ON. Does not operate when the input type is current output.

6. Event output indicator: turns ON when the according event output is ON.
※The Event 2 output indicator does not operation in TZ4SP.

7. Mode key: enter parameter group, return to RUN mode, switch parameters, save setting values

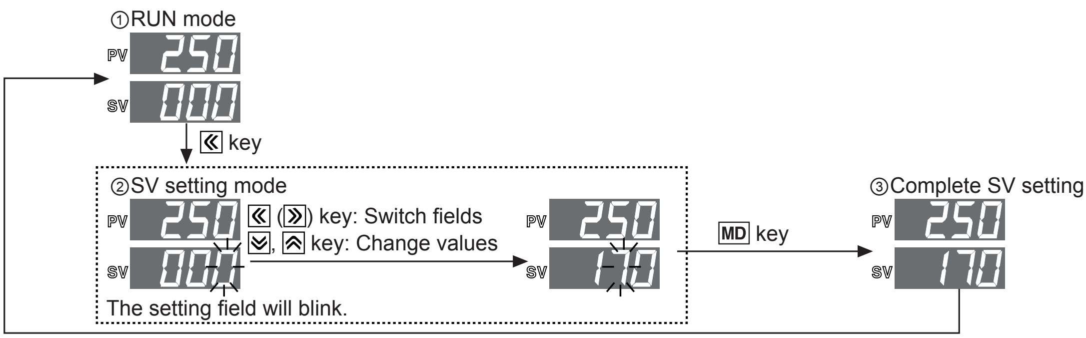
8. Auto-tuning key: hold the key for 3 sec to start auto-tuning. Hold the key for 5 sec while auto-tuning to stop auto-tuning.

9. Setting keys: enter SV change mode, switch fields, change value
(≫ key in the dotted line is only available in TZ4M and TZ4L models)

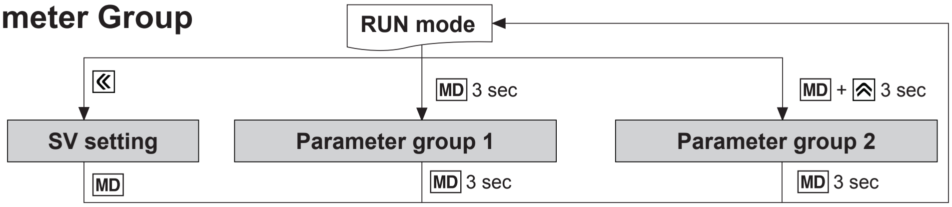
10. Key adjustment order chart

▣ SV Setting

※When changing the previous SV of 0℃ to 170℃,



■ Parameter Group



※Parameter setting order **Parameter group 2** → **Parameter group 1** → **SV setting**
The parameters are related to each other. Please set the parameters in the order above.
※When there is no key input for 60 sec while in SV setting mode or parameter groups, the unit will return to RUN mode automatically.

● **Parameter group 1**

※1: S: 《 (》)key-Switch fields, ︾, ︽ key-Change values
※2: Press the MD key after checking or changing the values in parameter settings to save the setting value and move to the next parameter.
※Hold the MD key for 3 sec anytime during parameter settings to save the setting value and return to RUN mode.
※The dotted line parameters ⬚ may not appear depending on the model or other parameter settings.

MD 3 sec → RUN mode → MD 3 sec

Parameter	PV display	SV display	Description
SV 2 temperature	SU-2	0	Setting range: refer to "■ Input Type and Temperature Range". (S ※1, MD ※2)
Event 1 alarm temperature	AL1	10	Setting range: refer to "■ Input Type and Temperature Range". ※[AL1, AL2] parameters do not appear when Event 1/2 [EU-1, EU-2] of parameter group 2 is set to AL-0, LbA, SbA. ※[AL2] parameter only appears in models that support Event 2 output.
Event 2 alarm temperature	AL2	10	
LBA monitoring time	LbA	600	Setting range: 0 to 999 sec ※Only appears when Event1/2 [EU-1, EU-2] of parameter group 2 is set to LbA. ※Does not appears in current output models.
Alarm output hysteresis	AHYS	2	Setting range: 1 to 100°C/°F (0.1 to 100.0°C/°F) ※Does not appears when Event 1/2 [EU-1, EU-2] of parameter group 2 is set to AL-0, LbA, SbA.
Proportional band	P	3.0	Setting range: 0.0 to 100.0% ※ON/OFF control: Set to 0.0, PID control: Set to over 0.0
Integral time	I	0	Setting range: 0 to 3,600 sec ※Integral operation is turned OFF when set to 0.
Derivative time	d	0	Setting range: 0 to 3,600 sec ※Derivative operation is turned OFF when set to 0.
Control period	t	20	Setting range: 1 to 120 sec ※Set to a small value in SSR drive output models. (i.e. 2 sec)
Hysteresis	HYS	2	Setting range: 1 to 100°C/°F (0.1 to 100.0°C/°F) ※Only appears during ON/OFF control (proportional band [P] set to 0.0).
Input correction	In-b	0	Setting range: -49 to 50°C/°F (-50.0 to 50.0°C/°F)
Manual reset	rESt	0.0	Setting range: 0.0 to 100% ※Only appears when P control (proportional band [P] set to over 0.0, integral time [I], and derivative time [d] are set to 0)
Ramp up time	rAPU	10	Setting range: 1 to 99 min ※Only appears when ramp function [rAmP] of parameter group 2 is set to on.
Ramp down time	rAPd	10	
Lock	LoC	oFF ↔ on ↔ on1	Setting range: see table below

※Only appears during PID control (proportional band [P] set to over 0.0). (Integral time, Derivative time, Control period)

Setting range:

oFF	Unlock
on	Lock parameter 1 (AT key available)
on1	Lock parameter 1(AT key unavailable)

● Parameter group 2

※1: S: ≪ (≫)key-Switch fields, ⩔, ⩓ key-Change values
※2: Press the MD key after checking or changing the values in parameter settings to save the setting value and move to the next parameter.
※Hold the MD key for 3 sec anytime during parameter settings to save the setting value and return to RUN mode.
※The dotted line parameters ⬚ may not appear depending on the model or other parameter settings.

RUN mode → MD + ⩓ 3 sec → Input type; MD 3 sec → RUN mode

S ※1 (PV display → SV display), MD ※2 (next parameter)

Parameter	PV display	SV display	Setting range / Notes
Input type	In-t	tCA.H	Setting range: refer to "■ Input Type and Temperature Range".
Event 1	EV-1	AL-1	Setting range: refer to '3. Alarm'. ※Event 2 [EV-2] only appears in models that support Event 2 output.
Event 2	EV-2	AL-2	
Alarm option	AL-t	AL-A	Setting range: refer to '3. Alarm'. ※Does not appear when Event 1/2 [EV-1, EV-2] is set to AL-0, LbA, SbA.
Auto-tuning mode	At.t	tun1 ⇄ tun2	
PID method	PId.t	PId.S ⇄ PId.F	
Heating/ Cooling	o-Ft	HEAt ⇄ CooL	※Please set according to control application. Do not change the settings during operation. It may result in fire or accidents.
Temperature unit	UnIt	°C ⇄ °F	
SV high-limit	H-SC	1300	Setting range: refer to "■ Input Type and Temperature Range".
SV low-limit	L-SC	-100	
Decimal point	dot	0	Setting range: 0, 0.0, 0.00, 0.000 ※Only appears with analog input.
Trans. output high-limit	FS-H	1300	Setting range: refer to "■ Input Type and Temperature Range". ※Only appears in models that support PV transmission.
Trans. output low-limit	FS-L	-100	
Ramp function	rAmP	oFF ⇄ on	
Com. speed	bPS	2400 ⇄ 4800 ⇄ 9600	※Only appears in models that support RS485 communication
Com. address	AdrS	01	Setting range: 1 to 99 (address)
Lock	LoC	oFF ⇄ on	Setting range:

oFF	Unlock
on	Lock parameter 2

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Factory Defaults

• **Parameter group 1**

Parameter	Default	Parameter	Default	Parameter	Default
SU-2	0	P	3.0	In-b	0
AL1	10	I	0	rESt	0.0
AL2	10	d	0	rAPU	10
LbA	600	t	20	rAPd	10
AHYS	2	HYS	2	LoC	oFF

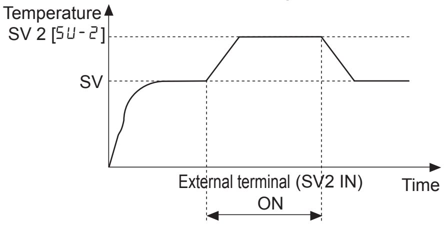
• **Parameter group 1**

Parameter	Default	Parameter	Default	Parameter	Default
In-t	KCA.H	o-Ft	HEAt	FS-L	-100
EU-1	AL-1	Unit	°C	rAmP	oFF
EU-2	AL-2	H-SC	1300	bPS	2400
AL-t	AL-A	L-SC	-100	Adr5	01
At.t	tun1	dot	0	LoC	oFF
PIdt	PId.S	FS-H	1300		

▣ Functions

◎ SV 2 temperature

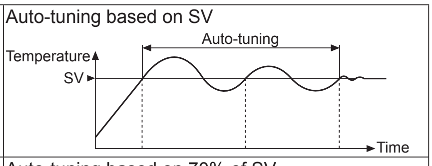
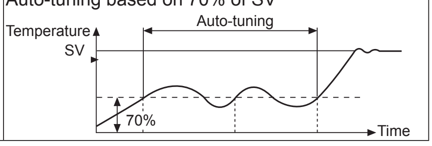
You can control an additional temperature value at a desired range by using SV2. Connect a contact signal (under 5VDC, 250μA) at the external terminal, to operate in the range where the signal turns ON. Set the SV2 temperature in SV2 temperature [SU-2] in parameter group 1.



E.g.)The internal temperature of an electric oven may drop rapidly if the door is opened while the oven is maintaining a specific temperature. Set SV2 temperature [SU-2] to a higher value than SV, and input a signal to the external terminal (SV2 IN), to quickly raise the temperature.

◎ Auto-tuning

Auto-tuning allows the temperature controller to detect the thermal characteristics and response rates of the control target. It then calculates the PID time constant and sets the value to allow fast response rates and high accuracy. Hold the AT key for 3 sec during RUN mode to start auto-tuning. The auto-tuning indicator will blink. When auto-tuning is completed, the auto-tuning indicator will durn off and the PID time constant will be saved to each parameter of parameter group 1. The saved parameters can be adjusted as desired.

TUN1 mode [tUn1]	Auto-tuning based on SV 
TUN2 mode [tUn2]	Auto-tuning based on 70% of SV 

To manually stop auto-tuning, hold the AT key for 5 sec. When auto-tuning is stopped, the controller maintains the PID value before auto-tuning. TZ Series supports 2 auto-tuning modes.

Select TUN1 mode or TUN2 mode [tUn1, tUn2] from auto-tuning mode [At.t] of parameter group 2.

※Run auto-tuning during initial setup of the temperature controller.

※If the thermal characteristics of the control target device has changed after extended usage, re-run auto-tuning.

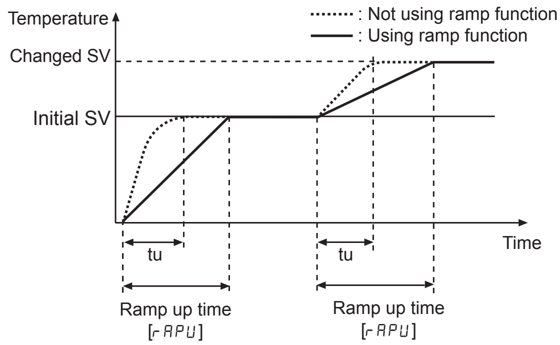
◎ Ramp

The ramp function can delay the rate of temperature rise/fall. If the SV value is changed during stabilized control, the temperature of the controlled target will rise/fall during ramp up/down time [rAPU, rAPd] of parameter group 1. The ramp function activates when the power is reset or when the SV value is changed during stable control.

※The ramp up/down time [rAPU, rAPd] appear only when the ramp function [rAmP] of parameter group 2 is set to on.

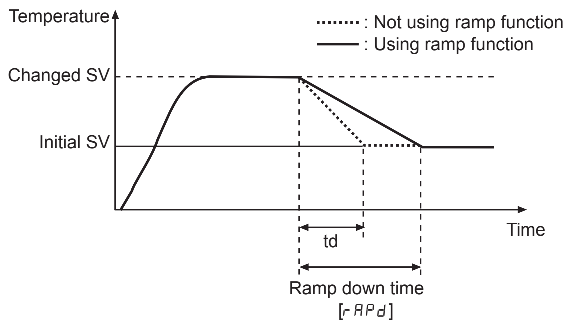
●RAMP up time[rAPU]

When delaying the rise of initial control temperature or changing the SV during stable control, you can delay temperature rise. Set the ramp up time [rAPU] longer than the temperature rise time (tu) when not using the ramp function.



●Ramp down time [rAPd]

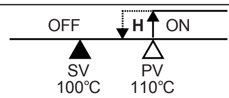
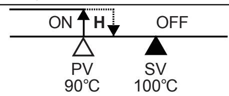
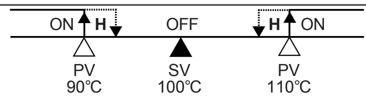
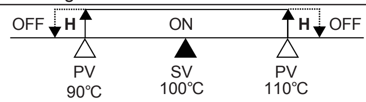
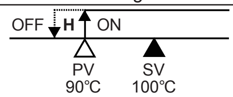
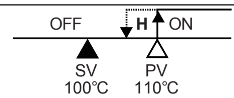
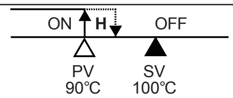
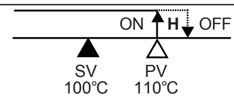
Delays declining temperature. Set the ramp down time [rAPd] longer than the temperature decline time (td) when not using the ramp function.



◎ Alarm(Event)

Alarm output can be configured by combining alarm operation and alarm options. Set the alarm operation in event 1/2 [EV1, EV2] of parameter group 2, and set the alarm options in alarm option[AL-t].

1)Alarm operation

Mode	Name	Alarm operation		Description
AL-0	—	—		Alarm output not used.
AL-1	Deviation high-limit alarm	 High-limit deviation: 10℃		If the deviation of PV and SV are higher than the high-limit deviation, the alarm output turns ON.
AL-2	Deviation low-limit alarm	 Low-limit deviation: 10℃		If the deviation of PV and SV are higher than the low-limit deviation, the alarm output turns ON.
AL-3	Deviation high-limit /low-limit alarm	 High-limit/low-limit deviation: 10℃		If the deviation of PV and SV are higher than the high-limit deviation or low-limit deviation, the alarm output turns ON.
AL-4	Deviation high-limit /low-limit reverse alarm	 High-limit/low-limit deviation: 10℃		If the deviation of PV and SV are higher than the high-limit deviation or low-limit deviation, the alarm output turns OFF.
AL-5	Absolute value high-limit alarm	 Absolute value alarm: 90℃	 Absolute value alarm: 110℃	Alarm output turns ON when PV is higher than the absolute value.
AL-6	Absolute value low-limit alarm	 Absolute value alarm: 90℃	 Absolute value alarm: 110℃	Alarm output turns ON when PV is lower than the absolute value.
SbA	Sensor break	—		Alarm output turns ON when sensor disconnection is detected.
LbA	Loop break	—		Alarm output turns ON when loop break is detected.

※ H: Alarm output hysteresis[AHYS]

2)Alarm options

Mode	Name	Description
AL-A	Standard alarm	Alarm output turns ON upon alarm condition, and alarm output turns OFF when condition is cleared.
AL-b	Alarm latch	Alarm output turns ON and maintains ON upon alarm condition.
AL-C	Standby sequence	The first alarm condition is ignored. It will operate as standard alarm from the second alarm condition. If it is under alarm condition when power is supplied, it will ignore the condition and operate as standard alarm from the next alarm condition.
AL-d	Alarm latch and standby sequence	It will operate as both alarm latch and standby sequence upon alarm condition. If it is under alarm condition when power is supplied, it will ignore the condition and operate as alarm latch from the next alarm condition.

3) Sensor break alarm

Alarm output turns ON when sensor is not connected or loses its connection during temperature control. Sensor disconnection can be tested by connecting buzzers or other devices to the alarm output contact. Sensor break alarm output operates through EV1 OUT or EV2 OUT contacts. Alarm output is disengaged after resetting the power.

4) Loop break Alarm (LBA)

Diagnose control loop and transmit alarm output through temperature change of control target. During heating(cooling) control, the alarm output turns ON if the PV does not rise/drop by a specific amount (approx. 2℃) during LBA monitoring period [LbA] while control output amount is at 100%(0%).

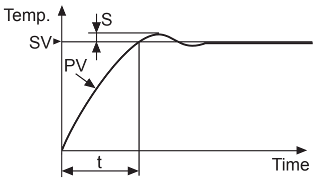
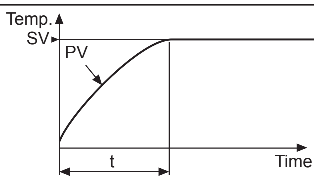
※If the thermal response of the control target is slow, the LBA monitoring period [LbA] of parameter group 1 should be set longer.

※LBA only operates when the control output amount is 100%(0%) so it cannot be used in current output models.

※If the alarm output turns ON after the sensor has been disconnected, the alarm output will not turn OFF even after reconnecting the sensor. To disengage the alarm output, the temperature controller power must be reset.

◎ Dual PID control

The response rate of the PID control can be selected depending on the characteristics of the control target.
Select high-speed response mode or low-speed response mode [PId.F, PId.S] from PID method [PIdt] of parameter group 2.

High-speed response mode [PId.F]		Used to minimize the time (t) required to reach the SV. Overshoot (S) occurs. Used in machinery that may require warming up. (injection molding machine, electric furnace, etc.)
Low-speed response [PId.S]		Used to minimize overshoot (S). Time (t) required to reach SV may be slower. Used for machinery or environments where overshoot may cause explosion or fire. (oil temperature control, metal plating machinery, etc.)

◎ Input correction [In-b]

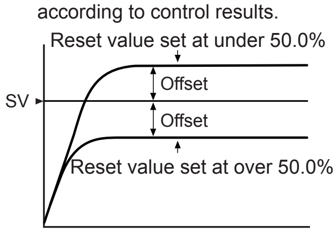
Used to correct deviation from external devices such as temperature controllers.

E.g.)If the actual temperature is 80℃ but the display value is 78℃, set the input correction [In-b] value to 2 and it will display 80℃ as the display value.

◎ Manual reset [rESt]

When using proportional control (P control), the time of temperature rising time and falling time may differ depending on factors such as the heat capacity of the control device or the heater. A certain amount of deviation occurs even under stable conditions.
This deviation is referred to as offset, and can be configured/corrected using manual reset [rESt].
When PV and SV are equal, the reset value is 50.0%. If the PV is lower than the SV during stable control, set the value to over 50.0%, and if the PV is higher than the SV, set the value to under 50.0%

- Configuring manual reset [rESt] according to control results.



▣ RS485 communication

Applicable for models that support RS485 communication.
Please refer to '▣ Ordering Information'.
It is used to transmit PV or SV, and/or set the SV.

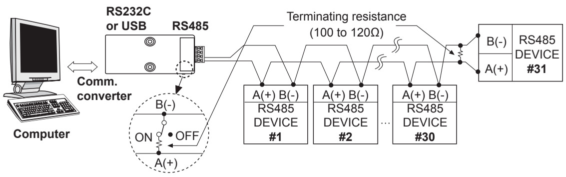
◎ Interface

Protocol	BCC
Applied standard	EIA RS485
Max. connections	31 units (address: 1 to 99)
Communication method	2-wire half duplex
Synchronization method	Asynchronous
Communication distance	Within 1.2km
Communication speed	2400, 4800, 9600bps
Start bit	1-bit fixed
Data bit	8-bit fixed
Parity bit	None
Stop bit	1-bit fixed

※It is not allowed to set overlapping communication address at the same communication line. Use twisted pair wire for RS485 communication.

◎ Application of system organization

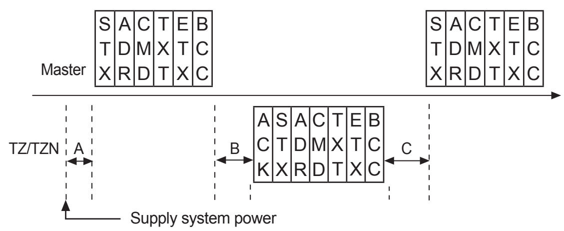
※Only for RS485 communication output model.



※It is recommended to use Autonics communication converter; SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately). Please use twisted pair wire for RS485 communication.

◎ Communication control ordering

1. The communication control ordering of TZ/TZN Series is exclusive protocol.
2. After 4 sec being supplied the power into master system, then able to start communicating.
3. Initial communication will be started by master system. When Command signal comes out from master system then TZ/TZN Series will respond.



※A → Over min. 4 sec, B → Within max. 300ms, C → Over min. 20ms

◎ Communication Command and Block

Format of Command and Response

STX	10^1	10^0	R/W	X/D		ETX	FSC
Start Code	Address Code		Header Code		Text	END Code	BCC Code

Calculation range of Block Check Character

① Start code
It indicates the first of Block STX → [02H], in case of response, ACK will be added.

② Address code
This code is master system can discern TZ/TZN Series and able to set within range of 01 to 99. (BCD ASCII)

③ Header code:
It indicates command as 2 alphabets as below.
RX (Read request) → R [52H], X [58H]
RD (Read response) → R [52H], D [44H]
WX (Write request) → W [57H], R [58H]
WD (Write response) → W [57H], D [44H]

④ Text: It indicates the detail contents of Command/ Response. (see command)

⑤ END code: It indicates the end of Block. ETX → [03H]

⑥ BCC: It indicates XOR operating value from the first to ETX of the protocol as abbreviation of TZ/TZN.

◎ Communication Command

● Read [RX] of measurement/setting value: Address 01, Command RX

1.Command (Master)

① Command

STX	0	1	R	X	P	0	ETX	FSC
Start	Address		Command head		P:Process value S:Setting value		End	BCC

② Application: Address (01), Header code (RX), Process value (P)

STX	0	1	R	X	P	0	ETX	FSC
02	30	31	52	58	50	30	03	BCC

● Write [WX] of setting value: Address 01, Command WX

1.Command (Master)

① Command

STX	0	1	W	X	S	0	Symbol	10^3	10^2	10^1	10^0	ETX	FSC
Start	Address		Command head		S:Setting value		Space/-	10^3	10^2	10^1	10^0	End	BCC

② Application: In case of writing Address (01), Heading Coad (WX), Setting value (S) +123.

STX	0	1	W	X	S	0	Symbol	10^3	10^2	10^1	10^0	ETX	FSC
02	30	31	57	58	53	30	20	30	31	32	33	03	BCC

◎ Response

● Read of process/Setting value

1. In case of receiving normal process value:
The data is transmitted adding ACK [60H].
(In case process value is +123.4)

ACK	STX	0	1	R	D	P	0	Symbol	10^3	10^2	10^1	10^0	Decimal point	ETX	FSC	NULL
ACK	STX	0	1	R	D	P	0	Space	1	2	3	4	1	ETX	BCC	NULL
06	02	30	31	52	44	50	30	20	31	32	33	34	31	03	BCC	00

2. In case process value is -100

ACK	STX	0	1	R	D	P	0	—	0	1	0	0	0	ETX	BCC	NULL
06	02	30	31	52	44	50	30	2D	30	31	30	30	30	03	BCC	00

※It is responded with 1 byte sized NULL (00H) at the end of response frame (next BCC 16).

● Write of setting value

In case setting value is -100

ACK	STX	0	1	W	D	S	0	Symbol	10^3	10^2	10^1	10^0	ETX	FSC
ACK	STX	0	1	W	D	S	0	—	0	1	0	0	ETX	BCC
06	02	30	31	57	44	53	30	2D	30	31	30	30	03	BCC

● Others: In case of no response of ACK

① When the address is not the same after receiving STX.
② When receiving buffer overflow is occurred.
③ When the baud rate or others communication setting value are not the same.

● When there are no ACK response

① Check the status of lines
② Check the communication condition (Setting value)
③ When assuming the problem is due to noise, try to operate communication 3 times more until recovery.
④ When occurred communication failure frequently, please adjust the communicating speed.

■ Error Display

Display	Description	Troubleshooting
oPEn	Blinks when input is disconnected.	Check input status.
HHHH	Blinks when the measured input value is higher than the temperature range.	Adjust the value to within the temperature range.
LLLL	Blinks when the measured input value is lower than the temperature range.	

■ Proper Usage

◎ Troubleshooting

Symptoms	Troubleshooting
oPEn is displayed on the PV display during operation	Disconnect the power and check the input connection. If the input is connected, disconnect the input wiring from the temperature controller and short the + and - terminals. Power the temperature controller and check if it displays the room temperature. If it does not display the room temperature and continues to display oPEn, the controller is broken. Please contact our technical support. (Input type is thermocouple)
Load (heater, etc.) does not operate during operation	Check the state of the control output indicator on the front panel. If the indicator is not working, check parameter settings. If the indicator is working, disconnect the wiring from the output terminal of the temperature controller and check the output (replay contact, SSR drive, current)
ErrO (error) is displayed on the PV display during operation	Indicates damage to internal chip by strong noise (2kVAC). Please contact our technical support. Locate the source of the noise and devise countermeasures.

◎ Caution during use

- Please separate the unit wiring from high voltage lines or power lines to prevent inductive noise.
- Use the following shaped M3.5 crimp terminals.

- Install a power switch or circuit breaker to control the power supply.
- The power switch or circuit breaker should be installed where it is easily accessible by the user.
- The unit is designed for use as a temperature controller. Do not use the unit as a volt-meter or an ampere-meter.
- When using thermocouple temperature sensors, prescribed extension wiring must be used. Using general wiring may cause temperature deviation where the thermocouple meets the wire.
- When using RTD temperature sensors, 3-wire type wiring must be used. When extending the wires, use 3 wires that have the same length and thickness. Different line resistance may cause temperature deviation.
- If the power line and the input signal line must be close to each other, make sure to install a line filter on the power line for noise protection and use a shielded input signal line.
- Keep away from the high frequency instruments. (High frequency welding machine & sewing machine, large capacity SCR controller).
- If the unit displays HHHH or LLLL after supplying measured input, there may be a problem with the measured input. Disconnect the power and check the wiring.
- When changing user input settings, please disconnect the power. Adjust the internal switch (S/W1, S/W2) as required, connect the power and select the input type [In-t] of parameter group 2.
- The SSR drive output, current output are separated and insulated from internal circuits of the unit.
- Do not connect the power supply to the event output terminal or sensor terminals.
- This unit may be used in the following environments.
  ①Indoors
  ②Pollution degree 2
  ③Altitude under 2,000m
  ④Installation category II

Thumbwheel Switch Setting Type Temperature Controller

■ Features

- Various size as DIN specifications
  (W48×H48, W48×H96, W72×H72, W96×H96mm)
- Various control output (Relay/SSR drive/current)
- Dual setting for simultaneous control for heater and cooler (T4LP)

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

T 3 S [ ] - B 4 R P 4 C - N

Item	Code	Description
New※1	N	New type
Temperature unit	C	℃
	F	℉
Temperature range※4	0	-99 to 199℃, -99.9 to 199.9℃
	1	0 to 99.9℃
	2	0 to 200℃, 0 to 200.0℃
	4	0 to 400℃
	8	0 to 800℃/℉
	A	0 to 999℃
	C	0 to 1200℃
	F	600 to 1600℃
Input type※4	P	DPt100Ω
	J	J(IC)
	K	K(CA)
	R	R(PR)
Control output※3	R	Relay output
	S	SSR drive output
	C	Current output
Power supply	4	100-240VAC 50/60Hz
Control method	B	ON/OFF control, Proportional control
Alarm/Sub output※3	No-mark	None
	A	Alarm output
	S	Sub output
	P	Dual setting output
Size	S	DIN W48×H48mm (8-pin plug type)※2
	M	DIN W72×H72mm
	H	DIN W48×H96mm
	L	DIN W96×H96mm
Digit	3	999 (3-digit)
	4	9999 (4-digit)
Item	T	Temperature Controller

※1: Name plate and connections are different from previous T3/T4 Series.
※2: Sockets (PG-08, PS-08(N)) are sold separately.
※3: Output by Series

Series	T3S	T3H	T3HA	T3HS	T4M	T4MA	T4L	T4LA	T4LP
Control output	●	●	–	–	●	–	●	–	–
Control output+Alarm/Sub output	–	–	●	●	–	●	–	●	–
Dual setting output	–	–	–	–	–	–	–	–	●

※4: Input type and temperature range by Series

Input type			Model \ Series	T3S	T3H	T3HA	T3HS	T4M T4MA	T4L T4LA	T4LP
Thermocouples	K(CA)	0 to 400℃	4	●	●	●	●	●	●	●
		0 to 800℃	8	●	●	●	-	●	●	●
		0 to 999℃	A	-	●	●	-	-	-	-
		0 to 1200℃	C	-	-	-	-	●	●	●
	J(IC)	0 to 200℃	2	●	-	-	-	-	-	-
		0 to 400℃	4	●	●	●	●	●	●	●
		0 to 800℉	8	-	●	-	-	-	-	-
	R(PR)	600 to 1600℃	F	-	-	-	-	●	●	●
RTD	DPt 100Ω	-99.9 to 199.9℃	0	-	-	-	-	●	●	-
		-99 to 199℃	0	-	●	●	-	-	-	-
		0 to 99.9℃	1	●	●	-	-	-	-	-
		0 to 200.0℃	2	-	-	-	-	-	-	●
		0 to 200℃	2	●	-	-	-	-	-	-
		0 to 400℃	4	●	●	●	●	●	●	●

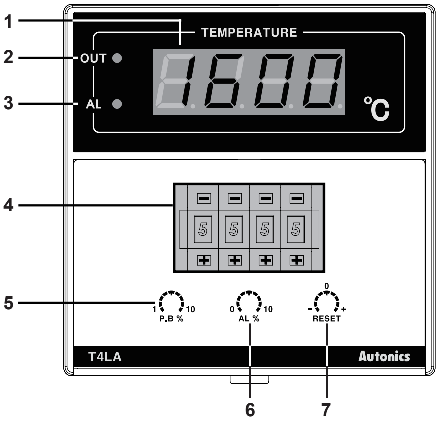
※Please contact us for temperature unit ℉ model.

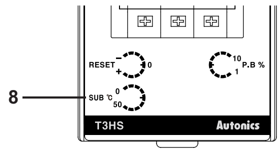
■ Specifications

Series		T3S	T3H	T3HA	T3HS	T4M	T4MA	T4L	T4LA	T4LP
Power supply		100-240VAC 50/60Hz								
Allowable voltage range		90 to 110% of rated voltage								
Power consumption		Max. 5VA								
Display method		7-segment (red) LED method								
Character size (W×H)		3.8×7.6mm	6.0×10.0mm					8.0×14.2mm		
Input type	RTD	DPt100Ω (Allowable line resistance max.5Ω per a wire)								
	TC	K(CA), J(IC)				K(CA), J(IC), R(PR)				
Display accuracy※1	RTD	●At room temperature (23ºC ± 5ºC): (PV ± 0.5% or ±1ºC, select the higher one) ± 1-digit								
	TC	●Out of room temperature range: (PV± 0.5% or ±2ºC, select the higher one)± 1-digit								
Control output	Relay	OUT1: 250VAC 5A 1c, OUT2: 250VAC 2A 1c※2								
	SSR	Max. 12VDC±2V 20mA								
	Current	DC4-20mA (resistive load max. 500Ω)								
Alarm/Sub/ Dual setting output		—		250VAC 2A 1c		—	250VAC 2A 1a	—	250VAC 2A 1c	
Sampling period		100ms								
Control method		ON/OFF, Proportional control								
Hysteresis		F.S. 0.5%	F.S. 0.2 to 3% variable							
Proportional band		F.S. 3%	F.S. 1 to 10% variable							
Proportional cycle		20 sec								
RESET range		F.S. -3 to 3% variable								
Relay life cycle	Mechanical	Over 5,000,000 times								
	Electrical	OUT1: Over 100,000 times, OUT2: Over 200,000 times								
Dielectric strength		2,000VAC 50/60Hz for 1min (between input terminal and power terminal)								
Vibration		0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours								
Insulation resistance		Over 100MΩ (at 500VDC megger)								
Noise immunity		Square-wave noise by noise simulator (pulse width 1μs) ±2kV R-phase and S-phase								
Memory retention		Approx. 10 years (when using non-volatile semiconductor memory type)								
Environ-ment	Ambient temperature	-10 to 50℃, Storage: -20 to 60℃								
	Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH								
Weight※3		Approx. 135g (approx. 95g)	Approx. 239g (approx. 176g)			Approx. 246g (approx. 180g)		Approx. 310g (approx. 222g)		

※1: In case of the T3S Series and the decimal point display models
At room temperature (23ºC±5ºC): (PV ±0.5% or ±2℃, select the higher one)±1-digit
Out of room temperature range: (PV ±0.5% or ±3℃, select the higher one)±1-digit
※2: Dual setting output of the T4LP is fixed as relay output and, it is also available as alarm output.
※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Unit Description





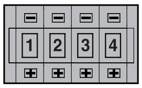
1. Present temperature (PV) display
It displays present temperature.

2. Control output (OUT) indicator
It turns ON when control output is ON.
※In case of the T3S, the upper DOT of last digit flashes.

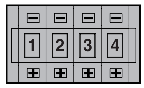
3. Alarm output (AL) indicator
It turns ON when alarm output is ON. (only for alarm output model)
In case of the sub output model (T3HS), the sub (SUB) indicator turns ON when sub output is ON.

4. Set value (SV) thumbwheel switch
Switch for setting temperature.
(-) button: Decreases number, (+) button: Increases number
If the setting is out of the temperature range of temperature sensor, the present temperature (PV) display part flashes SuEr and the present value in turn.
※The models which temperature range is 0 (-99.9 to 199.9℃, -99 to 199℃) of temperature sensor DPt100Ω are only set 1↔0↔ (-).
※The dual setting output model (T4LP) has two thumbwheel switches.

LO SET (low set output)



HI SET (high set output)



LO SET (low set output) heating control, HI SET (high set output): cooling control

5. Hysteresis/Proportional width volume switch (except T3S)
ON/OFF control: Setting for hysteresis. [Setting range] F.S. 0.2 to 3% (For T3S, F.S. 0.5% fixed)
Proportional control: Setting for proportional width. [Setting range] F.S. 1 to 10% (For T3S, F.S. 3% fixed)
Proportional cycle: 20 sec fixed

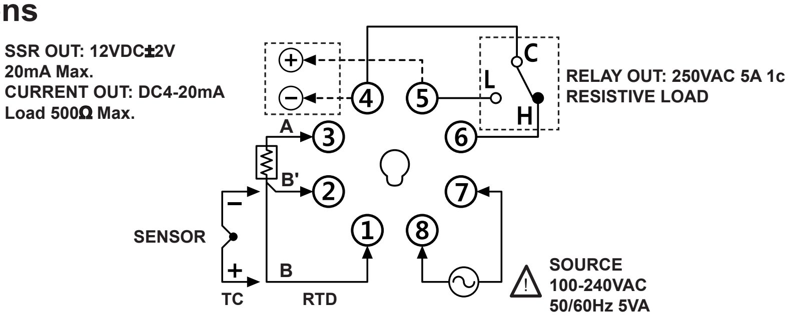
6. Alarm output value volume switch (only for alarm output model)
It sets alarm output value. [Setting range] F.S. 0 to 10%

7. RESET volume switch
In case of proportional control, it sets offset. [Setting range] F.S. -3 to 3%

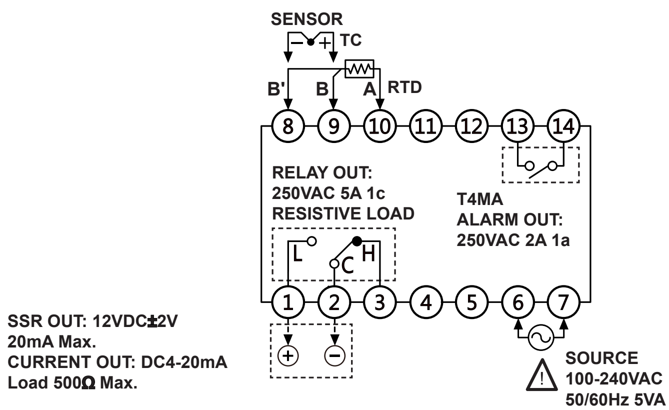
8. Temperature setting of sub output volume switch (only for T3HS)
It sets temperature of the sub output. This output operates as deviation low-limit alarm based on the set sub-output temperature (SV). Setting range: 0 to 50℃

■ Connections

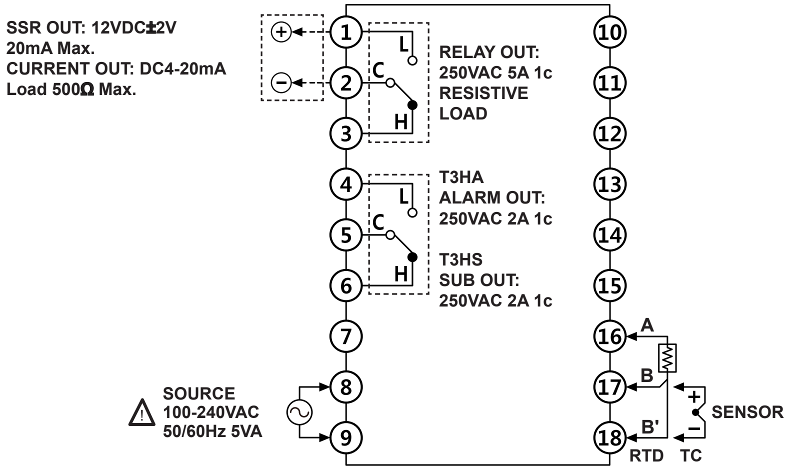
● T3S



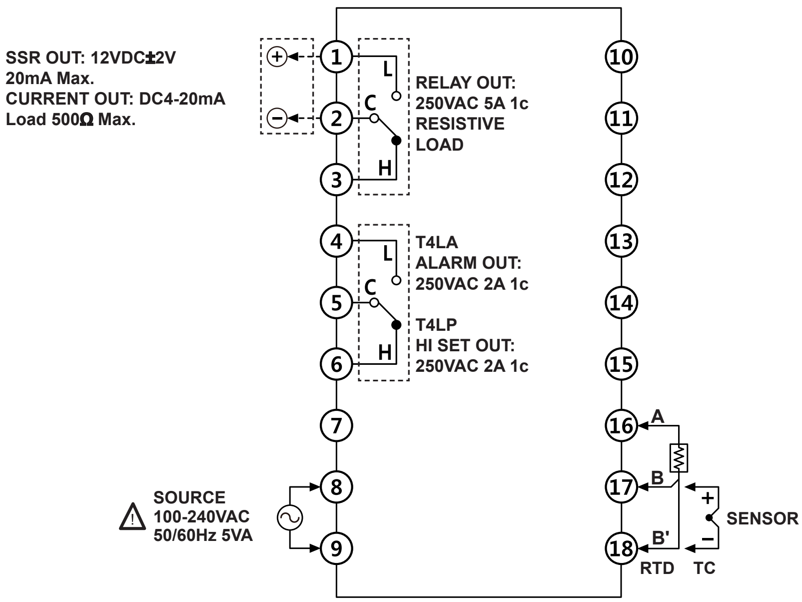
● T4M/T4MA



● T3H/T3HA/T3HS



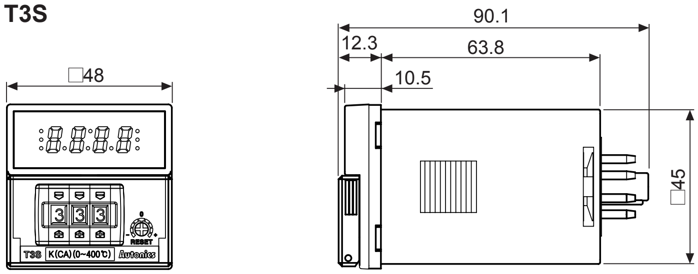
● T4L/T4LA/T4LP



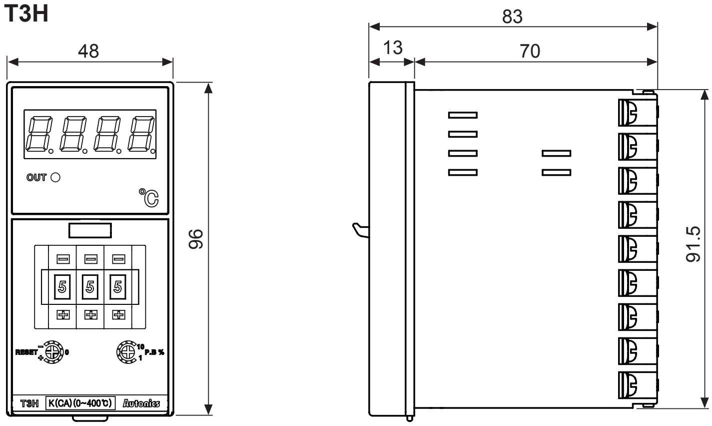
■ Dimensions

(unit: mm)

● T3S

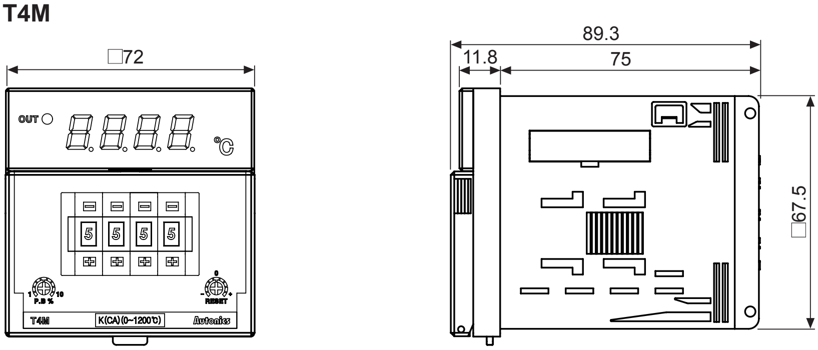


● T3H



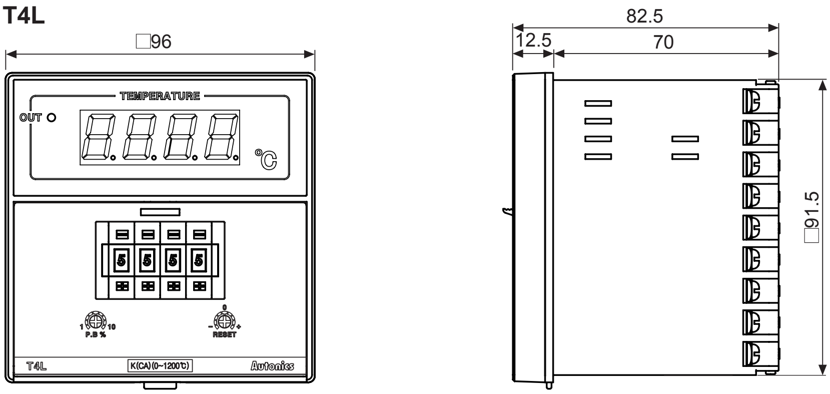
※T3HA, alarm output model, has the alarm output value volume switch.
※T3HS, sub output model, has the temperature setting of sub output volume switch.

● T4M



※T4MA, alarm output model, has the alarm output value volume switch.

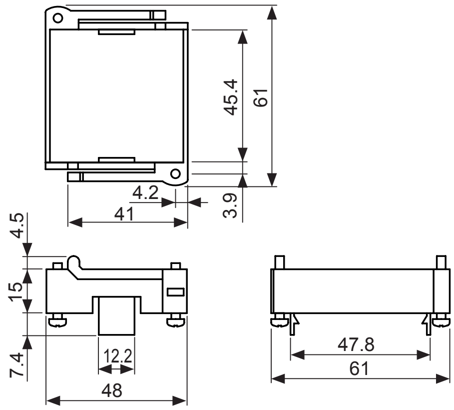
● T4L



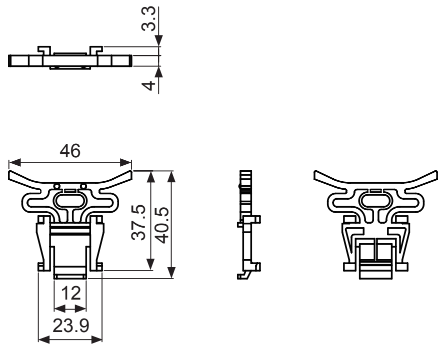
※T4LA, alarm output model, has the alarm output value volume switch.
※T4LP, dual setting output model, has the two thumbwheel switches.

● Bracket

●T3S

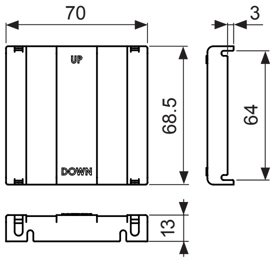


●T3H/T4M/T4L

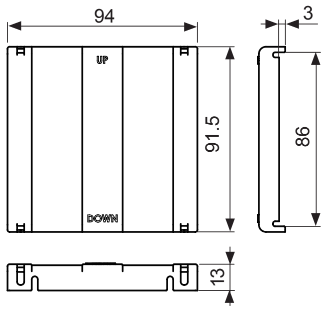


● Terminal cover (sold separately)

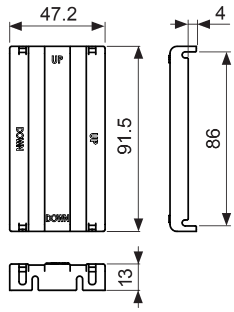
●RMA-COVER (72×72mm)



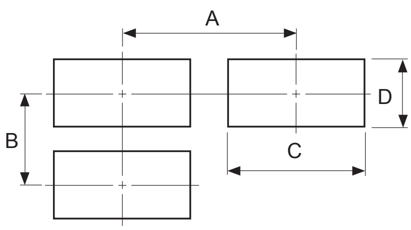
●RLA-COVER (96×96mm)



●RHA-COVER (48×96mm)



●Panel cut-out



Series \ Size	A	B	C	D
T3S	Min. 65	Min. 65	$45^{+0.6}_{0}$	$45^{+0.6}_{0}$
T3H	Min. 65	Min. 115	$45^{+0.6}_{0}$	$92^{+0.8}_{0}$
T4M	Min. 90	Min. 90	$68^{+0.7}_{0}$	$68^{+0.7}_{0}$
T4L	Min. 115	Min. 115	$92^{+0.8}_{0}$	$92^{+0.8}_{0}$

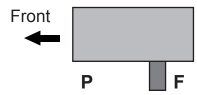
▣ Function

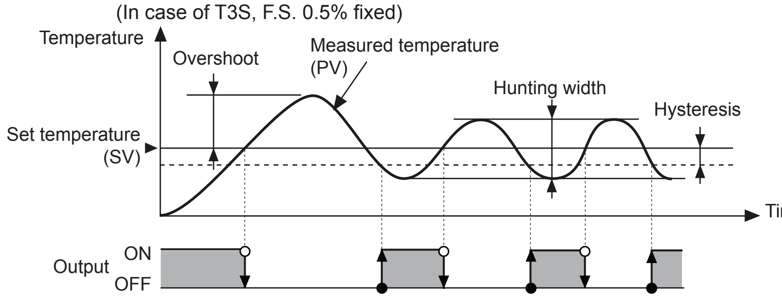
1. Control method

1)ON/OFF control

Comparing the present measured temperature and the set temperature, the temperature controller turns ON/OFF of the load power. Interval between ON and OFF of control output is set by the set hysteresis. When hysteresis of control output is too narrow, hunting (overshoot, chattering) may occur by external noise.
[Setting range of Hysteresis] F.S. 0.2 to 3%
(In case of T3S, F.S. 0.5% fixed)

※Control method setting switch

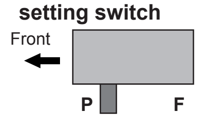


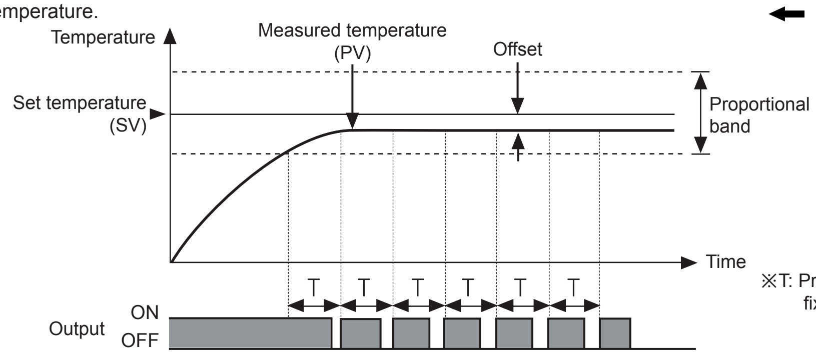


2)Proportional control

Proportional control has control output which is proportional to deviation from the present temperature to the set temperature in the proportional band to the set temperature.

※Control method setting switch



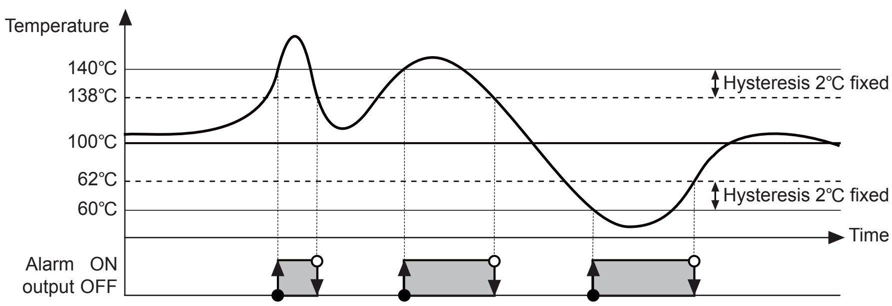


※T: Proportional band is fixed as 20 sec.

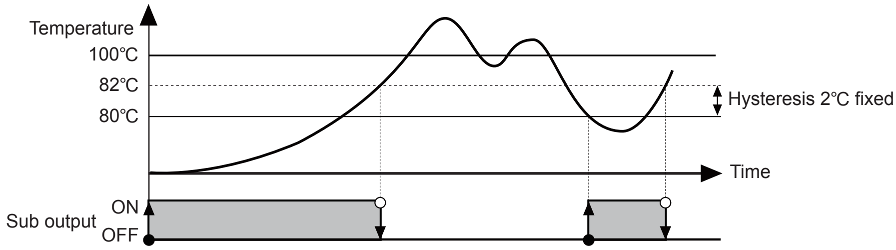
It is available to control without overshoot or hunting comparing ON/OFF control but it may cause offset. Correct the offset with the RESET volume switch.
[Setting range of Proportional band] F.S. 1 to 10% (In case of T3S, F.S. 3% fixed)
[Setting range of RESET] F.S. -3 to 3%

2. Alarm output

Alarm temperature is applied to the high/low-limit based on the set temperature. Alarm output operates deviation high/low-limit.
Setting range of Alarm temperature: F.S. 0 to 10%
E.g.) When F.S. is 400℃ and max. alarm temperature (F.S. 10%) is 40℃.
When the set temperature is set as 100℃, alarm output operation range is 140℃ to 60℃.

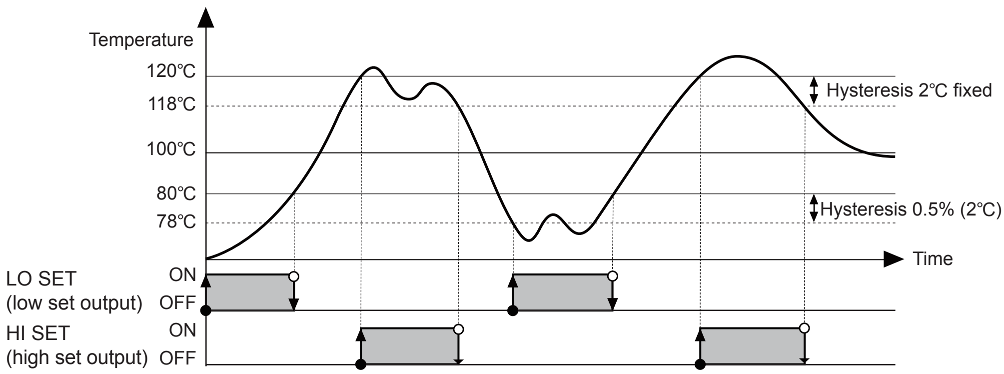


3. Sub output (Only for T3HS)
Only the T3HS model has sub output. This output operates as deviation low-limit alarm.
[Setting range of Sub output]: 0 to 50℃
E.g.)Set temperature is set as 100℃ and sub-output is set as 20℃



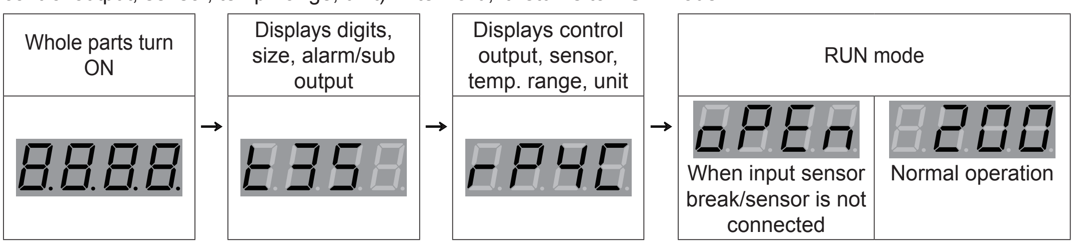
4. Dual setting output (Only for T4LP)
Only the T4LP model has dual setting output.
-LO SET (low set output: ON/OFF control (Hysteresis: F.S. 0.2 to 3%),
Proportional control (Proportional band: F.S. 1 to 10%)
-HI SET (high set output): Absolute value high-limit alarm output (Hysteresis: 2℃ fixed)
E.g.)T4LP, temperature sensor: DPt100, temperature range: 0 to 400℃

Type	Set temperature	Output	Hysteresis
LO SET (low set output)	80℃	ON/OFF control	0.5% (400×0.5%=2℃)
HI SET (High set output)	120℃	Absolute value high-limit alarm output	2℃ (fixed)



■ Display When Power Is ON

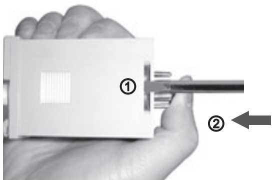
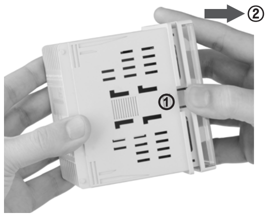
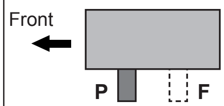
When power is supplied, whole display parts turn ON for 1 sec. It displays model type (digits, size, alarm/sub output and control output, sensor, temp. range, unit). Afterward, it returns to RUN mode.



When input sensor break/sensor is not connected, it displays [oPEn]. In case of normal operation, it displays the present input temperature and controls temperature.
※**During displaying model type, control output does not operate.**

■ Control Method (ON/OFF, Proportional Control) Setting

Before supplying power, remove the case and set the control method by the control method setting switch.

T3S	Other Series	Control method setting switch
 Press the 8-pin plug with your thumb. Insert a flat head driver to the ① groove and uplift the case (same as the other side). Push it to the ② direction and the case is removed.	 Press the ① with your thumb. Pull the case to the ② direction and it is removed.	 P: Proportional control (default) F: ON/OFF control

■ Error Display And Output Operation

●: ON
○: OFF

Display	Description	Control output※1	Alarm output	Sub output	Dual output	Troubleshooting
oPEn	Flashes when a temperature sensor is broken or not connected.	○	●	○	●	Check the status of the temperature sensor. When the sensor is connected correctly, it is clear.
HHHH	Flashes when the measured input value is higher than the temperature range of the sensor.	○	●	○	●	When the measured temperature is within the temperature range of the sensor, it is clear.
LLLL	Flashes when the measured input value is lower than the temperature range of the sensor.	●	●	●	○	
SuEr ※2	Flashes with the present value when the set value is out of the temperature range of the sensor.	○	○	○	○	The set value should be within the temperature range of the sensor.

※1: T4LP (Dual setting output) is the single output.
※2: When SuEr and oPEn/HHHH/LLLL occur at the same time, SuEr and oPEn/HHHH/LLLL flash in turn and all output turns OFF.

Temperature Indicator

■ Features

- Various size as DIN specifications (W48×H24, W72×H36, W96×H48, W48×H48, W48×H96, W72×H72, W96×H96mm)

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

T 3 S I - N 4 N P 4 C - N

New※1	N	New type
Temperature unit	C	℃
Temperature range※3	0	-99.9 to 99.9, -99 to 199℃, -99.9 to 199.9℃
	1	0 to 99.9℃
	2	0 to 200℃
	4	0 to 400℃
	5	0 to 500℃
	8	0 to 800℃
	A	0 to 999℃
	C	0 to 1200℃
	F	600 to 1600℃
Input type※3	P	DPt100Ω
	J	J(IC)
	K	K(CA)
	R	R(PR)
Control output	N	Indicator
Power supply	X	12-24VDC
	4	100-240VAC 50/60Hz
Control method	N	Indicator
Alarm/Sub output	I	Indicator
Size	N	DIN W48×H24mm
	Y	DIN W72×H36mm
	W	DIN W96×H48mm
	S	DIN W48×H48mm (8-pin plug type)※2
	H	DIN W48×H96mm
	M	DIN W72×H72mm
	L	DIN W96×H96mm
Digit	3	999 (3-digit)
	4	9999 (4-digit)
Item	T	Temperature Controller

※1: Name plate and connections are different from previous T3/T4 Series.
※2: Sockets (PG-08, PS-08(N)) are sold separately.

※3: Input type and temperature range by Series

Input type			Series / Model	T3NI	T4YI, T4WI	T3SI	T3HI	T4MI, T4LI
Thermocouples	K(CA)	0 to 200℃	2	●	-	-	-	-
		0 to 400℃	4	●	-	-	-	-
		0 to 800℃	8	●	-	●	-	●
		0 to 999℃	A	●	-	-	●	-
		0 to 1200℃	C	-	●	-	-	●
	J(IC)	0 to 200℃	2	●	-	-	-	-
		0 to 400℃	4	●	-	●	●	●
		0 to 500℃	5	●	●	-	-	-
	R(PR)	600 to 1600℃	F	-	-	-	-	●
RTD	DPt 100Ω	-99.9 to 99.9℃	0	●	-	-	-	-
		-99.9 to 199.9℃	0	-	●	-	-	●
		-99 to 199℃	0	-	-	-	●	-
		0 to 99.9℃	1	●	-	●	-	-
		0 to 200℃	2	●	-	-	-	-
		0 to 400℃	4	●	●	●	●	●

※Please contact us for temperature unit ℉ model.

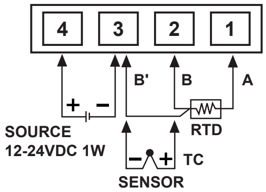
■ Specifications

Series		T3NI	T4YI	T4WI	T3SI	T3HI	T4MI	T4LI
Power supply		12-24VDC	100-240VAC 50/60Hz					
Allowable voltage range		90 to 110% of rated voltage						
Power consumption		Max. 1W	Max. 3VA					
Display method		7-segment (red) LED method						
Character size (W×H)		3.8×7.6mm	8.0×14.2mm		3.8×7.6mm	6.0×10.0mm		8.0×14.2mm
Input type	RTD	DPt100Ω (allowable line resistance max. 5Ω per a wire)						
	TC	K(CA), J(IC)					K(CA), J(IC), R(PR)	
Display accuracy※1	RTD	●At room temperature (23ºC ± 5ºC): (PV ± 0.5% or ±1ºC, select the higher one)±1-digit ●Out of room temperature range: (PV± 0.5% or ±2ºC, select the higher one)±1-digit						
	TC							
Sampling period		100ms						
Dielectric strength		1,000VAC 50/60Hz for 1 min (between input terminal and power terminal)	2,000VAC 50/60Hz for 1 min (between input terminal and power terminal)					
Vibration		0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours						
Insulation resistance		Over 100MΩ (at 500VDC megger)						
Noise immunity		Square-wave noise by noise simulator (pulse width 1μs) ±500V R-phase and S-phase	Square-wave noise by noise simulator (pulse width 1μs) ±2kV R-phase and S-phase					
Environ-ment	Ambient temp.	-10 to 50℃, storage: -20 to 60℃						
	Ambient humi.	35 to 85% RH, storage: 35 to 85% RH						
Weight※2		Approx. 48g (approx. 25g)	Approx. 181g (approx. 123g)	Approx. 231g (approx. 140g)	Approx. 120g (approx. 80g)	Approx. 203g (approx. 137g)	Approx. 202g (approx. 137g)	Approx. 274g (approx. 185g)

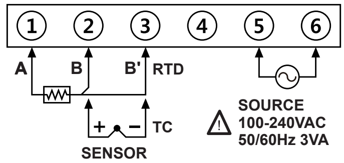
※1: In case of the T3NI, T3SI Series and the decimal point display models
At room temperature (23ºC±5ºC): (PV ±0.5% or ±2℃, select the higher one)±1-digit
Out of room temperature range: (PV ±0.5% or ±3℃, select the higher one)±1-digit
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Connections

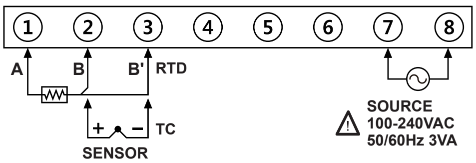
- T3NI



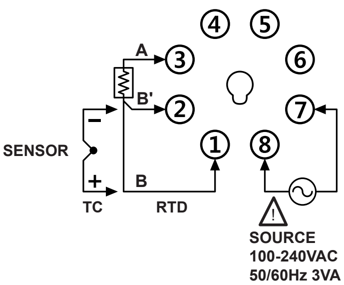
- T4YI



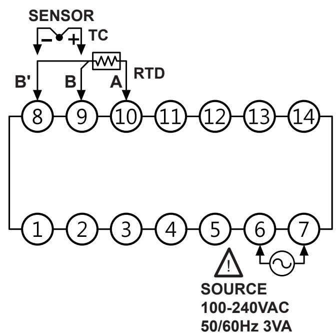
- T4WI



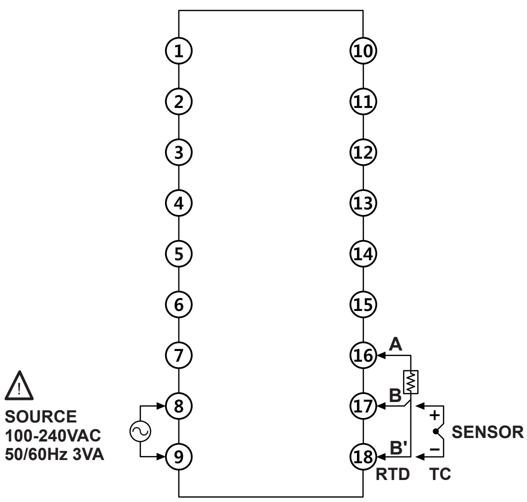
- T3SI



- T4MI



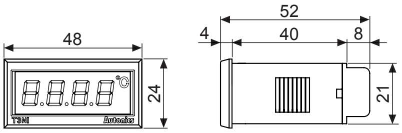
- T3HI, T4LI



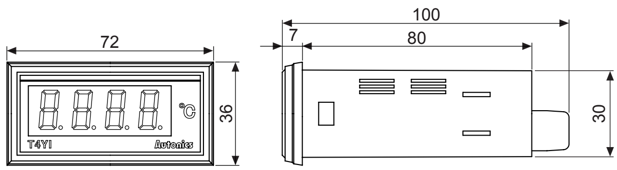
Dimensions

(unit: mm)

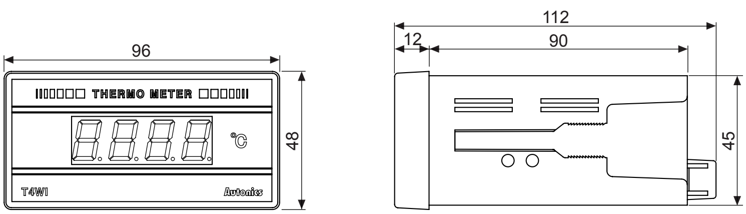
- **T3NI**



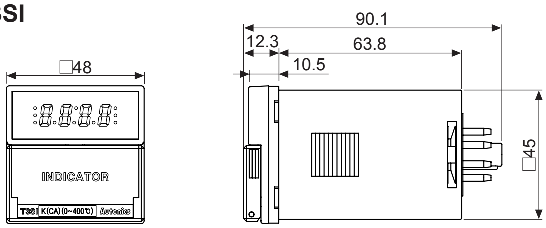
- **T4YI**



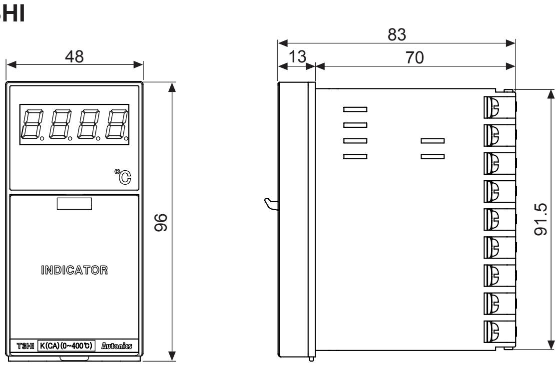
- **T4WI**



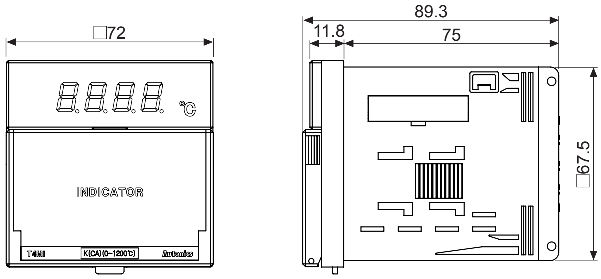
- **T3SI**



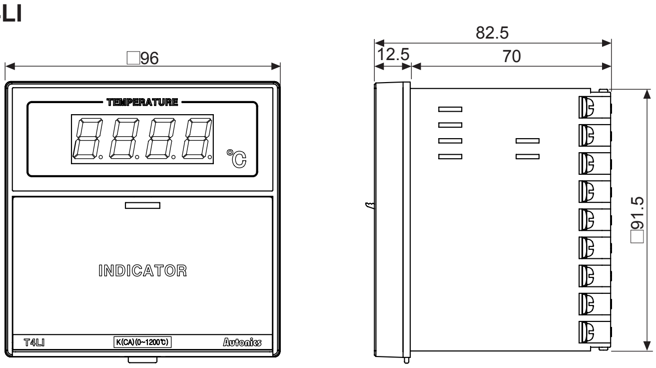
- **T3HI**



● T4MI



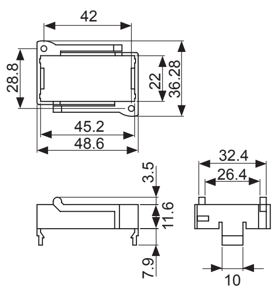
● T4LI



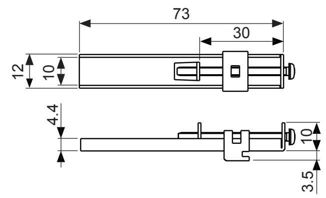
● Bracket

(unit: mm)

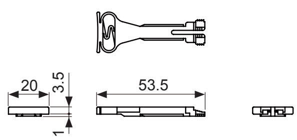
●T3NI Series



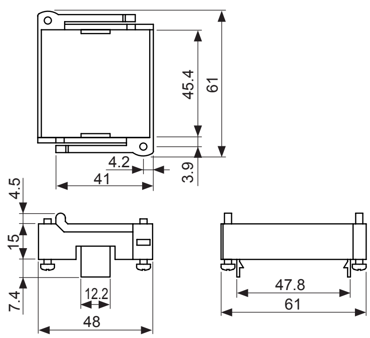
●T4YI Series



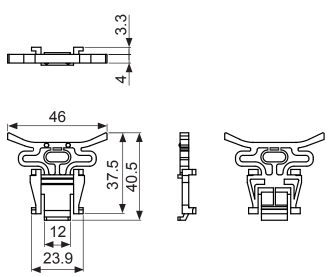
●T4WI Series



●T3SI Series



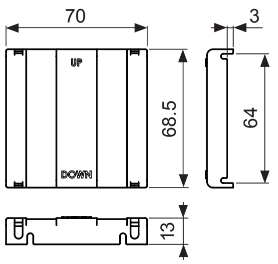
●T3HI/T4MI/T4LI Series



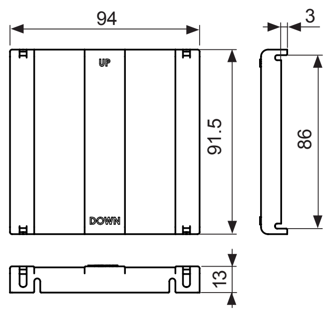
● **Terminal cover (sold separately)**

(unit: mm)

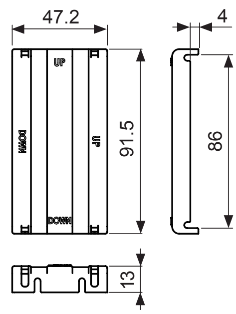
●RMA-COVER (72×72mm)



●RLA-COVER (96×96mm)

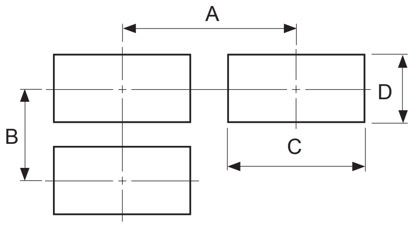


●RHA-COVER (48×96mm)



●**Panel cut-out**

(unit: mm)



Series \ Size	A	B	C	D
T3NI	Min. 55	Min. 37	$45^{+0.5}_{0}$	$22.2^{+0.3}_{0}$
T4YI	Min. 91	Min. 40	$68^{+0.7}_{0}$	$31.5^{+0.6}_{0}$
T4WI	Min. 116	Min. 52	$92^{+0.8}_{0}$	$45^{+0.6}_{0}$
T3SI	Min. 65	Min. 65	$45^{+0.6}_{0}$	$45^{+0.6}_{0}$
T3HI	Min. 65	Min. 115	$45^{+0.6}_{0}$	$92^{+0.8}_{0}$
T4MI	Min. 90	Min. 90	$68^{+0.7}_{0}$	$68^{+0.7}_{0}$
T4LI	Min. 115	Min. 115	$92^{+0.8}_{0}$	$92^{+0.8}_{0}$

■ Display When Power Is ON

When power is supplied, whole display parts turn ON for 1 sec. It displays model type (digits, size, alarm/sub output and control output, sensor, temp. range, unit). Afterward, it returns to RUN mode.

Whole parts turn ON

→ Displays digits, size, alarm/sub output

→ Displays control output, sensor, temp. range, unit

→ RUN mode

When input sensor break/sensor is not connected

Normal operation

When input sensor break/sensor is not connected, it displays [oPEn].
In case of normal operation, it displays the present input temperature.

■ Error Display

Display	Description	Troubleshooting
oPEn	Flashes when a temperature sensor is broken or not connected.	Check the status of the temperature sensor. When the sensor is connected correctly, it is clear.
HHHH	Flashes when the measured input value is higher than the temperature range of the sensor.	When the measured temperature is within the temperature range of the sensor, it is clear.
LLLL	Flashes when the measured input value is lower than the temperature range of the sensor.	

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Analog, Non-Display Type Temperature Controller

■ Features

- Non-indicating type
- Setting temperature by Dial
- Includes burn out function
- Universal power: TOS

⚠ **Please read "Caution for your safety" in operation manual before using.**

(TOS Series only)

■ Ordering Information

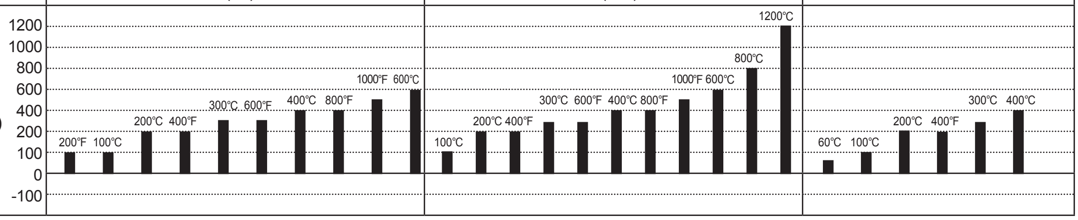
T O S — B 4 R P 4 C

Code position	Item	Code	Description
C	Unit	C	℃
		F	℉
4	Temperature range	X	0 to 60
		1	0 to 100
		2	0 to 200
		3	0 to 300
		4	0 to 400
		6	0 to 600
		8	0 to 800
		A	0 to 1000
		C	0 to 1200
P	Sensor input type	P	DPt100Ω
		J	J(IC)
		K	K(CA)
R	Control output	R	Relay output
		S	SSR drive output
4	Power supply	3	110/220VAC 50/60Hz
		4	100-240VAC 50/60Hz
B	Control method	P	Proportional control
		F	ON/OFF control
		B	ON/OFF, P control
S	Size	S	DIN W48×H48mm
		M	DIN W72×H72mm
		L	DIN W96×H96mm
O	Digit	O	Non-indicating
T	Item	T	Temperature Controller

※Refer to page H-123 about sensor temperature range for selection.

■ Temperature Range For Each Sensor

Series	TOS / TOM / TOL		
Sensor input type	Thermocouples		RTD
	J(IC)	K(CA)	DPt100Ω
Standard scale range (℃)			



※Temperature range of each mode is different.

■ Specifications

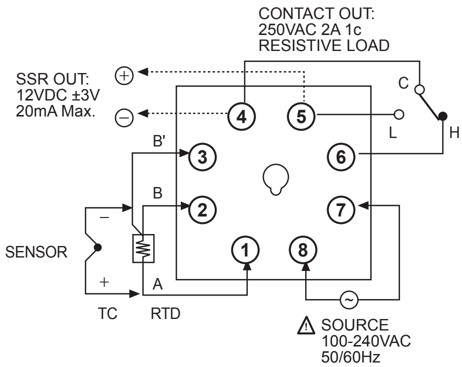
Series		TOS	TOM	TOL
Power supply		100-240VAC 50/60Hz	110/220VAC 50/60Hz	
Allowable voltage range		90 to 110% of rated voltage		
Power consumption		Max. 2.2VA	Max.3VA	
Display method		LED ON	LED ON/OFF	
Setting type		Dial setting		
Setting accuracy		F.S. ±2%		
Sensor input		Thermocouples: K(CA), J(IC) / RTD: DPt100Ω		
Input line resistance		Thermocouples: Max. 100Ω, RTD: Allowable line resistance max. 5Ω per a wire		
Control method	ON/OFF	Hysteresis: F.S. 0.5% ±0.2% fixed		
	Proportional	Proportional band: F.S. 3% fixed, Period: 20 sec fixed		
Control output		• Relay output: 250VAC 2A 1c • SSR drive output: 12VDC ±3V Load 20mA Max.	• Relay output: 250VAC 3A 1c • SSR drive output: 12VDC ±3V 20mA Max.	
Self-diagnosis		Built-in burn out function (cut off output when sensor is disconnected)		
Insulation resistance		Over 100MΩ (at 500VDC megger)		
Dielectric strength		2,000VAC 50/60Hz for 1 min		
Noise immunity		±1kV the square wave noise (pulse width: 1μs) by the noise simulator		
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour		
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min		
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times		
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times		
Relay life cycle	Mechanical	Min. 10,000,000 operations		
	Electrical	Min. 100,000 operations (250VAC 3A at resistive load)		
Environ-ment	Ambient temperature	-10 to 50℃, storage: -25 to 65℃		
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH		
Approval		c UL us	—	—
Unit weight		Approx. 155g (approx. 104g)※1	Approx. 419g	Approx. 426g

※F.S. is same with sensor measuring temperature range.
E.g.) In case of using temperature is from 0 to 800℃, Full scale is "800".
※1. The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

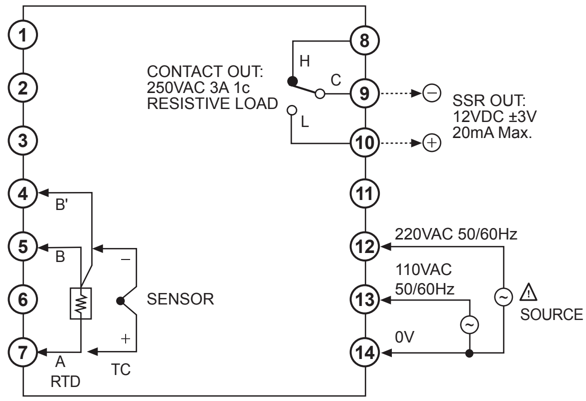
■ Connections

※RTD: DPt100Ω (3-wire type) ※Thermocouple: K(CA), J(IC)

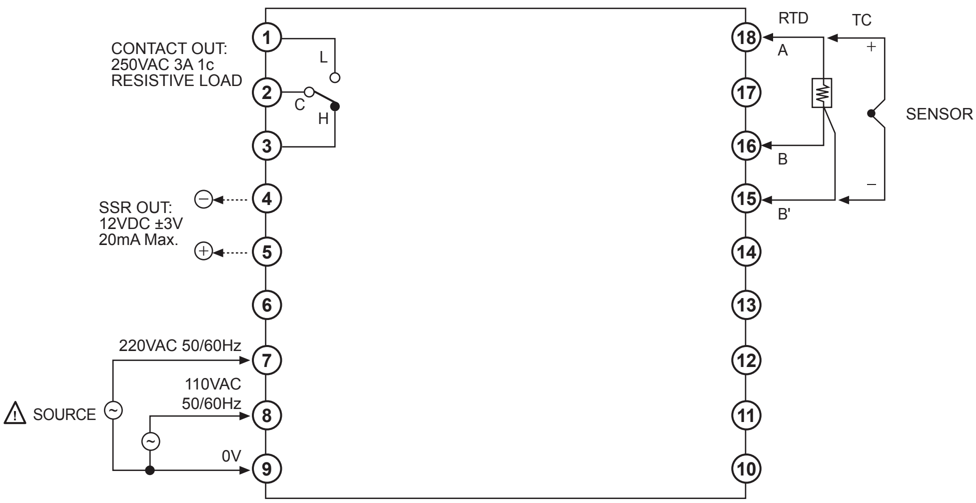
● TOS



● TOM



● TOL

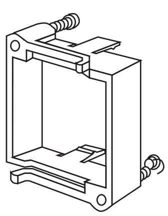


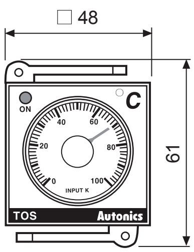
■ Dimensions

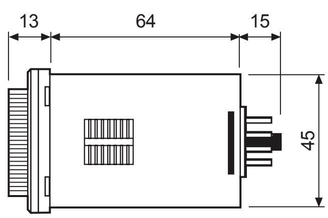
(unit: mm)

● TOS

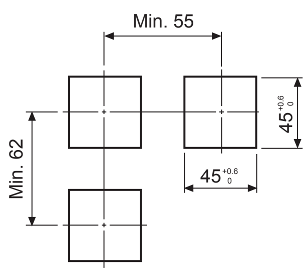
<Bracket>







●Panel cut-out

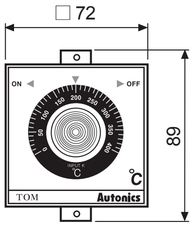


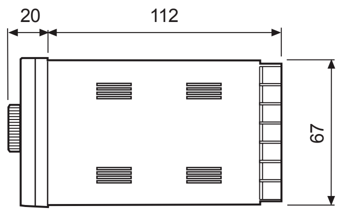
※Socket: PG-08, PS-08(N) (sold separately)

▣ Dimensions

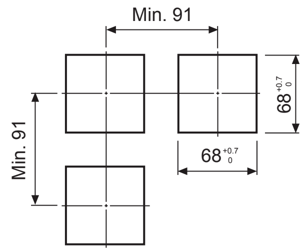
(unit: mm)

● TOM

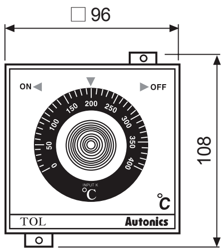


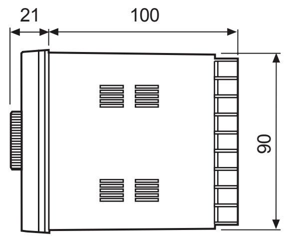


●Panel cut-out

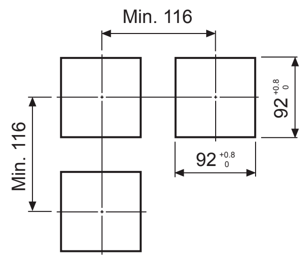


● TOL





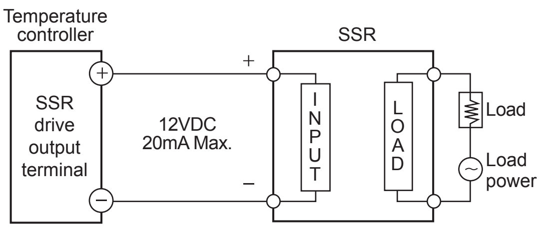
●Panel cut-out



▣ Proper Usage

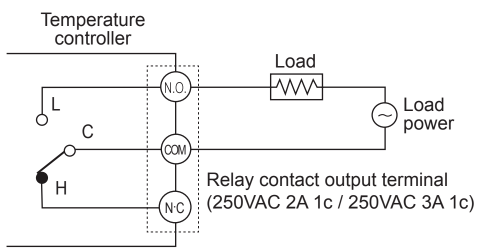
◎ Application of temperature controller and load connection

● SSR drive output connection



※When using voltage (for driving SSR) in the other purposes, do not over the range of the rated current.

● Relay output connection



◎ Normal/Reverse operation

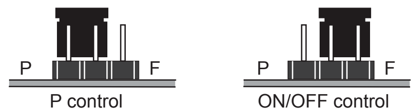
Reverse operation executes to output ON when processing value is lower than setting value, and it is used for heating.

Normal operation is executed conversely and used for cooling. (This item runs as a reverse operation.)

◎ How to select control mode

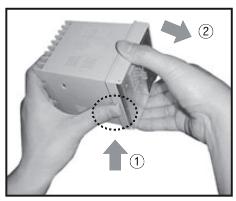
Factory specification is P control. When using ON/OFF control, transfer the switch of control method from P to F after detaching the case from its body.

Note)Several models require to change control method by jump line or solder.



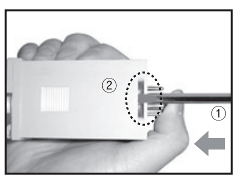
◎ Case detachment

● TOM, TOL



Pressing the front guide of Lock toward ① and squeeze and pull toward ②, it is detached.

● TOS



Pressing Pin plug ①, raise it up with a driver as ② and it is detached.

※Refer to page H-172 for caution during use and simple error diagnosis.

Refrigeration Temperature Controller

Features

- ON/OFF Control
- Input specification - Basic specification: NTC (Thermistor), Option: RTD (DPt100Ω)
- Temperature display range
  NTC sensor type: -40.0 to 99.9℃ (-40 to 212℉)
  RTD sensor type: -99.9 to 99.9℃ (-148 to 212℉)
- Supports various delay functions for utilize freezing
  Auto/Manual Defrost selection function, Start-up delay of compressor,
  Re-operation delay, Minimum ON time, Delay of defrost-end,
  Operation delay of evaporation-fan
- Input correction function
- Enable to set operation period for protecting compressor in error.

⚠ Please read "Caution for your safety" in operation manual before using.

c UL us (except 12-24VDC)

Ordering Information

TC | 3 | Y | F — 1 | 4 | R

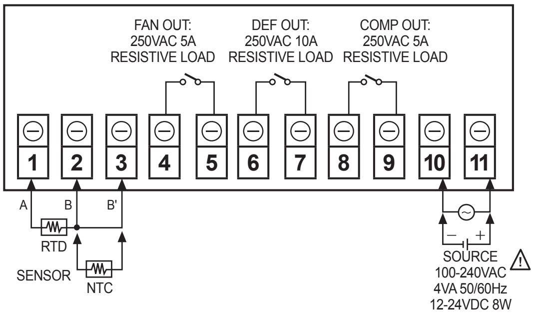
Position	Code	Description
Control output	R	Relay output
Power supply	1	12-24VDC
	4	100-240VAC 50/60Hz
Control output type refrigeration	1	Compressor output
	2	Compressor+Defrost output
	3	Compressor+Defrost+Evaporation output
Control mode	F	Freezing control
Size	Y	DIN W72×H36mm
Digit	3	999 (3-digit)
Item	TC	Temperature Controller

Specifications

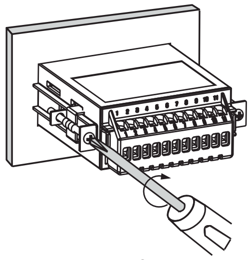
Model		TC3YF-1□R	TC3YF-2□R	TC3YF-3□R
Power supply	AC power	100-240VAC 50/60Hz		
	DC power	12-24VDC		
Allowable voltage range		90 to 110% of rated voltage		
Power consumption	AC power	Max. 4VA (100-240VAC 50/60Hz)		
	DC power	Max. 8W (12-24VDC)		
Display method		7 Segment LED method (red)		
Character size (W×H)		7.4×15.0mm		
Input type		NTC: 5kΩ, RTD※1: DPt 100Ω		
Input line resistance		Allowable line resistance is max. 5Ω per a wire		
Sampling period		500ms		
Display accuracy		• At room temp. (23 ±5℃): (PV ±0.5% or 1℃, select the higher one) rdg ±1digit • Out of room temp. range: (PV ±0.5% or 1℃, select the higher one) rdg ±1℃		
Control output	Compressor (COMP)	250VAC 5A 1a		
	Defrost (DEF)	—	250VAC 10A 1a	
	Evaporator-fan (FAN)	—	—	250VAC 5A 1a
Control method		ON/OFF control		
Hysteresis		0.5 to 5.0℃, 2 to 50℉ variable		
Relay life cycle	Compressor (COMP)	Mechanical: Min. 20,000,000 operations, Electrical: Min. 50,000 operations (250VAC 5A resistive load)		
	Defrost (DEF)	Mechanical: Min. 20,000,000 operations, Electrical: Min. 100,000 operations (250VAC 10A resistive load)		
	Evaporator-fan (FAN)	Mechanical: Min. 20,000,000 operations, Electrical: Min. 50,000 operations (250VAC 5A resistive load)		
Memory retention		Approx. 10 years (non-volatile memory method)		
Insulation resistance		100MΩ (at 500VDC megger)		
Dielectric strength		2000VAC 60Hz for 1 min (between all external terminals and case)		
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min		
Noise resistance	AC power	Square-wave noise by the noise simulator (pulse width: 1μs) ±2kV R-phase and S-phase		
	DC power	Square-wave noise by the noise simulator (pulse width: 1μs) ±500V R-phase and S-phase		
Environ-ment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃		
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH		
Protection structure		IP65 (front part, IEC Standards)		
Approval		c UL us (except DC power)		
Weight※2		Approx. 229g(Approx. 143g)		

※1: RTD input type is option. ※Environment resistance is rated at no freezing or condensation.
※2: The weight includes packaging. The weight in parentheses is for unit only. The weight may be varied bymodel specification and option.

Connections



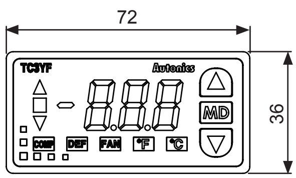
Installation

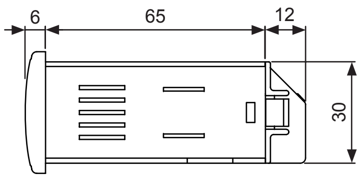


※Insert this unit into a panel, fasten bracket by pushing with tools as shown

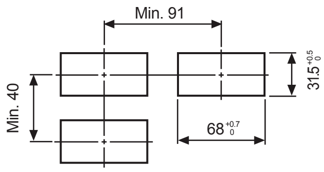
Dimensions

(unit: mm)

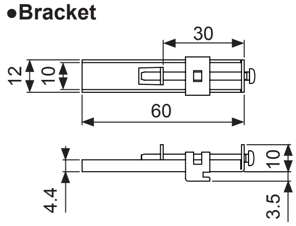




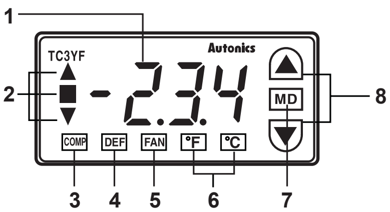
●Panel cut-out



●Bracket



Unit Description



1. Measured value (PV) display component (red):
RUN mode: Displays currently measured value (PV).
Setting mode: Displays parameter and setting value.

2. Deviation indicator [▲, ▼ (red)/■ (green)]:
Displays deviation of present value (PV) based on setting value (SV).

3. Compressor (COMP) output indicator:
Turns ON for compressor output. Flashes for protection operation, not compressor output.

4. Defrost (DEF) output indicator: Turns ON for defrost output. Flashes for defrost delay operation.

5. Evaporator-fan (FAN) output indicator:
Turns ON for Evaporator-fan output. Flashes for delay operation of Evaporator-fan output.

6. Unit indicator (℃, ℉): Displays temperature unit

7. MD key: Used for entering parameter setting group, returning RUN mode, moving parameter or saving SV.

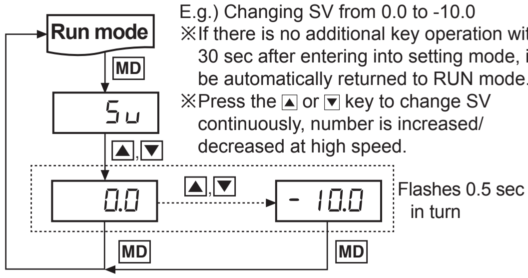
8. ▲, ▼ key: Used for changing SV of parameter setting.
Hold the ▲ key for 3 sec in RUN mode to execute/stop manual defrost.

Input Type And Range

※1: RTD input type is option.

Input sensor	Temperature range (℃)	Temperature range (℉)
Thermistor (5kΩ)	-40.0 to 99.9	-40 to 212
RTD (DPt100Ω)	-99.9 to 99.9	-148 to 212

SV Setting



E.g.) Changing SV from 0.0 to -10.0
※If there is no additional key operation within 30 sec after entering into setting mode, it will be automatically returned to RUN mode.
※Press the ▲ or ▼ key to change SV continuously, number is increased/decreased at high speed.

Flashes 0.5 sec in turn

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Parameter 1 Group

※Press the MD key after checking/changing each parameter to save the SV and it moves to the next parameter.
※Hold the MD key for 3 sec while in setting mode to return RUN mode.

RUN mode — MD 3 sec → Hysteresis; MD 3 sec → RUN mode

Parameter	Display	Value (▲, ▼)	Setting range
Hysteresis	HYS	1.0	Setting range: 0.5 to 5.0℃, 2 to 50℉
Defrost cycle	dIn	4	Setting range: 0 to 24 hour ※Setting as [0], only manual defrost is available.
Defrost time	dEt	30	Setting range: 0 to 59 min ※Setting as [0], defrost output does not operate.
LBA monitoring time	LbA	0	Setting range: 0 to 999 sec ※Setting as [0], LBA function does not operate.
Input correction	Inb	0.0	Setting range: -10.0 to 10.0℃, -18 to 18℉
SV low-limit	LSu	-40.0	Setting range: Refer to '■ Input Type and Temperature Range '.
SV high-limit	HSu	99.9	Setting range: Refer to '■ Input Type and Temperature Range '.

(Each parameter moves to the next with MD; after SV high-limit, MD returns to Hysteresis.)

■ Parameter 2 Group

※Press the MD key after checking/changing each parameter to save the SV and it moves to the next parameter.
※Hold the MD key for 3 sec while in setting mode to return RUN mode.
※ The dot line parameter may not be displayed by other parameter setting.

RUN mode — MD 5 sec → Compressor start-up delay and restart delay time; MD 3 sec → RUN mode

Parameter	Display	Value (▲, ▼)	Setting range
Compressor start-up delay and restart delay time	SdL	0.20	Setting range: 0 min 10 sec to 9 min 59 sec
Compressor min. operation time	ont	0.20	Setting range: 0 min 10 sec to 5 min 00 sec
Defrost end delay and Evaporator-fan delay time	drP	1.00	Setting range: 0 min 00 sec to 5 min 59 sec
Evaporator-fan operation mode	FAn	EF1 ↔ EF2 ↔ EF3 ↔ EF4 ↔ EF5	
Compressor operation cycle when error occurs	CLE	0	Setting range: 0 to 20 min
Compressor duty ratio when error occurs	dUt	50	Setting range: 0 to 100% ※Not appear when compressor operation cycle when error occurs [CLE] is set as [0].
Temperature unit	Unt	°C ↔ °F	
Lock	LoC	oFF ↔ LC.1 ↔ LC.2 ↔ LC.3	

▣ Factory Default

● **SV Setting**

Parameter	Default
Su	0.0

● **Parameter 1 group**

Parameter	Default	Parameter	Default
HYS	1.0	Inb	0.0
dIn	4	LSu	40.0
dEt	30	HSu	99.9
LbA	0		

● **Parameter 2 group**

Parameter	Default	Parameter	Default
SdL	0.20	CLE	0
ont	0.20	dUt	50
drP	1.00	Unt	°C
FAn	EF1	LoC	oFF

▣ Function

◎ Compressor Protection

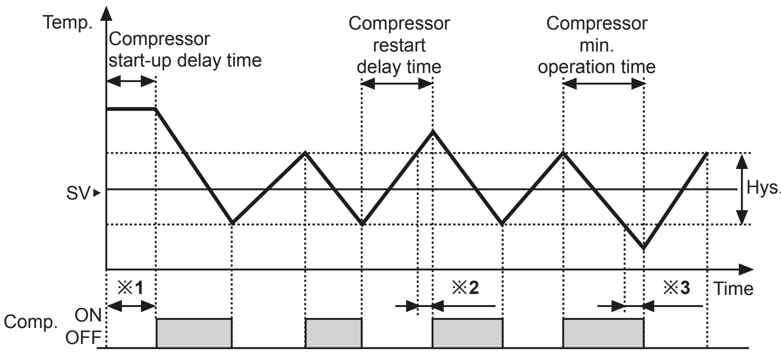
This function is for preventing compressor from life cycle shortening or malfunction by overload and frequent ON/OFF of compressor. As compressor protection settings, when compressor output does not ON, the front compressor (COMP) output indicator is flashing.

● Compressor start-up delay and restart delay time [SdL]

If power turns ON instantly from break-down or power OFF, it delays start-up during the set time of compressor. To prevent frequent compressor ON/OFF, set compressor ON time after compressor turns OFF.
Setting range: 0 min 10 sec to 9 min 59 sec

● Compressor min. operation time [ont]

To prevent frequent compressor ON/OFF, set min. operation time. Setting range:0 min 10 sec to 5 min 00 sec



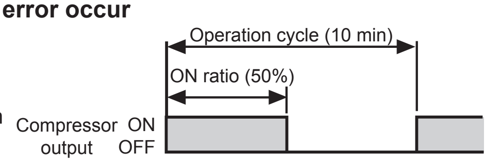
※1. When starting compressor, if present temperature (PV) is out of hysteresis range, compressor output does not turn ON and the compressor (COMP) output indicator is flashing during compressor start-up delay time.
※2. When present temperature (PV) is out of hysteresis, compressor output does not turn ON and the compressor (COMP) output indicator is flashing during compressor restart delay time.
※3. If present temperature (PV) is below the SV, compressor output maintains ON status during compressor min. operation time. After compressor min. operation time, it turns OFF.

◎ Compressor Control When Error Occur

If normal temperature control is impossible due to error, it controls compressor output by the set operation cycle and duty ratio to protect control object. Until error is cleared, operation cycle and duty ratio are applied repeatedly.

● Compressor operation cycle [CLE], duty ratio [dUt] when error occur

Set Compressor operation cycle and ON duty ration when error occur.
Set operation cycle as [0], and compressor output turns OFF.
Set duty ratio as [100], and compressor output turns ON continuously.
Setting range of compressor operation cycle when error occur: 0 to 20 min
Setting range of compressor duty ratio when error occur: 0 to 100%



E.g.) When compressor operation cycle when error occur [CLE] is set as 10 min and compressor duty ratio when error occur [dUt] is set as 50%, compressor output has 10 min cycle and turns ON for 5 min and turns OFF for 5 min.

◎ Defrost Control

When operating a compressor for a long time, an evaporator and a freezer are freezing and thermal efficiency of compressor is decreased. For increasing thermal efficiency, defrost operation helps to remove frost or ice around of evaporator.
Set defrost cycle, time, etc. to operate defrost (heater defrost).
The front defrost (DEF) output indicator turns ON during defrost output and it flashes during defrost delay operation.

● Defrost cycle [dIn], Defrost time [dEt]

Set defrost cycle and time to operate defrost at every set cycle and during the set time.
Set defrost cycle as [0], only manual defrost is available.
Setting range of defrost cycle: 0 to 24 hour   Defrost time Setting range: 0 to 59 min

● Manual defrost

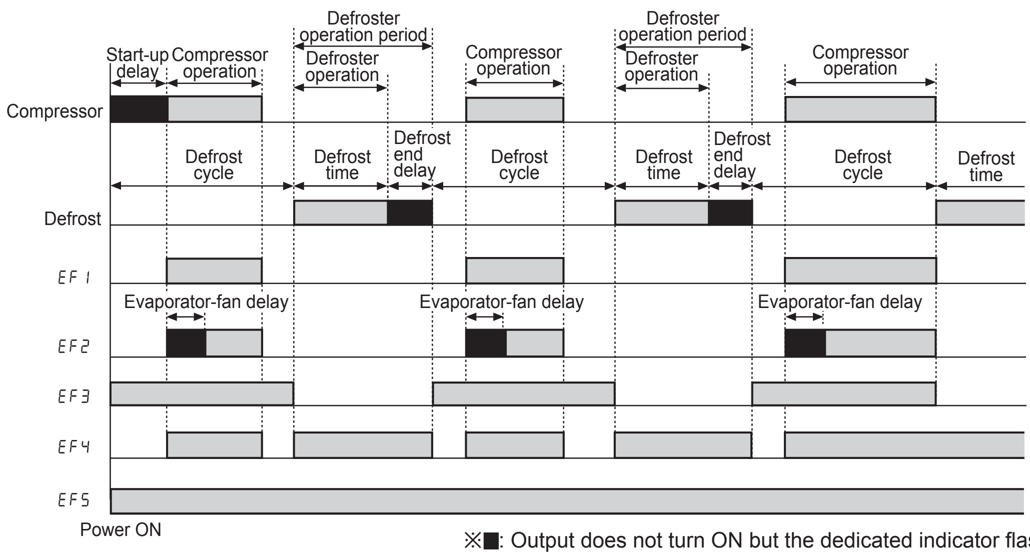
Execute defrost manually regardless of the set defrost cycle. Hold the ▲ key for 3 sec to operate defrost during the set defrost time. When defrost output turns ON, operating compressor output, Evaporator-fan output turn OFF. Hold the ▼ key for 3 sec during manual defrost, applied manual defrost is complete and pre-set defrost cycle restarts.

● Defrost end delay and Evaporator-fan start-up delay time [drP]

Defrost end delay time and Evaporator-fan start-up delay time operate individually bye one setting.
Setting range: 0 min 00 sec to 5 min 59 sec

- Defrost end delay time: During defrost operation, drops may exist at evaporator. Set the time to drain remained drops after completing defrost.
- Evaporator-fan start-up delay time: If evaporator temperature is increased by defrost operation, warm air may flow into cooling system by Evaporator-fan operation. Set Evaporator-fan start-up delay time to prevent warm air inflow, and it may increase cooling efficiency.

◎ Evaporator-fan operation mode



※■: Output does not turn ON but the dedicated indicator flashes.

Parameter	Operation method
EF1	When compressor operates, evaporator-fan also operates. When compressor operation is finished, evaporator-fan also operation turns OFF.
EF2	When compressor operates, evaporator-fan operates after the set evaporator-fan start-up delay time. When compressor operation is finished, evaporator-fan operation turns OFF. (regardless of defroster operation)
EF3	When power turns ON, evaporator-fan operates. When defroster operates, evaporator-fan stops. (regardless of compressor operation)
EF4	Evaporator-fan operates only when operating compressor or defrost. Evaporator-fan stops when compressor and defroster stops. (for above zero temperature control)
EF5	Evaporator-fan operates from power ON to power OFF. (regardless of compressor, defroster operation)

◎ Loop Break Alarm (LBA) [LbA]

When freezer temperature is not changed over 1.0 (2°F) during set LBA monitoring time [LbA] of parameter 1 group, it regards as abnormal compressor and it displays error. (Err↔LbA, flashings in turn) When error occur, compressor is controlled according to the set compressor operation cycle [CLE]and duty ratio [dUt] when error occur. Check the compressor and hold the ▲+▼ keys for 3 sec and error clears and it operates normally.
Setting range: 0 to 999 sec (Setting as [0], LBA function does not operate)

◎ Lock

For preventing changing SV and parameters of each parameter group.

Display	Description
oFF	Unlock
LC.1	Parameter 2 group
LC.2	Locks parameter 1, 2 groups
LC.3	Locks parameter 1, 2 groups, SV setting

◎ Error Display

Flashing in turn	Description	Troubleshooting
Err↔oPn	When input sensor is break or sensor is disconnected.	Check input sensor status.
Err↔HHH	If the measured temperature is higher than high-limit temperature among temperature setting range.	It clears when input is within the display range.
Err↔LLL	If the measured temperature is lower than low-limit temperature among temperature setting range.	
Err↔LbA	Even though input sensor is normal, freezer temperature does not change over 1.0℃ (2°F) during LBA monitoring time [LbA].	Check the compressor and hold the ▲+▼ key at the same time for 3 sec. It clears when input is within the adequate range.

■ Proper Usage

- Please beware not to exceed the rated specification of relay when using relay contact or it may cause a fire with breakdown.
- Please mount a surge absorption device at coil when controlling high-capacity power relay or a magnet, the counter electromotive force can be flowed into the inside of the device for relay contact operation.
- Please install power switch or circuit-breaker in order to cut power supply off.
- The switch or circuit-breaker should be installed near by users.
- This unit is designed for temperature controlling only. Do not apply this unit as a voltage meter or a current meter.
- In case of using RTD sensor, 3-wire type must be used. If you need to extend the line, 3-wire must be used with the same thickness as the line. It might cause temperature difference if the resistance of line is different.
- Please check the polarity and connect correctly when connecting RTD sensor to temperature controller. NTC sensor is a non-polarity.
- In case of making power line and input signal line close, line filter for noise protection should be installed at power line and input signal line should be shielded.

  (Note) Please make sensor line shortly and use it because the narrow range of input correction range.
- Keep away from the high frequency instruments. (High frequency welding machine & sewing machine, big capacitive SCR controller)
- Please use AWG28-12 for power input and relay output connection, fasten the terminal block as a torque 0.3N·m.
- This unit may be used in the following environments.
  - Indoor
  - Altitude: Under 2,000m
  - Pollution degree 2
  - Installation category II

Simple Operation Type Temperature Controller

■ Features

- Simple operation type
- ON/OFF and proportional control
- Input correction, offset correction, manual reset, cooling/heating operation functions
- PV deviation indicator

Please read "Caution for your safety" in operation manual before using.

c UL us

■ Ordering Information

TC 3 Y T — B 4 R 3

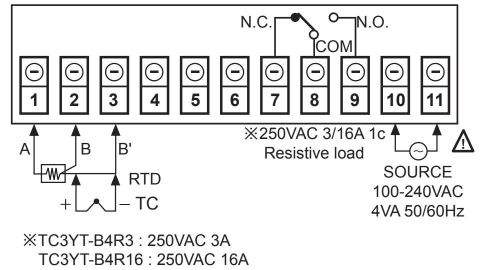
Item	Code	Description
Relay capacity	3	250VAC 3A 1c
	16	250VAC 16A 1c
Control output	R	Relay output
Power supply	4	100-240VAC 50/60Hz
Control mode	B	ON/OFF and proportional control (common use)
Setting type	T	Touch S/W single setting type
Size	Y	DIN W72×H36mm
Digit	3	999 (3-digit)
Item	TC	Temperature Controller

■ Specifications

Model		TC3YT-B4R3	TC3YT-B4R16
Power supply		100-240VAC 50/60Hz	
Allowable voltage range		90 to 110% of rated voltage	
Power consumption		Approx. 4VA	
Display method		7-segment Red LED Display [Deviation "■" signal (green), unit display (yellow)]	
Character size		W7.4 × H15mm	
Input type		TC: K(CA), J(IC), RTD: DPt100Ω (DIN)	
Control output		Relay output 250VAC 3A 1c	Relay output 250VAC 16A 1c
Control method		ON/OFF and proportional control (common use)	
Hysteresis		1 to 100℃	
Proportional band		0 to 100%	
Offset correction		0 to 100%	
Control period		1 to 120 sec	
Display method		±1-digit with a bigger one of ±0.5% of PV or ±1℃	
Setting type		Setting by front push buttons	
Sampling period		500ms	
Dielectric strength		2000VAC 60Hz for 1 min (between external terminal and case)	
Vibration		0.75mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 1 hour	
Relay life cycle	Mechanical	Min. 10,000,000 operations	
	Malfunction	Min. 100,000 operations (250VAC 3A resistive load)	Min. 100,000 operations (250VAC 16A resistive load)
Insulation resistance		Over 100MΩ (at 500VDC megger)	
Noise immunity		±2kV R-phase and S-phase (pulse width: 1μs)	
Memory retention		Approx. 10 years (When using non-volatile semiconductor memory type)	
Environment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃	
	Ambient humidity	35 to 85%RH	
Protection		IP65	
Approval		c UL us	
Unit weight		Approx. 99g	Approx. 103g

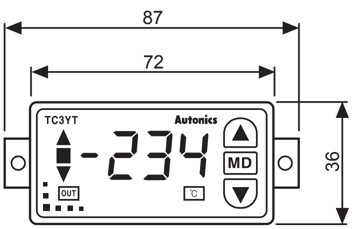
※Environment resistance is rated at no freezing or condensation.

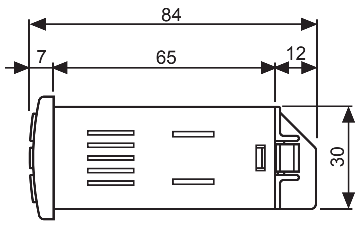
■ Connections



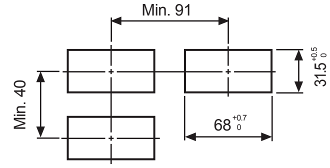
■ Dimensions

(unit: mm)

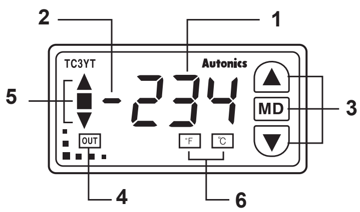




●Panel cut-out



■ Unit Description



1. PV (Process value) display (Red)
2. Minus display (Red)
3. Controlling a setting value (MD, UP, DOWN)
4. Display an operation of control output (Red)
5. Display a deviation between PV (Process value) and SV (Setting value) : ▲, ▼ (Red) / ■ (Green)
6. PV (Process value) ℃/℉ unit display (Yellow)

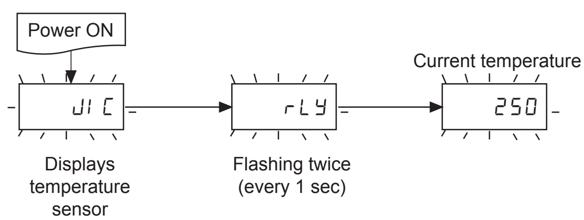
■ Input Type And Range

Input sensor		Display	Temperature range (℃)	Temperature range (℉)
Thermocouple	K(CA)	KCA	0 to 999	32 to 999
	J(IC)	JIC	0 to 400	32 to 752
RTD	DPt H	Pt.H	0 to 400	32 to 752
	DPt L	Pt.L	-99.9 to 199.9	-146 to 390

※A temperature sensor converts temperature into electrical signal so that a controller can do ON/OFF the control output.
※The setting is available with the using range.
※The setting range of the SV is limited within the using temperature range.
※Using temperature : It can be set as ℃, ℉ are displayed on the front side.

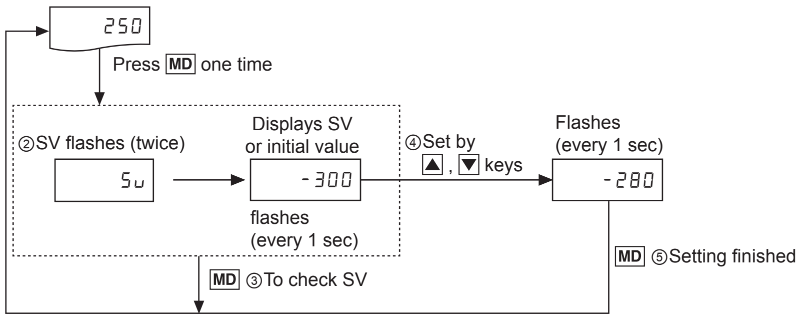
■ Display For Power ON

For power ON, it displays current temperature after temperature sensor and the type of control output flashes twice (every 1 sec). In case of error, Error signal flashes instead of current temperature.



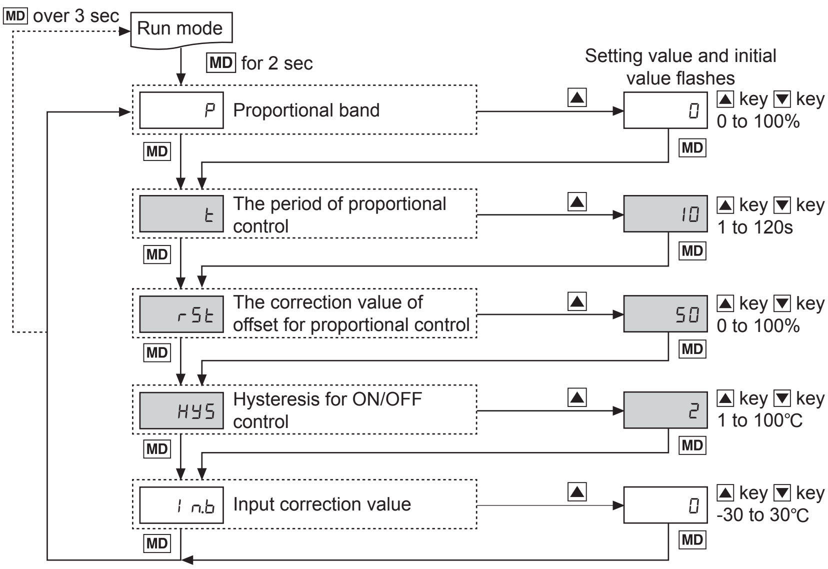
■ Checking And Setting SV

- SV can be checked and set on operation mode.
- Press MD key on operation mode.



①PV is displayed on operation mode,
②Press MD key, the SV is indicated after "Su" is flashing 2 times.
③In case of checking the SV only, after check it pressing MD key, then it returned to the drive mode.
④In case of changing and setting the SV, set it with ▲ , ▼ keys. If you press ▲ , ▼ keys continuously, the SV is increased/decreased with high-speed.
⑤If press MD key after setting, the setting value is saved and the mode returns to operation.
※**When there is no input for 1 min for setting operation, it returns to operation mode and the parameter setting value is not changed the prior value is saved.**

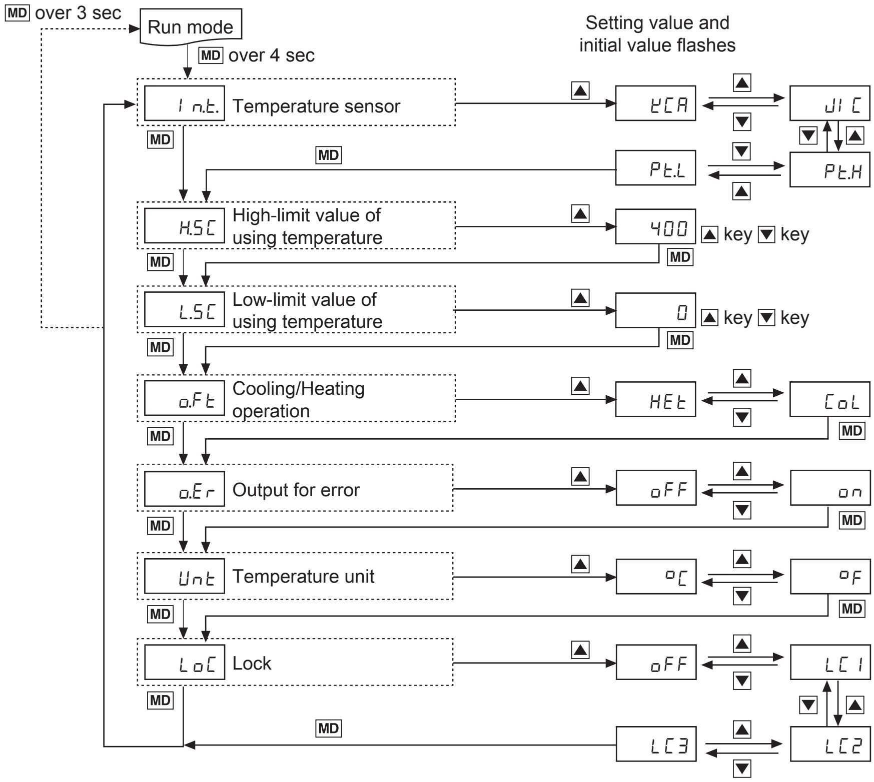
■ Parameter 1 Group



- In operation mode, if press MD key for 2 sec, it enters setting group 1.
  At the beginning of MD key input, Su signal is displayed. And then P signal, the first mode of group 1 is displayed for 2 to 3 sec. It enters the first mode of group 1 for finishing press MD.
- Parameter will be displayed when entering setting mode.
- Press MD key one time, parameter move to the next. Moreover for changing a setting value, press ▲ key. (Setting value is flashing every one sec.)
- Press a MD key after changing a setting value or for the statue of setting change, the setting value is saved and the parameter is changed to the next.
- In any moment during the setting operation, if press MD key for 3 sec, the changed value is saved and the mode is changed to operation mode.
- When there is no input for 1 min for setting operation, it returns to operation mode and the parameter setting value is not changed the prior value is saved.
- When P is not "0", [HYS] parameter is not displayed.
- When P is "0", ON/OFF control, [t] and [rSt] parameter is not displayed.

※When it is entered to the setting mode for all cases, applicable parameters will be displayed.

■ Parameter 2 Group



- In operation mode, if press MD key for 4 sec, it enters setting group 2.
  At the beginning of MD key input, Su signal is displayed. And then P signal, the first mode of group 1, is displayed for 2 to 3 sec for the moment of 4 sec past, In.t , the first mode of setting group 2, is displayed. It enters the first mode of group 2 for finishing press MD key.
- Parameter will be displayed when entering setting mode.
- Press MD key one time, parameter move to the next. Moreover for changing a setting value, press ▲ key.
  (Setting value is flashing every 1 sec.)
- Press a MD key after changing a setting value or for the statue of setting change, the setting value is saved and the parameter is changed to the next.
- In any moment during the setting operation, if press MD key for 3 sec, the changed value is saved and the mode is changed to operation mode.
- When there is no input for 1 min for setting operation, it returns to operation mode and the parameter setting value is not changed the prior value is saved.

※When it is entered to the setting mode for all cases, applicable parameters are displayed.
※When the unit of the using temperature is changed, the SV is changed as 0℃.

■ Factory Default

● Parameter 1 group

Parameter	Description	Setting range	Unit	Factory default
P	Proportional band	0 to 100	%	0
t	The period of proportional control	1 to 120	Sec	10
rSt	The correction value of offset for proportional control	0 to 100	%	50
HYS	Hysteresis for ON/OFF control	2 to 100	℃	2
In.b	Input correction value	-30 to 30	℃	0

● Parameter 2 group

Parameter	Description	Setting range	Unit	Factory default
In.t	Temperature sensor	KCA, JIC, PtH, PtL	-	JIC
H.SC	High-limit value of using temperature	Refer "▣ Input specifications and range."	℃	400
L.SC	Low-limit value of using temperature		℃	0
o.Ft	Cooling/Heating operation	HEt ↔ CoL	-	HEt
o.Er	Output for error	on ↔ oFF	-	oFF
Unt	Temperature unit	°C ↔ °F	-	°C
LoC	Lock	oFF, LC1, LC2, LC3	-	oFF

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Functions

◎ Input correction [I n.b]

- Input revise corrects the deviation, occurred from temperature sensor such as thermocouples, RTD, Analogue sensor etc.
- There are grades for temperature sensor and high accuracy one is a high price, normal products are usually used. Check the deviation of every thermo sensor precisely to measure temperature accurately.
- Use this mode after measuring deviation occurred from temperature sensor exactly because if measured deviation value is not correct, displayed temperature will be too high or too low.
- Setting range : -49 to 50℃ (Factory default : 0℃)
  E.g.)When even though current temperature is 80℃, display value is 78℃, input correction value should be 2 to display 80℃.

◎ Hysteresis [HYS]

- In the ON/OFF control, the ON/OFF interval of the output is required, this interval is hysteresis. When this interval is too narrow, it causes hunting such as chattering by external noise.
- For ON/OFF control, even when control is stable, there is hunting.
  Because the hunting is generated by combined cause, HYS setting value, response spec, sensor position, etc., it is not regular. To minimize it, proper HYS value, the capacity and characteristic of heater, and response and position of sensor need to be considered.
- Setting range : 1 to 100℃ (Factory default : 2℃)

◎ Proportional band [P]

- If current temperature (PV) is within the proportional control, it controls the ratio of ON and OFF during proportional control. At this moment the term of proportional control for setting value is called proportional band
- Setting range : 0 to 100% (Factory default : 0%)

◎ Control period (Proportional control) [t]

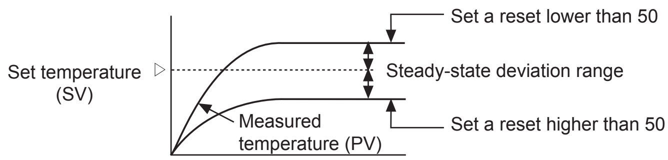
- When output the control value by using relay and SSR on the proportional control, it repeats ON for set time and OFF.
- The set time is called proportional control period.
- Setting range : 1 to 120 sec (Factory default: 10 sec)

◎ Setting range

- Hysteresis / proportional band / proportional period is set on parameter
- Setting range of hysteresis [HYS] : 1 to 100℃
- Setting range of proportional band [P] : 0 to 100%
- Setting range of control period [t] : 1 to 120 sec
- ON/OFF control ↔ Proportional control conversion: When P is 0%, it is ON/OFF control: if there is a value for P, is proportional control.
  The parameter of hysteresis [HYS] appears when [P], proportional band, is 0%.

◎ Offset correction / Manual reset [rSt]

- When use the proportional control, even when it is stable statue, deviation can occur because of heat capacity and heater capacity. It is called offset.
- Offset is set on the parameter of inner manual reset [rSt].
- Offset correction is used only for proportional control. (Not for [P]=0%). Therefore if proportional band [P] is set as 0%, manual reset parameter [rSt] is not shown.
- Setting range : 0 to 100% (Factory default : 50%)
- Set a value as 50% when PV is equal to SV. After control is stable, if measured temperature is lower than SV, setting value is over than 50%, otherwise lower than 50%.
- Controlling a manual reset [rSt] by control result



◎ Control mode switch

- User can choose ON/OFF and proportional control.
- **ON/OFF control** - Proportional control conversion:
  When P is 0%, it is ON/OFF control: if there is a value for P, is proportional control.
- Factory default : ON/OFF control (P : 0%)

◎ The conversion of temperature unit (℃ / ℉) [Unt]

- By choosing ℃ or ℉ on temperature unit setting parameter, [Unt] conversion is available.
- After choosing a temperature unit, LED is ON.
- Factory default : ℃

◎ Cooling / Heating operation

- Generally there are two ways to control temperature, one (heat-function) is to heat when PV is getting down (heater). The other (cool-function) is to cool when PV is getting high refrigerator).
- Setting range: HEt (Heat) / CoL (Cool) (factory default : HEt)

◎ Display PV deviation

- It displays the deviation between the PC and the SV.
- When the PV is higher than the SV (PV > SV+2℃), △ is lighted.
- When the PV is lower than the SV (PV < SV-2℃), ▽ is lighted.
- When the deviation of the PV is within ±2℃, □ is lighted.

◎ High/low limit setting for using temperature

- Set a high/low limit of temperature and the setting range is within using range.
- If setting a high-limit of temperature on [H.SC], it is a high-limit SV
- If setting a low-limit of temperature on [L.SC], it is a low-limit SV.
- L.SC ≤ SV ≤ H.SC . In case of L.SC = SV = H.SC , the output is OFF.
- If change L.SC and H.SC , the using range and proportional band also are changed.

◎ Error display

●If Error occurs during the operation, error display flashes every 1 sec.

Display	Description
oPn	When the input sensor is not connected or its wire is cut. (Normal operation after connecting a sensor)
LLL	When the measured input temperature is lower than input range of the sensor.
HHH	When the measured input temperature is higher than input range of the sensor.

- When error [oPn] / [HHH] / [LLL] occur
  After the causes of error is solved, it operates normally.
- The priority of 'Error' display : oPn → HHH, LLL

◎ Output setting for error [o.Er]

For error, the statue of output is set by [o.Er] of setting group 2.

- For setting OFF: Output is always OFF for error.
- For setting ON: Output is always ON for error.
- Factory default : OFF

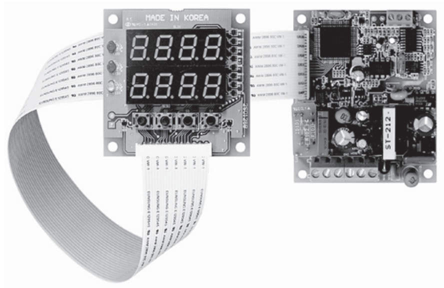
◎ Lock setting [LoC]

- This function limits the change of parameters on each setting group.
  It can be set setting group 2.
- For setting [LC1], changing the parameter, "Setting group 2", is not available.
- For setting [LC2], changing the parameter, "Setting group 1 + Setting group 2", is not available.
- For setting [LC3], changing the parameter, "Setting group 1 + Setting group 2 + SV setting parameter", is not available.
- For setting [oFF], Lock off for all setting group

Board Type, Dual PID Control Temperature Controller

■ Features

- High quality and economical product
- Convenient organization of panel to use
- Dual PID control
- Time reservation



⚠ **Please read "Caution for your safety" in operation manual before using.**

c UL US

■ Ordering Information

TB 4 2 — 1 4 R

Item	Code	Description
Control output	R	Relay output
	S	SSR drive output
	C	Current output (DC4-20mA)
	N	PV Transmission output (DC4-20mA)※1
Power supply	4	100-240VAC 50/60Hz
Sub output	1	Event 1 output type
Display	2	2 Display
Digit	4	9999 (4-digit)
Item	TB	Temperature Controller Board

※1: PV transmission output type does not have Event 1 output.

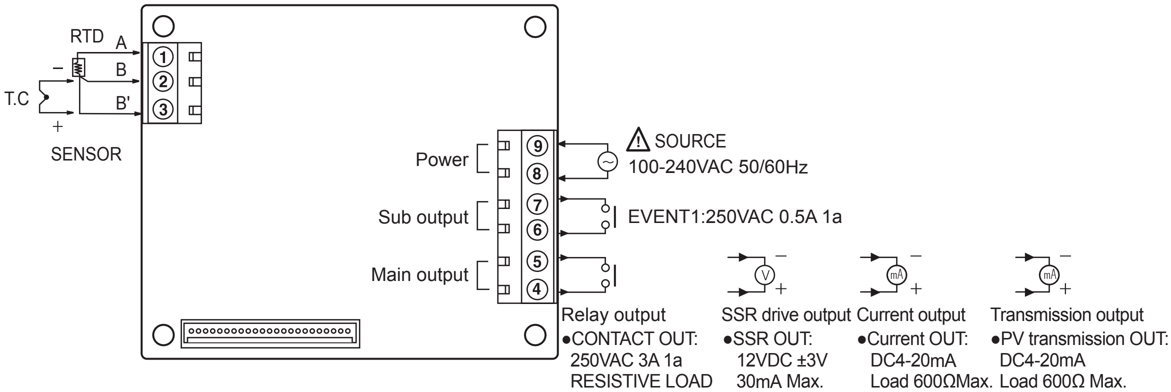
■ Specifications

Model		**TB42-14R**	**TB42-14S**	**TB42-14C**	**TB42-14N**
Power supply		100-240VAC 50/60Hz			
Allowable voltage range		90 to 110 of rated voltage			
Power consumption		Max. 5VA			
Display method		7-segment (PV: green, SV: red) LED method			
Character size (W×H)		8×10mm			
Input type	RTD	DPt100Ω, JPt100Ω [Allowable line resistance is max. 5Ω per a wire]			
	Thermocouple	K(CA), J(IC) [Tolerance outer resistance is max. 100Ω]			
Control output	Relay	250VAC 3A 1a	—	—	—
	SSR	—	12VDC ±3V 30mA Max.	—	—
	Current	—	—	DC4-20mA (max. load 600Ω)	—
	Transmission	—	—	—	DC4-20mA (Max. load 600Ω)
Sub output		• Event 1 output: Relay output (250VAC 0.5A 1a) • Event 2 output: OK monitoring display by LED			
Control method		ON/OFF control, P, PI, PD, PIDF, PIDS control			
Setting type		Front push buttons			
Display accuracy		F.S ± 0.3% or 3℃, select the higher one			
Hysteresis		1 to 100℃ (0.1 to 100.0℃) variable (at ON/OFF control)			
Proportional band (P)		0.0 to 100.0%			
Integral time (I)		0 to 3600 sec			
Derivative time (D)		0 to 3600 sec			
Control cycle (T)		1 to 120 sec			
Sampling period		0.5 sec			
Dielectric strength		2,000VAC 50/60Hz for 1 minute (Between input and power terminal)			
Vibration		0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Relay life cycle	Main output	Mechanical: Min. 10,000,000, Electrical: Min. 100,000 (250VAC 3A resistive load)			
	Sub output	Mechanical: Min. 20,000,000, Electrical: Min. 200,000 (250VAC 0.5A resistive load)			
Insulation resistance		Over 100MΩ (at 500VDC megger)			
Noise immunity		±2kV the square wave noise (pulse width: 1μs) by the noise simulator			
Memory retention		Approx. 10 years (when using non-volatile semiconductor memory type)			
Environ-ment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Approval		c UL US			
Unit weight		Approx. 113.5g			

※Environment resistance is rated at no freezing or condensation.

■ Connections

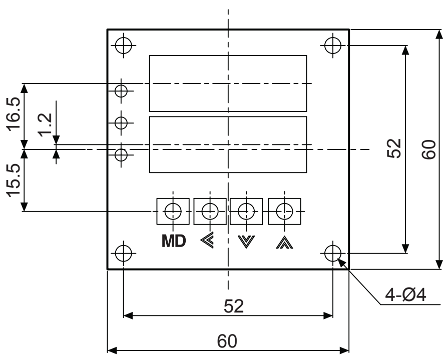
※RTD: DPt100Ω, JPt100Ω (3-wire type) ※Thermocouple: K(CA), J(IC)



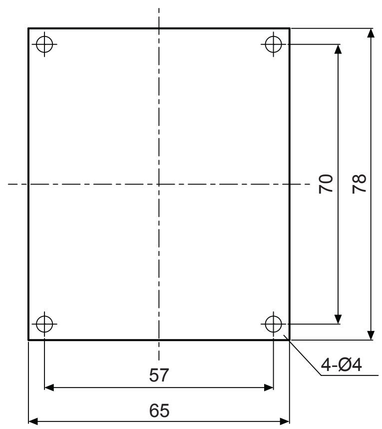
■ Dimensions

(unit: mm)

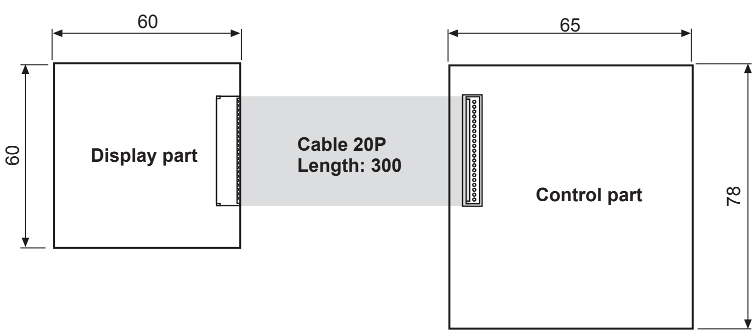
● Display part



● Control part

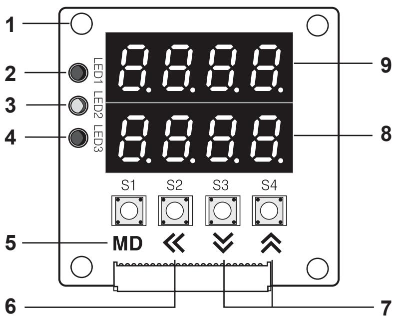


● Layout



※Cable length is 300mm.
※The size of board is based on user's application. (customizable)

▣ Unit Description



1. Mounting hole (Ø4.0mm)

2. Main output operation display LED (LED 1)
It indicates the operation status of control output and displayed on "LED 1".
But when it is current output or retransmission output "LED 1" does not operate. (LED indication is OFF)

3. Event 1 output operation display LED (LED 2)
It indicates the operating status of alarm output and displayed on "LED 2".

4. O.K monitor operation display LED (LED 3)
It indicates the operating status of alarm output and displayed on "LED 3".
After setting alarm output in Event 2, if execute Auto-tuning, O.K monitor operation will be displayed after AT function.
(it flashes during AT function, and turns OFF after completing AT function)

5. Mode key (S1)
It is used to enter into every parameter group or move to other parameters. It is "S1" on this PCB.

6. Shift key (S2)
It is used when change the setting value or move to digit at the parameter. It is "S2" on this PCB.

7. Up / Down key (S3/S4)
It is used when change the setting value or select setting function.
Up key is "S4" and Down key is "S3" on this PCB.

8. SV display part
The setting temperature is displayed in red LED.
But when timer function is used, the setting time will be displayed at t-Su.
If time function is OFF, it will return to the setting temperature.

9. PV display part
It displays measured temperature in green LED.

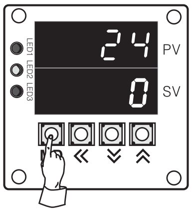
▣ Input Type And Range

Input sensor		Display	Temperature range (℃)	Temperature range (℉)
Thermocouple	K(CA)	K CA	-100 to 1300	-148 to 2372
	J(IC)	J IC	0 to 800	32 to 1472
RTD	JPt H	JPt.H	0 to 500	32 to 932
	JPt L	JPt.L	-199.9 to 199.9	-199.9 to 392.0
	DPt H	Pt .H	0 to 500	32 to 932
	DPt L	Pt .L	-199.9 to 199.9	-199.9 to 392.0

■ SV Setting

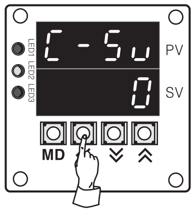
Example of setting 100℃

1.



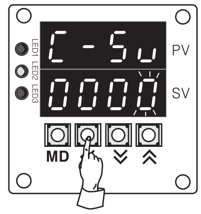
When PV and SV are displayed, press the MD key (S1).

2.



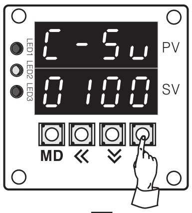
C-Su is displayed in the PV display part, 0 is displayed in the SV display part. Press the « key (S2).

3.



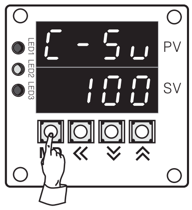
10^0 digit flashes in the SV display part. Move the digit by pressing « key (S2) twice.

4.



Press the ⩓ key (S4) and set 1 at 10^2 digit and press the MD key.

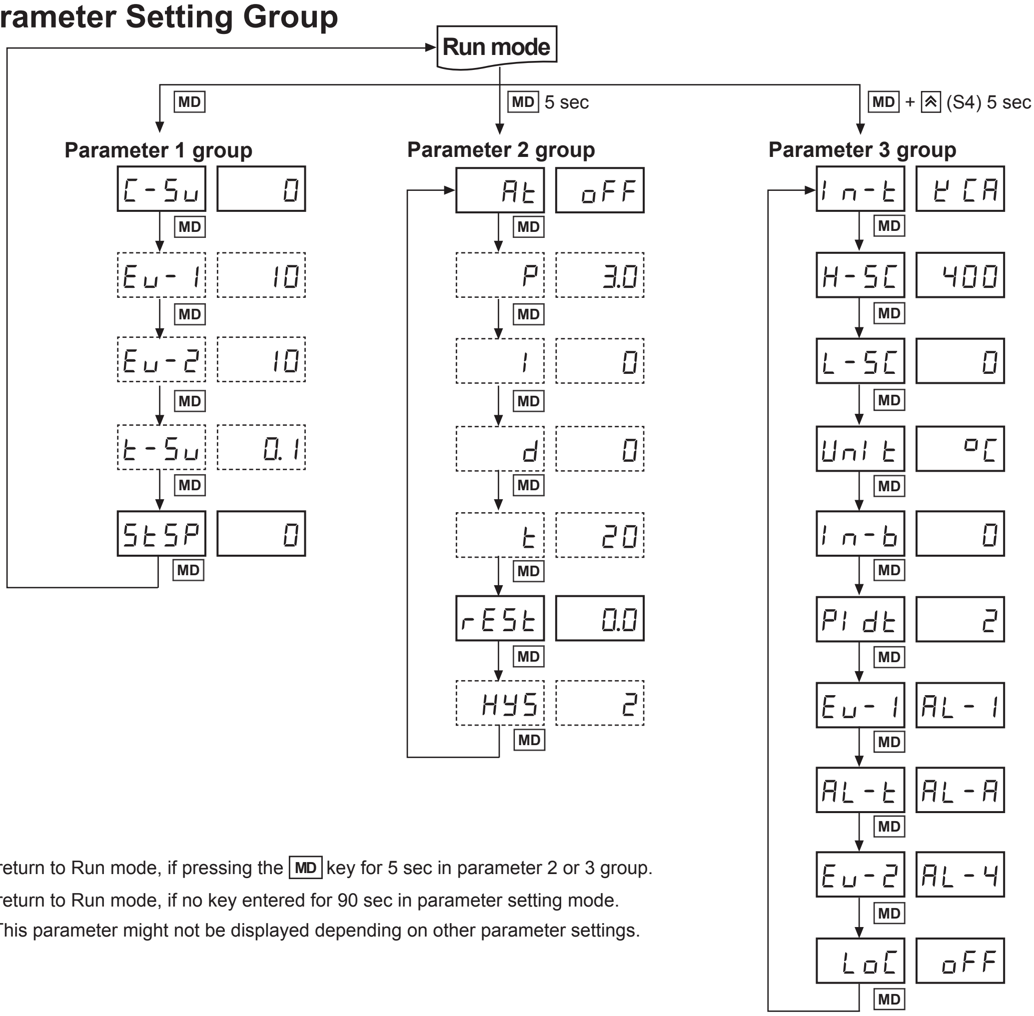
5.



Now SV value is set, then move to Eu-1 by pressing the MD key once.

※S1, S2, S3, S4 are on on this PCB Board.

■ Parameter Setting Group



※It will return to Run mode, if pressing the MD key for 5 sec in parameter 2 or 3 group.

※It will return to Run mode, if no key entered for 90 sec in parameter setting mode.

※[dashed box] This parameter might not be displayed depending on other parameter settings.

▣ Parameter 1 Group

※To set SV, press the [≪] key and SV of the SV display part flashes. Press the [⋀], [⋁] keys and change SV and press the [MD] key to save the value and SV of the SV display part flashes.
※The value in every parameter is factory default.
※Entering parameter 1 group is not available in transmission output type. (TB42-14N)
※Some parameter is able to set decimal point by temperature sensor type.
※When pressing [MD] key for 5 sec at each parameter or there is no key operation for 90 sec it returns to RUN mode.
※[ ] This parameter might not be displayed depending on other parameter settings.

Run mode
[MD]

C-Su | 0
Set SV (setting value).
Set range: Within the rated temperature range by input sensor
[MD]

Eu-1 | 10
Set temperature of Alarm operation which has been set in Event 1 of parameter 3 group.
Set range: Within the rated temperature range by input sensor
※If setting Alarm operation as AL-0 in Eu-1 of parameter 3 group, this parameter is not displayed.
[MD]

Eu-2 | 10
Set temperature of Alarm operation which has been set in Event 2 of parameter 3 group.
Set range: Within the rated temperature range by input sensor
※If setting Alarm operation as AL-0 in Eu-2 of parameter 3 group, this parameter is not displayed.
[MD]

t-Su | 0.1
When it is used as timer function, this parameter is for setting the time of using.
Set range: 0.1 to 999.9 hour
※If selecting as 0 in StSP, this parameter is not displayed.
[MD]

StSP | 0
Select timer function.
0: No Timer function
1: Cut off output after stop the time
2: Output operation after stop the time. (reservation function)
[MD]

▣ Parameter 2 Group

※To set SV, press the [≪] key and SV of the SV display part flashes. Press the [⋀], [⋁] keys and change SV and press the [MD] key to save the value and SV of the SV display part flashes.
※For ON/OFF control, only P and HYS parameters are displayed.
※The value in every parameter is factory default.
※Entering parameter 2 group is not available in transmission output type (TB42-14N).
※When pressing [MD] key for 5 sec at each parameter or there is no key operation for 90 sec it returns to RUN mode.
※[ ] This parameter might not be displayed depending on other parameter settings.

Run mode
[MD] 5 sec

At [≪] → oFF [⋀] / [⋁] on ([MD] ←)
Select whether operates Auto-tuning or not.
After completing auto-tuning, SV returns to oFF.
[MD]

P | 3.0
Set proportional band.
Set range: 0.0 to 100.0%
※If P value is 0.0, it becomes ON/OFF control function.
[MD]

I | 0
Set integral time.
Set range: 0 to 3600 sec
※If I is 0, this function will be OFF.
[MD]

d | 0
Set derivative time.
Set range: 0 to 3600 sec
※If d is 0, this function will be OFF.
[MD]

t | 20
Set cycle of control.
Set range: 1 to 120 sec
※For SSR drive output type (TB42-14S), control cycle for factory default is 2 sec.
[MD]

rESt | 0.0
This mode is for compensating deviation, which occurs when proportional control is used.
Set range: 0.0 to 100.0%
[MD]

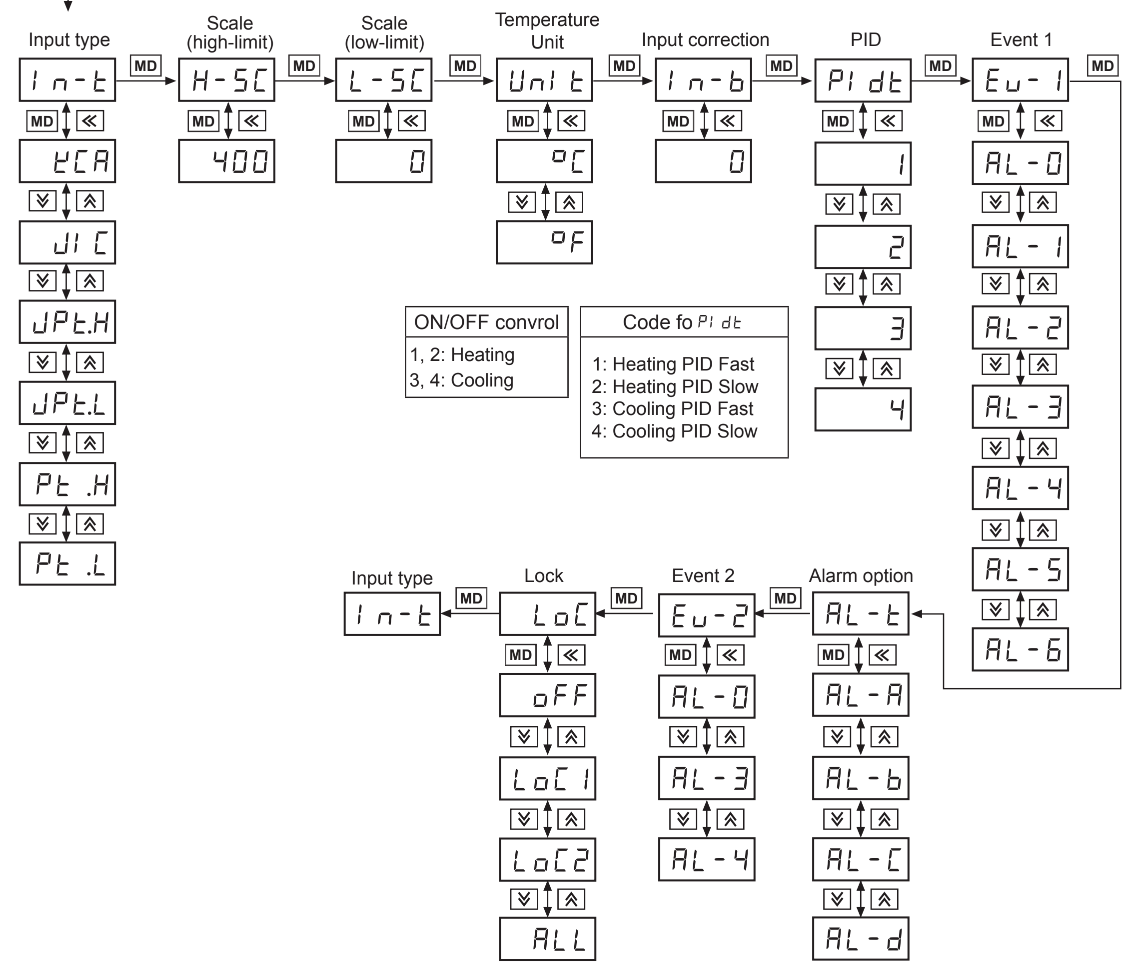
HYS | 2
This mode is for setting hysteresis when it is used ON/OFF control.
Set range: 1 to 100℃ (0.1 to 100.0℃)
[MD]

■ Parameter 3 Group

Run mode

MD + ⩓ 5 sec

※To set SV, press the ≪ key and SV of the SV display part flashes. Press the ⩓, ⩔ keys and change SV and press the MD key to save the value and SV of the SV display part flashes.
※The value in every parameter is factory default.
※Entering parameter 2 group is not available in transmission output type (TB42-14N).
※When pressing MD key for 5 sec at each parameter or there is no key operation for 90 sec it returns to RUN mode.

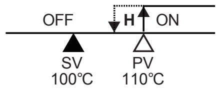
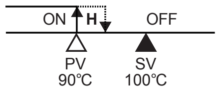
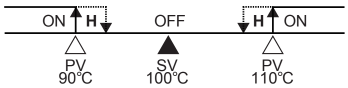
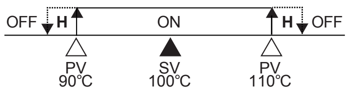
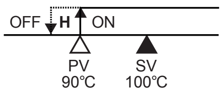
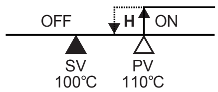
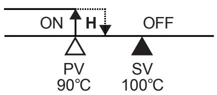
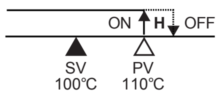


In-t	tCA	Select one input sensor among 6 types.
H-SC	400	Set high-limit of temperature (20mA output value for transmission output). Set range: Within the rated range
L-SC	0	Set low-limit of temperature (4mA output value for transmission output). Set range: Within the rated range
Unit	°C	Set the unit of temperature between ℃ or ℉.
In-b	0	Set the correction value for error from input sensor. Set range: -50 to 50℃ (-50.0 to 50.0℃).
PIdt	1	Select PID control type among 4 kinds.
Eu-1	AL-1	Select Alarm output function of Event 1 among 7 kinds.
AL-t	LA-A	Select Alarm output option function among 4 kinds.
Eu-2	AL-4	Select Alarm output function of Event 2 among 3 kinds.
LoC	oFF	Set whether it is locked or not of setting value among 4 kinds.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Alarm

◎ Alarm operation

Mode	Name	Alarm operation	Description
AL-0	—	—	No alarm output
AL-1	Deviation high-limit alarm	 High deviation: Set as 10℃	If deviation between PV and SV as high-limit is higher than set value of deviation temperature, the alarm output will be ON.
AL-2	Deviation low-limit alarm	 Low deviation: Set as 10℃	If deviation between PV and SV as low-limit is higher than set value of deviation temperature, the alarm output will be ON.
AL-3	Deviation high/low-limit alarm	 High/Low deviation: Set as 10℃	If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be ON.
AL-4	Deviation high/low-limit reserve alarm	 High/Low deviation: Set as 10℃	If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be OFF.
AL-5	Absolute value high limit alarm	 Absolute-value Alarm: Set as 90℃  Absolute-value Alarm: Set as 110℃	If PV is higher than the absolute value, the output will be ON.
AL-6	Absolute value low limit alarm	 Absolute-value Alarm: Set as 90℃  Absolute-value Alarm: Set as 110℃	If PV is lower than the absolute value, the output will be ON.

※ **H**: means fixed 2℃ as interval between ON and OFF when alarm output is operating.

◎ Alarm option

Mode	Name	Description
AL-A	Standard alarm	If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.
AL-b	Alarm latch	If it is an alarm condition, alarm output is ON and maintains ON status.
AL-C	Standby sequence	First alarm condition is ignored and from second alarm condition, standard alarm operates. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, standard alarm operates.
AL-d	Alarm latch and standby sequence	If it is an alarm condition, it operates both alarm latch and standby sequence. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, alarm latch operates.

▣ Functions

◎ Event

This function can execute as main control output and sub function.

● Event 1 output

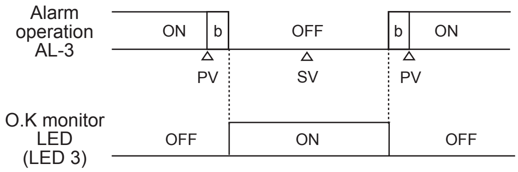
Event 1 output is relay contact and contact capacity is 250VAC 0.5A 1a. Event 1 output is alarm output and there are 7 modes including deviation and absolute alarm. The operation of Event 1 output is displayed on LED 2 at front.

● Event 2 output

There is no terminals for Event 2 output but front LED 3 lamp displays the input range as O.K monitor.

Event 2 output operates as O.K monitor by setting Event 2 [Eu-2] as AL-3 or AL-4 in Parameter 3 group and set the deviation temperature at Eu-2 in Parameter 1 group.

< Example of O.K monitor >



◎ Auto-tuning [At]

PID Auto-tuning function is automatically to measure thermal characteristics and response of the control object and then execute its value under high response & stability after calculating the time constant of PID required to control optimum temperature.

When AT function is started, LED 3 will flash and when LED 3 is OFF this operation will stop.

(Note) For ON/OFF control, AT function does not operate.

◎ Dual PID function

One is that PV is reached at SV with fast response speed, but a little of overshoot occurs, the other is that PV is reached at SV with slow response speed, but overshoot will be minimized.

● PID Fast

This mode is applied at the machines or systems which requite stop fast response speed, and allowable a little overshoot which requite.

● PID Slow

This mode is applied at the machine which overshoot must not occur, because the fire can be and allowable low response time.

◎ Error

If error occurs while the controller is operating, it will be displayed as follow.

● LLLL flashes
when measured input temperature is lower than input range of the sensor.

● HHHH flashes
when measured input temperature is higher than input range of the sensor.

● oPEn flashes
when the input sensor is not connected or its wire is cut.

◎ Transmission output (PV)

This function is to transmit the current value (PV) to external equipment such as PC or recorder etc. the output is DC 4-20mA and cannot be used with control output at the same time.

It will output 20mA, when PV reaches to the temperature in H-SC and output 4mA, when PV reaches to the temperature in L-SC.

Min. resolutions are 16,000 divisions available. (TB42-14N)

◎ Manual reset [rESt]

Proportional control has an offset because rising time is not the same as falling time, even if the unit operates normally. This function is to correct offset.

◎ Lock

Setting value cannot be changed by unauthorized person. There are 4 types of lock mode in this unit.

- oFF : Unlocks for all parameters
- LoC1 : Locks parameter 2, 3 groups
- LoC2 : Locks parameter groups except C-Su parameter
- ALL : Locks all parameters

◎ Timer [StSP]

There is no output terminal in this function, it controls main output by setting of Timer function.

● Timer operation

- When StSP parameter is set as 0.
  No timer function. t-Su parameter is not displayed.
- When StSP parameter is set as 1.
  This unit controls temperature for the set time of t-Su.

E.g.)When t-Su is set as 5.0, this unit controls temperature for 5 hours and completes to control.

- When StSP parameter is set as 2.
  This unit controls temperature after the set time of t-Su.

E.g.)When t-Su is set as 5.0, this unit controls temperature after 5 hours.

● To stop timer function, enter StSP parameter and set 0.

● During timer function, the set time at t-Su is displayed on the SV display part in RUN mode. If not using the timer function, it displays SV.

■ Proper Usage

◎ Front part

Front part is able to customized for user's application.

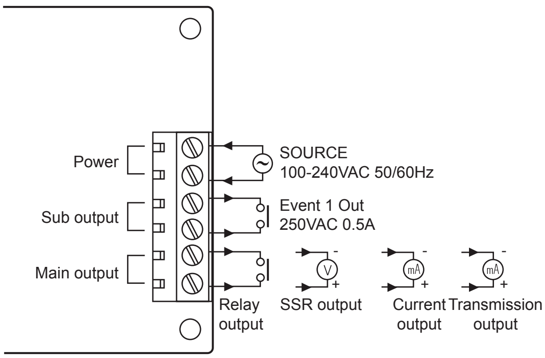
The length of connector cable connected the front part and control part is basically 300mm and also 100mm.

◎ Output

This unit has main output terminals and sub output terminals.

Main output terminals is for relay, SSR, current, transmission output and sub output terminals are fixed for Event 1 output.

Be sure that output terminals are as below.



※Relay output: 1a contact output. Contact capacity is 250VAC 3A.

※SSR drive output: It outputs Max. 12VDC ±3V 30mA max. voltage to drive SSR. For using SSR drive voltage to other applications, use this within the rated current.

※Current output: It outputs DC4-20mA within the hysteresis.

※Transmission output: It outputs DC4-20mA within the set range at H-SC and L-SC parameters. (resolutions: 16,000 divisions)

◎ When changing the sensor type

Be sure that when changing the sensor type during operation, the set SV is cleared.

◎ Caution for when mounting on Panel

This unit does not have an additional external case but has only a PCB. When mounting this unit on panel, maintain insulation between iron plates. If dust, oil, or water is enter to inside of panel, inner may be short.

Be sure that interval between terminals is narrow to wire cables. The cable (20P) connected control PCB and front PCB is sensitive signal line.

Be careful when wiring this cable not to enter noise or affect to high voltage line.

◎ Caution during use

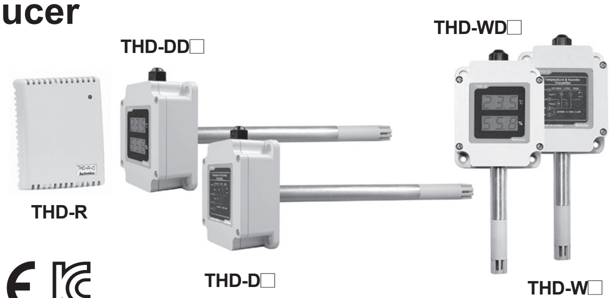
- The connection wire of this unit should be separated from the power line and high voltage line in order to prevent from inductive noise.
- Please install power switch or circuit-breaker in order to cut power supply off.
- The switch or circuit-breaker should be installed near by users.
- This unit is designed for temperature controlling only. Do not apply this unit as a voltage meter or a current meter.
- In case of using RTD sensor, 3-wire type must be used. If you need to extend the line, 3-wire must be used with the same thickness as the line. It might cause temperature difference if the resistance of line is different.
- In case of making power line and input signal line close, line filter for noise protection should be installed at power line and input signal line should be shielded.
- Keep away from the high frequency instruments. (High frequency welding machine & sewing machine, big capacitive SCR controller)
- This unit may be used in the following environments.
  - Indoor
  - Altitude: Under 2,000m.
  - Pollution degree 2
  - Installation category II

Room/Wall Mount/Duct Mount Type Temperature/HumidityTransducer

■ Features

- Compact design
- Built-in temp./humidity sensor
- 7 Segment LED Display (THD-DD/THD-WD)
- Various output modes
  DC4-20mA, 1-5VDC, RS485 (Modbus RTU)
- Wide range of temp./humidity measurement
  -19.9 to 60.0℃ / 0.0 to 99.9%RH
- Communication speed: 115200bps

⚠ **Please read "Caution for your safety" in operation manual before using.**



(only for THD-□-T model)

■ Ordering Information

THD — D D 1 — C

Code	Position	Value	Description
Output	C	PT※	DPt100Ω resistance value (Temp.)
		PT/C※	DPt100Ω resistance value (Temp.) / Current output (Humidity)
		C	Current output (Temp./Humidity)
		V	Voltage output (Temp./Humidity)
		T	RS485 communication output (Temp./Humidity)
Length of sensor pole	1	No mark※	Built-in
		1	100mm
		2	200mm
Display	D	No mark	Non-Display type
		D	Display type
Mounting	D	R	Room type (for indoor)
		D	Duct mounting type
		W	Wall mounting type
Item	THD	THD	Temperature Humidity Double

※It is only for THD-R.

■ Specifications

Model		THD-R-PT	THD-R-PT/C	THD-R-C THD-R-V THD-R-T	THD-D□-□ THD-W□-□	THD-DD□-□ THD-WD□-□
Power supply		—	24VDC			
Allowable voltage range		—	90 to 110% of rated voltage			
Power consumption		—	Max. 2.4W			
Sensor type		Temperature sensor	Temperature/Humidity sensor			
Display type		Non-indicating type				7-segment LED display
Display digit		—				Each 3 digits for temp./humidity
Character size		—				W6.2×H10.0mm
Measurement range	Temp.	-19.9 to 60.0℃				
	Humidity	—	0.0 to 99.9%RH (THD-R is required to attend for using over 90%RH.)			
Accuracy※1	Temp.	Max. ±0.8℃	±1.0℃ (at room temperature)			
	Humidity	—	±3%RH (30 to 70%RH, at room temp.), ±4%RH (10 to 90%RH)		±2%RH (10 to 90%RH, at room temp.)	
Output	Temp.	DPt100Ω resistance value (TCR: 3850ppm/℃)		DC4-20mA(allowable impedance: max. 600Ω), 1-5VDC, RS485 communication (Modbus RTU)		
	Humidity	—	DC4-20mA (allowable impedance: max. 600Ω)			
Resolution		—	1/1000			
Sampling cycle		—	0.5 sec			
Insulation resistance		—	Over 100MΩ (at 500VDC megger)			
Dielectric strength		—	500VAC 50/60Hz for 1 minute			
Noise immunity		—	±0.3kV the square wave noise (pulse width: 1μs) by the noise simulator			

※1: •Room temperature is 23℃±5℃.
•It may cause degree of degradation when this unit is exposed to organic chemicals such as alcohol gas or sulfuric acid.
•It may cause degree of degradation for humidity when using this unit at high temperature/humidity environment for a long time.
•It may cause error of humidity value when this unit is exposed to high humidity environment (over 80%RH) for a long time.

■ Specifications

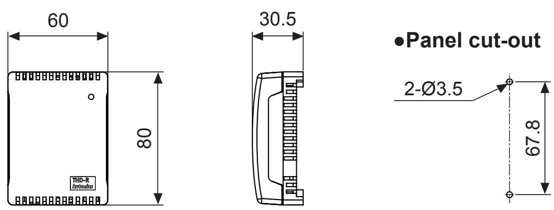
Model		THD-R-PT	THD-R-PT/C	THD-R-C THD-R-V THD-R-T	THD-D□-□ THD-W□-□	THD-DD□-□ THD-WD□-□
Vibration	Mechanical	—	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour			
	Malfunction	—	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min			
Shock	Mechanical	—	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times			
	Malfunction	—	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times			
Protection structure		IP10			IP65 (except sensing part)	
Ambient temperature		-20 to 60℃, storage: -20 to 60℃				
Cable		—			Ø4mm, 4-wire, Length: 2m (AWG22, Core diameter: 0.08mm, number of cores: 60, insulation out diameter: Ø1.25mm)	
Approval		CE, (only for THD-□-T model)				
Weight※2		Approx. 98g (approx. 55g)			Approx. 415g (approx. 160g)	

※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

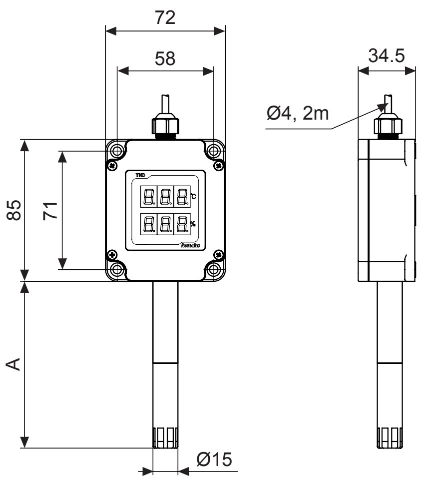
■ Dimensions

(unit: mm)

● THD-R

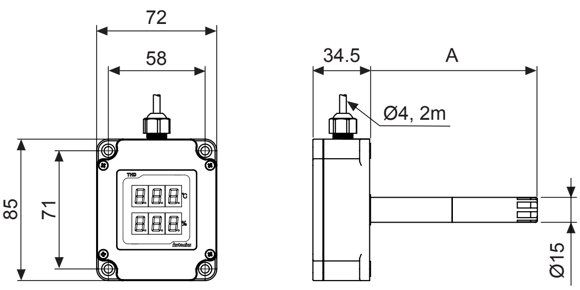


● THD-W

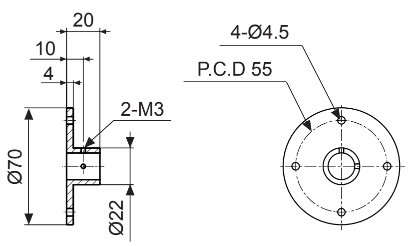


Model	Length of sensor pole (A)
THD-□1-□	100mm
THD-□2-□	200mm

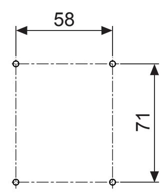
● THD-D



● Bracket

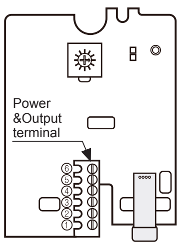


●Panel cut-out



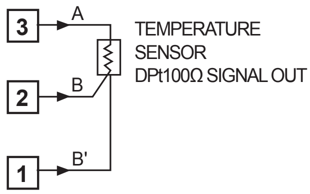
▣ Connections

◎ THD-R

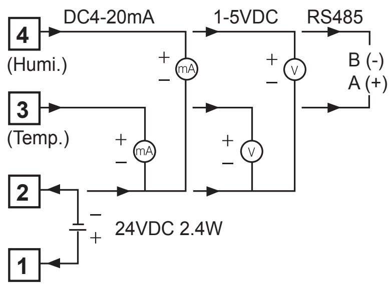


※Check the terminal connection diagram and be sure that when connecting the power.

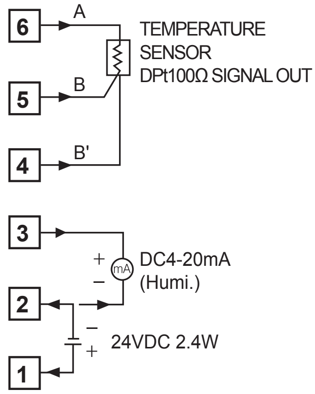
● **THD-R-PT**



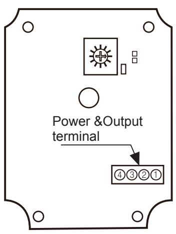
● **THD-R-C, V, T**



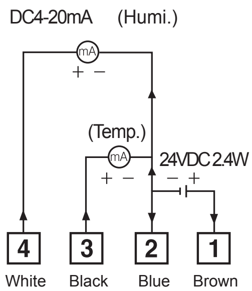
● **THD-R-PT/C**



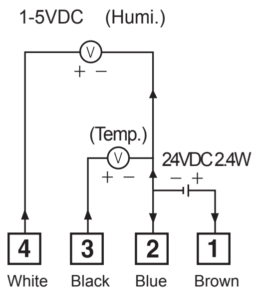
◎ THD-D / THD-W



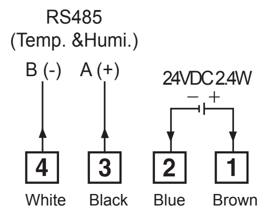
● **THD-D-C / THD-W-C**



● **THD-D-V / THD-W-V**



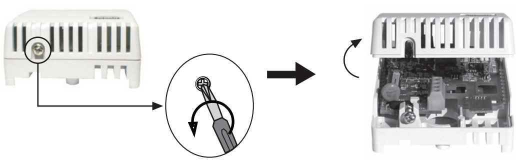
● **THD-D-T / THD-W-T**



▣ Case Detachment

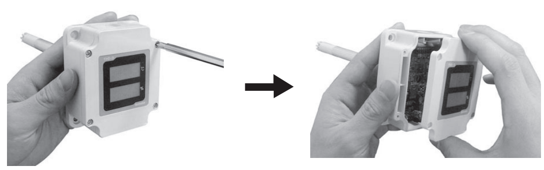
● **THD-R**

Unfasten the bolt on the bottom of the product, separate the case from it.



● **THD-D / THD-W**

Unfasten 4 bolts on the top of the product, separate the case cover from it.



THD Series

▣ Functions

◎ Voltage output

It transmits current temperature/humidity to other devices (PC, recorder, etc.) and outputs 1-5VDC.
It outputs 1VDC at -19.9℃ of temperature and 0%RH of humidity, 5VDC at 60℃ of temperature and 99.9%RH of humidity.
The temperature and humidity output are separated and the resolution is divisible by 1,000.

◎ Current output

It transmits current temperature/humidity to other devices (PC, recorder, etc.) and outputs DC4-20mA.
It outputs DC4mA at -19.9℃ of temperature and 0%RH of humidity, DC20mA at 60℃ of temperature and 99.9%RH of humidity. The temperature and humidity output are separated and the resolution is divisible by 1,000.

◎ DPt 100Ω resistance value output

It transmits current temperature to other devices (recorder, thermometer, etc.). It outputs 100Ω at 0℃ and 119.40Ω at 50℃. (Temperature coefficient(TCR)=3850 ppm/℃)

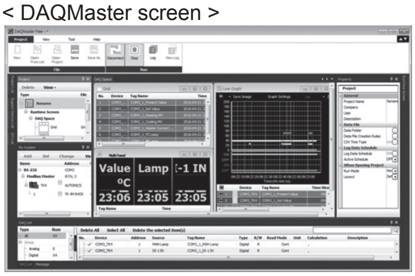
▣ Comprehensive Device Management Program [DAQMaster]

- DAQMaster is comprehensive device management program for convenient management of multiple device data monitoring.
- Visit our website (www.autonics.com) to download user manual and comprehensive device management program.

< Computer specification for using software >

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS-232 serial port (9-pin), USB port

< DAQMaster screen >



▣ Sold Separately

◎ Communication converter

- **SCM-38I**
  (RS232C to RS485 converter)

- **SCM-US48I**
  (USB to RS485 converter)

◎ Display units (DS/DA-T Series)

- **DS/DA-T Series**
  (RS485 communication input type display unit)

DS16-□T

DS22/DA22-□T

DS40/DA40-□T

DS60/DA60-□T

※Connect RS485 communication input type display unit (DS/DA-T Series) and RS485 communication output model of THD Series, the display unit displays present value of the device without PC/PLC.

▣ RS485 Communication Output

It is output transmit current temperature and humidity to other devices by communication.

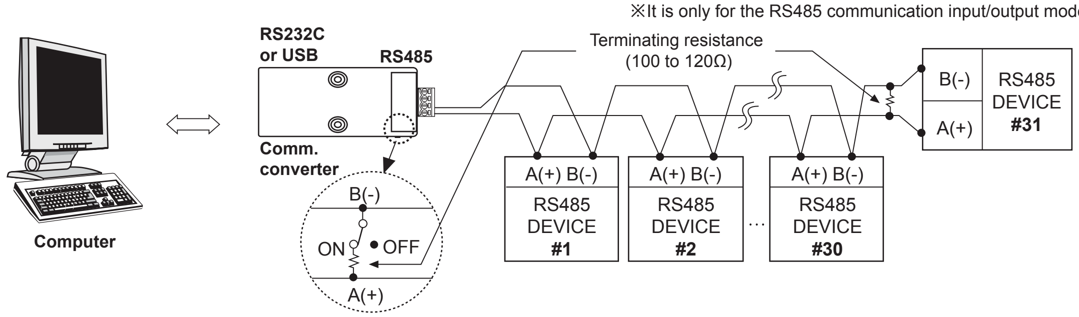
◎ Interface

Comm. protocol	Modbus RTU
Connection type	RS485
Application standard	Compliance with EIA RS485
Max. connection	31units (address: 01 to 31)
Synchronous method	Asynchronous
Comm. method	Two-wire half duplex
Comm. distance	Max. 800m
Comm. speed	1200 to 115200bps (selectable)
Start bit	1-bit (fixed)
Data bit	8-bit (fixed)
Parity bit	None (fixed)
Stop bit	1-bit (fixed)

※It is not possible to change parameter related to communication of THD under the communication with high order system.
※Match the parameter of THD communication to be same as the high order system.
※It is not allowed to set overlapping communication address at the same communication line.

◎ Application of system organization

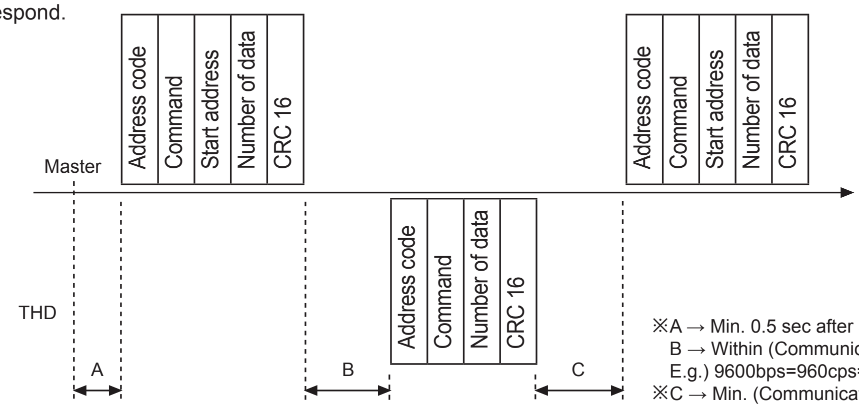
※It is only for the RS485 communication input/output model.



※It is recommended to use Autonics communication converter; SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately). Please use twisted pair wire for RS485 communication.

◎ Ordering of communication control

- The communication method is Modbus RTU.
- After 0.5 sec being supplied the power into master system, it is able to start communication.
- The initial communication is started by master system. When a command comes out from the master system, THD will respond.



※A → Min. 0.5 sec after supplying power
B → Within (Communication speed×10)×10
E.g.) 9600bps=960cps=1.04ms×10
※C → Min. (Communication speed×10)×4

● Communication command and block

The format of query and response.

Query

Address code	Command	Start address	Number of data	CRC16

Calculation range of CRC16

①Address code: This address code is for identifying THD by master system and able to set within range of 01 to 31.
②Command: Read command for input register
③Start address: The start address of input register to read (Start address). It is available to select 0000 and 0001 for start address. 16bit data in the address 0000 indicates temperature value, 16bit data in the address 0001 indicates humidity value. (Refer to Modbus Mapping table.)
④Number of data: The number of 16bit data from start address (No. of Points). When start address is 0000, it is available to read 2 of 16 bit data, or when start address is 0001, it is available to read 1 of 16 bit data.
⑤CRC16: Checksum for checking the whole frame and it is used for more reliable transmit/receive to check the error between transmitter and receiver.

Response

Address code	Command	Number of data	Temperature data	Humidity data	CRC16

Calculation range of CRC16

①Address code: This address code is for identifying THD by master system and able to set within range of 01 to 31.
②Command: A response for read command of input register
③Number of data: The number of 8 bit data to send from start address (No. of bytes). When start address is 0000, it is available to read 4 of 8 bit data, or when start address is 0001, it is available to read 2 of 8 bit data.
④Temperature data: This is the value of 16bit. To get a current temperature value, divide read value by 100.
E.g.)When read data is 0×09B0, decimal value is 2480, the current value is 2480/100=24.80℃.
⑤Humidity data: This is the value of 16bit. To get a current humidity value, divide read value by 100.
E.g.)When read data is 0×0B68, decimal value is 2920, the current value is 2920/100=29.20%RH.
⑥CRC16: Checksum for checking the whole frame.

● Application for communication command

(Query): Address code (01), Start address (0000), The number of 16 bit data to read (2) CRC16 (0x71CB)

01	04	00	00	00	02	71	CB
Address code	Command	Start address		Amount of data		CRC16	
		High	Low	High	Low	High	Low

(Response): Address code (01), The number of 8 Bit data to read (4), Temperature (0x09B0), Humidity (0x0B68) CRC (0x94DE)

01	04	04	09	B0	0B	68	94	DE
Address code	Response command	Amount of data	Temperature data		Humidity data		CRC16	
			High	Low	High	Low	High	Low

● Error processing (Slave → Master)

1. Not supported command

01	8X	01	XX	XX
Address code	Response command	Exception code	CRC16	

※Set a received highest bit and send it to response command and exception code 01.

2. The start address of queried data is inconsistent with the transmittable address or the requested number of data is bigger than the transmittable address.

01	84	02	C2	C1
Address code	Response command	Exception code	CRC16	

※Set a received highest bit and send it to response command and exception code 02.

◎ Setting communication speed

1) Turn off the power of the unit.
2) Set SW1 to 0 and apply the power.
3) Operation indicator LED is flashing.
4) Set a communication speed after choose SW1 within the range 1 to 8 and hold it for 3 sec.
5) After setting a communication speed, the LED will be ON. At the moment turn OFF the power.

※Factory default communication speed is 9600bps.

<Setting table for communication speed (bps)>

SW1	Communication speed (bps)
1	1200
2	2400
3	4800
4	9600
5	19200
6	38400
7	57600
8	115200

◎ Change the communication address

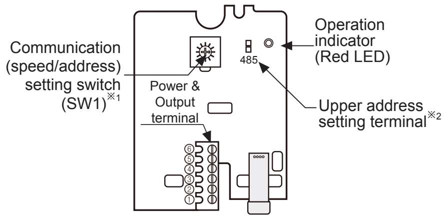
1) Turn off the power of the unit.
2) Set Upper address setting terminal and SW1 at new address, apply the power.
3) The communication address is changed automatically.

※Factory default communication address is 01. (SW1: 1, Upper address setting terminal: Open)

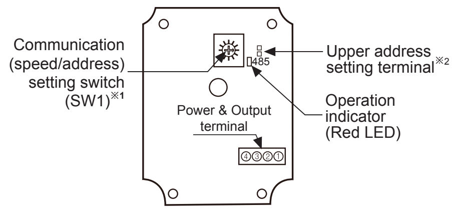
※Setting table of communication address

Upper address setting terminal	SW1	Add no.	Upper address setting terminal	SW1	Add no.
OPEN	1	01	SHORT	0	16
OPEN	2	02	SHORT	1	17
OPEN	3	03	SHORT	2	18
OPEN	4	04	SHORT	3	19
OPEN	5	05	SHORT	4	20
OPEN	6	06	SHORT	5	21
OPEN	7	07	SHORT	6	22
OPEN	8	08	SHORT	7	23
OPEN	9	09	SHORT	8	24
OPEN	A	10	SHORT	9	25
OPEN	B	11	SHORT	A	26
OPEN	C	12	SHORT	B	27
OPEN	D	13	SHORT	C	28
OPEN	E	14	SHORT	D	29
OPEN	F	15	SHORT	E	30
—	—	—	SHORT	F	31

<Inner PCB of THD-R>



<Inner PCB of THD-D/THD-W>



※1. Only when communication setting, remove the case cover and adjust the communication setting switch to set address and communication speed.

※2. Short terminal as upper address setting terminal, the lower address setting is available.

◎ Modbus Mapping Table

Address	Item	Remark
30001 (0000)	Temperature value	Temperature value × 0.01
30002 (0001)	Humidity value	Humidity value × 0.01

※Visit our website (www.autonics.com) to download monitoring program for RS485 communication output.

■ Caution During Use

- After checking the input specification, terminal polarity, connect the wires correctly.
- Do not connect a wire, examine and repair when the power is applying.
- Do not touch the temperature/humidity sensor by hands.
- When removing a packing box, do not store this unit at the high temperature/humidity environment.
- Do not use or storage this unit at over the 90%RH for a long time.
- This unit must be mounted on the wall. (THD-R)
- Caution for cleaning
  - Use dry towel.
  - Do not use acid, chrome acid, solvent but alcohol.
  - Turn off the power before cleaning the unit. After 30 min of cleaning, supply the power to the unit.
- Do not inflow dust or wire dregs into the unit.
- The connection wire of this unit should be separated from the power line and high voltage line in order to prevent from inductive noise.
- Keep away from the high frequency instruments. (High frequency welding machine & sewing machine, big capacitive SCR controller)
- The switch or circuit-breaker should be installed near by users.
- This unit may be used in the following environments
  - Indoor
  - Altitude: Under 2,000m
  - Pollution degree 2
  - Installation category II

T4WM Series

5-CH Temperature Indicator

■ Features

- Indication type only
- High accuracy measurement: F.S. ±0.5%
- 5-Point temperature measurement
- Automatic or manual display of temperature in each point

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

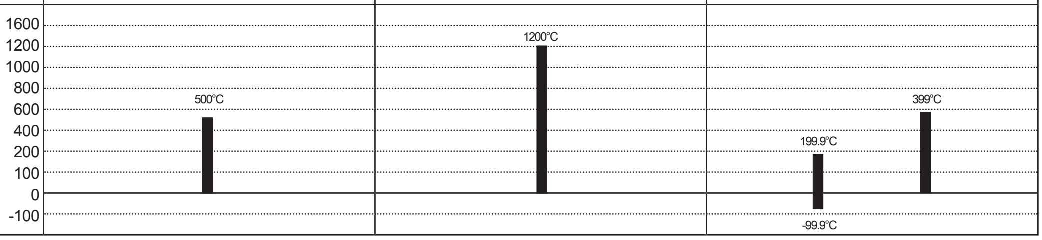
T 4 W M — N 3 N P 4 C

Item	Code	Description
Unit	C	℃
Temperature range	0	-99.9 to 199.9
	4	0 to 399
	5	0 to 500
	C	0 to 1200
Sensor input type	P	DPt100Ω
	J	J(IC)
	K	K(CA)
Control output	N	No output
Power supply	3	110/220VAC 50/60㎐
Control method	N	No control
Input	M	5-Point Indicator
Size	W	DIN W96×H48mm
Digit	4	9999 (4-digit)
Item	T	Temperature Controller

※ **Please check the range of temperature when select model.**

■ Temperature Range For Each Sensor

Model	T4WM		
Sensor input type	Thermocouples		RTD
	J(IC)	K(CA)	DPt100Ω
Standard scale range	(see chart)		

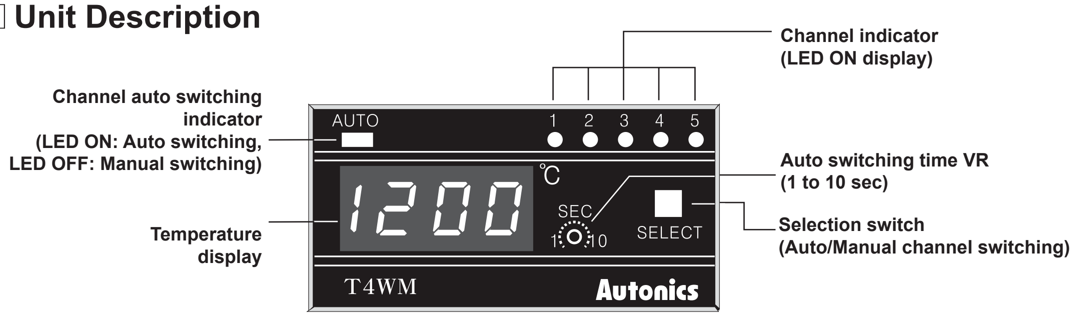


■ Specifications

Series		**T4WM**
Power supply		110/220VAC 50/60Hz
Allowable voltage range		90 to 110% of rated voltage
Power consumption		Max. 3VA
Display method		7-segment LED method
Character size (W×H)		9.8×14.2mm
Display accuracy		F.S. ±0.5% rdg ±1-digit
Input sensor		Thermocouples: K(CA), J(IC) / RTD: DPt100Ω
Input line resistance		Thermocouples: Max. 100Ω / RTD: Allowable line resistance max. 5Ω per a wire
Connectable sensors		5 (thermocouple, RTD are not used as mixed)
Channel switch		Selectable Auto/Manual switching
Auto switching time		Variable 1 to 10 sec (by built-in VR)
Insulation resistance		Over 100MΩ (at 500VDC megger)
Dielectric strength		2,000VAC 50/60Hz for 1 min
Noise immunity		±1kV the square wave noise (pulse width: 1μs) by the noise simulator
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times
Environ-ment	Ambient temperature	-10 to 50℃, storage:-25 to 65℃
	Ambient humidity	35 to 85%RH
Unit weight		Approx. 322g

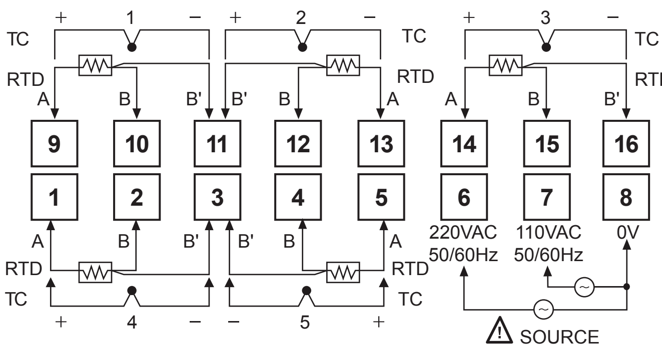
※Environment resistance is rated at no freezing or condensation.

■ Unit Description



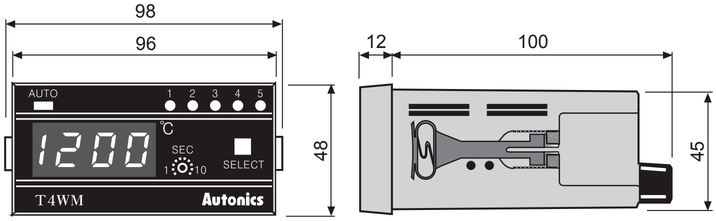
■ Connections

※RTD: DPt100Ω (3-wire type) ※Thermocouple: K(CA), J(IC)

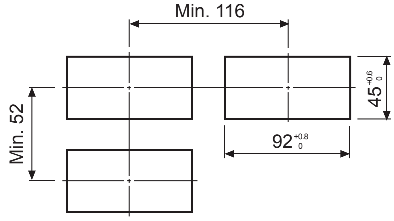


▣ Dimensions

(unit: mm)



● **Panel cut-out**



▣ Channel Switching

◎ Auto/Manual channel switching

Auto switching	Select switch	Manual swithcing
When pressing this for 3 sec and the channel auto switching indicator turns ON and channels switch automatically. (AUTO LED: ON)	 SELECT	When press this once, the channel indicator turns ON and channels switch manually (AUTO LED: OFF)

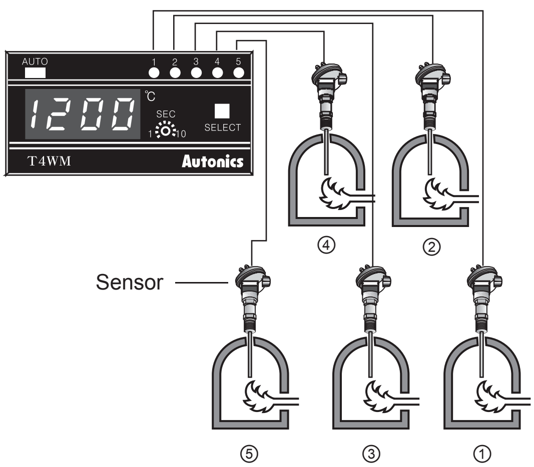
◎ Auto channel switching

- The temperature of each channel is displayed during auto switching time and switching to the next channel automatically.
- Auto switching time is variable up to 10 sec by the front VR.
- When it is auto channel switching, the channel auto switching indicator turns ON.

◎ Manual channel switching

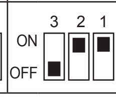
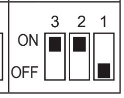
Whenever touching selection switch (SELECT), channel switches.

When a channel indicator turns ON, the temperature of the channel is displayed and whenever touching the switch, it moves to next channel.



▣ Selection Of Input Sensor Number By Internal DIP Switch

Max. 5 different sensors can be connected but do not use thermocouple and DPt100Ω together.

Sensor	2	3	4	5
DIP switch				

▣ Memory Protection

When the power fails, the data value will be protected for 3 months. (The battery must be charged fully.)

2-CH USB Temperature Data Logger

NEW

■ Features

- Multi-channel (4 channel/ 2 channel) simultaneous controlling possible
- Transmit 2-channels of real-time temperature data to PCs
- Record and monitor temperature using DAQ Master (comprehensive device management software)
- USB-powered device with USB communication interface (Modbus RTU)
- Supports various types of input (thermocouple, RTD, mA, V) and different sensors can be assigned to each channel.
- Easy wiring with plug/socket type terminal
- Compact, space-saving design
- DIN rail or screw mount

⚠ Please read "Caution for your safety" in operation manual before using.

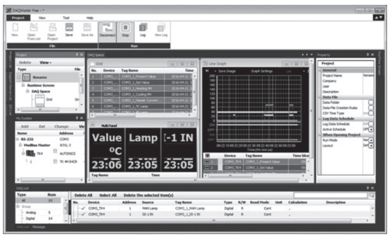
■ Comprehensive Device Management Program (DAQMaster)

- DAQMaster is comprehensive device management program for convenient management of parameters and multiple device data monitoring.
- Visit our website (www.autonics.com) to download user manual and comprehensive device management program.

< Computer specification for using software >

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS-232 serial port (9-pin), USB port

< DAQMaster screen >

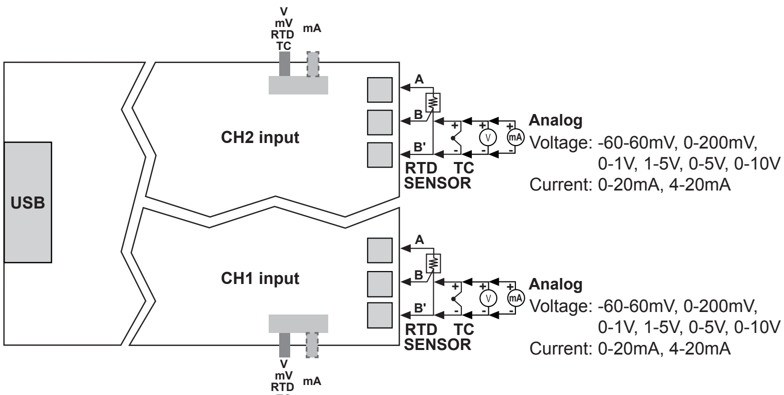


■ Specifications

Model		SCM-USU2I
Power supply		USB BUS POWER (5VDC)
Permissible voltage range		90 to 110% of rated voltage
Communication method		USB
Protocol		Modbus RTU
Display method		Check via PC Software (DAQMaster)
Input type	RTD	DPt100Ω, DPt50Ω, JPt100Ω, Cu100Ω, Cu50Ω, Nickel120Ω
	Thermocouple	K(CA), J(IC), E(CR), T(CC), B(PR), R(PR), S(PR), N(NN), C(TT), G(TT), L(IC), U(CC), Platinel II
	Analog	Voltage: -60-60mV, 0-200mV, 0-1V, 1-5V, 0-5V, 0-10V Current: 0-20mA, 4-20mA
Display accuracy※1	RTD	●At room temperature range (23℃±5℃) : (PV ±0.3% or ±1℃, select the higher one) ±1-digit ●Out of room temperature range : (PV ±0.5% or ±2℃, select the higher one) ±1-digit
	Thermocouple	
	Analog	●At room temperature range (23℃±5℃): ±0.3% F.S. ±1-digit ●Out of room temperature range: ±0.5% F.S. ±1-digit
Sampling period		50ms (2-CH simultaneous sampling)
Dielectric strength		500VAC 50/60Hz for 1 min (between input terminal and power terminal)
Vibration		0.75mm amplitude at frequency of 5 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times
Insulation resistance		Over 100MΩ (at 500VDC megger)
Memory retention		Approx. 10 years (when using non-volatile semiconductor memory type)
Environ-ment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Protection structure		IP20 (IEC standard)
Insulation type		Double insulation or reinforced insulation
Installation		DIN rail or panel mounting
Accessory		USB 2.0 AB type cable: 1 (length: 1m)
Approval		CE
Weight※2		Approx. 195g (approx. 140g)

※1: ◎At room temperature range (23℃±5℃)
●Below -100℃ of thermocouple K, J, T, N, E, and L, U, PLII, RTD Cu50Ω, DPt50Ω
: (PV ±0.3% or ±2℃, select the higher one)±1-digit
●Below 200℃ of thermocouple C, G and R, S
: (PV ±0.3% or ±3℃, select the higher one)±1-digit
●Below 400℃ of thermocouple B does not have accuracy standard.
◎Out of room temperature range
●RTD Cu50Ω, DPt50Ω: (PV 0.5% or ±3℃, select the higher one)±1-digit
●Thermocouple R, S, B, C, G, L, U: (PV ±0.5% or ±5℃, select the higher one)±1-digit
●Below -100℃ of other sensors: within ±5℃
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

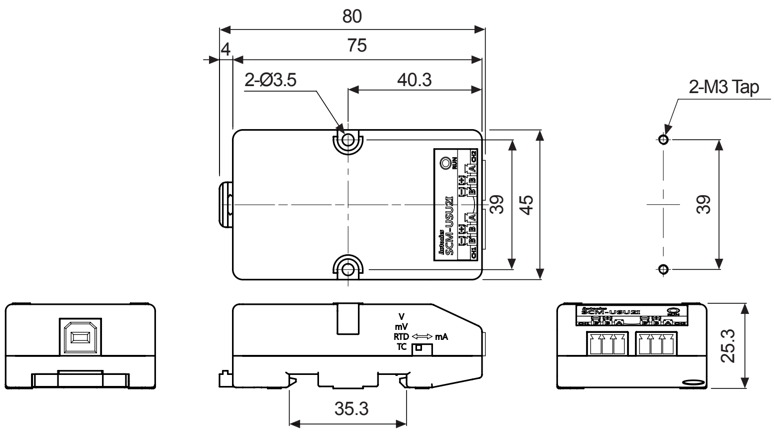
■ Connections And Block Diagram



※Input parts and USB cable connection part are insulated each other.

■ Dimensions

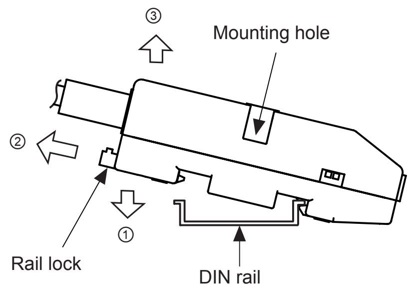
(unit: mm)



■ Installation

◎ Mounting & Removing the unit on DIN rail

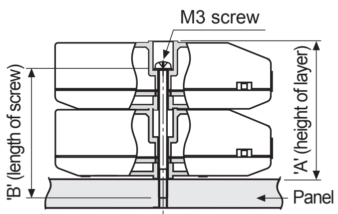
- Mounting
  1) Hook DIN rail connector on to DIN rail.
  2) Push the unit down to the direction "①".
- Removing
  1) Pull the rail lock of the unit to the direction "②".
  2) Remove the unit by pulling to the direction "③".



◎ Mounting the unit to panel

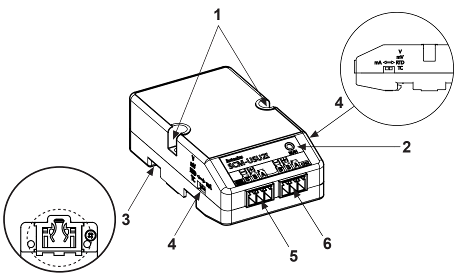
1) The unit is able to mount on the panel with two mounting holes.
2) For mounting this unit to panel, use M3 screws. Tightening torque is 0.4N.m.

※Multi-layer
Use long fixing screws and several units are fixed by stacking as multi-layer.



Number of layers(N)	'A' (23N+0.5)	'B' (23N-3)
1	23.5mm	20mm
2	46.5mm	43mm
3	69.5mm	66mm
4	92.5mm	89mm

■ Unit Description



1. Mounting hole:
Used when the unit mounts to the panel.

2. Power indicator (red):
Turns ON the power indicator (red) when supplying the power.

3. Rail Lock:
Used when the unit mounts on DIN rail.

4. Input type selector:
Input type selector by each CH.
The left selector is for CH1 and
the right one is for CH2 in the face.

V, mV, RTD, TC ◄─► mA
(default)

5. CH1 connector

6. CH2 connector

■ Input Sensor Type And Temperature Range

Input type			Display	Temperature range (℃)	Temperature range (℉)
Thermocouple	K(CA)		K(CA).H	-200 to 1350	-328 to 2462
			K(CA).L	-200.0 to 1350.0	-328.0 to 2462.0
	J(IC)		J(IC).H	-200 to 800	-328 to 1472
			J(IC).L	-200.0 to 800.0	-328.0 to 1472.0
	E(CR)		E(CR).H	-200 to 800	-328 to 1472
			E(CR).L	-200.0 to 800.0	-328.0 to 1472.0
	T(CC)		T(CC).H	-200 to 400	-328 to 752
			T(CC).L	-200.0 to 400.0	-328.0 to 752.0
	B(PR)		B(PR)	0 to 1800	32 to 3272
	R(PR)		R(PR)	0 to 1750	32 to 3182
	S(PR)		S(PR)	0 to 1750	32 to 3182
	N(NN)		N(NN)	-200 to 1300	-328 to 2372
	C(TT)※1		C(TT)	0 to 2300	32 to 4172
	G(TT)※2		G(TT)	0 to 2300	32 to 4172
	L(IC)		L(IC).H	-200 to 900	-328 to 1652
			L(IC).L	-200.0 to 900.0	-328.0 to 1652.0
	U(CC)		U(CC).H	-200 to 400	-328 to 752
			U(CC).L	-200.0 to 400.0	-328.0 to 752.0
	Platinel II		PLII	0 to 1390	32 to 2534
RTD	Cu50Ω		CU50 .L	-200.0 to 200.0	-200.0 to 392.0
	Cu100Ω		CU100 .L	-200.0 to 200.0	-200.0 to 392.0
	JPt100Ω		JPt100.H	-200 to 600	-328 to 1112
			JPt100 .L	-200 to 600.0	-328.0 to 1112.0
	DPt50Ω		DPt50 .L	-200 to 600.0	-328.0 to 1112.0
	DPt100Ω		DPt100.H	-200 to 600	-328 to 1112
			DPt100. L	-200.0 to 600.0	-328 to 1112.0
	Nickel120Ω		NI120.H	-80 to 200	-112 to 392
Analog	Voltage	0-10V	AV1	-9999 to 9999 (the display range varies depending on the decimal point setting.)	
		0-5V	AV2		
		1-5V	AV3		
		0-1V	AV4		
		0-200mV	AmV1		
		-60-60mV	AmV2		
	Current	0-20mA	AmA1		
		4-20mA	AmA2		

※1: C (TT): Same as existing W5 (TT).

※2: G (TT): Same as existing W (TT).

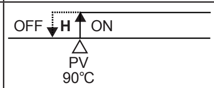
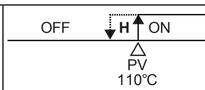
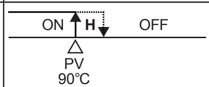
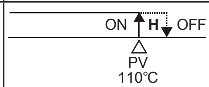
■ Parameter Groups

1. Parameter 1 group

※Alarm□ : Alarm1, Alarm2, Alarm3, Alarm4 ※CH□ : CH1, CH2

Parameter	Display	Descriptions
Alarm output□ target CH	Alarm□ Target CH	Set the CH for monitoring by alarm. Setting range : CH1, CH2, CH1 or CH2, CH1 and CH2
Alarm output□ mode※1	Alarm□ Mode	Setting range : OFF, AL-1, AL-2
Alarm output□ low-limit SV CH□	Alarm□ Low_CH□	Setting range : Refer to the '■ Input type and Temperature Range' ※When changing alarm operation mode, alarm output high/low-limit SV is automatically reset as min./max. value which has no alarm.
Alarm output□ high-limit SV CH□	Alarm□ High_CH□	
Alarm output□ hysteresis CH□	Alarm□ Hysteresis_CH□	Set the hysteresis of alarm output. Setting range : 1 to 100 (000.1 to 100.0)

※1: Alarm output mode

Mode	Name	Operations		Descriptions
OFF	—	—		No alarm output
AL-1	Absolute value high-limit alarm			Alarm output turns ON when PV is more than alarm absolute value.
		Alarm absolute value: Sets 90℃	Alarm absolute value: Sets 110℃	
AL-2	Absolute value low-limit alarm			Alarm output turns ON when PV is lower than alarm absolute value.
		Alarm absolute value: Sets 90℃	Alarm absolute value: Sets 110℃	

※H: Alarm output hysteresis

2. Parameter 2 group

Parameter	Display	Descriptions
CH□ input type	CH□ Input Type	Setting range: Refer to the '■ Input type and temperature range'.
CH□ sensor temperature unit	CH□ Unit	℃↔℉ ※Does not set in analog input.
CH□ low-limit input value	CH□ Low Range	Set the low-limit input value within analog input range. Setting range: Min. range to {high-limit input value (CH□ High Range)-F.S. 10% digit}
CH□ high-limit input value	CH□ High Range	Set the high-limit input value within analog input range. Setting range: {low-limit input value (CH□ Low Range)+F.S. 10% digit}] to Max. range
CH□ decimal point place of scale value	CH□ Scale Dot	Within high/low-limit scale value, set the decimal point place for display value (PV). Setting range: 0, 0.0, 0.00, 0.000
CH□ low-limit scale value	CH□ Low Scale	Set display scale for analog low-limit input value (CH□ Low Range). Setting range : -9999 to 9999
CH□ high-limit scale value	CH□ High Scale	Set display scale for analog high-limit input value (CH□ High Range). Setting range : -9999 to 9999
CH□ analog display unit	CH□ Digital Unit	For analog input, set the display unit. Setting range : ℃, ℉, % , OFF
CH□ input correction	CH□ Input Bias	Input correction is to correct deviation occurred from temperature sensor. ※After input correcting, when present value (PV) is over the temperature range of the sensor, HHHH or LLLL is displayed. Setting range: -999 to 999 (-999.9 to 999.9)
CH□ input digital filter	CH□ Digital Filter	If the present value (PV) is fluctuating repeatedly by rapid change of input signal, stable recording is difficult. Input digital filter makes the present value stable. When input digital filter is set as 0.4 sec., input digital filter is applied for the input values for 0.4 sec. and the present value is may be different with the actual input value. Setting range: 0.1 to 120.0 (sec)

※□ : Enables to set in analog input.

3. Parameter 3 group

Parameter	Display	Descriptions
Communication write enable/disable	Communications Write	Parameter setting is enable or disable by software (DAQMaster) setting. (reading parameter set value (Read) is always possible.) Enable : Enables changing and writing by parameters Disable : Disables changing and writing by parameters
Parameter reset	Parameter Initialize	Setting range : NO, YES

※Parameters reset by changing the parameter

Group	Parameter	Display	Reset parameters
Parameter 1 group	Alarm output□ mode	Alarm□ Mode	Alarm□ High/Low_CH□
Parameter 2 group	CH□ input type	CH□ Input type	Alarm□ High/Low_CH□, CH□ Low/High Range, CH□ Scale Dot, CH□ Low/High Scale, CH□ Digital Unit, CH□ Input Bias
	CH□ sensor temperature unit	CH□ Unit	Alarm□ High/Low_CH□, CH□ Input Bias

■ Troubleshooting

Displays at software (DAQMaster).

Display	Description	Troubleshooting
OPEN	Flashes if input is broken or disconnected.	Check input sensor status.
HHHH	Flashes if present value is higher than the temperature range of the sensor.	When input is within the rated temperature range of the sensor, this display disappears.
LLLL	Flashes if present value is lower than the temperature range of the sensor.	

※When error displays and input is connected or within the rated temperature range of the sensor, the error display disappears and the unit operates normally.

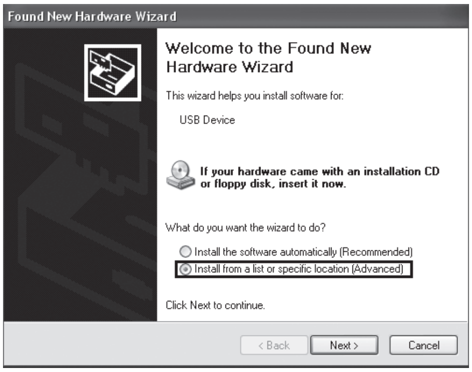
■ Factory Default

Group	Parameter display	Factory default	Parameter display	Factory default
Parameter 1 group	Alarm□ Target CH	Alarm1/2 : CH1 Alarm3/4 : CH2	Alarm□ High_CH□	1350
	Alarm□ Mode	Alarm1/3 : AL-1 Alarm2/4 : AL-2	Alarm□ Hysteresis_CH□	1
	Alarm□ Low_CH□	-200	—	—
Parameter 2 group	CH□ Input Type	K (CA).H	CH□ Low Scale	000.0
	CH□ Unit	℃	CH□ High Scale	100.0
	CH□ Low Range	000.0	CH□ Digital Unit	%
	CH□ High Range	100.0	CH□ Input Bias	0
	CH□ Scale Dot	0	CH□ Digital Filter	0.1
Parameter 3 group	Communications Write	Enable	Parameter Initialize	NO

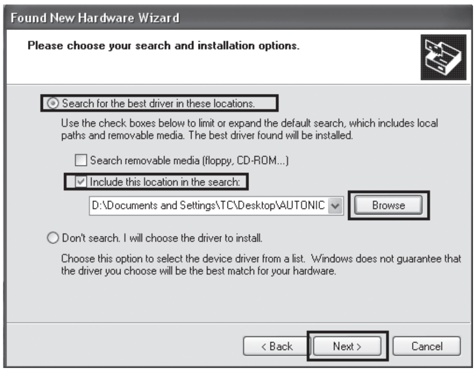
▣ Driver Installation

◎ USB Driver Installation

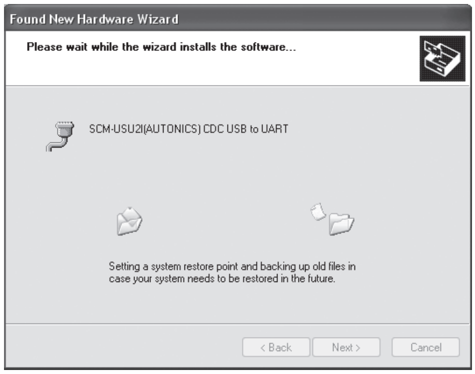
1) Visit our website (http://www.autonics.com) and download 'SCM-USU2I Driver'.
2) Unzip the downloaded file to the desired directory.
3) When connecting this product with an USB port, the 'Found New Hardware Wizard' appears automatically.
At 'Do you want to search software by connecting 'Window Update'?', click 'No' and the following dialog box appears to start Driver installation.
Select 'Install from a list or specific location (Advanced)' and click 'Next'.

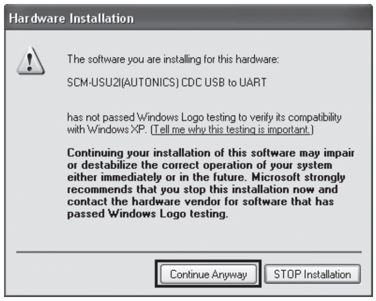


4) Select 'Search for the best driver in these locations' and 'Include this location in the search'.
Click 'Browse'.
5) The 'Browse Folder' dialog box appears. Select 'SCM-USU2I(AUTONICS) CDC USB to UART' and click 'Finish'.
Click 'Next' to start the USB Driver installation.

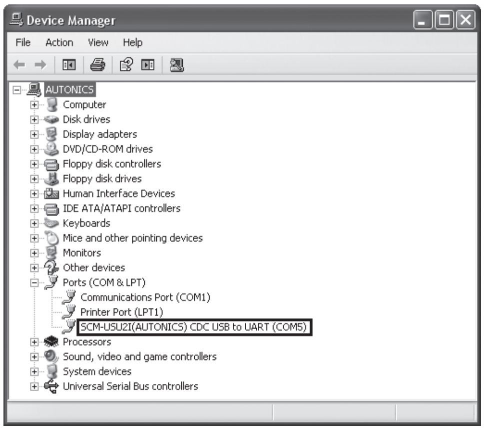


6) The 'Hardware Installation' dialog box appears.
Click 'Continue Anyway' to proceed with installation.





7) The following dialog box appears when the USB Driver is installed properly.
Click 'Finish'.



※Check that drivers are installed properly at 'Device Manager' after installing USB Driver and Serial Port Driver.

Select My Computer > Properties > Hardware tab > Device Manager.

Or select Start > Control Panel > System > Hardware tab > Device Manager.

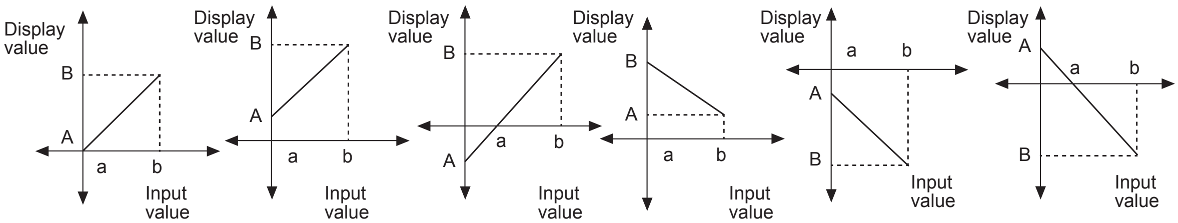
Make sure that 'SCM-WF48 Driver(Autonics Corp)' is found and in 'Universal Serial Bus Controller' category and 'SCM-USU2I(AUTONICS) CDC USB to UART(COM5)' is found in 'Ports (COM and LPT)'.

※This Driver Installation shows the procedure for Windows XP. There might be some differences in the specification above depending on OS.

▣ Functions

◎ High/Low Scale [CH□ Low Scale/CH□ High Scale]

For analog input, this function is to set (−9999 to 9999)for particular high/low limit value in order to display high/low limit value of measurement input. If measurement inputs are 'a' and 'b' and particular values are 'A' and 'B', it will display a=A, b=B as below graphs.



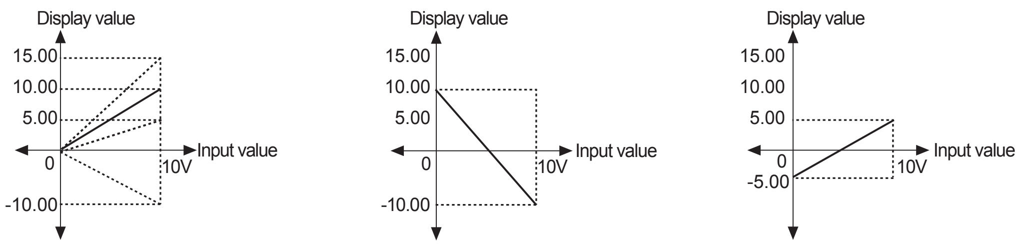
Display scale function is able to change display value for max./min. measured input by setting high limit scale[H-SC] and low limit scale [L-SC] in program mode.

※E.g.) Set high/low scale value (input range is 0 to 10V)

Low Scale=0.00
High Scale=5.00,10.00,15.00, 0.00

Low Scale=10.00
High Scale=-10.00

Low Scale=-5.00
High Scale=5.00



※ When changing input type, high/low scale is changed as factory default.

■ Proper Usage

◎ Caution during use

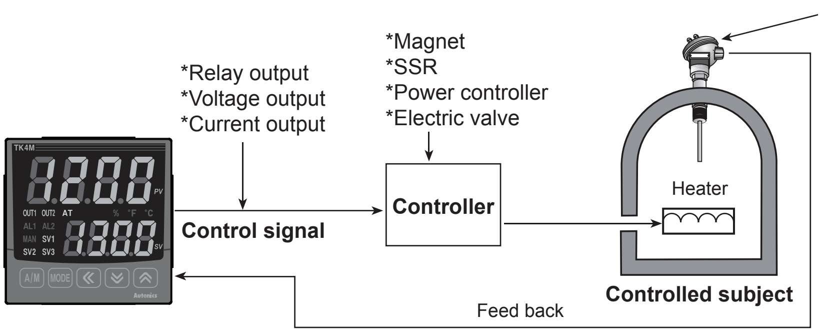
- When connecting PC with the unit, and changing PC USB port to another (changed) USB port, USB driver will be reinstalled. This is not unit malfunction.
- In case of connect PC with the several units, number of COM port will be numbered in order. This is not unit malfunction. (e.g.: COM14, COM15 ... COM256)
- When connecting PC with the unit via USB connector, check COM port number before communication. (This is not unit malfunction.)
- When connecting PC with the unit via USB cable, do not use the extension cable to extend USB cable length. It may cause malfunction.
- When connecting PC with the unit via USB hub which is external power supply type, external power must be supplied for normal operation.
- USB cable must be the dedicated specifications.
- When using USB cable over 3m, make sure the noise countermeasures.
- USB cable should not be broken or shorted. Check the cable before supplying the power.
- Check the connection is correct.
- Use the unit within the rated voltage range.
- For preventing inductive noise, the unit should be separated with high-voltage cable or power cable.
- Do not use the unit with the below environment.
  - Place where severe vibration or shock is present
  - Place where strong alkalis or acids are used
  - Place where direct ray of the sun is present
  - Place where strong magnetic field or electric noise are generated
- Storage

  Keep the unit -20 to 60℃, 35 to 85%RH with avoiding direct ray of light. It is recommended to keep the unit package as it is.
- This unit may be used in the following environments.
  - It shall be used indoor.
  - Altitude up to 2,000m
  - Pollution degree 2
  - Installation category Ⅰ

Technical Description

■ Example Of Temperature Control Configuration

The following example describes the basic configuration for temperature control.



● **Temperature sensor**
Consists of an element protected by a pipe.
Use it to locate this element where temperature control is required.

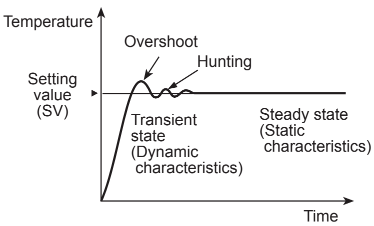
● **Temperature controller**
Controls by receiving electrical signal input from temperature sensor and comparing the setting temperature value to provide adjustment signals for the controller.

● **Controller**
Controls by heating or cooling. For example, a magnetic switch which opens/closes current for supplying heater or a solenoid valve which supplies the fuel.

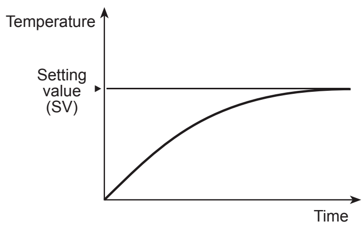
■ Optimal Temperature Control

Optimal temperature control is that there is no overshoot, no hunting, no late response, and no influences on any external disturbances like figure (3). However, due to the characteristic of a controlled subject, optimal temperature control is hard to be realized. The fast response causes overshoot or hunting, reversely the slow response causes lots of time to reach the setting value. However, depending on the application, the desired control is different; like figure (1) fast control with overshoot, or figure (2) slow control without overshoot is able to be the desired temperature control. Therefore, optimal temperature control is various from application, and purpose. The figure (3) may be the general optimal temperature control.

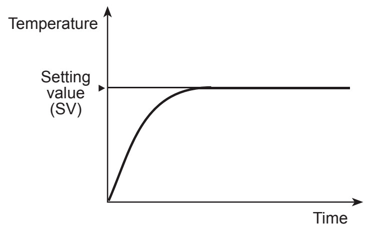
(1) Fast response (the temperature stabilizes after overshooting several times)



(2) The response that is slow in reaching the set point.



(3) Optimal temperature control



■ Characteristics Of The Controlled Subject

For the optimal temperature control, it is required to understand the thermal characteristics of the controlled subject before selecting a temperature controller or a temperature sensor.

Characteristics of the Controlled Subject	
Heat capacity	The ease of heating depending on the capacity of the controlled subject (an electric furnace, etc)
Static characteristics	The heating capability depending on the capacity of the heater
Dynamic characteristics	The transient response characteristics in the initial heating
External disturbances	The causes of temperature changes such as opening/closing the furnace door, entering/exiting contents, or changing of ambient temperature

■ Temperature Control Operation And Characteristics

Operation	Advantages	Disadvantages
ON/OFF control	• Easy to control • Offset does not occur	• Overshoot and hunting occur
Proportional control (P)	• Less overshoot and hunting	• It takes time for the stable control • Offset occurs
Proportional Integral control (PI)	• Removes offset	• It takes more time for the stable control than proportional control (P) (I control shall be used with P control.)
Proportional Derivative control (PD)	• Fast response to external disturbances	• It cannot be controlled by itself. (D control shall be used with P control.)
PID control	• It is able to get an excellent control characteristics	• It needs to set PID parameter.

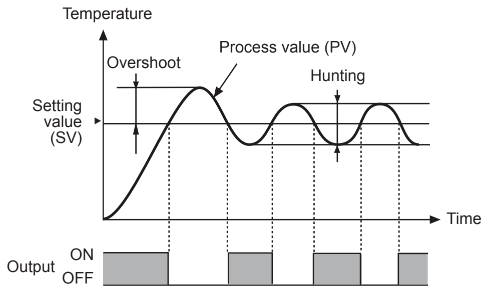
◎ ON/OFF control

If the present value is lower than the setting value, the output is turned ON and the heater power is supplied.

If the present value is higher than the setting value, the output is turned OFF and heater power is shut off. ON/OFF control operation is to ON/OFF heater power by comparing the present value and the setting value.

Like figure 1, exceeded temperature rise at start is overshoot, and the constant cycle based on the setting value is hunting.

Therefore, ON/OFF control operation is not appropriate to optimal control due to overshoot and hunting.



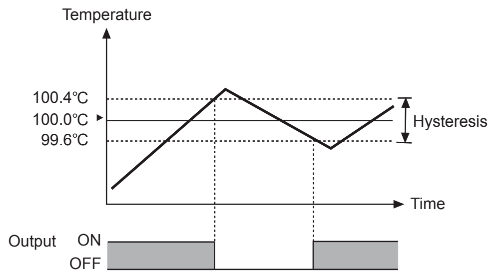
(Figure 1)

● Hysteresis

For ON/OFF control, when ON, OFF control operates only at the setting value, output has oscillation and is subject to noise. Therefore, it should have ON, OFF section to operate ON, OFF at this section like figure 2. This section is called hysteresis.

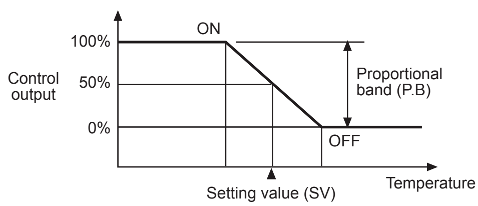
For a freezer, hysteresis should be large enough because repeated ON/OFF control is hard on a compressor.

E.g.) If a temperature controller with temperature range of 0 to 400℃ has 0.2 hysteresis (D=F.S 0.2 to 3%), hysteresis (D) is 0.8℃. If the setting value is 100℃, the output is OFF at 100.4℃ and it is ON at 99.6℃.



(Figure 2)

◎ Proportional control (P control)

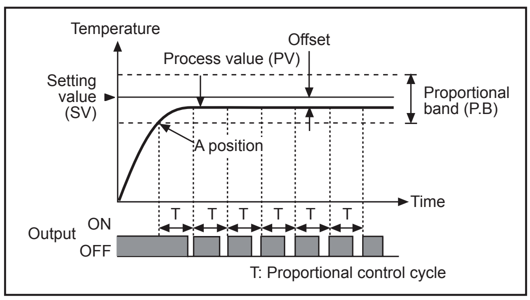


Proportional control (P control) has control output which is proportional to deviation from the present temperature to the setting value in the proportional band to the setting value.

Before the present value reaches A position, control output is ON at 100%. When the present value exceeds A position (lowest level of proportional band), the control output repeats ON/OFF operation in the proportional control cycle.

When the present value reaches setting value, control output is 50% and ON/OFF time ratio is 1:1. (If the present value exceeds the setting value, ON time of control output is short and OFF time is long.)

P control minimizes hunting of ON/OFF control. However, P control has long time to reach the set value and offset.

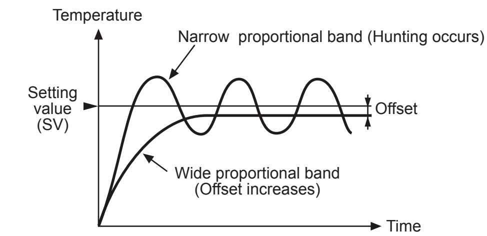


● **Wide proportional band is set**

Present value takes long time to reach the set value and has wide offset because control output operates ON/OFF at the below setting value.

● **Narrow proportional band is set**

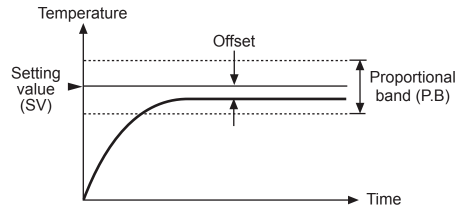
Present value takes short time to reach the set value and has hunting because control output operates ON/OFF approaching the setting value.



● Offset

In proportional control, there is certain error despite stable operation status by the heat capacity of controlled subject, or the heating capability.

This error is offset which occurs only in proportional control and is adjustable by reset volume. PID control removes offset automatically.



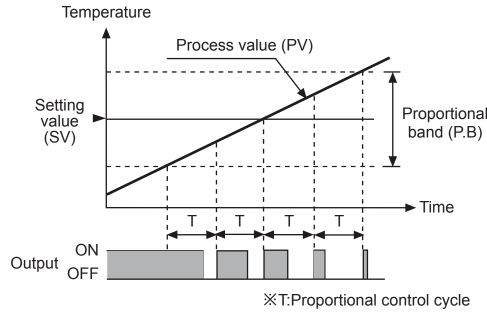
● Proportional control cycle and time-proportioning control

In the proportional control, control output with relay, SSR is turned ON for a set time period and is turned OFF for the left time.

This set time period is proportional control cycle and this control operation is time-proportioning control.

※Control cycle is fixed to 20 sec. in standard temperature controller.

※Control cycle is flexible to be changed from 1 to 120 sec. with PID temperature controller.

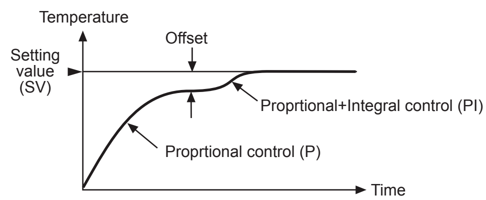


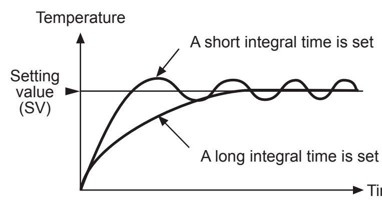
◎ Proportional integral control (PI control)

Integral action automatically adjusts the offset of proportional control to control stably at the setting value. However, it takes long time to stabilize the temperature changes about the external disturbances.

Integral action cannot be operated by itself, it shall be operated with P control.

- The shorter reset time, the stronger integral action is. It adjusts offset for shorter time but causes hunting.
- The longer reset time, the weaker integral action is. It takes longer time to remove offset.

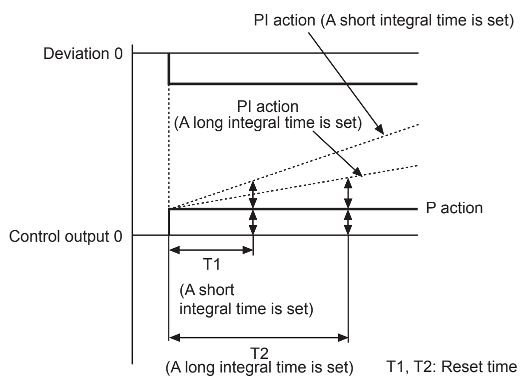




● Reset time

Reset time, the unit of intensity of integral action, is the taking time to coincide with the control output of integral action and the control output of proportional action.

Too short integral time causes the strong integral action and hunting.



◎ Proportional derivation control (PD control)

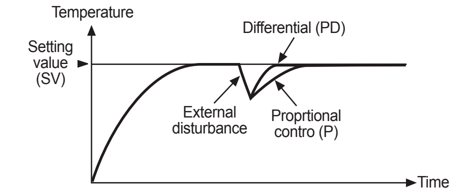
Comparing with proportional control, proportional derivative control has fast response to temperature changes about the external disturbances.

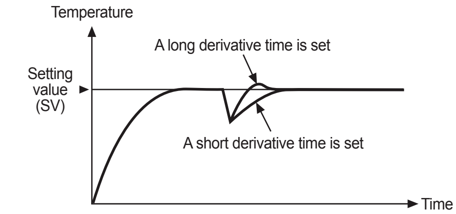
Derivation control adjusts with the control output which is proportional to the slope of temperature changes. Therefore, derivation control stabilizes the temperature changes with high control output to the external disturbances.

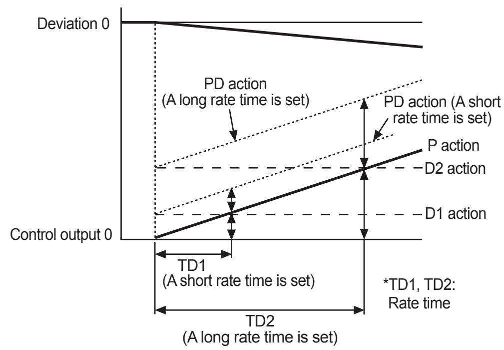
- The shorter rate time, the weaker derivation action responds slowly to external disturbances. Therefore, it takes longer time to reach the setting value but there is no hunting.
- The longer rate time, the stronger derivation action response quickly to external disturbances. Therefore, it takes shorter time to reach the setting value but it is easy to occur in hunting.

● Rate time

Rate time, the unit of intensity of derivative action, is the taking time to coincide with the control output of the derivative action and the control output of proportional action when the deviation is ramp type.



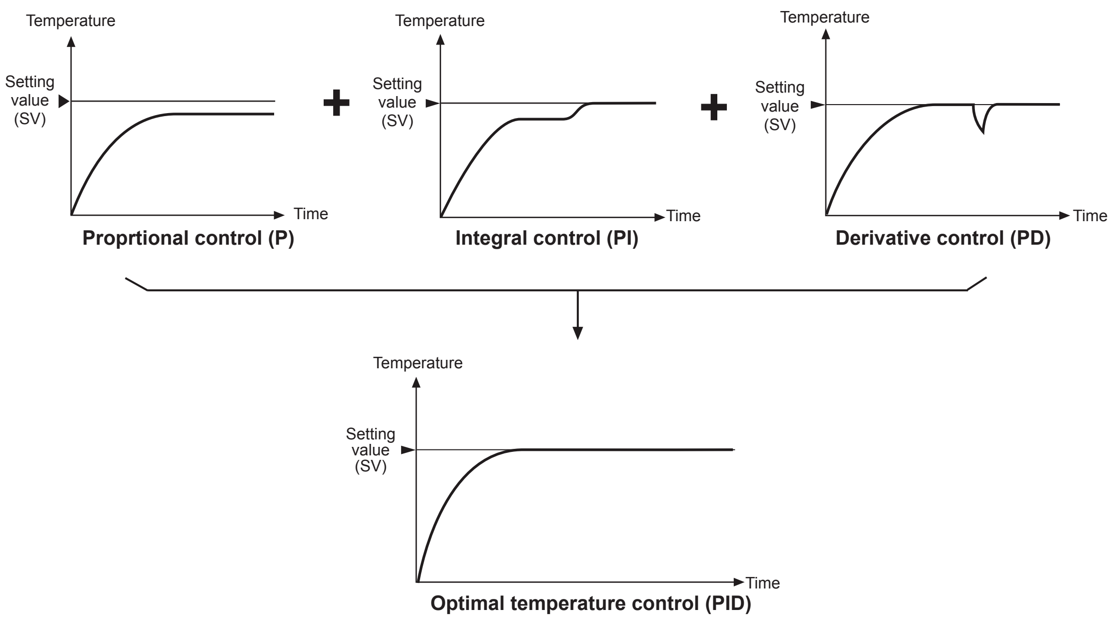




◎ PID control (Proportional + Integral + Derivation control)

PID control combined with proportional, integral, and derivation control modes has good control output to a controlled subject which has delay time.

PID control does not have overshoot and hunting of proportional control (P control), adjusts automatically offset of integral control (I control), and has fast response to external disturbance with derivative control (D control). As the result, PID control is realized optimal temperature control.



▣ Control Outputs

◎ Relay output

Relay output is used to control the ON/OFF operation of subject devices through the built-in relay contact.

◎ SSR drive output

SSR drive output releases DC voltage as an output to control SSRs (solid state relay: non-contact relay).

Using solid state relays can help maintain a small configuration size and achieve a semi-permanent life cycle.

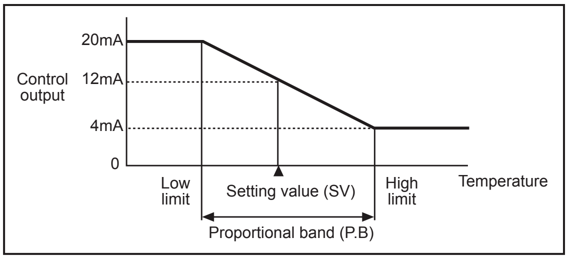
- SSRP function (only TX, TK, TCN, TC Series)
  SSRP output is selectable one of standard ON/OFF control, cycle control, phase control by utilizing standard SSR drive output.

◎ Current output

A current output is a control output used to drive an external power controller (SCR UNIT), control valve, etc.

It is also called analog output, and the output is stable and does not have rapid change, and it can process a stabilized control.

(e.g.) current output 4-20mA of TZ/TZN Series



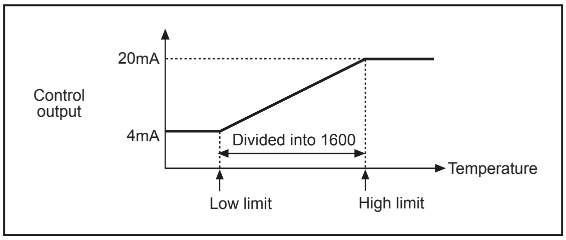
◎ Transmission output

It is not for controlling but for transmitting PV to outside.

Generally, PV is transmitted as current.

In case of transmission output DC 4-20mA, it outputs DC 4-20mA within the set high/low-limit range.

(e.g.) transmission output DC 4-20mA, resolution 16,000 of TZ/TZN Series



◎ RS485 communication function

By RS485 communication, data of temperature controller is transmitted or set to external devices. You can set communication address, speed, parity bit, stop bit, response waiting time, write enable/disable of the temperature controller.

▣ Glossary

◎ Deviation
It means the deviation of the controlled value from the setting value.

◎ Burn out function
Output turns OFF when sensor is disconnected.
It is the thermal response time of heater and is percentage constituents.

$$\text{Thermal response} = \frac{\text{Fall time}}{\text{Rise time+Fall time}} \times 100\ (\%)$$

◎ Linearize
Non-linear response to changing temperature needs to be revised and this modification is called linearize.

Uneven gradations to linearize analog temperature controller, linear analyze circuit to linearize thumbwheel switch type temperature controller.

▣ Temperature Sensor
Temperature can be simply classified into two groups, contact and non-contact. Most of sensors such as platinum resistance thermometer, thermistor, thermocouple, etc. are contact temperature sensors, and it literally contacts with object to infer the temperature.

◎ Platinum resistance thermometer (RTD: Resistance Temperature Detector)
The electrical resistance of the metal used by platinum resistance thermometers has a fixed relationship to the temperature. Therefore, a platinum wire is used for the resistor. The most reproducible temperature sensor, platinum RTD has a near linear positive temperature coefficient from -260 to 630℃. In this reason, RTDs are used as industry standard.

Sensor is put in protecting tube charged with insulation and widely used for dyeing, physical/chemical appliances, controlling processor, but it is somewhat expensive.

● Standard Platinum Resistance Thermometer

Symbol	Resistance
Pt100	100Ω
Pt50	50Ω

※Resistance is specified by its value at 0℃.
※Resistance fluctuation per 1℃
• DIN Pt (the German Institute for Standardization): 0.385Ω/℃
• JIS Pt100 (Japanese Industrial Standard): 0.3916Ω/℃

◎ Thermistor
A thermistor is a semiconductor device with an electrical resistance that is proportional to temperature, and there are two types, PTC (Positive Temperature Coefficient) and NTC (Negative Temperature Coefficient).

It is mostly used for assembling machines, inexpensive and small. But they are incompatible and non-linear.

And so circuits cannot be used for an industrial purpose or in circumstances where compatibility with sensor is required. NTC is used for temperature sensing/controlling, liquid/wind/vacuum level detecting, inrush current preventing, retardation element, etc., and PTC is for motoring, degaussing, heating a fixed temperature, overcurrent device, etc.

◎ Thermocouple
Thermo electromotive force is provoked when providing temperature for the junction of the difference metals which is joined and welding. This thermo electromotive force has the certain value depending on temperature changes.

Thermocouple sensor is generally used for industrial use such as the steel, power plant, or heavy chemical industry. However, thermocouple's accuracy is not higher than platinum RTD and thermocouple is able to be expensive than platinum RTD because thermocouple requires compensating lead wires.

※Depending on the kind of metal, thermocouple has different thermo electromotive force.

※Material codes and temperature range.

• K(CA): -100 to 1300℃
• J(IC): 0 to 800℃
• R(PR): 0 to 1700℃
• E(CR): 0 to 800℃
• T(CC): -200 to 400℃
• S(PR): 0 to 1700℃
• N(NN): 0 to 1300℃
• W(TT): 0 to 2300℃

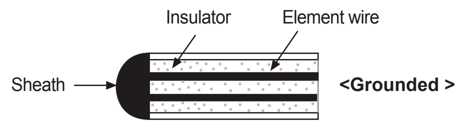
*Former models name in parenthesis.

● Sheathed thermocouple
Sheathed thermocouple consists of sheath, and sealed insulator of high magnesium with element wire.

Sheathed thermocouple has fast response of temperature changes, high resistance, high corrosion-resistance, and high pressure-resistance.

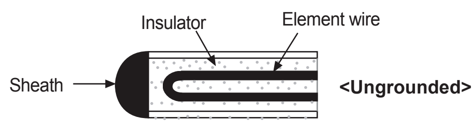
● Grounded

Grounded type which is welded element wires and sheath directly has fast response. It is suitable to measure high temperature and pressure. However, it which is non insulated has a limit on various applications.



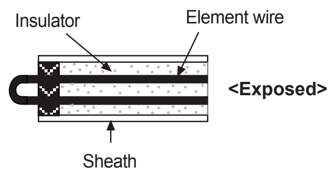
● Ungrounded

Ungrounded type which is completely insulated between element wires and sheath has slow response. However, it has small impact on external factors such as corrosion, high pressure, or high temperature. Due to this reason, it is suitable for prolonged use.



● Exposed

Exposed type which consists of exposed element wires to the sheath has the fastest response among three sheath types. However, it which has low mechanical intensity is not suitable for corrosive, high pressure, or high temperature environment.



● Cold junction compensating circuit

When connecting a thermocouple and input terminal of temperature controller, thermo electromotive force is provoked on a point of contact between a thermocouple and input terminal metal. The thermo electromotive force causes a temperature error, and for correcting this the temperature of the point should be maintained 0℃.

However, it is hard to be maintained at 0℃. Because of this reason, the point of contact has an individual temperature sensor to detect the temperature of the point. Sensing circuit subtracts this temperature for correcting error, and this circuit is called cold junction compensating circuit. Most of temperature controllers have integrated cold junction compensating circuit.

● Compensating lead wire

These are compensating lead wires used when the temperature measurement point and the temperature controller are far apart.

1) Purpose of compensating lead wire using

The principle of thermocouple temperature sensor is that after joining and welding two difference metals, thermo electromotive force is provoked when providing temperature on the junction.

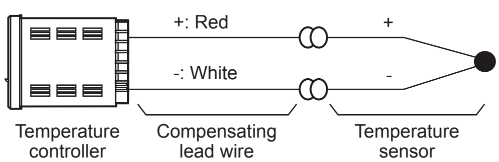
Thus, in case of the distance between the thermocouple and the temperature controller is too long, compensating lead wires are required. Using normal wire extension can cause an error, because a connecting point could be another sensor. For this reason, consider the construction and resistive value. The compensating lead wires consist of materials that match the potential difference of the thermocouple to be use.

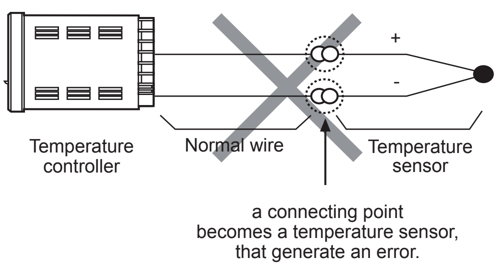
2) Polarity of compensating lead wire

There are two wires, red color wire for phases and blue one for neutral (white or black).

Please note that, if compensating lead wire polarity is unmatched, it generates error.

E.g.)Use K type thermocouple compensating lead wire for K type thermocouple.





▣ Proper Usage

◎ Caution during use (Common features)

- Use the regulated compensating lead wire only. Because a connecting point where normal wire and thermocouple wire joined together could be another sensor, using normal wire for extension can cause an error.
- 3-wire circuit connection is required for RTD sensor. Compensating wire that is the same length and diameter as the sensor wire is compulsory in using RTD sensor. Two different metal wires cause two different temperature values.
- Input signal wire is needed to be placed in an area that does not get much noise from wires around such power, loads, etc.
- If it is unavoidable for input signal wire to be placed near power line, line-filter capacitors are required to be set at power line of controller, and use shield wire for signal input line.
- Avoid using near devices that make high frequency noise (high frequency welder/sewing machine, large-capacity SCR controller).

◎ Simple "error" diagnosis

● Incorrect temperature indicated.

Inspect input part in priority in this case. To find out at which part has problems if using thermocouple, disconnect the sensor from input terminal and check if it shows the room temperature on the display. And also, if using RTD type, make sure that if all the wires are 3-wire, the same diameters. Using 2-wire or 3-wire that different diameter, temperature deviation occurs.

● Controlled temperature differs from SV when operation finished

Thermal response time of heater or controlled subject could be the problem in this case. Rearrange Reset VR on the front side of controller so that the deviation disappears.

● Oscillating output relay

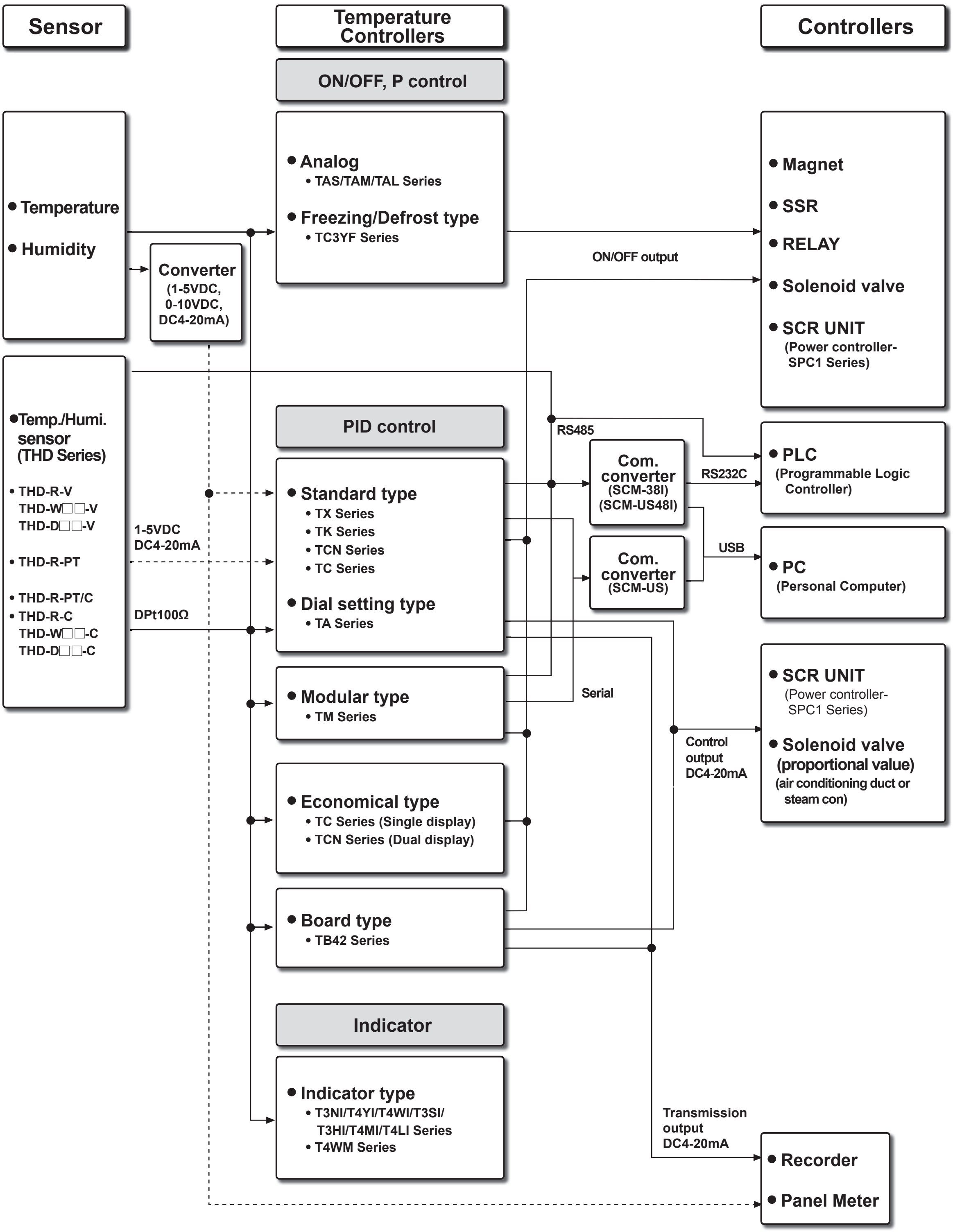
Which happens when back electromotive force generated from external magnet S/W comes in through power line or strong high-frequency device is being used nearby.

Be far away from high-frequency devices. And stay two power lines, magnet S/W power's and controller's, apart from each other. If it is hard to rearrange track, add mylar condenser, 0.1μF/600V or 1μF/600V, on power terminal of external magnet S/W to remove oscillating.

● Being observed right temperate in a room temperature but wide temperature deviation occur in high temperature,

Check out if the sensor type is correspond with temperature controller. (It can be the problem of sensor characteristics)

■ Product System



(I) SSRs / Power Controllers

Single-Phase, Detachable Heatsink Type SSR SR1 Series

Single-Phase, Slim Detachable Heatsink Type SSR SRC1 Series

Single-Phase, Integrated Heatsink Type SSR SRH1 Series

Single-Phase, Analog Input Type SSR SRPH1 Series

Single-Phase, Socket Detachable Heatsink Type SSR SRS1 Series

Single-Phase, Power Controller SPC1 Series

Product Overview

Single-Phase, Detachable Heatsink Type SSR

Series	**SR1**
Appearances & Dimensions	  [W44×H58×L28.3mm]
Reference	**I-5 to 8**

Model	Rated input voltage	Rated load current	Rated load voltage	Function
SR1-1215	4-30VDC	15A	24-240VAC	Zero cross turn-on
SR1-4215	90-240VAC			
SR1-1225	4-30VDC	25A		
SR1-4225	90-240VAC			
SR1-1240	4-30VDC	40A		
SR1-4240	90-240VAC			
SR1-1250	4-30VDC	50A		
SR1-4250	90-240VAC			
SR1-1275	4-30VDC	75A		
SR1-4275	90-240VAC			

Model	Rated input voltage	Rated load current	Rated load voltage	Function
SR1-1415	4-30VDC	15A	48-480VAC	Zero cross turn-on
SR1-1415R				Random turn-on
SR1-4415	90-240VAC			Zero cross turn-on
SR1-1425	4-30VDC	25A		Zero cross turn-on
SR1-1425R				Random turn-on
SR1-4425	90-240VAC			Zero cross turn-on
SR1-1440	4-30VDC	40A		Zero cross turn-on
SR1-1440R				Random turn-on
SR1-4440	90-240VAC			Zero cross turn-on
SR1-1450	4-30VDC	50A		Zero cross turn-on
SR1-1450R				Random turn-on
SR1-4450	90-240VAC			Zero cross turn-on
SR1-1475	4-30VDC	75A		Zero cross turn-on
SR1-1475R				Random turn-on
SR1-4475	90-240VAC			Zero cross turn-on

Single-Phase, Slim Detachable Heatsink Type SSR

Series	**SRC1**
Appearances & Dimensions	   [W22.5×H98×L33.5mm]
Reference	**I-9 to 12**

Model	Rated input voltage	Rated load current	Rated load voltage	Function
SRC1-1215	4-30VDC	15A	24-240VAC	Zero cross turn-on
SRC1-4215	90-240VAC			
SRC1-1220	4-30VDC	20A		
SRC1-4220	90-240VAC			
SRC1-1230	4-30VDC	30A		
SRC1-4230	90-240VAC			
SRC1-1420	4-30VDC	20A	48-480VAC	
SRC1-4420	90-240VAC			
SRC1-1420R	4-30VDC			Random turn-on

Single-Phase, Integrated Heatsink Type SSR

Series	SRH1		
Appearances & Dimensions	CE cULus		
	● 15A/20A Rated load current	● 30A/40A Rated load current	● 60A Rated load current
			
	[W22.5×H100×L100mm]	[W45×H100×L100mm]	[W110×H100×L100mm]
Reference	**I-13 to 17**		

Model	Rated input voltage	Rated load current	Rated load voltage	Function
SRH1-1215	4-30VDC	15A	24-240VAC	Zero cross turn-on
SRH1-2215	24VAC			
SRH1-4215	90-240VAC			
SRH1-1220	4-30VDC	20A		
SRH1-2220	24VAC			
SRH1-4220	90-240VAC			
SRH1-1230	4-30VDC	30A		
SRH1-2230	24VAC			
SRH1-4230	90-240VAC			
SRH1-1240	4-30VDC	40A		
SRH1-2240	24VAC			
SRH1-4240	90-240VAC			
SRH1-1260	4-30VDC	60A		
SRH1-2260	24VAC			
SRH1-4260	90-240VAC			

Model	Rated input voltage	Rated load current	Rated load voltage	Function
SRH1-1420	4-30VDC	20A	48-480VAC	Zero cross turn-on
SRH1-1420R				Random turn-on
SRH1-2420	24VAC			Zero cross turn-on
SRH1-1430	4-30VDC	30A		Zero cross turn-on
SRH1-1430R				Random turn-on
SRH1-2430	24VAC			Zero cross turn-on
SRH1-1460	4-30VDC	60A		Zero cross turn-on
SRH1-1460R				Random turn-on
SRH1-2460	24VAC			Zero cross turn-on

Single-Phase, Analog Input Type SSR

Series	SRPH1	
Appearances & Dimensions	CE cULus	
	● 20A/30A Rated load current	● 60A Rated load current
		
	[W45×H100×L100mm]	[W110×H100×L100mm]
Reference	**I-18 to 23**	

Model	Rated load current	Rated load voltage
SRPH1-A220	20A	100-240VAC
SRPH1-A230	30A	
SRPH1-A260	60A	

Model	Rated load current	Rated load voltage
SRPH1-A420	20A	200-480VAC
SRPH1-A430	30A	
SRPH1-A460	60A	

Product Overview

Single-Phase, Socket Type SSR

Series	SRS1
Appearances & Dimensions	● SRS1-A (Autonics socket: SK-G05)  [W13×H29×L28mm] [W13×H29×L38mm] ● SRS1-B (universal socket: LY2)  [W21×H27×L34.5mm]
Reference	**I-24 to 30**

Model	Rated input voltage	Rated load current	Rated load voltage	Function
SRS1-A1202	4-24VDC	2A	24-240VAC	Zero cross turn-on
SRS1-A1202R				Random turn-on
SRS1-A1203		3A		Zero cross turn-on
SRS1-A1203R				Random turn-on
SRS1-A1205		5A		Zero cross turn-on
SRS1-A1205R				Random turn-on
SRS1-A1D101		1A	5-100VDC	—
SRS1-A1D102		2A		
SRS1-A1D201		1A	5-200VDC	
SRS1-A1X201			5-240VAC/5-200VDC	
SRS1-B1202-2	4-30VDC	2A (consists to 2 circuits)	90-240VAC	Zero cross turn-on
SRS1-B1202R-2				Random turn-on
SRS1-B1203-1		3A		Zero cross turn-on
SRS1-B1203R-1				Random turn-on
SRS1-B1205-1		5A		Zero cross turn-on
SRS1-B1205R-1				Random turn-on

Single-Phase, Power Controller

Model	SPC1-35	SPC1-50
Appearances & Dimensions	 [W94.6×H124.8×L92mm]	
Power supply	220VAC 50/60Hz	
Allowable voltage range	90 to 110% of rated voltage	
Max. rated current	35A (single-phase)	50A (single-phase)
Control power	220VAC	
Control range	Phase control: 0 to 98%, Cycle control: 0 to 100%	
Application load	Resistance load (min. load: over 5% of rated current)	
Cooling method	Natural cooling	
Control circuit	Micom control type	
Control input	• 1-5VDC • DC4-20mA (250Ω) • ON/OFF (external contact or 24VDC) • External VR (1kΩ) • Output limit input (front OUT ADJ. VR)	
Control mode	• Phase control • Cycle control (Zero cross turn-on) - Period 0.5 sec, 2.0 sec, 10 sec • ON/OFF control (Zero cross turn-on)	
Starting type	SOFT START (0 to 50 sec variable)	
Display	Output indication (LED)	
Reference	**I-29 to 34**	

Single-Phase, Detachable Heatsink Type SSR

■ Features

- Compact, universal design for flexible installation
- Dielectric strength: 4000 VAC
- High heat dissipation efficiency with ceramic PCB
- Zero cross turn-on, random turn-on models available
- Input indicator (green LED)

⚠ **Please read "Safety considerations" in operation manual before using.**

■ Ordering Information

SR 1 – 1 4 25 R

Item	Code	Description
Function	No Mark	Zero cross turn-on
	R	Random turn-on
Rated load current (resistive load)	15	15A
	25	25A
	40	40A
	50	50A
	75	75A
Rated load voltage	2	24-240VAC
	4	48-480VAC
Rated input voltage	1	4-30VDC
	4	90-240VAC
Control phase	1	Single-phase
Item	SR	Solid State Relay (detachable heatsink type)

Model	Rated input voltage	Rated load current	Rated load voltage	Function
SR1-1215	4-30VDC	15A	24-240VAC	Zero cross turn-on
SR1-4215	90-240VAC			
SR1-1225	4-30VDC	25A		
SR1-4225	90-240VAC			
SR1-1240	4-30VDC	40A		
SR1-4240	90-240VAC			
SR1-1250	4-30VDC	50A		
SR1-4250	90-240VAC			
SR1-1275	4-30VDC	75A		
SR1-4275	90-240VAC			
SR1-1415	4-30VDC	15A	48-480VAC	Zero cross turn-on
SR1-1415R				Random turn-on
SR1-4415	90-240VAC			Zero cross turn-on
SR1-1425	4-30VDC	25A		Zero cross turn-on
SR1-1425R				Random turn-on
SR1-4425	90-240VAC			Zero cross turn-on
SR1-1440	4-30VDC	40A		Zero cross turn-on
SR1-1440R				Random turn-on
SR1-4440	90-240VAC			Zero cross turn-on
SR1-1450	4-30VDC	50A		Zero cross turn-on
SR1-1450R				Random turn-on
SR1-4450	90-240VAC			Zero cross turn-on
SR1-1475	4-30VDC	75A		Zero cross turn-on
SR1-1475R				Random turn-on
SR1-4475	90-240VAC			Zero cross turn-on

▣ Specifications

◎ Input

Rated input voltage range		**4-30VDC**	**90-240VACrms (50/60Hz)**
Allowable input voltage range		4-32VDC	85-264VACrms (50/60Hz)
Max. input current		9mA (Zero cross turn-on), 13mA (Random turn-on)	7mArms (240VACrms)
Pick-up voltage		Min. 4VDC	Min. 85VACrms
Drop-out voltage		Max. 1VDC	Max. 10VACrms
Turn-on time	Zero cross turn-on	Max. 0.5 cycle of load source + 1ms	Max. 1.5 cycle of load source + 1ms
	Random turn-on	Max. 1ms	—
Turn-off time		Max. 0.5 cycle of load source + 1ms	Max. 1.5 cycle of load source + 1ms

◎ Output

Rated load voltage range		**24-240VACrms (50/60Hz)**					**48-480VACrms (50/60Hz)**				
Allowable load voltage range		24-264VACrms (50/60Hz)					48-528VACrms (50/60Hz)				
Rated load current	Resistive load (AC-51)※1	15Arms	25Arms	40Arms	50Arms	75Arms	15Arms	25Arms	40Arms	50Arms	75Arms
Min. load current		0.15Arms	0.2Arms		0.5Arms		0.5Arms				
Max. 1 cycle surge current (60Hz)		190A	270A	330A	1000A		300A	500A		1000A	
Max. non-repetitive surge current (I^2t, t=8.3ms)		$150A^2s$	$300A^2s$	$500A^2s$	$4000A^2s$		$350A^2s$	$1000A^2s$		$4000A^2s$	
Peak voltage (non-repetitive)		600V					1200V (zero cross turn-on), 1000V (random turn-on)				
Leakage current (Ta=25℃)		Max. 10mArms (240VAC/60Hz)					Max. 10mArms (480VAC/60Hz)				
Output on voltage drop[Vpk] (Max. load current)		Max. 1.6V									
Static off-state dv/dt		500V/μs									

※1: AC-51 are utilization category at IEC 60947-4-3.

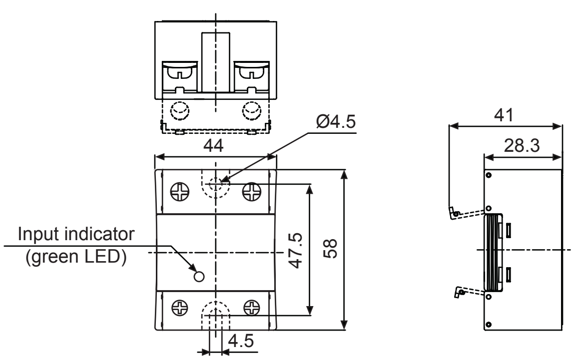
◎ General Specifications

Dielectric strength (Vrms)		4000VAC 50/60Hz 1min (Input-Output, Input/Output-Case)
Insulation resistance		Over 100MΩ (at 500VDC megger)
Indicator		Input indicator: Green LED
Environment	Ambient temp.	-30 to 80℃ (in case of the rated input voltage 90-240VAC: -20 to 70℃), storage: -30 to 100℃ (The rated load current capacity is different depending on ambient temperature. Refer to '▣ SSR Derating Curve'.)
	Ambient humi.	45 to 85%RH, storage: 45 to 85%RH
Input terminal connection		Min. 1×0.5mm^2 (1×AWG20), Max. 1×1.5mm^2 (1×AWG16) or 2×1.5mm^2 (2×AWG16)
Output terminal connection		Min. 1×1.5mm^2 (1×AWG16), Max. 1×16mm^2 (1×AWG6) or 2×6mm^2 (2×AWG10)
Input terminal fixed torque		0.75 to 0.95N·m
Output terminal fixed torque		1.6 to 2.2N·m
Approval		CE cULus
Unit weight		Approx. 73g

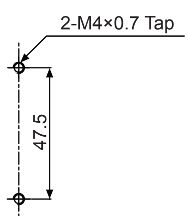
※Environment resistance is rated at no freezing or condensation.
※For wiring the terminal, an O-ring terminal must be used.

▣ Dimensions

(unit: mm)

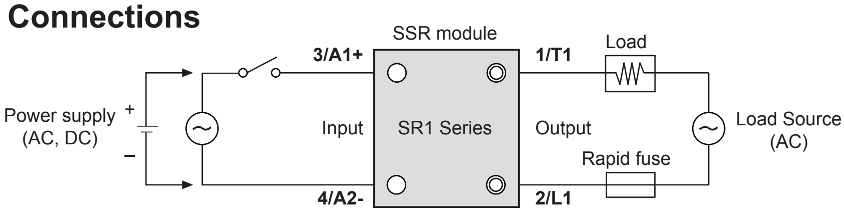


◎ Hole cut-out for panel front mounting



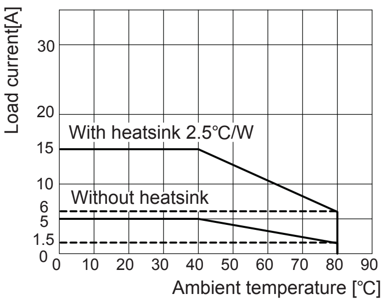
※Screw tightening torque for mounting: 1.8 to 2.5N·m

■ Connections

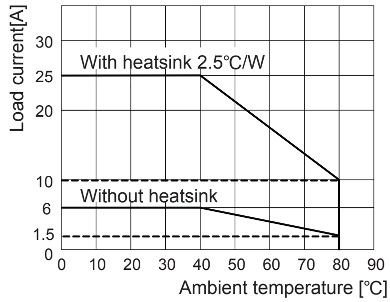


■ SSR Derating Curve

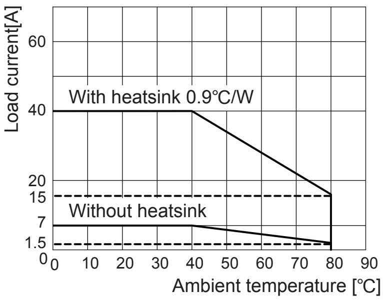
◎ SR1-1215/4215



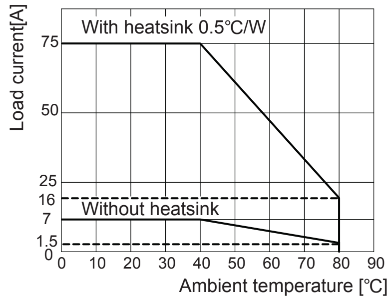
◎ SR1-1225/4225



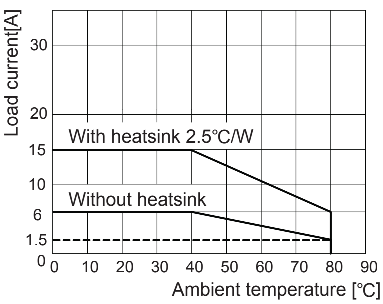
◎ SR1-1240/4240



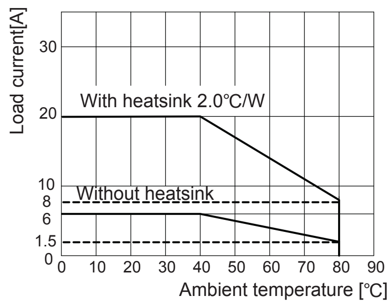
◎ SR1-1275/1475/1475R/4275/4475



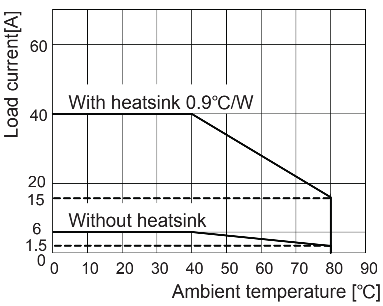
◎ SR1-1415/1415R/4415



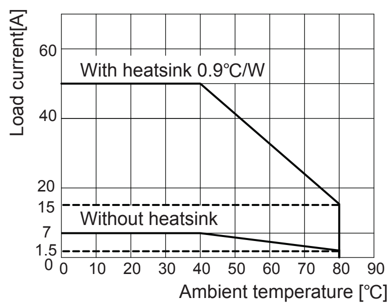
◎ SR1-1425/1425R/4425



◎ SR1-1440/1440R/4440



◎ SR1-1250/1450/1450R/4250/4450



■ Proper Usage

High temperature caution

Make sure do not touch the heat sink or the unit body while power is supplied or right after load power is turned off. If not, it may cause a burn.

Cautions during use

1. Attach a heatsink and ventilate for smooth convection current. If not, congested heat transfer may cause product failure or malfunction.
2. For mounting multiple SSR, please keep certain installation intervals for heat prevention. For horizontal installation (when the heights of input part and output part are equal), it is recommended to apply less than 50% of the rated load current.
3. Make sure do not touch the heatsink or the unit body while power is supplied or right after load power is turned OFF. If not, it may cause a burn.
4. Connect the proper cable for the rated load current with output terminal.
5. Use rapid fuse of which I^2t is under 1/2 of SSR I^2t in order to protect the unit from load's short- circuit current.
6. In case of a short-circuit please replace the fuse with a 1/2 of SSR I^2t value specified semiconductor protective type.
7. In case that load's current is lower than SSR min. load current, connect dummy resistance to the load in parallel so as to make load's current higher than SSR min. load current.
8. When selecting phase control with random turn-on model, install the noise filter between load and load's source.
9. Make sure that the screw on output terminal is tightly fastened. Using the unit with loose bolt may cause product failure or malfunction.
10. Do not touch the load's terminal even if output is OFF. It may cause electric shock.
11. The signal input of the 4-30VDC model should be supplied by the insulated and limited voltage/current or by Class 2 power supply.
12. To attach the heatsink, use Thermal Grease as below or that of equal specification.
    ※Thermal Grease: GE TOSHIBA (YG6111), KANTO-KASEI (FLOIL G-600), SHINETSU (G746)
13. Avoid following environments to install this unit.
    ① Where temperature/humidity is beyond the specification
    ② Where dew condensation occurs due to temperature change
    ③ Where inflammable or corrosive gas exists
    ④ Where direct rays of light exist
    ⑤ Where severe shock, vibration or dust exists
    ⑥ Where near facilities generating strong magnetic forces or electric noise
14. This product may be used in the following environments.
    ① Indoors
    ② Max. altitude: 2,000m
    ③ Pollution degree 2
    ④ Installation category III

Single-Phase, Slim Detachable Heatsink Type SSR

■ Features

- Slim, compact size (22.5 mm width)
- Dielectric strength: 4000 VAC
- High heat dissipation efficiency with ceramic PCB
- Zero cross turn-on, random turn-on models available
- Input indicator (green LED)

⚠ Please read "Safety considerations" in operation manual before using.

■ Ordering Information

SRC 1 – 1 4 20 R

Function	No Mark	Zero cross turn-on
	R	Random turn-on
Rated load current (resistive load)	15	15A
	20	20A
	30	30A
Rated load voltage	2	24-240VAC
	4	48-480VAC
Rated input voltage	1	4-30VDC
	4	90-240VAC
Control phase	1	Single-phase
Item	SRC	Solid State Relay (slim type)

Model	Rated input voltage	Rated load current	Rated load voltage	Function
SRC1-1215	4-30VDC	15A	24-240VAC	Zero cross turn-on
SRC1-4215	90-240VAC			
SRC1-1220	4-30VDC	20A		
SRC1-4220	90-240VAC			
SRC1-1230	4-30VDC	30A		
SRC1-4230	90-240VAC			
SRC1-1420	4-30VDC	20A	48-480VAC	
SRC1-4420	90-240VAC			
SRC1-1420R	4-30VDC			Random turn-on

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Specifications

◎ Input

Rated input voltage range		**4-30VDC**	**90-240VACrms (50/60Hz)**
Allowable input voltage range		4-32VDC	85-264VACrms (50/60Hz)
Max. input current		9mA (Zero cross turn-on), 13mA (Random turn-on)	7mArms (240VACrms)
Pick-up voltage		Min. 4VDC	Min. 85VACrms
Drop-out voltage		Max. 1VDC	Max. 10VACrms
Turn-on time	Zero cross turn-on	Max. 0.5 cycle of load source + 1ms	Max. 1.5 cycle of load source + 1ms
	Random turn-on	Max. 1ms	—
Turn-off time		Max. 0.5 cycle of load source + 1ms	Max. 1.5 cycle of load source + 1ms

◎ Output

Rated load voltage range		**24-240VACrms (50/60Hz)**			**48-480VACrms (50/60Hz)**
Allowable load voltage range		24-264VACrms (50/60Hz)			48-528VACrms (50/60Hz)
Rated load current	Resistive load (AC-51)※1	15Arms	20Arms	30Arms	20Arms
Min. load current		0.15Arms	0.2Arms	0.2Arms	0.5Arms
Max. 1 cycle surge current (60Hz)		190A	270A	330A	300A
Max. non-repetitive surge current (I^2t, t=8.3ms)		150A^2s	300A^2s	500A^2s	350A^2s
Peak voltage (non-repetitive)		600V			1200V (zero cross turn-on),1000V (random turn-on)
Leakage current (Ta=25℃)		Max. 10mArms (240VAC/60Hz)			Max. 10mArms (480VAC/60Hz)
Output on voltage drop[Vpk] (Max. load current)		Max. 1.6V			
Static off-state dv/dt		500V/µs			

※1: AC-51 are utilization category at IEC 60947-4-3.

◎ General Specifications

Dielectric strength (Vrms)		4000VAC 50/60Hz 1min (Input-Output, Input/Output-Case)
Insulation resistance		Over 100MΩ (at 500VDC Megger)
Vibration		10 to 55Hz double amplitude 0.75mm in each X, Y, Z direction for 1 hour
Indicator		Input indicator: Green LED
Environment	Ambient temp.	-30 to 80℃ (in case of the rated input voltage 90-240VAC: -20 to 70℃), storage: -30 to 100℃ (The rated load current capacity is different depending on ambient temperature. Refer to '■ SSR Derating Curve'.)
	Ambient humi.	45 to 85%RH, storage: 45 to 85%RH
Input terminal connection		Min. 1×0.5mm^2 (1×AWG20), Max. 1×1.5mm^2 (1×AWG16) or 2×1.5mm^2 (2×AWG16)
Output terminal connection		Min. 1×0.75mm^2 (1×AWG18), Max. 1×4mm^2 (1×AWG12) or 2×2.5mm^2 (2×AWG14)
Input terminal fixed torque		0.75 to 0.95N·m
Output terminal fixed torque		1 to 1.35N·m
Approval		CE cULus
Unit weight		Approx. 85g

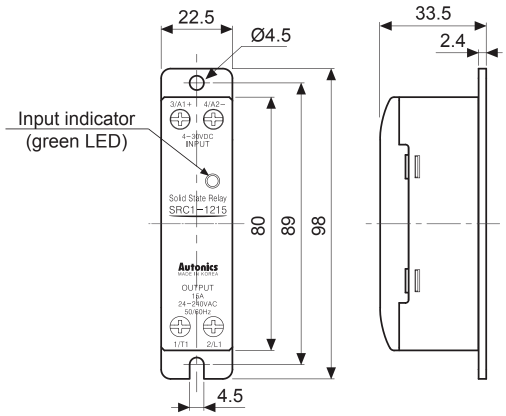
※Environment resistance is rated at no freezing or condensation.
※For wiring the terminal, an O-ring terminal must be used.

Single-Phase, Slim Detachable Heatsink Type SSR

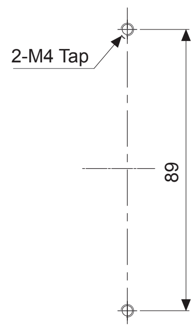
■ Dimensions & Mounting

(unit: mm)

◎ Dimensions

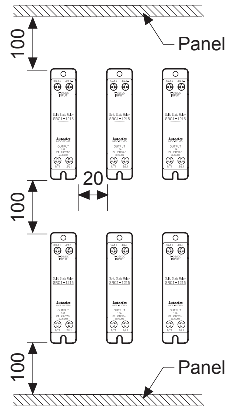


◎ Hole cut-out for panel front mounting



※Screw tightening torque for mounting: 1.8 to 2.5N·m

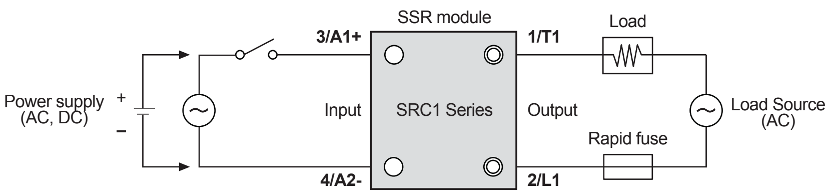
◎ Installation interval



High temperature caution
Make sure do not touch the heat sink or the unit body while power is supplied or right after load power is turned off. If not, it may cause a burn.

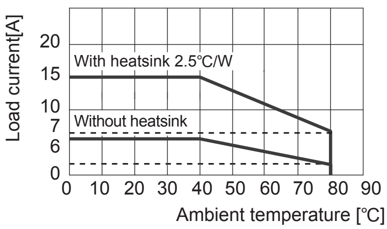
※For mounting multiple SSR, please keep certain installation intervals for heat prevention.
For horizontal installation (when the heights of input part and output part are equal), it is recommended to apply 50% of rated load current.

■ Connections

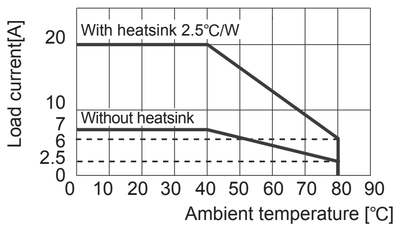


■ SSR Derating Curve

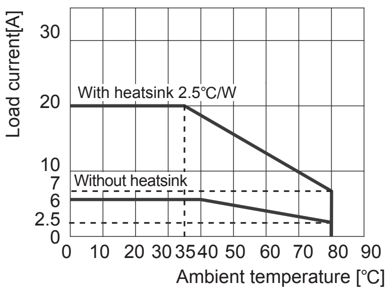
◎ SRC1-1215/4215



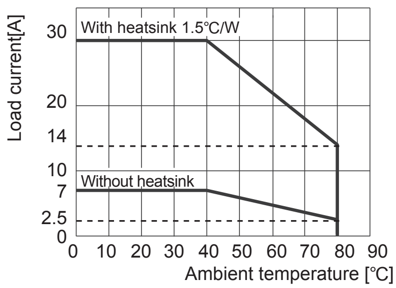
◎ SRC1-1220/4220



◎ SRC1-1420/4420/1420R



◎ SRC1-1230/4230



⚠Please supply less than 50% of the rated load current when installing several SSRs closely due to decreasing effectiveness of protection against heat.

■ Proper Usage

High temperature caution

Make sure do not touch the heat sink or the unit body while power is supplied or right after load power is turned off. If not, it may cause a burn.

Cautions during use

1. Attach a heatsink and ventilate for smooth convection current. If not, congested heat transfer may cause product failure or malfunction.
2. For mounting multiple SSR, please keep certain installation intervals for heat prevention. For horizontal installation (when the heights of input part and output part are equal), it is recommended to apply less than 50% of the rated load current.
3. Make sure do not touch the heatsink or the unit body while power is supplied or right after load power is turned OFF. If not, it may cause a burn.
4. Connect the proper cable for the rated load current with output terminal.
5. Use rapid fuse of which I^2t is under 1/2 of SSR I^2t in order to protect the unit from load's short- circuit current.
6. In case of a short-circuit please replace the fuse with a 1/2 of SSR I^2t value specified semiconductor protective type.
7. In case that load's current is lower than SSR min. load current, connect dummy resistance to the load in parallel so as to make load's current higher than SSR min. load current.
8. When selecting phase control with random turn-on model, install the noise filter between load and load's source
9. Make sure that the screw on output terminal is tightly fastened. Using the unit with loose bolt may cause product failure or malfunction.
10. Do not touch the load's terminal even if output is OFF. It may cause electric shock.
11. The signal input of the 4-30VDC model should be supplied by the insulated and limited voltage/current or by Class 2 power supply.
12. To attach the heatsink, use Thermal Grease as below or that of equal specification.
    ※Thermal Grease: GE TOSHIBA (YG6111), KANTO-KASEI (FLOIL G-600), SHINETSU (G746)
13. Avoid following environments to install this unit.
    ① Where temperature/humidity is beyond the specification
    ② Where dew condensation occurs due to temperature change
    ③ Where inflammable or corrosive gas exists
    ④ Where direct rays of light exist
    ⑤ Where severe shock, vibration or dust exists
    ⑥ Where near facilities generating strong magnetic forces or electric noise
14. This product may be used in the following environments.
    ① Indoors
    ② Max. altitude: 2,000m
    ③ Pollution degree 2
    ④ Installation category III

Single-Phase, Integrated Heatsink Type SSR

■ Features

- DIN rail mount or panel mount installation
- Dielectric strength: 4000 VAC
- High heat dissipation efficiency with ceramic PCB and integrated heatsink
- Zero cross turn-on, random turn-on models available
- Input indicator (green LED)

⚠ Please read "Safety considerations" in operation manual before using.

■ Ordering Information

SRH | 1 | – | 1 | 4 | 60 | R

Field	Code	Description
Function	No Mark	Zero cross turn-on
	R	Random turn-on
Rated load current (resistive load)	15	15A
	20	20A
	30	30A
	40	40A
	60	60A
Rated load voltage	2	24-240VAC
	4	48-480VAC
Rated input voltage	1	4-30VDC
	2	24VAC
	4	90-240VAC
Control phase	1	Single-phase
Item	SRH	Solid State Relay (integrated heatsink type)

Model	Rated input voltage	Rated load current	Rated load voltage	Function
SRH1-1215	4-30VDC	15A	24-240VAC	Zero cross turn-on
SRH1-2215	24VAC			
SRH1-4215	90-240VAC			
SRH1-1220	4-30VDC	20A		
SRH1-2220	24VAC			
SRH1-4220	90-240VAC			
SRH1-1230	4-30VDC	30A		
SRH1-2230	24VAC			
SRH1-4230	90-240VAC			
SRH1-1240	4-30VDC	40A		
SRH1-2240	24VAC			
SRH1-4240	90-240VAC			
SRH1-1260	4-30VDC	60A		
SRH1-2260	24VAC			
SRH1-4260	90-240VAC			
SRH1-1420	4-30VDC	20A	48-480VAC	Zero cross turn-on
SRH1-1420R				Random turn-on
SRH1-2420	24VAC			Zero cross turn-on
SRH1-1430	4-30VDC	30A		Zero cross turn-on
SRH1-1430R				Random turn-on
SRH1-2430	24VAC			Zero cross turn-on
SRH1-1460	4-30VDC	60A		Zero cross turn-on
SRH1-1460R				Random turn-on
SRH1-2460	24VAC			Zero cross turn-on

▣ Specifications

◎ Input

Rated input voltage range		**4-30VDC**	**24VACrms (50/60Hz)**	**90-240VACrms (50/60Hz)**
Allowable input voltage range		4-32VDC	19-30VACrms (50/60Hz)	85-264VACrms (50/60Hz)
Max. input current		9mA (Zero cross turn-on), 13mA (Random turn-on)	12mArms (24VACrms)	7mArms (240VACrms)
Pick-up voltage		Min. 4VDC	Min. 19VACrms	Min. 85VACrms
Drop-out voltage		Max. 1VDC	Max. 4VACrms	Max. 10VACrms
Turn-on time	Zero cross turn-on	Max. 0.5 cycle of load source + 1ms	Max. 1.5 cycle of load source + 1ms	Max. 1.5 cycle of load source + 1ms
	Random turn-on	Max. 1ms	—	—
Turn-off time		Max. 0.5 cycle of load source + 1ms	Max. 1.5 cycle of load source + 1ms	Max. 1.5 cycle of load source + 1ms

◎ Output

Rated load voltage range		**24-240VACrms (50/60Hz)**					**48-480VACrms (50/60Hz)**		
Allowable load voltage range		24-264VACrms (50/60Hz)					48-528VACrms (50/60Hz)		
Rated load current	Resistive load (AC-51)※1	15Arms	20Arms	30Arms	40Arms	60Arms	20Arms	30Arms	60Arms
Min. load current		0.15Arms	0.2Arms	0.2Arms	0.5Arms	0.5Arms	0.5Arms	0.5Arms	0.5Arms
Max. 1 cycle surge current (60Hz)		190A	270A	330A	500A	1000A	300A	500A	1000A
Max. non-repetitive surge current (I^2t, t=8.3ms)		$150A^2s$	$300A^2s$	$500A^2s$	$1000A^2s$	$4000A^2s$	$350A^2s$	$1000A^2s$	$4000A^2s$
Peak voltage (non-repetitive)		600V					1200V (Zero cross turn-on), 1000V (Random turn-on)		
Leakage current (Ta=25℃)		Max. 10mArms (240VAC/60Hz)					Max. 10mArms (480VAC/60Hz)		
Output on voltage drop[Vpk] (Max. load current)		Max. 1.6V							
Static off-state dv/dt		500V/㎲							

※1: AC-51 are utilization category at IEC 60947-4-3.

◎ General Specifications

Dielectric strength (Vrms)		400VAC 50/60Hz for 1 min (Input-Output, Input/Output-Case)
Insulation resistance		Over 100MΩ (at 500VDC megger)
Vibration		10 to 55Hz double amplitude 0.75mm in each X, Y, Z direction for 1 hour
Indicator		Input indicator: Green LED
Environment	Ambient temp.	-30 to 80℃ (in case of the rated input voltage 90-240VAC: -20 to 70℃), storage: -30 to 100℃ (The rated load current capacity is different depending on ambient temperature. Refer to '▣ SSR Derating Curve'.)
	Ambient humi.	45 to 85%RH, storage: 45 to 85%RH
Input terminal connection		Min. 1×0.5mm² (1×AWG 20) Max. 1×1.5mm² (1×AWG 16) or 2×1.5mm² (2×AWG 16)
Output terminal connection		• Case width 22.5mm (M4 terminal bolt): Min. 1×0.75mm² (1×AWG18) Max. 1×4mm² (1×AWG12) or 2×2.5mm² (2×AWG14) • Case width 45mm (M5 terminal bolt): Min. 1×1.5mm² (1×AWG16) Max. 1×16mm² (1×AWG6) or 2×6mm² (2×AWG10) ※Use wires compliant with load current capacity to connect to the terminal.
Input terminal fixed torque		0.75 to 0.95N·m
Output terminal fixed torque		• Case width 22.5mm (M4 terminal bolt): 15A/20A: 1 to 1.35N·m • Case width 45mm (M5 terminal bolt): 30A/40A/60A: 1.6 to 2.2N·m
Approval		CE cULus
Unit weight		• Rated load current (Resistive load) 15A/20A: Approx. 225g • Rated load current (Resistive load) 30A/40A: Approx. 410g • Rated load current (Resistive load) 60A: Approx. 680g

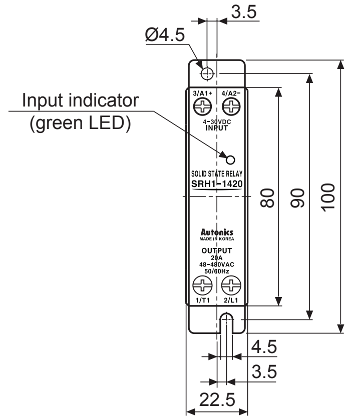
※Environment resistance is rated at no freezing or condensation.
※For wiring the terminal, an O-ring terminal must be used.

■ Dimensions & Mounting

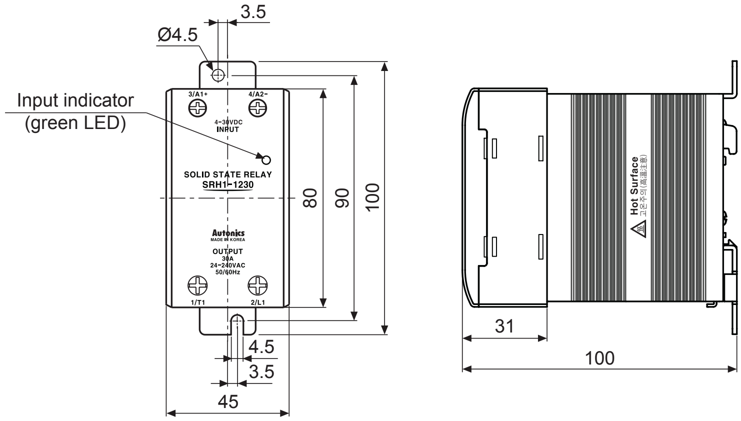
◎ Dimensions

(unit: mm)

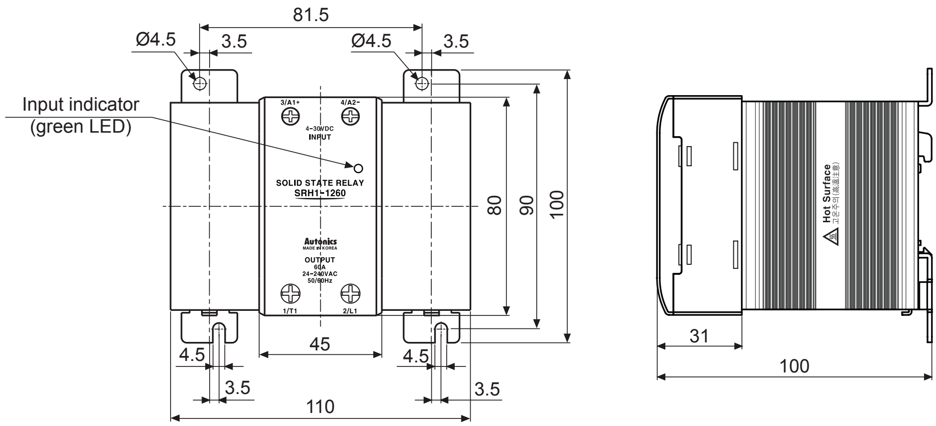
● 15A/20A rated load current



● 30A/40A rated load current

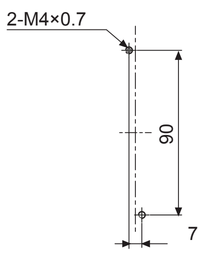


● 60A rated load current

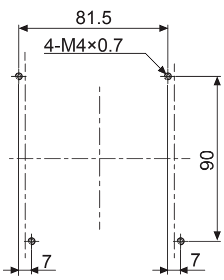


◎ Hole cut-out for panel front mounting

● 15A/20A/30A/40A rated load current



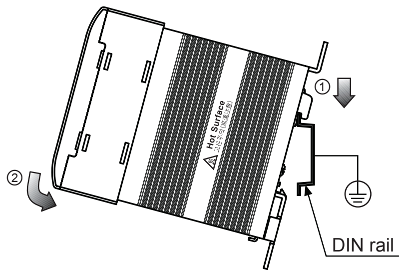
● 60A rated load current



※Screw tightening torque for mounting: 1.8 to 2.5N·m

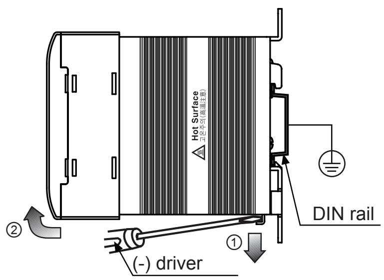
◎ **DIN rail mounting**

● **DIN rail attachment**



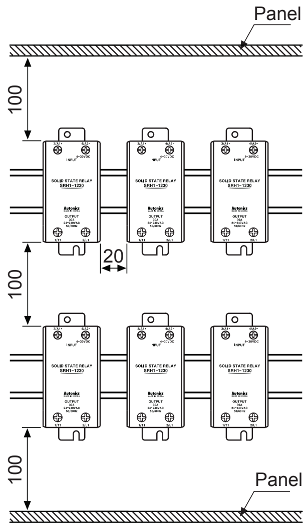
※DIN rail must be grounded.

● **DIN rail detachment**



◎ **Installation interval**

(unit: mm)

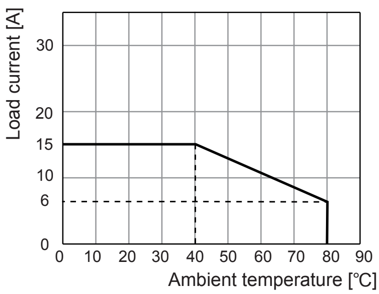


※For mounting multiple SSR, please keep certain installation intervals for heat prevention.
For horizontal installation (when the heights of input part and output part are equal), it is recommended to apply 50% of rated load current.

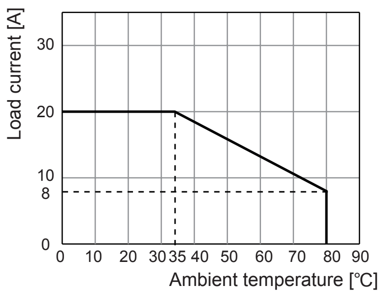
High temperature caution
Make sure do not touch the heat sink or the unit body while power is supplied or right after load power is turned off. If not, it may cause a burn.

▣ SSR Derating Curve

◎ **SRH1-1215/2215/4215**



◎ **SRH1-1220/2220/4220**
SRH1-1420/1420R/2420



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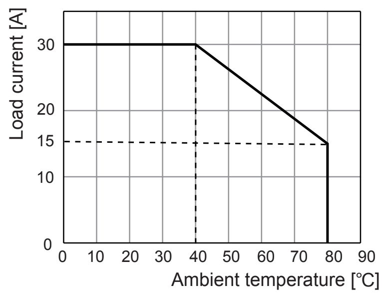
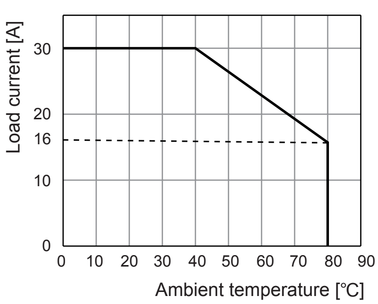
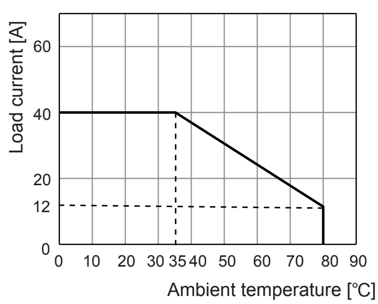


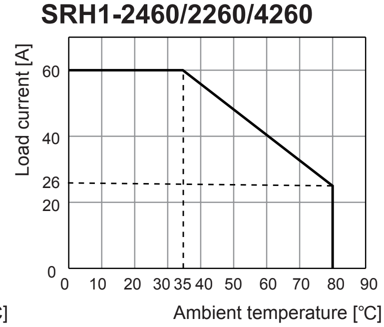
◎ **SRH1-1430/1430R/2430**



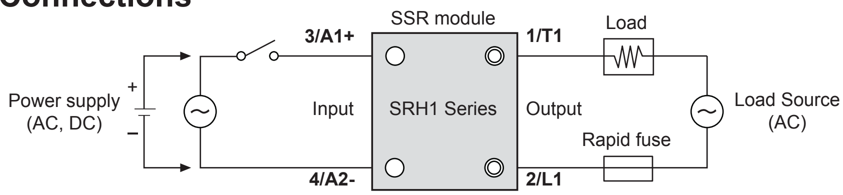
◎ **SRH1-1240/2240/4240**



◎ **SRH1-1260/1460/1460R**
SRH1-2460/2260/4260



■ Connections



■ Proper Usage

High temperature caution

Make sure do not touch the heat sink or the unit body while power is supplied or right after load power is turned off. If not, it may cause a burn.

Cautions during use

1. Attach a heatsink and ventilate for smooth convection current. If not, congested heat transfer may cause product failure or malfunction.
2. For mounting multiple SSR, please keep certain installation intervals for heat prevention. For horizontal installation (when the heights of input part and output part are equal), it is recommended to apply less than 50% of the rated load current.
3. Make sure do not touch the heatsink or the unit body while power is supplied or right after load power is turned OFF. If not, it may cause a burn.
4. Connect the proper cable for the rated load current with output terminal.
5. Use rapid fuse of which I^2t is under 1/2 of SSR I^2t in order to protect the unit from load's short- circuit current.
6. In case of a short-circuit please replace the fuse with a 1/2 of SSR I^2t value specified semiconductor protective type.
7. In case that load's current is lower than SSR min. load current, connect dummy resistance to the load in parallel so as to make load's current higher than SSR min. load current.
8. When selecting phase control with random turn-on model, install the noise filter between load and load's source.
9. Make sure that the screw on output terminal is tightly fastened. Using the unit with loose bolt may cause product failure or malfunction.
10. Do not touch the load's terminal even if output is OFF. It may cause electric shock.
11. The signal input of the 4-30VDC, 24VAC model should be supplied by the insulated and limited voltage/current or by Class 2 power supply.
12. Avoid following environments to install this unit.
    ① Where temperature/humidity is beyond the specification
    ② Where dew condensation occurs due to temperature change
    ③ Where inflammable or corrosive gas exists
    ④ Where direct rays of light exist
    ⑤ Where severe shock, vibration or dust exists
    ⑥ Where near facilities generating strong magnetic forces or electric noise
13. This product may be used in the following environments.
    ① Indoors
    ② Max. altitude: 2,000m
    ③ Pollution degree 2
    ④ Installation category III

Single-Phase, Analog Input Type SSR

■ Features

- Phase control and cycle control possible with 4-20 mA analog input
  - Phase control
    (output power control / phase angle control)
  - Cycle control (fixed cycle / variable cycle)
- DIN rail mount or panel mount installation
- Dielectric strength: 4000 VAC
- High heat dissipation efficiency with ceramic PCB and integrated heatsink
- Zero cross turn-on, random turn-on models available
- Input indicator (green LED)

⚠ **Please read "Safety considerations" in operation manual before using.**

■ Ordering Information

SRP | H | 1 | - | A | 2 | 30

Item	Code	Description
Rated load current (resistive load)	20	20A
	30	30A
	60	60A
Rated load voltage	2	100-240VAC
	4	200-480VAC
Rated input current	A	4-20mA analog input
Control phase	1	Single-phase
Type	H	Integrated heatsink type
Item	SRP	Solid State Relay (analog input type)

Model	Rated load current	Rated load voltage
SRPH1-A220	20A	100-240VAC
SRPH1-A230	30A	
SRPH1-A260	60A	

Model	Rated load current	Rated load voltage
SRPH1-A420	20A	200-480VAC
SRPH1-A430	30A	
SRPH1-A460	60A	

Specifications

Input

Rated input current	**4-20mA**
Max. allowable input current	50mA
Pick-up current	Min. 4.2mA
Static off current	Max. 0.2mA
Power factor	Min. 0.9 (max. 25° of difference between voltage phase and current phase)
Start-up time	60Hz: 200ms, 50Hz: 250ms
Operation time	60Hz: 16.6ms, 50Hz:20ms
Operation mode※1	Phase control (phase equality division type, power equality division type) Cycle control (fixed cycle, variable cycle)

※1: You can change operation mode by jumper pin. Default is Phase control (Power equality division type).

Output

Rated load voltage range		**100-240VACrms (50/60Hz)**			**200-480VACrms (50/60Hz)**		
Allowable load voltage range		90-264VACrms (50/60Hz)			200-528VACrms (50/60Hz)		
Rated load current	Resistive load (AC-51)※1	20Arms	30Arms	60Arms	20Arms	30Arms	60Arms
Min. load current		0.5Arms			0.5Arms		
Max. 1 cycle surge current (60Hz)		300A	500A	1000A	300A	500A	1000A
Max. non-repetitive surge current (I^2t, t=8.3ms)		$350A^2s$	$1000A^2s$	$4000A^2s$	$350A^2s$	$1000A^2s$	$4000A^2s$
Peak voltage (non-repetitive)		600V			1000V		
Leakage current (Ta=25℃)		Max. 10mArms (240VAC/60Hz)			Max. 10mArms (480VAC/60Hz)		
Output on voltage drop[Vpk] (Max. load current)		Max. 1.6V					
Static off-state dv/dt		500V/μs					

※1: AC-51 are utilization category at IEC 60947-4-3.

General Specifications

Phase control (phase equality division type)		5 to 99%
Phase control (power equality division type)		10 to 99%
Frequency reading function		Yes
Dielectric strength (Vrms)		4000VAC 50/60Hz for 1min. (Input-Output, Input/Output-Case)
Insulation resistance		Over 100MΩ (at 500VDC megger)
Vibration		10 to 55Hz double amplitude 0.75mm in each X, Y, Z direction for 1 hour
Indicator		Input indicator: Green LED
Environment	Ambient temp.	-20 to 70℃, storage : -20 to 100℃ (The rated load current capacity is different depending on ambient temperature. Refer to '■ SSR Derating Curve'.)
	Ambient humi.	45 to 85%RH, storage: 45 to 85%RH
Input terminal connection		Min. 1×0.5mm² (1×AWG20) Max. 1×1.5mm² (1×AWG6) or Max. 2×1.5mm² (2×AWG16)
Output terminal connection		Min. 1×1.5mm² (1×AWG16) Max.1×16mm² (1×AWG6) or Max. 2×6mm² (2×AWG10) ※Connect appropriate cable for the load current capacity to output terminal.
Input terminal fixed torque		0.75 to 0.95N·m
Output terminal fixed torque		1.6 to 2.2N·m
Approval		CE cULus
Unit weight		• SRPH1-A220, SRPH1-A230, SRPH1-A420, SRPH1-A430 : Approx. 410g • SRPH1-A260, SRPH1-A460 : Approx. 680g

※Environment resistance is rated at no freezing or condensation.
※For wiring the terminal, an O-ring terminal must be used.

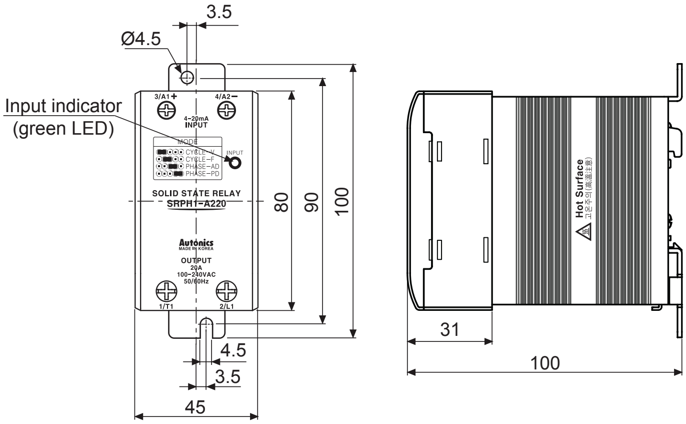
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Dimensions & Mounting

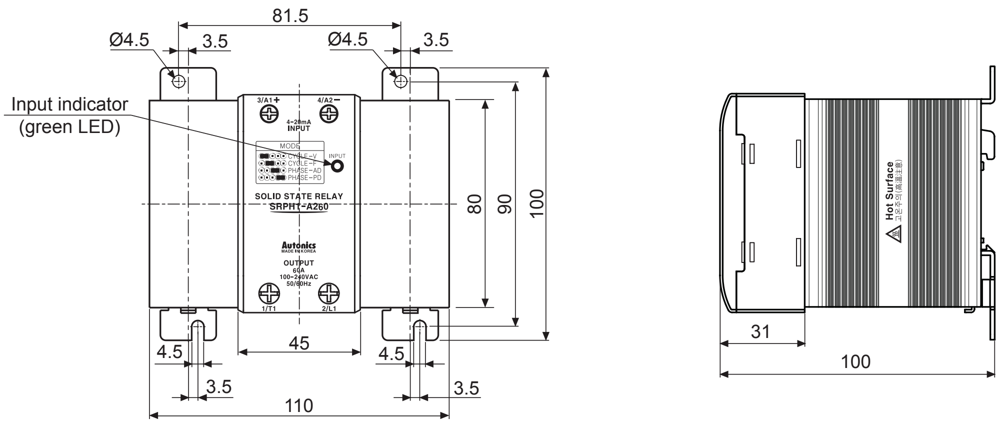
(unit: mm)

◎ Dimensions

● **20A/30A rated load current**

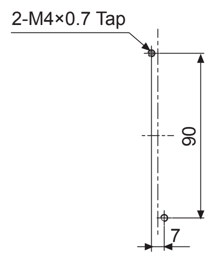


● **60A rated load current**

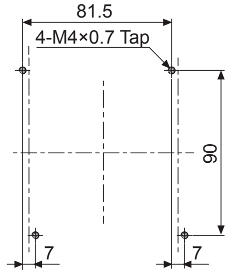


◎ Hole cut-out for panel front mounting

● **20A/30A rated load current**



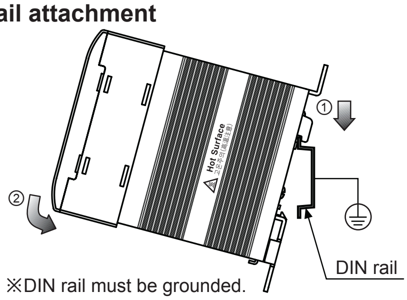
● **60A rated load current**



※Screw tightening torque for mounting: 1.8 to 2.5N·m

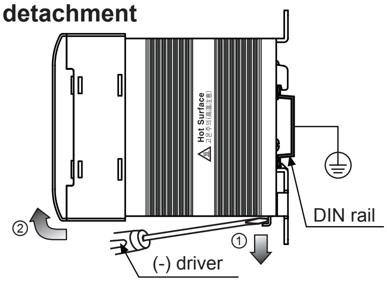
◎ DIN rail mounting

● **DIN rail attachment**

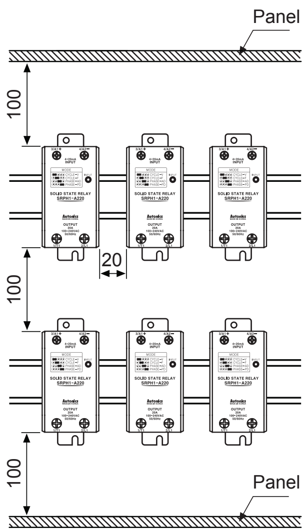


※DIN rail must be grounded.

● **DIN rail detachment**



◎ Installation interval

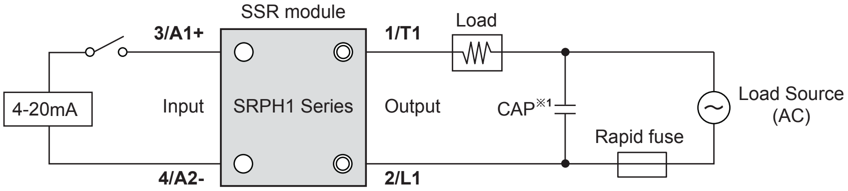


※For mounting multiple SSR, please keep certain installation intervals for heat prevention.
For horizontal installation (when the heights of input part and output part are equal), it is recommended to apply 50% of rated load current.

High temperature caution

Make sure do not touch the heat sink or the unit body while power is supplied or right after load power is turned off.
If not, it may cause a burn.

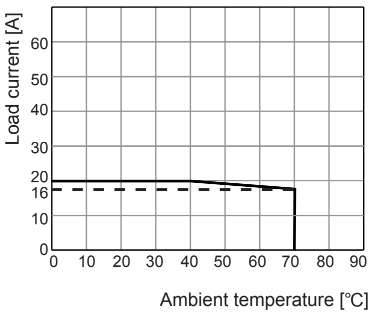
■ Connections



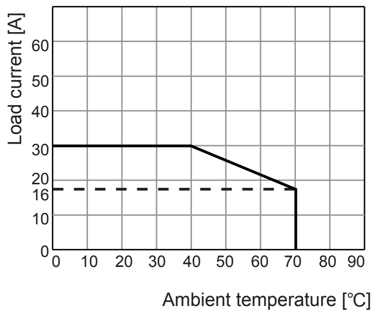
※**1:** As above connection, connect a capacitor. It is proper to EMC.
CAP: Load voltage 100-240VAC → 1uF/250VAC, Load voltage 200-480VAC → 0.47uF/500VAC

■ SSR Derating Curve

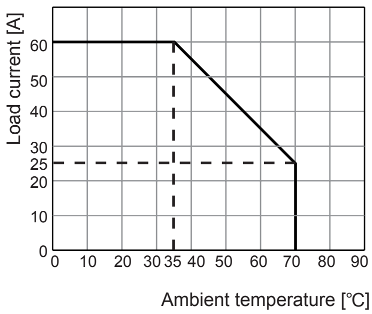
◎ SRPH1-A220/A420



◎ SRPH1-A230/A430



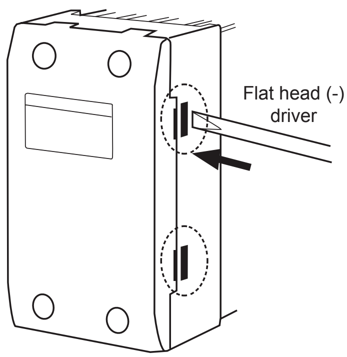
◎ SRPH1-A260/A460



■ Operation Setting

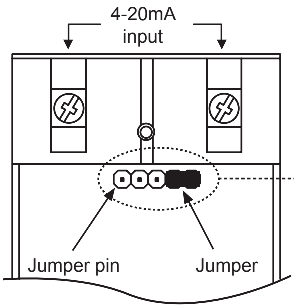
● Detach front cover

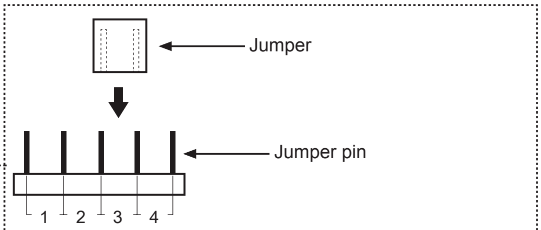
Press front cover connection 4 parts at right and left side with (-) driver, and front cover is detached.
※Before detaching front cover, you must cut off load current and input.



● Jumper pin setting

Operation mode is decided by jumper position.
After changing operation mode, re-supply input signal.





1. CYCLE-V: Cycle control (variable cycle)
2. CYCLE-F: Cycle control (fixed cycle)
3. PHASE-AD: Phase control (phase equality division type)
4. PHASE-PD: Phase control (power equality division type) (factory default)

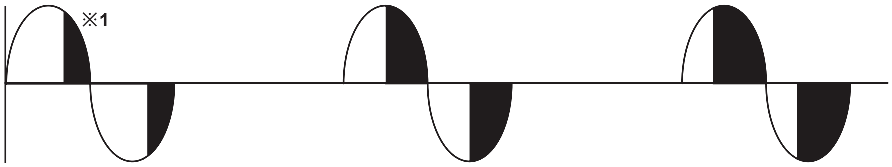
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Operation Mode

◎ Phase control

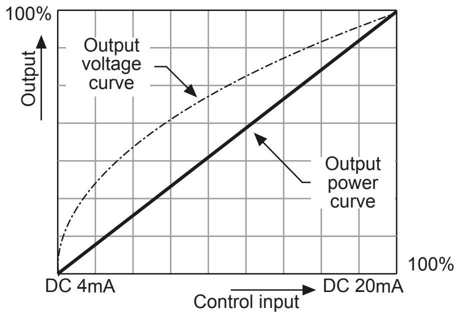
● **Output waveform of phase control**

• When control input signal is 25% • When control input signal is 50% • When control input signal is 75%



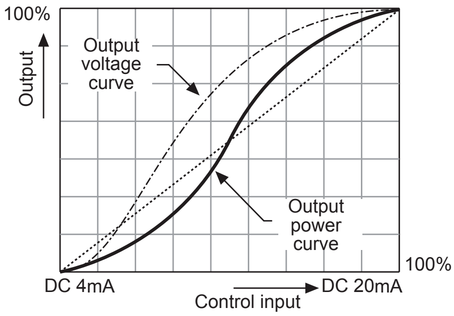
※1: The black parts of output waveform are output on the load.

● **Power equality division type**



Controls output power which is proportional to control input (4-20mA) level.

● **Phase equality division type**



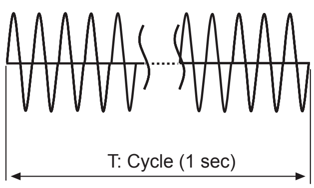
Controls phase angle which is proportional control input (4-20mA) level.

◎ Cycle control

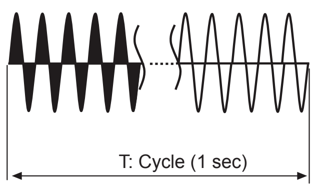
● **Fixed cycle**

Controls continuously the number of full cycle which is supplied to load every 1 sec by being proportional to control input (4-20mA).

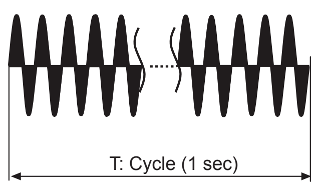
• When control input signal is 0%



• When control input signal is 50%



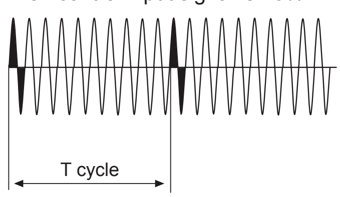
• When control input signal is 100%



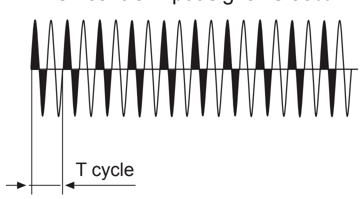
● **Variable cycle**

Controls fast and accurately the subject with optimized the number of AC voltage cycle which is supplied to load by being proportional to control input (4-20mA).

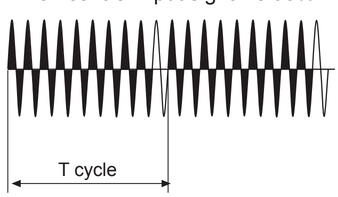
• When control input signal is 10%



• When control input signal is 50%



• When control input signal is 90%



■ Proper Usage

High temperature caution

Make sure do not touch the heat sink or the unit body while power is supplied or right after load power is turned off. If not, it may cause a burn.

Cautions during use

1. Attach a heatsink and ventilate for smooth convection current. If not, congested heat transfer may cause product failure or malfunction.
2. For mounting multiple SSR, please keep certain installation intervals for heat prevention. For horizontal installation (when the heights of input part and output part are equal), it is recommended to apply less than 50% of the rated load current.
3. Make sure do not touch the heatsink or the unit body while power is supplied or right after load power is turned OFF. If not, it may cause a burn.
4. Connect the proper cable for the rated load current with output terminal.
5. Use rapid fuse of which I^2t is under 1/2 of SSR I^2t in order to protect the unit from load's short- circuit current.
6. In case of a short-circuit please replace the fuse with a 1/2 of SSR I^2t value specified semiconductor protective type.
7. In case that load's current is lower than SSR min. load current, connect dummy resistance to the load in parallel so as to make load's current higher than SSR min. load current.
8. Make sure that the screw on output terminal is tightly fastened. Using the unit with loose bolt may cause product failure or malfunction.
9. Do not touch the load's terminal even if output is OFF. It may cause electric shock.
10. The input of the 4-20mA should be supplied by the insulated and limited voltage/current or by class 2 power supply.
11. Avoid following environments to install this unit.
    ① Where temperature/humidity is beyond the specification
    ② Where dew condensation occurs due to temperature change
    ③ Where inflammable or corrosive gas exists
    ④ Where direct rays of light exist
    ⑤ Where severe shock, vibration or dust exists
    ⑥ Where near facilities generating strong magnetic forces or electric noise
12. This product may be used in the following environments.
    ① Indoors
    ② Max. altitude: 2,000m
    ③ Pollution degree 2
    ④ Installation category III

Single-Phase, Socket Type SSR

■ Features

- Socket type for easier installation and maintenance
  - SRS1-A: Autonics socket SK-G05 (AC, DC, AC/DC)
  - SRS1-B: Universal LY2 sockets (AC)
- Dielectric strength: 2500 VAC
- Zero cross turn-on, random turn-on models available
- Input indicator (red LED)

SRS1-A

SRS1-B

⚠ **Please read "Safety considerations" in operation manual before using.**

■ Ordering Information

SRS | 1 | - | B | 1 | 2 | 02 | R | - | 2

Item	Code	Description
Number of output circuit	1	1
	2	2
Function	No mark	Zero cross turn-on
	R	Random turn-on
Rated load current (resistive load)	01	1A
	02	2A
	03	3A
	05	5A
Rated load voltage — SRS1-A	2	24-240VAC
	D1	5-100VDC
	D2	5-200VDC
	X2	5-240VAC/5-200VDC (universal)
Rated load voltage — SRS1-B	2	90-240VAC
Rated input voltage — SRS1-A	1	4-24VDC
Rated input voltage — SRS1-B	1	4-30VDC
Socket	A	Autonics socket (Model: SK-G05)
	B	Universal LY2 socket
Control phase	1	Single-phase
Item	SRS	Solid State Relay (socket type)

Model		Rated input voltage	Rated load current	Rated load voltage	Function
SRS1-A	SRS1-A1202	4-24VDC	2A	24-240VAC	Zero cross turn-on
	SRS1-A1202R				Random turn-on
	SRS1-A1203		3A		Zero cross turn-on
	SRS1-A1203R				Random turn-on
	SRS1-A1205		5A		Zero cross turn-on
	SRS1-A1205R				Random turn-on
	SRS1-A1D101		1A	5-100VDC	—
	SRS1-A1D102		2A		
	SRS1-A1D201		1A	5-200VDC	
	SRS1-A1X201			5-240VAC/5-200VDC	
SRS1-B	SRS1-B1202-2	4-30VDC	2A (consists of 2 circuits)	90-240VAC	Zero cross turn-on
	SRS1-B1202R-2				Random turn-on
	SRS1-B1203-1		3A		Zero cross turn-on
	SRS1-B1203R-1				Random turn-on
	SRS1-B1205-1		5A		Zero cross turn-on
	SRS1-B1205R-1				Random turn-on

■ Specifications

◎ Input

Series	SRS1-A	SRS1-B
Rated input voltage range	4-24VDC	4-30VDC
Allowable input voltage range	4-26.4VDC	4-32VDC
Max. input current	15mA (Random turn-on)	13mA (Random turn-on)
Pick-up voltage	Min. 4VDC	
Drop-out voltage	Max. 1VDC	

◎ Output (AC)

Model		SRS1-A1202(R)	SRS1-A1203(R)	SRS1-A1205(R)	SRS1-B1202(R)-2	SRS1-B1203(R)-1	SRS1-B1205(R)-1
Rated load voltage range		24-240VACrms (50/60Hz)			90-240VACrms (50/60Hz)		
Allowable load voltage range		24-264VACrms (50/60Hz)			90-264VACrms (50/60Hz)		
Rated load current	Resistive load (AC-51)※1	2Arms	3Arms	5Arms	2Arms	3Arms	5Arms
Min. load current		0.15Arms	0.2Arms		0.15Arms		
Max. 1cycle surge current (60Hz)		126A	250A		126A		250A
Max. non-repetitive surge current (I^2t, t=8.3ms)		$65A^2s$	$400A^2s$		$65A^2s$		$220A^2s$
Peak voltage (Non-repetitive)		600V					
Leakage current (Ta=25℃)		Max. 2mArms (240VAC/60Hz)					
Output on voltage drop[Vpk] (Max. load current)		Max. 1.6V					
Static off-state dv/dt		500V/μs					
Turn-on time	Zero cross turn-on	Max. 0.5 cycle of load source + 1ms					
	Random turn-on	Max. 1ms					
Turn-off time		Max. 0.5 cycle of load source + 1ms					

※1: AC-51 is utilization category at IEC 60947-4-3.

◎ Output (DC, AC/DC)

Model		SRS1-A1D101	SRS1-A1D102	SRS1-A1D201	SRS1-A1X201
Rated load voltage range		5-100VDC		5-200VDC	5-240VACrms (50/60Hz) / 5-200VDC
Allowable load voltage range		3-120VDC		3-220VDC	3-264VACrms (50/60Hz) / 3-220VDC
Rated load current	Resistive load (AC-51)※1	1Adc	2Adc	1Adc	1Arms/1Adc
Min. load current		10mA			10mA
Max. surge current (t=10ms)		5A	10A	4A	4A
Leakage current		Max. 100uA			Max. 2mArms
Output on voltage drop[Vpk] (Max. load current)		Max. 1.1V			Max. 2.2V
Static off-state dv/dt		500V/μs			500V/μs
Turn-on time		Max. 1ms	Max. 2ms	Max. 1ms	Max. 2ms
Turn-off time		Max. 1ms			

※1: AC-51 is utilization category at IEC 60947-4-3.

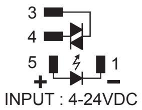
◎ General Specifications

Series		SRS1-A	SRS1-B
Dielectric strength (Vrms)		2,500VAC 50/60Hz 1min. (Input-Output, Input/Output-Case)	
Insulation resistance		Over 100MΩ (at 500VDC Megger)	
Indicator		Input indicator: Red LED	
Environ-ment	Ambient temperature	-20 to 70℃, storage: -30 to 100℃	-20 to 80℃, storage: -30 to 100℃
		(The rated load current capacity is different depending on ambient temperature. Refer to '■ SSR Derating Curve'.)	
	Ambient humidity	45 to 85%RH, storage: 45 to 85%RH	
Protection		IP10 (Protection structure of socket, SK-G05)	According to protection of the universal LY2 socket
Approval		CE c UL us	
Weight※1		3A and below: Approx. 270g (approx. 17g) 5A: Approx. 380g (approx. 28g)	Approx. 400g (approx. 30g)

※1: The weight is per 10 units with packing and the weight of parenthesis is per 1 unit.
※Environment resistance is rated at no freezing or condensation.

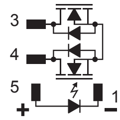
■ Connections

◎ SRS1-A1202 (R)/A1203 (R)/A1205 (R)



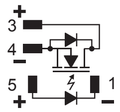
※SRS1-A1202 (R): 250VAC 2A Resistive Load
SRS1-A1203 (R): 250VAC 3A Resistive Load
SRS1-A1205 (R): 250VAC 5A Resistive Load

◎ SRS1-A1X201



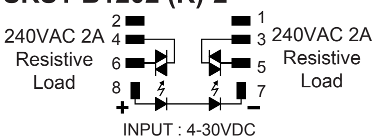
※SRS1-A1X201:
240VAC 1A Resistive Load
200VDC 1A Resistive Load

◎ SRS1-A1D101/A1D102/A1D201

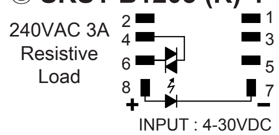


※SRS1-A1D101: 100VDC 1A Resistive Load
SRS1-A1D102: 100VDC 2A Resistive Load
SRS1-A1D201: 100VDC 1A Resistive Load

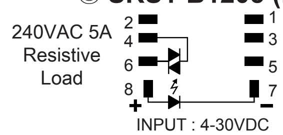
◎ SRS1-B1202 (R)-2



◎ SRS1-B1203 (R)-1



◎ SRS1-B1205 (R)-1

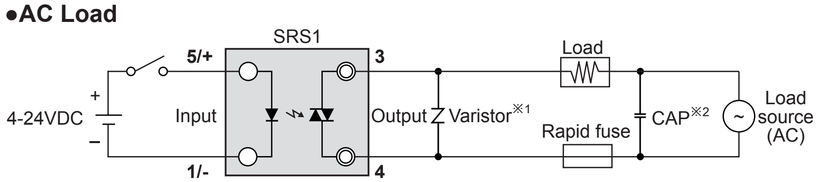


※Using the general LY2 type power relay socket.

■ Example Of Connection

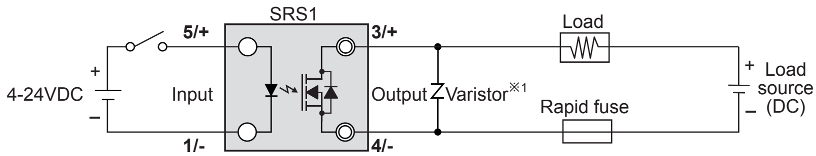
◎ SRS1-A

●AC Load



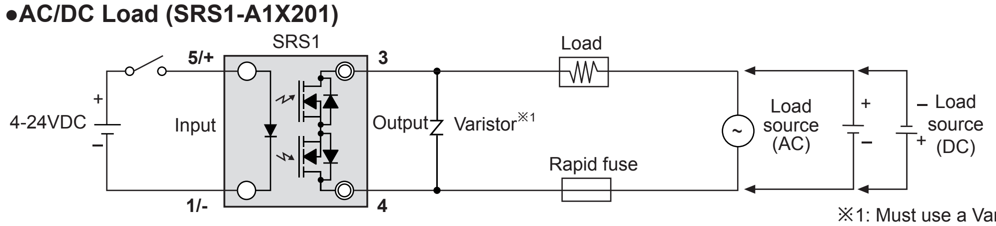
※1: Must use a Varistor (470V, 0.6W)
※2: When connecting capacitor as above, it is appropriate for EMC.
CAP: 1uF/250VAC

●DC Load (SRS1-A1D101/A1D102/A1D201)



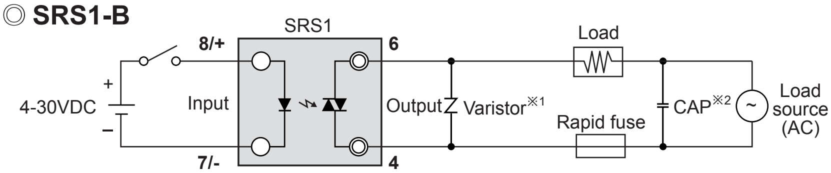
※1: Must use a Varistor (270V, 0.6W)

●AC/DC Load (SRS1-A1X201)



※1: Must use a Varistor (470V, 0.6W)

◎ SRS1-B

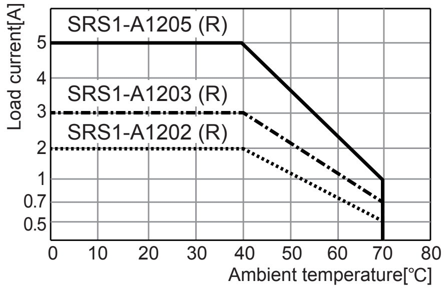


※1: Must use a Varistor (470V, 0.6W)
※2: When connecting capacitor as above, it is appropriate for EMC.
CAP: 1uF/250VAC

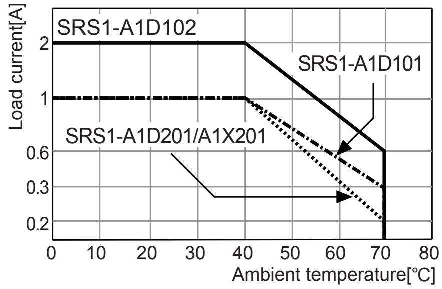
▣ SSR Characteristic Curve

◎ SRS1-A

●SRS1-A1202 (R)/A1203 (R)/A1205 (R)



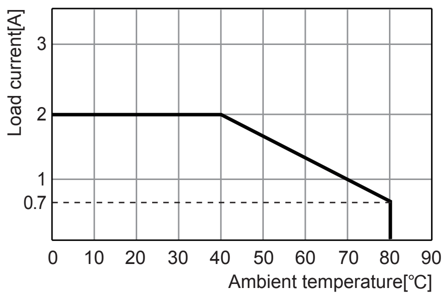
●SRS1-A1D102/A1D101/A1D201/A1X201



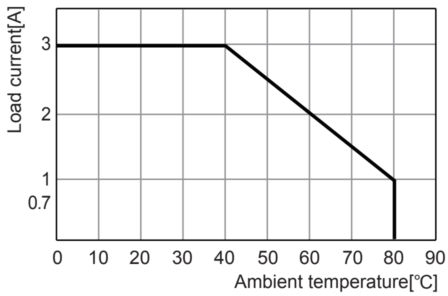
⚠ Please supply less than 50% of the rated load current when installing several SSRs closely due to decreasing effectiveness of protection against heat.

◎ SRS1-B

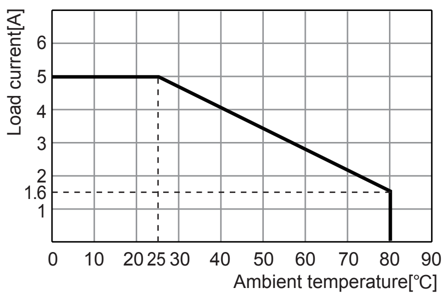
●SRS1-B1202(R)-2



●SRS1-B1203(R)-1



●SRS1-B1205(R)-1

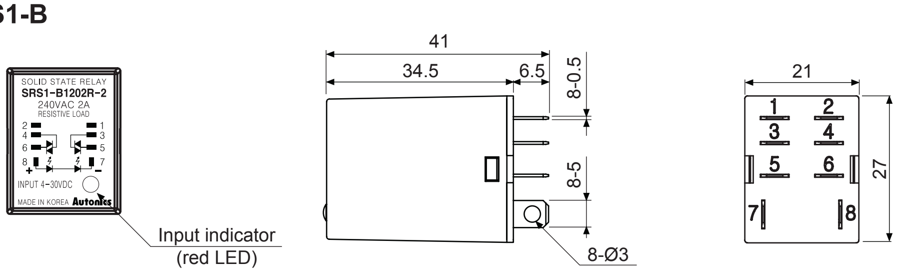


⚠ Please supply less than 50% of the rated load current when installing several SSRs closely due to decreasing effectiveness of protection against heat.

▣ Dimensions

◎ SRS1-B

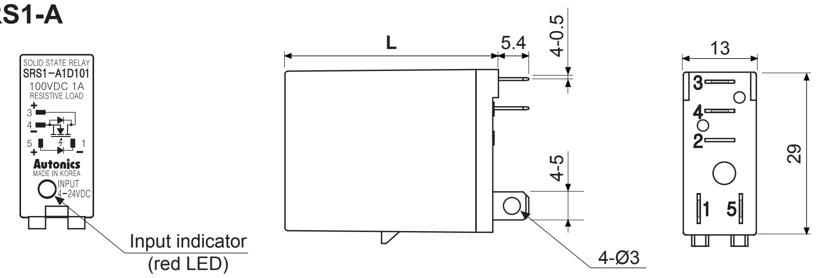
(unit: mm)



■ Dimensions

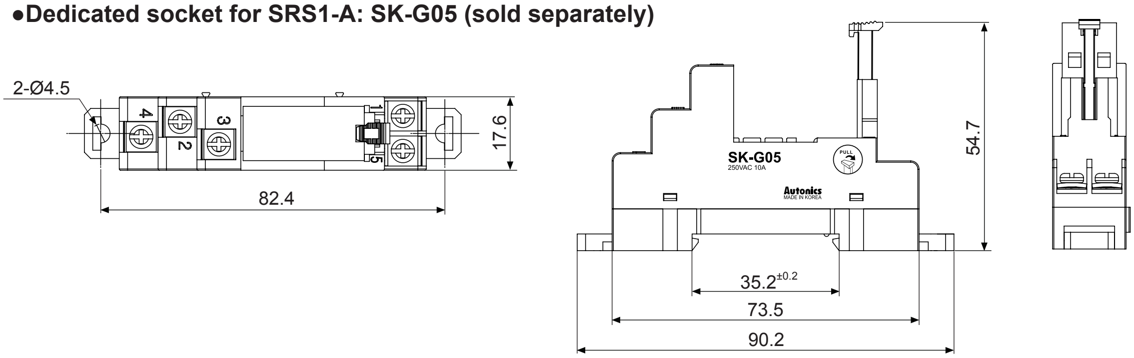
(unit: mm)

◎ SRS1-A



	Max. 3A	5A
L	28	38

●**Dedicated socket for SRS1-A: SK-G05 (sold separately)**



■ Proper Usage

High temperature caution
Make sure do not touch the heat sink or the unit body while power is supplied or right after load power is turned off. If not, it may cause a burn.

Cautions during use

1. Attach a heatsink and ventilate for smooth convection current. If not, congested heat transfer may cause product failure or malfunction.
2. For mounting multiple SSR, please keep certain installation intervals for heat prevention. For horizontal installation (when the heights of input part and output part are equal), it is recommended to apply less than 50% of the rated load current.
3. Make sure do not touch the heatsink or the unit body while power is supplied or right after load power is turned OFF. If not, it may cause a burn.
4. Connect the proper cable for the rated load current with output terminal.
5. Use rapid fuse of which I^2t is under 1/2 of SSR I^2t in order to protect the unit from load's short-circuit current.
6. In case that load's current is lower than SSR min. load current, connect dummy resistance to the load in parallel so as to make load's current higher than SSR min. load current.
7. When selecting phase control with random turn-on model, install the noise filter between load and load's source.
8. Make sure that the screw on output terminal is tightly fastened. Using the unit with loose bolt may cause product failure or malfunction.
9. Before or during installation this unit, turn OFF the power of this unit.
10. Do not touch the load's terminal even if output is OFF. It may cause electric shock.
11. Proper application environment (Avoid following environments to install)
    ① Where temperature/humidity is beyond the specification
    ② Where dew condensation occurs due to temperature change
    ③ Where inflammable or corrosive gas exists
    ④ Where direct rays of light exist
    ⑤ Where severe shock, vibration or dust exists
    ⑥ Where near facilities generating strong magnetic forces or electric noise
12. This unit may be used in the following environments.
    ① Indoors ② Max. altitude: 2,000m
    ③ Pollution degree 2 ④ Installation category II

Single-Phase, Power Controller

■ Features

- **Various and simple input specification**
  - DC4-20mA, 1-5VDC, External 24VDC
  - External adjuster (1kΩ)
  - External contact (ON/OFF)
- **Various function**
  - OUT ADJ (output limit) function
  - SOFT START function (except for ON/OFF control type)
  - OUT display function
  - 50/60Hz automatic converting function
- **Various control type by mode switches**
  - Phase control type
  - Cycle control type (zero cross turn-on)
  - ON/OFF control type (zero cross turn-on)

⚠ **Please read "Safety considerations" in operation manual before using.**

■ Ordering Information

SPC 1 - 35

Field	Code	Description
Rated load current	35	35A
	50	50A
Control phase	1	Single-phase
Item	SPC	Solid state power controller

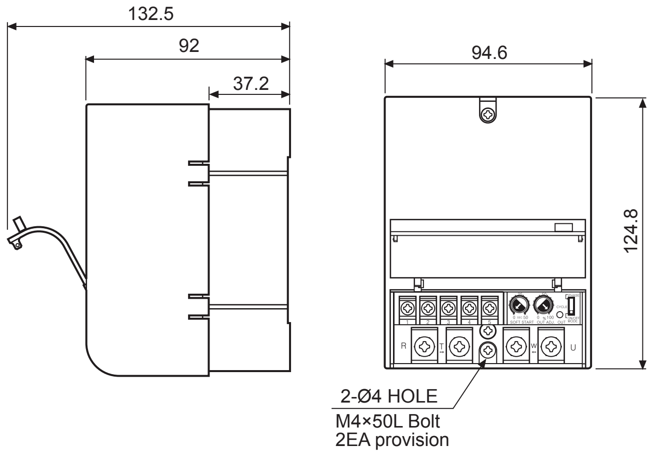
■ Specifications

Model		SPC1-35	SPC1-50
Power supply		220VAC 50/60Hz	
Allowable voltage range		90 to 110% of rated voltage	
Maximum rated current		35A (single-phase)	50A (single-phase)
Control power		220VAC	
Control range		Phase control: 0 to 98%, Cycle control: 0 to 100%	
Application load		Resistance load (min. load: over 5% of rated current)	
Cooling method		Natural cooling	
Control circuit		Micom control type	
Control input		• 1-5VDC • DC4-20mA (250Ω) • ON/OFF (external relay contact or 24VDC) • External VR (1kΩ) • Output limit input (front OUT ADJ. VR)	
Control type	By selection S/W	• Phase control※1 • Cycle control (zero cross turn-on)-Period 0.5sec, 2.0sec, 10sec ※1 • ON/OFF control (zero cross turn-on)	
Starting type		SOFT START (0 to 50 sec variable)	
Display function		Output indication (LED)	
Insulation resistance		Over 100MΩ (at 500VDC megger)	
Dielectric strength		2000VAC 50/60Hz for 1minute	
Noise immunity		±2kV the square wave noise (pulse width: 1us) by the noise simulator	
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour	
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min	
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times	
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Environ-ment	Ambient temperature	0 to 50℃, storage: -25 to 65℃	
	Ambient humidity	35 to 85%RH	
Unit weight		Approx. 1kg	

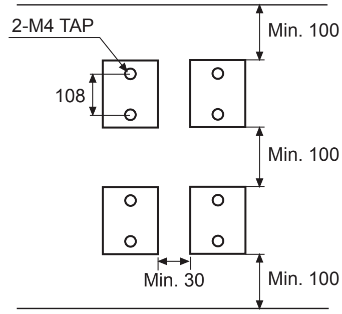
※1: Refer to ◎ **Control mode selection**.
※Environment resistance is rated at no freezing or condensation.

■ Dimensions

(unit: mm)



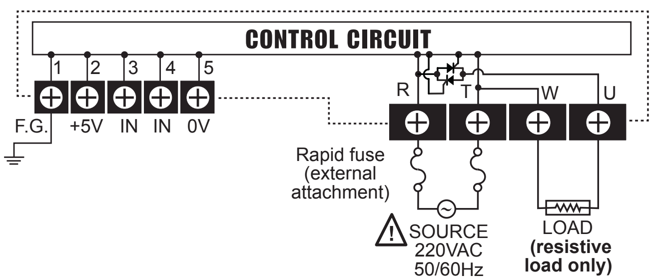
● **Panel lay-out**



※It should have enough space between units for proper cooling.

■ Connections

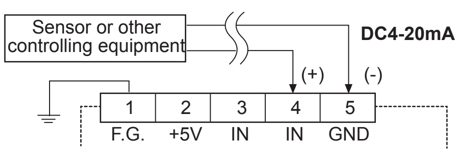
1. External connection



2. Connection of control input terminals

1) DC4-20mA control input

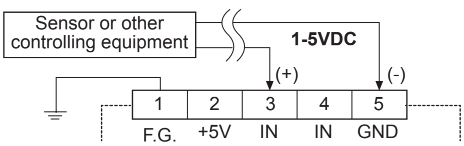
It controls 0 to 100% when you apply DC4-20mA on ④, ⑤ terminals when power is applied.



※It is not available in ON/OFF control mode.

2) 1-5VDC control input

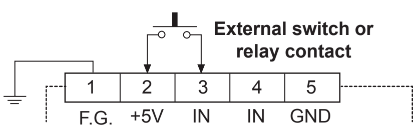
It controls 0 to 100% when you apply 1-5VDC on ③, ⑤ terminals when power is applied.



※It is not available in ON/OFF control mode.

3) ON/OFF External contact control input

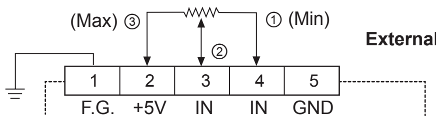
It controls 100% if you connect external switch or relay contact to ②, ③ terminal when it is ON, it controls 0% when it is OFF.



**※It is available in all control modes.
OUT ADJ. and SOFT START function are not available in ON/OFF control mode.**

4) External adjuster control input

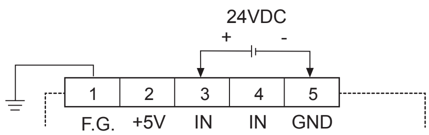
After power is applied, connecting the external adjuster 1kΩ to ②, ③ and ⑤ terminals and turning adjuster control from 0% to 100%.
It is available to control as OUT ADJ, adjuster for the above 1), 2), 3) and set at 100% when it is not used.



※It is not available in ON/OFF control mode.

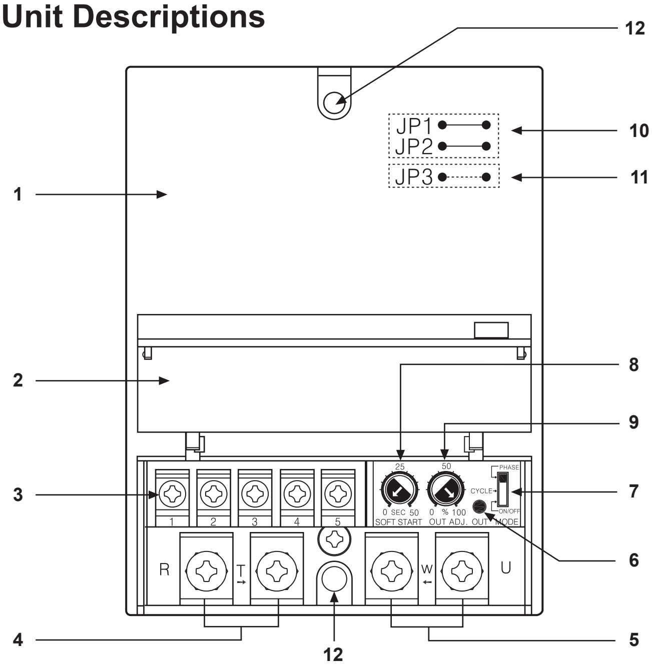
5) External 24VDC control input

It can be used with external 24VDC voltage as below.
It is available to control of ON/OFF, outputs 100% for applying 24VDC and 0% for applying 0VDC.



※It is available in all control modes.
OUT ADJ. and SOFT START function are not available in ON/OFF control mode.

■ Unit Descriptions



1. Case
2. Terminal block cover
3. Terminal block for control input
4. Terminal block of the power
5. Terminal block for load connection
6. LED display for output
7. Selection S/W of control mode
8. SOFT START adjusting volume
9. OUT ADJ. volume
10. Selection jumper of control period
11. Selection jumper of control type
12. The hole for fixing on panel
    (Bolt size:M4×50mm)

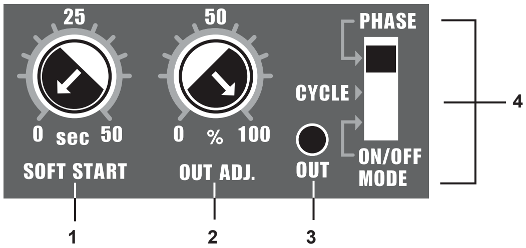
※10, 11 are placed on the inner PCB of the product.

■ Factory Default

Control mode	Phase control mode
Control type	Phase equality division type according to control input
Control cycle	0.5 sec (JP1, JP2 short)
SOFT START setting	0 sec
OUT ADJ. setting	100%

▣ Operation And Function

◎ Front



1. **SOFT START time setting adjuster (0 to 50 sec)**
2. **Output limiting setting adjuster (0 to 100%)**
3. **Output operation display LED**
4. **Control mode switch**

PHASE: Phase control mode
CYCLE: Cycle control mode
ON/OFF: ON/OFF control mode

◎ Control mode selection

Control mode	Phase control mode	Cycle control mode (zero cross)	ON/OFF control mode (zero cross)
Mode switch	PHASE / CYCLE / ON/OFF	PHASE / CYCLE / ON/OFF	PHASE / CYCLE / ON/OFF

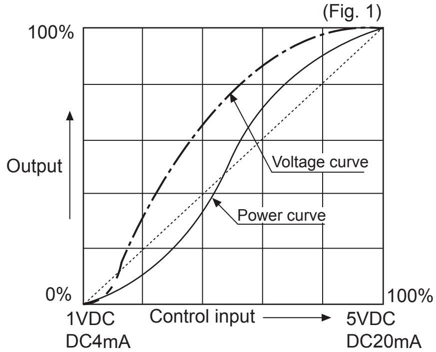
※When selecting cycle control mode, the cycle has been set as 0.5 sec It can be changed to 2.0sec, 10sec by selection.
※The mode cannot be changed during it is operating. **Turn OFF the power at first** then change the mode and supply the power again.

1) Phase control
It is output type to control phase of an alternating signal according to control input signal.

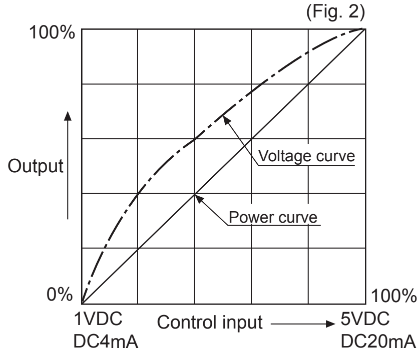
● Equality division type of phase by control input
This is analog type to output control angle with dividing equally according as control input signal. It shows power characteristic as (Fig. 1) and it might occur over power and lack power at point middle of control input.

● Equality division type of power by control input
It divides control angle non-equally according as control input signal then make power curve linerization, so it becomes possible to output the power, which is proportioned control input as outputting (Fig. 1).

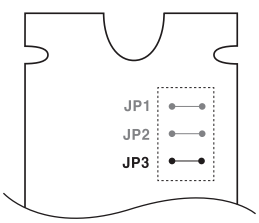
(Fig. 1)



(Fig. 2)



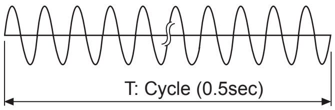
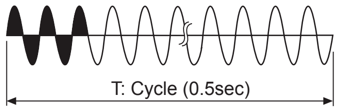
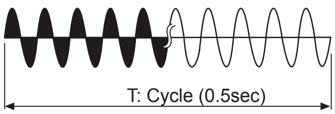
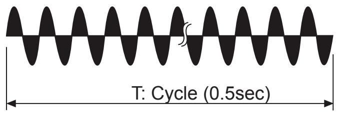
※To change the control method, change TP3 of PCB as below.



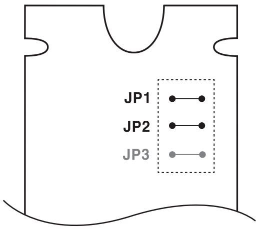
JP3	Division method (control method)
SHORT	Equal division of phase according to control input
OPEN	Equal division of power according to control input

※ SHORT OPEN

2) Cycle control-Zero cross
It controls the power, which is applied into the load to repeat ON/OFF cycle like below picture with constant proportion according to control input signal. It is easy to control the load and there is no ON/OFF noise because it turns ON and OFF at the zero point of AC.
Usually it is used in a place or electric furnace which is not easily effected by external noise.

When control input signal is 0% (DC4mA, 1VDC)	When control input signal is 25% (DC8mA, 2VDC)
 T: Cycle (0.5sec)	 T: Cycle (0.5sec)
When control input signal is 50% (DC12mA, 3VDC)	When control input signal is 100% (DC20mA, 5VDC)
 T: Cycle (0.5sec)	 T: Cycle (0.5sec)

※To change cycle, please change JP1 and JP2 of PCB as below.

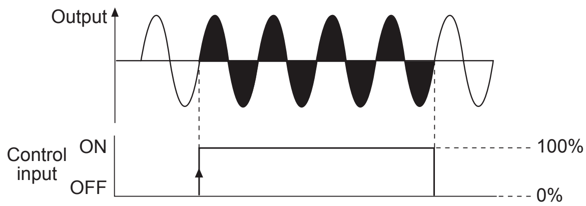


JP1	JP2	Cycle (sec)
SHORT	SHORT	0.5sec
SHORT	OPEN	2.0sec
OPEN	SHORT	10sec
OPEN	OPEN	X (not used)

※ SHORT OPEN

3) ON/OFF control-Zero cross

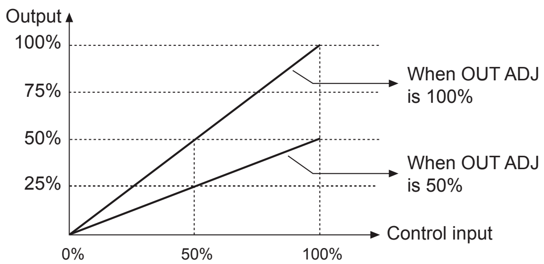
This function is when control input is ON, output is 100%.
When it is OFF, output is 0%.
It is the same function as SSR (Solid State Relay).
(ON and OFF is operated on the ZERO point of AC.)
※**OUT ADJ. and SOFT START function are not available in ON/OFF control.**



< Output wave form of ON/OFF control >

◎ OUT ADJ. (output limit) (0 to 100%)

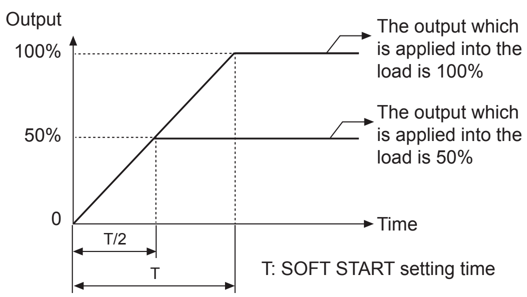
This function will be [Control input (%) × OUT ADJ. (%) = Output] and it controls the power supplied into the load. Although control input is 100% (5V or 20mA), the output is the 50% which is proportioned with OUT ADJ. When not using OUT ADJ. function, please make set value 100%.
※**This function must not be used in ON/OFF control mode.**



<The output characteristic of OUT ADJ. and control input>

◎ SOFT START (0 to 50 sec)

When the power is supplied, this function is able to protect the load when it controls load (molybdan, white gold, infrared lamp) with inrush current or the width of rising temperature in big (SV is big).
SOFT START set time (T) is the required time that output reaches to 100%, and it is differentiated by OUT ADJ. set value. For example, SOFT START is set as 10sec and OUT ADJ. is set as 70%, it takes 7 sec to reach goal output.
[Set time (T)×OUT ADJ. set value (%)=10 sec×0.7 = 7 sec]
If increasing the OUT ADJ. before output reaches to goal output, it delays as much as the value, multiply of increased value (%) and SOFT START set time. When not using SOFT START function, please make set value 0.
※**This function must not be used in ON/OFF control mode.**



※T: Time to get the output which is applied into the load is 100%.
T/2: Time to get the output which is applied into the load is 50%.

◎ OUT display

This is LED lamp to display the status of output and will be getting brighter according as output.
(0%: Min. LED light, 100%: Max. LED light)

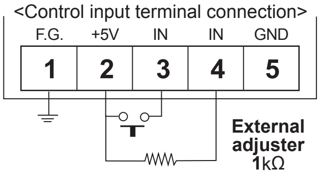
Applications

E.g. 1) When it needs to control accurately by adjusting the power in phase control and cycle control mode. For example, if it needs to control 80% output when it is ON, 24% output when it is OFF, please keep below.

Firstly set OUT ADJ. as 80% and connect external adjuster and external relay contact switch as the figure then set external adjuster as 30%.

● When the External contact signal is ON
: 100% (External contact input)×80% (OUT ADJ.)=80%
● When the External contact signal is OFF
: 30% (Adjuster input)×80% (OUT ADJ.)=24%

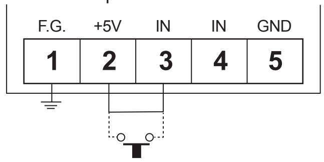
<Control input terminal connection>



E.g. 2) This is how to control 0 to 100% without external adjuster in phase control mode and cycle control mode.

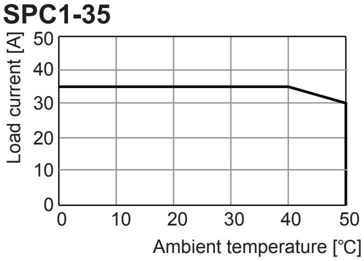
It is possible to control 0 to 100% by turning OUT ADJ. in state of connecting terminal 2 and terminal 3.

<Control input terminal connection>

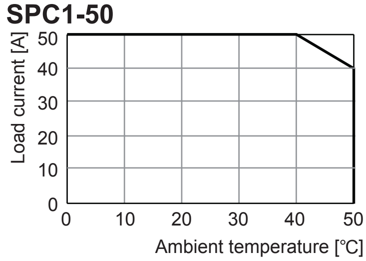


Temperature Characteristic Curve

◎ **SPC1-35**



◎ **SPC1-50**



Proper Usage

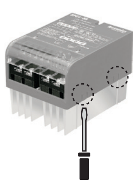
⚠ **Warning**
When using this item, ground F.G terminals to avoid an electric shock.
Do not touch the heat sink since it radiates high temperature.

⚠ **Cautions during use**

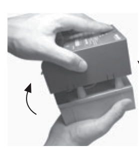
1. When you install it on panel, it should be installed vertically at the place, which is well ventilated. If install it horizontally, under 70% of rated current should be applied, and a vent fan needs to be installed on the upper part of panel.
2. Be careful to attach prompt fuse between R phase terminal and power.
3. If over the maximum rated current, it causes product damage.
   (Do not over maximum rated current when using high rush current.)
4. Since it is only for resistive load, the inductive load cannot be used.
5. After supplying power to this unit, it has 1 to 3 sec preparation time.
6. When connecting power and load, please use the cable (When rated current is 35A: Min. 8.4mm^2, when rated current is 50A: Min. 13.3mm^2) which is able to send the maximum rated current.
7. Before using this unit, set the proper mode and function. Especially, if the setting of OUT ADJ. is 0%, it does not operate.
8. The mode cannot be changed while it is operating. Please be sure to set the proper mode after cutting the power off and then apply the power.
9. Do not use this unit as following place.
   ① Place where corrosive or inflammable gas occur.
   ② Place where water and oil is occurred.
   ③ Place where there are a lot of dusts.
10. Case detachment
    Please turn off the power and detach the case.

① Widen lock device toward the outside with a driver.

⚠ Be careful to use machine tools, it may cause an injury.



② Put the case up and separate it.



(J) Counters

**Compact LCD Counter
LA8N Series**

**Programmable
Counter/Timer
CT Series**

Product Overview

Series		LA8N (LCD type)				
Digit		8-digit (count up, count down, count up/down: -9999999 to 99999999 / count up: 0 to 99999999)				
Model		**LA8N-BN**	**LA8N-BN-L**	**LA8N-BV**	**LA8N-BV-L**	**LA8N-BF**
Appearances & Dimensions		 [W48×H24×L54mm]				
Display method		LCD Zero Blanking type (character height size: 8.7mm)				
Operation method		Count up, Count down, Count up/down	Count up	Count up, Count down, Count up/down	Count up	Count up
Power supply		Built-in battery				
Backlight power supply		—	24VDC±10%	—	24VDC±10%	—
Input method		No-voltage input		Voltage input		Free voltage input
Max. counting speed		1cps / 30cps / 1kcps				20cps
Count input		Residual voltage: Max. 0.5VDC Short-circuit impedance: Max. 10kΩ Open-circuit impedance: Min. 750kΩ		[H]: 4.5-30VDC [L]: 0-2VDC		[H]: 24-240VAC/6-240VDC [L]: 0-2VAC/0-2.4VDC
RESET input		No-voltage input		Voltage input		No-voltage input
Min. input signal width		UP/DOWN, RESET: Apporx. 20ms	RESET: Approx. 20ms	UP/DOWN, RESET: Approx. 20ms	RESET: Approx. 20ms	RESET: Approx. 20ms
Battery life cycle		Approx. over 7 years at 20℃				
External setting switch		SW1, SW2, SW3				SW1, SW3
Insulation resistance		Over 100MΩ (at 500VDC megger)				
Dielectric strength		2,000VAC 60Hz for 1minute				
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour				
	Malfunction	0.3mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min				
Shock	Mechanical	300m/s^2 (approx. 30G) in each X, Y, Z direction for 3 times				
	Malfunction	100m/s^2 (approx. 10G) in each X, Y, Z direction for 3 times				
Reference		**J-4 to 7**				

Series			CTS		CTY		CTM	
Digit			4-digit	6-digit	6-digit		6-digit	
Model	1-stage preset		**CT4S-1P□□**	**CT6S-1P□□**	**CT6Y-1P□□**		**CT6M-1P□□**	
	2-stage preset		**CT4S-2P□□**	**CT6S-2P□□**	**CT6Y-2P□□**		**CT6M-2P□□**	
	Indicator		—	**CT6S-I □□**	**CT6Y-I □□**		**CT6M-I □□**	
Appearances & Dimensions			 [W48×H48×L90mm]		 [W72×H36×L77mm]		 [W72×H72×L85mm]	
Operation method			Count up, Count down, Count Up/Down					
Power Supply	AC voltage		100-240VAC 50/60Hz					
	AC/DC voltage		24VAC 50/60Hz, 24-48VDC					
Allowable voltage range			90 to 110% of rated voltage					
Max. counting speed			Selectable 1cps / 30cps / 1kcps / 5kcps / 10kcps					
Min. input signal width	Counter		RESET: Selectable 1ms/20ms					
	Timer		INA, INH, RESET: Selectable 1ms/20ms				INA, RESET, INHIBIT, BATCH RESET: Selectable 1ms/20ms	
Input method			Selectable voltage input or No-voltage input **[Voltage input]** Input impedance is 5.4kΩ, [H]: 5-30VDC, [L]: 0-2VDC **[No-voltage input]** Short-circuit impedance: Max. 1kΩ, Residual voltage: Max. 2VDC					
One-shot output time			0.01s to 99.99s setting					
			Standard	Comm.	Standard	Comm.	Standard	Comm.
Control output: Contact output	Type	1-stage	SPDT(1c): 1		SPDT(1c): 1		SPDT(1c): 1	
	Type	2-stage	SPST(1a): 2		SPST(1a): 1, SPDT(1c): 1	SPST(1a): 2	SPST(1a): 1, SPDT(1c): 1	
	Capacity		250VAC 5A resistive load		250VAC 3A resistive load		250VAC 5A resistive load	
Control output: Solid state output (NPN open collector)	Type	1-stage	1	—	1	1	2	2
	Type	2-stage				—	3	
	Capacity		Max. 30VDC, 100mA					
External power supply			Max. 12VDC ±10%, 100mA					
Reference			**J-8 to 35**					

Series			FXY		FXS		FX		FXH	FXL	
Digit			4-digit	6-digit	4-digit	5-digit	4-digit	6-digit	4-digit	4-digit	6-digit
Model	1-stage preset		—	—	**FX4S**	—	**FX4**	**FX6**	**FX4H**	—	—
	2-stage preset		—	—	—	—	**FX4-2P**	**FX6-2P**	**FX4H-2P**	**FX4L-2P**	**FX6L-2P**
	Indicator		**FX4Y-I**	**FX6Y-I**	—	**FX5S-I**	**FX4-I**	**FX6-I**	**FX4H-I**	**FX4L-I**	**FX6L-I**
Appearances & Dimensions			 [W72×H36×L93mm]		 [W48×H48×L91mm]		 [W72×H72×L112.3mm]		 [W48×H96×L100mm]	 [W144×H72×L112mm]	
Operation method			Count up, Count down, Count Up/Down								
Power supply	AC Voltage		100-240VAC 50/60Hz								
	AC/DC Voltage		12-24VAC 50/60Hz, 12-24VDC								
Allowable voltage range			90 to 110% of power supply								
Max. counting speed			Selectable **1cps, 30cps, 2kcps, 5kcps** by internal DIP switch								
Min. input signal width			INHIBIT, RESET: Approx. 20ms								
Input	CP1, CP2 input		**[No-voltage input]** Impedance at short-circuit: Max. 470Ω, Residual voltage at short-circuit: Max. 1V, Impedance at open-circuit: Min. 100kΩ		**[Voltage input]** Input impedance: 5.4kΩ, [H]: 5-30VDC, [L]: 0-2VDC **[No-voltage input]** Impedance at short-circuit: Max. 1kΩ, Residual voltage at short-circuit: Max. 2VDC, Impedance at open-circuit: Min. 100kΩ						
	RESET input										
Control output	Contact	Type	—		SPDT (1c)	—	1-stage preset: SPDT (1c), 2-stage preset: 1st. output SPDT (1c), 2nd. output SPDT (1c)				
		Capacity	—		250VAC 3A resistive load	—	250VAC 3A resistive load				
	Solid state	Type	—		1 NPN open collector	—	1-stage preset: 1 NPN open collector, 2-stage preset: 1st. output 1 NPN open collector, 2nd. output 1 NPN open collector				
		Capacity	—		Max. 30VDC 100mA	—	Max. 30VDC 100mA				
External power			Max. 12VDC ±10% 50mA								
Reference			**J-36 to 41**		**J-42 to 49**		**J-50 to 58**				

Series			FS		F	L	FM		LM	
Digit			4-digit	5-digit	8-digit	8-digit	4-digit	6-digit	4-digit	6-digit
Model	1-stage preset		**FS4A**	—	**F8A**	**L8A**	**F4AM**	**F6AM**	—	—
	2-stage preset		—	—	—	—	**F4AM-2P**	**F6AM-2P**	**L4AM-2P**	**L6AM-2P**
	Indicator		—	**FS5B**	**F8B**	**L8B**	**F4BM**	**F6BM**	**L4BM**	**L6BM**
Appearances & Dimensions			※**8Pin plug type**  [W48×H48×L85mm]		 [W72×H72×L112mm]	 [W144×H72×L112mm]	 [W72×H72×L112mm]		 [W144×H72×L112mm]	
Operation method			Count up, Count down		Count up, Count down, Count Up/Down					
Power supply	AC Voltage		100-240VAC 50/60Hz							
	AC/DC Voltage		12-24VAC 50/60Hz, 12-24VDC							
Allowable voltage range			90 to 110% of power supply							
Max. counting speed			Selectable **1cps, 30cps, 2kcps, 5kcps** by internal DIP switch							
Min. input signal width			RESET: Approx. 20ms							
Input	CP1, CP2 input		**[No-voltage input]** Impedance at short-circuit: Max. 470Ω, Residual voltage at short-circuit: Max. 1V, Impedance at open-circuit: Min. 100kΩ		**[Voltage input]** Input impedance: 5.4kΩ, [H]: 5-30VDC, [L]: 0-2VDC **[No-voltage input]** Impedance at short-circuit: Max. 1kΩ, Residual voltage at short-circuit: Max. 2VDC, Impedance at open-circuit: Min. 100kΩ					
	RESET input									
Control output	Contact	Type	SPST (1a)	—	SPDT (1c)		1-stage preset: SPDT (1c) 2-stage preset : 1st. output SPST (1a), 2nd. output SPST (1a)		2-stage preset : 1st. output SPDT (1c), 2nd. output SPDT (1c)	
		Capacity	250VAC 3A resistive load	—	250VAC 3A resistive load					
	Solid state	Type	—		1 NPN open collector		1-stage preset: 1 NPN open collector output, 2-stage preset: 2 NPN open collector output			
		Capacity	—		Max. 30VDC, 100mA					
External sensor power			Max. 12VDC ±10% 50mA							
Reference			**J-59 to 63**		**J-64 to 70**		**J-71 to 79**			

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

DIN W48×H24mm, Indication Only, LCD Counter

■ Features

- No additional power due to internal battery
- Signal input method: No-voltage input, voltage input, free voltage input
- Screw terminal type (attaching terminal cover)
- LCD display, backlight model
- IP66 protection structure

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

LA 8 N – B N – L

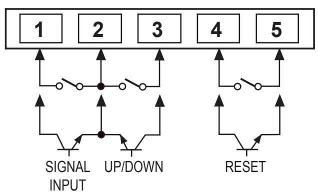
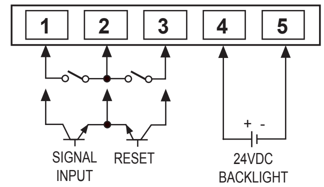
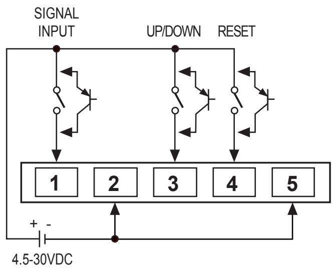
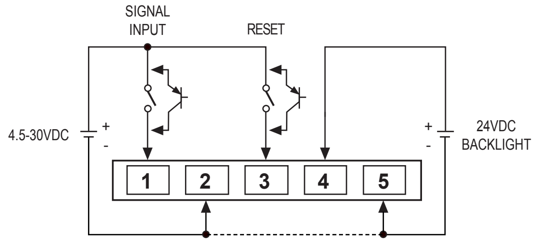
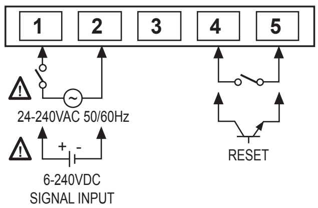
Backlight	No mark	None
	L	Backlight function
Input type	N	No-voltage (small signal) input
	V	Voltage input
	F	Free voltage input
Power supply	B	Internal lithium battery
Size	N	DIN W48×H24mm
Digit	8	99999999 (8-digit)
Item	LA	LCD Counter

■ Specifications

Model		**LA8N-BN**	**LA8N-BN-L**	**LA8N-BV**	**LA8N-BV-L**	**LA8N-BF**
Digit		8-digit (count up, count down, count up/down: -9999999 to 99999999 / count up: 0 to 99999999)				
Digit size		W3.4×H8.7mm				
Display method		LCD Zero Blanking type (character height size: 8.7mm)				
Operation method		Count up, Count down, Count up/down	Count up	Count up, Count down, Count up/down	Count up	Count up
Power supply		Built-in battery				
Battery life cycle		Approx. over 7 years at 20℃				
Backlight power supply		—	24VDC±10%	—	24VDC±10%	—
Input method		No-voltage input		Voltage input		Free voltage input
Count input		Residual voltage: Max. 0.5VDC Short-circuit impedance: Max. 10kΩ Open-circuit impedance: Min. 750kΩ		[H]: 4.5-30VDC [L]: 0-2VDC		[H]: 24-240VAC/6-240VDC [L]: 0-2VAC/0-2.4VDC
RESET input		No-voltage input		Voltage input		No-voltage input
Min. input signal width		UP/DOWN, RESET: Approx. 20ms	RESET: Approx. 20ms	UP/DOWN, RESET: Approx. 20ms	RESET: Approx. 20ms	RESET: Approx. 20ms
Max. counting speed		1cps / 30cps / 1kcps				20cps
External setting switch		SW1※1, SW2※2, SW3※3				SW1※1, SW3※3
Insulation resistance		Over 100MΩ (at 500VDC megger)				
Dielectric strength※4		2,000VAC 60Hz for 1minute				
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour				
	Malfunction	0.3mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min				
Shock	Mechanical	300m/s^2 (approx. 30G) in each X, Y, Z direction for 3 times				
	Malfunction	100m/s^2 (approx. 10G) in each X, Y, Z direction for 3 times				
Environ-ment	Ambient temp.	-10 to 55℃, storage: -25 to 65℃				
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH				
Protection structure		IP66 (when using waterproof rubber for front panel)				
Accessory		Mounting bracket, Rubber waterproof ring				
Approval		CE cULus				
Weight※5		Approx. 96g (approx. 50g)				

※1: SW1 is the front panel RESET key enable/disable setting switch.
※2: SW2 is the max. counting speed setting switch.
※3: SW3 is the decimal point setting switch.
※4: No-voltage input, voltage input: between terminals and the case / Free voltage input: between the free voltage input terminal and the RESET input terminal, between terminals and the case.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Connections

Input type	No-backlight	Backlight
No-voltage input type	●LA8N-BN※1 	●LA8N-BN-L  ※Terminal (1, 2, 3) and (4, 5) are insulated inside.
Voltage input type	●LA8N-BV※1 	●LA8N-BV-L  ※Terminal (1, 2, 3) and (4, 5) are insulated inside. ※Backlight power is available as signal input and reset.
Free voltage input type	●LA8N-BF  ※Terminal (1, 2) and (4, 5) are insulated inside.	—

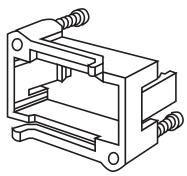
※1: Terminal 2 and 5 are connected inside. (non-isolated)

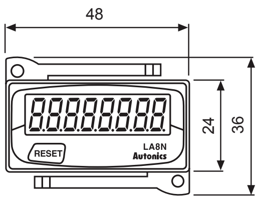
※Use reliable contacts enough to flow 5㎂ current.

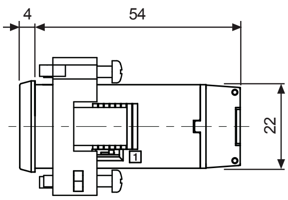
▣ Dimensions

(unit: mm)

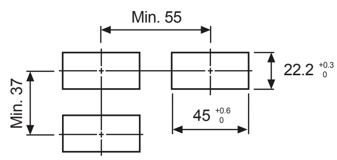
● **Bracket**







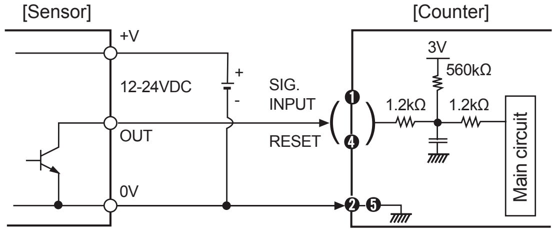
● **Panel cut-out**



▣ Input Connections

◎ No-voltage input (standard sensor: NPN open collector output type sensor)

● **Solid-state input**

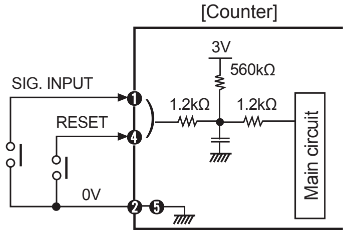


※When power is applied to terminal No ❶ and ❹, input terminal circuit can be broken and a malfunction can occur. (NPN output, PNP output, PNP open collector output type sensor cannot be used.)

※❷ and ❺ are connected inside.

※For backlight function model, the input terminals are no. ❶, ❸ and the GND terminal is no. ❷ .

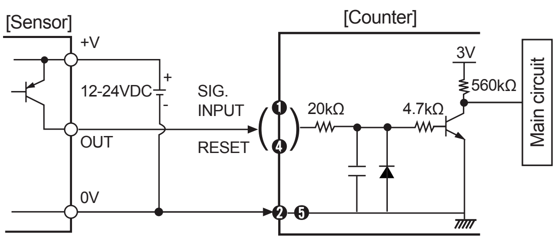
● **Contact input**



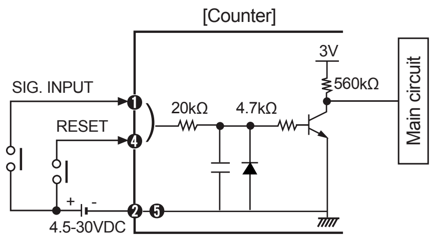
※Please use reliable contacts enough to flow 3VDC 5㎂ of current.

◎ Voltage input (standard sensor: PNP open collector output type sensor)

● Solid-state input



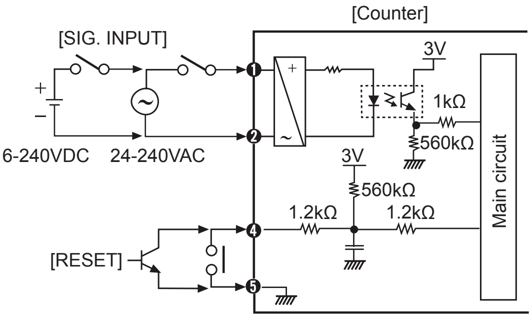
● Contact input



※Please use reliable contacts enough to flow 3VDC 5μA of current.

※For backlight function model, the input terminals are no. ❶, ❸ and the GND terminal is no. ❷ .

◎ Free voltage input

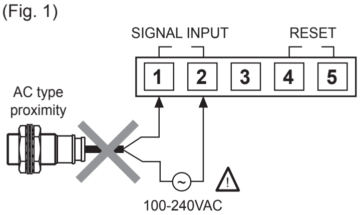


※AC type proximity sensor cannot be used as the source of count input signals.
※Input terminal (❶, ❷)and reset terminal (❹, ❺)are insulated inside.
※It is not possible to reset with AC power or DC power.
※When relay contact is used as the source of RESET signal, please use reliable contacts enough to flow 3VDC 5μA of current.

◎ Input from AC type proximity sensor

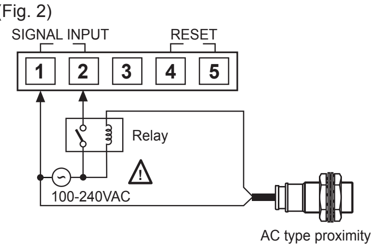
In case of free voltage input type, do not connect AC proximity sensors instead of a switch as shown in the figure 1. It may cause malfunction due to sensor's leakage current. Connect a relay as shown in the figure 2.

(Fig. 1)



<Example of wrong connection>

(Fig. 2)

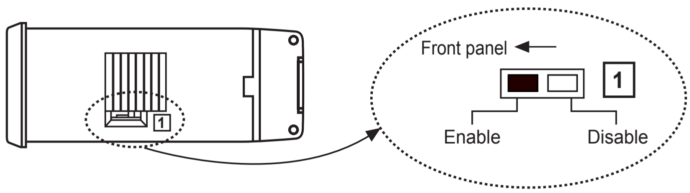


<Example of correct connection>

▣ Setting Switch

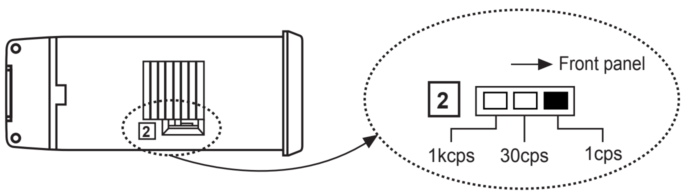
◎ SW1 (1 switch)

SW1 is a switch to Enable/Disable the front panel RESET key.
※Factory default: Enable



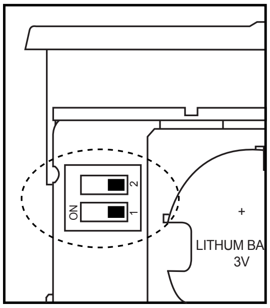
◎ SW2 (2 switch)

SW2 is a switch for setting max. counting speed.
※Factory default: 1cps
(Free voltage input type: 20cps is fixed)



◎ SW3

SW3 is a switch for decimal point position. (※factory default: no decimal point)

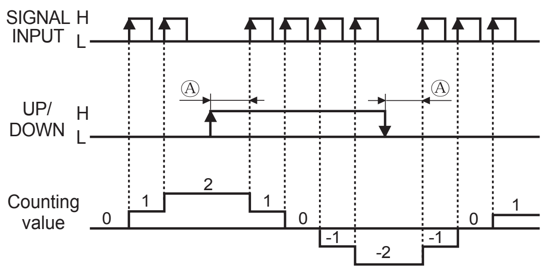


SW3	Decimal point
2 OFF, 1 OFF	Not use decimal point
2 OFF, 1 ON	0.0
2 ON, 1 OFF	0.00
2 ON, 1 ON	0.000

※Change SW3 setting after removing the case.
※Supply RESET signal (front panel or terminal RESET) after setting SW2, SW3 during operation.

▣ Counter Operation Mode

● **LA8N-BN/LA8N-BV model**

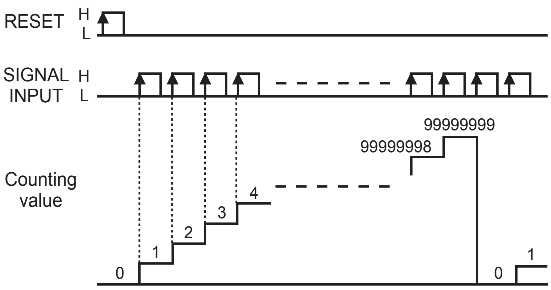


※SIGNAL INPUT: Counting input,
UP/DOWN: Counting instruction input
※UP/DOWN as "L" is count up (UP)
UP/DOWN as "H" is count down (DOWN)
※The meaning of "H" and "L"

	Voltage input	No-voltage input	Free voltage input
H	4.5-30VDC	Short	6-240VAC, 24-240VDC
L	0-2VDC	Open	0-2VAC, 0-2.4VDC

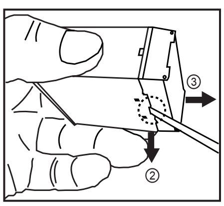
※Ⓐ should be over 20ms of min. signal width. If it is below 20ms, it may cause counting error.

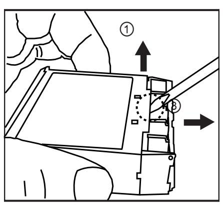
● **LA8N-BN-L/LA8N-BV-L/LA8N-BF model**



▣ Case Detachment And Battery Replacement

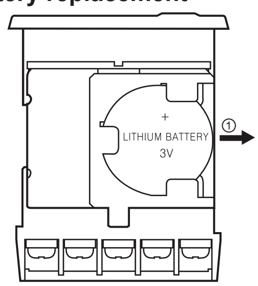
● **Case detachment**





※Hold up Lock part toward ①, ② of the product with the tool and pull toward ③ to detach the case.
⚠When using the tools, be careful not to be wounded.

● **Battery replacement**



1. Detach the case.
2. Push the battery and detach it toward ①.
3. Insert a new battery with correct alignment of polarity pushing it toward opposite of ①.

※The battery is sold separately.
Please replace a battery by yourself. (sold separately)
※Do not burn up or disassemble the lithium battery.

DIN W48×H48mm, W72×H36mm, W72×H72mm Counter/Timer

■ Features

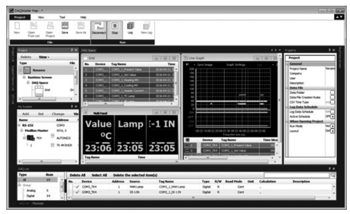
- Prescale value setting range – 6-digit model: 0.00001 to 99999.9 / 4-digit model: 0.001 to 999.9
- Communication function supported (communication model): RS485 (Modbus RTU)
- One-shot output time setting range - 0.01 sec to 99.99 sec by setting per 10ms
- [Counter]
  9 input modes/11 output modes
  BATCH counter,
  Count Start Point (counting initial value) setting function
- [Timer]
  13 output modes
  Various time setting range– 6-digit model: 0.001 sec to 99999.9 hour / 4-digit model: 0.001 sec to 9999 hour
  '0' time setting function
  Selectable timer memory retention function for indicator model.

Please read "Caution for your safety" in operation manual before using.

■ DAQMaster (Comprehensive Device Management Program)

- DAQMaster is comprehensive device management program for convenient management of parameters and multiple device data monitoring.
- Visit our website (www.autonics.com) to download user manual and comprehensive device management program.

< DAQMaster screen >



Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS-232 serial port (9-pin), USB port

■ Ordering Information

CT 6 M - 2P 4 T

Field	Code	Description
Communication	No-mark	None
	T	RS 485 communication output
Power supply	2	24VAC 50/60Hz, 24-48VDC
	4	100-240VAC 50/60Hz
Output	1P	1-stage preset
	2P	2-stage preset
	I※1	Indicator
Size	S	DIN W48×H48mm
	Y	DIN W72×H36mm
	M	DIN W72×H72mm
Display digits	4	9999 (4-digit)
	6	999999 (6-digit)
Item	CT	Counter/Timer

※1: CT4S model does not support indicatior type.

■ Communication Specification

Comm. protocol	Modbus RTU with 16-bit CRC
Connection type	RS485
Application standard	Compliance with EIA RS485
Max. connection	31 units (address: 1 to 127)
Synchronous method	Asynchronous
Comm. type	Two-wire half duplex
Comm. distance	Max. 800 m
Comm. speed	2400, 4800, 9600 (factory default), 19200, 38400bps
Comm. response time	5 to 99ms (factory default: 20ms)
Start bit	1-bit (fixed)
Data bit	8-bit (fixed)
Parity bit	None (factory default), Even, Odd
Stop bit	1, 2-bit (factory default: 2-bit)

※It is recommended to use communication converter, RS485 to Serial converter (SCM-38I, sold separately), USB to RS485 converter (SCM-US48I, sold separately). Please use a proper twist pair for RS485 communication.

■ Specifications

Series			CTS		CTY		CTM	
Model	1-stage preset		**CT4S-1P□□**	**CT6S-1P□□**	**CT6Y-1P□□**		**CT6M-1P□□**	
	2-stage preset		**CT4S-2P□□**	**CT6S-2P□□**	**CT6Y-2P□□**		**CT6M-2P□□**	
	Indicator		—	**CT6S-I□□**	**CT6Y-I□□**		**CT6M-I□□**	
Display digits			4-digit	6-digit	6-digit		6-digit	
Display method			7 segment (counting value: red, setting value: yellow-green) LED method					
Character size(W×H)	Counting value		6.5×10mm	4.5×10mm	4.2×9.5mm		6.6×13mm	
	Setting value		4.5×8mm	3.5×7mm	3.5×7mm		5×9mm	
Power supply	AC voltage		100-240VAC 50/60Hz					
	AC/DC voltage		24VAC 50/60Hz, 24-48VDC					
Permissible voltage range			90 to 110% of rated voltage					
Power consumption	AC voltage		Max. 12VA					
	AC/DC voltage		AC: Max. 10VA, DC: Max. 8W					
Counter	INA/INB Max. counting speed		Selectable 1cps/30cps/1kcps/5kcps/10kcps					
	Counting range		-999 to 9999	-99999 to 999999				
	Scale		Decimal point up to third digit	Decimal point up to fifth digit				
	Min. input signal width		RESET: Selectable 1ms/20ms					
Timer	Time range	4-digit	9.999s, 99.99s, 999.9s, 9999s, 99m59s, 999.9m, 9999m, 99h59m, 9999h					
		6-digit	999.999s, 9999.99s, 99999.9s, 999999s, 99m59.99s, 999m59.9s, 9999m59s, 99999.9m, 999999m, 99h59m59s, 9999h59m, 99999.9h					
	Operation method		Count up, Count down, Count Up/Down					
	Min. input signal width		INA, INH, RESET: Selectable 1ms/20ms				INA, RESET, INHIBIT, BATCH RESET: Selectable 1ms/20ms	
	Repeat error		In case of power ON start: Max. ±0.01% ±0.05s In case of signal start: Max. ±0.01% ±0.03s					
	Set error							
	Voltage error							
	Temp. error							
Input method			Selectable voltage input or no-voltage input [Voltage input]-input impedance: 5.4kΩ, [H]: 5-30VDC, [L]: 0-2VDC [No-voltage input]-short-circuit impedance: Max. 1kΩ, short-circuit residual voltage: Max. 2VDC					
One-shot output time			0.01s to 99.99s setting					
			Standard	Comm.	Standard	Comm.	Standard	Comm.
Control output: Contact output	Type	1-stage	SPDT(1c): 1		SPDT(1c): 1		SPDT(1c): 1	
		2-stage	SPST(1a): 2		SPST(1a): 1, SPDT(1c): 1	SPST(1a): 2	SPST(1a): 1, SPDT(1c): 1	
	Capacity		250VAC 5A resistive load		250VAC 3A resistive load		250VAC 5A resistive load	
Control output: Solid state output (NPN open collector)	Type	1-stage	1	—	1	1	2	2
		2-stage				—	3	
	Capacity		Max. 30VDC, 100mA					
External power supply			Max. 12VDC ±10%, 100mA					
Memory retention			Approx. 10 years (non-volatile memory)					
Insulation resistance			Over 100MΩ (at 500VDC megger)					
Dielectric strength			2,000VAC 50/60Hz for 1 min					
Noise immunity			Square-wave noise by noise simulator (pulse width 1μs) ±2kV					
Vibration	Mechanical		0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour					
	Malfunction		0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 minutes					
Shock	Mechanical		300m/s² (approx. 30G) in each X, Y, Z direction for 3 times					
	Malfunction		100m/s² (approx. 10G) in each X, Y, Z direction for 3 times					
Relay life cycle	Mechanical		Min. 10,000,000 operations					
	Malfunction		Min. 100,000 operations					
Protection structure			IP65 (front part, IEC standard)					
Environmental	Ambient temp.		-10 to 55℃, storage: -25 to 65℃					
	Ambient humi.		35 to 85%RH, storage: 35 to 85%RH					
Approval			CE c UL us					
Weight※1			Approx. 212g (approx. 159g)		Approx. 228g (approx. 140g)		Approx. 322g (approx. 252g)	

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

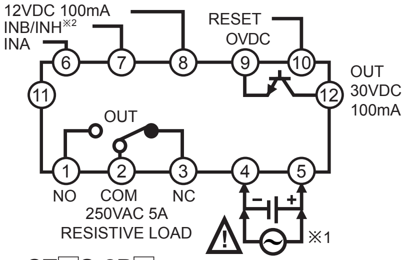
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Connections

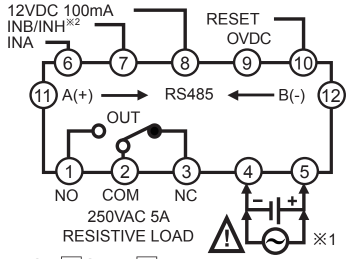
⚠ **Be sure that connection is varied by supporting RS485 communication.**

◎ CTS Series

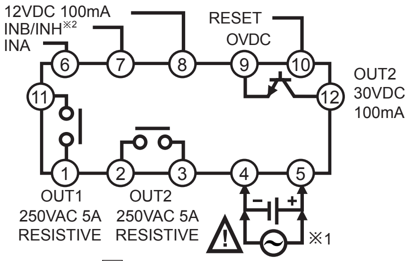
● CT□S-1P□



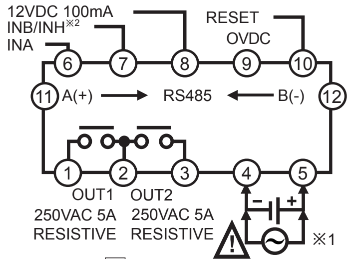
● CT□S-1P□T



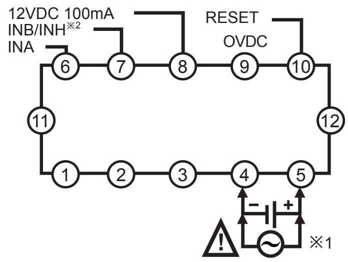
● CT□S-2P□



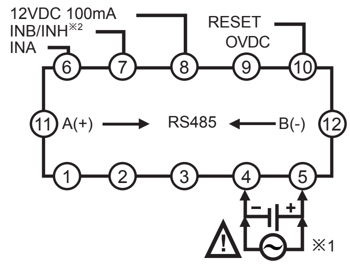
● CT□S-2P□T



● CT6S-I□

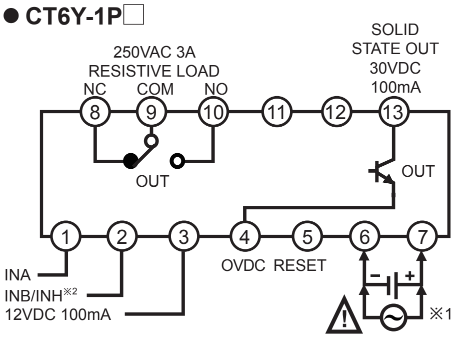


● CT6S-I□T

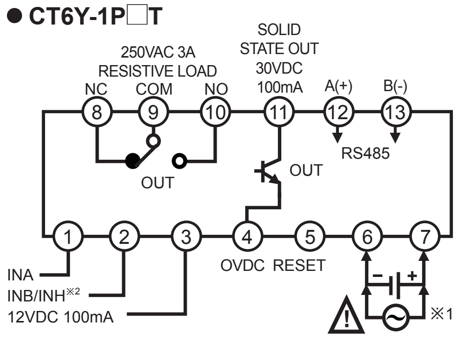


◎ CTY Series

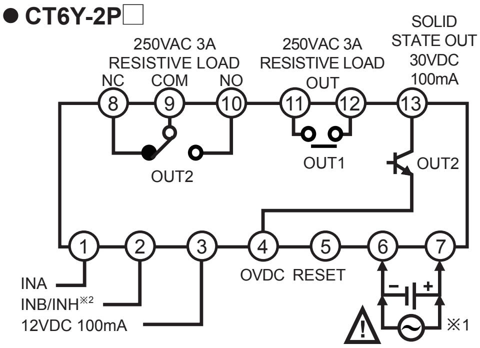
● CT6Y-1P□



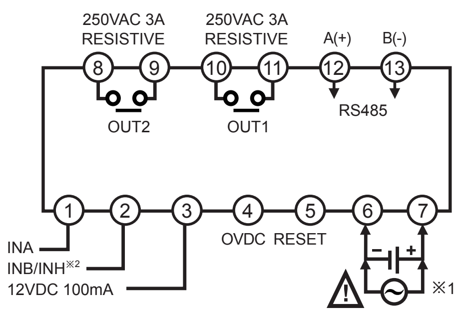
● CT6Y-1P□T



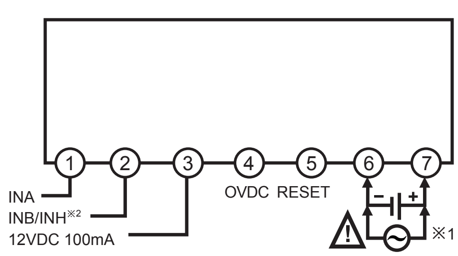
● CT6Y-2P□



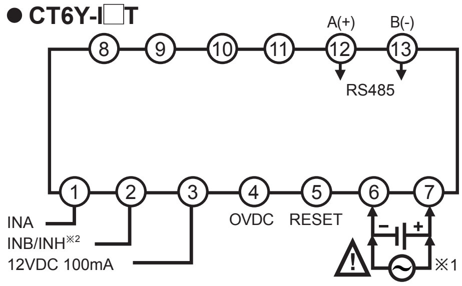
● CT6Y-2P□T



● CT6Y-I□

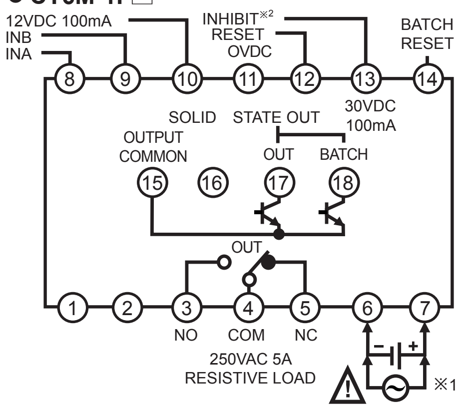


● CT6Y-I□T

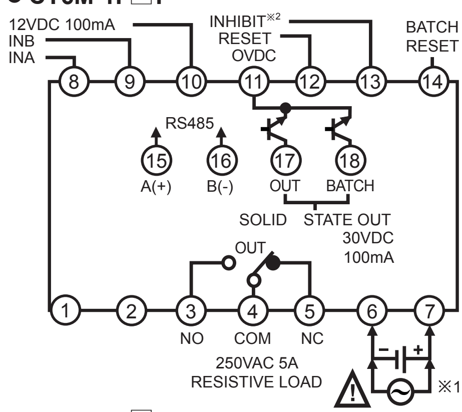


◎ CTM Series

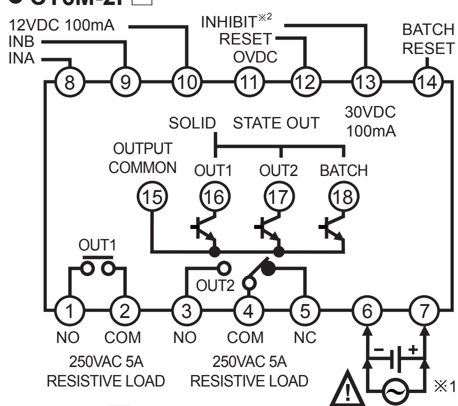
● CT6M-1P□



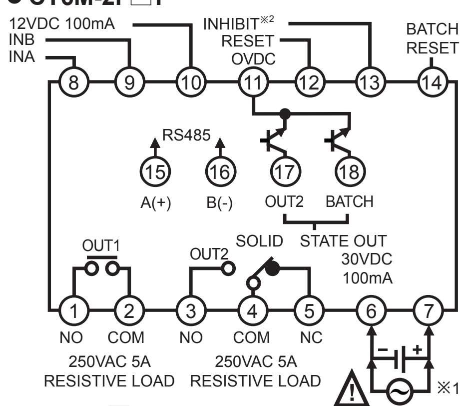
● CT6M-1P□T



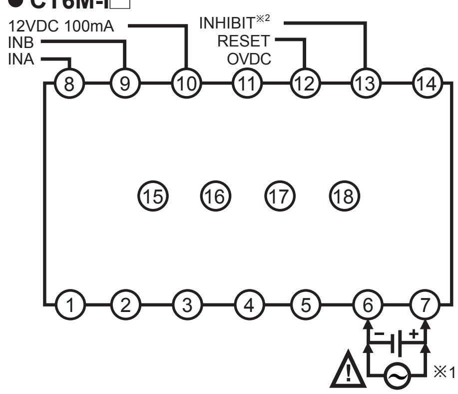
● CT6M-2P□



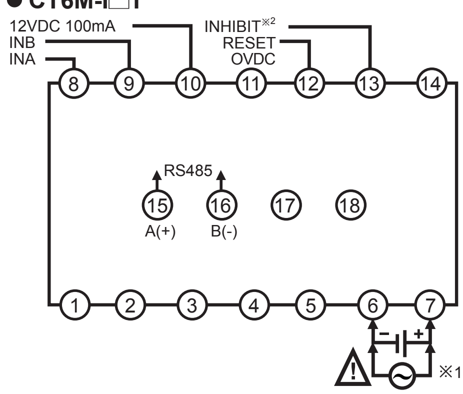
● CT6M-2P□T



● CT6M-I□



● CT6M-I□T



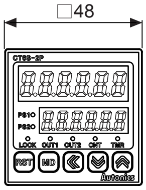
※1: AC Voltage: 100-240VAC 50/60Hz
AC/DC Voltage: 24VAC 50/60Hz, 24-48VDC

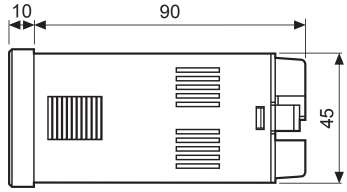
※2: Counter operation: If INHIBIT signal is applied, count input will be prohibited.
Timer operation: If INHIBIT signal is applied, time progressing will stop. (HOLD)

▣ Dimensions

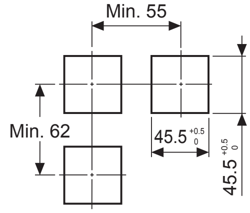
(unit: mm)

◎ CTS Series

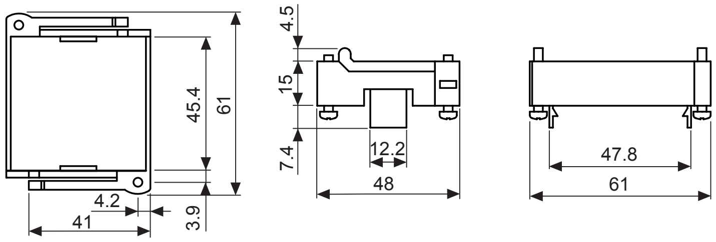




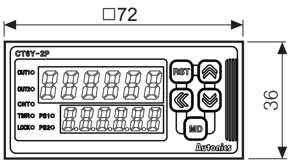
● Panel cut-out

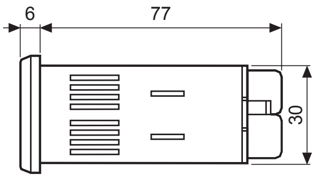


● Bracket

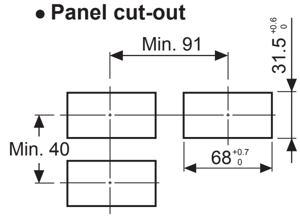


◎ CTY Series

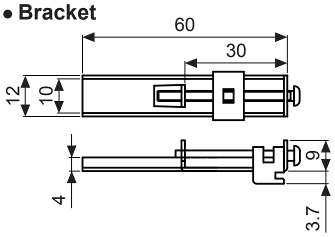




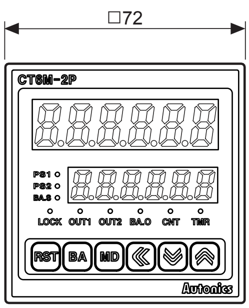
● Panel cut-out

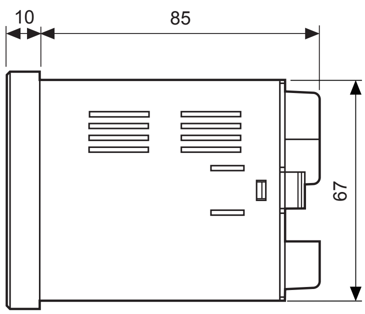


● Bracket

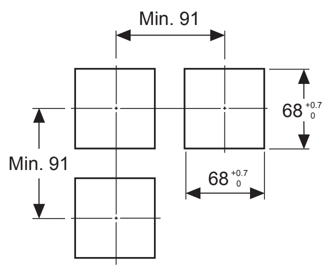


◎ CTM Series

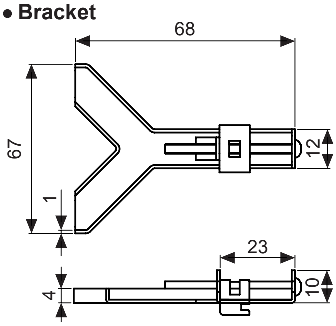




● Panel cut-out



● Bracket



▣ Sold Separately

◎ Communication converter

- **SCM-38I**
  (RS232C to RS485 converter)
  CE

- **SCM-US48I**
  (USB to RS485 converter)
  CE

◎ Display Units (DS/DA-T Series)

- **DS/DA-T Series**
  (RS485 communication input type display unit) CE

DS16-□T

DS22/DA22-□T

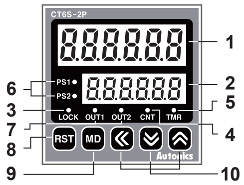
DS40/DA40-□T

DS60/DA60-□T

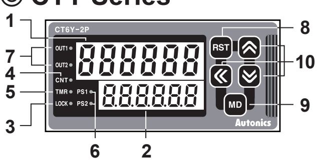
※Connect RS485 communication input type display unit (DS/DA-T Series) and RS485 communication output model of CT Series, the display unit displays present value of the device without PC/PLC.

▣ Unit Description

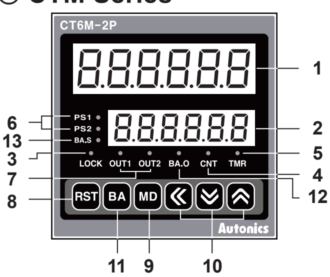
◎ CTS Series



◎ CTY Series



◎ CTM Series



Model	Changed	Notice
CT4S-1P	PS2→PS OUT2→OUT	There are no PS1, OUT1 LEDs.
CT6S-1P		
CT6Y-1P		
CT6M-1P		
CT6S-I	PS2→PS	There are no PS1, OUT1, OUT2 LEDS.
CT6Y-I		There are no PS1, OUT1, OUT2, BA.S, BA.O LEDs, BA key.
CT6M-I		

1. Counting value display component (red)
RUN mode: Displays counting value for counter operation or time progress value for timer operation.
Function setting mode: Displays setting item.

2. Setting value display component (yellow-green)
RUN mode: Displays setting value.
Function setting mode: Displays setting content.

3. Key lock indicator (LOCK): Turns ON for key lock setting.

4. Counter indicator (CNT): Turns ON for counter operation.

5. Timer indicator (TMR): Flashes (progressing time) or Turns ON (stoping time) for timer operation.

6. Preset value checking and changing indicator (PS1, PS2)
: Turns ON when checking and changing preset value.

7. Output indicator (OUT1, OUT2): Turns ON for the dedicated control output ON.

8. RST key
RUN mode: Press the RST key to reset the counting value.
BATCH counter mode: Press the RST key to reset the batch counting value.

9. MD key
RUN mode: Hold the MD key over 3 sec to enter function setting mode(parameter setting).
Hold the MD key over 5 sec to enter function setting mode(communication setting).
Function setting mode: Press the MD key to select function setting mode parameter.
Hold the MD key over 3 sec to return RUN mode.

10. ≪, ≫, ≫ key
1) ≪ key
RUN mode: Press the ≪ key to enter preset mode.
Preset mode: Press the ≪ key to move preset digits.
2) ▽, △ key
RUN mode: Hold the △ key over 1 sec to enter Function setting check mode.
Preset mode: Used for increasing or decreasing preset value.
Function setting mode: Changes the settings.
Function setting check mode: Press the ▽ key to move the previous parameter.
Press the △ key to the next parameter.

11. BA key
RUN mode: Press the RST key to enter BATCH counter indication mode.

12. BATCH output indicator (BA.O) (red)

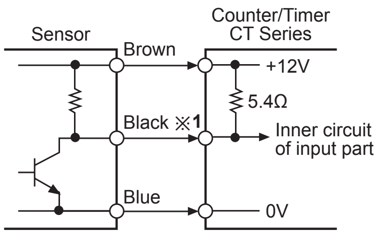
13. BATCH preset value checking and changing indicator (BA.S) (yellow-green)
: Turns ON when checking and changing BATCH preset value.

※The indicator type does not exist in CT4S model.

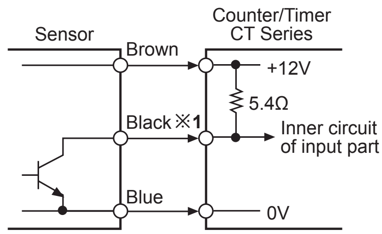
▣ Input Connections

◎ No-voltage input (NPN)

● Solid-state input (standard sensor: NPN output type sensor)

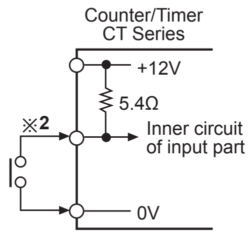


(NPN output)



(NPN open collector output)

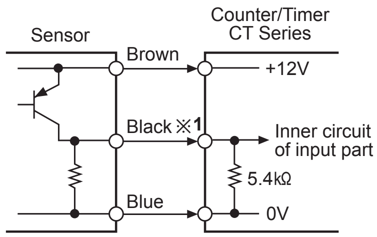
● Contact input



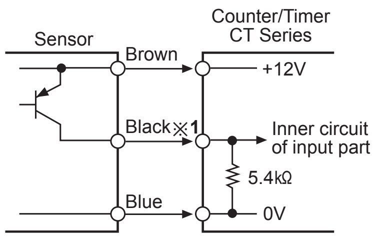
※1: INA, INB/INH, RESET, INHIBIT, BATCH RESET input part
※2: Counting speed: 1 or 30cps setting (counter)

◎ Voltage input (PNP)

● Solid-state input (standard sensor: PNP output type sensor)

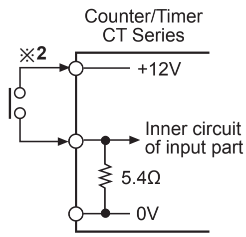


(PNP output)



(PNP open collector output)

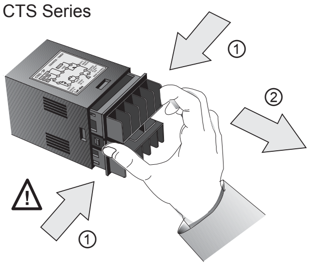
● Contact input



※1: INA, INB/INH, RESET, INHIBIT, BATCH RESET input part
※2: Counting speed: 1 or 30cps setting (counter)

▣ Input Logic Selection [No-Voltage Input (NPN)/Voltage Input (PNP)]

CTS Series

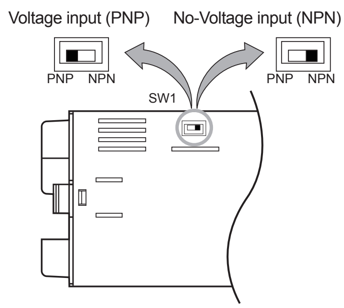


1. The power must be cut off.
2. Squeeze toward ① and pull toward ② as the figure. (CTS/CTY Series)
3. Select input logic by using input logic switch (SW1) inside Counter/Timer.
4. Push a case in the opposite direction of ②.
5. Then supply the power to counter/timer.

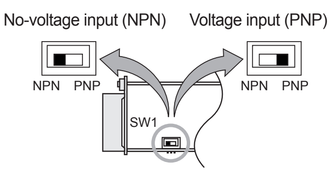
※ Case detachment
Squeeze toward ① and pull toward ② as shown in picture.

⚠ **Turn OFF the power before changing input logic (PNP/NPN)**

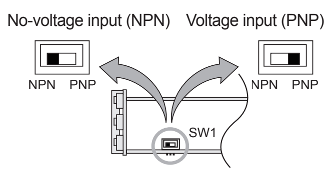
● CTM



● CTS



● CTY

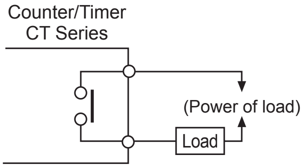


▣ Error Display

Error display	Errors	Output status	How to return
EEP PS1○ PS2○ FAIL	Failed in data loading for exsiting setting values	OFF	Power on again

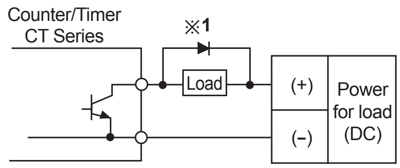
Output Connections

◎ Contact output



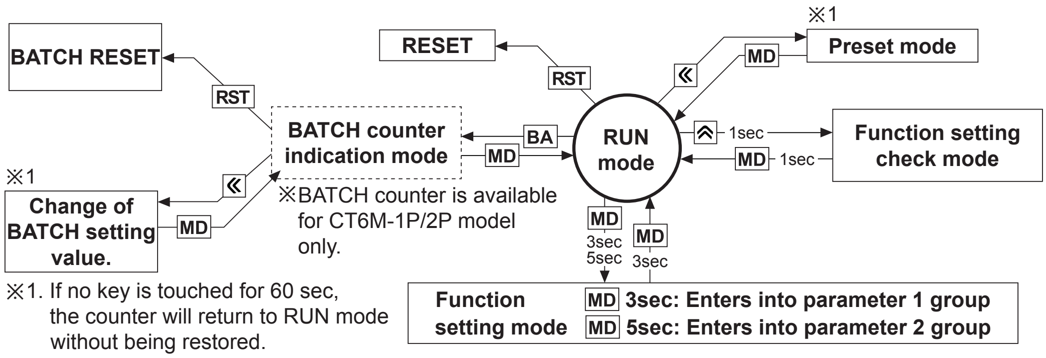
※Use proper load not to exceed the capacity.

◎ Solid-state output



※Use proper load and power for load not to excess ON/OFF capacity (Max. 30VDC, 100mA) of solid state output.
※Be sure not to apply reverse polarity of power.
※1: When using inductive load (relay etc.), surge absorber (diode, varistor etc.) must be connected between both sides of the load.

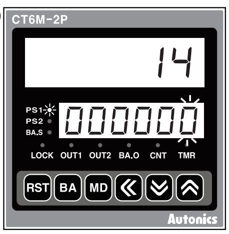
Operations And Functions



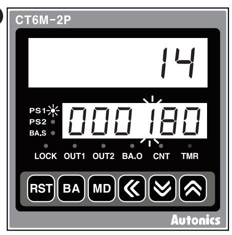
※1. If no key is touched for 60 sec, the counter will return to RUN mode without being restored.

◎ Change of preset (Counter/Timer)

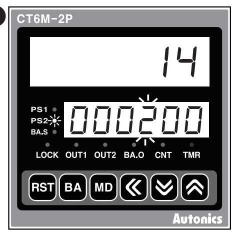
● Even if changing the preset value, input operation and output control will continue. In addition, the preset value could be set to 0 and the output of 0 preset value turns ON. According to output mode, preset value could not be set to 0. (When setting to 0, preset value "0" will flash 3 times.)

❶


In RUN mode, press the « key to enter preset mode. 'PS1' indicator turns ON and first digit of preset value flashes.

❷


Press the « , ⩓ and ⩔ keys to set the desired value (example, 180). Press the MD key to enter the PS2 setting mode.

❸


Press the « , ⩓ and ⩔ keys to set the desired value (example, 200). Press the MD key to return RUN mode.

◎ Function setting check mode

Setting value of function setting mode can be confirmed using the ⩓ and ⩔ keys.

◎ Switching display function in preset indicator

Setting value1 (PS1) and setting value2 (PS2) are displayed each time pressing MD key in PRESET2 model.
(in timer, it is available for ond, ond.1 or ond.2 output mode.)

◎ Reset

In RUN mode or function setting mode, if pressing RST key or applying the signal to the RESET terminal on the back side, present value will be reset and output will maintain off status. When selecting voltage input (PNP), short no. 10 and no. 12 terminals, or when selecting no-voltage input (NPN), short no.11 and no.12 terminals to reset.

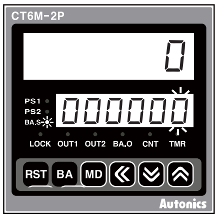
▣ BATCH Counter (For CT6M-1P□□ /CT6M-2P□□ Model Only)

In BATCH counter indication mode, 'BATCH counter value' is displayed in count indicator and 'BATCH counter setting value' is displayed in preset indicator.

◎ Change of BATCH setting value

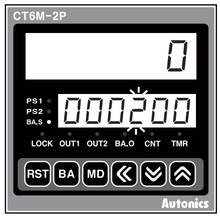
If pressing BA key in Run mode, it will enter into BATCH counter indication mode.

1.



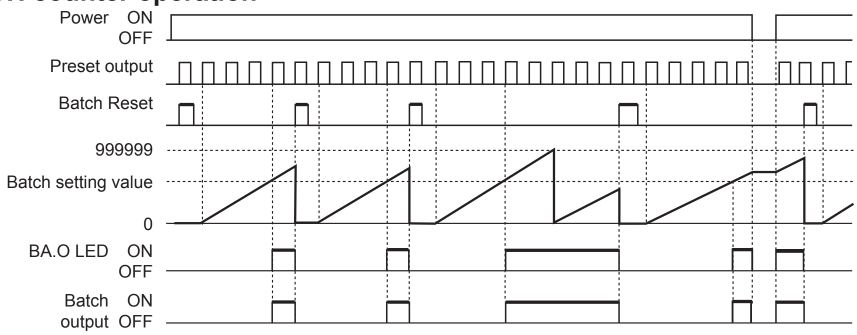
It enters into settingvalue change mode using « key. (BA.S lights, first digit of setting value flashes.)

2.



BATCH value is set to '200' using «, ⮝ and ⮟ keys, then press MD key to complete BATCH setting value and move to BATCH counter indication mode.

◎ BATCH counter operation



◎ BATCH counting operation

- BATCH counting value is increasing until BATCH reset signal applied. BATCH counting value will be circulated when it is over 999999.
  1) BATCH counting operation in Counter: Counts the number of reaching setting value of CT6M-1P or reaching dual setting value of CT6M-2P□□
  2) BATCH counting operation in Timer: Counts the number of reaching setting time. (In case of "FLK" output mode, count the number of reaching T.off setting time and T.on setting time.)

◎ BATCH output

- If input signal is applied while changing BATCH setting value, counting operation and output control will be performed.
- If BATCH count value equals to BATCH setting value, BATCH output will be ON and maintain ON status until BATCH reset signal is applied.
- When the power is cut off then resupplied in status of BATCH output is ON, BATCH output maintains ON status until BATCH reset signal is applied.

◎ BATCH reset input

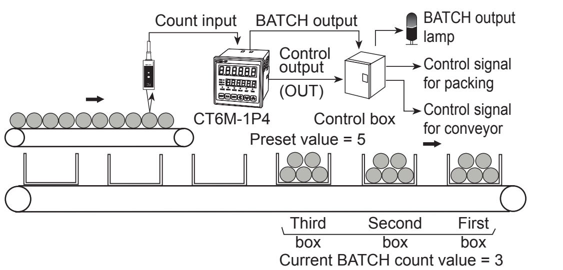
- If pressing RST key or applying the signal to BATCH reset terminal on the back side panel, BATCH counting value will be reset. When selecting voltage input (PNP), short terminals 10 and 14, or when selecting no-voltage input (NPN), short terminals 11 and 14 to reset.
- When BATCH reset is applied, BATCH counting value maintains at 0 and BATCH output maintains in the OFF status.

◎ Application of BATCH counter function

● Counter

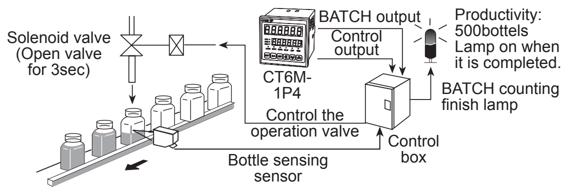
In case, put 5 products in a box then pack the boxes when they reaches to 200.

- Counter preset setting value="5", BATCH setting value="200"
- When the count value of counter reaches to the preset value "5", the control output (OUT) will be on, and at this time the count value of the BATCH counter will be increased by "1". The control box which is received the control output (OUT) repeatedly controls conveyor to move the full box and to place the next empty box for standby. When the BATCH count value reaches to "200", BATCH output will be ON. Then the control box stops conveyor and provides a control signal for packing.

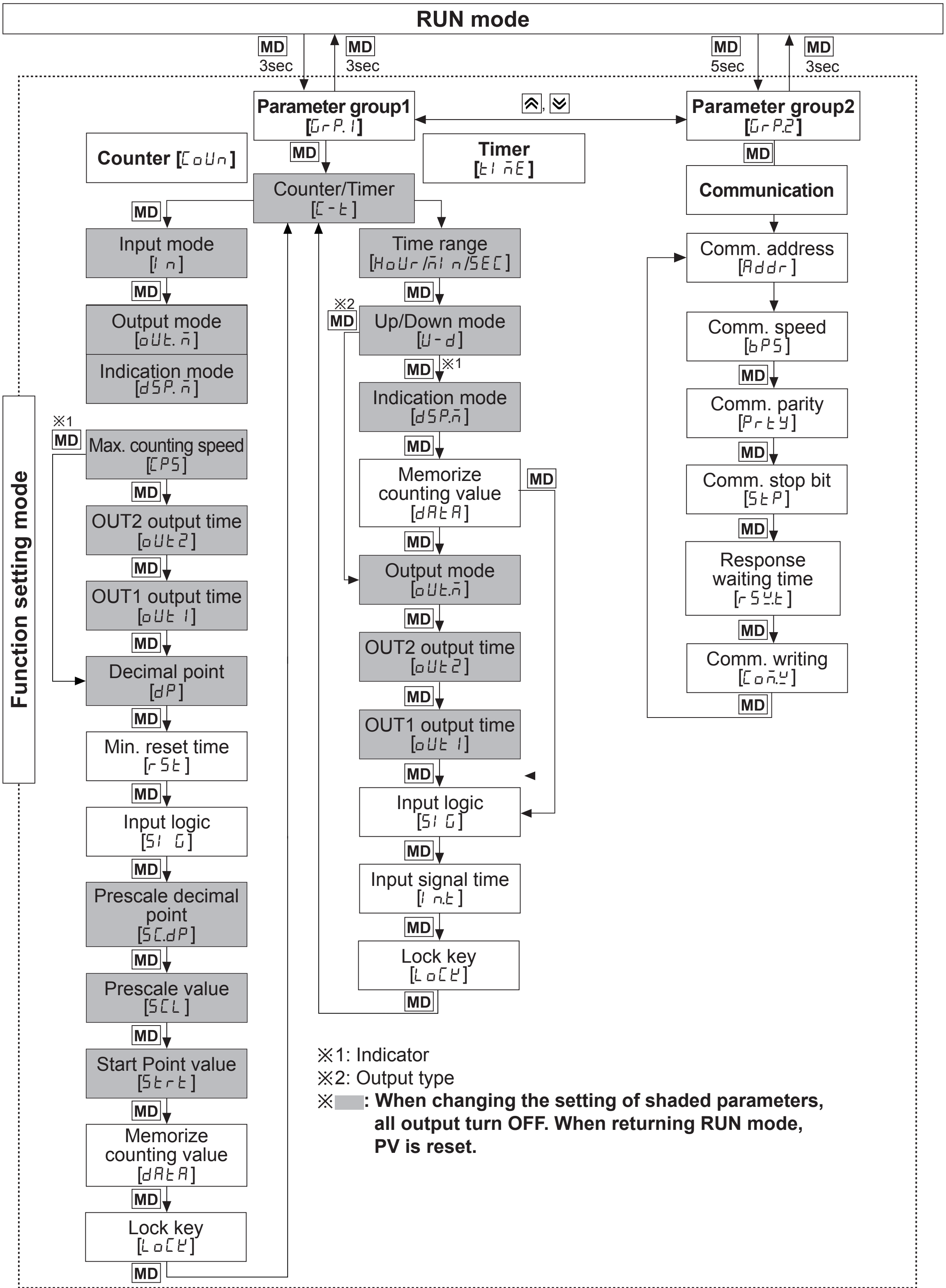


● Timer

Fills milk into the bottle for 3sec (setting time) When 500 bottles are filled, BATCH counting finish lamp is turned on. (Setting time: 3sec, BATCH setting value: 500)



■ Flow Chart For Function Setting Mode



※1: Indicator
※2: Output type
※ : **When changing the setting of shaded parameters, all output turn OFF. When returning RUN mode, PV is reset.**

※If changing Parameter group1 setting value, display value and output are reset.
※Parameter 2 group is not available to non-communication models.

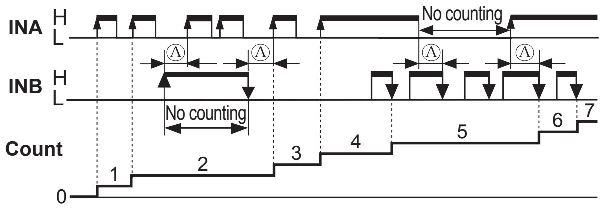
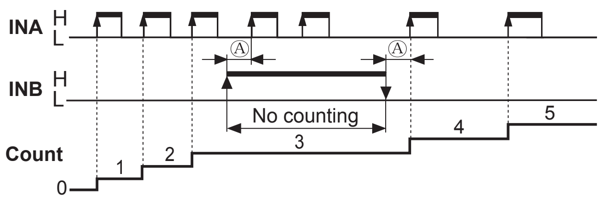
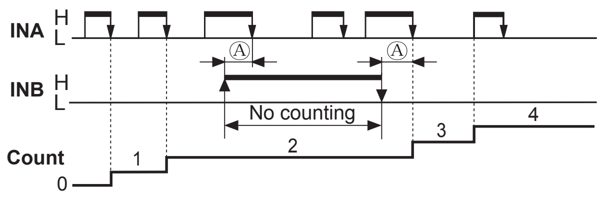
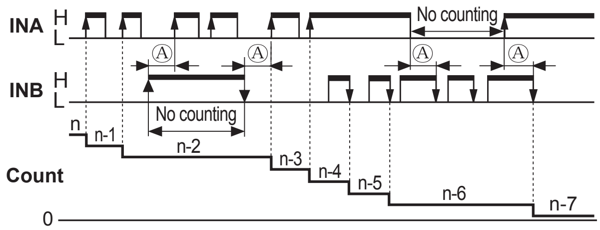
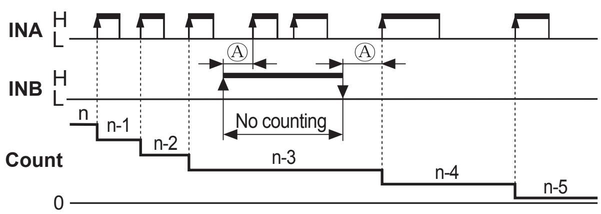
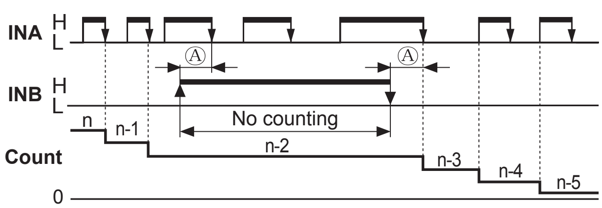
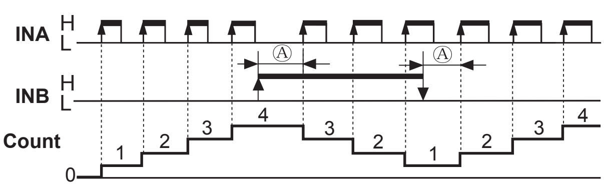
▣ Parameter Setting (Counter)

(MD key: Moves the settings, ⩔, ⩓ key: Changes the settings)

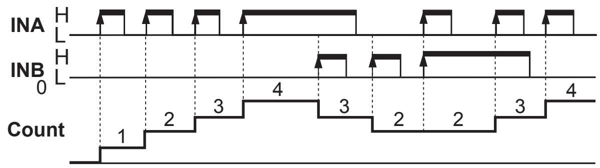
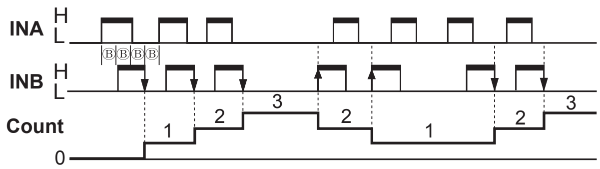
Parameter	Setting
Counter/ Timer [C-t]	CoUn ↔ tInE ※CoUn: Counter tInE: Timer
Input mode [In]	Ud-C ↔ UP ↔ UP-1 ↔ UP-2 ↔ dn ↔ dn-1 ↔ dn-2 ↔ Ud-A ↔ Ud-b
Output mode [oUt.M]	• Input mode is UP, UP-1, UP-2 or dn, dn-1, dn-2, F ↔ n ↔ C ↔ r ↔ K ↔ P ↔ q ↔ A • Input mode is Ud-A, Ud-b, Ud-C, F ↔ n ↔ C ↔ r ↔ K ↔ P ↔ q ↔ A ↔ S ↔ t ↔ d ※If max. counting speed is 5kcps or 10kcps, and output mode is d, max. counting speed is automatically changed as 30cps, factory default.
Indication mode [dSP.M]	• In case of the indicator type HoLd ↔ totAL ※In case of the indicator type, indicate mode selection [dSP.M] is displayed. ※It is the added function to set the preset value when selecting HoLd.
Max. counting speed [CPS]	30 ↔ 1K ↔ 5K ↔ 10K ↔ 1 ※Max. counting speed is when duty ratio of INA or INB input signal is 1:1. It is applied for INA, or INB input as same. ※When output mode is d, set max. counting speed one among 1cps, 30cps, or 1kcps.
OUT2 output time※1 [oUt2]	※Set one-shot output time of OUT2. ※Setting range: 00.01 to 99.99sec ※When input mode is F, n, S, t, d, oUt2 does not appear. (fixed as HOLD)
OUT1 output time※1 [oUt1]	※Set one-shot output time of OUT1. ※Setting range: 00.01 to 99.99sec, Hold. ※When 1st digit is flashing, press the ⪡ key once and HoLd appears. ※When input mode is S, t, d, oUt1 does not appear. (fixed as HOLD)
OUT output time※1 [oUt.t]	※Setting range: 00.01 to 99.99sec ※When input mode is F, n, S, t, d, oUt.t does not appear. (fixed as HOLD)
Decimal point※2 [dP]	**• 6-digit type** ------ ↔ -----.- ↔ ----.-- ↔ ---.--- ↔ --.---- ↔ -.----- **• 4-digit type** ---- ↔ ---.- ↔ --.-- ↔ -.--- ※Decimal point is applied to counting value and setting value.
Min. reset time [rSt]	1 ↔ 20, unit: ms ※Set min. width of external reset signal input.
Input logic [SIG]	nPn: No-voltage input, PnP: Voltage input ※Check input logic value (PNP, NPN).
Prescale decimal point※2 [SC.dP]	**• 6-digit type** -----.- ↔ ----.-- ↔ ---.--- ↔ --.---- ↔ -.----- **• 4-digit type** ---.- ↔ --.-- ↔ -.--- ※Decimal point of prescale should not set smaller than decimal point [dP].
Prescale value [SCL]	※Setting range of prescale value 6-digit type: 0.00001 to 99999.9, 4-digit type: 0.001 to 999.9
Start point value [Strt]	※Setting range (linked with decimal point [dP]): 6-digit type: 0.00001 to 999999, 4-digit type: 0.001 to 9999 ※When input mode is dn, dn-1, dn-2, start point value does not appear.
Memory protection [dAtA]	CLr ↔ rEC ※CLr: Resets the counting value when power OFF. rEC: Maintains the counting value when power OFF. (memory protection)
Key lock [LoCK]	LoFF ↔ LoC.1 ↕ ↕ LoC.3 ↔ LoC.2 ※LoFF: Unlock keys, key lock indicator turns OFF LoC.1: Locks RST key, key lock indicator turns ON LoC.2: Locks ⪡, ⩔, ⩓ keys, key lock indicator turns ON LoC.3: Locks RST, ⪡, ⩔, ⩓ keys, key lock indicator turns ON

※1: For PRESET1 model, oUt1 does not appear. The output time of oUt2 is displayed as oUt.t.
※2: Decimal point and prescale decimal point
Decimal point: Set the decimal point for display value regardless of prescale value.
Prescale decimal point: Set the decimal point for prescale value of counting value regardless of decimal point of display value.

■ Input Operation Mode (Counter)

Input mode	Counting chart	Operation
UP [UP]		※When INA is counting input, INB is no counting input. When INB is counting input, INA is no counting input.
UP-1 [UP- 1]		※When INA input signal is rising (_↑‾), it counts. ※INA: Counting input ※INB: No counting input
UP-2 [UP-2]		※When INA input signal is falling (‾↓_), it counts. ※INA: Counting input ※INB: No counting input
Down [dn]		※When INA is counting input, INB is no counting input. When INB is counting input, INA is no counting input.
Down-1 [dn- 1]		※When INA input signal is rising (_↑‾), it counts. ※INA: Counting input ※INB: No counting input
Down-2 [dn-2]		※When INA input signal is falling (‾↓_), it counts. ※INA: Counting input ※INB: No counting input
Up/ Down-A [Ud-A]		※INA: Counting input INB: Counting command input ※When INB is "L", counting command is up. When INB is "H", it is counting command is down .

Input Operation Mode (Counter)

<table>
<tr><th>Input mode</th><th>Counting chart</th><th>Operation</th></tr>
<tr><td>Up/
Down-B
[Ud-b]</td><td></td><td>※INA: Up counting input
INB: Down counting input
※When INA and INB input signals are rising ( ) at the same time, it maintains previous counting value.</td></tr>
<tr><td>Up/
Down-C
[Ud-C]</td><td></td><td>※When connecting encoder output A, B phase with counter input, INA, INB, set input mode [In.m] as phase different input [Ud-C] for counter operation.</td></tr>
</table>

※1: For selectable no-voltage input (PNP) , voltage input (NPN) model.
※A: over min. signal width, B: over than 1/2 of min. signal width. If the signal is smaller than these width, it may cause counting error (±1) .

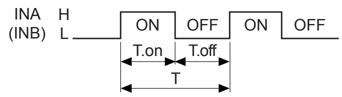
※The meaning of "H", "L"

Input method / Character	Voltage input (PNP)	No-voltage input (NPN)
H	5-30VDC	Short
L	0-2VDC	Open

※Min. signal width by counting speed

Counting speed	Min. signal width
1cps	500ms
30cps	16.7ms
1kcps	0.5ms
5kcps	0.1ms
10kcps	0.05ms

1cps=1Hz

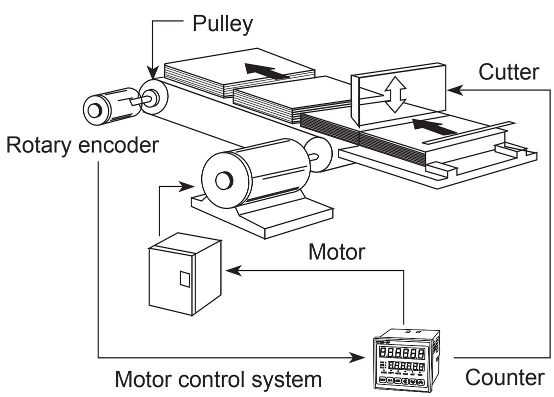


※T.on, T.off: Min. signal width

Prescale Function (Counter)

This function is to set and display calculated unit for actual length, liquid, position, etc. It is called “prescale value” for measured length, liquid, or position, etc per 1 pulse. For example, when moving L, the desired length to be measured, and P, the number of pulses per 1 revolution of a rotary encoder, occurs, prescale value is L/P.

E.g.) Positioning control by counter and encoder



[Diameter (D) of pulley connected with encoder= 22mm, the number of pulses by 1 rotation of encoder=1,000]

●Prescale value $= \dfrac{\pi \times \text{Diameter (D) of pulley}}{\text{The number of pulses by 1 rotation of encoder}}$

$= \dfrac{3.1416 \times 22}{1000}$

$= 0.069\text{mm/pulse}$

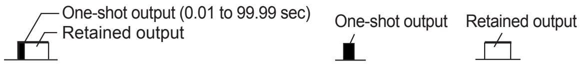
Set decimal point[dP] as [- - - - - .-], prescale decimal point [SC.dP] as [- - - .- - -], prescale value [SCL] as [0.069] at function setting mode. It is available to control conveyer position by 0.1mm unit.

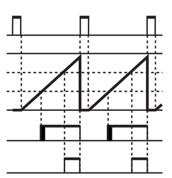
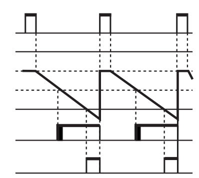
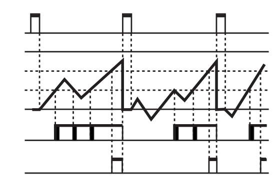
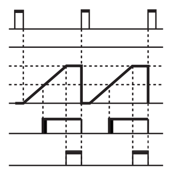
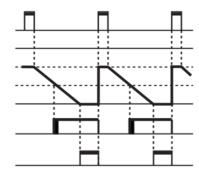
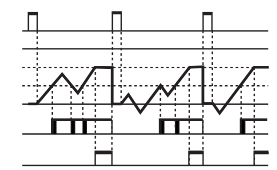
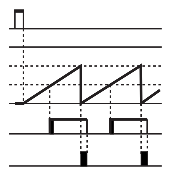
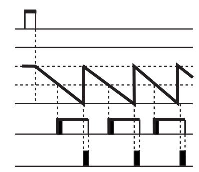
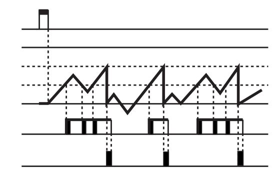
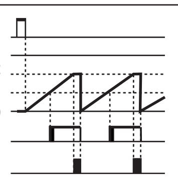
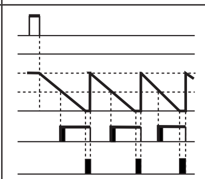
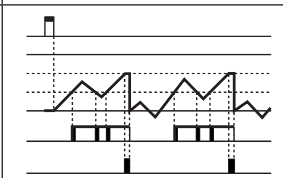
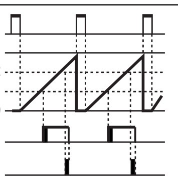
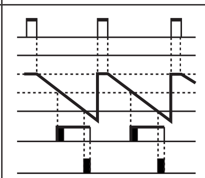
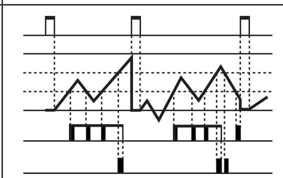
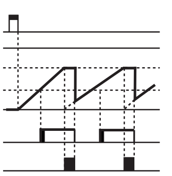
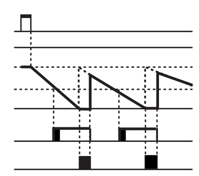
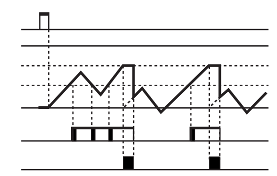
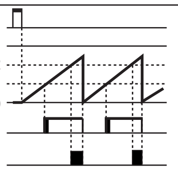
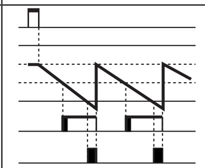
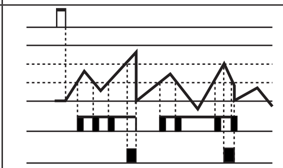
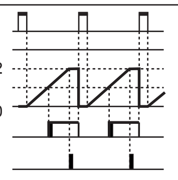
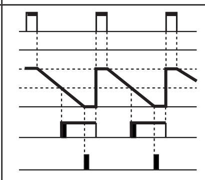
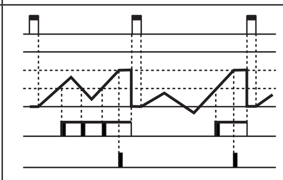
Start Point Function (Counter)

This function is that start at initial value set at Start Point [Strt] when on counting mode.

- In case of dn, dn-1 or dn-2 in timer input mode, it is not available.
- When reset is applied, the present value is initialized to start point.
- In case of C, r, P, q output operation mode, the present value starts at START POINT value after counting up.

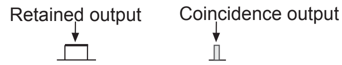
■ Output Operation Mode (Counter)

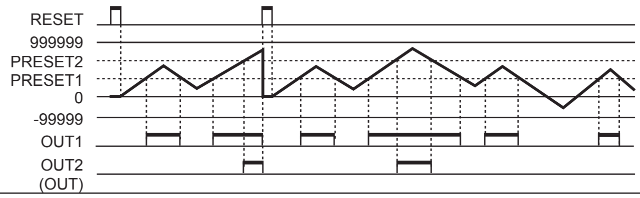
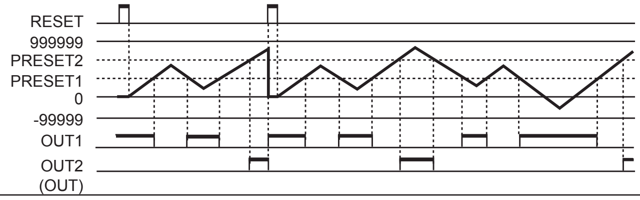
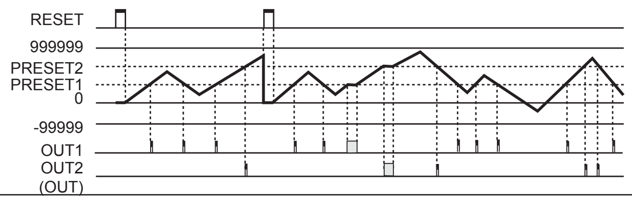


Output mode	Input mode: Up, Up-1, 2	Input mode: Down, Down-1, 2	Input mode: Up/Down A, B, C	Operation
F [F]	RESET 999999 PRESET2 PRESET1 0 OUT1 OUT2 (OUT) 			※After count-up, counting display value increases or decreases until reset signal is applied and retained output is maintained.
N [n]	RESET 999999 PRESET2 PRESET1 0 OUT1 OUT2 (OUT) 			※After count- up, counting display value and retained output are maintained until reset signal is applied.
C [C]	RESET 999999 PRESET2 PRESET1 0 OUT1 OUT2 (OUT) 			※When count-up, counting display value will be reset and count simultaneously. ※OUT1 retained output will be off after OUT2 one- shot time. ※The one-shot output time of OUT1 one-shot output time is operated gardless of OUT2 output.
R [r]	RESET 999999 PRESET2 PRESET1 0 OUT1 OUT2 (OUT) 			※After count-up, counting value display is reset after one-shot output time of OUT2 and it counts simultaneously. ※OUT1 retained output will be off after OUT2 one-shot time. ※OUT1 one-shot output time is operated regardless of OUT2 output.
K [k]	RESET 999999 PRESET2 PRESET1 0 OUT1 OUT2 (OUT) 			※After count-up, counting display value increases or decreases until RESET input is applied. ※OUT1 retained output is off after OUT2 one-shot time. ※OUT1 one-shot output time is operated regardless of OUT2 output.
P [P]	RESET 999999 PRESET2 PRESET1 0 OUT1 OUT2 (OUT) 			※After count-up, counting display value is maintained while OUT2 output is on. Counting value is internally reset and counts simultaneously. ※When OUT2 output is off, displays counting value while OUT2 is ON, and it increases or decreases. ※OUT1 retained output is off after OUT2 one-shot time. ※OUT1 one-shot output time is operated regardless of OUT2 output.
Q [q]	RESET 999999 PRESET2 PRESET1 0 OUT1 OUT2 (OUT) 			※After count-up, counting display value increases or decreases during OUT2 one-shot time. ※OUT1 retained output is off after OUT2 one-shot time. ※OUT1 one-shot output time is operated regardless of OUT2 output.
A [A]	RESET 999999 PRESET2 PRESET1 0 OUT1 OUT2 (OUT) 			※After count-up, counting display value and OUT1 retained output are maintained until RESET input is applied. ※OUT1 one-shot output time is operated regardless of OUT2 output.

※The PRESET1 type output (OUT) is operated as OUT2 of PRESET2 type.
※OUT1 output could be set to 0 in all modes and 0 value output turns ON.
※OUT2 output could not set to 0 in C[C], R[r], P[P] or Q[q] output mode.

■ Output Operation Mode (Counter)

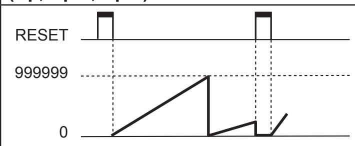
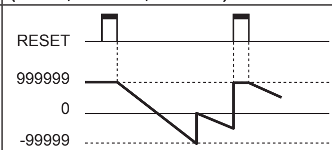
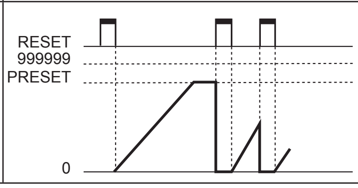
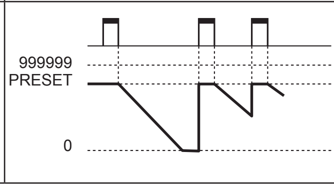


Output mode	Up/Down - A, B, C	Operation
S [S]		※OUT1 and OUT2 keep ON status in following condition: Counting display value ≧ PRESET1 Counting display value ≧ PRESET2
T [t]		※OUT1 output is off: Counting display value ≧ PRESET1 ※OUT2 keeps ON status in following condition: Counting display value ≧ PRESET2
D [d]		※When counting display value is equal to setting value [PRESET1, PRESET2) only, OUT1 or OUT2 output keeps ON status. ※When setting 1kcps for counting speed, solid state contact output should be used.

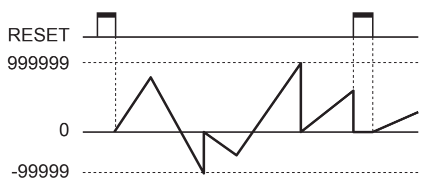
※The PRESET1 type output (OUT) is operated as OUT2 of PRESET2 type.
※The PRESET2 model OUT1 output is operated as one-shot or retained output. (except S, t, d mode)
※OUT1 output could be set to 0 in all modes and 0 value output turns ON.
※OUT2 output could not set to 0 in C[C], R[r], P[P] or Q[q] output mode.

■ Counter Operation Of The Indicator (CT6S-I, CT6Y-I, CT6M-I)

※Only displays on indicator models

Indicate mode [dSP.m]	Count chart: In case of input mode is Up (Up, Up-1, Up-2)	Count chart: In case of input mode is Down (Down, Down-1, Down-2)	Operation
TOTAL [totAL]			Count value increases or decreases until RESET input is applied. When input is over max./min. counting value, it displays 0. When Reset input is applied, it displays 0(Up)/999999(Down).
HOLD [HoLd]			Count value increases or decreases until RESET input is applied. When input is reaching preset value(Up)/0(Down), the display value is hold. When Reset input is applied, it displays 0(Up)/preset value(Down).

● In case of the Command input [Ud-A], Individual input [Ud-b], Phase difference input [Ud-C] mode.



※In case of UP/DOWN [Ud-A, Ud-b, Ud-C] input mode, indication mode [dSP.m] of the configuration is not displayed.

■ Parameter Setting (Timer)

([MD] key: Moves the settings, [▽], [△] key: Changes the settings)

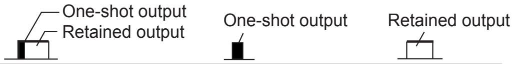
Parameter	Setting
Counter/Timer [C-t]	CoUn ↔ tI nE ※CoUn: Counter tI nE: Timer
Time range [HoUr/nI n/SEC]	● 6-digit type SEC 999.999 (0.001s to 999.999s) ↔ SEC 9999.99 (0.01s to 9999.99s) ↔ SEC 99999.9 (0.1s to 99999.9s) ↔ SEC 999999 (1s to 999999s) ↔ n S 9959.99 (0.01s to 99m59.99s) SEC 999.999 ↔ HoUr 99999.9 (0.1h to 99999.9h) n S 9959.99 ↔ n S 99959.9 (0.1s to 999m59.9s) HoUr 99999.9 ↔ H n 999959 (1m to 9999h59m) ↔ H n S 995959 (1s to 99h59m59s) ↔ nI n 999999 (1m to 999999m) ↔ nI n 99999.9 (0.1m to 99999.9m) ↔ n S 999959 (1s to 9999m59s) n S 99959.9 ↔ n S 999959 ● 4-digit type SEC 9.999 (0.001s to 9.999s) ↔ SEC 99.99 (0.01s to 99.99s) ↔ SEC 999.9 (0.1s to 999.9s) ↔ SEC 9999 (1s to 9999s) ↔ n S 9959 (1s to 99m59s) SEC 9.999 → HoUr 9999 (1h to 9999h) ↔ H n 9959 (1m to 99h59m) ↔ nI n 9999 (1m to 9999m) ↔ nI n 999.9 (0.1m to 999.9m) n S 9959 ↔ nI n 999.9
Up/Down mode [U-d]	UP ↔ dn ※UP: Time progresses from '0' to the setting time. dn: Time progresses from the setting time to '0'.
Indication mode [dSP.n]	totAL ↔ HoLd ↔ ont.d ↔ totAL ※Used for the indicator type only. ※It is added that the feature which set the setting time when selecting HoLd or ont.d
Memory protection [dAtA]	CLr ↔ rEC ※Used for the indicator type only. ※CLr: Reset time value when power is off. rEC: Memorizes time value at the moment of power off.
Output mode [oUt.n]	ond ↔ ond.1 ↔ ond.2 ↔ FLK ↔ FLK.1 ↔ FLK.2 ↔ I nt ↔ I nt.1 ↔ I nt.2 ↔ oFd ↔ nFd ↔ nFd.1 ↔ I ntG ↔ ond
OUT2 output time [oUt2]※1	※Set one-shot output time of OUT2. ※Setting range: 00.01 to 99.99sec, Hold. ※When 1st digit is flashing, press the [◁] key once and HoLd appears.
OUT1 output time [oUt1]※1	※Set one-shot output time of OUT1. ※Setting range: 00.01 to 99.99sec, Hold. ※When 1st digit is flashing, press the [◁] key once and HoLd appears.
OUT output time [oUt.t]※1	※Setting range: 00.01 to 99.99sec, Hold. ※When 1st digit is flashing, press the [◁] key once and HoLd appears.
Input logic [SI G]	nPn: No-voltage input, PnP: Voltage input ※Check input logic value (PNP, NPN).
Input signal time [I n.t]	1 ↔ 20, unit: ms ※CTS/CTY: Set min. width of INA, INH, RESET signal. ※CTM: Set min. width of INA, RESET, INHIBIT, BATCH RESET signal.
Key lock [LoCK]	LoFF ↔ LoC.1 ↔ LoC.2 ↔ LoC.3 ↔ LoFF ※LoFF: Unlock keys, key lock indicator turns OFF LoC.1: Locks [RST] key, key lock indicator turns ON LoC.2: Locks [◁], [▽], [△] keys, key lock indicator turns ON LoC.3: Locks [RST], [◁], [▽], [△] keys, key lock indicator turns ON

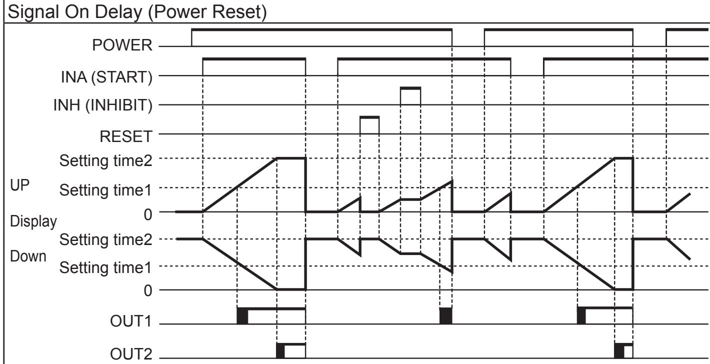
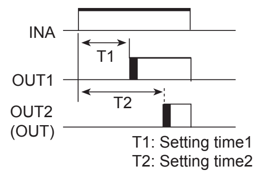
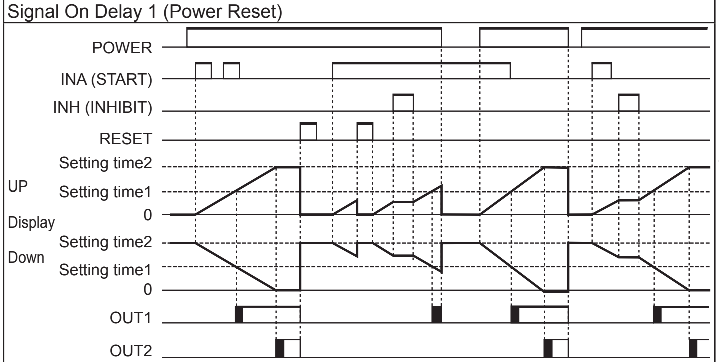
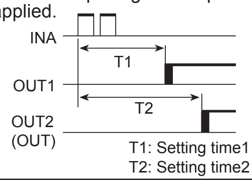
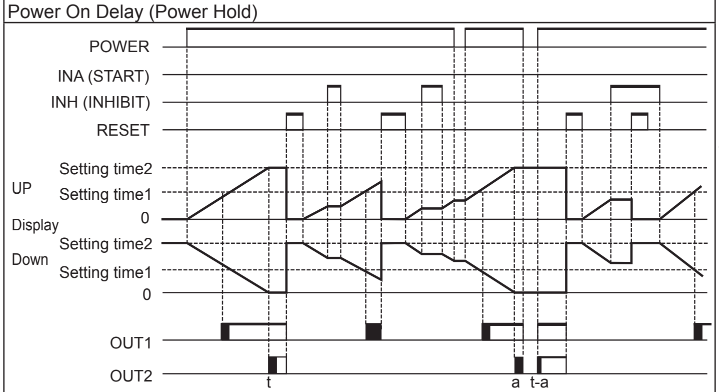
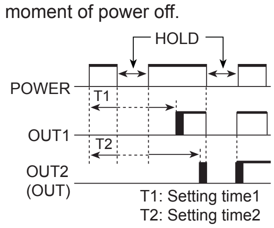
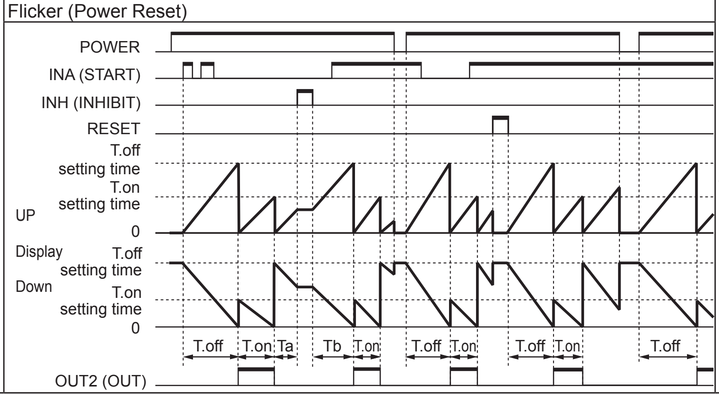
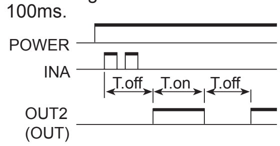
※1: When output mode is FLK.1, FLK.2, I ntG and ond, ond.1, ond.2 of PRESET1 model, oUt 1 does not appear. The output time of oUt2 is displayed as oUt.t . When output mode is ond, ond.1, ond.2, I nt.2, oUt 1 appears.

※2: I nt.2 mode is available only for PRESET2 model.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

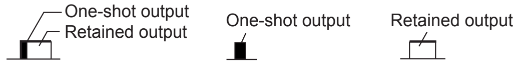
▣ Output Operation Mode (Timer)

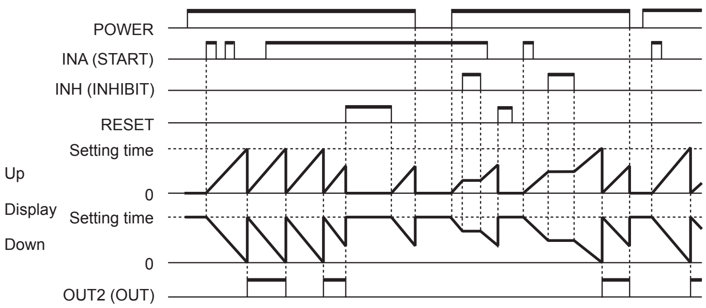
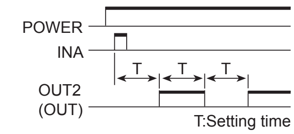
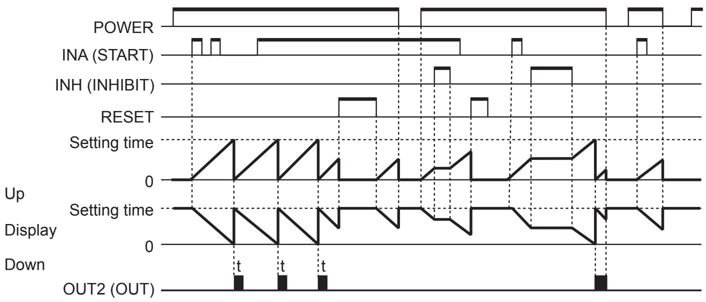
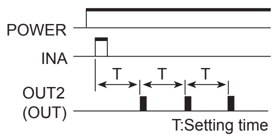
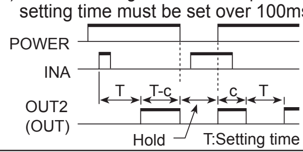
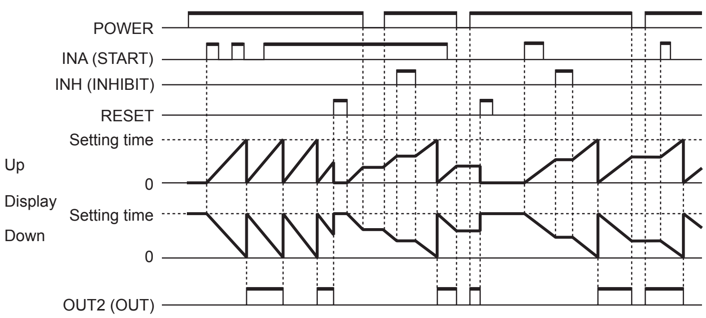
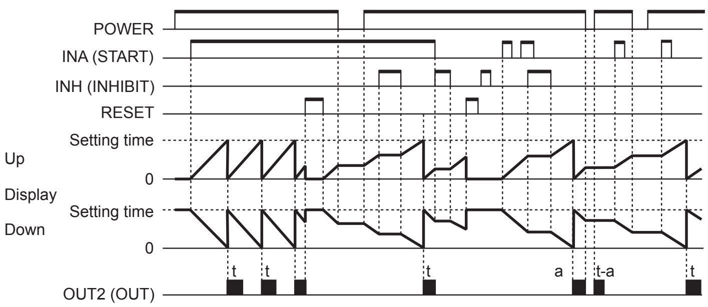
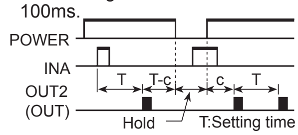


Output mode	Input mode	Operation
OND [ond]	Signal On Delay (Power Reset) 	1) Time starts when INA signal turns on. 2) When INA signal turns off, time resets. 3) When INA signal is on: Power ON Time Start is operated Power OFF Time Start is operated 4) Control output operates as retained or one-shot output. 
OND.1 [ond.1]	Signal On Delay 1 (Power Reset) 	1) Time starts when INA signal turns on, if INA signal is applied repeatedly, only initial signal is recognized. 2) When INA signal is on: Power ON Time Start is operated Power OFF Time Start is operated 3) Control output operates as retained or one-shot output. 4) Only first INA input signal is valid in case INA input signal is repeatedly applied. 
OND.2 [ond.2]	Power On Delay (Power Hold) 	1) Time starts when power turns on. (There is no INA function.) 2) Time resets when reset turns on. Time starts when reset turns off. 3) Control output operates as retained or one-shot output. 4) It memorizes display value at the moment of power off. 
FLK [FLK]	Flicker (Power Reset) 	1) Time starts when INA signal turns on. 2) When INA signal is on: Power ON Time Start is operated Power OFF Time Start is operated 3) Control output operates as retained output, output turns off for the T.off time and turns off for the T.off time and turns on for the T.on time repeatedly. Ta+Tb = T.off setting time 4) The T.on time and T.off time must be set individually. 5) In case of using the contact output, min.setting time must be set over 100ms. 

※Power Reset: There is no memory protection. (Initializes the display value when power is off)
Power Hold: There is memory protection. (Memorizes the display value at the moment of power off, indicates the memorized display value when power is resupplied.)

▣ Output Operation Mode (Timer)

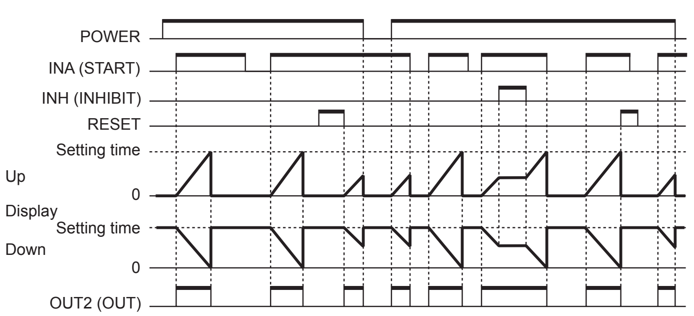
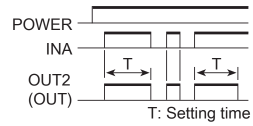
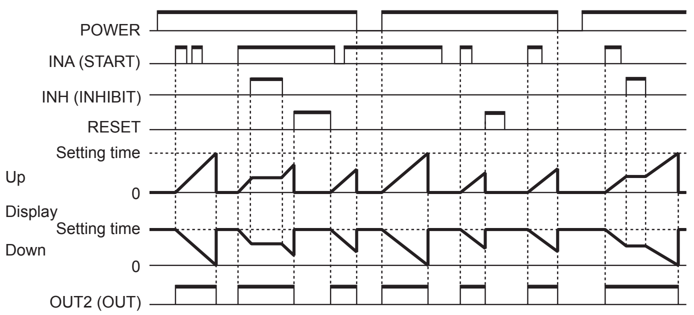
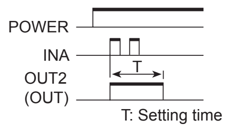
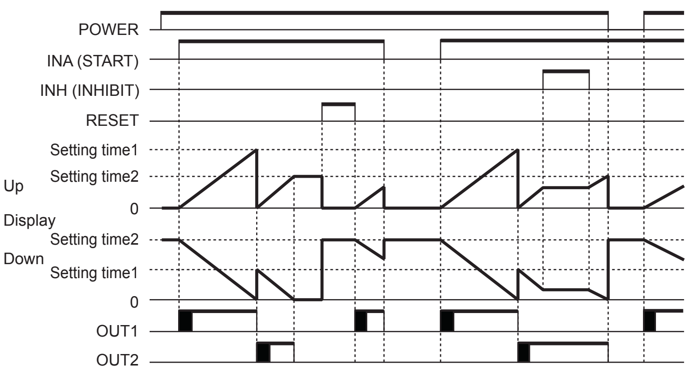
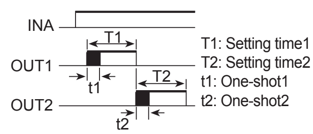


Output mode	Input mode	Operation
FLK.1 [FLK.1]	Flicker 1 (Power Reset)	
	Hold output 	1) Time starts when INA signal turns on. 2) When INA signal is on: Power ON Time Start is operated Power OFF Time Start is operated 3) Control output operates as retained output. 4) In case of using the contact output, min. setting time must be set over 100ms. 
	One-Shot output 	1) Time starts when INA signal turns on. 2) When INA signal is on: Power ON Time Start is operated Power OFF Time Start is operated 3) Control output operates as one-shot output. 4) In case of using the contact output, min. setting time must be set over 100ms. 
FLK.2 [FLK.2]	Flicker 2 (Power Hold)	1) Time starts when INA signal turns ON and the display value at the moment when power is off is memorized. 2) When INA signal is on: Power ON Time Start is operated Power OFF Time Start is operated 3) Control output operates as retained output. 4) Control output will be reversed when it reaches to setting time. (At the initial start, OUT2 control output is OFF). 5) In case of using the contact output, min. setting time must be set over 100ms. 
	Hold output 	
	One-Shot output 	1) Time starts when INA signal turns ON and the display value at the moment when power is off is memorized. 2) When INA signal is on: Power ON Time Start is operated Power OFF Time Start is operated 3) Control output operates as one-shot output. 4) In case of using the contact output, min. setting time must be set over 100ms. 

※Power Reset: There is no memory protection. (Initializes the display value when power is off)
Power Hold: There is memory protection. (Memorizes the display value at the moment of power off, indicates the memorized display value when power is resupplied.)

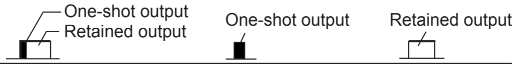
■ Output Operation Mode (Timer)

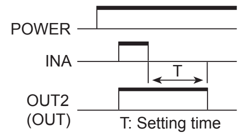
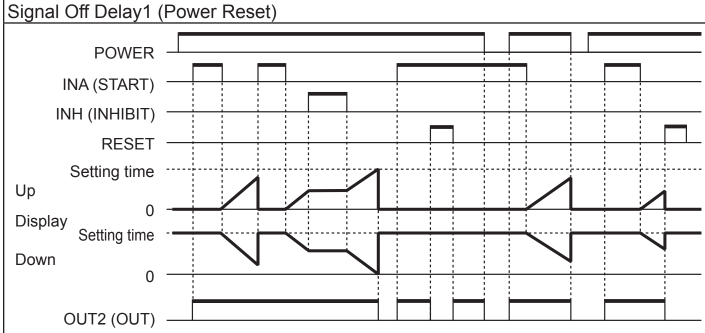
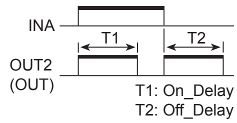
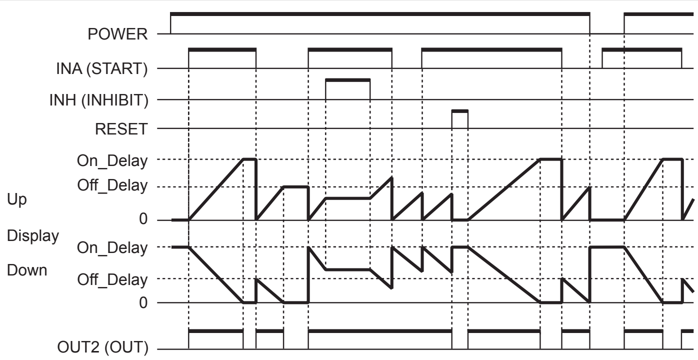
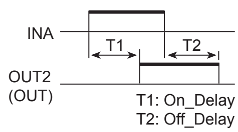
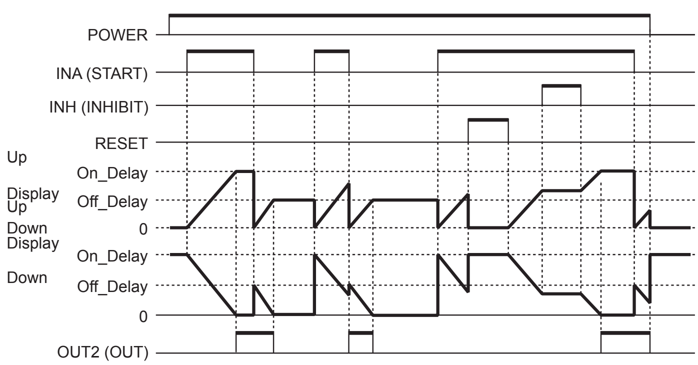
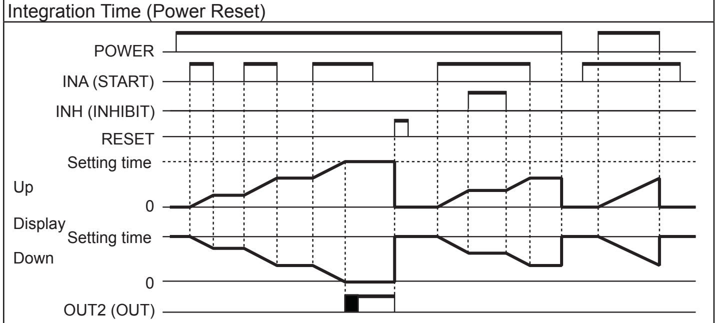
One-shot output / Retained output | One-shot output | Retained output

Output mode	Input mode	Operation
INT [int]	Interval (Power Reset)  	1) Control output turns ON and time starts when INA signal turns ON. 2) When INA signal is on: Power ON Time Start is operated Power OFF Time Start is operated 3) When it reaches setting time, indication value and control output are reset automatically. 4) Control output is ON when time is progressing. 
INT.1 [int.1]	Interval 1 (Power Reset)  	1) Control output turns ON and time starts when INA signal turns ON. 2) When INA signal is on: Power ON Time Start is operated Power OFF Time Start is operated 3) When it reaches setting time, indication value and control output are reset automatically. 4) Control output is ON when time is progressing. 5) INA input is ignored while time is progressing. 
INT.2 [int.2]	Interval 2 (Power Reset)  	1) Time starts when INA input is ON and resets when INA input is OFF. 2) INA input is ON, OUT1 output is ON during T1 or t1. 3) When it reaches setting time1, display value resets and OUT2 output is ON during T2 or t2 output time. ※ Output turns OFF when reaching the setting time even if one-shot time is longer than setting time.  (PRESET1 model has no INT.2 mode)

※Power Reset: There is no memory protection. (Initializes the display value when power is off)
Power Hold: There is memory protection. (Memorizes the display value at the moment of power off, indicates the memorized display value when power is resupplied.)

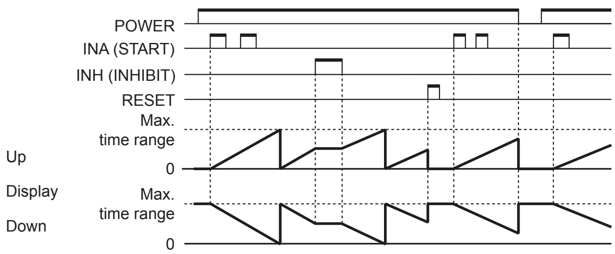
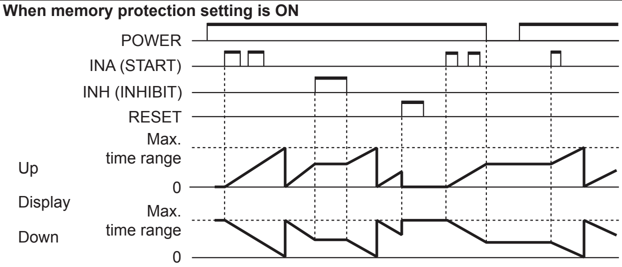
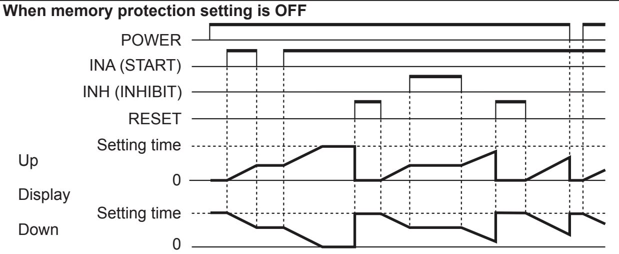
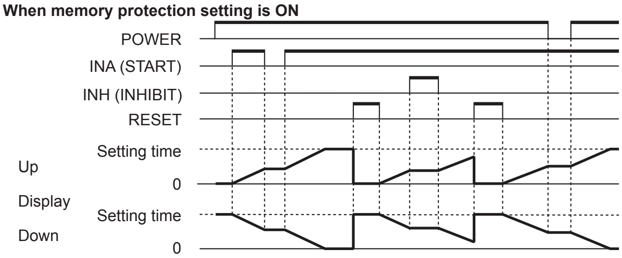
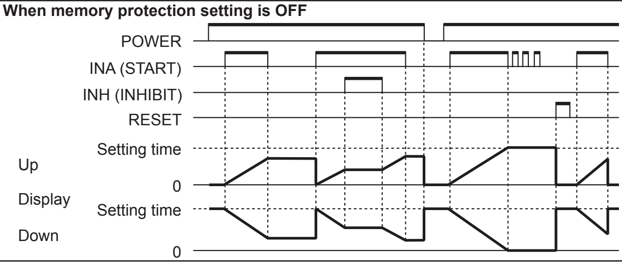
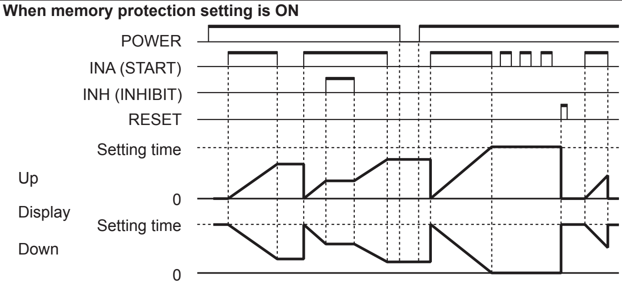
■ Output Operation Mode (Timer)



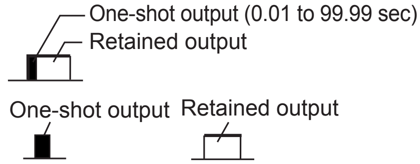
<table>
<tr><th>Output mode</th><th>Input mode</th><th>Operation</th></tr>
<tr><td rowspan="2">OFD
[oFd]</td><td>Signal Off Delay1 (Power Reset)</td><td rowspan="2">1) If INA is ON, control output remains ON. (except when power is off and reset is on)
2) When INA signal is OFF, time processes.
3) When it reaches setting time, indication value and control output are reset automatically.

</td></tr>
<tr><td>
</td></tr>
<tr><td rowspan="2">NFD
[nFd]</td><td>On-Off Delay (Power Reset)</td><td rowspan="2">1) When INA input is ON, output is ON and time is progressing, then output is OFF after On_Delay time.
2) When INA input is OFF, output is ON and time is progressing, then output is OFF after Off_Delay time.
3) If INA input is OFF within On_Delay time, step 2 starts again.
4) If INA input is ON within Off_Delay time, step 1 starts again.

</td></tr>
<tr><td>
</td></tr>
<tr><td rowspan="2">NFD.1
[nFd.1]</td><td>On-Off Delay1 (Power Hold)</td><td rowspan="2">1) When INA input turns ON, time progresses and output turns ON after On_Delay time.
2) When INA input turns OFF, time progresses and output turns OFF after Off_Delay time.
3) If INA input turns OFF within On_ Delay time, output will turn ON and step2 operate.
4) If INA input turns ON within Off_ Delay time, output will turn OFF and step1 operate.

</td></tr>
<tr><td>
</td></tr>
<tr><td rowspan="2">INTG
[IntG]</td><td>Integration Time (Power Reset)</td><td rowspan="2">1) Time is progressing while INA input is ON.
2) Time progress stops while INA input is OFF.
3) When it reaches the setting time, output is ON.</td></tr>
<tr><td>
</td></tr>
</table>

※Power Reset: There is no memory protection. (Initializes the display value and the output status when re-supplying the power.)
Power Hold: There is memory protection. (It memorizes the status of power off. When re-supplying the power, it returns the memorized display value and the output status.)

■ Timer Operation Of The Indicator (CT6S-I, CT6Y-I, CT6M-I)

TOTAL [totAL]	**When memory protection setting is OFF** 	1) Time starts when INA input is ON. 2) Setting value is initialized when Reset input is ON. 3) Time progress stops when INHIBIT input is ON. 4) Resets when power is OFF.
	When memory protection setting is ON 	1) Time starts when INA input is ON. 2) Setting value is initialized when Reset input is ON. 3) Time progress stops while INHIBIT input is ON. 4) Display value at the moment of power OFF is memorized.
HOLD [HoLd]	**When memory protection setting is OFF** 	1) Time progresses when INA input is ON. 2) Time progress stops while INA input is OFF. 3) When time reaches setting time, display value will stop and flash. 4) When reset input is applied, display value is initialized. 5) Resets when power is OFF.
	When memory protection setting is ON 	1) Time progresses when INA input is ON. 2) Time progress stops while INA input is OFF. 3) When time reaches setting time, display value will stop and flash. 4) When reset input is applied, display value is initialized. 5) Display value the moment when power is OFF is memorized.
On Time Display [ont.d]	**When memory protection setting is OFF** 	※ON time indicate mode of INA input 1) Time reset start operates when INA input turns ON. 2) Time progress stops while INA input is OFF. 3) When time progress stops and power is off, the display value is initialized. 4) If progress time is greater than setting time when INA input turns off, display value flashes and operation stops until reset signal is applied.
	When memory protection setting is ON 	※ON time indicate mode of INA input 1) Time reset start operates when INA input turns ON. 2) Time progress stops while INA input is OFF. 3) When time progress stops and power is off, the display value is memorized. 4) If progress time is greater than setting time when INA input turns off, display value flashes and operation stops until reset signal is applied.

▣ Timer '0' Time Setting



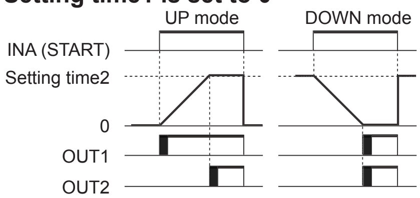
◎ Available output operation mode to set '0' time setting

ond, ond.1, ond2, nFd, nFd.1

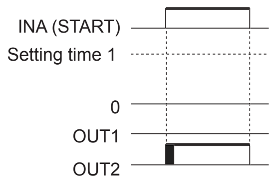
◎ Operation according to output mode (at 0 time setting)

1) OND (Signal ON Delay) mode [ond]

● Setting time1 is set to 0

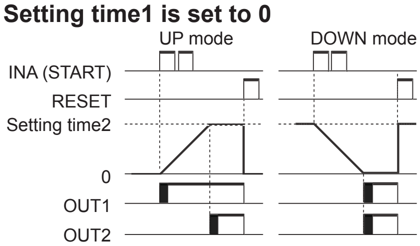


● Setting time2 is set to 0

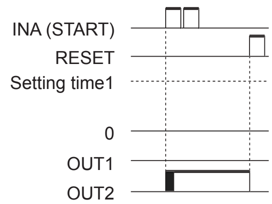


2) OND.1 (Signal ON Delay 1) mode [ond.1]

● Setting time1 is set to 0

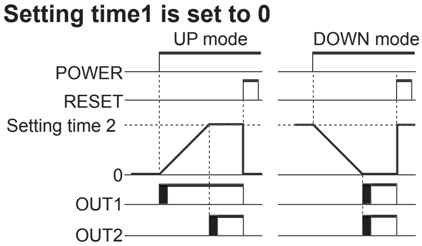


● Setting time2 is set to 0

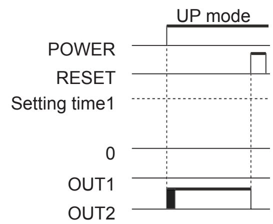


3) OND.2 (Power ON Delay2) mode [ond2]

● Setting time1 is set to 0

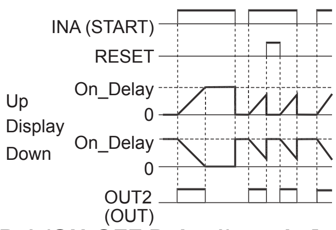


● Setting time2 is set to 0

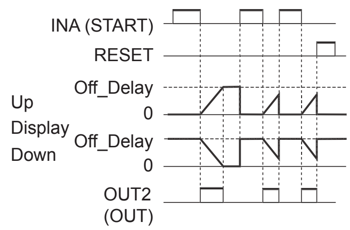


4) NFD (ON-OFF Delay) mode [nFd]

● OFF_Delay setting time is set to 0

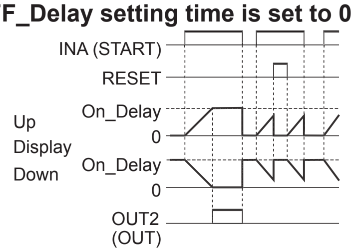


● ON_Delay setting time is set to 0

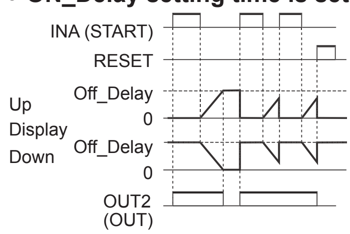


5) NFD.1 (ON-OFF Delay1) mode [nFd.1]

● OFF_Delay setting time is set to 0



● ON_Delay setting time is set to 0



◎ Setting value1 (PS1) is higher than Setting value2 (PS2)

OND[ond], OND.1[ond.1] or OND.2[ond2] output mode

- UP mode: When the timer setting value1 is greater than the setting value 2, OUT1 output does not turn ON.
- DOWN mode: When the timer setting value1 is greater than the setting value 2, OUT1 output does not turn ON. If the setting value 1 is same as the setting value2 and START signal is applied, OUT1 output turns ON immediately.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

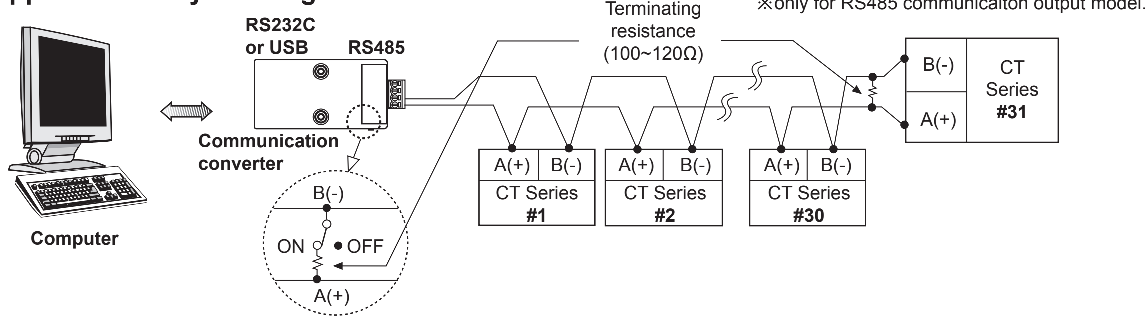
▣ Communication Mode

◎ Parameter setting

(MD key: To select setting mode, ⋎ or ⋏ key: To change setting value)

Setting mode	How to set	
Comm. address [Addr]	≪: To shift flashing digits of Comm. address. ⋎, ⋏: To change the flashing digits.	※Setting range of Comm. address: 1 to 127 ※If the same address is applied during multiComm., it will not work correctly.
Comm. speed [bPS]	24 ↔ 48 ↔ 96 ↔ 192 ↔ 384	※2400/4800/9600/19200/38400bps
Comm. parity [PrtY]	nonE ↔ EvEn ↔ odd	※nonE: None EvEn: Even number odd: Odd number
Comm. stop bit [StP]	1 ↔ 2	
esponse waiting time [rSwt]	≪: To shift flashing digits position of Comm. response waiting time. ⋎, ⋏: To change the flashing digits position value.	※Setting range according to comm. speed. 2400bps: 16ms to 99ms 4800bps: 8ms to 99ms 9600bps: 5ms to 99ms 19200bps: 5ms to 99ms 38400bps: 5ms to 99ms
Comm. write [Comw]	EnA ↔ diSA	※EnA: Permits Comm. write (Enable) diSA: Prohibits Comm. write (Disable)

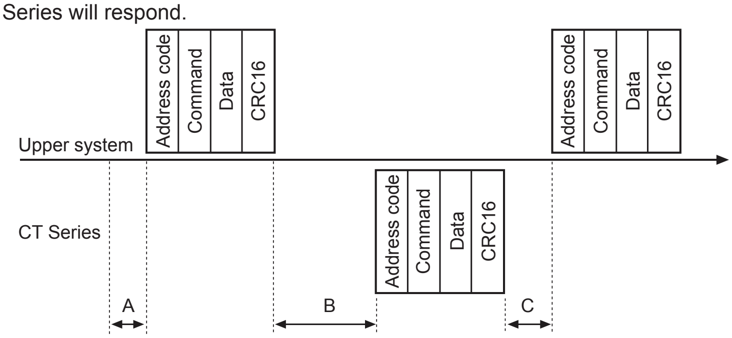
◎ Application of system organization



※It is recommended to use communication converter, RS485 to Serial converter (SCM-38I, sold separately), USB to RS485 converter (SCM-US48I, sold separately). Please use a proper twist pair for RS485 communication.

◎ Communication control ordering

1. The communication method is Modbus RTU (PI-MBUS-300-REV.J).
2. After 1sec of power supply into the high order system, it starts to communicate.
3. Initial communication will be started by the high order system. When a command comes out from the high order system, CT Series will respond.



※A → Min. 1sec after applying power

B → 38400bps: Approx. 1ms.
19200bps: Approx. 2ms.
9600bps: Approx. 4ms.
4800bps: Approx. 8ms.
2400bps: Approx. 16ms.

C → Min. 20ms

◎ Communication command and block

The format of query and response

1) Read Coil Status (Func. 01 H), Read Input Status (Func. 02 H)

● **Query (Master)**

Slave Address	Function	Starting Address		No. of Points		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC 16

● **Response (Slave)**

Slave Address	Function	Byte Count	Data	Data	Data	Error Check (CRC 16)	
						Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC 16

2) Read Holding Registers (Func. 03 H), Read Input Registers (Func. 04 H)

● **Query (Master)**

Slave Address	Function	Starting Address		No. of Points		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC 16

● **Response (Slave)**

Slave Address	Function	Byte Count	Data		Data		Data		Error Check (CRC 16)	
			High	Low	High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC 16

3) Force Single Coil. (Func 05 H)

● **Query (Master)**

Slave Address	Function	Coil Address		Force Data		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC 16

● **Response (Slave)**

Slave Address	Function	Coil Address		Force Data		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC 16

4) Preset Single Register (Func. 06 H)

● **Query (Master)**

Slave Address	Function	Register Address		Preset Data		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC 16

● **Response (Slave)**

Slave Address	Function	Register Address		Preset Data		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC 16

5) Preset Multiple Registers (Func. 10 H)

● **Query (Master)**

Slave Address	Function	Starting Address		No. of Register		Byte Count	Data		Data		Error Check (CRC 16)	
		High	Low	High	Low		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC 16

● **Response (Slave)**

Slave Address	Function	Starting Address		No. of Register		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC 16

6) Application

Read Coil Status (Func. 01 H)
Master reads OUT2 00002 (0001H) to 00003 (0002H), OUT1 output status (ON: 1, OFF: 0) from the Slave (Address 01).

● **Query (Master)**

Slave Address	Function	Starting Address		No. of Points		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
01 H	01 H	00 H	01 H	00 H	02 H	EC H	0B H

On slave side OUT2 00003 (0002H): OFF,
OUT1 00002 (0001H): ON

● **Response (Slave)**

Slave Address	Function	Byte Count	Data (00003 to 00001)	Error Check (CRC 16)	
				Low	High
01 H	01 H	01 H	02 H	D0 H	49 H

Read Input Register (Func. 04 H)Master reads preset value 21004 (03EBH) to 21005 (03ECH) of counter/timer, Slave (Address 15).

● **Query (Master)**

Slave Address	Function	Starting Address		No. of Points		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
0F H	04 H	03 H	EB H	00 H	02 H	00 H	95 H

In case that the present value is 123456 (0001 E240 H) in slave side, 31004 (03EBH): E240 H, 31005 (03ECH): 0001H

● **Response (Slave)**

Slave Address	Function	Byte Count	Data		Data		Error Check (CRC 16)	
			High	Low	High	Low	Low	High
0F H	04 H	04 H	E2 H	40 H	00 H	01 H	E2 H	28 H

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

◎ Modbus Mapping Table

1) Reset/Output

No. (Address)	Func.	Explanation	Setting range	Notice
00001 (0000)	01/05	Reset	0:OFF 1:ON	—
00002 (0001)	01	OUT2 output	0:OFF 1:ON	—
00003 (0002)	01	OUT1 output	0:OFF 1:ON	—
00004 (0003)	01	BATCH output	0:OFF 1:ON	For BATCH output model
00005 (0004)	01/05	BATCH resets	0:OFF 1:ON	For BATCH output model

2) Terminal input status

No. (Address)	Func.	Explanation	Setting range	Notice
10001 (0000)	02	INA input status	0:OFF 1:ON	Terminal input status
10002 (0001)	02	INB input status	0:OFF 1:ON	Terminal input status
10003 (0002)	02	INHIBIT input status	0:OFF 1:ON	Terminal input status
10004 (0003)	02	RESET input status	0:OFF 1:ON	Terminal input status
10005 (0004)	02	BATCH RESET input status	0:OFF 1:ON	Terminal input status

3) Product Information

No. (Address)	Func.	Explanation	Notice
30001 to 30100	04	Reserved	—
30101 (0064)	04	Product number H	Model ID
30102 (0065)	04	Product number L	
30103 (0066)	04	Hardware version	—
30104 (0067)	04	Software version	—
30105 (0068)	04	Model no. 1	"CT"
30106 (0069)	04	Model no. 2	"6M"
30107 (006A)	04	Model no. 3	"-2"
30108 (006B)	04	Model no. 4	"PT"
30109 (006C)	04	Reserved	—
30110 (006D)	04	Reserved	—
30111 (006E)	04	Reserved	—
30112 (006F)	04	Reserved	—
30113 (0070)	04	Reserved	—
30114 (0071)	04	Reserved	—
30115 (0072)	04	Reserved	—
30116 (0073)	04	Reserved	—
30117 (0074)	04	Reserved	—
30118 (0075)	04	Coil Status Start Address	0000
30119 (0076)	04	Coil Status Quantity	—
30120 (0077)	04	Input Status Start Address	0000
30121 (0078)	04	Input Status Quantity	—
30122 (0079)	04	Holding Register Start Address	0000
30123 (007A)	04	Holding Register Quantity	—
30124 (007B)	04	Input Register Start Address	0064
30125 (007C)	04	Input Register Quantity	—

4) Monitoring data

No. (Address)	Func.	Explanation	Setting range	Notice
31001 (03E8)	04	BA.O LED display status	0:OFF 1:ON	Bit 5
		OUT2 LED display status	0:OFF 1:ON	Bit 6
		OUT1 LED display status	0:OFF 1:ON	Bit 7
		BA.S LED display status	0:OFF 1:ON	Bit 10
		LOCK LED display status	0:OFF 1:ON	Bit 11
		PS2 LED display status	0:OFF 1:ON	Bit 12
		PS1 LED display status	0:OFF 1:ON	Bit 13
		TMR LED display status	0:OFF 1:ON	Bit 14
		CNT LED display status	0:OFF 1:ON	Bit 15
31002 (03E9)	04	Present value of BATCH counter	0 to 999999	For BATCH output model
31003 (03EA)				
31004 (03EB)	04	Present value of counter/timer	Counter 6digit type: -99999 to 999999 4digit type: -999 to 9999 Timer: Within time setting range	Use counter and timer in common
31005 (03EC)				
31006 (03ED)	04	Display unit	Counter: decimal point of display value Timer: Time range	Counter: 40058 Data Timer: 40102 Data
31007 (03EE)	04	PS (2) setting value	Counter 6digit type: -99999 to 999999 4digit type: -999 to 9999 Timer: Within time setting range	Use counter and timer in common
31008 (03EF)				
31009 (03F0)	04	PS1 setting value	Counter 6digit type: -99999 to 999999 4digit type: -999 to 9999 Timer: Within time setting range	Use counter and timer in common
31010 (03F1)				
31011 (03F2)	04	Setting value of BATCH counter	0 to 999999	Use counter and timer in common
31012 (03F3)				
31013 (03F4)	04	Checking the input logic	0: NPN, 1: PNP	

● Date format of 31001 (03E8) address bit

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit4	Bit 3	Bit 2	Bit 1	Bit 0
CNT	TMR	PS1	PS2	LOCK	BA.S	—	—	OUT1	OUT2	BA.O	—	—	—	—	—
0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0	0	0 or 1	0 or 1	0 or 1	0	0	0	0	0

※2 Words data format: Upper data has high number address.
E.g.)31004: Present Value (Low Word),
31005: Present Value (High Word)

5) Preset value setting group

No. (Address)	Func.	Explanation	Setting range	Notice
40001 (0000)	03 06 16	PS2 setting value PS setting value	Counter 6digit type: 0 to 999999 4digit type: 0 to 9999 Timer: Within time setting range	Use counter and timer in common
40002 (0001)				
40003 (0002)	03 06 16	PS1 setting value		Use counter and timer in common
40004 (0003)				
40005 (0004)	03 06 16	BATCH counter setting value	0 to 999999	Use counter and timer in common
40006 (0005)				

6) Function setting mode (Counter group)

No. (Address)	Func.	Explanation	Setting range	Notice
40051 (0032)	03/06/16	Counter/Timer [C-t]	1:CoUn 1:tImE	Use counter and timer in common
40052 (0033)	03/06/16	Input mode [In]	0:UP 1:UP-1 2:UP-2 3:dn 4:dn-1 5:dn-2 6:Ud-A 7:Ud-b 8:Ud-C	—
40053 (0034)	03/06/16	Indication mode [dISm]	0:totAL 1:HoLd	For the indicator
40054 (0035)	03/06/16	Output mode [oUtm]	0:F 1:n 2:C 3:r 4:K 5:P 6:q 7:A 8:S 9:t 10:d	—
40055 (0036)	03/06/16	Maximum counting speed [CPS]	0: 1 1: 30 2: 1K 3: 5K 4: 10K	—
40056 (0037)	03/06/16	OUT2 (OUT) output time	0001 to 9999	unit: ×10ms
40057 (0038)	03/06/16	OUT1 Output time	0001 to 9999	unit: ×10ms
40058 (0039)	03/06/16	Decimal point [dP]	0:------ 2:----.-- 4:--.---- 1:-----.- 3:---.--- 5:-.-----	4digit type 0:---- 1:---.- 2:--.-- 3:-.---
40059 (003A)	03/06/16	Min. reset time [rSt]	0: 1 1: 20	unit: ms
40060 (003B)	03/06/16	Prescale decimal point position [SCL.d]	0:-----.- 3:---.--- 5:-.----- 2:----.-- 4:--.----	4digit type 1:---.- 2:--.-- 3:-.---
40061 (003C) 40062 (003D)	03/06/16	Prescale value [SCL]	6digit type: 0.00001 to 999999 4digit type: 0.001 to 9999	Connected with prescale decimal point position
40063 (003E) 40064 (003F)	03/06/16	Start value [Strt]	6digit type: 000000 to 999999 4digit type: 0000 to 9999	Connected with decimal point position of display value
40065 (0040)	03/06/16	Memory protection [dAtA]	0:CLr 1:rEC	Use counter and timer in common
40066 (0041)	03/06/16	Lock key [LoCK]	0:L.oFF 1:LoC.1 2:LoC.2 3:LoC.3	

7) Function setting mode (Timer group)

No. (Address)	Func.	Explanation	Setting range	Notice
40101 (0064)	03/06/16	Counter/Timer[C-t]	0: CoUn 1: tImE	Use counter and timer in common
40102 (0065)	03/06/16	Time range [HoUr/mIn/SEC]	4digit type 0: 0.001s to 9.999s 1: 0.01s to 99.99s 2: 0.1s to 999.9s 3: 1s to 9999s 4: 1s to 99m59s 5: 0.1m to 999.9m 6: 1m to 9999m 7: 1m to 99h59m 8: 1h to 9999h 6digit type 0: 0.001s to 999.999s 1: 0.01s to 9999.99s 2: 0.1s to 99999.9s 3: 1s to 999999s 4: 0.01s to 99m59.99s 5: 0.1s to 999m59.9s 6: 1s to 9999m59s 7: 1m to 99999.9m 8: 1m to 999999m 9: 1s to 99h59m59s 10: 1m to 9999h59m 11: 0.1h to 99999.9h	—
40103 (0066)	03/06/16	UP/Down mode [U-d]	0: UP 1: dn	—
40104 (0067)	03/06/16	Output mode [oUtm]	0: ond 1: ond.1 2: ond.2 3: FLK 4: FLK.1 5: FLK.2 7: Int.1 8: Int.2 9: oFd 10: nFd 11: nFd.1 12: Int.G	—
40105 (0068)	03/06/16	OUT2 (OUT) Output time [oUt2]	0000 to 9999 (0: Hold)	unit: ×10ms
40106 (0069)	03/06/16	OUT1 Output time [oUt1]	0000 to 9999 (0: Hold)	unit: ×10ms
40107 (006A)	03/06/16	Input signal time [Int]	0: 1 1: 20	unit: ms
40108 (006B)	03/06/16	Memory protection [dAtA]	0: CLr 1: rEC	Use counter and timer in common
40109 (006C)	03/06/16	Lock key [LoCK]	0: L.oFF 1: LoC.1 2: LoC.2 3: LoC.3	Use counter and timer in common
40110 (006D)	03/06/16	ndication mode [dSP.m]	0: totAL 1: HoLd 2: ont.d	For the indicator

8) Function setting mode (Communication group)

No. (Address)	Func.	Explanation	Setting range	Notice
40151 (0096)	03/06/16	Comm. address [Addr]	1 to 127	—
40152 (0097)	03/06/16	Comm. speed [bPS]	0: 24 1: 48 2: 96 3: 192 4: 384	unit: ×100bps
40153 (0098)	03/06/16	Comm. parity [PrtY]	0: nonE 1: EvEn 2: odd	—
40154 (0099)	03/06/16	Stop bit [StP]	0: 1 1: 2	—
40155 (009A)	03/06/16	Response waiting time [rSW.t]	05 to 99	unit: ms
40156 (009B)	03/06/16	Comm. writing [Com.W]	0: EnA 1: dISA	—

◎ Exception processing

When communication error occurs, the highest bit of received function is set to 1, then sends response command and transmits exception code.

Slave Address	Function + 80H	Exception Code	Error Check (CRC16)	
			Low	High
1Byte	1Byte	1Byte	1Byte	1Byte

- Illeegal Function (Exception Code: 01H): Not supporting command
- Illegal Data Address (Exception Code: 02H): Mismatch between the number of asked data and the number of ansmittable data.
- Illegal Data Value (Exception Code: 03H): Mismatch between asked the number of data and transmittable the number of data in device
- Slave Device Failure (Exception Code: 04H): Command is processed incorrectly.

Example)
Master reads output status (ON:1, OFF:0) of non existing coil 01001 (03E8 H) from Slave (Address17).

● Query (Master)

Slave Address	Function	Starting Address		No. of Points		Error Check (CRC16)	
		High	Low	High	Low	Low	High
11H	01H	03H	E8H	00H	01H	##H	##H

● Response (Slave)

Slave Address	Function + 80H	Exception Code	Error Check (CRC16)	
			Low	High
11H	81H	02H	##H	##H

▣ Read And Write Of Parameter Value Using Communication

◎ Read of the parameter area

00002 (OUT2), 00003 (OUT1), 00004 (BA, 0), 10001 to 10005 (Terminal input), 30101 to 30125 (Product information), 31001 to 31013 (Monitoring data)

◎ Read and write of the parameter area

00001 (Reset starts), 00005 (BATCH Reset starts), 40001 to 40006 (Setting value saving group),
40051 to 40066 (Counter setting group), 40101 to 40110 (Timer setting group),
40151 to 40156 (Communication setting group)

◎ Read of communication

Read parameter value using communication. (Function: 01H, 02H, 03H, 04H)
It is able to read communication regardless of permitting/prohibiting communication writing.

◎ Communication write

Change parameter value using communication. (Function: 05H, 06H, 10H)

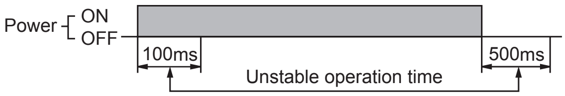
- When changing the parameter setting value of '▣ Function setting mode Counter group' or '▣ Function setting mode Timer group' using communication, reset indication will flash in 3 sec and display value will be reset. (Counting display value and progress time before changing parameter setting value are not saved.)
- When changing the parameter setting value of '▣ Preset value setting group' or '▣ Function setting mode Communication group' using communication, counting display value or progress time will not be reset.
- In prohibit writing communication setting (Com.W = 1: dISA), a write command does not process.
- If setting value beyond the setting range, this setting value is substituted for the value within the setting range and then memorized.

▣ Factory Default

	Parameter	Factory default
Counter	In	Ud-C
	oUt.ñ	F
	dSP.ñ	totAL
	CPS	30
	oUt2 (oUt.t)	Hold (fixed)
	oUt1	00.10
	dP	------
	rSt	20
	SIG	nPn
	SC.dP	6-digit type: -.----- 4-digit type: -.---
	SCL	6-digit type: 1.00000 4-digit type: 1.000
	Strt	000000
	dAtA	CLr
Timer	HoUr/ñIn/SEC	6-digit type: 0.001s–999.999s 4-digit type: 0.001s–9.999s
	U-d	UP
	dSP.ñ	totAL
	dAtA	CLr
	oUt.ñ	ond
	oUt2 (oUt.t)	HoLd
	oUt1	00.10
	SIG	nPn
	Int	20
General	LoCK	L.oFF
	PS1	1000
	PS2	5000
Comm.	Addr	001
	bPS	96
	PrtY	nonE
	StP	2
	rSWt	20
	CoñW	EnA

▣ Cautions During Use

◎ Power ON/OFF



- The inner circuit voltage rises within 100ms after supplying the power to the unit. The input is unavailable at this period. Be sure that the inner circuit voltage drops within 500ms after turning OFF the power.

◎ In case of 24VAC / 24-48VDC model, power supply should be insulated and limited voltage/current or Class 2 power supply device.

◎ Input signal line

- Shorten the cable from the sensor to the unit.
- Use shield cable when input cable is longer.
- Wire the input signal line separately from power line.

◎ Input logic selection

Before selecting input logic, must cut off the power to counter/timer. Select the input logic following the instruction.

◎ Contact counting input (counter operation)

If apply contact input at high speed mode (1k, 5k, 10kcps), it may cause miscount by chattering.
Therefore set low speed mode (1cps or 30cps) at contact input.

◎ Testing dielectric voltage or insulation resistance when the unit is installed at control panel

- Isolate the unit from the circuit of control panel.
- Short all terminals of the unit.

◎ Do not use the unit in the following environments.

- Environments with high vibration or shock.
- Environments with strong alkali or strong acid materials
- Environments with exposure to direct sunlight
- Near machinery which produce strong magnetic force or electric noise

◎ This product may be used in the following environments.

- Indoor
- Max. altitude: 2,000m
- Pollution degree 2
- Installation category II

FXY Series

DIN W72×H36mm Of Counter/Timer With Indication Only

■ Features

- Upgraded counting speed: 1cps/30cps/2kcps/5kcps
- Application of Up/Down input mode
- Selectable Up/Down indication of display value
- Wide range of input power supply:
  100-240VAC 50/60Hz
  12-24VAC 50/60Hz, 12-24VDC universal
- Selectable Counter or Timer function by internal DIP switch
  selectable time ranges
- Built-in Microprocessor

⚠ **Please read "Caution for your safety" in operation manual before using.**

c US

■ Ordering Information

FX | 4 | Y — I

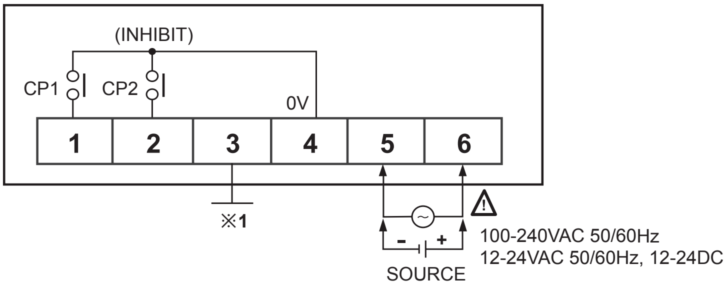
Code		Description
Output	I	Indicator
Size	Y	DIN W72×H36mm
Digit	4	9999 (4-digit)
	6	999999 (6-digit)
Item	FX	Counter/Timer

■ Specifications

Model		FX4Y-I	FX6Y-I
Digit		4-digit	6-digit
Digit size		W8×H14mm	W4×H8mm
Power supply	AC voltage	100-240VAC 50/60Hz	
	AC/DC voltage	12-24VAC 50/60Hz, 12-24VDC	
Allowable voltage range		90 to 110% of rated voltage	
Power consumption	AC voltage	Max. 4.5VA (100-240VAC 50/60Hz)	
	AC/DC voltage	Max. 4.5VA (12-24VAC 50/60Hz), Max. 2.8W (12-24VDC)	
Max. counting speed		Selectable 1cps/30cps/2kcps/5kcps by internal DIP switch	
Min. input signal width	INHIBIT input	Approx. 20ms	
	RESET input		
Input	CP1, CP2 input	No voltage input - Impedance at short-circuit: Max. 470Ω, Residual voltage at short-circuit: Max. 1VDC Impedance at open-circuit: Min. 100kΩ	
	RESET input		
Memory protection		Approx. 10 years (when using non-volatile semiconductor memory)	
Eexternal power		Max. 12VDC ±10% 50mA	
Insulation resistance		Over 100MΩ (at 500VDC megger)	
Dielectric strength		2,000VAC 50/60Hz for 1 minute	
Noise immunity	AC voltage	±2kV the square wave noise (pulse width: 1μs) by the noise simulator	
	DC voltage	±500V the square wave noise (pulse width: 1μs) by the noise simulator	
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1hour	
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min	
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times	
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Environ-ment	Ambient temperature	10 to 55℃, storage: -25 to 65℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Approval		c US	
Unit weight		Approx. 130g	Approx. 132g

※Environment resistance is rated at no freezing or condensation.

■ Connections

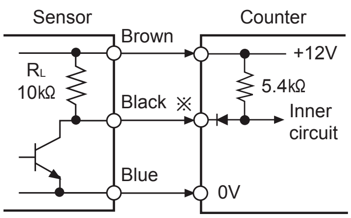


※1: It can be selected RESET or sensor power (+12VDC 50mA) by internal PIN operation. (Refer to J-40)
※CP1, CP2: Input signal terminals when using as counter.
※INHIBIT (CP2): Time Hold terminal when using for timer (Connect switch to ❷+❹ from the external.)
※Operated by a Power ON Start method when it is used as a timer.

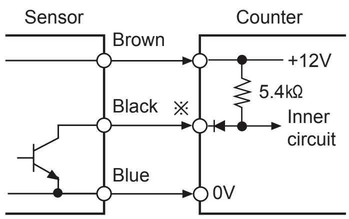
■ Input Connections

◎ Using for no-voltage input (NPN)

● Solid-state input (standard sensor: NPN output type sensor)



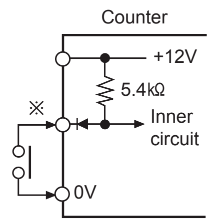
(NPN output)



(NPN open collector output)

※CP1, CP2 (INHIBIT), RESET input

● Contact input

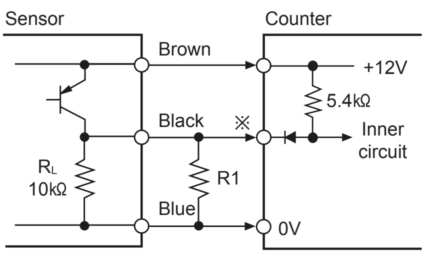


※Counting speed:
1 or 30cps setting (counter)

◎ Using for voltage input (PNP)

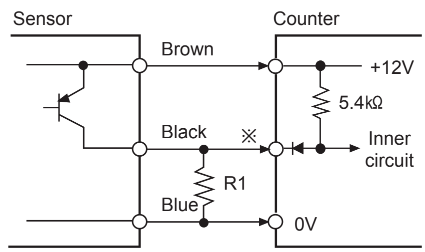
FXY series is for no-voltage input type, it is not available to count applying DC voltage from the external.
For using PNP type sensor, please use as the following to count.

● PNP output type sensor



(PNP output)

● PNP open collector output type sensor



(PNP open collector output)

※Please set R1 value to make the composed resistance of R_L + R1 as Max. 470kΩ is an impedance for short-circuit.
※CP1, CP2 (INHIBIT), RESET input

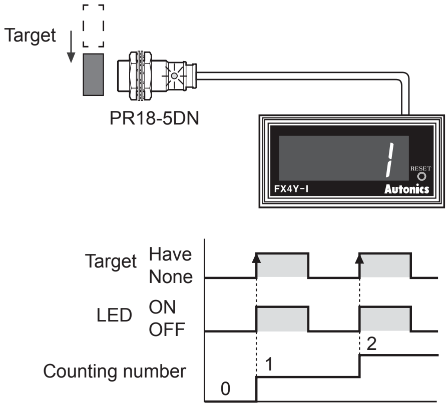
※In case of PNP open collector output type sensor, please connect lower than 470Ω of R1 to input terminal before using.

■ Counting Method

Be careful to select sensor because the counting method of NPN output type sensor is different from PNP output type sensor.

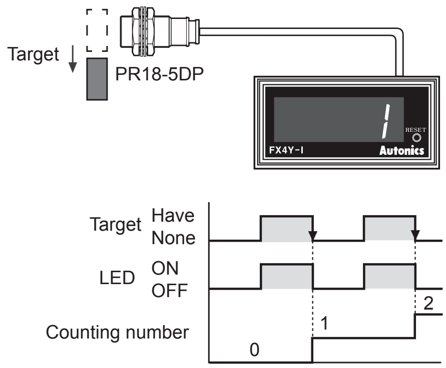
● NPN output type sensor

: When the sensor is changed from OFF to ON, it counts.



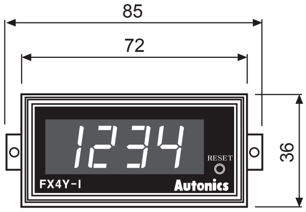
● PNP output type sensor

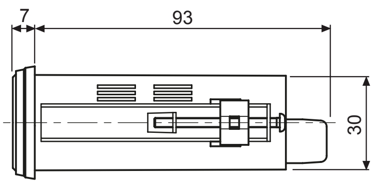
: When the sensor is changed from ON to OFF, it counts.



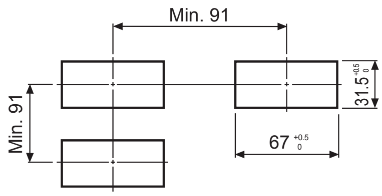
■ Dimensions

(unit: mm)



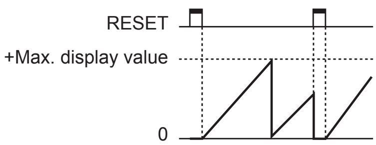


● Panel cut-out

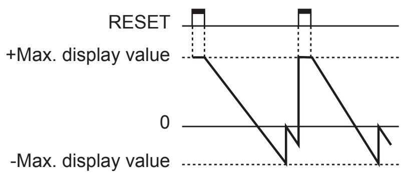


■ Counting Operation Of Indication Type (Counter)

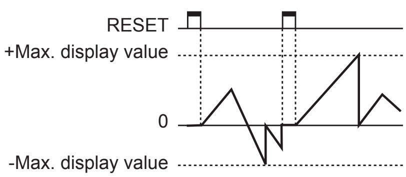
● Up mode



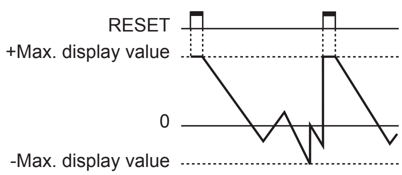
● Down mode



● Up/Down-A, B, C mode

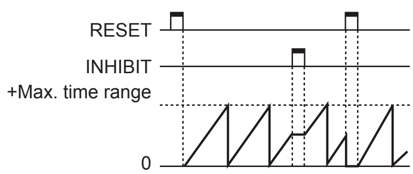


● Up/Down-D, E, F mode

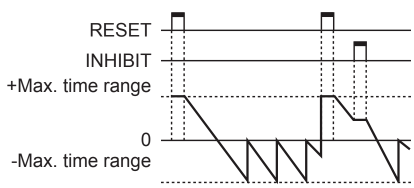


■ Counting Operation Of Indication Type (Timer)

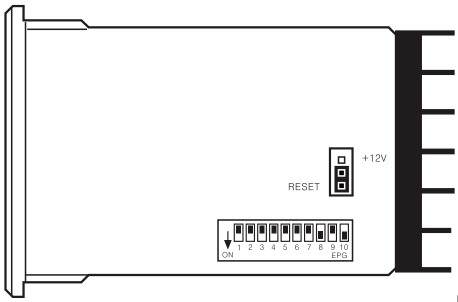
● Up mode

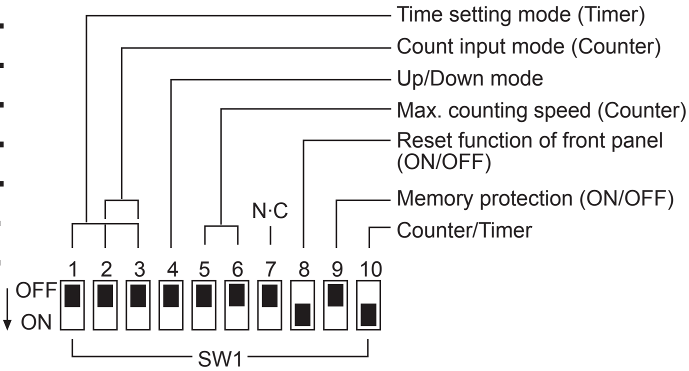


● Down mode



Description Of Inner DIP Switches





※Inner selection switch is changed from 8pin to 10pin with upgrade of counting speed.

● Up/Down mode

SW1		Function
4	OFF	Up mode
	ON	Down mode

● Reset function of front panel (ON/OFF)

SW1		Function
8	OFF	Disable the front panel reset function
	ON	Enable the front panel reset function

● Memory protection (ON/OFF)

SW1		Function
9	OFF	Enable the memory protection
	ON	Disable the memory protection

● Counter/Timer

SW1		Function
10	OFF	Timer
	ON	Counter

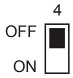
● Max. counting speed

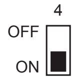
SW1 (5, 6)	CP1, CP2
5: ON, 6: OFF	**1cps**
5: OFF, 6: OFF	30cps
5: OFF, 6: ON	2kcps
5: ON, 6: ON	**5kcps**

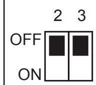
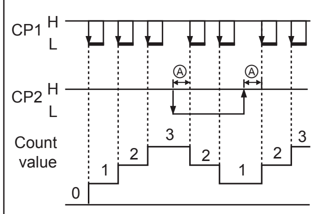
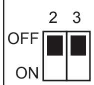
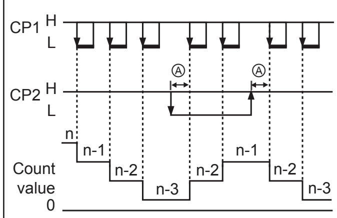
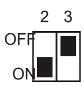
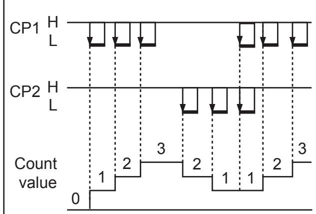
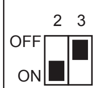
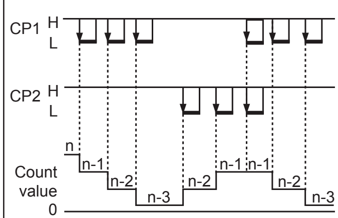
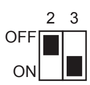
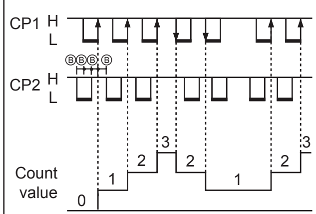
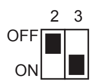
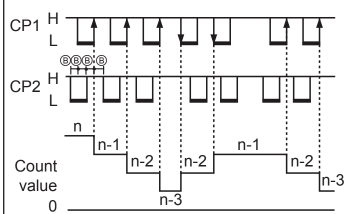
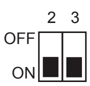
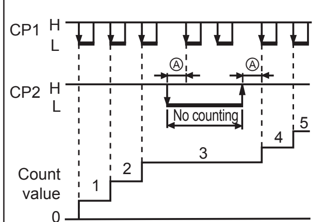
Time Setting Mode (Timer)

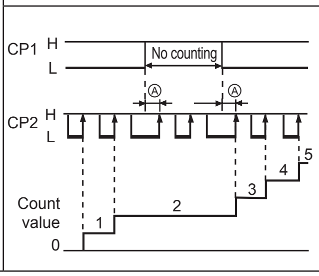
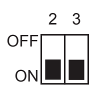
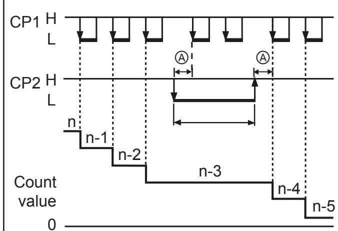
SW1 (1 2 3)	4-digit	6-digit	SW1 (1 2 3)	4-digit	6-digit
OFF OFF OFF	**99.99sec**	**99999.9sec**	OFF OFF ON	**999.9min**	**99999.9min**
ON OFF OFF	**999.9sec**	**999999sec**	ON OFF ON	**99hour 59min**	**99hour 59min 59sec**
OFF ON OFF	**9999sec**	**99min 59.99sec**	OFF ON ON	**999.9hour**	**9999hour 59min**
ON ON OFF	**99min 59sec**	**999min 59.9sec**	ON ON ON	**9999hour**	**99999.9hour**

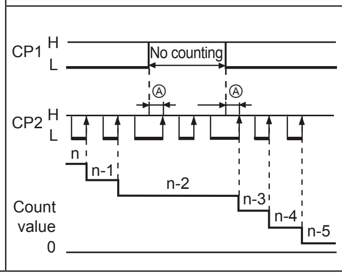
■ Input Mode (Counter)

<table>
<tr><td>Input mode</td><td>SW1</td><td>

Up mode</td><td>Input mode</td><td>SW1</td><td>

Down mode</td></tr>
<tr><td>Up/Down-A (Command input)</td><td>
</td><td>
</td><td>Up/Down-D (Command input)</td><td>
</td><td>
</td></tr>
<tr><td>Up/Down-B (Individual input)</td><td>
</td><td>
</td><td>Up/Down-E (Individual input)</td><td>
</td><td>
</td></tr>
<tr><td>Up/Down-C (Phase difference input)</td><td>
</td><td>
</td><td>Up/Down-F (Phase difference input)</td><td>
</td><td>
</td></tr>
<tr><td>UP (Count up input)</td><td>
</td><td>


</td><td>Down (Count down input)</td><td>
</td><td>


</td></tr>
</table>

※Ⓐ: Over min. signal width, Ⓑ: Over 1/2 of min. signal width.
If the signal width of Ⓐ or Ⓑ is less than min. signal width, ±1 of count error occurs.
※n: + max. display value (FX4Y-I: 9999, FX6Y-I: 999999)

■ Proper Usage

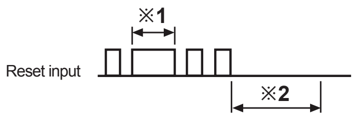
◎ Reset

● Reset

When selecting a reset input/output mode, please apply the external reset or manual reset signal.
If it is not reset, it is operated as the prior mode.

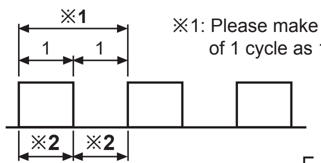
● Reset signal width

It is reset perfectly when the reset signal is applied for **min. 20ms** regardless of the contact input & solid-state input.



※1: In case of a contact reset, it is reset perfectly if the ON time of reset signal is applied for min. 20ms even though a chattering occurs.
※2: Signal input (CP1, CP2) is possible if there is no reset input for min. 50ms after reset input.

◎ Min.signal width

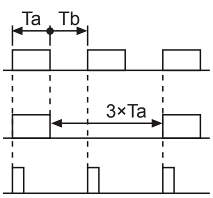


※1: Please make duty ratio (ON/OFF) of 1 cycle as 1:1.

※2: Min. signal width
- 1cps: Min. 500ms
- 30cps: Min. 16.7ms
- 2kcps: Min. 0.25ms
- 5kcps: Min. 0.1ms

◎ Max. counting speed

This is a response speed per 1 sec when the duty ratio (ON/OFF) of input signal is 1:1.
If the duty ratio is not 1:1, the width between ON and OFF should be over min. signal width and the response speed will getting slower against input signal. And one of ON width and OFF width is under min. signal width, this product may not response.



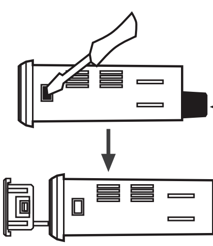
Ta (ON width) and Tb (OFF width)need to be over min. signal width.

When duty ratio is 1:3, the max.counting speed will be 1/2 from the rated spec.

It can not respond if it is smaller than min. signal width (Ta).

◎ Detach the case from body

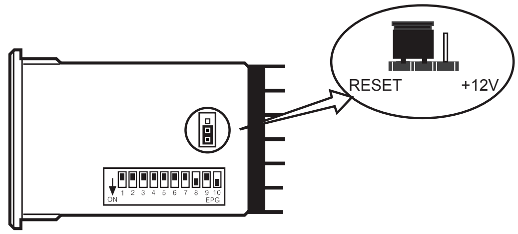
While pushing the Lock part with driver to the front, push the terminal block.



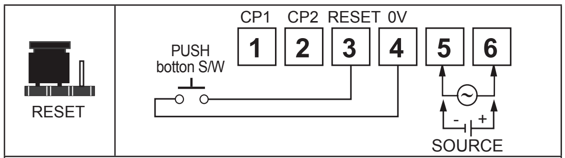
Push the terminal block to front part.

※Be careful not to be wounded by tools.

◎ Using switching pin of Reset / +12V

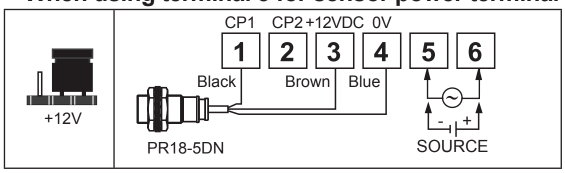


● When using terminal 3 for external reset terminal

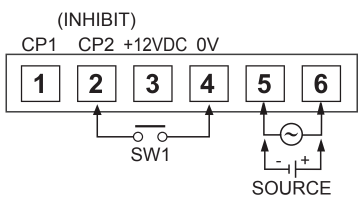


Provide sensor power from external when using sensor and connect counter 0V terminal 4 to GND (0V) of external power.

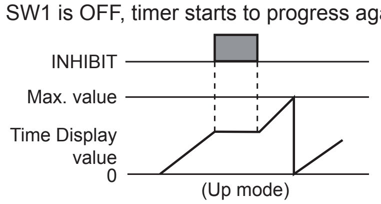
● When using terminal 3 for sensor power terminal



◎ INHIBIT [For timer]

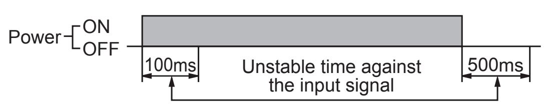


- It becomes the INHIBIT mode when SW1 turns on. (Time Hold)
- When power is applied, it starts to progress and INHIBIT mode is used to stop the time is under the progress at the moment.
- When SW1 is OFF, timer starts to progress again.



◎ Power

The inner circuit voltage starts to rise up for the first 100ms after power on, the input may not work at this time. And also the inner circuit voltage drops down for the last 500ms after power off, the input may not work at this time.



DIN W48×H48mm, Compact Counter/Timer

■ Features

- Upgraded counting speed: 1cps/30cps/2kcps/5kcps
- Selectable voltage input (PNP) or No-voltage input (NPN)
- Addition of Up/Down input mode
- Available to set a decimal point (fixed decimal point of display)
- Wide range of input power supply: 100-240VAC 50/60Hz
  12-24VAC 50/60Hz, 12-24VDC universal
- Selectable Counter/Timer by internal DIP switch
- Various time range: Built-in micro computer (Micom)

Please read "Caution for your safety" in operation manual before using.

c US

■ Ordering Information

FX 4 S — I

Output	No mark	1-stage preset
	I	Indicator
Size	S	DIN W48×H48mm
Digit	4	9999 (4-digit)
	5	99999 (5-digit)
Item	FX	Counter/Timer

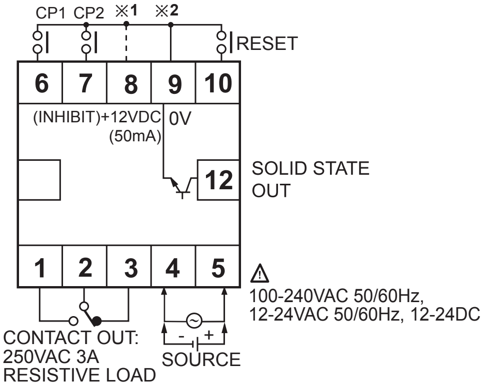
■ Specifications

Model	1-stage preset		**FX4S**	—
	Indicator		—	**FX5S-I**
Digit			4-digit	5-digit
Digit size			W3.8×H7.6mm	W4×H8mm
Power supply	AC voltage		100-240VAC 50/60Hz	
	AC/DC voltage		12-24VAC 50/60Hz, 12-24VDC	
Allowable voltage range			90 to 110% of rated voltage	
Power consumption	AC voltage		• Indicator: Max. 4.7VA • 1-stage preset: Max. 5.7VA (100-240VAC 50/60Hz)	
	AC/DC voltage		• Indicator: Max. 4.5VA • 1-stage preset: Max. 5.6VA (12-24VAC 50/60Hz) • Indicator: Max. 2.8W • 1-stage preset: Max. 3W (12-24VDC)	
Max. counting speed for CP1, CP2			Selectable 1cps/30cps/2kcps/5kcps by internal DIP switch	
Min. input signal width	INHIBIT input		Approx. 20ms	
	RESET input			
Input	CP1, CP2 input (INHIBIT)		Input logic is selectable [Voltage input] Input impedance: 5.4kΩ "H" level: 5-30VDC, "L" level: 0-2VDC [No-voltage input] Impedance at short-circuit: Max. 1kΩ, Residual voltage at short-circuit: Max. 2VDC, Impedance at open-circuit: Min. 100kΩ	
	RESET input			
One-shot output time			0.05 to 5sec	—
Control output	Contact	Type	SPDT (1c)	—
		Capacity	250VAC 3A at resistive load	—
	Solid state	Type	NPN open collector	—
		Capacity	Max. 30VDC, 100mA	—
Memory protection			Approx. 10 years (when using non-volatile semiconductor memory)	
External power			Max. 12VDC±10% 50mA	
Insulation resistance			Over 100MΩ (at 500VDC megger)	
Dielectric strength			2,000VAC 50/60Hz for 1 minute	
Noise immunity	AC voltage		±2kV the square wave noise (pulse width: 1μs) by the noise simulator	
	DC voltage		±500V the square wave noise (pulse width: 1μs) by the noise simulator	
Vibration	Mechanical		0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour	
	Malfunction		0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min	
Shock	Mechanical		300m/s² (approx. 30G) in each X, Y, Z direction for 3 times	
	Malfunction		100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Relay life cycle	Mechanical		Min. 10,000,000 operations	
	Electrical		Min. 100,000 operations (250VAC 3A at resistive load)	
Environ-ment	Ambient temp.		10 to 55℃, storage: -25 to 65℃	
	Ambient humi.		35 to 85%RH	
Approval			c US	
Unit weight			Approx. 153g	Approx. 143g

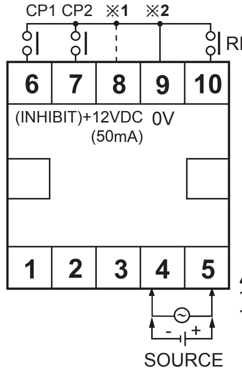
※Environment resistance is rated at no freezing or condensation.

■ Connections

● FX4S



● FX5S-I

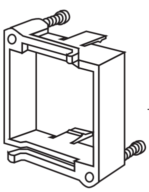


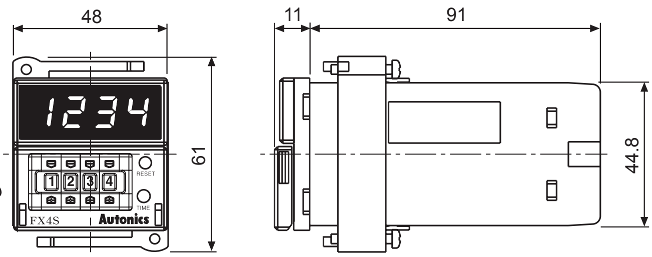
※1: Connection of PNP input
※2: Connection of NPN input
※CP2 (INHIBIT)
: Time Hold terminal when using for timer.
※Operated by a power ON start when it is used as a timer.

■ Dimensions

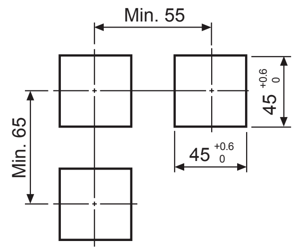
(unit: mm)

● Bracket





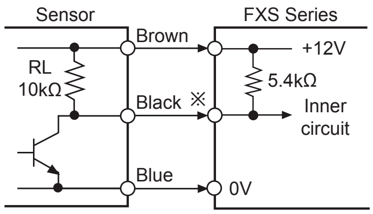
● Panel cut-out



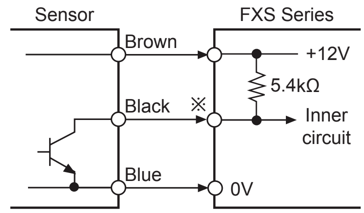
■ Input Connections

◎ Input logic: No-voltage (NPN) input

● Solid-state input (standard sensor: NPN output type sensor)



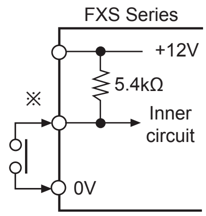
(NPN output)



(NPN open collector output)

※CP1, CP2 (INHIBIT), RESET input

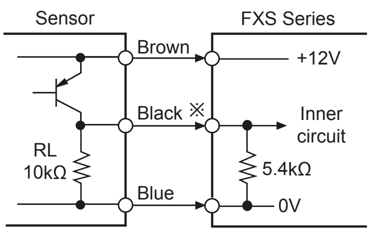
● Contact input



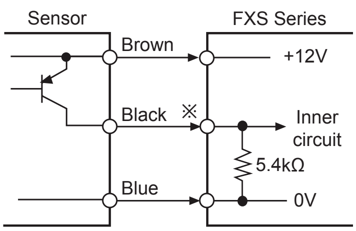
※Counting speed:
1 or 30cps setting (counter)

◎ Input logic: Voltage (PNP) input

● Solid-state input (standard sensor: PNP output type sensor)



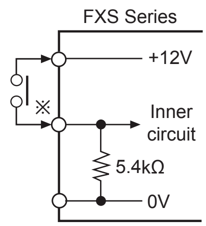
(PNP output)



(PNP open collector output)

※CP1, CP2 (INHIBIT), RESET input

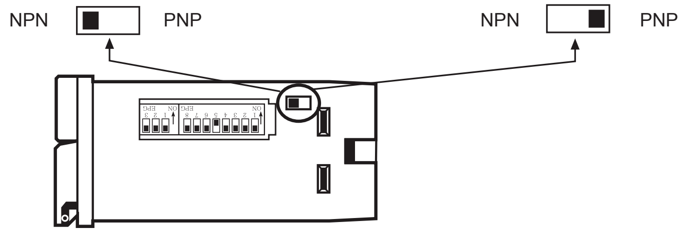
● Contact input



※Counting speed:
1 or 30cps setting (counter)

■ Input Logic Selection

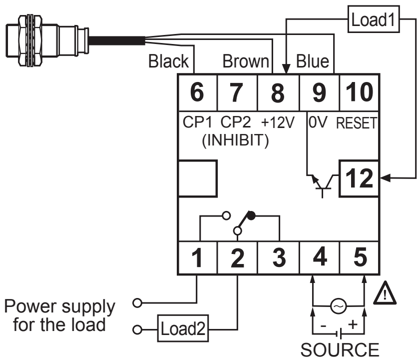
● **Select NPN (No-voltage input) (factory default)** ● **Select PNP (voltage input)**



※Please be sure to turn OFF the power before changing input logic.

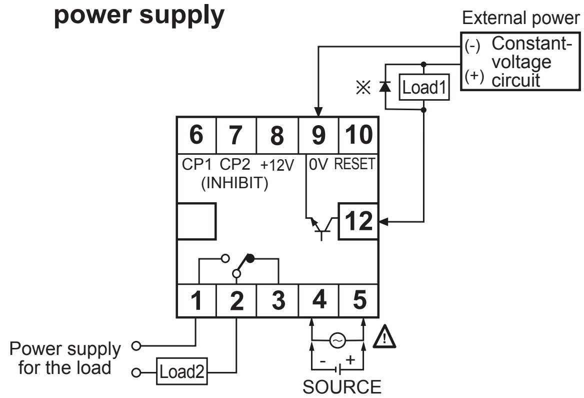
■ Input & Output Connections

◎ In case of operating the load by power supply of the sensor



● Please select proper capacity of load, because total current consumption should not be exceed current capacity. (Max. 50mA)
● Contact capacity: Max. 250VAC 3A

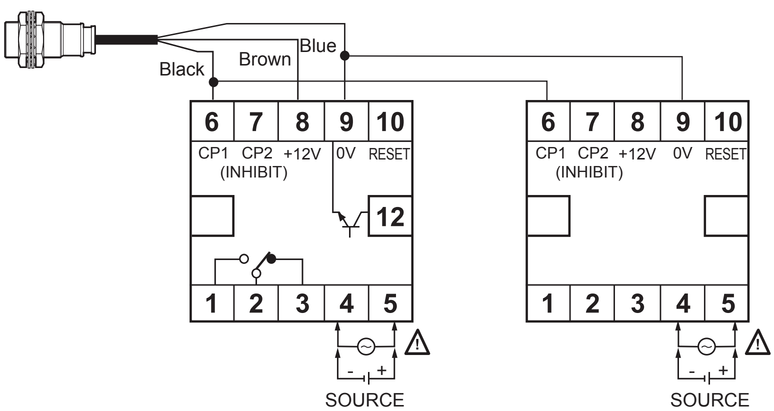
◎ In case of operating the load by external power supply



● The capacity of Load1 must not be exceed Max. 30VDC, Max. 100mA of the switching capacity of the transistor.
● Please do not supply the reverse polarity voltage.
※Please connect the surge absorber (Diode) at both terminals of Load1, in case of using the inductive load. (Relay, etc.)

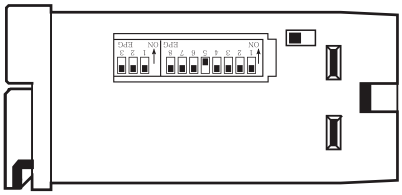
◎ Using 2 counters with one sensor

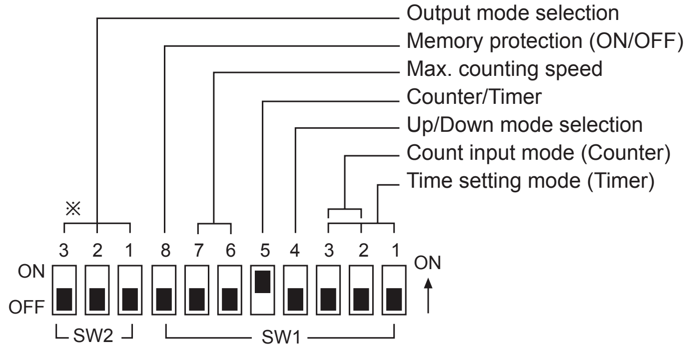
It is available to use 2 counters with one sensor.
Please connect as the power of sensor is supplied from only one way of counters and design input logic with same way.



<FX4S> <FX5S-I>

Description Of Inner DIP Switches





※ **Inner selection switch is changed from 10pin to 11pin with upgrade of counting speed.**
※ **There is no output operation mode in Indicator (FX5S-I) and SW2 selection switch.**

● Up/Down mode

SW1		Function
4	ON	Down mode
	OFF	Up mode

● Counter/Timer selection

SW1		Function
5	ON	Counter
	OFF	Timer

● Memory protection

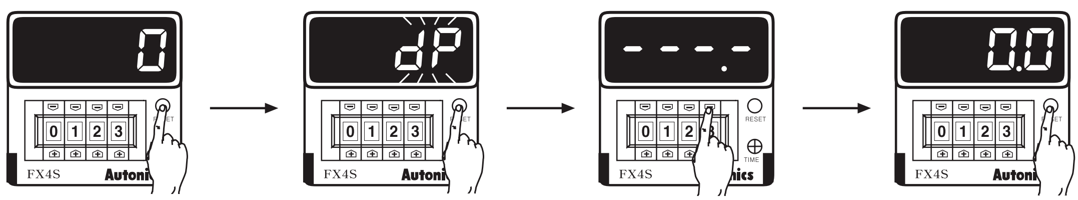
SW1		Function
8	ON	Disable the memory protection
	OFF	Enable the memory protection

● Max. counting speed

SW1		CP1, CP2
6: ON	7: OFF	**1cps**
6: OFF	7: OFF	30cps
6: OFF	7: ON	2kcps
6: ON	7: ON	**5kcps**

Setting Function Of Decimal Point

Displays the decimal point.



RUN mode → → → Return to RUN mode

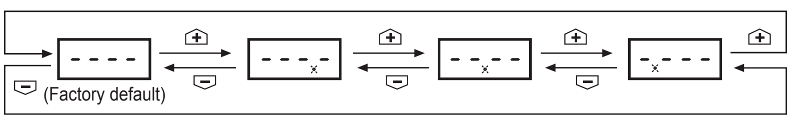
※If pressing RESET button for over 3sec, it advanced to decimal point setting mode.

※When "dP" flashes, touch RESET button once.

※Set the position of decimal point using ⊕, ⊖ buttons of digital switch.

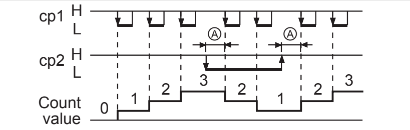
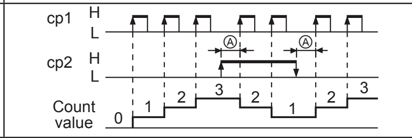
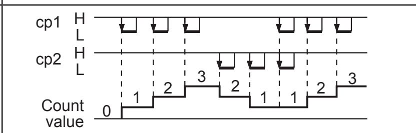
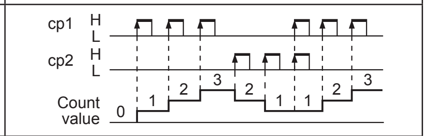
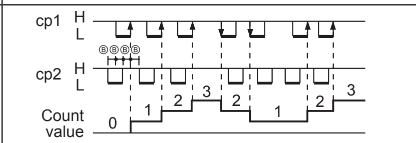
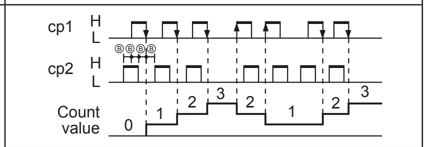
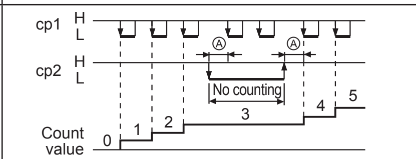
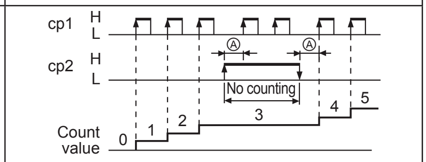
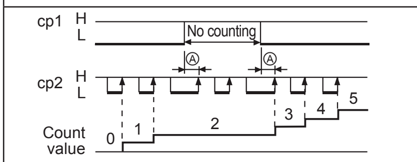
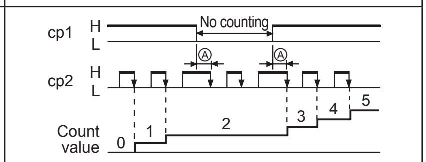
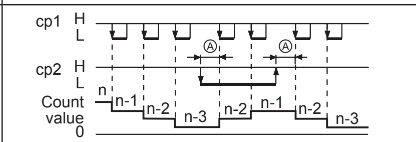
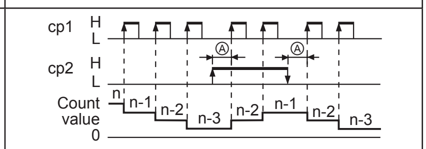
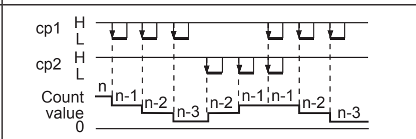
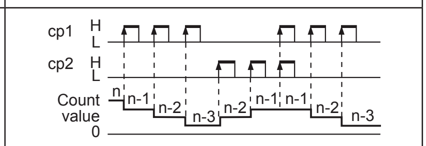
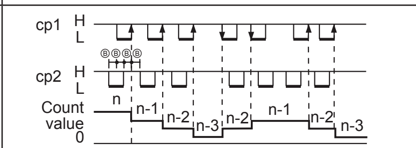
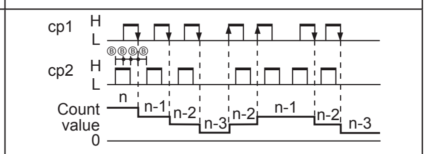
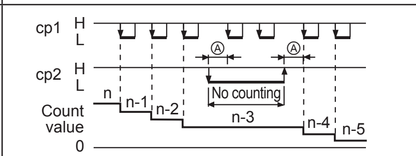
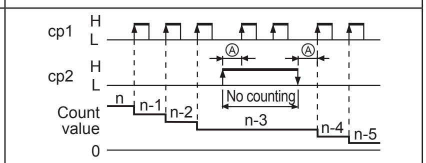
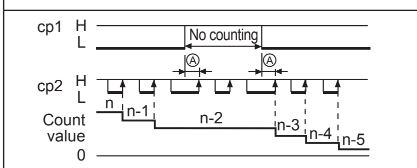
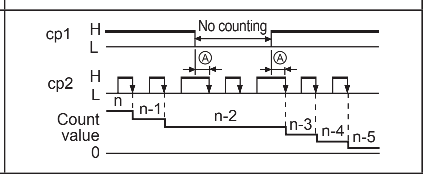
※It returns to RUN mode by press RESET button over 3sec

● Changing the decimal point



※It returns to RUN mode if no RESET button or digital switch is applied for 60sec in decimal point setting status.
※The decimal point setting is not existed in Indicator.

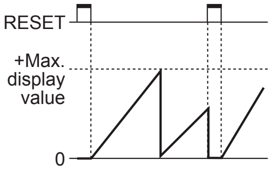
■ Input Operation Mode (Counter)

Input mode		SW1	No-voltage input (NPN)	Voltage input (PNP)
Count up mode (4: ON/OFF)	Up/Down-A (Command input)	2 3 ON OFF		
	Up/Down-B (Individual input)	2 3 ON OFF		
	Up/Down-C (Phase difference input)	2 3 ON OFF		
	Up (Count up input)	2 3 ON OFF		
				
Count down mode (4: ON/OFF)	Up/Down-D (Command input)	2 3 ON OFF		
	Up/Down-E (Individual input)	2 3 ON OFF		
	Up/Down-F (Phase difference input)	2 3 ON OFF		
	Down (Count down input)	2 3 ON OFF		
				

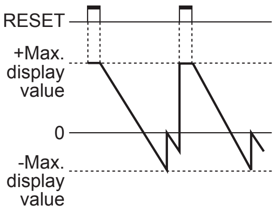
※Ⓐ: Over Min. signal width, Ⓑ: Over 1/2 of Min. signal width. Counting miss by one (±1) occurs if the signal width of or is less than min. signal width.

■ Counting Operation Of Indicator (Counter)

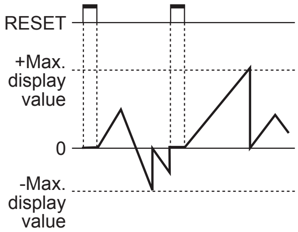
● **Up input mode**



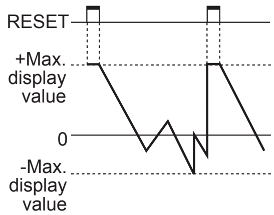
● **Down input mode**



● **Up/Down-A, B, C input mode**

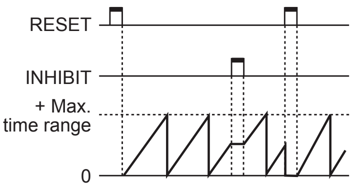


● **Up/Down-D, E, F input mode**

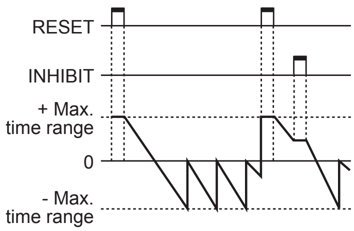


■ Time Operation Of Indicator (Timer)

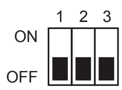
● **Up input mode**



● **Down input mode**

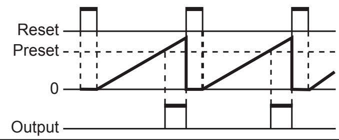
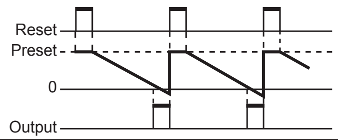
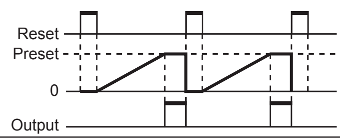
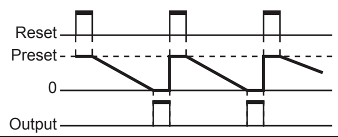
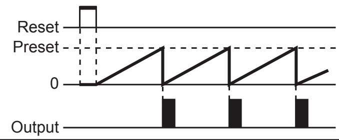
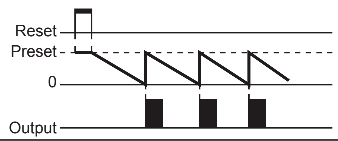
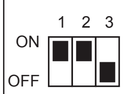
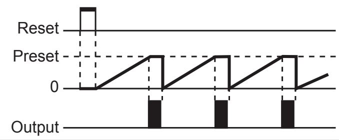
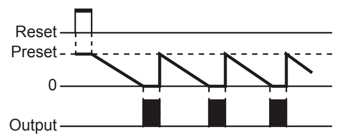
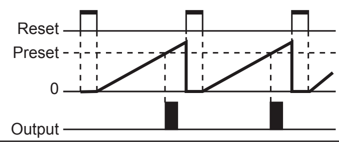
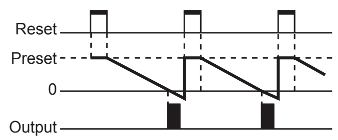
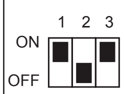
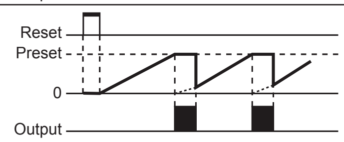
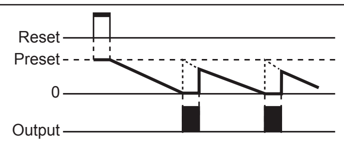
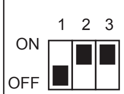
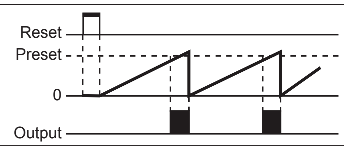
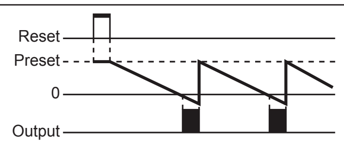
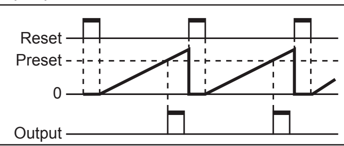
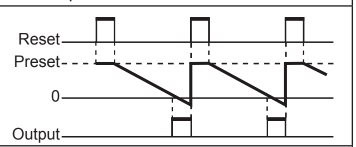
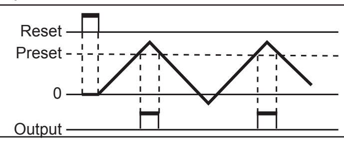
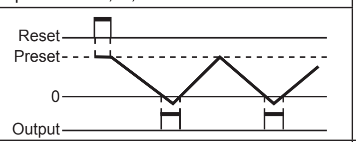
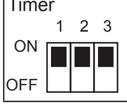
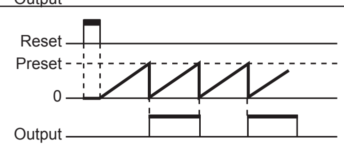
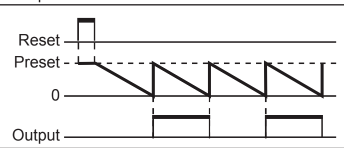


■ Time Setting Mode (Timer)

SW1	4-digit	5-digit
	99.99sec	9999.9sec
	999.9sec	99999sec
	9999sec	9min 59.99sec
	99min 59sec	99min 59.9sec
	999.9min	9999.9min
	99hour 59min	9hour 59min 59sec
	999.9hour	999hour 59min
	9999hour	9999.9hour

▣ Output Operation Mode (By Internal DIP Switch)

▮ ← One-shot output (0.05 to 5sec)   ⊓ ← Retained output

Output mode (SW2)	SW1 ON / OFF 4 **Up mode**	SW1 ON / OFF 4 **Down mode**	Operation after count up
	Up, Up / Down-A, B, C	Up, Up / Down-D, E, F	
F 			• The display value continues until reset signal is applied then output is held. • Retained output will be maintained until reset signal is applied.
N 			Display value and retained output are maintained until Reset signal is applied.
C 			The display value returns to reset start status as soon as display value is reached to preset value.
R 			The display value is held until output is OFF then returns to reset start status.
K 			The display value continues until reset signal is applied.
P 			The display value is held during one-shot output time, counting process is returned to reset start status as soon as output is ON.
Q 			The display value continues during one-shot output time.
S	Up input	Down input	
Counter 			• Up, UP/Down-A, B, C input mode -Output is ON when (Display value) ≥ (Preset value) • Down, UP/Down-D, E, F input mode-Output is ON when (Display value) ≤ (Zero)
	Up / Down-A, B, C	Up / Down-D, E, F	
			
S Timer 			The output turns ON after the setting time and then turns OFF after the setting time. This operation is repeated sequentially. (Flicker operation)

※One-shot output time is set by front TIME adjuster.

▣ Proper Usage

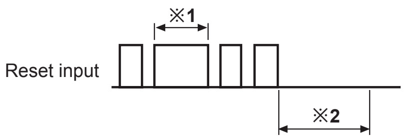
◎ Reset function

● **Reset**

In case of changing the input mode after supplying the power, please take external reset or manual reset.
If reset is not executed, the counter will be working as previous mode.

● **Reset signal width**

It is reset perfectly when the reset signal is applied during **min. 20ms** regardless of the contact input & solid-state input.

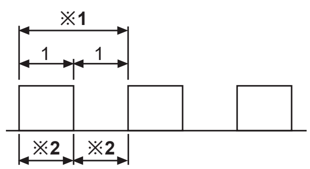


※1: In case of a contact reset, it is reset perfectly if the ON time of reset signal is applied during min. 20ms even though a chattering occurs.
※2: It can be input the signal of CP1, CP2 after min. 50ms from closing time of reset signal.

◎ Sensor power

The power 12VDC which is provided to sensor is built in it. Please use it under Max. DC50mA.

◎ Min. signal width

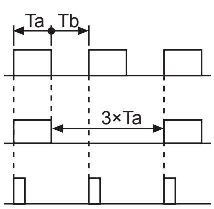


※1: Please make duty ratio (ON/OFF) 1:1

※2: Min. signal width
- 1cps: Min. 500ms
- 30cps: Min. 16.7ms
- 2kcps: Min. 0.25ms
- 5kcps: Min. 0.1ms

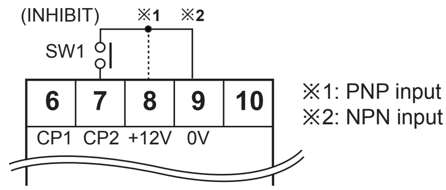
◎ Max. counting speed

This is a response speed per 1 sec when the duty ratio (ON:OFF) of input signal is 1:1.
If the duty ratio is not 1:1, the width between ON and OFF should be over min. signal width and the response speed will getting slower against input signal. And one of ON width and OFF width is under min. signal width, this product may not respond.



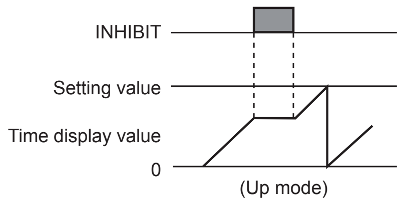
Width of Ta (ON) and Tb (OFF) must be larger than Min. signal width.
Max. counting speed is 1/2 value of rated spec. when duty ratio is 1:3.
It can not respond if it is smaller than min. signal width (Ta).

◎ INHIBIT (for timer)



※1: PNP input
※2: NPN input

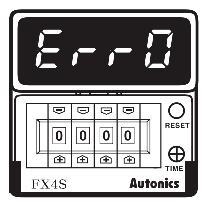
- If SW1 is ON, it becomes INHIBIT. (Time Hold)
- When power is applied, it starts to progress and INHIBIT mode is used to stop the time is under the progress at the moment.
- When SW1 is OFF, timer starts to progress again.



◎ Error display

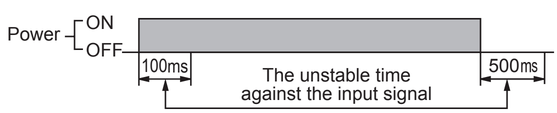
Error signal	Error description	Returning method
Err0	Zero setting status	Change the setting value to non zero status

※When Error is displayed, the output continues OFF state.
※There is no Error function in indicator.

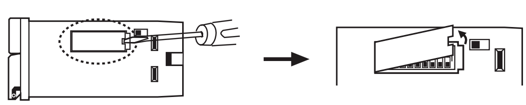


◎ Power

The inner circuit voltage starts to rise up for the first 100ms after power on, the input may not work at this time. And also the inner circuit voltage drops down for the last 500ms after power off, the input may not work at this time.



◎ DIP switch detachment



Push a lock part to front direction and widen it simultaneously.
※Please be careful of the injury caused by tools.

DIN W72×H72, W48×H96, W144×H72mm Counter/Timer

■ Features

- 36 input modes and 20 output modes
- Counting speed: 1cps/30cps/2kcps/5kcps
- Selectable voltage input (PNP) or No voltage input (NPN)
- Addition of Up/Down input mode
- Wide range of power supply: 100-240VAC 50/60Hz 12-24VAC 50/60Hz, 12-24VDC universal
- Selectable Counter/Timer by internal DIP switch
- Various time range
- Built-in Microprocessor

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

FX | 4 | H — 2P

Code position	Code	Description
Output	No mark	1-stage preset
	2P	2-stage preset
	I	Indicator
Size	L	DIN W144×H72mm
	H	DIN W48×H96mm
	No mark	DIN W72×H72mm
Digit	4	9999 (4-digit)
	6	999999 (6-digit)
Item	FX	Counter/Timer

■ Specifications

Model	1-stage preset		**FX4**	**FX6**	**FX4H**	—	—
	2-stage preset		**FX4-2P**	**FX6-2P**	**FX4H-2P**	**FX4L-2P**	**FX6L-2P**
	Indicator		**FX4-I**	**FX6-I**	**FX4H-I**	**FX4L-I**	**FX6L-I**
Digit			4-digit	6-digit	4-digit	4-digit	6-digit
Digit size			W8×H14mm	W4×H8mm	W6×H10mm	W8×H14mm	
Power supply	AC voltage		100-240VAC 50/60Hz				
	AC/DC voltage		12-24VAC 50/60Hz, 12-24VDC				
Allowable voltage range			90 to 110% of rated voltage				
Power consumption	AC voltage		• Indicator: Max. 6VA • 1-stage preset: Max. 7VA • 2-stage preset: Max. 8VA (100-240VAC 50/60Hz)				
	AC/DC voltage		• Indicator: Max. 5.8VA • 1-stage preset: Max. 6.8VA • 2-stage preset: Max. 7.6VA (12-24VAC 50/60Hz) • Indicator: Max. 2.7W • 1-stage preset: Max. 3.3W • 2-stage preset: Max. 3.8W (12-24VDC)				
Max. counting speed for CP1, CP2			Selectable 1cps/30cps/2kcps/5kcps by internal DIP switch				
Min. input signal width	INHIBIT input		Approx. 20ms				
	RESET input						
Input	CP1, CP2 input (INHIBIT)		Input logic is selectable [Voltage input] Input impedance: Max. 5.4kΩ, [H]: 5-30VDC, [L]: 0-2VDC [No-voltage input] Impedance at short-circuit: Max. 1kΩ, Residual voltage at short-circuit: Max. 2VDC, Impedance at open-circuit: Min. 100kΩ				
	RESET input						
One-shot output time			• 1-stage preset: 0.05 to 5sec • 2-stage preset: 1st. output 0.5sec fixed, 2nd. output: 0.05 to 5sec				
Control output	Contact	Type	• 1-stage preset: SPDT (1c), • 2-stage preset: 1st. output SPDT (1c), 2nd. output SPDT (1c)				
		Capacity	250VAC 3A at resistive load				
	Solid state	Type	• 1-stage preset: 1 NPN open collector • 2-stage preset: 1st. output 1 NPN open collector, 2nd. output 1 NPN open collector				
		Capacity	Max. 30VDC, 100mA				
Memory protection			Approx. 10 years (when using non-volatile semiconductor memory)				
External sensor power			Max. 12VDC±10% 50mA				
Environment	Ambient temperature		-10 to 55℃, storage: -25 to 65℃				
	Ambient humidity		35 to 85%RH, storage: 35 to 85%RH				
Insulation resistance			Over 100MΩ (at 500VDC megger)				
Dielectric strength			2,000VAC 50/60Hz for 1 minute				
Noise immunity	AC voltage		±2kV the square wave noise (pulse width: 1μs) by the noise simulator				
	DC voltage		±500V the square wave noise (pulse width: 1μs) by the noise simulator				

※Environment resistance is rated at no freezing or condensation.

Thumbweel Switch Setting Type Up.Down Counter/Timer

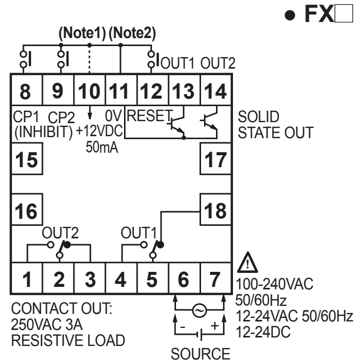
■ Specifications

Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour				
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min				
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times				
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times				
Relay life cycle	Mechanical	Min. 10,000,000 operations				
	Electrical	Min. 100,000 operations (at 250VAC 3A resistive load)				
Approval		c UL us (except for AC/DC voltage type)				
Weight※1		FX4: Approx. 385g (approx. 249g) FX4-2P: Approx. 396g (approx. 258g) FX4-I: Approx. 353g (approx. 216g)	FX6: Approx. 395g (approx. 259g) FX6-2P: Approx. 398g (approx. 262g) FX6-I: Approx. 351g (approx. 214g)	FX4H: Approx. 349g (approx. 234g) FX4H-2P: Approx. 375g (approx. 261g) FX4H-I: Approx. 321g (approx. 206g)	FX4L-2P: Approx. 651g (approx. 467g) FX4L-I: Approx. 593g (approx. 400g)	FX6L-2P: Approx. 678g (approx. 494g) FX6L-I: Approx. 586g (approx. 404g)

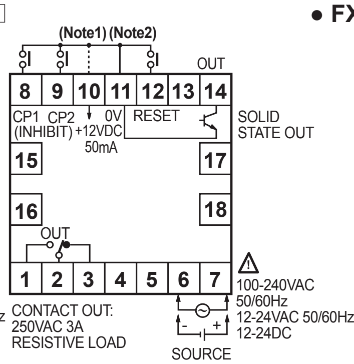
※1: The weight includes packaging. The weight in parenthesis is for unit only.

■ Connections

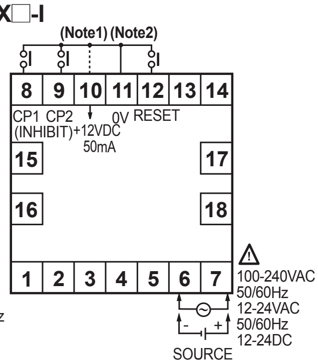
● FX□-2P



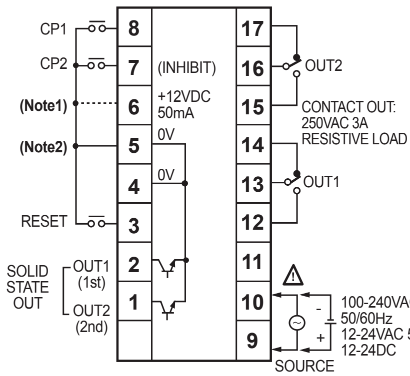
● FX□



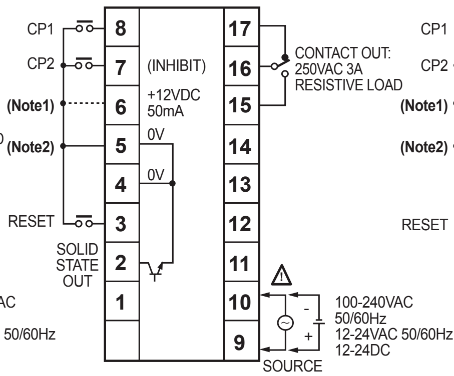
● FX□-I



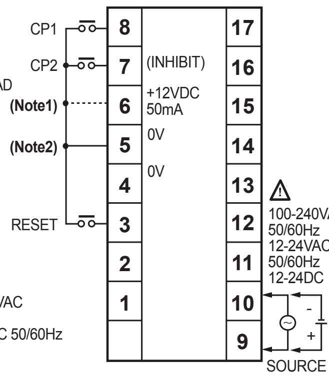
● FX4H-2P



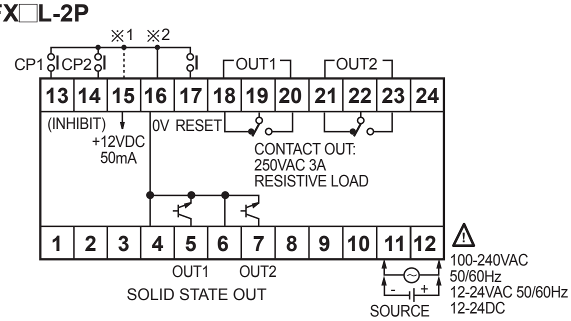
● FX4H



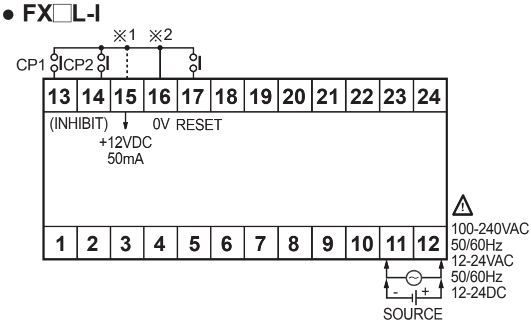
● FX4H-I



● FX□L-2P



● FX□L-I



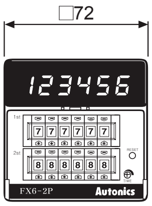
※ CP2 (INHIBIT): Time hold terminal when using for timer.
※ It is operated by power ON start type when using for timer.

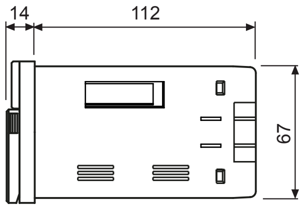
※1: Connection for PNP input
※2: Connection for NPN input

■ Dimensions

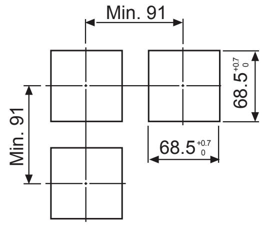
● FX Series

(unit: mm)



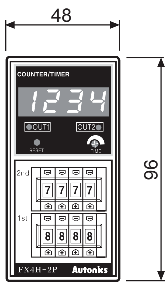


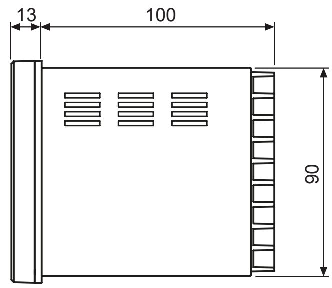
● Panel cut-out



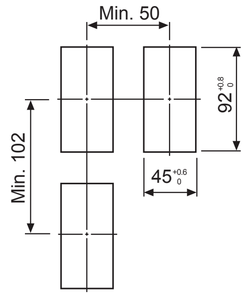
● FXH Series

(unit: mm)



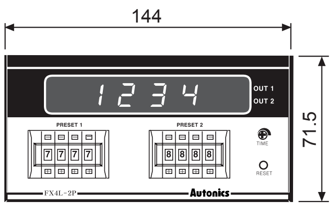


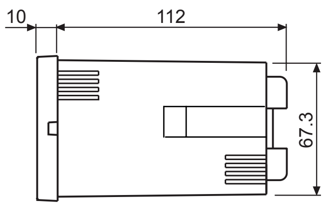
● Panel cut-out



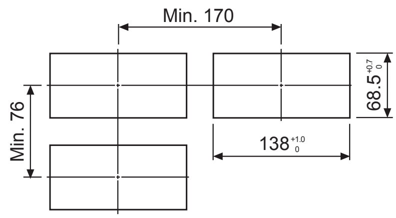
● FXL Series

(unit: mm)





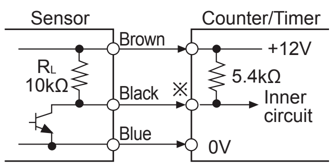
● Panel cut-out



■ Input Connections

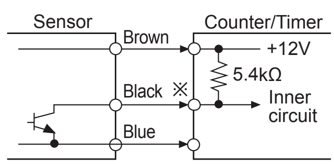
◎ No-voltage input (NPN) (factory default)

● Solid-state input (standard sensor: NPN output type sensor)



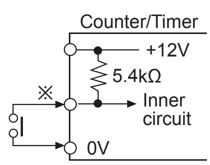
(NPN output)

※CP1, CP2 (INHIBIT), RESET input



(NPN open collector output)

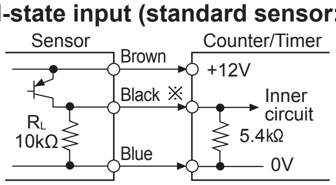
● Contact input



※Counting speed:
1 or 30cps setting (counter)

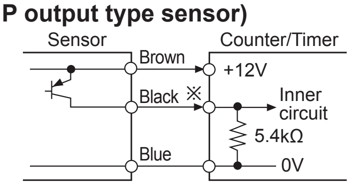
◎ Voltage input (PNP)

● Solid-state input (standard sensor: PNP output type sensor)



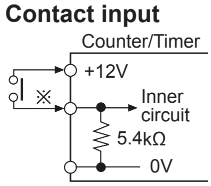
(PNP output)

※CP1, CP2 (INHIBIT), RESET input



(PNP open collector output)

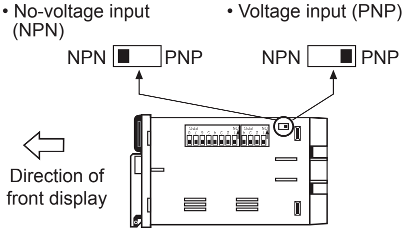
● Contact input



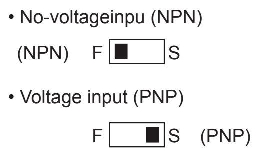
※Counting speed:
1 or 30cps setting (counter)

▣ Input Logic Selection

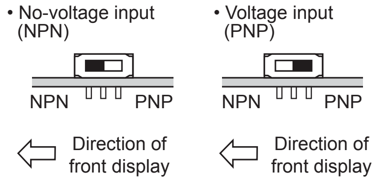
● **FX Series**
Input logic is changeable by input logic selection switch located at the one-side of case.



● **FXL Series**
Input logic is changeable by input logic selection switch located at the terminal block.



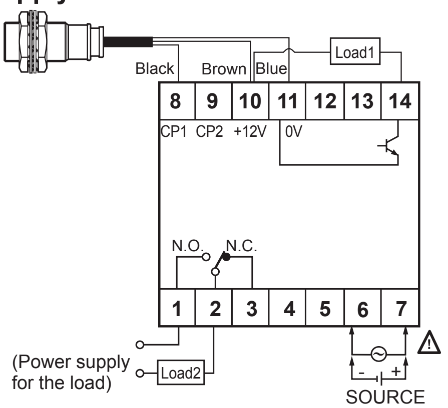
● **FXH Series**
Input logic is changeable by input logic selection switch (SW3) located at inside of the case.



※**Please be sure to turn power OFF before changing input logic.**

▣ Input & Output Connections

◎ In case of operating the load by power supply of the sensor

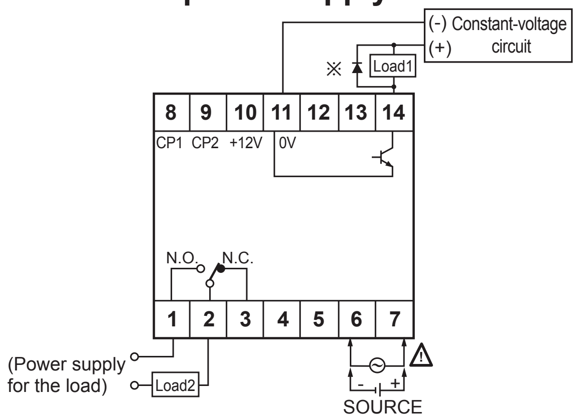


● Please select proper capacity of load, because total value of load capacity and current consumption should not be exceed current capacity. (Max. 50mA)

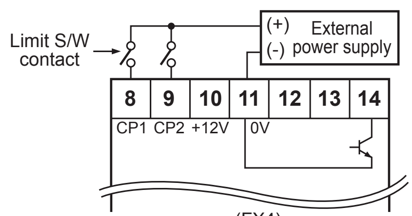
◎ How to count by external power supply

This unit starts to count when "High" level (5-30VDC) is applied at CP1 or CP2 after selecting PNP.
("Low" level: 0-2VDC)

◎ In case of operating the load by external power supply



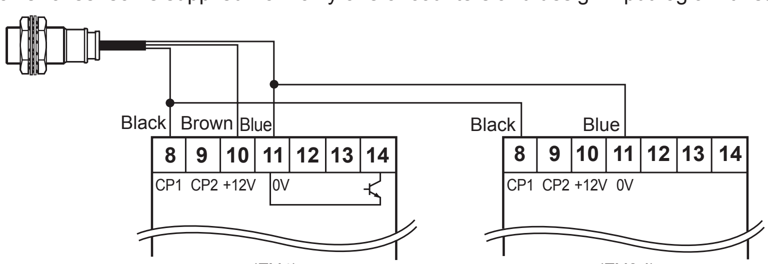
● The capacity of the load must not be exceed max. 30VDC, max. 100mA of the switching capacity of the transistor.
● Please do not supply the reverse polarity voltage.
※Please connector the surge absorber (Diode) at both terminals of the load, in case of using the inductive load. (Relay, etc.)



(FX4)

◎ Using 2 counters with one sensor

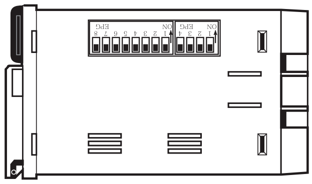
Please connect as the power of sensor is supplied from only one of counters and design input logic with same way.



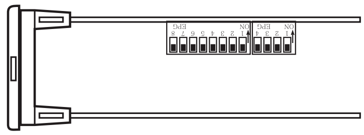
(FX4) (FX6-I)

Description Of Inner DIP Switches

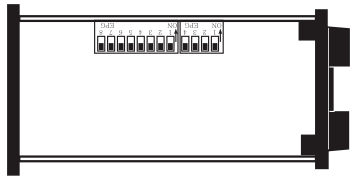
- **FX Series**

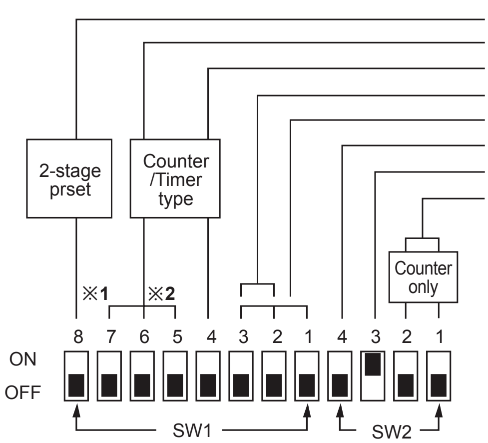


- **FXH Series**

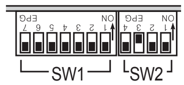


- **FXL Series**

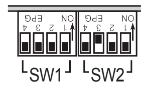




※1: 1-stage preset model (There is 8 of SW1)



※2: Indication model (There is 5, 6, 7, 8 of SW1)



- **Max. counting speed**

SW2	Functions
1: ON, 2: OFF	1cps
1: OFF, 2: OFF	30cps
1: OFF, 2: ON	2kcps
1: ON, 2: ON	5kcps

- **Conter/Timer selection**

SW2		Functions
3	ON	Conter
	OFF	Timer

- **Memory protection**

SW2		Functions
4	ON	Disable the memory protection
	OFF	Enable the memory protection

- **Up/Down mode selection**

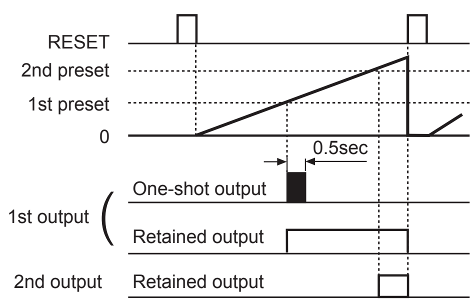
SW1		Functions
4	ON	Down mode
	OFF	Up mode

- **1st output one-shot (ON/OFF)**

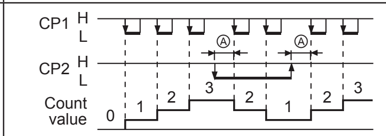
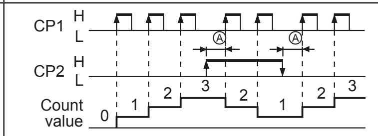
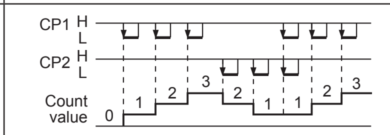
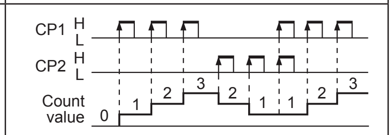
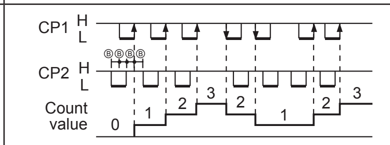
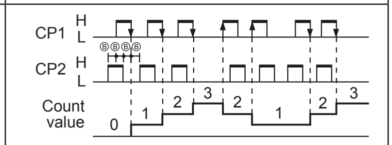
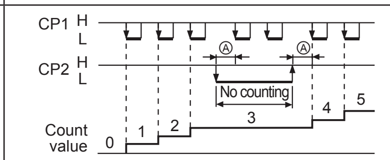
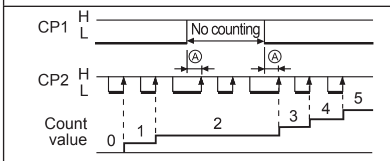
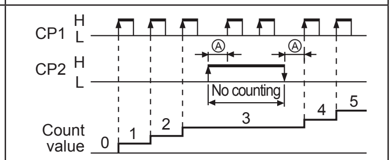
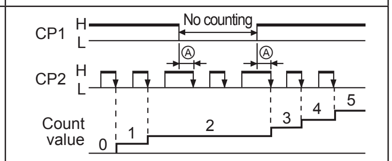
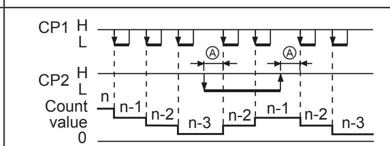
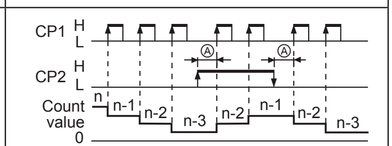
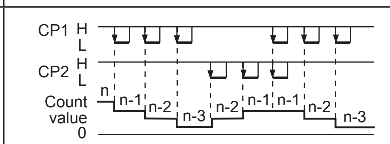
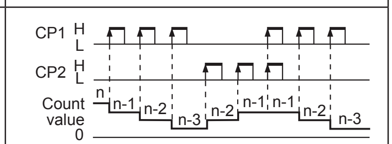
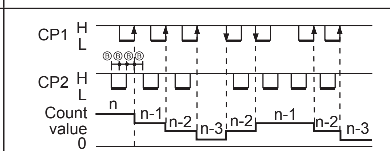
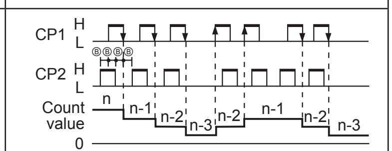
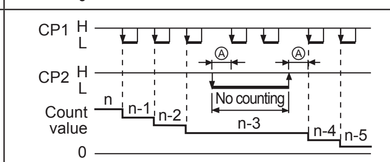
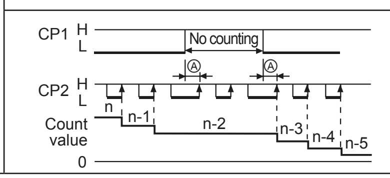
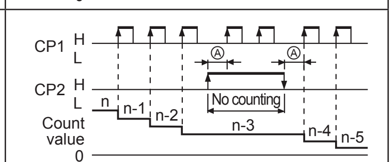
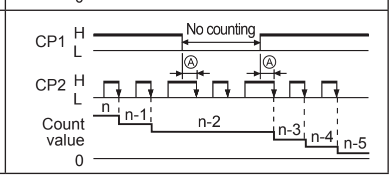
SW1		Functions
8	ON	1st output: One-shot output
	OFF	1st output: Retained output

※This mode selects a one-shot output (0.5sec fixed) or retained output (until 2nd output turns off) for 1st output in the 2-stage preset coaunter.

※Example of F output operation mode



■ Input Operation (Counter)

Input mode		SW1	No-voltage input type (NPN)	Voltage input type (PNP)
4 ON OFF **Up mode**	Up/Down-A (Command input)	2 3 ON OFF		
	Up/Down-B (Individual input)	2 3 ON OFF		
	Up/Down-C (Phase difference input)	2 3 ON OFF		
	Up (Count up input)	2 3 ON OFF	 	 
4 ON OFF **Down mode**	Up/Down-D (Command input)	2 3 ON OFF		
	Up/Down-E (Individual input)	2 3 ON OFF		
	Up/Down-F (Phase difference input)	2 3 ON OFF		
	Down (Count down input)	2 3 ON OFF	 	 

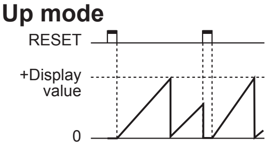
※Ⓐ: Over min. signal width, Ⓑ: Over 1/2 of min. signal width.
If the signal width of Ⓐ or Ⓑ is less than min. signal width, ±1 of count error occurs.

■ Time Setting Mode (Timer)

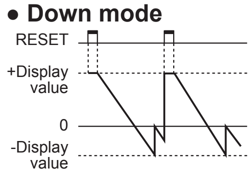
SW1		4-digit	6-digit
A	1 2 3 ON OFF	99.99sec	99999.9sec
B	1 2 3 ON OFF	999.9sec	999999sec
C	1 2 3 ON OFF	9999sec	99min 59.99sec
D	1 2 3 ON OFF	99min 59sec	999min 59.9sec
E	1 2 3 ON OFF	999.9min	9999.9min
F	1 2 3 ON OFF	99hour 59min	99hour 59min 59sec
G	1 2 3 ON OFF	999.9hour	9999hour 59min
H	1 2 3 ON OFF	9999hour	99999.9hour

■ Counting Operation Of Indication Type (Counter)

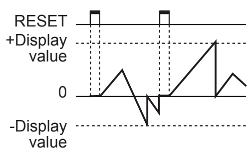
● Up mode



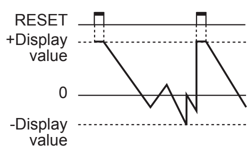
● Down mode



● Up / Down-A, B, C mode

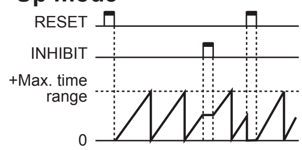


● Up / Down-D, E, F mode

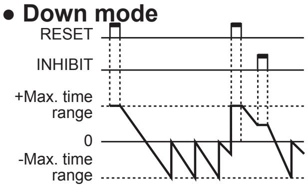


■ Time Operation Of Indication Type (Timer)

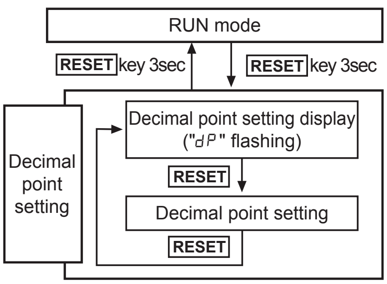
● Up mode



● Down mode



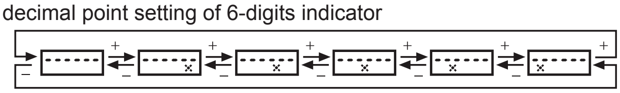
■ Setting Function Of Decimal Point



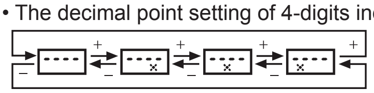
※It advances to "Decimal point setting mode" if press RESET key for 3sec
※It returns to RUN mode by press RESET key for 3sec in "Decimal point setting mode".
※It returns to RUN mode if no RESET button or digital switch (Dual-setting digital switch for dual preset type) is applied for 60sec in the "Decimal point setting mode".
※The decimal point setting does not exist in indicator.

● **Decimal point setting**

• The decimal point setting of 6-digits indicator



• The decimal point setting of 4-digits indicator

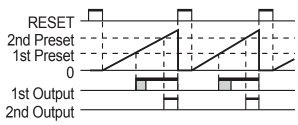
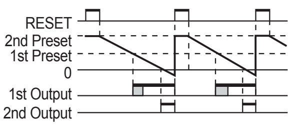
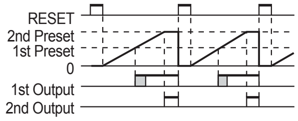
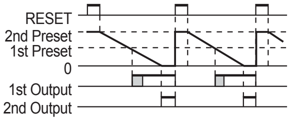
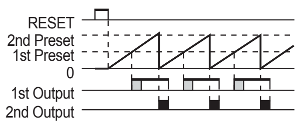
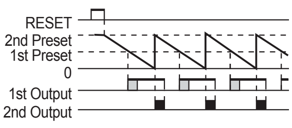
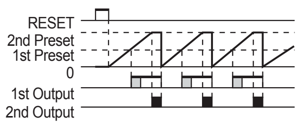
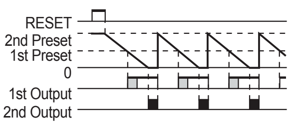
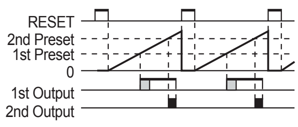
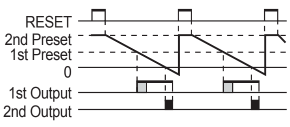
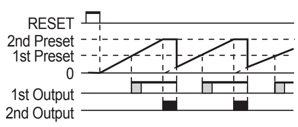
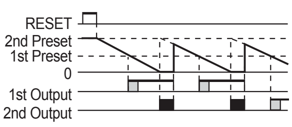
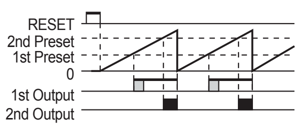
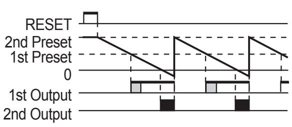
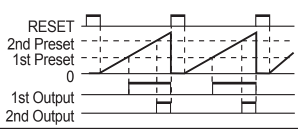
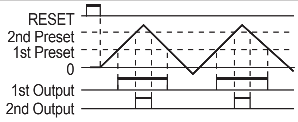
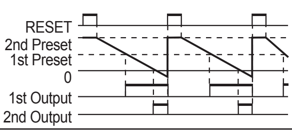
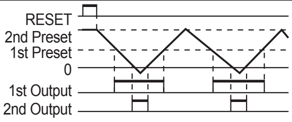
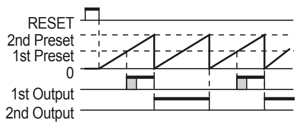
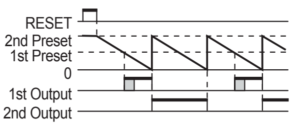


※Existing decimal point setting is displayed when entering into decimal point setting mode.
※If pressing one of digital switch (2nd preset type: 2nd preset digital switch) Up (+) buttons in decimal point setting mode, decimal point will be moved to Up (+) direction.
If pressing one of digital switch (2nd preset type: 2nd preset digital switch) Down (-) buttons, decimal point will be moved to Down (-) direction.

Output Operation Mode

One-shot output (0.05 to 5sec) of 2nd output — Retained output — One-shot output (0.5sec) of 1st output — Retained output

※The output of 1-stage preset type is operated at the status of the second output mode

Output mode (SW1)	4 ON OFF **Up mode** **Up, Up / Down-A, B, C**	4 ON OFF **Down mode** **Down, Up / Down-D, E, F**	Operation after count up
F 5 6 7 ON OFF			The display value continues until Reset signalapplied and the output is held. • 1st retained output and 2nd output are maintained until Reset signal is applied. • When using 1st output as one-shot output, it will return after operating for 0.5sec
N 5 6 7 ON OFF			The display value and output will be held until Reset input is applied.
C 5 6 7 ON OFF			The display value will be Reset Start status as soon as it reaches to 2nd setting value. • 1st retained output will be OFF after 2nd one-shot output. • 1st one-shot output will be reset after operating 0.5sec, and it is not related to 2nd output.
R 5 6 7 ON OFF			Display value will be maintained until 2nd output is Off, then it will be reset. • 1st retained output will be OFF after 2nd one-shot output. • 1st one-shot output will be reset after operating 0.5sec, and it is not related to 2nd output.
K 5 6 7 ON OFF			The display value continues until Reset signalapplied. • 1st retained output will be OFF after 2nd one-shot output. • 1st one-shot output will be reset after operating 0.5sec, and it is not related to 2nd output.
P 5 6 7 ON OFF			The display value will be Reset Start status as soon as it reaches to 2nd setting value. • 1st retained output will be OFF after 2nd one-shot output. • 1st one-shot output will be reset after operating 0.5sec, and it is not related to 2nd output.
Q 5 6 7 ON OFF			The display continues until 2nd output is OFF. • 1st retained output will be OFF after 2nd one-shot output. • 1st one-shot output will be reset after operating 0.5sec not related to 2nd output.
S Counter 5 6 7 ON OFF	**Up**  **Up / Down-A, B, C** 	**Down**  **Up / Down-D, E, F** 	• Up, Up/Down-A, B, C input mode - OUT1 is ON when (Display value) ≥ (1st setting value) - OUT2 is ON when (Display value) ≥ (Dual setting value) • Down, Up/Down-D, E, F input mode - OUT1 is ON when (Display value) ≤ (1st setting value) - OUT2 is ON when (Display value) ≤ (Zero)
S Timer 5 6 7 ON OFF			When it is used as Timer, 1st output and 2nd output are flashing repeatedly.

※One-shot output time is set by front TIME adjuster.

■ Proper Usage

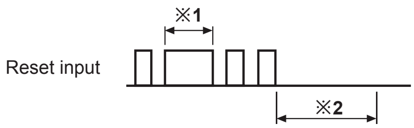
◎ Reset

● Reset

In case of changing the input mode after supplying the power, please provide an external reset or manual reset. If reset is not executed, the counter will be working in previous mode.

● Reset signal width

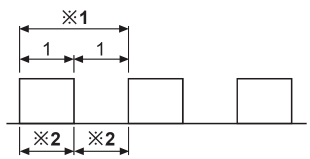
To guarantee proper reset, the signal must be supplied for a minimum of **min. 20ms** regardless the signal comes from a contact or a solid-state input.



※1: In case of a contact reset, contact chattering will not affect the reset as long as it is applied for a minimum of 20ms.

※2: Input signal at CP1 & CP2 must be applied for a minimum of 50ms after the reset is removed.

◎ Mini. count signal width

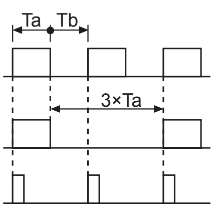


※1: Please make duty ratio (ON/OFF) as 1:1.

※2: Min. signal width
- 1cps: Min. 500ms
- 30cps: Min. 16.7ms
- 2kcps: Min. 0.25ms
- 5kcps: Min. 0.1ms

◎ Max. counting speed

This is a response speed per 1 sec when the duty ratio (ON/OFF) of input signal is 1:1. If the duty ratio is not 1:1, the width between ON and OFF should be over min. signal width and the response speed will getting slower against input signal. If either ON or OFF signal is shorter than minimum signal width, this product may not respond.



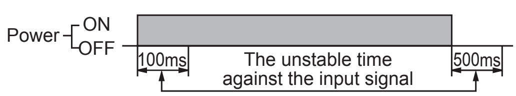
Ta (ON width) and Tb (OFF width) needed to be over min.signal width.

Max. counting speed is 1/2 value of rated spec. when duty ratio is 1:3.

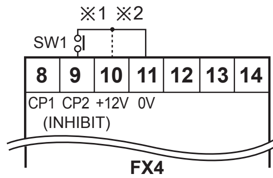
It can not respond if it is smaller than min. singal width (Ta).

◎ Power

The inner circuit voltage starts to rise up for the first 100ms after power on, the input may not work at this time. And also the inner circuit voltage drops down for the last 500ms after power off, the input may not work at this time.

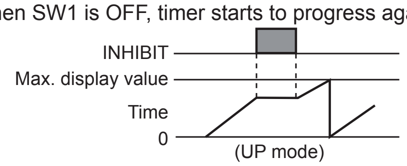


◎ INHIBIT (For timer)



※1: Connection for PNP
※2: Connection for NPN

- INHIBIT mode is active when SW1 turns ON. (Time Hold)
- When power is applied, it starts to progress and INHIBIT mode is used to stop the time is under the progress at the moment.
- When SW1 is OFF, timer starts to progress again.

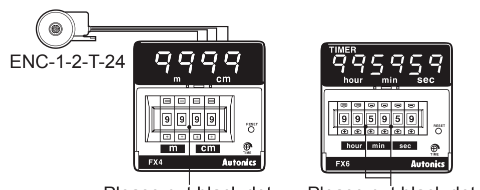


◎ How to use the sticker

The below sticker can be found inside the box.
Use the sticker according to application as follow;

E.g. 1) Measurement of length by the rotary encoder

E.g. 2) Timer [F mode]

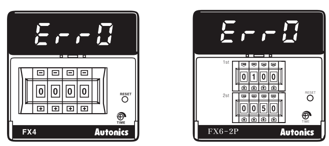


Please put black dot. Please put black dot.

◎ Error display

Error signal	Error description	Returning method
Err0	When 2nd setting value is 0	Change the setting value to non zero status
	When 2nd setting value is smaller than 1st setting value	Make 2nd setting value bigger than 1st setting value

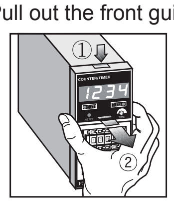
※There is no Error display function in indication type.
※There is no Error function in indicator.
※When Error is display, the OUTPUT continues OFF state.
※1st output maintains OFF status by 1st setting value as 0.



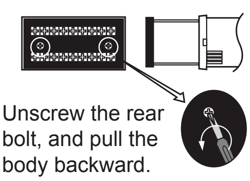
◎ Case & DIP switch detachment

● FXH Series

① Push down the front guide.
② Pull out the front guide.



● FXL Series



Unscrew the rear bolt, and pull the body backward.

※Please be careful of the injury caused by tools.

DIN W48×H48mm 8-Pin Plug Counter

■ Features

- Counting speed: 1cps / 30cps / 2kcps / 5kcps
- Decimal point setting (fixed decimal point of display)
- Wide range of power supply: 100-240VAC 50/60Hz
  12-24VAC 50/60Hz, 12-24VDC universal
- Memory protection for 10years (using non-volatile semiconductor)
- Selectable Up/Down for counting value
- Built-in Microprocessor

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

FS | 4 | A

Position	Code	Description
Output	A	1-stage preset
	B	Indicator
Digit	4	9999 (4-digit)
	5	99999 (5-digit)
Item	FS	8-pin plug counter

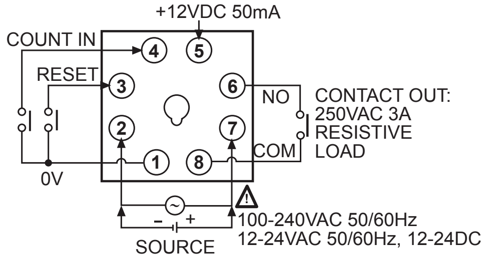
■ Specifications

Model	1-stage preset		**FS4A**	—
	Indicator		—	**FS5B**
Digit			4-digit	5-digit
Digit size			W3.8×H7.6mm	W4×H8mm
Power supply	AC voltage		100-240VAC 50/60Hz	
	AC/DC voltage		12-24VAC 50/60Hz, 12-24VDC	
Allowable voltage range			90 to 110% of rated voltage	
Power consumption	AC voltage		• Indicator: Max. 4.7VA • 1-stage preset: Max. 5.7VA (100-240VAC 50/60Hz)	
	AC/DC voltage		• Indicator: Max. 4.5VA • 1-stage preset: Max. 5.5VA (12-24VAC 50/60Hz) • Indicator: Max. 2.8W • 1-stage preset: Max. 3W (12-24VDC)	
Max. counting speed for CP1, CP2			Selectable 1cps/30cps/2kcps/5kcps by internal DIP switch	
Min. input signal width	RESET		Approx. 20ms	
Input	COUNT IN		No-voltage input - Impedance at short-circuit: Max. 470kΩ, Residual voltage at short-circuit: Max. 1VDC Impedance at open-circuit: Min. 100kΩ	
	RESET			
One-shot output time			0.05 to 5sec	
Control output	Contact	Type	SPST (1a)	—
		Capacity	250VAC 3A resistive load	—
Memory protection			Approx. 10 years (when using non-volatile semiconductor memory)	
External power			Max. 12VDC ±10% 50mA	
Insulation resistance			Over 100MΩ (at 500VDC megger)	
Dielectric strength			2,000VAC 50/60Hz for 1 minute	
Noise immunity	AC voltage		±2kV the square wave noise (pulse width: 1μs) by the noise simulator	
	DC voltage		±500V the square wave noise (pulse width: 1μs) by the noise simulator	
Vibration	Mechanical		0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour	
	Malfunction		0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min	
Shock	Mechanical		300m/s² (approx. 30G) in each X, Y, Z direction for 3 times	
	Malfunction		100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Relay life cycle	Mechanical		Min. 10,000,000 operations	—
	Electrical		Min. 100,000 operations (250VAC 3A at resistive load)	—
Environment	Ambient temperature		-10 to 55℃, storage: -25 to 65℃	
	Ambient humidity		35 to 85%RH, storage: 35 to 85%RH	
Unit weight			Approx. 130g	Approx. 120g

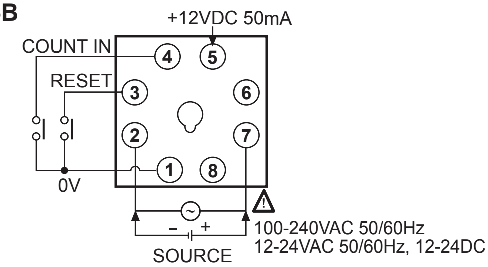
※Environment resistance is rated at no freezing or condensation.

▣ Connections

● **FS4A**



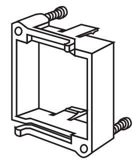
● **FS5B**

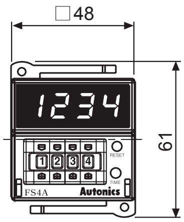


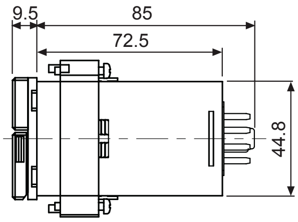
▣ Dimensions

(unit: mm)

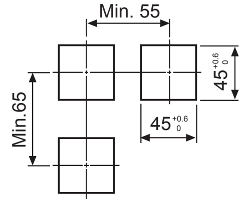
● **Bracket**



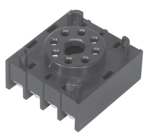
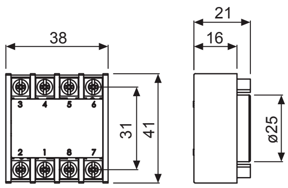
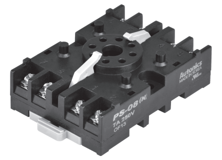
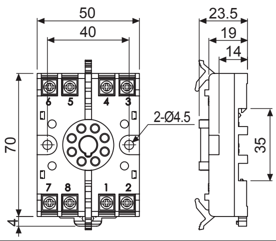




● **Panel cut-out**



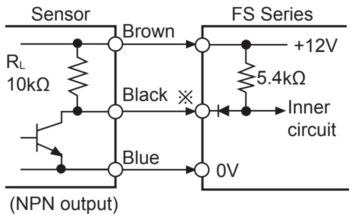
● **Socket (Sold separately)**

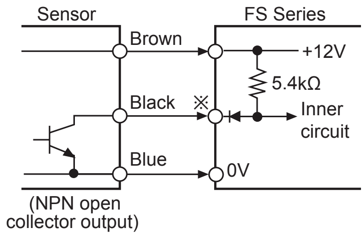
PG-08	PS-08(N)
 	 

▣ Input Connections

◎ No-voltage input (NPN)

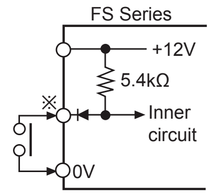
● **Solid-state input (Standard sensor: NPN output type sensor)**





※CP1, CP2 (INHIBIT), RESET input

● **Contact input**

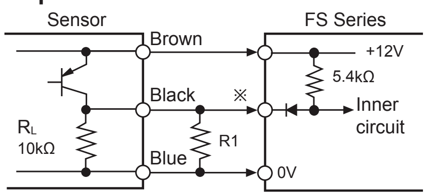


※Counting speed:
1 or 30cps setting (counter)

◎ Voltage input (PNP)

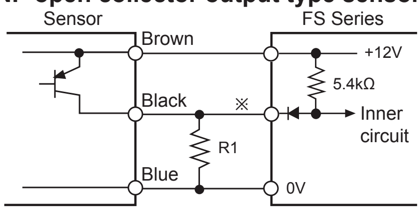
FXY series is for no voltage input type, it is not available to count applying DC voltage from the external.
For using PNP type sensor, please use as the following to count.

● **PNP output sensor**



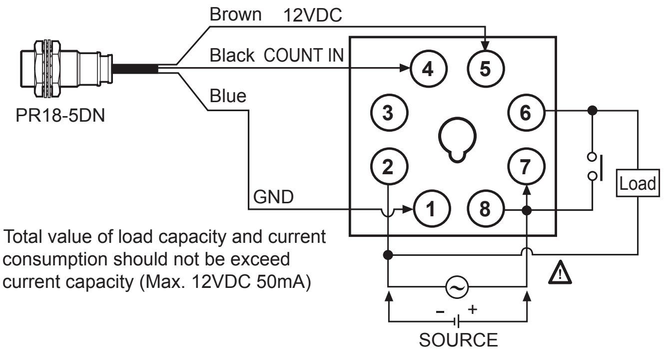
※Please set R1 value to make the composed resistance of R_L+R1 as Max. 470Ω is an impedance for short-circuit.
※CP1, CP2 (INHIBIT), RESET input

● **PNP open collector output type sensor**



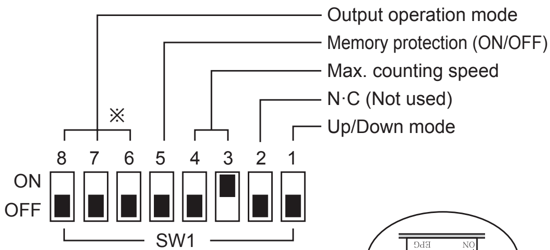
※In case of PNP open collector output type sensor, please connect lower than 470Ω of R1 to input terminal before using.

◎ Input & output connections

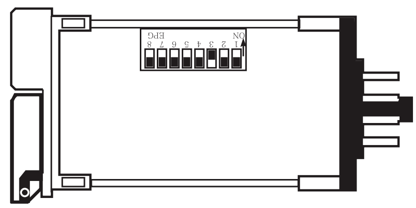


- Total value of load capacity and current consumption should not be exceed current capacity (Max. 12VDC 50mA)
- Please select proper capacity of load not to exceed contact capacity. Contact capacity: 250VAC 3A Max. Contact type: 1a

▣ Description Of Inner DIP Switches



※There is no output operation mode SW (6, 7, 8) in FS5B.



※The max. counting speed is upgraded as 8 DIP SW numbers.

● Max. counting speed

SW1	Function
3: ON, 4: OFF	1cps
3: OFF, 4: OFF	30cps
3: OFF, 4: ON	2kcps
3: ON, 4: ON	5kcps

● Up/Down mode

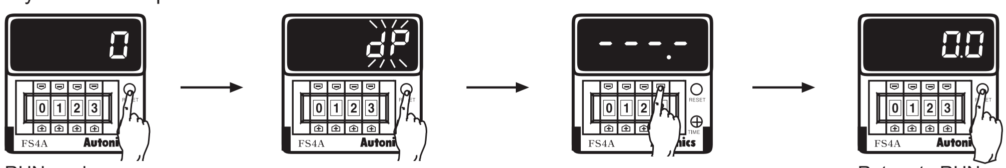
SW1		Function
1	ON	Down mode
	OFF	Up mode

● Memory protection

SW1		Function
5	ON	Disable the memory protection
	OFF	Enable the memory protection

▣ Setting Function Of Decimal Point

Display the decimal point.



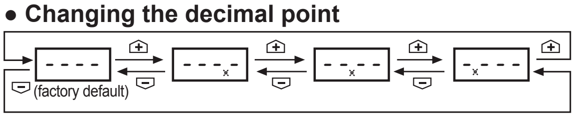
RUN mode
※Press RESET button for over 3sec, it advances to decimal point setting mode.

※When "dP"is flashing, one touch the Reset button.

※Set the position of decimal point using ⊕, ⊖ button of digital switch.

Return to RUN mode
※Press RESET button for over 3sec, it returns to RUN mode.

● Changing the decimal point

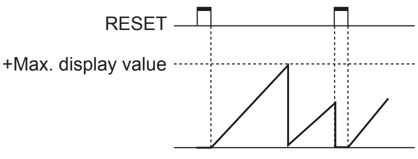


※It returns to RUN mode if no RESET button or digital switch is applied for 60sec in decimal point setting status.
※The decimal point setting is existed in indication type.

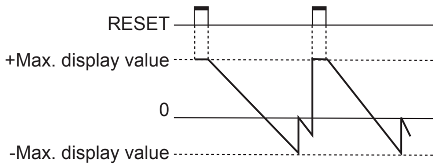
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Counting Operation Of Indication Mode (Indication Model)

● **Up mode**

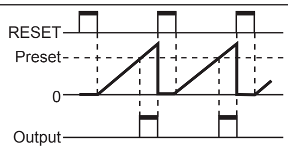
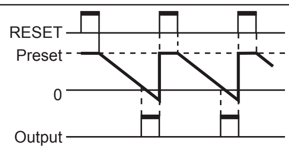
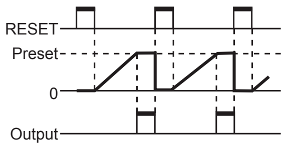
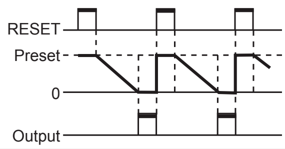
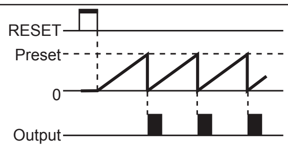
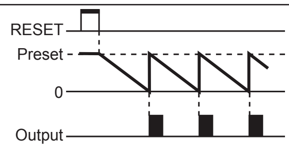
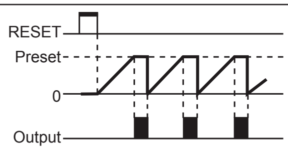
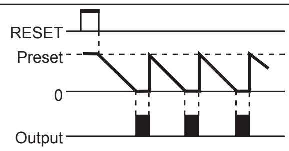
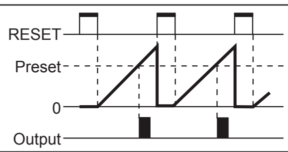
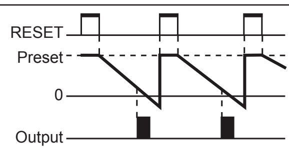
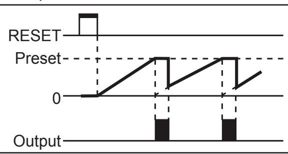
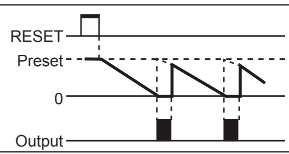
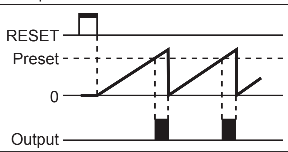
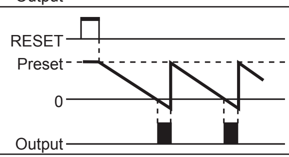
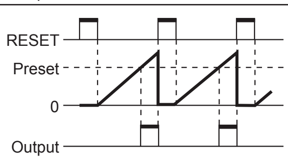
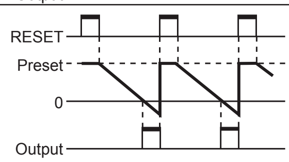


● **Down mode**



■ Output Operation Mode

← One-shot output **(0.05 to 5sec)**	← Retained output

Output mode (SW1)	1 ON OFF **Up mode**	1 ON OFF **Down mode**	Operation after count up
F 6 7 8 ON OFF			The display value continues until reset signal is applied then output is held. • Retained output will be maintained until Reset signal is applied.
N 6 7 8 ON OFF			Display value and retained output are maintained until Reset signal is applied.
C 6 7 8 ON OFF			The display value returns to reset start status when display value is reached to setting value.
R 6 7 8 ON OFF			The display value is held until output is OFF then returns to reset start status.
K 6 7 8 ON OFF			The display value continues until reset signal is applied.
P 6 7 8 ON OFF			The display value is held during one-shot output time, counting process is returned to reset start status as soon as output is ON.
Q 6 7 8 ON OFF			The display value continues during one-shot output time.
S 6 7 8 ON OFF			• Up input mode -Output is ON when (Display value) ≥ (Setting value) • Down input mode-Output is ON when (Display value) ≤ (Zero)

※One-shot output time is set by front TIME adjuster.

▣ Proper Usage

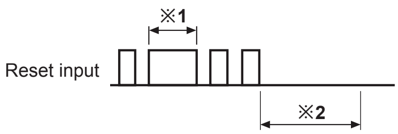
◎ Reset function

● Reset

In case of changing the input mode after supplying the power, please take a external reset or manual reset. **If reset is not executed, the counter will be working as previous mode.**

● Reset signal width

It is reset perfectly when the reset signal is applied during **min. 20ms** regardless of the contact input & solid-state input.

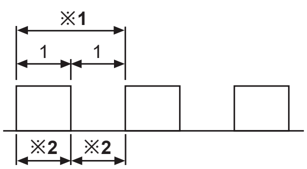


※1: In case of a contact reset, it is reset perfectly if the ON time of reset signal is applied during min. 20ms even though chattering occurs.
※2: It can be input the signal of CP1&CP2 after min. 50ms from closing time of reset signal.

◎ Sensor power

The power 12VDC which is provided to sensor is built in it. Please use it under Max. DC50mA.

◎ Min. signal width

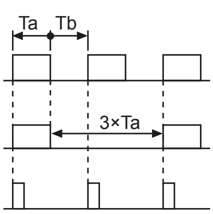


※1: Please make duty ratio (ON:OFF) 1:1.

※2: Min. signal width
- 1cps: Min. 0.5sec
- 30cps: Min.16.7ms
- 2kcps: Min. 0.25ms
- 5kcps: Min.0.1ms

◎ Max. counting speed

This is a response speed per 1 sec when the duty ratio (ON/OFF) of input signal is 1:1. If the duty ratio is not 1:1, the width between ON and OFF should be over min. signal width and the response speed is getting slower against input signal. If either ON or OFF signal is shorter than minimum signal width, this product may not respond.



Therefore Ta (ON width) and Tb (OFF width) needed to be over min. signal width.

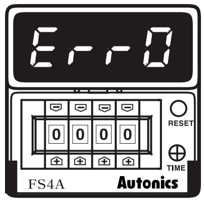
Max. counting speed is 1/2 value of rated spec. when duty ratio is 1:3.

It can not respond if it is smaller than min. signal width (Ta).

◎ Error display

Error signal	Error description	Returning method
Err0	Zero setting status	Change the setting value to non zero status

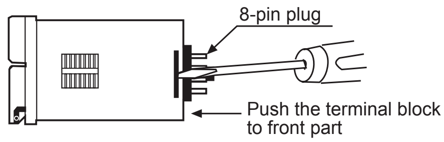
※When Error is displayed, the output continues OFF state.
※There is no Error function in indicator.



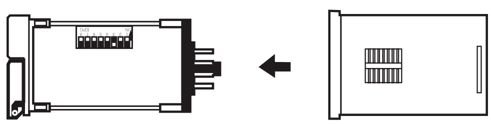
◎ Detach the case from body

While pushing the Lock part with with driver to the front, push the terminal block.

1) Widen the lock device toward outside, push the plug to the front.



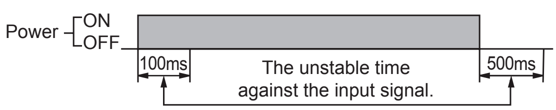
2) Detach the case.



※Please be careful to use with tools, it may cause injury.

◎ Power

The inner circuit voltage starts to rise up for the first 100ms after power on, the input may not work at this time.
And also the inner circuit voltage drops down for the last 500ms after power off, the input may not work at this time.



DIN W72×H72, W144×H72mm Of 8-Digit Up/Down Counter

■ Features

- 8 digits counter: Selectable Up, Down, Up/Down mode
- Counting speed: 1cps, 30cps, 2kcps, 5kcps
- Selectable voltage input (PNP) or no-voltage input (NPN)
- Decimal point setting (fixed decimal point of display)
- Wide range of power supply
  : 100-240VAC 50/60Hz
  12-24VAC 50/60Hz, 12-24VDC universal
- Built-in Microprocessor

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

F 8 A

Output	A	1-stage preset
	B	Indicator
Digit	8	99999999 (8-digit)
Size	F	DIN W72×H72mm
	L	DIN W144×H72mm

■ Specifications

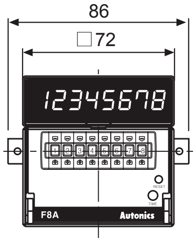
Model	1-stage preset		**F8A**	**L8A**
	Indicator		**F8B**	**L8B**
Digit			8-digit	
Digit size			W4×H8mm	W6.3×H10mm
Power supply	AC voltage		100-240VAC 50/60Hz	
	AC/DC voltage		12-24VAC 50/60Hz, 12-24VDC	
Allowable voltage range			90 to 110% of rated voltage	
Power consumption	AC voltage		• Indicator: Max. 5.4VA • 1-stage preset: Max. 6.1VA (100-240VAC 50/60Hz)	
	AC/DC voltage		• Indicator: Max. 5.5VA • 1-stage preset: Max. 6.3VA (12-24VAC 50/60Hz) • Indicator: Max. 2.6W • 1-stage preset: Max. 3.1W (12-24VDC)	
Max. counting speed			Selectable 1cps/30cps/2kcps/5kcps by internal DIP switch	
Min. signal input width	RESET		Approx. 20ms	
Input type	CP1, CP2 Input		[Voltage input] Input impedance: 5.4kΩ, [H]: 5-30VDC, [L]: 0-2VDC [No-Voltage input] Impedance at short-circuit: Max. 1kΩ, Residual voltage at short-circuit: Max. 2VDC, Impedance at open-circuit: Min. 100kΩ	
	RESET input			
One-shot output time			0.05 to 5sec	
Control output	Contact	Type	1-stage preset: SPDT (1c)	
		Capacity	250VAC 3A resistive load	
	Solid state	Type	1-stage preset type: 1 NPN open collector	
		Capacity	Max. 30VDC, 100mA	
Memory protection			Approx. 10 years (when using non-volatile semiconductor memory)	
External power			Max. 12VDC±10% 50mA	
Insulation resistance			Over 100MΩ (at 500VDC megger)	
Noise immunity	AC voltage		±2kV the square wave noise (pulse width: 1μs) by the noise simulator	
	DC voltage		±500V the square wave noise (pulse width: 1μs) by the noise simulator	
Vibration	Mechanical		0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour	
	Malfunction		0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min	
Shock	Mechanical		300m/s² (approx. 30G) in each X, Y, Z direction for 3 times	
	Malfunction		100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Relay life cycle	Mechanical		Min. 10,000,000 operations	
	Electrical		Min. 100,000 operations (250VAC 3A at resistive load)	
Environment	Ambient temperature		-10 to 55℃, storage: -25 to 65℃	
	Ambient humidity		35 to 85%RH, storage: 35 to 85%RH	
Unit weight			F8A: Approx. 287g, F8B: Approx. 253g	L8A: Approx. 500g, L8B: Approx. 446g

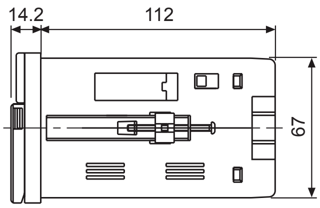
※Environment resistance is rated at no freezing or condensation.

Dimensions

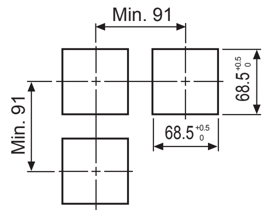
(unit: mm)

● F Series



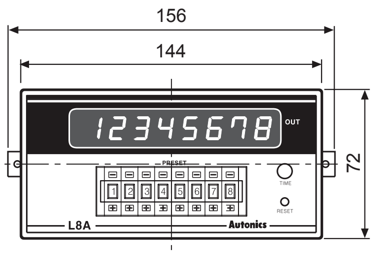


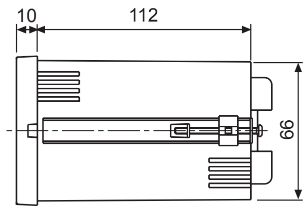
● Panel cut-out



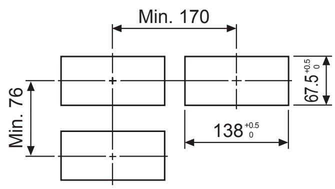
●L Series

(unit: mm)



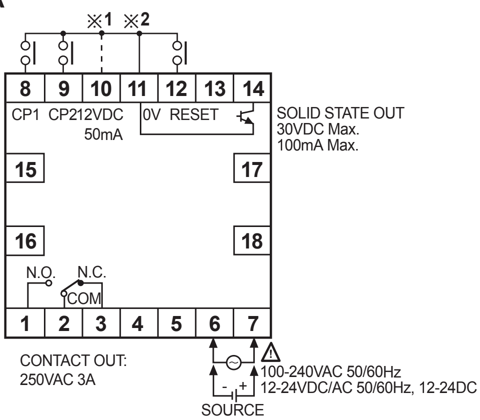


● Panel cut-out

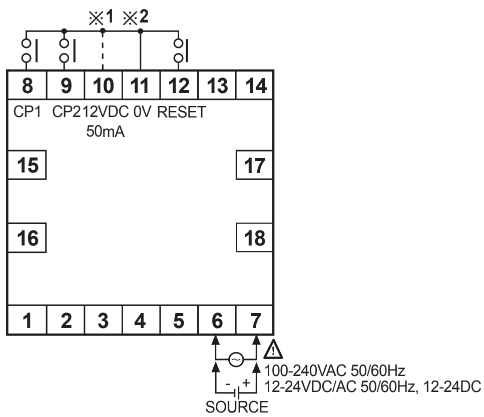


Connections

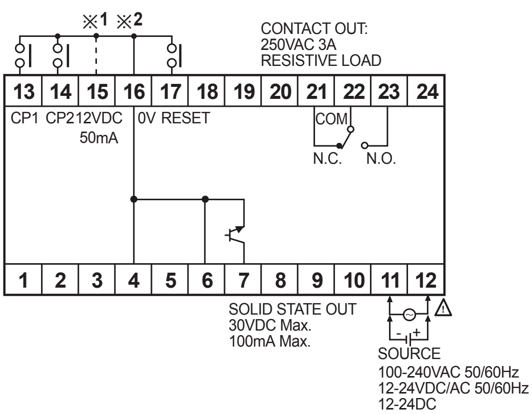
● F8A



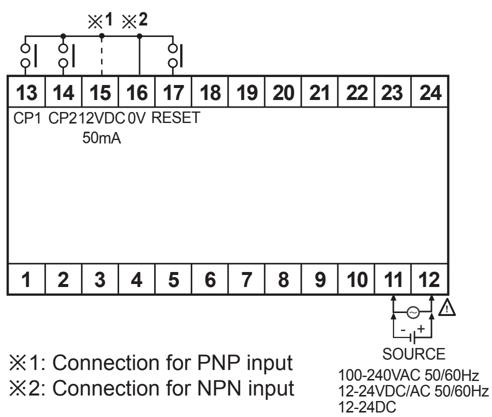
● F8B



● L8A



● L8B



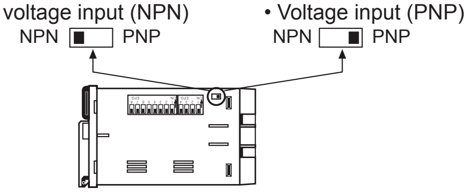
※1: Connection for PNP input
※2: Connection for NPN input

▣ Input Logic Selection

● F Series

Input logic is changeable by input logic selection switch located at the one-side of case.

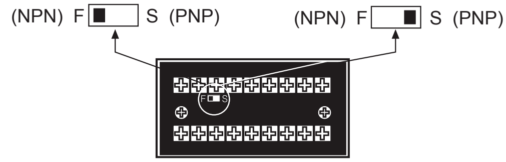
• No voltage input (NPN) • Voltage input (PNP)



● L Series

Input logic is changeable by input logic selection switch located at the terminal block.

• No voltage input (NPN) • Voltage input (PNP)

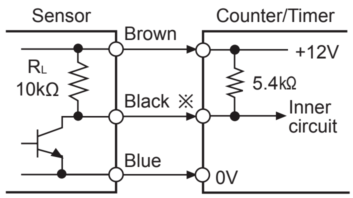


※Please be sure to turn OFF the power before changing input logic.

▣ Input Connections

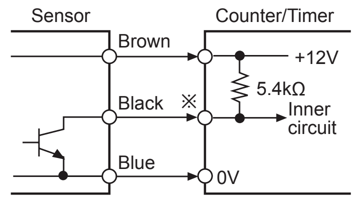
◎ No voltage input (NPN)

● Solid-state input (Standard sensor: NPN output type sensor)



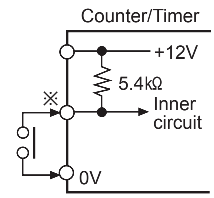
(NPN output)

※CP1, CP2, RESET input



(NPN open collector output)

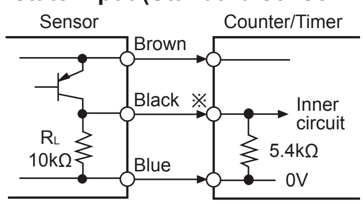
● Contact input



※Counting speed: 1 or 30cps setting (counter)

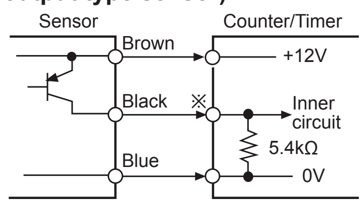
◎ Voltage input (PNP)

● Solid-state input (Standard sensor: PNP output type sensor)



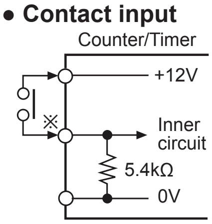
(PNP output)

※CP1, CP2 (INHIBIT), RESET input



(PNP open collector output)

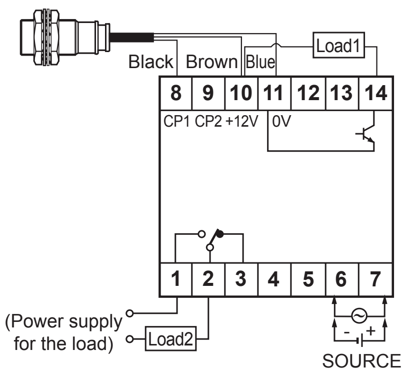
● Contact input



※Counting speed: 1 or 30cps setting (counter)

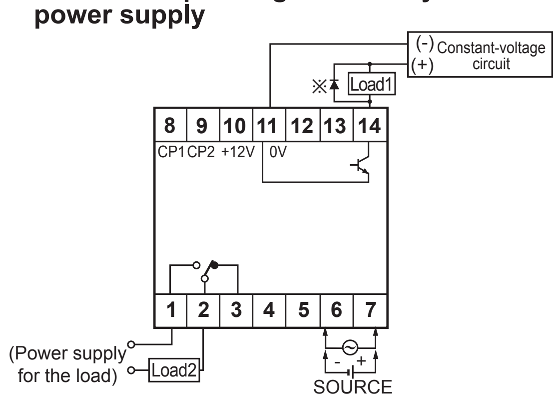
▣ Input & Output Connections

◎ In case of operating the load by power supply of the sensor



● Please select proper capacity of load, because total value of load capacity and current consumption should not be exceed current capacity (Max. 50mA).

◎ In case of operating the load by external power supply



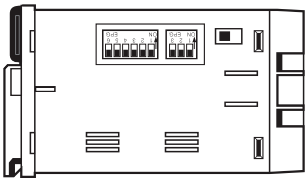
● The capacity of the load must not be exceed Max. 30VDC, Max. 100mA of the switching capacity of the transistor.

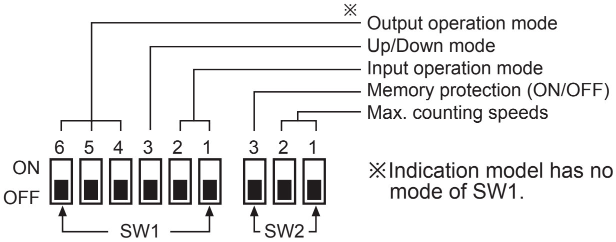
● Please do not supply the reverse polarity voltage.

※In case of using the inductive load (Relay, etc.), please connector the surge absorber (Diode)at both terminals of the load, in case of using the inductive load.

Description Of Inner DIP Switches

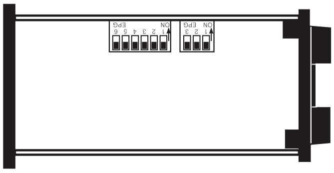
● F Series





※Indication model has no 4, 5, 6 mode of SW1.

● L Series



● Up/Down mode

SW1	Function
3 ON	Up mode
3 OFF	Down mode

● Memory protection

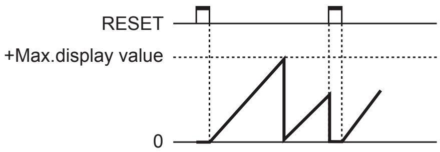
SW2	Function
3 ON	Disable the memory protection
3 OFF	Enable the memory protection

● Selecting Max. counting speed

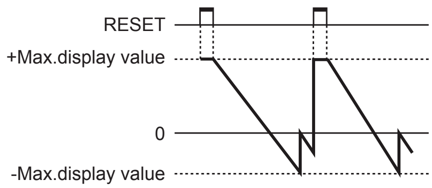
SW2	Function
1 ON, 2 OFF	1cps
1 OFF, 2 OFF	30cps
1 OFF, 2 ON	2kcps
1 ON, 2 ON	5kcps

Counting Operation Of Indication Type

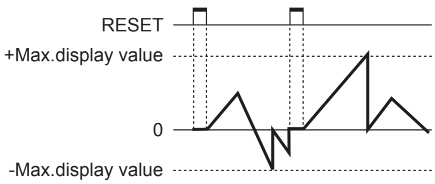
● Up mode



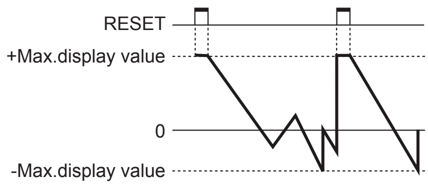
● Down mode



● Up / Down-A, B, C input mode

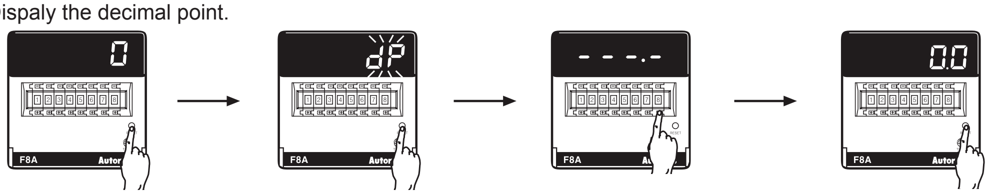


● Up / Down-D, E, F mode



Setting Function Of Decimal Point

Dispaly the decimal point.



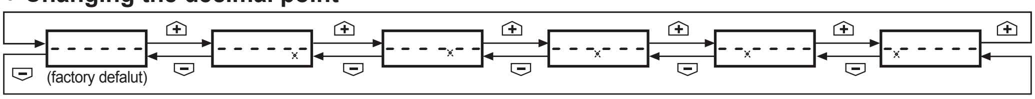
RUN mode
※Press RESET button for over 3sec, it advances to decimal point setting mode.

※When "dP" is flashing, one touch the Reset button.

※Set the position of decimal point using ⊕, ⊖ button of digital switch.

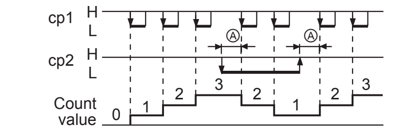
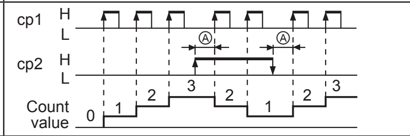
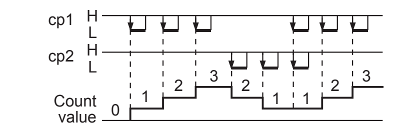
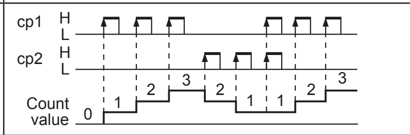
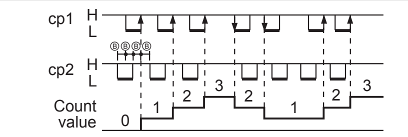
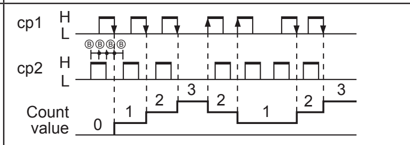
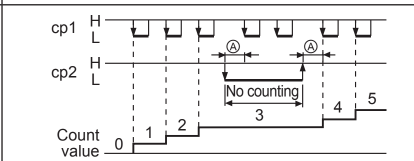
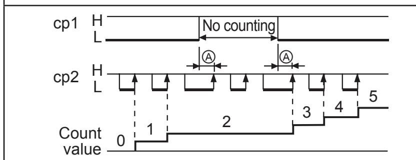
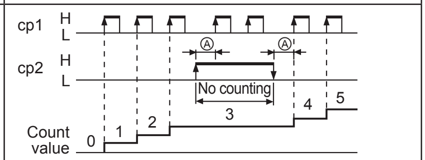
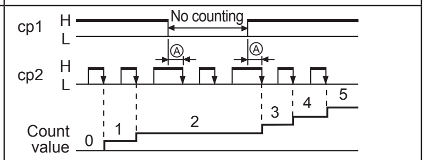
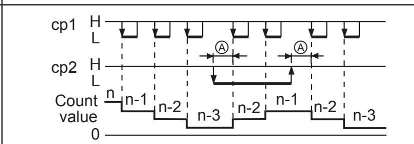
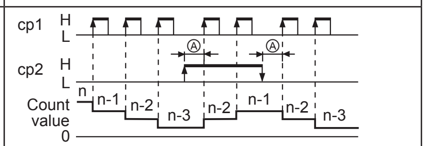
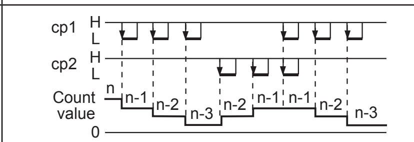
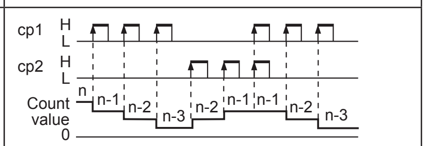
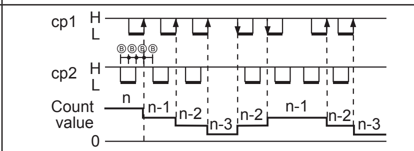
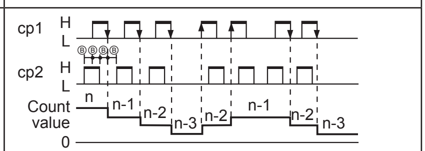
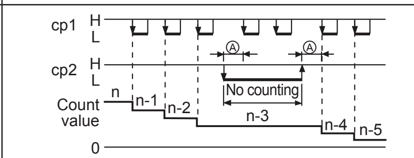
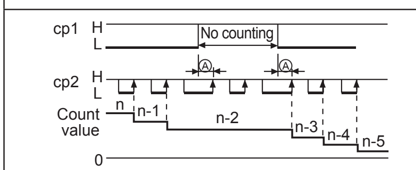
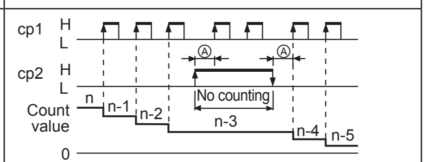
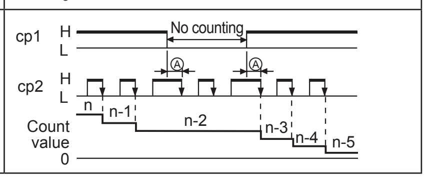
Return to RUN mode
※Press RESET button for over 3sec, it returns to RUN mode.

● Changing the decimal point



※It returns to RUN mode if no RESET button or digital switch is applied for 60sec in decimal point setting status.
※The decimal point setting is existed in indication type.

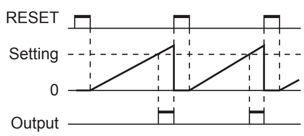
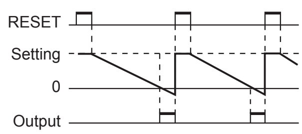
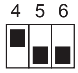
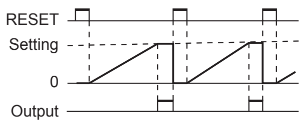
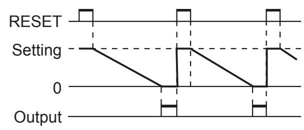
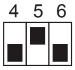
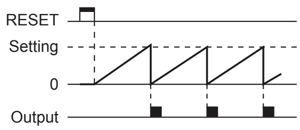
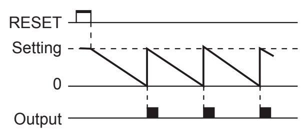
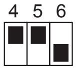
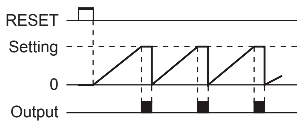
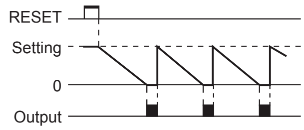
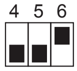
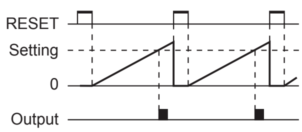
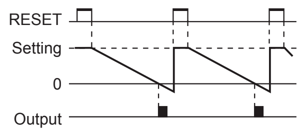
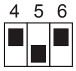
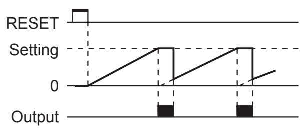
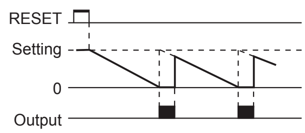
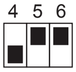
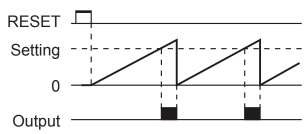
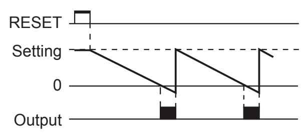
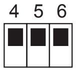
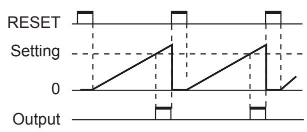
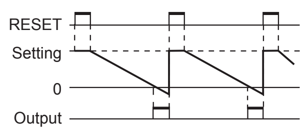
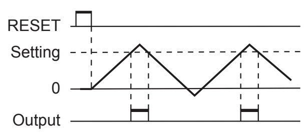
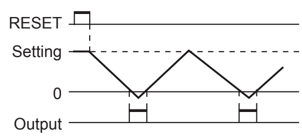
■ Input Operation Mode (Counter)

Input mode (SW1)		SW1	No-voltage input type (NPN)	Voltage input type (PNP)
3 ON OFF **Up mode**	Up/Down-A (Command input)	1 2 ON OFF		
	Up/Down-B (Individual input)	1 2 ON OFF		
	Up/Down-C (Phase difference input)	1 2 ON OFF		
	Up (Count up input)	1 2 ON OFF	 	 
3 ON OFF **Down mode**	Up/Down-D (Command input)	1 2 ON OFF		
	Up/Down-E (Individual input)	1 2 ON OFF		
	Up/Down-F (Phase difference input)	1 2 ON OFF		
	Down (Count down input)	1 2 ON OFF	 	 

※Ⓐ: Over min. signal width, Ⓑ: Over 1/2 of min. signal width.
It the signal width of Ⓐ or Ⓑ is less than min. signal width, ±1 of count error occurs.

Output Operation Mode

 ← One-shot output **(0.05 to 5sec)**  ← Retained output

Output mode (SW1)	ON / OFF (4)  **Up mode** **UP, UP / Down-A, B, C**	ON / OFF (4)  **Down mode** **Down, UP / Down-D, E, F**	Operation after count up
F 4 5 6 ON OFF 			The display value continues until reset signal is applied and the output will be held. • Retained output will be maintained until Reset signal is applied.
N 4 5 6 ON OFF 			Display value and retained output are maintained until Reset signal is applied.
C 4 5 6 ON OFF 			The display value returns to reset start status when display value is reached to setting value.
R 4 5 6 ON OFF 			The display value is held until output is OFF then returns to reset start status.
K 4 5 6 ON OFF 			The display value continues until reset signal is applied.
P 4 5 6 ON OFF 			The display value is held during one-shot output time, counting process is returned to reset start status when output is ON.
Q 4 5 6 ON OFF 			The display value continues during one-shot output time.
S	**Up input**	**Down input**	
4 5 6 ON OFF 			• Up, UP/Down-A, B, C input mode - Output is ON when (Display value)≥ (Setting value) • Down, UP/Down-D, E, F input mode - Output is ON when (Display value)≤ (Zero)
	Up, Up / Down-A, B, C	**Down, Up / Down-D, E, F**	
			

※One-shot output time is set by front TIME adjuster.

▣ Proper Usage

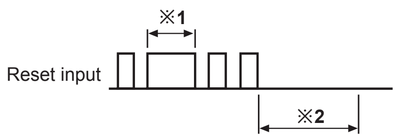
◎ Reset function

● Reset

In case of changing the input mode after supplying the power, please take an external reset or manual reset. **If reset is not executed, the counter will be working as previous mode.**

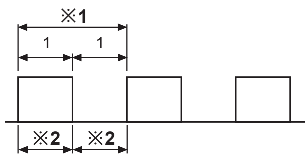
● Reset signal width

It is reset perfectly when the reset signal is applied during **min. 20ms** regardless of the contact input & solid-state input.



※1: In case of a contact reset, it is reset perfectly if the ON time of reset signal is applied during min. 20ms even though a chattering occurs.
※2: It can be input the signal of CP1 & CP2 after min. 50ms from closing time of reset signal.

◎ Min. signal width of CP1, CP2 input

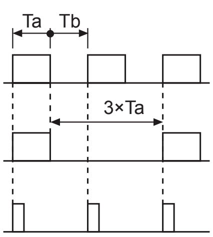


※1: Please make duty ratio (ON:OFF) as 1:1.

※2: Min. signal width
- 1cps: Min. 500ms
- 30cps: Min. 16.7ms
- 2kcps: Min. 0.25ms
- 5kcps: Min. 0.1ms

◎ Max. counting speed

This is a response speed per 1 sec when the duty ratio (ON/OFF) of input signal is 1:1. If the duty ratio is not 1:1, the width between ON and OFF should be over min. signal width and the response speed is getting slower against input signal. If either ON or OFF signal is shorter than minimum signal width, this product may not respond.



Therefore Ta (ON width) and Tb (OFF width) needed to be over min. signal width.

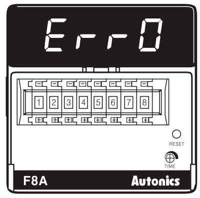
Max. counting speed is 1/2 value of rated spec. when duty ratio is 1:3.

It can not respond if it is smaller than min. signal width (Ta).

◎ Error display

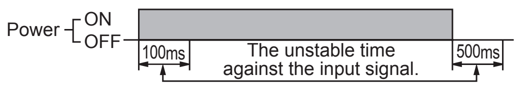
Error signal	Error description	Returning method
Err0	Zero setting status	Change the setting value to non zero status

※When Error is displayed, the output continues OFF state.
※There is no Error function in indicator.



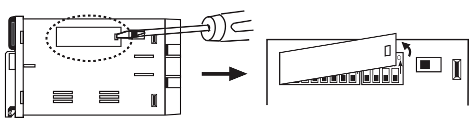
◎ Power

The inner circuit voltage starts to rise up for the first 100ms after power on, the input may not work at this time. And also the inner circuit voltage drops down for the last 500ms after power off, the input may not work at this time.



▣ Case & DIP Switch Detachment

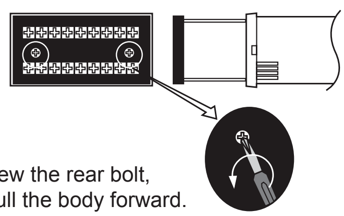
● F Series



Push a lock part to front direction and widen it simultaneously.
※Please be careful to use with tools, it may cause injury.

● L Series

Please turn off the power before detaching the case.



Unscrew the rear bolt, and pull the body forward.

※Please be careful of the injury caused by tools.

DIN W72×H72, W144×H72mm Of Up / Down / Up·Down Measure Counter

■ Features

- Selectable Multi/Divide function
- Upgrade counting speed: 1cps, 5kcps
- Selectable voltage input (PNP) or no-voltage input (NPN)
- Memory protection for 10 years (using non-voltage semiconductor)
- Decimal point setting (fixed decimal point of display)
- Wide range of power supply
  : 100-240VAC 50/60Hz,
  12-24VAC 50/60Hz, 12-24VDC universal
- Built-in Microprocessor

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

F 4 A M — 2P

Item	Code	Description
Output	No mark	1-stage preset
	2P	2-stage preset
Function	M	Measure function
Output	A	Preset
	B	Indicator
Digit	4	9999 (4-digit)
	6	999999 (6-digit)
Size	F	DIN W72×H72mm
	L	DIN W144×H72mm

■ Specifications

Model	1-stage preset		**F4AM**	**F6AM**	—	—
	2-stage preset		**F4AM-2P**	**F6AM-2P**	**L4AM-2P**	**L6AM-2P**
	Indicator		**F4BM**	**F6BM**	**L4BM**	**L6BM**
Digit			4-digit	6-digit	4-digit	6-digit
Digit size			W8×H14mm	W4×H8mm	W8×H14mm	
Power supply	AC voltage		100-240VAC 50/60Hz			
	AC/DC voltage		12-24VAC 50/60Hz, 12-24VDC			
Allowable voltage range			90 to 110% of rated voltage			
Power consumption	AC voltage		• Indicator: Max. 4.7VA • 1-stage preset: Max. 5.6VA • 2-stage preset: Max. 6.5VA (100-240VAC 50/60Hz)			
	AC/DC voltage		• Indicator: Max. 5.1VA • 1-stage preset: Max. 6VA • 2-stage preset: Max. 6.5VA (12-24VAC 50/60Hz) • Indicator: Max. 2.7W • 1-stage preset: Max. 3.3W • 2-stage preset: Max. 3.8W (12-24VDC)			
Max. counting speed			Selectable 1cps/30cps/2kcps/5kcps by internal DIP switch			
Min. input signal width			Approx. 20ms			
Input type	CP1,CP2 input		Input logic is selectable [Voltage input] Input impedance: 5.4kΩ, [H]: 5-30VDC, [L]: 0-2VDC [No-Voltage input] Impedance at short-circuit: Max. 1kΩ, Residual voltage at short-circuit: Max. 2VDC, Impedance at open-circuit: Min. 100kΩ			
	RESET input					
One-shot output time			• 1-stage preset type - 0.05 to 5sec • 2-stage preset type - 1st. output 0.5sec fixed, 2nd. output: 0.05 to 5sec			
Control output	Contact	Type	1-stage preset: SPDT (1c) 2-stage preset: 1st. output SPST (1a), 2nd. output SPST (1a)		2-stage preset: 1st. output SPDT (1c), 2nd. output SPDT (1c)	
		Capacity	250VAC 3A resistive load			
	Solid state	Type	1-stage preset: 1 NPN open collector output, 2-stage preset: 2 NPN open collector output			
		Capacity	Max. 30VDC, 100mA			
Memory protection			Approx. 10 years (when using non-volatile semiconductor memory)			
External power			12VDC±10% 50mA Max.			

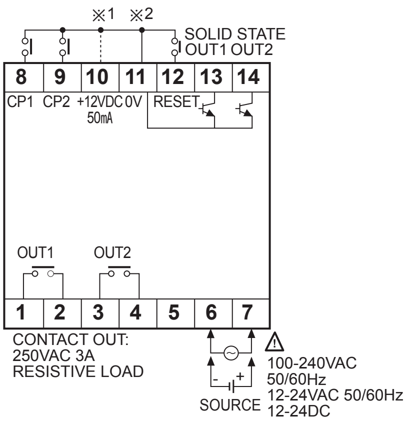
■ Specifications

Insulation resistance		Over 100MΩ (at 500VDC megger)
Dielectric strength		2,000VAC 50/60Hz for 1 minute
Noise immunity	AC voltage	±2kV the square wave noise (pulse width: 1μs) by the noise simulator
	DC voltage	±500V the square wave noise (pulse width: 1μs) by the noise simulator
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times
Relay life cycle	Mechanical	Min. 10,000,000 operations
	Electrical	Min. 100,000 operations (250VAC 3A at resistive load)
Environ-ment	Ambient temperature	-10 to 55℃, storage: -25 to 65℃
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Unit weight	AC Voltage type	**F4AM:** Approx. 273g, **F6AM:** Approx. 280g, **F4AM-2P:** Approx. 275g, **F6AM-2P:** Approx. 282g, **F4BM:** Approx. 229g, **F6BM:** Approx. 236g, **L4AM:** Approx. 505g, **L6AM-2P:** Approx. 533g, **L4AM-2P:** Approx. 438g, **L6BM:** Approx. 445g
	AC/DC Voltage type	**F4AM:** Approx. 268g, **F6AM:** Approx. 275g, **F4AM-2P:** Approx. 270g, **F6AM-2P:** Approx. 287g, **F4BM:** Approx. 224g, **F6BM:** Approx. 231g, **L4AM-2P:** Approx. 511g, **L6AM-2P:** Approx. 538g, **L4BM-2P:** Approx. 444g, **L6BM:** Approx. 450g

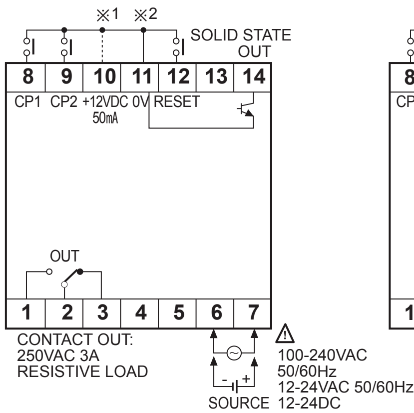
※Environment resistance is rated at no freezing or condensation.

■ Connections

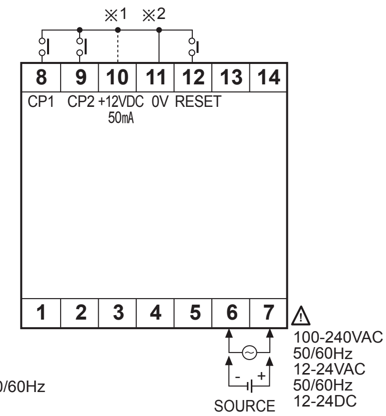
● F4AM-2P / F6AM-2P



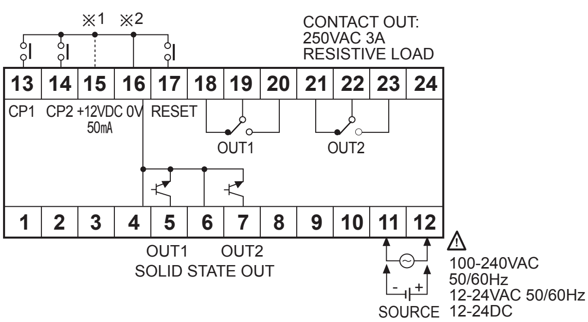
● F4AM / F6AM



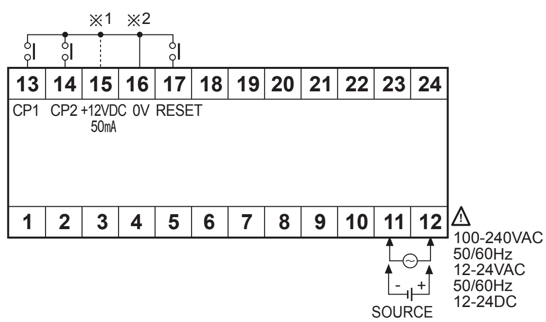
● F4BM / F6BM



● L4AM-2P / L6AM-2P



● L4BM / L6BM

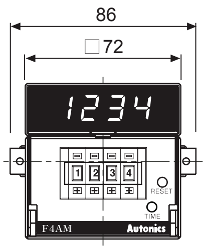


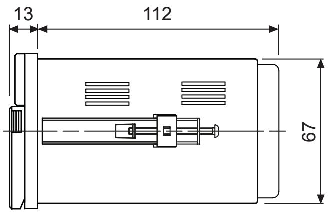
※1: Connection for PNP input in contact input
※2: Connection for NPN input in contact input

■ Dimensions

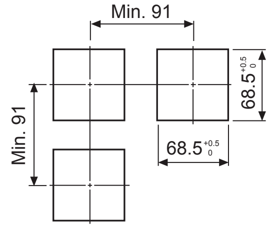
(unit: mm)

● FM Series



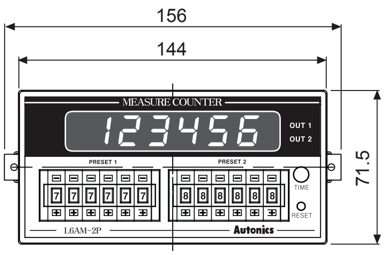


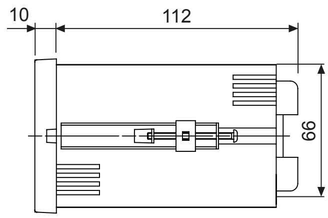
● Panel cut-out



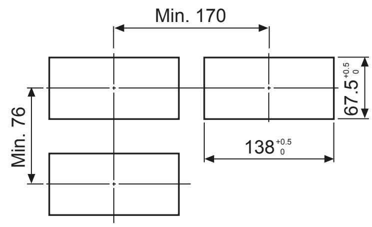
● LM Series

(unit: mm)





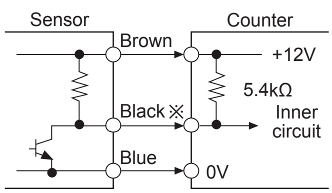
● Panel cut-out



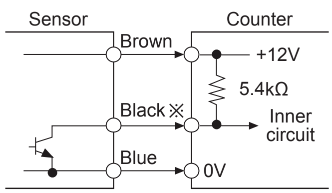
■ Input Connections

◎ No-voltage input (NPN)

● Solid-state input (Standard sensor: NPN output type sensor)



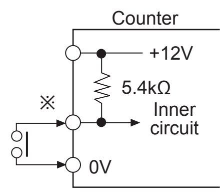
(NPN output)



(NPN open collector output)

※CP1, CP2, RESET input

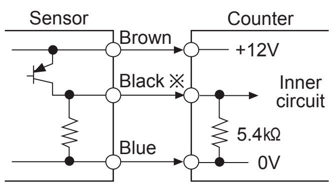
● Contact input



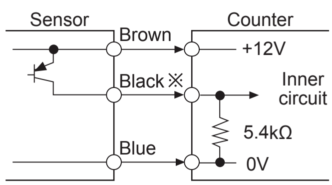
※Counting speed: 1 or 30cps setting (counter)

◎ Voltage input (PNP)

● Solid-state input (Standard sensor: PNP output type sensor)



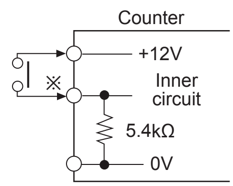
(PNP output)



(PNP open collector output)

※CP1, CP2, RESET input

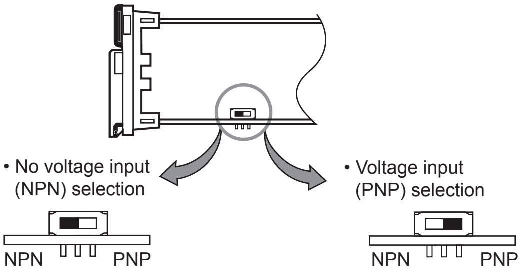
● Contact input



※Counting speed: 1 or 30cps setting (counter)

▣ Description Of Inner DIP Switches

● **FM Series**



※Please be sure to turn OFF the power before changing input logic.

● **LM Series**

Input logic is changeable by input logic selection switch located at the terminal block.

• No voltage input (NPN)

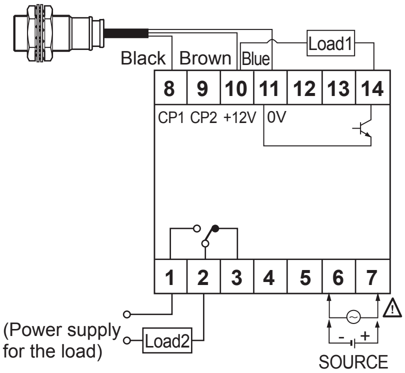
(NPN) F ■ S (PNP)

• Voltage input (PNP)

(NPN) F ■ S (PNP)

▣ Input & Output Connections

◎ In case of operating the load by power supply of the sensor

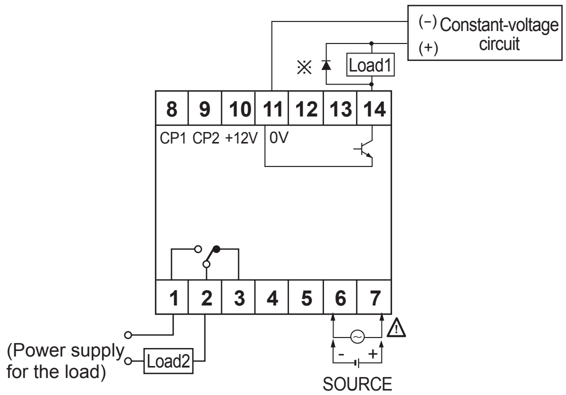


● Please select proper capacity of load, because total value of load capacity and current consumption should not be exceed current capacity (Max. 50mA).

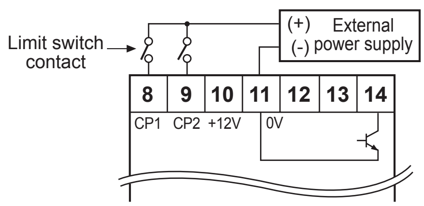
◎ How to count by external power supply

This unit start to count when "High" level (5-30VDC) is applied at CP1 or CP2 after selecting PNP.
("Low level": 0-2VDC)

◎ In case of operating the load by external power supply

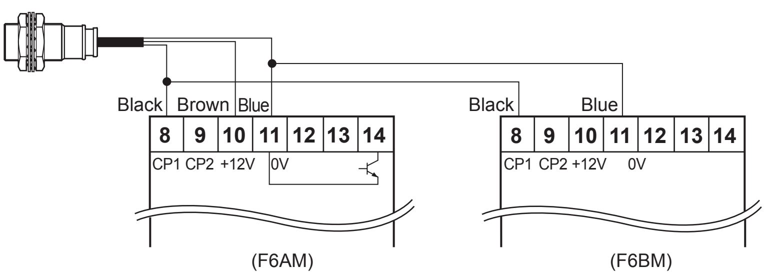


● The capacity of the load must not be exceed Max. 30VDC, Max. 100mA of the switching capacity of the transistor.
● Please do not supply the reverse polarity voltage.
※In case of using the inductive load (Relay, etc.), please connector the surge absorber (Diode)at both terminals of the load, in case of using the inductive load.



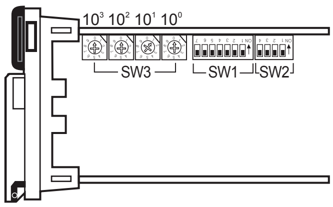
◎ Using 2 counters with one sensor

● Please connect as the power of sensor is supplied from only one of counters and design input logic with same way.

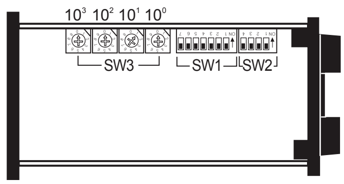


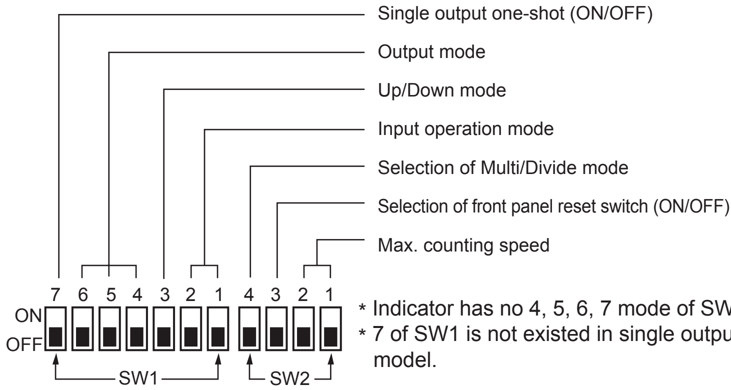
▣ Selection By DIP Switches

● **FM Series**



● **LM Series**





* Indicator has no 4, 5, 6, 7 mode of SW1.
* 7 of SW1 is not existed in single output model.

● Max. counting speed

SW2	Function
1 2 ON OFF	**1cps**
1 2 ON OFF	30cps
1 2 ON OFF	2kcps
1 2 ON OFF	**5kcps**

※Factory default: 30cps

● Reset switch of front panel

SW2		Function
3	ON OFF	Use
	ON OFF	Not used

※Factory default: Not used

● Measure function

SW1		Function
4	ON OFF	Multi mode
	ON OFF	Divide mode

※Refer to the J-75 for "▣ Measure Counter".
※Factory default: Divide mode (SW3:0001)

● Up/Down mode selection

SW1		Function
3	ON OFF	Up mode
	ON OFF	Down mode

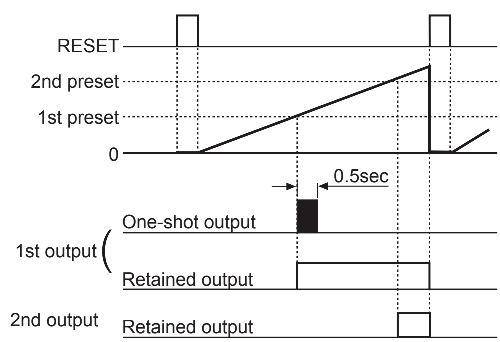
※Factory default: Up mode

● Single output one-shot (ON/OFF)

SW1		Function
7	ON OFF	One-shot output
	ON OFF	Retained output

※Factory default: Retained output
※This mode selects one-shot output (0.5sec) or remained output (until 2nd output turns off) for 1st output in the 2-stage preset counter.

※Example of F output operation mode



Measure Counter

Measure counter sets multiply or divide integer per 1 pulse input.

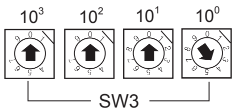
SW2		Function
4	ON / OFF	Multi

SW2		Function
4	ON / OFF	Divide

● Multi Mode

It multiplies the inner SW3 setting value at a count input signal and displays it.

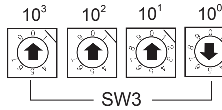
Input signal (N)×SW3 preset value=Indication value



∴ N × 4 = 4, 8, 12 … (N=1, 2, 3 ..)

● Divide Mode

It displays as 1 when the count input signal is entered as preset value of inner SW3.

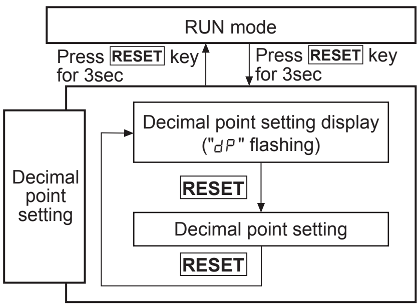


$\frac{\text{Input signal (N)}}{\text{SW3 preset value}}$ = Indication value

∴ $\frac{N}{5}$ = 1, 2, 3 … (N=5, 10, 15 ..)

※Please be cautious the error can occur when down count is executed during up count.

Setting Function Of Decimal Point



※It advances to "Decimal point setting mode" if press RESET key for 3sec

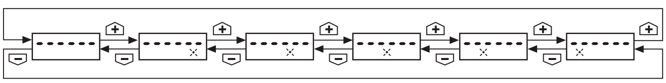
※It returns to RUN mode by press RESET key for 3sec in "Decimal point setting mode".

※It returns to RUN mode if no RESET button or digital switch (Dual-setting digital switch for 2-stage preset type) is applied for 60sec in the "Decimal point setting mode".

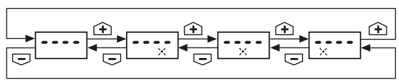
※The decimal point setting is not existed in indicator.

● Decimal point setting

• The decimal point setting of 6-digits indicator



• The decimal point setting of 4-digits indicator

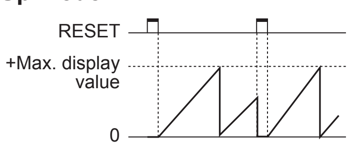


※When it enters to the "Decimal point of setting mode, the prior decimal setting status is displayed.

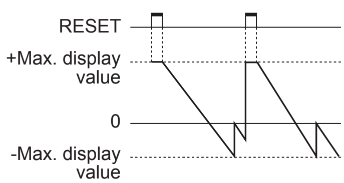
※In the decimal point setting mode, when pressing one of the Up (⊕) button of digital switch (Dual-setting digital switch for 2-stage preset type), the point is moved to left direction and it is moved to right direction when one of Down (⊖) button of digital switch (Dual-setting digital switch for 2-stage preset type).

Counting Operation Of Indication Type

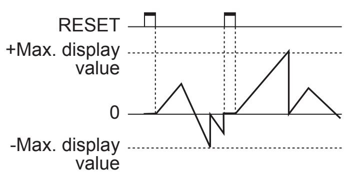
● Up mode



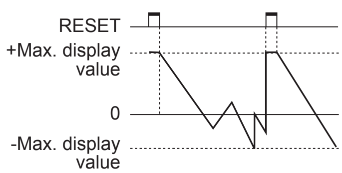
● Down mode



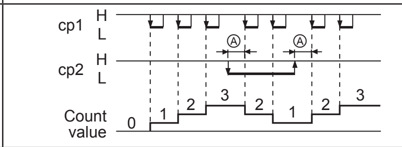
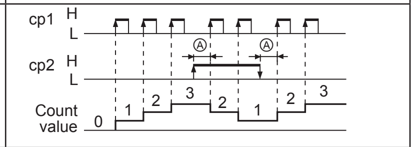
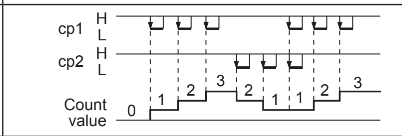
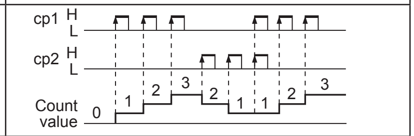
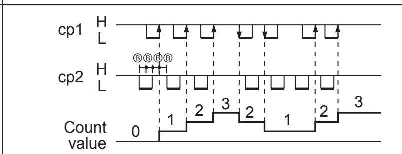
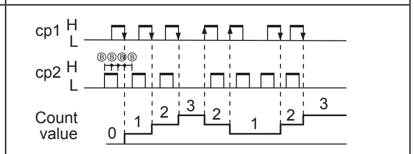
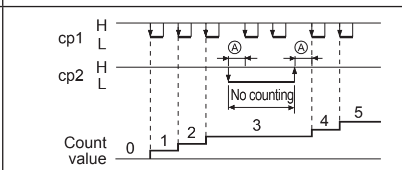
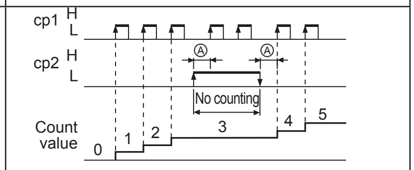
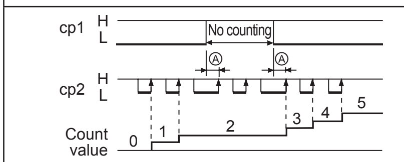
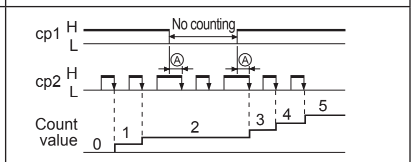
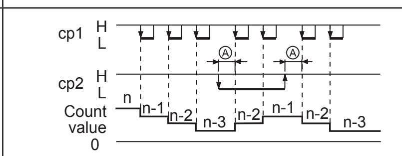
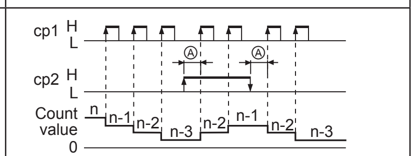
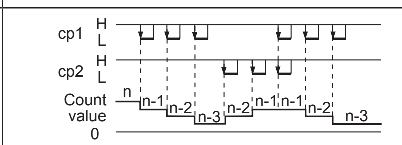
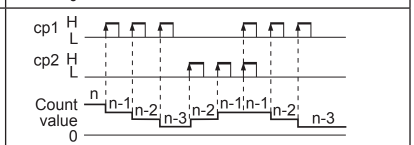
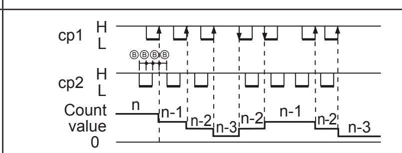
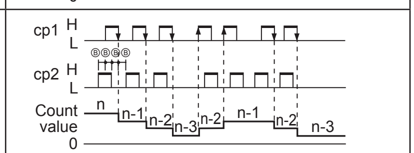
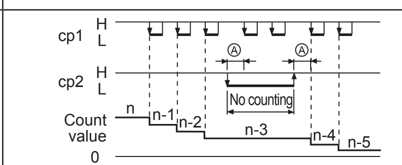
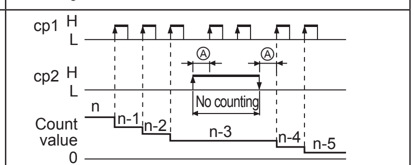
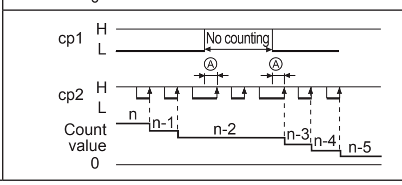
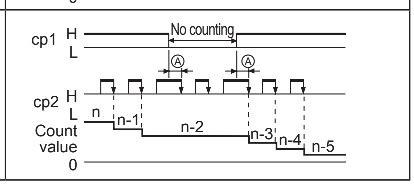
● Up / Down-A, B, C mode



● Up / Down-D, E, F mode



■ Input Operation Mode

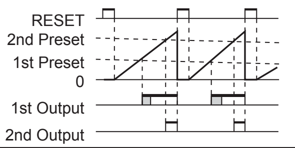
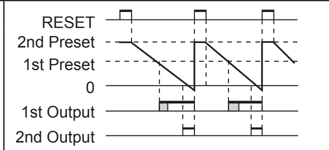
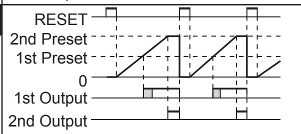
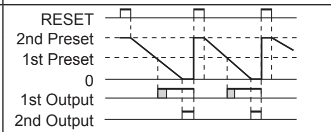
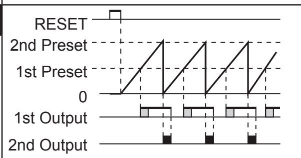
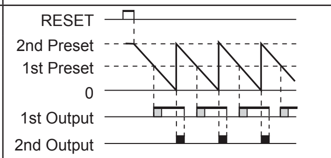
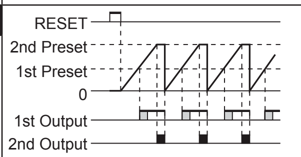
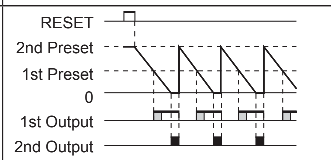
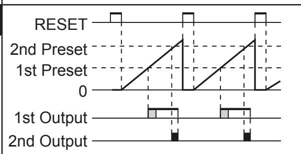
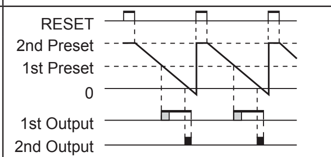
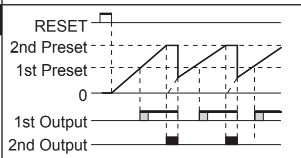
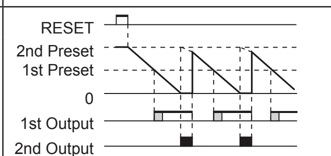
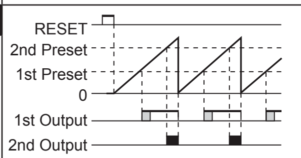
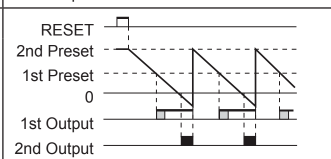
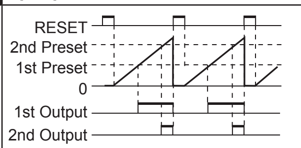
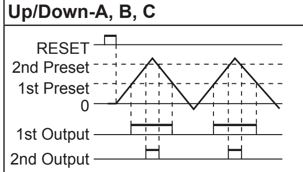
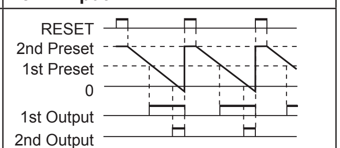
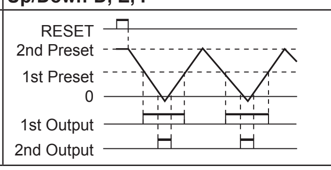
Input mode (SW1)		SW1	No-voltage input type (NPN)	Voltage input type (PNP)
Up mode (3: ON)	Up/Down-A (Command input)	1: OFF, 2: OFF		
	Up/Down-B (Individual input)	1: ON, 2: OFF		
	Up/Down-C (Phase difference input)	1: OFF, 2: ON		
	Up (Count up input)	1: ON, 2: ON		
				
Down mode (3: OFF)	Up/Down-D (Command input)	1: OFF, 2: OFF		
	Up/Down-E (Individual input)	1: ON, 2: OFF		
	Up/Down-F (Phase difference input)	1: OFF, 2: ON		
	Down (Count down input)	1: ON, 2: ON		
				

※Ⓐ: Over min. signal width, Ⓑ: Over 1/2 of min. signal width.
It the signal width of Ⓐ or Ⓑ is less than min. signal width, ±1 of count error is occured.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Output Operation Mode

■ ← One-shot output (0.05 to 5sec) of 2nd output | Retained output / One-shot output (0.5sec) of 1st output | ← Retained output | ※ The output of 1-stage preset type is operated at the status of the second output mode

Output mode (SW1)	3 ON OFF Up mode Up, Up/Down-A, B, C mode	3 ON OFF Down mode Down, Up/Down-D, E, F mode	Operation after count up
4 5 6 ON OFF			The display value continues until Reset signal applied and the output is held. • 1st retained output and 2nd output are maintained until Reset signal is applied. • When using 1st output as one-shot output, it will return after operating for 0.5sec
N 4 5 6 ON OFF			Display value and retained output are maintained until Reset signal is applied. • When using 1st output as one-shot output, it will return after operating for 0.5sec
C 4 5 6 ON OFF			The display value will be Reset Start status as soon as it reaches to 2nd setting value. • 1st retained output will be OFF after 2nd one-shot output. • 1st one-shot output will be reset after operating 0.5sec, and it is not related to 2nd output.
R 4 5 6 ON OFF			The display value will be held until 2nd output is OFF then reset. • 1st retained output will be OFF after 2nd one-shot output. • 1st one-shot output will be reset after operating 0.5sec, and it is not related to 2nd output.
K 4 5 6 ON OFF			The display value continues until Reset signal applied. • 1st retained output will be OFF after 2nd one-shot output. • 1st one-shot output will be reset after operating 0.5sec, and it is not related to 2nd output.
P 4 5 6 ON OFF			The display value will be Reset Start status as soon as it reaches to 2nd setting value. • 1st retained output will be OFF after 2nd one-shot output. • 1st one-shot output will be reset after operating 0.5sec, and it is not related to 2nd output.
Q 4 5 6 ON OFF			The display continues until 2nd output is OFF. • 1st retained output will be OFF after 2nd one-shot output. • 1st one-shot output will be reset after operating 0.5sec not related to 2nd output.
S 4 5 6 ON OFF	**Up input**  **Up/Down-A, B, C** 	**Down input**  **Up/Down-D, E, F** 	• Up, Up/Down-A, B, C input mode - OUT1 is ON when (Display value) ≥ (1st setting value) - OUT2 is ON when (Display value) ≥ (Dual setting value) • Down, Up/Down-D, E, F input mode - OUT1 is ON when (Display value) ≤ (1st setting value) - OUT2 is ON when (Display value) ≤ (Zero)

※One-shot output time is set by front TIME adjuster.

▣ Proper Usage

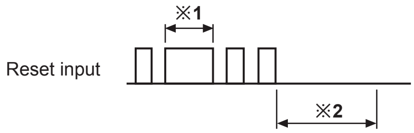
◎ Reset function

● Reset

In case of changing the input mode after supplying the power, please take an external reset or manual reset.
If reset is not executed, the counter will be working as previous mode.

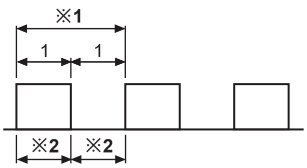
● Reset signal width

It is reset perfectly when the reset signal is applied during **min. 20ms** regardless of the contact input & solid-state input.



※1: In case of a contact reset, it is reset perfectly if the ON time of reset signal is applied during Min. 20ms even though a chattering occurs.
※2: It can be input the signal of CP1 & CP2 after Min. 50ms from closing time of reset signal.

◎ Min. signal width

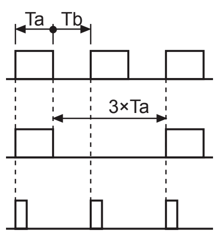


※1: Please make duty ratio (ON:OFF) 1:1.

※2: Min. signal width
- 1cps: Min. 500ms
- 30cps: Min. 16.7ms
- 2kcps: Min. 0.25ms
- 5kcps: Min. 0.1ms

◎ Max. counting speed

This is a response speed per 1 sec when the duty ratio (ON/OFF) of input signal is 1:1. If the duty ratio is not 1:1, the width between ON and OFF should be over min. signal width and the response speed is getting slower against input signal. If either ON or OFF signal is shorter than minimum signal width, this product may not respond.



Ta (ON width) and Tb (OFF width) need to be over min. signal width.

Max. counting speed is 1/2 value of rated spec. when duty ratio is 1:3. It can not respond if it is smaller than min. signal width (Ta).

◎ Error display

Error signal	Error description	Returning method
Err0	The state that second preset is 0	Change the setting value to non zero status

※When Error is displayed, the output continues OFF state.
※1st output maintains OFF status by set 1st setting value as 0.
※There is no Error function in indicator.

◎ Detach the case from body

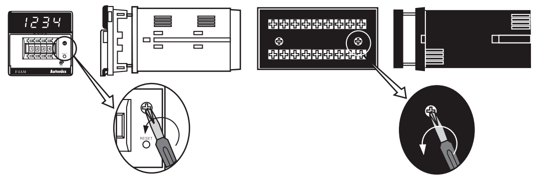
Cut OFF the power to the counter before detaching the case.

● FM Series

Unscrew the front bolt, and pull the body forward.

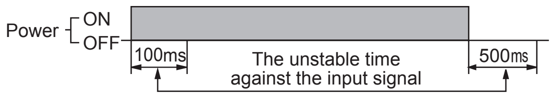
● LM Series

Unscrew the rear bolt, and pull the body forward.



◎ Power

● The inner circuit voltage starts to rise up for the first 100ms after power on, the input may not work at this time. And also the inner circuit voltage drops down for the last 500ms after power off, the input may not work at this time.



● Please use the power within rated power and apply or cut the power at once to prevent from chattering.

◎ Input signal line

● Shorten the cable distance between the sensor and this product.
● Please use shield wire for input signal needed to be long.
● Please wire input signal line separated from power line.

◎ Test circuit dielectric, impulse voltage and measure insulated resistor by installing in control panel

● Separate the unit from control box circuit.
● Short-circuit all terminals in terminal block.

◎ Do not use this unit at below places.

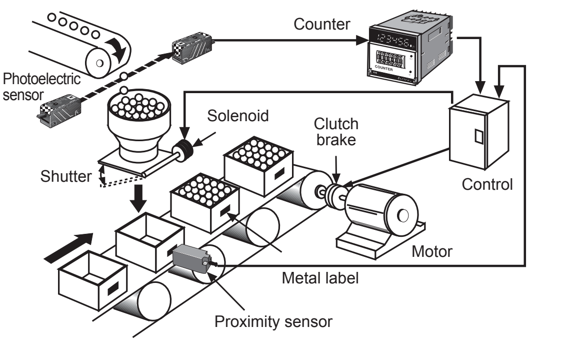
● Place where there is severe vibration or impact.
● Place where strong alkalis or acids are used.
● Place where there is direct ray of the sun
● Place where strong magnetic field or electric noise is generated.

◎ This unit may be used in the following environments.

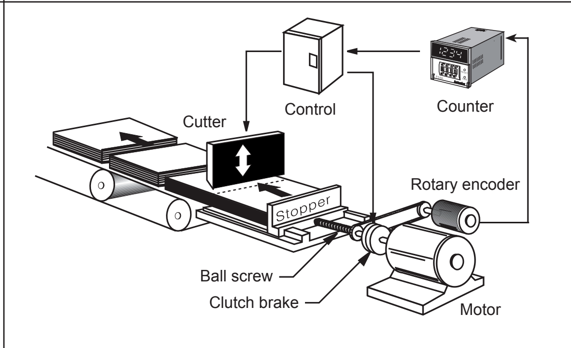
● Indoor
● Altitude: Under 2,000m
● Pollution degree 2
● Installation category II

Applications

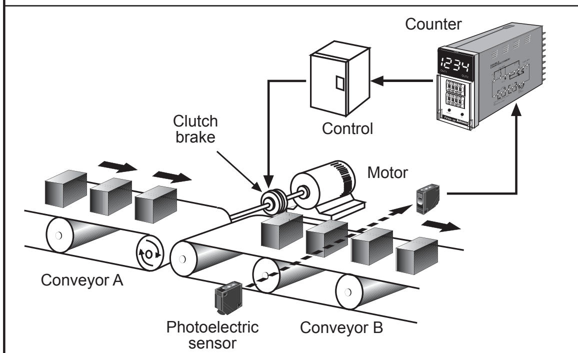
Quantity control



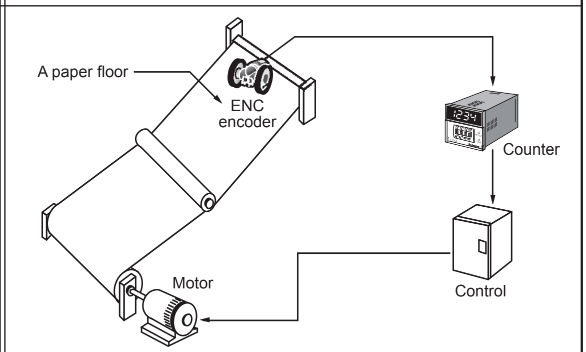
Length measurement



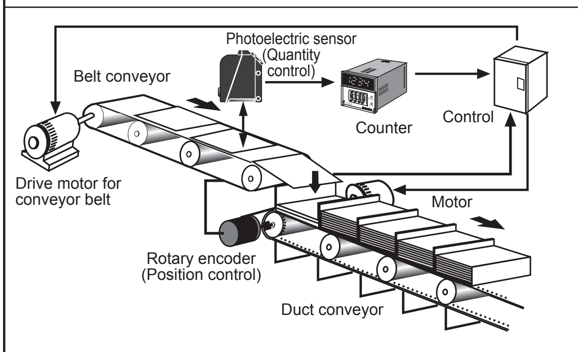
Quantity control



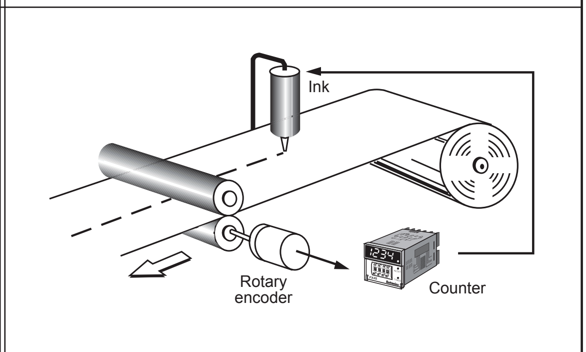
Length measurement



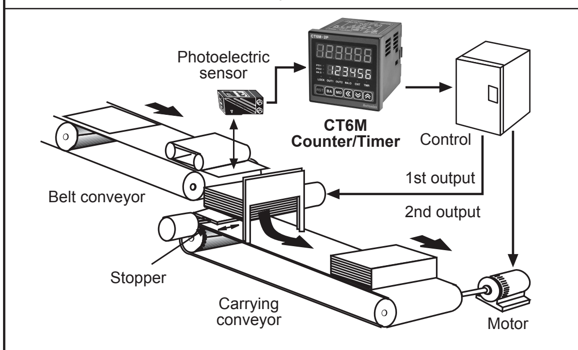
Quantity control



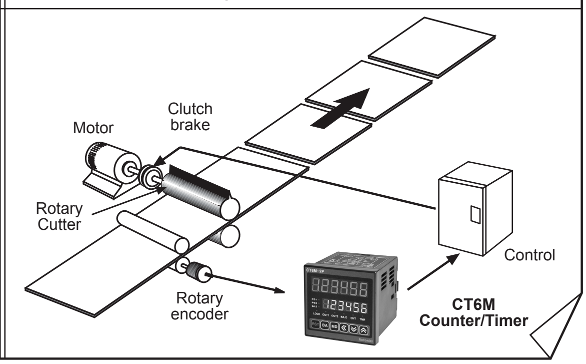
Length measurement



Quantity control

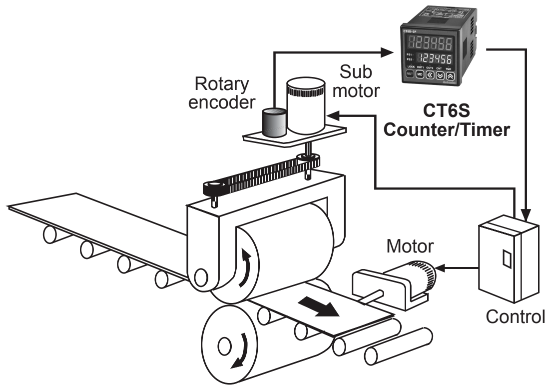


Length measurement

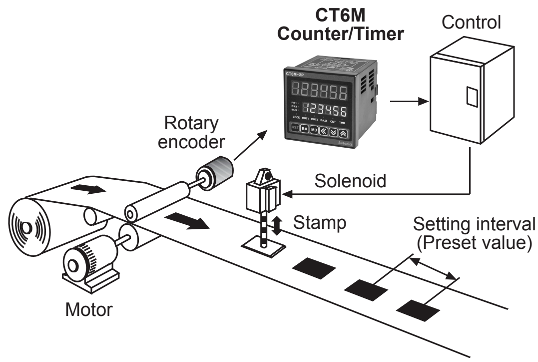


■ Applications

Position control



Position control



Length measurement

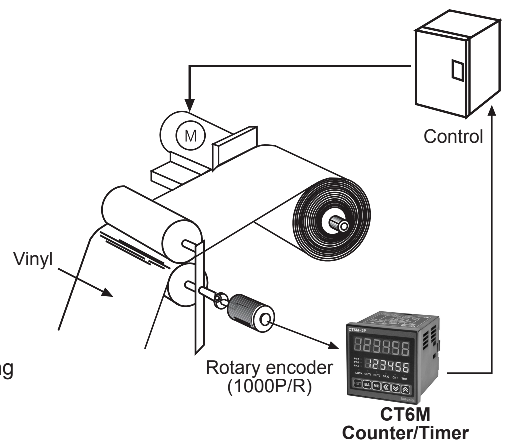
If you want to cut the vinyl in 300mm lengths using 1000P/R Encoder for roller (200mm diameter)

- Prescale value = $\dfrac{\pi \times \text{Diameter of roller (D)}}{\text{The number of generating pulse per 1 revolution of Encoder}}$

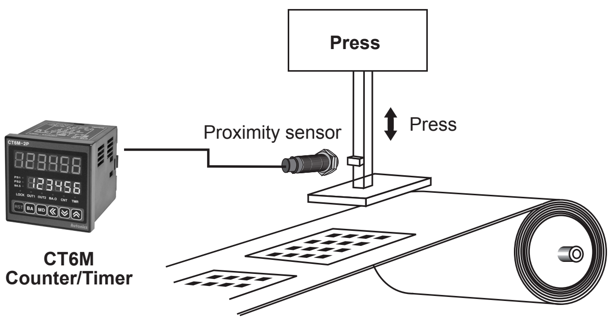
$$= \frac{3.1416 \times 200}{1000}$$

$$= 0.628\text{mm / Pulse}$$

- Set prescale value as 0.628 in function setting mode
- Select the second decimal point in function setting mode
- Setting preset value as 300.00 (mm), this unit will count 0.628 per one input signal and output is operated displaying 300.18mm when 478 signals are inputted.



Quantity control

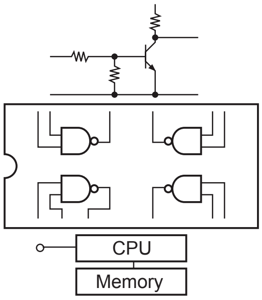


Using prescale value on counter to multiply.
In application of making 16pcs of the products each time the press machine operates, the prescale value should be set to 0016 on the counter, and then it will indicate 16, 32, 48,... each time the press machine operates 1, 2, 3 times,...

▣ Overview And Principle

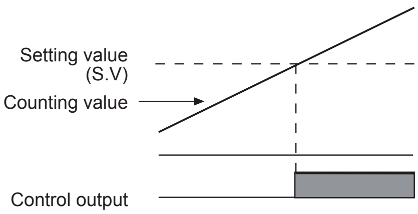
◎ Electronic counter

A counter which mainly consists of transistors, ICs, micro-computers, etc.



● Preset counter

A counter whose control output operates when it counts up to a setting value.



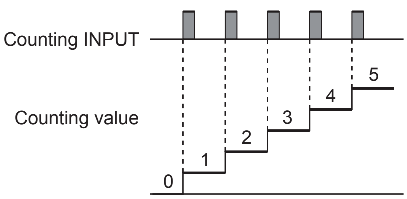
● Indicator counter

A counter which indicates the total value of the counting inputs is not provided with a control output.

◎ Input mode

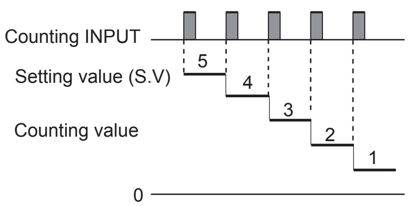
● Up mode

A mode that counting value is ascending from "zero" when one pulse signal comes in.



● Down mode

A mode that counting value is descending from SV when one pulse signal comes in. For indicator type, counting value is descending from + max. display value.

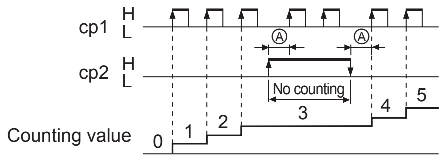


◎ Input operation mode

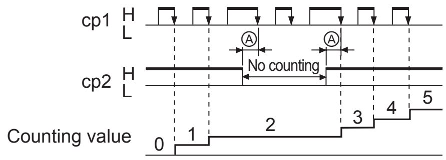
There are several input operation modes; Command input mode (Up/Down-A,D), Individual input mode (Up/Down-B,E), Phase difference input mode (Up/Down-C), Count up input mode (Up), Count down input mode (Down).
Counting value is either ascended or descended depends on input signal condition (cp1, cp2). Following explanations focus on using voltage input (PNP) state.

● Up mode

① Count up input mode (Up)
Counting up as the number of cp1 signals, but it does not count while cp2 signal is being applied.



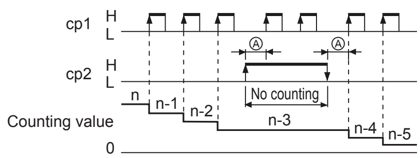
When it is on Count up input mode, counting is still available even if sensor's output type is not matched with counter's input type. (e.g. Voltage input type of counter connected with NPN output type sensor.)



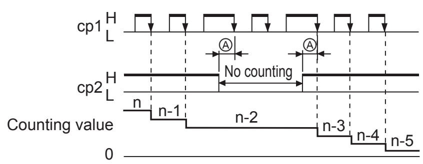
※Ⓐ: Over min. signal width, Ⓑ: Over 1/2 of min. signal width. If the signal width of Ⓐ or Ⓑ is less than min. signal width, it may cause ±1 count error.

● Down mode

① Count down input mode (Down)
Counting down as the number of cp1 signals, but it does not count while cp2 signal is being applied.



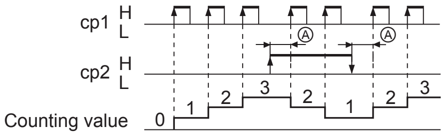
When it is on Count up input mode, counting is still available even if sensor's output type is not matched with counter's input type. (e.g. Voltage input type of counter connected with NPN output type sensor.)



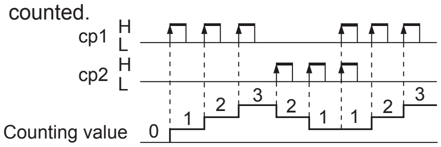
※Ⓐ: Over min. signal width, Ⓑ: Over 1/2 of min. signal width. It the signal width of Ⓐ or Ⓑ is less than min. signal width, it may cause ±1 count error.

● Up/Down mode

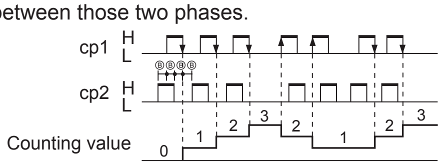
① Command input mode (Up/Down-A)
Counting up as the number of cp1 signals, and counting down as the number of cp1 signals while cp2 signals are being applied.



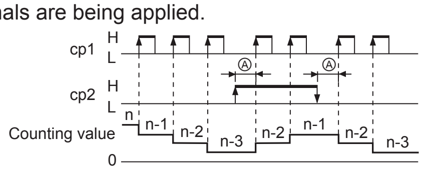
② Individual input mode (Up/Down-B)
Counting up as the number of cp1 signals, and counting down as the number of cp2 signals. However, if cp1 and cp2 signals are applied at a same time, it will not be counted.



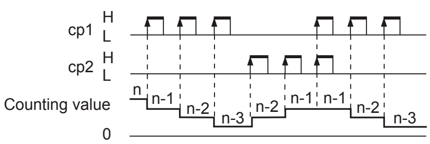
③ Phase difference input mode (Up/Down-C)
It is a mode that measures each phases of cp1 and cp2. It counts up when cp1 signal phase applied later than cp2 signal, and counts down when cp1 signal phase is applied earlier. There have to be phase difference between those two phases.



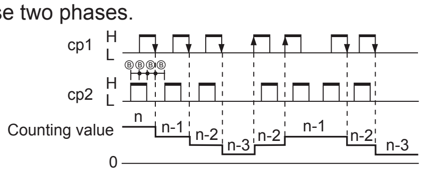
④ Command input mode (Up/Down-D)
Counting down as the number of cp1 signals, and counting up as the number of cp1 signals while cp2 signals are being applied.



⑤ Individual input mode (Up/Down-E)
Counting down as the number of cp1 signals, and counting up as the number of cp2 signals. However, if cp1 and cp2 signals are applied at the same time, it will not be counted.



⑥ Phase difference input mode (Up/Down-F)
It is a mode that measures each phases of cp1 and cp2. It counts down when cp1 signal phase applied later than cp1's, and counts up when cp1 signal phase is applied earlier. There have to be phase difference between those two phases.



◎ About Counting

● Pulse

An wave that has repetitive and temporal changes of its level.

● Count

Counting the number of pulses.

● Miss count

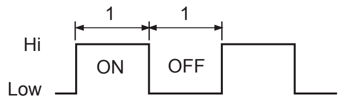
A state that number of pulses and counted is not matched.

● CPS (Count Per Second)

Unit of counts per second that express counting speed.

● Duty ratio

The ratio of the ON signal time of a given input signal to the OFF signal time of the same input signal. (The maximum counting speed of each counter is determined by a counting input signal with an ON/OFF ratio of 1:1.)



● Maximum counting speed

The maximum counting speed at which the output section of the counter operates accurately without miscounting when input signal with ON/OFF ratio is 1:1. [The maximum counting speed is expressed in units of counts per second (CPS)].

● Zero blanking

A function that removes unnecessary "zero" on display so that users do not have to be confused when reading display.
E.g.) When "123" is being displayed

- * Display with zero blanking function applied: 
- * Display without zero blanking function: 

◎ Memory protection

A function that restores data counted until right before the main power is cut off and shows it on the display when having power source back.

◎ Reset

To restore the counting, display and output sections of the counter, to their initial states.

● Manual reset

To mechanically reset the counter by manual means.

● Power reset

To reset the counter by cutting off the operating supply voltage.

● External reset

To reset the counter by applying a specific signal to the reset input signal terminal.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Technical Description

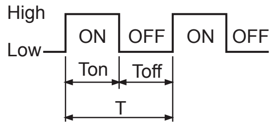
● **Automatic reset**
To reset the counter automatically with a signal generated from inside the counter.

● **Reset signal width**
Min. reset signal width to reset by power off or by applying external (manual) reset signal.

◎ Input
If the signal width of either ON or OFF is narrower than regular, it may not be counted as a signal.
E.g.)Maximum counting speed is 2kcps.

$$\text{Cycle} = \frac{1}{2\text{kHz}} = 0.5\text{ms}$$

Thus, signal width of ON and OFF should be at least over 0.25ms.



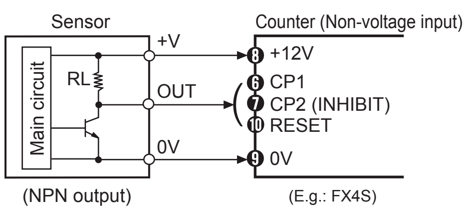
※Ton, Toff: Over the min. width of pulse

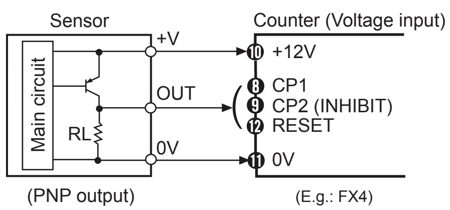
Input counting speed	ON or OFF time
1cps	0.5sec
30cps	16.7ms
2kcps	0.25ms
5kcps	0.1ms
7kcps	0.07ms
10kcps	0.05ms

● **Non-voltage input**
A way that counter receiving input signal from input terminal (cp1, cp2) when whose electric potential phase is turning "High" to "Low".

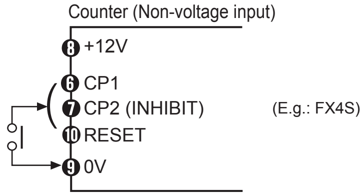
● **Voltage input**
Electric potential is applied through input terminal (cp1, cp2), and counter receives input signal when electric potential phase is turning "Low" to "High".
(High: 5-30VDC, Low: Max. 2VDC)

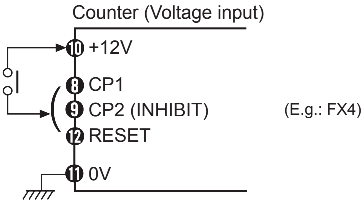
● **Solid state input signal**
Input signal generated by transistors of semiconductor circuit (Proximity sensor, Photo sensor, Rotary encoder, Fiber optic cable sensor, etc.).





● **Contact input signal**
Contact input signal generated by micro S/W, relay, push button, etc.





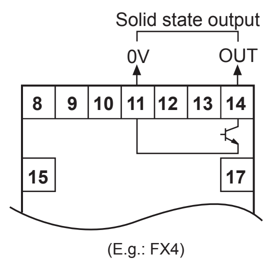
※Set max. counting speed 1 or 30cps to use relay contact signal as input signal source.

◎ Output
● **Count up**
A state that output part started operation after counted value reaching to SV.

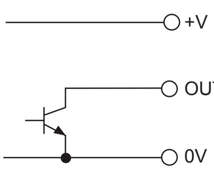
● **Retained output**
Output status that starts operation once counted value reaches SV, and maintains producing output signal until reset signal applied.

● **One-shot output**
After counting up, operating output for one-shot time period, returning back to its old position.
(Set one-shot time with Time VR on the front or in setting mode.)

● **Solid state output**
An output signal that generated by transistors.

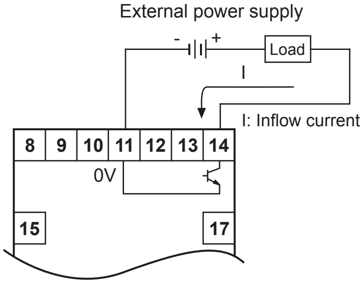


● **NPN open collector output**
The solid state output which is open between collector of transistor and +V power terminal.



● **Allowable inflow current**

The maximum permissible limit of current that transistor can stand with when load is connected to SSR. (Max. allowable inflow current is under 100mA)



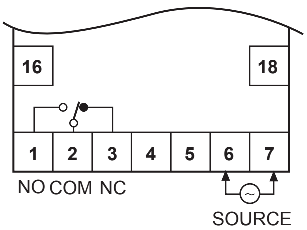
(E.g.: FX4)

● **Allowable voltage**

The maximum allowable voltage that is receivable for transistor to operate itself when load is connected to SSR, and the max. allowable voltage is 30VDC.

● **Relay contact output**

Output signal generated by built-in relay contactor inside counter.



(E.g.: FX4)

◎ **Contact organization**

● **SPST (Single Pole Single Throw)**

Organized one COM and one a-contact or b-contact. Indicates as SPST (1a) or SPST (1b).

● **SPDT (Single Pole Double Throw)**

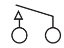
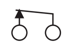
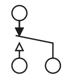
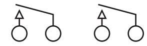
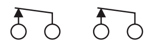
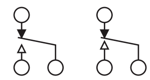
Organized one COM and one a-contact and one b-contact. Indicates as SPDT (1a1b) or SPDT (1c).

● **DPST (Double Pole Single Throw)**

Organized two COMs and two a-contact or b-contact. Indicates as DPST (2a) or DPST (2b).

● **DPDT (Double Pole Double Throw)**

Organized two COMs and two a-contact and two b-contact. Indicates as DPDT (2a2b) or DPDT (2c).

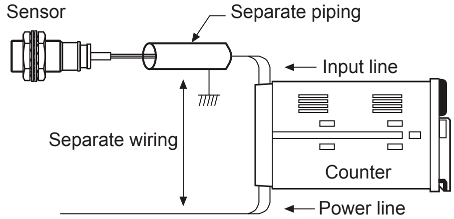
SPST (1a) (Single Pole Single Throw)	
SPST (1b) (Single Pole Single Throw)	
SPDT (1a1b) or SPDT (1c) (Single Pole Double Throw)	
DPST (2a) (Double Pole Single Throw)	
DPST (2b) (Double Pole Single Throw)	
DPDT (2a2b) or DPDT (2c) (Double Pole Double Throw)	

▣ Proper Usage

Several problems may happen in those conditions below, appropriate countermeasures are required.

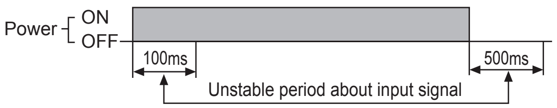
◎ Signal input line

- ● Keep signal input wire short enough; otherwise input part of counter will get more impedance.
- ● If using SSR as input source with input speed under 30cps, set counting speed 30cps so that it can be strong on noise.
- ● If using relay contact as input signal source, make sure to use the contact with high reliability.
- ● Do not set counting speed too high when counting relay contact signal. Set counting speed to 1 or 30cps.
- ● If there are any devices that generates arc with its relay operation, put in surge absorbers.
- ● Be careful with turning input signal source's power ON or OFF when counter power is on. These can cause transient pulse and it can flow into counter.
- ● Input signal line should be separated with power line for wiring.
- ● When input signal wire is needed to be long, use shield wire and it should be separately grounded.



◎ Power supply

- Separate counter power line with other high- voltage wire and wrap the power line with pipe separately.
- When inductive load (motor, solenoid, magnet) is installed, put noise filter on power part.
- It is period for stabilizing for the first 100ms after power is on. It may not operate regularly with input signal during that time.
  And it also has unstable period of voltage drop for 500ms after power is OFF.



- Obey allowable voltage range for power source, and supply power to S/W, etc. at a time so that no chattering happens.

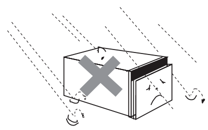
◎ Noise

- If impulse noise happens, put 0.1 to 1μF of D.C condenser in power terminal.
- When testing inner voltage, impulse and insulation resistance after put them together in control board,
  1) Separate this product from circuit.
  2) Make every terminal disconnected.
     (It is to stop part of devices that have problem with inner pressure, insulation, etc. damaging to other parts.)
- If it suddenly stops operating (displaying wrong value or not even doing it at all), reboot it and it will work normally. This happens when strong noise flow into inner micro computer (Micom), so put serge absorber to both side of load.

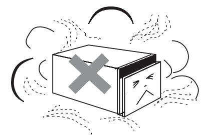
◎ Environment

Avoid described environment as below.

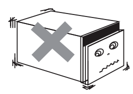
- A place where components and devices can be stressed by vibrations or impact.
- A place where inflammable and corrosive gas, water or oil is around of or is rather dusty.
- A place where there are machines that create magnetism or electric noise.
- A place of which humidity or temperature exceeds regulation.
- A place where strong alkalis/acids are used.
- A place where there are direct rays of the sun.



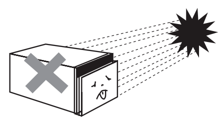
Avoid a place where water or oil is spattering and especially near strong alkalis/acids are being used.



Avoid a place where corrosive or inflammable gas is around of or is rather dusty.



Avoid a place where there is sever vibration or impact.



Avoid a place where there is direct rays of the sun.

(K) Timers

Compact LCD Display Timer
LE8N Series

LCD Display Timer
LE4S Series

Miniature Analog Timer
ATM Series

Compact Multi Function Analog Timer
ATS Series

Compact Twin Analog Timer
ATS8W/11W Series

Multi Function Analog Timer
ATN Series

Product Overview

Type	LCD Timer (LCD type)				
Series	**LE8N Series**				
Digit	8-digit (0 to 99999999)				
Model	**LE8N-BN**	**LE8N-BN-L**	**LE8N-BV**	**LE8N-BV-L**	**LE8N-BF**
Appearances & Dimensions	 [W48×H24×L54mm]				
Display method	LCD Zero Blanking type (character height: 8.7mm)				
Operation method	Count up				
Power supply	Built-in battery				
Battery life cycle	Approx. over 10 years at 20℃				
Backlight power supply	—	24VDC±10%	—	24VDC±10%	—
Input method	No-voltage input		Voltage input		Free voltage input
START input	Residual voltage: Max. 0.5VDC Short-circuit impedance: Max. 10kΩ Open-circuit impedance: Min. 750kΩ		[H]: 4.5-30VDC [L]: 0-2VDC		[H]: 24-240VAC/6-240VDC [L]: 0-2VAC/0-2.4VDC
RESET input	No-voltage input		Voltage input		No-voltage input
Min. input signal width	SIGNAL, RESET: Approx. 20ms				
Time specification (TS1)	9999.59.59 (h.m.s), 99999.59.9 (h.m), 999999.59 (h.m)				
Time specification (TS2)	9999.23.59 (d.h.m), 9999d23.9 (d.h), 99999999 (s)				
Time specification (TS3)	9999h59.9 (h.m), 99999h59 (h.m), 999999.9h (h)				
Time error, Temperature error	±0.01%				
External set switch	SW1※1, SW2※2, SW3※3				
Reference	**K-8 to 11**				

※1: SW1 is the front panel RESET key enable/disable set switch.
※2: SW2 is the time range set switch.
※3: SW3 is available to select time specification TS1, TS2, or TS3.

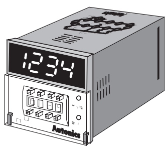
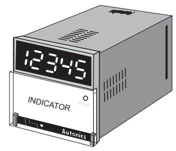
Type		Digital Timer (LCD type)			Digital timer (backlight LCD type)	
Model		**LE3S**	**LE3SA**	**LE3SB**	**LE4S**	**LE4SA**
Appearances & Dimensions		 [W48×H48×L67mm]			 [W48×H48×L70mm]	
Function		**Multi time, Multi operation**	**Multi time, Power ON delay**		**Multi time, Multi operation**	
Time setting range		0.01sec to 999hour			0.01sec to 9999hour	
Power supply		24-240VAC 50/60Hz, 24-240VDC universal				
Allowable voltage range		90 to 110% of rated voltage				
Return time		Max. 200ms	Max. 100ms			
Min. input signal width		Approx. 20ms	—		Selectable 1 or 20ms	—
Timing operation		Signal ON Start	Power ON Start		Signal ON Start	Power ON Start
Control output	Contact type	Time limit SPDT (1c)	Time limit DPDT (2c)	Time limit SPDT (1c), Instantaneous SPDT (1c)	Time limit SPDT (1c)	Selectable Time limit DPDT (2c), Time limit SPDT (1c)+ Instantaneous SPDT (1c) (depends on operation mode)
	Contact capacity	250VAC 5A resistive load	250VAC 3A resistive load		250VAC 5A resistive load	250VAC 3A resistive load
Relay life cycle	Mechanical	Min.10,000,000 operations				
	Electrical	Min. 100,000 operations (250VAC 5A resistive load)	Min. 100,000 operations (250VAC 3A resistive load)		Min. 100,000 operations (rated contact capacity)	
Repeat error		Max. ±0.01% ±0.05sec (for Power ON Start) Max. ±0.005% ±0.03sec (for Signal ON Start)	Max. ±0.01% ±0.05sec		Max. ±0.01% ±0.05sec (for Power ON Start) Max. ±0.005% ±0.03sec (for Signal ON Start)	Max. ±0.01% ±0.05sec
SET error						
Voltage error						
Temperature error						
Reference		**K-12 to 19**			**K-20 to 36**	

Item			Programmable Counter/Timer					
Series			**CTS**		**CTY**		**CTM**	
Digit			4-digit	6-digit	6-digit		6-digit	
Model	1-stage preset		**CT4S-1P□□**	**CT6S-1P□□**	**CT6Y-1P□□**		**CT6M-1P□□**	
	2-stage preset		**CT4S-2P□□**	**CT6S-2P□□**	**CT6Y-2P□□**		**CT6M-2P□□**	
	Indicator		—	**CT6S-I □□**	**CT6Y-I □□**		**CT6M-I □□**	
Appearances & Dimensions			CE cULus  [W48×H48×L90mm]		CE cULus  [W72×H36×L77mm]		CE cULus  [W72×H72×L85mm]	
Operation method			**Count up, Count down, Count Up/Down**					
Power Supply	AC voltage		100-240VAC 50/60Hz					
	AC/DC voltage		24VAC 50/60Hz, 24-48VDC					
Allowable voltage range			90 to 110% of rated voltage (AC voltage type)					
INA/INB max. counting speed			Selectable 1cps / 30cps / 1kcps / 5kcps / 10kcps					
Min. input signal width	Counter		RESET: Selectable 1ms/20ms					
	Timer		INA, INH, RESET: Selectable 1ms/20ms				INA, RESET, INHIBIT, BATCH RESET: Selectable 1ms/20ms	
Input method			Selectable voltage input or no-voltage input [Voltage input]-input impedance: 5.4kΩ, [H]: 5-30VDC, [L]: 0-2VDC [No-voltage input]-short-circuit impedance: Max. 1kΩ, short-circuit residual voltage: Max. 2VDC					
One-shot output time			0.01s to 99.99s setting					
			Standard	Comm.	Standard	Comm.	Standard	Comm.
Control output	Contact output	Type 1-stage	SPDT(1c): 1		SPDT(1c): 1		SPDT(1c): 1	
		Type 2-stage	SPST(1a): 2		SPST(1a): 1, SPDT(1c): 1	SPST(1a): 2	SPST(1a): 1, SPDT(1c): 1	
		Capacity	250VAC 5A resistive load		250VAC 3A resistive load		250VAC 5A resistive load	
	Solid state output (NPN open collector)	Type 1-stage	1	—	1	1	2	2
		Type 2-stage				—	3	
		Capacity	Max. 30VDC, 100mA					
External power supply			Max. 12VDC ±10%, 100mA					
Reference			**Refer to the Counter J-8 to 35 for details about Counter/Timer products.**					

Item			Count up/down Counter/Timer								
Series			**FXY**		**FXS**		**FX**		**FXH**	**FXL**	
Digit			4-digit	6-digit	4-digit	5-digit	4-digit	6-digit	4-digit	4-digit	6-digit
Model	1-stage preset		—	—	**FX4S**	—	**FX4**	**FX6**	**FX4H**	—	—
	2-stage preset		—	—	—	—	**FX4-2P**	**FX6-2P**	**FX4H-2P**	**FX4L-2P**	**FX6L-2P**
	Indicator		**FX4Y-I**	**FX6Y-I**	—	**FX5S-I**	**FX4-I**	**FX6-I**	**FX4H-I**	**FX4L-I**	**FX6L-I**
Appearances & Dimensions			cULus  [W72×H36×L93mm]		cULus  [W48×H48×L91mm]		cULus  [W72×H72×L112.3mm]		cULus  [W48×H96×L100mm]	cULus  [W144×H72×L112mm]	
Operation method			Count up, Count down, Count Up/Down								
Power supply	AC voltage		100-240VAC 50/60Hz								
	AC/DC voltage		12-24VAC 50/60Hz, 12-24VDC								
Allowable voltage range			90 to 110% of rated voltage								
Max. counting speed			Selectable 1cps/30cps/2kcps/5kcps by internal DIP switch								
Min. input signal width			INHIBIT, RESET: Approx. 20ms								
Input	CP1, CP2 input		**[No-voltage input]** Impedance at short-circuit: Max. 470Ω, Residual voltage at short-circuit: Max. 1V, Impedance at open-circuit: Min. 100kΩ		**[Voltage input]** Input impedance: 5.4kΩ, [H]: 5-30VDC, [L]: 0-2VDC **[No-voltage input]** Impedance at short-circuit: Max. 1kΩ, Residual voltage at short-circuit: Max. 2VDC, Impedance at open-circuit: Min. 100kΩ						
	RESET input										
Control output	Contact	Type	—		SPDT (1c)	—	1-stage preset: SPDT (1c), 2-stage preset: 1st. output SPDT (1c), 2nd. output SPDT (1c)				
		Capacity	—		250VAC 3A resistive load	—	250VAC 3A resistive load				
	Solid state	Type	—		1 NPN open collector	—	1-stage preset: 1 NPN open collector 2-stage preset: 1st. output 1 NPN open collector, 2nd. output 1 NPN open collector				
		Capacity	—		Max. 30VDC 100mA	—	Max. 30VDC 100mA				
External power			Max. 12VDC ±10% 50mA								
Reference			**Refer to the Counter J-36 to 58 for details about Counter/Timer products.**								

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Product Overview

Item		Digital Timer (LED type)	
Model		**FS4E**	**FS5EI**
Appearances & Dimensions		 [W48×H48×L85mm]	 [W48×H48×L85mm]
Function		**Count up, Count down**	
Time setting range		0.01sec to 9999hour	0.01sec to 9999.9hour
Power supply	AC voltage	100-240VAC 50/60Hz	
	AC/DC voltage	12-24VAC 50/60Hz, 12-24VDC	
Allowable voltage range		90 to 110% of rated voltage	
Return time		Max. 500ms	
Min. input signal width		RESET, INHIBIT: Approx. 20ms	
Timing operation		Power ON Start	
Memory protection		Over 10 years (when using non-volatile semiconductor memory)	
Control output	Contact type	Time limit SPDT (1c)	—
	Contact capacity	250VAC 3A resistive load	—
Relay life cycle	Mechanical	Min. 10,000,000 operations	—
	Electrical	Min. 100,000 operations (250VAC 3A resistive load)	—
Repeat error		Max. ±0.01% ±0.05sec	
SET error			
Voltage error			
Temperature error			
Reference		**K-37 to 41**	

Item		Small Timer		
Model		**ATM4 - 2□S 2□M 23H**	**ATM4 - 5□S 5□M 53H**	**ATM4 - 6□S 6□M 63H**
Appearances & Dimensions		[W21.5×H28×L59.3mm] 		
Function		**Power ON delay**		
Time setting range		**sec** (1, 5, 10, 30, 60), **min** (3, 5, 10, 30, 60), **hour** (3)		
Power supply		24VDC	220VAC 50/60Hz	110VAC 50/60Hz
Allowable voltage		21.6~26.4VDC	200-230VAC 50/60Hz	100-120VAC 50/60Hz
Return time		Max. 100ms		
Timing operation		Power ON Start		
Control output	Contact type	4PDT (4c)		
	Contact capacity	250VAC 3A resistive load		
Relay life cycle	Mechanical	Min. 10,000,000 operations		
	Electrical	Min. 200,000 operations		
Repeat error		Max. ±0.5% ±10ms		
SET error		Max. ±10% ±50ms		
Voltage error		Max. ±0.5% ±10ms		
Temperature error		Max. ±2% ±10ms		
Reference		**K-42 to 44**		

Item		Analog Multi Function Timer					
Model		ATS8-□1	ATS8-□3	ATS11-□1D	ATS11-□3D	ATS11-□1E	ATS11-□3E
Appearances & Dimensions		 [W38×H42×L83.5mm]		 [W38×H42×L83.5mm]		 [W38×H42×L83.5mm]	
Function		**Multi Time Range, Multi Function** (includes 6 output modes)					
Time setting range		0.1sec to 10hour	0.3sec to 30hour	0.1sec to 10hour	0.3sec to 30hour	0.1sec to 10hour	0.3sec to 30hour
Power supply		• 100-240VAC 50/60Hz, 24-240VDC universal • 24VAC 50/60Hz, 24VDC universal • 12VDC					
Allowable voltage range		90 to 110% of rated voltage					
Return time		Max. 100ms					
Min. input signal width		―		START, INHIBIT, RESET: Approx. 50ms			
Timing operation		Power ON Start		Signal ON Start			
Control output	Contact type	Time limit DPDT (2c) or Time limit SPDT (1c)+ Instantaneous SPDT (1c) selectable by output operation mode		Time limit DPDT (2c)		Time limit SPDT (1c)+ Instantaneous SPDT (1c)	
	Contact capacity	250VAC 3A resistive load					
Relay life cycle	Mechanical	Min. 10,000,000 operations					
	Electrical	Min. 100,000 operations (250VAC 3A resistive load)					
Repeat error		Max. ±0.2 % ±10ms					
SET error		Max. ±5% ±50ms					
Voltage error		Max. ±0.5%					
Temperature error		Max. ±2%					
Reference		**K-45 to 51**					

Item		Star-Delta Timer	Power OFF Delay Timer		Twin (Flicker) Timer			
Model		ATS8SD-4	ATS8P-□S	ATS8P-□M	ATS8W-□1	ATS11W-□1	ATS8W-□3	ATS11W-□3
Appearances & Dimensions		 [W38×H42×L83.5mm]	 [W38×H42×L75.5mm]		  [W38×H42×L75.5mm]			
Function		**Star (⅄)-Delta (Δ)**	**Power OFF dalay**		**ON/OFF Flicker operation**			
Time setting range		0.5 to 100sec	0.1 to 10sec	0.1 to 10min	0.1sec to 10hour		0.3sec to 30hour	
Power supply		•100-240VAC 50/60Hz, 24-240VDC universal	•100-120VAC 50/60Hz •200-240VAC 50/60Hz •24VAC 50/60Hz, 24VDC universal		•100-240VAC 50/60Hz, 24-240VDC universal •24VAC 50/60Hz, 24VDC universal •12VDC			
Allowable voltage range		90 to 110% of rated voltage						
Return time		Max.100ms	―		Max.100ms			
Timing operation		Power ON Start	Power OFF Start		Power ON Start			
Control output	Contact type	⅄ contact: SPST (1a), Δ contact: SPST (1a)	Time limit DPDT (2c)		Time limit DPDT (2c), Instantaneous SPDT (1c)+ Time limit SPDT (1c) selectable by output operation mode			
	Contact capacity	250VAC 3A resistive load						
Relay life cycle	Mechanical	Min. 10,000,000 operations						
	Electrical	Min. 100,000 operations (250VAC 3A resistive load)						
⅄Setting error		Max. ±5% ±50ms	―					
⅄-Δ Switching time error		Max. ±25%	―					
Repeat error		Max. ±0.2% ±10ms						
SET error		―	Max. ±5% ±50ms					
Voltage error		Max. ±0.5%						
Temperature error		Max. ±2%						
Reference		**K-52 to 54**	**K-55 to 57**		**K-58 to 61**			

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
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(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
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(N) Display Units
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(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Product Overview

Item		Analog Multi Function Timer		
Model		**AT8N**	**AT11EN**	**AT11DN**
Appearances & Dimensions		 [W48×H48×L64.5mm]	 [W48×H48×L64.5mm]	 [W48×H48×L64.5mm]
Function		**Multi Function** (includes 6 output modes)		
Time setting range		0.05sec to 100hour		
Power supply		•100-240VAC 50/60Hz, 24-240VDC universal	•24VAC 50/60Hz, 24VDC universal	•12VDC
Allowable voltage range		90 to 110% of rated voltage		
Return time		Max.100ms		
Min. input signal width		—	INHIBIT, START, RESET: Approx. 50ms	
Timing operation		Power ON Start	Signal ON Start	
Control output	Contact type	Time limit DPDT (2c), Time limit SPDT (1c)+ Instantaneous SPDT (1c) selectable by output operation mode	Time limit SPDT (1c)+ Instantaneous SPDT (1c)	Time limit DPDT (2c)
	Contact capacity	250VAC 5A resistive load		
Relay life cycle	Mechanical	Min. 10,000,000 operations		
	Electrical	Min. 100,000 operations (250VAC 5A resistive load)		
Repeat error		Max. ±0.2 % ±10ms		
SET error		Max. ±5% ±50ms		
Voltage error		Max. ±0.5%		
Temperature error		Max. ±2%		
Reference		**K-62 to 67**		

Item		Analog Timer		
Model		**AT8SDN**	**AT8PSN**	**AT8PMN**
Appearances & Dimensions		 [W48×H48×L64.5mm]	 [W48×H48×L64.5mm]	 [W48×H48×L64.5mm]
Function		**Star (⅄)-Delta (Δ)**	**Power OFF delay**	
Time setting range		0.5 to 100sec	0.05 to 10sec	0.05 to 10min
Power supply		100-240VAC 50/60Hz, 24-240VDC universal	• 100-120VAC 50/60Hz • 100/110VDC	• 200-240VAC 50/60Hz • 24VAC 50/60Hz, 24VDC universal
Allowable voltage range		90 to 110% of rated voltage		
Return time		Max. 100ms	—	
Timing operation		Power ON Start	Power OFF Start	
Control output	Contact type	⅄ contact: SPST (1a), Δ contact: SPST (1a)	Time limit DPDT (2c)	
	Contact capacity	250VAC 5A resistive load	250VAC 3A resistive load	
Relay life cycle	Mechanical	Min. 10,000,000 operations		
	Electrical	Min. 100,000 operations (250VAC 5A resistive load)	Min. 100,000 operations (250VAC 3A resistive load)	
⅄Setting error		Max. ±5% ±50ms	—	
⅄-Δ Switching time error		Max. ±25%	—	
Repeat error		Max. ±0.2 % ±10ms		
SET error		—	Max. ±5% ±50ms	
Voltage error		Max. ±0.5%		
Temperature error		Max. ±2%		
Reference		**K-68 to 70**	**K-71 to 73**	

Item		Analog Timer		
Model		**ATE- □S □M □H**	**ATE1- □S □M □H**	**ATE2- □S □M □H**
Appearances & Dimensions		 [W48×H48×L80mm]	 [W48×H48×L80mm]	 [W48×H48×L80mm]
Function		**Power ON delay** (general purpose timer)		
Time setting range		Sec (1, 3, 6, 10, 30, 60), Min (3, 6, 10, 30, 60), Hour (3, 6, 12, 24)		
Power supply		110/220VAC 50/60Hz	110VAC, 220VAC 50/60Hz, 12VDC, 24VDC	
Allowable voltage range		90 to 110% of rated voltage		
Return time		Max. 200ms		
Timing operation		Power ON Start		
Control output	Contact type	Time limit SPDT (1c), Instantaneous SPDT (1a)	Time limit DPDT (2c)	Time limit SPDT (1c), Instantaneous SPDT (1c)
	Contact capacity	250VAC 3A resistive load		
Relay life cycle	Mechanical	Min. 10,000,000 operations		
	Electrical	Min. 100,000 operations (250VAC 3A resistive load)		
Repeat error		Max. ±0.3%		
SET error		Max. ±5% ±50ms		
Voltage error		Max. ±0.5%		
Temperature error		Max. ±2%		
Reference		**K-74 to 76**		

Item		Digital Weekly/Yearly Timer (LCD type)	
Model		**LE7M-2**	**LE365S-41**
Appearances & Dimensions		 [W72×H72×L60mm]	 [W48×H48×L60mm]
Function		**Weekly/Yearly timer**	
Power supply		100-240VAC 50/60Hz	
Allowable voltage range		90 to 110% of rated voltage	
Timing program		48 steps for weekly, 24 steps for yearly	
Operation mode		ON/OFF mode, cycle mode, pulse mode	
Time deviation		±15sec/month (ambient temperature: 25℃) (±4sec/week)	
Memory protection		Over 5 years (at 25℃)	
Control Output	Contact type	SPDT (Single Pole Double Throw)	SPST (Single Pole Single Throw)
	Contact capacity	250VAC 10A resistive load	250VAC 15A resistive load
	Output number	Independent 2 output (1c×2)	Independent 1 circuit (1a)
Relay life cycle	Mechanical	Min. 5,000,000 operations (switching capacity: 30 times/min)	
	Electrical	50,000 operations <switching capacity: 20 times/min, 250VAC 10A (resistive load)>	50,000 operations <switching capacity: 20 times/min, 250VAC 15A (resistive load)>
Reference		**K-77 to 88**	**K-89 to 99**

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

DIN W48×H24mm, Indication Only, LCD Timer (Hour Meter)

■ Features

- No additional power due to internal battery
- Signal input method: No-voltage input, voltage input, free voltage input
- Screw terminal type (attaching terminal cover)
- LCD display, backlight model
- Protection structure: IP66

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

LE | 8 | N – B | N – L

Code		Description
Backlight	No mark	None
	L	Backlight function
Input type	N	No-voltage (small signal) input
	V	Voltage input
	F	Free voltage input
Power supply	B	Internal lithium battery
Size	N	DIN W48×H24mm
Digit	8	99999999 (8-digit)
Item	LE	Compact LCD Timer

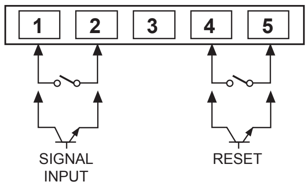
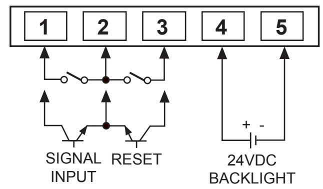
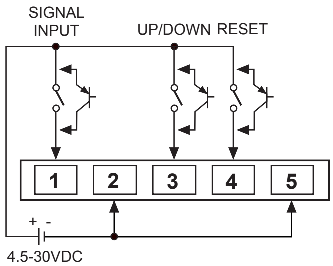
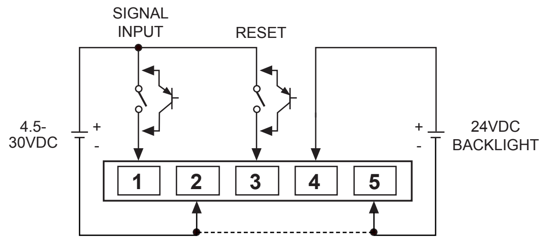
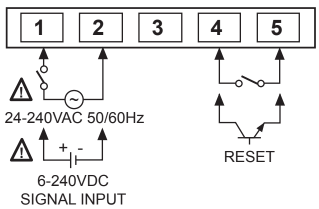
■ Specifications

Model		LE8N-BN	LE8N-BN-L	LE8N-BV	LE8N-BV-L	LE8N-BF
Digit		8-digit (0 to 99999999)				
Digit size		W3.4×H8.7mm				
Display method		LCD Zero Blanking type (character height size: 8.7mm)				
Operation method		Count up				
Power supply		Built-in battery				
Battery life cycle		Approx. over 10 years at 20℃				
Backlight power supply		—	24VDC±10%	—	24VDC±10%	—
Input method		No-voltage input		Voltage input		Free voltage input
START input		Residual voltage: Max. 0.5VDC Short-circuit impedance: Max. 10kΩ Open-circuit impedance: Min. 750kΩ		[H]: 4.5-30VDC [L]: 0-2VDC		[H]: 24-240VAC/6-240VDC [L]: 0-2VAC/0-2.4VDC
RESET input		No-voltage input		Voltage input		No-voltage input
Min. input signal width		SIGNAL, RESET input: Approx. 20ms				
Time specification (TS1)		9999.59.59 (h.m.s), 99999.59.9 (h.m), 999999.59 (h.m)				
Time specification (TS2)		9999.23.59 (d.h.m), 9999d23.9 (d.h), 99999999 (s)				
Time specification (TS3)		9999h59.9 (h.m), 99999h59 (h.m), 999999.9h (h)				
Time error, Temperature error		±0.01%				
External set switch		SW1※1, SW2※2, SW3※3				
Insulation resistance		Over 100MΩ (at 500VDC megger)				
Dielectric strength※4		2,000VAC 60Hz for 1minute				
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour				
	Malfunction	0.3mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min				
Shock	Mechanical	300m/s^2 (approx. 30G) in each X, Y, Z direction for 3 times				
	Malfunction	100m/s^2 (approx. 10G) in each X, Y, Z direction for 3 times				
Environ-ment	Ambient temp.	-10 to 55℃, storage: -25 to 65℃				
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH				
Protection structure		IP66 (using waterproof rubber for front panel)				
Accessory		Mounting bracket, Rubber waterproof ring				
Approval		CE c UL us				
Weight※5		Approx. 96g (approx. 50g)				

※1: SW1 is the front panel RESET key enable/disable set switch.
※2: SW2 is the time range set switch.
※3: SW3 is available to select time specification TS1, TS2, or TS3.
※4: No-voltage input, voltage input: between terminals and the case/Free voltage input: between the free voltage input terminal and the RESET input terminal, between terminals and the case
※5: The weight includes packaging. The weight in parenthesis is for unit only.

※Environment resistance is rated at no freezing or condensation.

▣ Connections

Input type	No-backlight	Backlight function
No-voltage input type	●LE8N-BN※1 	●LE8N-BN-L※2 
Voltage input type	●LE8N-BV※1 	●LE8N-BV-L※2  ※Backlight power is available as signal input and reset.
Free voltage input type	●LE8N-BF  ※Terminal (1, 2) and (4, 5) are insulated inside.	—

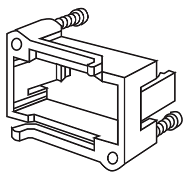
※1: Terminal 2 and 5 are connected inside. (non-isolated)
※Use reliable contacts enough to flow 5μA current.

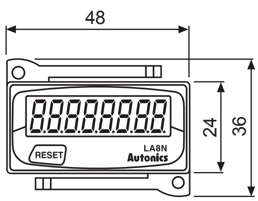
※2: Terminal (1, 2, 3) and (4, 5) are insulated inside.

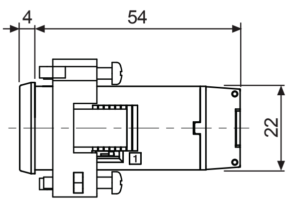
▣ Dimensions

(unit: mm)

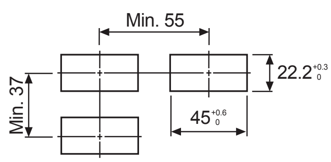
● Bracket



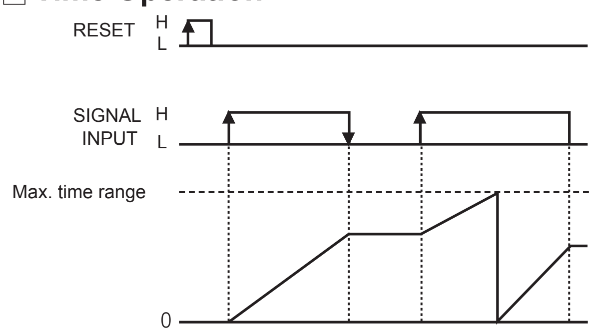




● Panel cut-out



▣ Time Operation



(A) Photoelectric Sensors
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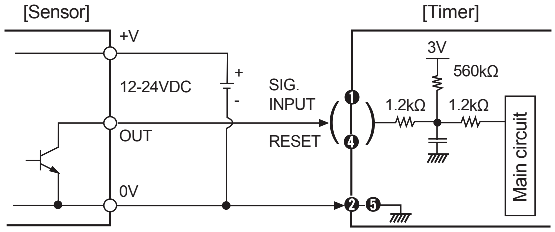
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

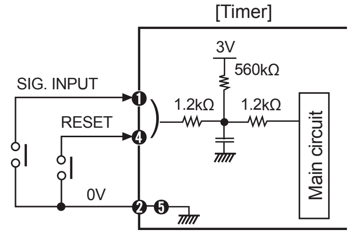
▣ Input Connections

◎ No-voltage input (standard sensor: NPN open collector output type)

● **Solid-state input**



● **Contact input**



※When power is applied to terminal No ❶ and ❹, input terminal circuit can be broken and a malfunction can occur. (NPN output, PNP output, PNP open collector output type sensor cannot be used.)

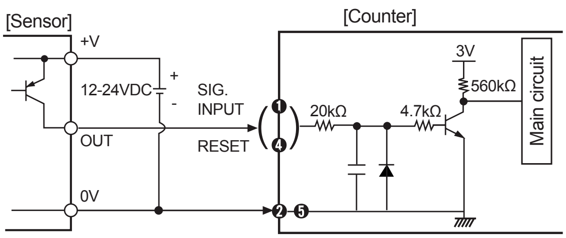
※❷ and ❺ are connected inside.

※Please use reliable contacts enough to flow 3VDC 5μA of current.

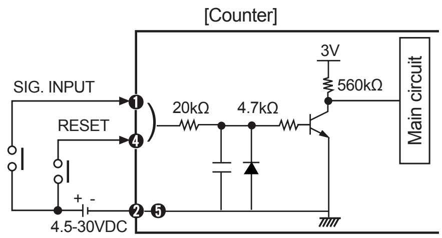
※For backlight function model, the input terminals are ❶, ❸ and the GND terminal is ❷.

◎ Voltage input (standard sensor: PNP open collector output type)

● **Solid-state input**



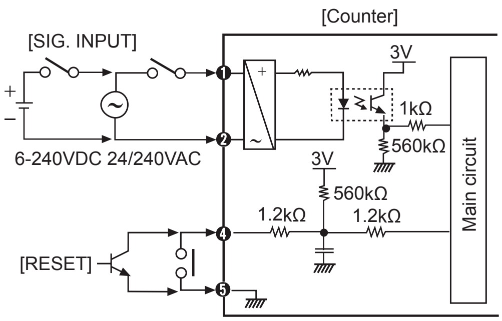
● **Contact input**



※Use reliable contacts enough to flow 3VDC 5μA of current.

※For backlight function model, the input terminals are ❶, ❸ and the GND terminal is ❷.

◎ Free voltage input



※AC type proximity sensor cannot be used as the source of input signals.

※Input terminal (❶, ❷) and reset terminal (❹, ❺) are insulated inside.

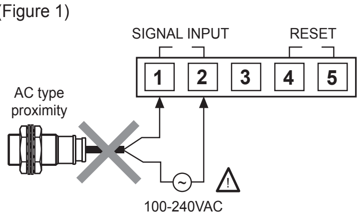
※It is not possible to reset with AC power or DC power.

※When relay contact is used as the source of RESET signal, please use reliable contacts enough to flow 3VDC 5μA of current.

◎ Input from AC type proximity sensor

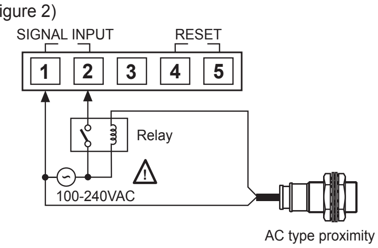
In case of free voltage input type, do not connect AC proximity sensors instead of a switch as shown in the figure 1. It may cause malfunction due to sensor's leakage current. Connect a relay as shown in the figure 2.

(Figure 1)



<example of wrong connection>

(Figure 2)

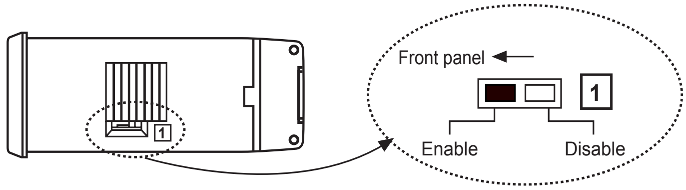


<example of correct connection>

■ Set Switch

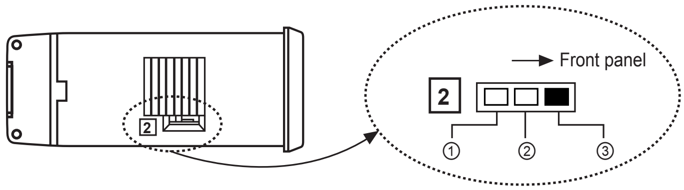
◎ SW1 setting (1 switch)

SW1 is a switch to Enable/Disable the front panel RESET key.
※Factory default: Enable



◎ SW2 setting (2 switch)

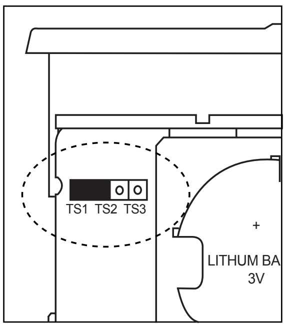
SW2 is a switch for setting time range.
※Factory default: 9999.59.59 (h.m.s)

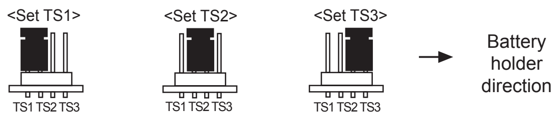


※Refer to "**<Time range>**" table of **SW3** for ①, ②, ③ descriptions.

◎ SW3 setting

SW3 is a switch for setting time sepcification. TS1, TS2, TS3 (※Factory default: TS1)





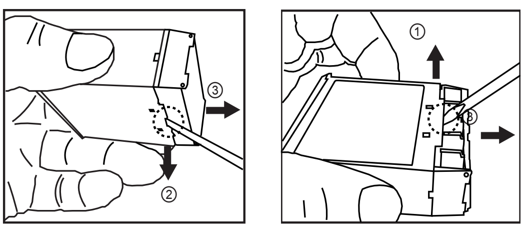
<Time range>※1

	TS1	TS2	TS3
①	hour min. 999999.59	sec. 99999999	hour 999999.9h
②	hour min. 99999.59.9	day hour 9999d23.9	hour min. 99999h59
③	hour min. sec. 9999.59.59	day hour min. 9999.23.59	hour min. 9999h59.9

※1: Time range is set as SW2, SW3 combination.

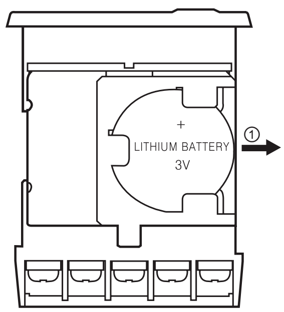
■ Case Detachment And Battery Replacement

● Case detachment



※Hold up Lock part toward ①, ② of the product with the tool and pull toward ③ to detach the case.
⚠When using the tools, be careful not to be wounded.

● Battery replacement



1. Detach the case.
2. Push the battery and detach it toward ①.
3. Insert a new battery with correct alignment of polarity pushing it toward opposite of ①.

※The battery is sold separately. Please replace a battery by yourself.
※Do not burn up or disassemble the lithium battery.

Digital LCD Timer DIN W48×H48mm

■ Features

- Upgraded power supply
  : 24-240VAC 50/60Hz, 24-240VDC universal
- Easy to switch Up/Down mode
- 10 programmable output modes
  and timing ranges (LE3S)
- Selectable function by front digital switches
- Graphic output contact status display (NO/NC)
- BAR graph display of time progressing in 5% increments
- Compact size (length: 74mm)

Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

LE | 3 | S | □

Output	No mark	Time-limit SPDT (1c)
	A	Time-limit DPDT (2c)
	B	Time-limit SPDT (1c), Instantaneous SPDT (1c)
Size	S	DIN W48×H48mm
Digit	3	999 (3-digit)
Item	LE	LCD timer (digital switch type)

※Sockets (PG-08, PS-08(N), PS-M8) are sold separately.

■ Specifications

Model		LE3S	LE3SA	LE3SB
Function		**Multi time and operation**	**Multi time range, Power ON Delay operation**	
Display method		LCD display (character size: W4×H8mm)		
Power supply		24-240VAC 50/60Hz, 24-240VDC universal		
Allowable voltage range		90 to 110% of rated voltage		
Power consumption		Max. 2.5VA (24-240VAC 50/60Hz), Max. 1W (24-240VDC)	Max. 3.3VA (24-240VAC 50/60Hz), Max. 1.5W (24-240VDC)	
Return time		Max. 200ms	Max. 100ms	
Min. input signal width	START	Approx. 20ms	—	
	INHIBIT			
	RESET			
Input	START	• No-voltage input Impedance at short-circuit: Max. 1kΩ Residual voltage: Max. 0.5VDC Impedance at open-circuit: Min. 100kΩ	—	
	INHIBIT			
	RESET			
Timing operation		Signal ON Start	Power ON Start	
Control output	Contact type	Time limit SPDT (1c)	Time limit DPDT (2c)	Time limit SPDT (1c), Instantaneous SPDT (1c)
	Contact capacity	250VAC 5A resistive load	250VAC 3A resistive load	
Relay life cycle	Mechanical	Min. 10,000,000 operations		
	Electrical	Min. 100,000 operations (250VAC 5A resistive load)	Min. 100,000 operations (250VAC 3A resistive load)	
Output mode		10 operation modes	Power ON Delay mode fixed	
Environ-ment	Ambient temp.	-10 to 55℃, storage: -25 to 65℃		
	Ambient humidity	35 to 85%RH		
Accessory		Bracket		

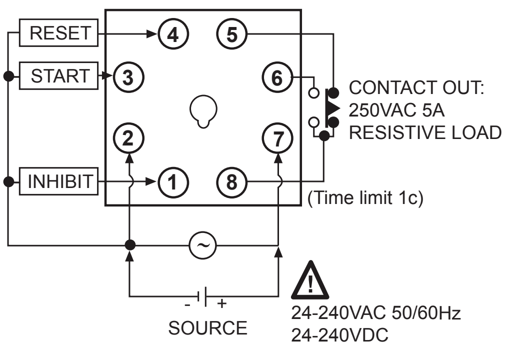
※Environment resistance is rated at no freezing or condensation.

Specifications

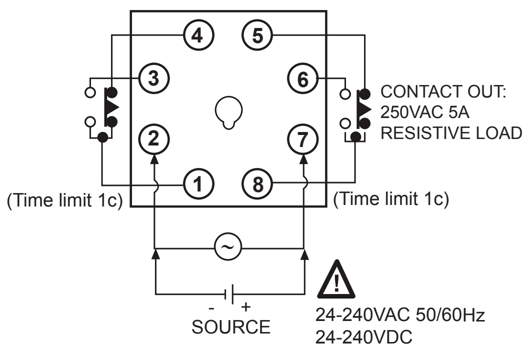
Model		LE3S	LE3SA	LE3SB
Repeat error		Max. ±0.01% ±0.05sec (for Power ON Start) Max. ±0.005% ±0.03sec (for Signal ON Start)	Max. ±0.01% ±0.05sec	
SET error				
Voltage error				
Temperature error				
Insulation resistance		Over 100MΩ (at 500VDC megger)		
Dielectric strength		2,000VAC 50/60Hz for 1 minute		
Noise immunity		±2kV the square wave noise (pulse width: 1μs) by the noise simulator		
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour		
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min		
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times		
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times		
Approval		CE cULus		
Unit weight		Approx. 100g	Approx. 105g	

Connections

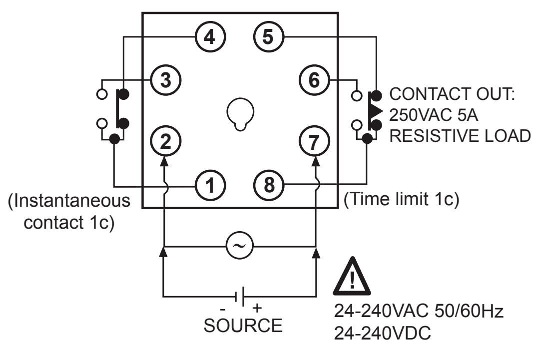
● LE3S



● LE3SA



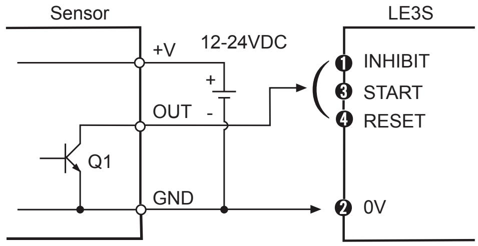
● LE3SB



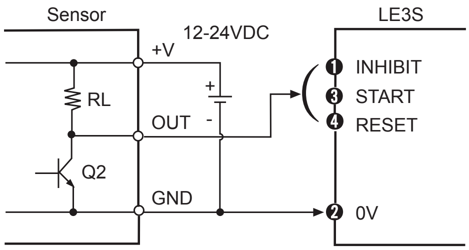
LE3S Series

▣ Input Connections (LE3S Only)

◎ Solid-state input

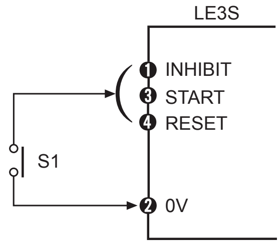


- Q1 is ON: Operating
- Sensor: NPN open collector output



- Q2 is ON: Operating
- Sensor: NPN universal output

◎ Contact input



- S1 is ON: Operating
- S1: Micro switch, push button switch, relay

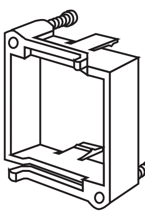
● Input level

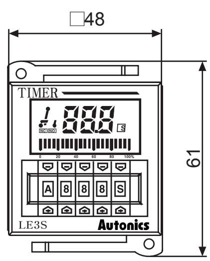
No voltage input	● Short-level (transistor is ON) • Residual voltage: Max. 0.5V • Impedance: Max. 1kΩ
	●Open-level (transistor is OFF) • Impedance: Min. 100kΩ
Contact input	Please use reliable contacts enough to flow 5VDC 1mA of current.

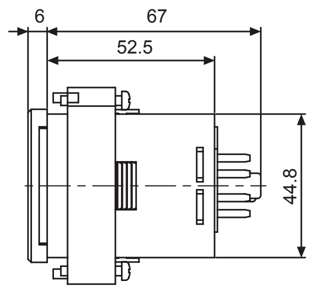
▣ Dimensions

(unit: mm)

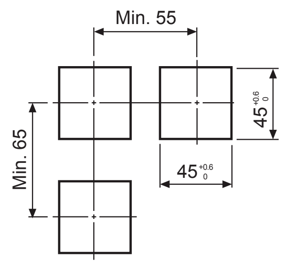
● Bracket

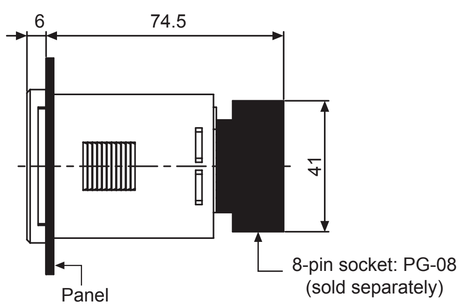




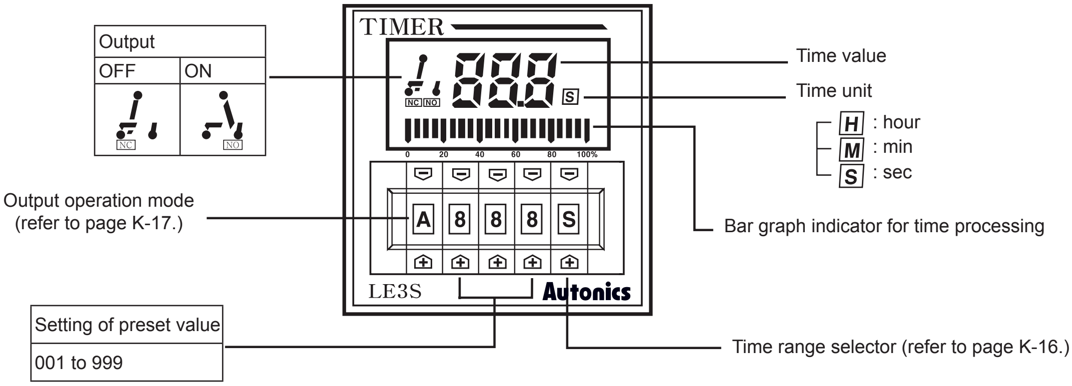


● Panel cut-out

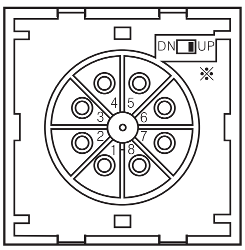




■ Unit Description



■ Up/Down Mode



※Output operate as Up or Down mode by Up/Down switch location.

Up	Down
DN ■ UP	DN ■ UP

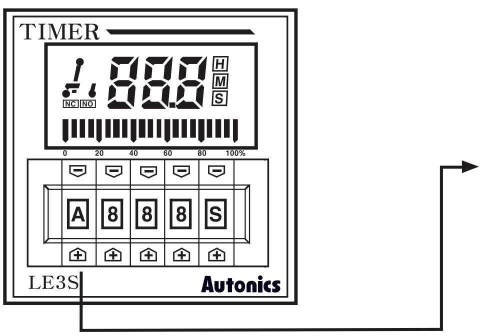
⚠ **Power must be cut off.**

● **Default specifications**

LE3S	LE3SA, LE3SB
Up/Down mode: Up	• Up/Down mode: Up • Output mode: A mode (fixed) ※Down mode is option.

■ Output Operation Mode Selection

Please select operation mode by press the left of ⊕, ⊖ keys in front panel.

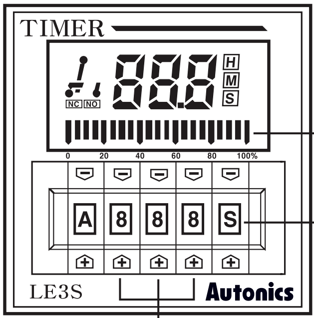


Output operation mode	
A	ON Delay Ⓐ
B	Interval Delay Ⓐ
C	ON Delay Ⓑ
D	Flicker Ⓐ
E	Flicker Ⓑ
F	One-shot Out Flicker
H	OFF Delay
K	ON/OFF Delay
L	Interval Delay Ⓑ
N	Integration Time

※Refer to the K-17 to 18 for details about output operation mode.
● ON Delay Ⓐ of A mode and ON Delay Ⓑ of C mode are different.
● Interval delay Ⓐ of B mode and Interval Delay Ⓑ of L mode are different.
● Flicker Ⓐ of D mode and Flicker Ⓑ of E mode are different.
※Output mode Ⓐ is operated as time progresses only when the START signal applied continuously.
※Output mode Ⓑ is operated as time progresses even the START signal is applied as One-shot signal.
(one-shot input signal should be over 20ms.)

■ Time Specifications And Time Range

Please select time unit and range by press the right of ⊕, ⊖ keys in front panel.

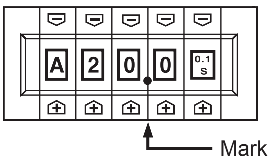


BAR graph: Display % for the time progressing against setting time

Time Range mode	
0.01s	0.01sec to 9.99sec
0.1s	0.1sec to 99.9sec
s	1sec to 999sec
0.1m	0.1min to 99.9min
m	1min to 999min
0.1h	0.1hour to 99.9hour
h	1hour to 999hour
10h	10hour to 9990hour
S	0 min 01sec to 9min 59sec
M	0 hour 01min to 9hour 59min

Time setting digital switch

● Setting of operation time: Please select operation time by press the center of 3 ⊕, ⊖ keys in front panel.
※When using this unit with 20.0 sec of operation time.
After selecting 0.1 s as time range, then set digital switches as 20.0 sec
In this case, it is convenient to put a decimal point as below figure.

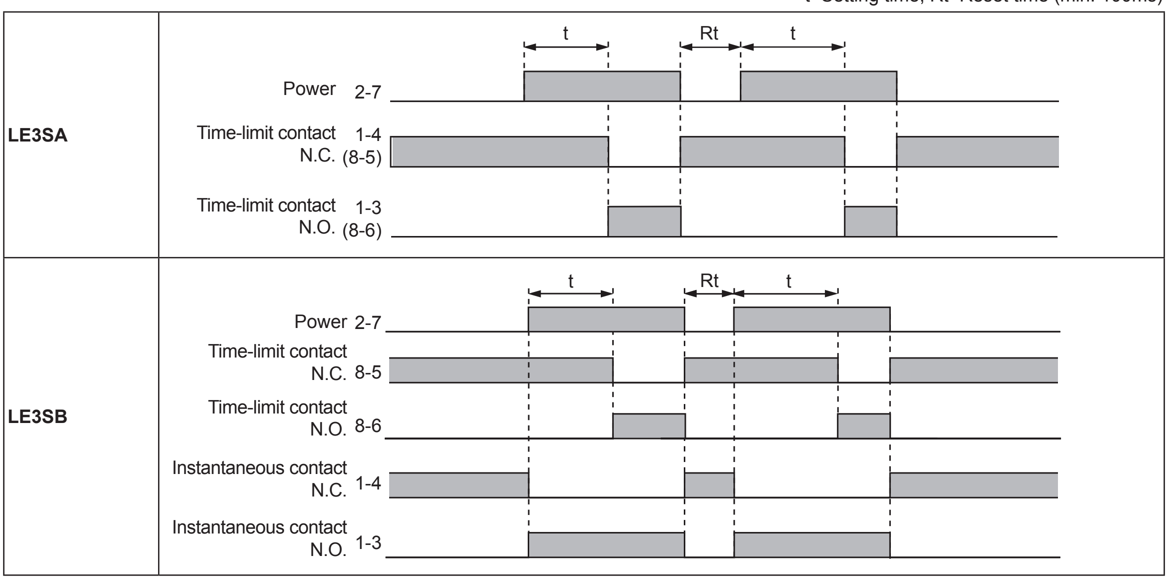


Mark a decimal point.

● Bar graph display: Display the progress rate of time for setting time with bar, it is calculated as below for 1bar.
Setting value (operation time) ÷ 20 (total number of bars) = The time for 1 bar is lighted.

■ LE3SA, LE3SB Output Operation Mode

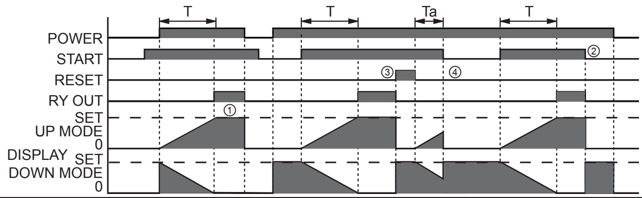
t=Setting time, Rt=Reset time (min. 100ms)

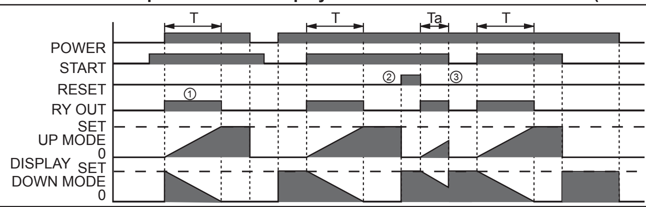


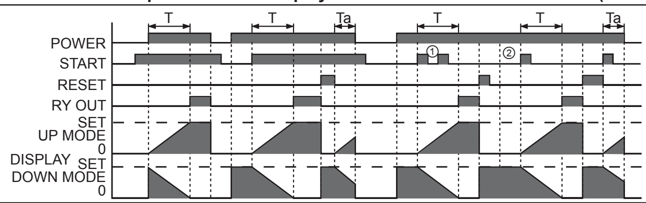
▣ LE3S Output Operation Mode

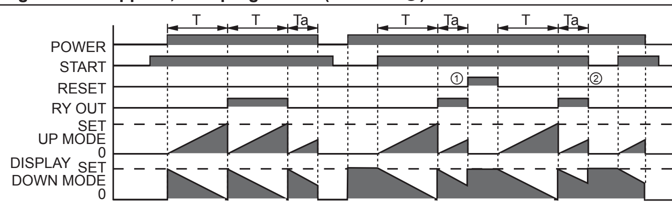
T=Setting time, T >Ta

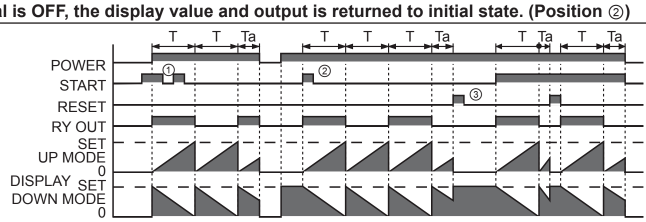
<table>
<tr><th>Mode</th><th>Time chart</th></tr>
<tr><td>A

ON Delay
Ⓐ</td><td>
1. Time progresses when START signal is ON.
2. The output will be ON when the setting value is equal to the display value. (Position ①)
3. When the RESET signal is ON, the display value is returned to the initial state. (Position ③)
4. When the setting value is equal to the display value, if START signal is OFF, the output turns off, the display value is held. (Position ②)
※If START signal is OFF when the output is OFF the display value is returned to initial state (Position ④).</td></tr>
<tr><td>B

Interval Delay
Ⓐ</td><td>
1. The output turns ON and time progresses when START signal is ON.
2. The output will be ON when the setting value is equal to the display value. (Position ①)
3. When the RESET signal is ON, the display value is returned to the initial state. (Position ②)
※If START signal is OFF when the output is OFF the display value is returned to initial state. (Position ③)</td></tr>
<tr><td>C

ON Delay
Ⓑ</td><td>
1. Time proceeds when START signal is ON.
2. The output will be ON when the setting value is equal to the display value. (Position ①)
3. When the RESET signal is ON, the display value is returned to the initial state.
※When start signal is applied repeatedly (Position ①), only the initial signal is recognized.
※Even if the START signal is not applied, time progresses. (Position ②)</td></tr>
<tr><td>D

Flicker
Ⓐ</td><td>
1. Time progresses repeatedly when the START signal is ON.
2. The output operates from N.C. to N.O., and from N.O. to N.C. repeatedly.
3. If RESET signal is ON, it is returned to initial state. (Position ①)
※If the START signal is OFF, the display value and output is returned to initial state. (Position ②)</td></tr>
<tr><td>E

Flicker
Ⓑ</td><td>
1. Time progresses repeatedly when the START signal is ON.
2. The output operates from N.C. to N.O., and from N.O. to N.C. repeatedly.
3. If RESET signal is ON, it is returned to initial state. (Position ③)
※When START signal is applied repeatedly, only the initial signal is recognized. (Position ①)
※Even if the START signal is not applied, time progresses. (Position ②)</td></tr>
</table>

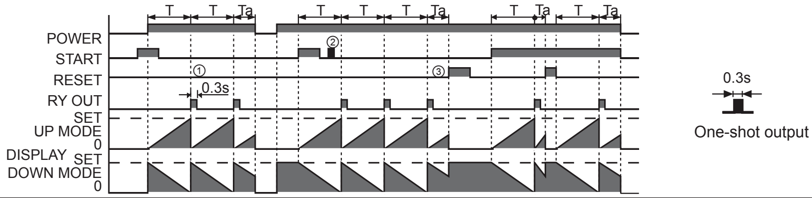
※Initial state: Output is OFF, the display value is "0". (UP mode). The output is OFF and the display value is the setting value (DOWN mode)
※When using D, E output operation modes, if the time is set too short, the output may not work properly. Please set the time at least over 100ms.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

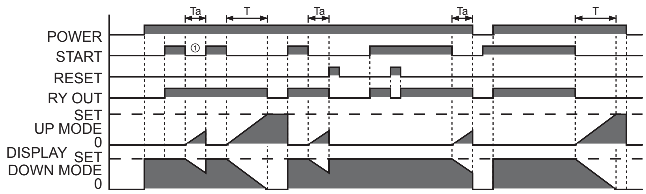
▣ LE3S Output Operation Mode

T=Setting time, T=T1+T2+T3, T >Ta, T >Ta+Tb

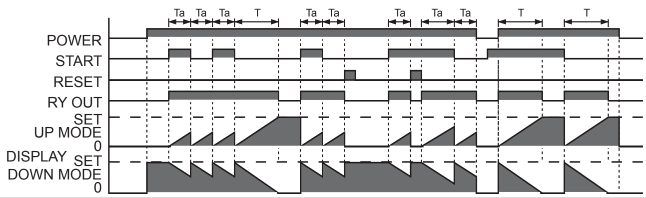
<table>
<tr><th>Mode</th><th>Time chart</th></tr>
<tr><td>F

One-shot Out Flicker</td><td>

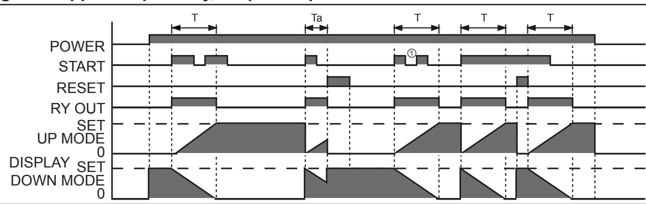
1. Time progresses from initial value to the preset value repeatedly and the output operates as one-shot (0.3 sec), when the START signal is ON. (Position ①)
2. If the RESET signal is ON, it is returned to initial state. (Position ③)
※When START signal is applied repeatedly, only the initial signal is recognized. (Position ②)</td></tr>
<tr><td>H

OFF Delay</td><td>

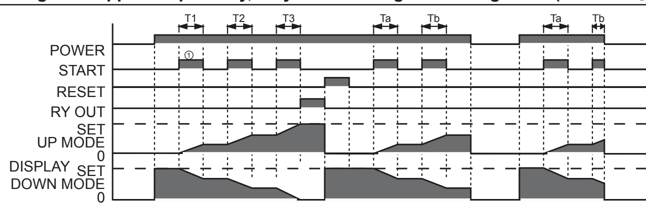
1. The START signal & the output are ON at the same time. The output will return and the display value is held after the setting time.
2. If the RESET signal is ON, the display value is returned to initial state.
※If the START signal is applied continuously, the output will be ON but time is not progressed.</td></tr>
<tr><td>K

ON-OFF Delay</td><td>

1. When the START signal is ON the output is ON the output will be reset and display value is held when setting value is equal to display value.
2. The START signal turns OFF, the output turns ON, the output will be reset and display value is held when setting value is equal to display value.
3. If RESET signal is ON, it is returned to initial state.
※If START signal is applied repeatedly, output keeps ON but be sure that the time will be initialized.</td></tr>
<tr><td>L

Interval Delay
Ⓑ</td><td>

1. When START signal is ON, the output turns ON and the time progresses at the same time.
2. When the time reaches at the preset value the output will be reset, and the display value is held.
3. If RESET signal is applied, the display value is returned to initial state.
※When START signal is applied repeatedly, only the initial signal is recognized. (Position ①)</td></tr>
<tr><td>N

Integration Time</td><td>

1. When START signal is ON, time progresses.
2. If START signal turns off before the display value reaches the setting value, the time (display value) will be held.
3. If RESET signal is ON, it is returned to initial state.</td></tr>
</table>

※Initial state: The output is OFF, the display value is "0". (UP mode) The output is OFF and the display value is setting value. (DOWN mode)
※When using F output operation modes, if the time is set too short, the output may not work properly. Please set the time at least over 100ms.

▣ Proper Usage

⚠ Caution

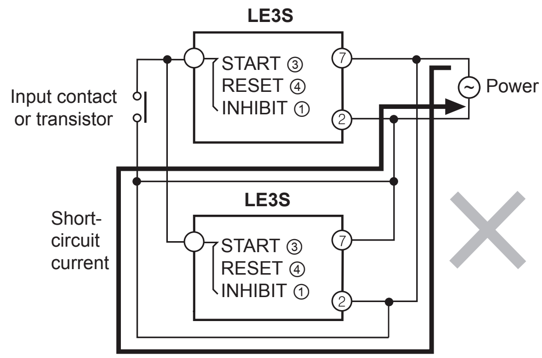
It may cause electric shock if touching the input signal terminal (between start, reset, inhibit and terminal ②) when the power is supplied.

◎ Power connection

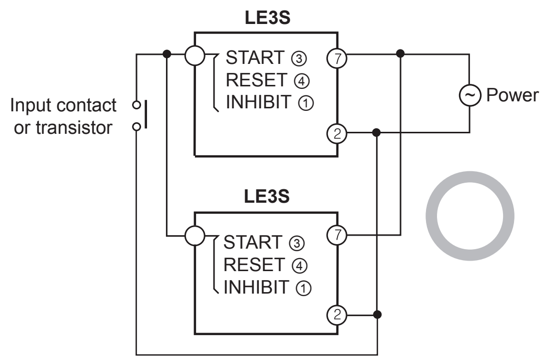
- Connect AC power line between (②-⑦) for LE3S AC power type. But please aware power connection for DC power type. (② ← ⊖ , ⑦ ← ⊕)
- When turning off power, be sure about inductive voltage, residual voltage between terminal (②-⑦), it may cause problem with low voltage because power consumption is low and impedance is high. (if using power line in with another high voltage line or energy line in the same conduit, it may cause inductive voltage. Therefore please use separate conduit for power line.)
- Power ripple should be under 10% and power supply should be within range of allowable voltage for DC power type.
- Please supply power quickly as using a switch or relay contact, otherwise it may cause timing error.
- When using SSR (solid state relay) for switching power source of Timer, dielectric strength voltage should be 2 times higher than power source.

◎ Input/Output

- Please check operation mode of this unit before connecting the power.
- If setting「000」for operation time, output may not work.
- When using a relay contact as input signal, please use reliable contact enough to flow 5VDC 1mA of current. (short circuited: Contact resistance under 1kΩ, Open circuit: Residual voltage under 0.5V)
- In case of connecting START terminal (③) and power terminal (②) of LE3S, do not start time at the same time applying power. Please use relay contact or transistor to start. (time error occurs when time starts the moment power is supplied.)
- When power is applied to LE3SA, LE3SB, it starts to operate,please check operation specification before using. (it may cause breakdown of peripheral device when power is applied without any check.)
- LE3S is transformer-less type, therefore please check following for connecting a relay contact, input signal and transistor.
- When connecting 2 or more than 2 Timers with 1 relay contact for input or transistor, please connect as following <Figure. 2 >.

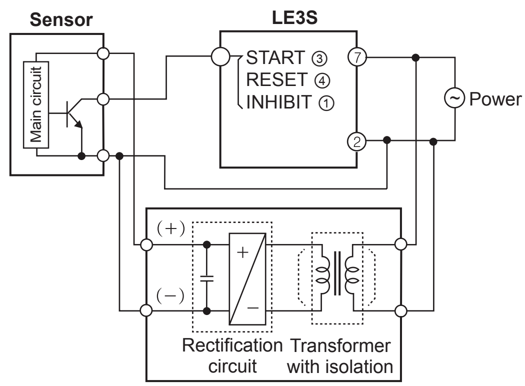


< Figure. 1 >



< Figure. 2 >

- Please use transformer with primary and secondary isolated power for input.



< Sensor power supply device>

DIN W48×H48mm Digital Backlight LCD Timer

■ Features

- Mounting space saving with compact design
  : downsized by approx. 22% in depth compared to existing models
  (length of panel on the back side is 56mm)
- Available to set each value and time range separately when choosing Flicker (FK, FK I) or ON-OFF Delay (ON OFF D, ON OFF D I) output mode
- Adds Flicker 1 mode (LE4SA)
- Settable One-shot output time (0.01 to 99.99sec) (existing model: fixed 0.5 sec)
- Configurable time range (added 9.999sec)
  : Settable by 0.001sec unit
- Selectable Min. input time: 1ms or 20ms (LE4S)
- Improved return time: 100ms
- Backlight ON/OFF function
- Wide time range (0.01sec to 9999hour)
- Lock setting function for saving setting data
- Soft touch setting
- High visibility display with backlight

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

LE | 4 | S | ☐

Code		Description
Output	No mark	Time-limit SPDT (1c)
	A	Time-limit DPDT (2c), Time-limit SPDT (1c)+Instantaneous SPDT (1c) (selectable)
Size	S	DIN W48×H48mm
Digit	4	9999 (4-digit)
Item	LE	LCD Timer (touch type)

※Sockets (PG-08, PS-08(N)) are sold separately.

■ Specifications

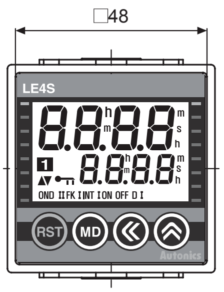
Model		LE4S	LE4SA
Function		**Multi time and Multi operation**	
Display method		LCD display (backlight)	
Power supply		24-240VAC 50/60Hz, 24-240VDC universal	
Allowable voltage range		90 to 110% of rated voltage	
Power consumption		Max. 4.5VA (24-240VAC 50/60Hz), Max. 2W (24-240VDC)	Max. 4VA (24-240VAC 50/60Hz), Max. 1.6W (24-240VDC)
Return time		Max. 100ms	
Min. input signal width	START	1ms, 20ms (selectable)	—
	INHIBIT		
	RESET		
Input	START	• No-voltage input Impedance at short-circuit: Max. 1kΩ, Residual voltage: Max. 0.5V, Impedance at open-circuit: Min. 100kΩ	—
	INHIBIT		
	RESET		
Timing operation		Signal ON Start	Power ON Start
Control output	Contact type	Time limit SPDT (1c)	Selectable Time limit DPDT (2c), Time limit SPDT (1c)+ Instantaneous SPDT (1c) (depends on operation mode)
	Contact capacity	250VAC 5A resistive load	250VAC 3A resistive load
Relay life cycle	Mechanical	Min. 10,000,000 operations	
	Electrical	Min. 100,000 operations (at rated contact capacity)	
Output mode		10 operation modes	8 operation modes
Environment	Ambient temp.	-10 to 55℃, storage: -25 to 65℃	
	Ambient humi.	35 to 85%RH	
Accessory		Bracket	

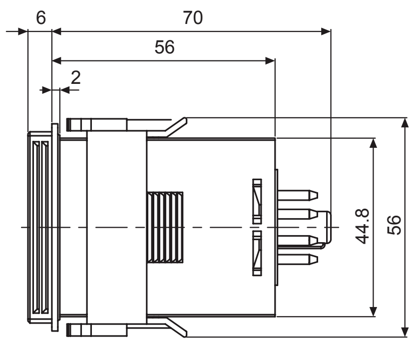
※Environment resistance is rated at no freezing or condensation.

■ Specifications

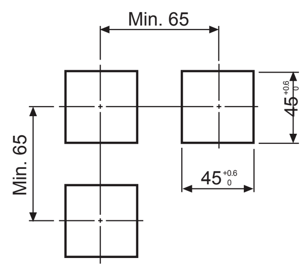
Model		LE4S	LE4SA
Repeat error		Max. ±0.01% ±0.05sec (for Power ON Start) Max. ±0.005% ±0.03sec (for Signal ON Start)	Max. ±0.01% ±0.05sec
SET error			
Voltage error			
Temperature error			
Insulation resistance		Over 100MΩ (at 500VDC megger)	
Dielectric strength		2,000VAC 50/60Hz for 1 minute	
Noise immunity		±2kV the square wave noise (pulse width: 1μs) by the noise simulator	
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1hour	
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min	
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times	
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Approval		CE c UL us	
Unit weight		Approx. 98g	

■ Dimensions



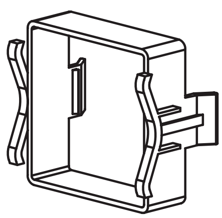


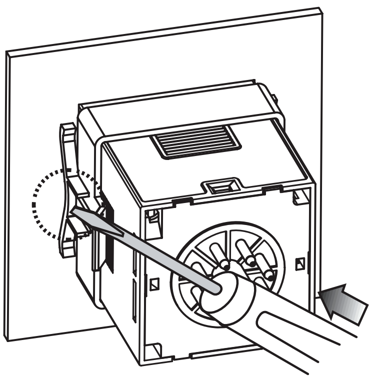
● **Panel cut-out**



※Refer to page G-19 for 8-pin socket (sold separately).

● **Bracket and mounting**

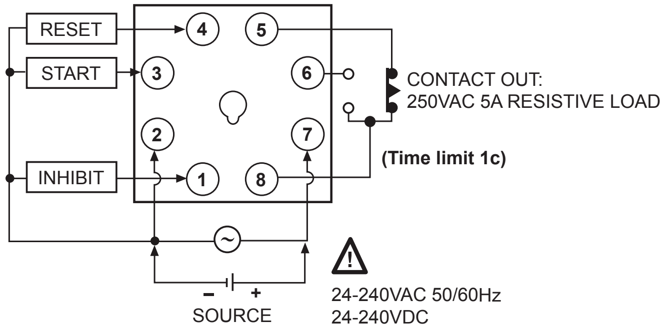




※Insert product into a panel, fasten bracket by pushing with tools as shown above.

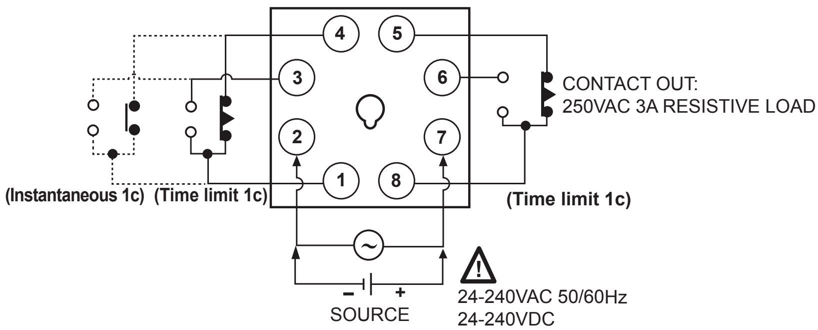
▣ Connections

◎ LE4S



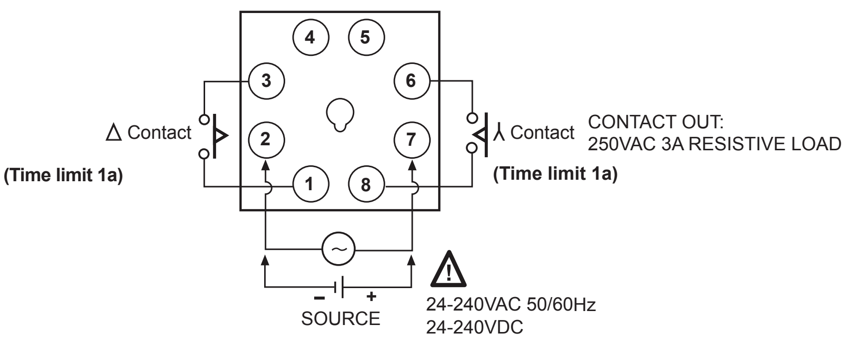
◎ LE4SA

● **[ON.D] [ON.D.II] [FK] [FKI] [INT] [T] [T.I]** mode



※Time limit 1c + Instantaneous 1c or Time limit 2c (selectable)
([**T**] [**T.I**]: Time limit 2c only.)

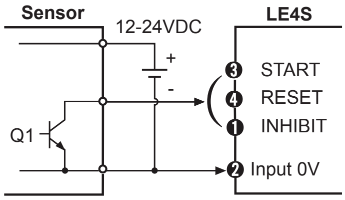
● **[⅄-△] mode**



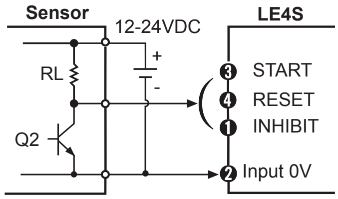
■ Input Connections

LE4S is No-voltage input (short-circuit and open) type.

◎ Solid-state input

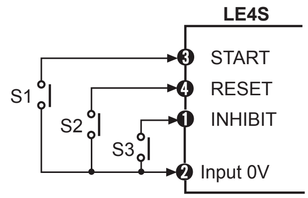


- Q1 is ON: Operating
- Sensor: NPN open collector output



- Q2 is ON: Operating
- Sensor: NPN universal output

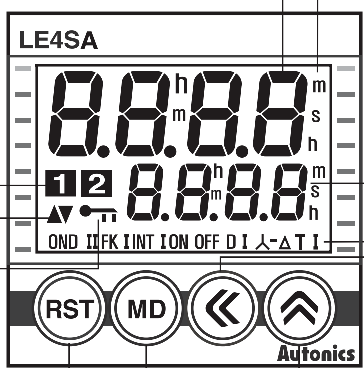
◎ Contact input



- S1, S2, S3 are ON: Operating
- Please use reliable contact enough to flow 5VDC 1mA.

※Be sure that it is not insulated between power and input terminal block.

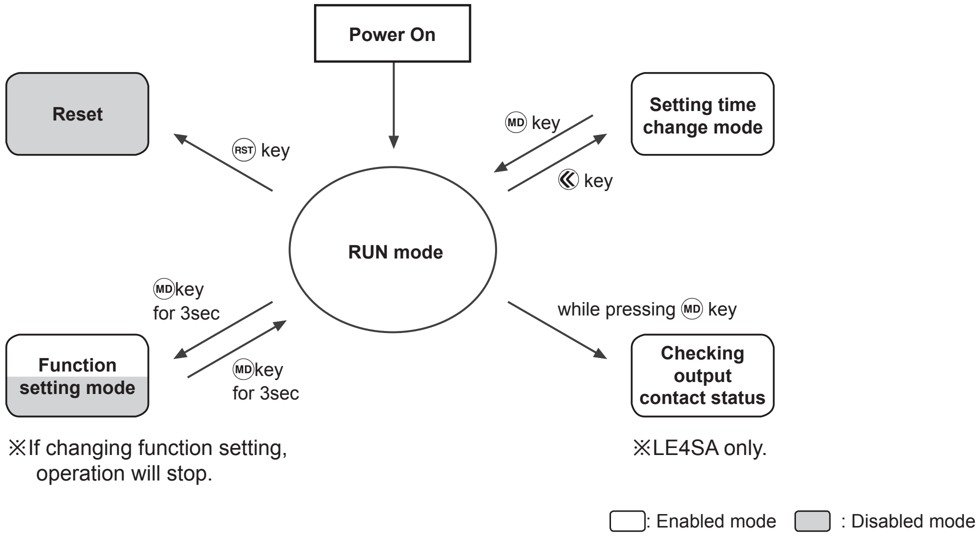
■ Unit Description



- Output display
  It displays the status of output contact.
- UP/DOWN
  It displays time progressing UP (▲), DOWN (▼).
- Key lock display
  It displays the status of key lock.
- RESET key
  Used for initializing time progressing and output return.
- Time progressing display
  It displays the current time.
- Time unit
  It displays the time unit.
  (h: hour) (m: min) (s: sec)
  ※When the time is progressing, it is flashing at a rate of (0.5sec)
- Time setting display
  It displays the setting time.
- Operation mode
  It displays the current operation mode.
  (E.g.: OND=ON Delay)
- SHIFT key
  Used for advancing to setting time change mode and moving to each digit.
- UP key
  Used for advancing to function setting mode, setting time change checking.
- MODE key
  Used for changing the set value.

▣ Function And Time Setting

◎ Configuration



● Reset

Reset using RST key in Run mode

● Run mode

The operation status (when power is on for the first time: factory default setting) is displayed.
It could enter into function setting mode, setting value change mode and output contact status mode.

● Function setting mode

If pressing MD key over 3 sec in the Run mode, it will enter into function setting mode and if pressing MD key over 3 sec in function setting mode, it will return to Run mode.
※Even if it enters into function setting mode in Run mode, time progressing and output control will continue.
※If operation settings are changed in function setting mode, all outputs will be off and reset on returning to run mode.

● Output contact status mode (LE4SA only)

Output contact status are displayed while pressing MD key in Run mode.
※If pressing MD key over 3 sec, it will enter into function setting mode.

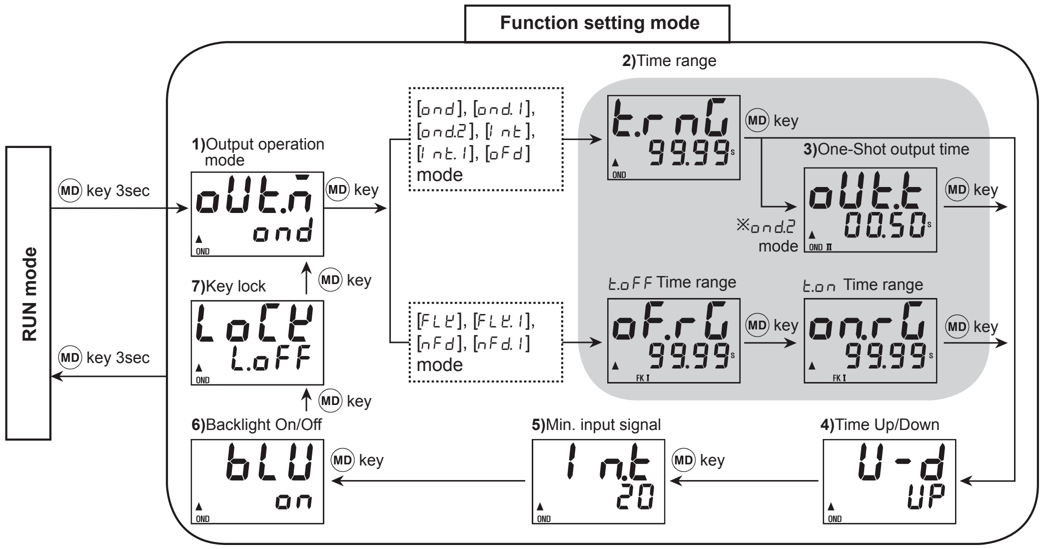
● Setting time change mode

Press 《 key to enter into setting time change mode and press MD key to return to Run mode.
Even if signal is input when changing setting time, time progressing and output control will be continue.
If no key is pressed over 60 sec in setting time change mode, it will return to Run mode.

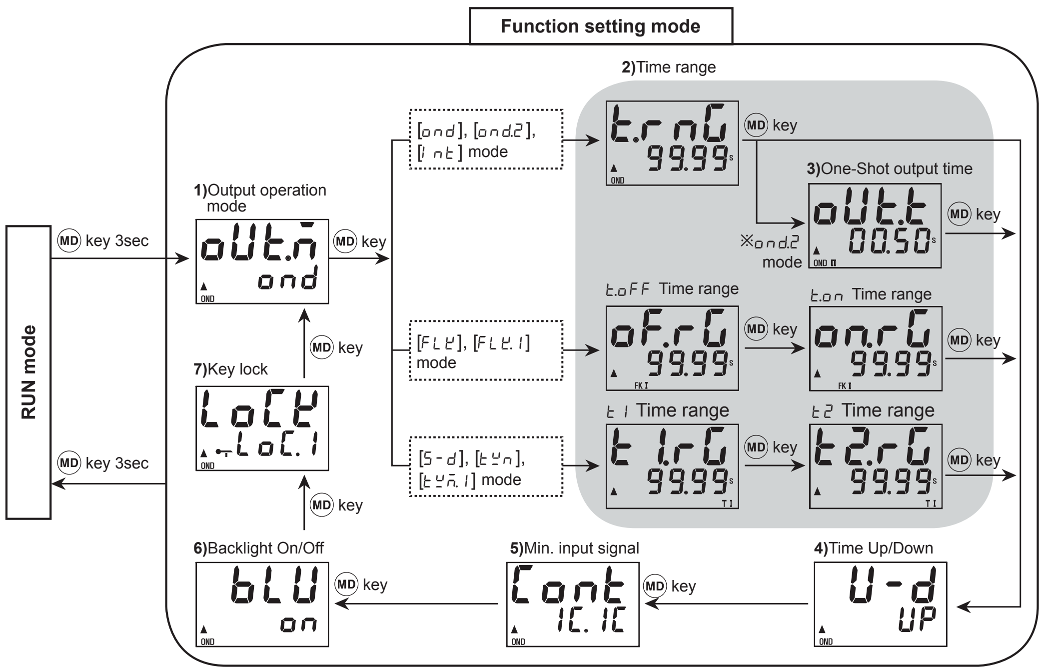
※If no key is pressed over 60 sec in setting time change mode, it will return to Run mode and previous parameter value is not stored.

■ Function Setting Mode

◎ LE4S



◎ LE4SA



■ Factory Default

◎ LE4S

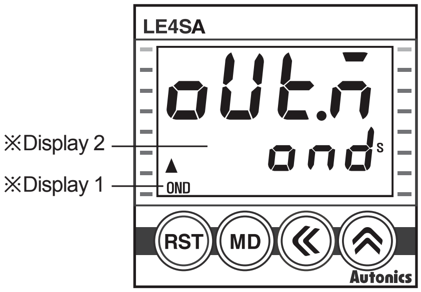
Parameter		Factory default
Output operation mode	oUt.m	ond
Time range	t.rnG	9 9.99
Time Up/Down	U-d	UP
Min. input signal	I nt	20
Backlight On/Off	bLU	on
Key lock	LoCK	L.oFF
Setting time	—	50.00

◎ LE4SA

Parameter		Factory default
Output operation mode	oUt.m	ond
Time range	t.rnG	9 9.99
Time Up/Down	U-d	UP
Output contact	Cont	1C.1C
Backlight On/Off	bLU	on
Key lock	LoCK	LoC.1
Setting time	—	50.00

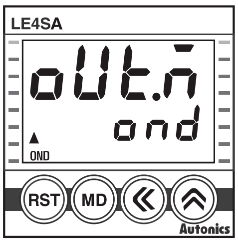
▣ Output Operation Mode

● LE4S/LE4SA output operation mode



NO	※Display 1	※Display 2	Operation mode	LE4S	LE4SA
1	**OND**	ond	ON Delay	○	○
2	**OND**I	ond.1	ON Delay 1	○	—
3	**OND**II	ond.2	ON Delay 2	○	○
4	**FK**	FLK	Flicker	○	○
5	**FK**I	FLK.1	Flicker 1	○	○
6	**INT**	Int	Interval	○	○
7	**INT**I	Int.1	Interval 1	○	—
8	**ON OFF D**	nFd	ON-OFF Delay	○	—
9	**ON OFF D**I	nFd.1	ON-OFF Delay 1	○	—
10	**OFF D**	oFd	OFF Delay	○	—
11	**⅄ - Δ**	S-d	STAR-Delay	—	○
12	**T**	tYn	Twin	—	○
13	**T**I	tYn.1	Twin 1	—	○

● Output operation mode

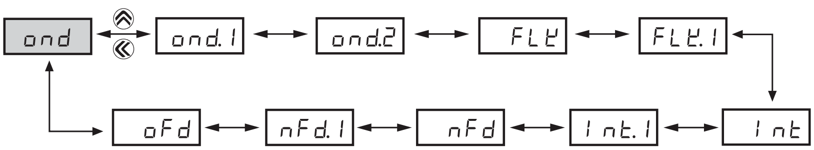


[Figure1]

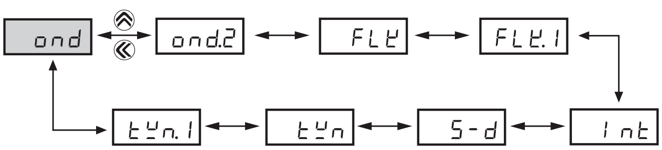
1) In function setting mode, it enters into output operation mode as shown in the [Figure 1].
2) Select proper output operation mode using ≪ and ≫ key.
   (refer to Output operation flowchart)
3) Press MD key to set output operation mode and move to next mode.
4) If pressing MD key for 3 sec in any function setting mode, it will return to Run mode.

※Output operation flowchart

< LE4S >



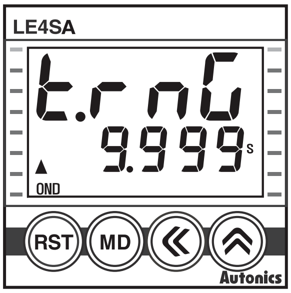
< LE4SA >



※The shaded parameter (▭) is factory default.

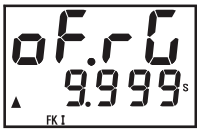
■ Time Range

● Time range specifications

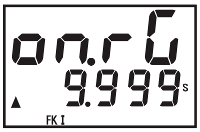


Parameter		Time range specification
9.999 s	(9.999s)	0.001sec to 9.999sec
99.99 s	(99.99s)	0.01sec to 99.99sec
999.9 s	(999.9s)	0.1sec to 999.9sec
9999 s	(9999s)	1sec to 9999sec
99m59 s	(99m59s)	0m01sec to 99min 59sec
999.9 m	(999.9m)	0.1min to 999.9min
9999 m	(9999m)	1min to 9999min
99h59m	(99h59m)	0h01min to 99hour 59min
99.99 h	(99.99h)	0.01hour to 99.99hour
999.9 h	(999.9h)	0.1hour to 999.9hour
9999 h	(9999h)	1hour to 9999hour

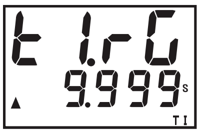
t.oFF time range



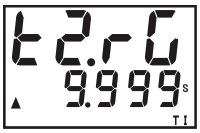
t.on time range



t 1 time range



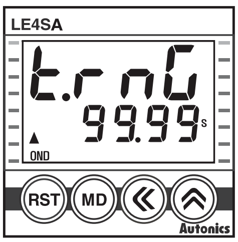
t 2 time range



※**Time range according to output operation mode**

-Time range[t.rnG]
:ond, ond.1, ond.2, Int, Int.1, oFd mode
-t.oFF/t.on time range[oF.rG/on.rG]
:FLK, FLK.1, nFd, nFd.1 mode
-t 1/t 2 time range[t 1.rG/t 2.rG]
:S-d, tYn, tYn.1 mode

● Time range selection method



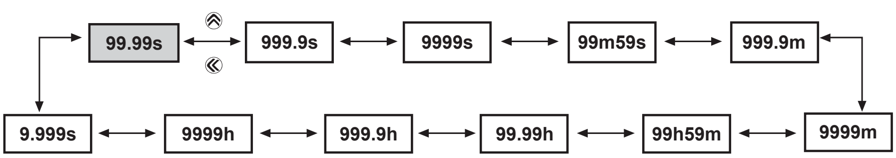
[Figure1]

When ond, ond.1, ond.2, Int, Int.1, oFd mode

1) In function setting mode, if it enters into time range mode, the characters will be displayed as shown in the [Figure 1].
2) Select the time range using ≪ and ⩓ key.
   (refer to time range flowchart)
3) Press MD key to complete the time range setting and the next mode.
4) If pressing MD key for 3 sec, it will return to Run mode.

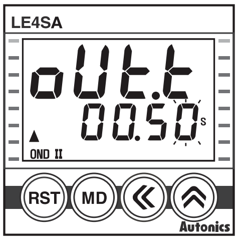
※When FLK, FLK.1, nFd, nFd.1, S-d, tYn, tYn.1 time range[t 1.rG, t 2.rG or oF.rG, on.rG can be individually set.

※Time range flowchart



※The shaded parameter ( ) is factory default.

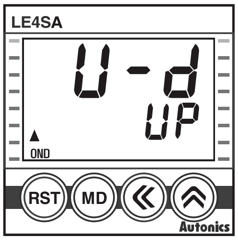
● One-shot output time setting



[Figure2]
※Factory default

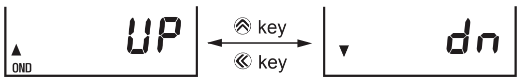
When output operation mode ON Delay 2[ond.2],
1) In function setting mode, if it enters into One-shot output time setting mode as shown in the [Figure 2], the last digit will flash.
2) Set One-shot output time using ≪ and ⩓ key. (setting range: 0.01s to 99.99s)
3) Pressing MD key to complete one-shot output time setting and move to the next mode.
4) If pressing MD key for 3 sec in any function setting mode, it will return to Run mode.

● Time progress UP/DOWN setting



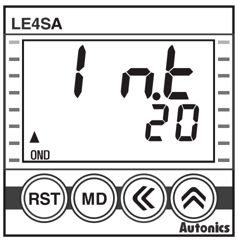
[Figure3]
※Factory default

1) In function setting mode, if it advances to UP/DOWN setting mode, the characters will be displayed as shown in the [Figure 3].
2) Select UP (▲), dn (▼) using ≪, ⩓ key.



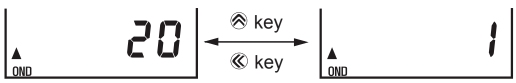
3) Press MD key to complete UP/DOWN setting and move to the next mode.
4) If pressing MD key for 3sec in any function setting mode, it will return to Run mode.

● The minimum input signal setting (LE4S only)



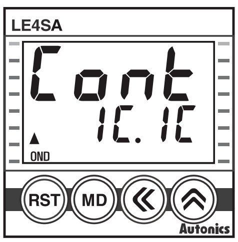
[Figure4]
※Factory default

RESET, START and INHIBIT.
1) In function setting mode, if it enters into input signal setting mode, the characters will be displayed as shown in the [Figure 4].
2) Select 1ms or 20 ms using ≪, ⩓ keys.



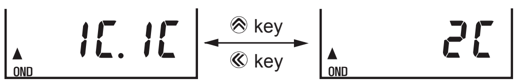
3) Press MD key to complete input signal width and move to the next mode.
4) If Pressing MD key over 3 sec in any function setting mode, it will return to Run mode.

● Output contact setting (LE4SA only)



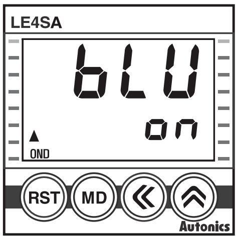
[Figure5]
※Factory default

1) In function setting mode, if it enters into output contact setting mode, the characters will be displayed as shown in the [Figure 5].
2) Select time limit 1c+instant limit 1c or time limit 2c using ≪, ⩓ keys.
(refer to LE4SA Connections on page K-22 for output contact connections)



3) Press MD key to complete output contact setting and move to the next mode.
4) If pressing MD key for 3 sec in any function setting, it will return to Run mode.
※Except for Star-Delta, Twin and Twin 1 modes (2C is set automatically)
※If pressing MD key in Run mode, output contact setting value will be displayed.
(if no key is pressed over 3 sec, it will enter into function setting mode.)

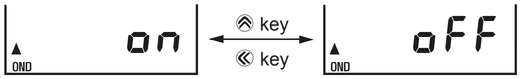
- **Backlight ON/OFF setting**



[Figure6]

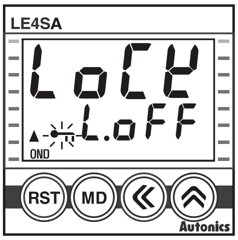
※Factory default

1) In function setting mode, if it enters into Backlight ON/OFF setting mode, the characters will be displayed as shown in the [Figure 6].
2) Select Backlight on or oFF using ≪, ⋀ key.



3) Press MD key to complete Backlight ON/OFF setting and move to the next mode.
4) If pressing MD key for 3 sec in any function setting mode, it will return to Run mode.

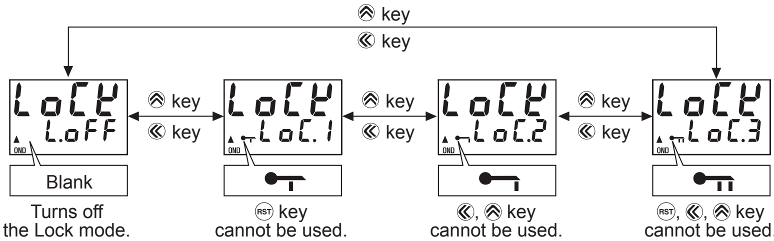
- **Key Lock setting**



[Figure7]

※Factory default

1) In function setting mode, if it enters into Key Lock setting mode, the characters will be displayed as shown in the [Figure 7].
2) Select L.oFF, LoC.1, LoC.2 or LoC.3 using ≪, ⋀ key.



3) Press MD key to complete key lock setting and move to the next mode.
4) If pressing MD key for 3 sec in any function setting mode, it will return to Run mode.

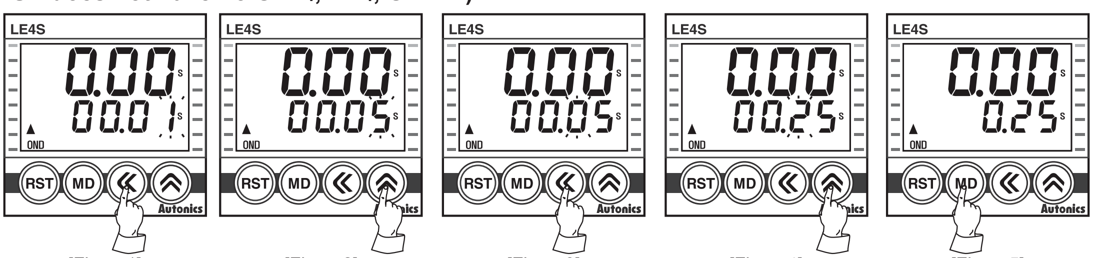
※Factory default for LE4S is L.oFF and Factory default for LE4SA is LoC.1.
※Key Lock function

Display	Function
L.oFF	Turns off the key Lock mode.
LoC.1	RST key cannot be used.
LoC.2	≪, ⋀ key cannot be used.
LoC.3	RST, ≪, ⋀ key cannot be used.

■ Setting Time Change

Please set operation time according to following instruction as the setting is different depending on the output operation mode.

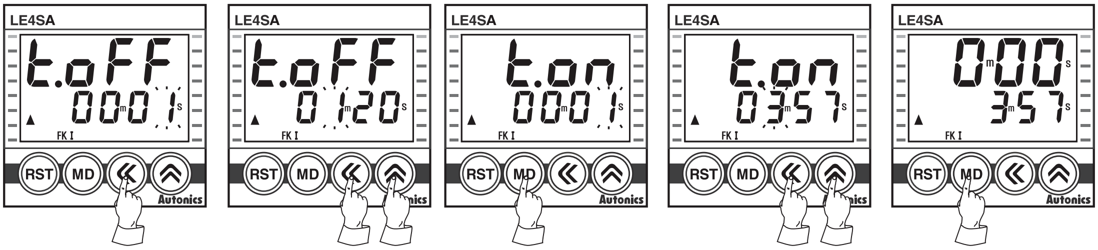
- **Output operation mode: OND, ONDⅠ, ONDⅡ, INT, INTⅠ, OFF D (LE4SA does not have no ONDⅠ, INTⅠ, OFF D.)**



[Figure1] [Figure2] [Figure3] [Figure4] [Figure5]

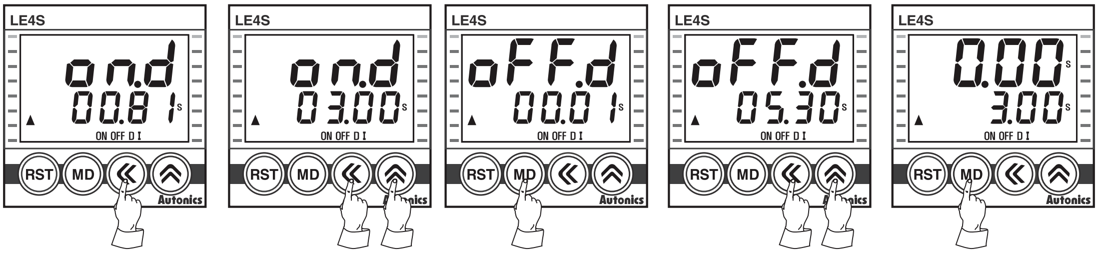
1) Press ≪ key in RUN mode, time set digits will flash. [Figure 1]
2) Change setting time by using ≪ or ⋀ key. [Figure 2,3,4]
   - ≪ key : Shift the setting digits.
   - ⋀ key : Shift the flashing position value. As press ⋀ key once, it will increase by 1digit, number will increase faster by press ⋀ key for over 2sec
3) When the setting is completed, it will be stored and return to RUN mode by pressing MD key. [Figure 5]

● **Output operation mode: FK, FK I**



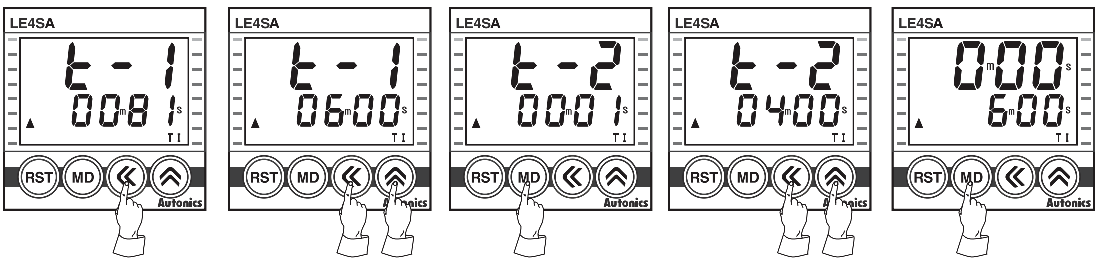
Run mode → Setting of t.oFF time → Setting the time → MD → Setting of t.on time → Setting the time → MD → Run mode

● **Output operation mode: ON OFF D, ON OFF D I (LE4S only)**



Run mode → Setting of on.d time → Setting the time → MD → Setting of oFF.d time → Setting the time → MD → Run mode

● **Output operation mode: 人-△, T, TI (LE4SA only)**



Run mode → Setting of t - 1 time → Setting the time → MD → Setting of t - 2 time → Setting the time → MD → Run mode

※It is able to change the setting time during the time progressing, but be sure about the time progressing while changing of the time.

※If pressing MD key while setting time is shorter than min. setting time, setting value will be flickering three times and it will be returned to setting mode again, not to RUN mode.

※If there is no additional key operations in 60 sec after entering into setting mode, it will be return to RUN mode. (set value is not stored.)

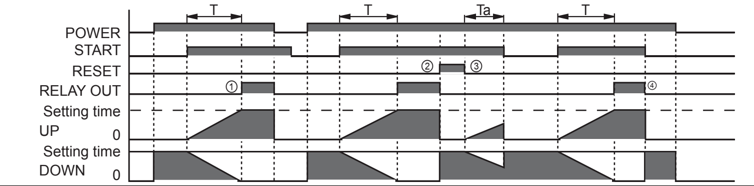
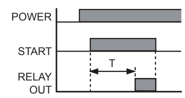
※Min. setting time: 0.01 sec
(in case of: ond, ond.1, ond.2 modes, it is able to set "0" since no min. setting time is applied.)

■ LE4S Output Operation Mode

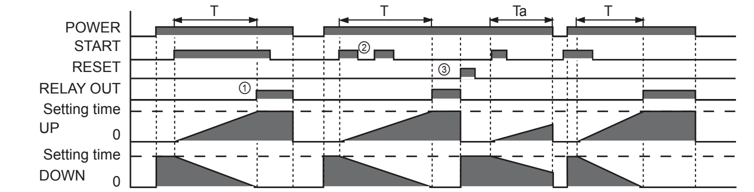
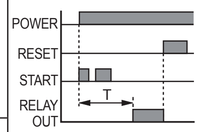
T = Setting time, T > Ta

<table>
<tr><th>Mode</th><th>Time chart</th><th>Operation</th></tr>
<tr><td>[ond]
OND

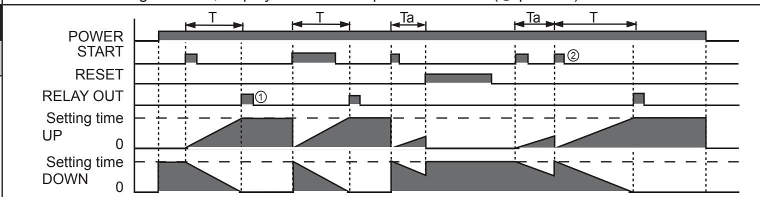
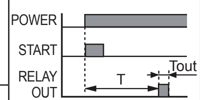
ON Delay

T > Ta</td><td>
1. Timing operation starts when START signal is ON at status of power on.
2. Output will be ON when timing operation is progressed up to the setting time. Display value will be HOLD. (① position)
3. When RESET signal is ON, display value and output will be reset. (② position)
4. If RESET signal is OFF while START signal is ON,“STEP 1”will be restarted. (③ position)
5. When START signal is OFF, display value and output will be reset. (④ position)</td><td>
T = set time</td></tr>
<tr><td>[ond.1]
ONDI

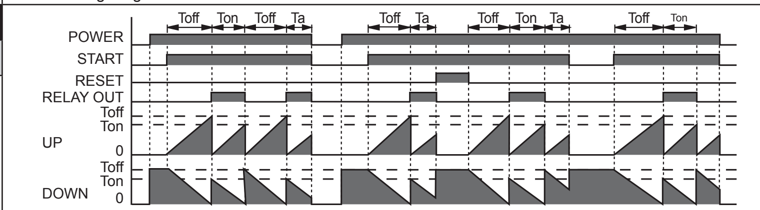
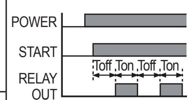
ON Delay 1

T > Ta</td><td>
1. Timing operation starts when START signal is ON at status of power on.
2. Output will be ON when timing operation is progressed up to the setting time. Display value will be HOLD. (① position)
3. Even though START signal is applied repeatedly, only the initial signal is recognized. (② position)
4. When RESET signal is ON, display value and output will be reset. (③ position)</td><td>
T = set time</td></tr>
<tr><td>[ond.2]
ONDII

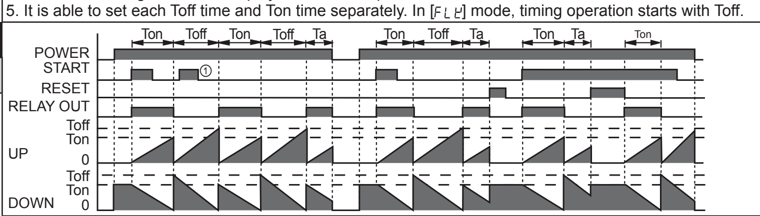
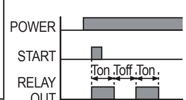
ON Delay 2 (One-shot output)

T > Ta</td><td>
1. Timing operation starts when START signal is ON at status of power on.
2. Time limit output will be ON and goes OFF during Tout setting time when timing operation is progressed up to the setting time. Display value will be HOLD. (① position)
3. When RESET signal is ON, display value and output will be reset.
4. If START signal is applied while time is progressing, Timing operation will be reset and started again. (② position)
5. Tout setting range: 0.01 sec to 99.99 sec</td><td>
Tout = output time
T = set time</td></tr>
<tr><td>[FLK]
FK

Flicker (Toff operation precedes)

Ton, Toff > Ta</td><td>
1. If START signal is ON, output will be repeatedly OFF during Toff setting time and will be OFF during Ton setting time when power is ON.
2. When RESET signal is ON, display value and output will be reset.
3. If RESET signal is OFF when START signal is ON, “STEP 1” will be restarted.
4. When START signal is OFF, display value and output will be reset.
5. It is able to set each Toff time and Ton time separately. In [FLK] mode, timing operation starts with Toff.</td><td>
Ton, Toff = set time
Enables to set Ton and Toff time differently.</td></tr>
<tr><td>[FLK.1]
FK. I

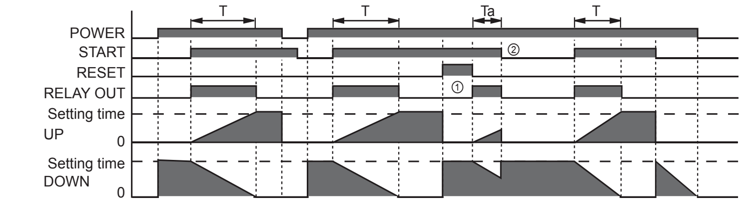
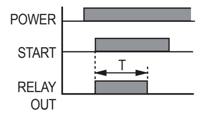
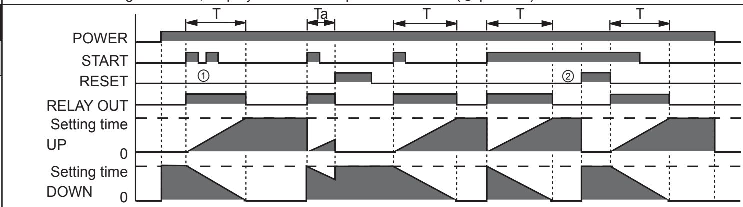
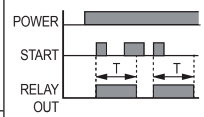
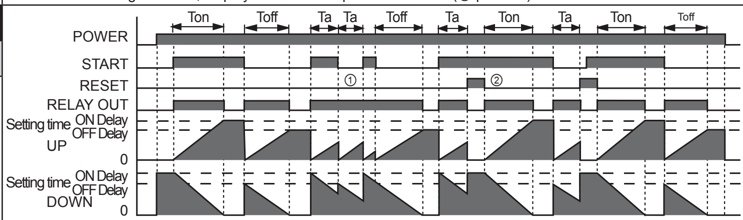
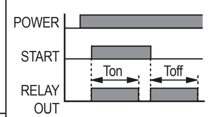
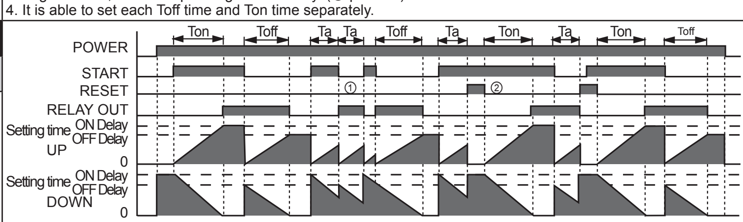
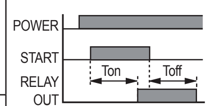
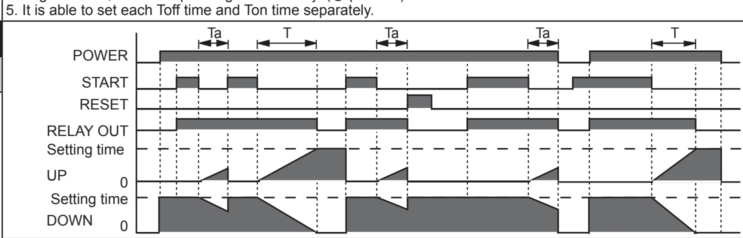
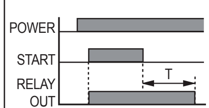
Flicker 1 (Ton operation precedes)

Ton, Toff > Ta</td><td>
1. IF START signal is ON, output will be repeatedly ON during Ton setting time and will be OFF during Toff setting time when power is ON.
2. Even though START signal is applied repeatedly, only the initial signal is recognized. (① position)
3. When START signal is ON, display value and output will be reset. If START signal is ON, it will be restarted.
4. It is able to set each Toff time and Ton time separately. In [FLK.1] mode, timing operation starts with Ton.</td><td>
Ton, Toff = set time
Enables to set Ton and Toff time differently.</td></tr>
</table>

※Initial status: UP mode-display value is "0", output is "OFF". DOWN mode-display value is "setting time", output is "OFF".

▣ LE4S Output Operation Mode

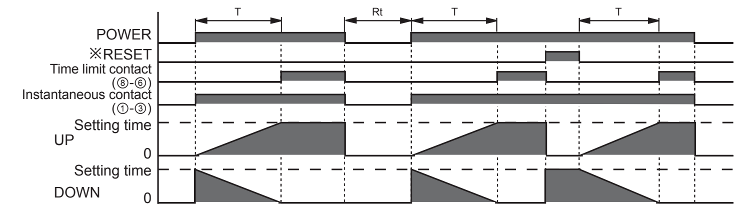
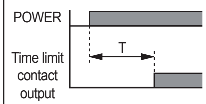
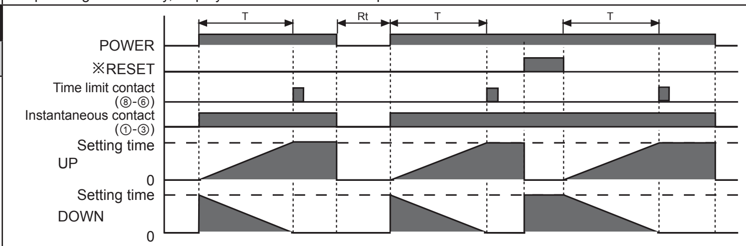
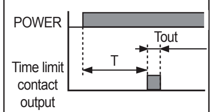
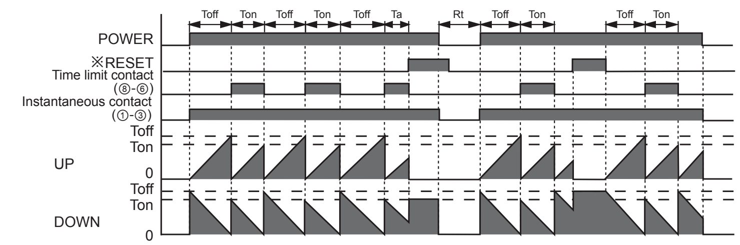
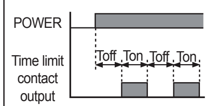
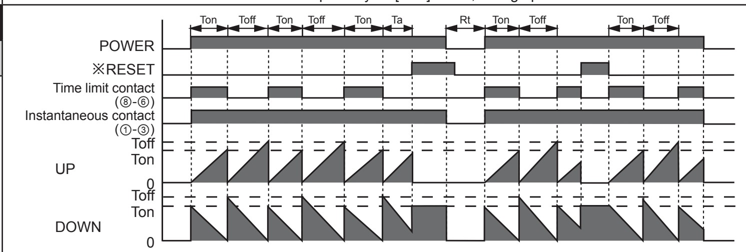
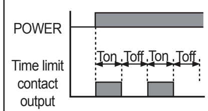
T = Setting time, T > Ta

Mode	Time chart	Operation
[Int] **INT** **Interval** T > Ta	 1. Output will be ON when START signal is ON at status of power on and Timing operation starts. 2. Output will be OFF when timing operation is progressed up to the setting time. Display value will be HOLD. 3. When RESET signal is ON, display value and output will be reset. (① position) 4. If RESET signal is OFF when START signal is ON,"STEP 1" will be restarted. 5. When START signal is OFF, display value and output will be reset. (② position)	 T = set time
[Int.1] **INTI** **Interval 1** T > Ta	 1. Output will be ON when START signal is ON at status of power on and Timing operation starts. 2. Output will be OFF when timing operation is progressed up to the setting time. Display value will be HOLD. 3. Even though START signal is applied repeatedly, only the initial signal is recognized. (① position) 4. If START signal is ON after timing operation is progressed up to the setting time, Output will be ON and setting time will be reset and then timing setting starts. 5. When RESET signal is ON, display value and output will be reset. (② position)	 T = set time
[nFd] **ON OFF D** **ON-OFF Delay** T > Ta	 1. If START signal is ON when power is on, Output will be ON when timing operation is progressed up to the Ton setting time (On-Delay). IF START signal is OFF, output will be ON when timing operation is progressed up to the Toff setting time (OFF-Delay). 2. If START signal is applied repeatedly, output is ON and display value will be reset. (① position) 3. When RESET signal is ON, display value and output will be reset. When RESET signal is OFF while START signal is ON, it will be operating as On-Delay. (② position) 4. It is able to set each Toff time and Ton time separately.	 Ton, Toff = set time
[nFd.1] **ON OFF DI** **ON-OFF Delay 1** T > Ta	 1. If START signal is ON when power is on, timing operation starts. Output will be ON when timing operation is progressed up to the Ton setting time (On-Delay). IF START signal is OFF, output will be ON when timing operation is progressed up to the Toff setting time (OFF-Delay). 2. Output will be ON when START signal is ON and goes OFF during setting time and display value will be reset. (① position) 3. Output will be OFF when START signal is OFF and goes ON during setting time and display value will be reset. (① position) 4. When RESET signal is ON, display value and output will be reset. When RESET signal is OFF while START signal is ON, it will be operating as On-Delay. (② position) 5. It is able to set each Toff time and Ton time separately.	 Ton, Toff = set time
[oFd] **OFF D** **OFF Delay** T > Ta	 1. If START signal is ON when power is on, output will be ON. 2. When START signal is OFF, timing operation starts. Output will be OFF when timing operation is progressed up to the setting time. Display value will be HOLD. 3. When RESET signal is ON, display value and output will be reset.	 T = set time

※Initial status: UP mode-display value is "0", output is "OFF". DOWN mode-display value is "setting time", output is "OFF".

■ LE4SA Output Operation Mode

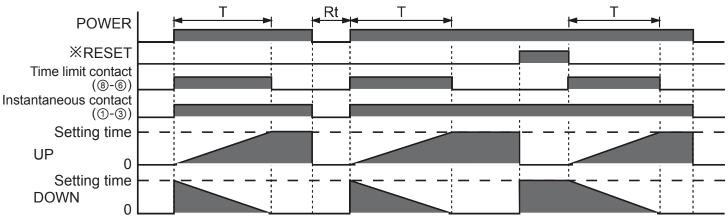
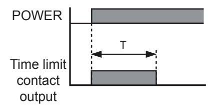
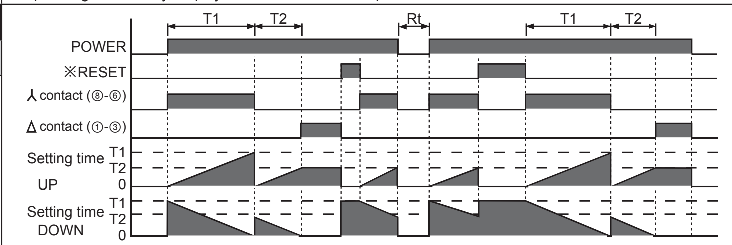
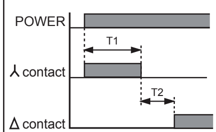
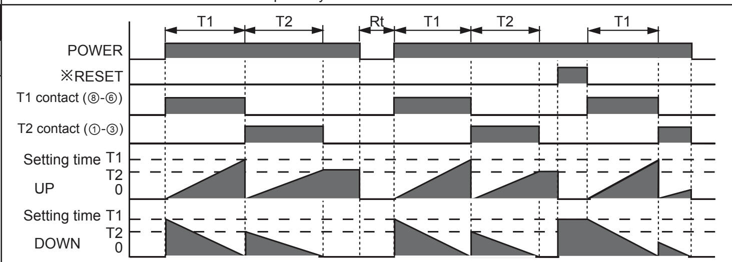
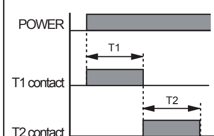
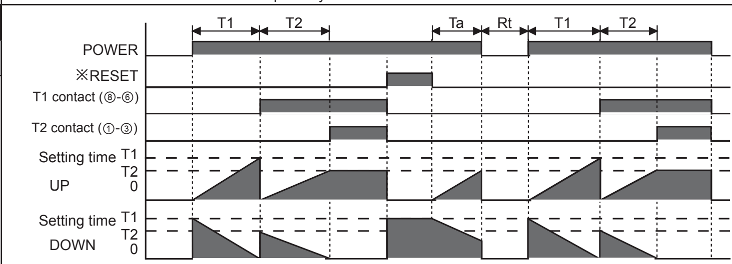
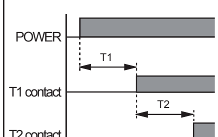
T = Setting time, T > Ta, Rt = Reset time

Mode	Time chart	Operation
[ond] **OND** **ON Delay**	 1. Timing operation starts when power is ON. 2. Time limit output will be ON when timing operation is progressed up to the setting time. Display value will be HOLD. 3. If selecting time limit 1c + instantaneous 1c mode, instantaneous output will be ON when power is ON and goes OFF when power is OFF. 4. If pressing RESET key, display value and time limit output will be reset.	 T = set time
[ond.2] **ONDII** **ON Delay 2 (One-shot output)**	 1. Timing operation starts when power is ON. 2. Time limit output will be ON during Tout setting time and goes OFF when timing operation is progressed up to the setting time. Display value will be HOLD. 3. If selecting time limit 1c + instantaneous 1c mode, instantaneous output will be ON when power is ON and goes OFF when power is OFF. 4. If pressing RESET key, display value and time limit output will be reset. 5. Tout setting range: 0.01 sec to 99.99 sec	 Tout = output time T = set time
[FLK] **FK** **Flicker (Toff operation precedes)** Ton, Toff > Ta	 1. Control output will be repeatedly OFF during Toff setting time and will be ON during Ton setting time when power is ON. 2. If selecting time limit 1c + instantaneous 1c mode, instantaneous output will be ON when power is ON and goes OFF when power is OFF. 3. If pressing RESET key, display value and time limit output will be reset. 4. It is able to set each Toff time and Ton time separately. In [FLK] mode, timing operation starts with Toff.	 Ton, Toff = set time **Enables to set Ton and Toff time differently.**
[FLK.1] **FKI** **Flicker 1 (Ton operation precedes)**	 1. Control output will be repeatedly ON during Ton setting time and will be OFF during Toff setting time when power is ON. 2. If selecting time limit 1c + instantaneous 1c mode, instantaneous output will be ON when power is ON and goes OFF when power is OFF. 3. If pressing RESET key, display value and time limit output will be reset. 4. It is able to set each Ton time and Toff time separately. In [FLK.1] mode, timing operation starts with Ton.	 Ton, Toff = set time **Enables to set Ton and Toff time differently.**

※Initial status: UP mode-display value is "0", output is "OFF". DOWN mode-display value is "setting time", output is "OFF".
※Instantaneous contact (OUT2) will be returned when power is off.
※RESET key is locked for default set and release the lock to use.

▣ LE4SA Output Operation Mode

Rt: Reset time (Min. 500ms)

Mode	Time chart	Operation
I nt **INT** **Interval**	 1. Time limit output will be ON when power is ON and Timing operation starts. 2. Time limit output will be OFF when timing operation is progressed up to the setting time. Display value will be HOLD. 3. If selecting time limit 1c + instantaneous 1c mode, instantaneous output will be ON when power is ON and goes OFF when power is OFF. 4. If pressing RESET key, display value and time limit output will be reset.	 T = set time
S - d **⅄ - Δ** **Star-Delta** **(output will be set automatically as Time limit 2c)**	 1. ⅄ contact will be ON when power is ON and Timing operation starts. 2. ⅄ contact will be OFF when timing operation is progressed up to the T1 setting time. Timing operation will be reset and started again. 3. Δ contact will be ON when timing operation is progressed up to the T2 switching time. Display value will be HOLD. 4. If pressing RESET key, display value and ⅄ - Δ contacts will be reset. 5. It is able to set each T1 and T2 time separately.	 ※T1: set time T2: switching time (⅄-Δ switching time)
tYn **T** **Twin** **(output will be set automatically as Time limit 2c)**	 1. T1 contact will be ON when power is ON and Timing operation starts. 2. T1 contact will be OFF and T2 contact will be ON when timing operation is progressed up to the T1 setting time. Timing operation will be reset and started again. T2 contact will be OFF when timing operation is progressed up to the T2 setting time. Display value will be HOLD. 3. If pressing RESET key, display value and T1, T2 contacts will be reset. 4. It is able to set each T1 and T2 time separately.	 T1, T2 = set time Enables to set T1 and T2 time same or differently
tYn. 1 **TI** **Twin 1** **(output will be set automatically as Time limit 2c)**	 1. Timing operation starts when power is ON. 2. T1 contact will be ON when timing operation is progressed up to the T1 setting time. Timing operation will be reset and started again. 3. T2 contact will be ON when timing operation is progressed up to the T2 setting time. Display value will be HOLD. 4. If pressing RESET key, display value and T1 and T2 contacts will be reset. 5. It is able to set each T1 and T2 time separately.	 T1, T2 = set time Enables to set T1 and T2 time same or differently

※Initial status: UP mode-display value is "0", output is "OFF". DOWN mode-display value is "setting time", output is "OFF".
※Instantaneous contact (OUT2) will be returned when power is off.
※RESET key is locked for default set and release the lock to use.

▣ Proper Usage

⚠ Caution

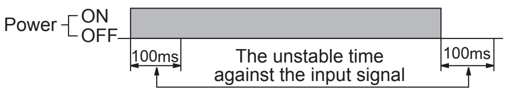
It may give an electric shock if touch the input signal terminal (between START, RESET, INHIBIT and terminal ②) when the power is supplied.

◎ Power connection

- Connect AC power line between (②-⑦) for LE4S, LE4SA AC power type. Be careful of power connection for DC power type. (②← ⊖, ⑦ ← ⊕)
- LE4S, LE4SA work stably within range of rated power. (if using power line with another high voltage line or energy line in the same conduit, it may cause inductive voltage.
  Therefore please use separate conduit for power line)

◎ Power start

- Caution for power rising time (100ms) after power on and power falling time (100ms) after power off.

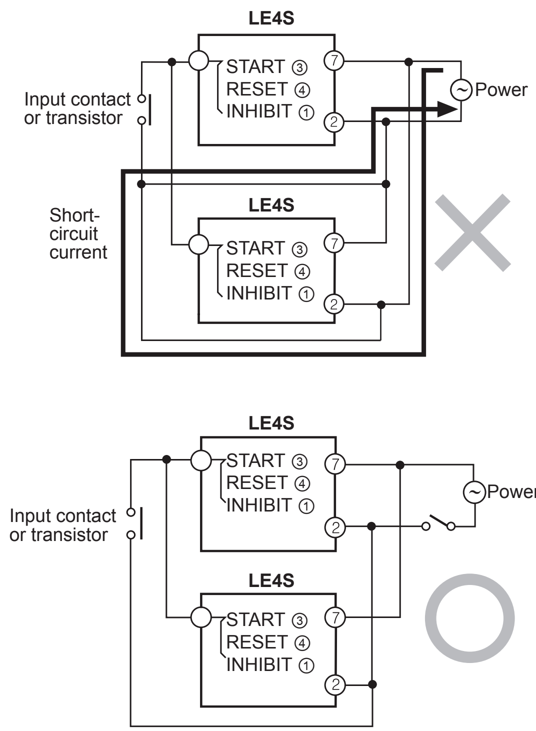


- Power ON Start
  LE4SA model is starting after 100ms of supplying the power due to rising time of other devices (sensor, etc.) (refer to the above figure.)
  For power ON Start, under 100ms setting may cause unstable operation. (it operates normally over 100ms setting)
  For using under 100ms time operation, use LE4S, Signal ON Start type.
- Supply the power at once by a switch or relay contact, otherwise it may cause timing error.

◎ Input/Output

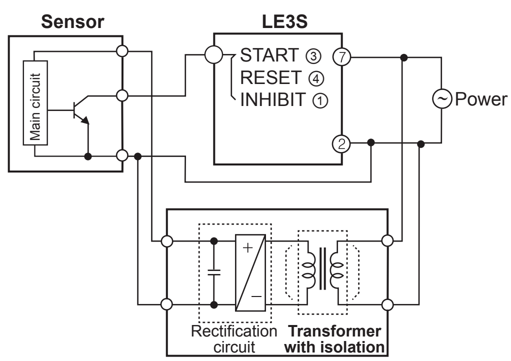
- Power terminal and Input terminal have not been insulated because there is no power transformer in this Timer.
  ① When using the sensor of SSR output type with input terminal of timer, please check whether Double insulated or not.
  ② Please use double insulated relay when connecting relay output with input terminal.
- Please use 8 Pin socket when connecting this Timer with other equipment and do not touch the socket when power on.
- Please use Power supply with over current protection circuit. (250V 1A fuse)
- When using relay contact as input signal, please use a contact that can function reliable at 5VDC, 1mA.
- In case of connecting START terminal (③) and power terminal (②) of LE4S, do not use it to start at the same time applying power.
- LE4S is transformer less type, therefore please check following for connecting relay contact for input signal and transistor.

• When connecting more than 2 timers with 1 relay contact for input or transistor, please wire following <Figure 2>. Please use relay contact or transistor to start.
(time error can occurs under 100ms setting because of rising time of Timer).



< Figure 2 >

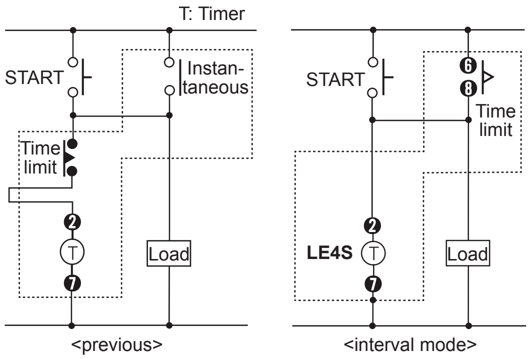
• Please use transformer with primary and secondary isolated for input.



< external sensor power supply >

- Be sure that the specifications of this unit. Because when supplying the power to LE4SA, this unit operates instantly. (if supplying the power without the right checking, it may cause malfunction.)
- ond, ond.1, ond.2 operation modes are available to set as "0".

◎ Interval mode
It is able to make Instantaneous ON and time limit OFF (holding device) with using interval mode.



◎ Change of output operation mode and timer range
If changing output operation mode or time range,previous reset value will be deleted.
But, UP/DOWN selection mode and lock mode are exception.

◎ Change of preset value
- If changing setting value while time progressing, new preset value should be higher than previous preset value.
  Otherwise output may work while changing setting value.
- If changing setting value while it is running, it will work as changed setting value. Please use lock function in order to avoid malfunction.

◎ Noise
We test 2kV, pulse width 1μs against Impulse voltage between power terminals and 1kV, pulse width 1μs at noise simulator against external noise voltage. Please install MP condenser (0.1 to 1μF) or oil condenser between power terminals when over impulse noise voltage occurs.

◎ Environment
Please avoid the following places;
- Place where the unit may be damaged by strong impact or vibration.
- Place where there is corrosive gas or flammable gas and water, oil, dust exist.
- Place where magnetic and electrical noise occurs.
- Place where there is high temperature and humidity beyond rated specification.
- Place where there is strong alkalis and acids.
- Place where there is direct ray of sun.

DIN W48×H48mm 8-pin Plug Timer

■ Features

- Wide range of the time selection (0.01 sec to 9999.9 hour)
- Power supply: 100-240VAC 50/60Hz
  12-24VAC 50/60Hz, 12-24VDC universal
- Memory protection: Over 10 years
  (when using non-volatile semiconductor memory)
- Built-in Microprocessor
- 8-pin plug connection type

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

FS | 4 | E | □

	Code	Description
Output	No mark	1-stage preset
	I	Indicator
Timer	E	Timer
Digit	4	9999 (4-digit)
	5	99999 (5-digit)
Item	FS	8-pin plug timer

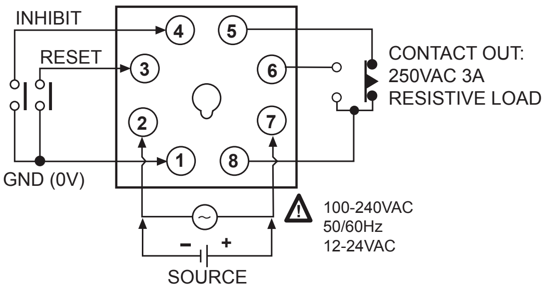
■ Specifications

Model		**FS4E**	**FS5EI**
Function		**1-stage preset Up/Down Timer**	**Up/Down indicator**
Character size		W4×H8mm	
Power supply	AC voltage	100-240VAC 50/60Hz	
	AC/DC voltage	12-24VAC 50/60Hz, 12-24VDC	
Allowable voltage range		90 to 110% of rated voltage	
Power consumption	AC voltage	Max. 4.5VA (100-240VAC 50/60Hz)	Max. 3.5VA (100-240VAC 50/60Hz)
	AC/DC voltage	Max. 4.3VA (12-24VAC 50/60Hz), Max. 2.5W (12-24VDC)	Max. 3.4VA (12-24VAC 50/60Hz), Max. 2.2W (12-24VDC)
Return time		Min. 500ms	
Min. input signal width	RESET	Approx. 20ms	
	INHIBIT		
Input	RESET	No-voltage input - Impedance at short-circuit: Max. 470Ω, Residual voltage at short-circuit: Max. 1VDC Impedance at open circuit: Min. 100kΩ	
	INHIBIT		
Timing operation		Power ON Start	
One-shot output time		0.05 to 5sec	
Control output	Contact type	Time-limit SPDT (1c)	—
	Contact capacity	250VAC 3A at resistive load	—
Relay life cycle	Mechanical	Min. 10,000,000 operations	—
	Electrical	Min. 100,000 operations (250VAC 3A resisitive load)	—
Memory protection		Over 10 years (when using non-volatile semiconductor memory)	
Repeat error		Max. ±0.01% ±0.05sec	
SET error			
Voltage error			
Temperature error			
Insulation resistance		Over 100MΩ (at 500VDC megger)	
Dielectric strength		2,000VAC 50/60Hz for 1 minute	
Noise immunity	AC voltage	±2kV the square wave noise (pulse width: 1μs) by the noise simulator	
	DC voltage	±500V the square wave noise (pulse width: 1μs) by the noise simulator	
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1hour	
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min	
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times	
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Environment	Ambient temp.	-10 to 55℃, storage: -25 to 65℃	
	Ambient humi.	35 to 85%RH	
Accessory		Bracket	
Unit weight		Approx. 130g	Approx. 120g

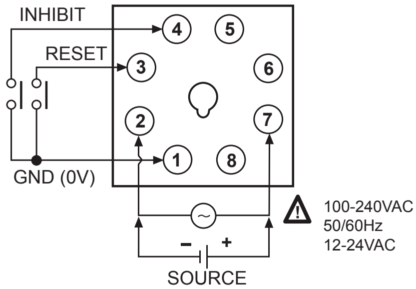
※Environment resistance is rated at no freezing or condensation.

▣ Connections

● FS4E

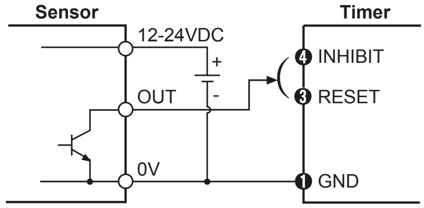


● FS5EI



▣ Input Connections

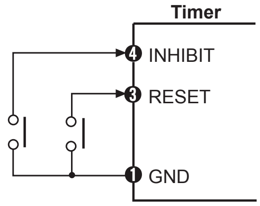
◎ Solid-state input



- Transistor ON → INHIBIT, RESET
- NPN open collector output sensor

※Above numbers are terminal block.

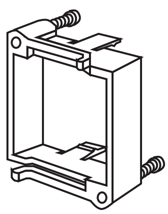
◎ Contact input



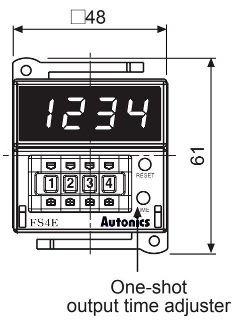
- Contact ON → INHIBIT, RESET
- Limit switch, Micro switch, Relay contact
- Please use reliable contacts enough to flow 5VDC 1mA of current.

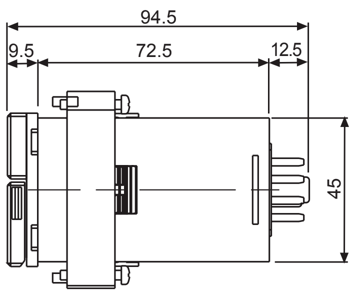
▣ Dimensions

(unit: mm)

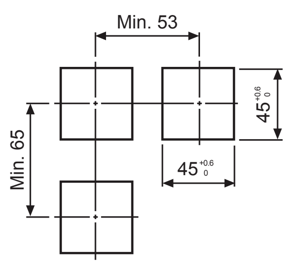


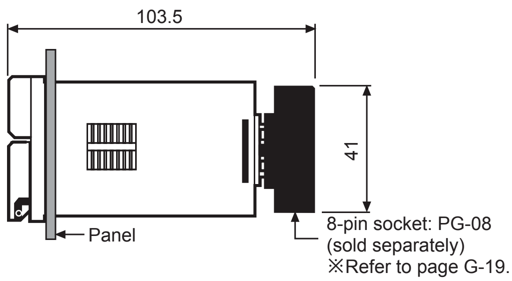
<bracket>





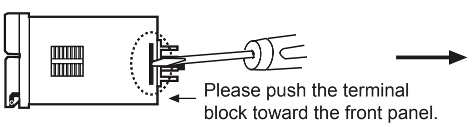
● Panel cut-out





▣ Case Detachment

Please cut off the power and detach the case from body.

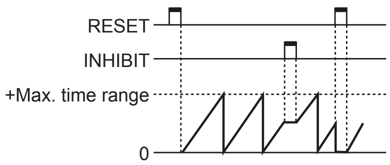


Please widen the Lock of product with driver and push it toward the front panel with, it will be detached.
※Please be careful of the injury cause by tools.

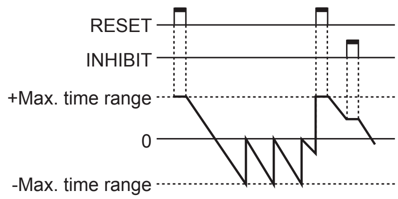
Thumbwheel Switch Setting Type 8 Pin Plug Timer

■ Time Operation Of Indication Type

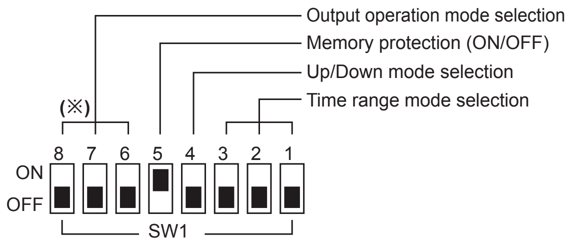
● **Up mode**

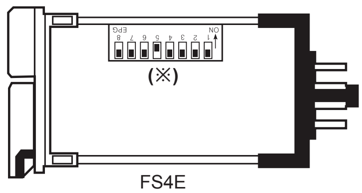


● **Down mode**



■ Description Of Inner DIP Switches





※In case of indicator (FS5EI), 5-pin DIP switch is included, because there is no output operation mode.

※As upgraded model do not have unnecessary functions (5: Timer, 6: N.C.), inner DIP switch is changed as 8-pin.

● **Up/Down mode**

SW1		Function
4	ON ■ / OFF □	Down mode
	ON □ / OFF ■	Up mode

● **Memory protection**

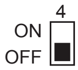
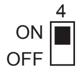
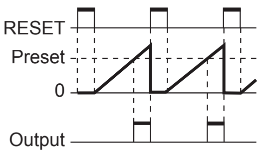
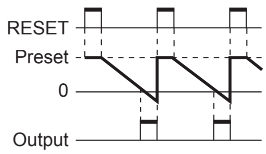
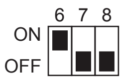
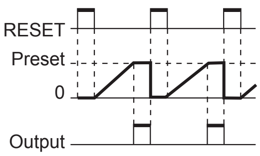
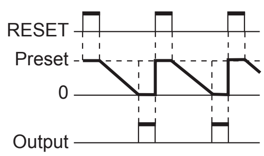
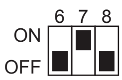
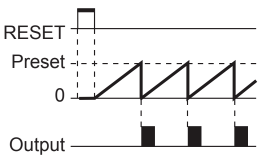
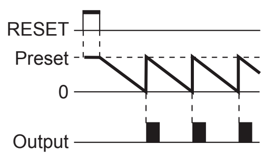
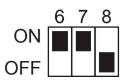
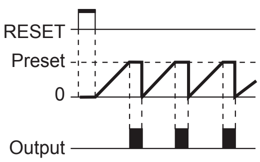
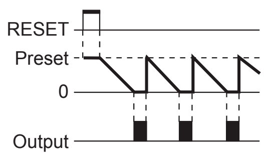
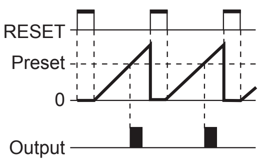
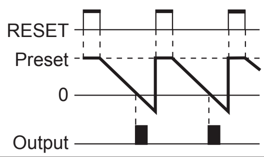
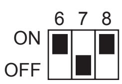
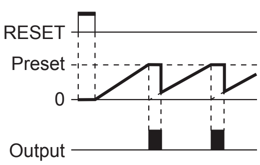
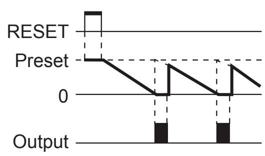
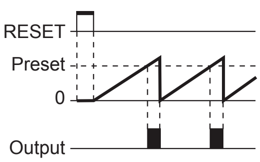
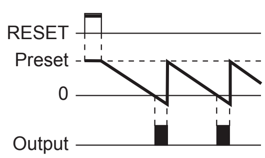
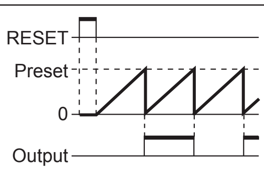
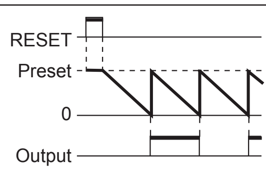
SW1		Function
5	ON ■ / OFF □	Disable the memory protection
	ON □ / OFF ■	Enable the memory protection

■ Time Range Mode

SW1 \ Model (1 2 3)	FS4E	FS5EI
ON □□□ / OFF ■■■	99.99sec	9999.9sec
ON ■□□ / OFF □■■	999.9sec	99999sec
ON □■□ / OFF ■□■	9999sec	9min 59.99sec
ON ■■□ / OFF □□■	99min 59sec	99min 59.9sec
ON □□■ / OFF ■■□	999.9min	9999.9min
ON ■□■ / OFF □■□	99hour 59min	9hour 59min 59sec
ON □■■ / OFF ■□□	999.9hour	999hour 59min
ON ■■■ / OFF □□□	9999hour	9999.9hour

■ FS4E Output Operation Mode

 ← One-shot output (0.05 to 5sec)    ← Retained output

Output mode (SW1)	 Up mode	 Down mode	Operation after time up
F 			The display value continues until Reset signal applied and the output will be held.
N 			The display value and output will be held until Reset signal.
C 			The processing time restarts at the same time when reset automatically regardless of output. The output is One-shot.
R 			The process time will be held until output is OFF and restarts at the same time when reset automatically. The output is One-shot.
K 			The time continues until Reset signal is applied. The output is One-shot.
P 			The processing time will be held until output is OFF and restarts at the same time when reset automatically. It progresses displaying One-shot output when restarting.
Q 			The processing time will be held until output is OFF and restarts at the same time when reset automatically. The output is One-shot.
S 			The output will be OFF and ON for setting time and repeats (flashing) this cycle.

※Time Up: When processing time reaches to setting time.
※**Applying reset signal after time up, it will display zero for up mode and time range for down mode (displaying max. value in case of indication type).**

Thumbwheel Switch Setting Type 8 Pin Plug Timer

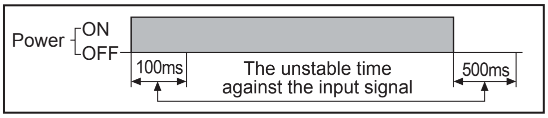
▣ Proper Usage

◎ Preset value

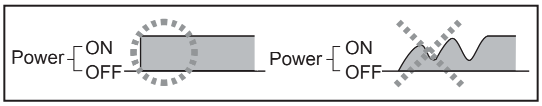
Able to change setting value while it is running but setting value should be higher than previous setting value.

◎ Power

- The inner circuit voltage starts to rise up for the first 100ms after power on, the input may not work at this time.
  And also the inner circuit voltage drops down for the last 500ms after power off, the input may not work at this time.

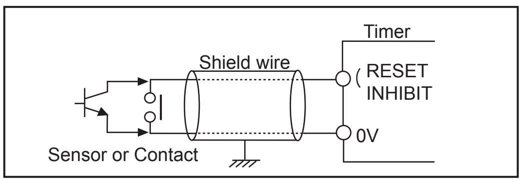


- Even though the power is applied, and the display does not turn on, please check the reset terminal.
- Please supply the power within rated power and apply or cut the power quickly to prevent chattering.



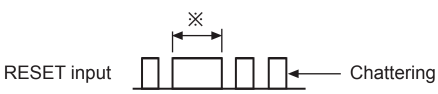
◎ Input signal line

- Shorten the cable distance between the sensor and this product.
- Please use shield wire for input signal.
- Please wire input signal line separated from power line.



◎ The reset signal width

It is reset perfectly when the reset signal is applied for max. 20ms regardless of the contact input & solid-state input.



※In case of a contact reset, it is reset perfectly if the ON time of reset signal is applied for max. 20ms even though a chattering occurs.

◎ Error display

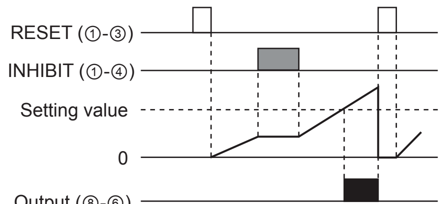
If setting value is "0000", "Err0" will be displayed.
If setting value is changed to non-zero, this function is cancelled.
However, the output in the status of Error signal will be OFF.
※The indicator does not have Error display function.

◎ RESET

RESET has two function, which are memorizing DATA function and resetting output function.
When changing an inner selection switch, manual RESET or external RESET must be held after applying the power by all means. Otherwise, it will operate as previous mode. Selecting a RESET input/output mode again after applying power, please reset or reset manually, otherwise the previous mode will be operating.

◎ INHIBIT

- When you need to check the real operating time, please use INHIBIT function.
- If you need to stop the time progressing, please use INHIBIT function.



(E.g. FS4E)

◎ Environment

Please avoid the following places:
- Place where the unit may be damaged by strong impact or vibration.
- Place where there is corrosive gas or flammable gas and water, oil, dust.
- Place where magnetic and electrical noise occurs.
- Place where there is high temperature and humidity beyond the rated specification.
- Place where there is strong alkalis and acids.
- Place where there is direct ray of sun.

◎ Noise

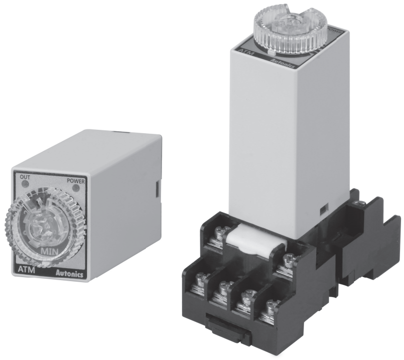
- We test 2kV, Pulse width 1μs against Impulse voltage between power terminals and 1kV, pulse width 1μs at noise simulator against external noise voltage. Please install MP condenser (0.1 to 1μF) or oil condenser between power terminals when over Impulse noise voltage occurs.
- When testing dielectric voltage and insulation resistance of the control panel with this unit installed.
  ① Please isolate this unit from the circuit of control panel.
  ② Please make all terminals of this unit short-circuited.
- Sudden function stop while it is running
  (when displaying wrong numbers or nothing)
  In this case, please power off and turn on again. This is due to strong noise flows into this product therefore please try to separate inductive load from input signal line of this product or install surge absorber between inductive loads.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

W21.5×H28mm Miniature Timer

■ Features

- Miniature Size (W21.5×H28×L59.3mm)
- 4c (4PDT) contact (250VAC, 3A)
- High precise time control
- Easy time setting using dial
- Various time ranges: 0.1 sec to 3 hour
  (11 time ranges, different by models)
- Power supply
  - ATM4-2: 24VDC
  - ATM4-5: 220VAC 50/60Hz
  - ATM4-6: 110VAC 50/60Hz



Mounting My socket
(sold separately)

■ Ordering Information

ATM 4 — 5 10 S

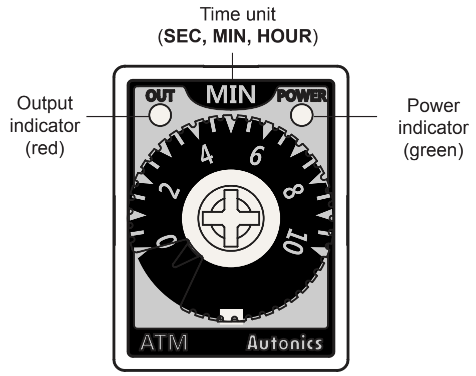
Time unit	S	Sec (1, 5, 10, 30, 60)
	M	Min (3, 5, 10, 30, 60)
	H	Hour (3)
Time range	Number	Max. time range
Power supply	2	24VDC
	5	220VAC 50/60Hz
	6	110VAC 50/60Hz
Output	4	4c (4PDT)
Item	ATM	Miniature Analog Timer

■ Specifications

Model		ATM4 - 2□S 2□M 23H	ATM4 - 5□S 5□M 53H	ATM4 - 6□S 6□M 63H
Function		**Power ON Delay**		
Control time setting range※1		0.1sec to 3hour		
Power supply		24VDC	220VAC 50/60Hz	110VAC 50/60Hz
Allowable voltage range		21.6-26.4VDC	200-230VAC 50/60Hz	100-120VAC 50/60Hz
Power consumption		Approx. 1.2W	Approx. 3VA	Approx. 3VA
Return time		Max. 100ms		
Timing operation		Power ON Start		
Control output	Contact type	4PDT (4c)		
	Contact capacity	250VAC 3A resistive load		
Relay life cycle	Mechanical	Min. 10,000,000 operations		
	Electrical	Min. 200,000 operations		
Repeat error		Max. ±0.5% ±10ms		
SET error		Max. ±10% ±50ms		
Voltage error		Max. ±0.5% ±10ms		
Temperature error		Max. ±2% ±10ms		
Insulation resistance		Over 100MΩ (at 500VDC megger)		
Dielectric strength		3,000VAC 50/60Hz for 1 min		
Noise immunity		±2kV the square wave noise (pulse width: 1μs) by noise simulator		
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour		
	Electrical	0.5mm amplitude at frequency of 10 to 55HHz (for 1 min) in each X, Y, Z direction for 10 min		
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction 3 times		
	Electrical	100m/s² (approx. 10G) in each X, Y, Z direction 3 times		
Environment	Ambient temperature	-10 to 50℃, storage: -25 to 65℃		
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH		
Weight※2		Approx. 48g (approx. 42g)		

※1: Refer to time specifications for control time setting range by model.
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

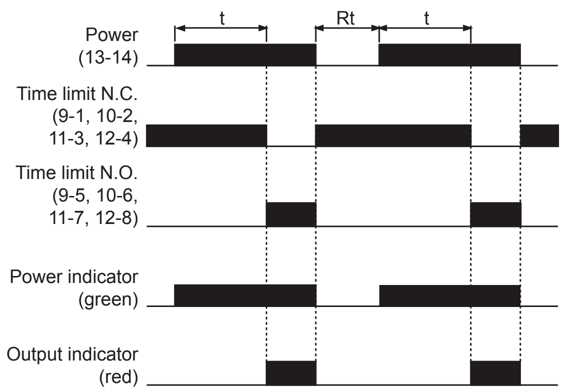
Unit Descriptions



Time Specifications

Model	Time unit	Time setting range
ATM4-□1S	SEC	0.1 to 1sec
ATM4-□5S		0.5 to 5sec
ATM4-□10S		1 to 10sec
ATM4-□30S		3 to 30sec
ATM4-□60S		6 to 60sec
ATM4-□3M	MIN	0.3 to 3min
ATM4-□5M		0.5 to 5min
ATM4-□10M		1 to 10min
ATM4-□30M		3 to 30min
ATM4-□60M		6 to 60min
ATM4-□3H	HOUR	0.3 to 3hour

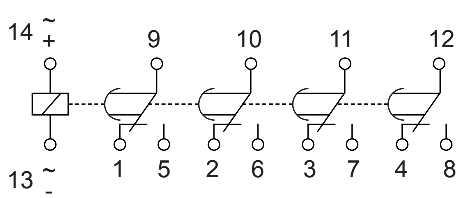
Operation Specifications



Connections

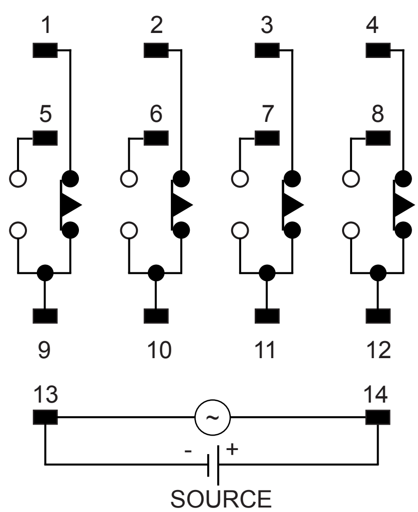
SOURCE	ATM4-2□□	24VDC 1.2W
	ATM4-5□□	200-230VAC 50/60Hz 3VA
	ATM4-6□□	100-120VAC 50/60Hz 3VA
CONTACT		250VAC 3A RESISTIVE LOAD

●IEC marking



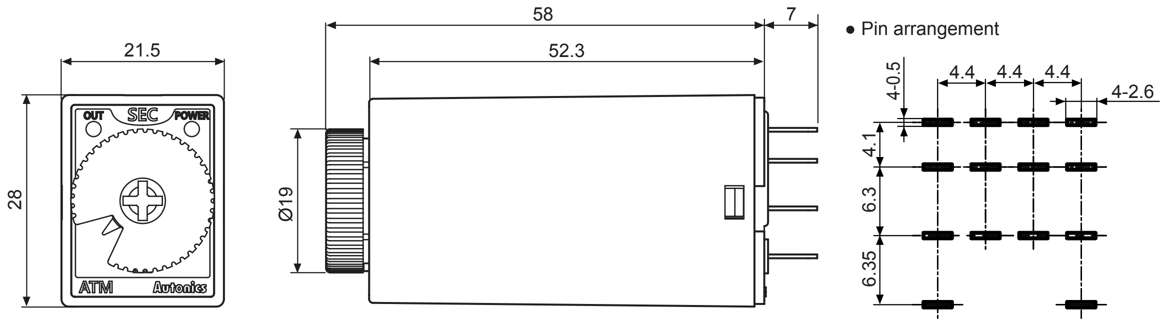
※IEC marking is on the unit.

●NEMA marking



■ Dimensions

(unit: mm)

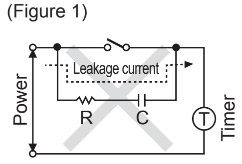


※Use My socket which is commercially available.

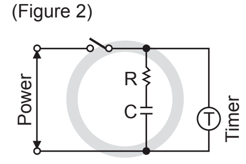
■ Proper Usage

- For DC power supply type, be sure to check the polarity of terminals.
- Please supply power quickly at once with using switch or relay contact. Otherwise it may cause time error or power reset failure.
- When supplying the power to the timer, connection shown in (Figure 1) might cause malfunction due to leakage current through R and C. Please connect R and C as shown in (Figure 2) to prevent malfunction.

(Figure 1)



(Figure 2)



- Do not use this unit at below places.
  - Place where temperature or humidity is out of the rated specifications.
  - Place where there is condensation by temperature changes.
  - Place where there is flammable gas or corrosive gas.
  - Place where there is dust, oil or severe vibration or impact.
  - Place where strong alkalis or acids is used.

Multi Function Timer With Free Power, Compact Size W38×H42mm

■ Features

- Wide power supply range
  : 100-240VAC 50/60Hz, 24-240VDC universal,
  24VAC 50/60Hz, 24VDC universal, 12VDC
- Various output operations (6 operation modes)
- Multi time range (12 types of time range)
- Wide time setting range (0.1sec to 30hour)
- Close and DIN rail mounting
  with the dedicated socket (PS-M8) width 41mm (for ATS8)
- Easy mounting and installation/maintenance
  with the dedicated bracket for DIN 48×48mm

⚠ Please read "Caution for your safety" in operation manual before using.

CE c UR US

■ Ordering Information

ATS 8 4 1 □

Code	Value	Description
Output	No mark	Time limit DPDT (2c) or Instantaneous SPDT (1c) + Time limit SPDT (1c) selectable by output operation mode
	D	Time limit DPDT (2c)
	E	Instantaneous SPDT (1c) + Time limit SPDT (1c)
Time range	1	Time range 1 (0.1 to 1)
	3	Time range 3 (0.3 to 3)
Power supply	1	12VDC
	2	24VAC 50/60Hz, 24VDC
	4	100-240VAC 50/60Hz, 24-240VDC
Number of plug pins	8	8-pin plug type
	11	11-pin plug type
Item	ATS	Small Analog Timer

※Sockets (8-pin sockets: PG-08, PS-08(N), PS-M8/11-pin sockets: PG-11, PS-11(N)) are sold separately.

■ Specifications

Model		ATS8-□1	ATS8-□3	ATS11-□1D	ATS11-□3D	ATS11-□1E	ATS11-□3E
Function		Multi Function Timer					
Control time setting range※1		0.1sec to 10hour	0.3sec to 30hour	0.1sec to 10hour	0.3sec to 30hour	0.1sec to 10hour	0.3sec to 30hour
Power supply		•100-240VAC 50/60Hz, 24-240VDC universal •24VAC 50/60Hz, 24VDC universal •12VDC					
Allowable voltage range		90 to 110% of rated voltage					
Power consumption		•Max. 4.2VA (100-240VAC), Max. 2W (24-240VDC) •Max. 4.5VA (24VAC), Max. 2W (24VDC) •Max. 1.5W (12VDC)		•Max. 3.5VA (100-240VAC), Max. 1.5W (24-240VDC) •Max. 4VA (24VAC), Max. 1.5W (24VDC) •Max. 1W (12VDC)		•Max. 4.2VA (100-240VAC), Max. 2W (24-240VDC) •Max. 4.5VA (24VAC), Max. 2W (24VDC) •Max. 1.5W (12VDC)	
Return time		Max. 100ms					
Timing operation		Power ON Start		Signal ON Start			
Min. input signal width		—		START, INHIBIT, RESET: Approx. 50ms			
Input		—		START, INHIBIT, RESET: [No-voltage input] - Short-circuit impedance: Max. 1kΩ, Residual voltage: Max. 0.5V, Open-circuit impedance: Min. 100kΩ			
Control output	Contact type	Time limit DPDT (2c) or Instantaneous SPDT (1c) + Time limit SPDT (1c) selectable by output operation mode		Time limit DPDT (2c)		Instantaneous limit SPDT (1c) + Time limit SPDT (1c)	
	Contact capacity	250VAC 3A resistive load					
Relay life cycle	Mechanical	Min. 10,000,000 operations					
	Electrical	Min. 100,000 operations (250VAC 3A resistive load)					

※1: Refer to time specifications for control time setting range by model.

■ Specifications

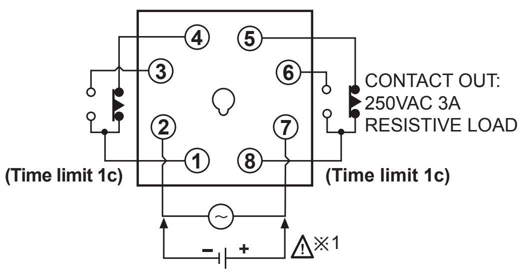
Model		ATS8-□1	ATS8-□3	ATS11-□1D	ATS11-□3D	ATS11-□1E	ATS11-□3E
Repeat error		Max. ±0.2% ±10ms					
SET error		Max. ±5% ±50ms					
Voltage error		Max. ±0.5%					
Temperature error		Max. ±2%					
Insulation resistance		Over 100MΩ (at 500VDC megger)					
Dielectric strength		2,000VAC 50/60Hz for 1 minute					
Noise immunity	ATS□-1□□ ATS□-2□□	±500V the square wave noise (pulse width 1μs) by noise simulator					
	ATS□-4□□	±2kV the square wave noise (pulse width 1μs) by noise simulator					
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1min) in each X, Y, Z direction for 1hour					
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1min) in each X, Y, Z direction for 10min					
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction 3 times					
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction 3 times					
Environment	Ambient temp.	-10 to 55℃, storage: -25 to 65℃					
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH					
Approval		CE cULus					
Accessory		Bracket					
Weight※2		Approx. 95g (approx. 70g)					

※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

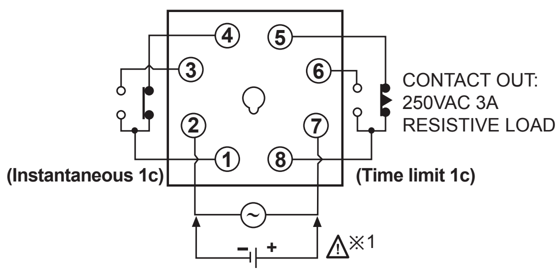
■ Connections

◎ ATS8

●When selecting [A], [F] output operation mode

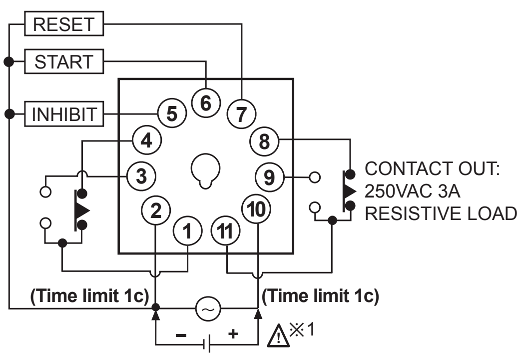


●When selecting [A1], [B], [F1], [I] output operation mode

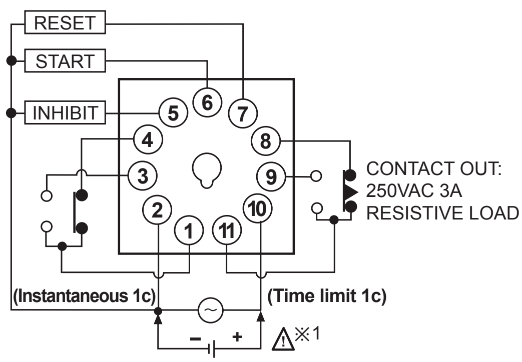


※1: AC/DC voltage: 100-240VAC 50/60Hz, 24-240VDC
24VAC 50/60Hz, 24VDC
DC voltage: 12VDC

◎ ATS11-□□D



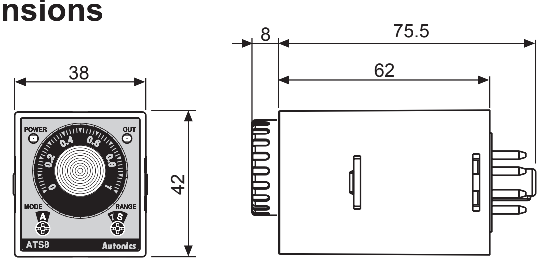
◎ ATS11-□□E



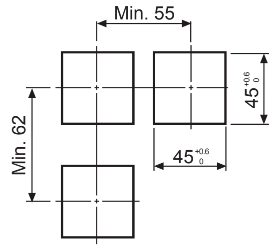
※1: AC/DC voltage: 100-240VAC 50/60Hz, 24-240VDC
24VAC 50/60Hz, 24VDC
DC voltage: 12VDC

▣ Dimensions

(unit: mm)

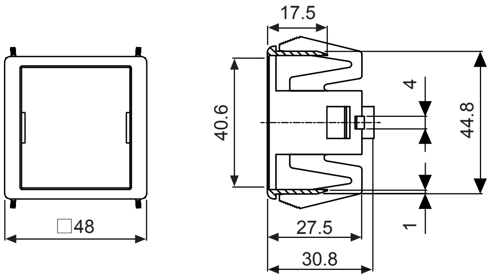


●Panel cut-out

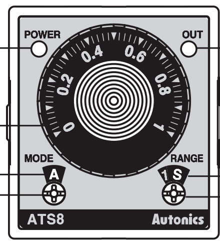


※8-pin, 11-pin socket (sold separately) refer to page G-19.

● Bracket



▣ Unit Description



Operation/Power indicator (flashes for timer operation, Turns ON for timer stop)

Time setting dial

Output operation mode indicator

- **ATS8 (A, A1, B, F, F1, I mode)**
- **ATS11 (A, F, F1, C, D, I mode)**

Output operation mode setting switch

Time limit output indicator

Time range indication **(1S, 10S, 1M, 10M, 1H, 10H)**

Time range setting switch

▣ Time Specifications

Model	Time range	Time unit	Time setting range
ATS□-□1□	1S	**SEC**	0.1 to 1sec
	10S		1 to 10sec
	1M	**MIN**	0.1 to 1min
	10M		1 to 10min
	1H	**HOUR**	0.1 to 1hour
	10H		1 to 10hour
ATS□-□3□	1S	**SEC**	0.3 to 3sec
	10S		3 to 30sec
	1M	**MIN**	0.3 to 3min
	10M		3 to 30min
	1H	**HOUR**	0.3 to 3hour
	10H		3 to 30hour

▣ Output Operation Mode

●ATS8

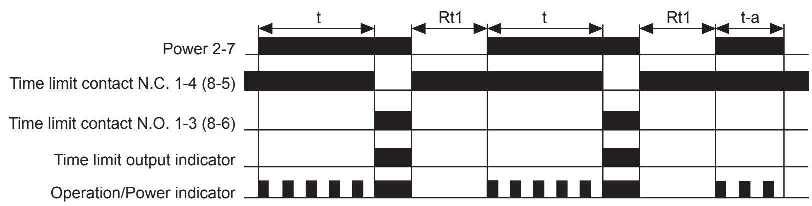
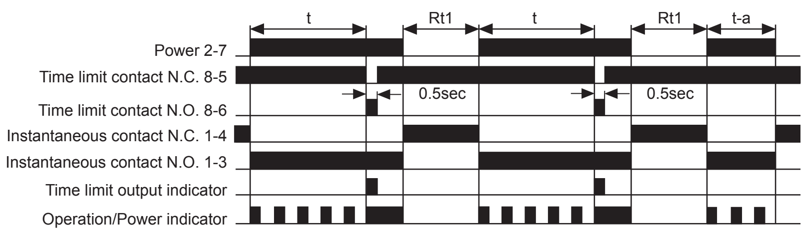
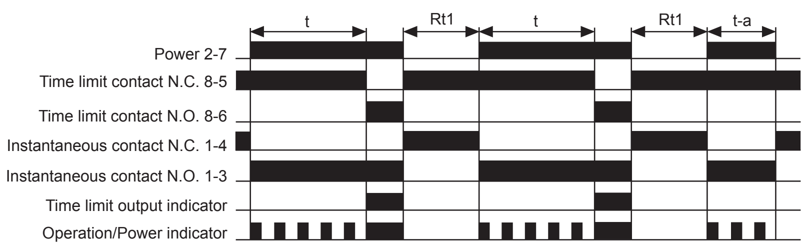
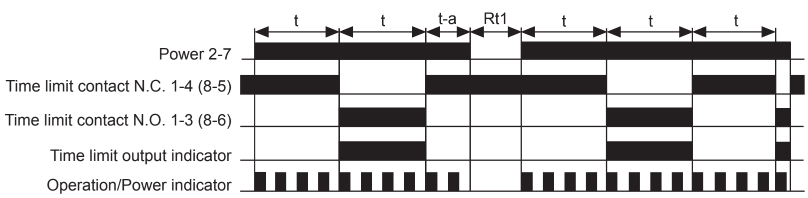
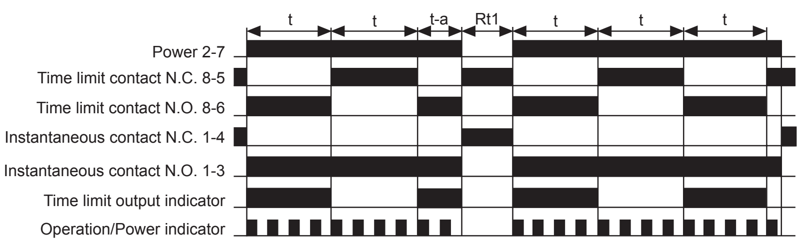
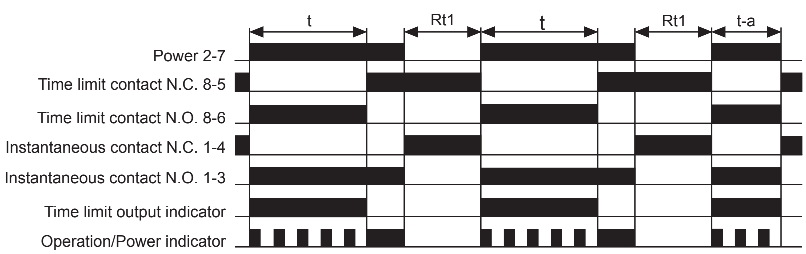
Display	Output operation mode
A	Power ON Delay
A1	Power ON Delay 1 (One-Shot output)
B	Power ON Delay 2
F	Flicker (OFF Start)
F1	Flicker 1 (ON Start)
I	Interval

●ATS11

Display	Output operation mode
A	Signal ON Delay
F	Flicker (OFF Start)
F1	Flicker 1 (ON Start)
C	Signal OFF Delay
D	Signal ON/OFF Delay
I	Interval

▣ Output Operation Mode (ATS8)

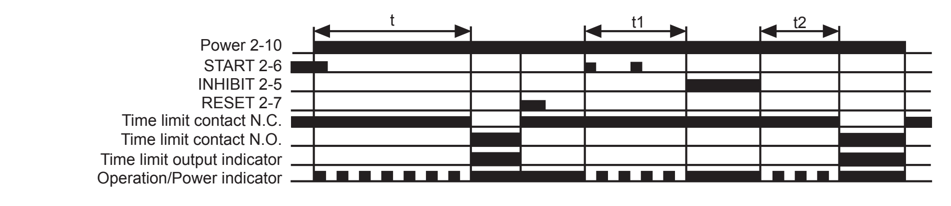
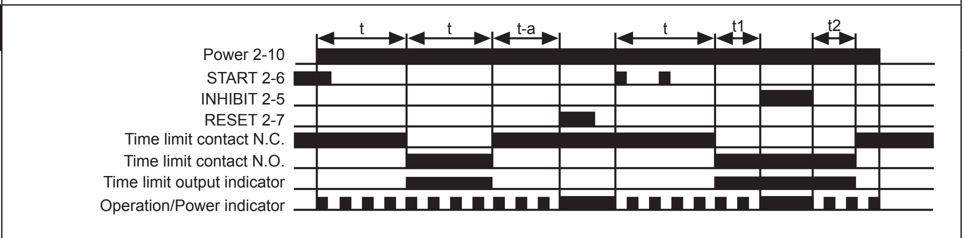
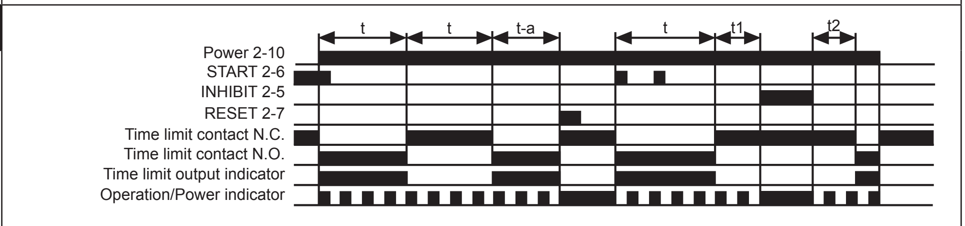
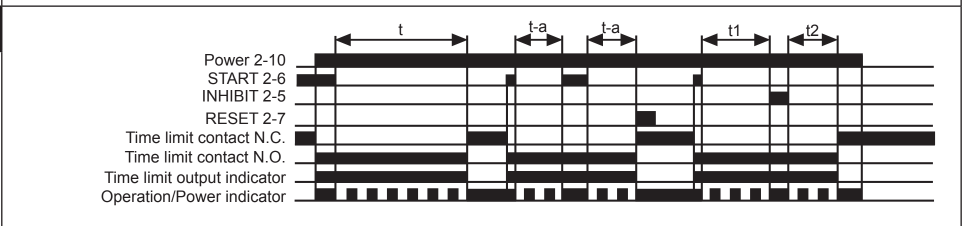
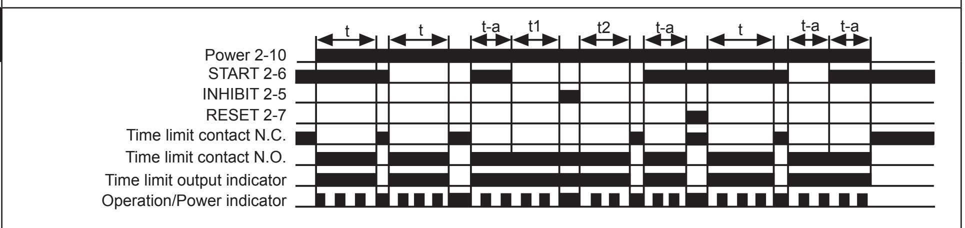
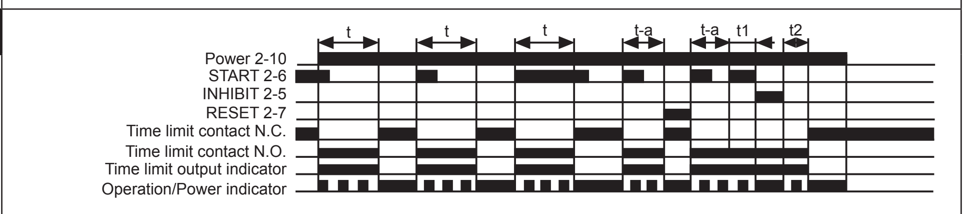
[t: Setting time, t>t-a, Rt: Return time, Rt1>Rt]

Mode	Time chart
A **Power ON Delay**	
A1 **Power ON Delay 1 (One-Shot output)**	 ※One-Shot output is 0.5sec fixed.
B **Power ON Delay 2**	
F **Flicker (OFF Start)**	
F1 **Flicker 1 (ON Start)**	
I **Interval**	

※In case of F, F1 output operation mode, setting time should be over 100ms.
If not, it may cause abnormal output operation due to under 100ms of setting time.

■ Output Operation Mode (ATS11)

[t: Setting time, t=t1+t2, t>t-a]

Mode	Time chart
A **Signal ON Delay**	
F **Flicker (OFF Start)**	
F1 **Flicker 1 (ON Start)**	
C **Signal OFF Delay**	
D **Signal ON/OFF Delay**	
I **Interval**	

※If power is cut or the RESET terminal is short-circuited, the timer will be RESET.
※If the INHIBIT terminal is short-circuited during a time limit operation, the time will stop.
※In case of F, F1 output operation mode, setting time should be over 100ms.
If not, it may cause abnormal output operation due to under 100ms of setting time.

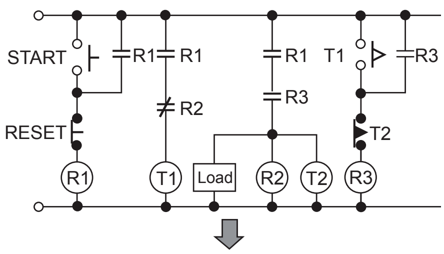
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Proper Usage

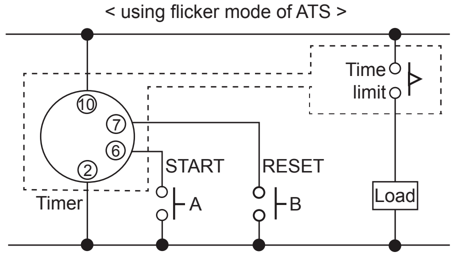
◎ Flicker mode

- Flicker mode which needs 3 subsidiary relays and 2 timers is available with an ATS timer.
  You can organize flicker function economically.
- START it with a switch A and RESET it with a switch B.

< existing method >

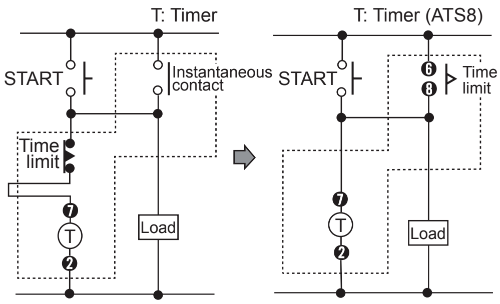


< using flicker mode of ATS >



◎ Interval mode

When using interval mode, you can simply organize Instantaneous ON, Time limit OFF (self hold circuit).



(existing wiring) (using Interval mode)

◎ Conditions of input signal (ATS11-□□D, ATS11-□□E)

1. Input with contact

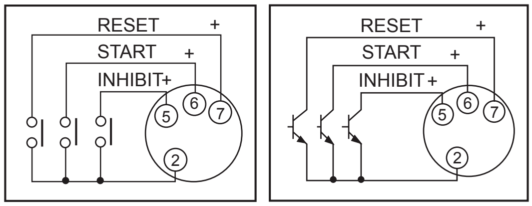
Use a switch which is gilded and has good reliability of contact.

Use a switch which has short bound(chattering) time for input contact because bound(chattering) time of contact timer may be error for operation time. Open resistance should be over 100kΩ and short resistance should be below 1kΩ.

※Use contact which has good reliability to open/close for 0.4mA small current.

2. Input with NPN open collector type

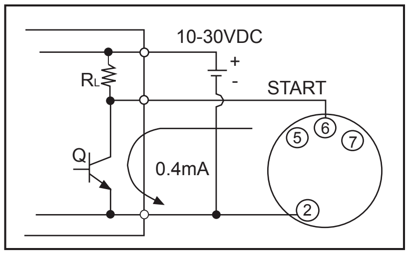
Characteristics of transistor should be Vceo = Min. 25V, Ic = Min. 10mA, Icbo = Max. 0.2μA, residual voltage = Max. 0.5V.



3. Input with NPN universal type

For non-contact circuit (proximity sensor, photoelectric sensor, etc.) which output voltage range is 10-30VDC, voltage output is also available as input signal not as open collector output.

In this case, when signal changes from H to L, a timer starts. Residual voltage should be below 0.5V when transistor (Q) is ON.



◎ Terminal connection

- Refer to the connection diagrams and wire it correctly.
- Power connection

For power connection of ATS Series, when it is AC power, connect it to the designated power terminal regardless of polarity. When it is DC power input after checking polarity of power.

Power voltage	8-pin type	11-pin type
AC type	Terminal ② - ⑦	Terminal ② - ⑩
DC type	Terminal ② - ⊖ Terminal ⑦ - ⊕	Terminal ② - ⊖ Terminal ⑩ - ⊕

- Turn OFF a power switch and be sure not to supply induced voltage, residual voltage between timer power terminals. (when wiring power cable parallel with high voltage line, power line, induced voltage may occur between power terminals.)
- For DC power, ripple should be below 10% and power voltage should be within the allowable range.
- When applying the power to the Timer, please apply the rated power at the moment by switch, relay, etc. Otherwise it might cause malfunction.
- Load for control output should be below the rated load capacity.

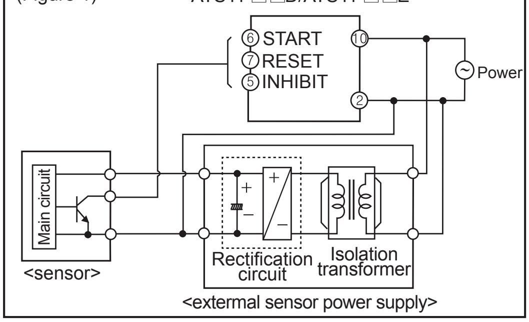
◎ Changing of setting time, time range, operation mode

It might cause malfunction if changing the setting time, time range or operation mode during operating unit. Please Change the setting time, time range or operation mode after cut the power off.

◎ Input connection

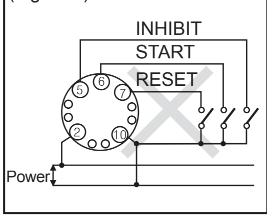
- Power circuit of ATS11- □□D/ATS11- □□E timer does not use trans. Use isolation transformer which secondary part is not grounded as (Figure 1) to cut off peripheral current flow for supplied power to external input deivces.

(Figure 1)

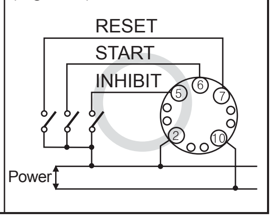


- As (Figure 2), if using terminal ⑩ as common terminal of input signal, it may cause damage to inner circuit of ATS11 timer. Use terminal ② as common terminal referring to (Figure 3).

(Figure 2)

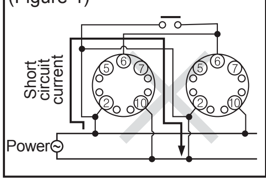


(Figure 3)

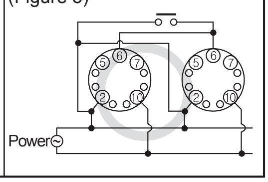


- When controlling several timers by one input contact or transistor, do not wire it as (Figure 4). This wiring causes short current due to not accorded phase of power. Wire it as (Figure 5) to accord to phase of power.

(Figure 4)



(Figure 5)

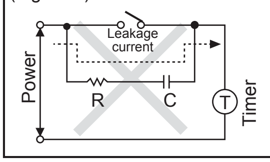


- In order to apply input signals (INHIBIT, START, RESET), short-circuit the terminal no. ②-⑤, ②-⑥ or ②-⑦. It may cause internal circuit damage by wrong connections.
- Do not wire INHIBIT, START, RESET signal input line with power line, high voltage line in parallel.
- Use shield cable when input (INHIBIT, START, RESET) cable is longer. Cable length should be as short as possible.

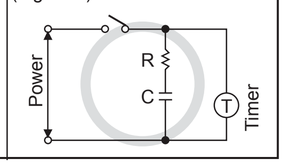
◎ Common

- Be sure that when using a timer at high temperature for a long time, it may cause deterioration for inner parts (electrolytic condenser, etc.).
- In case of 12VDC, 24VDC, 24VAC model, isolated and limited voltage/current or Class 2 source should be provided for power supply.
- When supply the power to the Timer, connection shown in (Figure 6) might cause malfunction due to leakage current through R and C. Please connect R and C as shown in (Figure 7) to prevent malfunction.

(Figure 6)



(Figure 7)



- Do not use this unit at below places.
  - Place where there are severe vibration or impact.
  - Place where strong alkalis or acids are used.
  - Place where there are direct ray of the sun.
  - Place where strong magnetic field or electric noise are generated.

- Installation environment
  - Indoor
  - Altitude Max. 2,000m
  - Pollution Degree 2
  - Installation Category II

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

ATS8SD-4

Star-Delta Timer With Free Power, Compact Size W38×H42mm

■ Features

● Wide power supply range
: 100-240VAC 50/60Hz, 24-240VDC universal
● Wide time setting range and switching time
• T1 (setting time): selectable 0.5 to 100 sec
• T2 (switching time): selectable 0.05, 0.1, 0.2, 0.3, 0.4, 0.5 sec
● Close and DIN rail mounting
with the dedicated socket (PS-M8) width 41mm
● Easy mounting and installation/maintenance
with the dedicated bracket for DIN 48×48mm
● Application: Starting large capacity motors

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

ATS **8** **SD** – **4**

Code		Description
Power supply	4	100-240VAC 50/60Hz, 24-240VDC universal
Time operation	SD	Star-Delta type
Number of plug pins	8	8-pin plug type
Item	ATS	Small Analog Timer

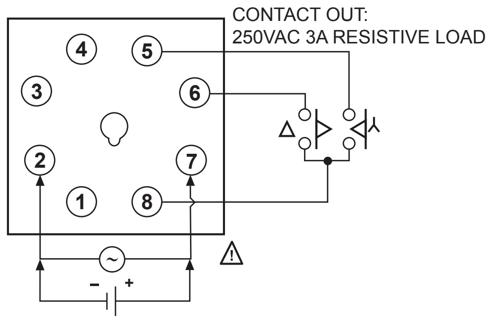
※Sockets (PG-08, PS-08(N), PS-M8) are sold separately.

■ Specifications

Model		**ATS8SD-4**
Function		**Star-Delta Timer**
Control time setting range※1		0.5 to 100sec
Power supply		100-240VAC 50/60Hz, 24-240VDC universal
Allowable voltage range		90 to 110% of rated voltage
Power consumption		Max. 3VA (100-240VAC), Max. 1.5W (24-240VDC)
Return time		Max. 100ms
Timing operation		Power ON Start
Control output	Contact type	⅄ contact: SPST (1a), Δ contact: SPST (1a)
	Contact capacity	250VAC 3A resistive load
Relay life cycle	Mechanical	Min. 10,000,000 operations
	Electrical	Min. 100,000 operations (250VAC 3A resistive load)
Repeat error		Max. ±0.2% ±10ms
⅄ setting error		Max. ±5% ±50ms
Voltage error		Max. ±0.5%
Temperature error		Max. ±2%
⅄ -Δ switching time error		Max. ±25%
Insulation resistance		Over 100MΩ (at 500VDC megger)
Dielectric strength		2,000VAC 50/60Hz for 1 min
Noise immunity		±2kV the square wave noise (pulse width 1μs) by noise simulator
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction 3 times
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction 3 times
Environ-ment	Ambient temp.	-10 to 55℃, storage: -25 to 65℃
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH
Approval		
Accessory		Bracket
Unit weight		Approx. 72g

※1: Refer to time specifications for control time setting range.
※Environment resistance is rated at no freezing or condensation.

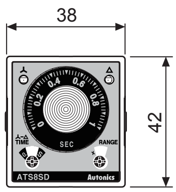
■ Connections

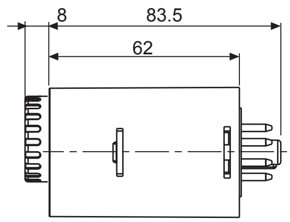


SOURCE: 100-240VAC 50/60Hz, 24-240VDC universal

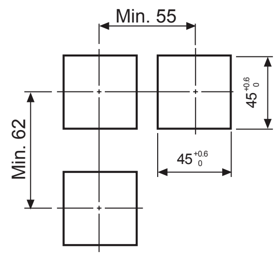
■ Dimensions

(unit: mm)

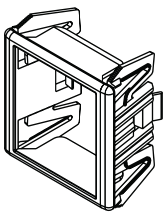


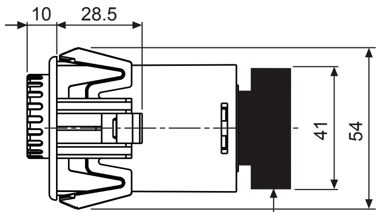


●Panel cut-out



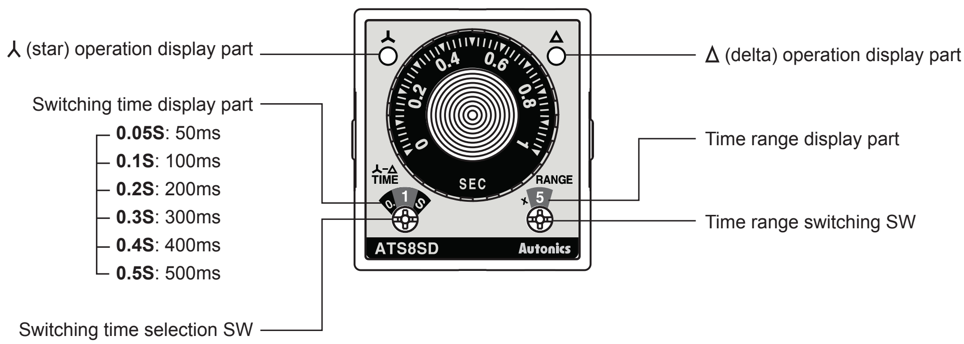
●Bracket





8-pin socket (sold separately)
※Refer to page G-19.

■ Unit Description



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

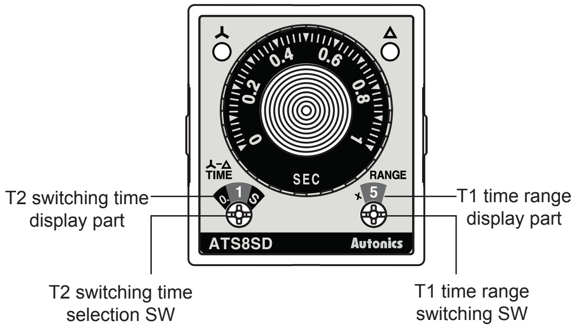
■ Time Specifications

1. T1 (setting time) time

Time range	Time unit	Time setting range
5	SEC	0.5 to 5sec
10		1 to 10sec
50		5 to 50sec
100		10 to 100sec

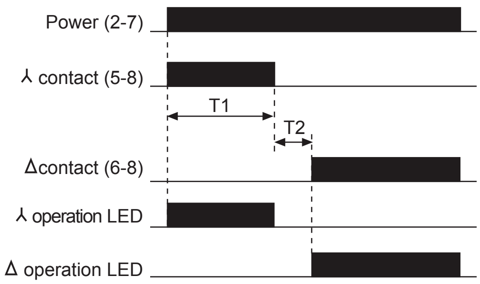
2. T2 (⅄-Δ switching time) time (unit: sec)

Switching time display part	**0.05S**	**0.1S**	**0.2S**	**0.3S**	**0.4S**	**0.5S**
T2 (⅄-Δ switching time)	0.05	0.1	0.2	0.3	0.4	0.5



■ Operation

When power is applied, ⅄ contact will be ON. When reaching to T1 setting time, ⅄ contact will be OFF and Δ contact will be ON after switching time of T2 is passed. If the power is OFF, ⅄ contact will be OFF.



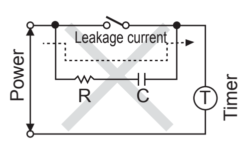
※T1: setting time (⅄ contact operation time)

※T2: ⅄-Δ switching time (⅄ contact and Δ contact are OFF simultaneously at power ON)

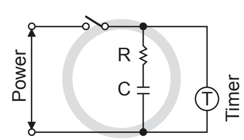
■ Proper Usage

- Please supply power quickly at once with using switch or relay contact. Otherwise it may cause time error or power reset failure.
- When supplying power for a long time, timer life cycle may be shorten due to overheat of inner components of timer.
- When supplied power of timer is DC, be sure that the polarity.
- When supplying the power to the timer, connection shown in (Figure 1) might cause malfunction due to leakage current through R and C. Please connect R and C as shown in (Figure 2) to prevent malfunction.

(Figure 1)



(Figure 2)



- Change the setting time (T1), time range or switching time (T2). Otherwise, it might cause malfunction if changing the setting time (T1), time range or switching time (T2) during operation.
- Do not use this unit at below places.
  - Place where temperature or humidity is out of the rated specifications.
  - Place where there is condensation by temperature changes.
  - Place where there is flammable gas or corrosive gas.
  - Place where there is dust, oil or severe vibration or impact.
  - Place where strong alkalis or acids is used.
  - Place where there is direct ray of the sun.
  - Place where strong magnetic field or electric noise is generated.

Power-OFF Delay Timer, Compact Size W38×H42mm

■ Features

- Control time range
  (ATS8P-□S: 0.1 to 10sec, ATS8P-□M: 0.1 to 10min)
- Direct reading for time setting and time range with easy adjustment
- Power supply: 100-120VAC50/60Hz, 200-240VAC 50/60Hz,
  24VAC 50/60Hz, 24VDC universal
- Close and DIN rail mounting
  with the dedicated socket (PS-M8) width 41mm
- Easy mounting and installation/maintenance
  with the dedicated bracket for DIN 48×48mm
- Application
  : Protection circuit when momentary power failure and start it again

⚠ Please read "Caution for your safety" in operation manual before using.

CE cULus

■ Ordering Information

ATS 8 P – 2 S

Position	Code	Description
Time unit	S	SEC
	M	MIN
Power supply	2	24VAC 50/60Hz, 24VDC type
	5	200-240VAC 50/60Hz
	6	100-120VAC 50/60Hz
Time operation	P	Power OFF Delay
Number of plug pins	8	8-pin plug type
Item	ATS	Compact Analog Timer

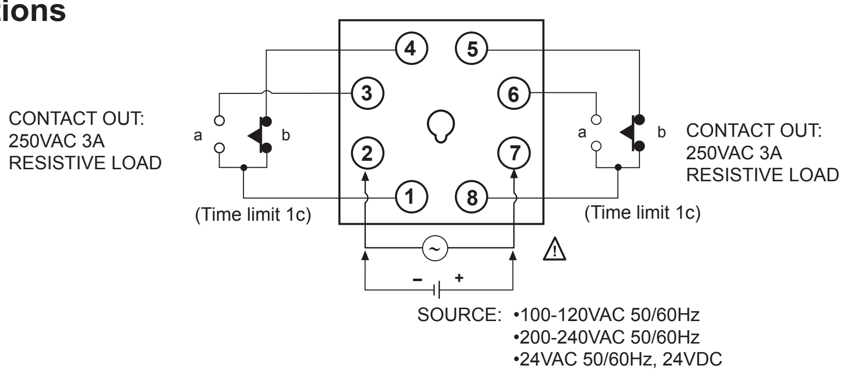
※Sockets (PG-08, PS-08(N), PS-M8) are sold separately.

■ Specifications

Model		ATS8P-□S	ATS8P-□M
Function		**Power OFF Delay**	
Control time setting range※1		0.1 to 10sec	0.1 to 10min
Power supply		•100-120VAC 50/60Hz •200-240VAC 50/60Hz •24VAC 50/60Hz, 24VDC universal	
Allowable voltage range		90 to 110% of rated voltage	
Power consumption		•Max. 1.5VA (100-120VAC 50/60Hz) •Max. 1.5VA (200-240VAC 50/60Hz) •Max. 0.2VA (24VAC 50/60Hz), Max. 0.2W (24VDC)	
TIming operation		Power OFF Start	
Control output	Contact type	Time limit DPDT (2c)	
	Contact capacity	250VAC 3A resistive load	
Relay life cycle	Mechanical	Min. 10,000,000 operations	
	Electrical	Min. 100,000 operations (250VAC 3A resistive load)	
Repeat error		Max. ±0.2% ±10ms	
SET error		Max. ±5% ±50ms	
Voltage error		Max. ±0.5%	
Temperature error		Max. ±2%	
Insulation resistance		Over 100MΩ (at 500VDC megger)	
Dielectric strength		2,000VAC 50/60Hz for 1 min	
Noise immunity		±2kV the square wave noise (pulse width: 1μs) by noise simulator	
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour	
	Malfunction	0.5mm mplitude at frequency of 10 to 55HHz (for 1 min) in each X, Y, Z direction for 10 min	
Shock	Mechanical	300m/s^2 (approx. 30G) in each X, Y, Z direction 3 times	
	Malfunction	100m/s^2 (approx. 10G) in each X, Y, Z direction 3 times	
Environ-ment	Ambient temp.	-10 to 55℃, storage: -25 to 65℃	
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH	
Approval		CE cULus	
Accessory		Bracket	
Unit weight		Approx. 80g	Approx. 85g

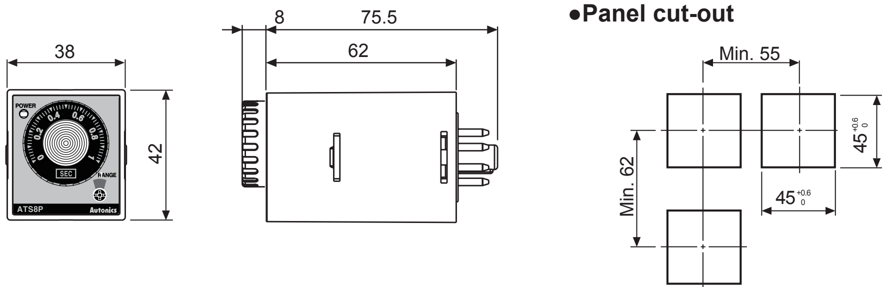
※1: Refer to time specifications for control time setting range by model.
※Environment resistance is rated at no freezing or condensation.

Connections

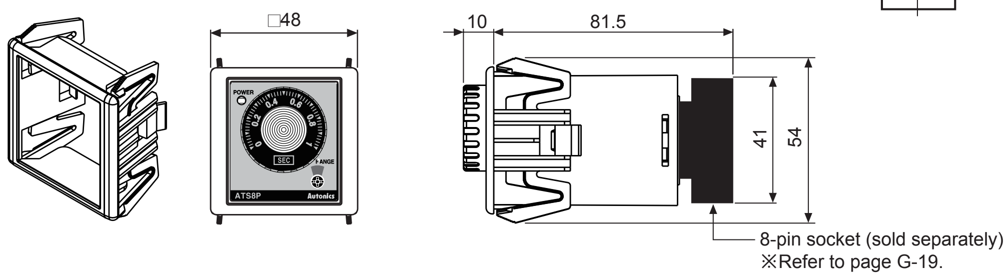


Dimensions

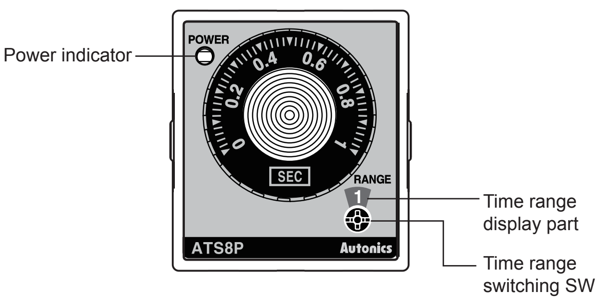
(unit: mm)



● Bracket



Unit Description

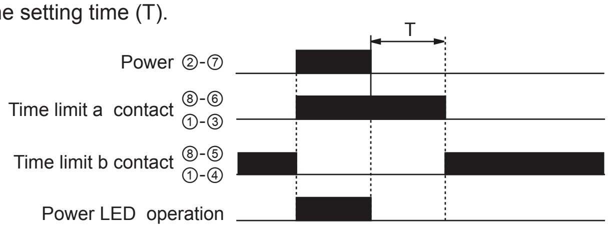


●Time specifications

Model	Time range	Time unit	Time setting range
ATS8P-□S	1	**SEC**	0.1 to 1 sec
	10		1 to 10 sec
ATS8P-□M	1	**MIN**	0.1 to 1 min
	10		1 to 10 min

Operation

When supplying the power, 'a' contact turns ON at the same time. When turning OFF the power, 'a' contact turns OFF after the setting time (T).

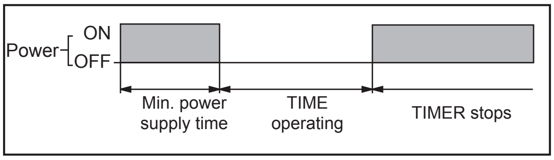


※T: setting time

▣ Proper Usage

◎ Power

- This product is Power OFF Delay Timer, the time of min. power supply is 0.1 sec for ATS8P-□S, and 2 sec for ATS8P-□M. Therefore be sure that this timer does not operate when supplying power but operates when turning OFF the power.



- Please observe the allowable voltage range and apply or cut the power af once to prevent from chattering.
- When supplying the power to the timer with 100-120VAC, 200-240VAC, approx. 0.5A will flow for 0.05 sec (ATS8P-□S), 0.5 sec (ATS8P-□M). When supplying the power to the timer with 24VDC voltage, approx. 1.5A will flow for 0.05 sec (ATS8P-□S), 0.5 sec (ATS8P-□M). Therefore, be sure about the rated of contact and the power capacity.

◎ Noise

- We test 2kV, pulse width 1μs against Impulse voltage between power terminals and 1kV, pulse width 1μs at noise simulator against external noise voltage. Please install MP condenser (0.1 to 1μF) or oil condenser between power terminals when over impulse noise voltage occurs.
- Dielectric, impulse voltage or insulation resistance test of electrical circuit when this unit is installed in the control panel.

• Separate the unit from control panel circuit.
• Short circuit all terminals of the unit.
(to prevent from damage of this inner circuit by inner, insulation failure of control panel parts)

◎ Environment

Do not use this unit at below places.

• Place where temperature and humidity is out of the rated specifications.
• Place where freezing generates by temperature changes
• Place where there is flammable or explosive gas
• Place where there is lots of dust, oil or strong vibration or shock
• Place where strong alkalis or acid is used.
• Place where there is direct ray of the sun
• Place where strong magnetic field or electric noise is generated

Twin Timer With Free Power, Compact Size W38×H42mm

■ Features

- Wide power supply range
  : 100-240VAC 50/60Hz, 24-240VDC universal,
  24VAC 50/60Hz, 24VDC universal, 12VDC
- Various output operations (6 operation modes)
- Multi time range (12 types of time range)
- Twin timer to set ON/OFF time individually
- Close and DIN rail mounting
  with the dedicated socket (PS-M8) width 41mm (for ATS8W)
- Easy mounting and installation/maintenance with
  the dedicated bracket for DIN 48×48mm

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

ATS | 8 | W — 4 | 1

	Code	Description
Time range	1	Time range 1 (0.1 to 1)
	3	Time range 3 (0.3 to 3)
Power supply	1	12VDC
	2	24VAC 50/60Hz, 24VDC
	4	100-240VAC 50/60Hz, 24-240VDC
Time operation	W	Twin (flicker) operation
Number of plug pins	8	8-pin plug type
	11	11-pin plug type
Item	ATS	Compact Analog Timer

※Sockets (8-pin sockets: PG-08, PS-08(N), PS-M8/11-pin sockets: PG-11, PS-11(N)) are sold separately.

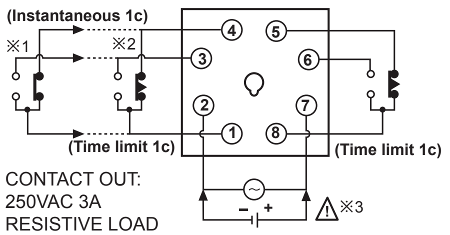
■ Specifications

Model		**ATS8W-□1**	**ATS11W-□1**	**ATS8W-□3**	**ATS11W-□3**
Function		**ON/OFF Flicker operation**			
Control time setting range※1		0.1sec to 10hour		0.3sec to 30hour	
Power supply		•100-240VAC 50/60Hz, 24-240VDC universal •24VAC 50/60Hz, 24VDC universal •12VDC			
Allowable voltage range		90 to 110% of rated voltage			
Power consumption		•Max. 4.2VA (100-240VAC), Max. 2W (24-240VDC) •Max. 4.5VA (24VAC), Max. 2W (24VDC) •Max. 1.5W (12VDC)			
Return time		Max. 100ms			
Timing operation		Power ON Start			
Control output	Contact type	Time limit DPDT (2c) or Instantaneous SPDT (1c)+Time limit SPDT (1c) selectable by output operation mode			
	Contact capacity	250VAC 3A resistive load			
Relay life cycle	Mechanical	Min. 10,000,000 operations			
	Electrical	Min. 100,000 operations (250VAC 3A resistive load)			
Repeat error		Max. ±0.2% ±10ms			
SET error		Max. ±5% ±50ms			
Voltage error		Max. ±0.5%			
Temperature error		Max. ±2%			
Insulation resistance		Over 100MΩ (at 500VDC megger)			
Dielectric strength		2,000VAC 50/60Hz for 1 minute			
Noise immunity	ATS□W-1□ ATS□W-2□	±500V the square wave noise (pulse width 1μs) by noise simulator			
	ATS□W-4□	±2kV the square wave noise (pulse width 1μs) by noise simulator			
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1min) in each X, Y, Z direction for 1hour			
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1min) in each X, Y, Z direction for 10min			
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction 3 times			
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction 3 times			
Environ-ment	Ambient temp.	-10 to 55℃, storage: -25 to 65℃			
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH			
Approval		CE cULus			
Accessory		Bracket			
Weight※2		Approx. 100g (approx. 75g)			

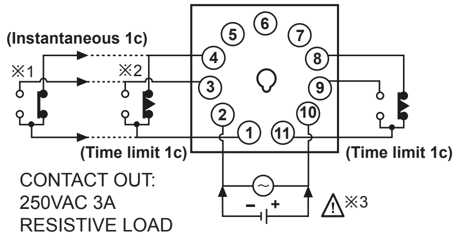
※1: Refer to time specifications for control time setting range by model.
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

Connections

◎ ATS8W



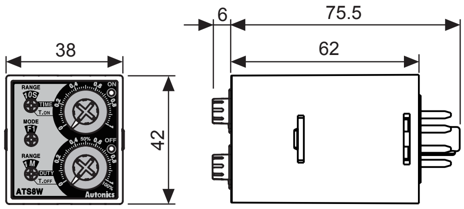
◎ ATS11W



※1: When selecting [F2], [N2] output operation mode.
※2: When selecting [F1], [F3], [N1], [N3] output operation mode.
※3: AC/DC voltage: 100-240VAC 50/60Hz, 24-240VDC
24VAC 50/60Hz, 24VDC
DC voltage: 12VDC

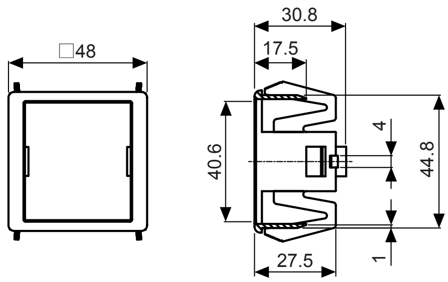
Dimensions

(unit: mm)

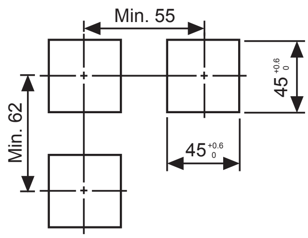


※8-pin, 11-pin socket (sold separately) refer to page G-19.

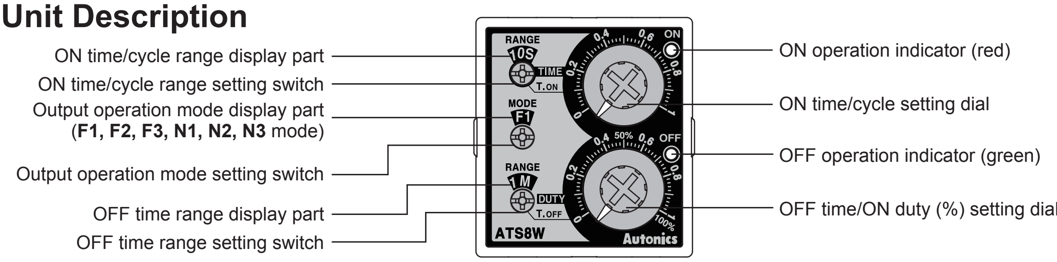
● Bracket



●Panel cut-out



Unit Description



Time Specifications

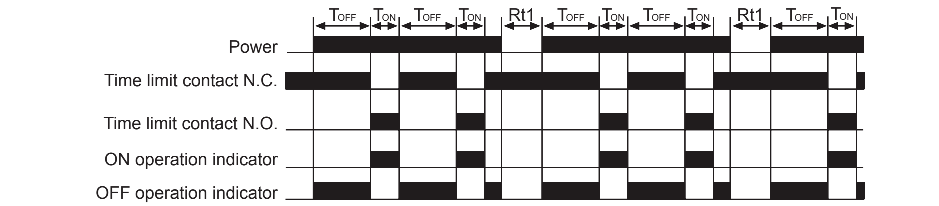
Model	Time range	Time unit	Time setting range
ATS□W-□1	1S	**SEC**	0.1 to 1sec
	10S		1 to 10sec
	1M	**MIN**	0.1 to 1min
	10M		1 to 10min
	1H	**HOUR**	0.1 to 1hour
	10H		1 to 10hour
ATS□W-□3	1S	**SEC**	0.3 to 3sec
	10S		3 to 30sec
	1M	**MIN**	0.3 to 3min
	10M		3 to 30min
	1H	**HOUR**	0.3 to 3hour
	10H		3 to 30hour

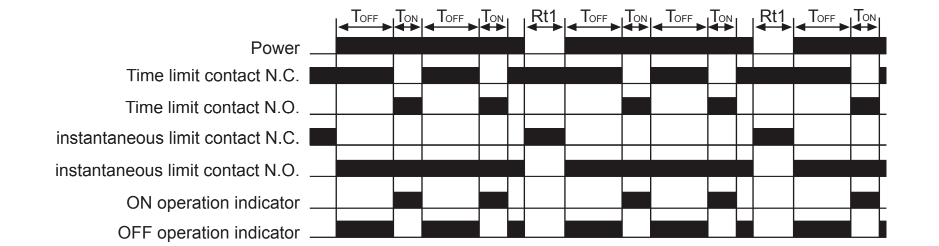
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

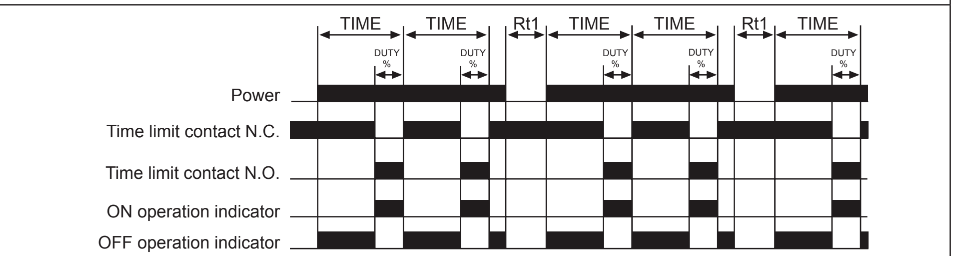
■ Output Operation Mode

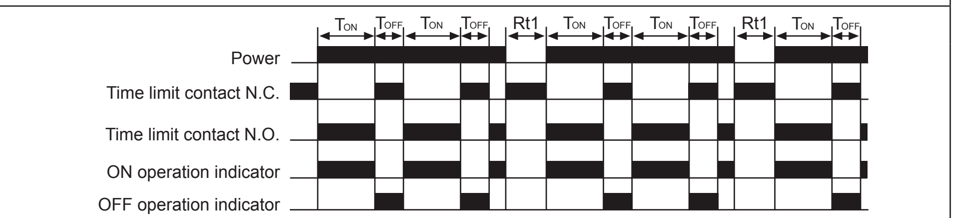
[T_{ON}: ON Setting time, T_{OFF}: OFF Setting time, TIME: Cycle, DUTY: ON Time duty rate, Rt: Return time, Rt1>Rt]

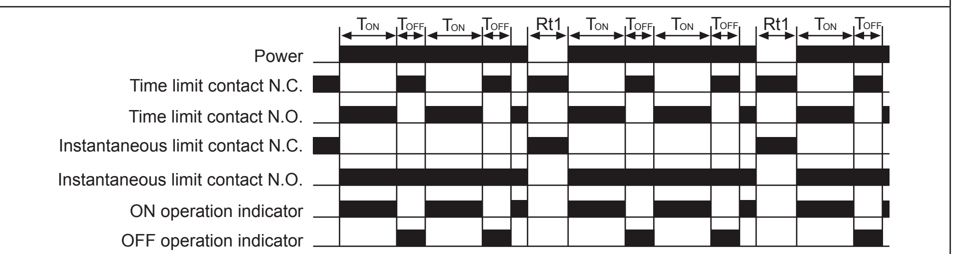
<table>
<tr><th>Mode</th><th>Time chart</th></tr>
<tr><td>F1

OFF Start
Flicker1</td><td>
</td></tr>
<tr><td>F2

OFF Start
Flicker2</td><td>
</td></tr>
<tr><td>F3

OFF Start
Flicker3</td><td>
</td></tr>
<tr><td>N1

ON Start
Flicker1</td><td>
</td></tr>
<tr><td>N2

ON Start
Flicker2</td><td>
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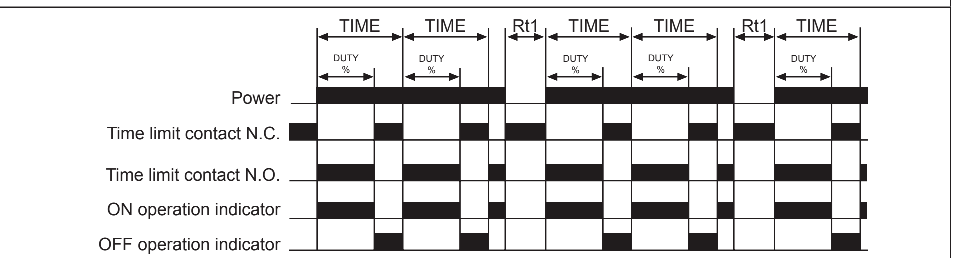
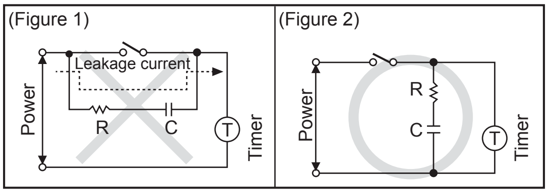
<tr><td>N3

ON Start
Flicker3</td><td>
</td></tr>
<tr><td colspan="2">※Setting time should be over 100ms. If not, it may cause abnormal output operation due to under 100ms of setting time.
※[F3], [N3] mode operates flicker by setting cycle (time) and ON duty (%). ON time range changes to cycle (time) range and OFF time range changes to ON duty (%).</td></tr>
</table>

▣ Proper Usage

- Connect DC power input after checking polarity of power.
- In case of 12VDC, 24VDC, 24VAC model, isolated and limited voltage/current or Class 2 sources should be provided for power supply.
- When applying the power to the timer, apply the rated power at the moment by switch, relay, etc. Otherwise it might cause malfunction.
- [F3], [N3] mode operates flicker by setting cycle (time) and ON duty(%). ON time range changes to cycle (time) range and OFF time range changes to ON duty(%).
- When supply the power to the Timer, connection shown in (Figure 1) might cause malfunction due to leakage current through R and C.
  Connect R and C as shown in (Figure 2) to prevent malfunction.



- It might cause malfunction if changing the setting time, time range or operation mode during operating unit. Change the setting time, time range or operation mode after cut the power off.
- Do not use this unit at below places.
  - Place where there are severe vibration or impact.
  - Place where strong alkalis or acids are used.
  - Place where there are direct ray of the sun.
  - Place where strong magnetic field or electric noise are generated.
- Installation environment
  - Indoor
  - Altitude Max. 2,000m
  - Pollution Degree 2
  - Installation Category II

DIN W48×H48mm, Universal Voltage Multi-Function Timer

■ Features

- Realization of wide range of power supply
  :100-240VAC 50/60Hz, 24-240VDC universal,
  24VAC 50/60Hz, 24VDC universal, 12VDC
- Various output operation (6 kinds modes)
- Multi time range (16 kinds of time range)
- Wide control time (0.05sec to 100hour)
- Easy setting of time, time range, output operation mode
- Easy to check output status by indicator

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

AT | 8 | N – □

Power supply	No mark	100-240VAC 50/60Hz, 24-240VDC
	1	12VDC
	2	24VAC 50/60Hz, 24VDC
Time operation	N	Time limit DPDT (2c) or instantaneous SPDT (1c)+Time limit SPDT (1c) selectable by output operation mode
	DN	Time limit DPDT (2c)
	EN	Instantaneous SPDT (1c)+Time limit SPDT (1c)
Number of plug pins	8	8-pin plug type
	11	11-pin plug type
Item	AT	Analog Timer

※Sockets (8-pin sockets: PG-08, PS-08(N)/11-pin sockets: PG-11, PS-11(N)) are sold separately.

■ Specifications

Model		**AT8N-□**	**AT11DN-□**	**AT11EN-□**
Function		**Multi Function Timer**		
Control time setting range※1		0.05sec to 100hour		
Power supply		• 100-240VAC 50/60Hz, 24-240VDC universal • 24VAC 50/60Hz, 24VDC universal • 12VDC		
Allowable voltage range		90 to 110% of rated voltage		
Power consumption		• Max. 4.3VA (100-240VAC), Max. 2W (24-240VDC) • Max. 4.5VA (24VAC), Max. 2W (24VDC) • Max. 1.5W (12VDC)	• Max. 3.5VA (100-240VAC), Max. 1.5W (24-240VDC) • Max. 4VA (24VAC), Max. 1.5W (24VDC) • Max. 1W (12VDC)	• Max. 4.3VA (100-240VAC), Max. 2W (24-240VDC) • Max. 4.5VA (24VAC), Max. 2W (24VDC) • Max. 1.5W (12VDC)
Return time		Max. 100ms		
Timing operation		Power ON Start	Signal ON Start	
Min. input signal width		—	INHIBIT, START, RESET: Approx. 50ms	
Input		—	INHIBIT, START, RESET: [No-voltage input] - Short-circuit impedance: Max. 1kΩ, Residual voltage: Max. 0.5V, Open-circuit impedance: Min. 100kΩ	
Control output	Contact type	Time limit DPDT (2c) or Instantaneous SPDT (1c)+ Time limit SPDT (1c) selectable by output operation mode	Time limit DPDT (2c)	Instantaneous SPDT (1c)+ Time limit SPDT (1c)
	Contact capacity	250VAC 5A resistive load		
Relay life cycle	Mechanical	Min. 10,000,000 operations		
	Electrical	Min. 100,000 operations (250VAC 5A resistive load)		
Repeat error		Max. ±0.2% ±10ms		
SET error		Max. ±5% ±50ms		
Voltage error		Max. ±0.5%		
Temperature error		Max. ±2%		
Insulation resistance		Over 100MΩ (at 500VDC megger)		

※1: Refer to time specifications for control time setting range by model.

■ Specifications

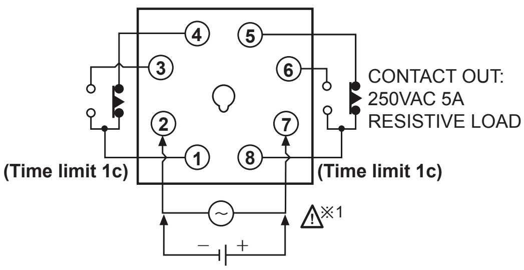
Model		AT8N-□	AT11DN-□	AT11EN-□
Dielectric strength		2,000VAC 50/60Hz for 1 minute		
Noise immunity	AT□□-1 AT□□-2	±500V the square wave noise (pulse width 1μs) by noise simulator		
	AT□□	±2kV the square wave noise (pulse width 1μs) by noise simulator		
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1min) in each X, Y, Z direction for 1hour		
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1min) in each X, Y, Z direction for 10min		
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction 3 times		
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction 3 times		
Environ-ment	Ambient temperature	-10 to 55℃, storage: -25 to 65℃		
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH		
Approval		CE cULus		
Accessory		Bracket		
Weight※2		Approx. 134.12g (approx. 86.71g)	Approx. 132.2g (approx. 85g)	Approx. 134.7g (approx. 87.5g)

※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

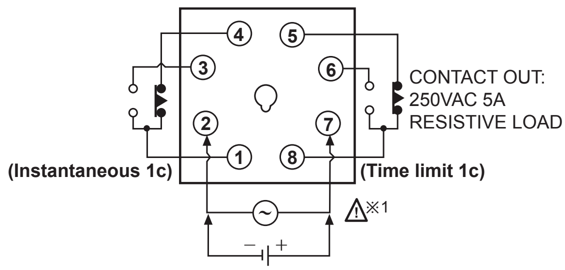
■ Connections

◎ AT8N

● When selecting [A], [F] output operation mode

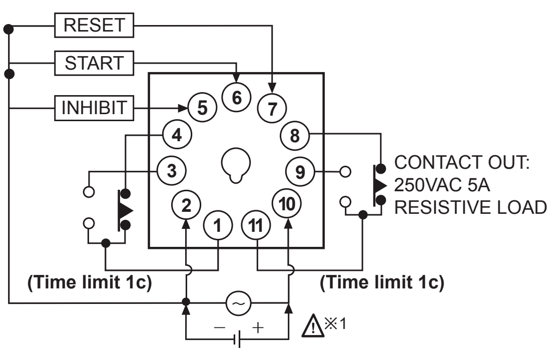


● When selecting [A1], [B], [F1], [I] output operation mode

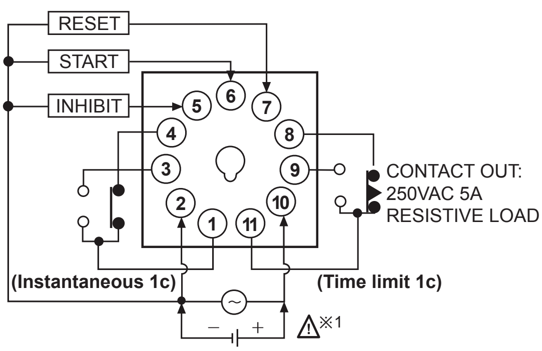


※1: AC/DC voltage: 100-240VAC 50/60Hz, 24-240VDC
: 24VAC 50/60Hz, 24VDC
DC voltage:12VDC

◎ AT11DN



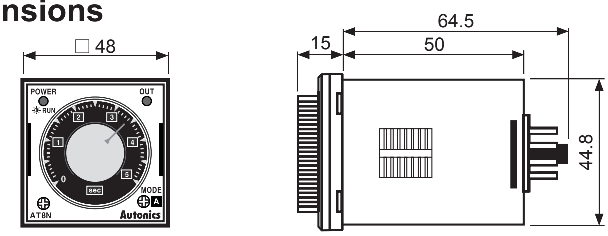
◎ AT11EN



※1: AC/DC voltage: 100-240VAC 50/60Hz, 24-240VDC
: 24VAC 50/60Hz, 24VDC
DC voltage:12VDC

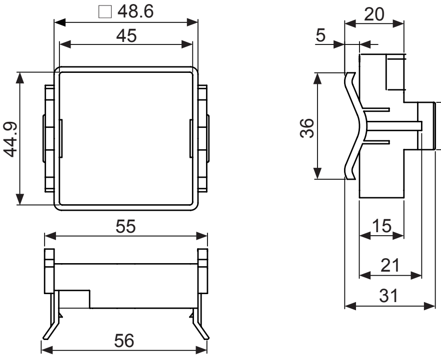
■ Dimensions

(unit: mm)

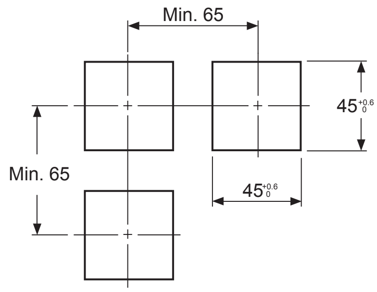


※8-pin, 11-pin socket (sold separately) refer to page G-19.

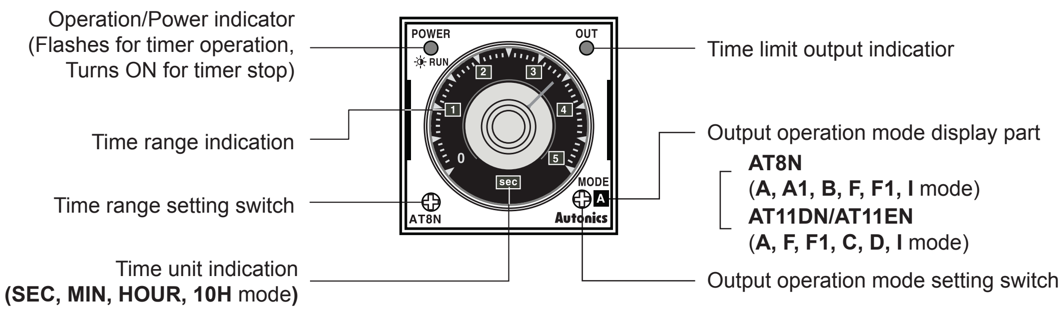
● **Bracket**



● **Panel cut-out**



■ Unit Description



■ Time Specifications

Time range	Time unit	Time setting range	Time range	Time unit	Time setting range
0.5	**SEC**	0.05 to 0.5sec	0.5	**HOUR**	0.05 to 0.5hour
1		0.1 to 1sec	1		0.1 to 1hour
5		0.5 to 5sec	5		0.5 to 5hour
10		1 to 10sec	10		1 to 10hour
0.5	**MIN**	0.05 to 0.5min	0.5	**10H**	0.5 to 5hour
1		0.1 to 1min	1		1 to 10hour
5		0.5 to 5min	5		5 to 50hour
10		1 to 10min	10		10 to 100hour

■ Output Operation Mode

● **AT8N**

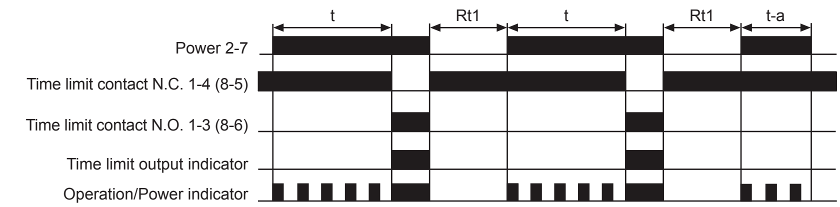
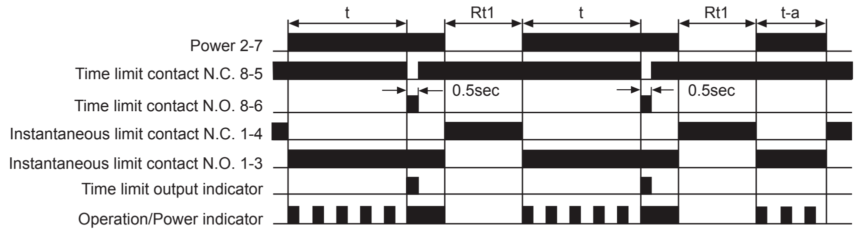
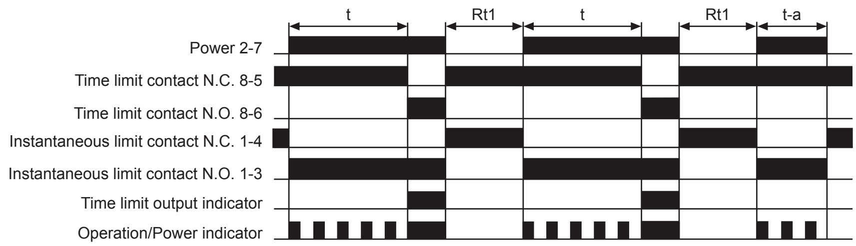
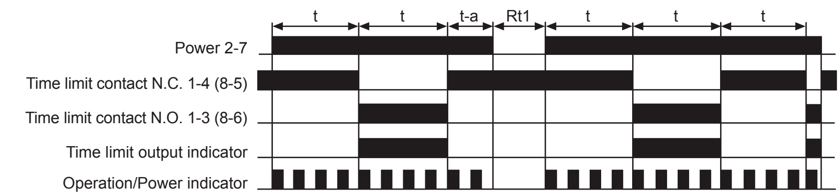
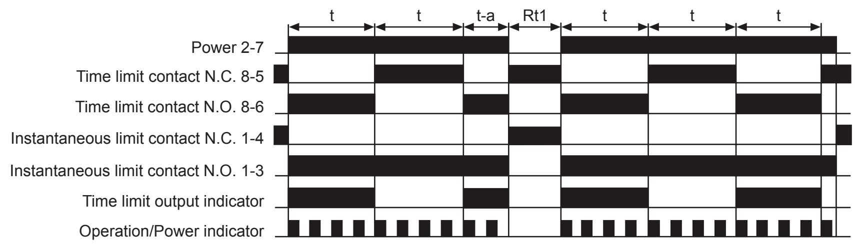
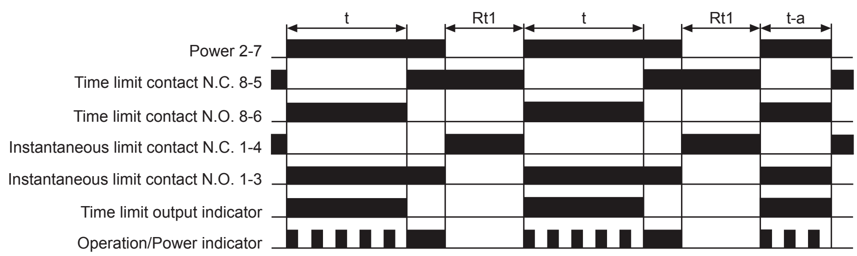
Display	Output operation mode
A	Power ON Delay
A1	Power ON Delay1 (One-Shot output)
B	Power ON Delay2
F	Flicker (OFF Start)
F1	Flicker1 (ON Start)
I	Interval

● **AT11DN/AT11EN**

Display	Output operation mode
A	Signal ON Delay
F	Flicker (OFF Start)
F1	Flicker1 (ON Start)
C	Signal OFF Delay
D	Signal ON/OFF Delay
I	Interval

■ Output Operation Mode (AT8N)

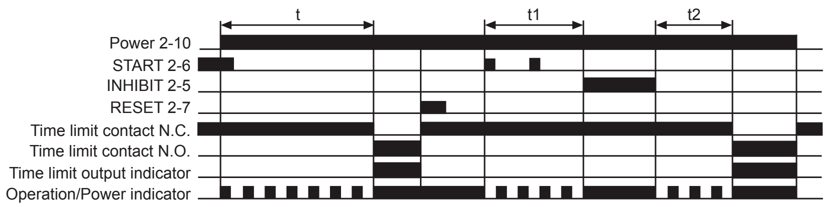
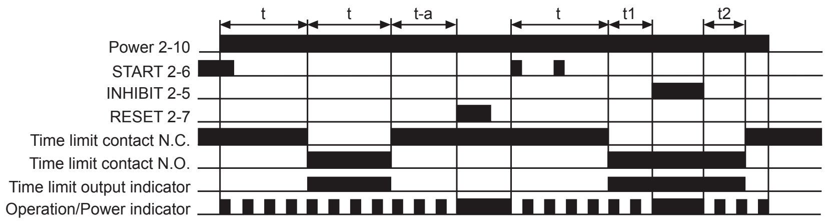
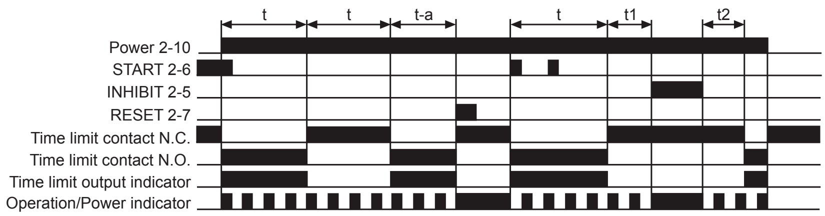
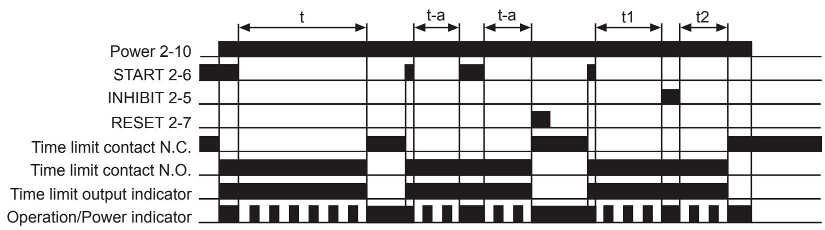
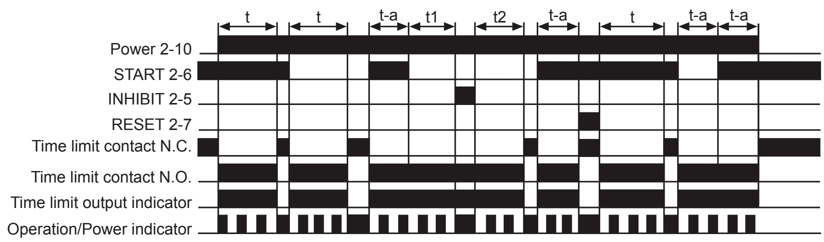
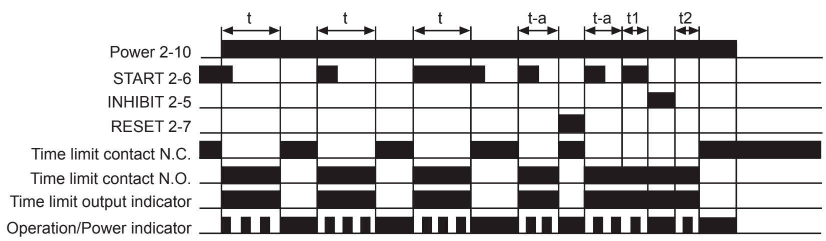
[t: Setting time, t > t-a, Rt: Return time, Rt1>Rt]

Mode	Time chart
A	
Power ON Delay	
A1	
Power ON Delay1 (One-Shot output)	 ※One- Shot output is 0.5sec fixed.
B	
Power ON Delay2	
F	
Flicker (OFF Start)	
F1	
Flicker1 (ON Start)	
I	
Interval	

※In case of F, F1 output operation mode, setting time should be over 100ms.
If not, it may cause abnornal output operation due to under 100ms of setting time.

■ Output Operation Mode (AT11DN/AT11EN)

[t: Setting time, t=t1+t2, t>t-a]

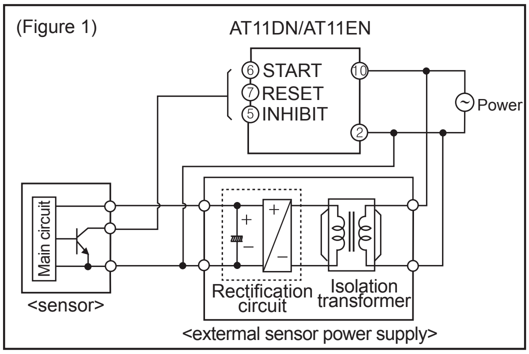
Mode	Time chart
A **Signal ON Delay**	
F **Flicker (OFF Start)**	
F1 **Flicker1 (ON Start)**	
C **Signal OFF Delay**	
D **Signal ON/OFF Delay**	
I **Interval**	

※If power is cut or the RESET terminal is short-circuited, the titmer will be RESET.
※If the INHIBIT terminal is short-circuited during a time limit operation, the time will stop.
※In case of F, F1 output operation mode, setting time should be over 100ms.
If not, it may cause abnormal output operation due to under 100ms of setting time.

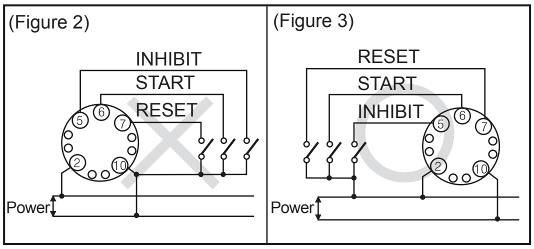
▣ Proper Usage

◎ Input connection (AT11DN/AT11EN)

- Power circuit of AT11DN/EN timer does not use trans. Use isolation transformer which secondary part is not grounded as (Figure 1) to cut off peripheral current flow for supplied power to external input deivces.



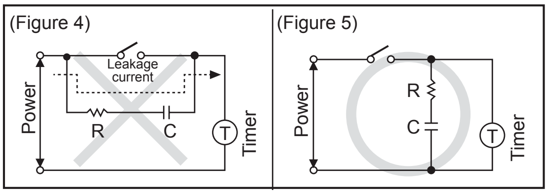
- As (Figure 2), if using terminal ⑩ as common terminal of input signal, it may cause damage to inner circuit of AT11DN/EN timer. Use terminal ② as common terminal referring to (Figure 3).



- In order to apply input signals (INHIBIT, START, RESET), short-circuit the terminal no. ②-⑤, ②-⑥ or ②-⑦. It may cause internal circuit damage by wrong connections.
- Do not wire INHIBIT, START, RESET signal input line with power line, high voltage line in parallel.

◎ Common

- Please connect DC power input after checking polarity of power.
- In case of 12VDC model, isolated and limited voltage/current or Class 2 sources should be provided for power supply.
- When applying the power to the timer, please apply the rated power at the moment by switch, relay, etc. Otherwise it might cause malfunction.
- When supply the power to the timer, connection shown in (Figure 4) might cause malfunction due to leakage current through R and C.
  Please connect R and C as shown in (Figure 5) to prevent malfunction.



- It might cause malfunction if changing the setting time, time range or operation mode during unit operating unit. Please change the setting time, time range or operation mode after cut the power off.
- Do not use this unit at below places.
  - Place where there are severe vibration or impact.
  - Place where strong alkalis or acids are used.
  - Place where there are direct ray of the sun.
  - Place where strong magnetic field or electric noise are generated.
- Installation environment
  - Indoor
  - Altitude Max. 2,000m
  - Pollution Degree 2
  - Installation Category II

AT8SDN

DIN W48×H48mm Star-Delta Timer

■ Features

- Realization of wide range of power supply
  : 100-240VAC 50/60Hz, 24-240VDC universal
- Wide range of setting time and switching time
  - T1 (setting time): Selectable 0.5 to 100sec
  - T2 (switching time): Selectable 0.05, 0.1, 0.2, 0.3, 0.4, 0.5sec
- Simple setting time, switching time operation
- Easy to check output status by LED display
- Application: Starting large capacity motors

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

AT | 8 | SDN

Time operation	SDN	Star-Delta type
Number of plug pins	8	8-pin plug type
Item	AT	Analog Timer

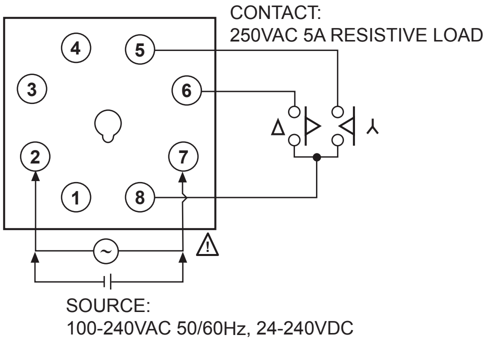
※Sockets (PG-08, PS-08(N)) are sold separately.

■ Specifications

Model		**AT8SDN**
Function		**Star-Delta timer**
Control time setting range※1		0.5 to 100 sec
Power supply		100-240VAC 50/60Hz, 24-240VDC universal
Allowable voltage range		90 to 110% of rated voltage
Power consumption		Max. 3.2VA (100-240VAC), Max. 1.5W (24-240VDC)
Return time		Max. 100ms
Timing operation		Power ON start type
Control output	Contact type	⅄ contact: SPST (1a), Δ contact: SPST (1a)
	Contact capacity	250VAC 5A resistive load
Relay life cycle	Mechanical	Min. 10,000,000 operations
	Electrical	Min. 100,000 operations (250VAC 5A resistive load)
Repeat error		Max. ±0.2 % ±10ms
⅄Setting error		Max. ±5% ±50ms
Voltage error		Max. ±0.5%
Temperature error		Max. ±2%
⅄-Δ Switching time error		Max. ±25%
Insulation resistance		Over 100MΩ (at 500VDC megger)
Dielectric strength		2,000VAC 50/60Hz for 1 minute
Noise immunity		±2kV the square wave noise (pulse width: 1μs) by the noise simulator
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hours
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times
Environment	Ambient temperature	-10 to 55℃, storage: -25 to 65℃
	Ambient humidity	35 to 85%RH
Approval		CE cULus
Accessory		Bracket
Unit weight		Approx. 90g

※1: Refer to time specifications for control time setting range.
※Environment resistance is rated at no freezing or condensation.

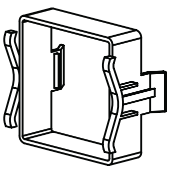
■ Connections

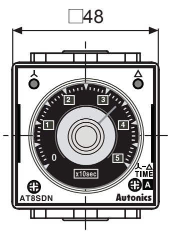


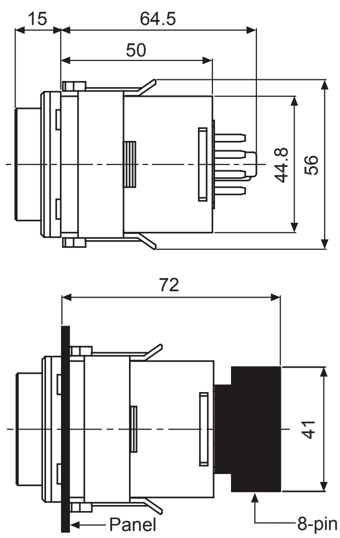
■ Dimensions

(unit: mm)

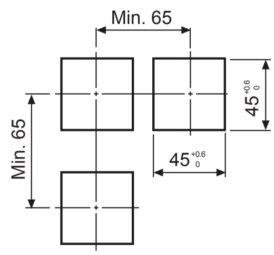
● Bracket



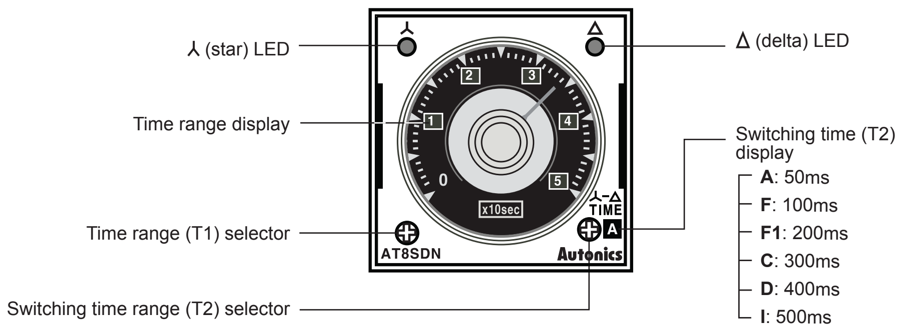




● Panel cut-out



■ Parts Description



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Time Specifications

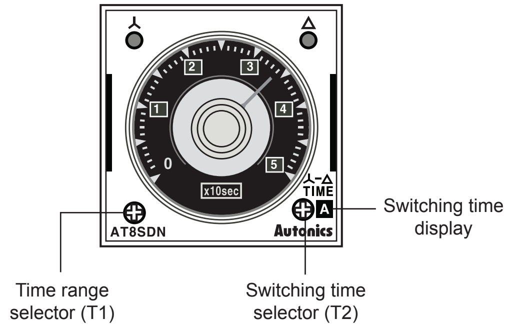
1. T1 (setting time)

Time range	Time unit	Time setting range
0.5	**10SEC**	0.5 to 5sec
1		1 to 10sec
5		5 to 50sec
10		10 to 100sec

2. T2 (⅄ - Δ switching time)

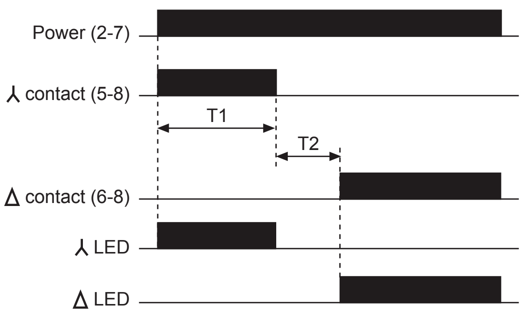
(unit: sec)

Display	**A**	**F**	**F1**	**C**	**D**	**I**
T2 (⅄-Δ switching time)	0.05	0.1	0.2	0.3	0.4	0.5



■ Output Operation Mode

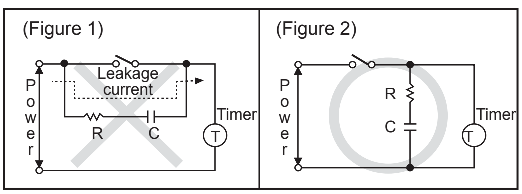
⅄ contact will be ON as soon as power is supplied, ⅄ contact will be OFF when T1 setting time is up then Δ contact will be ON after T2 switching time is up. Δ contact will be OFF when cut off the power at the status of Δ contact is ON.



※T1: Setting time (⅄contact operation time)
※T2: ⅄-Δ Swtiching time (⅄ and Δ contact are OFF when power is ON.)

■ Proper Usage

- Please supply power quickly at once with using switch or relay contact. Otherwise it may cause time error or power reset failure.
- When supply the power to the timer, connection shown in (Figure 1) might cause malfunction due to leakage current through R and C. Please connect R and C as shown in (Figure 2) to prevent malfunction.



- Change the setting time (T1), time range or ⅄-Δ switching time (T2). Otherwise, it might cause malfunction if changing the setting time (T1), time range or ⅄-Δ switching time (T2) during operation.
- When performing dielectric voltage test or insulation resistance test while the unit is installed on control panel,
  - Please isolate this unit from the circuit of control panel.
  - Please make all terminals of this unit short-curcuited.
- Do not use this unit at below places.
  - Place where there is severe vibration or impact.
  - Place where strong alkalis or acids is used.
  - Place where there is direct ray of the sun
  - Place where strong magnetic field or electric noise is generated.
- This unit may be used in the following environments.
  - Indoor
  - Altitude: Max. 2,000m
  - Pollution Degree 2
  - Installation Category II

DIN W48×H48mm Solid-State, Power OFF Delay Timer

■ Features

- Time setting range
  (AT8PSN: 0.05 to 10sec, AT8PMN: 0.05 to 10min)
- Simple time setup and direct read of time range
- Power supply
  : 100-120VAC 50/60Hz, 200-240VAC 50/60Hz
  100/110VDC, 24VAC 50/60Hz, 24VDC universal
- Application: Protect circuit when momentary power failure and start it again

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

AT | 8 | P | SN – □

Field	Code	Description
Power supply	No mark	200-240VAC 50/60Hz
	2	24VAC 50/60Hz, 24VDC
	6	100-120VAC 50/60Hz
	7	100/110VDC
Time unit	SN	SEC
	MN	MIN
Time operation	P	Power OFF Delay
Number of plug pins	8	8-pin plug type
Item	AT	Analog Timer

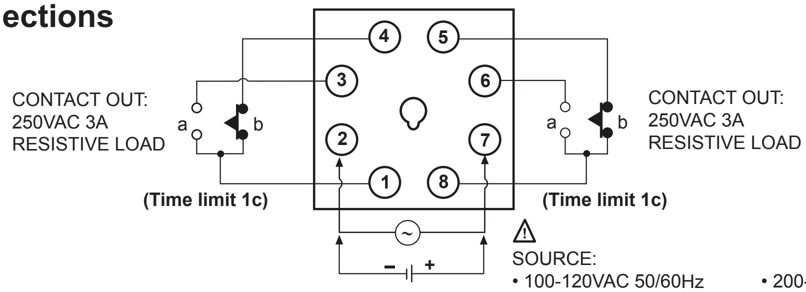
※Sockets (PG-08, PS-08(N)) are sold separately.

■ Specifications

Model			AT8PSN-□	AT8PMN-□
Function			**Power OFF Delay**	
Control time setting range※1			0.05 to 10 sec	0.05 to 10 min
Power supply			• 100-120VAC 50/60Hz • 200-240VAC 50/60Hz • 100/110VDC • 24VAC 50/60Hz, 24VDC universal	
Allowable voltage range			90 to 110% of rated voltage	
Power consumption			• Max. 1.5VA (100-120VAC) • Max. 1.5VA (200-240VAC) • Max. 0.8W (100/110VDC) • Max. 0.2VA (24VDC), Max. 0.2W (24VDC)	
Timing operation			Power OFF start	
Control output	Contact type		Time limit DPDT (2c)	
	Contact capacity		250VAC 3A resistive load	
Relay life cycle	Mechanical		Min.10,000,000 operations	
	Electrical		Min. 100,000 operations (250VAC 3A resistive load)	
Repeat error			Max. ±0.2% ±10ms	
SET error			Max. ±5% ±50ms	
Voltage error			Max. ±0.5%	
Temperature error			Max. ±2%	
Insulation resistance			Over 100MΩ (at 500VDC megger)	
Dielectric strength			2,000VAC 50/60Hz for 1 minute	
Noise immunity			±2kV the square wave noise (pulse width: 1μs) by the noise simulator	
Vibration	Mechanical		0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hours	
	Malfunction		0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min	
Shock	Mechanical		300m/s² (approx. 30G) in each X, Y, Z direction 3 times	
	Malfunction		100m/s² (approx. 10G) in each X, Y, Z direction 3 times	
Environment	Ambient temperature		-10 to 55℃, storage: -25 to 65℃	
	Ambient humidity		35 to 85%RH	
Approval			CE c UL us	
Accessory			Bracket	
Unit weight			Approx. 100g	

※1: Refer to time specifications for control time setting range.
※Environment resistance is rated at no freezing or condensation.

■ Connections

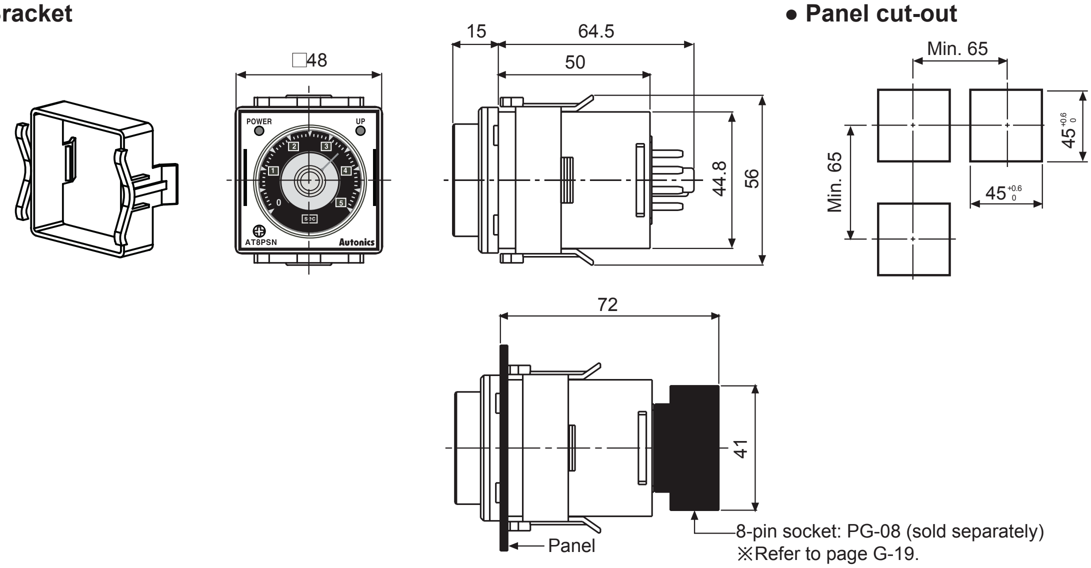


SOURCE:
- 100-120VAC 50/60Hz
- 24VAC 50/60Hz, 24VDC
- 200-240VAC 50/60Hz
- 100/110VDC

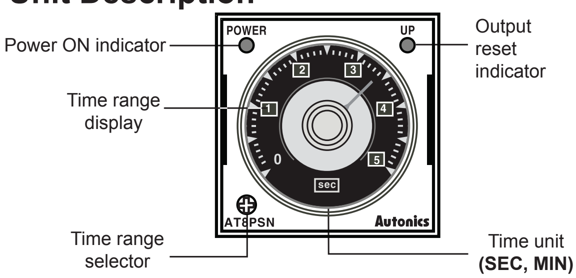
■ Dimensions

(unit: mm)

- **Bracket**
- **Panel cut-out**



■ Unit Description

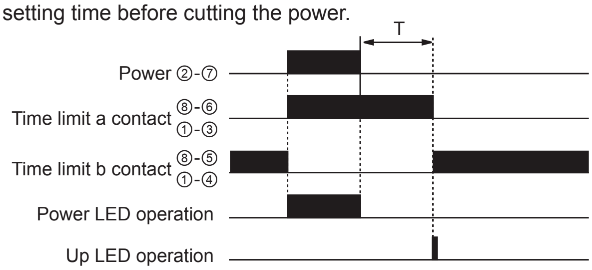


- **Time specifications**

Model	Time range	Time unit	Time setting range
AT8PSN-□	0.5	SEC	0 to 0.5 sec
	1		0 to 1 sec
	5		0 to 5 sec
	10		0 to 10 sec
AT8PMN-□	0.5	MIN	0 to 0.5 min
	1		0 to 1 min
	5		0 to 5 min
	10		0 to 10 min

■ Output Operation Mode

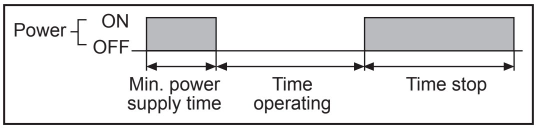
Contact a turns ON when the power applied and then turns off after setting time (T) is passed when the power off. There is memory protection function. Even though changing setting time after cutting the power, time limit a contact turns OFF after the setting time before cutting the power.

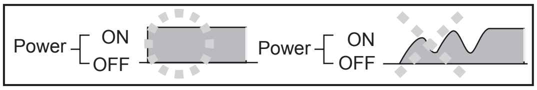


※T: Setting time

▣ Proper Usage

● Power
- The unit is power OFF delay timer, the time of min. power supply is 0.1sec for AT8PSN-□ type and 2sec for AT8PMN-□. Therefore be sure that the unit will operation after power off.
- Please observe the allowable voltage range and apply or cut the power at once to prevent from chattering.





※Please use the power within rating power and apply.

● In case of 24VDC/DC, 100/110VDC model, isolated and limited voltage/current or Class 2 source should be provided for power supply.

● When supplying the power to the timer with 100-120VAC or 200-240VAC, approx. 0.5A will flow for 0.5 sec (AT8PMN-□), or for 0.05 sec (AT8PSN-□). When supplying the power to the timer with 24VDC, 100/110VDC approx. 1.5A will flow for 0.5 sec (AT8PMN-□), or for 0.05 sec (AT8PSN-□). Therefore be sure about the rating of contact and the power capacity.

● When performing dielectric voltage test or insulation resistance test while the unit is installed on control panel,
- Please isolate this unit from the circuit of control panel.
- Please make all terminals of this unit short-circuited.

● Do not use this unit at below places.
- Place where there is severe vibration or impact.
- Place where strong alkalis or acids is used.
- Place where there is direct ray of the sun
- Place where strong magnetic field or electric noise is generated.

● This unit may be used in the following environments.
- Indoor
- Altitude: Max. 2,000m
- Pollution Degree 2
- Installation Category II

DIN W48×H48mm Solid State ON Delay Timer

■ Features

- DIN W48×H48mm
- Easy and simple time setting
- Cost-effective
- Easy time setting
- Wide range of time
- Power supply
  - ATE: 110/220VAC 50/60Hz
  - ATE1, ATE2: 110VAC, 220VAC 50/60Hz, 12VDC, 24VDC

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

ATE | □ | — | **10** | **S**

Time unit

S	sec (1, 3, 6, 10, 30, 60)
M	min (3, 6, 10, 30, 60)
H	hour (3, 6, 12, 24)

Time range

Number	Max. time range

Output

No mark	Time-limit SPDT (1c), Instantaneous SPST (1a)
1	Time-limit DPDT (2c)
2	Time-limit SPDT (1c), Instantaneous SPDT (1c)

Item

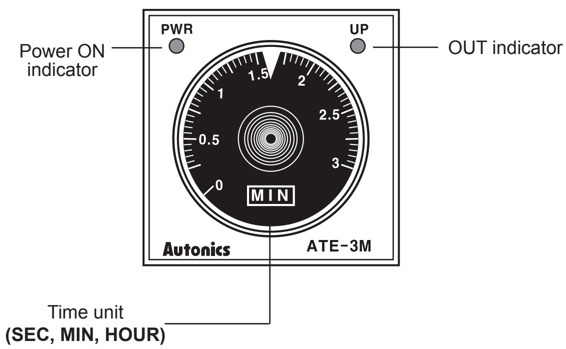
ATE	General-purpose analog timer

■ Specifications

Model		**ATE – □S □M □H**	**ATE1 – □S □M □H**	**ATE2 – □S □M □H**
Function		**Power ON Delay**		
Control time setting range※1		0 sec to 24 hour		
Power supply		110/220VAC 50/60Hz	110VAC, 220VAC 50/60Hz, 12VDC, 24VDC	
Allowable voltage range		90 to 110% of rated voltage		
Power consumption		Max. 10VA (110/220VAC 50/60Hz), Max. 2W (24VDC, 12VDC)		
Return time		Max. 200ms		
Timing operation		Power ON start		
Control output	Contact type	Time limit SPDT (1c), Instantaneous SPST (1a)	Time limit DPDT (2c)	Time limit SPDT (1c), Instantaneous SPDT (1c)
	Contact capacity	250VAC 3A resistive load		
Relay life cycle	Mechanical	Min. 10,000,000 operations		
	Electrical	Min. 100,000 operations (250VAC 3A resistive load)		
Repeat error		Max. ±0.3%		
SET error		Max. ±5% ±0.05sec		
Voltage error		Max. ±0.5%		
Temperature error		Max. ±2%		
Insulation resistance		Over 100MΩ (at 500VDC megger)		
Dielectric strength		2,000VAC 50/60Hz for 1 minute		
Noise immunity		±2kV the square wave noise (pulse width: 1μs) by the noise simulator		
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hours		
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min		
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times		
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times		
Environment	Ambient temperature	-10 to 55℃, storage: -25 to 65℃		
	Ambient humidity	35 to 80%RH		
Unit weight		Approx. 75g		

※1: Refer to time specifications for control time setting range by model.
※Environment resistance is rated at no freezing or condensation.

■ Unit Description

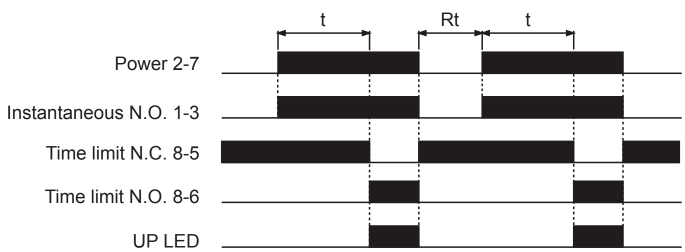
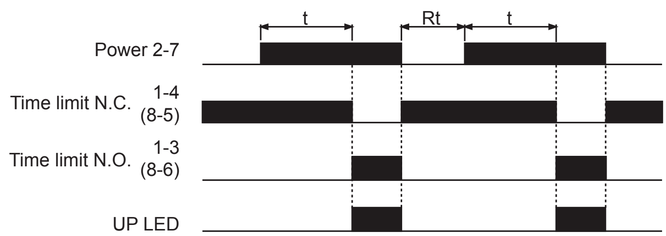
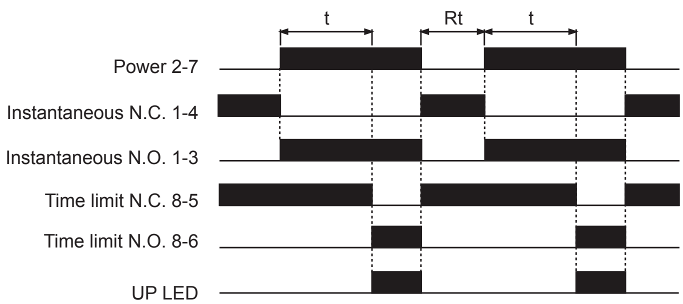


■ Time Specifications

Model	Time range	Time unit	Time setting range
ATE□T-□S	1	SEC	0 to 1sec
	3		0 to 3sec
	6		0 to 6sec
	10		0 to 10sec
	30		0 to 30sec
	60		0 to 60sec
ATE□T-□M	3	MIN	0 to 3min
	6		0 to 6min
	10		0 to 10min
	30		0 to 30min
	60		0 to 60min
ATE□T-□H	3	HOUR	0 to 3hour
	6		0 to 6hour
	12		0 to 12hour
	24		0 to 24hour

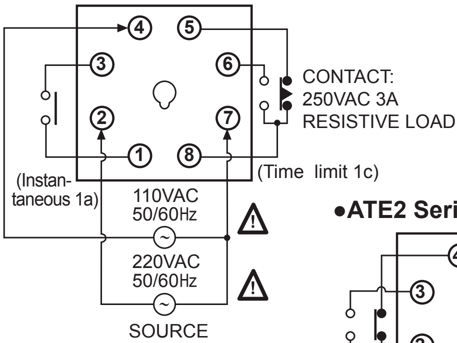
■ Output Operation Mode

t: Setting time, Rt: Reset time

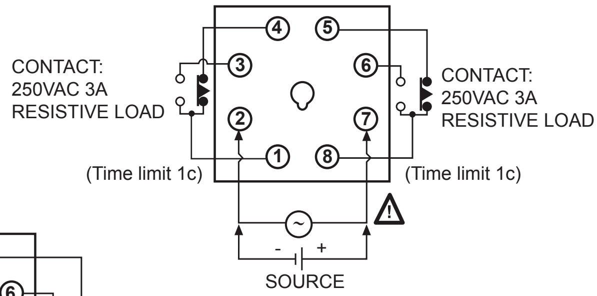
Model	Time chart
ATE	
ATE1	
ATE2	

Connections

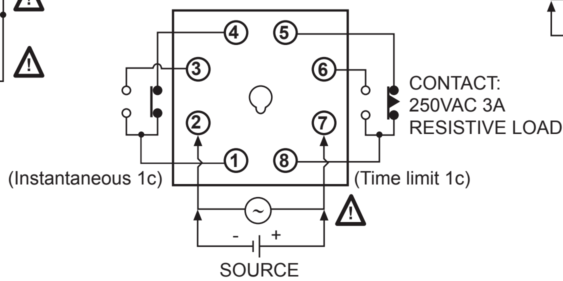
● **ATE Series**



● **ATE1 Series**



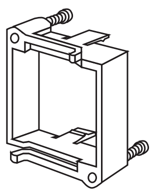
●**ATE2 Series**



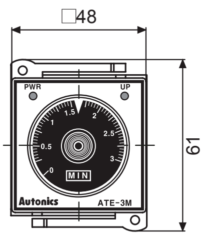
Dimensions

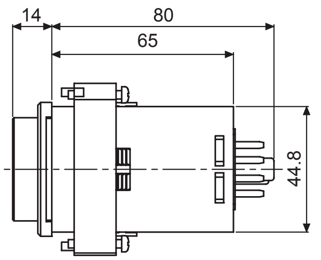
(unit: mm)

● **Bracket (sold separately)**

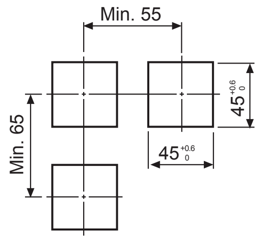


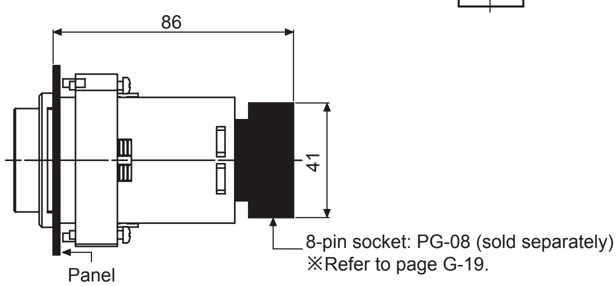
(model: PGB48-W)





● **Panel cut-out**





Proper Usage

◎ Environment

Please avoid the following places:
- Place where the unit may be damaged by strong impact or vibration.
- Place where corrosive gas or flammable gas and water, oil, dust exist.
- Place where magnetic and electrical noise occur.
- Place where high temperature and humidity is beyond rated specification.
- Place where there is strong alkalis and acids.
- Place where there is direct ray of sun.

◎ Noise

- We test 2kV, Pulse width 1μs against Impulse voltage between power terminals and 1kV, Pulse width 1μs at noise simulator against external noise voltage. Please install MP condenser (0.1 to 1μF) or oil condenser between power terminals when over impulse noise voltage occurs.
- When testing dielectric voltage and insulation resistance of the control panel with this unit installed.
  - Please isolate this unit from the circuit of control panel.
  - Please make all terminals of this unit short-circuited. (it prevents the damage of inner circuit.)

W72×H72mm, Weekly/Yearly Timer

■ Features

- Easy to check and change the program setting
- Customizable weekly or yearly unit time setting and control by user
- Includes daylight saving time function
- Built-in 2 independent control output (relay)
- Flush and surface mounting are in one unit
- Enable to mount on DIN rail with base plate

⚠ Please read "Caution for your safety" in operation manual before using.

c UL US

■ Ordering Information

LE7 M – 2

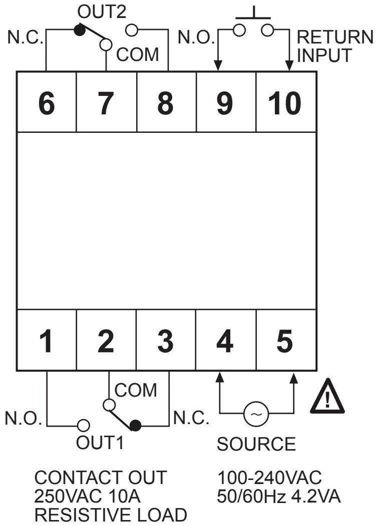
Output	2	2 Relay outputs
Size	M	DIN W72×H72mm
Item	LE7	Weekly/Yearly timer

■ Specifications

Model		LE7M-2
Power supply		100-240VAC 50/60Hz
Allowable voltage range		90 to 110% of rated voltage
Power consumption		Max. 4.2VA (100-240VAC)
RETURN input		Short-circuit or open by switch or relay
Timing program		48 steps for weekly, 24 steps for yearly
Operation mode		ON/OFF mode, cycle mode, pulse mode
Mounting		Front panel, surface, DIN rail
Time deviation		±15sec/month (ambient temperature: 25℃) (±4sec/week)
Temperature error		±0.01% ±0.05sec (ratio by set time)
Memory protection		Over 5 years (at 25℃)
Control Output	Contact type	SPDT (Single Pole Double Throw)
	Contact capacity	250VAC 10A resistive load
	Output number	Independent 2 output (1c×2)
Relay life cycle	Mechanical	Min. 5,000,000 operations (switching capacity: 30 times/min)
	Electrical	Min. 50,000 operations<switching capacity: 20 times/min, 250VAC 10A (resistive load)>
Insulation resistance		Over 100MΩ (at 500VDC megger)
Dielectric strength		2,000VAC 50/60Hz for 1minute
Noise immunity		±2kV the square wave noise (pulse width: 1μs) by the noise simulator
Environment	Ambient temperature	-10 to 55℃, storage: -25 to 65℃
	Ambient humidity	35 to 85%RH
Unit weight		Approx. 272g

※Environment resistance is rated at no freezing or condensation.

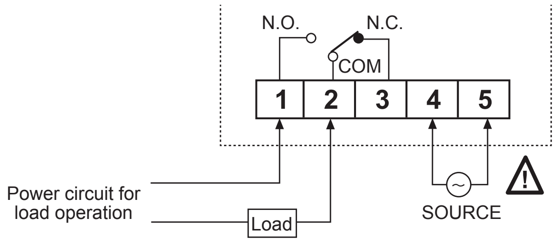
■ Connections



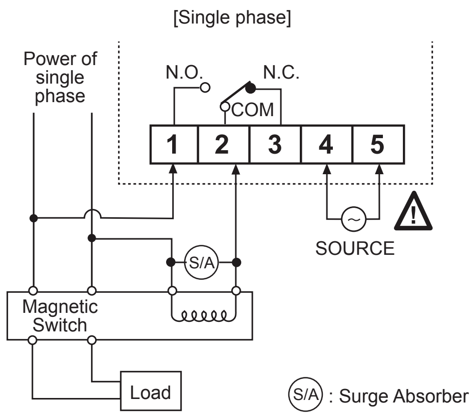
■ Load Connection

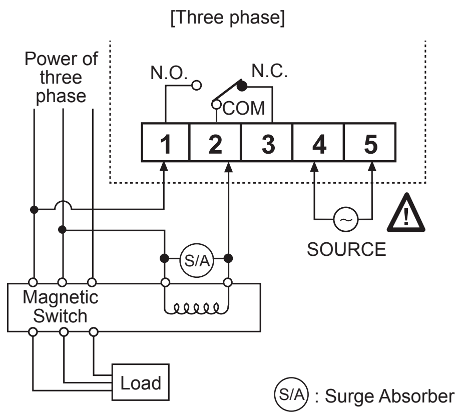
You must connect a surge absorber to the both ends of the load to prevent from damage or malfunction of this unit when controlling non-resistive load (E.g.: magnetic switch, etc).

● In case of controlling the load directly



● In case of controlling the load by using a magnetic switch

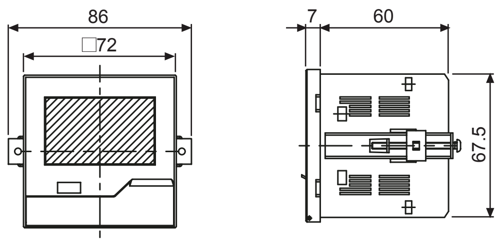




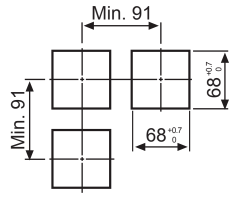
■ Dimensions & Mounting

(unit: mm)

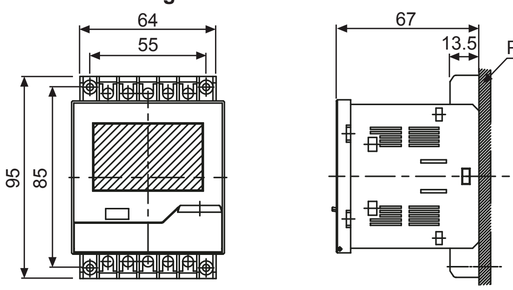
1) Front panel mounting



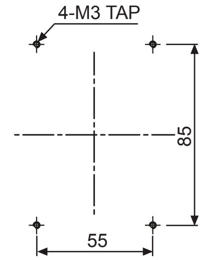
● Panel cut-out



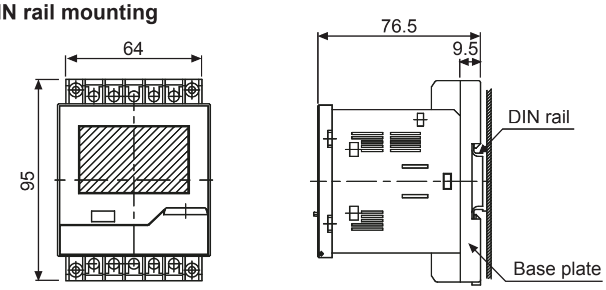
2) Surface mounting



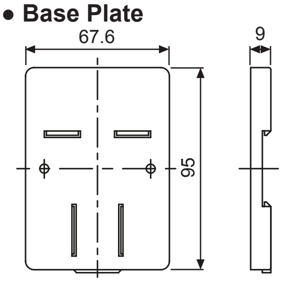
● Panel hole cut-out



3) DIN rail mounting



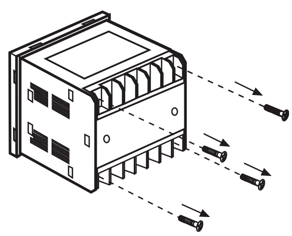
● Base Plate



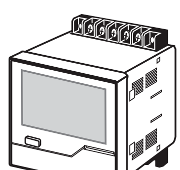
■ How To Switch From The Flush Mounting To Surface Mounting Type

Remove terminals from the body after unscrewing terminal screws, and then assemble terminals to the body after rotating terminals as shown below.

① Unscrew 4 bolts from terminal block.

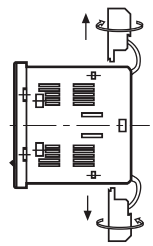


(front panel mounting)

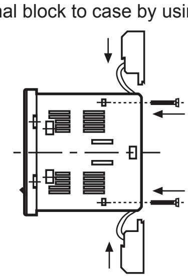


(surface mounting)

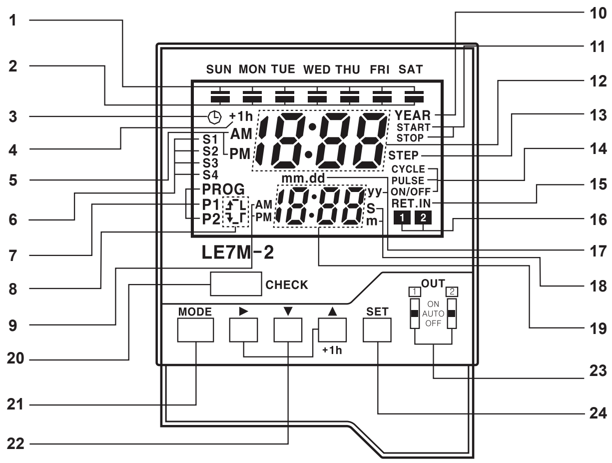
② Detach terminal block from case and then rotate it 180 degree.



③ Assemble terminal block to case by using the 4 bolts.



■ Unit Description



1. Day indicator
2. Day display
● Light: Day is selected.
● Light-out: Day is not selected.
3. Current time setting mode indicator
4. DST display (daylight saving time)
5. AM/PM display
6. Season display
7. Program display
8. Display ON time/day, OFF time/day, ON time width, OFF time width
9. AM/PM display
10. YEAR display
: It turns ON when set, check, modify, delete yearly program, set yearly holidays and operate yearly program.
11. Yearly START/STOP day display
12. Main display
13. Remaining step display
14. Operation mode display
15. Power restore input display
16. Output mode display
17. Year, month, date display
18. Unit of pulse width display
19. Sub-display
20. CHECK key
21. MODE key
22. Operation key
23. Output selection switch
● AUTO: Control output according to the set program.
● ON: Output is ON. (operation)
● OFF: Output is OFF.
※Output 1 (OUT1) and Output 2 (OUT2) are selected independently.
24. SET key

■ Functions

◎ Program setting and output operation

Output 1/Output 2 operates according to Program 1 and Program 2.

◎ Definitions

● Record: A part of program that controls output operation.
● Step: Basic component of record.

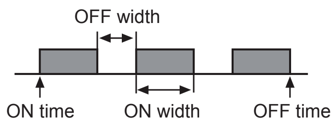
◎ Operation modes

If the operation mode of Program 1 (program 2) is set on pulse mode initially, the pulse mode is fixed for additional programs.
If the operation mode of Program 1 (program 2) is set on ON/OFF or cycle mode initially, pulse mode cannot be used for additional programs.

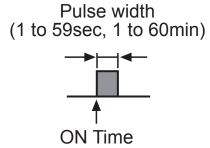
● Weekly ON/OFF mode
Output operation by ON/OFF set time.
• Min. time setting unit: 1 min
• It is able to set ON/OFF day separately.
• One record in two Steps
(ON day/ON time, OFF day/OFF time)

● Weekly Cycle mode
Output turns ON for ON time and turns OFF for OFF time. And the ON/OFF cycle is repeated.

• Set range for ON/OFF time width
: 1min to 12 hour 59min
• One record in 3 steps (ON day/ON time, OFF day/OFF time, ON time width/OFF time width)

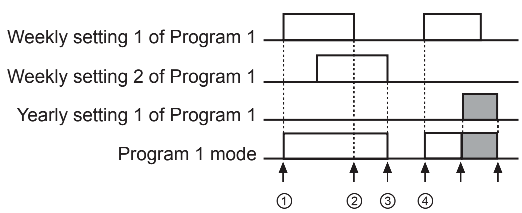


● Weekly pulse mode
Output turns ON at ON time for a specified pulse width. (pulse width: 1 to 59sec, 1 to 60min)
• One record in two steps (ON day/ON time, pulse width)



● Yearly ON/OFF mode
Output turns ON at ON time on START date and turns OFF at OFF time on STOP date.
• One record in three steps
(START/STOP date, ON/OFF time)
● Yearly pulse mode
Output turns ON at ON time on START date and turns OFF at OFF time on STOP time for a specified pulse width repeatedly. (pulse width: 1 to 59sec, 1 to 60min).
• One record in three steps (START/STOP date, ON time, pulse width)

◎ Program operation



● ① to ②: Operated by weekly setting 1 of Program 1.
● ② to ③: Operated by weekly setting 2 of Program 1.
● ④ to ⑤: Operated by weekly setting 1 of Program 1.
● ⑤ to ⑥: Operated by yearly setting 1 of Program 1.
(during weekly program operation at 12:00 AM on START date, the weekly program operation stops, and it changes to yearly program operation mode. The yearly program operation stops at 12:00 AM on the next day of STOP date.)

◎ Display and change of next mode

● The day of next mode in Program 1 or Program 2 is displayed on the day indicator, and the time of next mode is displayed on the lower row of screen.
Press **SET** + **CHECK** in RUN mode it is changed from program 1 to program 2 or from program 2 to program 1.
● In ON/OFF operation mode, set ON time and OFF time to next mode. In Pulse operation mode, set Pulse ON time to next mode.

◎ Power restore mode

In setting group 2-Level 2 (power restore), select auto [At] or normal [nor] by ▲ or ▼ key, and press **SET** key to set.
● Auto [At] power restore mode
Output (OUT1, OUT2) operates according to program when power turns on again after power failure.
● Normal [nor] power restore mode
When power turns on again after power failure, output is kept OFF and **RET.IN** flashes on the panel. When power restore input is detected, **RET.IN** turns off and output operates according to program.
• Power restore input
Input contact signal in external "Return input terminals (⑨ to ⑩)" by switch or relay, or press **SET** key for 3sec in RUN mode.
Please use reliable contacts enough to flow 0.1mA of current at 5VDC when use switch or relay.

◎ Season switching mode

This feature uses for setting seasonal weekly operation mode.
To operate this mode, save starting month and date, ending month and date of each season which displays S1, S2, S3, S4 then set day and time of each season in weekly program setting. It is also able to operate only in summer and winter season. (S1: set summer season, S2: set winter season, S3/S4: do not set)
At the season switching selection LEVEL 2 status in setting 2 group (SEn turns ON, oFF flashes), select ON [on] by pressing ▲ or ▼ key and press **SET** key to complete the season switching.
Be sure that if changing season switching from oFF to on or, on to oFF, the weekly program 1 (P1) and the weekly program 2 (P2) which are set before are deleted.
● ON [on] mode
Weekly program is switched automatically by season switching.
• Period setting per season
① At the season switching selection LEVEL 2 status in setting 2 group (SEn flashes, the set season turns ON, **START** and **STOP** turn ON), press **SET** key.
② Advance to the flashing position of season selection among S1, S2, S3, S4 by ▲ or ▼ key and press **SET** key.
③ After set START month, date per season and press **SET** key.
④ **SET** key is pressed after set STOP month, date per season, it is advanced to LEVEL1 of period setting per season. Add or adjust the period setting by **SET** key.
● It is disable to use when it is OFF [oFF].
● If season terms are overlapped, these are prioritized in S4>S3>S2>S1 order.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

◎ Daylight saving time

To utilize daylight during the summer season, daylight saving time is adjusted forward one hour from standard time.

In setting group 2-LEVEL 2 (dSt turns ON, At or nor flashes.), select Auto [At] or Normal [nor] by ▲ or ▼ key and press **SET** key to set.

● Auto[At] Daylight Saving Time mode

Current time will be faster as an hour when it is started and slower as an hour when it is finished.

• Automatic Daylight Saving Time period setting

① Automatic Daylight Saving Time period setting LEVEL 1 of setting group 2. (dSt flashes and **START** and **STOP** turn ON.)

② Set START date (month, date) of automatic Daylight Saving Time mode and press **SET** key.

③ Set START time (AM/PM, hour) of automatic Daylight Saving Time mode and press **SET** key.
But, the minute will be fixed as 00.

④ Set STOP date (month, date) of automatic Daylight Saving Time mode and press **SET** key.

⑤ Set STOP time (AM/PM, hour) of automatic Daylight Saving Time mode and press **SET** key. But, the minute will be fixed as 00.

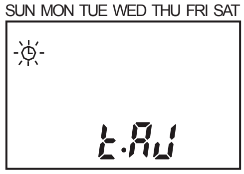
● Normal [nor] daylight saving time mode

Press **+1h** key over 3sec in RUN mode, **+1h** turns ON and current time is faster as an hour and **+1h** turns ON out or vice versa, when press **+1h** key over 3sec again.

◎ Current time setting

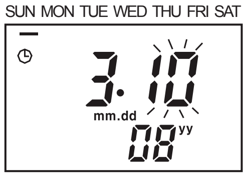
(E.g.) Set the current time as 10, Mar, 2008, 5:10 PM.

① Advance to the current time setting mode



MODE + **SET** keys are pressed over 3sec in RUN mode, it is advanced to current time setting of setting group 2 and clock will be flashed and t.AJ will be lighted in second display part, press **SET** key.

② Year, month, date setting

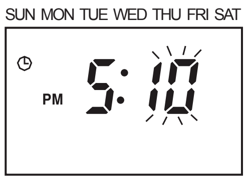


Press ▲ or ▼ key to set 08 (year 2008) and move the flashing digit to position month by ▶ key.
Press **SET** key after press ▲ or ▼ key to set date 10.

③ Current time (AM, PM) setting

Press ▲ or ▼ key to select PM and move the flashing digit to position hour by ▶ key.

④ Current time (hour, min) setting



Press ▲ or ▼ key to set 5 PM and move the flashing digit to position min by ▶ key. Press ▲ or ▼ key to set 10min and press **SET** key and it is returned to RUN mode when press **MODE** key over 3sec

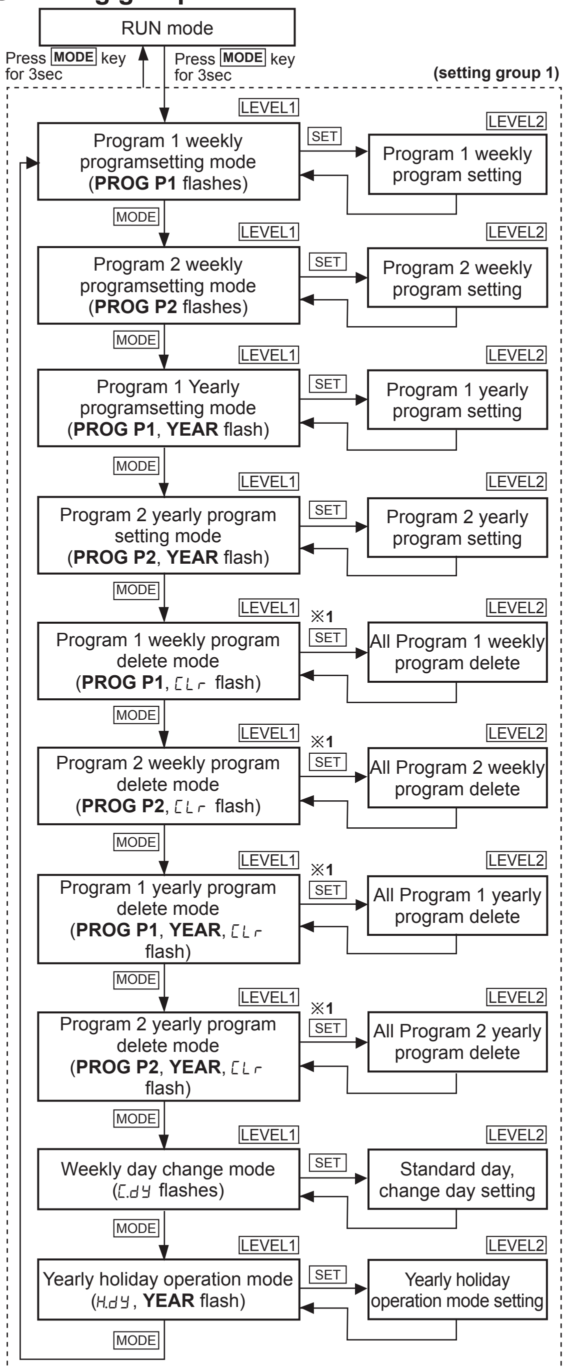
● It advances to "①Current time setting mode" in ON status and set current time as shown above ② to ④ by **SET** key.

● Current time is set up to 31, Dec., 2099.

● Check current year/month/date in RUN mode When ▶ key is pressed over 3sec in RUN mode, it advances to current year/month/date display. After display current year/month/ date for 3sec, it returns to RUN mode displaying current display.

▣ Program Setting

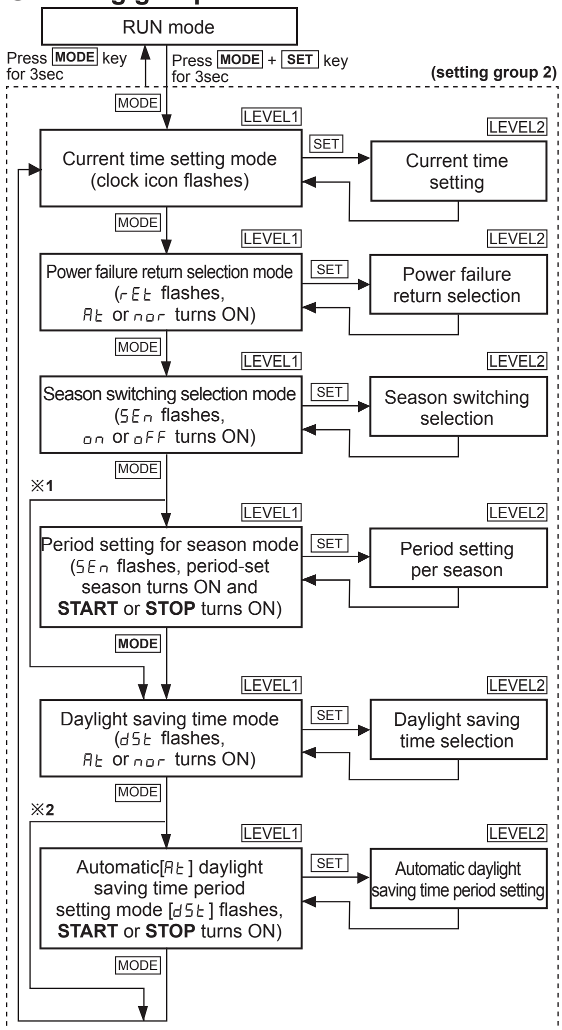
◎ Setting group 1



※1: When the CLr turns ON, hold the SET key for 3 sec, the ALL turns ON and all programs are deleted.

- When it advances to setting group 1 in RUN mode, output (OUT1, OUT2) will be OFF.
- It returns to previous setting group 1 when power of time switch is ON again in setting group 1.
- When MODE key is pressed in LEVEL2 of setting group 1, current setting will be canceled and it returns to previous LEVEL1.

◎ Setting group 2



※1: Season switching selection is oFF.
※2: Automatic switching selection of Daylight Saving Time is Normal [nor].

- When it advances to setting group 2 in RUN mode, output (OUT1, OUT2) will be OFF.
- When power of time switch is ON again in setting group 2, it returns to previous setting group 1.
- Front MODE key is pressed in LEVEL2 of setting group 2, it returns to previous LEVEL1.
- When season switching selection is changed from oFF to on or on to oFF, previous set weekly program will be deleted.

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(E) Pressure Sensors
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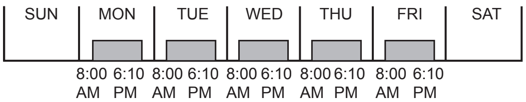
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

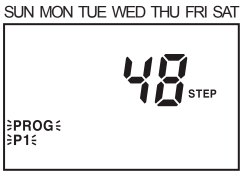
◎ Weekly program setting

● Weekly ON/OFF mode

(E.g.) Output 1 (OUT1) is ON from Monday to Friday at 8:00 AM and OFF at 6:10 PM.

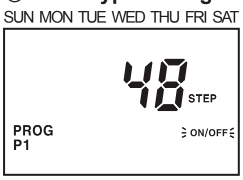


① Advance to program 1 (P1) weekly program setting mode



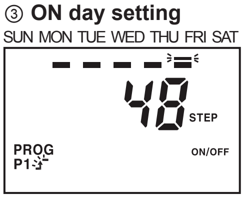
MODE key is pressed over 3sec in RUN mode, **PROG P1** flashes and press SET key.

② Mode type setting



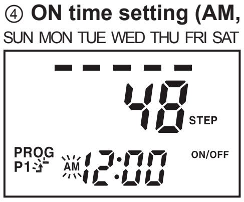
Press SET key in ON/OFF mode.

③ ON day setting



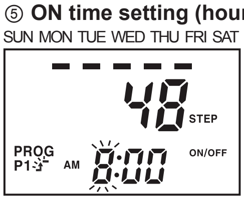
Press ▶ key to move the indicator to monday, it will be lighted when ▲ or ▼ key are pressed and move it to tuesday by ▶key.
Press SET key after tuesday, wednesday, thursday, friday turn ON.

④ ON time setting (AM, PM)



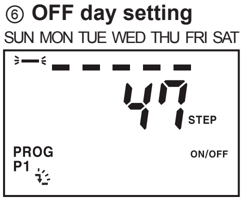
▶key is pressed, move the flashing to hour position and select PM by ▲ or ▼ key when ON time is afternoon.

⑤ ON time setting (hour, min)



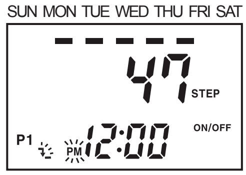
Set 8:00 by ▲ or ▼ key and press SET key.

⑥ OFF day setting



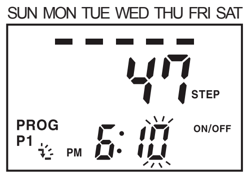
Press SET key to check ON/OFF day.

⑦ OFF time setting (AM, PM)



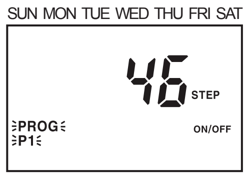
Select PM by ▲ or ▼ key and move the flashing to hour position by ▶ key.

⑧ OFF time setting (hour, min)



Move the flashing to minute position after set 6:00 by ▲ or ▼ key and set the minute as 10 and press SET key.

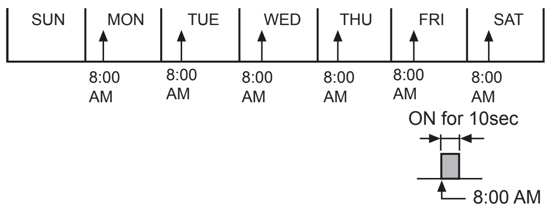
⑨ Complete to set



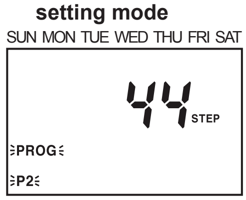
Press SET key to set additional program.

● Weekly pulse mode

Output 2 (OUT2) is ON for 10sec at 8:00AM from monday to friday during S2 season in case, period of S1, S2, S3, S4 is set.

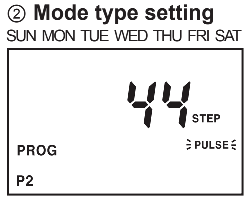


① Program 2 (P2) advance to weekly program setting mode



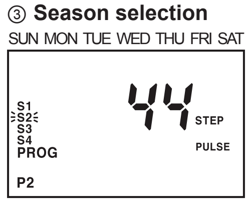
MODE key is pressed for 3secin RUN mode, **PROG P1** is flashed and press MODE key again, **PROG P2** flashes and press SET key.

② Mode type setting



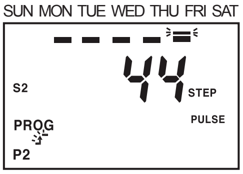
Press ▲ or ▼ key when ON/OFF flashes, Pulse flashes and press SET key.

③ Season selection



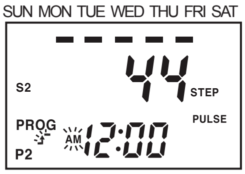
Press ▲ or ▼ key to select season S2 and press SET key.

④ **ON day setting**



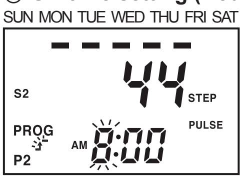
Press ▶ key to move the indicator to Monday, it will be lighted when ▲ or ▼ key is pressed and move it to Tuesday by ▶ key.
Press SET key after light Tuesday, Wednesday, Thursday and Friday.

⑤ **ON time setting (AM, PM)**



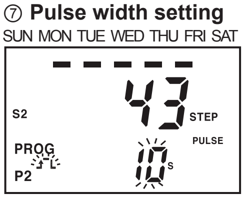
Press ▶ key, move the flashing to hour position and select PM by ▲ or ▼

⑥ **ON time setting (Hour, Min)**



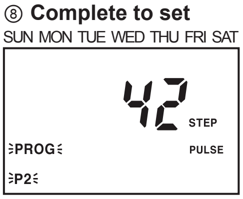
Set 8:00 by ▲ or ▼ key and press SET key.

⑦ **Pulse width setting**



Press ▲ or ▼ key to select pulse duration as 10s and press SET key.

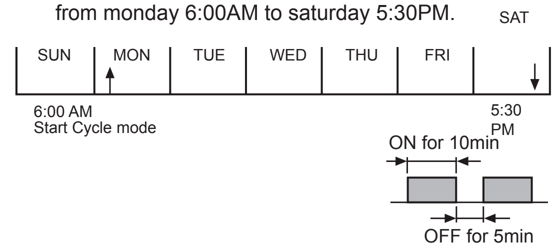
⑧ **Complete to set**



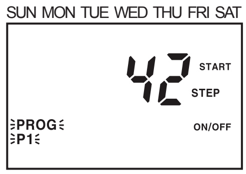
Press SET key to set additional program.

● **Weekly cycle mode**

(E.g.) Output 1 (OUT1) is ON for 10min and OFF for 5min from monday 6:00AM to saturday 5:30PM.

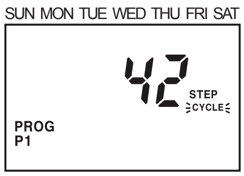


① **Advance to program 1 (P1) weekly program setting mode**



In RUN mode, press MODE key for 3 sec and **PROG P1** flashes. Press SET key.

② **Mode type setting**

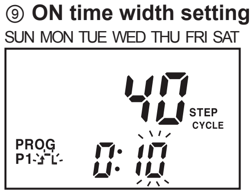


Press ▲ or ▼ key when ON/OFF flashes, CYCLE flashes and press SET key.

③ to ⑧

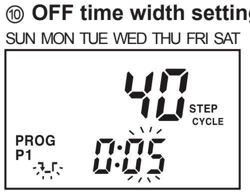
Refer to ③ to ⑧ of "**•Weekly ON/OFF mode**" to set ON day, ON time, OFF day and OFF time.

⑨ **ON time width setting**



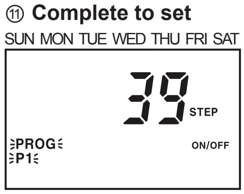
Press ▶ key to move the flashing to minute position and set as 10min by ▲ or ▼ key and press SET key

⑩ **OFF time width setting**



Press ▶ key to move the flashing to minute position and set as 5min by ▲ or ▼ key and press SET key.

⑪ **Complete to set**



Press SET key to set additional program.

◎ Weekly day change

It operates when the specified day mode is required to install in other day from the set day and it returns to previous program setting automatically when it is finished. It is applied to program 1 (P1) and program 2 (P2).

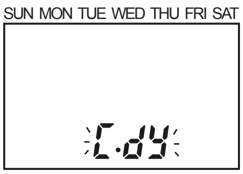
● Weekly day change cancellation

① Change current year, month, date in current time setting mode
② Change standard day
③ Delete all program in program 1 (P1) and program 2 (P2)
④ Season switching

● Setting example

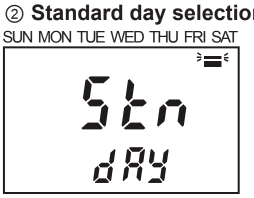
Output 1 (OUT1) is ON in Saturday at 9:00AM and OFF at 12:00PM and it is ON 8:30AM and OFF at 6:00PM from Monday to Friday and the mode of Monday and Tuesday is operated temporarily as Saturday (standard) program.

① Advance to weekly day change mode



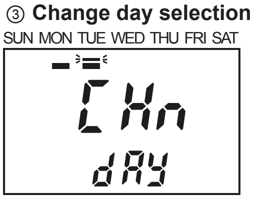
Press MODE key over 3sec to move to the setting group1 in RUN mode and press it repeatedly until C.dY is flashed in second display part and press SET key.

② Standard day selection



Press ▶ key to move the indicator to saturday and press SET key. after select saturday as standard day (sat turns ON) by ▲ or ▼ key.

③ Change day selection



Press ▶ key to move the indicator to monday and select monday to change (mon turns ON) by ▲ or ▼ key and repeat the procedure to select tuesday to change (tue turns ON) and press SET key to complete.

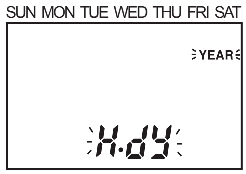
◎ Yearly holiday mode

It operates to off the output without program adjustment during previously set yearly holiday period available from present year to 31, Dec. of the next year.
Designate the start date of yearly holiday and year of end date as every year [- -] to repeat the holiday mode for specified in every year.

● Setting example

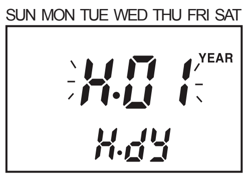
Set every year 5, May to off the output (OUT1, OUT2).

① Advance to yearly holiday mode



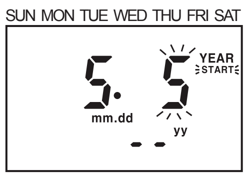
Press MODE key over 3secto move to the setting group1 in RUN mode and press it repeatedly until H.dY flashes in second display part and press SET key.

② Yearly holiday number display



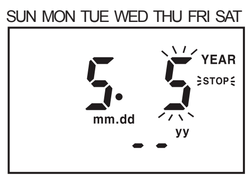
Press SET key after check yearly holiday number.

③ Start date of yearly holiday setting



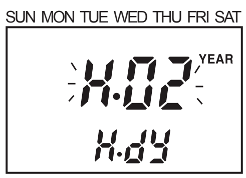
Press ▶ key until month position flashes and set May by ▲ or ▼ key and press ▶ key until date position flashes. Press SET key after set 5th by ▲ key.

④ End date of yearly holiday setting



The flashing is moved to month position directly and press ▲ or ▼ key to set May and press ▶ key until date position flashes.
Press SET key after set 5th by ▲ or ▼ key.

⑤ Complete to yearly holiday



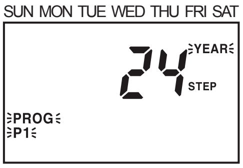
Press MODE key to finish the additional yearly holiday setting and press SET key to set .
※It is able to set yearly holiday up to 12 times.

◎ Yearly program setting

● Yearly ON/OFF mode

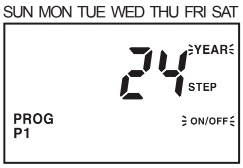
(E.g.) Output 1 (OUT1) is ON from every 5, Apr to 7, Apr at 9:00AM and OFF 5:10PM.

① Advance to program 1 (P1) yearly program setting mode



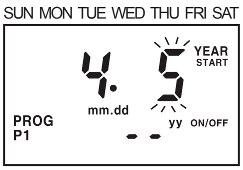
Press MODE key for 3sec in RUN mode, **PROG P1** is flashed and press MODE key 3 times more until **PROG P2 YEAR** flashes and press SET key.

② Mode type setting



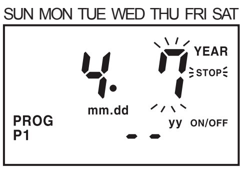
Press SET key when ON/OFF flashes.

③ Start date setting



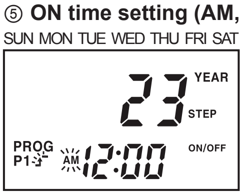
Press ▶ key until month position flashes and set April by▲ or ▼ key and press ▶ key until date position flashes. Press SET key after set 5th by ▲ or ▼ key.

④ End date setting



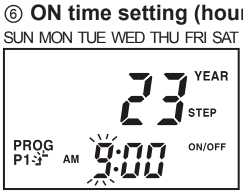
The flashing is moved to month position directly and press ▲ or ▼ key to set April and press ▲ or ▼ key until date position flashes. Press ▲ key after set 7th by SET key.

⑤ ON time setting (AM, PM)



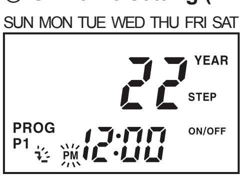
▶ key is pressed, move the flashing to hour position and select PM by ▲ or ▼ key when ON time is afternoon.

⑥ ON time setting (hour, min)



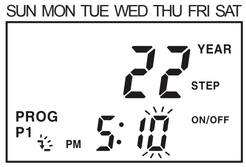
Press ▲ or ▼ key to set 9 and press SET key after check 00min

⑦ OFF time setting (AM, PM)



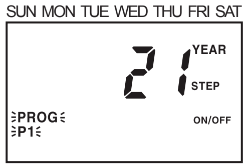
Select PM by ▲ or ▼ key and move the flashing to hour position by ▶ key.

⑧ OFF time setting (hour, Min)



Move the flashing to minute position after set 5:00 by ▲ or ▼ key and set the minute as 10 and press SET key.

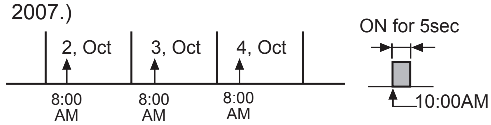
⑨ Complete to set



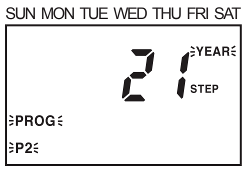
Press SET key to set additional program.

● Yearly pulse mode

(E.g.) Output 2 (OUT2) is ON from 2, Oct, 2008 to 4, Oct, 2008 at 10:00AM and OFF after 5sec (present is 2007.)

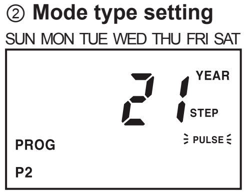


① Advance to program 2 (P2) yearly program setting mode



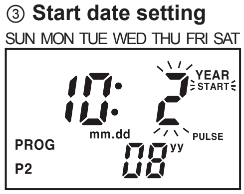
MODE key is pressed for 3secin RUN mode, **PROG P1** is flashed and press MODE key again, **PROG P2 YEAR** is flashed and press SET key.

② Mode type setting



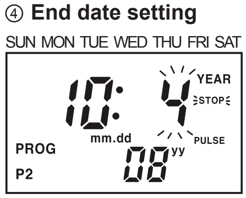
▲ or ▼ key is pressed when ON/OFF flashes to set pulse mode and press SET key.

③ Start date setting



Press ▲ or ▼ key twice to set 08 (year 2008) and move to month position by ▶ key.
Set Oct. by ▲ or ▼ key and move to date position by ▶ key and press SET key after set 2nd by ▲ or ▼ key.

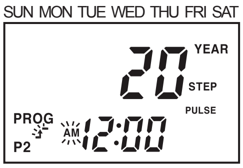
④ End date setting



The flashing is moved to month position directly by ▶ key and set 4th by ▲ or ▼ key after move it to date position by ▶ key, then press SET key.

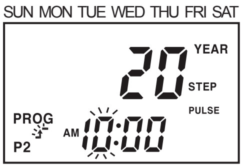
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

⑤ **ON time setting (AM, PM)**



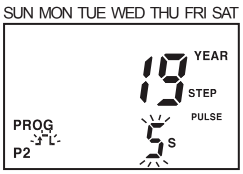
▶ key is pressed, move the flashing to hour position and select PM by ▲ or ▼ key when ON time is afternoon.

⑥ **ON time setting (hour, Min)**



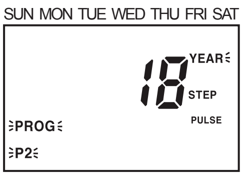
Press ▲ or ▼ key twice to set 10 and press SET key after check 00min

⑦ **Pulse width setting**



Press ▲ or ▼ key 4 times to select pulse width as 5s and press SET key.

⑧ **Complete to set**

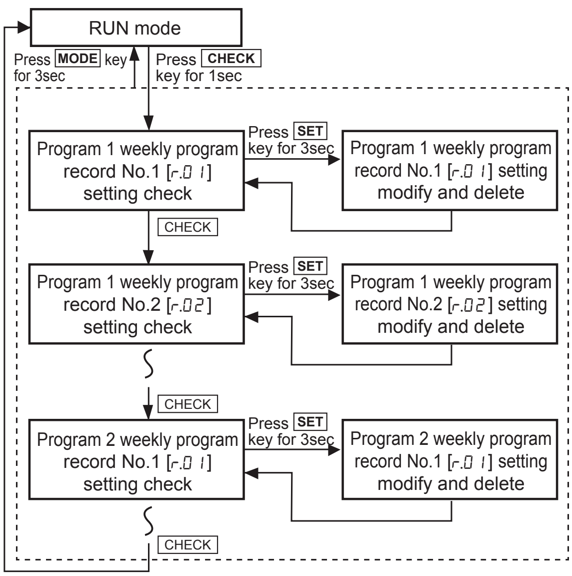


Press SET key to set additional program.

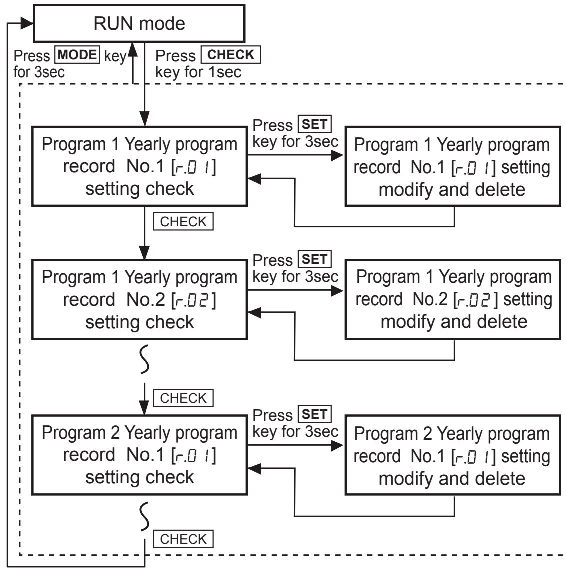
※It is able to set year of start/end date in yearly program setting up to 2 years later from the present year.

▣ Program Check, Modify And Delete

◎ Weekly program check, modify and delete



◎ Yearly program check, modify and delete



※**YEAR** turns ON when check, modify or delete yearly program.

- If any key is untouched for 60sec, it is returned to RUN mode in weekly or yearly program check.
- In weekly or yearly program check, it controls output according to program setting and output is OFF in modify or delete mode.
- When MODE key is pressed in weekly or yearly program record modify, delete stand by or delete mode, current work is cancelled and it is returned to check mode.
- Weekly or yearly program record modify and delete

(1) Program record modify

① When press SET key over 3sec in program check, Edt flashes in second display part, press SET key.

② It returns to check mode when finish the modify same as the above procedure.

(2) Program record delete

① When press SET key over 3sec in program check, Edt flashes in second display part, press ▲ or ▼ key until CLr flashes in second display part and press SET key.

② Press CLr key over 3sec when SET turns ON in second display part, it returns to program check.

W48×H48mm, Weekly/Yearly Timer

■ Features

- Easy to check and change the program setting
- Customizable weekly or yearly unit time setting and control by user
- Includes daylight saving time function
- 1 independent control output. (relay)
- Flush and surface, DIN rail mounting are in one unit.

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

LE365 S — 4 1

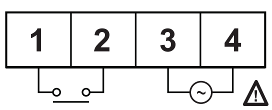
Output	1	1 Relay output
Power supply	4	100-240VAC 50/60Hz
Size	S	DIN W48×H48mm
Item	LE365	Weekly/Yearly timer

■ Specifications

Model		LE365S-41
Power supply		100-240VAC 50/60Hz
Allowable voltage range		90 to 110% of rated voltage
Power consumption		Max. 2.4VA (100-240VAC)
Timing program		48 steps for weekly, 24 steps for yearly
Operation mode		ON/OFF mode, cycle mode, pulse mode
Mounting		Panel flush, surface, DIN rail
Time deviation		±15sec/month (ambient temperature: 25℃) (±4sec/week)
Temperature error		±0.01% ±0.05sec
Memory protection		Over 5 years (at 25℃)
Control Output	Contact type	SPST (Single Pole Single Throw)
	Contact capacity	250VAC 15A resistive load
	Output number	Independent 1 output (1a)
Relay life cycle	Mechanical	Min. 5,000,000 operations (switching capacity 30 times/min)
	Electrical	50,000 operations<switching capacity 20 times/min, 250VAC 15A (resistive load)>
Insulation resistance		Over 100MΩ (at 500VDC megger)
Dielectric strength		2,000VAC 50/60Hz for 1minute
Noise immunity		±2kV the square wave noise (pulse width: 1μs) by the noise simulator
Environment	Ambient temperature	-10 to 55℃, storage: -25 to 65℃
	Ambient humidity	35 to 85%RH
Unit weight		Approx. 110g

※Environment resistance is rated at no freezing or condensation.

■ Connections



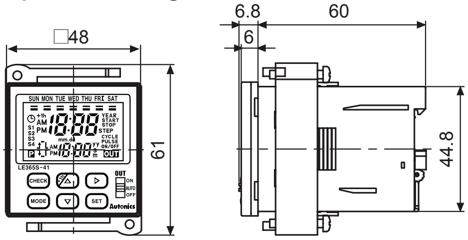
CONTACT OUT:
250VAC 15A
RESISTIVE LOAD

SOURCE:
100-240VAC
50/60Hz

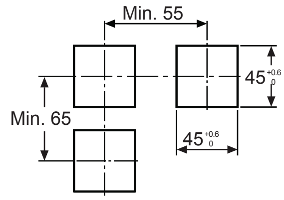
▣ Dimensions & Mounting

(unit: mm)

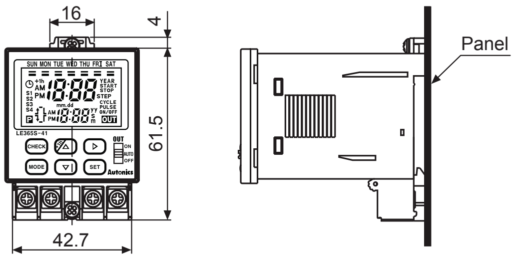
1) Front panel mounting



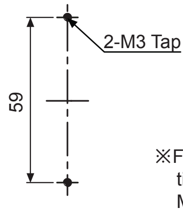
● Panel cut-out



2) Surface mounting

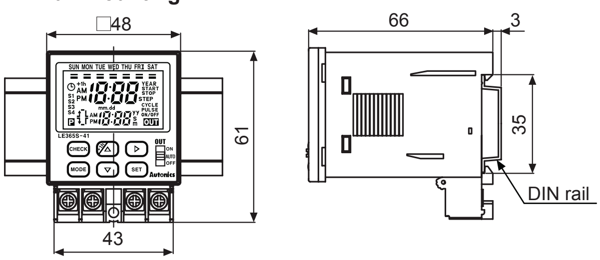


● Panel hole cut-out



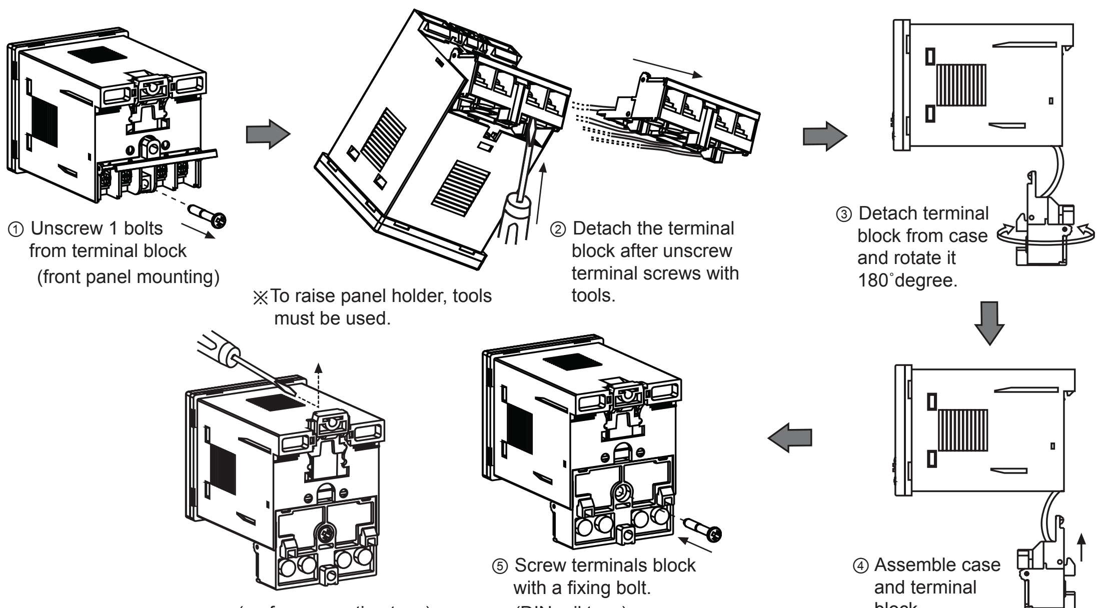
※Fix the Weekly/Yearly timer on the panel with M3 tapping screws.

3) DIN rail mounting



▣ How To Switch From The Flush Mounting To Surface Or DIN Rail Mounting Type

Remove terminals from the body after unscrewing terminals screws, and then assemble terminals to the body after rotating terminals as shown below.



① Unscrew 1 bolts from terminal block (front panel mounting)

※To raise panel holder, tools must be used.

② Detach the terminal block after unscrew terminal screws with tools.

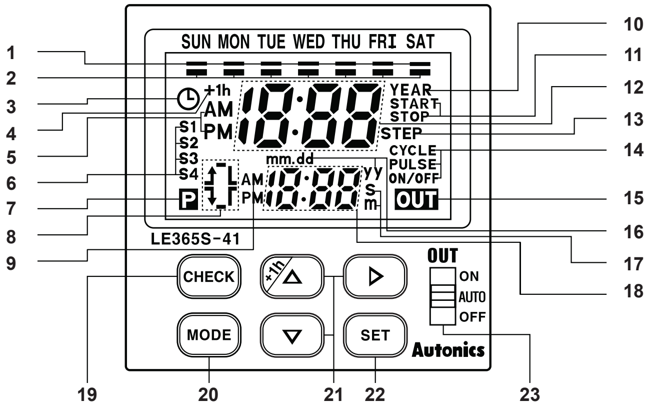
③ Detach terminal block from case and rotate it 180˚degree.

④ Assemble case and terminal block

⑤ Screw terminals block with a fixing bolt. (DIN rail type)

(surface mounting type)

▣ Unit Description



1. Day indicator
2. Day display
● Light: Day is selected.
● Light-out: Day is not selected.
3. Current time setting mode indicator
4. DST display (daylight saving time)
5. AM/PM display (main display)
6. Season display
7. Program display
8. Display ON time/day, OFF time/day, ON time width, OFF time width
9. AM/PM display (sub-display)
10. YEAR display
: It turns ON when set, check, modify, delete yearly program, set yearly holidays and operate yearly program.
11. Yearly START/STOP day display
12. Main display
13. Remaining step display
14. Operation mode display
15. Output mode display
16. Year, month, date display
17. Unit of pulse width display
18. Sub display
19. CHECK key
20. MODE key
21. Operation key
: Press +1h key over 3sec in RUN mode, DST mode is set and released.
22. SET key
23. Output selection switch
● AUTO: Control output according to the set program.
● ON: Output is ON. (operation)
● OFF: Output is OFF. (block)

▣ Functions

◎ Definitions
● Record: A part of program that controls output operation.
● Step: Basic component of Record.

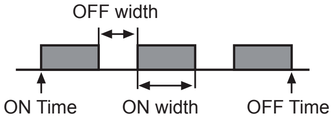
◎ Operation modes
● If the operation mode of Program 1 (program 2) is set on pulse mode initially, the pulse mode is fixed for additional programs. If the operation mode of Program 1 (program 2) is set on ON/OFF or cycle mode initially, pulse mode cannot be used for additional pulse programs.
● If the weekly operation mode is set on ON/OFF or cycle mode, the yearly operation mode is fixed on ON/OFF mode.
If the yearly operation mode is set on ON/OFF, the weekly operation mode is fixed on ON/OFF or cycle mode.
● If the weekly operation mode is set on pulse mode, the yearly operation mode is fixed on pulse mode. If the yearly operation mode is set on pulse mode, the weekly operation mode is fixed on pulse.

●Weekly ON/OFF mode
Output operation by ON/OFF set time.
• Min. time setting unit: 1 min
• It is able to set ON/OFF day separately.
• One record in two steps
(ON day/ON time, OFF day/OFF time)

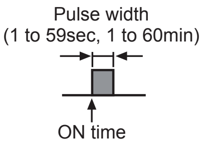
●Weekly Cycle operation
It outputs ON the set ON time width which is from Cycle operation ON time to Cycle operation OFF time, and it outputs OFF the set OFF time width.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

• Set range for ON/OFF time width
: 1min to 12 hour 59min
• One record in 3 steps (ON day/ON time, OFF day/OFF time, ON time width/OFF time width)



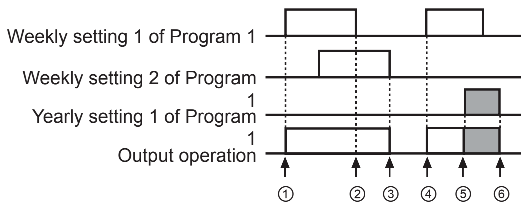
● Weekly pulse mode
Output turns ON at ON time for a specified pulse width. (Pulse width: 1 to 59sec, 1 to 60min)
• One record in two steps (ON day/ON time, pulse width)



● Yearly ON/OFF mode
Output turns ON at ON time on START date and turns OFF at OFF time on STOP date.
• One Record in three Steps (START/STOP date, ON/OFF time)

● Yearly pulse mode
Output turns ON at ON time on START date and turns OFF at OFF time on STOP time for a specified pulse width repeatedly.
• One record in three steps (START/STOP date, ON time, Pulse width)

◎ Program operation



● ① to ②: Operated by weekly setting 1 of Program 1.
● ② to ③: Operated by weekly setting 2 of Program 1.
● ④ to ⑤: Operated by weekly setting 1 of Program 1.
● ⑤ to ⑥: Operated by yearly setting 1 of Program 1. (during weekly program operation at 12:00 AM on START date, the weekly program operation stops, and it changes to yearly program operation mode. The yearly program operation stops at 12:00 AM on the next day of STOP date.)

◎ Display and change of next mode

● The day of next mode in Program is displayed on the day indicator, and the time of next mode is displayed on the lower row of screen.
● In ON/OFF operation mode, set ON time and OFF time to next mode. In Pulse operation mode, set Pulse ON time to next mode.

◎ Power restore mode

In setting group 2 - LEVEL2 (rEt turns ON, At or nor flashes), select Auto[At] or Normal [nor] by ▲ or ▼ key and press SET key to set.
● Auto [At] power restore mode
Output operates according to program when power turns ON again after power failure.
●Normal[nor] power restore mode
When power turns ON again after power failure, output is kept OFF and r.In flashes on the lower row of screen and power restore input (press SET key over 3 secin RUN mode) is applied, r.In turns OFF and output operates according to program.

◎ Season switching mode

This feature uses for setting seasonal weekly operation mode. To operate this mode, save starting month and date, ending month and date of each season which displays S1, S2, S3, S4 then set day and time of each season in weekly program setting. It is also able to operate only in summer and winter season. (S1: set summer season, S2: set winter season, S3/S4: do not set)
In setting group 2-Level 2 (SEn turns ON, oFF flashes.), select ON[on] by ▲ or ▼ key and press SET key to save.
When the season switching mode changed from oFF to on or vice versa, previous set programs are deleted.
● ON[on] mode
Weekly program is switched automatically by season switching.
• Period setting per season
① Press SET key in period setting per season mode of setting group 2. (SEn flashes, season with preset period turns ON and **START** and **STOP** turn ON.)
② Advance to the flashing position of season selection among S1, S2, S3, S4 by ▲ or ▼ key and press SET key.
③ After set **START** month, date per season and press SET key.
④ SET key is pressed after set **STOP** month, date per season, it is advanced to LEVEL1 of period setting per season. Add or adjust the period setting by SET key.
● It is disable to use when it is OFF [oFF].
● If season terms are overlapped, these are prioritized in S4>S3>S2>S1 order.

◎ Daylight saving time

To utilize daylight during the summer season, daylight saving time is adjusted forward one hour from standard time.

In setting group 2-LEVEL 2 (dSt turns ON, At or nor flashes), select Auto [At] or Normal [nor] by ▲ or ▼ key and press SET key to set.

● Auto [At] daylight saving time mode

Current time will be faster as an hour when it is started and slower as an hour when it is finished.

• Automatic daylight saving time period setting

① Automatic daylight saving time period setting LEVEL 1 of setting group 2.
(press SET key when dSt flashes and **START** and **STOP** turn ON.)

② Set START date (month, date) of automatic daylight saving time mode and press SET key.

③ Set START time (AM/PM, hour) of automatic daylight saving time mode and press SET key. But, the minute will be fixed as 00.

④ Set STOP date (month, date) of automatic daylight saving time mode and press SET key.

⑤ Set STOP time (AM/PM, hour) of automatic daylight saving time mode and press SET key. But, the minute will be fixed as 00.

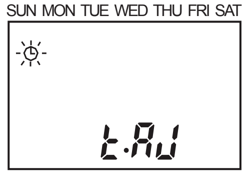
● Normal [nor] daylight saving time mode

Press +1h key over 3sec in RUN mode, "+1h" turns ON and current time is faster as an hour and "+1h" turns ON out or vice versa, when press +1h key over 3sec again.

◎ Current time setting

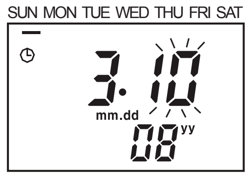
(E.g.) Set the current time as 10, Mar, 2008, 5:10 PM.

① Advance to the current time setting mode



MODE + SET keys are pressed over 3sec in RUN mode, it is advanced to current time setting of setting group 2 and clock will be flashed and t.AJ will be lighted in second display part, press SET key.

② Year, Month, Date setting

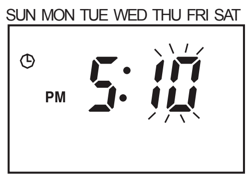


Press ▲ or ▼ key to set 08 (year 2008) and move the flashing digit to position month by ▶ key.
Press SET key after pressing ▲ or ▼ key to set date 10.

③ Current time (AM, PM) setting

Press ▲ or ▼ key to select PM and move the flashing digit to position hour by ▶ key.

④ Current time (hour, min) setting

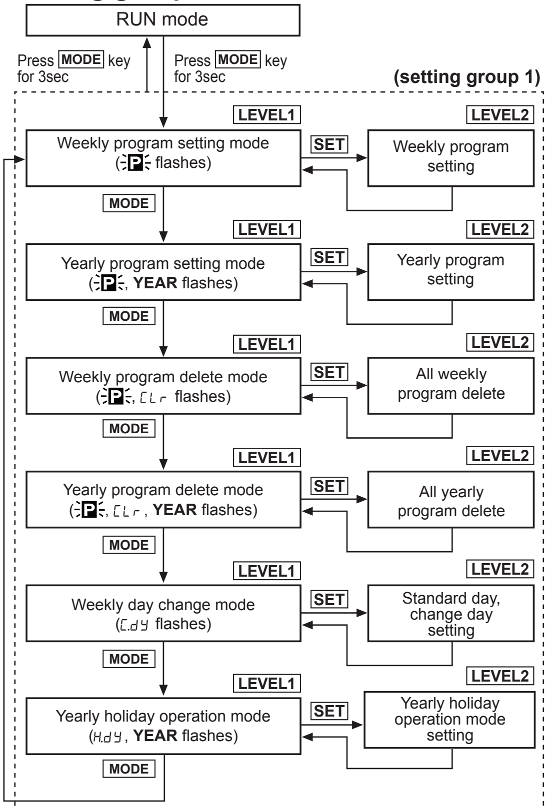


Press ▲ or ▼ key to set 5 PM and move the flashing digit to position min by ▶ key. Press ▲ or ▼ key to set 10min and press SET key and it is returned to RUN mode when pressing MODE key over 3sec

● It advances to to "①Current time setting mode" in ON status and set current time as shown above ② to ④ by SET key.
● Current time is set up to 31, Dec., 2099.
● Check current year/month/date in RUN mode When ▶ key is pressed over 3sec in RUN mode, it advances to current year/month/date display. After display current year/month/date for 3sec, it returns to RUN mode displaying current display.

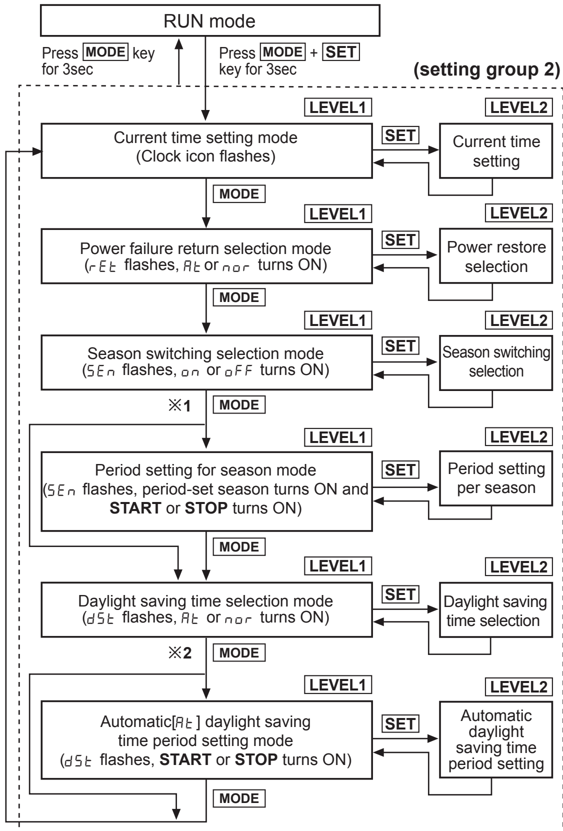
▣ Program Setting

◎ Setting group 1



- When it is advanced to setting group 1 in RUN mode, output will be OFF.
- It is returned to previous setting group 1 when power of time switch is ON again in setting group 1.
- When MODE key is pressed in LEVEL2 of setting group 1, current setting will be canceled and it is returned to previous LEVEL1.
- When press SET key to program over max. number of steps for weekly program in Weekly program setting mode of setting group 1-LEVEL 1, number of remaining steps and **STEP** flash and it returns to LEVEL 1 status.
- When press SET key to program over max. number of steps for yearly program in Yearly program setting mode of setting group 1-LEVEL 1, number of remaining steps and **STEP** flash it returns to LEVEL 1 status.

◎ Setting group 2



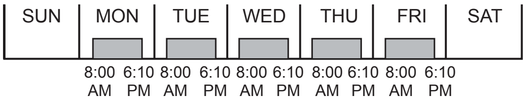
※**1:** Season switching selection is oFF.
※**2:** Automatic switching selection of Daylight Saving Time is Normal[nor].

- When it advances to setting group 2 in RUN mode, output (OUT1, OUT2) will be OFF.
- When power of time switch is ON again in setting group 2, it is returned to previous setting group 1.
- Front MODE key is pressed in LEVEL2 of setting group 2, it is returned to previous LEVEL1.
- When season switching selection is changed from oFF to on or on to oFF, previous set weekly program will be deleted.

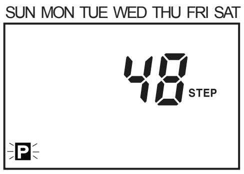
◎ Example of Weekly program setting

● Weekly ON/OFF mode

(E.g.) Output 1 (OUT1) is ON from Monday to Friday at 8:00 AM and OFF at 6:10 PM.

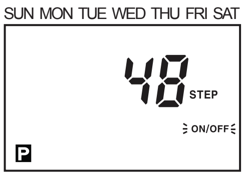


① Advance to weekly program setting mode



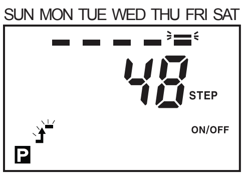
MODE key is pressed over 3sec in RUN mode P flashes and press SET key.

② Mode type setting



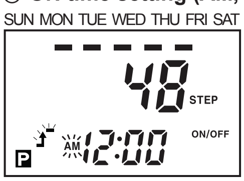
Press SET key in ON/OFF mode.

③ ON day setting



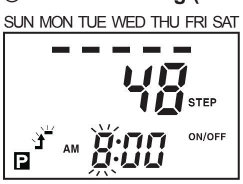
Press ▶ key to move the indicator to Monday, it will be lighted when ▲ or ▼ key are pressed and move it to Tuesday by ▶ key.
Press SET key after Tuesday, Wednesday, Thursday, Friday turn ON.

④ ON time setting (AM, PM)



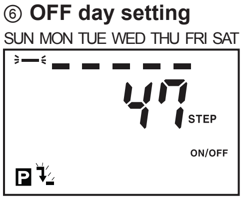
▶ key is pressed, move the flashing to hour position and select PM by ▲ or ▼ key when ON time is afternoon.

⑤ ON time setting (hour, min)



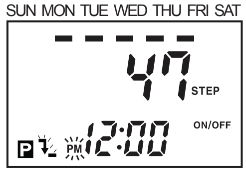
Set 8:00 by ▲ or ▼ key and press SET key.

⑥ OFF day setting



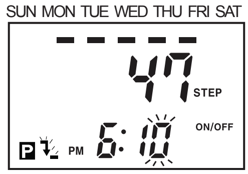
Press SET key to check ON/OFF day.

⑦ OFF time setting (AM, PM)



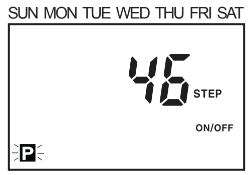
Select PM by ▲ or ▼ key and move the flashing to hour position by ▶ key.

⑧ OFF time setting (hour, min)



Move the flashing to minute position by ▶ key after set 6:00 by ▲ or ▼ key and set the minute as 10 by ▲ or ▼ key and press SET key.

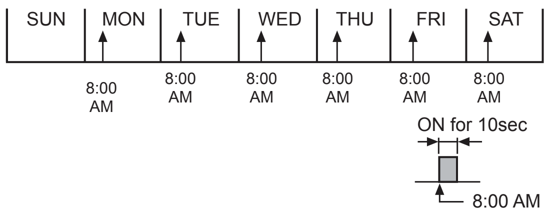
⑨ Complete to set



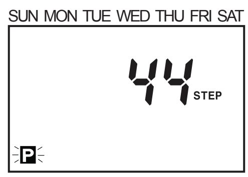
Press SET key to set additional program.

● Weekly Pulse mode

(E.g.) Output 2 (OUT2) is ON for 10sec at 8:00AM from Monday to Friday during S2 season in case, period of S1, S2, S3, S4 is set.

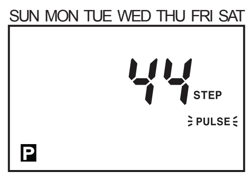


① Advance to weekly program setting mode



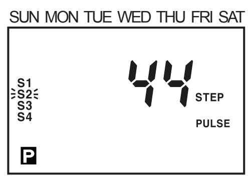
MODE key is pressed for 3sec in RUN mode, P flashes and press SET key.

② Mode type setting



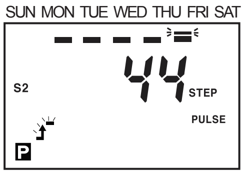
Press ▲ or ▼ key when ON/OFF flashes, pulse flashes and press SET key.

③ Season selection



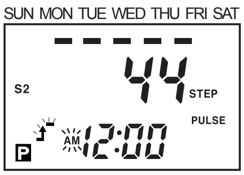
Press ▲ or ▼ key to select season S2 and press SET key.

④ ON day setting



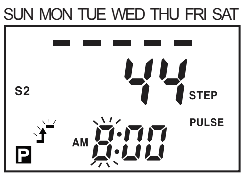
Press ▶ key to move the indicator to Monday, it will be lighted when ▲ or ▼ key is pressed and move it to tuesday by ▶ key. Press SET key after light tuesday, wednesday, thursday and friday.

⑤ ON time setting (AM, PM)



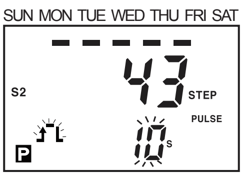
Press ▶ key, move the flashing to hour position and select PM by ▲ or ▼ key when ON time is afternoon.

⑥ ON time setting (hour, min)



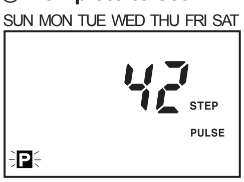
Set 8:00 by ▲ or ▼ key and press SET key.

⑦ Pulse width setting



Press ▲ or ▼ key to select pulse width as 10s (10sec) and press SET key.

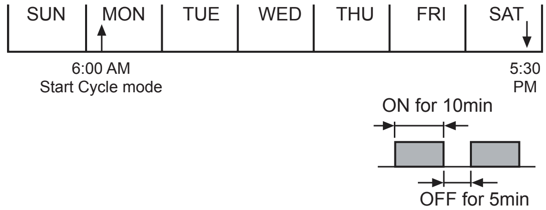
⑧ Complete to set



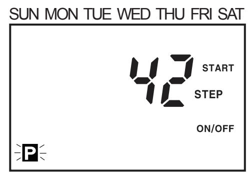
Press SET key to set additional program.

● Weekly Cycle mode

(E.g.) Output 1 (OUT1) is ON for 10min and OFF for 5min from Monday 6:00AM to Saturday 5:30PM.

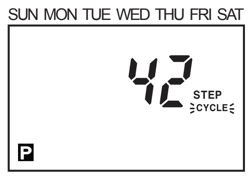


① Advance to weekly program setting mode



In RUN mode, press MODE key for 3 sec and P flashes. Press SET key.

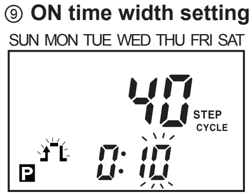
② Mode type setting



Press ▲ or ▼ key when ON/OFF flashes, cycle flashes and press SET key.

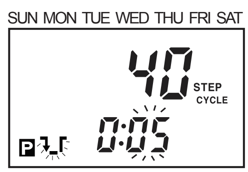
③ to ⑧
Refer to ③ to ⑧ of "Weekly ON/OFF mode" to set ON day, ON time, OFF day and OFF time.

⑨ ON time width setting



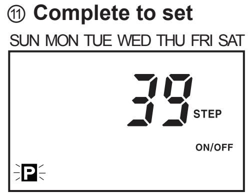
Press ▶ key to move the flashing to minute position and set as 10min by ▲ or ▼ key and press SET key.

⑩ OFF time width setting



Press ▶ key to move the flashing to minute position and set as 5min by ▲ or ▼ key and press SET key.

⑪ Complete to set



Press SET key to set additional program.

◎ Weekly day change

When the specified day mode is required to install in other day, it is started from the set day and returned to previous program setting automatically when it is finished.

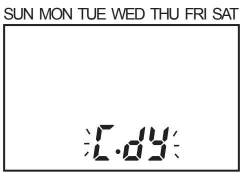
● Weekly day change cancellation

① Change current year, month, date in current time setting mode
② Change standard day
③ Delete all program in program
④ Season switching

● Setting example

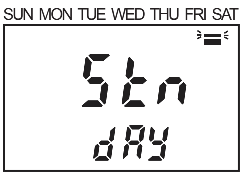
Output is ON in saturday at 9:00AM and OFF at 12:00PM and it is ON 8:30AM and OFF at 6:00PM from monday to friday and the mode of monday and Tuesday is operated temporarily as saturday (standard) program.

① Advance to weekly day change mode



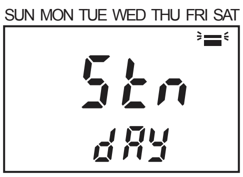
Press MODE key over 3sec to move to the setting group1 in RUN mode and press it repeatedly until C.dY flashes in second display part and press SET key.

② Standard day selection



Press ▶ key to move the indicator to saturday and press SET key. after select saturday as standard day (sat turns ON) by ▲ or ▼ key.

③ Change day selection

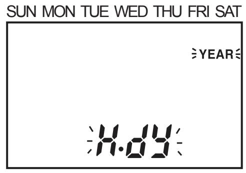


Press ▶ key to move the indicator to monday and select monday to change (monday turns ON) by ▲ or ▼ key and repeat the procedure to select tuesday to change (tue turns ON) and press SET key to complete.

◎ Yearly holiday mode

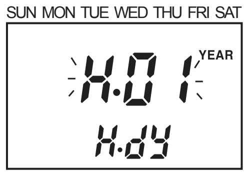
It operates to off the output without program adjustment during previously set yearly holiday period available from present year to 31, Dec. of the next year.
Designate the start date of yearly holiday and year of end date as every year [- -] to repeat the holiday mode for specified in every year.
● Setting example
Set every year 5, May to off the output.

① Advance to yearly holiday mode



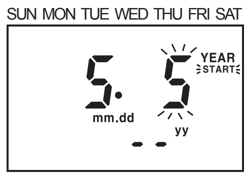
Press MODE key over 3sec to move to the setting group1 in RUN mode and press it repeatedly until H.dY flashes in second display part and press SET key.

② Yearly holiday number display



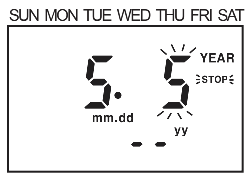
Press SET key after check yearly holiday number.

③ Start date of yearly holiday setting



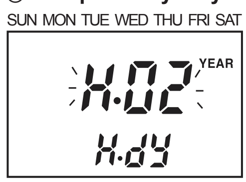
Press ▶ key until month[- -] position flashes and set May by ▲ or ▼ key and press ▶ key until date position flashes. Press SET key after set 5th by ▲ or ▼ key.

④ End date of yearly holiday setting



The flashing is moved to month[- -] position directly and press ▲ or ▼ key to set May and press ▶ key until date position flashes.
Press SET key after set 5th by ▲ or ▼ key.

⑤ Complete to yearly holiday



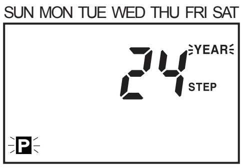
Press MODE key to finish the additional yearly holiday setting and press SET key to set .
※It is able to set yearly holiday up to 12 times.

◎ Yearly program setting

● Yearly ON/OFF mode

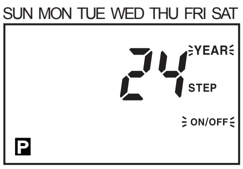
(E.g.) Output (OUT) is ON from every 5, Apr to 7, Apr at 9:00AM and OFF 5:10PM.

① **Advance to Program 1 (P1) yearly program setting mode**



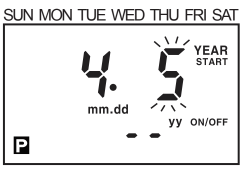
Press [MODE] key for 3 sec in RUN mode, [P] flashes and press [MODE] key once, then, [P] and YEAR flash and press [SET] key to set.

② **Mode type setting**



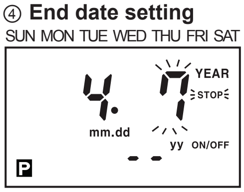
Press [SET] key when ON/OFF flashes.

③ **Start date setting**



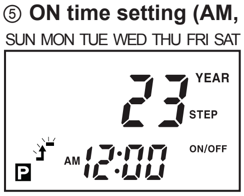
Press ▶ key until month position flashes and set Apr by ▲ or ▼ key and press ▶ key until date position flashes. Press [SET] key after set 5th by ▲ or ▼ key.

④ **End date setting**



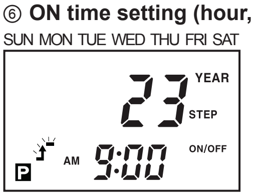
The flashing is moved to month position directly and press ▲ or ▼ key to set April and press ▶ key until date position flashes. Press [SET] key after set 7th by ▲ or ▼ key.

⑤ **ON time setting (AM, PM)**



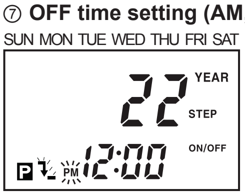
▶ key is pressed, move the flashing to hour position and select PM by ▲ or ▼ key when ON time is afternoon.

⑥ **ON time setting (hour, min)**



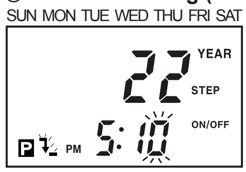
Press ▲ or ▼ key to set 9 and press [SET] key after check 00min

⑦ **OFF time setting (AM, PM)**



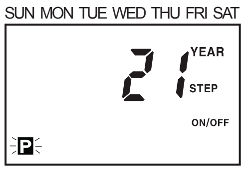
Select PM by ▲ or ▼ key and move the flashing to hour position by ▶ key.

⑧ **OFF time setting (hour, min)**



Move the flashing to minute position after set 5:00 by ▲ or ▼ key and set the minute as 10 and press [SET] key.

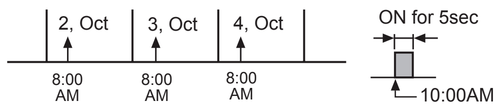
⑨ **Complete to set**



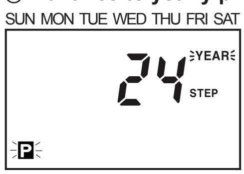
Press [SET] key to set additional program.

● **Yearly pulse mode**

(E.g.) Output (OUT) is ON from 2, Oct., 2008 to 4,Oct, 2008 at 10:00AM and OFF after 5sec (present is 2007.)

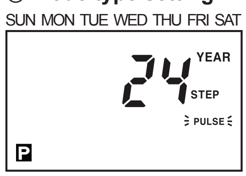


① **Advance to yearly program setting mode**



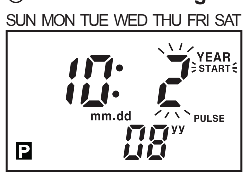
[MODE] key is pressed for 3sec in RUN mode, [P] flashes and press [MODE] key again, [P] flashes and press [SET] key.

② **Mode type setting**



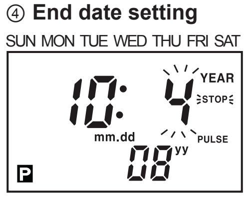
▲ or ▼ key is pressed when ON/OFF flashes to set pulse mode and press [SET] key.

③ **Start date setting**



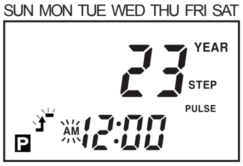
Press ▲ or ▼ key twice to set 08 (year 2008) and move to month position by ▶ key. Set Oct. by ▲ or ▼ key and move to date position by ▶ key and press [SET] key after set 2nd by ▲ or ▼ key.

④ **End date setting**



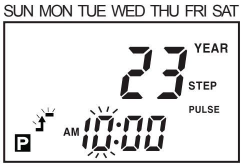
The flashing is moved to month position directly by ▶ key and set 4th by ▲ or ▼ key after move it to date position by ▶ key, then press [SET] key.

⑤ **ON time setting (AM, PM)**



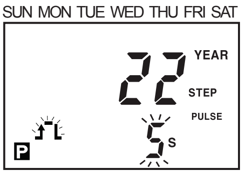
▶ key is pressed, move the flashing to hour position and select PM by ▲ or ▼ key when ON time is afternoon.

⑥ **ON time setting (hour, min)**



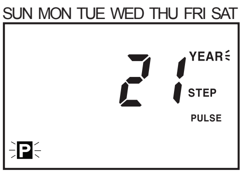
Press ▲ or ▼ key twice to set 10 and press SET key after check 00min

⑦ **Pulse width setting**



Press ▲ or ▼ key 4 times to select pulse width as 5s and press SET key.

⑧ **Complete to set**

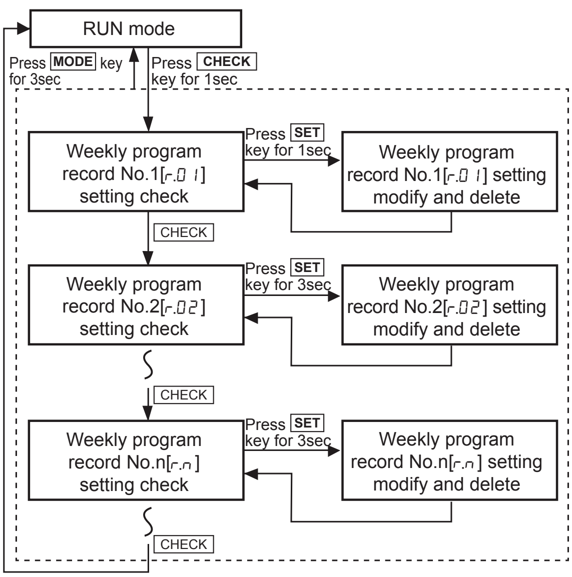


Press SET key to set additional program.

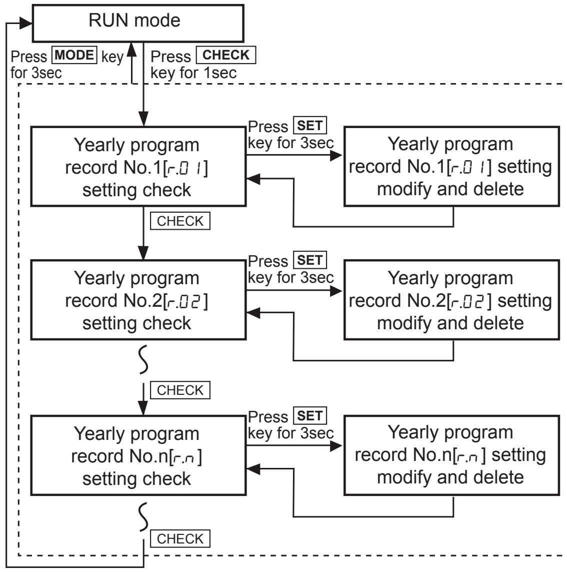
※It is able to set year of start/end date in yearly program setting up to 2 years later from the present year.

■ Program Check, Modify And Delete

◎ Weekly program check, modify and delete



◎ Yearly program check, modify and delete



※**YEAR** turns ON when check, modify or delete yearly program.

- If any key is untouched for 60sec, it is returned to RUN mode in weekly or yearly program check.
- In weekly or yearly program check, it controls output according to program setting and output is OFF in modify or delete mode.
- When MODE key is pressed in weekly or yearly program record modify, delete stand by or delete mode, current work is cancelled and it is returned to check mode.
- Weekly or yearly program record modify and delete

(1) Program record modify
 ① When press SET key over 3sec in program check, Edt flashes in second display part, press SET key.
 ② It returns to check mode when finish the modify same as the above procedure.

(2) Program record delete
 ① When press SET key over 3sec in program check, Edt flashes in second display part, press ▲ or ▼ key until CLr flashes in second display part and press SET key.
 ② Press CLr key over 3sec when SET turns ON in second display part, it returns to program check.

Technical Description

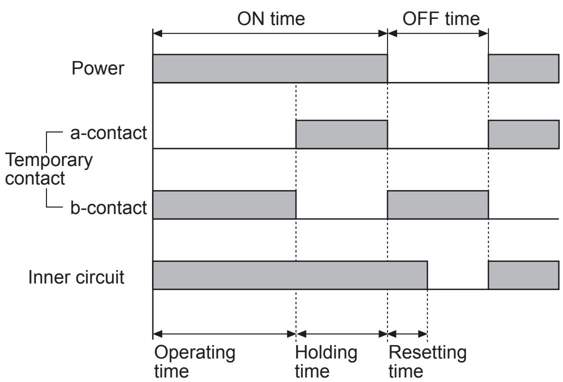
◎ ON time
The period of time during a required voltage is being applied to the timer or Start Signal.

◎ OFF time
The period of time between the moment that resetting begins and the moment that the operating voltage is applied to the operating circuit. Therefore, the OFF time of the timer is larger than the resetting time.

◎ Operating time
The period of time from ON time to the time convert b-contact to a-contact.

◎ Holding time
The period of time from temporary b-contact acts to return.

◎ Resetting time
The period of time after the power is cut until the return of the timer to its initial state.



(Figure a) Time temporary work chart

Resetting time is indicated on the specification of each series. When the timer is operated less than indicated OFF time, the timer running time will be short or will not work. Therefore, OFF time should be longer than resetting time.

◎ Self-reset
Turn off the power to reset. Called Power Reset.

◎ Electrical reset
To reset timer by applying a required voltage to the reset circuit.

◎ Manual reset
To mechanically reset the timer by manual operation.

◎ Timer error
Hour timer is represented by 5 articles, imbalance of operating time, set error, power of properties, effect of ambient temperature, and characterizes of OFF time. But, sometimes almost unaffected items are not listed in the individual specifications.

● Repeat error
Error occurs when after set at random times, repeat an action under the same conditions. Repeat error is calculated by following formula, and the number of calculation should be more than 5 times.

$$\text{Repeat error} = \pm \frac{1}{2} \times \frac{\text{Tmax-Tmin}}{\text{TMs}} \times 100\ (\%)$$

- Tmax: Maximum value of operating times measured at the same time
- Tmin: Minimum value of operating times measured at the same time
- TMs: Maximum scale time
  (TMs is a set value in the case of a digital timer)

● Setting error
Difference between the actual operation time and scale time.
Measurement position can be any position as long as it is set to ⅓ min. of the maximum scale time.

$$\text{Setting error} = \pm \frac{\text{TM-TS}}{\text{TMs}} \times 100\ (\%)$$

- TM: Average value of measured times (min. 5 times)
- TS: Set time (any scale time)
- TMs: Maximum scale time
  (TMs is a set value in the case of the digital timer)

● Influence of voltage
Fluctuation range about operating time when the current of operating power is fluctuating within allowable current fluctuation range.

$$\text{Influence of voltage} = \pm \frac{\text{TM}\times 1\text{-TM1}}{\text{TMs}} \times 100\ (\%)$$

- TM×1: The average current time when the TM1 deviation is maximum within allowable voltage fluctuation range.
- TM1: Average value of operating times at rated voltage.
- TMs: Maximum setting time
  (TMs is a set vale in the case of the digital timer.)

● OFF time characteristics
A change in operating time when the operating time is a given OFF time are changed.

$$\text{OFF time characteristics} = \pm \frac{\text{TM}\times 3\text{-TM3}}{\text{TMs}} \times 100\ (\%)$$

- TM×3: Average value of operating times measured with an OFF time that causes the maximum deviation from TMx3 within the specified OFF time range of 1 hour from the specified setting time.
- TM3: Average value of operating times measured with 1 second OFF time
- TMs: Maximum setting time
  (TMs is a set value in the case of the digital timer.)

OFF time characteristics are determined by the charging and discharging of a capacitor and resistor used in combination as an electronic timer. The characteristics vary by ±1.5 to ±5%.

● **Influence of temperature**

It converts and displays the effect that the change of temperature affects to the operating time in the range of the ambient temperature to the change of operating time.

$$\text{Influence of temperature} = \pm \frac{TM\times2-TM2}{TMs} \times 100\ (\%)$$

- TM×2: Average value of operating time measured at a temperature which causes the maximum deviation from TM2 within the ambient temperature range.
- TM2: Average value of operating times measured at 20℃.
- TMs: Maximum setting time (TMs is a set value in the case of the digital timer.)

◎ Contact organization

● **SPST (Single Pole Single Throw)**

Organized one COM and one a-contact or b-contact. Indicates as SPST (1a) or SPST (1b).

● **SPDT (Single Pole Double Throw)**

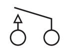
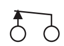
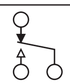
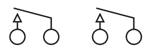
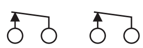
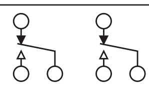
Organized one COM and one a-contact and one b-contact. Indicates as SPDT (1a1b) or SPDT (1c).

● **DPST (Double Pole Single Throw)**

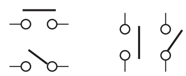
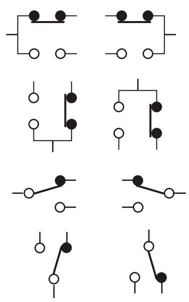
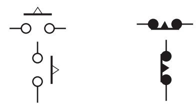
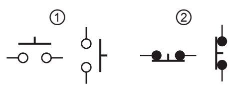
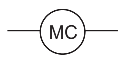
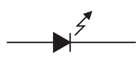
Organized two COMs and two a-contact or b-contact. Indicates as DPST (2a) or DPST (2b).

● **DPDT (Double Pole Double Throw)**

Organized two COMs and two a-contact and two b-contact. Indicates as DPDT (2a2b) or DPDT (2c).

SPST (1a) (Single Pole Single Throw)	
SPST (1b) (Single Pole Single Throw)	
SPDT (1a1b) or SPDT (1c) (Single Pole Double Throw)	
DPST (2a) (Double Pole Single Throw)	
DPST (2b) (Double Pole Single Throw)	
DPDT (2a2b) or DPDT (2c) (Double Pole Double Throw)	

◎ Symbols at internal connection diagram

Title	Symbol	Description
a-contact		Normally open contact when no relay input is applied
b-contact		Normally closed contact when no relay input is applied
c-contact		a-contact and b-contact are contacted at one line. b-contact is located right hand side or up side.
Time-limit operation		Instantaneous returning contact = ① is a-contact, ② is b-contact
Manually operation		Automatic returning contact = display push button switch control contact, ① is a-contact, ② is b-contact
Relay		Electromagnetic relay
LED		Used to indicate the operating state of the timer.

(L) Panel Meters

Small Multi Panel Meter M4NN Series

Multi Panel Meter MT4N Series

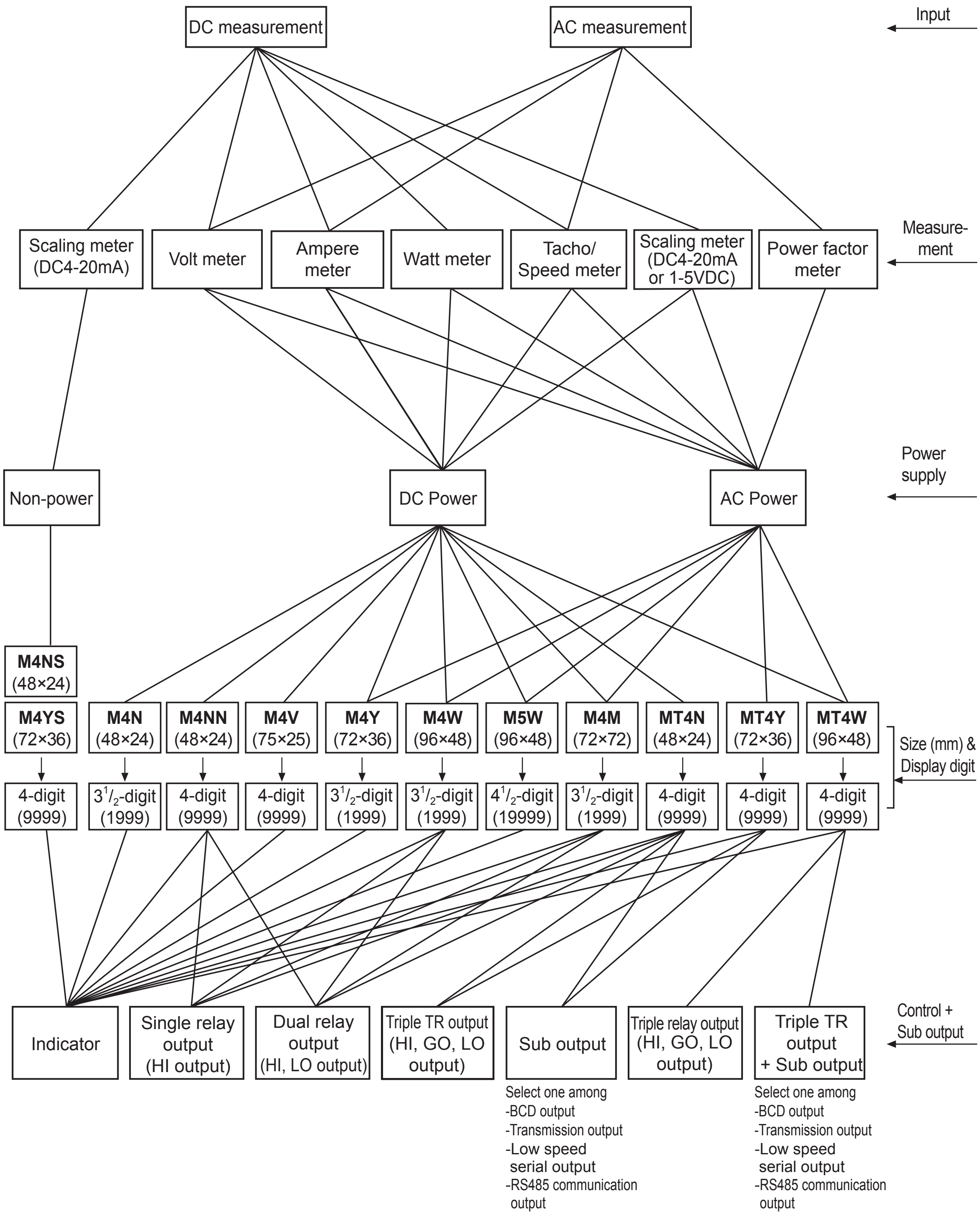
Multi Panel Meter MT4Y Series

Multi Panel Meter MT4W Series

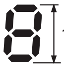
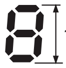
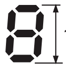
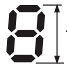
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Panel Meter Selection

■ Panel Meter Selection

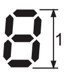
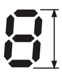
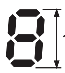
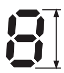
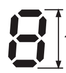


Indicator

Series	M4NN	M4N	M4NS	M4YS	M4V	MT4N
Appearances & Dimensions	CE  [W48×H24×L56.3mm]	 [W48×H24×L59mm]	 [W48×H24×L48mm]	 [W72×H36×L77mm]	 [W75×H25×L91mm]	CE  [W48×H24×L83mm]
Character height	 11mm	 10mm	 10mm	 14mm	 14mm	 9mm
Max. display range	**-1999 to 9999**	**1999**	**-1999 to 9999**		**-999 to 9999**	**-1999 to 9999**
Measurement input	DC voltage, DC current, AC voltage, AC current	DC voltage, DC current	DC4-20mA		DC voltage, DC current	DC voltage, DC current, AC voltage, AC current
AC measurement	AVG value	–				AVG value, RMS value
Display unit	V, V̰, mV, mV̰, kV, A, A̰, mA, mA̰, ㎂, W, kW, VA, kVA, var, kvar, mm, cm, m, km, ㎛, cm^2, m^2, mm^2, cm^3, m^3, mg, g, kg, g/cm, kg/m, kg/cm^2, sec, min, hour, rps, rpm, m/min, cm/min, mm/min, mm/sec, cm/sec, m/sec, Pa, kPa, mPa, kgf/cm^2, kg·m, kgf/mm^2, mmHg, mmH$_2$O, psi, cal, kcal, ℓ, ㎕, Mℓ, kℓ, Hz, kHz, MHz, %, ℃, ℉, Ω, kΩ, MΩ, COSØ, TON, DOC					
Power supply	5-24VDC	5VDC, 12-24VDC	Loop powered type		12-24VDC	12-24VDC/AC, 100-240VAC
Reference	**L-5 to 13**	**L-14 to 17**	**L-18 to 21**		**L-22 to 25**	**L-26 to 34**

※"Display unit" is for MT4Y, MT4W Series only.

Indicator

Series	MT4Y / MT4W	M4Y	M4W	M5W	M4M
Appearances & Dimensions	CE cULus  [W72×H36×L77mm] CE cULus  [W96×H48×L100mm]	 [W72×H36×L93mm]	 [W96×H48×L104mm]	 [W96×H48×L104mm]	 [W72×H72×L113mm]
Character height	 14.2mm	 14mm	 14mm	 14mm	 10mm
Max. display range	**-1999 to 9999**	**1999**		**19999**	**1999**
Measurement input	DC voltage, DC current, AC voltage, AC current				
AC measurement	AVG value, RMS value			RMS value	AVG value, RMS value
Display unit	V, V̰, mV̰, mV, kV, A, A̰, mA, mA̰, ㎂, W, kW, VA, kVA, var, kvar, mm, cm, m, km, ㎛, cm^2, m^2, mm^2, cm^3, m^3, mg, g, kg, g/cm, kg/m, kg/cm^2, sec, min, hour, rps, rpm, m/min, cm/min, mm/min, mm/sec, cm/sec, m/sec, Pa, kPa, mPa, kgf/cm^2, kg·m, kgf/mm^2, mmHg, mmH$_2$O, psi, cal, kcal, ℓ, ㎕, Mℓ, kℓ, Hz, kHz, MHz, %, ℃, ℉, Ω, kΩ, MΩ, COSØ, TON, DOC				
Power supply	100-240VAC, 12-24VDC (MT4W)	100-240VAC, 24-70VDC (option), 5VDC (option)	110/220VAC, 100-240VAC (option), 24-70VDC (option)	100-240VAC	110/220VAC
Reference	**L-35 to 45**	**L-48 to 59**			

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Product Overview

Setting type

Series	M4NN	MT4N	MT4Y	MT4W
Appearances & Dimensions	 [W48×H24×L56.3mm]	 [W48×H24×L83mm]	 [W72×H36×L77mm]	 [W96×H48×L104.4mm]
Character height	11mm	9mm	14.2mm	14.2mm
Max. display range	**-1999 to 9999**			
Measurement input	DC voltage, DC current, AC voltage, AC current			
AC measurement	AVG value	AVG value, RMS value		
Display unit	V, V̰, mV̰, mV, kV, A, A̰, mA, mA̰, μA, W, kW, VA, kVA, var, kvar, mm, cm, m, km, μm, cm^2, m^2, mm^2, cm^3, m^3, mg, g, kg, g/cm, kg/m, kg/cm^2, sec, min, hour, rps, rpm, m/min, cm/min, mm/min, mm/sec, cm/sec, m/sec, Pa, kPa, mPa, kgf/cm^2, kg·m, kgf/mm^2, mmHg, mmH_2O, psi, cal, kcal, ℓ, μℓ, Mℓ, kℓ, Hz, kHz, MHz, %, ℃, ℉, Ω, kΩ, MΩ, COSØ, TON, DOC			
Power supply	5-24VDC	12-24VDC/AC, 100-240VAC	100-240VAC	12-24VDC, 100-240VAC
Main output	Triple NPN open collector output (OUT1, GO, OUT2) Triple PNP open collector output (OUT1, GO, OUT2)	Single relay output (OUT1) Dual relay output (OUT1, OUT2) Triple NPN open collector output (OUT1, GO, OUT2) Triple PNP open collector output (OUT1, GO, OUT2)	Triple relay output (HI, GO, LO) Triple NPN open collector output (HI, GO, LO) Triple PNP open collector output (HI, GO, LO)	
Sub output	—	RS485 output, PV transmission (DC4-20mA) output	RS485 output, PV transmission (DC4-20mA) output, BCD output, Low speed serial output	
Reference	**L-5 to 13**	**L-26 to 34**	**L-35 to 45**	

※"Display unit" is for MT4Y, MT4W Series only.

Setting type

Series	M4W1P	M4W2P	M4M1P	M4M2P
Appearances & Dimensions	 [W96×H48×L104mm]	 [W96×H48×L104mm]	 [W72×H72×L113mm]	 [W72×H72×L113mm]
Character height	10mm	10mm	10mm	10mm
Max. display range	**1999**			
Measurement input	DC voltage, DC current, AC voltage, AC current			
AC measurement	AVG value, RMS value			
Display unit	V, V̰, mV̰, mV, kV, A, A̰, mA, mA̰, μA, W, kW, VA, kVA, var, kvar, mm, cm, m, km, μm, cm^2, m^2, mm^2, cm^3, m^3, mg, g, kg, g/cm, kg/m, kg/cm^2, sec, min, hour, rps, rpm, m/min, cm/min, mm/min, mm/sec, cm/sec, m/sec, Pa, kPa, mPa, kgf/cm^2, kg·m, kgf/mm^2, mmHg, mmH_2O, psi, cal, kcal, ℓ, μℓ, Mℓ, kℓ, Hz, kHz, MHz, %, ℃, ℉, Ω, kΩ, MΩ, COSØ, TON, DOC			
Power supply	110/220VAC100-240VAC (customizable)24-70VDC (customizable)			
Main output	Single relay output (HI)	Dual relay output (HI, LOW)	Single relay output (HI)	Dual relay output (HI, LOW)
Sub output	—	—	—	—
Reference	**L-48 to 58**			

DIN W48×H24mm Small Digital Multi Panel Meter

■ Features

- Various input options (by model)
  - Input options: DC voltage, DC current, AC voltage, AC current
- Isolated input and power modules allow powering of multiple units using a single power supply
- Display range: -1999 to 9999
- High/low-limit display scale function
- AC frequency measurement (range: 0.1 to 9999 Hz)
- Preset output mode: OUT1, GO, OUT2 (NPN/PNP open collector output)
- Power factor display function: displays analog outputs (1-5 V, 4-20 mA) from power factor converters as -0.50 to 1.00 to 0.50
- Various functions: peak display value monitoring, display cycle delay, zero-point adjustment, peak display value correction
- Power supply: 5-24 VDC (isolated type)

⚠ **Please read "Caution for your safety" in operation manual before using.**

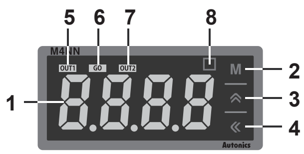
CE

■ Ordering Information

M 4 N N – DV – 1 N

	Code	Description
Control output	N	Indicator (without output function)
	1	NPN open collector output
	2	PNP open collector output
Power supply	1	5-24VDC
Input type	DV	DC Voltage (minus input)
	DA	DC Current (minus input)
	AV	AC Voltage
	AA	AC Current
Type	N	New Type
Size	N	DIN W48×H24mm
Digit	4	9999 (4-digit)
Item	M	Multi Meter

■ Unit Description

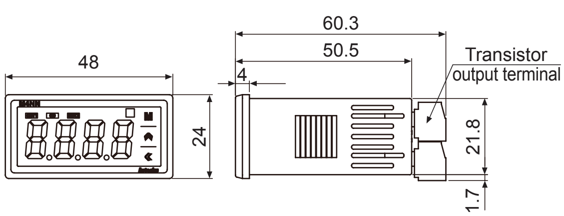


1. **Measurement value display part**
2. **Ⓜ Key:** MODE key
3. **⩓ Key:** Up key
4. **« Key**: Shift key
5. **OUT1 (red):** OUT1 output indicator of preset
6. **GO (green):** GO output indicator of preset
7. **OUT2 (red):** OUT2 output indicator of preset
8. **Unit sticker**

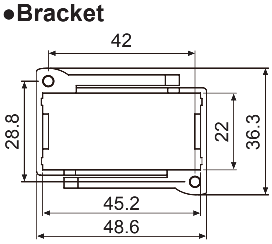
※Indicator model (M4NN-□□-1N) does not have transistor output terminal.

■ Dimensions

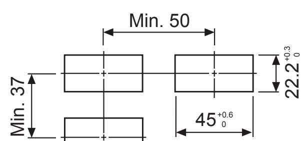
(unit: mm)



●**Bracket**



●**Panel cut-out**



※Indicator model (M4NN-□□-1N) does not have transistor output terminal.

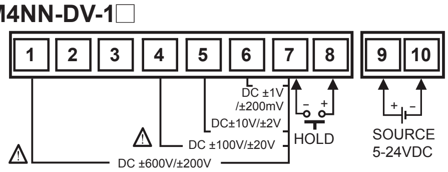
■ Specifications

Model		M4NN-DV-1□	M4NN-DA-1□	M4NN-AV-1□	M4NN-AA-1□
Input		DC voltage	DC current	AC voltage, frequency	AC current, frequency
Max. allowable input		-110 to 110% of the rated measurement input range (when not using minus input: -10 to 110%)		Approx. 110% of the rated measurement input range	
Power supply		5-24 VDC			
Allowable voltage range		90 to 110% of the rated voltage (5V is fixed for lower limit)			
Power consumption		Max. 3W			
Display method		7-segment LED display (red) (character height: 11mm)			
Display accuracy		•23℃±5℃-DC Input: ±0.1% F.S. ±2-digit / AC Input ±0.3% F.S. ±3-digit ※For 5A terminal of M4NN-DA, AA Input, ±0.3% F.S. ±3-digit •-10 to 50℃-DC/AC Input: ±0.5% F.S. ±3-digit / Frequency: ±0.5% F.S. ±3-digit ※For 5A terminal of M4NN-DA, AA Input, ±1% F.S. ±3-digit			
Display cycle		0.1 to 5.0 sec (selectable by 0.1 sec)			
A/D conversion method		Practical oversampling using successive approximation ADC			
Sampling cycle		50ms (resolution 1/12,000)		16.6ms (resolution 1/12,000)	
Max. display range		-1999 to 9999 (4-digit)			
Preset output※1		NPN/PNP open collector output: ·Load voltage: max. 30VDC ·Load current: max. 100mA ·Residual voltage: max. 1VDC (NPN), max. 2VDC (PNP)			
AC measurement※2		—		Average value (AVG) measurement	
Frequency measurement ※2		—		Measurement range: 0.100 to 9999Hz (variable by decimal point position)	
Insulation resistance		Over 100MΩ (at 500VDC megger)			
Dielectric strength		2000VAC for 1 min (between all terminals and case)			
Noise immunity		±2kV the square wave noise (pulse width: 1μs) by the noise simulator			
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min			
Shock	Mechanical	$100m/s^2$ (approx. 10G) in each X, Y, Z direction for 3 times			
	Malfunction	$300m/s^2$ (approx. 30G) in each X, Y, Z direction for 3 times			
Environ-ment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Connection		Plug/Socket terminal block (accessory)			
Insulation type		Double insulation or reinforced insulation (mark: ⧈, dielectric strength between the measured input part and the power part: 1kV)			
Approval		CE			
Weight※3		Approx. 83.6g (approx. 46.8g)	Approx. 83.7g (approx. 46.7g)	Approx. 83.8g (approx. 46.9g)	Approx. 83.8g (approx. 46.9g)

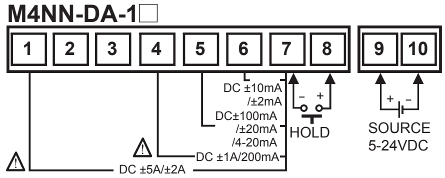
※1: Indicator (M4NN-□□-1N) model does not have output function. ※2: AC, frequency measurement functions are only for AC measurement type.
※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Connections

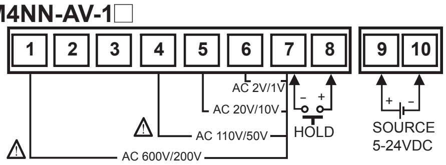
● M4NN-DV-1□



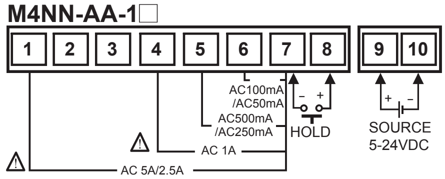
● M4NN-DA-1□



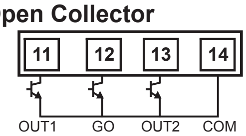
● M4NN-AV-1□



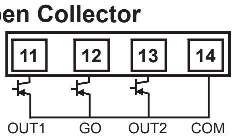
● M4NN-AA-1□



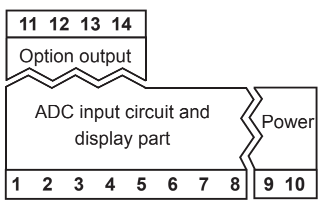
● NPN Open Collector



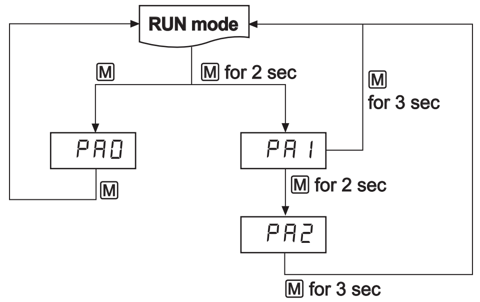
● PNP Open Collector



※Input and output are insulated from the power.



■ Parameter Settings

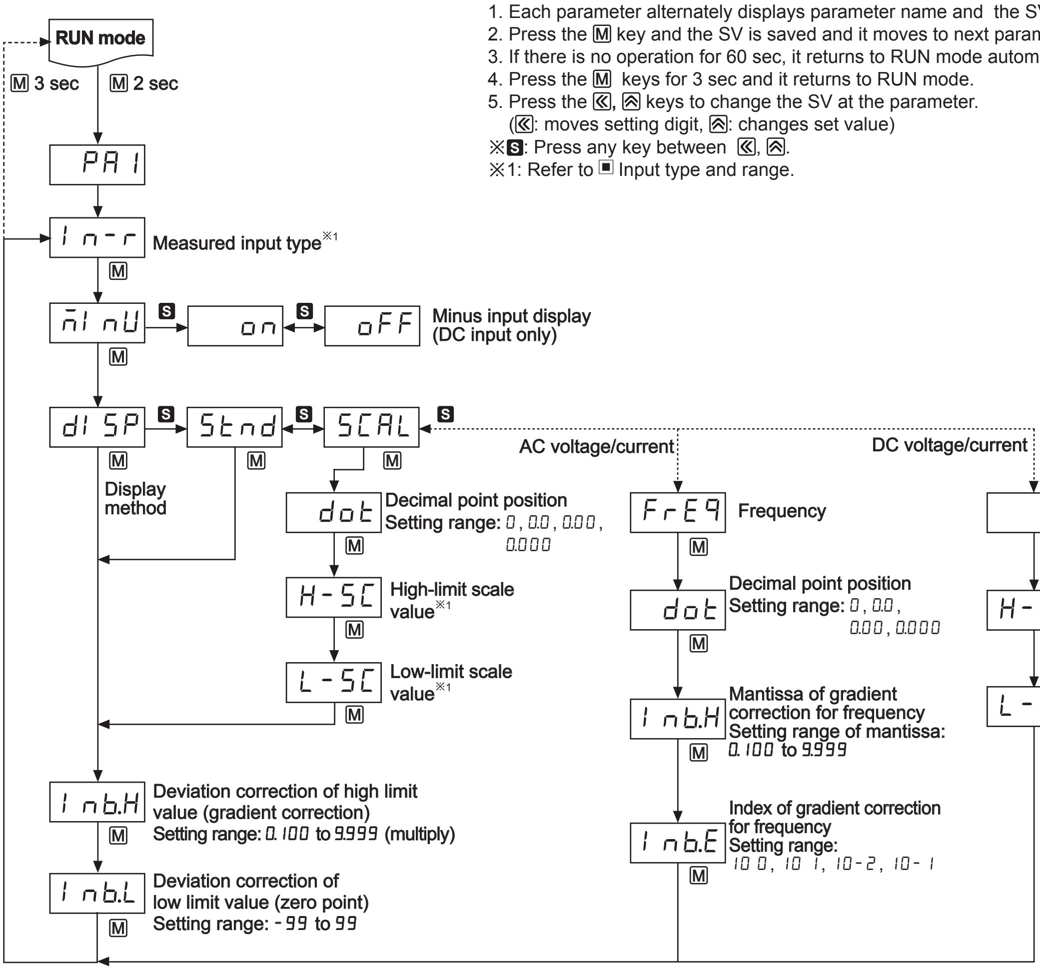


■ Parameter 1 Group

◎ **Parameter setting**

1. Each parameter alternately displays parameter name and the SV in 0.5 sec.
2. Press the M key and the SV is saved and it moves to next parameter.
3. If there is no operation for 60 sec, it returns to RUN mode automatically.
4. Press the M keys for 3 sec and it returns to RUN mode.
5. Press the ≪, ⩓ keys to change the SV at the parameter.
   (≪: moves setting digit, ⩓: changes set value)

※S: Press any key between ≪, ⩓.
※1: Refer to ■ Input type and range.



◎ Factory default

Parameter	M4NN-DV	M4NN-DA	M4NN-AV	M4NN-AA
In-r	600u	5A	600u	5A
mInU	on	on	—	—
dISP	Stnd	Stnd	Stnd	Stnd
dot	0	0	0	0
H-SC	600	500	600	5000
L-SC	-600	-500	0	0

Parameter	M4NN-DV	M4NN-DA	M4NN-AV	M4NN-AA
InbH	1.000	1.000	1.000	1.000
InbL	00	00	00	00
H-rG	600	5.00	—	—
L-rG	-600	-5.00	—	—
InbE	—	—	10 0	10 0

▣ Parameter 2 Group

◎ **Parameter (0 to 2) group setting method**
1. Each parameter alternately displays parameter name and the SV in 0.5 sec.
2. Press the [M] key and the SV is saved and it moves to next parameter.
3. If there is no operation for 60 sec, it returns to RUN mode automatically.
4. Press the [M] keys for 3 sec and it returns to RUN mode.
5. Press the [◀], [▲] keys to change the SV at the parameter.
   ([◀]: moves setting digit, [▲]: changes set value)

※[S]: Press any key between [◀], [▲].

RUN mode → [M] 3 sec → PA2

- oU1.t —[S]→ oFF —[M]
  Preset output operation mode of OUT1 (displayed only for OUT 1 output model)
  Setting range: oFF, HI, Lo, HL, HL-G
- oU2.t —[S]→ oFF —[M]
  Preset output operation mode of OUT2 (displayed only for OUT 2 output model)
- HYS.1 —[S]→ 001 —[M]
  Preset hysteresis of OUT1
  Setting range: within 10% of max. display range (unit: digit)
  ※When oU1.t parameter is oFF, it is not displayed.
- HYS.2 —[S]→ 001 —[M]
  Preset hysteresis of OUT2
  Setting range: within 10% of max. display range (unit: digit)
  ※When oU2.t parameter is oFF, it is not displayed.
- PEK.t —[S]→ 005 —[M]
  Monitoring delay time of peak monitoring function
  Setting range: 00 to 30 sec
- dIS.t —[S]→ 0.25 —[M]
  Display cycle
  Setting range: 0.1 to 5.0 sec
- LoC —[S]→ oFF —[M]
  Lock among 4 types.
  Setting range: oFF, LoC1, LoC2, LoC3

oFF	Unlock
LoC1	Lock Parameter 1 group
LoC2	Lock Parameter 1, 2 groups
LoC3	Lock Parameter 0, 1, 2 groups

◎ Factory default

Parameter	M4NN-DV	M4NN-DA	M4NN-AV	M4NN-AA	Parameter	M4NN-DV	M4NN-DA	M4NN-AV	M4NN-AA
oU1.t ※1	oFF	oFF	oFF	oFF	PEK.t	005	005	005	005
oU2.t ※1	oFF	oFF	oFF	oFF	dIS.t	0.25	0.25	0.25	0.25
HYS.1 ※1	—	—	—	—	LoC	oFF	oFF	oFF	oFF
HYS.2 ※1	—	—	—	—					

※It is not displayed for the indicator model.

▣ Parameter 0 Group

RUN mode

- oU1.H —[S]→ Max. display value —[M]
  High-limit preset of oUt1
  ※Not displayed when oU1.t parameter is oFF at Parameter 2 group.
- oU1.L —[S]→ Min. display value —[M]
  Low-limit preset of oUt1
  ※Not displayed when oU1.t parameter is oFF at Parameter 2 group.
- oU2.H —[S]→ Max. display value —[M]
  High-limit preset of oUt2
  ※Not displayed when oU2.t parameter is oFF at Parameter 2 group.
- oU2.L —[S]→ Min. display value —[M]
  Low-limit preset of oUt2
  ※Not displayed when oU2.t parameter is oFF at Parameter 2 group.
- H.PEK —[S]→ 0.0 —[M]
  It displays max. monitoring value (high peak value) in RUN mode.
  Press any key between [◀], [▲] and it is initialized (reset).
  ※H.PEK parameter is not displayed when PEK.t parameter is set as 00 sec[005] at Parameter 2 group.
- L.PEK —[S]→ 0.0 —[M]
  It displays min. monitoring value (low-limit value) in RUN mode.
  Press any key between [◀], [▲] and it is initialized (reset).
  ※L.PEK parameter is not displayed when PEK.t parameter is set as 00 sec[005] at Parameter 2 group.

◎ Factory default

Parameter	M4NN-DV	M4NN-DA	M4NN-AV	M4NN-AA	Parameter	M4NN-DV	M4NN-DA	M4NN-AV	M4NN-AA
oU1.H※1	600	5.00	600.0	5.000	oU2.L※1	-600	-5.00	000.0	0.000
oU1.L※1	-600	-5.00	000.0	0.000	H.PEK※1	0	0.00	0.0	0.000
oU2.H※1	600	5.00	600.0	5.000	L.PEK※1	0	0.00	0.0	0.000

※It is not displayed for the indicator model.

▣ Specification Of Measurement Input And Range

Type	Measured input range	Input impedance	Display range [Stnd]
DC voltage	-600-600V [600u]	4.694MΩ	-600 to 600
	-200-200V [200u]	4.694MΩ	-199.9 to 200.0
	-100-100V [100u]	794kΩ	-100.0 to 100.0
	-20-20V [20u]	79kΩ	-19.99 to 20.00
	-10-10V [10u]	79kΩ	-10.00 to 10.00
	-2-2V [2u]	79kΩ	-1.999 to 2.000
	-1-1V [1u]	7.5kΩ	-1.000 to 1.000
	-200-200mV [0.2u]	7.5kΩ	-199.9 to 200.0
DC current	-5-5A [5A]	0.01kΩ	-5.00 to 5.00
	-2-2A [2A]	0.01Ω	-1.999 to 2.000
	-1-1A [1A]	0.1Ω	-1.000 to 1.000
	-200-200mA [0.2A]	0.1Ω	-199.9 to 200.0
	-100-100mA [0.1A]	1.1Ω	-100.0 to 100.0
	-20-20mA [20mA]	1.1Ω	-19.99 to 20.00
	4-20mA [4-20]	1.1Ω	4.00 to 20.00
	-10-10mA [10mA]	11.1Ω	-10.00 to 10.00
	-2-2mA [2mA]	11.1Ω	-1.999 to 2.000
AC voltage	0-600V [600u]	4.987MΩ	0.0 to 600.0
	0-250V [250u]	4.987MΩ	0.0 to 250.0
	0-110V [110P]	1.087MΩ	0.0 to 440.0
	0-50V [50u]	1.087MΩ	0.00 to 50.00
	0-20V [20u]	200kΩ	0.00 to 20.00
	0-10V [10u]	200kΩ	0.00 to 10.00
	0-2V [2u]	20kΩ	0.000 to 2.000
	0-1V [1u]	20kΩ	0.000 to 1.000
AC current	0-5A [5A]	0.01Ω	0.000 to 5.000
	0-2.5A [2.5A]	0.01Ω	0.000 to 2.500
	0-1A [1A]	0.05Ω	0.000 to 1.000
	0-500mA [0.5A]	0.1Ω	0.0 to 500.0
	0-250mA [0.25A]	0.1Ω	0.0 to 250.0
	0-100mA [0.1A]	0.5Ω	0.0 to 100.0
	0-50mA [50mA]	0.5Ω	0.00 to 50.00

Note

※For DC input, not to display minus input, set minus input display [mInU] of parameter 1 group as oFF.
E.g.) When the display range is -600 to 600V, set mInU of parameter 1 group as oFF and this display range is 0 to 600V.

dot	Display range
0	-1999 to 9999
0.0	-199.9 to 999.9
0.00	-19.99 to 99.99
0.000	-1.999 to 9.999

(display range is variable according to decimal point position)

※Please wire proper terminal to its max. input voltage within 30 to 100% of input terminal. When it is higher than input voltage, it may cause breakdown of terminal and ouEr display range and the accuracy is decreased when it is connected to the terminal under 30%.

※For the range setting of AC voltage, when setting as 0 to 110V[110P] and using P.T for 440V/110VAC, 110V is input and 440V is displayed automatically by the set scale value for P.T users' convenience.

※Frequency measurement range (AC voltage/current) : 0.100 to 9999Hz

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Functions

◎ Minus input display [PA 1 group: mInU]

- When minus input is unnecessary, or when display 0 not to display minus input due to display minus input due to unstable input value around 0, set as oFF this minus input display function.
- When setting oFF, low-limit value of input range is set 0 and it displays minus input as 0.
- The low-limit value of L-SC, oU□.L, L-rG parameters is changed based on "0".
  Min. display value is "0" and H-SC, H-rG parameters display max. value of the input range.
  The Inb.H / Inb.L / oU□.t / HYS.□ / oU□.H parameters are initialized to factory default.

※In case of DC current measurement input model, when measurement input range [In-r] is set as 4-20, this parameter is not displayed.

◎ AC frequency measurement [PA 1 group: dISP]

It measures input signal frequency when it is an AC input. It uses fixed decimal point by dot parameter setting of parameter 1 group, measured range can be changed by setting and measured range of decimal point position is as below chart. It is available to adjust upper gradient at Inb.H and Inb.E of parameter 1 group. In order to measure frequency normally, input signal, over 10% F.S. of the measured range, should be supplied. Please select the proper point of measurement terminal.

- Measurement range

Dot position	0.000	0.00	0.0	0
Measurement range	0.100 to 9.999Hz	0.10 to 99.99Hz	0.1 to 999.9Hz	1 to 9999Hz

※Accuracy of frequency measurement: Below 1kHz, F.S. ±0.1rdg ±2-digit, from 1 to 10kHz, F.S. ±0.3 rdg ±2-digit

- Inb.H: 0.100 to 9.999
  [gradient adjustment of high-limit value]
- Inb.E: 10^{-2}, 10^{-1}, 10^{0}, 10^{1}[index adjustment of Inb.H]

◎ Zero adjustment [low-limit display value deviation correction]

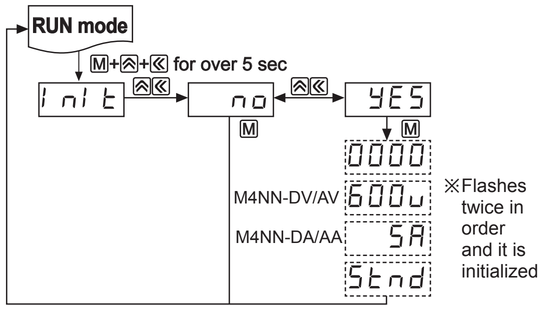
Forces the display value of measured input to 0 (Zero).

- Zero adjustment range: -99 to 99
- Zero adjustment method: Press ⩓ and ≪ key in RUN mode for 3 sec.

When zero point adjustment with front key and hold terminal is finished normally, zero point of measurement terminal is displayed and the adjusted value is saved in Inb.L automatically.

※If zero adjustment range is exceeded, the error[ouEr] flashes twice and then move to RUN mode, maintaining previous setting value.

◎ Initialization



◎ Error display

Display	Description
HHHH	Flashes when measured input is exceeded the max. allowable input (+110%)
LLLL	Flashes when measured input is exceeded the min. allowable input (minus input on: -110%, oFF: -10%)
d-HH	Flashes when display input is exceeded max. display range (9999)
d-LL	Flashes when display input is exceeded min. display range (-1999)
F-HH	Flashes when input frequency is exceeded the max. measured range (10kHz) and display range (9999)
PF-H	Flashes when power factor display value to measured input is over than LAG 0.50
PF-L	Flashes when power factor display value to measured input is less than LEAD -0.50

※Error is cleared when the input value is within measurement range or display range.

◎ Display cycle delay[PA 2 group: dISt]

In some applications the measured input may fluctuate which in turn causes the display to fluctuate. By adjusting the display cycle delay function time at dISt of parameter 2 group, the operator can adjust the display time within a range of 0.1 sec to 5 sec For example, if the operator sets the display cycle time to 4.0 sec, the display value is displayed the averaged input value over 4 sec in every 4 sec.

◎ Monitoring max./min. display value [PA 0 group: H.PEK/L.PEK, PA 2 group: PEK.t]

It monitors Max./Min. value of display value based on current display value and then display the data in H.PEK, L.PEK of parameter 0 group. Set delay time (0 to 30 sec) in PEK.t mode of parameter 2 group in order to avoid caused by initial overcurrent or over voltage, when monitoring the peak value. Delay time is 0 to 30 sec and it starts to monitor the peak value after set time.
When ≪, ⩓ keys are pressed at H.PEK, L.PEK mode of parameter 0 group, it will be initialized.

※H.PEK, L.PEK parameters is not displayed when monitoring delay time [PEK.t] of parameter 2 group is set as 00 sec[00 5].

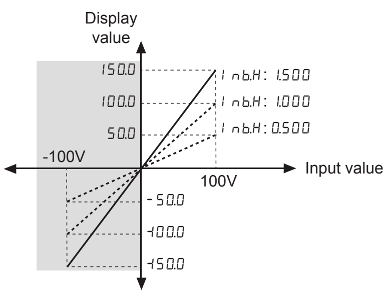
◎ Error correction[PA 1 group: Inb.H / Inb.L]

It corrects display value error of measurement input.
Inb.L : -99 to 99 (adjust deviation of low-limit value),
Inb.H: 0.100 to 9.999 (correct gradient of high-limit value)
Display value= (measured value × Inb.H) + Inb.L
E.g.) When the measured range is 0 to 500V, and the display range is 0 to 500.0. If the low display value is 1.2 to 0V input, set -12 as Inb.L value to display 0.0 by adjusting offset of the low-limit value. The display value to 500V measured input varies by adjusting the offset of low-limit value. If this display value is 501.0, calculate 500.0/501.0 (desired display value/the display value), and set the 0.998 correction value as the Inb.H to display 500.0 by adjusting gradient of high-limit value.
※The offset correction range of Inb.L is within -99 to 99 for D-0, D-1 digit regardless of decimal point position [dot].
※High limit error correction function is available as “Gradient correction function”and low limit error correction function is available as “Zero adjustment function”.

◎ Gradient correction[PA 1 group: Inb.H]

This function is to adjust gradient of standard display value or scale value for the input value within the measured input range. By adjusting gradient, it is available as “High limit error correction function”.
As the below (figure 1), in case of display gradient 1 for the measured input 100V, this function is to adjust display value by adjusting the gradient as 1.5 times or 0.5 times.
• Setting range: 0.100 to 9.999,
Factory default: 1.000 (unit: multiply)
E.g. 1) Gradient adjustment
①When the measured input is 100.0V in order to display 150.0, set gradient correction set value[Inb.H] as 1.500. This value is also applied for minus input. When the measured input is -100.0V, it displays -150.0.
②When the measured input is -100.0V in order to display -50.0, set gradient correction set value[Inb.H] as 0.500. This value is also applied for plus input. When the measured input is 100.0V, it displays 50.0.

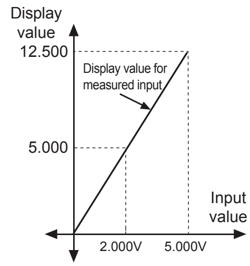
	Inb.H	Note
①	1.500	※Shaded part of Figure 1 is not displayed for the below cases. • AC input model • DC input model and minus input[m InU] is set as oFF. • DC current input model and Input range [In-r] is set as 4-20.
②	0.500	



(Figure 1)

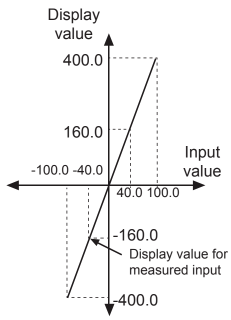
E.g. 2) Display scale setting [L-SC/H-SC]and gradient adjustment [Inb.H] (AC input)
①When the measured input AC 2.000V at the input range AC 0 to 5.000V and it displays 5.000, set decimal point position [dot] as 0.000 before setting the scale value.
②When the measured input is AC 2.000V in order to display 5.000, 12.500 should be displayed when max. input value is 5.000V. However, it cannot set because the max. set value is 9.999.
Set as Gradient correction set value [Inb.H] × High scale value[H-SC] = 12,500 as the following table.
③After this setting is finished, it displays 5.000 when the measured input is 2.000V.

H-SC	L-SC	Inb.H	Note
12.500	0.000	1.000	**Unavailable** to set because max. set value of H-SC is 9.999
6.250	0.000	2.000	In this case, any setting methods display the same display value.
3.125	0.000	4.000	
2.500	0.000	5.000	



E.g. 3) Display scale setting [L-SC/H-SC] and gradient adjustment [Inb.H] (DC minus input)
①When the measured input DC -40mA at the input range DC -100.0 to 100.0mA and it displays -160.0, set decimal point position[dot] as 0.000 before setting the scale value.
②When the measured input is DC -40mA in order to display -160.0, -400.0 should be displayed when min. input value is -100.0mA. However, it cannot set because the min. set value is -199.9.
Set as gradient correction set value[Inb.H]×low scale value [L-SC] =-400.0 as the following table.
Set high-limit scale value as (- (L-SC)) value. If high scale value is set at first, set low scale value as (- (H-SC)) value.
③After this setting is finished, it displays -160.0 when the measured input is DC-40.0mA.

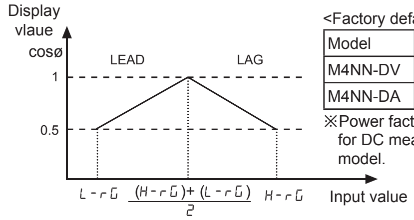
H-SC	L-SC	Inb.H	Note
400.0	-400.0	1.000	**Unavailable** to set because max. set value of L-SC is -19 9.9
200.0	-199.9	2.000	In this case, any setting methods display the same display value.
100.0	-100.0	4.000	
80.0	-80.0	5.000	



◎ Power factor (PF) display [PA 1 group: H-rG/L-rG]

- This function displays LEAD and LAG by analog output signal from the power factor transducer.
- It is available to accept several outputs of the power factor transducer by high-limit[H-rG]/low-limit[L-rG] analog output value setting in the power factor transducer.
- Power factor value is displayed as cosø value -0.50 (LEAD) to 1.00 to 0.50 (LAG).
- LEAD is when current phase leads voltage phase, LAG is when current phase lags behind voltage phase. LEAD and LAG are invalid power.
- Setting range: From min. to max. selected value from measurement input[In-r]

E.g.) When setting 200u in In-r, H-rG and L-rG are available to set from -199.9 to 200.0.
When setting 10u, H-rG and L-rG are available to set from -10.00 to 10.00. (※H-rG > L-rG)



<Factory default>

Model	H-rG	L-rG
M4NN-DV	600	-600
M4NN-DA	5.00	-5.00

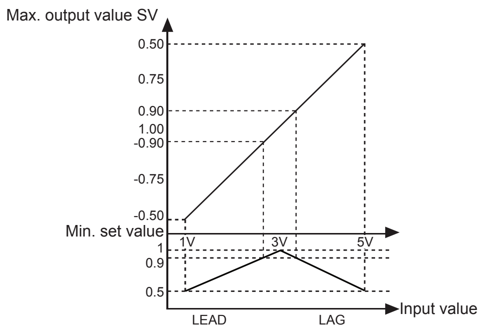
※Power factor display is only for DC measurement input model.

E.g. 1) When the output of the power factor transducer is DC 4-20mA,

① Connect the output to the input terminal 5 (+), 7 (-) of this unit, then set input range[In-r] as 4-20.
② When setting the input range as 4-20, L-rG is set as 4.00 and H-rG is set as 20.00 automatically. L-rG and H-rG is for the setting of the power factor transducer output.
③ If measured input is 4mA, it displays -0.50. For 12mA measured input, it displays 1.00 and for 20mA, it displays 0.50.

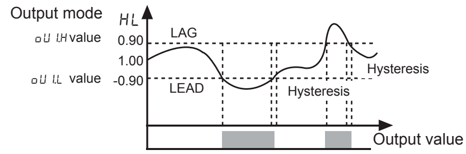
E.g. 2) When the output of the power factor transducer is DC1-5V,

① Connect the output to the input terminal 5 (+), 7 (-) of this unit, then set the input range [In-r] as 10u.
② Select minus input display function [mInU] as oFF not to display minus value.
③ Set H-rG as 5.00 and L-rG as 1.00 for the output of the power factor transducer.
④ If measured input is 1V, it displays -0.50. For 3V measured input, it displays 1.00 and for 5V, it displays 0.50.



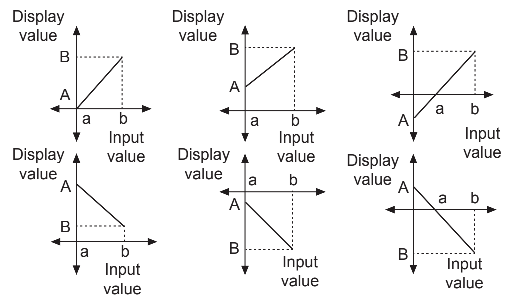
E.g. 3) When LEAD value is smaller than -0.90, LAG value is smaller than 0.90, and OUT1 is used,

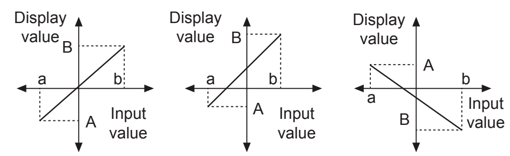
① Set oU1.t as HL at parameter 2 group.
② Set oU1.H as 0.90 and oU1.L as -0.90 at parameter 0 group.
※oU2.t is also same setting as oU1.t.



◎ Display scale [PA 1 group: H-SC / L-SC]

This function is to display setting (-1999 to 9999) of particular High/Low-limit value in order to display High/Low-limit value of measurement input. If measurement inputs are 'a' and 'b' and particular values are 'A' and 'B', it will display a=A, b=B as below graphs.

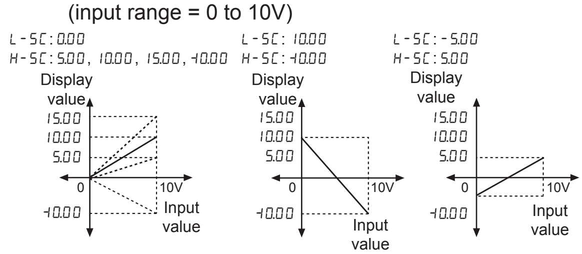




※In case of DC Volt/Ampere input model (M4NN-D□-□) and using Minus input, they are displayed.

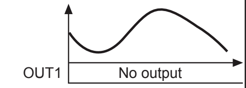
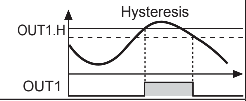
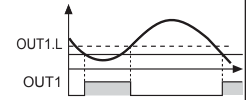
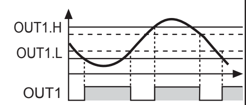
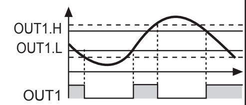
Display scale function is able to change display value for min./max. measured input by setting high limit scale H-SC, and low limit scale L-SC in parameter 1 group.

E.g.) High limit scale value and low limit scale value setting (input range = 0 to 10V)



※When changing measured input, high limit scale value and low limit scale value are automatically changed as the default display range of the changed measured input.

◎ Preset output mode [PA 2 group: oU1.t/oU2.t]

Mode	Output mode	Operation
oFF		No output
HI		Period ON : Display value ≥ oU1.H Period OFF : Display value ≤ oU1.H- HYS.1
Lo		Period ON : Display value ≤ oU1.L Period OFF : Display value ≥ oU1.L + HYS.1
HL		Period ON : Display value ≤ oU1.L or Display value ≥ oU1.H Period OFF : Display value ≥ oU1.L + HYS.1 or Display value ≤ oU1.H- HYS.1
HL-G		Period ON : Display value ≥ oU1.L or Display value ≤ oU1.H Period OFF : Display value ≤ oU1.H- HYS.1 or Display value ≥ oU1.H+ HYS.1

※Set output mode separately for each OUT1/OUT2.
※OUT1/OUT2 are operated individually depending on output operation mode.
※Setting value mode of parameter group 0 is displayed depending on output operation mode.
※GO outputs when the period both OUT1/OUT2 are off. (NPN/PNP open collector output type)

DIN W48×H24mm Small Size Digital Panel Meter

■ Features

- Max. display: 1999
- Auto Zero function and Hold function
- 7-segment LED display
- Power supply: 5VDC, 12-24VDC

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

◎ DC VOLTAGE METER / DC CURRENT METER

M 4 N – DV – 0 1

Measuring input range:

	DC voltage input F.S.	DC current input F.S.
1	199.9mV	199.9μA
2	1.999V	1.999mA
3	19.99V	19.99mA
4	199.9V	199.9mA
X	Option	Option

Field	Code	Description
Power supply	0	5VDC
	1	12-24VDC
Input type	DV	DC Voltage
	DA	DC Current
Size	N	DIN W48×H24mm
Digit	4	1999 (3½-digit)
Item	M	Meter

※M4N series is to measure DC only. AC voltage and AC current is not available to be measured.
※Measuring range for direct connection is max. 200VDC, max. DC200mA.

◎ DIGITAL SCALING METER

M 4 N – DI – 0 X

Field	Code	Description
	X	Option
Power supply	0	5VDC
	1	12-24VDC
Measurement input	DI	DC4-20mA (1-5VDC: option)
Size	N	DIN W48×H24mm
Digit	4	1999 (3½-digit)
Item	M	Meter

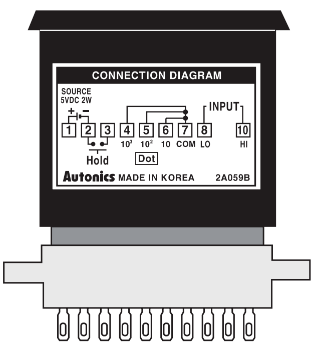
※1-5VDC measuring input is optional.
If there is no additional order, its factory default is DC4-20mA.

■ Specifications

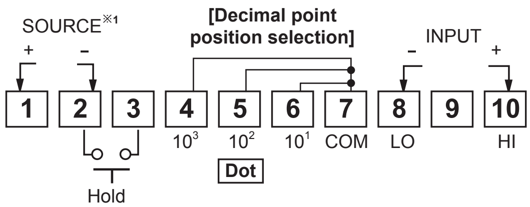
Model		M4N-DV-□□	M4N-DA-□□	M4N-DI-□□
Measurement input		DC voltage	DC current	DC4-20mA
Power supply		5VDC, 12-24VDC		
Allowable voltage range		90 to 110% of rated voltage		
Power consumption		2W		
Display method		7-segment LED display (red) (character height: 10mm)		
Max. display range		Max. 1999		
Display accuracy		F·S ±0.2% rdg ±1-digit		
Sampling period		300ms		
A/D switching method		Dual integral method		
Response time		Approx. 2sec (0 to 1999)		
Max. allowable input		150% of measurement input range		
Sampling time		2.5 times/sec		
Insulation resistance		Over 100MΩ (at 500VDC megger)		
Dielectric strength		2000VAC 50/60Hz for 1 min		
Noise immunity		±100V the square wave noise (pulse width: 1µs) by the noise simulator		
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour		
	Malfunction	0.5mm amplitude at frquency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min		
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times		
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times		
Environment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃		
	Ambient humidity	35 to 85%RH, storage: 35 to 95%RH		
Unit weight		Approx. 44g		

※Environment resistance is rated at no freezing or condensation.

■ Connection



※Socket Pin: 1 2 3 4 5 6 7 8 9 10



※1: 5VDC, 12-24VDC

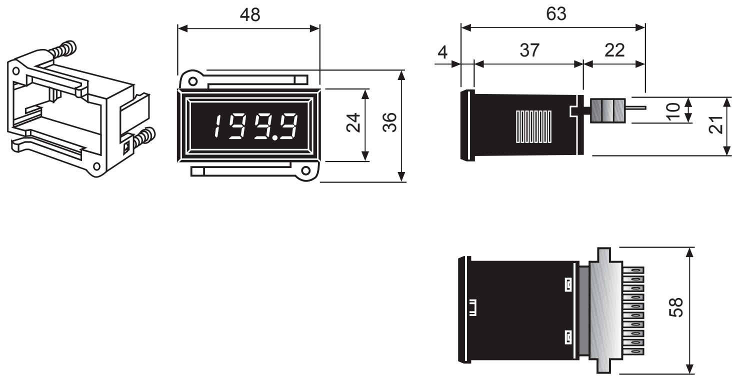
※In case of changing position of decimal point, disconnect switching pattern point on PCB and connect terminal contact according point to be changed.

※Socket pin 9, NC terminal, is not connected at inside.

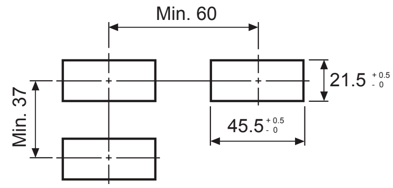
■ Dimensions

(unit: mm)

- Bracket

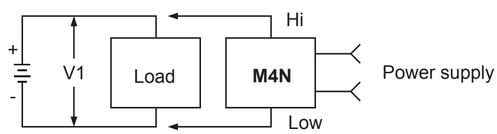


- Panel cut-out

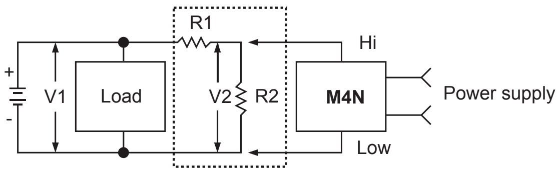


■ Connections

◎ DC volt meter connection



(Fig. 1) Measuring input (V1) is under 200VDC

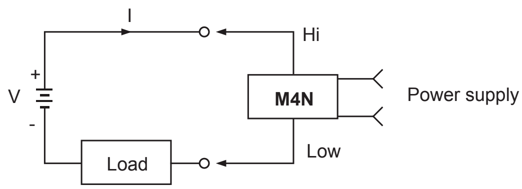


(Fig. 2) Measuring input (V1) is under 200VDC

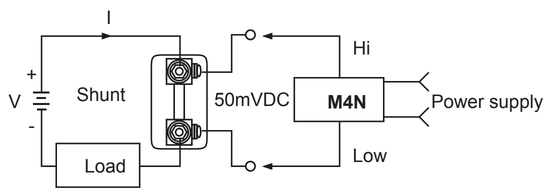
※When the measuring voltage is over 200VDC, please select R1 and R2 in order to make V2 less than max. measuring voltage using multiplier.

$$V2 = \frac{R2}{R1+R2} \times V1 \qquad R1 > R2$$

◎ DC current meter connection



(Fig. 3) Measuring current is under DC200mA

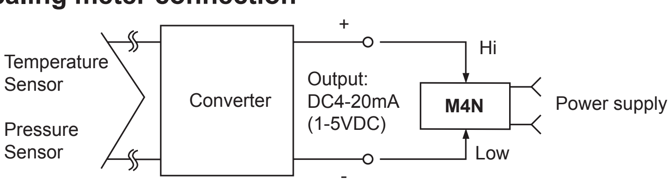


(Fig. 4) Measuring current is 50mVDC

※When the current is higher than DC200mA, please use shunt.

※Second section of shunt is DC50mV.

◎ Scaling meter connection

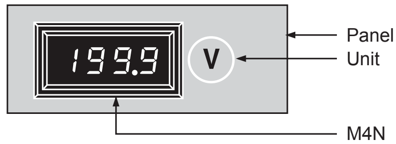


※1-5VDC output of converter is sold separately.

▣ Proper Usage

◎ Caution for selecting and using products

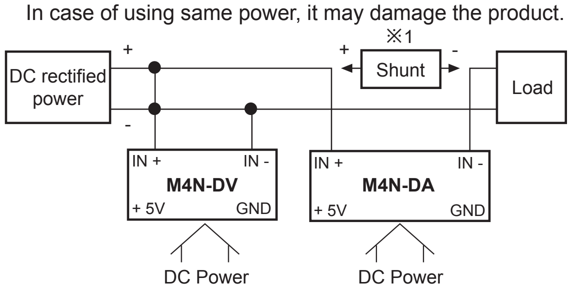
- Be careful customized product by requirement cannot be replaced.
- When power is applied, it may display arbitrary number, because measuring input terminal is opened. If connect Low terminal of measuring input to GND, it displays "000".
- If it indicates 1 or -1 during input signal is ON, please turn OFF the power and check the connection condition, because the input signal is too low or high.
- When measuring voltage is higher than 200VDC, please divide the voltage with multiplying resistance to make lower than 200VDC.
  (Refer to the connection method of DC volt meter in the application of connections)
  E.g.)Measuring 1000VDC
  As the above connection figure of DC volt meter, select the R1 value to make 200VDC on R2.
  (Generally R1 value will be higher than R2 value.)
  Order the D.P.M indicating 1000V for 300VDC.
- Select another item or use shunt for over than DC200mA of measured value.
  (See the connection method of DC current for the application of using shunt.)
  E.g.)In case of measuring 20ADC
  Use the shunt used for 20ADC/50mVDC and the specification
  should be ordered as M4N-DV-X 50mVDC/19.99.
  ※Our company does not sell a shunt. Please connect our distributor to purchase the item.
- M4N series is produced for 5VDC and 12-24VDC. Therefore, before you order the item please check the model again.
- The specification of measurement input, which is indicated in model ordering, is a standard specification,1:1 of measurement input and processing value. The additional specifications can be customizable.
  * The application of M4N-DV/M4N-DA
  M4N - DV - 0X 10VDC / 100.0
  M4N - DA - 0X DC50mA / 199.9
  * The application of M4N-DI
  M4N - DI - 0X DC4-20mA / 100.0
  Note)If measurement input is 1-5VDC, please indicate it. Other wise, it will be produced with DC4-20mA.
- Indicating method of unit
  M4N is not indicated a unit on the product, therefore please indicate it in panel.



- Display of decimal point
  The displaying decimal point is set in the product by your order.
  (The prior products display the decimal point by using jump line in external connector like as connection figures.)
  After purchasing the product, do not change the decimal point. If you need to change it, please connect us or distributor.

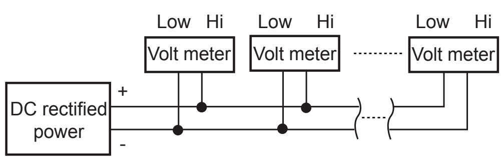
◎ Caution for connecting M4N

- In case of using both volt meter and current meter **Because the connection of measurement input terminal and power terminal is not insulated,** when you use volt meter and current meter by connecting one set, please provide individual power.
  In case of using same power, it may damage the product.



※1: If measure higher current than measuring input range, please use a shunt. If measure higher voltage than measuring input range, please use multiplier.
※If use a voltage measurement function meter and a current measurement function meter to a set, please use each DC power 1 individually.
※Power - terminal and measurement input terminal are shorted inside of the product.

- It is available using several volt meters with providing one DC power. However, the potential difference between - of measurement input and - of power may cause an error.



※Current meter cannot be used with above connection. Please provide power separately.

- Make sure to check the polarity of provided power before turn ON the power.
  (If the polarity is connected reversely, internal circuit could be damaged.)
- Please check if the pin numbers are changed after connecting.

DIN W48×H24mm, W72×H36mm Loop Powered Digital Scaling Meter

■ Features

- Loop powered type: Power from measured input
- Measurement input: DC4-20mA
- Max. display range: -1999 to 9999
- Prescale function (High / Low scale setting)
- Decimal point change function
- Hi / Low limit input correction function
- Display peak value monitoring function
- Changeable delay time of monitoring peak value
- Display cycle change function
  (Selectable 0.5sec/1sec/2sec/3sec/4sec/5sec)
- Error display function

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

M 4 N S − N A

Position	Item	Code	Description
A	Measuring input range	A	DC4-20mA
N	Power supply	N	Loop powered type
S	Measuring function	S	Scaling
N	Size	N	DIN W48×H24mm
		Y	DIN W72×H36mm
4	Digit	4	9999 (4-digit)
M	Item	M	Meter

■ Specifications

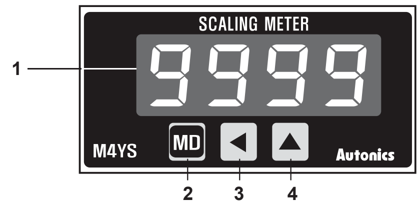
Model		M4NS-NA	M4YS-NA
Power supply		Loop powered type	
Display method		7-segment LED display	
Character height		10mm	14mm
Display accuracy※1		F.S. 0.3% rdg ±1-digit	
Display cycle		Selectable 0.5sec/1sec/2sec/3sec/4sec/5sec	
Resolution		12,000 resolution	
Max. display range		-1999 to 9999	
Setting type		Setting type with the front keys	
Measuring input range※2		DC4-20mA	
Self-diagnosis function		Error display function (HHHH/LLLL)	
Insulation resistance		Over 100MΩ (at 500VDC megger)	
Dielectric strength		2000VAC 50/60Hz for 1 min	
Vibration	Mechanical	0.75mm amplitude at frequency of -10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour	
	Malfunction	0.5mm amplitude at frequency of -10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min	
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times	
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Environ-ment	Ambient temperature	-10 to 50℃, storage: -25 to 60℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Unit weight		Approx. 44g	Approx. 110g

※1: Ambient temperature (25℃±5℃): F.S. 0.3% rdg of ±1-digit (-10 to 50℃: F.S. 0.4% rdg ±1-digit)
※2: Impedance between input lines: Max. 600Ω (based on 24VDC)
Please be aware that activating input power is based on 24VDC, and the recommended impedance also will be lowered if the activating power is lower.
※Environment resistance is rated at no freezing or condensation.

■ Unit Description

● M4NS-NA

● M4YS-NA



1. Display value, parameter, error display

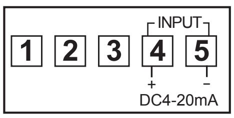
2. M, MD key: When enter into parameter group, return to RUN mode, after completing parameter setting

3. ▲, ▲ (Up) key: When enter into the status of parameter setting

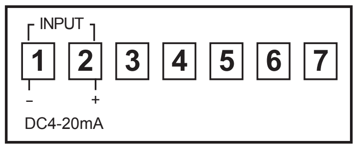
4. ▲, ◀ (Shift) key: When enter into the status of parameter setting and move digit

■ Connections

● M4NS-NA

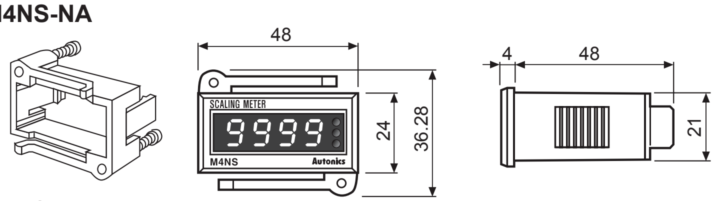


● M4YS-NA

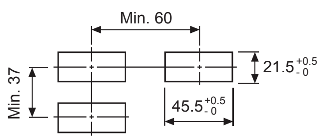


■ Dimensions

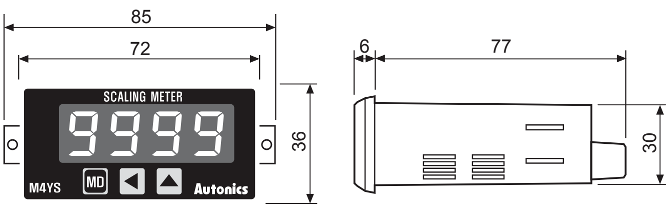
● M4NS-NA



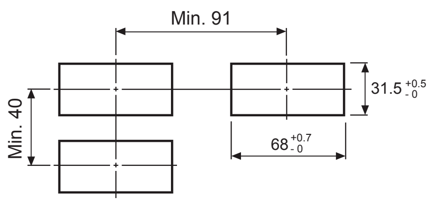
● Panel cut-out (unit: mm)



● M4YS-NA



● Panel cut-out (unit: mm)



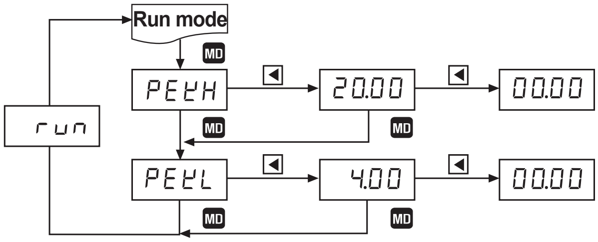
■ Parameter

Display		Function	Setting range
L-SC	Low scale	Low limit display value for 4mA input	-1.999 to 9.999, -19.99 to 99.99, -199.9 to 999.9, -1999 to 9999
H-SC	High scale	High limit display value for 20mA input	
dot	Decimal point	Set Decimal point position	0000, 000.0, 00.00, 0.000
InbL	Input bias low	Correct the Low-limit value of display value (digit)	-100 to 100
InbH	Input bias high	Correct the High-limit value of display value (%)	0.900 to 1.100
PEKt	Peak time	See the peak value monitoring delay time (sec)	0 to 30
dISt	Display time	Selectable sampling period (sec)	Selectable 0.5/1.0/2.0/3.0/4.0/5.0
E.PCt	Error %	Set % of HHHH/LLLL display range	0, 1, 2, 3, 4
LoC	Lock	Set the lock function	Selectable ON, OFF

■ Factory Default Setting

Parameter	Parameter display	Factory default
Low limit display value for 4mA input	L-SC	0400
Hi limit display value for 20mA input	H-SC	2000
Set Dot position	dot	00.00
Correction of Low limit value input	InbL	0000
Correction of Hi limit value input	InbH	1.000
Peak value monitoring delay time	PEKt	01 5
Display cycle	dISt	0.5 5
Set % of HHHH/LLLL display range	E.PCt	3
Lock setting	LoC	oFF

■ Parameter 0 Group (Monitoring Mode)



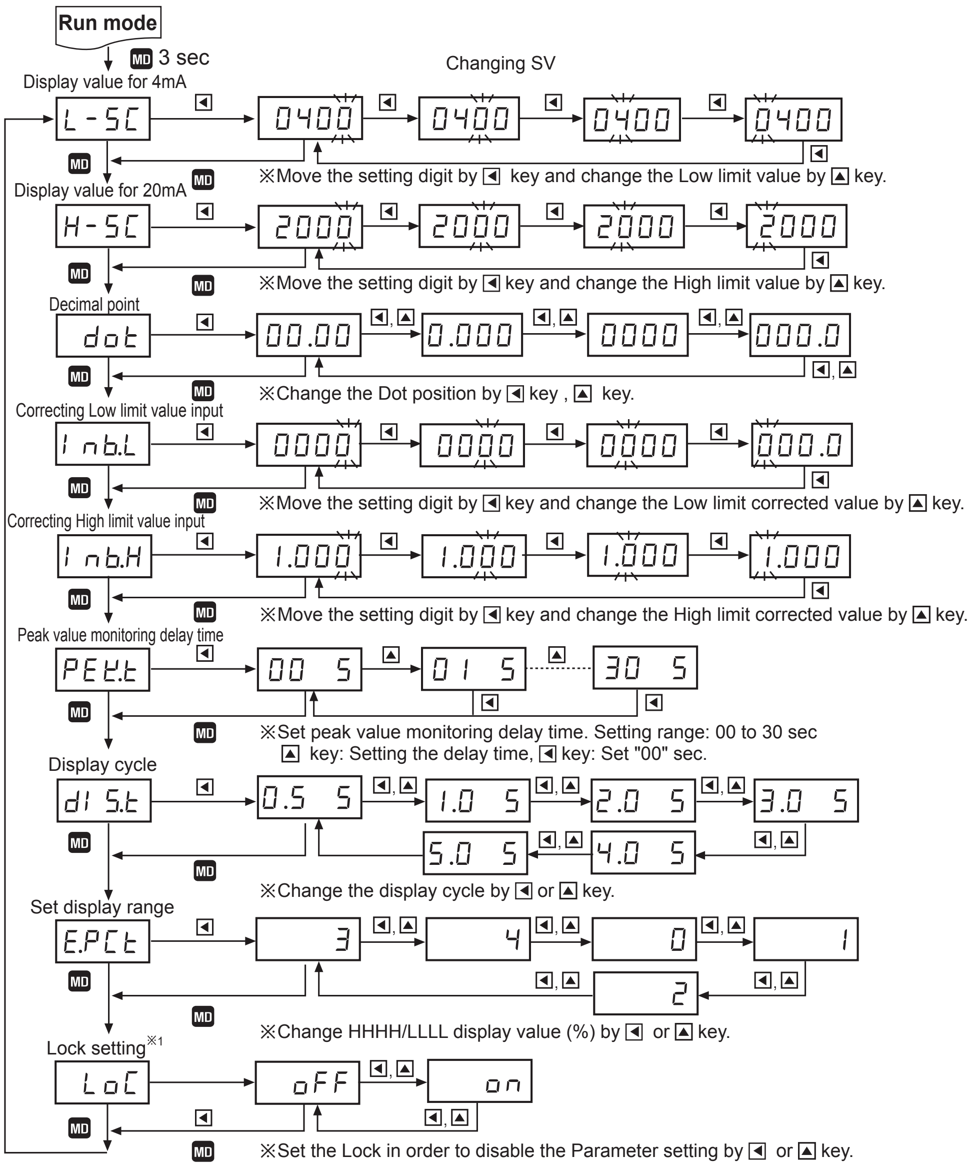
Pressing MD key to enter monitoring mode in RUN mode.

Each peak value will be shown by pressing ◀ key in monitoring mode and peak value will be initialized by pressing ◀ key once more.

If no key touched for 60sec, it will return to RUN mode.

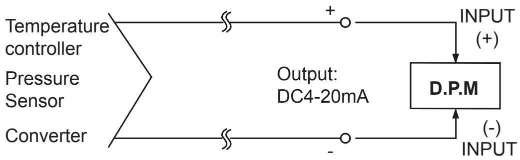
※When do not use monitoring function, set 00 5 for PEΚ.t in Parameter setting.

■ Parameter 1 Group



※Press MD key to complete the setting and move to next Parameter in status of changing setting value.
※Press MD key is pressed for 3 sec to move to RUN mode after displaying [run]
※If any key is untouched for 60 sec, it will return to RUN mode.
※1: Lock setting
- oFF : Enable to change or set Parameter.
- on : Disable to change or set Parameter but enable to check the setting value in Parameter group. Disable to enter into the status of change setting value by pressing ◀, ▲ keys.

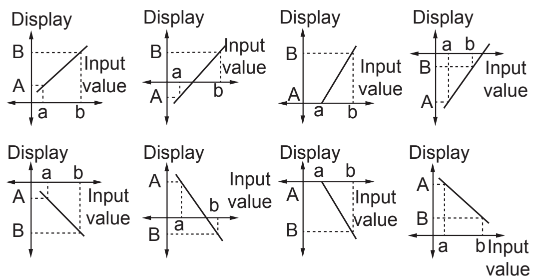
▣ Application Of Connections



▣ Functions

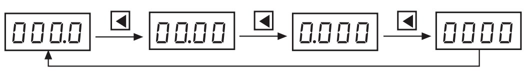
◎ Display scale[L-SC/H-SC]

This function is to display the value setting certain Hi/Low limit value against DC4-20mA input. For example if set a=DC4mA, b=DC20mA and A, B as display value, it will be displayed a=A, b=B.



◎ Decimal point setting[dot]

This function is to set the decimal point position of display value (Set in Parameter setting group)



Able to use ◀ (Shift) or ▲ (Up) for moving decimal.

◎ Correction[Inb.H/Inb.L]

This function is to adjust the error of display value after calculating scale value for measuring input and also correct the input error of sensor etc.

Inb.L :-100 to 100 [Adjust deviation of low value]

Inb.H: 0.900 to 1.100 [Correct gradient (%) of high value]

E.g.)When display value is 0.0 to 500.0 against 4-20mA input, if the display value is “1.2” for 4mA input, set -12 (Ignore the decimal point) as Inb.L value to display “0.0”.It is enable to remove offset of Low display value.

※When completed above Low value setting then apply 20mA, if the display value is “500.5, the correction value will be 5005/5000=0.999, set 0.999 as Inb.H value then enable to correct High value is 50005×0.999 = 5000).It is also ignore the decimal point.

◎ Display cycle delay

It is difficult to display when the measuring input value is fluctuating. In this case it is able to make display value stable by delaying display cycle.

Display cycle can be changed in dI S.t mode of Parameter 2 (Selectable 0.5s/1.0s/2.0s/3.0s/4.0s/5.0s).

If select 5.0s, it will be the measuring input value on an average for 5sec, then display it every 5sec.

◎ Error display[E.PCt]

● Error setting and sort

It will display the error message according to the setting value which set % value against analog input range and set it in E.PCt mode by ◀, ▲ key.

Display	Description
E.PCt 0	LLLL/HHHH are displayed when it is over 0% out DC4-20mA range
E.PCt 1	LLLL/HHHH are displayed when it is over 1% out DC4-20mA range
E.PCt 2	LLLL/HHHH are displayed when it is over 2% out DC4-20mA range
E.PCt 3	LLLL/HHHH are displayed when it is over 3% out DC4-20mA range
E.PCt 4	L-SC/H-SC are displayed always when it is out of DC4-20mA range

● Error display

① When [LLLL] flashes,
Input current is lower than 3% in 4-20mADC (16mA scale) LLLL will flash when it is under 3.52mA [16mA×3% =0.48mA] → 4mA-0.48mA=3.52mA When it is beyond Min. display value (-1999) [by display value]

② When [HHHH] flashes,
Input current is higher than 3% in 4-20mADC (16mA scale) HHHH flash [16mA×3%=0.48mA] → 20mA+0.48mA= 20.48mA.
When it is higher than 20.48mA.
When it is beyond Max. display value (9999) [by display value]

● Turn Error display off

LLLL and HHHH are displayed when input is out of measuring range, therefore it will be disappeared automatically when input returns to measuring range.

◎ Display peak value monitoring [PEKH/PEKL]

This function is to monitor Max. value and Min.value by current display value then display its Data in PEK.H mode and PEK.L mode.

Enable to set delay time in PEK.t mode to protect the wrong Data by initial over current and settable from 0 to 30sec and start to monitor after delay time.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

W75×H25mm Digital Graphic Panel Meter For Mosaic Panel

■ Features

- Various input function
  : 0-2VDC, 0-10VDC, 1-5VDC,
  DC0-1mA, DC4-20mA
- Prescale function (High / Low scale setting)
- Max. display range: -999 to 9999
- Error display function
- High quality by microprocessor built-in
- Display accuracy: F.S. ±0.2% rdg ±1-digit

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

M | 4 | V

Size	V	W75×H25mm
Digit	4	9999 (4-digit)
Item	M	Meter

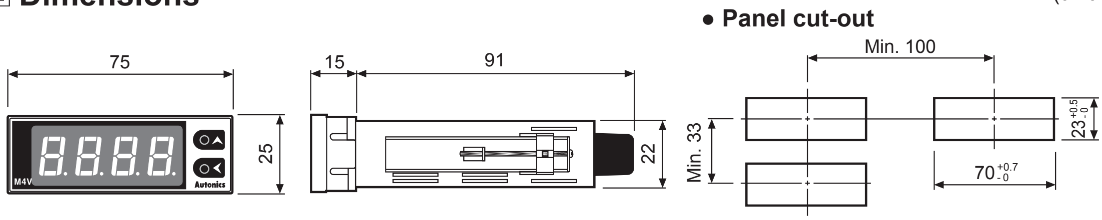
■ Specifications

Model		**M4V**				
Measurement function		DC voltage			DC current	
Measurement input		0-2VDC	1-5VDC	0-10VDC	DC0-1mA	DC4-20mA
Max. allowable input		110% of measurment input				
Power supply		12-24VDC				
Allowable voltage range		90 to 110% of rated voltage				
Power consumption		Approx. 2W				
Display method		7-segment LED display (red) (character height: 14mm)				
Display accuracy		0 to 50℃: F.S. ±0.2% rdg ±1-digit -10 to 0℃: F.S. ±0.3% rdg ±1-digit				
Sampling period		500ms				
Setting method		Scale set by front switches				
Set-diagnosis function		Error indication				
Insulation resistance		Over 100MΩ (at 500VDC megger)				
Dielectric strength		2000VAC 50/60Hz for 1 min				
Noise immunity		±300V the square wave noise (pulse width: 1µs) by the noise simulator				
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 50Hz (for 1 min) in each X, Y, Z direction for 1 hour				
	Malfunction	0.5mm amplitude at frequency of 10 to 50Hz (for 1 min) in each X, Y, Z direction for 10 min				
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times				
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z directions for 3 times				
Environ-ment	Ambient temperature	-10 to 50℃, storage: 20 to 60℃				
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH				
Accessory		Mosaic graphic panel mounting bracket				
Unit weight		Approx. 83g				

※Environment resistance is rated at no freezing or condensation.

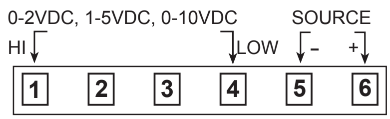
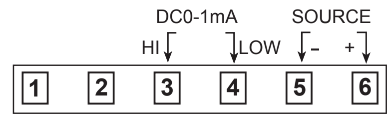
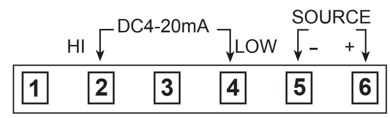
■ Dimensions

(unit: mm)



※It is attached on mosaic graphic panel. Please mount the unit properly on general panel

■ Input And Connection

Input	Display	Connection
0-2VDC	0-2V	
1-5VDC	1-5V	
0-10VDC	0- 10	
DC0-1mA	1 mA	
DC4-20mA	4-20	

■ Factory Defaults

In-t	0-2V	dot	0.0
L-SC	0.0	In-b	00
H-SC	100.0	LoC	OFF

■ Error Display

Display indicates "Error" when wrong measuring input value is applied.

◎ Display an Error

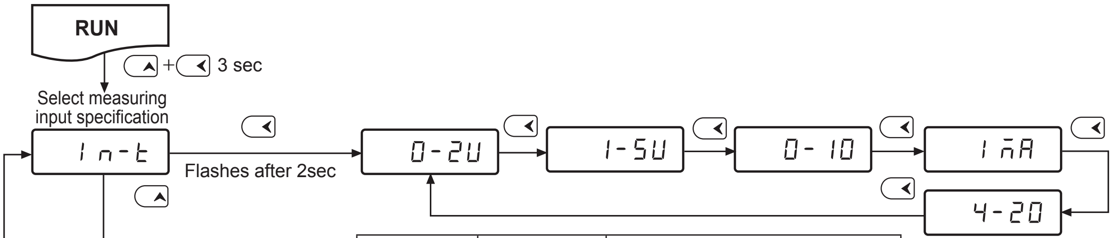
- In case of lower value than measuring input value.
  E.g.)In case of applying DC2mA when measuring input range is selected as DC4-20mA: LLLL flashes.
- In case of higher value than measuring input value.
  E.g.)In case of applying DC22mA when measuring input range is selected as DC4-20mA: HHHH flashes.
- In case of damaging the memory chip by high frequency noise, strong surge noise: Er-E flashes.

◎ Cancellation of Error

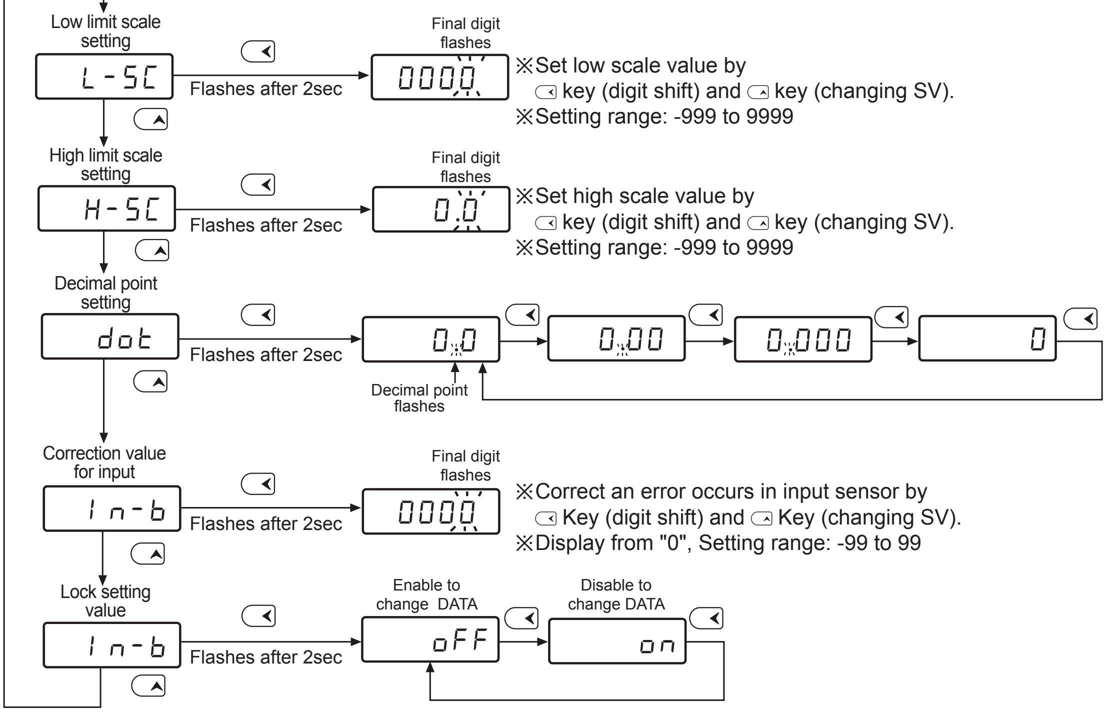
- HHHH and LLLL Error is to exceed measuring input range, therefore if measuring input value is applied with in input range, Error message will be cleared automatically.
- ouEr is indicated by mis-connection or in case of occurring something wrong in measuring input. Please cut off the power and then check measuring input.
- Er-E indicates data damage programmed in memory chip, and damaged data can not be recovered.
  Ask a dealer shop for A/S.
  It is impossible to clear Er-E by end-user, therefore it must be repaired by our engineer.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Parameter Description



Input	Display	Connection
0-2VDC	0-2U	0-2VDC, 1-5VDC, 0-10VDC HI (1) 2 3 (4) LOW
1-5VDC	1-5U	
0-10VDC	0-10	
DC0-1mA	1 mA	DC0-1mA 1 HI (2) 3 (4) LOW
DC4-20mA	4-20	DC4-20mA 1 HI (2) 3 (4) LOW



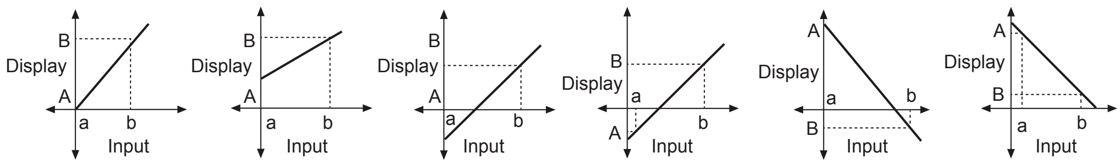
◎ How to change the setting value

1. When advance to MODE, change digit flashing by Key then set DATA value by Key.
2. After complete DATA value setting, please press Key for 2sec then it will move to next MODE saving DATA.
3. Press Key for 2sec to return RUN mode after changing (setting) DATA value in each MODE.

※Press Key for 2sec, then it will return to RUN without change setting value.
※When checking the setting value only in each mode. Press Key for 2sec, then press for 2sec again.
 (If press continuously, it will not advance to next mode and return to RUN mode)
※If any key is untouched for 60sec, it will return to RUN mode.

■ Prescale Function

This function is to display setting of particular high/low-limit value in order to display high/low-limit value of measuring input.
If measuring inputs are a or b and display values are A or B, it will display a=A, b=B as below graph.



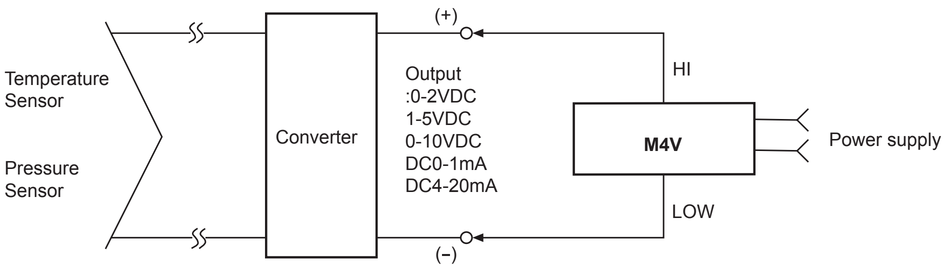
① ② ③ ④ ⑤ ⑥

E.g.) Enables to set the display value for input as certain value (Not "0") by using prescale function.

Measuring input	Prescale setting value		Display	Graph
0-10VDC	L-Scale: 0	H-Scale: 200	0 to 200	①
	L-Scale: 50	H-Scale: 200	50 to 200	②
	L-Scale: -100	H-Scale: 200	-100 to 200	③
	L-Scale: 200	H-Scale: -50	200 to -50	⑤

※Prescale value setting range →L-SC (low limit): -999 to 9999, H-SC (high limit): -999 to 9999
But, there must be offset "1" between L-SC and H-SC.

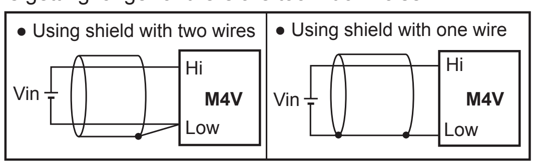
■ Application Of Connections



■ Proper Usage

● Please read this catalog before purchase Panel meter.
● Ambient condition
- Please use this product under -10 to 50℃ of ambient operating temperature and less than 35 to 85%RH of humidity. Moreover, use this item near normal temperature 20℃, the most important condition, which manages the accuracy.
- Please avoid the condition of dew status by rapidly changing temperature.
- Please avoid too much vibration or shock.
- Please avoid the place where there are drag, dust, and chemical agent or gas, which is destructive to electrical parts.
- Do not use this item where the voltage or noise is over the proper specification.
  it may cause malfunction.

● Storage
When you keep it, please avoid a direct ray of light and keep it under -20 to 60℃ of ambient operating temperature and less than 35 to 85%RH of humidity. Wrap and keep it as initial state.
● Input Line
Shield wire must be used when the measuring input line is getting longer or there are too much noise.



DIN W48×H24mm Small Size Digital Multi Panel Meter

■ Features

- Various input/output options (by model)
  - Input options: DC voltage, DC current, AC voltage, AC current
  - Output options: RS485 communication output, PV transmission output (DC 4-20 mA), NPN/PNP open collector output, relay contact output
    ※default option: indicator/no output
- Maximum allowed input: 50 VDC, DC 500 mA, 250 VAC, AC 5 A
- Display range: -1999 to 9999
- High/low-limit display scale function
- AC frequency measurement (range: 0.1 to 9999 Hz)
- Various functions: peak display value monitoring, display cycle delay, zero-point adjustment, peak display value correction, PV transmission output (DC 4-20 mA) scale
- Power supply: 12-24 VDC/VAC, 100-240 VAC

⚠ Please read "Caution for your safety" in operation manual before using.

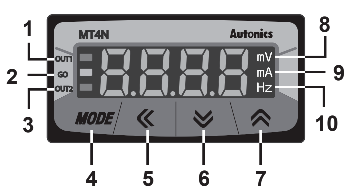
■ Ordering Information

MT | 4 | N – DV – E | N

Item	Code	Description
Output	N	Indicator (without output function)
	0	Relay (OUT1/OUT2) output
	1	NPN open collector output (OUT1, GO, OUT2)
	2	PNP open collector output (OUT1, GO, OUT2)
	3	Relay (OUT1)+transmission (DC4-20mA) output
	4	Relay (OUT1)+RS485 communication output
	5	Relay (OUT1/OUT2)+transmission (DC4-20mA) output
Power supply	E	12-24VDC/AC
	4	100-240AC
Measuring input	DV	DC voltage
	DA	DC current
	AV	AC voltage
	AA	AC current
Size	N	DIN W48×H24mm
Digit	4	9999 (4-digit)
Item	MT	Multi Meter

※To measure the current over DC5A, please select DV type because the shunt should be used.
※In case of selecting frequency display, no output will be provided even if it is output support models. (main output, sub output and RS485 communication output)

■ Unit Description



1. **OUT1**: Preset output of OUT1
2. **GO**: Preset Go output of OUT1/OUT2
3. **OUT2**: Preset output of OUT2
4. MODE **key**: Mode key
5. « **key**: Shift key
6. ⩔ **key**: Down key
7. ⩓ **key**: Up key
8. **mV, V unit**
9. **mA, A unit**
10. **Hz unit**

※There is no **1**, **2**, **3** on a display panel of MT4N-□-□N.
※MT4N-□-□3, □4 model has output display part of OUT1 only.

■ Specifications

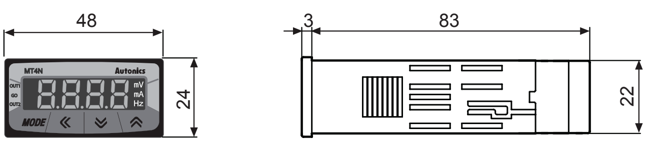
Series		MT4N-DV-E□ MT4N-DA-E□	MT4N-AV-E□ MT4N-AA-E□	MT4N-DV-4□ MT4N-DA-4□	MT4N-AV-4□ MT4N-AA-4□
Measurement input		DC voltage, current	AC voltage, current, frequency	DC voltage, current	AC voltage, current, frequency
Power supply		12-24VDC/AC		100-240VAC	
Allowable voltage range		90 to 110%			
Power consumption		DC: 3W, AC: 5VA For MT4N-□-E5 - DC: 5W, AC: 8VA		5VA	
Display method		7-segment LCD display (character height: 9mm)			
Display accuracy		• 23℃±5℃ - DC type: F.S. ±0.1% rdg ±2-digit / AC type: F.S. ±0.3% rdg ±3-digit DC/AC type: F.S. +0.3% rdg ±3-digit max. only for 5A terminal. • -10℃ to 50℃ - DC/AC type: F.S. ±0.5% rdg ±3-digit			
Max. allowable input		110% F.S. for each measured input range			
A/D conversion method		Practical oversampling using successive approximation ADC			
Sampling cycle		DC type: 50ms, AC type: 16.6ms			
Max. display range		-1999 to 9999 (4-digit)			
Preset output		• Relay output - Contact capacity: 125VAC 0.3A, 30VDC 1A/Contact composition: N.O (1a) • NPN/PNP Open Collector output - Max. 12-24VDC ±2V 50mA (resistive load)			
Sub output (transmission output)		• RS485 communication output - Baud rate: 1,200/2,400/4,800/9,600, Communication method : 2-wire half duplex, Synchronous method: Sub-synchronization, Protocol: Modbus type • DC4-20mA output - Resolution: 12,000 division (load resistance max. 600Ω)			
AC measuring function※1		Selectable RMS or AVG			
Frequency measuring function※1		Measurement range: 0.100 to 9999Hz (variable by decimal point position)			
Hold function※2		Includes (external hold function)			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Dielectric strength		1000VAC for 1 min (between external terminal and case)		2000VAC for 1 min (between external terminal and case)	
Noise immunity		±2kV the square wave noise (pulse width: 1㎲) by the noise simulator			
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min			
Shock	Mechanical	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times			
	Malfunction	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times			
Environ-ment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Insulation type		Double insulation or reinforced insulation (mark: ⧈, dielectric strength between the measuring input part and the power part: 1kV)			
Approval		CE		—	
Weight※3		Approx. 127g (approx. 64g)			

※1: AC measuring function, and frequency measuring function are only for AC measuring input type.
※2: The indicator has no Hold function.
※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

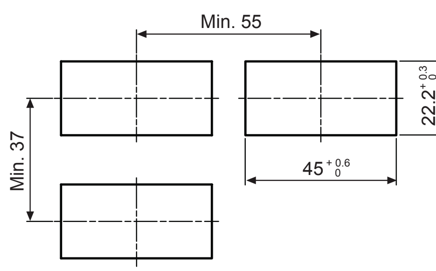
■ Dimensions

(unit: mm)

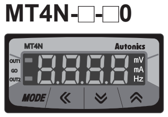
● MT4N-□-□N



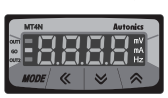
● Panel cut-out



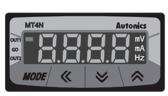
● MT4N-□-□0



● MT4N-□-□1, □2



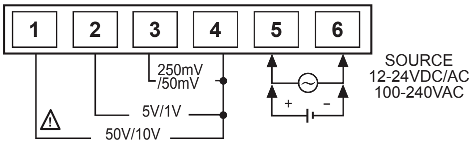
● MT4N-□-□3, □4



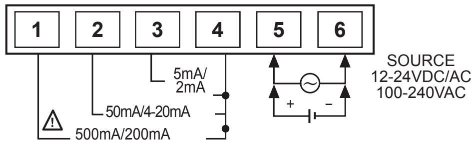
▣ Connections

◎ Measuring input terminal connection

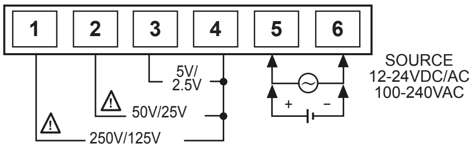
● **MT4N-DV-□□**



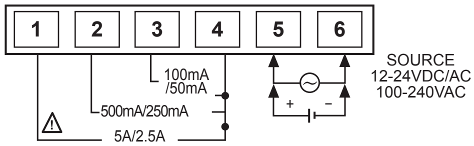
● **MT4N-DA-□□**



● **MT4N-AV-□□**

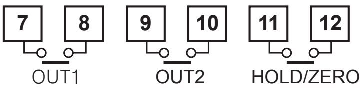


● **MT4N-AA-□□**

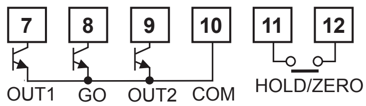


◎ Output terminal of connection

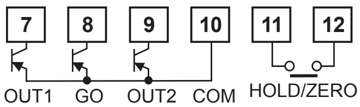
● **MT4N-□-□0**
(Relay output)



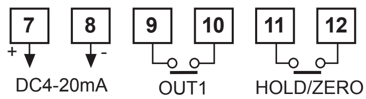
● **MT4N-□-□**
(NPN open collector output)



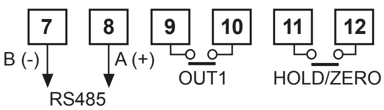
● **MT4N-□-□2**
(PNP open collector output)



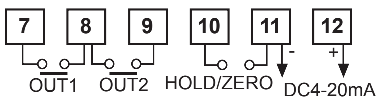
● **MT4N-□-□3**
(Relay+transmission (DC4-20mA) output)



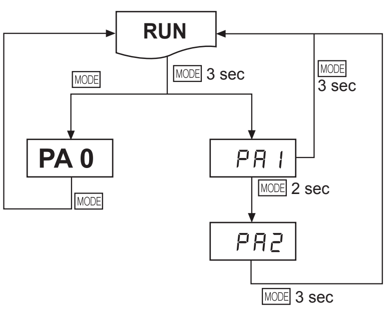
● **MT4N-□-□4**
(Relay+RS485 communication output)



● **MT4N-□-□5**
(Relay+transmission (DC4-20mA) output)

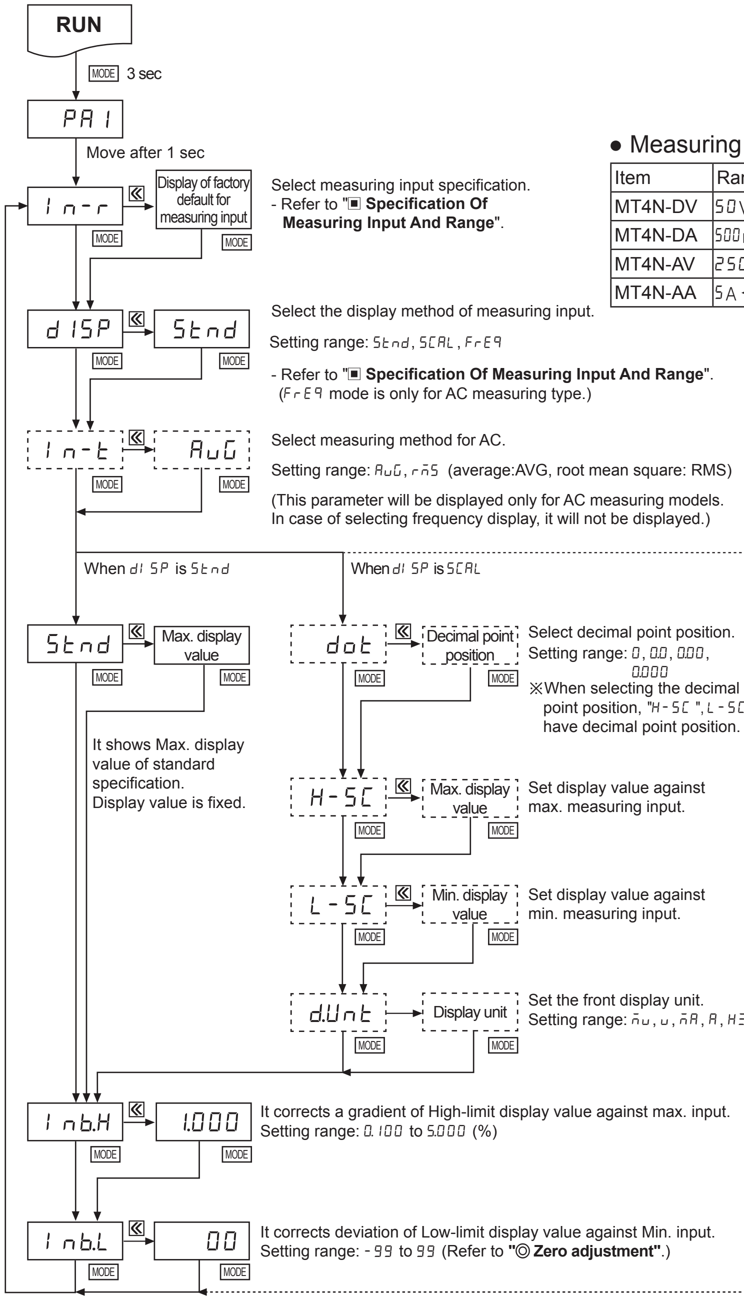


▣ Parameter Setting



※Press MODE key in **RUN** mode and it enters **PA 0** group.
※Press MODE key for over 3 sec in **RUN** mode, it displays [PA 1].
※Press MODE key for over 5 sec in **RUN** mode, it displays [PA2] after [PA 1].
When pressing MODE key continually, it stops displaying at [PA2].
※It is advanced to current display parameter releasing MODE key at [PA 1] or [PA2].
※Press MODE key for over 3 sec in any parameter groups, it returns to **RUN** mode.
※If any key is not entered for 60 sec in each parameter, it returns to **RUN** mode.
※After returning to **RUN** mode, press MODE key within 2 sec, it returns to previous parameter. (Refer to descriptions of each parameter group.)
※**PA 0** group cannot be entered when preset output mode of [PA2] group is oFF.

■ Parameter 1 Group



● Measuring input chart by model

Item	Range of measuring input
MT4N-DV	50V ↔ 10V ↔ 5V ↔ 1V ↔ 250mV ↔ 50mV ↔ 50V
MT4N-DA	500mA ↔ 200mA ↔ 50mA ↔ 4-20mA ↔ 5mA ↔ 2mA ↔ 500mA
MT4N-AV	250V ↔ 125V ↔ 50V ↔ 25V ↔ 5V ↔ 2.5V ↔ 250V
MT4N-AA	5A ↔ 25A ↔ 500mA ↔ 250mA ↔ 100mA ↔ 50mA ↔ 5A

0	1 to 9999Hz
0.0	0.1 to 999.9Hz
0.00	0.10 to 99.99Hz
0.000	0.100 to 9.999Hz

※In case of selecting frequency display, no output will be provided even if it is output support models (main output, Sub output and RS485 communication output) .

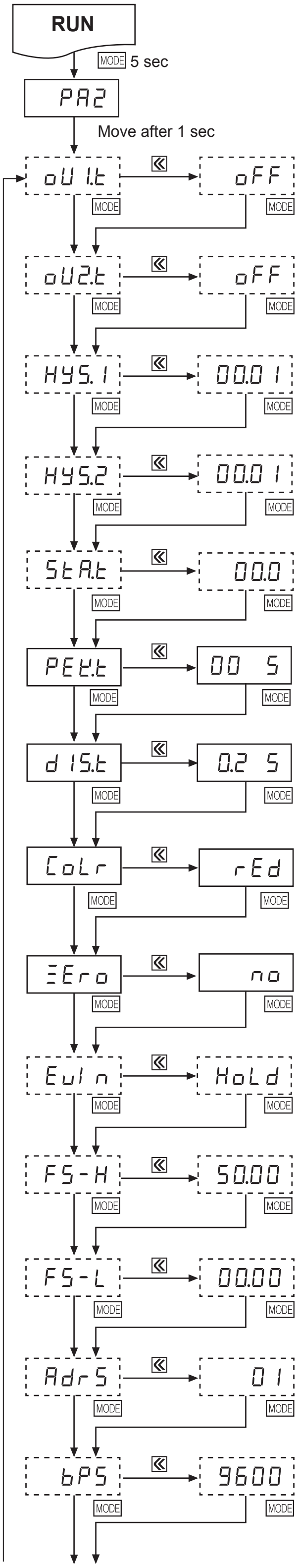
※After setting each mode, press MODE key for 2 sec to return to **RUN**.
※If any key is untouched for 60 sec after advance to Parameter, it will return to **RUN**.

◎ Factory defaults

Parameter	MT4N-DV	MT4N-DA	MT4N-AV	MT4N-AA
In-r	50	500	250	5
dISP	Stnd	Stnd	Stnd	Stnd
In-t	—	—	AvG	AvG
Stnd	50.00	500.0	250.0	5.000
d-Unt	u	A	u	A

Parameter	MT4N-DV	MT4N-DA	MT4N-AV	MT4N-AA
Inb.H	1.000	1.000	1.000	1.000
Inb.L	00	00	00	00
dot	0.00	0.0	0.0	0.000
Inb.E	—	—	10-0	10-0

■ Parameter 2 Group



Select Preset output mode of OUT1. (But, it is only displayed in OUT1 output included model.)
Setting range: oFF, HI, Lo, HL, HL-G

Select Preset output mode of OUT2. (But, it is only displayed in OUT2 output included model.)
Setting range: oFF, HI, Lo, HL, HL-G

Select Preset hysteresis of OUT1.
The range is within 10% of max. display range (unit: digit).
※ oU1.t mode is oFF, it is not displayed.

Select Preset hysteresis of OUT2.
The range is within 10% of max. display range (unit: digit).
※oU2.t mode is oFF, it is not displayed.

Set startup compensation time.
Setting range: 00 to 99.9 sec

Set a monitoring delay time for displayed peak value.
Setting range: 00 to 30 sec

Set display cycle and also variable sets by 0.1 sec.
Setting range: 0.1 to 5.0 sec

Selectable color with 5 modes.
Setting range: rEd, Grn, YEL, r-G, G-r
rEd, Grn, YEL: Display with 1 color. r-G, G-r: Color is changed when error occurs.
E.g.) r-G: Red is standard and green when error occurs.
※Color is changed only when error in "■ **Error Display Function**" occurs excluding 'over'.

Select zero function with operation at front.
When [«] + [⩓] Key are pressed for 3 sec to set YES, it will be zero function and the deviation value is saved automatically at Inb.L mode.

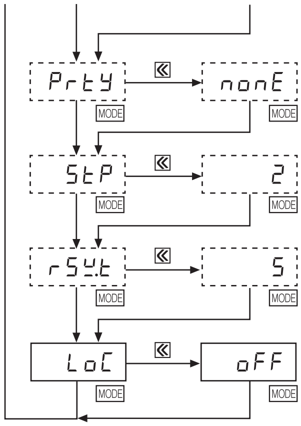
Select HoLd input with 11, 12 terminal or zero function for external signal.
(set with [⩓], [⩔] Key)
HoLd: Holding display value, ZEro: Zero function using Hold/Zero terminal

Set the high limit value, output point of current output 20mA.
(When changing measuring input and prescale mode, it is changed automatically as maximum value of input range.)

Set the low limit value, output point of current output 4mA.
(When changing measuring input and prescale mode, it is changed automatically as minimum value of input range.)

Set the address of RS485 communication output.
Setting range: 01 to 99

Select baud rate of RS485 communication output.
Setting range: 9600, 4800, 2400, 1200



Set parity bit of RS485 communication.
Setting range: nonE, EuEn, odd

Set stop bit of RS485 communication.
Setting range: 1, 2

Set response wait time of RS485 communication.
Setting range: 5 to 99

Set key lock function and select from 4 types.
Setting range: oFF, LoC1, LoC2, LoC3

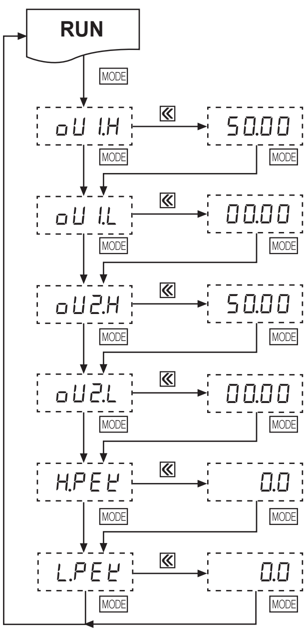
oFF	Disable to lock keys
LoC1	Lock Parameter 1
LoC2	Lock Parameter 1, 2
LoC3	Lock Parameter 0, 1 and 2

※The dotted mode is only displayed for output type.
※After setting each mode, press [MODE] key for 2 sec to return to **RUN** mode.
※If any key is untouched for 60 sec after advance to parameter, it will return to **RUN** mode.
※The min. setting interval between FS-H and FS-L is 10% F.S., it is fixed as 10% of the setting value when it is small.

◎ Factory defaults

Parameter	MT4N-DV	MT4N-DA	MT4N-AV	MT4N-AA	Parameter	MT4N-DV	MT4N-DA	MT4N-AV	MT4N-AA
oU1.t	oFF	oFF	oFF	oFF	ZEro	no	no	no	no
oU2.t	oFF	oFF	oFF	oFF	EuIn	HoLd	HoLd	HoLd	HoLd
HYS.1	00.01	000.1	000.1	0.001	FS-H	50.00	500.0	250.0	5.000
HYS.2	00.01	000.1	000.1	0.001	FS-L	00.00	000.0	0.0	0.000
PEK.t	00 5	00 5	00 5	00 5	Adrs	01	01	01	01
dIS.t	0.2 5	0.2 5	0.2 5	0.2 5	bPS	9600	9600	9600	9600
CoL.r	rEd	rEd	rEd	rEd	LoC	oFF	oFF	oFF	oFF

■ Parameter 0 Group



Set High-limit preset value of oU1.H. (set with [«], [⋀], [⋁] key)
※It is displayed when set the preset only.
When set oFF in oU1.t mode if **PA 2**, the parameter is not displayed.

Set Low-limit preset value of oU1.L. (set with [«], [⋀], [⋁] key)
※It is displayed when set the preset only.
When set oFF in oU1.t mode if **PA 2**, the parameter is not displayed.

Set High-limit preset value of oU2.H. (set with [«], [⋀], [⋁] key)
※It is displayed when set the preset only.
When set oFF in oU2.t mode if **PA 2**, the parameter is not displayed.

Set Low-limit preset value of oU2.L. (set with [«], [⋀], [⋁] key)
※It is displayed when set the preset only.
When set oFF in oU2.t mode if **PA 2**, the parameter is not displayed.

It shows High-limit monitoring value while it is **RUN** status.
It will be reset by pressing any [«], [⋀], [⋁] key.
※H.PEK parameter is not displayed when PEK.t parameter is set as 00 sec [00 5] at **PA 2**.

It shows Low-limit monitoring value while it is **RUN** status.
It will be reset by pressing any [«], [⋀], [⋁] key.
※L.PEK parameter is not displayed when PEK.t parameter is set as 00 sec [00 5] at **PA 2**.

※If any key is untouched for 60 sec after advance to parameter, it will return to **RUN** mode.

◎ Factory defaults

Parameter	MT4N-DV	MT4N-DA	MT4N-AV	MT4N-AA	Parameter	MT4N-DV	MT4N-DA	MT4N-AV	MT4N-AA
oU1.H	50.00	50.00	250.0	5.000	oU2.L	00.00	000.0	000.0	0.000
oU1.L	00.00	000.0	000.0	0.000	H.PEK	0.00	0.0	0.0	0.000
oU2.H	50.00	500.0	250.0	5.000	L.PEK	0.00	0.0	0.0	0.000

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Specification Of Measuring Input And Range

Type	Measuring input and range		Input impedance	Display range [Stnd]	Prescale display range [SCAL]
DC voltage	0-50V	[50V]	434.35kΩ	0.00 to 50.00 (fixed)	
	0-10V	[10V]	434.35kΩ	0.00 to 10.00 (fixed)	
	0-5V	[5V]	43.35kΩ	0.000 to 5.000 (fixed)	
	0-1V	[1V]	43.35kΩ	0.000 to 1.000 (fixed)	
	0-250mV	[250mV]	2.15kΩ	0.0 to 250.0 (fixed)	
	0-50mV	[50mV]	2.15kΩ	0.00 to 50.00 (fixed)	
DC current	0-500mA	[500mA]	0.1Ω	0.0 to 500.0 (fixed)	
	0-200mA	[200mA]	0.1Ω	0.0 to 200.0 (fixed)	
	0-50mA	[50mA]	1.1Ω	0.00 to 50.00 (fixed)	
	4-20mA	[4-20mA]	1.1Ω	4.00 to 20.00 (fixed)	
	0-5mA	[5mA]	101.1Ω	0.000 to 5.000 (fixed)	
	0-2mA	[2mA]	101.1Ω	0.000 to 2.000 (fixed)	
AC voltage	0-250V	[250V]	1.109MΩ	0.0 to 250.0 (fixed)	
	0-125V	[125V]	1.109MΩ	0.0 to 125.0 (fixed)	
	0-50V	[50V]	200kΩ	0.00 to 50.00 (fixed)	
	0-25V	[25V]	222kΩ	0.00 to 25.00 (fixed)	
	0-5V	[5V]	22kΩ	0 000 to 5.000 (fixed)	
	0-2.5V	[2.5V]	22kΩ	0.000 to 2.500 (fixed)	
AC current	0-5A	[5A]	0.01Ω	0.000 to 5.000 (fixed)	
	0-2.5A	[2.5A]	0.01Ω	0.000 to 2.500 (fixed)	
	0-500mA	[500mA]	0.1Ω	0.0 to 500.0 (fixed)	
	0-250mA	[250mA]	0.1Ω	0.0 to 250.0 (fixed)	
	0-100mA	[100mA]	0.5Ω	0.0 to 100.0 (fixed)	
	0-50mA	[50mA]	0.5Ω	0.00 to 50.00 (fixed)	

Prescale display range [SCAL]:

dot	Display range
0	-1999 to 9999
0.0	-199.9 to 999.9
0.00	-19.99 to 99.99
0.000	-1.999 to 9.999

(Display range is variable according to decimal point position.)

※Please wire the proper terminal to its max. input within 30 to 100% of the input terminal. When it is higher than input, it may cause terminal breakdown and HHHH appears. The accuracy is decreased when it is connected to the terminal under 30%.

▣ Sold Separately

◎ Communication converter

- **SCM-38I**
  (RS232C to RS485 converter)

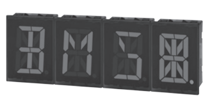
- **SCM-US48I**
  (USB to RS485 converter)

◎ Display Units (DS/DA-T Series)

- **DS/DA-T Series**
  (RS485 communication input type display unit)

DS16-□T

DS22/DA22-□T



DS40/DA40-□T

DS60/DA60-□T

※Connect RS485 communication input type display unit (DS/DA-T Series) and RS485 communication output model of MT4N Series, the display unit displays present value of the device without PC/PLC.

■ Functions

◎ AC frequency measurement [PA1 group: dISP]

It measures input signal frequency when it is AC input.
It uses fixed decimal point[**PA 1**: dot], measured range can be changed by setting and measured range of decimal point position is as below chart. It is available to adjust the upper gradient at [**PA 1**: Inb.H] and [**PA 1**: Inb.E]. In order to measure frequency normally, input signal, over 10% F.S. of the measured range, should be supplied. Please select the proper point of measurement terminal.

① Measuring range

Decimal point position	0.000	0.00	0.0	0
Decimal point position	0.100 to 9.999Hz	0.10 to 99.99Hz	0.1 to 999.9Hz	1 to 9999Hz

※Accuracy of frequency measurement:
Below 1kHz, F.S. ±0.1rdg ±2-digit.
From 1kHz to 10kHz, F.S. ±0.3rdg ±2-digit.

② Inb.H: 0.100 to 9.999
[Gradient adjustment of high value]

③ Inb.E: 10^{-2}, 10^{-1}, 10^{-0}, 10^{1} [Index adjustment of Inb.H]

◎ Zero adjustment [Deviation correction function of low limit display value]

It adjusts the display value of the optional configured input value as zero by force, zero point error can be adjusted with 3 ways as below. When zero point adjustment with front key and Hold terminal is finished normally, zero point of measurement terminal is displayed and the adjusted value at saved in Inb.L automatically.

Operation	Input correction value	Front panel key	Input external signal
Description	**PA 1**:Direct input correction value method at Inb.L	≪, ≫ keys are pressed for 3 sec at the RUN mode.	Short-circuit External hold terminal 11, 12 over min. 50m.

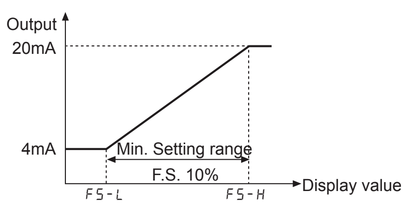
※Refer to "◎ **Error correction**", "◎ **Error display**" and "■ **Parameter 2 Group**" for function and error.

◎ Transmission (DC4-20mA) output scale [PA 2 group: FS-H / FS-L]

It sets transmission output for the display value at the output current DC4-20mA.
It sets display value for 4mA at FS-L and 20mA at FS-H and the range between FS-H and FS-L should be 10%

※When min. set interval between FS-H and FS-L is set as under 10% F.S., it changed as over 10% F.S. automatically.

※Preset display value is fixed to output as 4mA at under FS-L and 20mA at over FS-H.



◎ Initialization

It initializes as the factory default status. If press ≪, ≫, ⋎ keys together for 2 sec in **RUN** mode, InIt mode and the setting value [no] is displayed every 0.5 sec and it will be initialized as the factory default when press MODE key after change no → YES.

◎ Error display

Display	Description
HHHH	Flashes when measuring input is exceeded the max. allowable input (110%)
LLLL	Flashes when measuring input is exceeded the max. allowable input (-10%)
d-HH	Flashes when display input is exceeded max. display range (9999)
d-LL	Flashes when display input is exceeded min. display range (-1999)
F-HH	Flashes when measuring frequency is exceeded the max. measuring value (9999)
ouEr	Flashes when it exceeds zero adjustment range (±99)

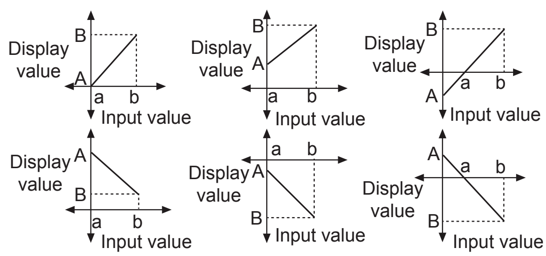
※Error display is released automatically when it is in the measured and display range.

※"LLLL" is displayed when the measuring input is DC4-20mA.

※After flashing "ouEr" 2 times when it exceeds the zero adjustment range, it returns to RUN mode.

◎ Display scale [PA 1 group: H-SC / L-SC]

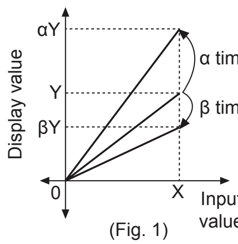
This function is to display setting (-1999 to 9999) of particular High/Low-limit value in order to display High/Low-limit value of measured input. If measured inputs are 'a' and 'b' and particular values are 'A' and 'B', it will display a=A, b=B as below graphs.



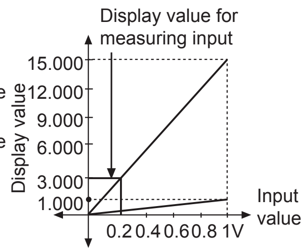
◎ Gradient correction [PA1 group: I nb.H]

It corrects the gradient of prescale value and display value. (Fig. 1) Display value Y can be adjusted as α, β times against X input value by correction function [I nb.H] and used as correction function of max. display value [H-SC]. Adjustment range is 0.100 to 5.000 and multiply current gradient.

E.g.) To display "3.000" in DC 200mV input for measured input specification as 0 to 1V.



(Fig. 1)



(example of gradient correction)

①Select 0-1VDC[Iu] for measured input in Parameter 1.
②Standard specification in input: 0-1VDC and 1.000 therefore it has to be 15.000[H-SC] for 1VDC (input) in order to display 3.000 for 200mVDC (input) .
But it is unable due to setting range is 9.999.
③In this case, please check below chart.
Please set as I nb.H × H-SC = 15.000

Setting	H-SC	L-SC	I nb.H	Note
①	Disable	0.000	1.000	—
②	7.500	0.000	2.000	In this case, any setting methods display the same display value.
③	5.000	0.000	3.000	
④	3.750	0.000	4.000	
⑤	3.000	0.000	5.000	

◎ Error correction [PA 1 group: I nb.H / I nb.L]

It corrects display value error of measured input.
I nb.L : ±99 [Adjust deviation of low value]
I nb.H: 5.000 to 0.100 [Correct gradient (%) of high value]
Display value= (measured value × I nb.H) + I nb.L
E.g.) When the measured range is 0 to 500V, and the display range is 0 to 500.0. If the low display value is "I.2" to 0V input, set -12 as I nb.L value to display "0.0" by adjusting offset of the low value. The display value to 500V measured input varies by adjusting the offset of low value. If this display value is "50 I.0", calculate 500.0/501.0 (desired display value/the display value) , and set the 0.998 correction value as the I nb.H to display 500.0 by adjusting gradient of high value.
※The offset correction range of I nb.L is within -99 to 99 for D^{-0}, D^{-1} digit regardless of decimal point.

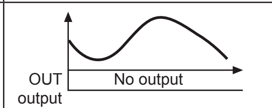
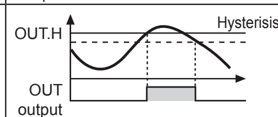
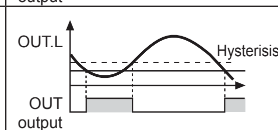
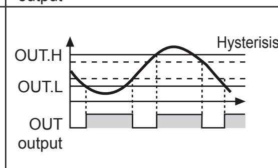
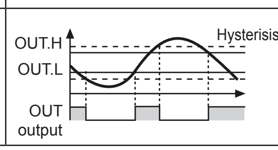
◎ Display cycle delay [PA 2 group: dI S.t]

In some applications the measured input may fluctuate which in turn causes the display to fluctuate. By adjusting the display cycle delay function time in the dI S.t of parameter 2, the operator can adjust the display time within a range of 0.1 sec to 5 sec For example, if the operator sets the display cycle time to 4.0 sec, the display value displayed will be the average input value over 4 sec and also will show any changes if any every 4 sec.

◎ Monitoring peak display value [PA 0 group: H.PEK / L.PEK, PA 2 group: PEK.t]

It monitors max./min. value of display value based on the current displays value and then displays the data at H.PEK, L.PEK of parameter 0. Set the delay time (0 to 30 sec) at PEK.t of parameter 2 in order to prevent malfunction caused by initial overcurrent or overvoltage, when monitoring the peak value.
Delay time is 0 to 30 sec and it starts to monitor the peak value after the set time. When pressing any one of ≪ ︾ ︽ keys at H.PEK, L.PEK of parameter 0, the monitored data is initialized.
※H.PEK, L.PEK parameters is not displayed when monitoring delay time [PEK.t] of parameter 2 group is set as 00 sec [00 S].

◎ Preset output operation mode [PA 2 group: oU I.t / oU2.t]

Mode	Output operation	Operation
oFF		No output
HI		Period ON : Display value ≥ OUT.H Period OFF : Display value ≤ OUT.H-Hys
Lo		Period ON : Display value ≤ OUT.L Period OFF : Display value ≥ OUT.L+Hys
HL		Period ON : Display value ≤ OUT.L or Display value ≥ OUT.H Period OFF : Display value ≥ OUT.L +Hys or Display value ≤ OUT.H-Hys
HL-G		Period ON : OUT.L ≤ Display value ≤ OUT.H+Hys Period OFF : Display value ≤ OUT. L -Hys or Display value ≥ OUT.H+Hys

※Set output mode separately for each OUT1/OUT2.
※OUT1/OUT2 are operated individually depending on output operation mode.
※Setting value mode of parameter group 0 is displayed by output operation mode selection.
※GO is outputted within the period both OUT1/OUT2 are off. (NPN/PNP open collector output type.)

■ Communication Output

(refer to pages L-46 to L-47.)

DIN W72×H36mm, W96×H48mm, Digital Multi Panel Meter

■ Features

- Various input/output (default: indicator)
  - Input: DC voltage, DC current, AC voltage, AC current
  - Output: RS485 communication output, Low speed serial output, transmission (DC4-20mA) output, BCD dynamic output, NPN/PNP open collector output, relay output
- Maximum allowed input
  : 500VDC, 500VAC, DC5A, AC5A
- Display range: -1999 to 9999
- High/low-limit display scale function
- AC frequency measurement (range: 0.1 to 9999Hz)
- Various functions: Monitoring peak display value function, display cycle delay function, zero adjustment function, high display correction function, transmission (DC4-20mA) output scale function etc.
- Power supply: 12-24VDC, 100-240VAC 50/60Hz

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

MT | 4 | W – DV – 4 | N

Output

Y Type

N	Indicator (without output function)
0	Relay output
1	NPN open collector output
2	PNP open collector output
3※1	Relay (low out)+transmission (DC4-20mA) output
4※1	Relay (low out)+RS485 communication output
5	BCD dynamic output
6	Low speed serial output

W Type

N	Indication type (no output function)
0	Relay+transmission (DC4-20mA) output
1	Relay output
2	NPN open collector+BCD dynamic output
3	PNP open collector+BCD dynamic output
4	NPN open collector+transmission (DC4-20mA) output
5	PNP open collector+transmission (DC4-20mA) output
6	NPN open collector+low speed serial output
7	PNP open collector+low speed serial output
8	NPN open collector+RS485 communication output
9	PNP open collector+RS485 communication output

Power supply

1※2	12-24VDC
4	100-240VAC 50/60Hz

Measuring input

DV	DC voltage
DA	DC current
AV	AC voltage
AA	AC current

Size

Y	DIN W72×H36mm
W	DIN W96×H48mm

Digit

4	9999 (4-digit)

Item

MT	Multi meter

※1: Only LSt (preset output mode) setting is available in MT4Y-□-43 (relay (low out)+transmission (DC4-20mA) output) and MT4Y-□-43 (relay (low out)+transmission (DC4-20mA) output) models.
※2: Only for MT4W. ※To measure the current over DC5A, please select DV type because the shunt should be used.
※In case of selecting frequency display, no output will be provided even if it is output support models. (main output, sub output and RS485 communication output)

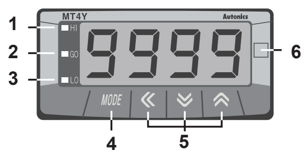
■ Specifications

Series		MT4Y-DV-4□ MT4Y-DA-4□	MT4Y-AV-4□ MT4Y-AA-4□	MT4W-DV-4□ MT4W-DA-4□	MT4W-AV-4□ MT4W-AA-4□	MT4W-DV-1□ MT4W-DA-1□	MT4W-AV-1□ MT4W-AA-1□
Measurement input		DC voltage, current	AC voltage, current, Frequency	DC voltage, current	AC voltage, current, Frequency	DC voltage, current	AC voltage, current, Frequency
Power supply		100-240VAC 50/60Hz				12-24VDC	
Allowable voltage range		90 to 110%				90 to 110%	
Power consumption		5VA				5W	
Display method		7-segment LED display (red) (character height: 14.2mm)					
Display accuracy		• 23℃±5℃ - DC Type: F.S. ±0.1% rdg±2-digit / AC Type: F.S. ±0.3% rdg±3-digit (frequency: F.S.±0.1% rdg±2-digit) DC/AC Type: F.S +0.3% rdg ±3-digit max. only for 5A terminal • -10℃ to 50℃ - DC/AC Type: F.S.±0.5% rdg±3-digit					
Max. allowable input		110% F.S. for each measured input range					
A/D conversion method		Practical oversampling using successive approximation ADC					
Sampling cycle		DC type: 50ms, AC type: 16.6ms					
Max. display range		-1999 to 9999 (4-digit)					
Preset output		• Relay output - Contact capacity: 250VAC 3A, 30VDC 3A / Contact composition: N.O (1a) • NPN/PNP Open collector output - Max. 12-24VDC ±2V 50mA (resistive load)					
Sub output (transmission output)		• RS485 communication output - Baud rate: 1,200/2,400/4,800/9,600, Communication method : 2-wire half duplex, Synchronous method: Asynchronous method, Protocol: Modbus type • Serial/BCD dynamic output - NPN Open collector output: 12-24VDC Max. 50mA (resistive load) • DC4-20mA output - Resolution: 12,000 division (load resistance max. 600Ω), Response time: max. 450ms					
AC measuring function※1		Selectable RMS or AVG					
Frequency measurement function※1		Measurement range: 0.100 to 9999Hz (variable by decimal point position)					
Hold function※2		Includes (external hold function)					
Insulation resistance		Over 100MΩ (at 500VDC megger, between external terminal and case)					
Dielectric stength		2000VAC for 1 min (between external terminal and case)					
Noise immunity		±2kV the square wave noise (pulse width: 1μs) by the noise simulator					
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min					
Shock	Mechanical	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times					
	Malfunction	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times					
Relay life cycle	Malfunction	Min. 20,000,000 operations					
	Mechanical	Min. 100,000 operations (250VAC 3A load current)					
Environ-ment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃					
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH					
Insulation type		Double insulation or reinforced insulation (mark: ⧈, dielectric strength between the measuring input part and the power part: 1kV)					
Approval		CE cULus				CE	
Weight※3		Approx. 213.5g (approx. 134g)		Approx. 326g (approx. 211g)			

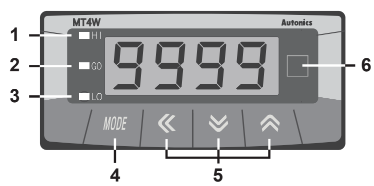
※1: AC measuring function, and frequency measuring function are only for AC measuring input type.
※2: MT4Y-□-4N model has no hold function.
※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Unit Description

● MT4Y Series



● MT4W Series



1. HI: High output indication of preset
2. GO: GO output indication of preset
3. LO: Low output indication of preset

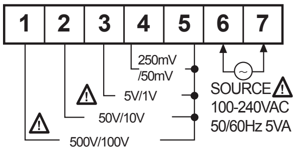
4. [MODE] **key:** mode key
5. ≪ **key:** moves digit, enters parameter mode, ≫ ≪ **key:** changes sv
6. unit label part

※There is no **1**, **2**, **3** on a display panel of MT4Y-□-4N, 45, 46 and MT4W-□-4N.
※In MT4Y-□-□3, □4, OUT is used for Go output display and there is no **1**, **3** in display panel.

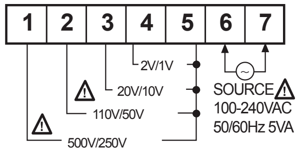
■ Connections

◎ Measuring input connection of MT4Y Series

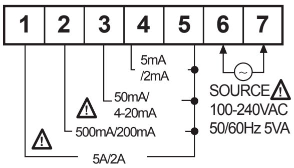
● MT4Y-DV-4□



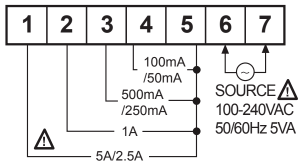
● MT4Y-AV-4□



● MT4Y-DA-4□

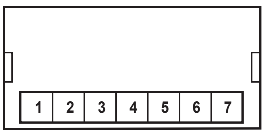


● MT4Y-AA-4□

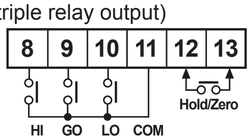


◎ Output terminal of connection of MT4Y Series

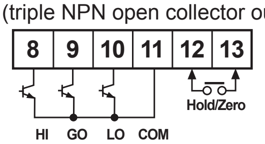
●MT4Y-□-4N (indicator)



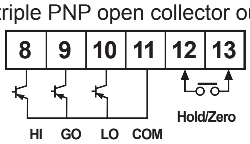
●MT4Y-□-40
(triple relay output)



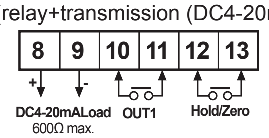
●MT4Y-□-41
(triple NPN open collector output)



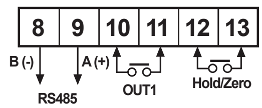
●MT4Y-□-42
(triple PNP open collector output)



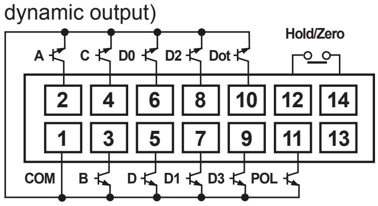
●MT4Y-□-43
(relay+transmission (DC4-20mA) output)

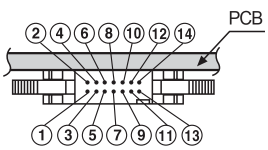


●MT4Y-□-44
(relay+RS485 communication output)

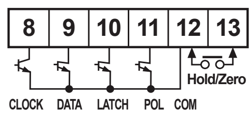


●MT4Y-□-45
(BCD dynamic output)





●MT4Y-□-46 (low speed serial output)



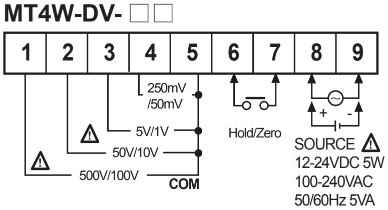
※POL: When a display value is "-", the signal of "-" will be outputted.

※Hirose connector pin header model of the unit: HIF3BA-14PA-2.54DS

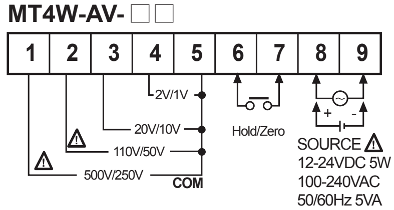
※Contact Hirose Electric to purchase socket and wires of Hirose connector. [Socket: HIF3BA-14D-2.54R]

◎ Measuring input connection of MT4W Series

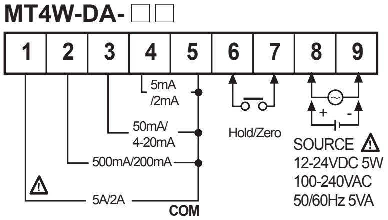
● MT4W-DV-□□



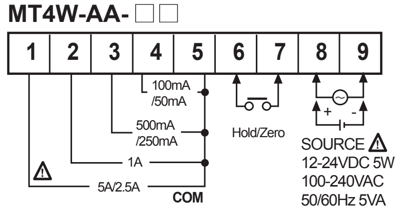
● MT4W-AV-□□



● MT4W-DA-□□



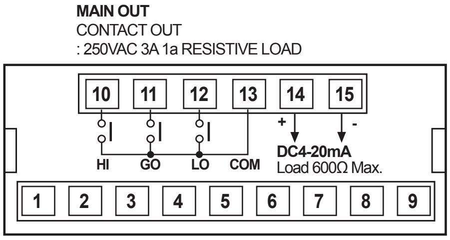
● MT4W-AA-□□

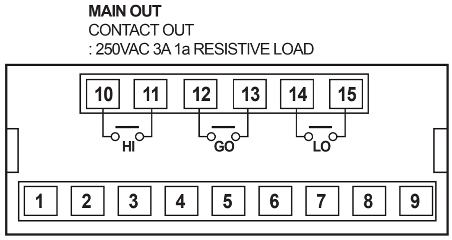


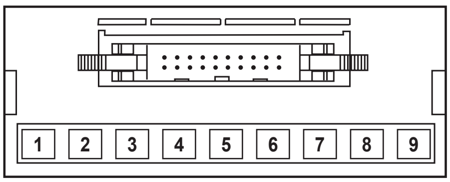
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

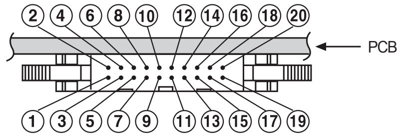
◎ Output terminal connection of MT4W Series

● **MT4W-□-□0** (triple relay+transmission (DC4-20mA) output) ● **MT4W-□-□1** (triple relay output)



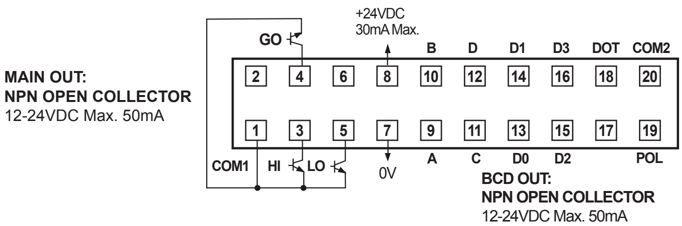


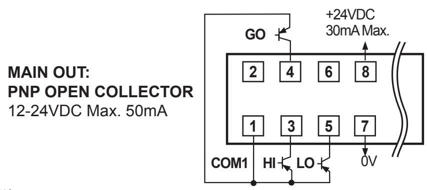




※Hirose connector pin header model of the unit: HIF3BA-20PA-2.54DS
※Contact Hirose Electric to purchase socket and wires of Hirose connector.
[Socket: HIF3BA-20D-2.54R]

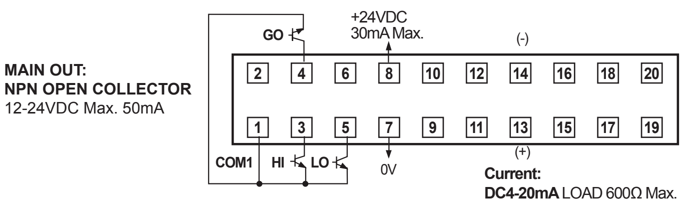
● **MT4W-□-□2 / MT4W-□-□3** (triple NPN/PNP open collector+BCD dynamic output)

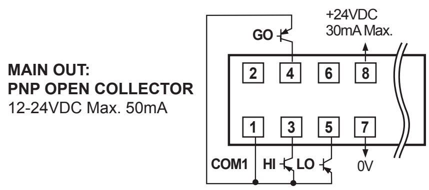




※POL: When a display value is "-", the signal of "-" will be outputted.

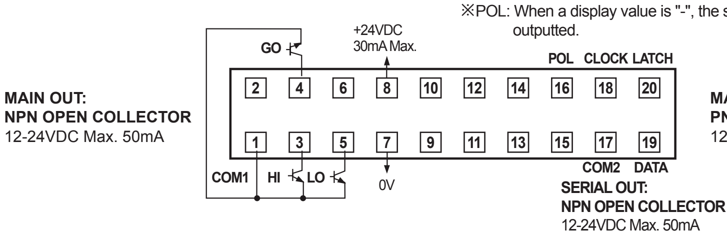
● **MT4W-□-□4 / MT4W-□-□5** (triple NPN/PNP open collector+transmission (DC4-20mA) output)

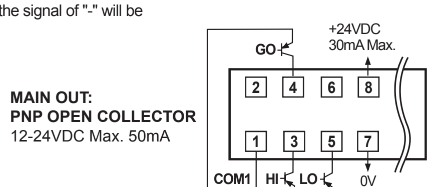




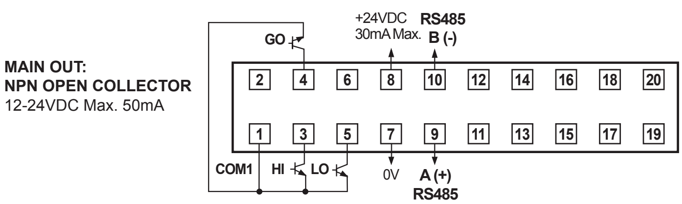
● **MT4W-□-□6 / MT4W-□-□7 (**triple NPN/PNP open collector+low speed serial output)

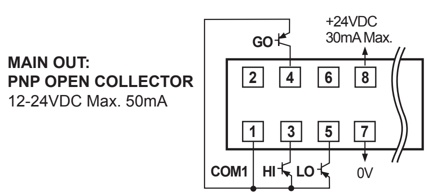
※POL: When a display value is "-", the signal of "-" will be outputted.





● **MT4W-□-□8 / MT4W-□-□9** (triple NPN/PNP open collector+RS485 communication output)

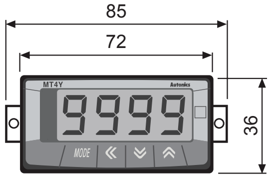


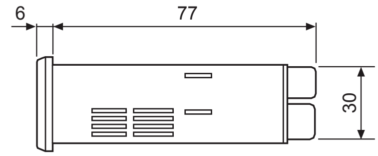


■ Dimensions

(unit: mm)

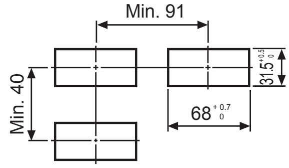
- **MT4Y-□-4N, 45, 46**



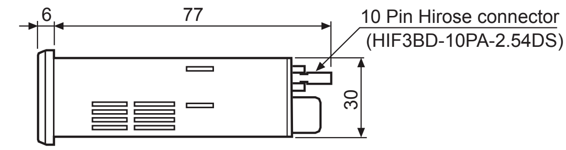


<MT4Y-□□-4N, 40 to 44, 46>

- **Panel cut-out**



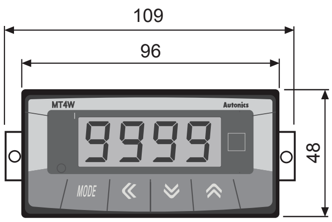
- **MT4Y-□-43, 44**

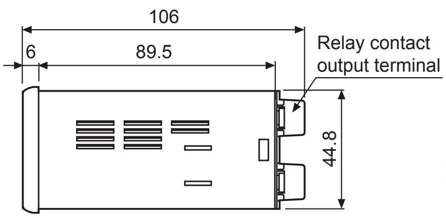


- **MT4Y-□-40, 41, 42**

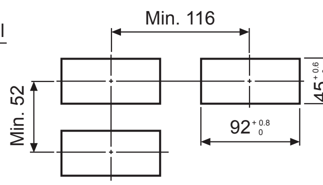
<MT4Y-□-45>

- **MT4W-□-□N (indicator)**





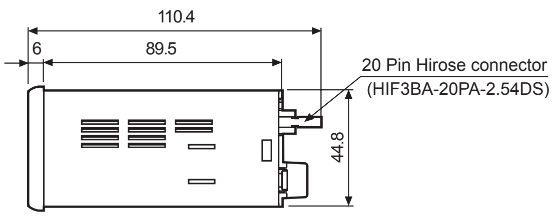
- **Panel cut-out**



※There is no Relay output terminal block in indication type.

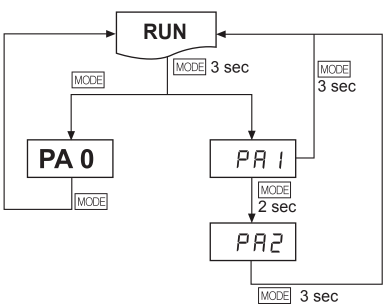
< MT4W-□-□N, MT4W-□-□0, □1 >

- **MT4W-□-□0 to □9**



< MT4W-□-□2 to □9 >

■ Parameter Setting



※Press MODE key in **RUN** mode and it enters **PA 0** group.
※Press MODE key for over 3 sec in **RUN** mode, it displays [PA 1].
※Press MODE key for over 5 sec in **RUN** mode, it displays [PA2] after [PA 1]. When pressing MODE key continually, it stops displaying at [PA2].
※It is advanced to current display parameter releasing MODE key at [PA 1] or [PA2].
※Press MODE key for over 3 sec in any parameter groups, it returns to **RUN** mode.
※If any key is not entered for 60 sec in each parameter, it returns to **RUN** mode.
※After returning to **RUN** mode, press MODE key within 2 sec, it returns to previous parameter. (Refer to the below descriptions of each parameter group.)
※**PA 0** group cannot be entered when preset output mode of [PA2] group is oFF.

▣ Parameter 1 Group

RUN

MODE 3 sec

PA1

In-r → Display of factory default for measuring input (MODE)

Select measuring input specification by ⋀ ⋁.
- Refer to "▣ **Specification Of Measuring Input And Range"**.

● Measuring input chart by model

Item	Range of measuring input
MT4Y/W-DV	500V ↔ 100V ↔ 50V ↔ 10V ↔ 5V ↔ 1V ↔ 0.25V ↔ 50mV ↔ 500V
MT4Y/W-DA	5A ↔ 2A ↔ 0.5A ↔ 0.2A ↔ 50mA ↔ 4-20mA ↔ 5mA ↔ 2mA ↔ 5A
MT4Y/W-AV	500V ↔ 250V ↔ 110P(※) ↔ 50V ↔ 20V ↔ 10V ↔ 2V ↔ 1V ↔ 500V
MT4Y/W-AA	5A ↔ 2.5A ↔ 1A ↔ 0.5A ↔ 0.25A ↔ 0.1A ↔ 50mA ↔ 5A

※Standard specification. (110P is 440VAC/110VAC P.T)

dISP → Stnd (MODE)

- Refer to "▣ **Specification Of Measuring Input And Range"**.
(FrEq mode is only for AC measuring type.)

In-t → AvG (MODE)

Select measuring method for AC.
Set range: AvG, rmS (average: AVG, root mean square: RMS)
(This parameter will be displayed only for AC measuring models. In case of selecting frequency display, it will not be displayed.)

When dISP is Stnd

Stnd → Max. display value (MODE)

It shows Max. display value of standard specification.
Display value is fixed.

When dISP is SCAL

dot → Decimal point position (MODE)

Select decimal point position.
Set range: 0, 0.0, 0.00, 0.000

※When selecting the decimal point position, "H-SC", L-SC" have decimal point position.

H-SC → Max. display value (MODE)

Set display value against max. measuring input.
(≪: shift the digit
⋀ ⋁: change setting value)

L-SC → Min. display value (MODE)

Set display value against min. measuring input.
(≪: shift the digit
⋀ ⋁: change setting value)

InbH → 1.000 (MODE)

It corrects a gradient of High-limit display value against max. input.
Set range: 0.100 to 5.000 (%)
(⋀ ⋁: change setting value, ≪: shift the digit)

Inb.L → 00 (MODE)

It corrects deviation of Low-limit display value against Min. input.
Set range: -99 to 99 (Refer to "◎ **Zero adjustment** ".)
(⋀ ⋁: set a deviation value, ≪: shift the digit)

When dISP is FrEq
(It is only displayed for AC measuring type.)

dot → Decimal point position (MODE)

Set frequency measuring range, it is decided as the decimal point position.
(⋀ ⋁ change the decimal point position)

0	1 to 9999Hz
0.0	0.1 to 999.9Hz
0.00	0.10 to 99.99Hz
0.000	0.100 to 9.999Hz

※In case of selecting frequency display, no output will be provided even if it is output support models (main output, Sub output and RS485 communication output).

InbH → 1.000 (MODE)

It corrects a gradient of display value against max. input.
Set range: 0.001 to 9.999
(≪: shift the digit
⋀ ⋁: change setting value)

Inb.E → 10-0 (MODE)

Set InbH
Set range: 10^{-2} to 10^{1}
(≪: shift the digit
⋀ ⋁: change setting value)

※After setting each mode, press MODE key for 2 sec to return to **RUN**.
※If any key is untouched for 60 sec after advance to parameter, it will return to **RUN**.

◎ Factory defaults

Parameter	MT4Y/W-DV	MT4Y/W-DA	MT4Y/W-AV	MT4Y/W-AA	Parameter	MT4Y/W-DV	MT4Y/W-DA	MT4Y/W-AV	MT4Y/W-AA
In-r	500V	5A	500V	5A	InbH	1.000	1.000	1.000	1.000
dISP	Stnd	Stnd	Stnd	Stnd	Inb.L	00	00	00	00
In-t	—	—	AvG	AvG	dot	0.0	0.000	0.0	0.000
Stnd	500.0	5.000	500.0	5.000	Inb.E	—	—	10-0	10-0

■ Parameter 2 Group

RUN

MODE 5 sec

PA2

Move after 1 sec

oUt.t → oFF
Select preset output mode. (only for available models)
Set range: oFF, L.St, H.St, LH.St, HH.St, LL.St, Ld.St
※Only L.St setting is available in MT4Y-□-43 and MT4Y-□-44 models.

HYS → 001
Set preset hysteresis. The range is within 10% of max. display range (unit: digit).
※ oUt.t mode is oFF, it is not displayed.

StAt → 00.0
Set startup compensation time.
(《: shift the digit, ⋀ ⋁: change setting value)
Set range: 0.0 to 99.9 sec

PEt.t → 00 5
Set monitoring delay time.
(《:shift the digit, ⋀ ⋁: change setting value)
Set range: 00 to 30 sec

dISt → 0.2 5
Set display cycle and also variable sets by 0.1 sec. (《: shift the digit, ⋀ ⋁: change setting value)
Set range: 0.1 to 5.0 sec

ZEro → no
Select zero function with operation at front. (set with ⋀ ⋁ key)
When 《 + ⋀ Key are pressed for 3 sec to set YES, it will be zero function and the deviation value is saved automatically at InbL mode.

EuIn → HoLd
Select input with 6, 7 (MT4W)[12, 13 (MT4Y)] terminal or zero function for external signal.
(set with ⋀, ⋁ Key)
HoLd: Holding display value, ZEro: Zero function using Hold/Zero terminal

FS-H → 500.0
Set the high limit value, output point of current output 20mA.
(《: shift the digit, ⋀ ⋁: change setting value)
(When changing measuring input and prescale mode, it is changed automatically as maximum value of input range.)

FS-L → 000.0
Set the low limit value, output point of current output 4mA.
(《: shift the digit, ⋀ ⋁: change setting value)
(When changing measuring input and prescale mode, it is changed automatically as minimum value of input range.)

AdrS → 01
Set the address of RS485 communication output.
(《: shift the digit, ⋀ ⋁: change setting value)
Set range: 01 to 99

bPS → 9600
Select Baud rate of RS485 communication output.
Set range: 9600, 4800, 2400, 1200

PrtY → nonE
Set parity bit of RS485 communication.
Set range: nonE, EuEn, odd

StP → 2
Set stop bit of RS485 communication.
Set range: 1, 2

rSYt → 5
Set response wait time of RS485 communication.
Set range: 5 to 99

LoC → oFF
Set key lock function and select from 4 types.
Set range: oFF, LoC1, LoC2, LoC3

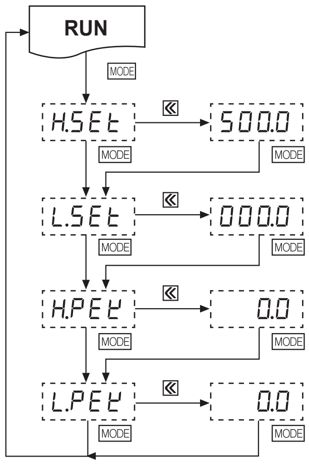
oFF	Disable to lock keys
LoC1	Lock Parameter 1
LoC2	Lock Parameter 1, 2
LoC3	Lock Parameter 0, 1 and 2

※The dotted mode is only displayed for output type.
※After setting each mode, press MODE key for 2 sec to return to **RUN** mode.
※If any key is untouched for 60 sec after advance to parameter, it will return to **RUN** mode.

◎ Factory defaults

Parameter	MT4Y/W-DV	MT4Y/W-DA	MT4Y/W-AV	MT4Y/W-AA	Parameter	MT4Y/W-DV	MT4Y/W-DA	MT4Y/W-AV	MT4Y/W-AA
oUt.t	oFF	oFF	oFF	oFF	EuIn	HoLd	HoLd	HoLd	HoLd
HYS	001	001	001	001	FS-H	500.0	5.000	500.0	5.000
StAt	00.0	00.0	00.0	00.0	FS-L	000.0	0.000	000.0	0.000
PEt.t	00 5	00 5	00 5	00 5	ArdS	01	01	01	01
dI St	0.2 5	0.2 5	0.2 5	0.2 5	bPS	9600	9600	9600	9600
ZEro	no	no	no	no	LoC	oFF	oFF	oFF	oFF

■ Parameter 0 Group



Set preset High-limit value. (set with [«], [▲], [▼] key)
※It is displayed when set the preset only.
When set oFF in oUt.t mode if **PA 2**, the parameter is not displayed.

Set preset Low-limit value. (set with [«], [▲], [▼] key)
※It is displayed when set the preset only.
When set oFF in oUt.t mode if **PA 2**, the parameter is not displayed.

It shows High-limit monitoring value while it is in RUN mode.
It will be reset by pressing [«], [▲], [▼] key.
※H.PEK parameter is not displayed when PEK.t parameter is set as 00 sec [00 5] at Parameter 2 group.

It shows Low-limit monitoring value while it is in RUN mode.
It will be reset by pressing [«], [▲], [▼] key.
※L.PEK parameter is not displayed when PEK.t parameter is set as 00 sec [00 5] at Parameter 2 group.

※If any key is untouched for 60 sec after advance to parameter, it will return to **RUN** mode.

◎ Factory defaults

Parameter	MT4Y/W-DV	MT4Y/W-DA	MT4Y/W-AV	MT4Y/W-AA	Parameter	MT4Y/W-DV	MT4Y/W-DA	MT4Y/W-AV	MT4Y/W-AA
H.SEt	500.0	5.000	500.0	5.000	H.PEK	0.0	0.000	0.0	0.000
L.SEt	000.0	0.000	000.0	0.000	L.PEK	0.0	0.000	0.0	0.000

■ Specification Of Measuring Input And Range

Type	Measuring input and range		Input impedance	Display range [Stnd]	Prescale display range [SCAL]
DC voltage	0-500V	[500u]	4.33MΩ	0.0 to 500.0 (fixed)	
	0-100V	[100u]	4.33MΩ	0.0 to 100.0 (fixed)	
	0-50V	[50u]	433.15kΩ	0.00 to 50.00 (fixed)	
	0-10V	[10u]	433.15kΩ	0.00 to 10.00 (fixed)	
	0-5V	[5u]	43.15kΩ	0.000 to 5.000 (fixed)	
	0-1V	[1u]	43.15kΩ	0.000 to 1.000 (fixed)	
	0-250mV	[0.25u]	2.15kΩ	0.0 to 250.0 (fixed)	
	0-50mV	[50mu]	2.15kΩ	0.00 to 50.00 (fixed)	
DC current	0-5A	[5A]	0.01Ω	0.000 to 5.000 (fixed)	
	0-2A	[2A]	0.01Ω	0.000 to 2.000 (fixed)	
	0-500mA	[0.5A]	0.1Ω	0.0 to 500.0 (fixed)	
	0-200mA	[0.2A]	0.1Ω	0.0 to 200.0 (fixed)	
	0-50mA	[50mA]	1.0Ω	0.00 to 50.00 (fixed)	
	4-20mA	[4-20]	1.0Ω	4.00 to 20.00 (fixed)	
	0-5mA	[5mA]	10.0Ω	0.000 to 5.000 (fixed)	
	0-2mA	[2mA]	10.0Ω	0.000 to 2.000 (fixed)	
AC voltage	0-500V	[500u]	4.98MΩ	0.0 to 500.0 (fixed)	
	0-250V	[250u]	4.98MΩ	0.0 to 250.0 (fixed)	
	0-110V	[110P]	1.08MΩ	0.0 to 440.0 (fixed)	
	0-50V	[50u]	1.08MΩ	0.00 to 50.00 (fixed)	
	0-20V	[20u]	200kΩ	0.00 to 20.00 (fixed)	
	0-10V	[10u]	200kΩ	0.00 to 10.00 (fixed)	
	0-2V	[2u]	20kΩ	0.000 to 2.000 (fixed)	
	0-1V	[1u]	20kΩ	0.000 to 1.000 (fixed)	
AC current	0-5A	[5A]	0.01Ω	0.000 to 5.000 (fixed)	
	0-2.5A	[2.5A]	0.01Ω	0.000 to 2.500 (fixed)	
	0-1A	[1A]	0.05Ω	0.000 to 1.000 (fixed)	
	0-500mA	[0.5A]	0.1Ω	0.0 to 500.0 (fixed)	
	0-250mA	[0.25A]	0.1Ω	0.0 to 250.0 (fixed)	
	0-100mA	[0.1A]	0.5Ω	0.0 to 100.0 (fixed)	
	0-50mA	[50mA]	0.5Ω	0.00 to 50.00 (fixed)	

dot	Display range
0	-1999 to 9999
0.0	-199.9 to 999.9
0.00	-19.99 to 99.99
0.000	-1.999 to 9.999

(Display range is variable according to decimal point position.)

※Please wire the proper terminal to its max. input within 30 to 100% of the input terminal. When it is higher than input, it may cause terminal breakdown and HHHH appears. The accuracy is decreased when it is connected to the terminal under 30%.

※In case of 0 to 110V [110P] of AC voltage range and using P.T (potential transformer) for 440V/110VAC, if 110V is input, a nd the unit displays 440V automatically by preset scale value for P.T user's convenient.

▣ Sold Separately

◎ Communication converter

- **SCM-38I**
  (RS232C to RS485 converter)

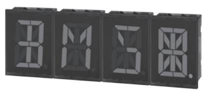
- **SCM-US48I**
  (USB to RS485 converter)

◎ Display Units (DS/DA-T Series)

- **DS/DA-T Series**
  (RS485 communication input type display unit)


DS16-□T


DS22/DA22-□T


DS40/DA40-□T


DS60/DA60-□T

※Connect RS485 communication input type display unit (DS/DA-T Series) and RS485 communication output model of MT4Y/MT4W Series, the display unit displays present value of the device without PC/PLC.

▣ Functions

◎ AC frequency measurement [PA 1 group: dI SP]

It measures input signal frequency when it is AC input.
It uses fixed decimal point [**PA1**: dot], measured range can be changed by setting and measured range of decimal point position is as below chart. It is available to adjust the upper gradient at [**PA 1**: I nb.H]and [**PA 1**: I nb.E]. In order to measure frequency normally, input signal, over 10% F.S. of the measured range, should be supplied. Please select the proper point of

① Measuring range

Decimal point position	0.000	0.00	0.0	0
Measurement range	0.100 to 9.999Hz	0.10 to 99.99Hz	0.1 to 999.9Hz	1 to 9999Hz

※Accuracy of frequency measurement:
Below 1kHz, F.S. ±0.1rdg ±2-digit.
From 1kHz to 10kHz, F.S. ±0.3rdg ±2-digit.

② I nb.H: 0.100 to 9.999 [Gradient adjustment of high value]

③ I nb.Eh. 10^{-2}, 10^{-1}, 10^{0}, 10^{1} [Index adjustment of I nb.H]

◎ Zero adjustment [Deviation correction function of low limit display value]

It adjusts the display value of the optional configured input value as zero by force, zero point error can be adjusted with 3 ways as below. When zero point adjustment with front key and Hold terminal is finished normally, zero point of measurement terminal is displayed and the adjusted value at saved in I nb.L automatically.

Operation	Input correction value	Front panel key	Input external signal
Description	PA 1: Direct input correction value method at I nb.L .	Press ≪, ⩓ key for 3 sec at the RUN mode.	Short-circuit external Hold terminal 11,12 [6, 7 (MT4W)] over min. 50m.

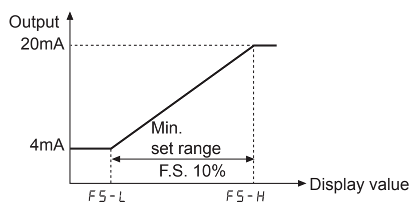
※Refer to "◎ **Error correction**", "◎ **Error display**" and "▣ **Parameter 2 Group**" for function and error.

◎ Transmission (DC4-20mA) output scale [PA2 group: FS-H / FS-L]

It sets transmission output for the display value at the output current DC4-20mA.
It sets display value for 4mA at FS-L and 20mA at FS-H and the range between FS-H and FS-L should be 10%

※When min. set interval between FS-H and FS-L is set as under 10% F.S., it changed as over 10% F.S. automatically.

※Preset display value is fixed to output as 4mA at under FS-L and 20mA at over FS-H.



◎ Initialization

It initializes as the factory default status. If press [≪], [⩓], [⩔] keys together for 2 sec in **RUN** mode, InLt mode and the setting value (no) is displayed every 0.5 sec and it will be initialized as the factory default when press [MODE] key after change no → YES.

◎ Startup compensation time [PA 2 group: StAt]

This time function limits the operation of an output until the measured input (overvoltage or inrush current) is stable at moment of power on. All outputs are off during startup compensation time setting after power is applied.
Set range: 00.0 to 99.9 (unit: sec)
Factory default: 00.0

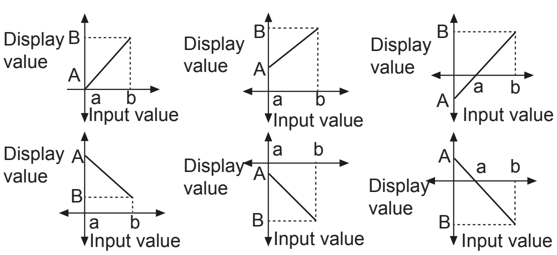
◎ Error display

Display	Description
HHHH	Flashes when measuring input is exceeded the max. allowable input (110%)
LLLL	Flashes when measuring input is exceeded the max. allowable input (-10%)
d-HH	Flashes when display input is exceeded the max. display range (9999)
d-LL	Flashes when display input is exceeded the min. display range (-1999)
F-HH	Flashes when measuring frequency is exceeded the max. measuring value (9999)
ouEr	Flashes when it exceeds zero adjustment range (±99)

※Error display is released automatically when it is in the measured and display range.
※"LLLL" is displayed when the measuring input is DC4-20mA.
※ After flashing "ouEr" 2 times when it exceeds the zero adjustment range, it returns to RUN mode.

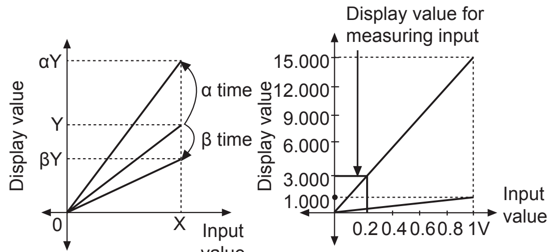
◎ Display scale [PA 1 group: H-SC/L-SC]

This function is to display setting (-1999 to 9999) of particular High/Low-limit value in order to display High/Low-limit value of measured input. If measured inputs are 'a' and 'b' and particular values are 'A' and 'B', it will display a=A, b=B as below graphs.



◎ Gradient correction [PA 1 group: Inb.H]

This function is to correct a gradient of prescale value and display value. (Fig.1) Display value Y can be used as α, β times against X input value by correction function [Inb.H]. And also can be used as correction function of max. display value (H-SC). Adjustment range is 0.100 to 5.000 and multiply current gradient.
E.g.) Input: DC200mV, Display: 3.000 for MT4W-DV



(Fig. 1) (example of gradient correction)

① Select 0-1VDC[Iu] for measuring input in Parameter1.
② Standard specification in input: 0-1VDC and 1.000 therefore it has to be 15.000 (H-SC) for 1VDC (input) in order to display 3.000 for DC200mV (input). But it is disable due to set range is 9.999
③ In this case, please check below chart.
Please set as Inb.H × H-SC =15.000

Setting	H-SC	L-SC	Inb.H	Other
①	Disable	0.000	1.000	—
②	7.500	0.000	2.000	In this case, any setting methods display the same display value.
③	5.000	0.000	3.000	
④	3.750	0.000	4.000	
⑤	3.000	0.000	5.000	

◎ Error correction [PA 1 group: Inb.H / Inb.L]

It corrects display value error of measured input.
Inb.L : ±99 [Adjust deviation of low value]
Inb.H: 5.000 to 0.100 [Correct gradient (%) of high value]
Display value= (measured value × Inb.H) + Inb.L
E.g.) When the measured range is 0 to 500V, and the display range is 0 to 500.0. If the low display value is "1.2" to 0V input, set -12 as Inb.L value to display "0.0" by adjusting offset of the low value. The display value to 500V measured input varies by adjusting the offset of low value. If this display value is "501.0", calculate 500.0/501.0 (desired display value/the display value), and set the 0.998 correction value as the Inb.H to display 500.0 by adjusting gradient of high value.
※The offset correction range of Inb.L is within -99 to 99 for D^{-0}, D^{-1} digit regardless of decimal point.

◎ Display cycle delay [PA 2 group: dISt]

In some applications the measured input may fluctuate which in turn causes the display to fluctuate. By adjusting the display cycle delay function time in the dISt of parameter 2, the operator can adjust the display time within a range of 0.1 sec to 5 sec. For example, if the operator sets the display cycle time to 4.0 sec, the display value displayed will be the average input value over 4 sec and also will show any changes if any every 4 sec.

◎ Monitoring peak display value [PA 0 group: H.PEK/L.PEK, PA 2 group: PEK.t]

It monitors max./min. value of display value based on the current displays value and then displays the data at H.PEK, L.PEK of parameter 0. Set the delay time (0 to 30 sec) at PEK.t of parameter 2 in order to prevent malfunction caused by initial overcurrent or overvoltage, when monitoring the peak value.
Delay time is 0 to 30 sec and it starts to monitor the peak value after the set time. When pressing any one of ≪ ≫ ⊼ keys at H.PEK, L.PEK of parameter 0, the monitored data is initialized.

※H.PEK, L.PEK parameters is not displayed when monitoring delay time [PEK.t] of parameter 2 group is set as 00 sec [00 S].

◎ Preset output operation mode [PA 2 group: oUt.t]

Mode	Output operation	Operation
	H.SEt, L.SEt	H: Hysteresis
oFF		No output
L.St	GO, LO	If it is equal or smaller than low setting value, LO output will be ON. If it is bigger than low setting value, GO output will be ON.
H.St	HI, GO	If it is equal or bigger than high setting value, HI output will be ON. If it is equal or smaller than high setting value, GO output will be ON.
LH.St	HI, GO, LO	If it is equal or smaller than low setting value and equal or bigger than high setting value, the output will be ON. If it is bigger than Low setting value and smaller than high setting value, GO output will be ON.
HH.St	HI, GO, LO	If it is equal or bigger than low set and equal or bigger than high set value, output will be ON. If it is smaller than low setting value and high setting value, GO output will be ON.
LL.St	HI, GO, LO	If it is equal or smaller than low setting value, LO output will be ON. If it is equal or smaller than high setting value, HI output will be ON. If it is bigger than low setting value and High setting value, GO output will be ON.
Ld.St	GO, LO	This operation is the same as L.St But it doesn't operate at initial low set value, it will operate at next low set value. If this is higher than low set value, Go output will be ON.

※"H" means hysteresis and able to set 1 to 99 at "HYS" mode in **PA 2** among above comparison output chart.
※ H.SEt is displayed according to the setting of output operation mode, when user sets "oFF", H.SEt / L.SEt are not displayed.
※Only L.St setting is available in MT4Y-□-43 and MT4Y-□-44 models.

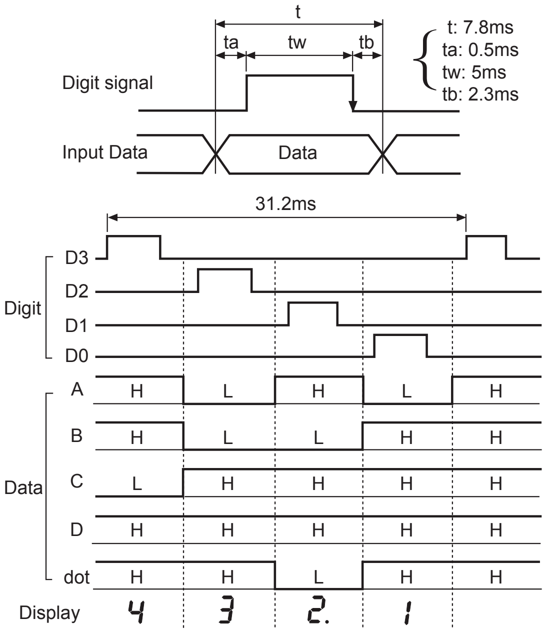
◎ Sub output

- RS485 communication output
  It is able to set address (01 to 99)
  It is able to transmit by selecting modulation speed (transmitted number of signal per 1 sec) of serial trans -mission. (selectable 1200, 2400, 4800, 9600bps)
- Low-speed serial output
  It outputs current display value as Low-frequency (50Hz) type.
- Transmission (DC4-20mA) output
  It outputs DC4-20mA against High/Low-limit scale. (resolution: 12000 division)
- BCD dynamic output
  It outputs display value as BCD Code.

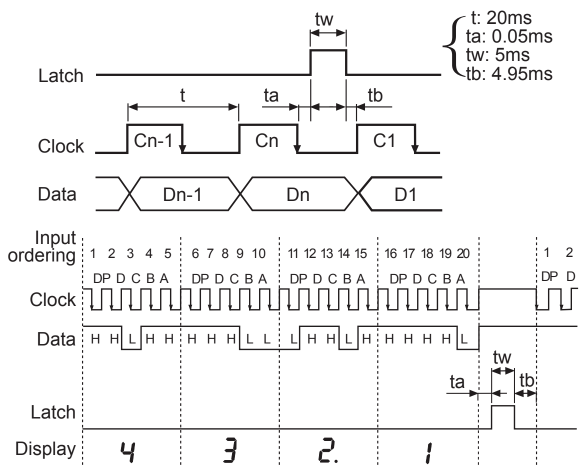
※**Only one sub-output is selectable.**
(More than one sub-output is not allowed.)

◎ Time chart of BCD dynamic output and Serial output

- BCD dynamic output (negative logic)



- Serial output (negative logic)-Clock frequency:50Hz



MT4N/MT4Y/MT4W Common Features

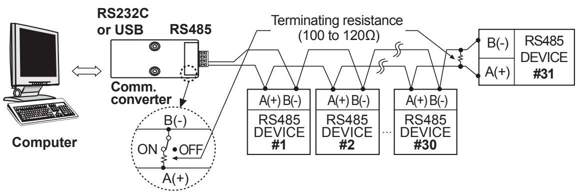
▣ Communication Output

The protocol is changed as Modbus type.

◎ Interface

Comm. protocol	Modbus RTU
Connection type	RS485
Application standard	Compliance with EIA RS485
Max. connection	31 units (address: 01 to 99)
Synchronous method	Asynchronous
Comm. method	Two-wire half duplex
Comm. distance	Max. 800m
Comm. speed	1200, 2400, 4800, 9600 bps
Start bit	1-bit (fixed)
Data bit	8-bit (fixed)
Parity bit	None, Even, Odd
Stop bit	1-bit, 2-bit (fixed)

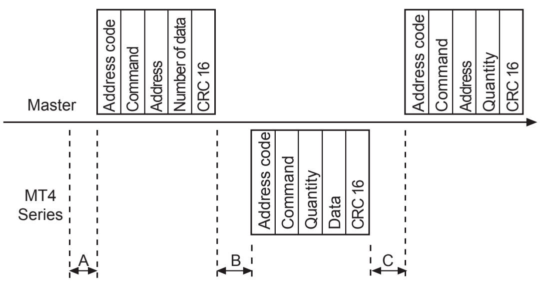
◎ Application of system organization



※It is recommended to use Autonics communication converter; SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately).
Please use twisted pair wire for RS485 communication.

◎ Communication control ordering

1. The communication ordering of MT4 Series is Modbus RTU. (PI-MBUS-300-REV.J)
2. After 0.5sec being supplied the power into the master system, it starts to communicate.
3. Initial communication will be started by the master system. When a command comes out from the master system, MT4 Series will respond.



※A → Min. 0.5sec after supplying power

B →
- 9600bps: Within 10.4ms
- 4800bps: Within 20.8ms
- 2400bps: Within 41.6ms
- 1200bps: Within 83.3ms

C →
- 9600bps: Within 4.2ms
- 4800bps: Within 8.4ms
- 2400bps: Within 16.7ms
- 1200bps: Within 33.4ms

◎ Communication command and block

The format of query and response

● **Query**

Address code	Command	Start address	Number of data	CRC16
①	②	③	④	⑤

Calculation range of CRC16 (①–④)

①Address code: This code is the master system can discern MT4 Series and able to set within range 01H-63H.
②Command: Read command for input register.
③Start address: The start address of input register to read (Start address), it is available to select 0000 to 0003 for start address.
④Number of data: The number of 16-bit data from start address (No. of points)
⑤CRC16: It is a Check Sum checking the whole frame and it is for more reliable transmit/receive to check the error between transmitter and receiver.

● **Response**

Address code	Response Command	Number of data	PV	Decimal point position	Hi peak value	Low peak value	CRC16
①	②	③	④	⑤	⑥	⑦	⑧

Calculation range of CRC16 (①–⑦)

①Address code: Distinguish MT4 Series and the number is available from 01H-63H.
②Response command:
Response for a read command of input register.
(Refer to Modbus mapping table)
③Amount of data: The number of 8-bit data on star code. (No. of points)
④PV: It is 16 Bit data, measuring and display value of MT4 Series. The decimal point data is not included in the transmitting PV.
⑤Decimal point position: It is the decimal point position is set in dot mode of Parameter 1.
⑥Hi peak value: The max. display value of PV
⑦Lo peak value: The min. display value of PV
⑧CRC16: It is a Check Sum checking the whole block.

◎ Application of communication command

In case, the display value of multi panel meter is 220.3V, the decimal point is 0.0, Hi Peak value is 220.4 and Lo Peak value is 0000.

● **Query**

Address code	Command	Start address		Number of data		CRC16	
		High	Low	High	Low	Low	High
01	04	00	00	00	04	F1	C9

● **Response**

Address code	Response command	Amount of data	Measured value		dot position		Hi Peak		Lo Peak		CRC16	
			High	Low	High	Low	High	Low	High	Low	Low	High
01	04	08	08	9B	00	01	08	9C	00	00	CRC16	

● Error processing (Slave → Master)

1. Non-supportable command

Address code	Response command	Exception code	CRC16	
01	81	01	81	90

※Set a received highest bit and send it to response command and exception code 01.

2. A start code of queried data is inconsistent with the transmittable code

Address code	Response command	Exception code	CRC16	
01	81	02	81	90

※Set a received highest bit and send it to response command and exception code 02.

3. The number of queried data is bigger than transmittable one

Address code	Response command	Exception code	CRC16	
01	81	03	—	—

※Set a received highest bit and send it to response command and exception code 03.

◎ Modbus Mapping Table

● Read Input Register

Start address	Com-mand	Transmission	Remark
30001 (0000)	04	Process value • Standard: Transmit up to -5 to 110% of display range • Scale: Able to transmit from -1999 to 9999% of display range	Data transmittance for measuring error • Standard: Transmit "9999" if "HHHH" is displayed. Transmit "-1999" if "LLLL" is displayed. • Scale: Transmit the setting value of H-SC and L-SC. Transmit "9999" if "d-HH" is displayed. Transmit "-1999" if "d-LL" is displayed
30002 (0001)	04	Dot setting value	Transmit the position setting value of decimal point of PA-1 **dot** mode. • Standard: 0.00 0→ 0003H, 0.00 → 0002H, 0.0 → 0001H, 0 → 0000H, • Scale: 0.000 → 0103H, 0.00 → 0102H, 0.0 → 0101H, 0 → 0100H,
30003 (0002)	04	High Peak value	Transmit the max. display value of measuring display value
30004 (0003)	04	Low Peak value	Transmit the min. display value of measuring display value

● Read Coil Status

Start address	Com-mand	Transmission	Remark
00001 (0000)	01	Output status • 01h:Lo output • 02h:Go output • 04h:Hi output • 05h:Lo/Hi output	Transmit "1" if the output is ON and "0" for OFF.

◎ Setting of communication speed

It is available to set the communication speed at bPS mode of **PA 2**. The factory default is 9600bps.

◎ Setting of communication address (Setting range: 01 to 99)

It is enable to set the communication speed at AdrS mode of **PA 2**. The factory default is **01**.

It is enable to set the communication address up to 99 but only 31 units can be connected to higher system.

◎ CRC16 Table

● High order byte table

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40
1	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×40
2	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41
3	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40
4	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41
5	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40
6	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40
7	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40	0×00	0×C1	0×86	0×40	0×01	0×C0	0×80	0×41
8	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41
9	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40
A	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40
B	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41
C	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40
D	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41
E	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41
F	0×00	0×C1	0×81	0×40	0×01	0×C0	0×80	0×41	0×01	0×C0	0×80	0×41	0×00	0×C1	0×81	0×40

● Low order byte table

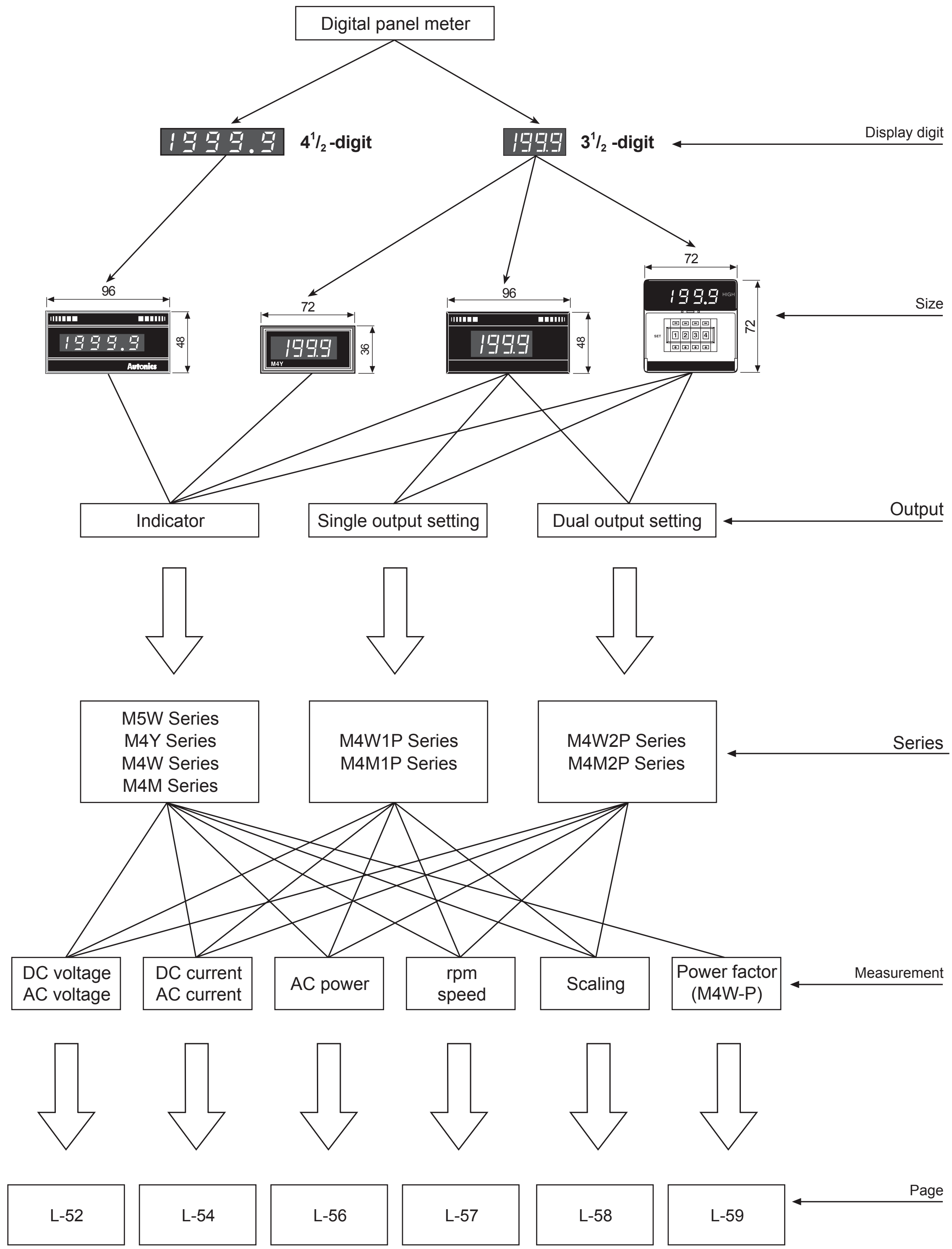
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0×00	0×C0	0×C1	0×01	0×C3	0×03	0×02	0×C2	0×C6	0×06	0×07	0×C7	0×05	0×C5	0×C4	0×04
1	0×C0	0×0C	0×0D	0×CD	0×0F	0×CF	0×CE	0×0E	0×0A	0×CA	0×CB	0×C7	0×05	0×C5	0×C4	0×04
2	0×D8	0×18	0×19	0×D9	0×1B	0×DB	0×DA	0×1A	0×1E	0×DE	0×DF	0×1F	0×DD	0×1D	0×1C	0×DC
3	0×14	0×D4	0×D5	0×15	0×D7	0×17	0×16	0×D6	0×D2	0×12	0×13	0×D3	0×11	0×D1	0×D0	0×10
4	0×F0	0×30	0×31	0×F1	0×33	0×F3	0×F2	0×32	0×36	0×F6	0×F7	0×37	0×F5	0×35	0×34	0×F4
5	0×3C	0×FC	0×FD	0×3D	0×FF	0×3F	0×3E	0×FE	0×FA	0×3A	0×3B	0×FB	0×39	0×F9	0×F8	0×38
6	0×28	0×E8	0×E9	0×29	0×EB	0×2B	0×2A	0×EA	0×EE	0×2E	0×2F	0×EF	0×2D	0×ED	0×EC	0×2C
7	0×E4	0×24	0×25	0×E5	0×27	0×E7	0×E6	0×26	0×22	0×E2	0×E3	0×23	0×E1	0×21	0×20	0×E0
8	0×A0	0×60	0×61	0×A1	0×63	0×A3	0×A2	0×62	0×66	0×A6	0×A7	0×67	0×A5	0×65	0×64	0×A4
9	0×6C	0×AC	0×AD	0×6D	0×AF	0×6F	0×6E	0×AE	0×AA	0×6A	0×6B	0×AB	0×69	0×A9	0×A8	0×68
A	0×78	0×B8	0×B9	0×79	0×BB	0×7B	0×7A	0×BA	0×BE	0×7E	0×7F	0×BF	0×7D	0×BD	0×BC	0×7C
B	0×B4	0×74	0×75	0×B5	0×77	0×B7	0×B6	0×76	0×72	0×B2	0×B3	0×73	0×B1	0×71	0×70	0×B0
C	0×50	0×90	0×91	0×51	0×93	0×53	0×52	0×92	0×96	0×56	0×57	0×97	0×55	0×95	0×94	0×54
D	0×9C	0×5C	0×5D	0×9D	0×5F	0×9F	0×9E	0×5E	0×5A	0×9A	0×9B	0×5B	0×99	0×59	0×58	0×98
E	0×88	0×48	0×49	0×89	0×4B	0×8B	0×8A	0×4A	0×4E	0×8E	0×8F	0×4F	0×8D	0×4D	0×4C	0×8C
F	0×44	0×84	0×85	0×45	0×87	0×47	0×46	0×86	0×82	0×42	0×43	0×83	0×41	0×81	0×80	0×40

■ Caution For Using

- It is disable to modify Parameter (Baud rate, Address etc)related to communication of MT4 Series on line with upper systems such as PC, PLC etc. (Error will occur)
- First make communication Parameter of MT4 Series and master system one.
- It is not allow to set overlapping communication number at the same communication line. (Error will occur)
- Please use twist pair wire for RS485 communication.
- The total length of communication is 800m and max. 31 units can be connected.
- When connecting communication cable between MT4 Series and master systems, the vertical resistance (100 to 120Ω) must be installed at between both communication lines.
- The setting item of communication parameter is as below.
  - Start bit: 1-bit (Fixed)
  - Stop bit: 1-bit (Fixed)
  - Parity bit: None (Fixed)
  - Data bit: 8-bit (Fixed)
  - Baud rate: 9600, 4800, 2400, 1200 (Setting)
  - Address: 01 to 99 (Setting)

▣ Panel Meter Selection Ⅱ

※This panel meter selection is except **MT4N / MT4Y / MT4W** Series.



■ Specifications

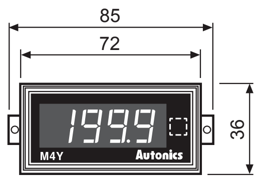
Classification		Indicator		Single preset output type	Dual preset output type
Measurement	DC, AC voltage	**M4Y-DV-□** **M4Y-AV□-□** **M5W-DV-□** **M5W-AV-□**	**M4W-DV-□** **M4W-AV□-□** **M4M-DV-□** **M4M-AV□-□**	**M4W1P-DV-□** **M4W1P-AV□-□** **M4M1P-DV-□** **M4M1P AV□-□**	**M4W2P-DV-□** **M4W2P-AV□-□** **M4M2P-DV-□** **M4M2P-AV□-□**
Measurement	DC, AC current	**M4Y-DA-□** **M4Y-AA□-□** **M5W-DA-□** **M5W-AA -□**	**M4W-DA-□** **M4W-AA□-□** **M4M-DA-□** **M4M-AA□-□**	**M4W1P-DA-□** **M4W1P-AA□-□** **M4M1P-DA-□** **M4M1P-AA□-□**	**M4W2P-DA-□** **M4W2P-AA□-□** **M4M2P-DA-□** **M4M2P-AA□-□**
Measurement	AC power (0-10VDC)	**M4Y-W-□** **M5W-W-□**	**M4W-W-□** **M4M-W-□**	**M4W1P-W-□** **M4M1P-W-□**	**M4W2P-W** **M4M2P-W**
Measurement	rpm, speed (0-10VDC) (0-10VAC)	**M4Y-T□-□** **M4Y-S□-□** **M5W-T-□** **M5W-S-□**	**M4W-T□-□** **M4W-S□-□** **M4M-T-□** **M4M-S-□**	**M4W1P-T□-□** **M4W1P-S□-□** **M4M1P-T-□** **M4M1P-S-□**	**M4W2P-T□-□** **M4W2P-S□-□** **M4M2P-T-□** **M4M2P-S-□**
Measurement	Power factor (DC4-20mA)	—	M4W-P (refer to L-59)	—	—
Max. allowable input		150% for each input specification (at 400VAC:120%)			
Power supply	AC power	100-240VAC 50/60Hz	110/220VAC 50/60Hz, 100-240VAC 50/60Hz※1		
Power supply	DC power	5VDC (except for M5W)※1 24-70VDC (except for M5W)※1	24-70VDC※1		
Allowable voltage range		90 to 110% of rated voltage			
Power consumption	AC power	4VA		5VA	
Power consumption	DC power	2W		3W	
Display method		7-segment LED display			
Character height		M4Y, M4W, M5W: 14mm / M4W1P, M4W2P, M4M, M4M1P, M4M2P: 10mm			
Display accuracy	AC power	F.S. ±0.5% rdg ±1-digit			
Display accuracy	DC power	F.S. ±0.2% rdg ±1-digit			
Sampling period		300ms			
A/D conversion method		Dual slope integral method			
Response time		2 sec (0 to max.)			
Display frequency		2.5 times/sec			
Contact capacity		—		Relay contact output: 250VAC 3A 1c	Relay contact output: 250VAC 3A 1c×2
Insulation resistance		Over 100MΩ (at 500VDC megger)			
Dielectric strength		2000VAC 50/60Hz for 1 min			
Noise immunity		±1kV the square wave noise (pulse width: 1us) by the noise simulator			
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour			
Vibration	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min			
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times			
Shock	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times			
Relay life cycle	Mechanical	—		Min. 10,000,000 operations	
Relay life cycle	Malfunction	—		Min. 100,000 operations (250VAC 3A resistive load)	
Environ-ment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃			
Environ-ment	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Unit weight		M4Y: Approx. 144g M5W: Approx. 172g	M4W: Approx. 168g M4M: Approx. 262g (M4M-P: Approx. 268g)	M4W1P: Approx. 253g M4M1P: Approx. 290g	M4W2P: Approx. 278g M4M2P: Approx. 316g

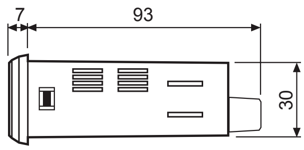
※1: It is optional.(customizable)
※Environment resistance is rated at no freezing or condensation.

■ Dimensions

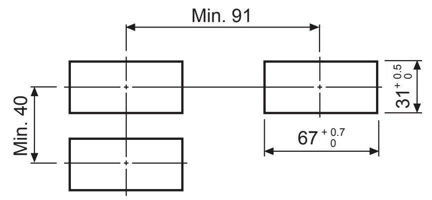
(unit: mm)

- M4Y





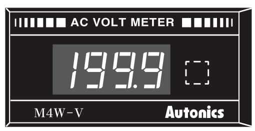
- Panel cut-out



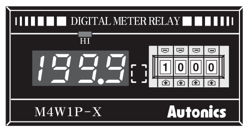
※Unit will be displayed in [ ] of front panel.

(unit: mm)

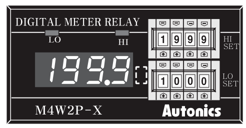
- M4W



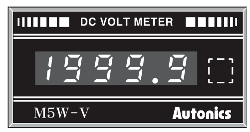
- M4W1P

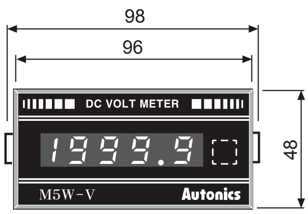


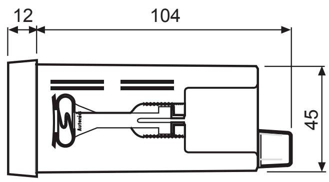
- M4W2P



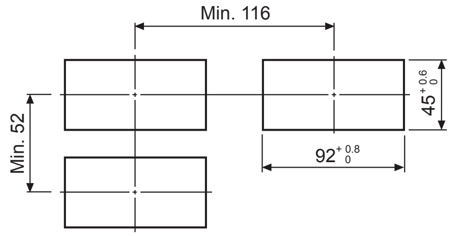
- M5W







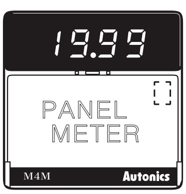
- Panel cut-out



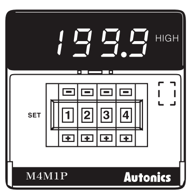
※Unit will be displayed in [ ] of front panel.

(unit: mm)

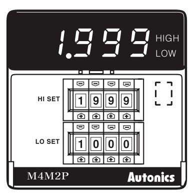
- M4M

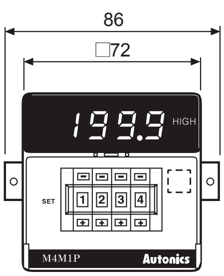


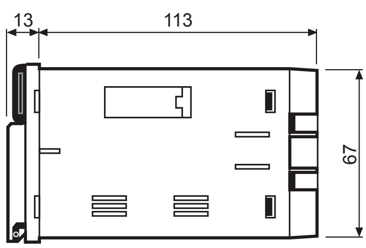
- M4M1P



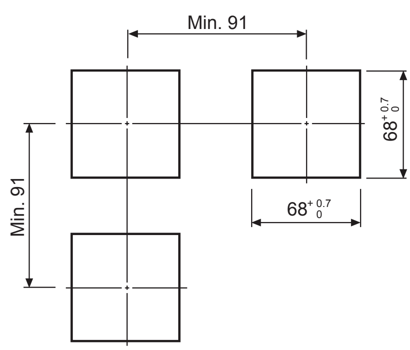
- M4M2P







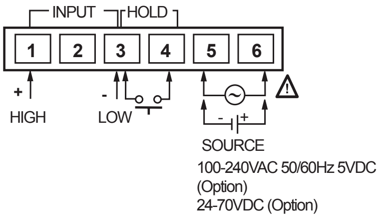
- Panel cut-out



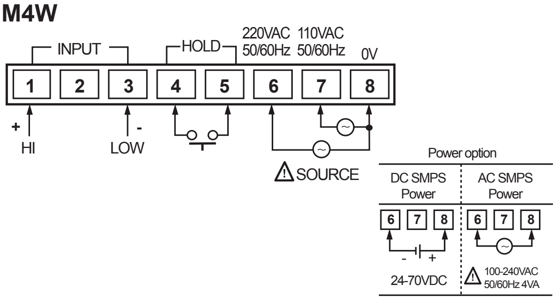
※Unit will be displayed in [ ] of front panel.

Connections

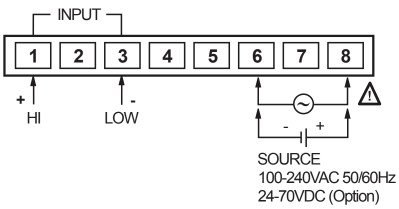
● M4Y



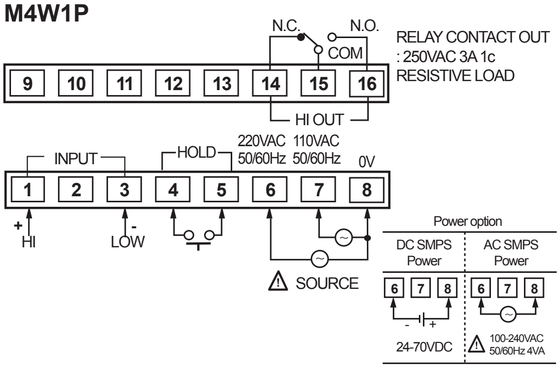
● M4W



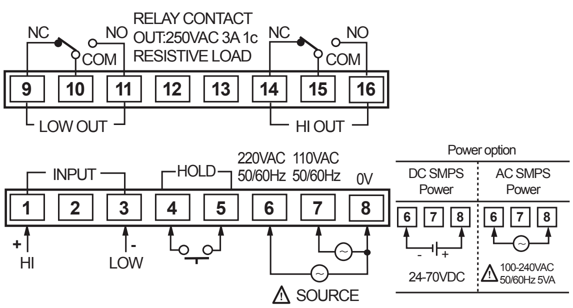
● M5W



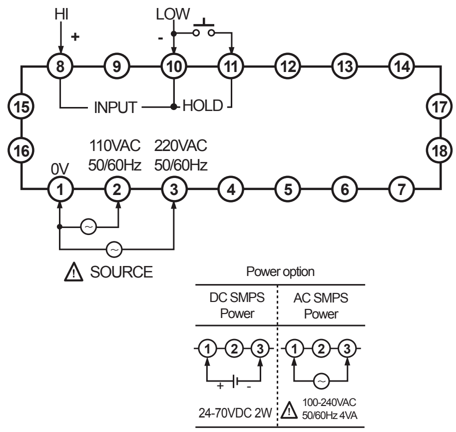
● M4W1P



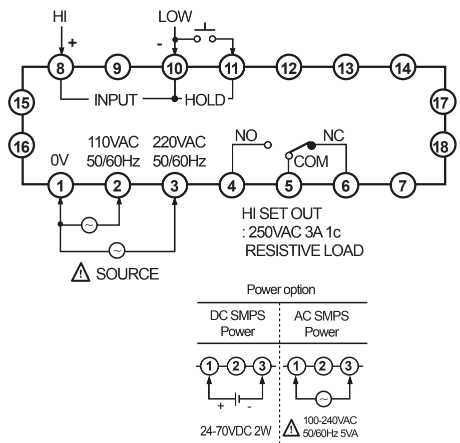
● M4W2P



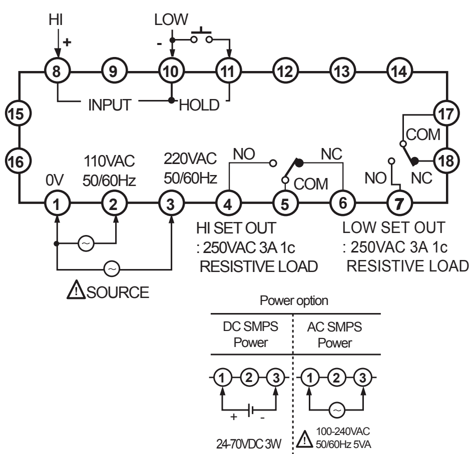
● M4M



● M4M1P



● M4M2P



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

DIN W72×H36mm, W96×H48mm, W72×H72mm Digital Panel Meter For Measuring Voltage

■ Features

- Max. display: 19999 (M5W), 1999 (others)
- Auto zero function or Hold function (except for M5W)
- Selcetable RMS/AVG value (AC voltage)
- 7-segment LED display
- Case size by DIN specification
- Indicator, Single preset output type, Dual preset output type

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

M | 4 | W | □ – AV | □ – 1

Measuring input※1

NO	M4Y / M4W / M4M		M5W	
	DC INPUT (F.S.)	AC INPUT (F.S.)	DC INPUT (F.S.)	AC INPUT (F.S.)
1	199.9mV	199.9mV	199.99mV	199.99mV
2	1.999V	1.999V	1.9999V	1.9999V
3	19.99V	19.99V	19.999V	19.999V
4	199.9V	199.9V	199.99V	199.99V
5※2	300V	—	300.0V	400.0V
6※2	—	400V	—	—
XX	Option		Option	

AC measuring method

No mark	AVG value
R※3	RMS value

Input

DV	DC voltage
AV	AC voltage

Output

No mark	Indicator
1P	Single setting
2P	Dual setting

Size

Y※4	DIN W72×H36mm
W※4	DIN W96×H48mm
M	DIN W72×H72mm

Digit

4	1999 (3½-digit)
5	19999 (4½-digit)

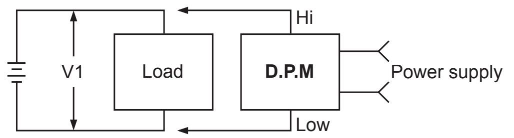
Item

M	Meter

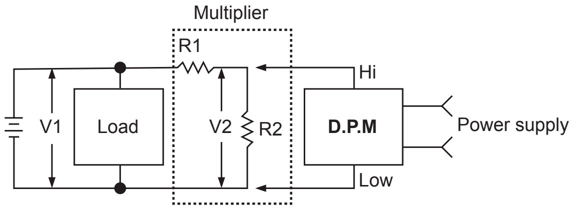
※1: Measuring input and display are 1:1.
※2: Available input can be direct connection if under 300VDC, 400VAC.
※3: M5W AC measurement type has RMS only. It does not have "R" in model name.
※4: M4Y, M5W are indicator.

▣ The Application Of Connections

◎ Measuring DC voltage



(Fig. 1) Measuring lower than 300VDC of measurement voltage (V1)



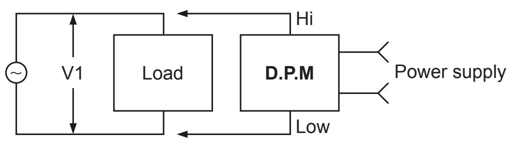
(Fig. 2) Measuring higher than 300VDC of measurement voltage

※When measuring voltage is higher than 300VDC, please select R1 and R2 with multiplying resistance on the external to make V2 less than max. measurement voltage.

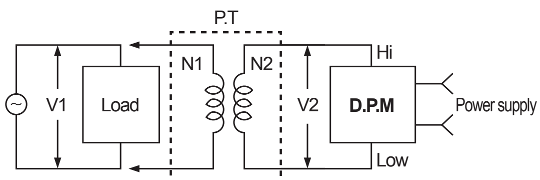
$$V2 = \frac{R2}{R1 + R2} \times V1 \qquad R1 > R2$$

E.g.)Ordering D.P.M for measuring 1000VDC
As above Fig. 2, select the R1 value to make 300VDC on R2.
(Generally R1 value will be higher than R2 value.)
Order the D.P.M indicating 1000V for 300VDC.

◎ Measuring AC voltage



(Fig. 3) Measuring lower than 400VAC of measurement voltage (V1)



(Fig. 4) Measuring higher than 400VAC of measurement voltage (V1)

※When measuring voltage is higher than 400VAC, please use the P.T on the external. (V2 voltage must be lower than max. measurement voltage)

$$V2 = \frac{N2}{N1} \times V1$$

E.g.)Ordering D.P.M for measuring 1000VAC
Select the P.T having 1000VAC of 1st part voltage and 220VAC of 2nd part voltage and order the D.P.M indicating 1000V for 220VAC.

▣ Proper Usage

- Please notice the product customized by requirement cannot be replaced.
- If it displays arbitrary number even though the power is ON, please remove the input signal and check whether it displays "000" after short the measurement terminal. (Checking auto zero function)

  If it does not display "000", please connect to our A/S center.

  Note)M5W Series does not have auto zero function.
- If it indicates "1999" or "-1999" during input signal is ON, please turn OFF the power and check the connection condition.

  It is because the input signal is too low or high. Note) M5W Series indicates "19999" or "-19999".
- The specification of measurement input, which is indicated in ordering information, is a standard specification, 1:1 of measurement input and process value. When it is an optional specification of AC voltmeter, please mark the specification of P.T after select a model.

  ※Please notice P.T is not included.
- The D.P.M for measuring AC voltage has both AVG type and RMS type separately. Because it is produced with AVG type, please mark the model name accurately.

  E.g.)In case of M4Y, M4W, M4M Series (Include setting type)

  The model of RMS type: M4W-AVR-6

  The model of AVG type: M4W-AV-6

  ※The specification will be set by sign "R".

  ※M5W Series has RMS type only, and it is not indicated "R" on the model name.
- In case of D.P.M for measuring AC voltage, please check if it is AVG type or RMS type when comparison measuring with other company's products.

M4Y/M4W/M5W/M4M Series

DIN W72×H36mm, W96×H48mm, W72×H72mm
Digital Panel Meter For Measuring Current

■ Features

- Max. display: 19999 (M5W), 1999 (others)
- Auto zero function or hold function (except for M5W)
- Selcetable RMS/AVG value (AC current)
- 7-segment LED display
- Case size by DIN specification
- Indicator, single preset output type,
  Dual preset output type

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

M | 4 | W | □ — AA | □ — 1

Measuring input※1

NO	M4Y / M4W / M4M DC INPUT (F.S.)	M4Y / M4W / M4M AC INPUT (F.S.)	M5W DC INPUT (F.S.)	M5W AC INPUT (F.S.)
1	199.9μA	19.99mA	199.99μA	19.999mA
2	1.999mA	199.9mA	1.9999mA	199.99mA
3	19.99mA	1.999A	19.999mA	1.9999A
4	199.9mA	19.99A	199.99mA	19.999A
5	1.999A	199.9A	1.9999A	199.99A
6	19.99A	1999A	19.999A	1999.9A
7	199.9A	—	199.99A	—
8	1999A	—	1999.9A	—
XX	Option		Option	

AC measuring method

No mark	AVG value
R※2	RMS value

Input

DA	DC current
AA	AC current

Output

No mark	Indicator
1P	Single setting
2P	Dual setting

Size

Y※3	DIN W72×H36mm
W※3	DIN W96×H48mm
M	DIN W72×H72mm

Digit

4	1999 (3½-digit)
5	19999 (4½-digit)

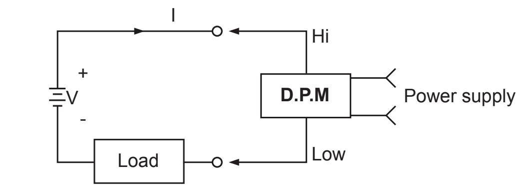
Item

M	Meter

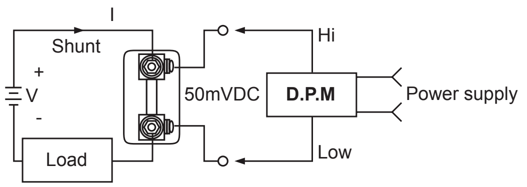
※1: Measuring input and display is 1:1 for DC INPUT No.1to 5 and AC INPUT No.1 to 3, DC INPUT No.6 to 8 is used with 50mVDC Shunt, AC INPUT No.4 to 6 are used with C.T (current transformer)
※2: M5W AC measurement type has RMS only. It does not have "R" in model name.
※3: M4Y, M5W are indicator.

▣ Connections

◎ Measuring DC current



(Fig. 1) Measuring lower than DC2A of current

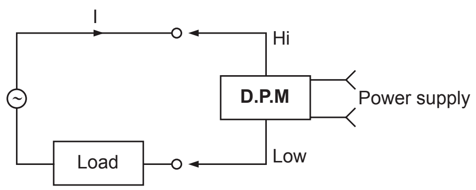


(Fig. 2) Measuring higher than DC2A of current

※Higher than DC2A is using shunt for measuring current.
※Basically the 2nd part of shunt value is 50mVDC.

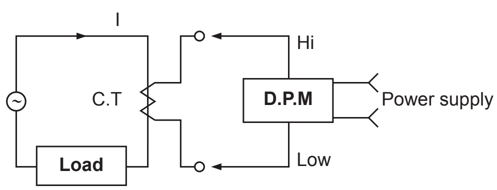
E.g.) Ordering D.P.M in case of DC10A of measuring current: Select DC10A/50mVDC of shunt and 50mVDC/DC10.00A of D.P.M.

◎ Measuring AC current



(Fig. 3) Measuring lower than AC5A of current

E.g.) Ordering D.P.M in case of lower than AC5A of measuring current: Select M4W-AA-XX AC5A/5.00A



(Fig. 4) Measuring higher than AC5A of current

※If the current is higher than AC5A, please use C.T.

E.g.) How to order D.P.M in case of AC300A of measuring current: Select AC300A/5A of C.T and AC5A/300A of D.P.M.

▣ Proper Usage

- Please notice the product customized by requirement cannot be replaced.
- If it displays arbitrary number even though the power is ON, please remove the input signal and check whether it displays "000"after short the measurement terminal. (Checking auto Zero function)

  If it does not display "000", please connect to our A/S center.

  Note) M5W Series does not have auto zero function.
- If it indicates "1999" or "-1999"during input signal is ON, please turn OFF the power and check the connection condition.

  It is because the input signal is too low or high.

  Note) M5W Series indicates "19999" or "-19999".
- The specification of measurement input, which is indicated in ordering information, is a standard specification, 1:1 of measurement input and process value.

  ※Please notice a shunt and C.T are not included.
- The D.P.M for measuring AC current has both AVG type and RMS type separately.

  Because it is produced with AVG type, please mark the model name accurately.

  E.g.) In case of M4Y, M4W, M4M Series (Include setting type)

  The model of RMS type: M4W-AAR-5

  The model of AVG type: M4W-AA-5

  ※The specification will be set by sign "R".

  ※M5W Series has RMS type only, and it is not indicated "R" on the model name.
- In case of D.P.M for measuring AC current, please check if it is AVG type or RMS type when comparison measuring with other company's products.

DIN W72×H36mm, W96×H48mm, W72×H72mm Digital Panel Meter For Displaying Power

■ Features

- Max. display: 19999 (M5W), 1999 (others)
- Display the output (0-10VDC) from transducer.
  (It is available to correspond when output is DC4-20mA, 1-5VDC.)
- Auto zero function and hold function (except for M5W)
- 7-segment LED display
- Case size by DIN specification.
- Indicator, single preset output type, Dual preset output type

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

M 4 W □ – W – 1

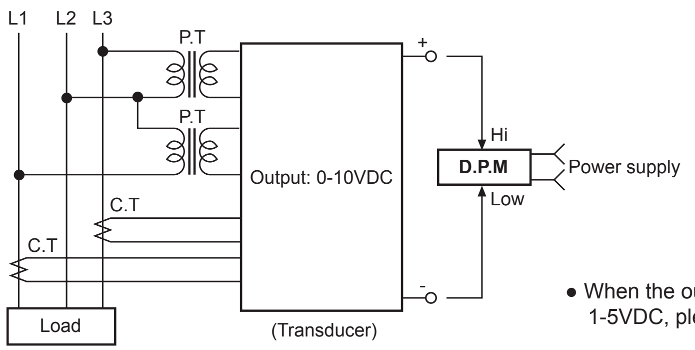
Display scale※1

NO	M4Y / M4W / M4M DISPLAY (F.S.)	M5W DISPLAY (F.S.)
1	199.9W	199.99W
2	1.999kW	1.9999kW
3	19.99kW	19.999kW
4	199.9kW	199.99kW
5	1999kW	1999.9kW
XX	Option	Option

Item	Code	Description
Display function	W	Watt Meter
Output	No mark	Indicator
	1P	Single setting
	2P	Dual setting
Size	Y※2	DIN W72×H36mm
	W※2	DIN W96×H48mm
	M	DIN W72×H72mm
Digit	4	1999 (3½-digit)
	5	19999 (4½-digit)
Item	M	Meter

※If output specification of transducer or converter is DC4-20mA or 1-5VDC, please use scaling meter.
※1: When output specification of transducer is 0-10VDC, display value is maximum.
※2: M4Y, M5W are indicator.

■ Application Of Connection



- When the output of transducer or converter is DC4-20mA or 1-5VDC, please use scaling meter.

DIN W72×H36mm, W96×H48mm, W72×H72mm Digital Panel Meter For Measuring Revolution/Speed

■ Features

- Max. display: 19999 (M5W), 1999 (others)
- Auto zero function or hold function (except for M5W)
- Selcetable RMS/AVG value (AC voltage)
- 7-segment LED display
- Case size by DIN specification
- Indicator, single preset output type, Dual preset output type

⚠ **Please read "Caution for your safety" in operation manual before using.**

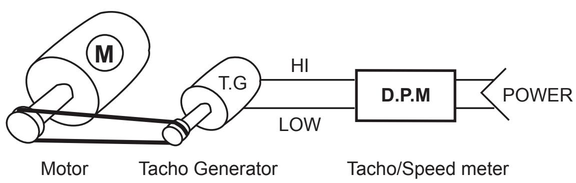
■ Ordering Information

M 4 W □ – T □ – 1

Item	Code	M4Y / M4W / M4M	M5W
Measuring input	NO	INPUT (F.S.)	INPUT (F.S.)
	1	0-10VDC / 1999	0-10VDC / 1999.9
	2	0-10VAC / 1999	0-10VAC / 1999.9
	DX	DC Input option	DC Input option
	AX	AC Input option	AC Input option
AC measuring method	No mark	AVG value	
	R※1	RMS value	
Measurement function	T	Tachometer (rpm)	
	S	Line Speed Meter (m/min)	
Output	No mark	Indicator	
	1P	Single setting output	
	2P	Dual setting output	
Size	Y※2	DIN W72×H36mm	
	W※2	DIN W96×H48mm	
	M	DIN W72×H72mm	
Digit	4	1999 (3½-digit)	
	5	19999 (4½-digit)	
Item	M	Meter	

※1: AC measuring type of M5W only applies to RMS and it is not marked with "R" in the model name.
※2: M4Y, M5W are indicator.

■ Application Of Connection



- Tacho Generator (T.G)
  This generator makes a voltage in proportion to revolution speed of motor. The D.P.M receives the voltage and displays the number of revolution and please check the specification of T.G.
- The specification of measuring input indicated in ordering information, is display value when output specification is 0-10VDC and 0-10VAC. Different output specification of tacho generator is optional.

M4Y/M4W/M5W/M4M Series

DIN W72×H36mm, W96×H48mm, W72×H72mm
Digital Scaling Meter

■ Features

● Max. display: 19999 (M5W), 1999 (others)
● 7-segment LED display
● Case size by DIN specification
● Linear display function by INPUT specification
● Indicator, single preset output type, dual preset output type

⚠ Please read "Caution for your safety" in operation manual before using.

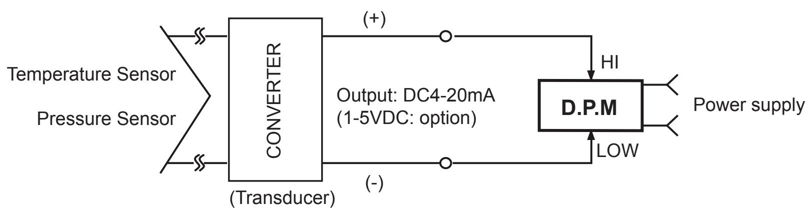
■ Ordering Information

M | 4 | W | ☐ – DI – X

Field	Code	Description
Display scale	X	Display range (option)
Input	DI	DC4-20mA (1-5VDC: option※1)
Output	No mark	Indicator
	1P	Single setting
	2P	Dual setting
Size	Y※2	DIN W72×H36mm
	W※2	DIN W96×H48mm
	M	DIN W72×H72mm
Digit	4	1999 (3½-digit)
	5	19999 (4½-digit)
Item	M	Meter

※1: 1-5VDC of measuring input specification is available by option.
It will be a default value if there is no request for order.
※2: M4Y, M5W are indicator.

■ Application Of Connection



● The measurement input specification of ordering information, is an output specification of converter and DC4-20mA is the standard specification. In case, the output of converter is 1-5VDC, it is customizable.
● DC voltmeter can be produced by requirement, in case, it is out of the 1-5VDC output specification.

DIN W96×H48mm, Digital Panel Meter For Displaying Power Factor

■ Features

- Display indicator of power factor
- Input: DC4-20mA (Output specification of power factor transducer)
- Display: -0.50 to 1.00 to +0.50

⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

M 4 W – P

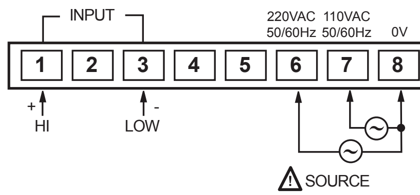
Measurement function	P	Power Factor
Size	W	DIN W96×H48mm
Digit	4	9999 (4-digit)
Item	M	Meter

■ Specifications

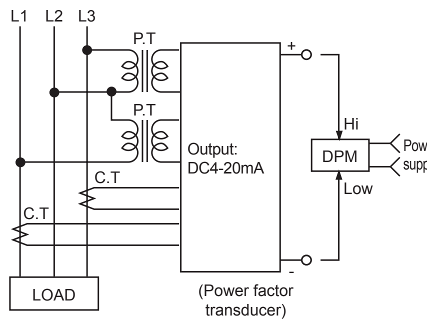
Model		M4W-P
Measurement function		Power factor
Input		DC4-20mA
Display		-0.50 to 1.00 to +0.50 cosø
Power supply		110/220VAC 50/60Hz
Allowable voltage range		90 to 110% of rated voltage
Power consumption		4VA
Display method		7-segment LED display
Character height		14mm
Display accuracy		F.S: ±3% rdg ±1-digit
Sampling period		300ms
Response speed		2sec (0 to max.)
Point display		Fixed point
Insulation resistance		Over 100MΩ (at 500VDC megger)
Dielectric strength		2000VAC 50/60Hz for 1 min
Noise immunity		±1kV the square wave noise (pulse width: 1µs) by the noise simulator
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times
Environ -ment	Ambient temperature	-10 to 50℃, storage: -25 to 60℃
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Unit weight		Approx. 317g

※Environment resistance is rated at no freezing or condensation.

■ Connections

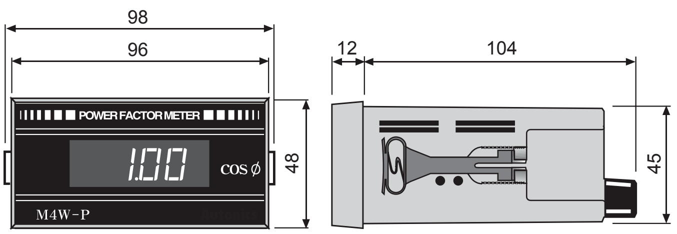


■ Application of connection

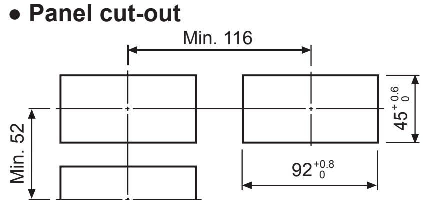


■ Dimension

(unit: mm)

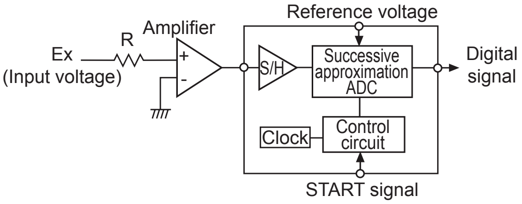


● **Panel cut-out**



▣ Analog To Digital Converter Method

1) ADC (Analog to Digital Converter) method



(Figure 1) ACD basic configuration

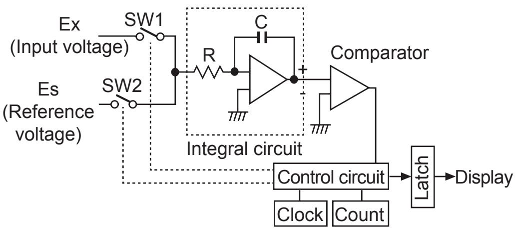
The measuring speed is fast, and the resolution is high because of sampling the input signal on ADC and then measuring the changes by successive approximation ADC like figure 1. Successive approximation ADC which converts from the highest order bit toward the lower order bit has fast convert time and simple circuit.

2) Dual slope integration method

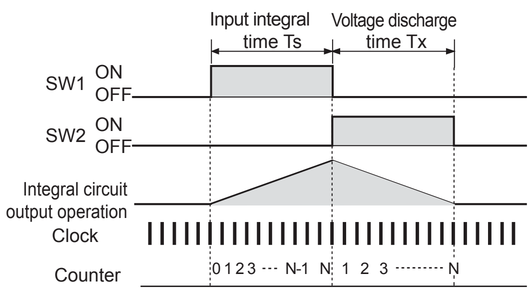
Like (Figure 2-1) if SW1 is ON, input voltage Ex is integrated by a certain time Ts. After finish integral of input voltage Ex, SW2 is ON, then when connect to reference voltage Es, it will be integral in the direction of zero voltage. (Based on Es, Ex becomes reverse polarity.) When integral operating becomes zero, comparator stops integral, and this integral time is Tx. The formula is

The formula is $EX = \frac{Tx}{Ts} Es$.

The integral times of Successive approximation Es and input voltage Ex are fixed. So, if Tx value is measured with the counter, the digital value proportional to the input can be obtained.



(Figure 2-1) Dual slope integration method basic configuration



(Figure 2-2) Integral waveform

3) Compare ADC and Dual slope integration method

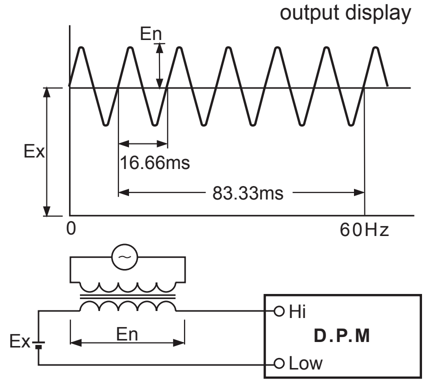
	ADC	Dual slope integration method
Property	◎Fast measurement ◎Improved noise characteristics ◎High resolution ◎Expansive price	◎Stable AD convert ◎Good linearity ◎Reasonable price

▣ Normal Mode Rejection Ratio (NMR)

NMR is the rate of ripple error caused by AC voltage when AC voltage of commercial power frequency is mixed at the measuring input terminal during measuring DC voltage. To remove this error, the rate of remove is changed depending on the method of the A/D change.
At the integral method like (Figure 3), the half cycle of + and the half cycle of - are cancelling each other, so mixed noise can be removed effectively, and if integral time of input is integral multiples of power frequency, it is able to get infinite noise remove ratio theoretically. And if filter method is inserted in the input circuit, NMR can be big, but it does not need to do because the response to reply to the change of signal voltage is worse.

$$\text{NMR (dB)} = 20 \log \frac{En}{\triangle E}$$

En: Input mixed AC voltage noise peak value
△E: Rate of change of output display

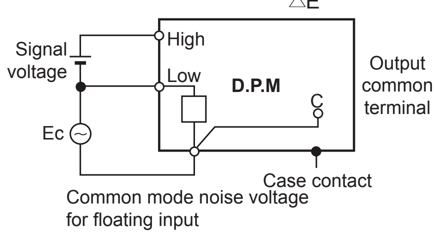


(Figure 3)

▣ Common Mode Rejection Ratio (CMR)

CMR is the rate of error occurred when receiving noise voltage of same phase (Common Mode) during the measuring input 2 terminals is same size as in common (ground). The measured degree under the real operating condition can be declined often by same phase noise.
This noise is that when the potential difference at the earth terminal is caused between earth terminal of panel meter and the ground, the terrestrial current enters into the meter. It is represented between high and low of measurement input terminal. Same phase noise can be neglected several V, dozens of V of the noise voltage when earthing point is long, or the earthing points of substation or the device using high power broadcasting is nearby.
The definition of CMR is that using the circuit on the (Figure 4) when applied E (Common Mode Current: AC Peak voltage), if output is changed as much as △E, the formula is below.

$$\text{CMR (dB)} = 20 \log \frac{Ec}{\triangle E}$$



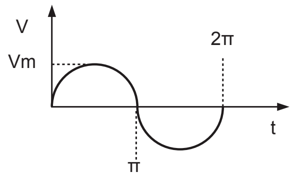
(Figure 4)

▣ Glossary

◎ Measurement of AVG/RMS

- There are two ways to measure voltage or current of AC waveforms.
  They are read AVG or RMS to get AC wave. User can select any kinds of measuring method.
- AVG
  The average value of each half cycle at AC waveforms.
- RMS
  AC is that voltage and current are changed every time not like DC. So, it can show same effectiveness which is the value of voltage and current like DC.
  Generally RMS of AC is the value of DC which is spent same quantity of electrical energy during same time at the same resistance. Generally use Root mean square (RMS) to get the real RMS value because AC has lots of electrostriction.

(For sine wave)



[Vm: Max. value]

$$AVG = \frac{2Vm}{\pi} = 0.637Vm$$

$$RMS = \frac{Vm}{\sqrt{2}} = 0.707Vm$$

- The result of measuring electrostriction waveform
  Measuring the average value:
  There can be big display deviation by the rate of electrostriction of waveform.
  Measuring the RMS value:
  There is no display deviation when measuring RMS value because sine wave or no sinusoidal wave is measured by its quantity of heat.
- In conclusion, the waveform close to sine wave does not have any big difference using AVG or RMS, but RMS is better to measure electrostriction of waveform.
- We produce both models for measuring AVG and RMS. For RMS model, indicate "R" on the name of the model, but no "R" for AVG model.
  But, there is only RMS measuring model for M5W Series, and "R" is not on the name of the model.
  And the method of AVG and RMS can be selected on the parameter for multi panel meter.

◎ Display accuracy

Display accuracy means the maximum error guaranteed by maker. It is displayed by % on the full scale of meter. (Full scale: the maximum display range. For 3½ line is 1999, 4 line is 9999, 4½ line is 19999.)

E.g.) The display accuracy of M4Y Series is ±0.2 rdg, ±1 digit for full scale. So, 1999 × ±0.2% = ±4digit, after include reading error ±1digit, the display accuracy is ±5 digit. rdg is the code address of reading.

◎ AUTO ZERO

When input is zero, corrects the offset value in the inner circuit, and displays "000" or "0000"

◎ HOLD

The function holds the display value by shorting and hold terminal when it is difficult to read the display value by changing input frequently.

◎ Display decimal point

All models adopt fixed decimal point function. Please do not change the decimal point arbitrarily. (Except multi-meter and scale function embedded types) Please contact main office or branches if there is any change.

▣ Proper Usage

- Please read this catalog before buy or use the Panel Meter. The shipped product which is produced by order error cannot be exchanged.
- After install this product, even though the input signal is zero if arbitrary number is shown, cut measurement input terminal and check 0000 is displayed after remove input signal. (Check auto zero function)
  If 0000 is not displayed, please contact us, but MT4Y, MT4W Series are able to revise this error using error correction function.
  Note) M5W Series does not have Auto Zero function.
- After install this product, when input signal is applied if 1999 or -1999 is displayed, it means that input signal is bigger than input specification or measurement input is not correct. In this case, shut down the power and check wires.
  Note) M5W Series displays 19999 or -19999.
  but Error display function embedded displays own error code.
- Be careful when order products because there are standard and option specifications for power supply of D.P.M.

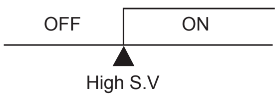
Series	Standard	Option
M4Y Series	100-240VAC	5VDC, 24-70VDC
M4W Series	110/220VAC	24-70VDC, 100-240VAC
M5W Series	100-240VAC	24-70VDC
M4M Series	110/220VAC	24-70VDC, 100-240VAC
MT4Y Series	100-240VAC	—
MT4W Series		12-24VDC

※Products for 24-70VDC cannot use 12VDC.

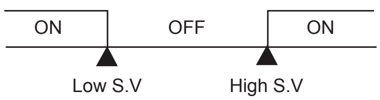
※Please fill in the supply voltage specification when order option products. If it does not fill in, the product will be in standard specification. ZERO function.

Technical Description

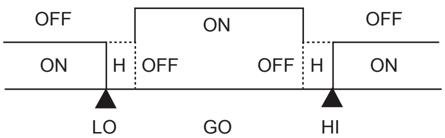
- The output of D.P.M for single setting works as the upper limit alarm output. If the measured value is higher than high setting value, the output works, and if the measured value is lower than high set value, the output does not work.
  Applied Series: M4W1P, M4M1P Series



- The output of D.P.M for dual setting works as the upper, lowest limited alarm output. The output works if the measured value is higher than high setting value or lower than low setting value. And if the measured value is lower than high setting value, and higher than low setting value, the output does not work. (The upper, lowest limits work separately.)
  Note)The setting value displays Error when Low ≥ High.
  Please set Low < High.
  Applied Series: M4W2P, M4M2P Series



- Multi panel meter (MT4Y/MT4W) works as triple output (LO, GO, HI), and provides 5 types of output except the upper limit output.
  (oFF, L.St, H.St, LH.St, LL.St, HH.St, LdSt Mode)
  E.g.) The upper/lowest limit alarm output (LH.St Mode)



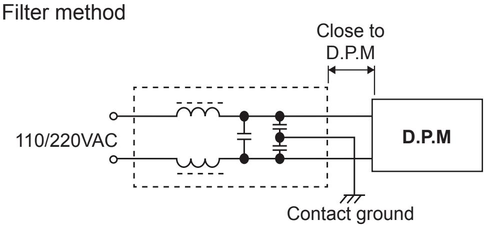
※Please refer to L-45 page for more detail information.

- Use environment
  1) Operate at temperature -10 to 50℃, humidity 85%. Please use at the room temperature because temperature will affect the accuracy of the measurement.
  2) Please avoid the condition of condensation caused by the rapid change of temperature.
  3) Please be careful not to cause vibration or shock. Please do not use in the surrounding of gases, dust, chemicals which is harmful to electric devices.

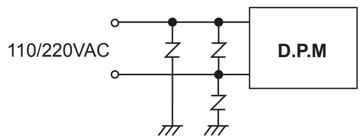
- Storage
  When store items for long term, avoid direct sunlight, keep in -20 to 60℃ temperature range and under 30 to 85% relative humidity. Keep the packaged products like factory condition.

- Noise
  The biggest problem is the noise which is mixed into power line at the AC power panel meter. Anti-noise condenser is available between wires at the 1st part of power Trans. But, it is difficult to put in the perfect anti-noise circuit in the small product like panel meter. Please use noise absorbing circuit like filter or varistor at the outside line when abnormal voltage is caused by power relay, magnet S/W, using high frequency device, high voltage spark, and thunderbolt at the same line.

1. Line Filter method

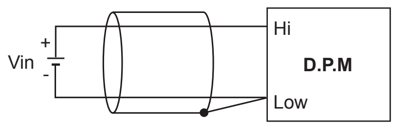


2. Varistor method

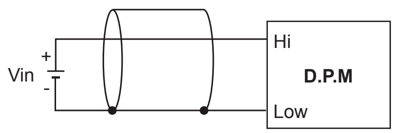


- Input line If the measuring input wire is long, please must use the shield wire at the place where noise can occur often.

1. Use 2 core Shield wire



2. Use 1 core Shield wire



(M)Tacho/Speed/Pulse Meters

Compact LCD Pulse Meter LR5N-B

Upgrade

Pulse Meter MP5M Series

Upgrade

Pulse Meter MP5S Series

Upgrade

Pulse Meter MP5Y Series

Upgrade

Pulse Meter MP5W Series

Product Overview

Compact LCD Pulse Meter

Model	**LR5N-B**
Appearances & Dimensions	 [W48×H24×L54mm]
Display method	LCD zero blanking method (character height: 8.7mm)
Display range	0 to 10000
Power supply	Internal lithium battery
Input method	[No-voltage input] Short-circuit impedance: max. 10kΩ, Residual voltage: max. 0.5V, Open-circuit impedance: min. 500kΩ [Voltage input 1] • High: 4.5-30VDC, Low: 0-2VDC • 3-30VAC [Voltage input 2] 30-240VAC
Measurement range	1 to 10000RPM, 0.1 to 1000.0RPM, 1 to 1000RPS, 1 to 1000Hz, 0.1 to 100.0Hz
Measurement accuracy	F.S. ±0.1% ±1-digit
Reference	**M-4 to 6**

Pulse Meter

Series			**MP5S**	**MP5Y**	**MP5W**
Appearances & Dimensions			Upgrade  [W48×H48×L90mm]	Upgrade  [W72×H36×L100mm]	Upgrade  [W96×H48×L100mm]
Display method			7-segment LED (zero blanking method)		
Character size			W4×H8mm	W7×H14mm	
Display range			-19999 to 99999		
Power supply	AC voltage		100-240VAC 50/60Hz		
	AC/DC voltage		24VAC 50/60Hz, 24-48VDC		
External sensor power			12VDC±10%, 80mA		
Sub power supply			—		24VDC 30mA
Input frequency			·Solid state input 1: Max. 50kHz (pulse width: min. 10μs) ·Solid state input 2: Max. 5kHz (pulse width: min. 100μs) ※For F7, F8, F9, F10 operation mode, max. 1kHz (pulse width: min. 500μs) ·Contact input: Max. 45Hz (pulse width: min. 11ms)		
Input method			[Voltage input] High: 4.5-24VDC, Low: 0-1.0VDC, Input impedance: 2.4kΩ [No-voltage input] Short-circuit impedance: Max. 80Ω, Residual voltage: Max. 1V, Open-circuit impedance: Min. 100kΩ		
Measurement range			·Operation mode F1, F2, F7, F8, F9, F10 : 0.0005Hz to 50kHz ·Operation mode F3, F4, F5, F6 : 0.01 to max. of each time range ·Operation mode F11, F12, F13, F16 : 0 to 99999 ·Operation mode F14, F15 : -19999 to 99999		
Measurement accuracy (23±5℃)			·Operation mode F1, F2, F7, F8, F9, F10 : F.S.±0.05%rdg±1-digit ·Operation mode F3, F4, F5, F6 : F.S.±0.01%rdg±1-digit		
Display cycle			OFF (for F2, F16 operation mode), 0.05, 0.5, 1, 2, 4, 8 sec (same as update output cycle)		
Operation mode			Frequency/Revolutions/Speed (F1), Passing speed (F2), Cycle (F3), Passing time (F4), Time interval (F5), Time differential (F6), Absolute ratio (F7), Error ratio (F8), Density (F9), Error (F10), Length measurement 1 (F11), Interval (F12), Accumulation (F13), Addition/Subtraction-individual input (F14), Addition/Subtraction-phase difference input (F15), Length measurement 2 (F16)		
Prescale function			Direct input method (0.0001×10^{-9} to 9.9999×10^{9})		
Hysteresis			0 to 9999 ※1		
Output	Main	Relay triple	—	250VAC 3A resistive load	
		Relay quintuple	—	—	250VAC 3A resistive load
		NPN/PNP open collector quintuple	—	Max. 30VDC 30mA	
	Sub	BCD Dynamic	—	Max. 30VDC 30mA	
		Analog	—	DC4-20mA/DC0-20mA max. load 500Ω	
		Communication	—	RS485 communication output (Modbus RTU method)	
Reference			**M-7 to 32**		

※1: Setting range will vary depending on the decimal point.

Pulse Meter- Thumbwheel Switch Setting Type

Model		MP5M-2N	MP5M-4N	MP5M-21	MP5M-41	MP5M-22	MP5M-42
		Indicator		High-limit setting		High/Low-limit setting	
Appearances & Dimensions		Upgrade  [W72×H72×L75mm]					
Display method		7-segment LED (zero blanking method)					
Character size		W4×H8mm					
Display range		-19999 to 99999					
Power supply	AC voltage	100-240VAC 50/60Hz					
	AC/DC voltage	24VAC 50/60Hz, 24-48VDC					
External sensor power		12VDC±10%, 80mA					
Input frequency		·Solid state input 1: Max. 50kHz (pulse width: min. 10µs) ·Solid state input 2: Max. 5kHz (pulse width: min. 100µs) ※For F7, F8 operation mode, max. 1kHz (pulse width: min. 500µs) ·Contact input: Max. 45Hz (pulse width: min. 11ms)					
Input method		[Voltage Input method] High: 4.5-24VDC, Low: 0-1.0VDC, Input impedance: 2.4kΩ [No-voltage Input method] Short-circuit impedance: Max. 80Ω, Residual voltage: Max. 1V, Open-circuit impedance: Min. 100kΩ					
Measurement range		·Operation mode F1, F2, F7, F8 : 0.0005Hz to 50kHz ·Operation mode F3, F4, F5, F6 : 0.01 to max. of each time range ·Operation mode F9, F10, F11, F14 : 0 to 99999 ·Operation mode F12, F13 : -19999 to 99999					
Measurement accuracy (23±5℃)		·Operation mode F1, F2, F7, F8 : F.S.±0.05% rdg±1-digit ·Operation mode F3, F4, F5, F6 : F.S.±0.01% rdg±1-digit					
Display cycle		OFF (for F2, F14 operation mode), 0.05, 0.5, 1, 2, 4, 8 sec (same as update output cycle)					
Operation mode		Frequency/Revolutions/Speed (F1), Passing speed (F2), Cycle (F3), Passing time (F4), Time interval (F5), Time differential (F6), Absolute ratio (F7), Density (F8), Length measurement 1 (F9), Interval (F10), Accumulation (F11), Addition/Subtraction-individual input (F12), Addition/Subtraction-phase difference input (F13), Length measurement 2 (F14)					
Prescale function		Direct input method (0.0001×10^{-9} to 9.9999×10^{9})					
Hysteresis		—		0 to 9999※1			
Main output	Relay single	—		250VAC 3A resistive load 1c		—	
	Relay dual			—		250VAC 3A resistive load 1a×2	
	NPN open collector			Max. 30VDC 100mA		Max. 30VDC 100mA×2	
Reference		**M-33 to 45**					

※1: Setting range will vary depending on the decimal point.

DIN W48×H24mm, Indication Only, LCD Pulse Meter (RPM, RPS, Hz)

■ Features

- **Upgraded version of LR7N series**
- Easy of 1 pulse input method per 1 revolution
- Display up to 10000RPM
- No need power supply by internal battery
- Protection structure IP66 (front panel only)
- Displays RPM, RPS of rotator
- Displays AC line frequency

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

LR 5 N — B

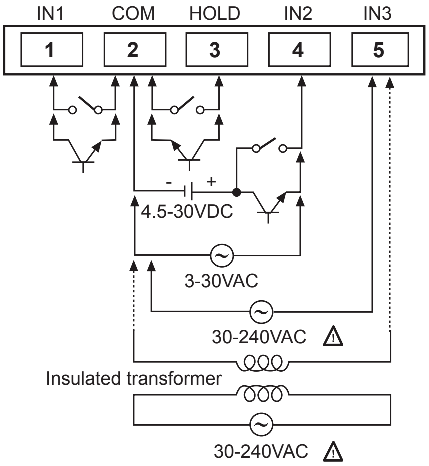
Power supply	B	Internal lithium battery
Size	N	DIN W48×H24mm
Digit	5	10000 (4½-digit)
Item	LR	LCD pulse meter

■ Specifications

Model		**LR5N-B**			
Input method		No-voltage input	Voltage input 1		Voltage input 2
Input signal level		Short-residual voltage : Max. 0.5V Max. short-circuit impedance : Max. 10kΩ Max. open-circuit impedance : Min. 500kΩ	DC	High input voltage range : 4.5-30VDC Low input voltage range : 0-2VDC	Voltage: 30-240VAC
			AC	Voltage: 3-30VAC	
Power		No-power [includes lithium battery (replaceable)]			
Battery life cycle		Over 3 years at 20℃ (replaceable)			
Dispaly method		LCD Zero blanking method (character height: 8.7mm)			
Display digits		5-digit			
Display range and Display accuracy		Display range		Display accuracy	
		RPM	1 to 10000RPM	1 to 5000RPM: F.S.±0.05%±1-digit	
				5001 to 10000RPM: F.S.±0.1%±1-digit	
		0.1RPM	0.1 to 1000.0RPM	F.S.±0.05%±1-digit	
		Hz	1 to 1000Hz	F.S.±0.1%±1-digit	
		0.1Hz	0.1 to 100.0Hz		
		RPS	1 to 1000RPS		
HOLD function		Includes (external HOLD function)			
Insulation resistance		Over 100MΩ (at 500VDC megger)			
Dielectric strength		2,000VAC 50/60Hz for 1 min (cutoff current=10mA)			
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1min) in each X, Y, Z direction for 1 hour			
	Malfunction	0.3mm amplitude at frequency of 10 to 55Hz (for 1min) in each X, Y, Z direction for 10 min			
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times			
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times			
Envion-ment	Ambient temperature	-10 to 55℃, Storage: -25 to 65℃			
	Ambient humidity	35 to 85%RH, Storage: 35 to 85%RH			
Protection structure		IP66 (when using waterproof rubber for front panel), terminal cover (finger protector)			
Weight※1		Approx. 91.5g (approx. 59g)			

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Connections



※Please use reliable contacts enough to flow 5㎂ of current when using input signal or reset signal as a contact.

※IN1 - No-voltage input

IN2 - Voltage input
- DC voltage input
- AC voltage input: Display AC frequency.

IN3 - AC voltage input: Display AC frequency.

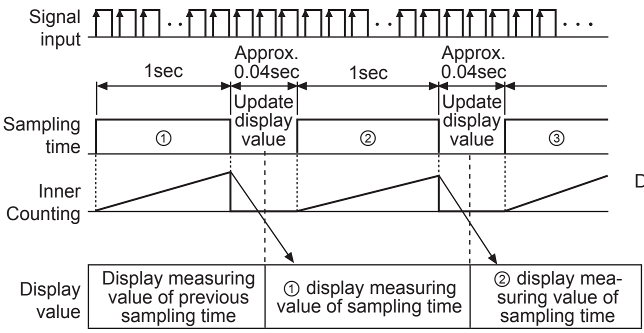
※Choose one among IN1, IN2 and IN3 to use.

⚠Caution for IN3 input

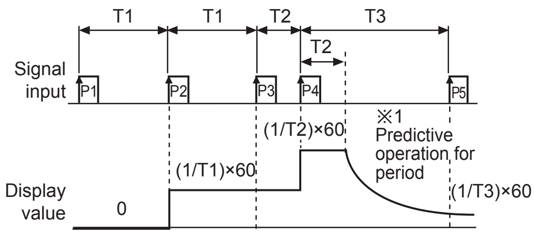
: If apply high voltage over 50VAC, it may cause an electric shock. Insulated transformer whose turn ratio is 1:1 must be installed, or countermeasures must be provided.

■ Operation Charts

● Setting RPS, Hz



● Setting RPM 0.1, RPM 0.1Hz

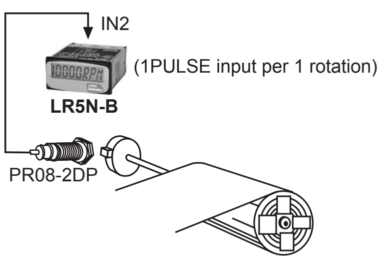


※1: It implements Predictive operation for period without Auto zero time setting function (If there is no pulse input within setting time, it displays the value as zero forcibly). If there is any input signal within certain time (T2), CPU considers input to be supplied, display value is decreased continuously.

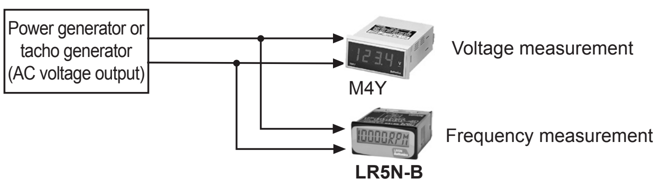
■ Operation Mode (Frequency/Revolution)

◎ **Frequency (Hz, 0.1Hz) = f, Revolution (RPM, 0.1RPM)= f × 60, Revolution (RPS)= f**

● Revolution



● AC frequency



AC input voltage
IN2: 3-30VAC
IN3: 30-240VAC ⚠

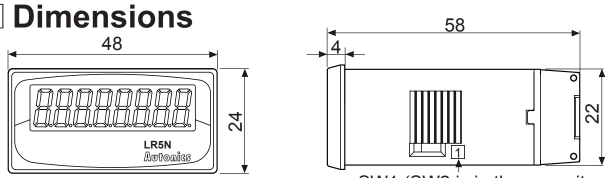
● Display value and unit

Display	Frequency		Revolution		
Unit	Hz	0.1Hz	RPM	0.1RPM	RPS (factory default)

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

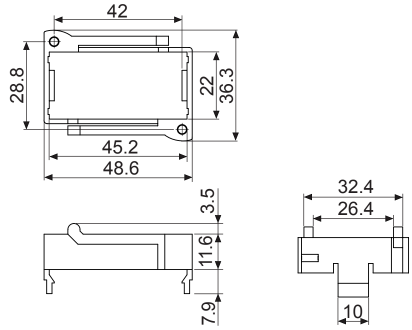
Dimensions

(unit: mm)

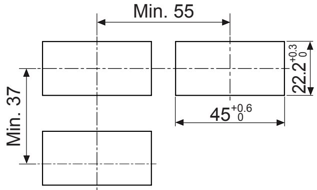


SW1 (SW2 is in the opposite side)

● Bracket

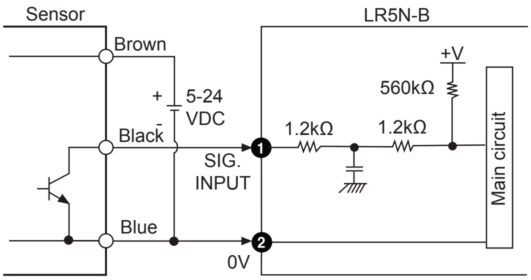


● Panel cut-out



Input Connections

● Standard input sensor
: NPN open collector output type

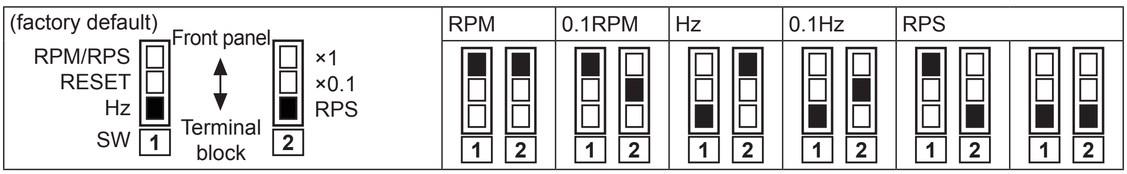


Function Description

● **RESET**
It initializes an unit and front LCD display. There are not indicated when set switch1 as RESET.

● **HOLD**
It stops display value by short circuit HOLD terminal when it is hard to read the value because of frequent input changes.

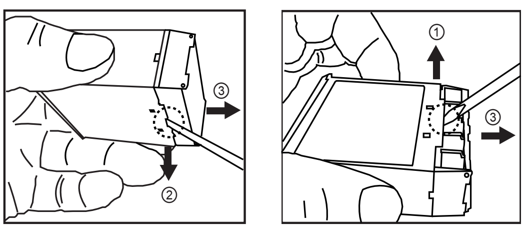
Display Range Selection



① Select one among ×1, ×0.1 and RPS by SW2.
② Shift SW1 to RESET.
③ Select one again between RPM/RPS and Hz by SW1.
※If set display range and front display LCD unit are not same, shift SW1 to RESET and select RPM/RPS or Hz.

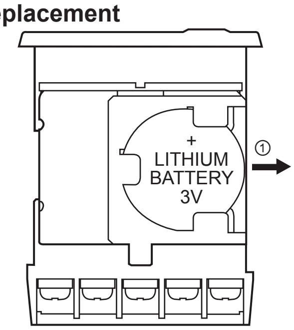
Case Detachment And Battery Replacement

● Case detachment



※Hold up Lock part toward ①, ② of the product with the tool and pull toward ③, the case is detached.
⚠ Please be careful of the injury caused by tools.

● Battery replacement



1) Detach the case.
2) Push the battery and detach toward ①.
3) Insert new battery with correct alignment of polarity pushing toward opposite of ①.
※Battery is sold separately.
※Do not burn up or disassemble the lithium battery.

High Performance, Digital Panel Meter

Upgrade

Shaded parts (■) are changed and added functions from previous MP5.

■ Features

- 3 types of operation mode are added.
  (total 16 types of operation mode)
  Frequency/Revolutions/Speed, Passing speed, Cycle, Passing time, Time interval, Time differential , Absolute ratio, Error ratio, Density, Error, Length measurement 1, Length measurement 2, Interval, Accumulation, Addition/Subtraction-individual input, Addition/Subtraction-phase difference input
- Various output models
  Relay triple/quintuple output, NPN/PNP open collector quintuple output, BCD dynamic output, PV transmission output (current output), **RS485 communication output (changed Modbus RTU)**
- Various functions
  Selectable NPN solid state/contact input, PNP solid state/contact input, prescale, delay monitoring, hysteresis, auto-zero time setting, lock setting, data bank function (MP5W series)
- Max. display range: -19999 to 99999
- Various display units
  rpm, rps, Hz, kHz, sec, min, m, mm, mm/s, m/s, m/min, m/h, ℓ/s, ℓ/min, ℓ/h, %, counts, etc.

MP5S

MP5Y

MP5W

⚠ Please read "Caution considerations" in operation manual before using.

■ Ordering Information

MP 5 Y - 4 N

Item	Code		Main output (comparative value output)	Sub output (display value output)
Output	S	N	Indicator	—
	Y	N	Indicator	—
	Y	1	NPN open collector quintuple output	—
	Y	2	PNP open collector quintuple output	—
	Y	3	Indicator	BCD dynamic
	Y	4	Indicator	PV transmission (current output)
	Y	5	Indicator	RS485 communication
	Y	6	Relay triple output (H, GO, L)	—
	W	N	Indicator	—
	W	A	Relay quintuple output (HH, H, GO, L, LL)	—
	W	1	Relay triple output (H, GO, L)	—
	W	2	NPN open collector quintuple output	BCD dynamic
	W	4	NPN open collector quintuple output	PV transmission (current output)
	W	5	PNP open collector quintuple output	PV transmission (current output)
	W	8	NPN open collector quintuple output	RS485 communication
	W	9	PNP open collector quintuple output	RS485 communication
Power supply	2		24VAC 50/60Hz, 24-48VDC	
	4		100-240VAC 50/60Hz	
Size	S		DIN W48×H48mm	
	Y		DIN W72×H36mm	
	W		DIN W96×H48mm	
Digits	5		99999 (5-digit)	
Item	MP		Pulse meter	

■ Specifications

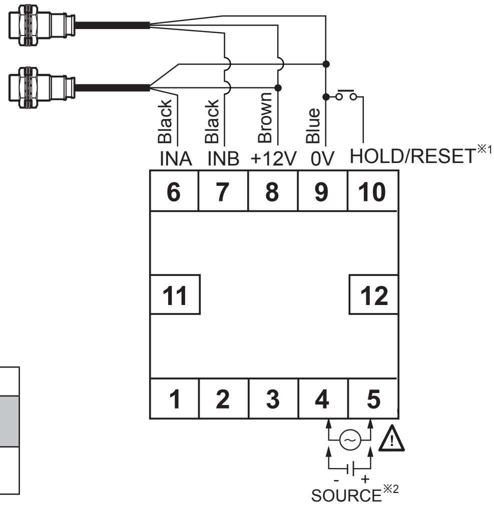
Series		MP5S	MP5Y	MP5W
Display method		7-segment LED (zero blanking method)		
Character size		W4×H8mm	W7×H14mm	
Display range		-19999 to 99999		
Power supply	AC voltage	100-240VAC 50/60Hz		
	AC/DC voltage	24VAC 50/60Hz, 24-48VDC		
Power consumption	AC voltage	Max. 7.5VA (100-240VAC 50/60Hz)	Max. 9.0VA (100-240VAC 50/60Hz)	Max. 10.0VA (100-240VAC 50/60Hz)
	AC/DC voltage	Max. 6.0VA (24VAC 50/60Hz), Max. 4.5W (24-48VDC)	Max. 7.0VA (24VAC 50/60Hz), Max. 6.2W (24-48VDC)	Max. 7.5VA (24VAC 50/60Hz), Max. 7.0W (24-48VDC)
Permissible voltage range		90 to 110% of rated voltage		
External sensor power		12VDC±10%, 80mA		
Sub power supply		—		24VDC 30mA
Input frequency		·Solid state input 1: Max. 50kHz (pulse width: min. 10μs) ·Solid state input 2: Max. 5kHz (pulse width: min. 100μs) ※For F7, F8, F9, F10 operation mode, max. 1kHz (pulse width: min. 500μs) ·Contact input: Max. 45Hz (pulse width: min. 11ms)		
Input method		[Voltage input] High: 4.5-24VDC, Low: 0-1.0VDC, Input impedance: 2.4kΩ [No-voltage input] Short-circuit impedance: Max. 80Ω, Residual voltage: Max. 1V, Open-circuit impedance: Min. 100kΩ		
Measurement range		·Operation mode F1, F2, F7, F8, F9, F10 : 0.0005Hz to 50kHz ·Operation mode F3, F4, F5, F6 : 0.01 to max. of each time range ·Operation mode F11, F12, F13, F16 : 0 to 99999 ·Operation mode F14, F15 : -19999 to 99999		
Measurement accuracy (23±5℃)		·Operation mode F1, F2, F7, F8, F9, F10 : F.S.±0.05%rdg±1-digit ·Operation mode F3, F4, F5, F6 : F.S.±0.01%rdg±1-digit		
Display cycle		OFF (for F2, F16 operation mode), 0.05, 0.5, 1, 2, 4, 8 sec (same as update output cycle)		
Operation mode		Frequency/Revolutions/Speed (F1), Passing speed (F2), Cycle (F3), Passing time (F4), Time interval (F5), Time differential (F6), Absolute ratio (F7), Error ratio (F8), Density (F9), Error (F10), Length measurement 1 (F11), Interval (F12), Accumulation (F13), Addition/Subtraction-individual input (F14), Addition/Subtraction-phase difference input (F15), Length measurement 2 (F16)		
Prescale function		Direct input method (0.0001×10^{-9} to 9.9999×10^{9})		
Hysteresis		0 to 9999 ※1		
Output – Main	Relay triple	—	250VAC 3A resistive load	
Output – Main	Relay quintuple	—	—	250VAC 3A resistive load
Output – Main	NPN/PNP open collector quintuple	—	Max. 30VDC 30mA	
Output – Sub	BCD dynamic	—	Max. 30VDC 30mA	
Output – Sub	Analog	—	DC4-20mA/DC0-20mA max. load 500Ω	
Output – Sub	Communication	—	RS485 communication output (Modbus RTU method)	
Memory retention		Non-volatile memory (number of inputs: 100,000 operations)		
Insulation resistance		Over 100MΩ (at 500VDC megger)		
Dielectric strength		2,000VAC 60Hz for 1min		
Noise immunity		±2kV the square wave noise (pulse width: 1μs) by the noise simulator		
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 1 hour		
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 10 min		
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times		
	Malfunction	100m/s² (approx. 30G) in each X, Y, Z direction for 3 times		
Relay life cycle	Mechanical	—	Min. 10,000,000 operations	
	Electrical	—	Min. 100,000 operations (250VAC 3A resistive load)	
Environment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃		
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH		
Approval		CE cULus		
Weight※2		Approx. 191g (approx. 132g)	Approx. 230g (approx. 140g)	Approx. 334g (approx. 210g)

※1: Setting range will vary depending on the decimal point.
※2:The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Connections

※Terminal connections differ by power supply and output type of each series and model.

◎ MP5S Series



※1: Operation mode F1 to F12:
Display value HOLD
Operation mode F13 to F16:
Display value RESET

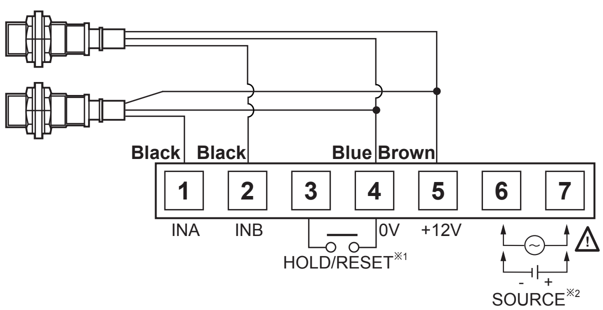
※2:

Model	Source
MP5S-2N	24-48VDC 24VAC 50/60Hz
MP5S-4N	100-240VAC 50/60Hz

◎ MP5Y Series

• Power/Input Terminal (common)

※MP5Y-□N (indicator) only has 'Power/Input terminals'.



※1: Operation mode F1 to F12:
Display value HOLD
Operation mode F13 to F16:
Display value RESET

※2:

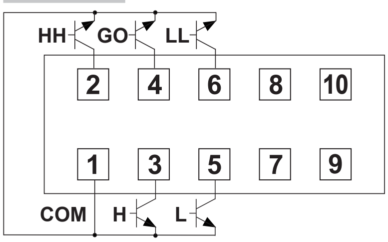
Model	Source
MP5Y-2□	24-48VDC 24VAC 50/60Hz
MP5Y-4□	100-240VAC 50/60Hz

• Output Connector (MP5Y-□1 to 5)

※Hirose connector: HIF3BA-10PA-2.54DS
※Hirose connector socket: HIF3BA-10D-2.54R (sold separately)
※Hirose connector socket is not included. Contact a hirose connector dealer regarding sockets and cables.

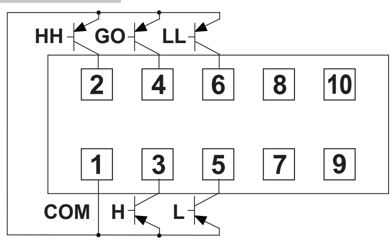
• MP5Y-□1 (NPN open collector output)

MAIN OUT (NPN OPEN COLLECTOR)
30VDC 30mA

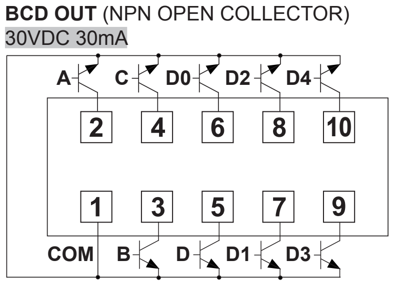


• MP5Y-□2 (PNP open collector output)

MAIN OUT (PNP OPEN COLLECTOR)
30VDC 30mA

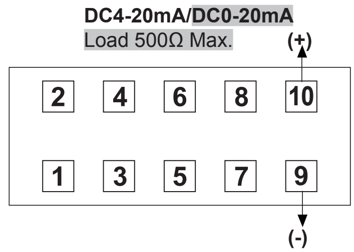


- MP5Y-□3 (BCD dynamic output)

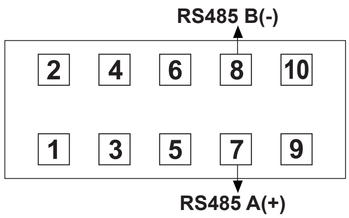


※Autonics display unit (DS/DA Series) is recommended for stable minus (-) sign display.

- MP5Y-□4 (PV transmission output)

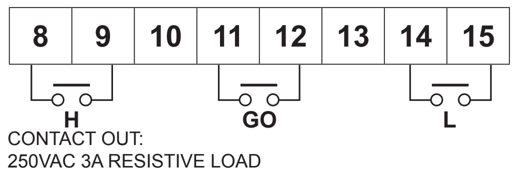


- MP5Y-□5 (RS485 communication otuput)



●Output Terminal (MP5Y-□6)

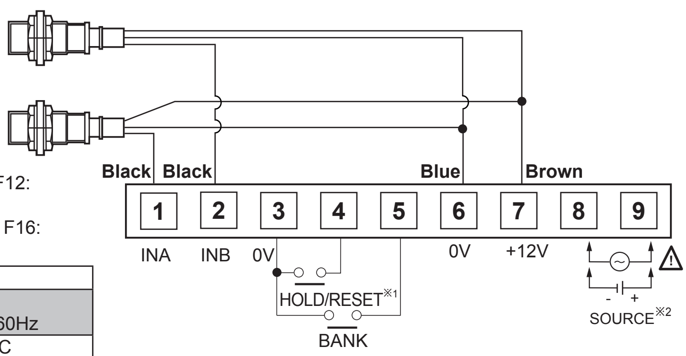
- MP5Y-□6 (Relay triple output)



◎ MP5W Series

●Power/Input Terminal (common)

※MP5W-□N (indicator) only has 'Power/Input terminals'.



※1: Operation mode F1 to F12: Display value HOLD
Operation mode F13 to F16: Display value RESET

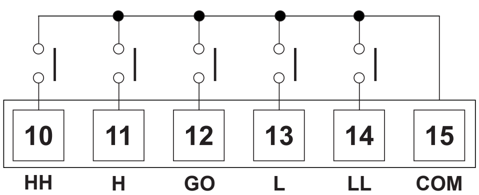
※2:

Model	Source
MP5W-2□	24-48VDC 24VAC 50/60Hz
MP5W-4□	100-240VAC 50/60Hz

●Output Terminal (MP5W-□1/2)

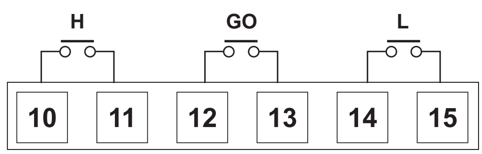
- MP5W-□A (relay quintuple output)

CONTACT OUT:
250VAC 3A RESISTIVE LOAD



- MP5W-□1 (relay triple output)

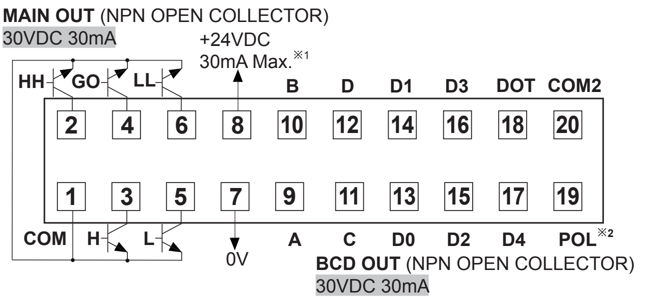
CONTACT OUT:
250VAC 3A RESISTIVE LOAD



Output Connector (MP5W-□2/4/5/8/9)

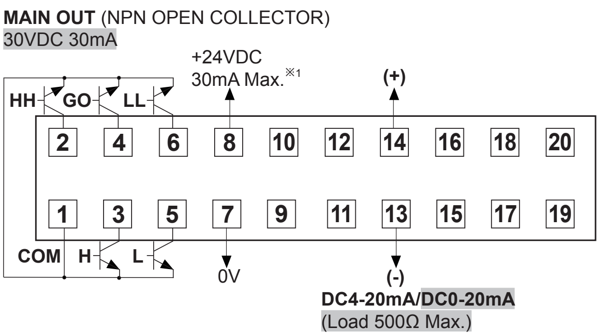
※Hirose connector: HIF3BA-20PA-2.54DS
※Hirose connector socket: HIF3BA-20D-2.54R (sold separately)
※Hirose connector socket is not included. Contact a hirose connector dealer regarding sockets and cables.
※1: Sub power supply
※2: POL signal turns ON when the display value is a minus (-) value.

MP5W-□2 (NPN open collector+BCD output)

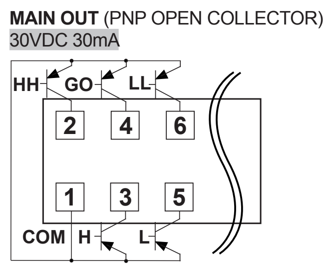


※Autonics display unit (DS/DA Series) is recommended for stable minus (-) sign display.

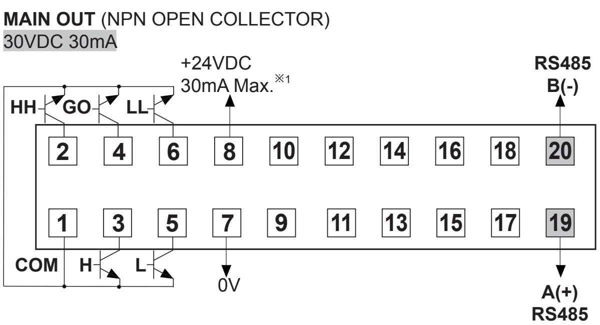
MP5W-□4 (NPN open collector+PV transmission output)



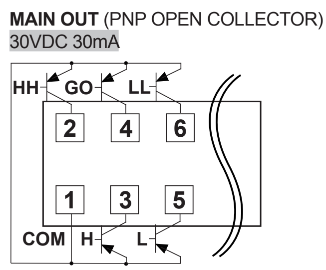
MP5W-□5 (PNP open collector+PV transmission output)



MP5W-□8 (NPN open collector+RS485 com. output)



MP5W-□9 (PNP open collector+RS485 com. output)



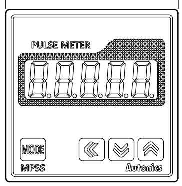
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

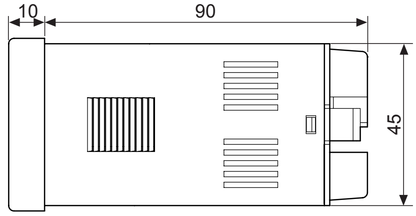
■ Dimensions

(unit: mm)

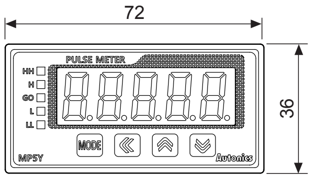
※Nameplate design is changed from the previous MP5.
※Side dimensions of MP5Y/W differ by output type.

●MP5S Series

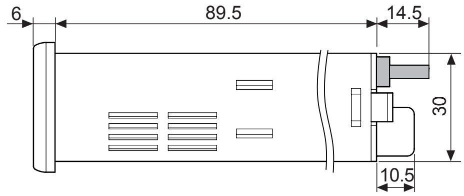




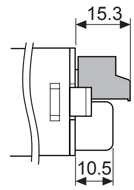
●MP5Y Series



● MP5Y-□1/2/3/4/5

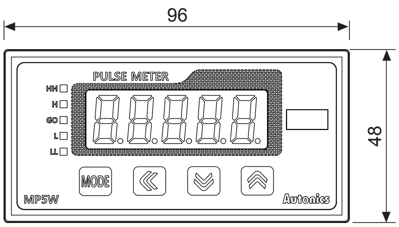


● MP5Y-□6

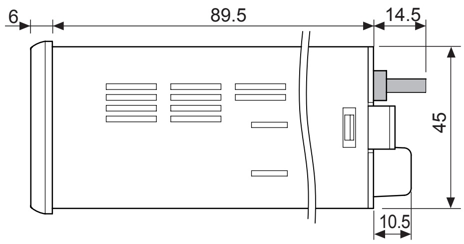


※MP5Y-□N (indicator) does not include the ■ shaded part (output hirose connector or output terminal).

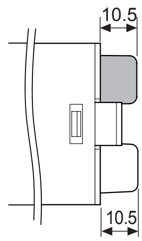
●MP5W Series



● MP5W-□2/4/5/8/9

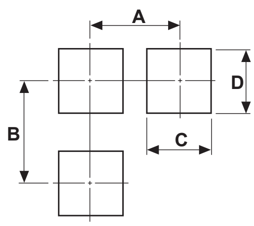


● MP5W-□A/1



※MP5W-□N (indicator) does not include the ■ shaded part (output hirose connector or output terminal).

● Panel cut-out dimensions

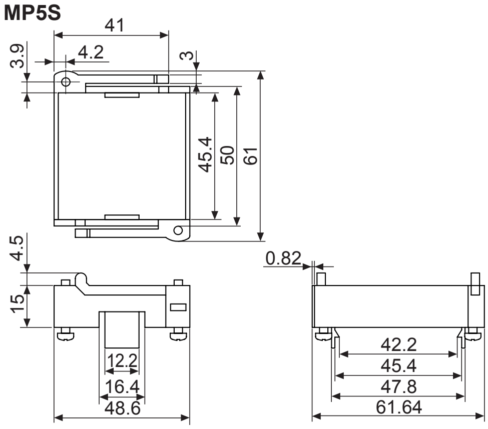


(unit: mm)

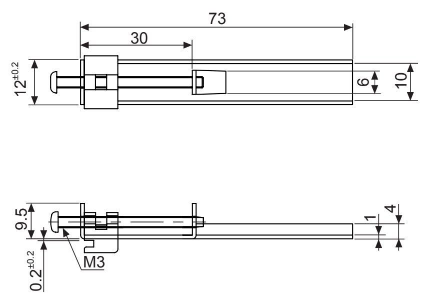
Size / Series	A	B	C	D
MP5S	Min. 55	Min. 62	$45.5^{+0.5}_{0}$	$45.5^{+0.5}_{0}$
MP5Y	Min. 91	Min. 40	$68^{+0.7}_{0}$	$31.5^{+0.5}_{0}$
MP5W	Min. 116	Min. 52	$92^{+0.8}_{0}$	$45^{+0.6}_{0}$

● Bracket

● For MP5S

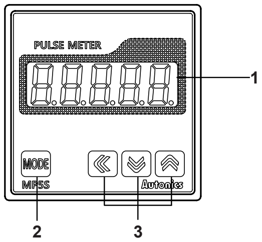


● For MP5Y/W

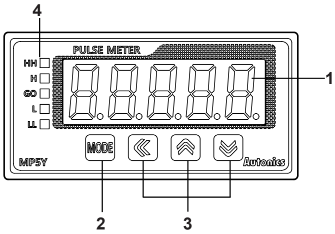


▣ Unit Description

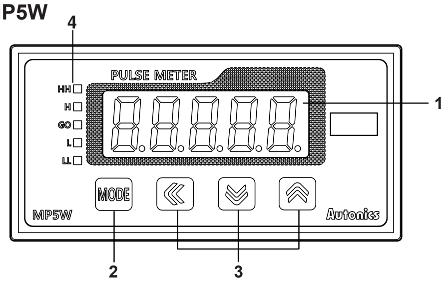
●MP5S



●MP5Y



●MP5W



1: Display component
Displays current value in RUN mode.
Alternately displays setting parameters and corresponding value in SETTING mode.

2: MODE key
In RUN mode, press the key once to check max./min. value.
In RUN mode, hold the key for over 2 sec to enter parameter groups.

3: ≪, ≫, ⌃ key
Select parameter groups, and select or setting values in the corresponding parameters.

4: Output status indicator

▣ Sold Separately

◎ Communication converter

- **SCM-38I**
  (RS232C to RS485 converter)
  CE

- **SCM-US48I**
  (USB to RS485 converter)
  CE

◎ Display Units (DS/DA-T Series)

- **DS/DA-T Series**
  (RS485 communication input type display unit) CE

DS16-□T

DS22/DA22-□T

DS40/DA40-□T

DS60/DA60-□T

※Connect RS485 communication input type display unit (DS/DA-T Series) and RS485 communication output model of MP5Y/MP5W Series, the display unit displays present value of the device without PC/PLC.

▣ Input Specifications

◎ Input Specifications

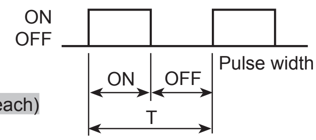
1. Input signal

Standard duty ratio of input signal is 1:1.

(1) Solid state input 1
  Input frequency: Max. 50kHz (ON/OFF pulse width: min. 10μs of each)

(2) Solid state input 2
  Input frequency: Max. 5kHz (ON/OFF pulse width: min. 100μs of each)
  ※For F7, F8, F9, F10 operation mode, max. 1kHz (ON/OFF pulse width: min. 500μs of each)

(3) Contact input
  ① Input frequency: Max. 45Hz (when each ON/OFF pulse width is over 11ms)
  ② Contact specifications: 12VDC, stable switching of load current as small as 5mA

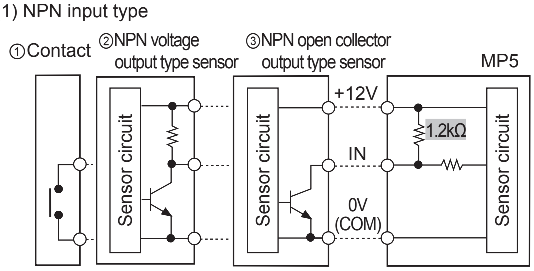


※T: single cycle of input signal

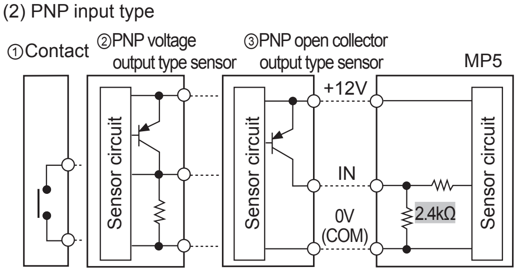
2. Input type [In-A, In-b]

MP5 allows selection between NPN input (solid state/contact) or PNP input (solid state/contact).

(1) NPN input type



(2) PNP input type



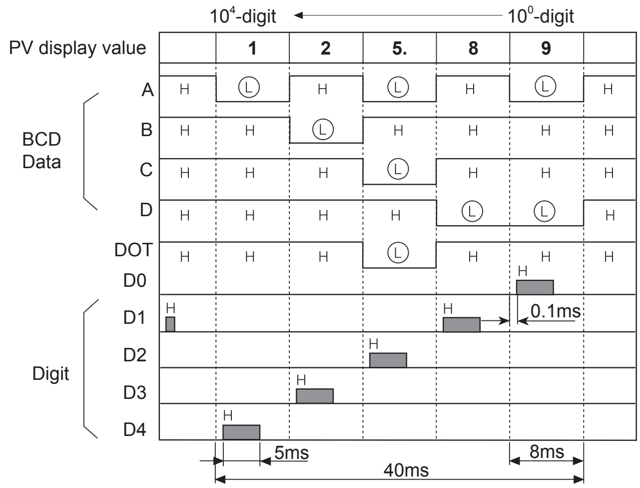
■ Output Specifications

1. Relay output
① Output: Comparative or alarm output (refer to "■ Output mode")
② Output type: Relay
③ Contact capacity: 250VAC 3A resistive load
④ Life cycle: [Mechanical] min. 10,000,000 operations (switching frequency 180 operations/min)
[Electrical] min. 100,000 operations (3A 250VAC, 30VDC resistive load) (switching frequency 20 operations/min)

2. Transistor output
① Output: Comparative output or alarm output (refer to "■ Output mode")
② Output type: NPN/PNP open collector
③ Rated load voltage: 30VDC
④ Max. load current: 30mA

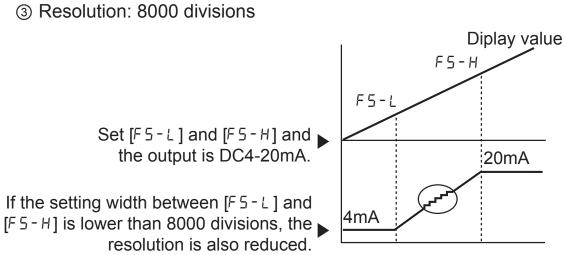
3. BCD dynamic output (negative logic)
① Output: present value
② Output signal: BCD data (A, B, C, D, DOT)
← A: lowest bit, DOT: highest bit
Digit data (D0, D1, D2, D3, D4)
← D0: lowest digit, D4: highest digit
③ Output type: NPN open collector
④ Rated load voltage: 30VDC
⑤ Max. load current: 30mA
⑥ Dynamic COM cycle (T) = 40ms

E.g.) To display value = 125.89 by BCD dynamic output

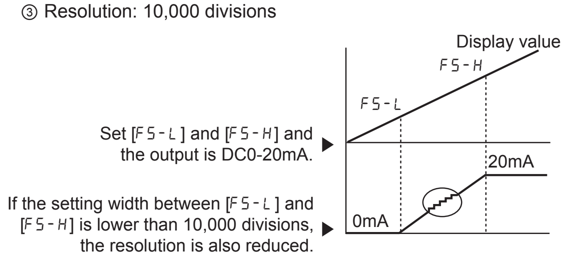


4. PV transmission output
① Application: transmit measured value
② Function: transmit measured value within setting range of high-limit output [FS-H] to low-limit output [FS-L] after conversion into **DC4-20mA** or **DC0-20mA** current.
③ Output range of high/low-limit
·High-limit [FS-H] range: From min. value to max. value within measurement range
·Low-limit [FS-L] range: From min. value to max. value within measurement range ([FS-H]≥[FS-L]+1)

(1) DC4-20mA transmission output
① Transmit measured value within setting range of high-limit output [FS-H] to low-limit output [FS-L] after conversion into DC4-20mA current.
② Resistive load: Max. 500Ω
③ Resolution: 8000 divisions



(2) DC0-20mA transmission output
① Transmit measured value within setting range of high-limit output [FS-H] to low-limit output [FS-L] after conversion into DC0-20mA current.
② Resistive load: Max. 500Ω
③ Resolution: 10,000 divisions

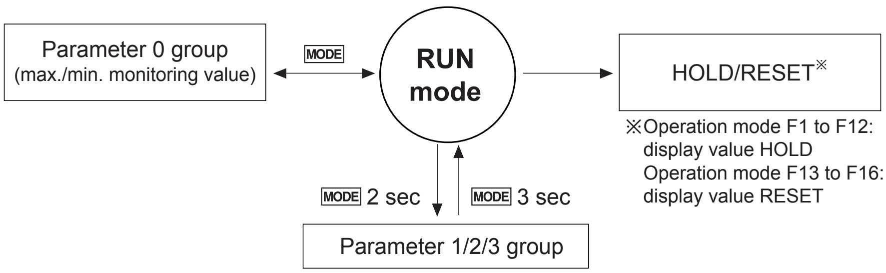


5. RS485 communication output

Comm. protocol	Modbus RTU	Communication Speed	2400, 4800, 9600 (default), 19200, 38400 bps
Connection type	RS485		
Application standard	Compliance with EIA RS485	Communication response time	5 to 99ms (default: 20ms)
Max. connection	31 units (address: 01 to 99)	Start Bit	1-bit fixed
Synchronous method	Asynchronous	Data Bit	8-bit fixed
Comm. method	Two-wire half duplex	Parity Bit	None (default), Even, Odd
Comm. distance	Max. 800m	Stop Bit	1, 2-bit (default)

※For more information about RS485 communication output specifications, refer to '■ RS485 communication output'.

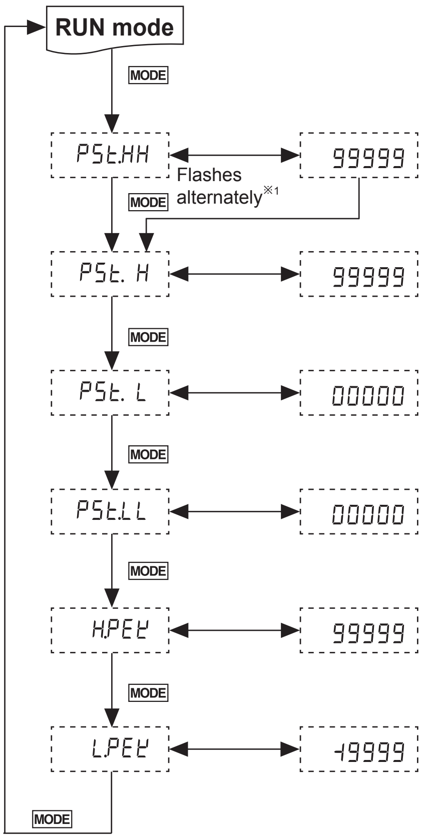
■ Parameter Groups



※Operation mode F1 to F12: display value HOLD
Operation mode F13 to F16: display value RESET

※Press the ⪡, ⩓, ⩔ keys to select or set the desired value.
※Press the MODE key once after changing the setting value, to save the setting value and move to the next parameter.
※Hold the MODE key for 1.5 sec at any parameters to return to the select parameter group mode.
※Hold the MODE key for 3 sec to save the setting value and return to RUN mode after changing the setting value.
※If there is no key input for 60 sec while setting the parameters, the new settings are ignored, and the unit will return to RUN mode with previous settings.
※The dotted line parameters may not appear depending on output specifications or other parameter settings. Please refer to '■ Operation mode by parameter group'.
※1: Each parameter and corresponding setting value will flash alternately every 0.5 sec.

● Parameter 0 group



HH comparative value
※Does not appear in F output mode

H comparative value

L comparative value

LL comparative value
※Does not appear in F output mode,

※The parameters are identical to [PSt.HH], [PSt. H], [PSt. L], [PSt.LL] of parameter 2 group and the setting values will be linked.
●Setting range by operation mode

Operation mode	Setting range
F1, F2, F7, F9, F11, F12, F13, F16	0 to 99999
F3, F4, F5, F6	0 to setting time range
F8, F10, F14, F15	-19999 to 99999

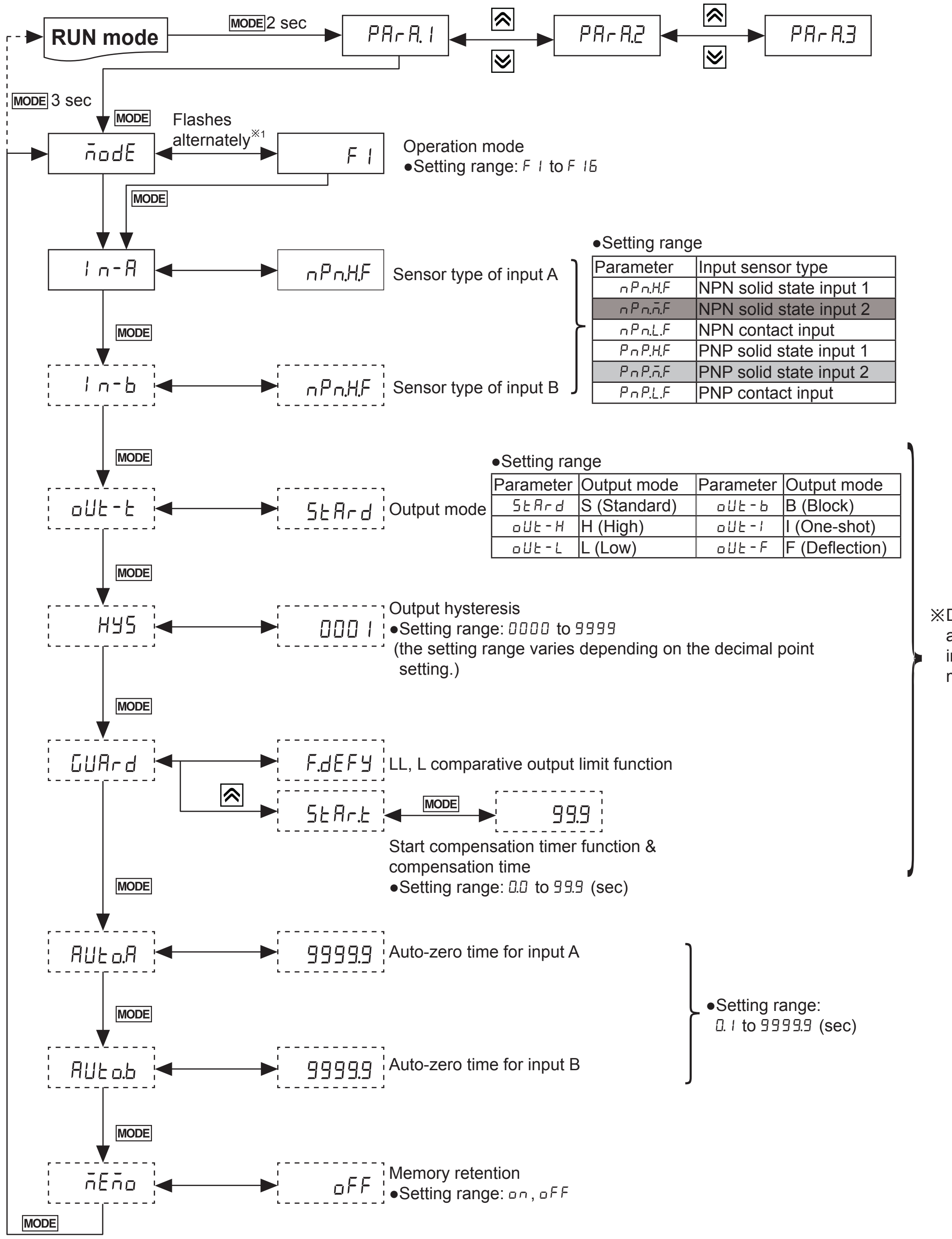
(the setting range varies depending on the decimal point setting.)
※Only appears in comparative value setting models.

Max. monitoring value

Min. monitoring value

※Resetting monitoring value
: Hold the ⪡ key for over 2 sec
(reset current value)

- **Parameter 1 group**



Parameter	Input sensor type
nPn.H.F	NPN solid state input 1
nPn.m.F	NPN solid state input 2
nPn.L.F	NPN contact input
PnP.H.F	PNP solid state input 1
PnP.m.F	PNP solid state input 2
PnP.L.F	PNP contact input

Parameter	Output mode	Parameter	Output mode
StArd	S (Standard)	oUt-b	B (Block)
oUt-H	H (High)	oUt-1	I (One-shot)
oUt-L	L (Low)	oUt-F	F (Deflection)

● **Parameter 2 group**

RUN mode ← MODE 2 sec → PArA.1 ↔ PArA.2 ↔ PArA.3

MODE 3 sec

PArA.2 → MODE → P.bAnK

P.bAnK ↔ 1 (Flashes alternately※1)
Data bank
●Setting range: 1, 2
※Only appears in MP5W.

MODE

dot ↔ 00000
Decimal point location of display value
●Setting range: 00000, 0000.0, 000.00, 00.000, 0.0000

MODE

t.Unt ↔ t.SEC ↔ 999.99
t.Unt ↔ t.MIn ↔ 999.99

Time unit and range
●Setting range

t.SEC (sec)		t.MIn (min)	
999.99	999.99s	999.99	999.99m
9999.9	9999.9s	9999.9	9999.9m
99.59.9	99m 59.9s	99.59.9	99h 59.9m
9.59.59	9h 59m 59s	999.59	999h 59m
99999	99999s	99999	99999m

MODE

PSt.HH ↔ 99999
HH comparative value
※Does not appear in F output mode

MODE

PSt. H ↔ 99999
H comparative value

MODE

PSt. L ↔ 00000
L comparative value

MODE

PSt.LL ↔ 00000
LL comparative value
※Does not appear in F output mode

※The parameters are identical to [PSt.HH], [PSt. H], [PSt. L], [PSt.LL] of parameter 0 group and the setting values will be linked.
●Setting range by operation mode

Operation mode	Setting range
F1, F2, F7, F9, F11, F12, F13, F16	0 to 99999
F3, F4, F5, F6	0 to set time range
F8, F10, F14, F15	-19999 to 99999

(the setting range varies depending on the decimal point setting.)
※Only appears in comparative value setting models.

MODE

PSC.A.X ↔ 6.0000
Prescale mantissa (X) of input A
●Setting range: 0.0001 to 9.9999

MODE

PSC.A.Y ↔ 10 01
Prescale exponent (y) of input A
●Setting range: 10 - 9 (10^{-9}) to 10 09 (10^{9})

MODE

PSC.b.X ↔ 6.0000
Prescale mantissa (X) of input B
●Setting range: 0.0001 to 9.9999

MODE

PSC.b.Y ↔ 10 01
Prescale exponent (y) of input B
●Setting range: 10 - 9 (10^{-9}) to 10 09 (10^{9})

MODE

dISP.t ↔ 0.05
Display cycle of measured value
●Setting range: 0.05, 0.5, 1, 2, 4, 8 (sec)
※Setting range in operation mode F2, F16
: oFF, 0.05, 0.5, 1, 2, 4, 8 (sec)

MODE

CoUn.b ↔ 99999
Setting value of input B
●Setting range: 1 to 99999

MODE

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

- **Parameter 3 group**

RUN mode ← MODE 2 sec → PAr A.1 ⇔ PAr A.2 ⇔ PAr A.3

MODE 3 sec

FS-H ↔ 99999 (Flashes alternately※1)
High-limit value of PV transmission output

MODE

FS-L ↔ 00000
Low-limit value of PV transmission output

MODE

mA ↔ 4-20
Current output specifications
●Setting range: 4-20, 0-20

●Setting range by operation mode

Operation mode	Setting range
F1, F2, F7, F9, F11, F12, F13, F16	0 to 99999
F3, F4, F5, F6	0 to set time range
F8, F10, F14, F15	-19999 to 99999

(the setting range varies depending on the decimal point setting.)
※Only appears in PV transmission output models.

MODE

Addr ↔ 01
Communication address
●Setting range: 01 to 99

MODE

bPS ↔ 9600
Communication speed
●Setting range: 9600, 19200, 38400, 2400, 4800 (bps)

MODE

Prty ↔ nonE
Communication parity bit
●Setting range: nonE (none), EvEn (even), odd (odd)

MODE

StP ↔ 2
Communication stop bit
●Setting range: 1, 2

MODE

rSW.t ↔ 20
Communication response wait time
●Setting range by communication speed

Communication speed (unit: bps)	Setting range (unit: ms)
2400	16 to 99
4800	8 to 99
9600, 19200, 38400	5 to 99

MODE

CoM.W ↔ dISA
Communication write
●Setting range: EnA (enable), dISA (disable)

※Only appears in RS485 output models.

MODE

LoC ↔ oFF
Lock
●Setting range:

Parameter	Function
oFF	Unlock
LoC.0	Lock all
LoC.1	Parameter 1/2/3 lock
LoC.2	Parameter 2/3 lock
LoC.3	Parameter 3 lock

MODE

■ Operation Mode By Parameter Groups

(◐: parameter display, X: no parameter display)

	Parameter \ Operation mode	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16
0 group	PSt.HH ※1	Appears in all operation modes (F1 to F16).															
	PSt. H ※2																
	PSt. L ※2																
	PSt.LL ※1																
	H.PEK	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	X	◐	◐	X
	L.PEK	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	X	◐	◐	X
1 group	MOdE	Appears in all operation mode (F1 to F16).															
	In-A																
	In-b	X	◐	X	X	X	◐	◐	◐	◐	◐	◐	◐	◐	◐	X ※3	◐
	oUt-t ※2	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	X	◐	◐	● ※4
	HYS ※2	◐	X	X	X	X	X	◐	◐	◐	◐	X	X	X	X	X	X
	GuArd ※2	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	X	X	X	X
	Auto.A	◐	X	X	◐	X	X	◐	◐	◐	◐	X	X	X	X	X	X
	Auto.b	X	X	X	X	X	X	◐	◐	◐	◐	X	X	X	X	X	X
	MEMo	X	X	X	X	X	X	X	X	X	X	X	X	◐	◐	◐	◐
2 group	P.bAnK	※Only appears in MP5W. Appears in all operation modes (F1 to F16).															
	dot	◐	◐	X	X	X	X	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐
	t.Unt	X	X	◐	◐	◐	◐	X	X	X	X	X	X	X	X	X	X
	PSt.HH ※1	Appears in all operation modes (F1 to F16).															
	PSt. H ※2																
	PSt.LL ※2																
	PSt. L ※1																
	PSC.A.H	◐	◐	X	◐	X	X	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐
	PSC.A.Y	◐	◐	X	◐	X	X	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐
	PSC.b.H	X	X	X	X	X	X	◐	◐	◐	◐	X	X	X	X	X	X
	PSC.b.Y	X	X	X	X	X	X	◐	◐	◐	◐	X	X	X	X	X	X
	dISP.t	◐	▣ ※5	X	X	X	X	◐	◐	◐	◐	X	X	X	X	X	▣
	CoUn.b	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	◐
3 group	FS-H	※Only appears in PV transmission output models. Appears in operation modes (F1 to F16).															
	FS-L																
	MA																
	Addr	※Only appears in RS485 output models. Appears in all operation modes (F1 to F16).															
	bPS																
	PrtY																
	StP																
	rEW.t																
	CoM.W																
	LoC	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐

※1: Only appears in only for quintuple output models.
※2: Only appears in triple, quintuple output models.
※3: The settings for In-b and In-A are applied.
※4: (●) F output mode [oUt-F] cannot be set.
※5: (▣) setting range: oFF, 0.05, 0.5, 1, 2, 4, 8

• Monitoring delay function by output mode

Output mode	S mode	H mode	L mode	B mode	I mode	F mode
Parameter	StArd	out-h	out-L	out-b	out-I	out-F
Comparative output limit	◐	X	X	◐	X	◐
Start compensation timer	◐	◐	◐	◐	◐	◐

■ Operation Modes [ModE]

- Select operation mode from operation mode[ModE]of parameter 1 group..
- MP5 has 16 operation modes.

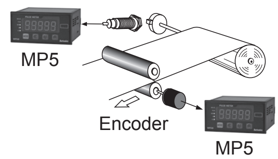
◎ F1 Mode: Frequency/Revolutions/Speed

Measures the frequency of input A and displays the calculated frequency, revolutions, and speed.

1) Frequency (Hz)	= f × α	(α= 1[sec])
2) Revolutions (rpm)	= f × α	(α= 60[sec])
3) Speed (m/min)	= f × α	(α= 60L[sec])

※L: travel distance of conveyor belt of 1 pulse cycle[m]
α: prescale value

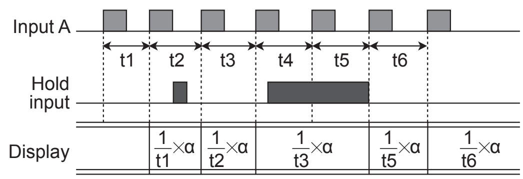
For multiple objects, $\alpha = \frac{60L}{N}$



- Display value and display unit

Display value	Display unit	α (prescale value)
Frequency	Hz	1
	kHz	0.001
Revolutions	rps	1
	rpm (default)	60
Speed	mm/sec	1,000L
	cm/sec	100L
	m/sec	1L
	m/min	60L
	km/hour	3.6L

- Timing chart

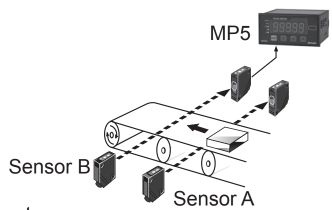


◎ F2 Mode: Passing Speed

Displays the passing speed between input A ON and input B ON.

Passing speed (V) = f × α (α = L[m])

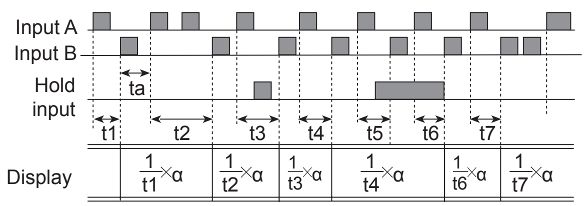
※f : reciprocal of time [sec] between input A (sensor) ON and input B (sensor) ON.
L: distance between input A (sensor) and input B (sensor) [m]
α: prescale value



- Display value and display unit

Display value	Display unit	α (prescale value)
Passing speed	mm/sec	1,000L
	cm/sec	100L
	m/sec (default)	1L
	m/min	60L
	km/hour	3.6L

- Timing chart



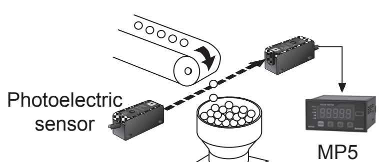
※ta: Return time (over 20ms)

◎ F3 Mode: Cycle

Displays the measured time from Input A ON to the next ON.

Cycle (T) = t

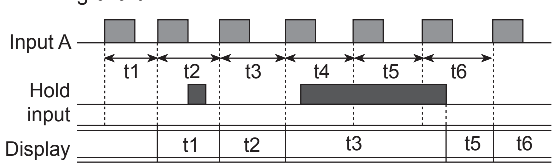
※t: measurement time[sec]



- Display value and display unit ([t.Unt] of parameter 2)

Display value	Display unit	
Cycle	Sec	Min
	999.99s (default)	999.99m
	9999.9s	9999.9m
	99m59.9s	99h59.9m
	9h59m59s	999h59m
	99999s	99999m

- Timing chart



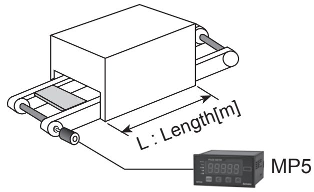
◎ F4 Mode: Passing Time

Measures the time from Input A ON to the next ON, and displays the passing time of the arbitrary distance.

Passing time[sec]= t × α

$$(\alpha = \frac{L[m]}{\text{Distance advanced in 1 pulse cycle [m]}})$$

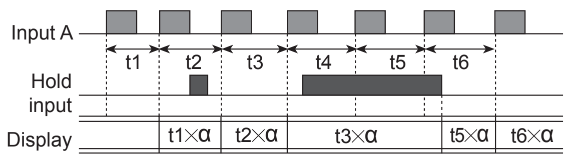
※t : measured time[sec], L : arbitrary distance[m]
α: prescale value



- Display value and display unit ([t.Unt] of parameter 2)

Display value	Display unit	
Passing time	SEC	MIN
	999.99s (default)	999.99m
	9999.9s	9999.9m
	99m59.9s	99h59.9m
	9h59m59s	999h59m
	99999s	99999m

- Timing chart

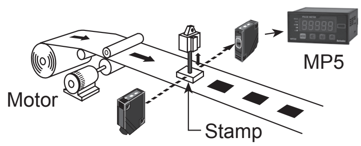


◎ F5 Mode: Time Interval

Displays measured time of Input A ON

Time interval (T) = t

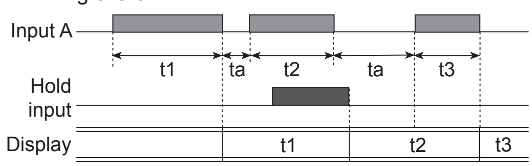
※t: measured time of input A ON [sec]



- Display value and display unit ([t.Unt] of parameter 2)

Display value	Display unit	
Time interval	SEC	MIN
	999.99s (default)	999.99m
	9999.9s	9999.9m
	99m59.9s	99h59.9m
	9h59m59s	999h59m
	99999s	99999m

- Timing chart



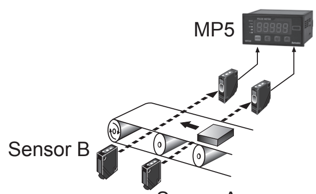
※ta: Return time (over 20ms)

◎ F6 Mode: Time Differential

Displays measured time from Input A ON to Input B ON.

Time differential (T) = t (ta to tb)

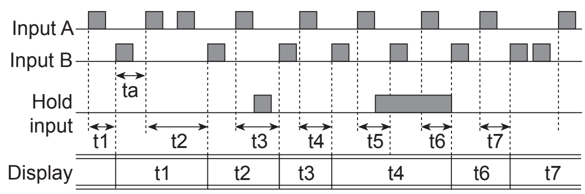
※t (ta to tb): measured time from input A ON to input B ON [sec]



- Display value and display unit ([t.Unt] of parameter 2)

Display value	Display unit	
Time difference	SEC	MIN
	999.99s (default)	999.99m
	9999.9s	9999.9m
	99m59.9s	99h59.9m
	9h59m59s	999h59m
	99999s	99999m

- Timing chart



※ta: Return time (over 20ms)

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

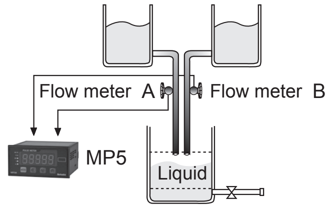
◎ F7 Mode: Absolute Ratio

Measures and displays relative speed, amount, speed, etc. of input B against input A in percentage (%).

Absolute ratio = (Input B / Input A) × 100%

$$\text{Absolute ratio} = \frac{\text{Frequency of input B[Hz]} \times B\alpha}{\text{Frequency of input A[Hz]} \times A\alpha} \times 100[\%]$$

※Aα: Prescale value of input A, Bα: Prescale value of input B

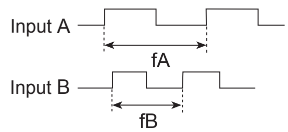


- Display value and display unit

Display value	Display unit
Absolute ratio	%

※Hold: When the hold signal turns ON, the display value is maintained until the display cycle turns to hold OFF.

- Timing chart



$$\text{Display} = \frac{\text{Frequency of input B[Hz]} \times B\alpha}{\text{Frequency of input A[Hz]} \times A\alpha} \times 100[\%]$$

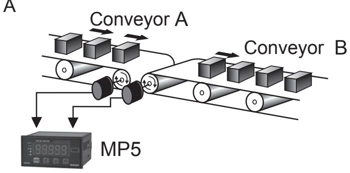
◎ F8 Mode: Error Ratio

Measures and displays the relative rate of input B against the reference value of input A in percentage (%).

$$\text{Error ratio} = \frac{\text{Input B-Input A}}{\text{Input A}} \times 100[\%]$$

$$\text{Error ratio} = \frac{(\text{Frequency of input B [Hz]} \times B\alpha)\text{-}(\text{Frequency of input A[Hz]} \times A\alpha)}{\text{Frequency of input A[Hz]} \times A\alpha} \times 100[\%]$$

※Aα: prescale value of input A, Bα: prescale value of input B

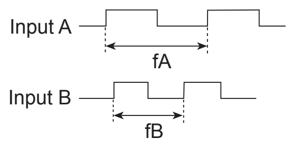


- Display value and display unit

Display value	Display unit
Error ratio	%

※Hold: When the hold signal turns ON, the display value is maintained until the display cycle turns to hold OFF.

- Timing chart



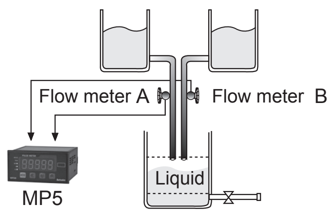
◎ F9 Mode: Density

Measures and displays the density ratio (%) of input B against the total sum of input A and input B.

$$\text{Density} = \frac{\text{Input B}}{\text{Input A + Input B}} \times 100[\%]$$

$$\text{Density} = \frac{\text{Frequency of Input B[Hz]} \times B\alpha}{(\text{Frequency of input A[Hz]} \times A\alpha) + (\text{Frequency of input B[Hz]} \times B\alpha)} \times 100[\%]$$

※Aα: Prescale value of input A, Bα: Prescale value of input B

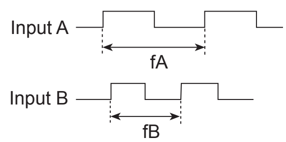


- Display value and display unit

Display value	Display unit
Density	%

※Hold: When the hold signal turns ON, the display value is maintained until the display cycle turns to hold OFF.

- Timing chart

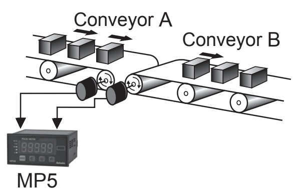


◎ F10 Mode: Error

Measures and displays the error of input B against reference value of input A.

Error = Input B - Input A
Error = (Frequency of input B[Hz] × Bα) - (Frequency of input A[Hz] × Aα)

※Aα: prescale value of input A, Bα: prescale value of input B

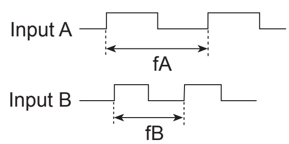


- Display value and display unit

Display value	Display unit
Error	END User setting

※Hold: When the hold signal turns ON, the display value is maintained until the display cycle turns to hold OFF.

- Timing chart

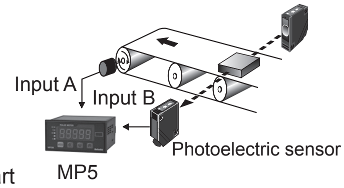


◎ F11 Mode: Length Measurement 1

Measure and display the number of input A pulses during input B ON.

$$\boxed{\text{Length measurement} = P \times \alpha}$$

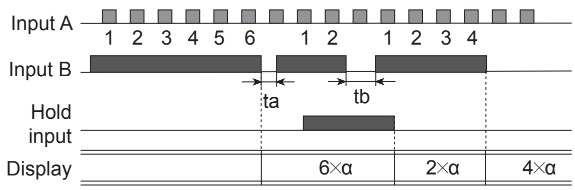
※P: Number of input A pulses, α: Prescale value



• Display value and display unit

Display value	Display unit
Length measurement	Quantity (default)
	mm
	cm
	m

• Timing chart



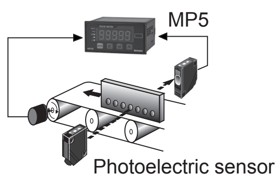
※ta, tb: return time (over 20ms)

◎ F12 Mode: Interval

Measures and displays the number of input A pulses from Input B ON to the next ON.

$$\boxed{\text{Interval} = P \times \alpha}$$

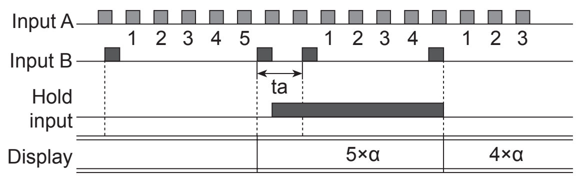
※P: Number of input A pulses, α: Prescale value



• Display value and display unit

Display value	Display unit
Interval	Quantity (default)
	mm
	cm
	m

• Timing chart



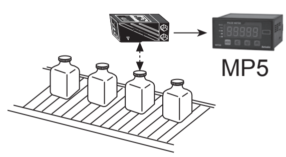
※ta: return time (over 20ms)

◎ F13 Mode: Accumulation

Measures and displays the counted value of input A pulses.

$$\boxed{\text{Accumulation} = P \times \alpha}$$

※P: Number of input A pulses, α: Prescale value



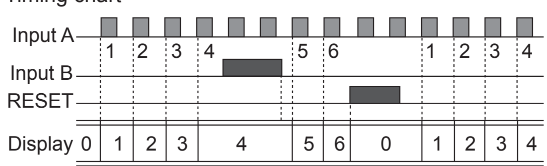
• Display value and display unit

Display value	Display unit
Accumulation	Quantity[EA]

• Operation

① Counts the number of input A pulses.
② Input B is an enable input signal. During ON, the quantity and display value of input A will be held, and during OFF input A will be re-counted.
③ When RESET input is ON, the integrated counted value will be reset to "0".

• Timing chart



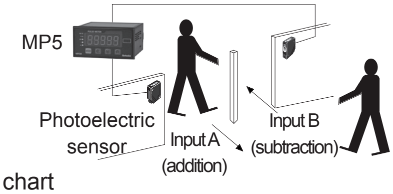
※α=1 display value

◎F14 Mode: Addition/Subtraction-Individual Input

Displays the counted value from added input A pulses and subtracted input B pulses. When there are two inputs simultaneously, it will not count.

Addition/Subtraction = Input A × α - Input B × β

※α: Prescale value of input A, β: Prescale value of input B



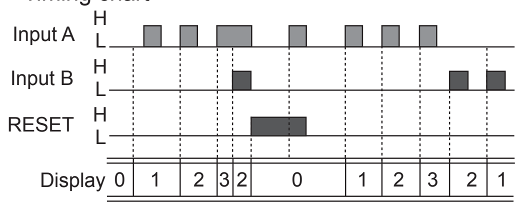
• Display value and display unit

Display value	Display unit
Addition/ Subtraction (individual input)	Quantity

• Operation and timing chart

Pulse of input A is added, and pulse of input B is subtracted.

• Timing chart

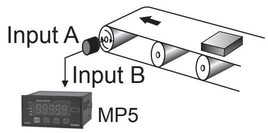


※α, β=1 display value

◎F15 Mode: Addition/Subtraction- Phase difference input

When input A is low, counting is added to the low of input B.
When input A is low, counting is subtracted from the high of input B.

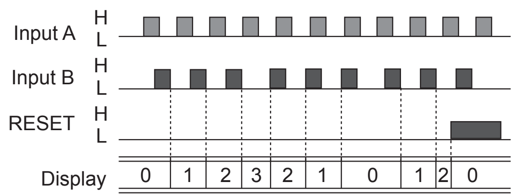
Addition/Subtraction (phase difference) = Detects position and speed using A and B phases of encoder outputs as input.



• Display value and display unit

Display value	Display unit
Up/Down counting (phase difference input)	Quantity

• Timing chart



◎F16 Mode: Length Measurement 2

Measures and displays the number of pulses from input A until the value of input B reaches the set value.

Length measurement 2 = P × α (until the setting value of Input B)

※P: Number of input A pulses, α: Prescale value

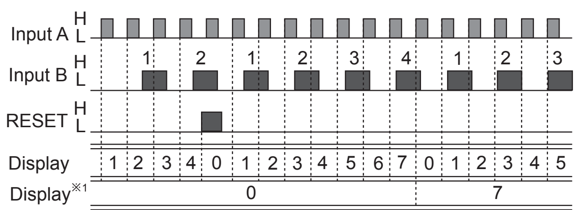
• Display value and display unit

Display value	Display unit
Length measurement 2	Quantity[EA]

※If input A and input B are ON during initial power supply, it will not count and only count the number of rising edge.

※Display value is renewed depending on the display cycle [dI SP.t] setting.

• Timing chart (e.g.) setting value of Input B=4



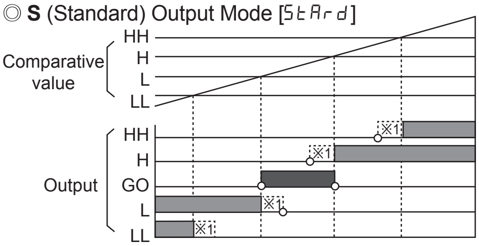
※1: When the display cycle [dI SP.t] setting is oFF, it will maintain the quantity of input A until the value of input B reaches the setting value B [CoUn.b].

■ Output Modes [oUt-t]

- MP5 Series supports 6 output modes. (There is no output mode in indicator models).
- Requirement for setting comparative value: (B output mode) LL<L<H<HH, (F output mode) L<H, (other output modes) individual output operation regardless of size or order of set comparative values.

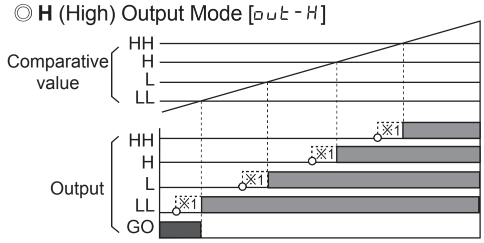
※1: hysteresis

◎ S (Standard) Output Mode [StArd]



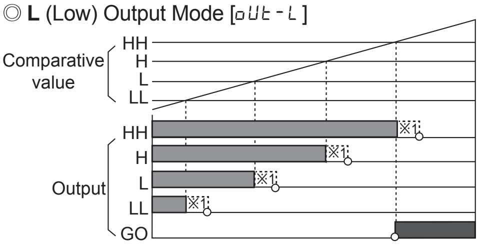
HH output : Display value ≥ Comparative setting value HH
H output : Display value ≥ Comparative setting value H
L output : Display value ≤ Comparative setting value L
LL output : Display value ≤ Comparative setting value LL
※GO output ON when there are no HH, H, L, LL outputs

◎ H (High) Output Mode [out-H]



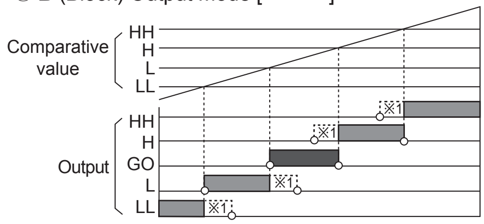
HH output : Display value ≥ Comparative setting value HH
H output : Display value ≥ Comparative setting value H
L output : Display value ≥ Comparative setting value L
LL output : Display value ≥ Comparative setting value LL
※GO output ON when there are no HH, H, L, LL outputs

◎ L (Low) Output Mode [oUt-L]



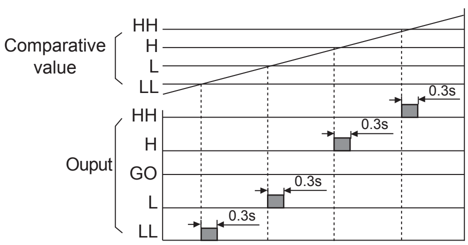
HH output : Display value ≤ Comparative setting value HH
H output : Display value ≤ Comparative setting value H
L output : Display value ≤ Comparative setting value L
LL output : Display value ≤ Comparative setting value LL
※GO output ON when there are no HH, H, L, LL outputs

◎ B (Block) Output Mode [oUt-b]



HH output : Display value ≥ Comparative setting value HH
H output : Comparative setting value HH > Display value ≥ Comparative setting value H
L output : Comparative setting value LL < Display value ≤ Comparative setting value L
LL output : Display value ≤ Comparative setting value LL
※GO output ON when there are no HH, H, L, LL outputs

◎ I (One-shot) Output Mode [oUt-I]



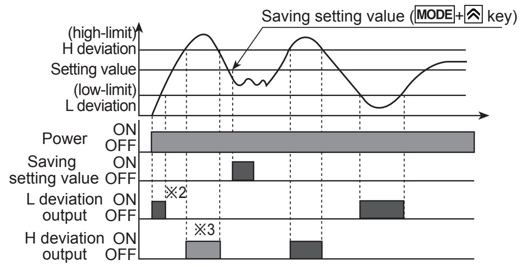
HH output : Display value ≥ Comparative setting value HH
H output : Comparative setting value HH > Display value ≥ Comparative setting value H
L output : Comparative setting value H > Display value ≥ Comparative setting value L
LL output : Comparative setting value L > Display value ≥ Comparative setting value LL
※No GO output
※One-shot output time is fixed at 0.3 sec.
※No hysteresis

◎ F (Deflection) Output Mode [out-F]

Transmits outputs when the saved setting value exceeds H deviation or L deviation.

- Saving setting value: press the MODE+⩓ keys to save as setting value.
- Checking setting value: press the ⩓ key to check the setting value.
- Setting deviation: Sets H deviation [PSt. H], and L deviation[PSt. L] of parameter group 0,2 with the setting value as reference. (The set deviation value is saved during Power OFF until it is re-set.)
- Deviation setting range: 0.0001 to 99999 (the setting range varies depending on the decimal point [dot] setting.)

E.g.)Decimal point[dot]: 0000.0, Setting range: 0.1 to 9999.9



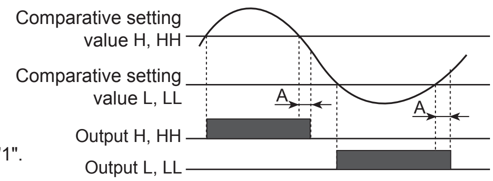
※2: When selecting initial comparative output limit function, it does not transmit outputs.
※3: The graph is assuming that there is a saved setting value prior to the setting value save point. The actual output position may be different.
※There are no HH, GO, LL outputs.
※The deviation can be set to "0" but the actual operation will be the same as "1".

■ Function

◎ Hysteresis [HYS]

The output may turn ON/OFF frequently near the comparative setting value. To prevent this, set the hysteresis value with the comparative setting value as reference.

※A: hysteresis value
※The hysteresis value can be set to "0" but the actual operation value will be at "1".

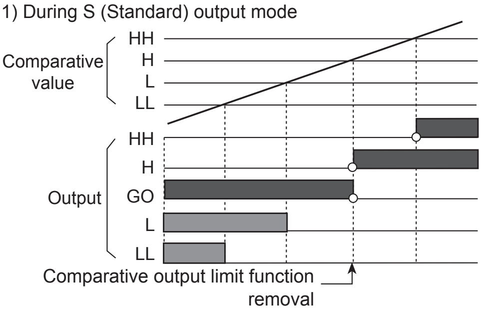


◎ Delay Monitoring [GUAr.d]

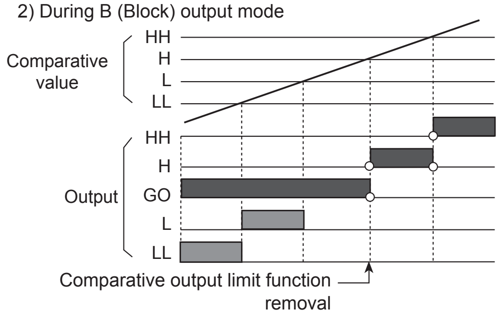
After supplying power, the the starting current of motors and other inputs may experience changes. This function allows stable control by limiting all outputs for a certain period until the target measurement unit stabilizes. It may also control L, LL outputs until a specific output is reached.

- Comparative output limit function [F.dEFY]
  : Only for S (Standard), B (Block), F (Deflection) output mode.
  : Limits L, LL output before H, HH output.
  ※Initial L, LL ouptuts does not operate, so GO output operates.

1) During S (Standard) output mode

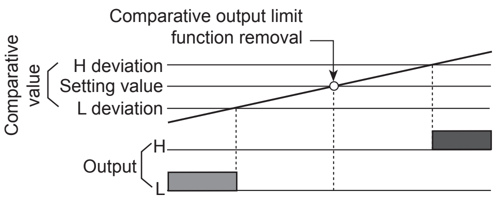


2) During B (Block) output mode



※After supplying power, there is no initial L, LL comparative outputs (▬) .
※Each setting value of HH, H, LL, L is not related to their relative sizes. Hence, HH value may be lower or equal to LL value.

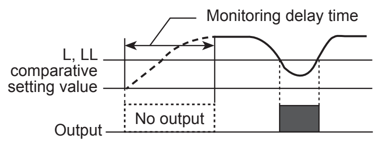
3) During F (Deflection) output mode



※After supplying power, there is no comparative output (▬) of L deviation.
※In F output mode, the comparative output limiting function is removed at the set value (standard setting)
※H and L deviation are not related to their relative sizes.
(H deviation setting value > L deviation setting value,
H deviation setting value < L deviation setting value)

- Start compensation timer function [StAr.t]

Set monitoring delay time so that there is no output during the delay time.



◎ Auto-zero Time Setting [AUto.A, AUto.b]

When there is no input signal during auto-zero set time, the display value is automatically set to 0 (zero). Please set the auto-zero set time so that it is longer than the interval of the slowest input signal. If the setting time is too long and there is no input signal, the rate at which the display value falls to 0 (zero) decrease, and output response rate may slow down.

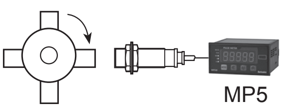
◎ Data bank [P.bAnK] (only for MP5W)

Comparative setting value and prescale value are saved as two types (data bank 1, 2) and can be selected for use by opening or shorting of terminals.

- Terminal 3, 5 open: use value of data bank 1
- Terminal 3, 5 short: use value of data bank 2

◎ Prescale [PSC.□.H, PSC.□.Y]

Displays values in required units or specific multiples by counting the number of input pulses, then multiplying the number of pulses or the length of pulses by variables (X×10y).



Number of revolutions (rpm) = f×α
= f×60×(1 / N)
= f×60×(1 / 4)
= f×60×0.25
= f×15

※f: The number of input pulses per second[Hz],
α: Prescale value
N: The number of pulses per revolution

- Setting prescale value (α=15)
  Set mantissa (X) as 1.5000, and exponent (Y) as 1 for prescale value (α)=15.
  The same display value can be obtained with α value set as X=0.1500, and Y=2.

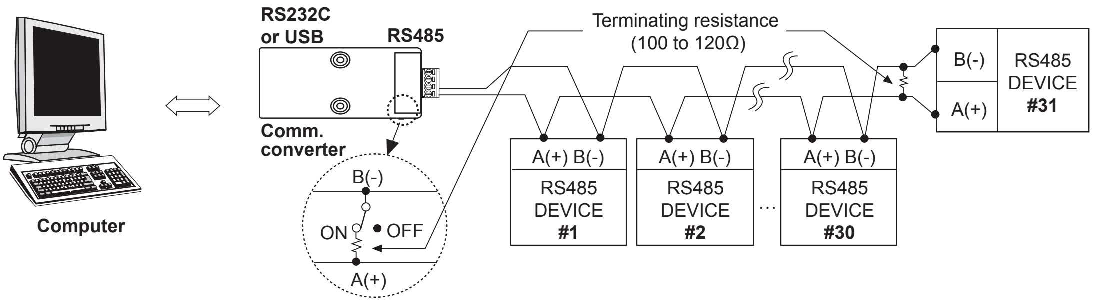
■ RS485 Communication Output

● Applicable for models with RS485 communication output through sub output (MP5Y-□5, MP5W-□8/9).
Please refer to '■Ordering information'.

1. Communication Specifications

Comm. protocol	Modbus RTU	Communication Speed	2400, 4800, 9600 (default), 19200, 38400 bps
Connection type	RS485		
Application standard	Compliance with EIA RS485	Communication response time	5 to 99ms (default: 20ms)
Max. connection	31 units (address: 01 to 99)	Start Bit	1-bit fixed
Synchronous method	Asynchronous	Data Bit	8-bit fixed
Comm. method	Two-wire half duplex	Parity Bit	None (default), Even, Odd
Comm. distance	Max. 800m	Stop Bit	1, 2-bit (default)

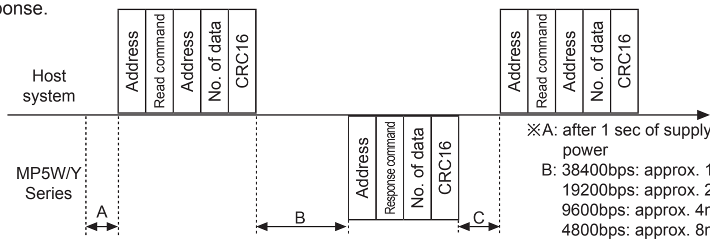
2. System Configuration



※It is recommended to use Autonics communication converter; SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately). Please use twisted pair wire for RS485 communication.

3. Communication Control Sequence

1. Communication equence follows Modbus RTU protocol.
2. Communication with the host system can be established after 1sec (1,000ms) of supplying power.
3. The initial transmission authority is held by the host device (PC). When the host device transmits a request, the MP5W/Y Series sends a response.



※A: after 1 sec of supplying power
B: 38400bps: approx. 1.75ms
19200bps: approx. 2ms
9600bps: approx. 4ms
4800bps: approx. 8ms
2400bps: approx.16ms
C: over 20ms

※The longer of the communication response wait time [rSWt] of parameter group 3 and response time of B is applied.

4. Cautions For Communication

1. Twisted pair cable (AWG24) is recommended for RS485 communication. When not using twisted pair cables, please make sure that A (+) and B (-) cable lengths are equal.
2. After connecting the communication cable, terminating resisters (100 to 120Ω) must be attached at both ends.

5. Communication Command And Block Definition

5-1. Read Coil Status (Func 01 H), Read Input Status (Func 02 H)

1) Query (Master)

Slave Address	Function (command)	Starting Address		No. of Points (no. of data)		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC16

2) Response (Slave)

Slave Address	Function (command)	Byte Count (no. of data byte)	Data (low)	Data	Data (high)	Error Check (CRC 16)	
						Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC16

5-2. Read Holding Registers (Func 03 H), Read Input Registers (Func 04 H)

1) Query (Master)

Slave Address	Function (command)	Starting Address		No. of Points (no. of data)		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC16

2) Response (Slave)

Slave Address	Function (command)	Byte Count (no. of data byte)	Data		Data		Data		Error Check (CRC 16)	
			High	Low	High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC16

5-3. Force Single Coil (Func 05 H)

1) Query (Master)

Slave Address	Function (command)	Coil Address		Force Data		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC16

2) Response (Slave)

Slave Address	Function (command)	Coil Address		Force Data		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC16

5-4. Preset Single Register (Func 06 H)

1) Query (Master)

Slave Address	Function (command)	Register Address		Preset Data		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC16

2) Response (Slave)

Slave Address	Function (command)	Register Address		Preset Data		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC16

5-5. Preset Multiple Registers (Func 10 H)

1) Query (Master)

Slave Address	Function (command)	Starting Address		No. of Register		Byte Count	Data		Data		Error Check (CRC 16)	
		High	Low	High	Low		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC16

2) Response (Slave)

Slave Address	Function (command)	Starting Address		No. of Register		Error Check (CRC 16)	
		High	Low	High	Low	Low	High
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

CRC16

5-6. Exception Response-Error Code (exception processing)

Slave Address	Function +80H	Exception code	Error Check (CRC 16)	
			Low	High
1Byte	1Byte	1Byte	1Byte	1Byte

CRC16

- When a communication error occurs, the highest bit from the received command (function) is set (1), a response command is sent, and the corresponding exception code is transmitted.

(1) ILLEGAL FUNCTION (exception code: 01 H)
: Unsupported command

(2) ILLEGAL DATA ADDRESS (exception code: 02 H)
: The requested start address does not not match the transmission address of the device.

(3) ILLEGAL DATA VALUE (exception code: 03 H)
: The number of requested data does not match the transmission number of the device.

(4) SLAVE DEVICE FAILURE (exception code: 04 H)
: The requested command cannot be processed properly. (CRC)

6. Address Mapping Table

6-1. Read Coil Status (Func 01) / Force Single Coil (Func 05)

No.(Address)	Func	R/W	Parameter		Description	Setting range	Note
000001(0000)	01	R/W	HH	HH comparative output	Comparative output LED	0: OFF / 1: ON	
000002(0001)	01	R/W	H	H comparative output		0: OFF / 1: ON	
000003(0002)	01	R/W	GO	GO comparative output		0: OFF / 1: ON	
000004(0003)	01	R/W	L	L comparative output		0: OFF / 1: ON	
000005(0004)	01	R/W	LL	LL comparative output		0: OFF / 1: ON	
000006(0005)	01	R/W				0: OFF / 1: ON	
000007(0006)	01	R/W				0: OFF / 1: ON	
000008 to 000050	01	R/W				0: OFF / 1: ON	

6-2. Read Input Status (Func 02)

No.(Address)	Func	R/W	Parameter		Description	Setting range	Note
100001(0000)	02	R		RESET(HOLD)	External input variables	RESET input status	
100002(0001)	02	R		BANK		BANK input status	
100003(0002)	02	R				0: OFF / 1: ON	
100004(0003)	02	R				0: OFF / 1: ON	
100005(0004)	02	R				0: OFF / 1: ON	
100006(0005)	02	R				0: OFF / 1: ON	
100007(0008)	02	R				0: OFF / 1: ON	
100008(0007)	02	R				0: OFF / 1: ON	
100009(0008)	02	R				0: OFF / 1: ON	
100010(0009)	02	R				0: OFF / 1: ON	
100011(000A)	02	R				0: OFF / 1: ON	
100012 to 100050	02	R				0: OFF / 1: ON	

6-3. Read Input Registers (Func 04)

No.(Address)	Func	R/W	Parameter	Description	Factory default	Note
300001 to 300100	04	R		Reserved		
300101(0064)	04	R		Product number H	0	Dedicated model number
300102(0065)	04	R		Product number L	0	
300103(0066)	04	R		Hardware Version	1	
300104(0067)	04	R		Software Version	1	
300105(0068)	04	R		Model 1	"MP"	MP5Y-□5, MP5W-□8 (※MP5W-□9 displayed as MP5W-□8)
300106(0069)	04	R		Model 2	"5□"	
300107(006A)	04	R		Model 3	"-□"	
300108(006B)	04	R		Model 4	"□"	
300109(006C)	04	R		Model 5	" "	
300110(006D)	04	R		Model 6	" "	
300111(006E)	04	R		Model 7	" "	
300112(006F)	04	R		Model 8	" "	
300113(0070)	04	R		Model 9	" "	
300114(0071)	04	R		Model 10	" "	
300115(0072)	04	R		Reserved		
300116(0073)	04	R		Reserved		
300117(0074)	04	R		Reserved		
300118(0075)	04	R		Coil Status Start Address	0000	
300119(0076)	04	R		Coil Status Quantity	0	
300120(0077)	04	R		Input Status Start Address	0000	
300121(0078)	04	R		Input Status Quantity	0	
300122(0079)	04	R		Holding Register Start Address	0000	
300123(007A)	04	R		Holding Register Quantity	0	
300124(007B)	04	R		Input Register Start Address	0000	
300125(007C)	04	R		Input Register Quantity	0	
300126 to 300200	04	R		Reserved		
No.(Address)	Func	R/W	Parameter	Description	Setting range	Note
301001(03E8)	04	R	HH / H / GO / L / LL — Front display LED	HH LED Display H LED Display GO LED Display L LED Display LL LED Display	0: OFF 1: ON 0: OFF 1: ON 0: OFF 1: ON 0: OFF 1: ON 0: OFF 1: ON	0 Bit 1 Bit 2 Bit 3 Bit 4 Bit
301002(03E9) 301003(03EA)	04	R	PV	Measurement value	-19999 to 99999	
301004(03EB)	04	R	DOT		0: 00000 3: 00.000 1: 0000.0 4: 0.0000 2: 000.00	
301005(03EC)	04	R	UNIT		0: 999.99s 5: 999.99m 1: 9999.9s 6: 9999.9m 2: 99m59.9s 7: 99h59.9m 3: 9h59m59s 8: 999h59m 4: 99999s 9: 99999m	
301006(03ED)	04	R	MODE	Operation mode	0: F1 to 1: F2 14: F15 2: F3 15: F16	
301007(03EE)	04	R				

6-4. Read Holding Registers (Func 03) / Preset Single Register (Func 06)/ Preset Multiple Registers (Func 16)

6-4-1. Comparative value settings and peak value check group

No.(Address)	Func	R/W	Parameter		Description	Setting range	Factory default
400001(0000) 400002(0001)	03/16	R/W	PSt.HH	Preset HH	HH comparative value	0 to 99999	99999
400003(0002) 400004(0003)	03/16	R/W	PSt. H	Preset H	H comparative value	0 to 99999	99999
400005(0004) 400006(0005)	03/16	R/W	PSt. L	Preset L	L comparative value	0 to 99999※1	00000
400007(0006) 400008(0007)	03/16	R/W	PSt.LL	Preset LL	LL comparative value	0 to 99999※1	00000
400009(0008) 400010(0009)	03/16	R/W	H.PEK	High Peak	High peak value of measured value	99999※2	—
400011(000A) 400012(000B)	03/16	R/W	L.PEK	Low Peak	Low peak value of measured value	-19999※2	—
400013 to 400050	03/06/16	R/W	Reserved				

※1: In operation modes F8, F10, F14, F15,the setting range is -19999 to 99999
※2: Max./Min. measurement value

6-4-2. Parameter 1 group

No.(Address)	Func	R/W	Parameter		Description	Setting range	Factory default
400051(0032)	03/06/16	R/W	ñodE	Mode	Input operation mode	0: F1 1: F2 2: F3 to 14: F15 15: F16	0
400052(0033)	03/06/16	R/W	In-A	Input A	Sensor type	0: nPn.H.F 1: nPn.ñ.F 2: nPn.L.F 3: PnP.H.F 4: PnP.ñ.F 5: PnP.L.F	0
400053(0034)	03/06/16	R/W	In-b	Input B			
400054(0035)	03/06/16	R/W	oUt-t	Output type	Output mode	0: StArd 1: oUt-H 2: oUt-L 3: oUt-b 4: oUt-I 5: oUt-F	0
400055(0036)	03/06/16	R/W	HYS	Hysteresis	Hysteresis value	1 to 9999	1
400056(0037)	03/06/16	R/W	GUAr.d	Output limit	Output limit function	0: F.dEFY 1: StAr.t	0
400057(0038)	03/06/16	R/W	StAr.t	Start limit value	Start compensation timer value	0.0 to 99.9	0.0
400058(0039)	03/16	R/W	AUto.A	Auto-zero A	Auto-zero time	0.1 to 9999.9	9999.9
400059(003A)	03/16	R/W					
400060(003B)	03/16	R/W	AUto.b	Auto-zero B			
400061(003C)	03/16	R/W					
400062(003D)	03/06/16	R/W	ñEño	Memory	Memory retention	0: oFF 1: on	0
400063 to 400100	03/06/16	R/W	Reserved				

6-4-3. Parameter 2 group

No.(Address)	Func	R/W	Parameter		Description	Setting range	Factory default
400101(0064)	03/06/16	R/W	P.bAnK	Data bank	Data bank	0: 1 1: 2	0
400102(0065)	03/06/16	R/W	dot	Dot	Decimal point	0: 00000 1: 0000.0 2: 000.00 3: 00.000 4: 0.0000	0
400103(0066)	03/06/16	R/W	t.Unt	Time unit	Time unit	0: t.SEC 1: t.ñIn	0
400104(0067)	03/06/16	R/W	t.SEC	Time sec	Time range	0: 999.99 999.99s 1: 9999.9 9999.9s 2: 99.59.9 99m59.9s 3: 9.59.59 9h59m59s 4: 99999 99999s 5: 999.99 999.99m 6: 9999.9 9999.9m 7: 99.59.9 99h59.9m 8: 999.59 999h59m 9: 99999 99999m	0

6-4-3. Parameter 2 group

No.(Address)	Func.	R/W	Parameter		Description	Setting range	Factory default
400105(0068)	03/16	R/W	PSt.HH	Preset HH	HH comparative value	0 to 99999	99999
400106(0069)	03/16	R/W					
400107(006A)	03/16	R/W	PSt. H	Preset H	H comparative value	0 to 99999	99999
400108(006B)	03/16	R/W					
400109(006C)	03/16	R/W	PSt. L	Preset L	L comparative value	0 to 99999※1	0
400110(006D)	03/16	R/W					
400111(006E)	03/16	R/W	PSt.LL	Preset LL	LL comparative value	0 to 99999※1	0
400112(006F)	03/16	R/W					
400113(0070)	03/16	R/W	PSC.A.H	Prescale A Mantissa	Prescale A mantissa	0.0001 to 9.9999	6.0000
400114(0071)	03/16	R/W					
400115(0072)	03/06/16	R/W	PSC.A.y	Prescale A Exponent	Prescale A exponent	00 to 09: + (0 to 9) 10 to 19: - (0 to 9)	01
400116(0073)	03/16	R/W	PSC.b.H	Prescale B Mantissa	Prescale B mantissa	0.0001 to 9.9999	6.0000
400117(0074)	03/16	R/W					
400118(0075)	03/06/16	R/W	PSC.b.y	Prescale B Exponent	Prescale B exponent	00 to 09: + (0 to 9) 10 to 19: - (0 to 9)	01
400119(0076)	03/06/16	R/W	dISP.t	Display time	Display cycle	0: oFF 1: 0.05 2: 0.5 3: 1 4: 2 5: 4 6: 8	1
400120(0077)	03/16	R/W	CoUn.b	INB Setting value	Operation mode F16 INB	1 to 99999	99999
400121(0078)	03/16	R/W					
400122 to 400150	03/06/16	R/W	Reserved				

※1: In operation modes F8, F10, F14, F15, the setting range is -19999 to 99999

6-4-4. Parameter 3 group

No.(Address)	Func.	R/W	Parameter		Description	Setting range	Factory default
400151(0096)	03/16	R/W	FS-H	Full scale High	High-limit value of PV transmission output	Setting range varies by model and operation mode※1	99999
400152(0096)							
400153(0096)	03/16	R/W	FS-L	Full scale Low	Low-limit value of PV transmission output		0
400154(0096)							
400155(0096)	03/06/16	R/W	mA	mA	Transmission output spec.	0: 4-20(mA) 1: 0-20(mA)	0
400156(0096)	03/06/16	R/W	Addr	Unit address	Communication address	1 to 99	1
400157(0096)	03/06/16	R/W	bPS	Bit per Sec	Communication Speed	0: 2400 1: 4800 2: 9600 3: 19200 4: 38400	2
400158(0096)	03/06/16	R/W	PrtY	Parity bit	Communication parity bit	0: nonE 1: EvEn 2: odd	0
400159(0096)	03/06/16	R/W	StP	Stop bit	Communication stop bit	0: 1 1: 2	1
400160(0096)	03/06/16	R/W	rSW.t	Response waiting time	Communication response waiting time	5 to 99(ms)	20
400161(0096)	03/06/16	R/W	ComW	Communi cation write	Communication write enable/disable	0: dISA 1: EnA	0
400162(0096)	03/06/16	R/W	LoC	Lock	Lock	0: oFF 1: LoC.0 2: LoC.1 3: LoC.2 4: LoC.3	0
400163 to 400200	03/06/16	R/W	Reserved				

※1: High-limit/low-limit setting value of PV transmission output. (varies by model and operation mode)

Series	Operation mode	Setting range
MP5Y MP5W	F1, F2, F7, F9, F11, F12, F13, F16	0 to 99999
	F3, F4, F5, F6	0.01 to set time range
	F8, F10, F14, F15	-19999 to 99999

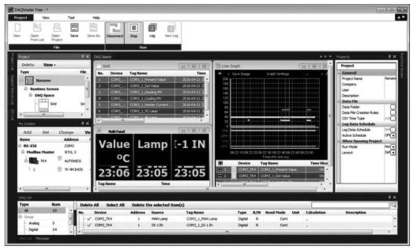
■ Comprehensive Device Management Program (DAQMaster)

- DAQMaster is comprehensive device management program for convenient management of parameters and multiple device data monitoring.
- Visit our website (www.autonics.com) to download user manual and comprehensive device management program.

< Computer specification for using software >

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS-232 serial port (9-pin), USB port

< DAQMaster screen >



■ Cautions During Use

- Please separate the unit wiring from high voltage lines or power lines to prevent inductive noise.
- Install a power switch or circuit breaker to control the power supply.
- The power switch or circuit breaker should be installed where it is easily accessible by the user.
- Do not use the unit in the following environments.
  ① Environments with high vibration or shock.
  ② Environments with exposure to direct sunlight.
  ③ Near machinery which produce strong magnetic force or electric noise.
- Storing the unit
  When storing the unit for an extended period, please avoid direct exposure to sunlight. Ambient temperature should be between -20℃ to 60℃ and ambient humidity should be between 35% to 85%RH. Store in factory packaging for best results.
- Input line
  Please use a shield wire in environments where noise may occur or instances where long measurement input lines are required.
- Please maintain distance between the power supply line and measurement input line.
- This product may be used in the following environments
  ① Indoors
  ② Max. altitude: 2,000m
  ③ Pollution degree 2
  ④ Installation category II

High Performance, Digital Panel Meter

Upgrade

Shaded parts ( ) are changed and added functions from previous MP5M Series.

■ Features

- 3 types of operation mode are added.
  (total 14 types of operation modes)
  Frequency/Revolutions/Speed, Passing speed, Cycle, Passing time, Time interval, Time differential, Absolute ratio, Density, Length measurement 1, Length measurement 2, Interval, Accumulation, Addition/Subtraction-individual input, Addition/Subtraction-phase difference input
- Shorten 32% of rear size than previous MP5M Series
- Various output models:
  Relay single (high-limit)/dual (high/low-limit)+ NPN open collector
- Various functions: Selectable NPN solid state/contact input, PNP solid state/contact input, prescale, delay monitoring function, hysteresis, auto-zero time, Lock setting
- Max. display range: -19999 to 99999
- Various display units
  rpm, rps, Hz, kHz, sec, min, m, mm, mm/s, m/s, m/min, m/h, ℓ/s, ℓ/min, ℓ/h, %, counts, etc.

⚠ Please read "Caution considerations" in operation manual before using.

■ Ordering Information

MP 5 M – 4 N

Code position	Code	Description
Output		Main output (comparative value output)
	N	Indicator
	1	Relay single (high-limit) output+NPN open collector output
	2	Relay dual (high/low-limit) output+NPN open collector output
Power supply	2	24VAC 50/60Hz, 24-48VDC
	4	100-240VAC 50/60Hz
Size	M	DIN W72×H72mm
Digit	5	99999 (5-digit)
Item	MP	Pulse meter

■ Specifications

Model		MP5M-2N	MP5M-4N	MP5M-21	MP5M-41	MP5M-22	MP5M-42
		Indicator		High-limit setting		High/Low-limit setting	
Display method		7-segment LED (zero blanking method)					
Character size		W4×H8mm					
Display range		-19999 to 99999					
Power supply	AC voltage	100-240VAC 50/60Hz					
	AC/DC voltage	24VAC 50/60Hz, 24-48VDC					
Power consumption	AC voltage	Max. 9.0VA (100-240VAC 50/60Hz)					
	AC/DC voltage	Max. 6.5VA (24VAC 50/60Hz), Max. 5.0W (24-48VDC)					
Permissible voltage range		90 to 110% of rated voltage					
External sensor power		12VDC±10%, 80mA					
Input frequency		·Solid state input 1: Max. 50kHz (pulse width: min. 10µs) ·Solid state input 2: Max. 5kHz (pulse width: min. 100µs) ※For F7, F8 operation mode, max. 1kHz (pulse width: min. 500µs) ·Contact input: max. 45Hz (pulse width: min. 11ms)					
Input method		[Voltage Input method] High: 4.5-24VDC, Low: 0-1.0VDC, Input impedance: 2.4kΩ [No-voltage Input method] Short-circuit impedance: Max. 80Ω, Residual voltage: Max. 1V, Open-circuit impedance: Min. 100kΩ					
Measurement range		·Operation mode F1, F2, F7, F8 : 0.0005Hz to 50kHz ·Operation mode F3, F4, F5, F6 : 0.01 to max. of each time range ·Operation mode F9, F10, F11, F14 : 0 to 99999 ·Operation mode F12, F13 : -19999 to 99999					
Measurement accuracy (23±5℃)		·Operation mode F1, F2, F7, F8 : F.S.±0.05% rdg±1-digit ·Operation mode F3, F4, F5, F6 : F.S.±0.01% rdg±1-digit					
Display cycle		OFF (for F2, F14 operation mode), 0.05, 0.5, 1, 2, 4, 8 sec (same as update output cycle)					
Operation mode		Frequency/Revolutions/Speed (F1), Passing speed (F2), Cycle (F3), Passing time (F4), Time interval (F5), Time differential (F6), Absolute ratio (F7), Density (F8), Length measurement 1 (F9), Interval (F10), Accumulation (F11), Addition/Subtraction-individual input (F12), Addition/Subtraction-phase difference input (F13), Length measurement 2 (F14)					

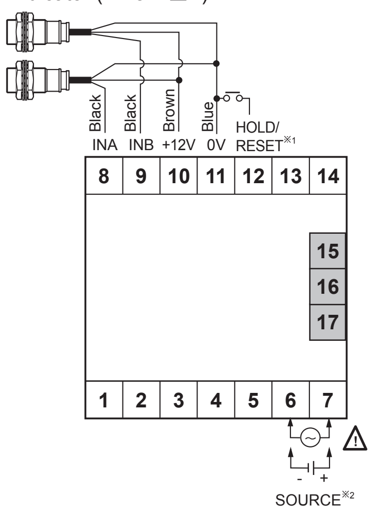
■ Specifications

Model		MP5M-2N	MP5M-4N	MP5M-21	MP5M-41	MP5M-22	MP5M-42
		Indicator		High-limit setting		High/Low-limit setting	
Prescale function		Direct input method (0.0001×10^{-9} to 9.9999×10^{9})					
Hysteresis		—		0 to 9999※1			
Main output	Relay single	—		250VAC 3A resistive load 1c		—	
	Relay dual			—		250VAC 3A resistive load 1a×2	
	NPN open collector			Max. 30VDC 100mA		Max. 30VDC 100mA×2	
Memory retention		Non-volatile memory (number of inputs: min. 100,000 operations)					
Insulation resistance		Over 100MΩ (at 500VDC megger)					
Dielectric strength		2,000VAC 60Hz for 1 min					
Noise immunity		±2kV the square wave noise (pulse width: 1µs) by the noise simulator					
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 1 hour					
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 10 min					
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times					
	Malfunction	100m/s² (approx. 30G) in each X, Y, Z direction for 3 times					
Relay life cycle	Mechanical	—		Min. 10,000,000 operations			
	Electrical	—		Min. 100,000 operations (250VAC 3A resistive load)			
Environment	Ambient temp.	-10 to 50℃, storage: -20 to 60℃					
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH					
Approval		CE cULus					
Weight※2		Approx. 243g (approx. 168g)		Approx. 256g (approx. 181g)		Approx. 265g (approx. 190g)	

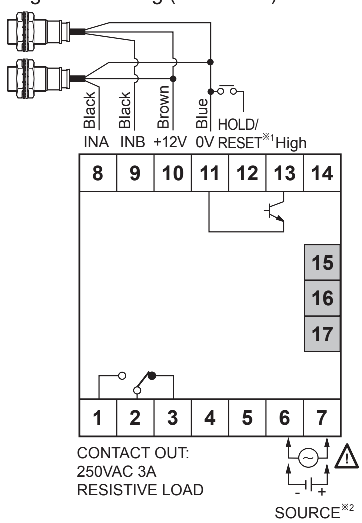
※1: Setting range will vary depending on the decimal point.
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Connections

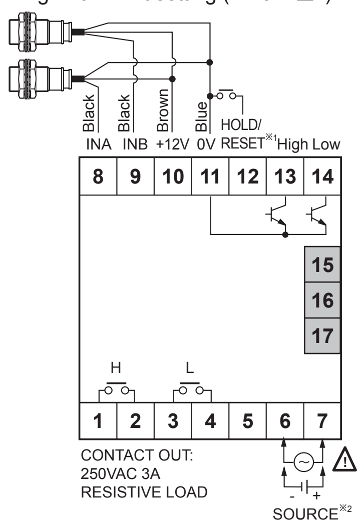
● Indicator (MP5M-□N)



● High-limit setting (MP5M-□1)



● High/Low-limit setting (MP5M-□2)



※1: Operation mode F1 to F10:
Display value HOLD
Operation mode F11 to F14:
Display value RESET

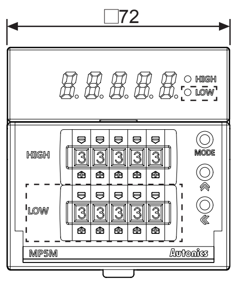
※2:

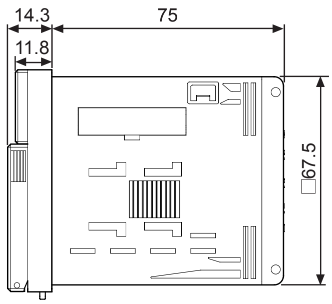
Model	Source
MP5M-21	24VAC 50/60Hz 24-48VDC
MP5M-22	
MP5M-2N	
MP5M-41	100-240VAC 50/60Hz
MP5M-42	
MP5M-4N	

■ Dimensions

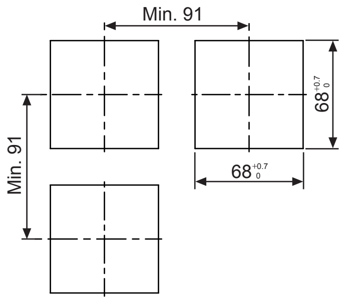
(unit: mm)

※Nameplate design is changed and rear length is shorten than previous MP5M Series.
※The high-limit setting model (MP5M-□1) does not include the dotted line parts.

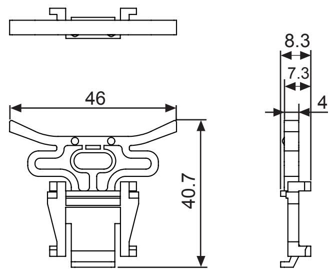




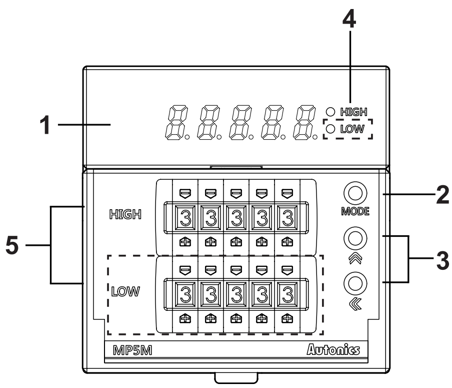
- **Panel cut-out dimensions**



- **Bracket**



■ Unit Description



※The high-limit setting model (MP5M-□1) does not include the dotted line parts.

1: Display
Displays current value in RUN mode.
Alternately displays setting parameters and corresponding value in SETTING mode.

2: MODE key
In RUN mode, press the key once to check max./min. value.
In RUN mode, hold the key for over 2 sec to enter parameter groups.

3: ⋀, ≪ key
Select parameter groups, and select or setting values in the corresponding parameters.

4: Output status indicator

5: Thumbwheel switch for HIGH/LOW setting value

■ Input Specifications

1. Input signal

Standard duty ratio of input signal is 1:1.

(1) Solid state input 1

Input frequency: Max. 50kHz (ON/OFF pulse width: min. 10µs of each)

(2) Solid state input 2

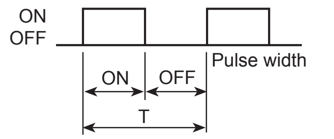
Input frequency: Max. 5kHz (ON/OFF pulse width: min. 100µs of each)

※For F7, F8 operation mode, max. 1kHz (ON/OFF pulse width: min. 500µs of each)

(3) Contact input

① Input frequency: Max. 45Hz (when each ON/OFF pulse width is over 11ms)

② Contact specifications: 12VDC, stable switching of load current as small as 5mA

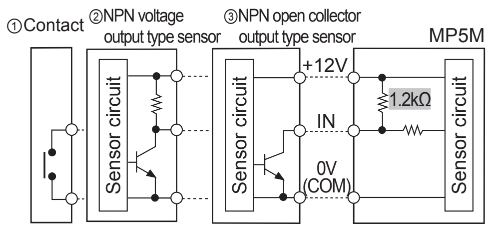


※T: Single cycle of input signal

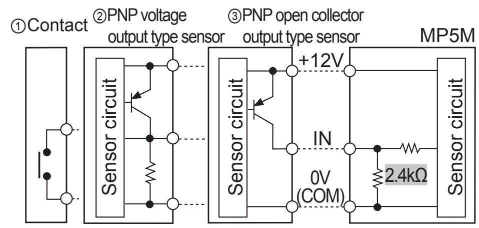
2. Input type [In-A, In-b]

MP5M allows selection between NPN input (solid state/contact) or PNP input (solid state/contact).

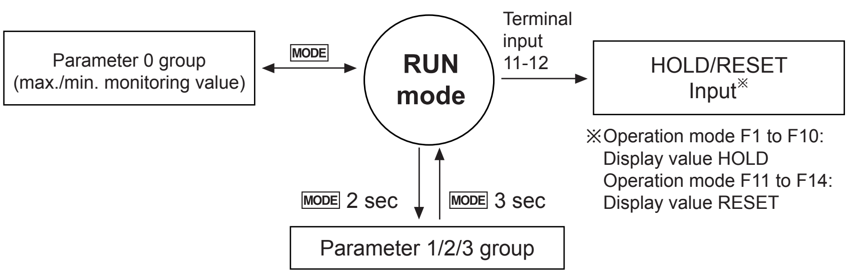
(1) NPN input type



(2) PNP input type



■ Parameter Groups



※Press the ⩓, « keys to select or set the desired value.

※Press the MODE key once after changing the setting value, to save the setting value and move to the next parameter.

※Hold the MODE key for 1.5 sec at any parameters to return to the select parameter group mode.

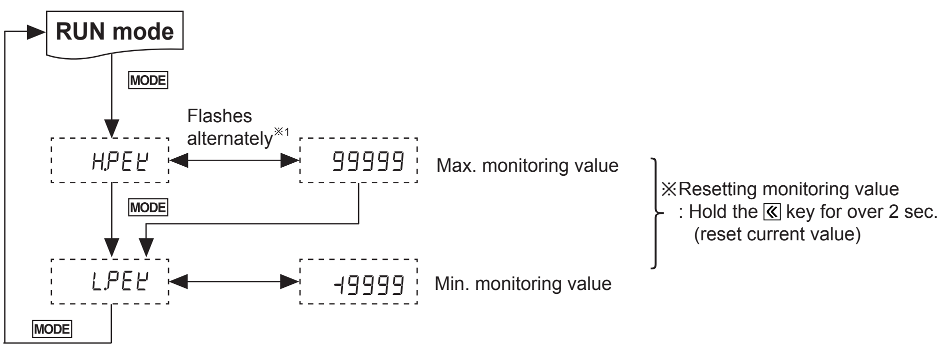
※Hold the MODE key for 3 sec to save the setting value and return to RUN mode after changing the setting value.

※If there is no key input for 60 sec while setting the parameters, the new settings are ignored, and the unit will return to RUN mode with previous settings.

※The dotted line parameters may not appear depending on output specifications or other parameter settings. Please refer to '■ Operation mode by parameter group'.

※1: Each parameter and corresponding setting value will flash alternately every 0.5 sec.

● **Parameter 0 group**



● **Parameter 1 group**

RUN mode — MODE 2 sec → PArA.1 → PArA.2 → PArA.3

MODE 3 sec

nodE ↔ **F 1** (Flashes alternately※1, MODE)

Operation mode
●Setting range: F 1 to F 14

In-A ↔ **nPn.H.F** Sensor type of input A

In-b ↔ **nPn.H.F** Sensor type of input B

●Setting range

Parameter	Input sensor type
nPn.H.F	NPN solid state input 1
nPn.ñ.F	NPN solid state input 2
nPn.L.F	NPN contact input
PnP.H.F	PNP solid state input 1
PnP.ñ.F	PNP solid state input 2
PnP.L.F	PNP Contact input

oUt-t ↔ **StArd** Output mode

●Setting range

Parameter	Output mode	Parameter	Output mode
StArd	S (Standard)	oUt-b	B (Block)
oUt-H	H (High)	oUt-I	I (One-shot)
oUt-L	L (Low)	oUt-F	F (Deflection)

※Only appears in high/low-limit setting model.

HYS ↔ **0001**

Output hysteresis
●Setting range: 0000 to 9999
(the setting range varies depending on the decimal point setting)
※Only appears in high-limit setting models, high/low-limit setting models.

GUArd ↔ **F.dEFY**

L comparative output limit
※Only appears in high/low-limit setting models.

StAr.t ↔ (MODE) **99.9**

Start compensation timer function & compensation time
●Setting range: 0.0 to 99.9 (sec)
※Only appears in high/low-limit setting models.

AUto.A ↔ **9999.9** Auto-zero time for input A

AUto.b ↔ **9999.9** Auto-zero time for input B

●Setting range:
0.1 to 9999.9 (sec)

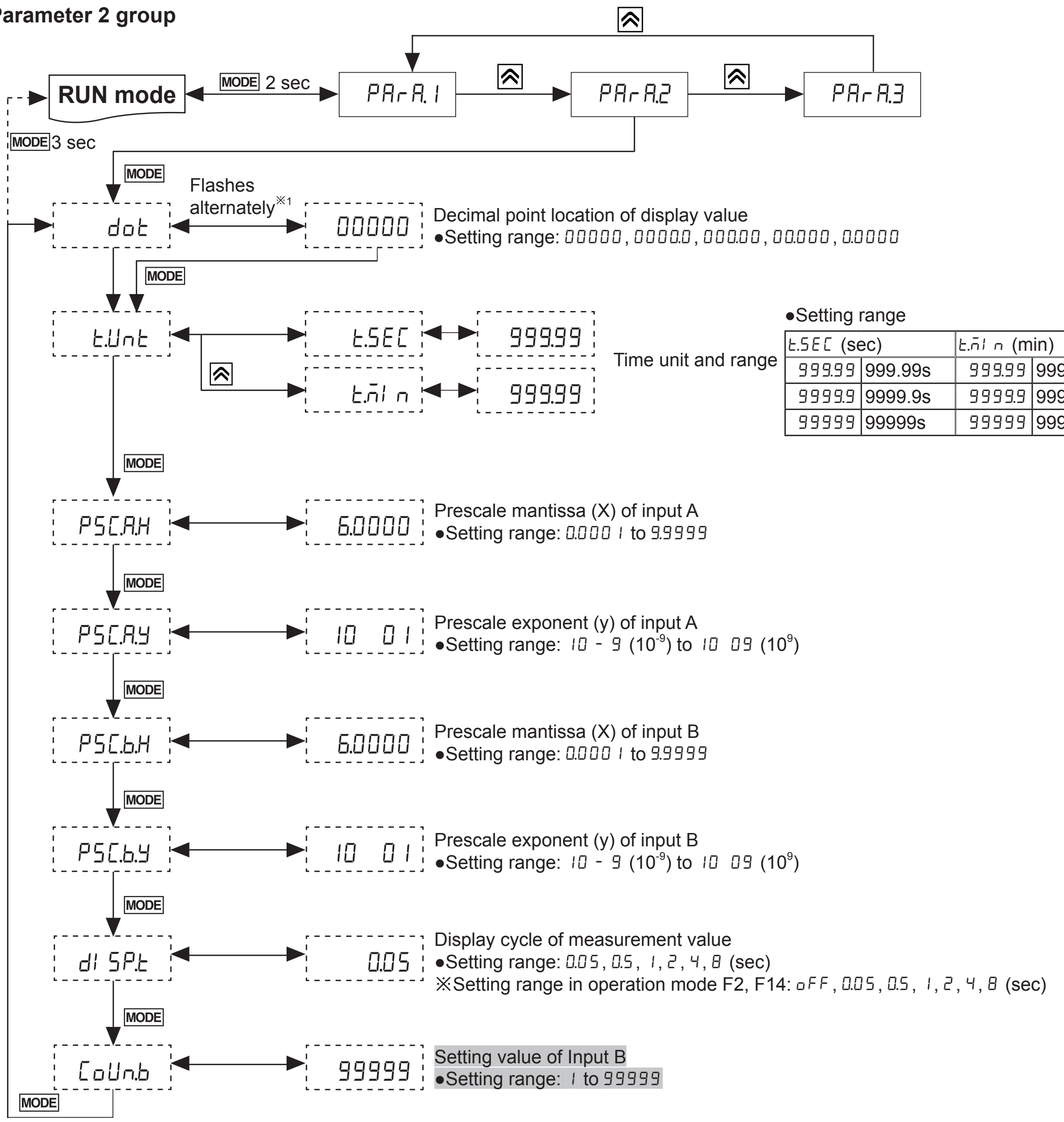
ñEño ↔ **oFF**

Memory retention
●Setting range: on, oFF

MODE

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

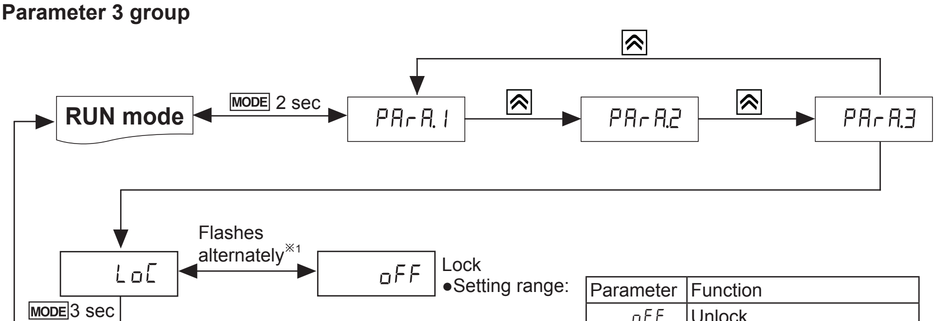
● **Parameter 2 group**



●Setting range

t.SEC (sec)		t.min (min)	
999.99	999.99s	999.99	999.99m
9999.9	9999.9s	9999.9	9999.9m
99999	99999s	99999	99999m

● **Parameter 3 group**



Parameter	Function
oFF	Unlock
LoC.0	Locks all
LoC.1	Parameter 1, 2, 3 lock
LoC.2	Parameter 2, 3 lock
LoC.3	Parameter 3 lock

■ Operation Mode By Parameter Groups

(◐: parameter display, X: no parameter display)

Parameter		F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14
0	H.PEK	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	X	◐	◐	X
	L.PEK	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	X	◐	◐	X
1	MODE	Appears in all operation modes (F1 to F14).													
	In-A														
	In-b ※1	X	◐	X	X	X	◐	◐	◐	◐	◐	◐	◐	X ※3	◐
	oUt-t ※2	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	X	◐	◐	● ※4
	HYS ※1	◐	X	X	X	X	X	◐	◐	X	X	X	X	X	X
	GuArd	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	X	X	X	X
	Auto.A	◐	X	X	◐	X	X	◐	◐	X	X	X	X	X	X
	Auto.b	X	X	X	X	X	X	◐	◐	X	X	X	X	X	X
	MEMo	X	X	X	X	X	X	X	X	X	X	◐	◐	◐	◐
2	dot	◐	◐	X	X	X	X	◐	◐	◐	◐	◐	◐	◐	◐
	t.Unt	X	X	◐	◐	◐	◐	X	X	X	X	X	X	X	X
	PSC.A.H	◐	◐	X	◐	X	X	◐	◐	◐	◐	◐	◐	◐	◐
	PSC.A.Y	◐	◐	X	◐	X	X	◐	◐	◐	◐	◐	◐	◐	◐
	PSC.b.H	X	X	X	X	X	X	◐	◐	X	X	X	X	X	X
	PSC.b.Y	X	X	X	X	X	X	◐	◐	X	X	X	X	X	X
	dISP.t	◐	▣ ※5	X	X	X	X	◐	◐	X	X	X	X	X	▣
	CoUn.b	X	X	X	X	X	X	X	X	X	X	X	X	X	◐
3	LoC	Appears in all operation modes (F1 to F14).													

※1: Only appears in high/low-limit setting models.
※2: Only appears in high-limit setting models, high/low-limit setting models.
※3: The settings for In-b and In-A are applied.
※4: (●) F output mode [oUt-F] cannot be set.
※5: (▣) setting range: oFF, 0.05, 0.5, 1, 2, 4, 8

• Monitoring delay function by output mode

Output mode	S mode	H mode	L mode	B mode	I mode	F mode
Parameter	StArd	out-h	out-L	out-b	out-I	out-F
Comparative output limit	◐	X	X	◐	X	◐
Start compensation timer	◐	◐	◐	◐	◐	◐

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Operation Modes [nodE]

- Select operation mode from operation mode[nodE]of parameter 1 group..
- MP5M has 14 operation modes.

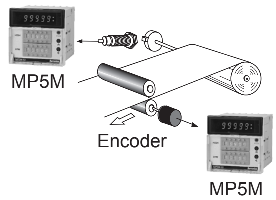
◎ F1 Mode: Frequency/Revolutions/Speed

Measures the frequency of input A and displays the calculated frequency, revolutions, and speed.

1) Frequency (Hz)	= f × α	(α= 1[sec])
2) Revolutions (rpm)	= f × α	(α= 60[sec])
3) Speed (m/min)	= f × α	(α= 60L[sec])

※L: travel distance of conveyor belt of 1 pulse cycle[m]
α: prescale value

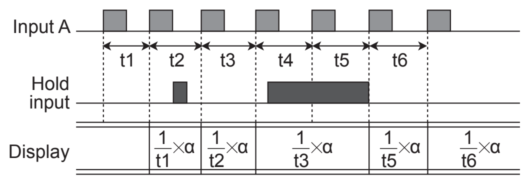
For multiple objects, $\alpha = \frac{60L}{N}$



- Display value and display unit

Display value	Display unit	α (prescale value)
Frequency	Hz	1
	kHz	0.001
Revolutions	rps	1
	rpm (default)	60
Speed	mm/sec	1,000L
	cm/sec	100L
	m/sec	1L
	m/min	60L
	km/hour	3.6L

- Timing chart

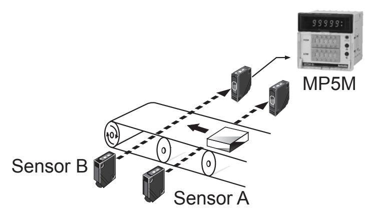


◎ F2 Mode: Passing Speed

Displays the passing speed between input A ON and input B ON.

Passing speed (V) = f × α (α = L[m])

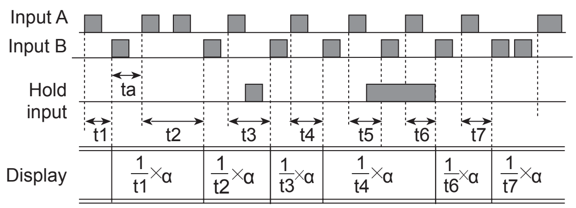
※f : reciprocal of time [sec] between input A (sensor) ON and input B (sensor) ON.
L: distance between input A (sensor) and input B (sensor) [m]
α: prescale value



- Display value and display unit

Display value	Display unit	α (prescale value)
Passing speed	mm/sec	1,000L
	cm/sec	100L
	m/sec (default)	1L
	m/min	60L
	km/hour	3.6L

- Timing chart

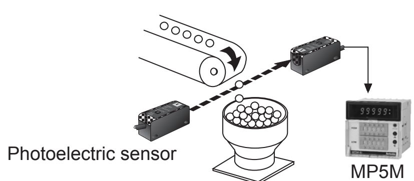


※ta: Return time (over 20ms)

◎ F3 Mode: Cycle

Displays the measured time from Input A ON to the next ON.

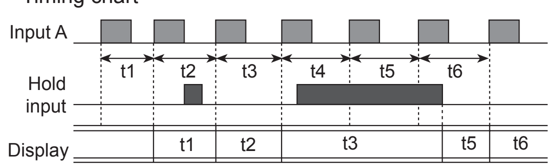
Cycle (T) = t ※t: measurement time[sec]



- Display value and display unit ([t.Unt] of parameter 2)

Display value	Display unit	
	SEC	MIN
Cycle	999.99s (default)	999.99m
	9999.9s	9999.9m
	99999s	99999m

- Timing chart

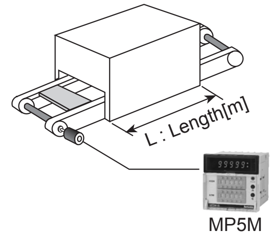


◎ F4 Mode: Passing Time

Measures the time from Input A ON to the next ON, and displays the passing time of the arbitrary distance.

Passing time[sec]= t × α $\left(\alpha = \dfrac{L[m]}{\text{Distance advanced in 1 pulse cycle [m]}}\right)$

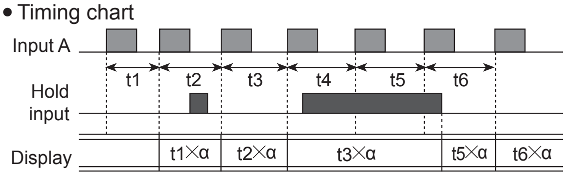
※t : measured time[sec], L : arbitrary distance[m]
α: prescale value



● Display value and display unit ([t.Unt] of parameter 2)

Display value	Display unit	
Passing time	SEC	MIN
	999.99s (default)	999.99m
	9999.9s	9999.9m
	99999s	99999m

● Timing chart

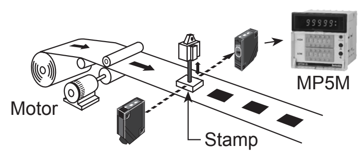


◎ F5 Mode: Time Interval

Displays measured time of Input A ON

Time interval (T) = t

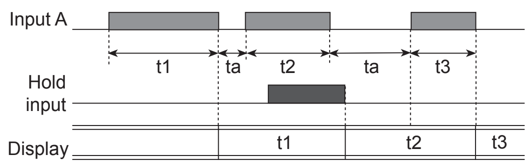
※t: measured time of input A ON [sec]



● Display value and display unit ([t.Unt] of parameter 2)

Display value	Display unit	
Time interval	SEC	MIN
	999.99s (default)	999.99m
	9999.9s	9999.9m
	99999s	99999m

● Timing chart



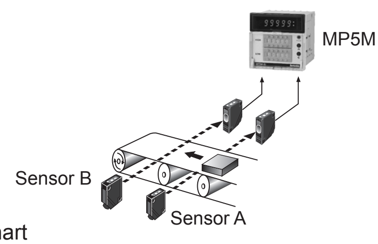
※ta: return time (over 20ms)

◎ F6 Mode: Time Differential

Displays measured time from Input A ON to Input B ON.

Time differential (T) = t (ta to tb)

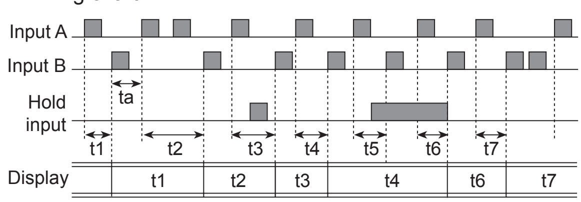
※t (ta to tb): measured time from input A ON to input B ON [sec]



● Display value and display unit ([t.Unt] of parameter 2)

Display value	Display unit	
Time difference	SEC	MIN
	999.99s (default)	999.99m
	9999.9s	9999.9m
	99999s	99999m

● Timing chart



※ta: return time (over 20ms)

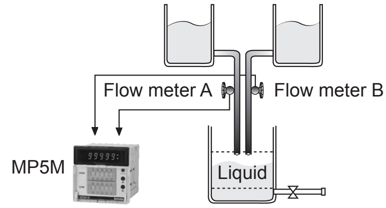
◎ F7 Mode: Absolute Ratio

Measures and displays relative speed, amount, speed, etc. of input B against input A in percentage (%).

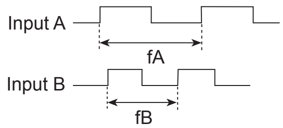
Absolute ratio = (Input B / Input A) × 100%

$$\text{Absolute ratio} = \frac{\text{Frequency of input B [Hz]} \times B\alpha}{\text{Frequency of input A[Hz]} \times A\alpha} \times 100[\%]$$

※Aα: Prescale value of input A, Bα: Prescale value of input B



● Timing chart



$$\text{Display} = \frac{\text{Frequency of input B[Hz]} \times B\alpha}{\text{Frequency of input A[Hz]} \times A\alpha} \times 100[\%]$$

● Display value and display unit

Display value	Display unit
Absolute ratio	%

※Hold: When the hold signal turns ON, the display value is maintained until the display cycle turns to hold OFF.

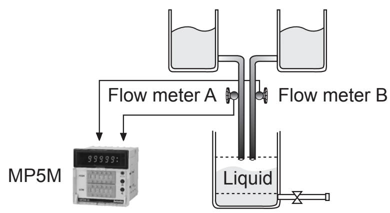
◎ F8 Mode: Density

Measures and displays the density ratio (%) of input B against the total sum of input A and input B.

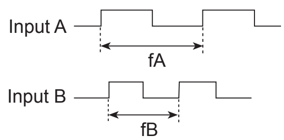
$$\text{Density} = \frac{\text{Input B}}{\text{Input A + Input B}} \times 100[\%]$$

$$\text{Density} = \frac{\text{Frequency of Input B[Hz]} \times B\alpha}{(\text{Frequency of input A[Hz]} \times A\alpha) + (\text{Frequency of input B[Hz]} \times B\alpha)} \times 100[\%]$$

※Aα: Prescale value of input A, Bα: Prescale value of input B



● Timing chart



● Display value and display unit

Display value	Display unit
Density	%

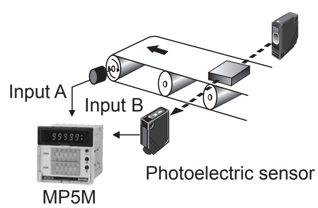
※Hold: When the hold signal turns ON, the display value is maintained until the display cycle turns to hold OFF.

◎ F9 Mode: Length Measurement 1

Measure and display the number of input A pulses during input B ON.

Length measurement = P × α

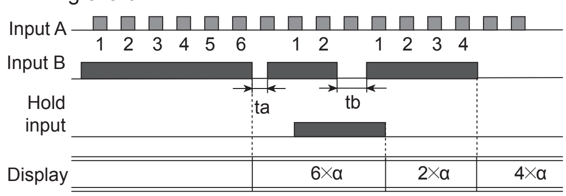
※P: Number of input A pulses, α: Prescale value



● Display value and display unit

Display value	Display unit
Length measurement	Quantity (default)
	mm
	cm
	m

● Timing chart



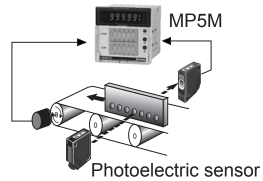
※ta, tb: return time (over 20ms)

◎ F10 Mode: Interval

Measures and displays the number of input A pulses from Input B ON to the next ON.

$\boxed{\text{Interval} = P \times \alpha}$

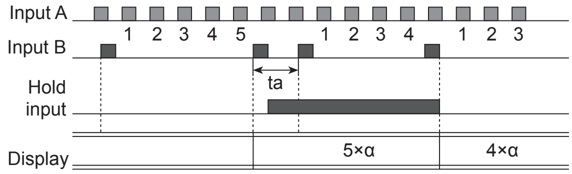
※P: Number of input A pulses, α: Prescale value



- Display value and display unit

Display value	Display unit
Interval	Quantity (default)
	mm
	cm
	m

- Timing chart



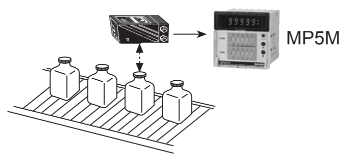
※ta: return time (over 20ms)

◎ F11 Mode: Accumulation

Measures and displays the counted value of input A pulses.

$\boxed{\text{Accumulation} = P \times \alpha}$

※P: Number of input A pulses, α: Prescale value



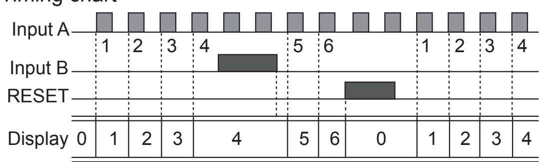
- Display value and display unit

Display value	Display unit
Accumulation	Quantity[EA]

- Operation

①Counts the number of input A pulses.
②Input B is an enable input signal. During ON, the quantity and display value of input A will be held, and during OFF input A will be re-counted.
③When RESET input is ON, the integrated counted value will be reset to "0".

- Timing chart



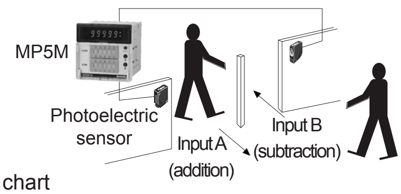
※α=1 display value

◎ F12 Mode: Addition/Subtraction-Individual Input

Displays the counted value from added input A pulses and subtracted input B pulses. When there are two inputs simultaneously, it will not count.

$\boxed{\text{Addition/Subtraction} = \text{Input A} \times \alpha - \text{Input B} \times \beta}$

※α: Prescale value of input A, β: Prescale value of input B



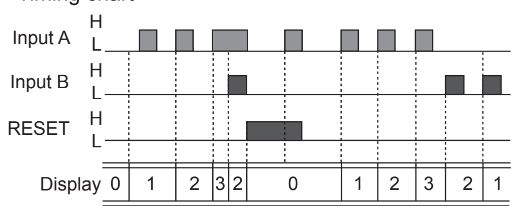
- Display value and display unit

Display value	Display unit
Addition/ Subtraction (individual input)	Quantity

- Operation and timing chart

Pulse of input A is added, and pulse of input B is subtracted.

- Timing chart

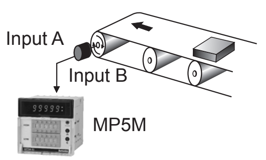


※α, β=1 display value

◎ F13 Mode: Addition/Subtraction- Phase difference input

When input A is low, counting is added to the low of input B.
When input A is low, counting is subtracted from the high of input B.

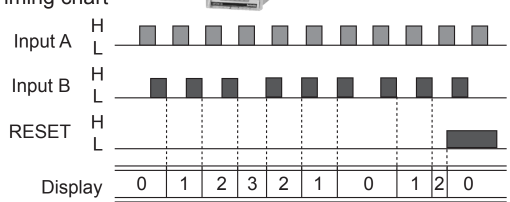
Addition/Subtraction (phase difference)
= Detects position and speed using A and B phases of encoder outputs as input.



- Display value and display unit

Display value	Display unit
Up/Down counting (phase difference input)	Quantity

- Timing chart



◎ F14 Mode: Length Measurement 2

Measures and displays the number of pulses from input A until the value of input B reaches the set value.

Length measurement 2 = P × α (until the setting value of Input B)

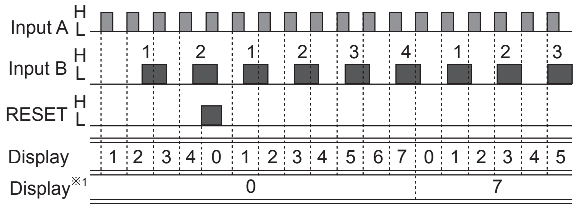
※P: Number of input A pulses, α: Prescale value

- Display value and display unit

Display value	Display unit
Length measurement 2	Quantity[EA]

※If input A and input B are ON during initial power supply, it will not count and only count the number of rising edge.
※Display value is renewed depending on the display cycle [dISP.t] setting.

- Timing chart (e.g.) setting value of Input B=4



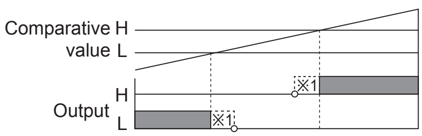
※1: When the display cycle[dISP.t] setting is oFF, it will maintain the quantity of input A until the value of input B reaches the setting value B[CoUn.b].

■ Output Modes [oUt-t]

- MP5M-□1: S output mode, MP5M-□2: S, B, H, L, I, F output mode
- Requirement for setting comparative value: (B output mode) L<H, (F output mode) L<H, (other output modes) individual output operation regardless of size or order of set comparative values.

※1: hysteresis

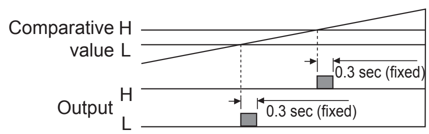
◎ **S** (Standard) Output Mode [StArd]
B (Block) Output Mode [oUt-b]



H output : Comparative value H ≤ Display value
L output : Comparative value L ≥ Display value

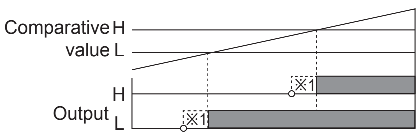
◎ **I** (One-shot) Output Mode [oUt-I]

※No hysteresis for I output mode



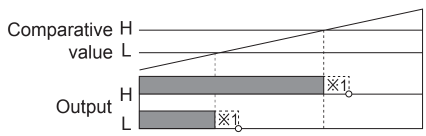
H output : Comparative value H ≤ Display value
L output : Comparative value L ≤ Display value

◎ **H** (High) Output Mode [oUt-H]



H output : Comparative value H ≤ Display value
L output : Comparative value L ≤ Display value

◎ **L** (Low) Output Mode [oUt-L]

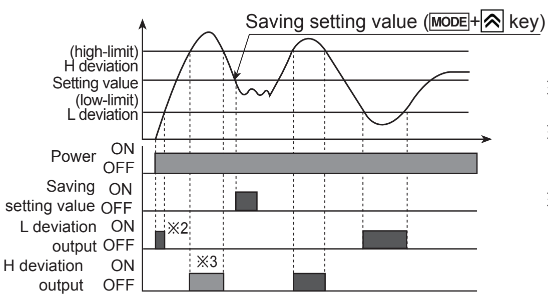


H output : Comparative value H ≥ Display value
L output : Comparative value L ≥ Display value

◎ **F** (Deflection) Output Mode [oUt-F]

Transmits outputs when the saved setting value exceeds H deviation or L deviation.

- Saving setting value: Press the MODE+⩓ keys to save as setting value.
- Checking setting value: Press the ⩓ key to check the setting value.
- Setting deviation: Based on the setting value, set H deviation, L deviation by the thumbwheel switches. (the set deviation value is saved during Power OFF until it is re-set.)
- Deviation setting range: 0.0001 to 99999 (setting range depends on the decimal point [dot] setting.)
  E.g.)Decimal point[dot]: "0000.0", Setting range: 0.1 to 9999.9



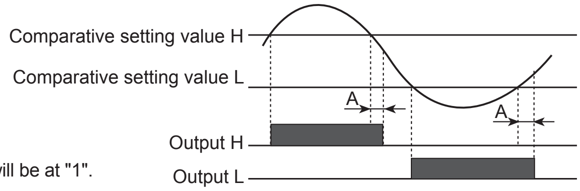
※2: When selecting initial comparative output limit function, it does not transmit outputs.
※3: The graph is assuming that there is a saved setting value prior to the setting value save point. The actual output position may be different.
※The deviation can be set to "0" but the actual operation will be the same as "1".

■ Function

◎ Hysteresis [HYS]

The output may turn ON/OFF frequently near the comparative setting value. To prevent this, set the hysteresis value with the comparative setting value as reference.

※A: hysteresis value
※The hysteresis value can be set to "0" but the actual operation value will be at "1".

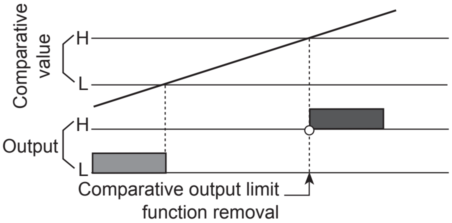


◎ Delay Monitoring [GUAr.d]

After supplying power, the the starting current of motors and other inputs may experience changes. This function allows stable control by limiting all outputs for a certain period until the target measurement unit stabilizes. It may also control L outputs until a specific output is reached.

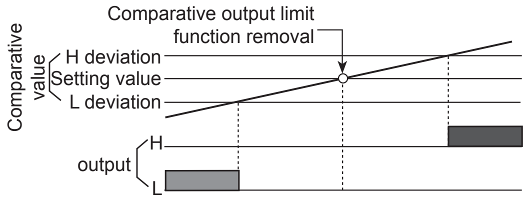
- Comparative output limit function [F.dEFY]
  : Only for S (Standard), B (Block), F (Deflection) output mode.
  : Limits L output before H output.

1) During S (Standard), B (Block) output mode



※After supplying power, there is no initial L comparative output (▇).
※Each setting value of H, L is not related to their relative sizes. Hence, H value may be lower or equal to L value.

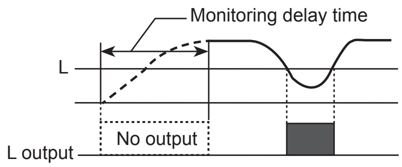
2) During F (Deflection) output mode



※After supplying power, there is no comparative output of L deviation (▇).
※H and L deviation are not related to their relative sizes. (H deviation setting value > L deviation setting value, H deviation setting value < L deviation setting value)

- Start compensation timer function [StAr.t]

Set monitoring delay time so that there is no output during the delay time.

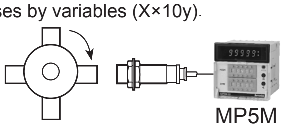


◎ Auto-Zero Time Setting [AUto.A, AUto.b]

When there is no input signal during auto-zero set time, the display value is automatically set to 0 (zero). Please set the auto-zero set time so that it is longer than the interval of the slowest input signal. If the setting time is too long and there is no input signal, the rate at which the display value falls to 0 (zero) decrease, and output response rate may slow down.

◎ Prescale [PSC.□.H, PSC.□.Y]

Displays values in required units or specific multiples by counting the number of input pulses, then multiplying the number of pulses or the length of pulses by variables (X×10y).



Number of revolutions (rpm) = f×α
= f×60× (1 / N)
= f×60× (1 / 4)
= f×60×0.25
= f×15

- Setting prescale value (α=15)
  Set mantissa (X) as 1.5000, and exponent (Y) as 1 for prescale value (α)=15.
  The same display value can be obtained with α value set as X=0.1500, and Y=2.

※f: The number of input pulses per second[Hz],
α: Prescale value
N: The number of pulses per revolution

■ Cautions During Use

- Please separate the unit wiring from high voltage lines or power lines to prevent inductive noise.
- Install a power switch or circuit breaker to control the power supply.
- The power switch or circuit breaker should be installed where it is easily accessible by the user.
- Do not use the unit in the following environments.
  ① Environments with high vibration or shock.
  ② Environments with exposure to direct sunlight.
  ③ Near machinery which produce strong magnetic force or electric noise.
- Storing the unit
  When storing the unit for an extended period, please avoid direct exposure to sunlight. Ambient temperature should be between -20℃ to 60℃ and ambient humidity should be between 35% to 85%RH. Store in factory packaging for best results.
- Input line
  Please use a shield wire in environments where noise may occur or instances where long measurement input lines are required.
- Please maintain distance between the power supply line and measurement input line.
- This product may be used in the following environments
  ① Indoors ② Max. altitude: 2,000m
  ③ Pollution degree 2 ④ Installation category II

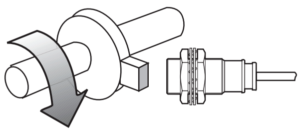
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Overview And Principle

◎ Overview

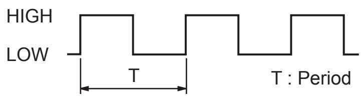
Reduction of human material and improve efficiency are the eternal theme given to production machinery equipment. And the speed of maximum efficiency for each machine is fixed.
Because of this, we need to know how the machine is currently operating in some condition.
The devices that measure the revolution and moving distance of the machine are called the revolution-indicator and speed meter.

◎ Period measuring method



● Period measuring method

When the measured object is rotating every cycle, the signal is detected by the sensor. This method is measuring the period of these signals and then calculating.



$$\text{rps} = \frac{1}{T\ (\text{sec})} = f\ (\text{Hz})$$

$$\text{rpm} = \frac{1}{T\ (\text{sec})} \times 60\ (\text{sec}) = f\ (\text{Hz}) \times 60\ (\text{sec})$$

$$※ f = \frac{1}{T}\ (\text{Hz})$$

◎ rps / rpm

- rps is the unit of revolution per second.
  E.g.)1rps=1 revolution at 1 second
- rpm is the unit of revolution per minute.
  E.g.)1rpm= 1 revolution at 1 minute
- relation between rpm and rps
  rpm = rps×60 (sec)

◎ Measuring input specification

Input frequency for solid state is max. 50kHz, and for relay contact is max. 45Hz.If the range of ON/OFF input signal for solid state is more than 10μs and for relay contact is more than 11ms, it is able to be measured.

◎ Measuring accuracy

Measuring accuracy is high, and does not decrease in high speed rotation adopted period measuring method in the micro computer.

◎ Measuring impact on rotation

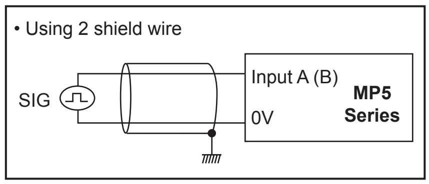
No effects to the rotation because of non-contact measuring for using proximity sensor, gear sensor, photoelectric sensor and rotary encoder.

◎ Selection

The more wide selection with various product size, several operation modes and output modes is available.

▣ Proper Usage

- If input line is long or in the place occurring noise, please use shield wire certainly.
- In order to prevent inductive noise, please separate wires from high voltage wire and power cable.
- This product needs to install power switch or circuit breaker to cut the power supply.
- The switch or circuit breaker should be installed close to user to operate easily.
- Please do not use in following environments to avoid the damage of the products
  - Place where there is severe vibration or impact
  - Place where there are direct ray of the sun
  - Place where strong magnetic force or electric noise are generated
- Storage
  When store items for long term, avoid direct sunlight, keep in -20 to 60℃ temperature range and under 35 to 85% relative humidity. Keep the packaged products like factory condition.
- This product may be used in the following environments.
  - Indoors
  - Max altitude: 2,000m
  - Pollution degree 2
  - Installation category II



- Keep distance between power line and measuring input line.

(N) Display Units

Line-up

Intelligent Display Unit
DS/DA Series

7-Segment Display Unit
D1SC-N

7-Segment Display Unit
D1SA Series

16-Segment Display Unit
D1AA Series

Panel Mount Type,
5-Digit Display Unit
D5Y/D5W Series

Product Overview

Intelligent Display Unit - Serial / Parallel / RS485 communication input type

Model	Basic unit	**DS16-□S/T**	**D□22-□S/P/T**	**D□40-□S/P/T**	**D□60-□S/P/T**
	Expansion unit	**DS16-□E**	**D□22-□E**	**D□40-□E**	**D□60-□E**
Appearances & Dimensions		CE  [W16×H24×L39.5mm]	CE  [W20×H33×L31.5mm]	CE  [W40×H60×L17mm]	CE  [W60×H96×L17mm]
Input method		D□□-□S: Serial			
		D□□-□P: Parallel (dynamic Parallel 1, dynamic Parallel 2)			
		D□□-□T: RS485 communication (modbus protocol)			
Display color		Red, Green (selectable by model)			
Power supply		12-24VDC			
Allowable voltage range		90 to 110% of rated voltage			
Current consumption	Red	Max. 20mA	Max. 25mA	Max. 55mA	Max. 65mA
	Green	Max. 15mA	Max. 20mA	Max. 40mA	Max. 45mA
Character size		W9×H16mm	W11.2×H22.5mm	W22.4×H40mm	W33.6×H60mm
Max. Clock※1, ※2		• Serial input: Max. 2kHz • Parallel input: Dynamic Parallel 1: Max. 3kHz, Dynamic Parallel 2: Max. 1.5kHz			
Input logic※1		Selectable positive logic (PNP) or negative logic (NPN) (change by the function set switch)			
Input resistance※1		20kΩ			
Input level※1		High: 4.5-24VDC, Low: 0-1.2VDC			
Display character		64 characters and signs (0 to 9, A to Z, 27 symbols, decimal point)			
The number of max. multi-stage connections		Serial / RS485 comm. input: 24 units			
		Parallel input: Dynamic Parallel 1: 6 units (4-bit), 4 units (6-bit), Dynamic Parallel 2: 24 units (6-bit)			
Reference		**N-5 to 26**			

※1: It is only for Serial, Parallel input models.
※2: Max. Clock is for 1:1 of duty ratio (ON, OFF ratio).

Intelligent Display Unit - RS485 synchronous communication type for time display

Model	Basic unit	**DS22-□C**	**DS40-□C**	**DS60-□C**
	Expansion unit	**D□22-□E**	**D□40-□E**	**D□60-□E**
Appearances & Dimensions		CE  [W20×H33×L31.5mm]	CE  [W40×H60×L17mm]	CE  [W60×H96×L17mm]
Input method		RS485 communication (modbus protocol)		
Display color		Red, Green (selectable by model)		
Power supply		12-24VDC		
Allowable voltage range		90 to 110% of rated voltage		
Current consumption	Red	Max. 25mA	Max. 55mA	Max. 65mA
	Green	Max. 20mA	Max. 40mA	Max. 45mA
Character size		W11.2×H22.5mm	W22.4×H40mm	W33.6×H60mm
Time display		World local time, 12/24-hour, summer time supported		
The number of max. multi-stage connections		10 units		
Reference		**N-5 to 26**		

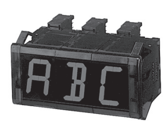
※1: Use 16-segment expansion unit for displaying delimiter for hour/min./sec. and 'M' character for AM/PM.

Intelligent Display Unit - Pt temp. sensor input / Pt temp. sensor input + RS485 comm. ouput type

Model				
Model	Basic unit	**DS22-RR**	**DS40-RR/RRT**	**DS60-RR/RRT**
	Expansion unit	**DS22-RE**	**DS40-RE**	**DS60-RE**
Appearances & Dimensions		 [W20×H33×L31.5mm]	 [W40×H60×L17mm]	 [W60×H96 ×L17mm]
Input method		Pt temp. sensor input (supports DPt100Ω, JPt 100Ω)		
Display color		Red		
Power supply		12-24VDC		
Allowable voltage range		90 to 110% of rated voltage		
Current consumption		Max. 40mA	Max. 55mA	Max. 65mA
Character size		W11.2×H22.5mm	W22.4×H40mm	W33.6×H60mm
Display temp. range		-50.0 to 400.0℃ or -58.0 to 752.0℉		
Display accuracy		F.S.±0.5%		
Output		—	RS485 comm. output (modbus RTU)※1	
The number of max. multi-stage connections		4 units (except unit-display unit)		
Reference		**N-5 to 26**		

※1: RS485 comm. output supports only DS40-RRT, DS60-RRT models.

Display Unit

Model	D1SC-N	D1SA-RN	D1SA-GN	D1AA-RN	D1AA-GN
Appearances & Dimensions	 [W72×H96×L25.7mm]	 [W20×H33×L54mm]		 [W20×H33×L54mm]	
Character size	W32×H57mm	W11×H22mm			
Power supply	12-24VDC				
Allowable voltage range	90 to 110% of rated voltage				
Current consumption	Max. 70mA	Max. 35mA		Max. 32mA	
Display method	7-segment LED display (red)	7-segment LED display (red)	7-segment LED display (green)	16-segment LED display (red)	16-segment LED display (green)
Display character	• Decimal number: 0 to 9, decimal point, Minus※1 • Hexadecimal number: 0 to 9, A to F, decimal point			0 to 9, A to Z, decimal point, 24 symbols	
Max. Clock	Max. 3kHz				
Input	• Parallel: Parallel 4-bit data, latch, zero blanking, decimal point • Serial: Serial 4-bit or 5-bit data, clock, zero blanking, latch, decimal point (for 4-bit input)			•Parallel: Parallel 6-bit data, latch, decimal point •Serial: Serial 6-bit or 7-bit data, clock, latch, decimal point (for 6-bit input)	
Output	Data output (serial input), zero blanking output			Data output (serial input)	
Input logic	Selectable positive logic (PNP) or negative logic (NPN) (by the function set switch)	Selectable positive (PNP) or negative (NPN) (by inner soldering)			
Input level	High: 4.5-24VDC, Low: 0-1.2VDC				
Input resistance	12kΩ	20kΩ			
Reference	**N-27 to 34**			**N-35 to 40**	

※**1:** Minus display is available only D1SC-N.
※Max. Clock is for 1:1 of duty ratio (ON, OFF ratio).

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Product Overview

Panel Mount Type, 5-Digit Display Uint

Model	**D5Y-M**	**D5W-M**	**D5W-MX**
Appearances & Dimensions	 [W72×H36×L91mm]	 [W96×H48×L99.5mm]	
Character size	W8×H14mm		
Power supply	12-24VDC		110/220VAC 50/60Hz
Allowable voltage range	90 to 110% of rated voltage		
Power consumption	Max. 1.1W		Max. 2VA
Display method	7-segment LED display (red)		
Display character	0 to 9, decimal point, Minus (for serial input)		
Max. Clock	100Hz to 5kHz		
Input method	Static, Dynamic, 4/5-bit serial, Serial (16/20/25-bit)		
Input logic	Selectable positive logic (PNP) or negative logic (NPN)		
Input level	High: 5-24VDC, Low: 0-1.2VDC		
Input resistance	22kΩ		
Reference	**N-41 to 48**		

※Max. Clock is for 1:1 of duty ratio (ON, OFF ratio).

Intelligent Display Unit

■ Features

DS(A)40 DS(A)60
DS16 DS(A)22

- Simple wiring without soldering
  : Multi-stage connection using expansion connectors or ribbon cables.
  : Power supply and data wiring required on base unit only.
- Various input options
  : Serial input
  : Parallel input
  : RS485 communication input
  : RS485 communication time sync display
  : PT temperature sensor input
  : PT temperature sensor + RS485 communication input
- Expandable up to 24 units with multi-stage connection
- Available in various sizes: 16 mm, 22.5 mm, 40 mm, 60 mm
- Available in 7-segment display and 16-segmentt display types
- Available in red display and green display types
- High luminance LED display
- Various unit display plates (switchable) with flashing or ON/OFF options
- Display 64 unique characters (0 to 9, A to Z, 27 symbols, period)

⚠ Please read "Safety considerations" in operation manual before using.

CE

■ Ordering Information

D S 16 — R S

Item	Code		Description
Unit type	S	Basic unit	Serial input
	P	Basic unit	Parallel input
	T	Basic unit	RS485 comm. input
	C	Basic unit	RS485 synchronous comm. type for time display
	R	Basic unit	Pt temp. sensor input
	RT	Basic unit	Pt temp. sensor input+RS485 comm. output
	E	Expansion unit	
	No-mark	Unit-display unit	
Display color	R※3	Red	
	G	Green	
Size (character size)	16※1	W16×H24mm (W9.0×H16.0mm)	
	22	W20×H33mm (W11.2×H22.5mm)	
	40	W40×H60mm (W22.4×H40.0mm)	
	60	W60×H96mm (W33.6×H60.0mm)	
Display method	S	7-segment	
	A	16-segment	
	U※2	Unit-display unit	
Item	D	Display unit	

※1: The '16' size model has the serial input model, RS485 comm. input model and does not support 16-segment display method.
※2: Unit-display unit has only 16, 22 size.
※3: Pt temp. sensor input, Pt temp. sensor input+RS485 comm. output models support only red display color.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Specifications

◎ Serial / Parallel / RS485 communication input type

Model					
Model	Basic unit	**DS16-□S/T**	**D□22-□S/P/T**	**D□40-□S/P/T**	**D□60-□S/P/T**
	Expansion unit	**DS16-□E**	**D□22-□E**	**D□40-□E**	**D□60-□E**
Input method		D□□-□S: Serial			
		D□□-□P: Parallel (dynamic Parallel 1, dynamic Parallel 2)			
		D□□-□T: RS485 communication (modbus protocol)			
Display color		Red, Green (selectable by model)			
Power supply		12-24VDC			
Allowable voltage range		90 to 110% of rated voltage			
Current consumption	Red	Max. 20mA	Max. 25mA	Max. 55mA	Max. 65mA
	Green	Max. 15mA	Max. 20mA	Max. 40mA	Max. 45mA
Character size		W9×H16mm	W11.2×H22.5mm	W22.4×H40mm	W33.6×H60mm
Max. Clock※1, ※2		• Serial input: Max. 2kHz • Parallel input: Dynamic Parallel 1: Max. 3kHz, Dynamic Parallel 2: Max. 1.5kHz			
Input logic※1		Selectable positive logic (PNP), negative logic (NPN) (change by the function set switch)			
Input resistance※1		20kΩ			
Input level※1		High: 4.5-24VDC, Low: 0-1.2VDC			
Display character		64 characters and signs (0 to 9, A to Z, 27 symbols, decimal point)			
The number of max. multi-stage connections		Serial / RS485 comm. input: 24 units			
		Parallel input: Dynamic Parallel 1: 6 units (4-bit), 4 units (6-bit), Dynamic Parallel 2: 24 units (6-bit)			

※1: It is only for Serial, Parallel input models.
※2: Max. Clock is for 1:1 of duty ratio (ON, OFF ratio).

◎ RS485 synchronous communication type for time display

Model				
Model	Basic unit	**DS22-□C**	**DS40-□C**	**DS60-□C**
	Expansion unit	**D□22-□E**	**D□40-□E**	**D□60-□E**
Input method		RS485 communication (modbus protocol)		
Display color		Red, Green (selectable by model)		
Power supply		12-24VDC		
Allowable voltage range		90 to 110% of rated voltage		
Current consumption	Red	Max. 25mA	Max. 55mA	Max. 65mA
	Green	Max. 20mA	Max. 40mA	Max. 45mA
Character size		W11.2×H22.5mm	W22.4×H40mm	W33.6×H60mm
Time display		World local time, 12/24-hour, summer time supported		
The number of max. multi-stage connections		10 units		

※1: Use 16-segment expansion unit for displaying delimiter for hour/min/sec and 'M' character for AM/PM.

◎ Pt temp. sensor input / Pt temp. sensor input + RS485 communication ouput type

Model				
Model	Basic unit	**DS22-RR**	**DS40-RR/RRT**	**DS60-RR/RRT**
	Expansion unit	**DS22-RE**	**DS40-RE**	**DS60-RE**
Input method		Pt temp. sensor input (supports DPt100Ω, JPt 100Ω)		
Display color		Red		
Power supply		12-24VDC		
Allowable voltage range		90 to 110% of rated voltage		
Current consumption		Max. 40mA	Max. 55mA	Max. 65mA
Character size		W11.2×H22.5mm	W22.4×H40mm	W33.6×H60mm
Display temp. range		-50.0 to 400.0℃ or -58.0 to 752.0℉		
Display accuracy		F.S.±0.5%		
Output		—	RS485 comm. output (modbus RTU)※1	
The number of max. multi-stage connections		4 units (except unit-display unit)		

※1: RS485 comm. output supports only DS40-RRT, DS60-RRT models.

▣ Specifications

◎ General Specifications

Model	Basic unit	**DS16-□S/T**	**D□22-□S/P/T/C/R**	**D□40-□S/P/T/C/R/RT**	**D□60-□S/P/T/C/R/RT**
	Expansion unit	**DS16-□E**	**D□22-□E**	**D□40-□E**	**D□60-□E**
Noise immunity		±500V the square wave noise (pulse width: 1μs) by the noise simulator			
Environ-ment	Ambient temp.	-10 to 55℃, storage: -25 to 65℃			
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH			
Accessory	Basic unit	Right/Left cap: 1	Right/Left cap: 1 Connector: 1	Connector: 1※1	
	Expansion unit	—		Ribbon cable (50mm) : 1	
Protection structure		IP40 (front part)			
Approval		CE			
Weight※2	Basic unit	Approx. 52g (approx. 12g)	Approx. 58g (approx. 17g)	Approx. 63g (approx. 28g)	Approx. 110g (approx. 60g)
	Expansion unit	Approx. 77g (approx. 12g)※3	Approx. 92g (approx. 17g)※9	Approx. 63g (approx. 28g)	Approx. 110g (approx. 60g)

※1: It is only for parallel input model.
※2: The weight includes packaging. The weight in parentheses is for unit only.
※3: This is 3 units' weight as packaging unit and the weight in parentheses is only unit weight.
※Environment resistance is rated at no freezing or condensation.

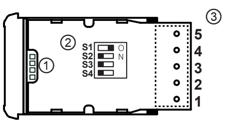
▣ Unit Description And Function Setting

Only the basic unit model has the function set switch and the input terminal.
The DS16, D□22 models have them at the side, and the D□40. D□60 models have them at the rear.

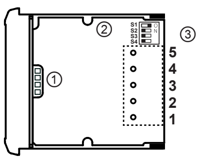
◎ Serial input model

① Expansion connector
Using for connecting units.
Refer to '▣ Connection of units'.

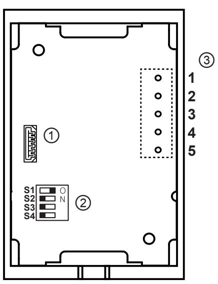
● **DS16-□S**



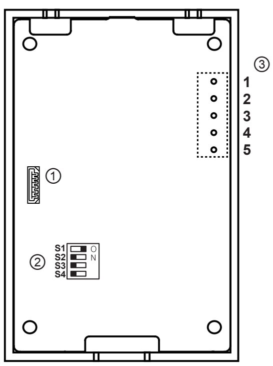
● **D□22-□S**



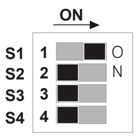
● **D□40-□S**



● **D□60-□S**



② Function set switches



<factory default>

No.	Switch		Function
	OFF(■□)	ON(□■)	
S1	Positive logic (PNP)	Negative logic (NPN)	Input logic
S2	Not used	Used	Zero Blanking
S3	Not used	Used	Decimal number display※1
S4	8-bit	5-bit※2	Data input bit

※1: The other data except 0 to 9 are blank.
※2: 5-bit data input is compatible with Autonics panel meter (MT4Y, MT4W).

③ Input terminal

No.	Code	Function
1	VCC	12-24VDC
2	GND	0V
3	Data	Data input
4	CLOCK	CLOCK input
5	LATCH	LATCH input

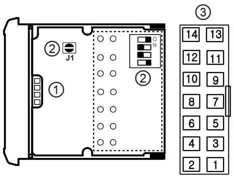
※For the D□22-□S, connect the connector to input terminal.

◎ Parallel input model

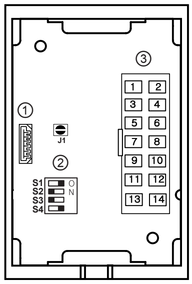
① Expansion connector

Using for connecting units.
Refer to ' ■ Connection of units'.

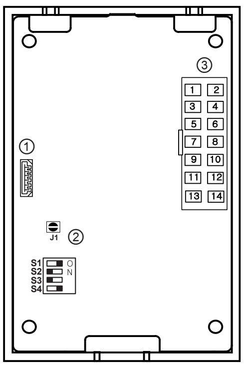
● D□22-□P



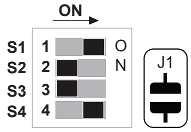
● D□40-□P



● D□60-□P



② Function set switches

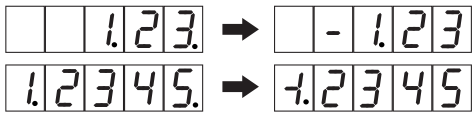


<factory default>

No.	Switch		Function
	OFF(■)	ON(■)	
S1	Positive logic (PNP)	Negative logic (NPN)	Input logic
S2	Not used	Used	Zero Blanking
S3	6-bit	4-bit※1,※2	Data input bit
S4	Dynamic 1	Dynamic 2	Dynamic 1/2 selection
J1			All Zero Blanking※3

※1: 4-bit data input is compatible with Autonics pulse meter (MP5Y, MP5W) and panel meter (MT4Y, MT4W).

※2: 4-bit data input displays "-" or "-1" when dot display data at the lowest display unit.
(Minus display function is available when Zero Blanking, or All Zero Blanking is set as ON)



※3: When every number is '0', it becomes All Zero Blanking.
E.g.) When displaying 000045 using two basic units,
Uses All Zero Blanking

Does not use All Zero Blanking

③ Input terminal

Terminal	Dytamic Parallel 1				Dytamic Parallel 2※1	
	4-bit Data input		6-bit Data input		6-bit Data input	
	Code	Function	Code	Function	Code	Function
1	VCC	12-24VDC	VCC	12-24VDC	VCC	12-24VDC
2	GND	0V	GND	0V	GND	0V
3	LE5	LATCH 5	LE3	LATCH 3	LATCH	LATCH input
4	LE4	LATCH 4	LE2	LATCH 2	CLOCK	CLOCK input
5	LE3	LATCH 3	LE1	LATCH 1	—	—
6	LE2	LATCH 2	LE0	LATCH 0	UNIT	Unit
7	LE1	LATCH 1	DP	Decimal point	DP	Decimal point
8	LE0	LATCH 0	D5	2^5 Data	D5	2^5 Data
9	DP	Decimal point	D4	2^4 Data	D4	2^4 Data
10	D3	2^3 Data	D3	2^3 Data	D3	2^3 Data
11	D2	2^2 Data	D2	2^2 Data	D2	2^2 Data
12	D1	2^1 Data	D1	2^1 Data	D1	2^1 Data
13	D0	2^0 Data	D0	2^0 Data	D0	2^0 Data
14	GND	0V	GND	0V	GND	0V

※1: When selecting Dynamic Parallel 2, 6-bit data input, All Zero Blanking OFF are fixed.

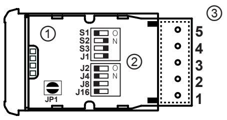
▣ Unit Description And Function Setting

◎ RS485 communication input model

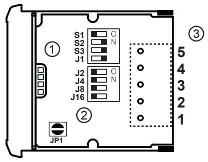
① Expansion connector

Using for connecting units.
Refer to '▣ Connection of units'.

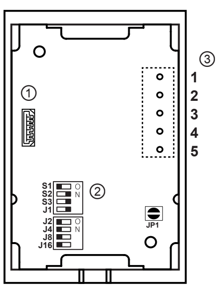
● DS16-□T



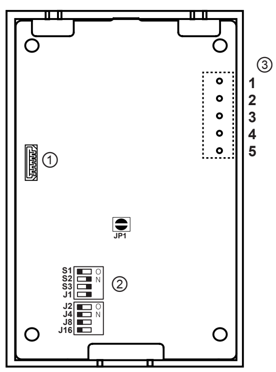
● D□22-□T



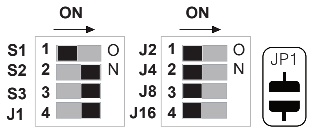
● D□40-□T



● D□60-□T



② Function set switches



<factory default>

※Functions are varied by JP1 setting (RS485 Master mode/RS485 Slave mode).

●RS485 Slave mode (JP1 (open))

No.	Switch OFF( )/ON( )	Function
S1	5ms 20ms	Comm. response time
S2	S2: 4800 9600 19200 38400	Comm. speed selection(bps)
S3	S3	
J1 to J16	1 2 .... 31 32 J1 J2 J4 J8 J16	Comm. address selection

●RS485 Master mode (JP1 (short))

No.	Switch OFF( )/ON( )	Function
S1	Auto setting, Manual setting	Series setting method
S2	S2: 4800 9600 19200 38400	Comm.speed selection (bps)
S3	S3	
J1 to J8	CT6 CT4 MP5 MT4 TK/TX TM2 TM4 THD J1 J2 J4 J8	Series selection (manual setting)
	CT6 MP5 MT4 TK/TX J1 J2 J4 J8	Series selection (manual setting), Not using the highest digit
J16	No Yes	Unit-display unit

※Refer to "▣ RS485 Master Mode".

③ Input terminal

No.	Code	Function
1	VCC	12-24VDC
2	GND	0V
3	—	—
4	A (+)	RS485 A (+)
5	B (-)	RS485 B (-)

※For D□22-□T connect the connector to input terminal.

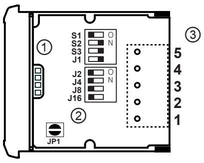
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

◎ RS485 synchronous communication type for time display model

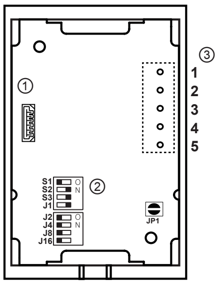
① Expansion connector

Using for connecting units.
Refer to '◾ Connection of units'.

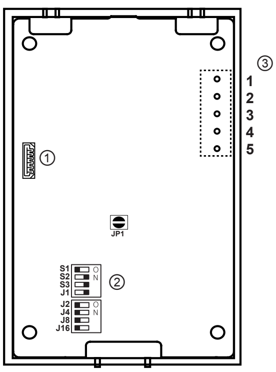
● **DS22-□C**



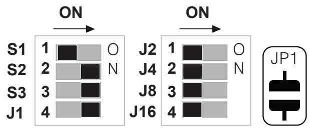
● **DS40-□C**



● **DS60-□C**



② Function set switches



<factory default>

● **JP1 terminal setting**

JP1	Delimiter for hour/min/sec
(Open)	Sign [:] (using 16-segment expansion unit)
(Short)	Period [.] (using 7-segment expansion unit)

● **Switch setting**

No.	Switch OFF( )/ON( )	Function
S1	24-hour 12-hour	12/24-hour setting
S2	4800 9600 19200 38400 (S2)	Comm. speed selection (bps)
S3	(S3)	Comm. speed selection (bps)
J1 to J16	UTC -12:00, UTC -11:00 …. UTC +11:00, UTC +12:00 (J1, J2, J4, J8, J16)	World time zone selection※1

※1: Refer to "◾ World Time Zone".

③ Input terminal

No.	Code	Function
1	VCC	12-24VDC
2	GND	0V
3	—	—
4	A (+)	RS485 A (+)
5	B (-)	RS485 B (-)

※For DS22-□C connect the connector to input terminal.

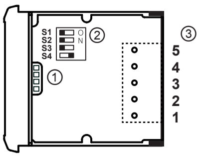
▣ Unit Description And Function Setting

◎ Pt temp. sensor input model

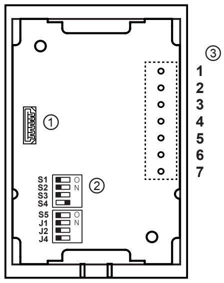
① Expansion connector

Using for connecting units.
Refer to '▣ Connection of units'.

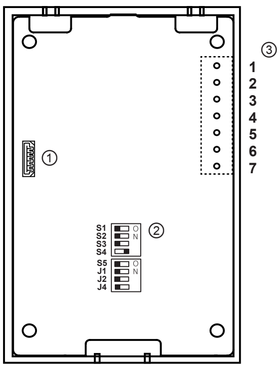
● DS22-RR



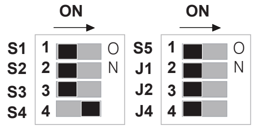
● DS40-RR/RRT



● DS60-RR/RRT



② Function set switches



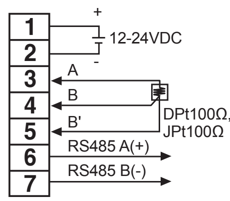
<factory default>

No.	Switch		Function
	OFF(■□)	ON(□■)	
S1	DPt100Ω	JPt100Ω	Temp.sensor
S2	℃	℉	Temp. unit
S3	10^2	10^1	Integer display
S4	Not used	Used	Decimal point
S5	9600bps	38400bps	Comm. speed selection (bps)
J1 J2 J4	1 2 … 7 8 (J1, J2, J4 switch settings)		Comm. address selection

③ Input terminal

No.	Code	Function
1	VCC	12-24VDC
2	GND	0V
3	A	Pt temp. sensor A
4	B	Pt temp. sensor B
5	B'	Pt temp. sensor B'
6	A (+)	RS485 A (+)
7	B (-)	RS485 B (-)

● Connections



※For DS22-RR connect the connector to input terminal.
※Function set switches S5, J1, J2, J4 and input terminal 6, 7 are only for RS485 comm. ouptut models (DS40-RRT, DS60-RRT).

▣ Unit-display Unit

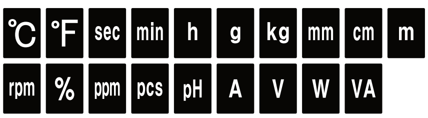
This unit is for displaying unit by inserting a name plate.
It has only 16, 22 sizes. (sold separately)

● Model

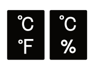
Size \ Color	Red	Green
16mm	DU16-R	DU16-G
22mm	DU22-R	DU22-G

◎ Unit name plates

It provides unit-printed name plates as an accessory. You can select the desired unit name plate and insert this plate.
(single-stage unit name plate: 19 types, dual-stage unit name plate: 2 types)



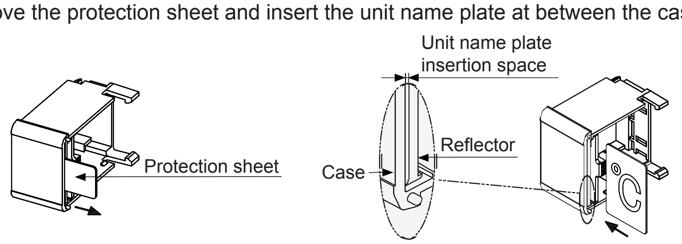
Single-stage unit name plate



Dual-stage unit name plate

◎ Unit name plate insertion

Remove the protection sheet and insert the unit name plate at between the case and the reflector.



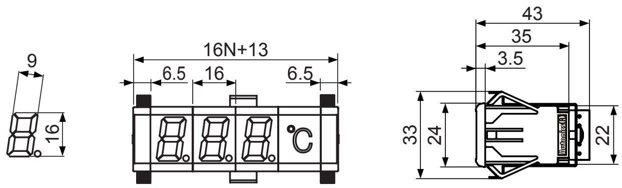
⚠ **Caution: Be sure about the correct insert direction.**

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

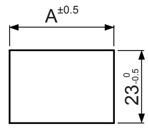
▣ Dimensions

◎ DS16

(unit: mm)



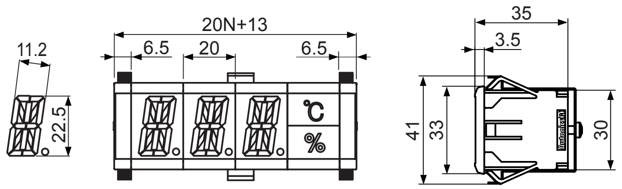
● **Panel cut-out**



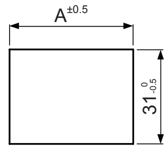
※N: Number of units
※Panel thickness: 1.5 to 4mm

Units (N)	A (16N+11)
1	27
2	43
3	59
4	75
5	91
:	:

◎ DS22/DA22

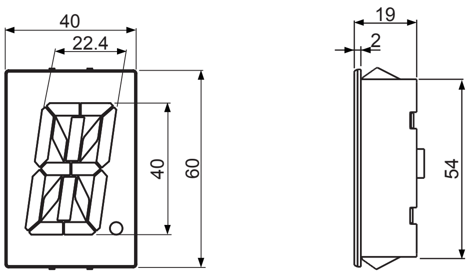


● **Panel cut-out**

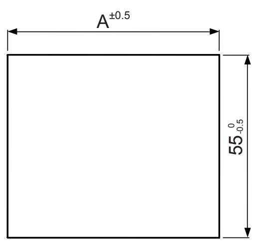


Units (N)	A (20N+11)
1	31
2	51
3	71
4	91
5	111
:	:

◎ DS40/DA40

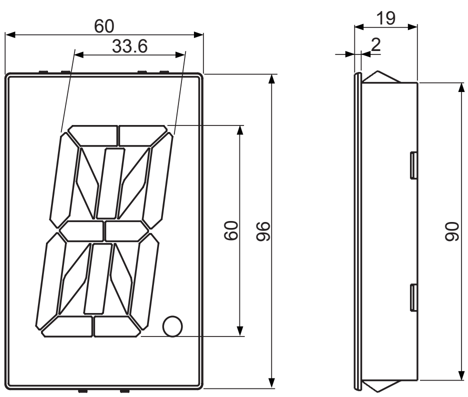


● **Panel cut-out**

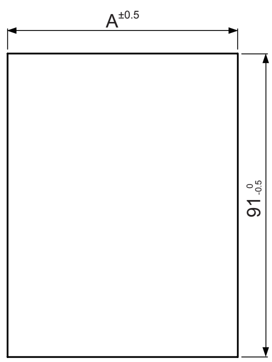


Units (N)	A (40N-2)
1	38
2	78
3	118
4	158
5	198
6	238
7	278
8	318
9	358
10	398
:	:

◎ DS60/DA60

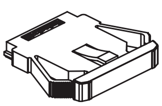


● **Panel cut-out**

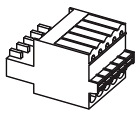


Units (N)	A (60N-3)
1	57
2	117
3	177
4	237
5	297
6	357
7	417
8	477
9	537
10	597
:	:

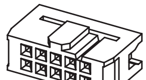
▣ Accessories



Cap for
DS16/D□22



Connector for
D□22※1



Connector for
D□□-P

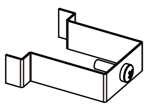
Ribbon cable (50mm)
for D□40/D□60

※1: For parallal input model, use the connector for D□□-P.

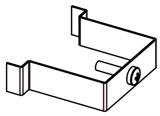
▣ Sold Separately

◎ Middle bracket

- **BK-D16R**
  (for DS16)



- **BK-D22R**
  (for D□22)



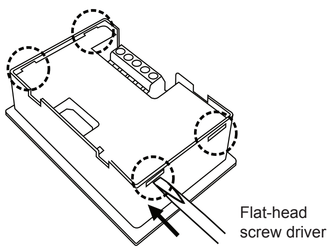
◎ Communication converter

- **SCM-38I**
  (RS232C to RS485 converter)

- **SCM-US48I**
  (USB to RS485 converter)

▣ Removing Protection Cover

To operate the function set switch of the D□40, D□60 models, you should remove the protection cover.
Press the connection parts (4-point) of the protection cover at the top/bottom of the product with a flat-head screwdriver and the protection cover is removed.

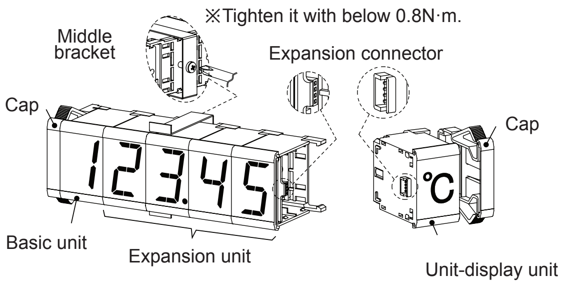


⚠**Caution: Before removing the protection cover, power must be turned OFF.**

▣ Connection Of Units

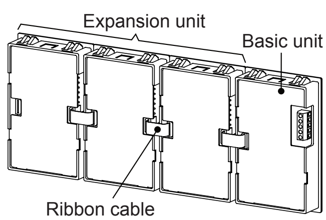
◎ DS16/D□22

- Connect a basic unit, expansion units, a unit-display unit from the left and connect the caps the end of right and left.
- The middle bracket (sold separately) helps to protect deflection when connecting over 7 units.
  Use one middle bracket per 7 units.
- The basic unit supplies the power for expansion units and the unit-display unit and DATA input.

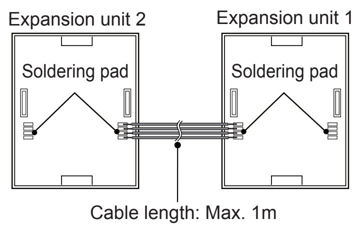


◎ D□40/D□60

Connect expansion connectors of units using a ribbon cable (accessory) as (Figure 1).
If the distance between expansion units is far as (Figure 2), you can connect the cable at the soldering pad.
To use a soldering pad, remove the protection cover which only expansion units have.



(Figure 1)



(Figure 2)

※You can use both the 7-segment display method model and the 16-segment display method model mixed.

▣ Input Data Chart [Serial, Parallel, RS485 Comm.(Slave Mode) Input Model]

When selecting 5-bit data input for the serial input model, or 4-bit data input for the parallel input model, it displays only shaded part (0 to 9, A to F). If there is no input data after supplying the power, the basic unit differently displays by each input method; serial input model displays 'S', parallel input model displays 'P', and RS485 communication input model displays 'T'.

※In case of positive logic (PNP)

DS Series (7-segment)				DA Series (16-segment)				DU Series (unit)	Hi 2-bit / Low 4-bit			
D5 L, D4 L	D5 L, D4 H	D5 H, D4 L	D5 H, D4 H	D5 L, D4 L	D5 L, D4 H	D5 H, D4 L	D5 H, D4 H	D5 X, D4 X	D3	D2	D1	D0
0	G	W	]	0	G	W	]	No unit	L	L	L	L
1	H	X		1	H	X	[	Upper-Lower OFF	L	L	L	H
2	I	Y		2	I	Y	+	Upper-Lower ON	L	L	H	L
3	J	Z		3	J	Z	:	Upper ON	L	L	H	H
4	K	-1	°	4	K	-1	;	Lower ON	L	H	L	L
5	L	(	₩	5	L	(	<	Upper-Lower flashes	L	H	L	H
6	M	)	H (h)	6	M	)	>	Upper flashes	L	H	H	L
7	N	'	I	7	N	'	|	Lower flashes	L	H	H	H
8	O	"	J	8	O	"	!	※1	H	L	L	L
9	P	^	K	9	P	^	@		H	L	L	H
A	Q	.	K	A	Q	.	#		H	L	H	L
B	R	/	N	B	R	/	$		H	L	H	H
C	S	?	O	C	S	?	%		H	H	L	L
D	T	-	T	D	T	-	&		H	H	L	H
E	U	_	X	E	U	_	★		H	H	H	L
F	V	=	Blank	F	V	=	Blank		H	H	H	H

※1: If this data is not for the unit-display unit, it maintains former state.
※The unit-display unit does not use the upper bit over D4. (Don't care: X)
※Unit-display unit function

Upper/Lower selection, ON/Flash function → 123 ℃ %

ON/Flash function → 123.45 sec

※It is only available to use the unit-display unit with serial 5-bit, parallel 4/6-bit Dynamic 1 input when connecting the unit display unit and turning ON it. (do not input data to the unit-display unit.)

※To display two data using zero blanking function

① Using the unit-display unit: If sending unit data signal after data 1 (00123), it applies zero blanking function when displaying data 2 (04567).

123% 4567

② Not using the unit-display unit: If sending no-unit data (HXXXLLLL) after data 1 (00123), it applies zero blanking function to display data 2. In this case, transmitted data should be added one to the display digits. (no-unit data is added)

123 4567

When do not using unit-display unit, no-unit data is used for data division. If it does not send no-unit data (HXXXLLLL), it displays data 1 (00123) and data 2 (04567) as one data. Zero-blanking function is applied to data 1 only.

12304567

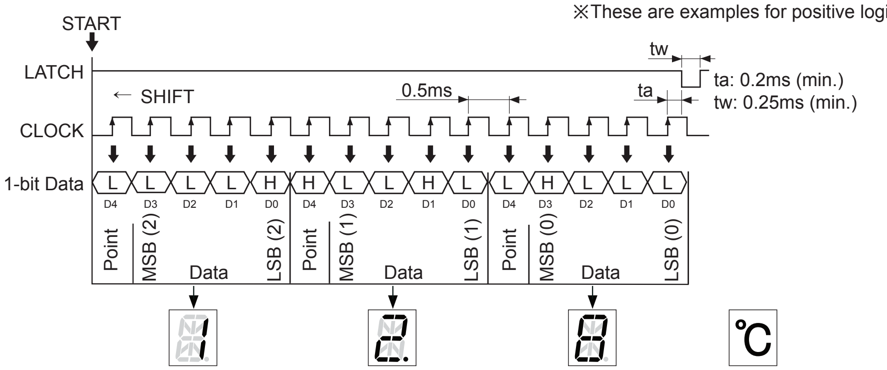
※Do not transfer unit data to basic/expansion unit. Unit bit (D7) of unit data is only for unit. If transferring unit data to basic/expansion unit, unit bit (D7) displays the ignored data value. In this case, Zero blanking does not operate normally.

▣ Data Input Method [Serial, Parallel, RS485 Comm. Input Model]

◎ Serial input model

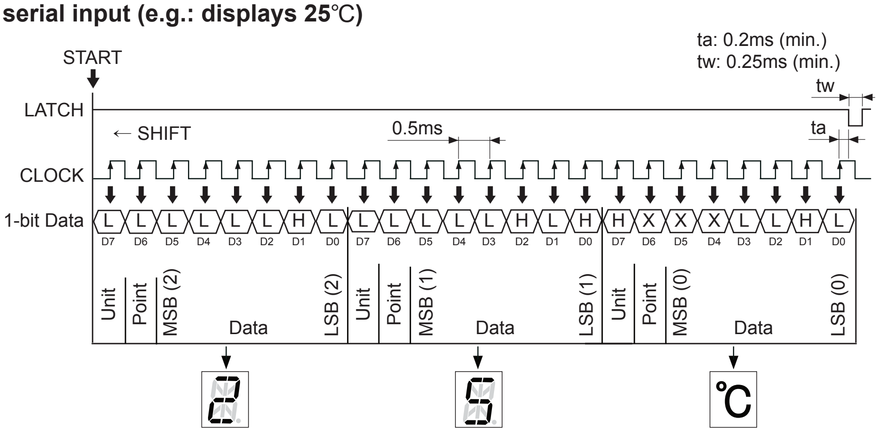
● 5-bit serial input (e.g.: displays 12.8℃)

※Clock: Max. 2kHz
※These are examples for positive logic (PNP).



⚠ **Caution: The unit-display unit is available only for turning ON. Do not input data to the unit-display unit.**

● 8-bit serial input (e.g.: displays 25℃)

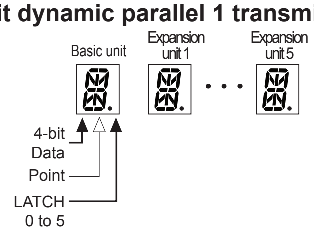


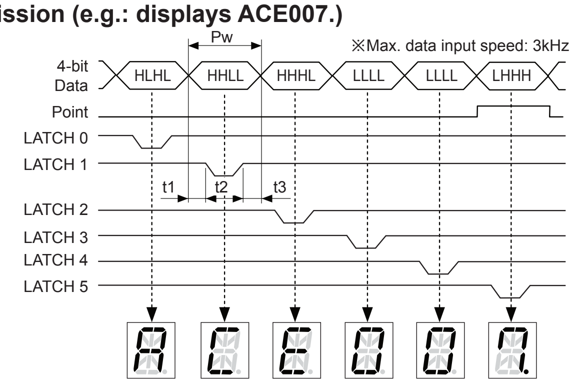
◎ Parallel input model

Example of unit organization by data input

Dynamic Parallel 1	4-bit	Connectable 1 basic unit and 5 expansion units (6-digit) E.g.) 10digit organization: (1 basic unit + 5 expansion units)+ (1 basic unit + 3 expansion units)
	6-bit	Connectable 1 basic unit and 3 expansion units (4-digit) E.g.) 10digit organization: (1 basic unit + 3 expansion units)×2+ (1 basic unit + 1 expansion units)
Dynamic Parallel 2	6-bit	Connectable 1 basic unit and 23 expansion units (24-digit) E.g.) 30digit organization: (1 basic unit + 23 expansion units)+ (1 basic unit + 5 expansion units)

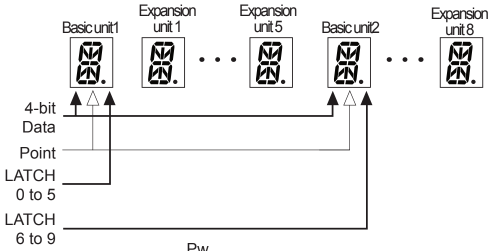
● 4-bit dynamic parallel 1 transmission (e.g.: displays ACE007.)



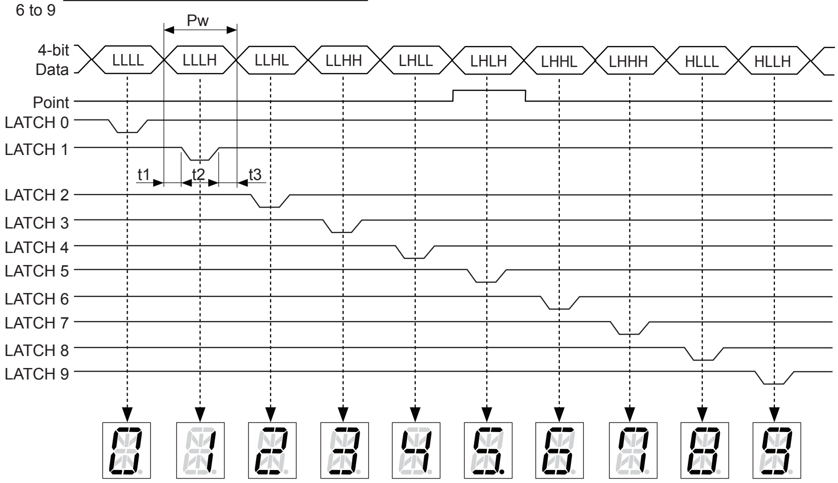


※Pw=t1+t2+t3
Pw: 0.33ms (min.)
t1: 0.05ms (min.) → Data LATCH
t2: 0.23ms (min.) → Data move
t3: 0.05ms (min.) → Data LATCH

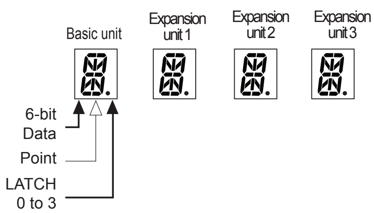
● 4-bit dynamic parallel 1 transmission (e.g.: displays 012345.6789)



※Pw=t1+t2+t3
Pw: 0.33ms (min.)
t1: 0.05ms (min.) → Data LATCH
t2: 0.23ms (min.) → Data move
t3: 0.05ms (min.) → Data LATCH
※Max. data input speed: 3kHz

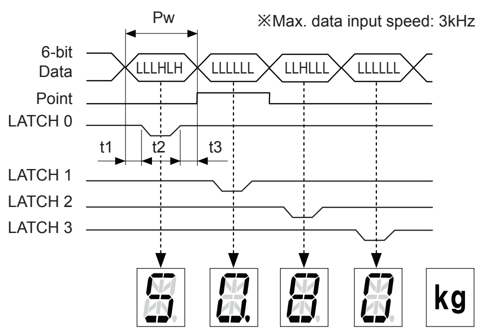


● 6-bit dynamic parallel 1 transmission (e.g.: displays 50.80kg)



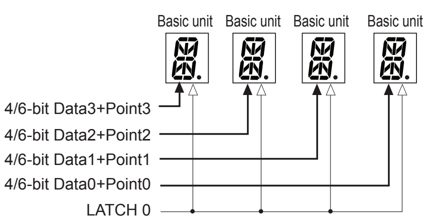
※Pw=t1+t2+t3
Pw: 0.33ms (min.)
t1: 0.05ms (min.) → Data LATCH
t2: 0.23ms (min.) → Data move
t3: 0.05ms (min.) → Data LATCH

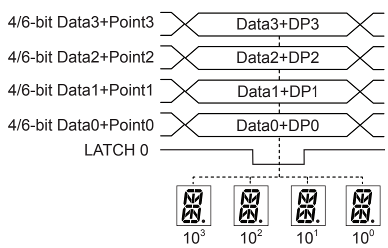
※Max. data input speed: 3kHz



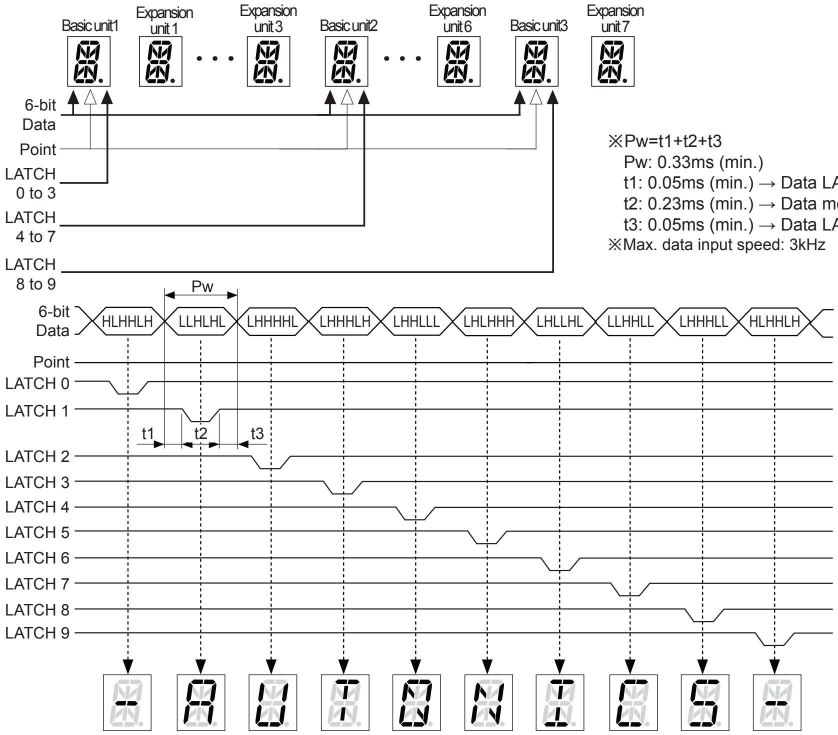
⚠**Caution: The unit-display unit is available only for turning ON. Do not input data to the unit-display unit.**

※General parallel input is only for basic unit (dynamic Parallel 1).



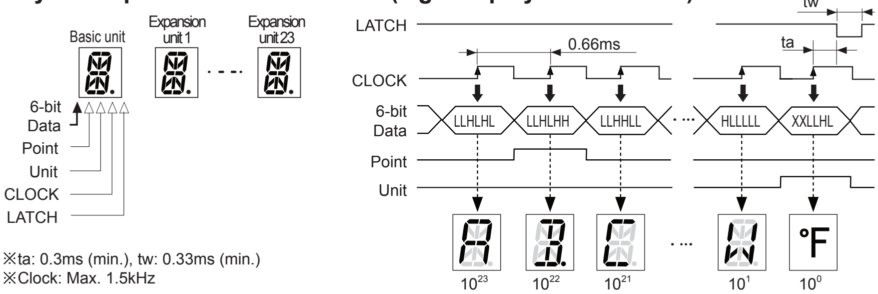


- **6-bit dynamic parallel 1 transmission (e.g.: displays-AUTONICS-)**



※Pw=t1+t2+t3
Pw: 0.33ms (min.)
t1: 0.05ms (min.) → Data LATCH
t2: 0.23ms (min.) → Data move
t3: 0.05ms (min.) → Data LATCH
※Max. data input speed: 3kHz

- **6-bit dynamic parallel 2 transmission (e.g.: displays AB.C... W˚F)**

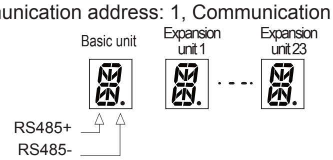


※ta: 0.3ms (min.), tw: 0.33ms (min.)
※Clock: Max. 1.5kHz

◎ RS485 comm. (slave mode) input model

• E.g.: Displays 10H38M (10 hour 38 min)

Communication address: 1, Communication speed: 9600bps, Data-bit: 8-bit, Start/Stop-bit: 1-bit, Parity-bit: None

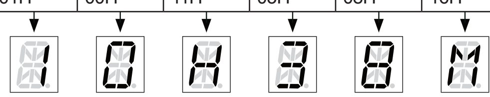


• Query (master)

Slave address	Function	Starting address		No. of Register	
		High	Low	High	Low
01H	10H	00H	00H	00H	04H

Byte Counter (No. of data byte)	Data (400001)		Data (400002)		Data (400003)		Data (400004)		Error check (CRC16)	
	High	Low	High	Low	High	Low	High	Low	Low	High
08H	00H	01H	01H	00H	11H	03H	08H	16H	D4H	59H

Zero Blanking ON



• Response (slave)

Slave Address	Function	Starting Address		No. of Register		Error Check (CRC16)	
		High	Low	High	Low	Low	High
01H	10H	00H	00H	00H	04H	C1H	CAH

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

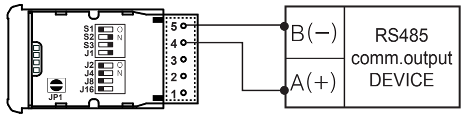
◎ RS485 comm. (master mode) input model

Connect the unit and the specified Autonics device which supports Master mode for displaying current value without PC/PLC.
The specified Autonics devices are connected by auto or manual setting.

● Supported Autonics device for RS485 Master mode

Only for RS485 communication output model of the below series.

Item	Series
Temperature controller/sensor	TK, TX, TM2, TM4, THD
Counter/Timer	CT4, CT6
Pulse meter	MP5
Panel meter	MT4



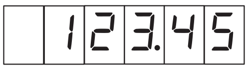
※Connect input terminal 4(A+) and 5(B-) of display unit to RS485 communication output terminal of the dedicated device.

▣ Examples Of Display

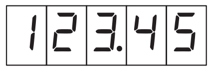
◎ RS485 communication input model

In case of manual connection setting, the highest digit may be not used.

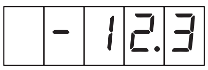
1) CT6 Series (using 6-digit)



2) CT6 Series (using 5-digit)

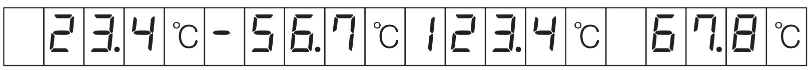


3) MP5 Series (using 5-digit)

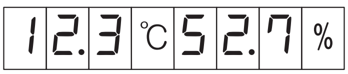


4) MP5 Series (using 4-digit)

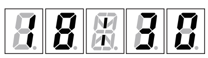
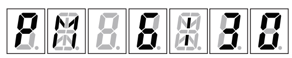
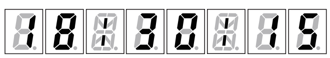
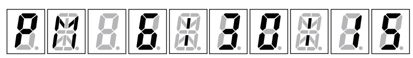
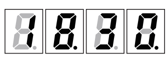
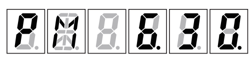
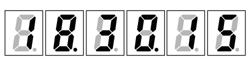
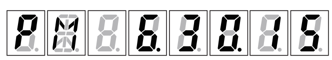
5) TM4 Series (4CH connection, using unit-display unit)



6) THD Series (using unit-display unit)



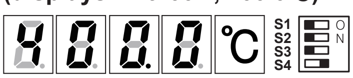
◎ RS485 synchronous comm. type for time display model (delimiter for hour/min/sec)

Delimiter for hour/min/sec		Displaying 24-hour	Displaying 12-hour[※1]
Sign [:] (using 16 seg. expansion unit)	Hour/Min		
	Hour/Min/Sec		
Period [.] (using 7 seg. expansion unit)	Hour/Min		
	Hour/Min/Sec		

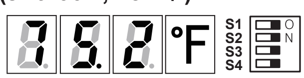
※Use 16-segment expansion unit for 'M' character for AM/PM when displaying 12 hours time.

◎ Pt temp. sensor input model

1) Temperature (℃) display (displays DPt100Ω, 400.0℃)



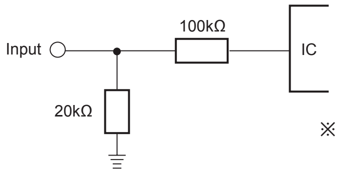
2) Temperature (℉) display (JPt100Ω, 75.2℉)



※Pt temp. sensor input model are applied Zero Blanking function automatically.

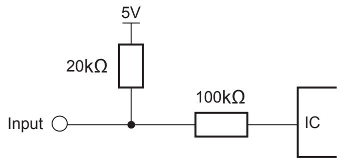
■ Input Circuit

● Positive logic (PNP) input



※Input level ┌ High: 4.5-24VDC
└ Low: 0-1.2VDC

● Negative logic (NPN) input



■ World Time Zone [RS485 Synchronous Comm. Type For Time Display Model]

※Select the desired world time zone by function set switches (J1 to J16).
※If communication is not connected when supplying the power, the unit displays the set local time zone.

No.	Switch OFF(■): 0 ON (■): 1					Time Zone	Location
	J1	J2	J4	J8	J16		
0	0	0	0	0	0	UTC-12:00	International Date Line West
1	0	0	0	0	1	UTC-11:00	Coordinated Universal Time -11
2	0	0	0	1	0	UTC-10:00	Hawaii
3	0	0	0	1	1	UTC-09:00	Alaska
4	0	0	1	0	0	UTC-08:00	Pacific Time(US&Canada), Baja California
5	0	0	1	0	1	UTC-07:00	Mountain Time(US&Canada), Arizona, Chihuahua, La Paz, Mazatlan
6	0	0	1	1	0	UTC-06:00	Guadalajara, Mexico City, Monterrey, Saskatchewan, Central America, Central Time(US&Canada)
7	0	0	1	1	1	UTC-05:00	Eastern Time(US&Canada), Indiana(East), Bogota, Lima, Quito, Rio Branco, Chetumal
8	0	1	0	0	0	UTC-04:00	Atlantic Time(Canada), Asuncion, Georgetown, La Paz, Manaus, San Juan, Cuiaba
9	0	1	0	0	1	UTC-03:30	Newfoundland
10	0	1	0	1	0	UTC-03:00	Greenland, Montevideo, Buenos Aires, Brasilia, Santiago, Salvador, Cayenne, Fortaleza
11	0	1	0	1	1	UTC-02:00	Coordinated Universal Time -02
12	0	1	1	0	0	UTC-01:00	Cabo Verde Is., Azores
13	0	1	1	0	1	UTC 00:00	Coordinated Universal Time, Dublin, Edinburgh, Lisbon, London, Monrovia, Reykjavik, Casablanca
14	0	1	1	1	0	UTC+01:00	Belgrade, Bratislava, Budapest, Ljubljana, Prague, Brussels, Copenhagen, Madrid, Paris, Windhoek, Sarajevo, Skopje, Warsaw, Zagreb, West Central Africa, Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
15	0	1	1	1	1	UTC+02:00	Damascus, E.Europe, Beirut, Athens, Bucharest, Amman, Jerusalem, Istanbul, Cairo, Kaliningrad, Tripoli, Harare, Pretoria, Helsinki, Kyiv, Riga, Sofia, Tallinn, Vilnius
16	1	0	0	0	0	UTC+03:00	Nairobi, Moscow, St. Petersburg, Volgograd, Minsk, Baghdad, Kuwait, Riyadh
17	1	0	0	0	1	UTC+03:30	Tehran
18	1	0	0	1	0	UTC+04:00	Baku, Abu Dhabi, Muscat, Yerevan, Izhevsk, Samara, Tbilisi, Port Louis
19	1	0	0	1	1	UTC+04:30	Kabul
20	1	0	1	0	0	UTC+05:00	Ashgabat, Tashkent, Ekaterinburg, Islamabad, Karachi
21	1	0	1	0	1	UTC+05:30	Sri Jayawardenepura, Chennai, Kolkata, Mumbai, New Delhi
22	1	0	1	1	0	UTC+05:45	Kathmandu
23	1	0	1	1	1	UTC+06:00	Novosibirsk, Dhaka, Astana
24	1	1	0	0	0	UTC+06:30	Yangon(Rangoon)
25	1	1	0	0	1	UTC+07:00	Bangkok, Hanoi, Jakarta, Krasnoyarsk
26	1	1	0	1	0	UTC+08:00	Beijing, Chongqing, Hong Kong, Urumqi, Ulaanbaatar, Irkutsk, Kuala Lumpur, Singapore, Taipei, Perth
27	1	1	0	1	1	UTC+09:00	Seoul, Yakutsk, Osaka, Sapporo, Tokyo
28	1	1	1	0	0	UTC+09:30	Darwin, Adelaide
29	1	1	1	0	1	UTC+10:00	Guam, Port Moresby, Magadan, Brisbane, Vladivostok, Canberra, Melbourne, Sydney, Hobart
30	1	1	1	1	0	UTC+11:00	Solomon Is., New Caledonia, Chokurdakh
31	1	1	1	1	1	UTC+12:00	Coordinated Universal Time +12, Anadyr, Petropavlovsk-Kamchatsky, Auckland, Wellington, Fiji

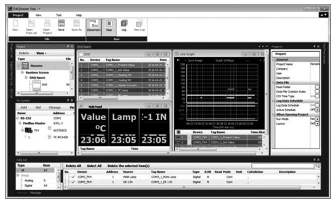
■ Comprehensive Device Management Program (DAQMaster)

- DAQMaster is comprehensive device management program for convenient management of parameters and multiple device data monitoring.
- Visit our website (www.autonics.com) to download user manual and comprehensive device management program.

< Computer specification for using software >

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS-232 serial port (9-pin), USB port

< DAQMaster screen >



■ Device Synchronized Time Transfer Program (World Clock)

- World Clock is time synchronization program for RS485 synchronous comm. type DS□-C Series.
- Visit our website (www.autonics.com) to download user manual and device synchronized time transfer program.

< Computer specification for using software >

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS-232 serial port (9-pin), USB port

< World Clock screen >

■ RS485 Communication Specifications

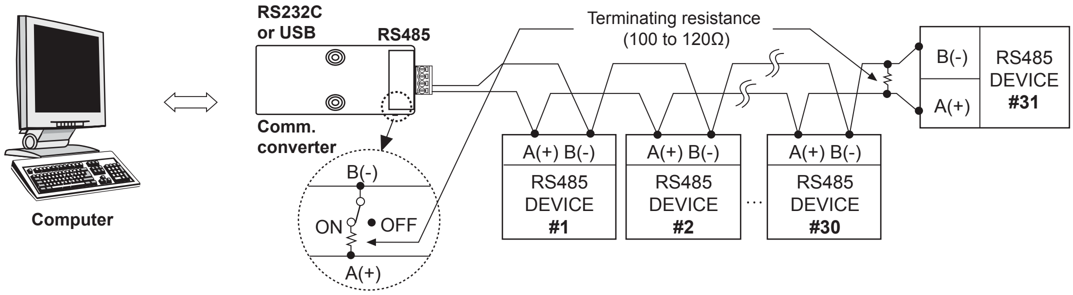
※Only for RS485 communication input/output model.

Item	RS485 comm. input model (D□□-□T)		RS485 synchronous comm. type for time display model (DS□-□C)	RS485 comm. output model (DS□-RRT)
	Slave mode	Master mode		
Comm. protocol	Modbus RTU with 16-bit CRC			
Connection type	RS485			
Application standard	Compliance with EIA RS485			
Max. connection	31 units (address: 01 to 32)	1 unit (address: 01(fixed))	1 unit (address: 226 (fixed))	8 units (address: 01 to 08)
Comm. type	Two-wire half duplex			
Comm. distance	Max. 800m			
Comm. speed (bps)	4800, 9600, 19200, 38400		4800, 9600, 19200, 38400	9600, 38400
Comm. response time	5ms, 20ms	—	—	5ms (fixed)
Start bit	1-bit (fixed)			
Data bit	8-bit (fixed)			
Parity bit	None (fixed)			
Stop bit	1-bit (fixed)			

▣ Communication Setting

◎ Application of system organization

※It is only for the RS485 communication input/output model.



※It is recommended to use Autonics communication converter; SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately). Please use twisted pair wire for RS485 communication.

◎ Modbus Address Mapping

● Data format

Digit 1, 3, 5, ...23 data								Digit 2, 4, 6, ...24 data							
D7	D6	D5	D4	D3	D2	D1	D0	D7	D6	D5	D4	D3	D2	D1	D0
Unit	DOT	Data													

※DOT, unit are displayed at 'H'.

● Product information

No. (Address)	Function	R/W	Parameter	Description	Factory default		Note	
					D□ □-□T	DS□-RRT	D□ □-□T	DS□-RRT
300001 to 300100	04	R	Reserved					
300101(0064)	04	R	—	Product number H	—		—	
300102(0065)	04	R	—	Product number L	—		—	
300103(0066)	04	R	—	Hardware version	—		—	
300104(0067)	04	R	—	Software version	—		—	
300105(0068)	04	R	—	Model name 1	'DS'		DS(A)xx-xT	DSxx-RRT
300106(0069)	04	R	—	Model name 2	'(A'	'xx'		
300107(006A)	04	R	—	Model name 3	')x'	'-R'		
300108(006B)	04	R	—	Model name 4	'x-'	'RT'		
300109(006C)	04	R	—	Model name 5	'xT'	0		
300110(006D) to 300114 (0071)	04	R	—	Model name 6 to 10	0		—	

※The below Series are automatically reconized RS485 Master mode.

No. (Address)	Function	R/W	Parameter	Description	Factory default							Note
					CT Series	MP5 Series	MT4 Series	TK Series	TX Series	TM Series	THD Series	
300105(0068)	04	R	—	Model name 1	'CT'	'MP'	'MT'	'TK'	'TX'	'TM'	'TH'	Series name
300106(0069)	04	R	—	Model name 2	'6M'	'5W'	'4W'	'4M'	'4'	'2'	'D'	
300107(006A)	04	R	—	Model name 3	'-2'	'-4'	'DV'	'14'	'S'	' '	' '	
300108(006B)	04	R	—	Model name 4	'PT'	'1X'	'-8'	'RR'	'14'	' '	' '	

● Monitoring data

※Supports only Pt temp. input+RS485 comm. output model (DS□-RRT).

No. (Address)	Function	R/W	Parameter	Description	Factory default	Note
301001(03E8)	04	R	—	℃ Temp. (-500 to 4000)	—	×10 data
301002(03E9)	04	R	—	℉ Temp. (-580 to 7520)	—	×10 data
301003 to 301100	04	R	—	Reserved		

● Display data (RS485 Slave mode)

※Supports only when RS485 comm. input model (D□□-□T) uses Slave mode.

No. (Address)	Function	R/W	Parameter	Parameter name	Description	Setting range	Factory default
400001(0000)	03/06/16	R/W	—	Zero Blanking	Zero Blanking ON/OFF set	0: OFF, 1 :ON	0
400002(0001)	03/06/16	R/W	—	Digit 1, 2	1, 2 display data	Refer to Input data chart	0
400003(0002)	03/06/16	R/W	—	Digit 3, 4	3, 4 display data		0
400004(0003)	03/06/16	R/W	—	Digit 5, 6	5, 6 display data		0
400005(0004)	03/06/16	R/W	—	Digit 7, 8	7, 8 display data		0
400006(0005)	03/06/16	R/W	—	Digit 9, 10	9, 10 display data		0
400007(0006)	03/06/16	R/W	—	Digit 11, 12	11, 12 display data		0
400008(0007)	03/06/16	R/W	—	Digit 13, 14	13, 14 display data		0
400009(0008)	03/06/16	R/W	—	Digit 15, 16	15, 16 display data		0
4000010(0009)	03/06/16	R/W	—	Digit 17, 18	17, 18 display data		0
4000011(000A)	03/06/16	R/W	—	Digit 19, 20	19, 20 display data		0
4000012(000B)	03/06/16	R/W	—	Digit 21, 22	21, 22 display data		0
4000013(000C)	03/06/16	R/W	—	Digit 23, 24	23, 24 display data		0
4000014 to 4000050	03/06/16	R/W	Reserved				

● Display data of RS485 Master mode supporting device

When using RS485 comm. input model (D□□-□T) as Master mode, it supports only for the Autonics device of supporting RS485 Master mode.

※CT Series

No. (Address)	Function	R/W	Parameter	Description	Setting range	Note
301004(03EB)	04	R	—	Current value	Counter: 6-digit -99999 to 99999 / 4-digit -999 to 9999 Timer: within time range	—
301005(03EC)	04	R	—			
301006(03ED)	04	R	—	Decimal point	Counter: Decimal Point Timer: Timer Time_Range	—

※MP5 Series

No. (Address)	Function	R/W	Parameter	Description	Setting range	Note
301002(03E9)	04	R	—	Current value	-19999 to 99999: Normal display >99999: Flashes 99999 <-19999: Flashes 19999	—
301003(03EA)	04	R	—			
301004(03EB)	04	R	—	Decimal point	0: 00000, 1: 0000.0, 2: 000.00, 3: 00.000, 4: 0.0000	—

※MT4 Series

No. (Address)	Function	R/W	Parameter	Description	Setting range		Note
300001(0000)	04	R	—	Current value	StAd: -5 to 110% SCAL: -1999 to 9999	30000: HHHH, -30000: LLLL, 30001: d.-HH, -30001: d.-LL, 30002: F-HH	—
300002(0001)	04	R	—	Decimal point	In case of StAd, 0: 0000, 1: 000.0 2: 00.00, 3: 0.000	In case of SCAL, 0x0100: 0000, 0x0101: 000.0, 0x0102: 00.00, 0x0103: 0.000	

※TK/TX Series

No. (Address)	Function	R/W	Parameter	Description	Setting range	Note
301001(03E8)	04	R	—	Current value	-1999 to 9999	—
301002(03E9)	04	R	—	Decimal point	0: 0000, 1: 000.0, 2: 00.00, 3: 0.000	

※TM Series

No. (Address)	Function	R/W	Parameter	Description	Setting range	Note
301001(03E8)	04	R	—	CH1 Current value	-1999 to 9999	—
301002(03E9)	04	R	—	CH1 Decimal point	0: 0000, 1: 000.0	
301007(03EE)	04	R	—	CH2 Current value	-1999 to 9999	
301008(03EF)	04	R	—	CH2 Decimal point	0: 0000, 1: 000.0	
301013(03F4)	04	R	—	CH3 Current value	-1999 to 9999	
301014(03F5)	04	R	—	CH3 Decimal point	0: 0000, 1: 000.0	
301019(03FA)	04	R	—	CH4 Current value	-1999 to 9999	
301020(03FB)	04	R	—	CH4 Decimal point	0: 0000, 1: 000.0	

※THD Series

No. (Address)	Function	R/W	Parameter	Description	Setting range	Note
300001(0000)	04	R	—	Temperature value	-1990 to 6000	×100 data
300002(0001)	04	R	—	Humidity value	0 to 9990	×100 data

▣ Communication Setting

◎ Modbus Address Mapping

When using RS485 comm. input model (D□□-□T) as Master mode, it supports only for the Autonics devices of supporting RS485 Master mode and **not using the upper digit.**

※CT6 Series (using 5-digit)

No. (Address)	Function	R/W	Parameter	Description	Setting range	Note
301004(03EB)	04	R	—	Current value	5 digit: -19999 to 99999	—
301005(03EC)	04	R	—			
301006(03ED)	04	R	—	Decimal point	Decimal point	—

※MP5 Series (using 4-digit)

No. (Address)	Function	R/W	Parameter	Description	Setting range	Note
301001(03E8)	04	R	—	Current value	4 digit: -1999 to 9999	—
301002(03E9)	04	R	—			
301003(03EA)	04	R	—	Decimal point	0: 0000, 1: 000.0, 2: 00.00, 3: 0.000	—

※MT4 Series (using 3-digit)

No. (Address)	Function	R/W	Parameter	Description	Setting range	Note
300001(0000)	04	R	—	Current value	3 digit: -199 to 999	—
300002(0001)	04	R	—	Decimal point	0: 000, 1: 00.0, 2: 0.00	

※TK/TX Series (using 3-digit)

No. (Address)	Function	R/W	Parameter	Description	Setting range	Note
301001(03E8)	04	R	—	Current value	3 digit: -199 to 999	—
301002(03E9)	04	R	—	Decimal point	0: 000, 1: 00.0, 2: 0.00	

● Time synchronized data

※Supports only when synchronous comm. type for time display model (DS□-□C).

<table>
<tr><th>No. (Address)</th><th>Function</th><th>R/W</th><th>Parameter</th><th>Description</th><th>Setting range</th><th>Note</th></tr>
<tr><td>400001(0000)</td><td>0x90</td><td>W</td><td>—</td><td rowspan="2">UTC universal time</td><td>Hour (high byte), Min (low byte)</td><td rowspan="10">—</td></tr>
<tr><td>400002(0001)</td><td>0x90</td><td>W</td><td>—</td><td>Sec (high byte), 1/100 sec (low byte)</td></tr>
<tr><td>400003(0002)</td><td>0x90</td><td>W</td><td>—</td><td rowspan="8">Summer time</td><td rowspan="8">· Configuration: 1-byte (summer time setting)
+1-byte (summer time setting)
· Summer time setting: local code (5-bit)+summer time (3-bit)
<table><tr><td>Summer time</td><td>+30 min</td><td>+1 hour</td><td>-1 hour</td><td>-30 min</td></tr><tr><td>3-bit</td><td>001 (1)</td><td>010 (2)</td><td>011 (3)</td><td>100 (4)</td></tr></table>· Available up to max. 16 locals
· For displaying summer time, transfer the local data and summer time data also.
E.g.) Seoul +1 hour (0b01001010)</td></tr>
<tr><td>400004(0003)</td><td>0x90</td><td>W</td><td>—</td></tr>
<tr><td>400005(0004)</td><td>0x90</td><td>W</td><td>—</td></tr>
<tr><td>400006(0005)</td><td>0x90</td><td>W</td><td>—</td></tr>
<tr><td>400007(0006)</td><td>0x90</td><td>W</td><td>—</td></tr>
<tr><td>400008(0007)</td><td>0x90</td><td>W</td><td>—</td></tr>
<tr><td>400009(0008)</td><td>0x90</td><td>W</td><td>—</td></tr>
<tr><td>400010(0009)</td><td>0x90</td><td>W</td><td>—</td></tr>
</table>

▣ Definition Of Communication Command And Block

- Displays format of Query and Response.

1) Read Coil Status (Func 01H), Read Input Status (Func 02H)

● Query (Server)

Address	Function	Start address		No. of data		CRC-16	
		HI	LO	HI	LO	LO	HI
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

● Response (Slave)

Address	Function	No. of data byte	Data	Data	Data	CRC-16	
						LO	HI
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

2) Read Holding Registers (Func 03H), Read Input Registers (Func 04H)

● Query (Server)

Address	Function	Start address		No. of data		CRC-16	
		HI	LO	HI	LO	LO	HI
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

● Response (Slave)

Address	Function	No. of data byte	Data		Data		Data		CRC-16	
			HI	LO	HI	LO	HI	LO	LO	HI
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

3) Force Single Coil (Func 05H)

● Query (Server)

Address	Function	Coil address		Force Data		CRC-16	
		HI	LO	HI	LO	LO	HI
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

●Response (Slave)

Address	Function	Coil address		Force Data		CRC-16	
		HI	LO	HI	LO	LO	HI
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

4) Preset Single Register (Func 06H)

● Query (Server)

Address	Function	Register address		Preset Data		CRC-16	
		HI	LO	HI	LO	LO	HI
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

● Response (Slave)

Address	Function	Register address		Preset Data		CRC-16	
		HI	LO	HI	LO	LO	HI
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

5) Preset Multiple Registers (Func 90H): Broadcast

● Query (Server)

Address	Function	Start address		No. of Reg		No. of data byte	Data		Data		CRC-16	
		HI	LO	HI	LO		HI	LO	HI	LO	LO	HI
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

● Response (Slave): No response

6) Preset Multiple Registers (Func 10H)

● Query (Server)

Address	Function	Start address		No. of Reg		No. of data byte	Data		Data		CRC-16	
		HI	LO	HI	LO		HI	LO	HI	LO	LO	HI
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

● Response (Slave)

Address	Function	Start address		Register Data		CRC-16	
		HI	LO	HI	LO	LO	HI
1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

Communication Output

◎ Example of communication: displays "DA16" 4-digit

● Communication setting

Communication address: 1 (J1-ON, J2-OFF, J3-OFF, J4-OFF, J8-OFF, J16-OFF)
Communication speed: 9600bps (S2-ON, S3-OFF)
Data bit: 8-bit (fixed)
Start/Stop bit: 1-bit (fixed)
Parity bit: None (fixed)

● Query

Address	Function	Start address		No. of data		No. of byte	Data (4000001)		Data (4000002)		Data (4000003)		Error Check (CRC16)	
		HI	LO	HI	LO		LO	HI	LO	HI	LO	HI	LO	HI
01	10	00	00	00	03	06	00	01	0D	0A	01	06	78	7C

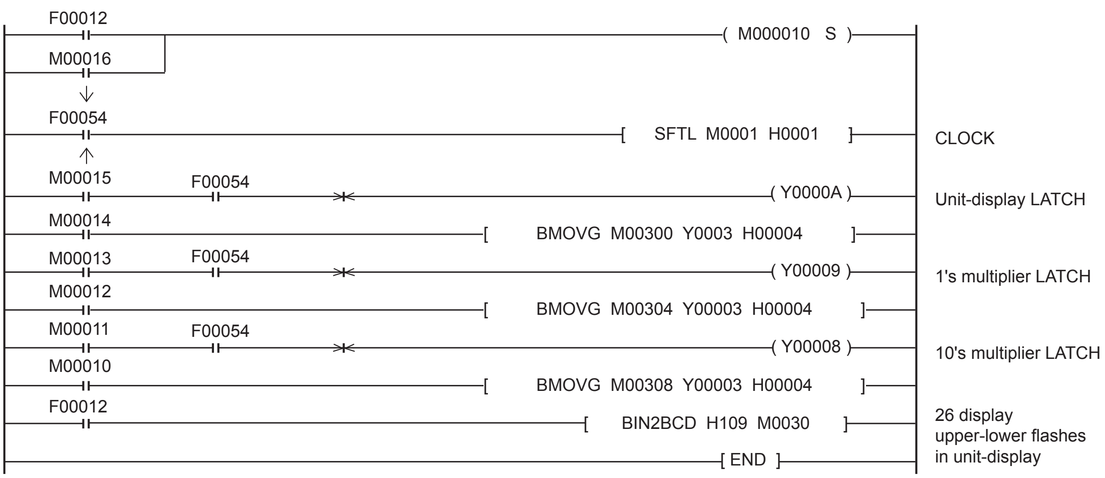
● Response

Address	Function	Start address		No. of data		CRC16	
		HI	LO	HI	LO	LO	HI
01	10	00	00	00	03	80	08

PLC Example Program

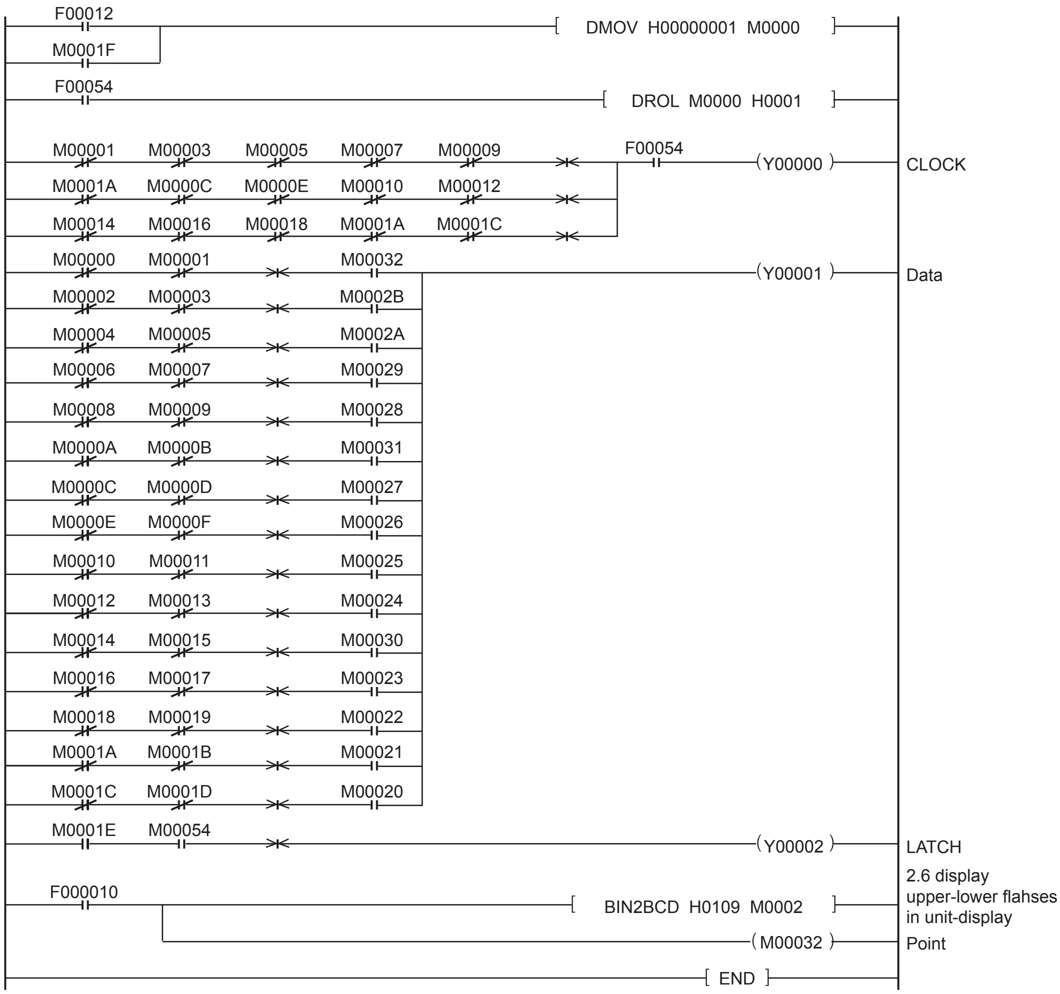
◎ Parallel dynamic1 (4-bit) input method

① Display Unit DS/DA22-RP: 1, Display Unit DS/DA22-RE: 1
② Data input method: Parallel Dynamic 1 (4-bit)
③ Display result: "26℃" 3-digit display (flashes ℃)
④ PLC: Autonics LP Series



◎ Serial (5-bit) input method

① Display Unit DS/DA22-RS:1, Display Unit DS/DA22-RE: 1
② Data input method: Serial (5-bit)
③ Display result: "26℃" Display (flashes ℃)
④ PLC: Autonics, LP Series



▣ Cautions During Use

1. This unit must be mounted on the panel.
2. This is non-insulated product. Use insulated power for power supply.
3. For using Pt temp. sensor input model, you must wire 3-wire. To extend the wire, the thickness and length of 3 wires should be same. If the resistance are different, temperature error occurs.
4. For Pt temp. sensor input, if input value is out of the range, each display unit displays Error message. When it is under min. input value, a unit displays 'L '. When it is over max. input value, a unit displays 'H'.
5. For Pt temp. sensor input model, if Pt temp. sensor is not connected, it displays 'oP (using 2 units)' or 'oPn (using 3 units)'.
6. Input signal line
   ① Shorten the cable distance between the external device and this product.
   ② Use shield cable when input wiring is long.
   ③ Wire the input signal line separately from the power line.
7. Dielectric or insulation resistance test when this unit is installed in the control panel.
   ① Separate the unit from the control panel.
   ② Short circuit all terminals of the unit.
8. Do not use this unit at below places.
   ① Place where there are severe vibration or impact.
   ② Place where strong alkalis or acids are used.
   ③ Place where there are direct ray of the sun
   ④ Place where strong magnetic field or electric noise are generated
9. This product may be used in the following environments.
   ① Indoors
   ② Max. altitude: 2,000m
   ③ Pollution Degree 2
   ④ Installation Category I

7-Segment Display Unit With High Bright Characters (D1SC-N : W32×H57mm, D1SA Series: W11×H22mm)

■ Features

- Selectable decimal (0 to 9) or hexadecimal (0 to 9, A to F) indication code
  Selectable positive or negative input logic
  Selectable serial or parallel data input method
- 7-segment, red/green display (D1SA Series)
- Power source: 12-24VDC
- Wide range on signal input voltage level
  (Low: Max. 0-1.2VDC, High: 4.5-24VDC)
- Easy multi-stages connection (D1SA Series)
- Zero Blanking function

D1SC-N

■ Applications

- Display for PLC
- Display for computer
- Various display

D1SA Sereis

⚠ Please read "Safety considerations" in operation manual before using.

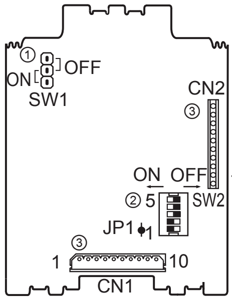
■ Specifications

Model		D1SC-N	D1SA-RN	D1SA-GN※1
Display method		7-segment LED display (red)		7-segment LED display (green)
Power supply		12-24VDC		
Allowable voltage range		90 to 110% of rated voltage		
Current consumption		Max. 70mA	Max. 35mA	
Character size		W32 × H57mm	W11×H22mm	
Display character※2		• Decimal number: 0 to 9, decimal point • Hexadecimal number: 0 to 9, A to F, decimal point		
Input		• Parallel: Parallel 4-bit data, latch, zero blanking, decimal point • Serial: Serial 4-bit or 5-bit data, clock, zero blanking, latch, decimal point (for 4-bit input)		
Input resistance		12kΩ	20kΩ	
Input level		High: 4.5-24VDC, Low: 0-1.2VDC		
Max. Clock		Max. 3kHz		
Output		Data output (serial input), zero blanking output		
Input logic		Selectable positive logic (PNP) or negative logic (NPN) (D1SC-N: by the function set switch, D1SA Series: by inner soldering)		
Noise immunity		±300V the square wave noise (pulse width: 1μs) by the noise simulator		
Environ-ment	Ambient temperature	0 to 60℃, storage: -10 to 85℃		
	Ambient humidity	35 to 85%RH		
Accessory		Housing[5264-10], Terminal[5263 (PBT)], Sub-PCB for multi-stage connection	Connector (CT-10S), Cap	
Unit weight		Approx. 100g	Approx. 22g (including right/left caps)	

※1: It is option.
※2: Only D1SC-N supports Minus displaying.
※Max. Clock is for 1:1 of duty ratio (ON, OFF ratio).
※Environment resistance is rated at no freezing or condensation.

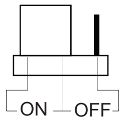
▣ Terminal Layout And Function

◎ D1SC-N



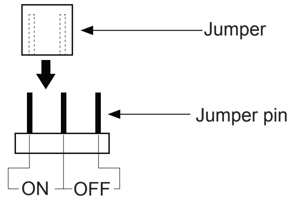
(rear terminal layout)

① Function set jumper (SW1)

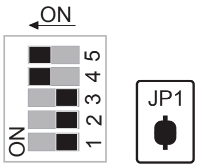


<factory default>

ON	OFF	Function
Pos. logic (NPN)	Neg. logic (PNP)	Input logic



② Function set switches (SW2, JP1)



<factory default>

Switch		ON	OFF	Function
SW2	1	Decimal	Hexadecimal	Characters
	2	Parallel	Serial	Input
	3	5-bit	4-bit	Serial input
	4	Used	Not used	Serial data output※1
	5	Used	Not used	Zero Blanking
JP1		7-segment	Minus	Minus

※1: For Serial input, set this as ON.
For Parallel input, set this as OFF.

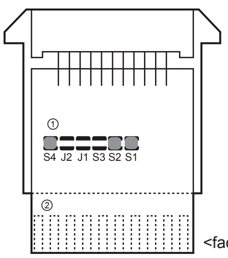
③ Input/Output terminals

Terminal \ Input	Parallel input		Serial input	
	Code	Function	Code	Function
1	V+	12-24VDC	VCC	12-24VDC
2	D0	Data input	N·C	Do not connect anything
3	D1		CK	Clock input
4	D2		DI	Data input
5	D3		DO	Data output
6	BI	Zero blanking input	BI	Zero blanking input
7	BO	Zero blanking output	BO	Zero blanking output
8	LE	Latch input	LE	Latch input
9	DP	Decimal point input	DP	Decimal point input
10	GND	0V	GND	0V

※Terminals of CN1 and CN2 is corresponding 1:1.

◎ D1SA Series

① Function set switches



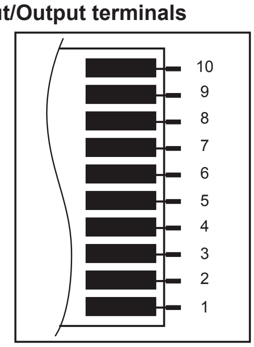
<factory default>

※ON = (short) OFF = (open)

Switch	ON	OFF	Function
S1	Decimal	Hexadecimal	Characters
S2	Parallel	Serial	Input
S3	5-bit	4-bit	Serial input
J1	Used	Not used	Serial data output※1
J2	Used	Not used	Zero Blanking
S4	Neg. logic (NPN)	Pos. logic (PNP)	Input logic

※1: For serial input, set this as ON. For Parallel input, set this as OFF.

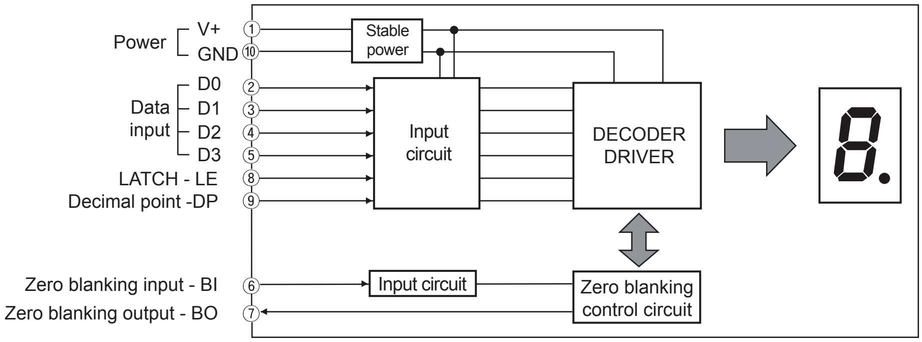
② Input/Output terminals



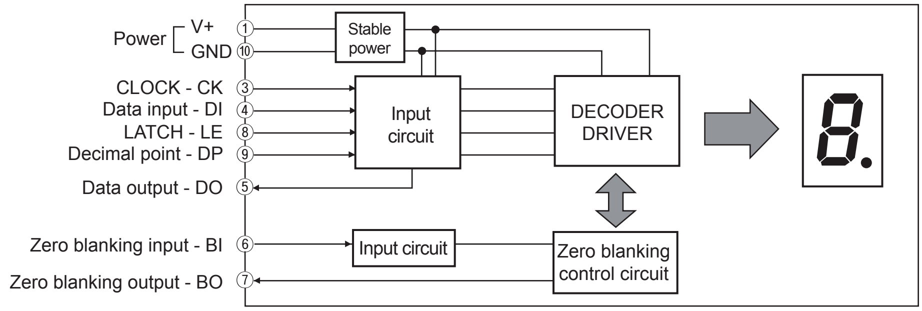
Terminal \ Input	Parallel input		Serial input	
	Code	Function	Code	Function
1	V+	12-24VDC	VCC	12-24VDC
2	D0	Data input	N·C	Do not connect anything
3	D1		CK	Clock input
4	D2		DI	Data input
5	D3		DO	Data output
6	BI	Zero Blanking input	BI	Zero Blanking input
7	BO	Zero Blanking output	BO	Zero Blanking output
8	LE	LATCH input	LE	LATCH input
9	DP	Point input	DP	Point input
10	GND	0V	GND	0V

■ Block Diagram

◎ Parallel input



◎ Serial input

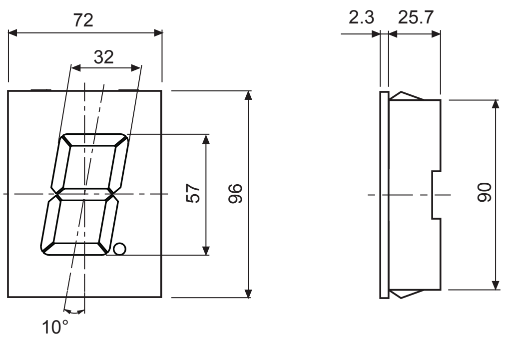


※The ② pin is not used.

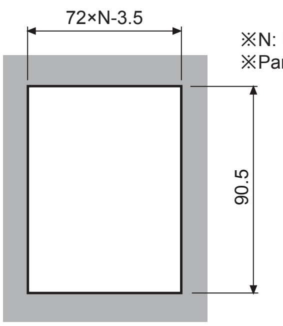
■ Dimensions

(unit: mm)

◎ D1SC-N

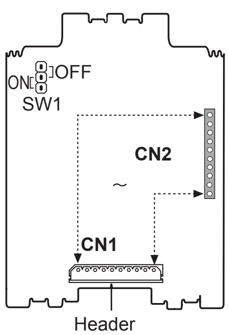


● **Panel cut-out**



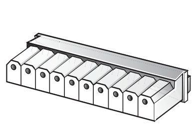
※N: Number of units
※Panel thickness: 2 to 4mm

◎ Accessories

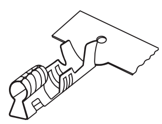


■ **CN1: Connector specification**

- Connector maker: Korea Morex
  - Housing: 5264-10
  - Header: 5264-10A (straight)
  - Terminal: 5263 (PBT)
- Using cable specification
  - AWG28 to 22 (cable diameter: Max. Ø1.9mm)
  - Shielding length of wire cover: 2.4 to 2.9mm



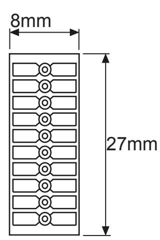
Housing[5264-10]



Terminal[5263 (PBT)]

■ **CN2: Connector for multi-stage**

- This connector must be used with connection PCB
- CN1 and CN2 must be connected as below drawing.

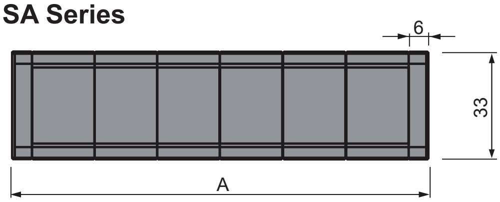


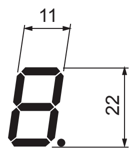
Multi-stage connector

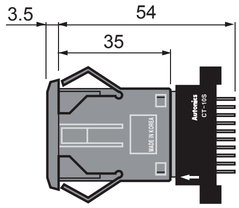
(A) Photo-electric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

◎ D1SA Series

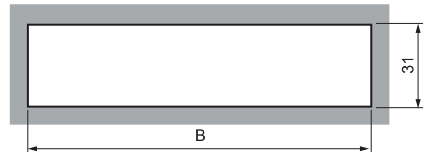
(unit: mm)







● **Panel cut-out**

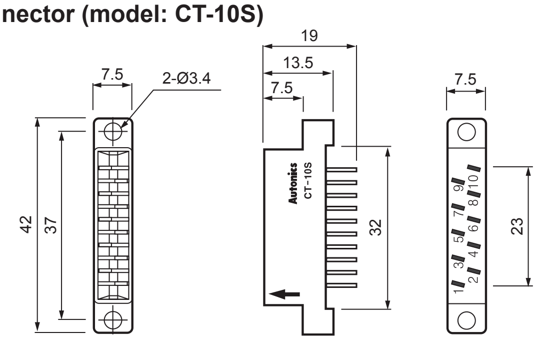


● **Panel cut-out chart**

Digit (N)	A (20×N+12)	B (20×N+10)
1	32	30±0.1
2	52	50±0.1
3	72	70±0.1
4	92	90±0.1
5	112	110±0.1
6	132	130±0.1
7	152	150±0.1
8	172	170±0.1

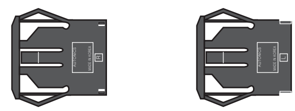
◎ Accessory

● **Connector (model: CT-10S)**



◎ Sold separately

● **CAP**



● D1SA-RN: DAR(L) -R (left/right 1 set)
● D1SA-GN: DAR(L) -BL (left/right 1 set)
※Cap is optional (1set).

■ Input Data Chart

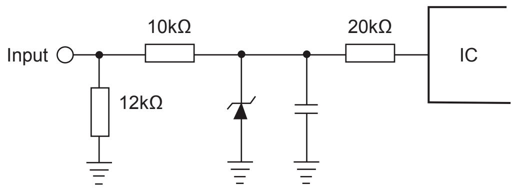
Indication				Negative input				Positive input			
Minus※1		7-segment									
Hexa decimal	Decimal	Hexa decimal	Decimal	D3	D2	D1	D0	D3	D2	D1	D0
Blank	Blank	0	0	H	H	H	H	L	L	L	L
Blank	Blank	1	1	H	H	H	L	L	L	L	H
-	-	2	2	H	H	L	H	L	L	H	L
-	-	3	3	H	H	L	L	L	L	H	H
-	-	4	4	H	L	H	H	L	H	L	L
-	-	5	5	H	L	H	L	L	H	L	H
-	-	6	6	H	L	L	H	L	H	H	L
Blank	Blank	7	7	H	L	L	L	L	H	H	H
-	-	8	8	L	H	H	H	H	L	L	L
-	-	9	9	L	H	H	L	H	L	L	H
-	Blank	A	Blank	L	H	L	H	H	L	H	L
-	Blank	b	Blank	L	H	L	L	H	L	H	H
Blank	Blank	C	Blank	L	L	H	H	H	H	L	L
-	Blank	d	Blank	L	L	H	L	H	H	L	H
-	Blank	E	Blank	L	L	L	H	H	H	H	L
-	Blank	F	Blank	L	L	L	L	H	H	H	H

※When BI terminal connect GND, "0" is displayed. When BI terminal is open, it is blank (not display)
※"X": Either high or low level can be input.
※1: Only D1SC-N supports Minus display. Set the rear JP1 as OFF.
※Blank: If input signal as input DATA, it does not display.

■ Input Circuit

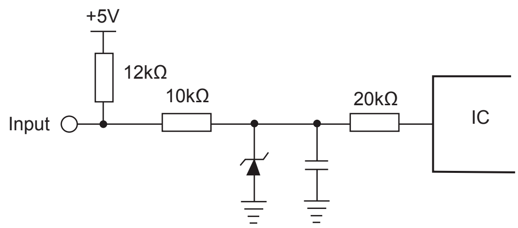
◎ D1SC-N

● **Positive logic (PNP) input (SW1: OFF)**



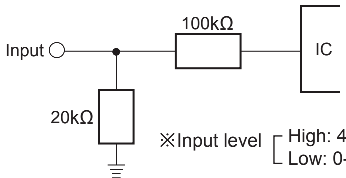
※Input level - High: 4.5-24VDC, Low: 0-1.2VDC

● **Negative logic (NPN) input (SW1: ON)**



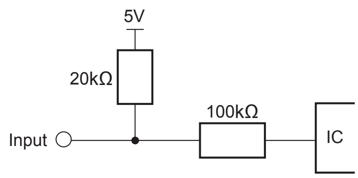
◎ D1SA Series

● **Positive logic (PNP) input (SW1: OFF)**



※Input level High: 4.5-24VDC, Low: 0-1.2VDC

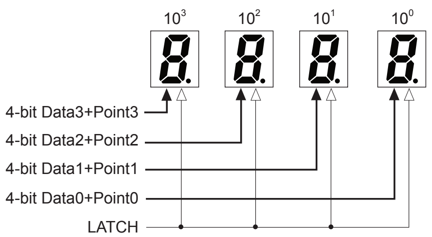
● **Negative logic (NPN) input (SW1: ON)**

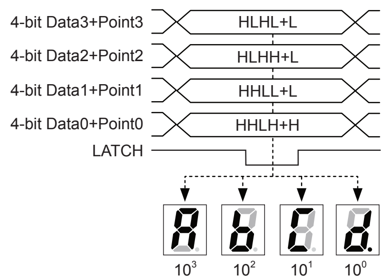


■ Data Input Method

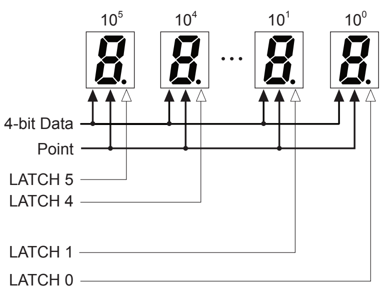
◎ Parallel input

● **4-bit static parallel input (e.g.: displays ABCD.)**

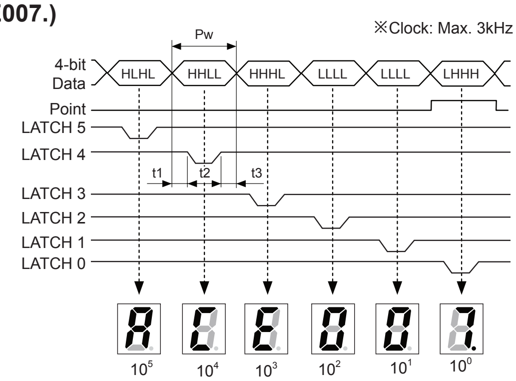




● **4-bit dynamic parallel input (e.g.: displays ACE007.)**



※Clock: Max. 3kHz

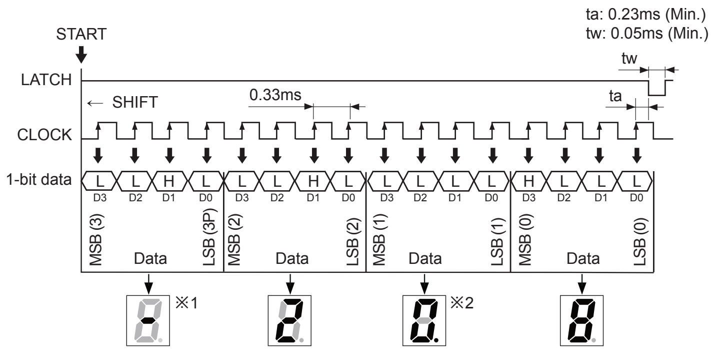


※Pw=t1+t2+t3
Pw: 0.33ms (Min.)
t1: 0.05ms (Min.) → Data LATCH
t2: 0.23ms (Min.) → Data move
t3: 0.05ms (Min.) → Data

◎ Serial input

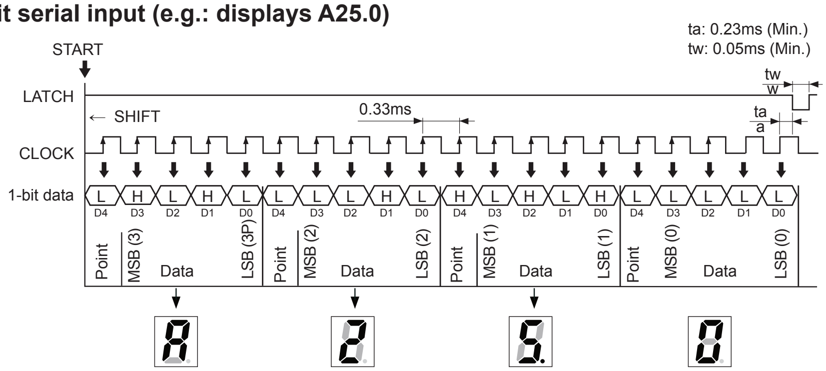
● 4-bit serial input (e.g.: displays -20.8)

※Clock max. 3kHz
※In case of positive logic (PNP), hexadecimal number



※1: To display Minus, set the rear JP1 as OFF.
※2: In case of 4-bit Serial input, to display decimal point, connect DP of the rear input terminal to V+.
In case of negative logic (NPN), connect DP to GND.

● 5-bit serial input (e.g.: displays A25.0)

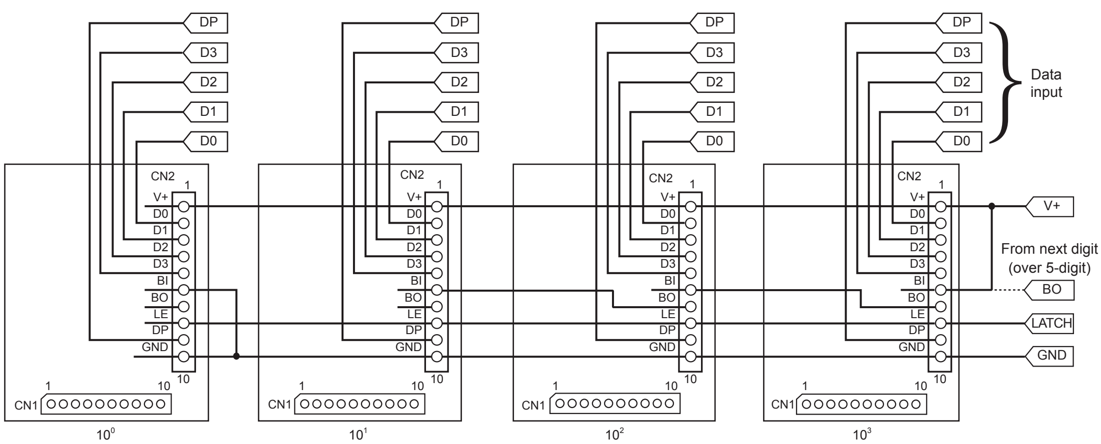


▣ Multi-Stage Connection Method

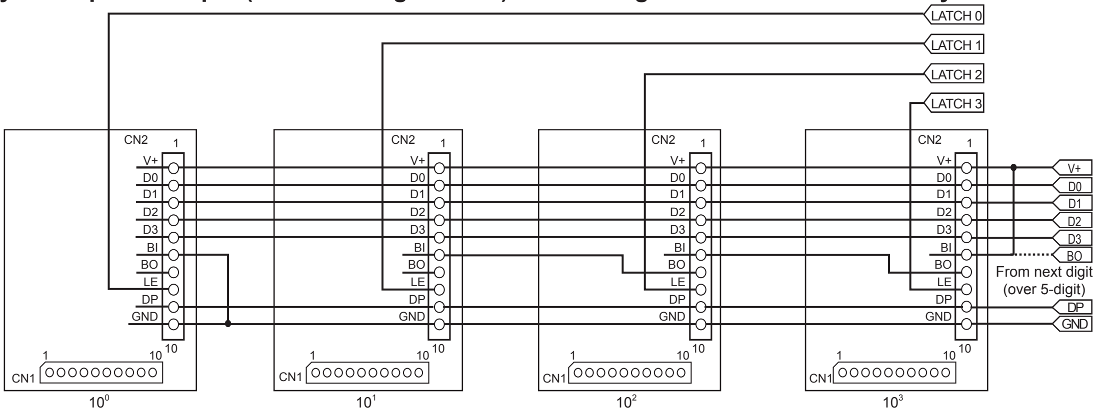
◎ Parallel input: 4-digit

※The below connection is example of D1SC-N. For D1SA, connection is same but the order of pin is reverse.
(connector image (refer to N-14 page of the 9th catalogue)
※CN1, CN2 terminals of D1SC-N corresponds 1:1 and it is able to connect as CN1 depending on the need.
※When not using Zero Blanking, connect BI terminal to GND.

● Static parallel input (zero blanking method): These diagrams are to wire at rear layout of the unit.

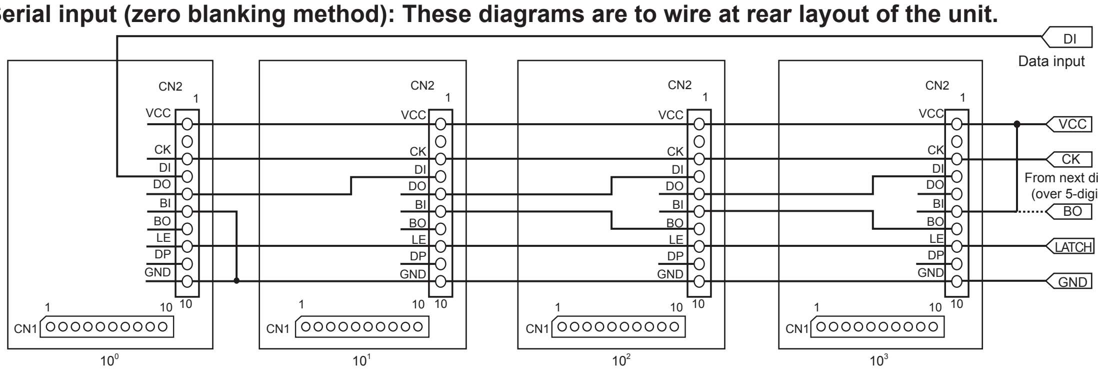


● **Dynamic parallel input (zero blanking method): These diagrams are to wire at rear layout of the unit.**



◎ Serial input: 4-digit

● **Serial input (zero blanking method): These diagrams are to wire at rear layout of the unit.**

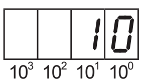


■ Zero Blanking Method?

It is to remove "0" indication which is no meaning.

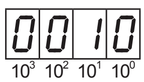
E.g.1) When displaying 10

① Using Zero Blanking



("0" of 10^3, 10^2 are no meaning and they are not displayed.)

② Not using Zero Blanking



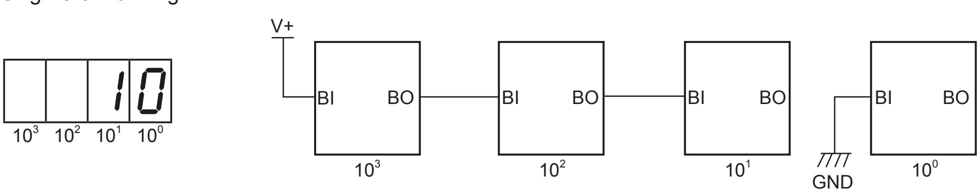
※If indication data is "101", meaningful tens place "0" will be displayed.

◎ Using zero blanking for multi-stage

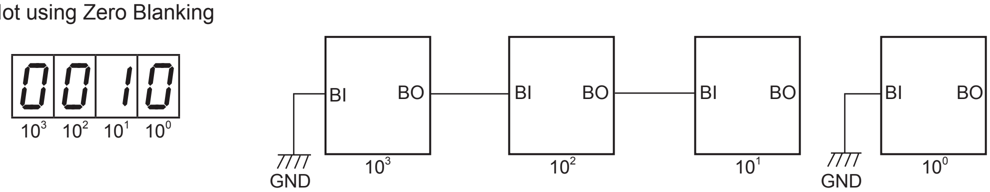
Set 5 (zero blanking output) of the rear function set switch (SW2) as ON.

For 10 (0) to display '0', set this as OFF.

1) Using Zero Blanking

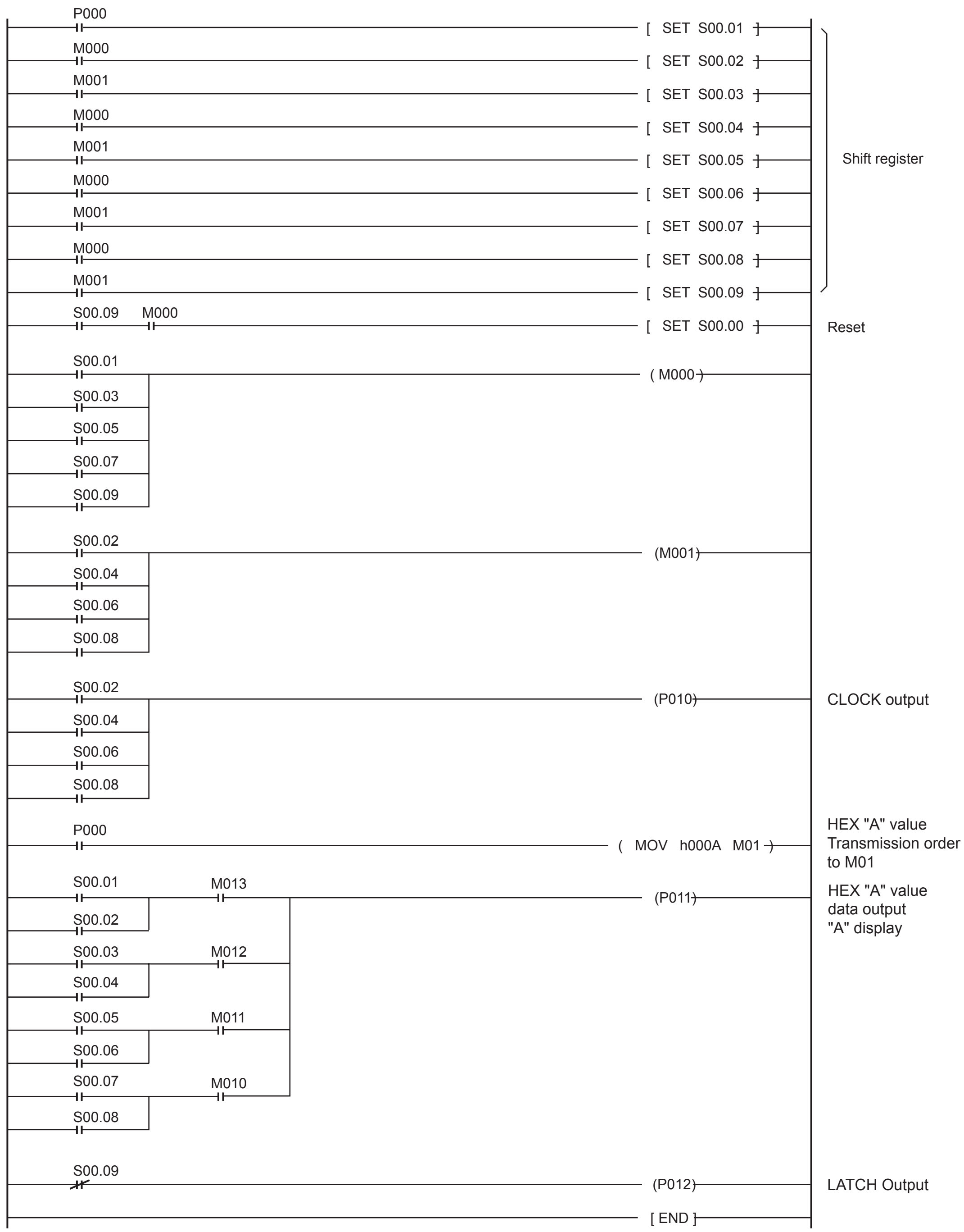


2) Not using Zero Blanking



▣ The Application Of PLC Program [Serial Input Type]

1. Display Unit D1SA-□
2. Data input type: Serial
3. Connection method: Refer to serial connection type when using more than 2.
4. Display result: "A" Display
5. PLC: LSIS (LS Industrial Systems), MASTER-K Series
6. When using serial type, use transistor output card of PLC
7. Negative logic (NPN)

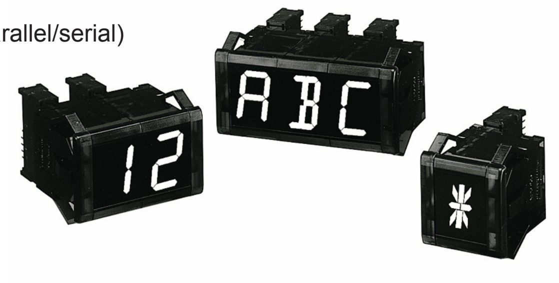


※Visit our web site (www.autonics.com) to download various applications of PLC program.

Small Display Unit For Vivid Display (W11×H22mm) And Various 61 Characters And Symbols

■ Features

- Displays 61 types of characters and signs (0 to 9, A to Z, decimal point, 24 symbols)
- Selectable input logic (PNP/NPN), data input type (parallel/serial)
- 16-segment in red/green
- Wide range of input signal level : Low: 0-1.2VDC, High: 4.5-24VDC
- 12-24VDC power supply
- Multi-stage connection available



■ Applications

- Display for PLC
- Display for computer
- Various display

⚠ Please read "Safety considerations" in operation manual before using.

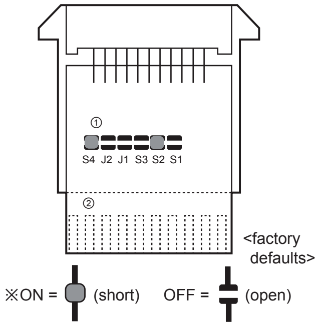
■ Specifications

Model		D1AA-RN	D1AA-GN※1
Display method		16-segment LED display (red)	16-segment LED display (green)
Power supply		12-24VDC	
Allowable voltage range		90 to 110% of rated voltage	
Current consumption		Max. 32mA	
Display character		61 characters (0 to 9, A to Z, decimal point, 24 symbols)	
Character size		W11×H22mm	
Input		•Parallel: Parallel 6-bit data, latch, decimal point •Serial: Serial 6-bit or 7-bit data, clock, latch, decimal point (for 6-bit input)	
Input level		High: 4.5-24VDC, Low: 0-1.2VDC	
Max. Clock		Max. 3kHz	
Input resistance		20kΩ	
Output		Data output (serial input)	
Input logic		Selectable positive (PNP) or negative (NPN) (by inner soldering)	
Noise immunity		±300V the square wave noise (pulse width: 1μs) by the noise simulator	
Environ-ment	Ambient temperature	0 to 60℃, storage: -10 to 85℃	
	Ambient humidity	35 to 85%RH	
Accessory		Connector	
Unit weight		Approx. 22g (including right/left caps)	

※1: It is option.
※Max. Clock is for 1:1 of duty ratio (ON, OFF ratio).
※Environment resistance is rated at no freezing of condensation.

■ Unit Description

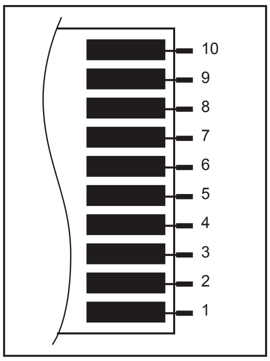
① Function set switches



Switch	ON	OFF	Function
S1	—	—	Unused
S2	Parallel	Serial	Input
S3	7-bit	6-bit	Serial input
J1	Use	Unused	Serial data output※1
J2	—	—	Always set as OFF.
S4	Negative (NPN)	Positive (PNP)	Input logic

※1: For Serial input, set this as ON. For Parallel input, set this as OFF.

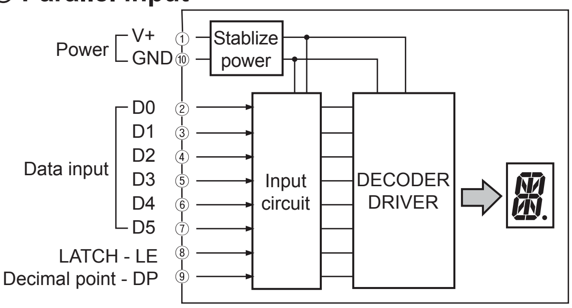
② Input/Output terminals



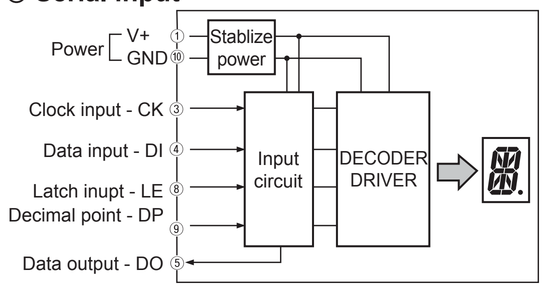
Input / Terminal	Parallel input		Serial input	
	Code	Function	Code	Function
1	VCC	12-24VDC	VCC	12-24VDC
2	D0	Data input	N·C	Do not connect anything.
3	D1		CK	Clock input
4	D2		DI	Data input
5	D3		DO	Data output
6	D4		N·C	Do not connect anything.
7	D5		N·C	
8	LE	Latch input	LE	Latch input
9	DP	Decimal point input	DP	Decimal point input
10	GND	0V	GND	0V

■ Block Diagram

◎ Parallel input



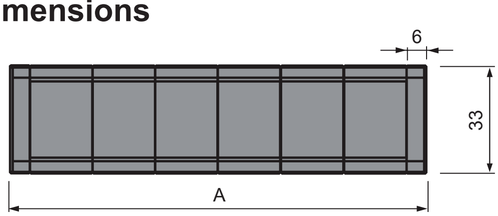
◎ Serial input

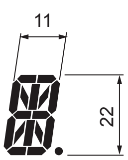


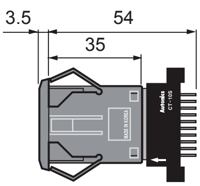
※The ②, ⑥, ⑦ pin are not used.

■ Dimensions

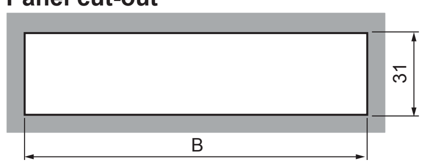
(unit: mm)







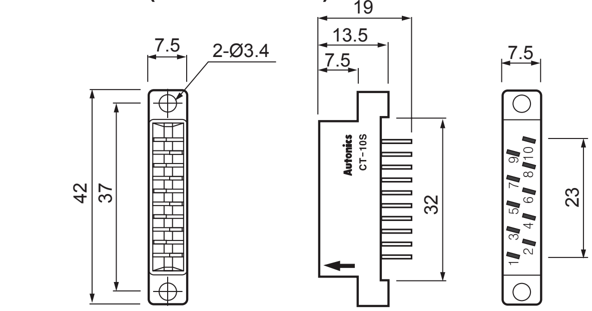
● **Panel cut-out**



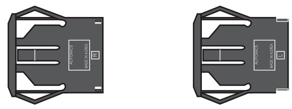
● **Panel cut-out chart**

Digit (N)	Dimension A (20×N+12)	Dimension B (20×N+10)
1	32	30±0.1
2	52	50±0.1
3	72	70±0.1
4	92	90±0.1
5	112	110±0.1
6	132	130±0.1
7	152	150±0.1
8	172	170±0.1

◎ Accessory
● Connector (model: CT-10S)



◎ Sold separately
● CAP



● D1AA-RN: DAR(L)-R (right/left 1 set)
● D1AA-GN: DAR(L)-BL (right/left 1 set)
※Cap is optional (1 set).

■ Input Data Chart

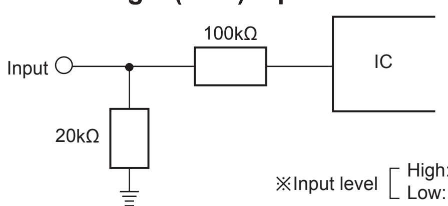
※In case of positive logic (PNP).

Upper 2-bit data (PNP type) in positive logic				Lower 4-bit data (PNP type) in positive logic			
D5 L, D4 L	D5 L, D4 H	D5 H, D4 L	D5 H, D4 H	D3	D2	D1	D0
Blank	P	Blank	0	L	L	L	L
A	Q	Blank	1	L	L	L	H
B	R	"	2	L	L	H	L
C	S	#	3	L	L	H	H
D	T	$	4	L	H	L	L
E	U	%	5	L	H	L	H
F	V	Blank	6	L	H	H	L
G	W	'	7	L	H	H	H
H	X	(	8	H	L	L	L
I	Y	)	9	H	L	L	H
J	Z	*	:	H	L	H	L
K	[	+	;	H	L	H	H
L	\	,	<	H	H	L	L
M	]	-	=	H	H	L	H
N	^	.	>	H	H	H	L
O	_	/	?	H	H	H	H

※Blank: Even though data is input as signal, it does not display.

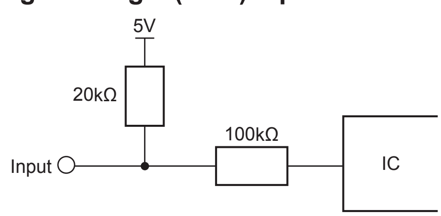
■ Input Circuit

◎ Positive logic (PNP) input



※Input level High: 4.5-24VDC, Low: 0-1.2VDC

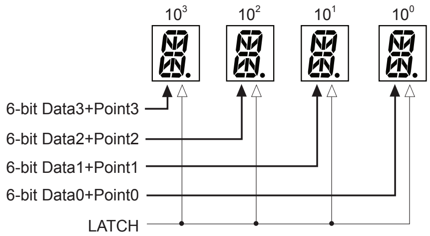
◎ Negative logic (NPN) input

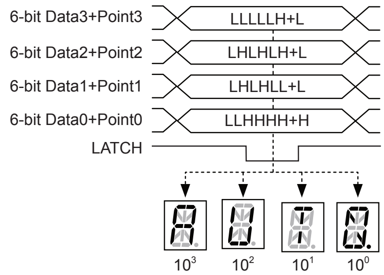


■ Data Input Method

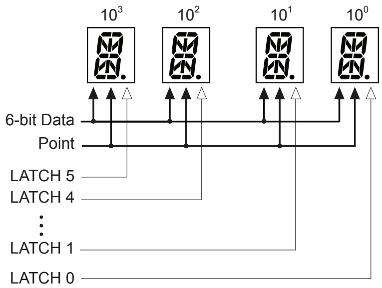
◎ Parallel input

● **6-bit static parallel input (e.g.: displays Auto.)**

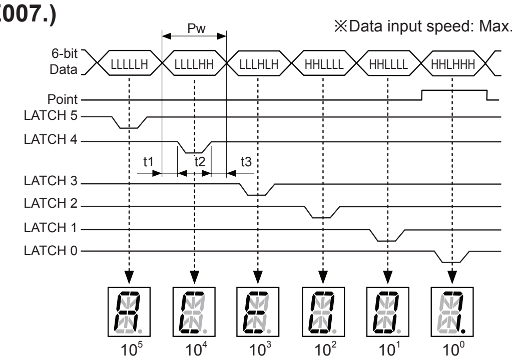




● **6-bit dynamic parallel input (e.g.: displays ACE007.)**



※Data input speed: Max. 3kHz

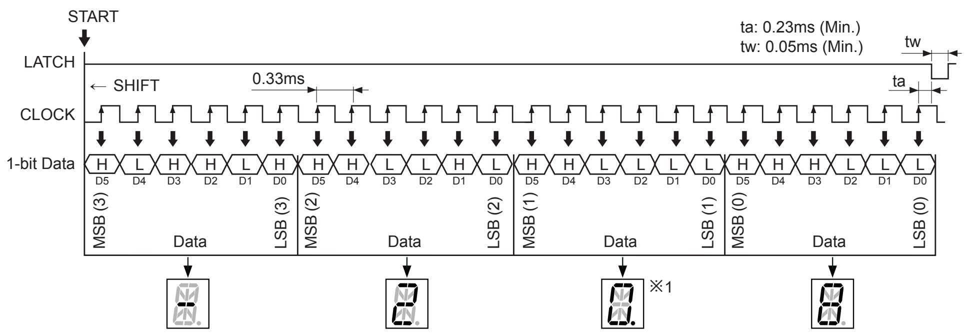


※Pw=t1+t2+t3
Pw: 0.33ms (Min.)
t1: 0.05ms (Min.) → Data LATCH
t2: 0.23ms (Min.) → Data move
t3: 0.05ms (Min.) → Data

◎ Serial input

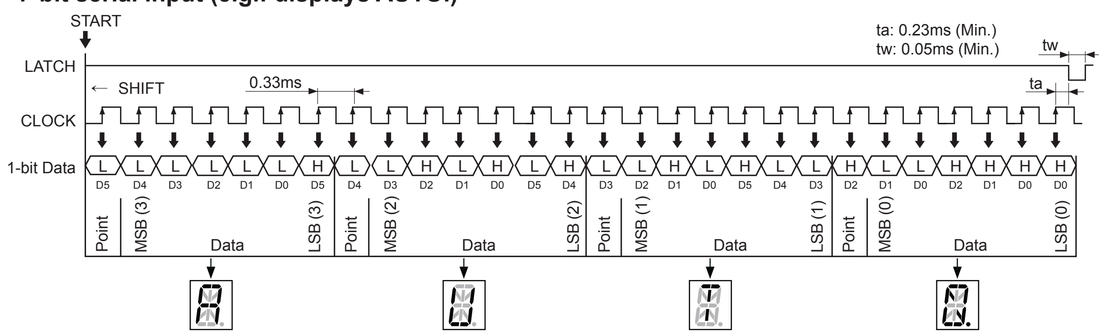
● **6-bit serial input (e.g.: displays -20.8)**

※Clock: Max. 3kHz
※In case of positive logic (PNP), hexadecimal number



※1: For 6-bit Serial input, connect DP of rear input terminal to V+ to display decimal point.
In case of negative logic (NPN), connect DP to GND.

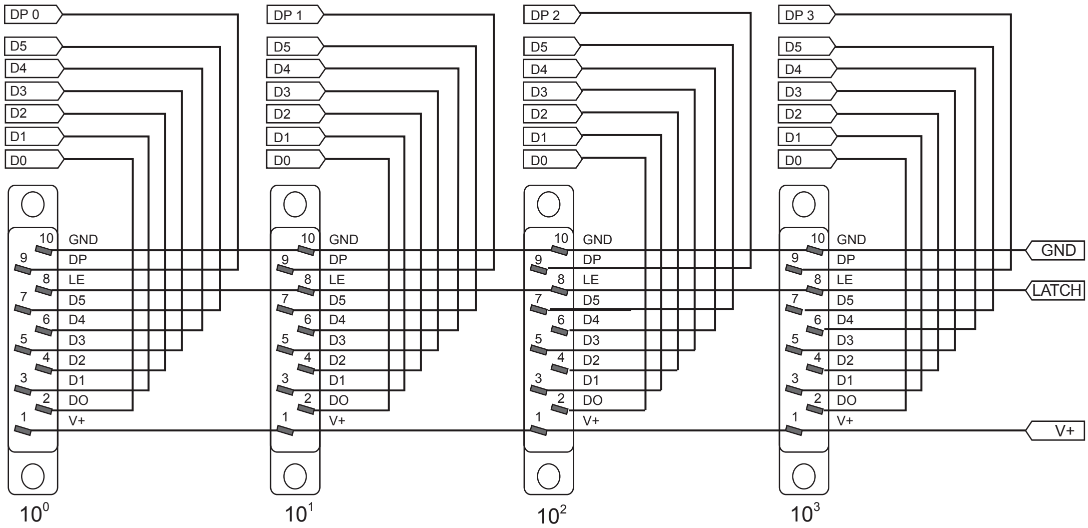
● **7-bit serial input (e.g.: displays AUTO.)**



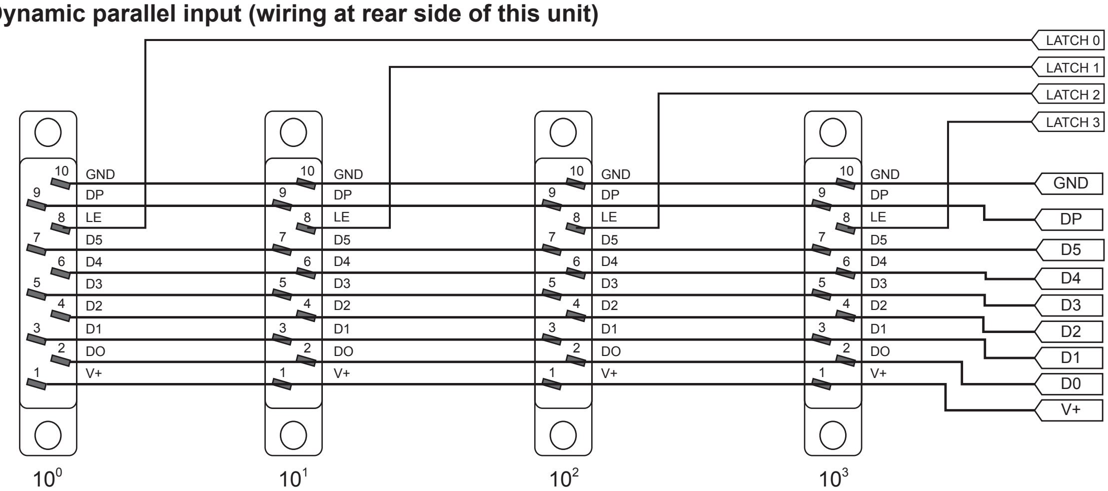
▣ Multi-Stage Connection Method

◎ Parallel input: 4-digit

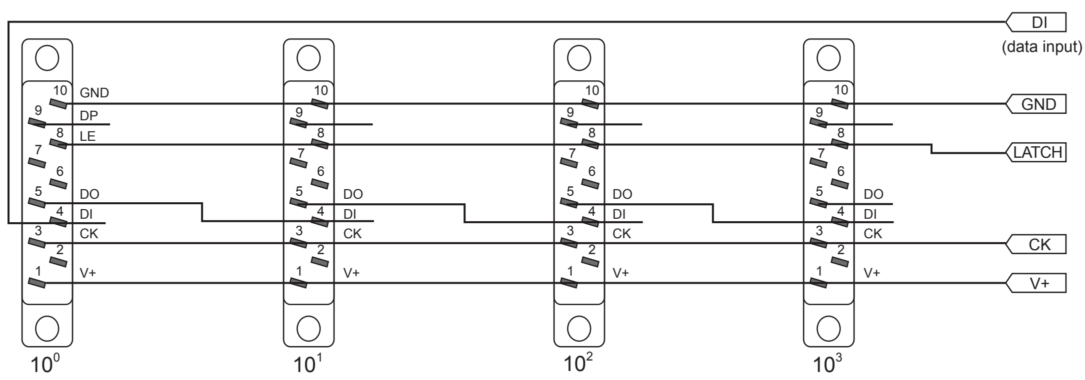
● Static parallel input (wiring at rear side of this unit)



● Dynamic parallel input (wiring at rear side of this unit)

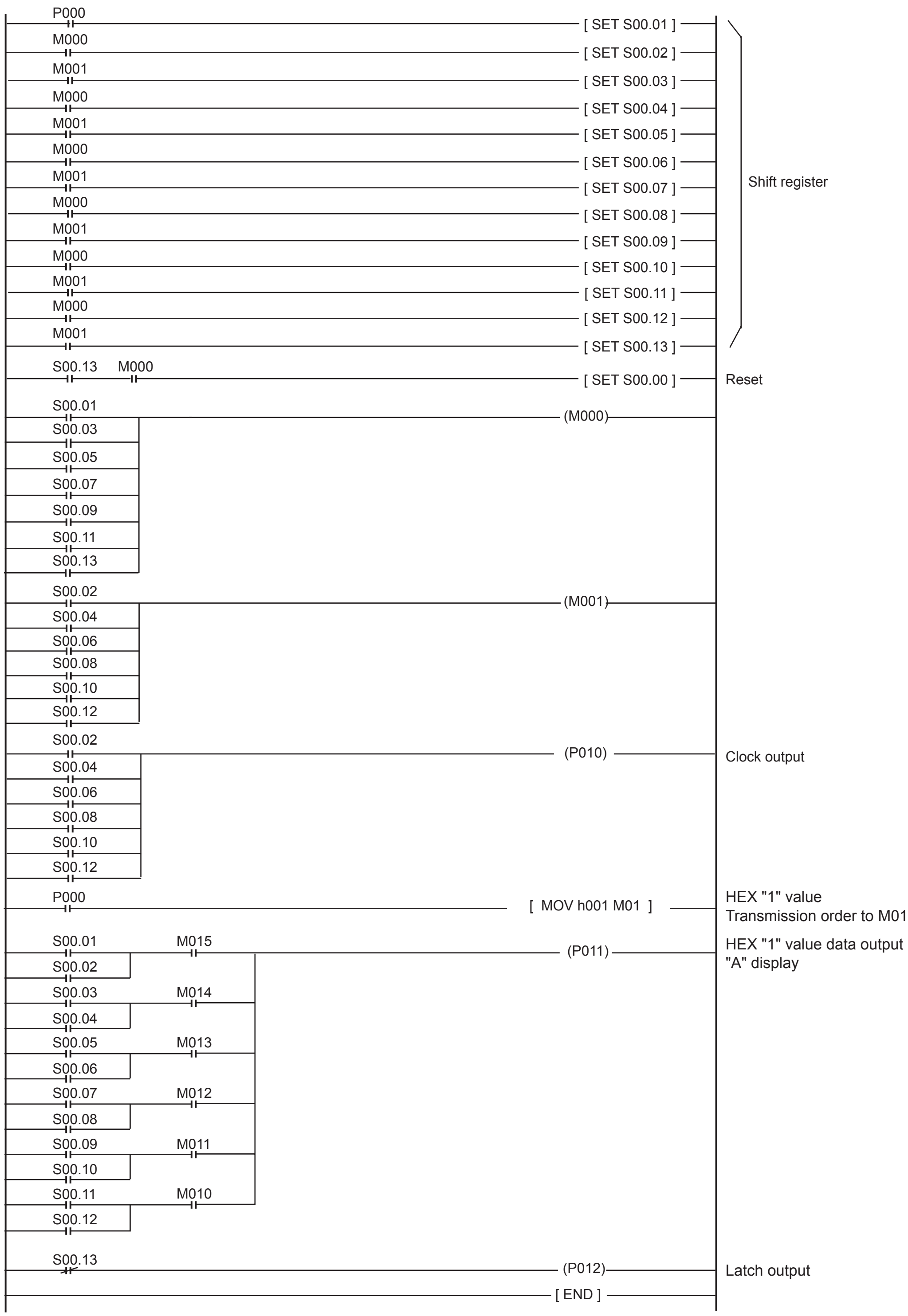


◎ Serial input: 4-digit (wiring at rear side of this unit)



■ The Application Of PLC Program [Serial Input Type]

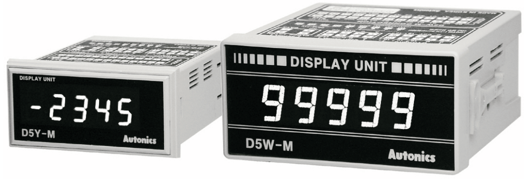
1. Display unit: D1AA - □
2. Data transmission type: Serial input
3. Connection method: Refer to serial connection type when using more than 2.
4. Display result: "A" display
5. PLC: LSIS (LS Industrial Systems), Master-K Series
6. When using serial type, use transistor output card of PLC
7. Negative logic (NPN)



Upgraded Display Unit From D4Y, D4W

■ Features

- Various input specifications
  : Static Parallel input, Dynamic Parallel input, 4/5-bit serial input,
  16/20/25-bit serial input method
- Decimal point, "–" minus sign display selection function
  : Display type by serial input
  Display type by external DP terminal and MINUS terminal
- Positive/Negative logic input selection function
- Display digit selection function
  : 4-digit (-9999 to 9999), 5-digit (0 to 99999)
- Zero blanking function selection function
- Selectable reversion function of latch signal



⚠ **Please read "Safety considerations" in operation manual before using.**

■ Ordering Information

D 5 W – M X

Code	Item	Option	Description
X	Power supply	No-mark	12-24VDC
		X※1	110/220VAC 50/60Hz
M	Input	M	Multi-input mode
W	Size	Y	DIN W72×H36mm
		W	DIN W96×H48mm
5	Digit	5	99999 (5-digit)
D	Item	D	Display Unit

※1: AC Power is only for D5W and it is option.

■ Specifications

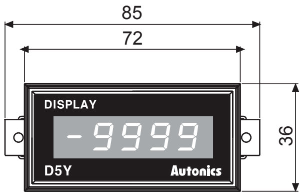
Model		D5Y-M	D5W-M	D5W-MX
Power supply		12-24VDC		110/220VAC 50/60Hz
Allowable voltage range		90 to 110% of rated voltage		
Power consumption		Max. 1.1W		Max. 2VA
Character size		W7×H14mm		
Display method		7-segment LED display (red)		
Display digit		Selectable 4-digit (or 4 ½ digit including symbol bit), 5-digit		
Max. Clock		100Hz to 5kHz		
Input logic		Selectable positive (PNP) or negative (NPN)		
Input method		Static parallel, Dynamic parallel, 4/5-bit serial, Serial (16/20/25-bit)		
Input level		High: 5-24VDC, Low: 0-1.2VDC		
Insulation resistance		Over 100MΩ (at 500VDC megger)		
Dielectric immunity		2,000VAC 50/60Hz for 1 minute		
Noise immunity		±1kV the square wave noise (pulse width: 1μs) by the noise simulator		
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour		
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 minutes		
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times		
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times		
Environ-ment	Ambient temperature	-10 to 50℃, storage: -25 to 65℃		
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH		
Unit weight		Approx. 75g	Approx. 165g	Approx. 267g

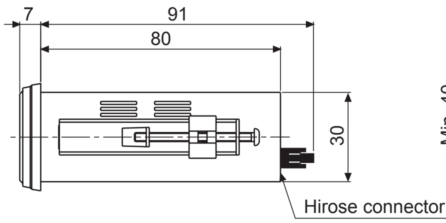
※Max. Clock is for 1:1 of duty ratio (ON, OFF ratio).
※Environment resistance is rated at no freezing or condensation.

Dimensions

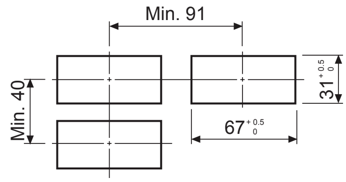
(unit: mm)

- **D5Y-M**

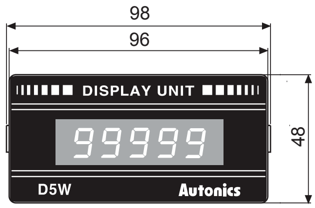


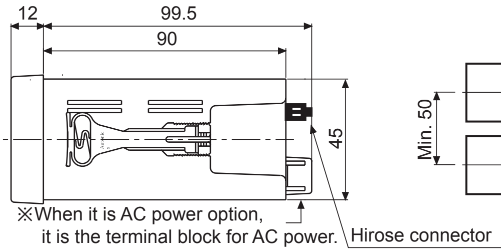


- **Panel cut-out**

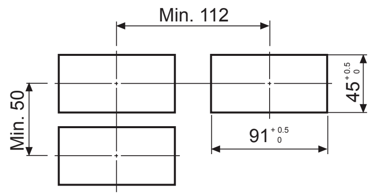


- **D5W-M/D5W-MX**

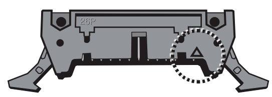




- **Panel cut-out**

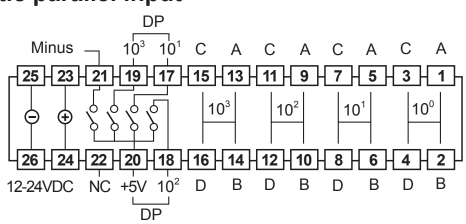


※Hirose connector pin header model: HIF3BA-26PA-2.54DS
※Hirose connector socket is not included with this unit.
Contact hirose connector vendors for socket and cable.
[Socket: HIF3BA-26D-2.54R]
※"△" mark indicates pin 1 of hirose connector.

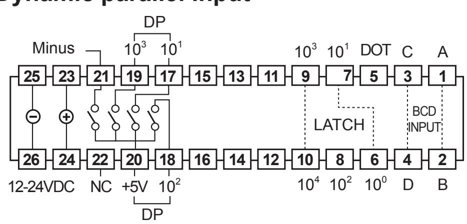


Connections

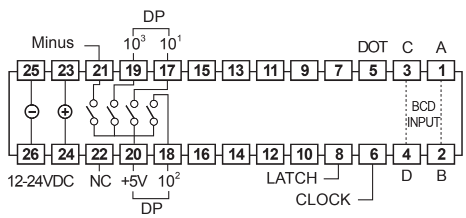
- **Static parallel input**



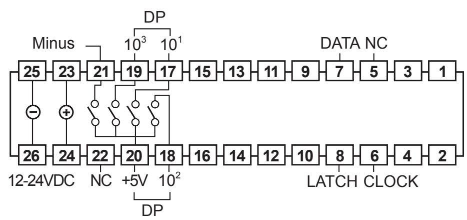
- **Dynamic parallel input**



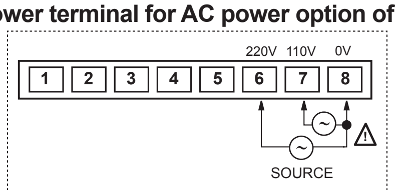
- **4/5-bit serial input**



- **Serial input**



- **Power terminal for AC power option of D5W series**

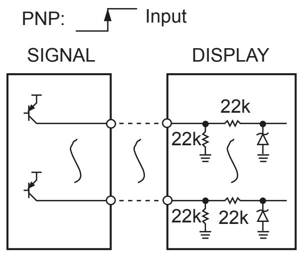


※Above terminal connection diagrams's number set by pin 1 of hirose connector. Please note that "△" mark indicates pin 1 of hirose connector.

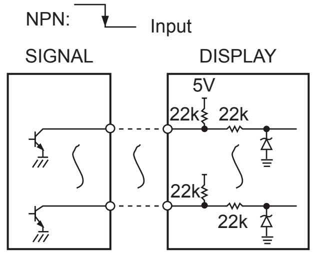
※In case of Static parallel input, 5-digit cannot be used because of external terminal
※To display 5 digit in Dynamic parallel, 4/5-bit serial, serial input, display range is 0 to 99999 and it cannot display minus sign. Therefore, the applied signal to the external minus sign input terminal (pin 21) is ignored.
※Regardless of input logic, connect external DP terminal (pin 17, 18, 19) or external minus sign input terminal (pin 21) to +5V (pin 20) and it displays decimal point and minus sign.

■ Input Circuit

● **Positive logic (PNP) input**



● **Negative logic (NPN) input**

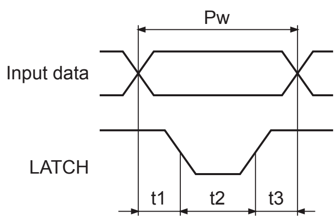


※Input level
- High: 5-24VDC
- Low: 0-1.2VDC

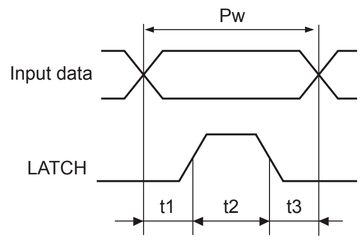
■ Input Timing

◎ Parallel input

● **Positive logic (PNP) input**



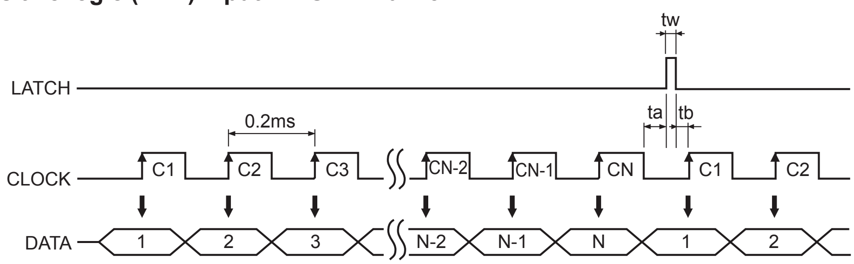
● **Negative logic (NPN) input**



Pw=t1+t2+t3 {
- Pw: Min. 0.2ms
- t1: Min. 0.05ms → Data latch
- t2: Min. 0.1ms → Data move
- t3: Min. 0.05ms → Data latch

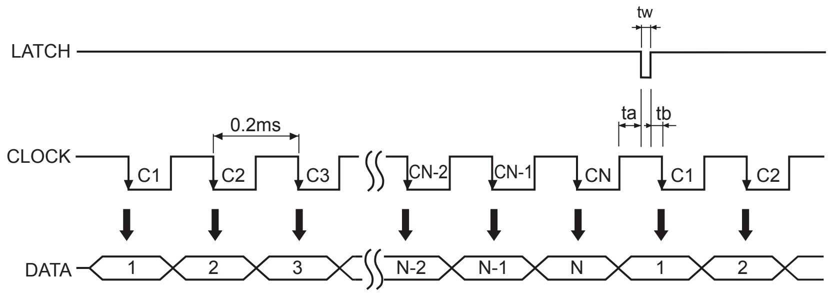
◎ Serial input

● **Positive logic (PNP) input: CLOCK Max. 5kHz**



{
- ta: Min. 0.05ms
- tw: Min. 0.02ms
- tb: Min.0.03m

● **Negative logic (NPN) input: CLOCK Max. 5kHz**



{
- ta: Min. 0.05ms
- tw: Min. 0.02ms
- tb: Min. 0.03ms

▣ Input Data Chart

Display	Negative (NPN) input					Positive (PNP) input				
	A	B	C	D	LATCH	A	B	C	D	LATCH
0	H	H	H	H	L	L	L	L	L	H
1	L	H	H	H	L	H	L	L	L	H
2	H	L	H	H	L	L	H	L	L	H
3	L	L	H	H	L	H	H	L	L	H
4	H	H	L	H	L	L	L	H	L	H
5	L	H	L	H	L	H	L	H	L	H
6	H	L	L	H	L	L	H	H	L	H
7	L	L	L	H	L	H	H	H	L	H
8	H	H	H	L	L	L	L	L	H	H
9	L	H	H	L	L	H	L	L	H	H
HOLD	X	X	X	X	H	X	X	X	X	L

※Input level: High → 5-24VDC, Low → 0-1.2VDC
※"X": Either high or low level can be input.

▣ How To Select Decimal Point

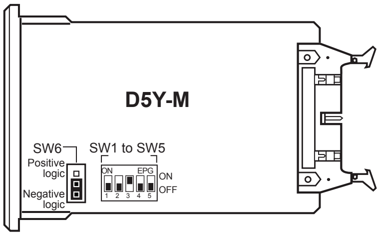
● DOT and minus sign input is not serial input [SW4 = OFF]

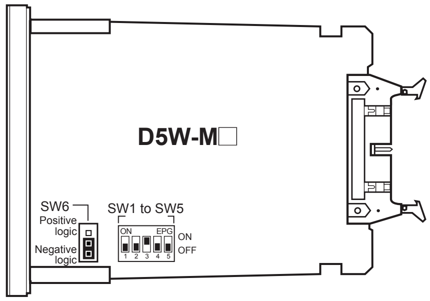
Terminal 17-20: 8888.8
18-20: 888.88
19-20: 88.888
21-20: -8888
OPEN: 88888

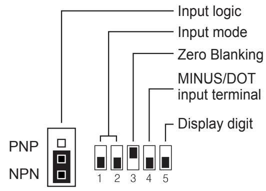
● DOT and minus sign input is serial input [SW4 = ON]

① When it is Dynamic parallel input and 4/5-bit input, it connects with pin 5. (refer to time chart for 4-digit)
② When it is serial input, 1-bit of serial data should have DOT and minus sign and the DATA is input. (refer to time chart for 4-digit)

■ Function Set Switches







● Input mode

SW1 SW2 ON ON OFF OFF	Static parallel input
SW1 SW2 ON ON OFF OFF	Dynamic parallel input
SW1 SW2 ON ON OFF OFF	4/5-bit serial input
SW1 SW2 ON ON OFF OFF	Serial input

● Zero blanking function

SW3	ON OFF	Using zero blanking function
	ON OFF	Non-using zero blanking function

※Zero blanking function
It is to remove "0"indication which is no meaning.
E.g.)When indication value is "10" in 4-digit LED
• Zero blanking function is applied: 10
• Zero blanking function is not applied: 0010

● Minus signal/DOT (decimal point) input terminal

SW4	ON OFF	Using DOT terminal (pin 5)
	ON OFF	Using external DP (pin 17, 18, 19, 20) terminal and minus (pin 21) terminal

● Display digit

SW5	ON OFF	5-digit (0 to 99999)
	ON OFF	4-digit (-9999 to 9999)

※In case of Static parallel input, 5-digit cannot be used because of external terminal.

● Input logic

SW6	PNP NPN	Positive (PNP) input
	PNP NPN	Negative (NPN) input

※If changing inner selecting switch when power is ON, it does not operate as a changed mode.
If the mode is changed when power is ON, please turn OFF and then turn ON the power.

● Latch input signal

SW7	ON	Reverse latch signal to set logic in SW6
	OFF	Correspond latch signal to set logic in SW6

※BCD output and latch signal of low speed serial output, which are optional of Autonics pulse meter (MP5Y/W Series) and panel meter (MT4Y/W Series) is output to positive logic (NPN). If connecting D5Y/W, use it after setting SW6 to NPN and soldering (ON) the semi-contact (SW7) of inner PCB solder plate.

◎ Factory default

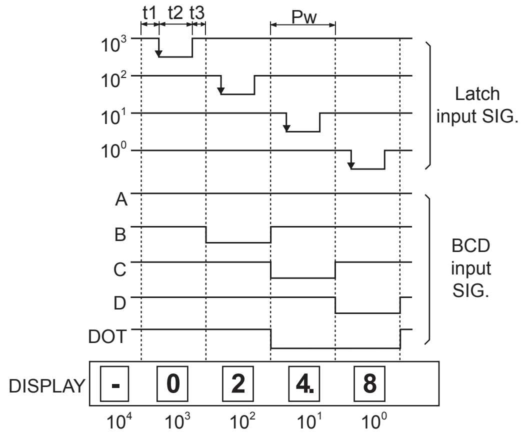
Selection switch	Factory default	Selection switch	Factory default
SW1	OFF	SW5	OFF
SW2	OFF	SW6	Negative logic
SW3	ON	SW7	OFF
SW4	OFF		

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Time Chart (4-digit)

◎ Dynamic parallel input

Function set switches: SW1 → ON, SW2 → OFF, SW3 → OFF, SW4 → ON, SW5 → OFF

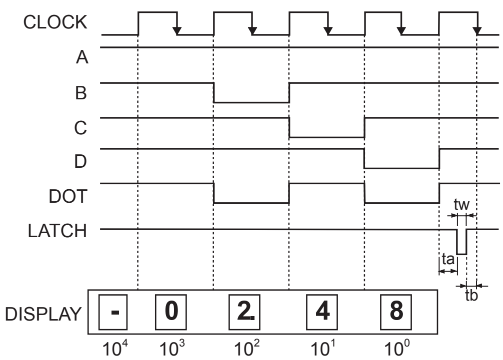


Pw = Min. 0.2ms
t1 = Min. 0.05ms
t2 = Min. 0.10ms
t3 = Min. 0.05ms

※The waveform is for negative logic input (NPN). In case of positive logic (PNP), it will be reversed.
※For 4 digit, external 10^4 LATCH input terminal is not available.
※If DOT data is inputted on 10^0 position, it displays "—" signal. (function set switches SW4 → ON)
※Concerning decimal point and "—" signal, it can be displayed using outer DP and minus terminal not a serial input. (function set switches SW4 → OFF)
※Latch input should be later than BCD input, otherwise, it will display the previous data.
※The left application of display indicates non-using zero black function. If using zero blank function, the "0" on 10^3 position is not displayed. (function set switches SW3 → ON)

◎ 4/5-bit serial input

Function set switches: SW1 → ON, SW2 → ON, SW3 → OFF, SW4 → ON, SW5 → OFF

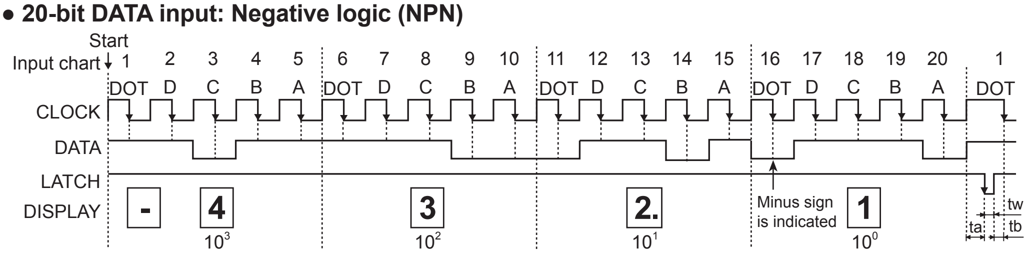


※The waveform is for negative logic input (NPN). In case of positive logic (PNP), it will be reversed.
※If dot data is inputted on 10^0 position, it displayed "—" signal. (function set switches SW4 → ON)
※Concerning decimal point and "—" signal, it can be displayed using outer DP and minus terminal not a serial input. (function set switches SW4 → OFF)
※The left application of display indicates non-using zero blank function. If using zero blank function, the "0" on 10^3 position is not displayed. (function set switches SW3 → ON)

ta = Min. 0.05ms
tw = Min. 0.02ms
tb = Min. 0.03ms

◎ Serial input

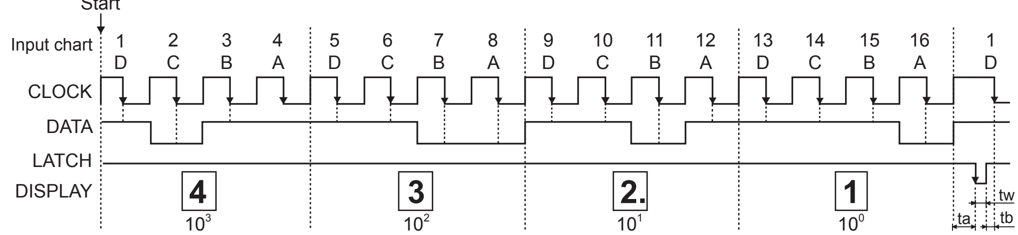
● 20-bit DATA input: Negative logic (NPN)



※The waveform is for negative logic input (NPN) . In case of positive logic (PNP), it will be reversed.
※When DOT signal data (16th) is input on 10^0 position, minus sign is indicated.

ta: Min. 0.05ms
tw: Min. 0.02ms
tb: Min. 0.03ms

● 16-bit DATA input: Negative logic (NPN)

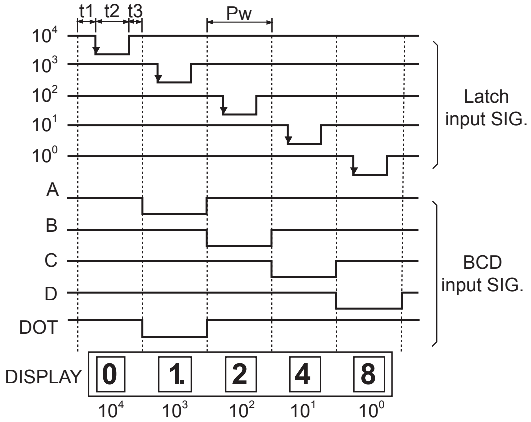


※The waveform is for negative logic input (NPN) . In case of positive logic (PNP), it will be reversed.
※DATA is fixed when CLOCK is changed from high to low and held when LATCH is changed from high to low.
※DATA hold term is before next LATCH is changed from high to low.

■ Time Chart (5-digit)

◎ Dynamic parallel input

Function set switches: SW1 → ON, SW2 → OFF, SW3 → OFF, SW4 → ON, SW5 → ON

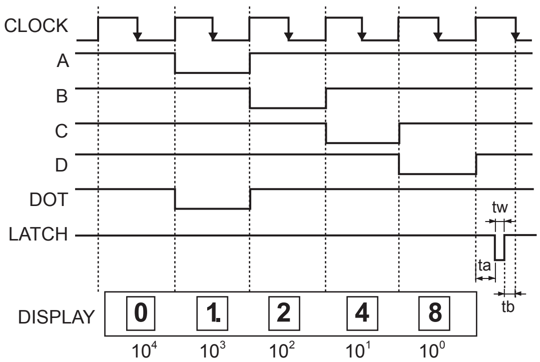


Pw = t1+t2+t3
Pw = Min. 0.2ms
t1 = Min. 0.05ms
t2 = Min. 0.10ms
t3 = Min. 0.05ms

※The waveform is for negative logic input (NPN) . In case of positive logic (PNP), it will be reversed.
※It is impossible to display the "—" at 5-digit line.
※LATCH input should be later than BCD input, otherwise, it will display the previous DATA.
※The left application of display indicates non-using zero blank function, If using zero blank function, the "0" on 10^4 position is not displayed.
(function set switches SW3 → ON)

◎ 4/5-bit serial input

Function set switches: SW1 → ON, SW2 → ON, SW3 → OFF, SW4 → ON, SW5 → ON

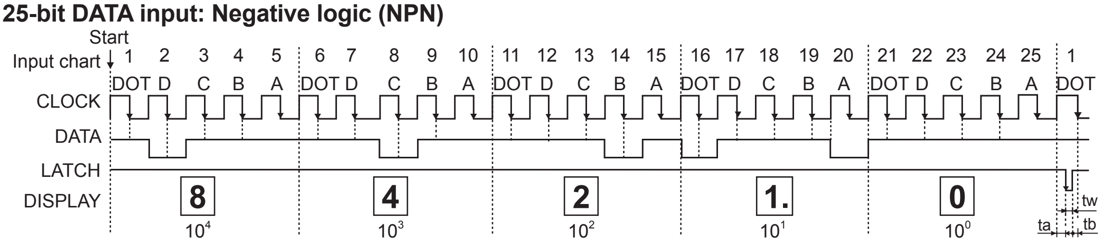


※The waveform is for negative logic input (NPN) . In case of positive logic (PNP), it will be reversed.
※It is impossible to display the "—" at 5-digit line.
※The left application of display indicates non-using zero blank function, the "0" on 10^4 position is not displayed.
(function set switches SW3 → ON)

ta = Min. 0.05ms
tw = Min. 0.02ms
tb = Min. 0.03ms

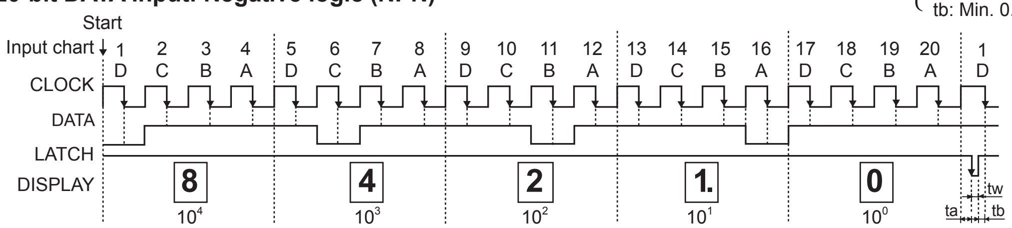
◎ Serial input

● 25-bit DATA input: Negative logic (NPN)



ta: Min. 0.05ms
tw: Min. 0.02ms
tb: Min. 0.03ms

● 20-bit DATA input: Negative logic (NPN)

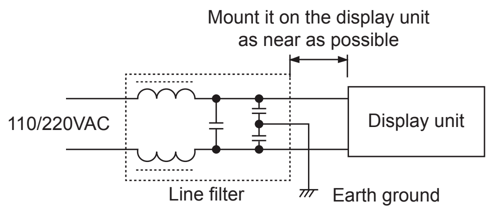


※The waveform is for negative logic input (NPN). In case of positive logic (PNP), it will be reversed.
※Minus sign cannot be indicated in 5-digit type. [The input of DOT signal on 100 position and MINUS terminal (pin 21) is ignored.]
※DATA is fixed when CLOCK is changed from high to low and held when LATCH is changed from high to low.
※DATA hold term is before next LATCH is changed from high to low.

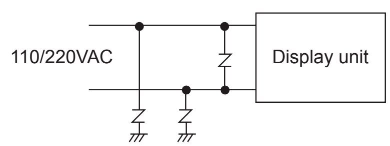
▣ Proper Usage

- Storage
  Avoid direct ray of light when keeping this unit long time, and keep it under -25 to 65℃, 35 to 85%RH of relative humidity.
- Noise
  In case of the product (D5W-MX) using AC power, inflow of noise through a power line is a major circuit built-in small product. Therefore, use an absorbing circuit such as outer line filter and varistor when abnormal voltage occurs in the same line by power relay, magnet S/W, using a high-frequency machine, high voltage of spark of lightning stroke.

● The method by line filter



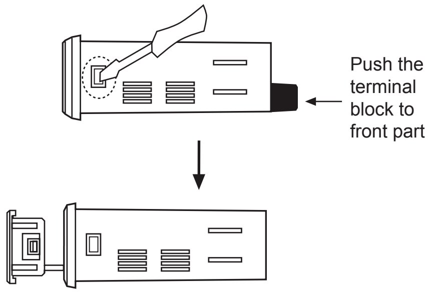
● The method by varistor and ZER



- Input signal line should be short as much as possible.
  If the line is too long, it is easy to affect noise.
- If the time of input signal is overlapped, it may occur faint light.
- Oil, soot or dust must not be flown into the product.
- A decimal point and minus sign can be displayed with the outer DP terminal and the minus terminal when signal level is "High". (high level: 5V-24VDC)
- Because hirose connector has both power line (12-24VDC) and data signal line, please connect the lines after checking the connection figure.

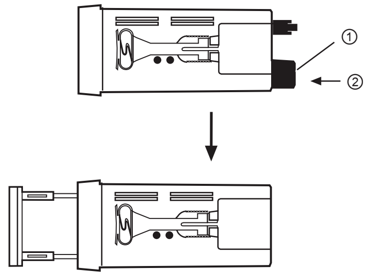
▣ Case Detachment

● **D5Y-M**



Widen the both inside of lock devices with a driver, and push the terminal block to the direction of front part.

● **D5W-M / D5W-MX**



Push the lock part on the side to the direction ①, and then push the terminal block to the direction ② to detach the case.

※Be careful in order not to be wounded.
※**Turn OFF the power** before detaching the case.

(O) Sensor Controllers

Gemeral-Purpose Sensor Controller PA12

Multifunctional Sensor Controller PA10-U

Multifunctional Sensor Controller PA10-V

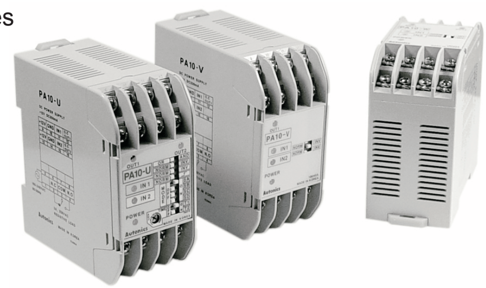
Multifunctional Sensor Controller PA10-W/WP

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Multifunctional Sensor Controller

■ Features

● 13 kinds of various operation modes selected by DIP switches
● High speed input response
● Flip-flop mode for level control
● Multifunctional unit with timer mode
● DIN rail, Mounting to panel
● Wide range of power supply (100-240VAC 50/60Hz)



Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

PA10 — U □

Position	Code	Description
Input	No mark	NPN input
	P	PNP input
Function	U	High function controller
	V	General purpose controller
	W	2-channel controller
Item	PA10	Power amplifier

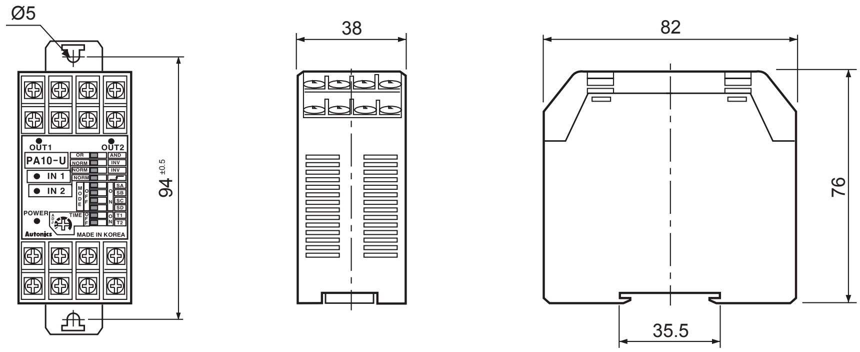
■ Specifications

Model		PA10-U	PA10-V	PA10-VP	PA10-W	PA10-WP
Power supply		100-240VAC 50/60Hz				
Allowable operation voltage		90 to 110% of rated voltage				
Power consumption		100VAC 50/60Hz: Approx. max. 10VA (condotion:12VDC/200mA resistive load)				
Power for external sensor		12VDC ±10% Approx. 200mA				
Input (IN1) (IN2)		Selectable NORM/INV. Selectable OR/AND operation for IN1, IN2 input. Selection function for IN2 derivative action.	Selectable NORM/INV. Operation for IN1, IN2 AND.		Selectable NORM/INV. Operation for IN1, IN2 AND.	
		NPN input type	**NPN input type**	**PNP input type**	**NPN input type**	**PNP input type**
Input type		● **PA10-U** (no-voltage input) Impedance at short-circuit: Max. 680Ω, Residual voltage at short-circuit: Max. 0.8V, Impedance at open: Min. 100kΩ ● **PA10-V/PA10-W** (no-voltage input) Impedance at short-circuit: Max. 300Ω, Residual voltage at short-circuit: Max. 2V, Impedance at open: Min. 100kΩ ● **PA10-VP/PA10-WP** (voltage input) Input impedance: 5.6kkΩ, "H" level voltage:5-30VDC, "L" level voltage: 0-2VDC				
Output	Contact output	OUT: 250VAC 3A (resistive load)			OUT1, OUT2: 250VAC 3A (resistive load)	
	Solid-state output	O.C. OUT1/O.C. OUT2 : NPN open collector output Max. 30VDC 100mA	O.C. OUT: NPN open collector output Max. 30VDC 100mA		—	
Response time		Relay output: Max. 10ms, Transistor output: Max. 0.05ms				
Time setting function by each mode ※Only for PA10-U	Have	• ON Delay Mode • One-Shot Delay Mode • Flicker One-Shot Mode • High-Speed Detection Mode			• OFF Delay Mode • Flicker Mode • Low-Speed Detection Mode • ON/OFF Delay Mode	
	None	• Normal Mode • Flip-Flop Mode • Encoder (mode 9 to 11)				
Relay life cycle	Mechanical	Min. 10,000,000 operations				
	Electrical	Min. 100,000 operations (250VAC 3A resistive load)				
Dielectric strength		2000VAC 50/60Hz for 1 minute				
Insulation resistance		Over 100MΩ (at 500VDC megger)				
Environ-ment	Ambient temperature	-10 to 55℃, storage: -25 to 60℃				
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH				
Unit weight		Approx. 150g			Approx. 160g	

※If the load is connected over 200mA at the sensor output, it may cause mechanical trouble.
※Environment resistance is rated at no freezing or condensation.

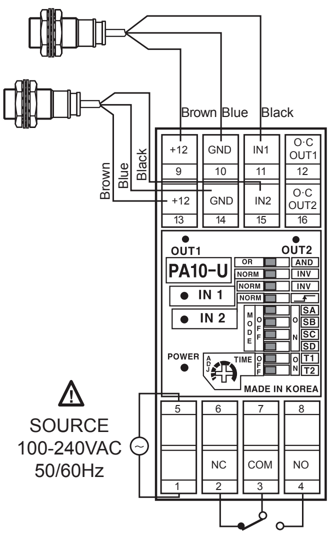
■ Dimensions

(unit: mm)



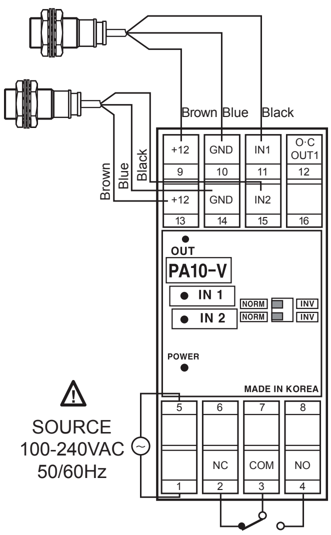
■ Connections

● PA10-U



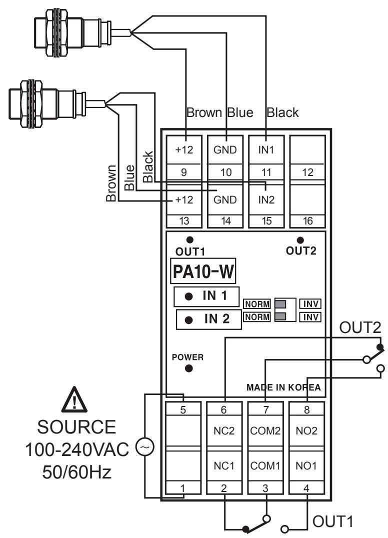
CONTACT OUT:
250VAC 3A
RESISTIVE LOAD

● PA10-V/PA10-VP



CONTACT OUT:
250VAC 3A
RESISTIVE LOAD

● PA10-W/PA10-WP



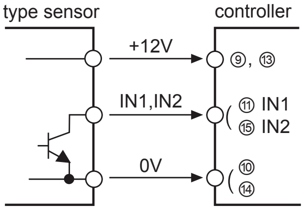
CONTACT OUT1,OUT2:
250VAC 3A
RESISTIVE LOAD

■ Input Connections

● PA10-U

NPN open collector output type sensor

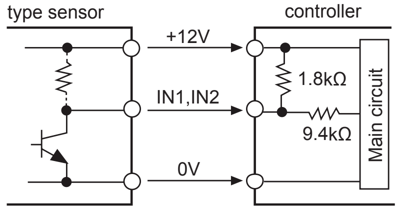
Sensor controller



● PA10-V / PA10-W

NPN open collector type & NPN universal output type sensor

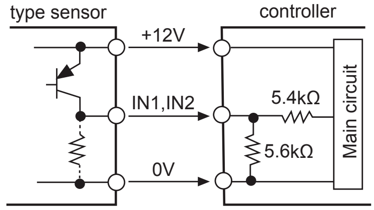
Sensor controller



● PA10-VP / PA10-WP

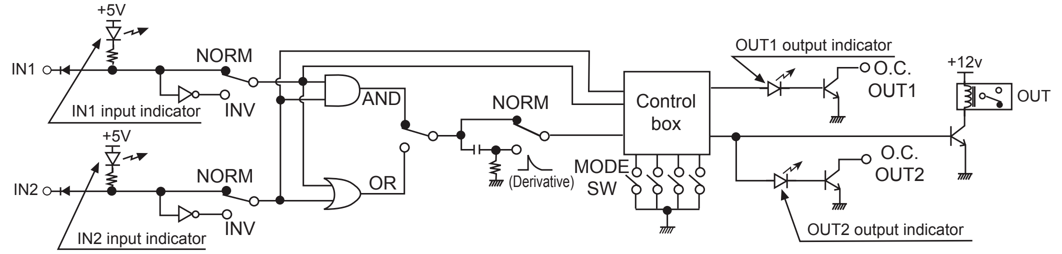
PNP open collector type & PNP universal output type sensor

Sensor controller

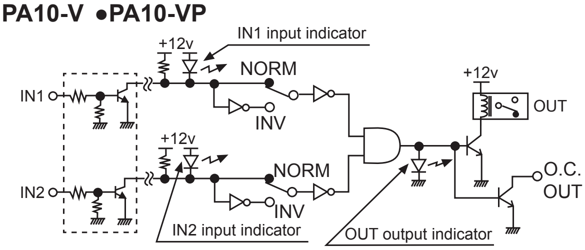


■ Function Diagram

●PA10-U

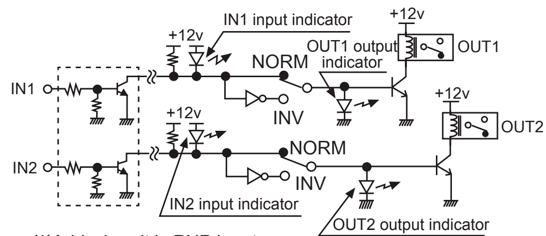


●PA10-V ●PA10-VP



※Add when it is PNP input

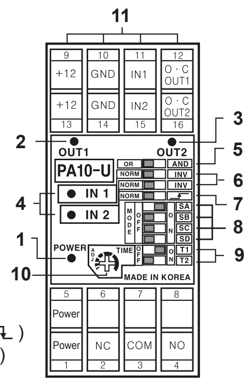
● PA10-W ● PA10-WP



※Add when it is PNP input

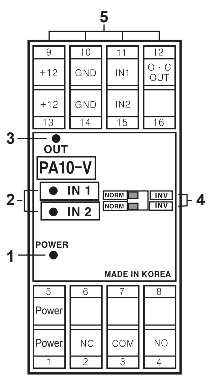
■ Front Panel Identification

● PA10-U



1. **Power indicator**:
   LED is turned on when AC power applied
2. **Output1 indicator**:
   Indication of output 1 operation status
3. **Output2 indicator**:
   Indication of output 2 operation status
4. **Sensor input indicator**
   Indicates sensor input signal
   (LED is turned on when sensor input is Low)
5. **AND/OR selection switch:**
   Select "AND" or "OR" for IN1, IN2 Input
6. **Selection switch of sensor input signal**
   NORM | INV (Reverse function of input signal)
   - NORM: LED is turned on when input signal is low. ( )
   - INV: LED is turned on when input signal is high. ( )
7. **Derivative action selection of IN2 input signal (OR/AND selection switch: AND)**
   NORM | (When input signal is high ( ) it is effective signal.)
   - NORM: IN2 input signal is operating as reverse turn function
   - : IN2 Derivative action of IN2 input signal. (※Refer to O-8, ■ Applicatio of derivative operation,)
8. **Selection switch for operation mode**:
   See <■Operation mode> in next page.
9. **Selection switch of time range and max. input frequency**: It is the switch to select time range (1 to 7 mode) or allowable input frequency (9 to 11 mode).
   - Time range: Approx. 0.01 to 0.1sec
     Max. input frequency: 100kHz
   - Time range: Approx. 0.1 to 1sec
     Max. input frequency: 10kHz
   - Time range: Approx. 1 to 10sec
     Max. input frequency: 1kHz
   - Time range: Approx. 10 to 100sec
     Max. input frequency: 100Hz
10. **Timer adjuster**
    Adjust time as same as the range of 9.
11. **Terminal block**

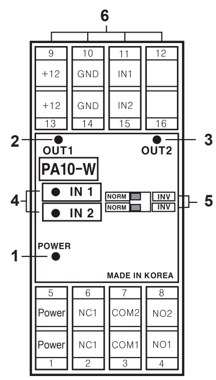
● PA10-V/PA10-VP



1. **Power indicator**:
   LED is turned on when AC power applied
2. **Output indicator**:
   Indicates output operation
3. **Sensor input indicator**:
   - PA10-V: Indicates sensor input signal (LED turns on when sensor input is Low)
   - PA10-VP: Indicates sensor input signal (LED turns on when sensor input is High)
4. **Selection switch of sensor input signal**
   - NORM: When sensor input signal is Low, it is vaild signal.
   - INV: When sensor input signal is High, it is valid signal.
5. **Terminal block**

※When IN1, IN2 input signal is AND, OUT will work.

● PA10-W/PA10-WP



※IN1, IN2 operates individually.

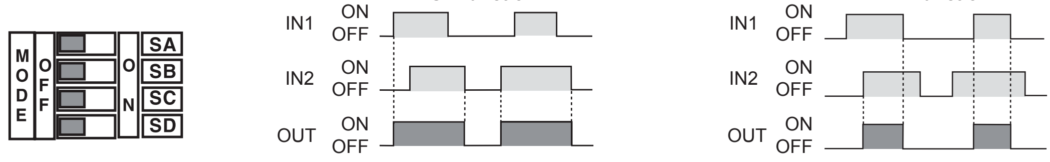
1. **Power indicator**:
   LED is turned on when AC power applied
2. **Output1 indicator**:
   Indication of output 1 operation status
3. **Output2 indicator**:
   Indication of output 2 operation status
4. **Sensor input indicator**:
   - PA10-W: Indicates sensor input signal (LED is turned on when sensor input is Low)
   - PA10-WP: Indicates sensor input signal (LED is turned on when sensor input is High)
5. **Selection switch of sensor input signal**
   - NORM: When sensor input signal is Low, it is valid signal.
   - INV: When sensor input signal is High, it is vaild signal.
6. **Terminal block**

▣ Operation Mode (PA10-U)

● MODE 0 Normal mode

OUT will work according to input signal regardless Timer.

<OR function> <AND function>



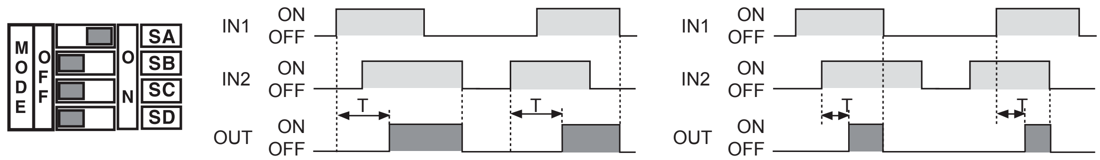
※Output will be ON when either IN1 or IN2 is ON.

※Output will be ON when both IN1 and IN2 are ON.

● MODE 1 ON-Delay mode

OUT will be ON after delayed as setting time according to one of IN1 and IN2 is ON. When IN1 and IN2 are OFF, OUT will be OFF.

<OR function> <AND function>



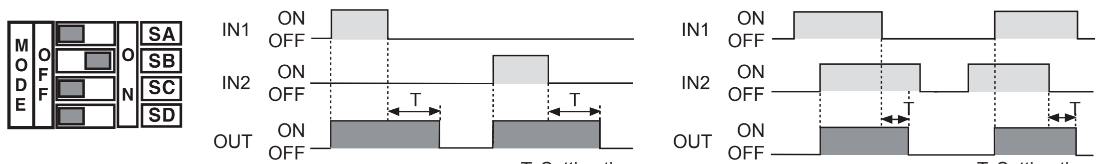
T: Setting time

T: Setting time

● MODE 2 OFF-Delay mode

OUT will be ON at the same time when IN1 or IN2 is ON then OUT will be OFF after delayed as setting time according to IN1 or IN2 is OFF.

<OR function> <AND function>



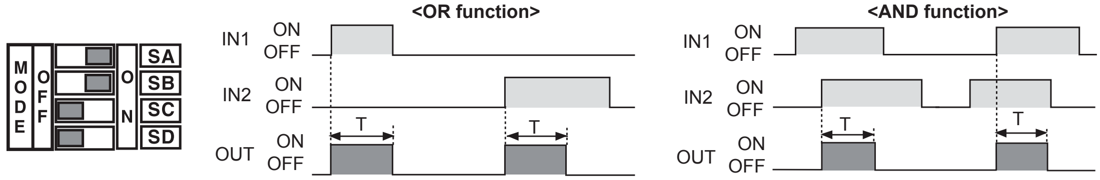
T: Setting time

T: Setting time

● MODE 3 ONE-Shot delay mode

OUT will be ON at the same time with IN1 or IN2 is ON then OUT will be OFF after delayed as setting time.

<OR function> <AND function>

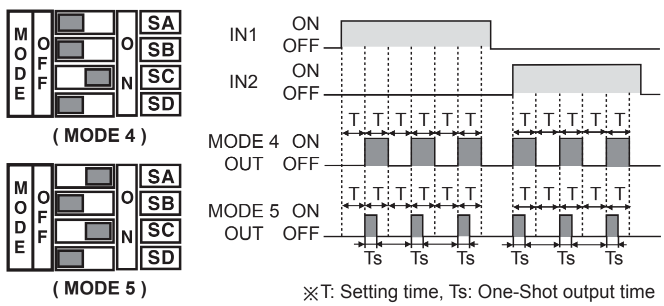


T: Setting time

T: Setting time

● MODE 4, 5 Flicker mode / Flicker one-shot mode

OUT will be ON after delayed as setting time for IN1 input then it is flashing and OUT will be flashing after setting time from ON. But, in case of one-shot mode, output time (Ts) will selected by NORM ▣ ⎍.
(⎍: Ts = Approx. 10ms, NORM : Ts = Approx. 100ms)



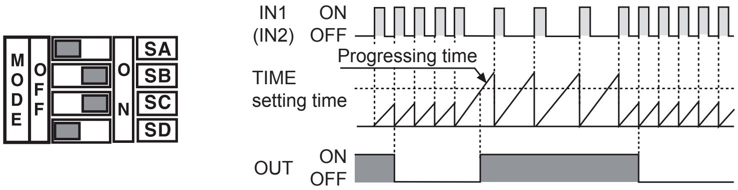
※T: Setting time, Ts: One-Shot output time

Note)ON/OFF ratio of flicker output is 1:1
Note)In case of flicker mode, it is not different between OR ▣ AND and NORM ▣ ⎍.
Note)In case of one-shot mode, it is not different between OR ▣ AND .

▣ Operation Mode (PA10-U)

● MODE 6 Low-speed detection mode

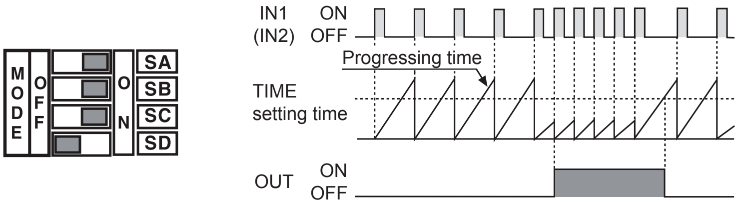
OUT will be ON when input signal (IN1) is longer than setting time by comparing it to the setting time by one cycle.



Note)Above is when input logic is OR and it will be the same by using IN2 input signal terminal instead of IN1.
Note)When use MODE 6 as above, be sure that OUT will be work at the same time with power supply.

● MODE 7 High-speed detection mode

OUT will be ON when input signal (IN1) is shorter than setting time by comparing it to the setting time by one cycle.



Note)Above is when input logic is OR and it will be the same by using IN2 input signal terminal instead of IN1.

◎ Time switches

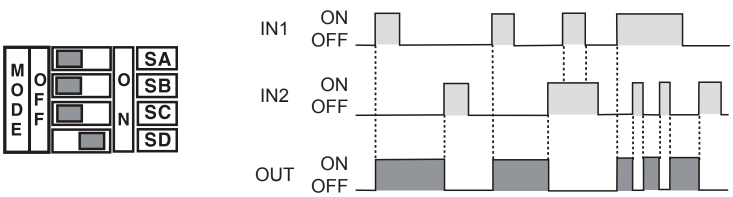
Set the time by time switches (T1, T2) and front time adjuster (ADJ).

TIME S/W \ Item \ MODE	MODE 1 to MODE 7, MODE 12	MODE 6 to MODE 7	
	Setting time range	Input frequency	rpm
OFF ON T1 T2	0.01 to 0.1sec	100 to 10Hz	6,000 to 600rpm
OFF ON T1 T2	0.1 to1sec	10 to 1Hz	600 to 60rpm
OFF ON T1 T2	1 to 10sec	1 to 0.1Hz	60 to 6rpm
OFF ON T1 T2	10 to 100sec	0.1 to 0.01Hz	6 to 0.6rpm

※Range of operating rpm is 1 pulse per 1 revolution.
※When the pulse is increasing per 1 revolution, range of operating rpm is decreasing.

● MODE 8 Flip-Flop mode [OUT latch operation]

When IN1 signal is input then the Flip-Flop output will be ON (SET). When the IN2 signal is input, Flip-Flop Signal will be OFF (RESET).



Note)IN2 will be prior to all input signal.
Note)Both OR ☐ AND and NORM ☐ ⎍ switches are allowed to use.
Note)There is no Timer function in Flip-Flop Mode, therefore use this unit with time switches (T1, T2) are OFF.

■ Operation Mode (PA10-U)

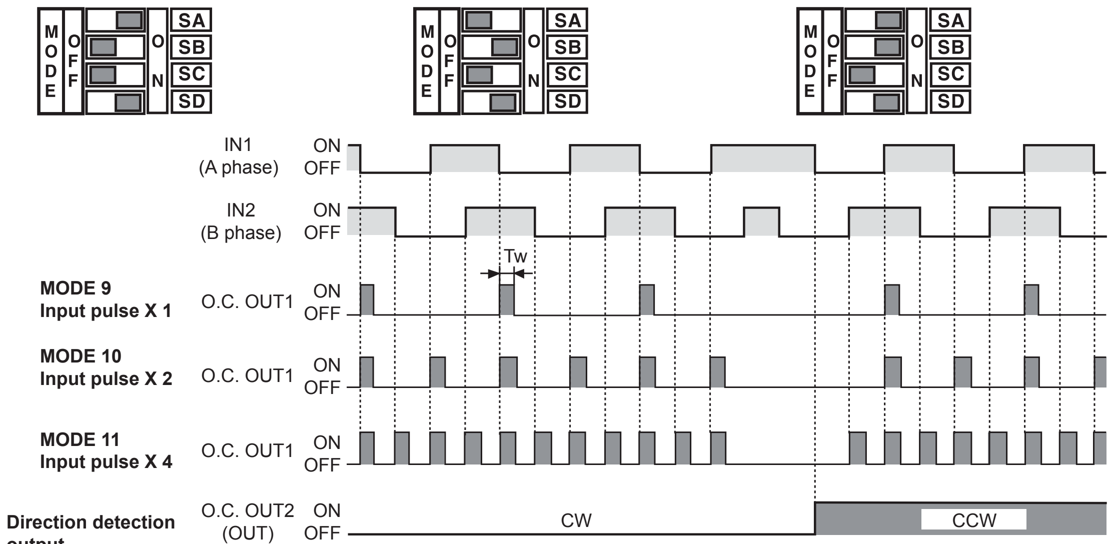
◎ Encoder mode (MODE 9 to MODE 11)

1) There should be 90° phase difference between IN1 and IN2 for input terminal.
2) Please connect A phase output of encoder to IN1 and B phase output of encoder to IN2, when use NPN open collector or totem pole output type of encoder with PA10-U. In this case, detection signal (O.C. OUT2) output of PA10-U will be OFF when turning encoder to CW direction.
3) There are output function of pulse (O.C. OUT1) has been multiplied (×1, ×2, ×4 times) against input signal and Direction detection output (O.C. OUT2) function which detects direction of encoder revolution in Encoder mode.
4) Be cautious about input speed (cps) of connected equipment due to pulse width of O.C. OUT1 is short.
5) OR ▭ AND NORM ▭ ⎍ NORM ▭ INV Selection switches can be set at any position.

● MODE 9 ENCODER (Input pulse × 1time)

● MODE 10 ENCODER (Input pulse × 2times)

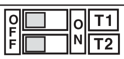
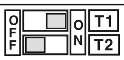
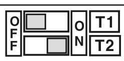
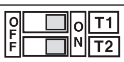
● MODE 11 ENCODER (Input pulse × 4times)



※Note)Tw (pulse width) can be changed according to max. input frequency.

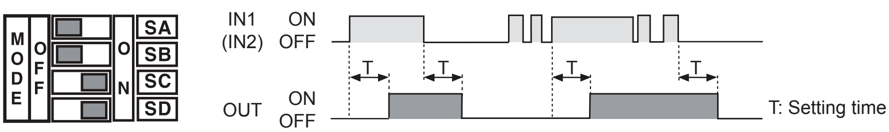
◎ Time switches in encoder mode

Time switch is to convert output pulse width (Tw).

Time switch	Max. input frequency	Output pulse width (Tw)	Input speed of connected equipment (cps)
	100kHz	Approx. 0.5μs	Min. 2000kHz (2,000kcps)
	10kHz	Approx. 5μs	Min. 200kHz (200kcps)
	1kHz	Approx. 50μs	Min. 20kHz (20kcps)
	100Hz	Approx. 500μs	Min. 2kHz (2kcps)

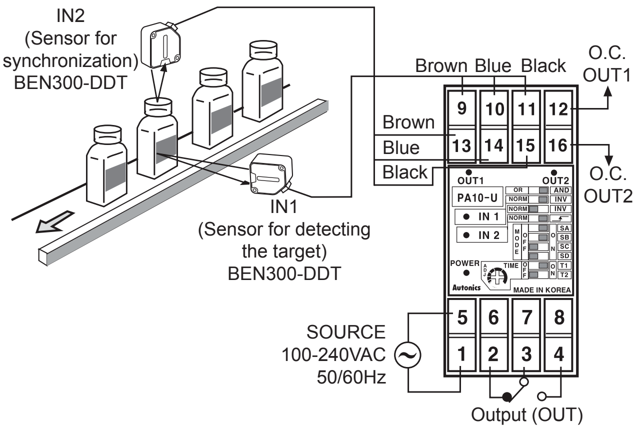
● MODE 12 ON/OFF-DELAY MODE

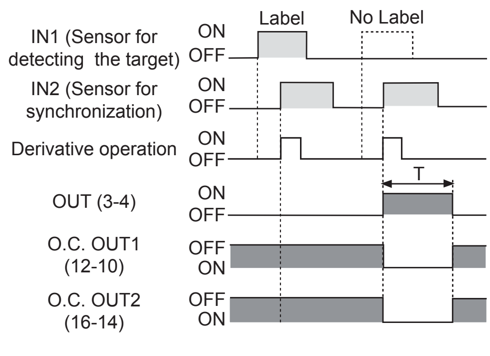
OUT will be ON after setting time when IN1 (or IN2) is ON. When IN1 (or IN2) is OFF, OUT will be OFF after setting time. (This is when input logic is OR)
※If IN1 (or IN2) ON/OFF time is shorter than setting time, OUT does not turn.



▣ Application Of Derivative Operation

◎ Sensing labels of glass bottles





※T: Setting time
(Refer to O-5 for the range of setting time.)

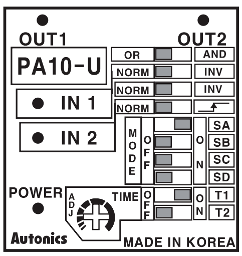
● **Operation**

When IN2 is ON after IN1 is ON, OUT will not operate. But if there is no label on bottle, OUT will operate with IN2 is ON only. OUT will be returned after setting time.

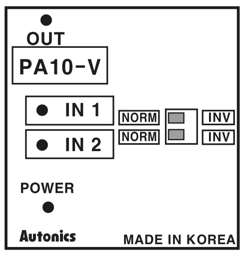
Note)Please install the sensor (IN1) to be operated first.

▣ Factory Default For S/W

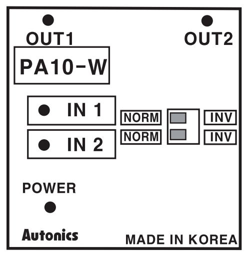
●PA10-U:
MODE1 ON-DELAY



●PA10-V: NORM
●PA10-VP: NORM



●PA10-W: NORM
●PA10-WP: NORM



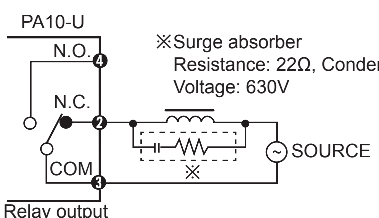
▣ Proper Usage

◎ Load connections

It is important to protect from surge or noise by installing a surge absorber across inductive loads (motor, solenoid, etc).

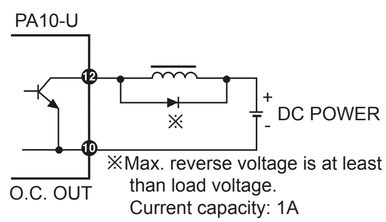
In case the load is a DC relay, please install a diode across relay as shown below.

(Be careful of polarity.)



※Surge absorber
Resistance: 22Ω, Condenser: 0.1μF,
Voltage: 630V

(Fig. 1) When it is relay output



※Max. reverse voltage is at least 3 times over than load voltage.
Current capacity: 1A

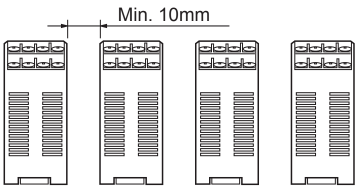
(Fig. 2)When it is NPN open collector

◎ Input signal line

- Please make the cable line short from input sensor to this controller.
- Do not put input signal line with other power cable in the same conduit.
- When need to extend the input signal line, please use shielded cable.

◎ Precaution for installation

When it is required to install more than two PA10s, the space between two PA10s should be larger than 10mm in order for proper cooling.



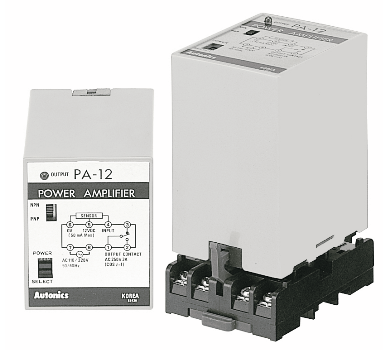
◎ Other precautions

- Installation and dismantlement should be done with power off.
- Please check connections before wiring.
- Good ventilation must be considered to protect heating from inner components.
  (Ambient operating temperature is -10℃ to 55℃.)
- Do not supply over 100-240VAC.
- Do not install this controller at place where there are dust,steam, corrosive gas,water etc.
- AC power line must be separated from O.C. output line or signal input line.
- This controller has been designed to have high speed response (5μs) for O.C. output. If using micro switch or limit switch for signal input, chattering might be occurred at O.C. output.

PA-12 Series

8-Pin Plug Type General-Purpose Sensor Controller

■ Features



- Selectable use of 110/220VAC
- Selectable use of NPN, PNP input
- Able to drive loads up to 3A, 250VAC with proximity sensor or photo sensor input
- Convenient to mount on socket by plug in type
- Output relay with both N.O. and N.C. contacts

⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering Information

PA — 12 — PG

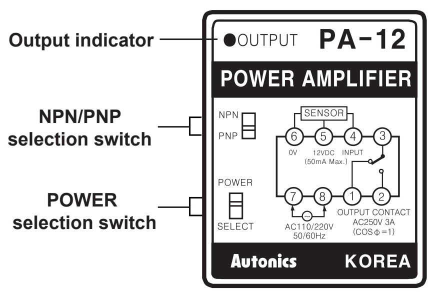
	No mark	Power Amplifier
	PG	Pulse generator (NPN type)
	PGP	Pulse generator (PNP type)
Power supply	12	Selectable 110/220VAC 50/60Hz
Item	PA	Power amplifier

■ Specifications

Model		PA-12	PA-12-PG	PA-12-PGP
Type		Selectable NPN/PNP	NPN open collector output	PNP open collector output
Power supply		Selectable 110/220VAC 50/60Hz	110/220VAC 50/60Hz	
Power consumption		Approx. 4VA		
Power for external sensor		12VDC 50mA	12VDC ±10% 30mA	
Input signal	NPN	Short-circuit impedance: Max. 1kΩ, Residual voltage: Max. 2VDC, Open-circuit impedance: Min. 100kΩ	Short-circuit impedance: Max. 1kΩ, Residual voltage: Max. 2VDC, Open-circuit impedance: Min. 100kΩ	—
	PNP	High level: 7-12VDC, Low level: 0-5VDC	—	High Level: 7-12VDC, Low Level: 0-5VDC
Response time	Input	Min. 0.2ms		
	Output	Min. 10ms		
Input resistance		10kΩ	—	—
Control output		Contact composition: SPDT (1a1b) Contact capacity: 250VAC 3A (for resistive load)	NPN open collector output	PNP open collector output
			Allowable input voltage: Max. 30VDC, Rated current: Max. 50mA	
Environment	Ambient temperature	-10 to 50℃		
	Ambient humidity	45 to 85%RH		
Relay life cycle	Mechanical	Min. 10,000,000 operations		
	Electrical	Min. 100,000 operations (250VAC 3A resistive load)		
Unit weight		Approx. 269g		

※Environment resistance is rated at no freezing or condensation.

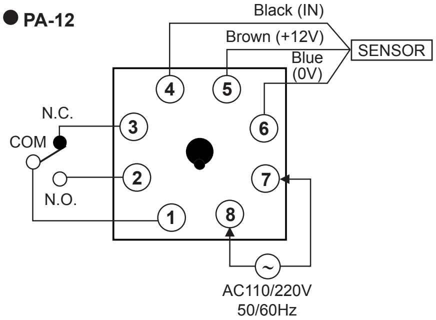
■ Unit Description



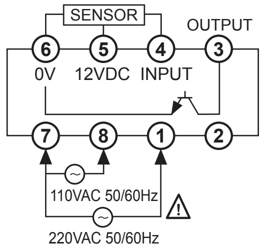
8-Pin Plug Type General-Purpose Sensor Controller

Connections

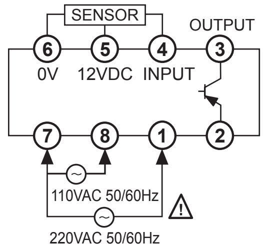
● **PA-12**



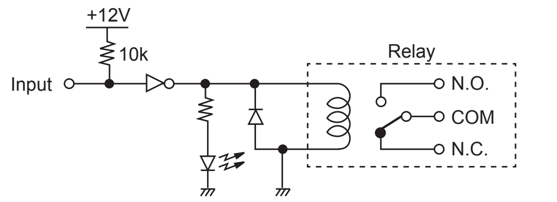
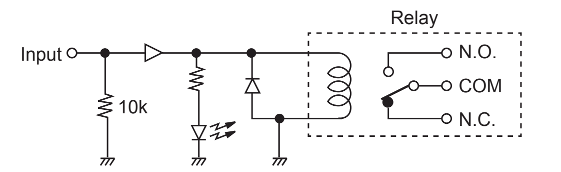
● **PA-12-PG**



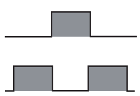
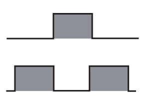
● **PA-12-PGP**



Function Diagram

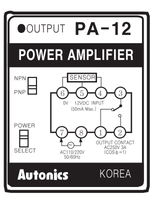
NPN circuit	PNP circuit
	

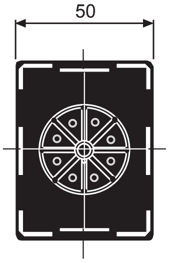
Operation Mode

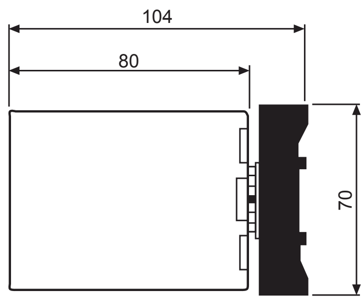
Input	NPN	PNP
Input level	H L 	H L 
Relay output	N.O. N.C. 	N.O. N.C. 
LED	ON OFF 	ON OFF 

Dimensions

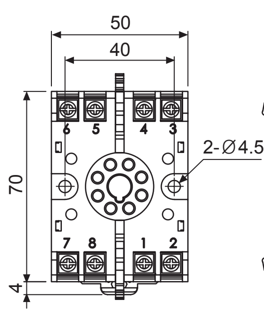
(unit: mm)

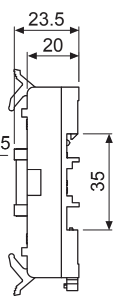






● **8 Pin socket: PS-08(N) (sold separately)**





Proper Usage

- Power selection switch is set according to power voltage.
- Please check connections before wiring.
- Please be cautious not to short-circuit the 12VDC terminal at GND.
- Do not install this unit at place where steam, dust, corrosive gas and water exist.

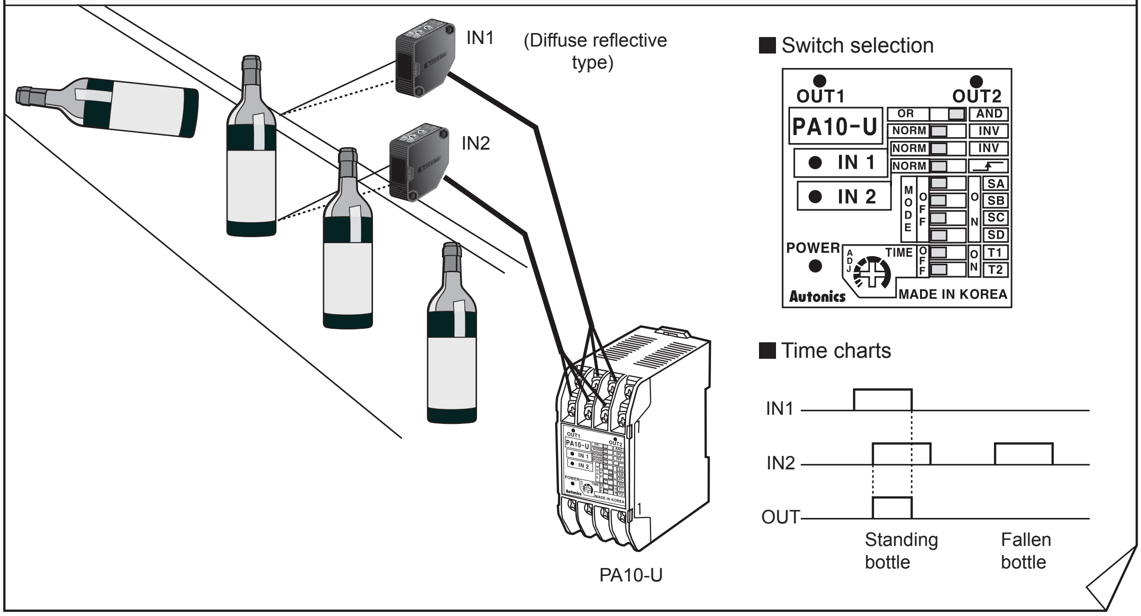
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Applications

■ Application 1

◎ When a bottle is fallen

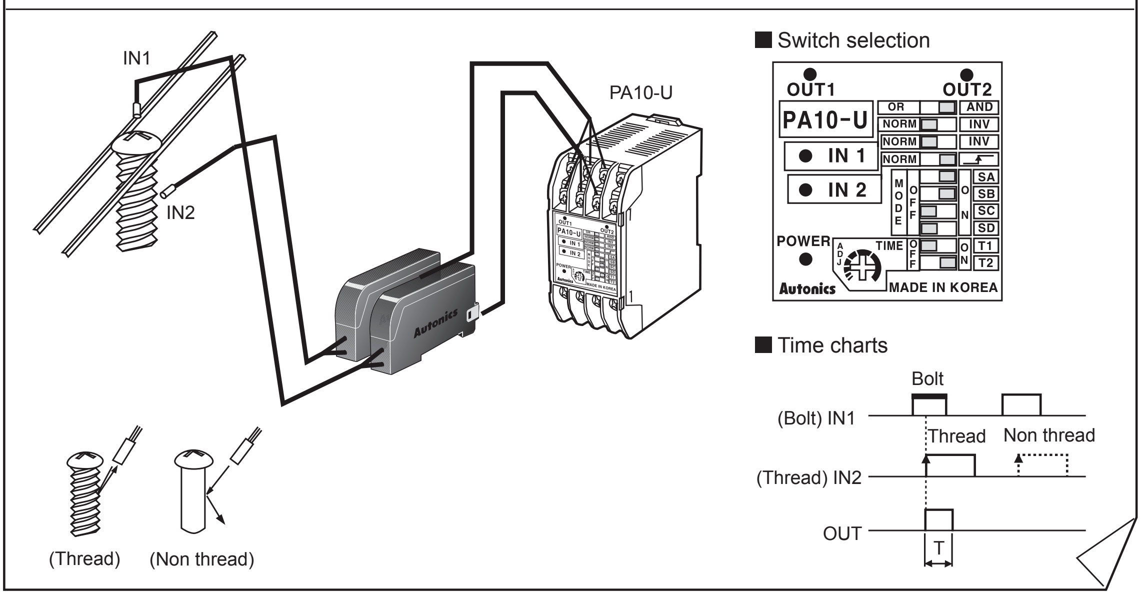
When a bottle is standing, IN1,IN2 are ON and when a bottle is fallen, IN2 is ON only.
Therefore, it detects fallen bottles when IN1, IN2 are ON by using (AND) operation.



■ Application 2

◎ Detecting thread of screws

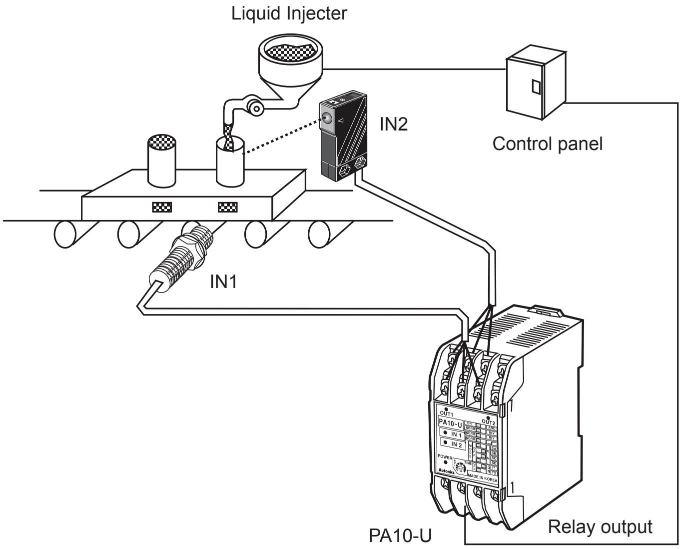
- IN1 is for detecting screws and IN2 is for detecting thread of screws.
- IN1 and IN2 are ON, OUT will be ON then automatically returned after setting time (T). (one shot delay)
- IN1 should be operating faster than IN2 and IN2, IN1 should be operating at once .



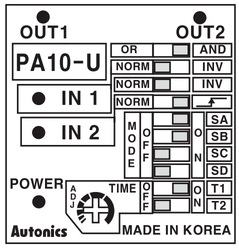
▣ Application 3

◎ Injecting constant volume of liquid

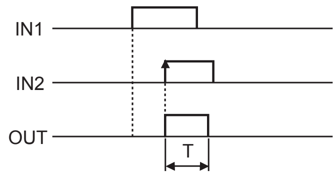
IN1 and IN2 are ON, OUT will be ON then automatically returned after setting time (T). (one shot delay)



■ Switch selection



■ Time charts

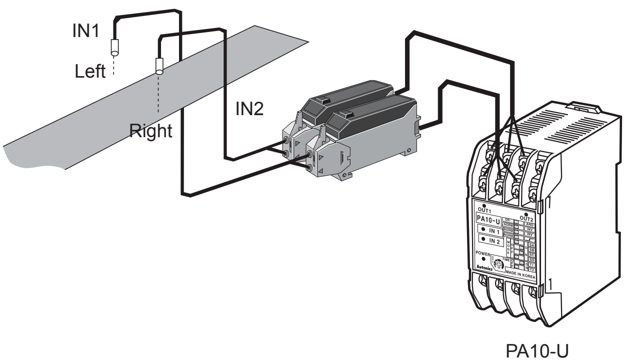


Inject liquid for setting time (T)

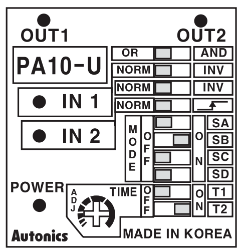
▣ Application 4

◎ Detecting location of sheet

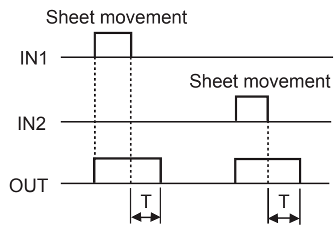
Install two sensors at both edges of sheet, when IN1 and IN2 are OFF, it detects this sheet is not out.
When one of them is ON, it detects that one side of sheet has moved and then output will be ON.
If IN1 and IN2 signal is ON then OFF, output will be OFF after setting time (T). (OFF delay)



■ Switch selection



■ Time charts

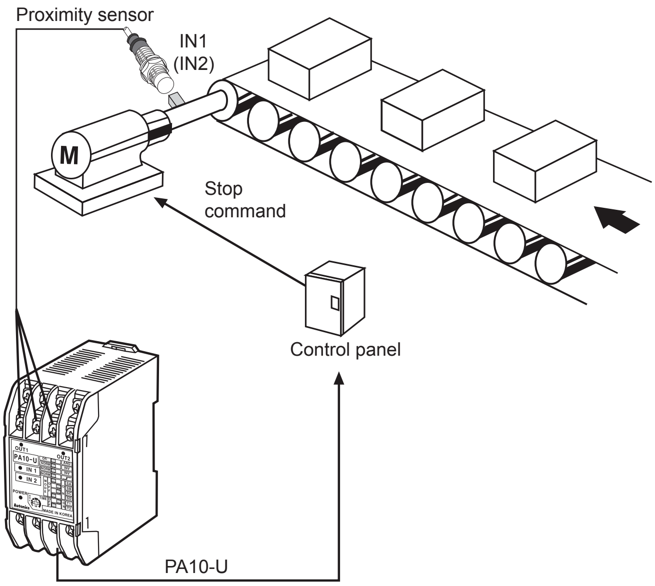


▣ Application 5

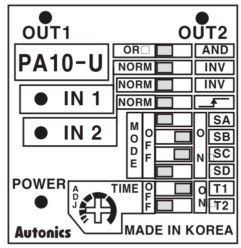
◎ Sensing a problem with the conveyor

The output will be ON when there is no input signal within setting time. (low-speed detection mode)

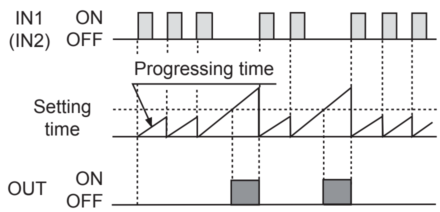
Ex)When setting as 3 sec for T (setting time), and there is no input signal within 3sec, the output will be ON and it is able to stop the motor by this output.



■ Switch selection



■ Time charts

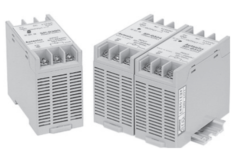


(P) Switching Mode Power Supplies

Line-up

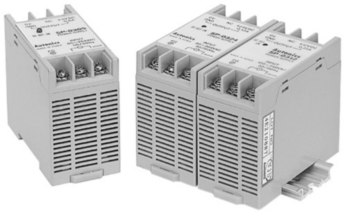
DIN Rail Mount Type SMPS
SPB Series

DIN Rail Mount Type SMPS
SP Series



General-Purpose SMPS
SPA Series

Product Overview

Type		DIN rail mount type Switching Mode Power Supply (SMPS)		
Model		**SP-0305**	**SP-0312**	**SP-0324**
Appearances & Dimensions		 [W37.5×H75×L65mm]		
Output power		3W		
Input	Voltage	100-240VAC (permissible voltage: 85-264VAC)		
Input	Frequency	50/60Hz		
Input	Current consumption	Max. 0.15A		
Input	Efficiency	67 to 74%		
Output	Voltage	5VDC	12VDC	24VDC
Output	Current	0.6A	0.25A	0.13A
Output	Voltage adjustment range	Max. ±5%		
Output	Ripple	Max. 5%		
Output	Voltage fluctuation ratio	Max. 0.5% (at 85-264VAC 100% load)		
Over-current protection		Min. 110%		
Reference		**P-4 to 7**		

Type		General-purpose Switcing Mode Power Supply (SMPS)											
Model		**SPA-030-05**	**SPA-050-05**	**SPA-030-12**	**SPA-050-12**	**SPA-030-24**	**SPA-050-24**	**SPA-075-05**	**SPA-100-05**	**SPA-075-12**	**SPA-100-12**	**SPA-075-24**	**SPA-100-24**
Appearances & Dimensions		CE (except for output voltage 5VDC) **SPA-030/050 Series**  [W97×H40×L120mm]						**SPA-075/100 Series**  [W97×H42×L160mm]					
Output power		30W	50W	30W	50W	30W	50W	75W	100W	75W	100W	75W	100W
Input	Voltage※5	100-240VAC (permissible voltage: 85-264VAC)						100-120/200-240VAC (permissible voltage: 85-132/170-264VAC) switching type					
Input	Frequency	50/60Hz											
Input	Efficiency※1	Min. 60%	Min. 67%	Min. 74%		Min. 80%		Min. 70%		Min. 78%	Min. 72%	Min. 78%	Min. 80%
Input	Current consumption※1	Max. 1.2A	Max. 1.6A	Max. 1.0A	Max. 1.4A	Max. 0.8A	Max. 1.1A	Max. 3.0A		Max. 2.0A	Max. 3.0A	Max. 2.0A	Max. 2.5A
Output	Voltage	5VDC		12VDC		24VDC		5VDC		12VDC		24VDC	
Output	Current	6A	10A	2.5A	4.2A	1.5A	2.1A	15A	20A	6.3A	8.5A	3.2A	4.2A
Output	Voltage adj. range※4	±5%											
Output	Input fluctuation※2	Max. ±0.5%											
Output	Load fluctuation※1	Max. ±2%		Max. ±1%				Max. ±2%		Max. ±1%			
Output	Ripple※1	Max. ±1%											
Output	Starting time※1	Max. 200ms		Max. 150ms				Max. 250ms					
Output	Holding time※1	Min. 10ms						Min. 5ms		Min. 10ms	Min. 5ms	Min. 10ms	
Protect function	Inrush current protection	Max. 30A (100VAC) /Max.40A (240VAC)		Max. 20A (100VAC)				Max. 45A (100VAC)/ Max. 50A (240VAC)		Max. 35A (100VAC) /Max. 40A (240VAC)	Max. 45A (100VAC) /Max. 50A (240VAC)	Max. 35A (100VAC)/ Max. 40A (240VAC)	
Protect function	Over-current protection	Min. 110%							Min. 105%	Min. 110%			
Protect function	Over-voltage protection※3	—						6.5V ±10%		16V ±10%		30V ±10%	
Protect function	Short protection	Max. 5ms						Max. 10ms		Max. 5ms	Max. 10ms	Max. 5ms	
Reference		**P-8 to 11**											

※1: 100% load for rated input voltage (100VAC).
※2: Rated input voltage [•SPA-030/050 Series: 100-240VAC (85-264VAC) / •SPA-075/100 Series: 100-120/200-240 (85-132/170-264VAC)] under 100% of load.
SPA-100-05 is under 100% of load for [100-120/200-240VAC (100-132/190-264VAC)].
※3: Rated input voltage (100VAC). ※4: Vary voltage by output voltage adjuster, it is changed over voltage adjustment range (±5%).
※5: The rated input voltage of SPA-100-05 is 100-120/200-240VAC (100-132/190-264VAC).

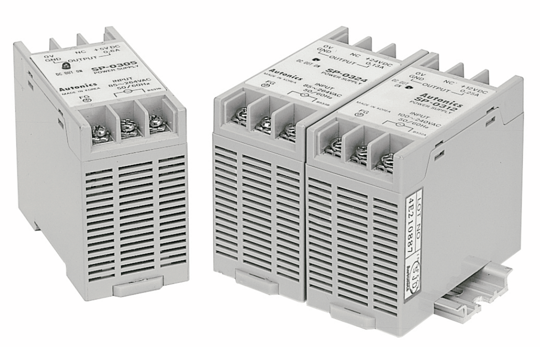
Type			DIN rail mount type Switching Mode Power Supply (SMPS)														
Model			**SPB -015 -05**	**SPB -015 -12**	**SPB -015 -24**	**SPB -030 -05**	**SPB -030 -12**	**SPB -030 -24**	**SPB -060 -12**	**SPB -060 -24**	**SPB -060 -48**	**SPB -120 -12**	**SPB -120 -24**	**SPB -120 -48**	**SPB -240 -12**	**SPB -240 -24**	**SPB -240 -48**
Appearances & Dimensions			CE  [W22.5×H90×L90mm]			CE  [W30×H90×L90mm]			CE Line-up  [W36×H100×L110mm]			CE Line-up  [W50×H115×L110mm]			CE  [W80×H115×L110mm]		
Output power			15W	15.6W		25W	30W	31.2W	60W		62.4W	96W	120W		240W		
Input	Voltage		100-240VAC (permissible voltage: 85-264VAC/120-370VDC)														
Input	Frequency		50/60Hz														
Input	Efficiency※1 (Typical)	100VAC	77%	80%	83%	77%	82%	84%	81%	84%	85%	82%	82%	85%	87%	89%	89%
Input		240VAC	76%	79%	82%	78%	83%	85%	83%	86%	87%	85%	85%	88%	90%	92%	92%
Input	Power factor※1		—			—			—			Min. 0.9			Min. 0.9		
Input	Current consumption※1 (Typical)	100VAC	0.35A	0.35A	0.34A	0.56A	0.63A	0.63A	1.24A	1.21A	1.19A	1.19A	1.49A	1.43A	2.76A	2.71A	2.73A
Input		240VAC	0.19A	0.19A	0.19A	0.30A	0.35A	0.35A	0.66A	0.65A	0.64A	0.52A	0.61A	0.61A	1.14A	1.12A	1.13A
Power factor correction circuit			—			—			—			Built-in			Built-in		
Output	Voltage		5VDC	12VDC	24VDC	5VDC	12VDC	24VDC	12VDC	24VDC	48VDC	12VDC	24VDC	48VDC	12VDC	24VDC	48VDC
Output	Current		3A	1.3A	0.65A	5A	2.5A	1.3A	5A	2.5A	1.3A	8A	5A	2.5A	20A	10A	5A
Output	Voltage adjustment range※2		Max. ±10%			Max. ±10%			Max. ±5%			Max. ±5%			Max. ±5%		
Output	Input variation※3		Max. ±0.5%			Max. ±0.5%			Max. ±0.5%			Max. ±0.5%			Max. ±0.5%		
Output	Load variation		Max. ±1%			Max. ±1%			Max. ±1%			Max. ±1%			Max. ±1%		
Output	Ripple&Ripple noise※1,※4		Max. ±1.5%	Max. ±1%		Max. ±1.5%	Max. ±1%		Max. ±1%			Max. ±1%			Max. ±1.5%	Max. ±1%	
Output	Start-up time※1 (Typical)	100VAC	500ms	550ms	650ms	600ms	550ms	550ms	520ms	550ms	1200ms	1200ms	760ms	1200ms	75ms	87ms	75ms
Output		240VAC	550ms	550ms	650ms	600ms	550ms	550ms	530ms	550ms	400ms	400ms	280ms	400ms	45ms	56ms	45ms
Output	Hold time※1 (Typical)	100VAC	24ms	25ms	25ms	20ms	15ms	15ms	15ms	14ms	15ms	98ms	81ms	87ms	33ms	36ms	25ms
Output		240VAC	190ms	190ms	190ms	130ms	110ms	110ms	100ms	110ms	108ms	97ms	81ms	86ms	33ms	36ms	25ms
Protection	Inrush current protection (Typical)	100VAC	7A	7A	7A	7A	7A	6A	13A	14A	10A	9A	16A	10A	8A	8A	8A
Protection		240VAC	32A	30A	31A	29A	31A	29A	19A	17A	37A	37A	20A	37A	22A	25A	26A
Protection	Over-current protection※4		105 to 160%			105 to 160%			105 to 160%			105 to 160%			105 to 160%		
Protection	Over-voltage protection		—			—			—			16.0V ±10%	30.0V ±10%	58.0V ±10%	16.0V ±10%	30.0V ±10%	58.0V ±10%
Protection	Output low-voltage indicate		4.2V ±10%	9.6V ±10%	20.0V ±10%	4.2V ±10%	9.6V ±10%	20.0V ±10%	9.6V ±10%	20.0V ±10%	43.0V ±10%	9.6V ±10%	20.0V ±10%	43.0V ±10%	10.0V ±10%	20.0V ±10%	43.0V ±10%
Reference			**P-12 to 15**														

※1: It is for 100% load.
※2: Adjusting voltage by the output adjuster (V.ADJ), it is changed the below voltage adjustment range.
※3: It is for the rated input voltage 100-240VAC (85-264VAC), and 100% load.
※4: It is for the rated input voltage 100-240VAC.

DIN Rail Mount Type Switching Mode Power Supply

■ Features

- Compact size, high quality, cost-effective
- Universal input power
- Enables to drive various controllers
- Built-in over-current protection circuit
- DIN rail mounting and mountable without the rail



⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Ordering Information

SP — 03 24

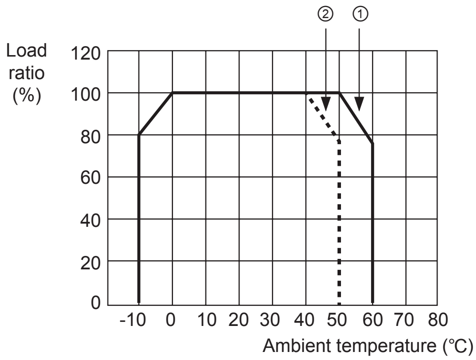
Output voltage	05	5VDC
	12	12VDC
	24	24VDC
Output power	03	3W
Item	SP	Switching Mode Power Supply

■ Specifications

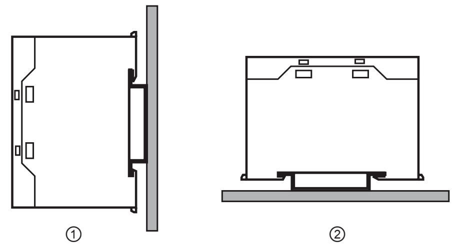
Model		**SP-0305**	**SP-0312**	**SP-0324**
Output power		3W		
Input	Voltage	100-240VAC (permissible voltage: 85-264VAC)		
	Frequency	50/60Hz		
	Efficiency	67 to 74%		
	Current consumption	Max. 0.15A		
Output	Voltage	5VDC	12VDC	24VDC
	Current	0.6A	0.25A	0.13A
	Allowable voltage range	Max. ±5%		
	Ripple	Max. 5%		
	Voltage fluctuation ratio	Max. 0.5% (at 85-264VAC 100% load)		
Over-current protection		Min. 110%		
Series / Parallel operation		Not available		
Indicator		Output indicator: Red LED		
Insulation resistance		Over 100MΩ (at 500VDC megger)		
Dielectric strength		2,000VAC 50/60Hz for 1 minute		
Vibration		0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		300m/s² (approx. 30G) in each X, Y, Z direction for 3 times		
Environ-ment	Ambient temperature	-10 to 50℃, storage: -20 to 70℃		
	Ambient humidity	35 to 85%RH		
Unit weight		Approx. 100g		

※Environment resistance is rated at no freezing of condensation.

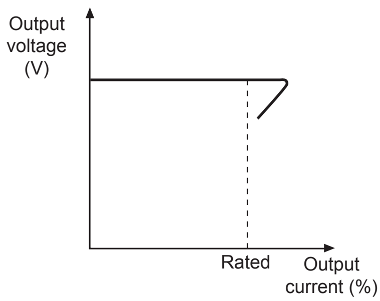
Output Derating Curve By Ambient Temperature



- Be sure when installing as the efficiency is decreased by ambient temperature.
- Refer to output feature beside when installing as the efficiency is affected by mounting status.

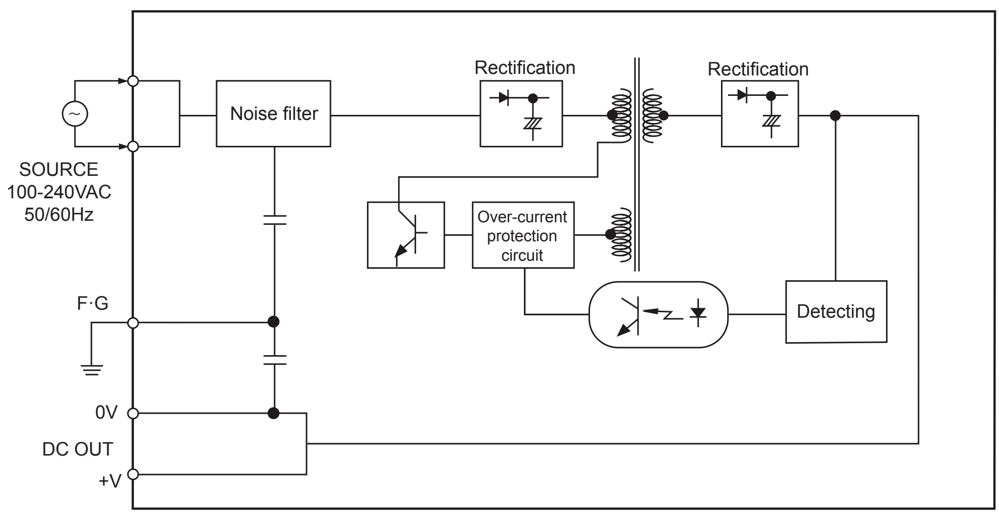


Feature Data Of Over-Current Protection



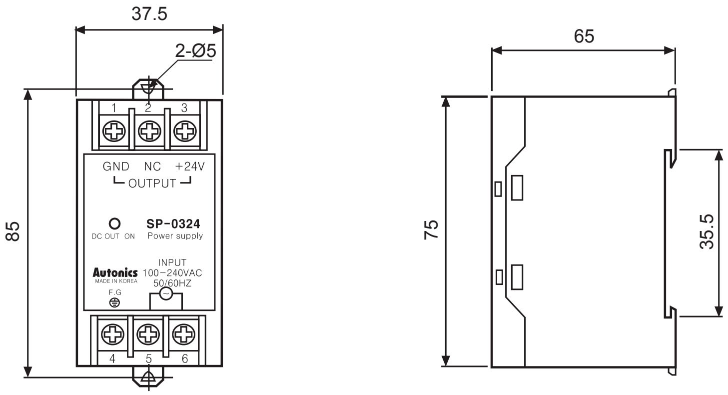
- It is able to protect overcurrent by load with built in over-current protection circuit. When the over rated current is flowed, the circuit is operated (output voltage is fallen) and it is released when the load current is under the rated current (it is returned to the rated output voltage).

Block Diagram

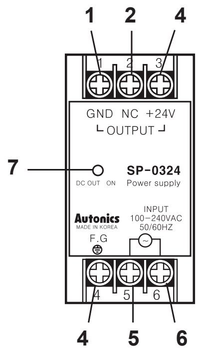


▣ Dimensions

(unit: mm)



▣ Unit Description



1. GND
2. N·C terminal
3. +V

− + Output power terminal

4. F.G. (Field Ground) terminal
5.
6.

~ Input power terminal

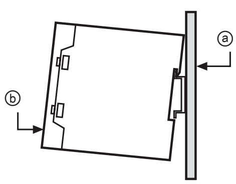
7. Output indicator (red)

▣ Rail Mounting Method

◎ Mounting on DIN rail and removing

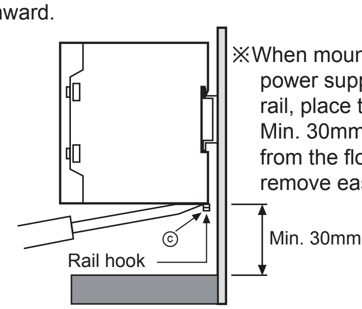
● To mount the power supply on DIN rail

First put the power supply on the part ⓐ of the rail and then press it for the direction ⓑ.



● To remove the power supply from DIN rail

Firstly put a screw driver into the part ⓒ and push it downward.

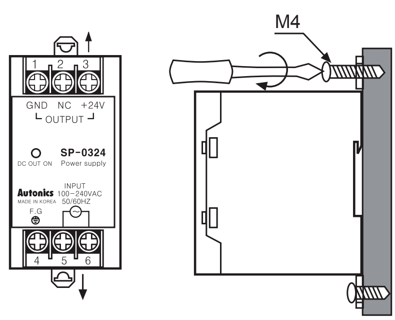


※When mounting the power supply on the rail, place the item Min. 30mm above from the floor to remove easily.

◎ Mounting on Panel

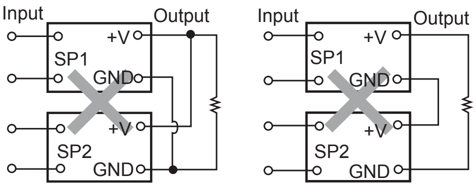
● When there is no DIN rail

If there is no rail, it is able to mount by screwing a bolt at the hook on the body as following figure.



▣ Proper Usage

◎ Serial or parallel operation

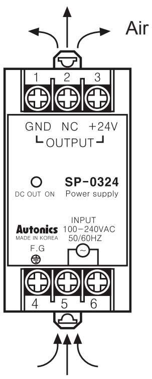


[Parallel connection] [Serial connection]

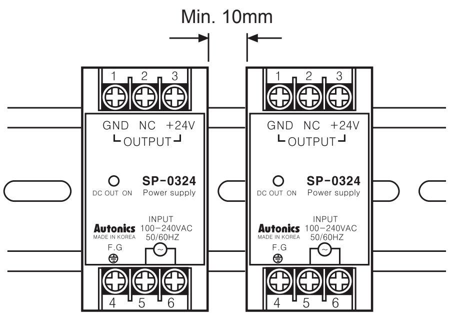
※The power supply should not be used in serial or parallel connection in any case.
Please use it individually always.

◎ Caution for mounting

● Please install it at ventilating place in order to dissipate the heat effectively then it is able to improve the reliability for a long time.



● When installing two or more power supplies side by side, please keep the interval at least 10mm so that the heat is dissipated effectively.



◎ Cautions during use

● Please wire input power (AC) to the input power terminal properly. If wiring it to other terminal the inner circuit will be broken.

● It is working with 2,000VAC between the terminal and case for a minute, but it will be broken if the overvoltage is supplied for several minutes.

● The power supply has 100MΩ of insulation resistance between the terminal and case.
Please use a DC insulation tester with 500VDC for the insulation resistance of the power supply.

● Please check as below when problem is happened.
① Short of DC output terminal.
(when overcurrent is supplied the overcurrent protection circuit is operated and when the load current is under the rated current it is stopped.)
② Wiring of AC input and DC output terminal properly.
③ AC input voltage in rated voltage.

SPA Series

Switching Mode Power Supply With Minimized Noise And Ripple

■ Features

- Built-in over-current protection, output short-circuit protection, overheating and over-voltage protection circuits (SPA-075/100)
- Standard on safety EN60950, EN50178
- EMS (Electromagnetic susceptibility) EN61000-6-2
- EMI (Electromagnetic interference) EN61000-6-4
- Output voltage: 5VDC, 12VDC, 24VDC
- Output current: 30W, 50W, 75W, 100W

⚠ Please read "Caution for your safety" in operation manual before using.

CE (except for output voltage 5VDC)

■ Ordering Information

SPA — 030 — 24

Code		Description
Output voltage	05	5VDC
	12	12VDC
	24	24VDC
Output power	030	30W
	050	50W
	075	75W
	100	100W
Item	SPA	Switching Mode Power Supply

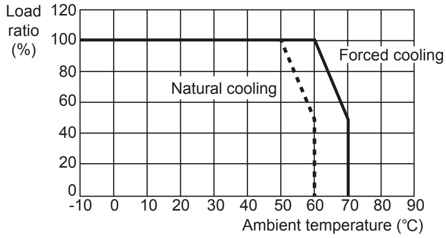
■ Specifications

Model		SPA-030-05	SPA-050-05	SPA-030-12	SPA-050-12	SPA-030-24	SPA-050-24	SPA-075-05	SPA-100-05	SPA-075-12	SPA-100-12	SPA-075-24	SPA-100-24
Output power		30W	50W	30W	50W	30W	50W	75W	100W	75W	100W	75W	100W
Input	Voltage※5	100-240VAC (permissible voltage: 85-264VAC)						100-120/200-240VAC (permissible voltage: 85-132/170-264VAC) switching type					
Input	Frequency	50/60Hz											
Input	Efficiency※1	Min. 60%	Min. 67%	Min. 74%		Min. 80%		Min. 70%		Min. 78%	Min. 72%	Min. 78%	Min. 80%
Input	Current consumption※1	Max. 1.2A	Max. 1.6A	Max. 1.0A	Max. 1.4A	Max. 0.8A	Max. 1.1A	Max. 3.0A		Max. 2.0A	Max. 3.0A	Max. 2.0A	Max. 2.5A
Output	Voltage	5VDC		12VDC		24VDC		5VDC		12VDC		24VDC	
Output	Current	6A	10A	2.5A	4.2A	1.5A	2.1A	15A	20A	6.3A	8.5A	3.2A	4.2A
Output	Voltage adjustment range※4	±5%											
Output	Input fluctuation ratio※2	Max. ±0.5%											
Output	Load fluctuation ratio※1	Max. ±2%		Max. ±1%				Max. ±2%		Max. ±1%			
Output	Ripple※1	Max. ±1%											
Output	Starting time※1	Max. 200ms		Max. 150ms				Max. 250ms					
Output	Holding time※1	Min. 10ms						Min. 5ms		Min. 10ms	Min. 5ms	Min. 10ms	
Protection	Inrush current protection	Max. 30A (100VAC) /Max. 40A (200VAC)		Max. 20A (100VAC)				Max. 45A (100VAC) /Max. 50A (240VAC)		Max. 35A (100VAC) /Max. 40A (240VAC)	Max. 45A (100VAC) /Max. 50A (240VAC)	Max. 35A (100VAC) /Max. 40A (240VAC)	
Protection	Over-current protection※3	Min. 110%							Min. 105%	Min. 110%			
Protection	Over-voltage protection	—						6.5V ±10%		16V ±10%		30V ±10%	
Protection	Output short-circuit protection	Max. 5ms						Max. 10ms		Max. 5ms	Min. 10ms	Max. 5ms	
Indicator		Output indicator: Green LED											
Insulation resistance		Over 100MΩ (between all input and output terminals with 500VDC)											
Dielectric strength		3,000VAC 50/60Hz for 1 min (between all input and output terminals)											
Dielectric strength		1,500VAC 50/60Hz for 1 min (between all input terminals F.G.)											
Vibration		0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours											
Shock		300m/s² (approx. 30G) in each X, Y, Z direction for 3 times											
EMS		Conforms to EN61000-6-2											
EMI		Conforms to EN61000-6-4											
Safety standards		EN60950, EN50178											
Environ-ment	Ambient temperature	-10 to 50℃	-10 to 40℃			-10 to 50℃							
Environ-ment	Storage temperature	-25 to 65℃											
Environ-ment	Ambient humidity	25 to 85%RH, storage: 25 to 90%RH											
Approval		CE (except for output voltage 5VDC)						—					
Unit weight		Approx. 350g						Approx. 400g					

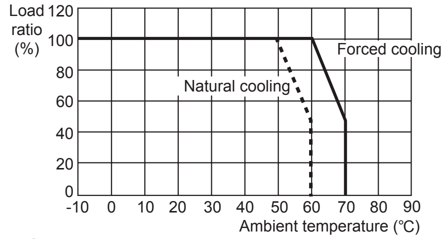
※1: 100% load for rated input voltage (100VAC).
※2: Rated input voltage [•SPA-030/050 Series: 100-240VAC (85-264VAC) / •SPA-075/100 Series: 100-120/200-240 (85-132/170-264VAC)] under 100% of load.
SPA-100-05 is under 100% of load for [100-120/200-240VAC (100-132/190-264VAC)].
※3: Rated input voltage (100VAC). ※4: Vary voltage by output voltage adjuster, it is changed over voltage variation range (±5%).
※5: The rated input volatge of SPA-100-05 is 100-120/200-240VAC (100-132/190-264VAC).
※Environment resistance is rated at no freezing or condensation.

■ Output Derating Curve By Ambient Temperature

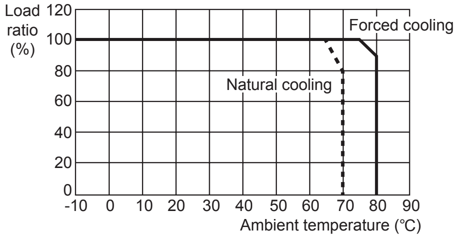
● SPA-030-05



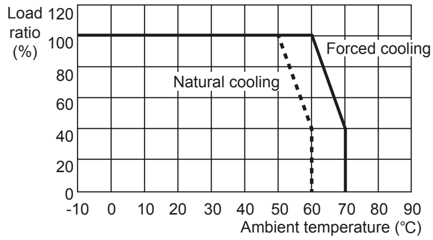
● SPA-075-05 ● SPA-100-05 ● SPA-100-12



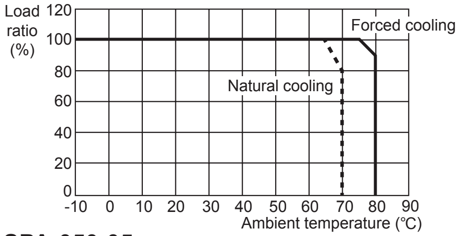
● SPA-030-12 ● SPA-050-12



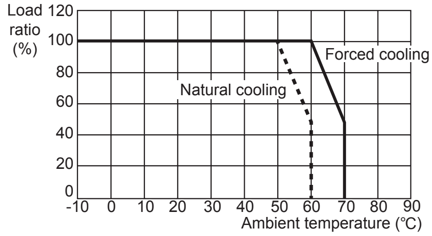
● SPA-075-12



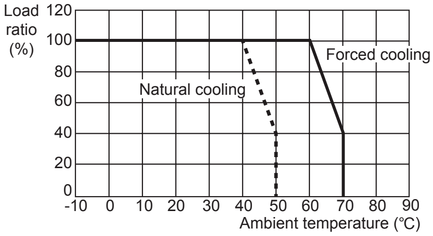
● SPA-030-24 ● SPA-050-24



● SPA-075-24 ●SPA-100-24

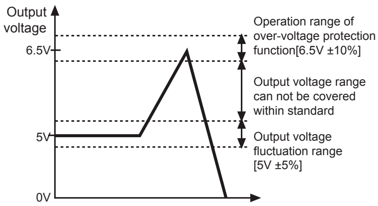


● SPA-050-05

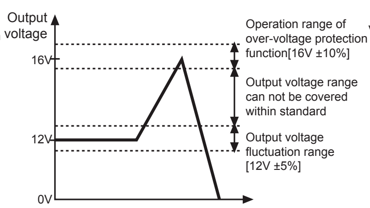


■ Feature Data Of Over-Voltage Protection

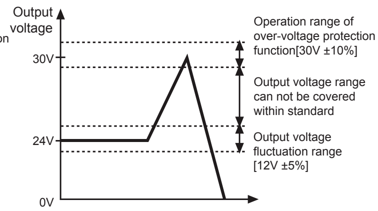
● SPA-075-05 / SPA-100-05



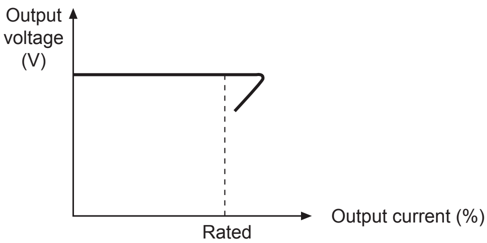
● SPA-075-12 / SPA-100-12



● SPA-075-24 / SPA-100-24



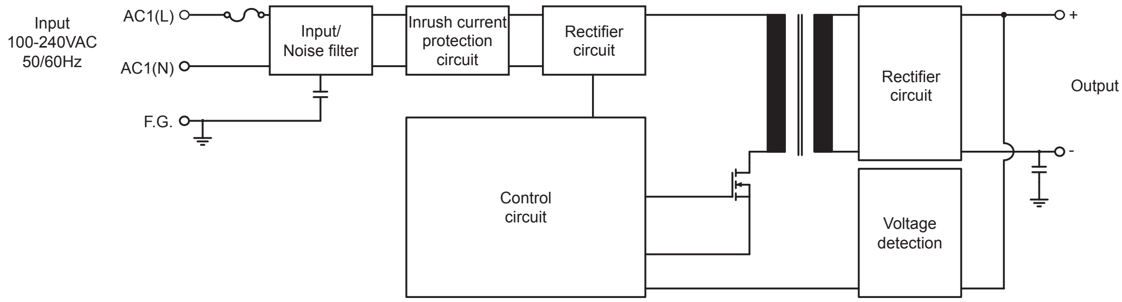
■ Feature Data Of Over-Current Protection



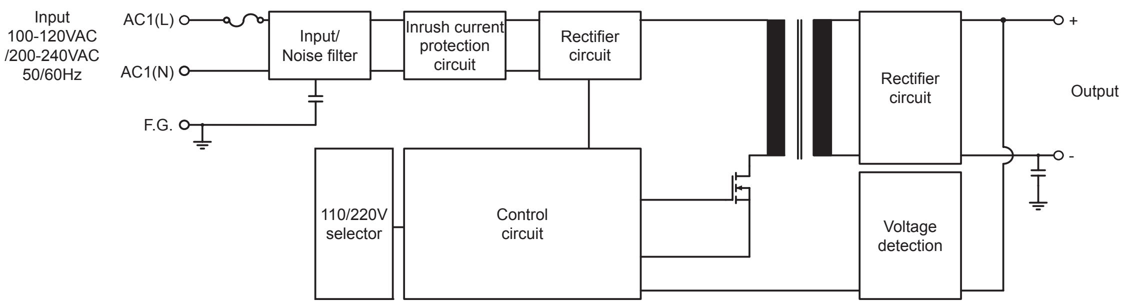
- It is when the rated input voltage is 100VAC, 100%.
- It is able to protect overcurrent by load with built-in over-current protection circuit.
  When the over rated current is flowed, the circuit is operated (outputvoltage is fallen) and it is cancelled when the load current is under the rated current. (it is returned to the rated output voltage)

■ Block Diagram

● SPA-030/050 Series



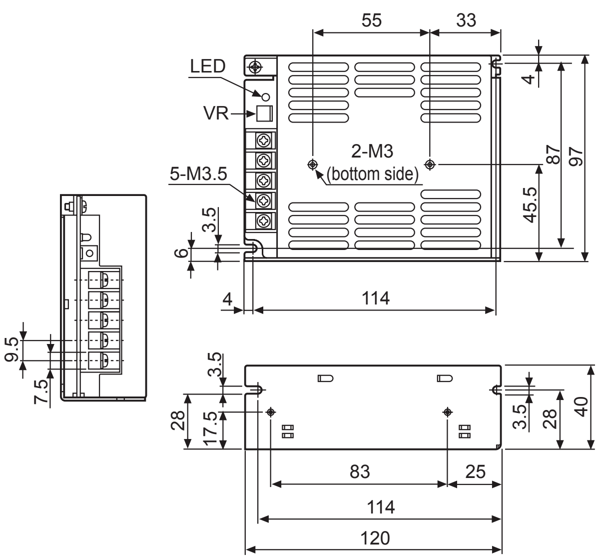
● SPA-075/100 Series



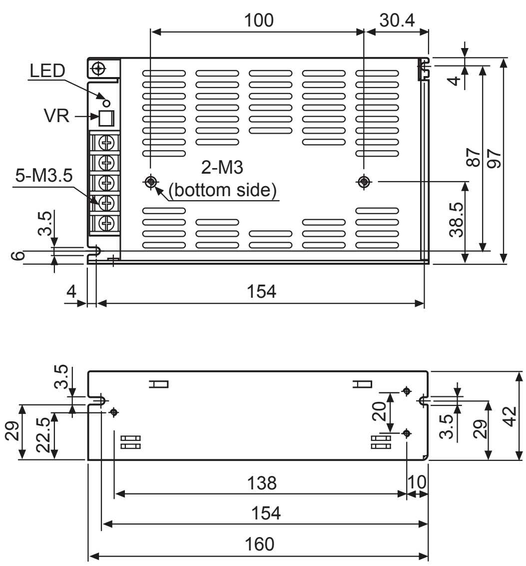
■ Dimensions

(unit: mm)

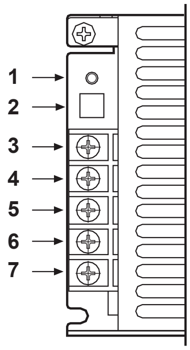
● SPA-030/050 Series



● SPA-075/100 Series



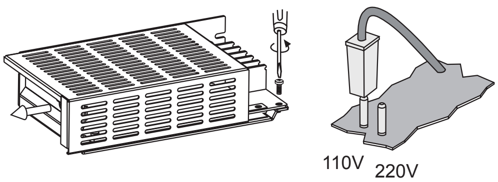
Unit Description



1. Output indicator (green)
2. Output voltage adjuster (V.ADJ)
3. Output power [+] terminal
4. Output power [-] terminal
5. Frame ground [F.G.] terminal
6. Input power [N] terminal
7. Input power [L] terminal

Proper Usage

- For switch input voltage type, input voltage is 220V as factory default. To switch input voltage for 110V, remove the cover then select proper jumper switch as below figures.



- Technical information of operation
  - This product is not available to operate of output voltage as parallel and series.
  - The output current should be used within the rated range. When it is operated in overcurrent status, the life span of product can be shortened.
  - The output voltage should be used within the rated range. When the over-voltage protection function is operated, the product operated normally with cancellation of input power for few minutes.
  - The over-voltage protection function is operated when it is exceeded the rated output voltage range with an output voltage adjuster.
  - This product has overheating protection function. It is operated normally when releasing the load connection for few minutes.
  - The power factor is within 0.5 to 0.7 using condenser rectified method. Please use the below formula and check the input power capacity when using a cabinet panel or transformer.

$$\text{Apparent power[VA]} = \frac{\text{Active Power [W]}}{\text{Power factor} \times \text{Efficiency}}$$

  - This product does not have harmonics suppression and power factor correction circuit.

Please mount the device for it.

  - This product has a noise filter, it can be changed with the mounting place and connection.
  - Please change as a same rated fuse when the inner fuse is broken.

- Caution for mounting
  - Please mount the device on metal panel for the reliability.
  - Please mount the device in a ventilate place for high radiation of heat.

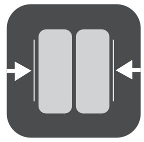
- Please use the power line as below specification.

Input power line specification	AWG21 to 19	AWG18 to 16
Model	SPA-030-05 SPA-030-12 SPA-050-12 SPA-075-12 SPA-030-24 SPA-050-24 SPA-075-24 SPA-100-24	SPA-050-05 SPA-075-05 SPA-100-05 SPA-100-12

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

DIN Rail Mount Switching Mode Power Supply

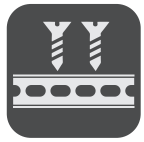
High Conversion Efficiency



Slim Size

Low Noise and Ripple

Terminal Protection Cover
(060/120/240 models)



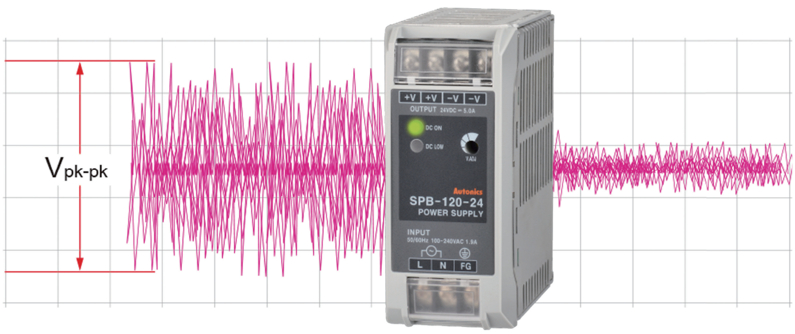
Various Mounting Methods

▣ Features

[Common Features]

● Minimal Noise and Ripple

The SPB series provides stable power supply my minimizing Vpk-pk* value of ripple noise.



※Vpk-pk: AC noise present in output voltage

● DIN Rail Mount and Screw Mount Methods

DIN rail mount and screw on mounting is possible for higher installation flexibility.

● DIN Rail Mount

● Screw Mount

● Output Indicator, Output Low Voltage Indicator

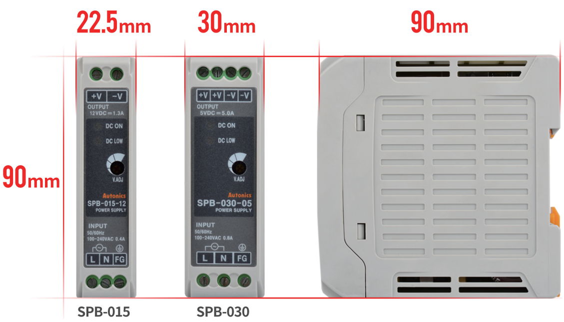
Users can easily check the operation status and voltage levels with LED status indicators.

▣ Features

[SPB-015/030 Features]

● Slim and Compact Size

The slim and compact sized design allows space-saving installation.



● Rising Clamp Type Terminals

Rising clamp type terminals provide easier wiring for users.

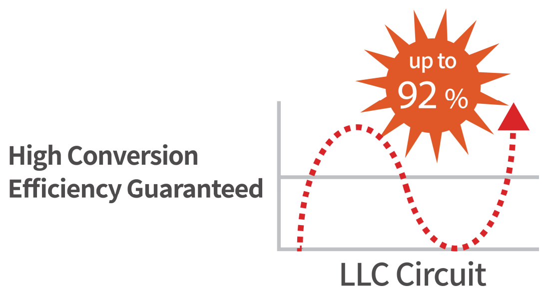
[SPB-060/120/240 Features]

● Terminal Protection Covers

Terminal protection covers protect the units from pollutants and prevent physical impact.

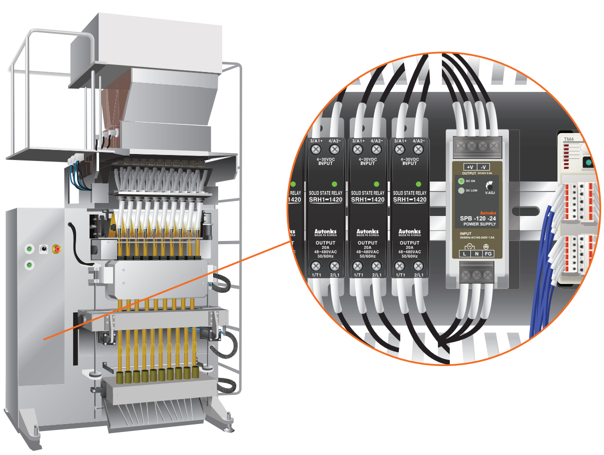
● High Power Conversion Efficiency

The switching mode power supplies guarantee high power conversion efficiency up to 92% with LLC circuits. (SPB-240)



▣ Application

Switching mode power supplies used to supply rated power voltage to sugar stick packaging machines



(A) Photoelectric Sensors
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(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

DIN Rail Mount Switching Mode Power Supply

■ Features

- DIN rail type mount and screw mount methods
- Efficient power conversion
  : High conversion efficiency up to 92% with LLC circuit (SPB-240)
  : Stable power supply with minimal noise and ripple
- Space efficient design
  : Slim and compact size for maximum space efficiency
  : Uniform depth size (except SPB-015/030) for neat and tidy installation
- Safety and user-friendly features
  : Terminal protection cover (SPB-060/120/240)
  : Easy wiring with rising clamp terminal (SPB-015/030)
  : Inrush current prevention, output overcurrent prevention, output overvoltage prevention, output short-circuit protection, circuit overheating protection
  : Low output voltage indicator (red LED), output indicator (green LED)
- Output power: 15W, 30W, 60W, 120W, 240W

Line-up

SPB-015/030 Series | SPB-060 Series | SPB-120 Series | SPB-240 Series

⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ Ordering Information

SPB — 120 — 24

Output voltage

5	5VDC
12	12VDC
24	24VDC
48	48VDC

Output power

015	15W	120	120W
030	30W	240	240W
060	60W		

Item

SPB	Switching Mode Power Supply

■ Specifications

Model			SPB -015 -05	SPB -015 -12	SPB -015 -24	SPB -030 -05	SPB -030 -12	SPB -030 -24	SPB -060 -12	SPB -060 -24	SPB -060 -48	SPB -120 -12	SPB -120 -24	SPB -120 -48	SPB -240 -12	SPB -240 -24	SPB -240 -48
Output power			15W	15.6W		25W	30W	31.2W	60W		62.4W	96W	120W		240W		
Input	Voltage		100-240VAC (permissible voltage: 85-264VAC/120-370VDC)														
Input	Frequency		50/60Hz														
Input	Efficiency※1 (typical)	100VAC	77%	80%	83%	77%	82%	84%	81%	84%	85%	82%	82%	85%	87%	89%	89%
Input		240VAC	76%	79%	82%	78%	83%	85%	83%	86%	87%	85%	85%	88%	90%	92%	92%
Input	Power factor※1		—			—			—			Min. 0.9			Min. 0.9		
Input	Current consumption※1 (typical)	100VAC	0.35A	0.35A	0.34A	0.56A	0.63A	0.63A	1.24A	1.21A	1.19A	1.19A	1.49A	1.43A	2.76A	2.71A	2.73A
Input		240VAC	0.19A	0.19A	0.19A	0.30A	0.35A	0.35A	0.66A	0.65A	0.64A	0.52A	0.61A	0.61A	1.14A	1.12A	1.13A
Power factor correction circuit			—			—			—			Built-in			Built-in		
Output	Voltage		5VDC	12VDC	24VDC	5VDC	12VDC	24VDC	12VDC	24VDC	48VDC	12VDC	24VDC	48VDC	12VDC	24VDC	48VDC
Output	Current		3A	1.3A	0.65A	5A	2.5A	1.3A	5A	2.5A	1.3A	8A	5A	2.5A	20A	10A	5A
Output	Voltage adjustment range※2		Max. ±10%			Max. ±10%			Max. ±5%			Max. ±5%			Max. ±5%		
Output	Input variation※3		Max. ±0.5%			Max. ±0.5%			Max. ±0.5%			Max. ±0.5%			Max. ±0.5%		
Output	Load variation		Max. ±1%			Max. ±1%			Max. ±1%			Max. ±1%			Max. ±1%		
Output	Ripple&Ripple noise※1,※4		Max. ±1.5%	Max. ±1%		Max. ±1.5%	Max. ±1%		Max. ±1%			Max. ±1%			Max. ±1.5%	Max. ±1%	
Output	Start-up time※1 (typical)	100VAC	500ms	550ms	650ms	600ms	550ms	550ms	520ms	550ms	1200ms	1200ms	760ms	1200ms	75ms	87ms	75ms
Output		240VAC	550ms	550ms	650ms	600ms	550ms	550ms	530ms	550ms	400ms	400ms	280ms	400ms	45ms	56ms	45ms
Output	Hold time※1 (typical)	100VAC	24ms	25ms	25ms	20ms	15ms	15ms	15ms	14ms	15ms	98ms	81ms	87ms	33ms	36ms	25ms
Output		240VAC	190ms	190ms	190ms	130ms	110ms	110ms	100ms	110ms	108ms	97ms	81ms	86ms	33ms	36ms	25ms

※1: It is for 100% load.
※2: Adjusting voltage by the output adjuster (V.ADJ), it is changed the below voltage adjustment range.
※3: It is for the rated input voltage 100-240VAC (85-264VAC), and 100% load.
※4: It is for the rated input voltage 100-240VAC.

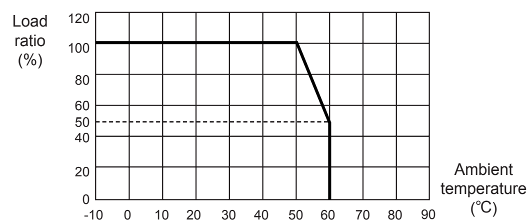
DIN Rail Mount Type Switching Mode Power Supply

■ Specifications

Model			SPB-015-05	SPB-015-12	SPB-015-24	SPB-030-05	SPB-030-12	SPB-030-24	SPB-060-12	SPB-060-24	SPB-060-48	SPB-120-12	SPB-120-24	SPB-120-48	SPB-240-12	SPB-240-24	SPB-240-48
Protection	Inrush current protection (typical)	100VAC	7A	7A	7A	7A	7A	6A	13A	14A	10A	9A	16A	10A	8A	8A	8A
		240VAC	32A	30A	31A	29A	31A	29A	19A	17A	37A	37A	20A	37A	22A	25A	26A
	Over-current protection※4		105 to 160%			105 to 160%			105 to 160%			105 to 160%			105 to 160%		
	Over-voltage protection		—			—			—			16.0V ±10%	30.0V ±10%	58.0V ±10%	16.0V ±10%	30.0V ±10%	58.0V ±10%
	Output low-voltage indicate		4.2V ±10%	9.6V ±10%	20.0V ±10%	4.2V ±10%	9.6V ±10%	20.0V ±10%	9.6V ±10%	20.0V ±10%	43.0V ±10%	9.6V ±10%	20.0V ±10%	43.0V ±10%	10.0V ±10%	20.0V ±10%	43.0V ±10%
Indicator			Output indicator: green LED, Output low-voltage indicator: red LED														
Insulation resistance			Over 100MΩ (at 500VDC megger between all input terminals and output terminals)														
Dielectric strength			3,000VAC 50/60Hz for 1 min (between all input terminals and output terminals)														
			1,500VAC 50/60Hz for 1 min (between all input terminals and F.G.)														
Vibration			0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hour														
Shock			300m/s² (approx. 30G) in each X, Y, Z direction for 3 times														
EMS			Conforms to EN61000-6-2														
EMI			Conforms to EN61000-6-4														
Safety standards			EN60950, EN50178														
Environ-ment	Ambient temp.		-10 to 50℃, storage: -25 to 65℃														
	Ambient humi.		25 to 85%RH, storage: 25 to 90%RH														
Input cable			AWG24 to 19			AWG24 to 19			AWG21 to 19			AWG21 to 19			AWG18 to 16		
Protection			IP20 (IEC standard)														
Approval			CE														
Weight※5			Approx. 202g (approx. 129g)			Approx. 249g (approx. 176g)			Approx. 347g (approx. 274g)			Approx. 570g (approx. 466g)			Approx. 866g (approx. 736g)		

※5: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment is rated at no freezing or condensation.

■ Output Derating Curve By Ambient Temperature



■ Over-Heating Protection

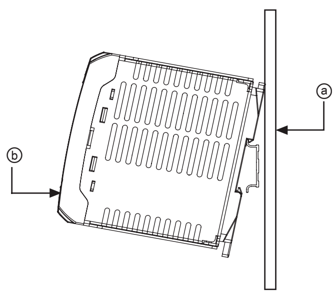
If the inner temperature of the switching element is around 140℃ by overheat, it stops switching operation and becomes open state. Output voltage is not output.

■ Installation

◎ DIN rail mounting

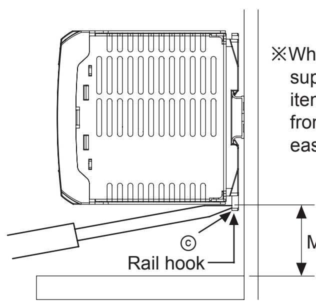
● To mount the power supply on the rail

First put the power supply on the part ⓐ of the rail and then press it for the direction ⓑ.



● To remove the power supply on the rail

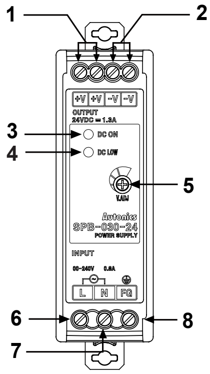
First put a screw driver into the part ⓒ and push it downward.



※When mounting the power supply on the rail, place the item at least 30mm above from the floor to remove it easily.

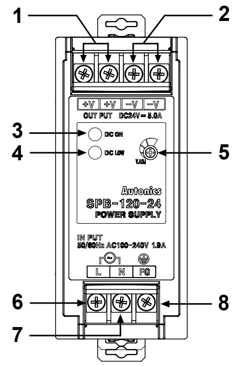
▣ Unit Description

● SPB-015/030 Series



1. Output power [+V] terminal
2. Output power [-V] terminal
3. Output (DC ON) indicator (green)
4. Output low voltage (DC LOW) indicator (red)
5. Output voltage adjuster (V.ADJ)
6. Input power [L] terminal
7. Input power [N] terminal
8. Frame ground [F.G.] terminal

● SPB-060/120/240 Series

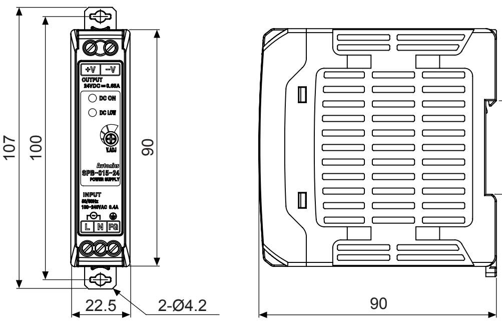


※SPB-015, SPB-060 Series has an output power (+V) terminal (1) and an output power (-V) terminal (2).

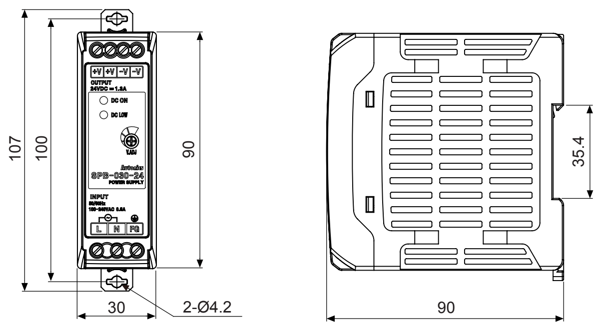
▣ Dimensions

(unit: mm)

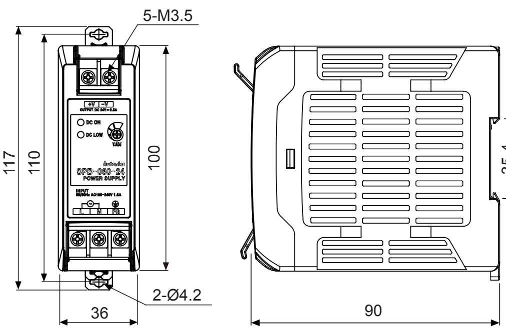
● SPB-015 Series



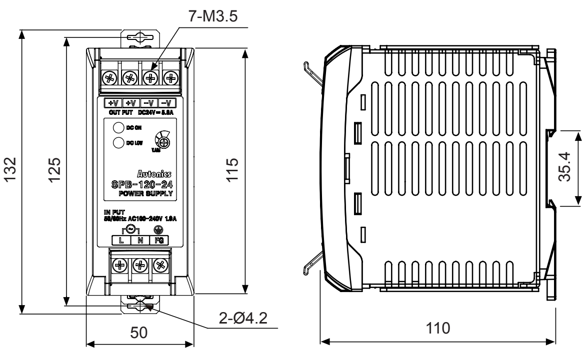
● SPB-030 Series



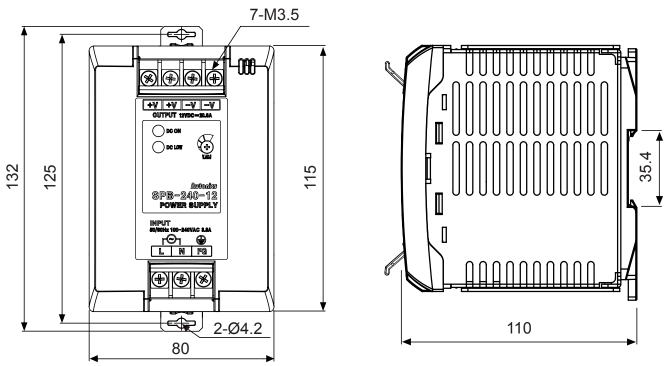
● SPB-060 Series



● SPB-120 Series



● SPB-240 Series



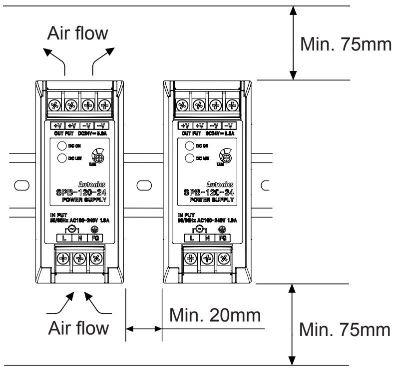
▣ Proper Usage

- Caution for operating
- This product does not have the function for parallel or series operation.
- The output current must be used within the rated specification.
  If over current is applied to the product, over-current protection is operating.
  It causes shorten the life cycle of the product.
- The output voltage must be used within the rated output specification.
- For the product, which has the control function for over-voltage, if making the output voltage adjuster (V.ADJ) to over rated voltage, the function starts to work.
- This product has the function of over-heating protection.
  The over-heating protection operates when the product has over-heating condition.
  The product normally operates if the load is removed for over 5 minutes.
- In case of the SPB-060, it does not have the harmonics suppression and power factor improvement circuit.
  To improve harmonics suppression and power factor, install the additional device.
- In case of the SPB-060, it uses condenser rectification, and power factor is within 0.4 to 0.6 range. To use a cabinet panel or a electric transformer, select input power capacity of this product as below formula.

$$\text{Input apparent power[VA]} = \frac{\text{Output active power[W]}}{\text{Power factor}\times\text{Efficiency}}$$

- This product is provided with a noise filter, but noise is variable according to operating conditions such as installation environment and wiring.
- When the inner fuse is damaged, replace the fuse of same specification.

- Caution for mounting
- Mount this product on the surface of metal panel vertically for the reliability.
- Please mount this product at a well-ventilated place in order to increase the heat radiation efficiency.
- Effective mounting
  When installing more than two power supplies, min. 20mm distance is required to radiate heat effectively.
  Assure min. 75mm distance of the upper or the lower product and mount the products as following figure.

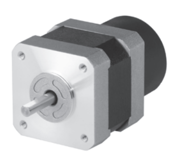


- Dielectric or insulation resistance test when this unit is installed in the control panel.
- Separate the unit completely from a control panel circuit.
- Short all terminals of the unit.
- Caution for connecting the input power terminal
  Connect input line (AC) to the input terminal correctly.
  When you connect this to the other terminal, it may cause damage to the power supply.
- Do not use this unit at below places.
- Place where there are severe vibration or impact.
- Place where strong alkalis or acids are used.
- Place where there is direct ray of the sun.
- Place where strong magnetic field or electric noise are generated.
- Installation environment
- Indoors
- Max. altitude: 2000m
- Pollution Degree 2
- Installation Category II

(Q) Stepper Motors & Drivers & Motion Controllers

2-Phase Stepper Motor Driver
MD2U Series

5-Phase Stepper Motor



5-Phase Stepper Motor Driver
MD5-HF14/MD5-ND14

2-Axis Interpolation/ Normal Motion Controller PMC-2HSP/PMC-2HSN

5-Phase Stepper Motor And Driver Specifications

(○: **General specifications**, ◎: **High-speed, High-torque specifications**)

Motor					Driver		
Frame size	Type	Model	Torque (kgf·cm)	Rated current (A/Phase)	**MD5-HD14/MD5-ND14/ MD5-HD14-2X(3X)**	**MD5-HF14/ MD5-HF14-AO**	**MD5-HF28**
24mm	Shaft type	**02K-S523(W)**	0.18	0.75	○	◎	—
		04K-S525(W)	0.28	0.75	○	◎	—
42mm	Shaft type / Shaft + Built-in brake type	**A1K-S543(W)-[B]**	1.3	0.75	○	◎	—
		A2K-S544(W)-[B]	1.8	0.75	○	◎	—
		A2K-M544(W)	1.8	1.4	○	◎	—
		A3K-S545(W)-[B]	2.4	0.75	○	◎	—
	Hollow shaft type	**AH1K-S543**	1.3	0.75	○	◎	—
		AH2K-S544	1.8	0.75	○	◎	—
		AH3K-S545	2.4	0.75	○	◎	—
	Geared type/ Geared + Built-in brake type	**A10K-S545(W)-G[B]5**	10	0.75	○	◎	—
		A15K-S545(W)-G[B]7.2	15	0.75	○	◎	—
		A15K-S545(W)-G[B]10	15	0.75	○	◎	—
60mm	Shaft type / Shaft + Built-in brake type	**A4K-S564(W)-[B]**	4.2	0.75	○	◎	—
		A4K-M564(W)-[B]	4.2	1.4	○	◎	—
		A4K-G564(W)	4.2	2.8	—	—	◎
		A8K-S566(W)-[B]	8.3	0.75	○	◎	—
		A8K-M566(W)-[B]	8.3	1.4	○	◎	—
		A8K-G566(W)	8.3	2.8	—	—	◎
		A16K-M569(W)-[B]	16.6	1.4	○	◎	—
		A16K-G569(W)-[B]	16.6	2.8	—	—	◎
	Hollow shaft type	**AH4K-S564(W)**	4.2	0.75	○	◎	—
		AH4K-M564(W)	4.2	1.4	○	◎	—
		AH8K-S566(W)	8.3	0.75	○	◎	—
		AH8K-M566(W)	8.3	1.4	○	◎	—
		AH16K-M569(W)	16.6	1.4	○	◎	—
		AH16K-G569(W)	16.6	2.8	—	—	◎
	Geared type/ Geared + Built-in brake type	**A35K-M566(W)-G[B]5**	35	1.4	○	◎	—
		A40K-M566(W)-G[B]7.2	40	1.4	○	◎	—
		A50K-M566(W)-G[B]10	50	1.4	○	◎	—
	Rotary actuator type/ Rotary actuator + Built-in brake type	**A35K-M566(W)-R[B]5**	35	1.4	○	◎	—
		A40K-M566(W)-R[B]7.2	40	1.4	○	◎	—
		A50K-M566(W)-R[B]10	50	1.4	○	◎	—
85mm	Shaft type / Shaft + Built-in brake type	**A21K-M596(W)-[B]**	21	1.4	○	◎	—
		A21K-G596(W)-[B]	21	2.8	—	—	◎
		A41K-M599(W)-[B]	41	1.4	○	◎	—
		A41K-G599(W)-[B]	41	2.8	—	—	◎
		A63K-M5913(W)-[B]	63	1.4	○	◎	—
		A63K-G5913(W)-[B]	63	2.8	—	—	◎
	Hollow shaft type	**AH21K-M596(W)**	21	1.4	○	◎	—
		AH21K-G596(W)	21	2.8	—	—	◎
		AH41K-M599(W)	41	1.4	○	◎	—
		AH41K-G599(W)	41	2.8	—	—	◎
		AH63K-M5913(W)	63	1.4	○	◎	—
		AH63K-G5913(W)	63	2.8	—	—	◎
	Geared type/ Geared + Built-in brake type	**A140K-M599(W)-G[B]5**	140	1.4	○	◎	—
		A140K-G599(W)-G[B]5	140	2.8	—	—	◎
		A200K-M599(W)-G[B]7.2	200	1.4	○	◎	—
		A200K-G599(W)-G[B]7.2	200	2.8	—	—	◎
		A200K-M599(W)-G[B]10	200	1.4	○	◎	—
		A200K-G599(W)-G[B]10	200	2.8	—	—	◎

※**(W)** stands for dual shaft of motor. (The built-in brake type provides single shaft type only.)
※The motor torque has a big difference in torque by the characteristics of the driver.
Please refer to the graph in this catalogue that shows the characteristics of motors and drivers.
For MD5-HD14, MD5-HD14-2X (3X), MD5-ND14, the high-speed region torque characteristics are better at 35VDC than at 20VDC.
In addition, MD5-HF14 and MD5-HF28 have further improved torque characteristics in the high-speed area than using DC type driver.

Small, Light, High Speed & Torque 5-Phase Stepper Motor Driver

Features

- Bipolar constant pentagon drive method
- Includes auto current down and self-diagnosis function
- Low speed rotation and high accuracy controlling with microstep-driving (MD5-HD14, MD5-HF14, MD5-HF14-AO, MD5-HF28)
  [Max. resolution - 250 division / In case of 5-phase stepper motor of which basic step angle is 0.72°, it enables to control up to 0.00288° per pulse and it requires 125,000 pulses per rotation.]
- Photocoupler input insulation method to minimize the effects from external noise

MD5-HF28 MD5-HF14 MD5-HF14-AO MD5-HD14 MD5-ND14

Please read "Caution for your safety" in operation manual before using.

CE

Ordering Information

MD 5 – H F 14 – □

Item	Code	Description
Output	No mark	Zero point excitation output※1
	AO	Alarm output
RUN current	14	1.4A/Phase
	28	2.8A/Phase
Power supply	D	20-35VDC
	F	100-220VAC 50/60Hz
Step type (resolution)	H	Micro step (250-division)
	N	Normal Step
Motor phase	5	5-Phase
Item	MD	Motor Driver

※1: Except MD5-ND14

※KR-55MC can be replaced with MD5-HD14.
※KR-5MC can be replaced with MD5-ND14.
※MD5-MF14 can be replaced with MD5-HF14.
※KR-505G can be replaced with MD5-HF28.

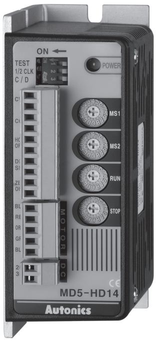
Specifications

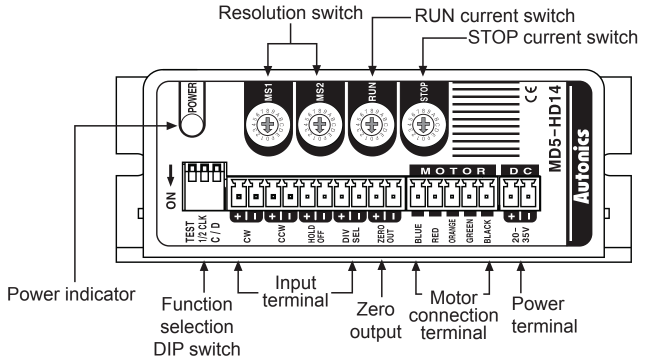
Model		**MD5-HD14**	**MD5-HF14**	**MD5-HF14-AO**	**MD5-HF28**	**MD5-ND14**
Power supply		20-35VDC※1	100-220VAC 50/60Hz			20-35VDC※1
Allowable voltage range		90 to 110% of the rated voltage				
Max. current consumption※2		3A			5A	3A
RUN current※3		0.4-1.4A/Phase			1.0-2.8A/Phase	0.5-1.5A/Phase
STOP current		27 to 90% of RUN current (set by STOP current switch)				25 to 75% of RUN current (set by STOP current volume)
Drive method		Bipolar constant current pentagon drive				
Basic step angle		0.72°/Step				
Resolution		1, 2, 4, 5, 8, 10, 16, 20, 25, 40, 50, 80, 100, 125, 200, 250-division (0.72° to 0.00288°/Step)				1, 2-division (0.72°, 0.36°/Step)
Input pulse characteristic	Pulse width	Min. 1μs (CW, CCW), Min. 1ms (HOLD OFF)				Min. 10μs (CW, CCW), Min. 1ms (HOLD OFF)
	Duty rate	50% (CW, CCW)				
	Rising/Falling time	Below 130ns (CW, CCW)				
	Pulse input voltage	[H]: 4-8VDC, [L]: 0-0.5VDC				
	Pulse input current	7.5-14mA (CW, CCW), 10-16mA (HOLD OFF, DIVISION SELECTION, ZERO OUT)※4				
	Max. input pulse frequency※5	Max. 500kHz (CW, CCW)				Max. 50kHz (CW, CCW)
Input resistance		270Ω (CW, CCW), 390Ω (HOLD OFF, DIVISION SELECTION), 10Ω (ZERO OUT)		270Ω (CW, CCW), 390Ω (HOLD OFF), 10Ω (ALARM)	270Ω (CW, CCW), 390Ω (HOLD OFF, DIVISION SELECTION), 10Ω (ZERO OUT)	390Ω (CW, CCW, HOLD OFF)
Insulation resistance		Over 100MΩ (at 500VDC megger, between all terminals and case)				
Dielectric strength		1000VAC 50/60Hz for 1min (between all terminals and case)				
Noise immunity		±500V the square wave noise (pulse width: 1μs) by the noise simulator	±2000V the square wave noise (pulse width: 1μs) by the noise simulator			±500V the square wave noise (pulse width: 1μs) by the noise simulator
Vibration	Mechanical	1.5mm amplitude at frequency of 5 to 60Hz (for 1 min) in each X, Y, Z direction for 2 hours				
	Malfunction	1.5mm amplitude at frequency of 5 to 60Hz (for 1 min) in each X, Y, Z direction for 10 min				
Environment	Ambient temp.	0 to 40℃, storage: -10 to 60℃	0 to 50℃, storage: -10 to 60℃			0 to 40℃, storage: -10 to 60℃
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH				
Approval		CE	CE	CE	CE	CE
Weight※6		Approx. 327.5g (approx. 220g)	Approx. 840g (approx. 680g)	Approx. 820g (approx. 660g)	Approx. 1.35kg (approx. 1.2kg)	Approx. 183g (approx. 130g)

※1: When using over 30VDC power supply, torque characteristics are improved but the driver temperature raise. The unit should be installed at the well ventilation environment.
※2: Based on ambient temperature 25℃, ambient humidity 55%RH.
※3: RUN current varies depending on the input RUN frequency and max. RUN current at the moment varies also varies depending on the load.
※4: In case of MD5-HF14-AO, MD5-ND14, there are no DIVISION SELECTION, ZERO OUT function.
※5: Max. input pulse frequency is max. frequency to be input and is not same as max. pull-out frequency or max. slewing frequency.
※6: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

5-Phase Micro Stepper Motor Driver [MD5-HD14]

▣ Unit Description





※Refer to page Q-3 for the specifications.

◎ Function selection DIP switch

	No.	Name	Function	Switch position	
1 2 3 ON				ON	OFF (default)
	1	TEST	Self diagnosis function	30rpm rotation	Not use
	2	1/2 CLK	Pulse input method	1-pulse input method	2-pulse input method
	3	C/D	Auto current down	Not use	Use

● TEST

- Self diagnosis function is for motor and driver test.
- This function makes the motor rotate with 30rpm in full step. Rotation speed varies with resolution settings.
- Rotation speed = 30rpm/resolution
- In 1-pulse input method, it rotates to CCW, and in 2-pulse input method, it rotates to CW.

※Be sure that the TEST switch is OFF before supplying the power.
If the TEST switch is ON, the motor operates immediately and it may be dangerous.

● 1/2 CLK

- 1/2 CLK switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

● C/D (auto current down)

- This function is to reduce the current provided for motor automatically for preventing severe motor's heat when motor stops.
- If motor RUN pulse is not applied, the current provided for motor reduces as the set STOP current.

※Be sure that when motor RUN current is reduced, the stop torque of motor also reduced.
※Set the STOP current by the STOP current switch.

◎ RUN current

	Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	Current (A/Phase)	0.4	0.5	0.57	0.63	0.71	0.77	0.84	0.9	0.96	1.02	1.09	1.15	1.22	1.27	1.33	1.4

- RUN current setting is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※Change RUN current only when the motor stops.

◎ STOP current

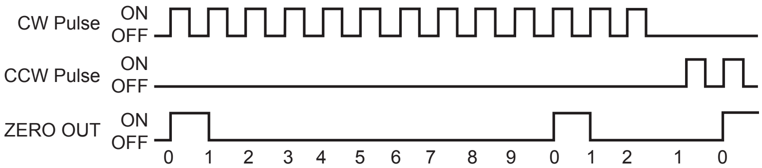
	Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

- STOP current setting is for the current provided for motor when the motor stops for preventing severe motor's heat.
- This setting is applied when using C/D (current down) function.
- Setting value of STOP current is percentage (%) ratio of the set RUN current.
  E.g.) Set RUN current as 1.4A and STOP current as 40%.
  STOP current is set as 1.4A×0.4=0.56A

※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

5-Phase Stepper Motor Driver (1.4A/Phase, DC Power)

◎ Zero point excitation output signal (ZERO OUT)



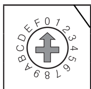
- This output indicates the initial step of excitation order of stepper motor and rotation position of motor axis.
- This signal outputs every 7.2° of rotation of the motor axis regardless of resolution.
  (50 outputs per 1 rotation of the motor.)
  E.g.) Full step: outputs one time by 10 pulses input, 20-division: outputs one time by 200 pulses input.

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to ▣ I/O Circuit and Connections.

◎ Microstep (microstep: resolution)

	Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	Resolution	1	2	4	5	8	10	16	20	25	40	50	80	100	125	200	250
	Step angle	0.72°	0.36°	0.18°	0.144°	0.09°	0.072°	0.045°	0.036°	0.0288°	0.018°	0.0144°	0.009°	0.0072°	0.00576°	0.0036°	0.00288°

● **Resolution (same as MS1, MS2)**

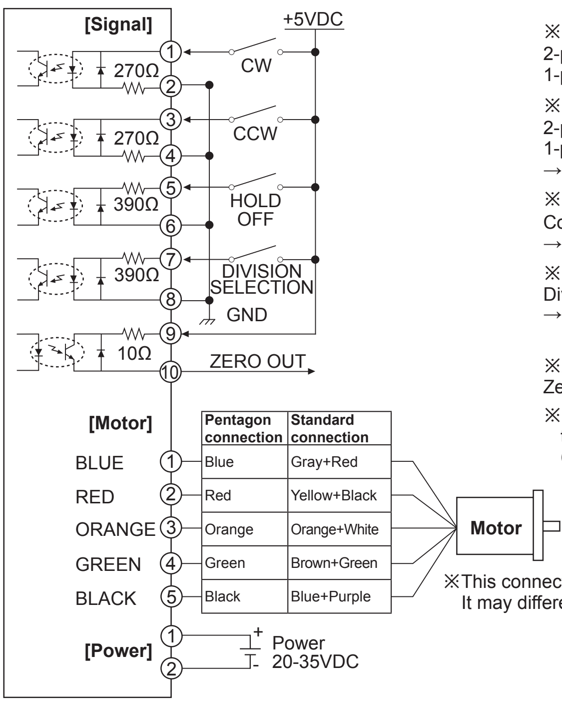
- The MS1, MS2 switches is for resolution setting.
- Select MS2 or MS2 by DIVISION SELECTION signal ([L]: MS1, [H]: MS2)
- Select the step angle (motor rotation angle per 1 pulse).
- The set step angle is dividing basic step angle (0.72°) of 5-phase stepper motor by setting value.
- The calculation formula of divided step angle is as below.

$$\text{Set step angle} = \frac{\text{Basic step angle (0.72°)}}{\text{Resolution}}$$

- When using geared type motor, the angle is step angle divided by gear ratio.
  Step angle / gear ratio = Step angle applied gear
  E.g) 0.72° / 10 (1:10) = 0.072°

※Must stop the motor before changing the resolution.

▣ I/O Circuit and Connections



Pentagon connection	Standard connection
Blue	Gray+Red
Red	Yellow+Black
Orange	Orange+White
Green	Brown+Green
Black	Blue+Purple

※This connection cable color is only for Autonics motors.
It may different cable color when using other motors.

※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)

※CCW
2-pulse input method (CCW rotation signal input)
1-pulse input method (rotation direction signal input)
→ [H]: CW, [L]: CCW

※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF

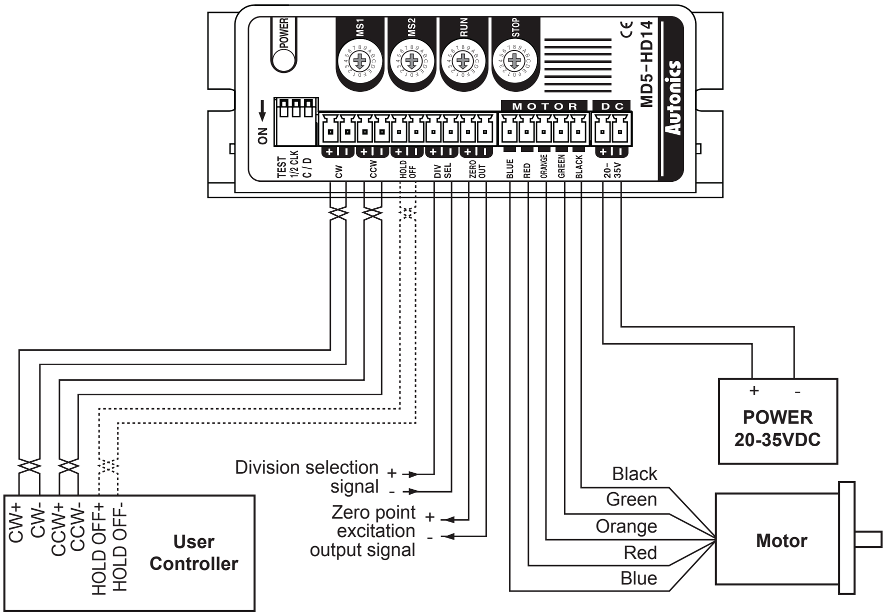
※DIVISION SELECTION
Division selection signal
→ [L]: Operated by MS1 setting resolution
[H]: Operated by MS2 setting resolution

※ZERO OUT
Zero point excitation output signal → Zero point status ON

※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside.
(input power max. 24VDC, input current 10-20mA)

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

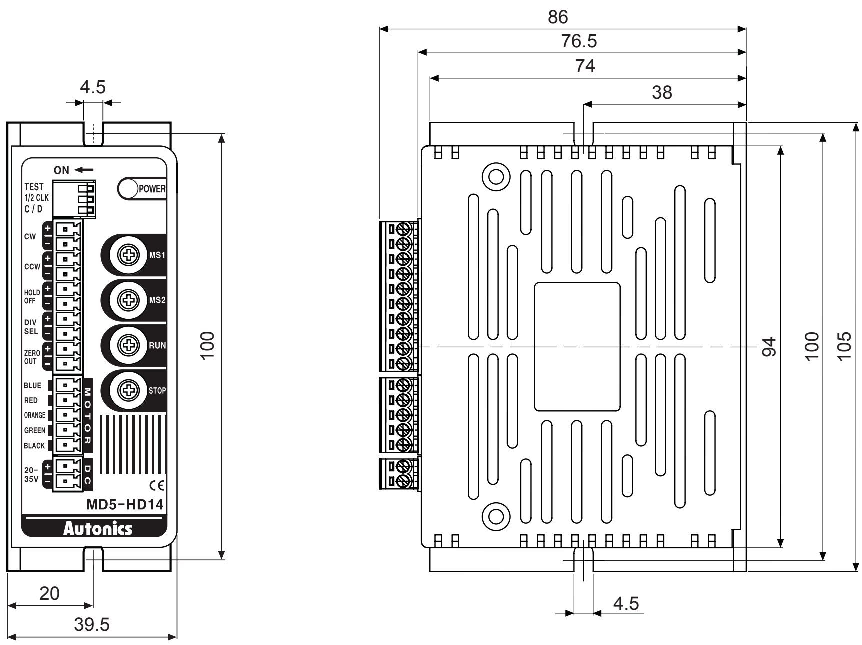
■ Connections



※Please refer to Q-40 for standard wiring.

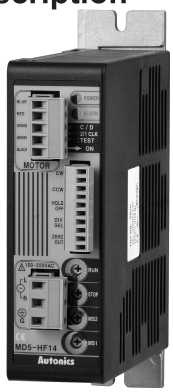
■ Dimensions

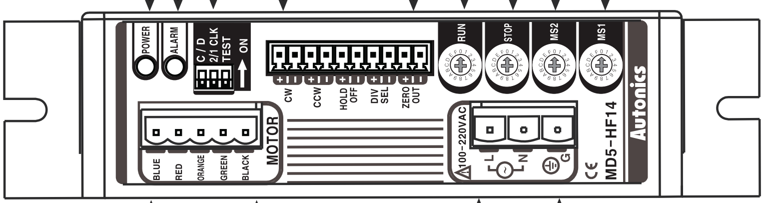
(unit: mm)



5-Phase Micro Stepper Motor Driver [MD5-HF14]

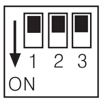
▣ Unit Description





※Refer to page Q-3 for the specifications.

◎ Function selection DIP switch

	No.	Name	Function	Switch position	
				ON	OFF (default)
	1	TEST	Self diagnosis function	30rpm rotation	Not use
	2	2/1 CLK	Pulse input method	1-pulse input method	2-pulse input method
	3	C/D	Auto current down	Not use	Use

● TEST

- Self diagnosis function is for motor and driver test.
- This function makes the motor rotate with 30rpm in full step. Rotation speed varies with resolution settings.
- Rotation speed = 30rpm/resolution
- In 1-pulse input method, it rotates to CCW, and in 2-pulse input method, it rotates to CW.

※Be sure that the TEST switch is OFF before supplying the power.
If the TEST switch is ON, the motor operates immediately and it may be dangerous.

● 2/1 CLK

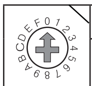
- 2/1 CLK switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

● C/D (auto current down)

- This function is to reduce the current provided for motor automatically for preventing severe motor's heat when motor stops.
- If motor RUN pulse is not applied, the current provided for motor reduces as the set STOP current.

※Be sure that when motor RUN current is reduced, the stop torque of motor also reduced.
※Set the STOP current by the STOP current switch.

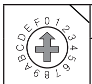
◎ RUN current

	Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	Current (A/Phase)	0.4	0.5	0.57	0.63	0.71	0.77	0.84	0.9	0.96	1.02	1.09	1.15	1.22	1.27	1.33	1.4

- RUN current setting is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※Change RUN current only when the motor stops.

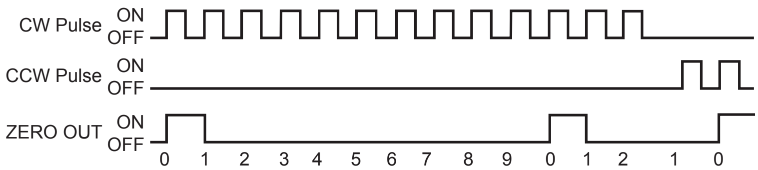
◎ STOP current

	Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

- STOP current setting is for the current provided for motor when the motor stops for preventing severe motor's heat.
- This setting is applied when using C/D (current down) function.
- Setting value of STOP current is percentage (%) ratio of the set RUN current.
  E.g.) Set RUN current as 1.4A and STOP current as 40%.
  STOP current is set as 1.4A×0.4=0.56A

※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

◎ Zero point excitation output signal (ZERO OUT)



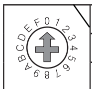
- This output indicates the initial step of excitation order of stepper motor and rotation position of motor axis .
- This signal outputs every 7.2° of rotation of the motor axis regardless of resolution.
  (50 outputs per 1 rotation of the motor.)
  E.g.) Full step: outputs one time by 10 pulses input, 20-division: outputs one time by 200 pulses input.

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to ▣ I/O Circuit and Connections.

◎ Microstep (microstep: resolution)

	Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	Resolution	1	2	4	5	8	10	16	20	25	40	50	80	100	125	200	250
	Step angle	0.72°	0.36°	0.18°	0.144°	0.09°	0.072°	0.045°	0.036°	0.0288°	0.018°	0.0144°	0.009°	0.0072°	0.00576°	0.0036°	0.00288°

● Resolution (same as MS1, MS2)

- The MS1, MS2 switches is for resolution setting.
- Select MS2 or MS2 by DIVISION SELECTION signal ([L]: MS1, [H]: MS2)
- Select the step angle (motor rotation angle per 1 pulse).
- The set step angle is dividing basic step angle (0.72°) of 5-phase stepper motor by setting value.
- The calculation formula of divided step angle is as follow.

$$\text{Set step angle} = \frac{\text{Basic step angle (0.72°)}}{\text{Resolution}}$$

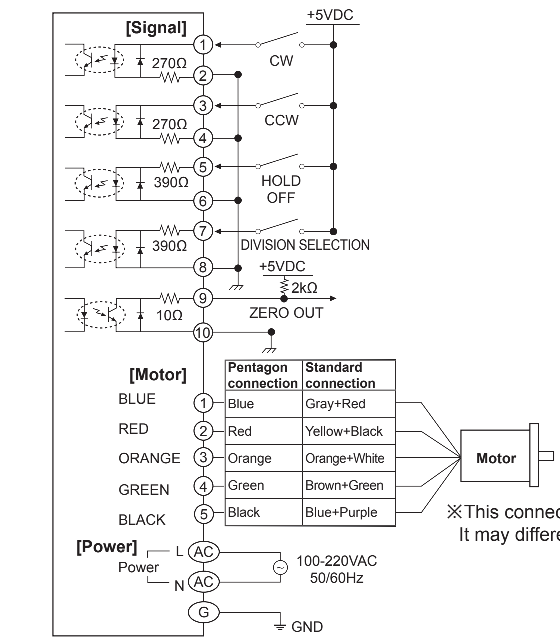
- When using geared type motor, the angle is step angle divided by gear ratio.
  Step angle / gear ratio = Step angle applied gear
  E.g) 0.72° / 10 (1:10) = 0.072°

※Must stop the motor before changing the resolution.

◎ Alarm output function

- Overheat: When the temperature of driver base is over 80℃, alarm indicator (red) turns ON and motor stops with holding the excision. Turn OFF the power and remove the causes. Turn ON the power and alarm output is OFF.
- Overcurrent: When overcurrent is applied from motor damage by burn, driver damage, or error, alarm LED (red) is flashed. When overcurrent occurs, the motor becomes HOLD OFF. Turn OFF the power and remove the causes to normal operation.

▣ I/O Circuit and Connections

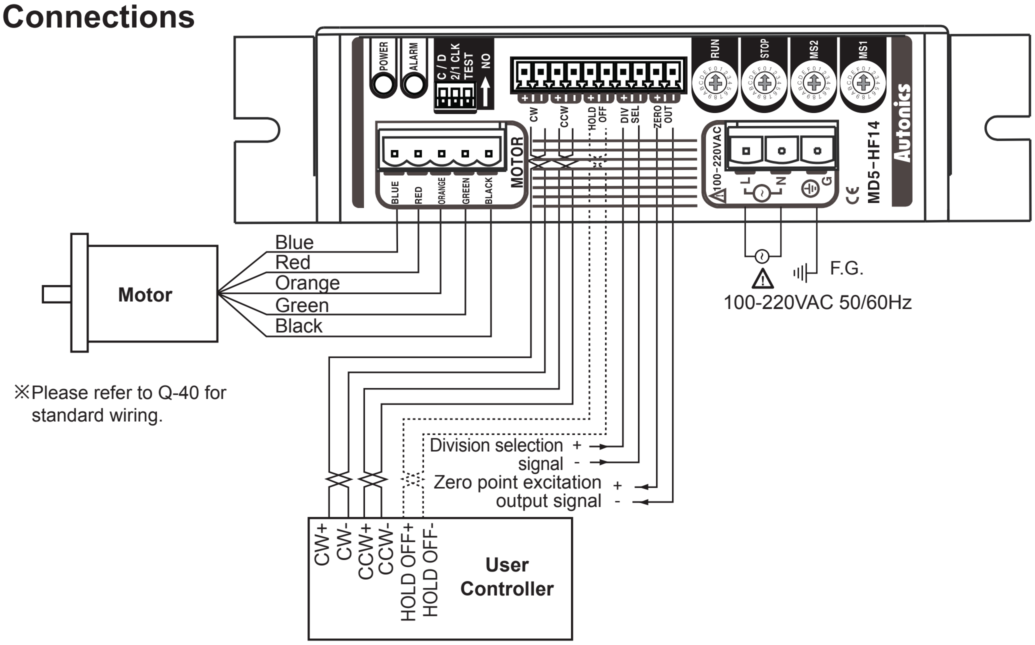


※This connection cable color is only for Autonics motors.
It may different cable color when using other motors.

※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)
※CCW
2-pulse input method (CCW rotation signal input)
1-pulse input method (rotation direction signal input)
→ [H]: CW, [L]: CCW
※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF
※DIVISION SELECTION
Division selection signal
→ [L]: Operated by switch MS1
[H]: Operated by switch MS2
※ZERO OUT
Zero point excitation output signal → Zero point status ON

※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside. (input power max. 24VDC, input current 10-20mA)

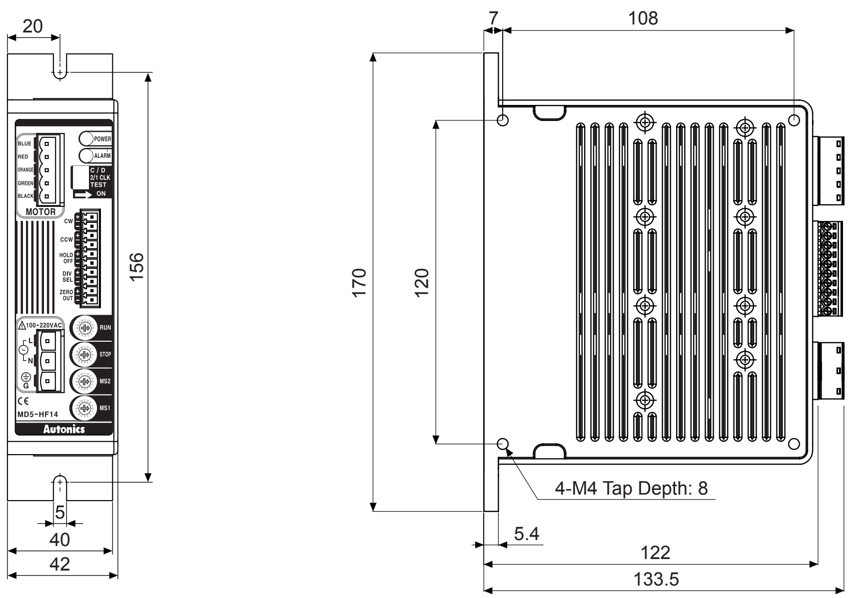
■ Connections



※Please refer to Q-40 for standard wiring.

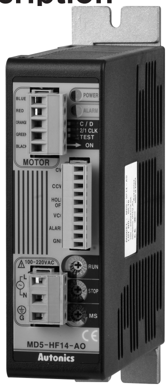
■ Dimensions

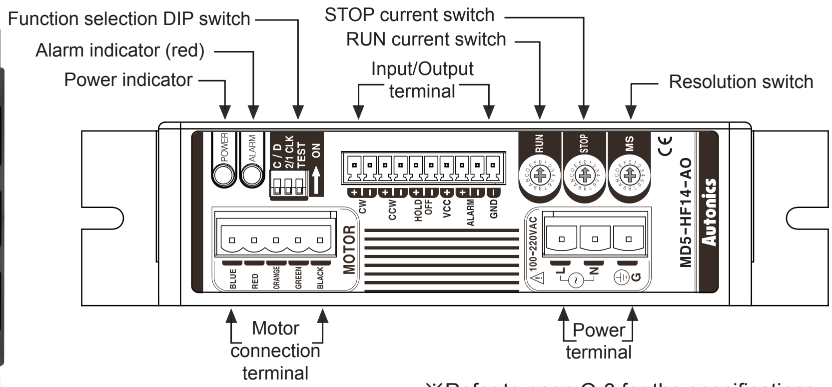
(unit: mm)



5-Phase Micro Stepper Motor Driver [MD5-HF14-AO]

▣ Unit Description





※Refer to page Q-3 for the specifications.

◎ Function selection DIP switch

No.	Name	Function	Switch position ON	Switch position OFF (default)
1	TEST	Self diagnosis function	30rpm rotation	Not use
2	2/1 CLK	Pulse input method	1-pulse input method	2-pulse input method
3	C/D	Auto current down	Not use	Use

● TEST

- Self diagnosis function is for motor and driver test.
- This function makes the motor rotate with 30rpm in full step. Rotation speed varies with resolution settings.
- Rotation speed = 30rpm/resolution
- In 1-pulse input method, it rotates to CCW, and in 2-pulse input method, it rotates to CW.

※Be sure that the TEST switch is OFF before supplying the power.
If the TEST switch is ON, the motor operates immediately and it may be dangerous.

● 2/1 CLK

- 2/1 CLK switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

● C/D (auto current down)

- This function is to reduce the current provided for motor automatically for preventing severe motor's heat when motor stops.
- If motor RUN pulse is not applied, the current provided for motor reduces as the set STOP current.

※Be sure that when motor RUN current is reduced, the stop torque of motor also reduced.
※Set the STOP current by the STOP current switch.

◎ RUN current

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (A/Phase)	0.4	0.5	0.57	0.63	0.71	0.77	0.84	0.9	0.96	1.02	1.09	1.15	1.22	1.27	1.33	1.4

- RUN current setting is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※Change RUN current only when the motor stops.

◎ STOP current

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

- STOP current setting is for the current provided for motor when the motor stops for preventing severe motor's heat.
- This setting is applied when using C/D (current down) function.
- Setting value of STOP current is percentage (%) ratio of the set RUN current.
  E.g.) Set RUN current as 1.4A and STOP current as 40%.
  STOP current is set as 1.4A×0.4=0.56A

※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

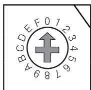
5-Phase Stepper Motor Driver (1.4A/Phase, AC Power, Alarm Output)

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to ▣ I/O Circuit and Connections.

◎ Microstep (microstep: resolution)



Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Resolution	1	2	4	5	8	10	16	20	25	40	50	80	100	125	200	250
Step angle	0.72°	0.36°	0.18°	0.144°	0.09°	0.072°	0.045°	0.036°	0.0288°	0.018°	0.0144°	0.009°	0.0072°	0.00576°	0.0036°	0.00288°

● Resolution (MS1)

- The set step angle is dividing basic step angle (0.72°) of 5-phase stepper motor by setting value.
- The calculation formula of divided step angle is as below.

$$\text{Set step angle} = \frac{\text{Basic step angle } (0.72°)}{\text{Resolution}}$$

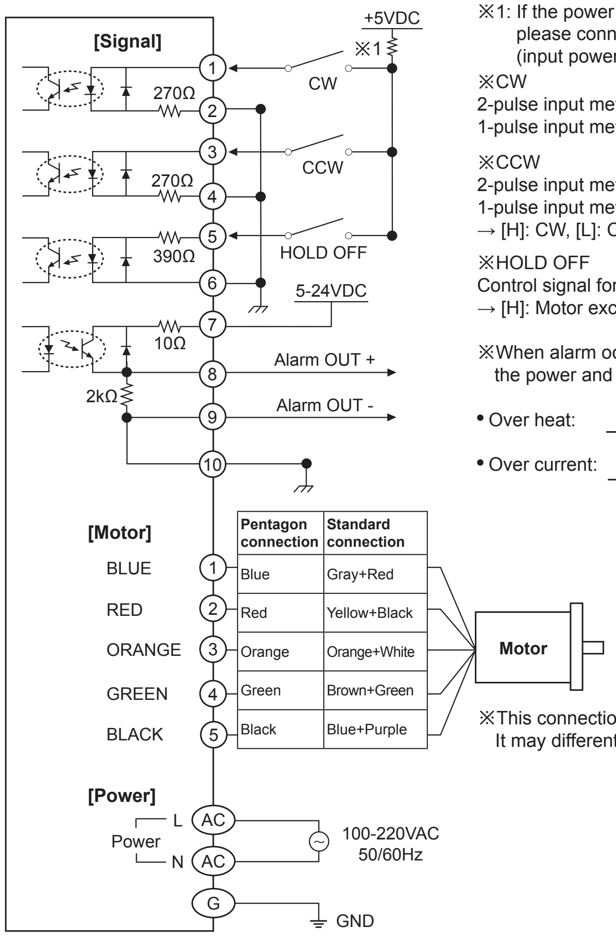
- When using geared type motor, the angle is step angle divided by gear ratio.
  Step angle / gear ratio = Step angle applied gear
  E.g) 0.72° / 10 (1:10) = 0.072°

※Must stop the motor before changing the resolution.

◎ Alarm output function

- Overheat: When the temperature of driver base is over 80℃, alarm indicator (red) turns ON and motor stops with holding the excision. Turn OFF the power and remove the causes. Turn ON the power and alarm output is OFF.
- Overcurrent: When overcurrent is applied from motor damage by burn, driver damage, or error, alarm LED (red) is flashed. When overcurrent occurs, the motor becomes HOLD OFF. Turn OFF the power and remove the causes to normal operation.

▣ I/O Circuit and Connections



Pentagon connection	Standard connection
Blue	Gray+Red
Red	Yellow+Black
Orange	Orange+White
Green	Brown+Green
Black	Blue+Purple

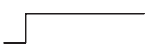
※1: If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside.
(input power max. 24VDC, input current 10-24mA)

※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)

※CCW
2-pulse input method (CCW rotation signal input)
1-pulse input method (rotation direction signal input)
→ [H]: CW, [L]: CCW

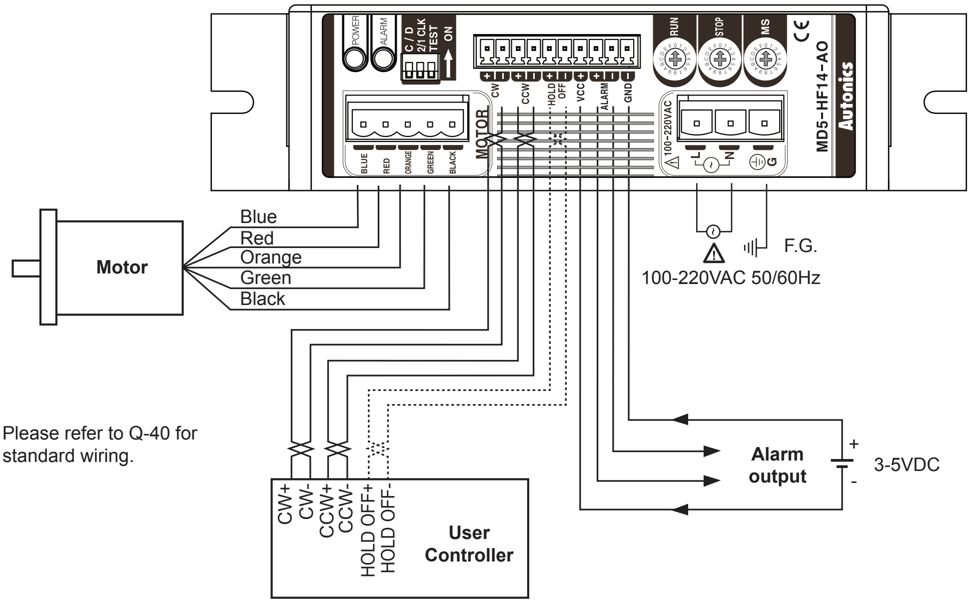
※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF

※When alarm occurs, the motor becomes HOLD OFF. Turn OFF the power and remove the causes to normal operation.

- Over heat: 
- Over current: 

※This connection cable color is only for Autonics motors.
It may different cable color when using other motors.

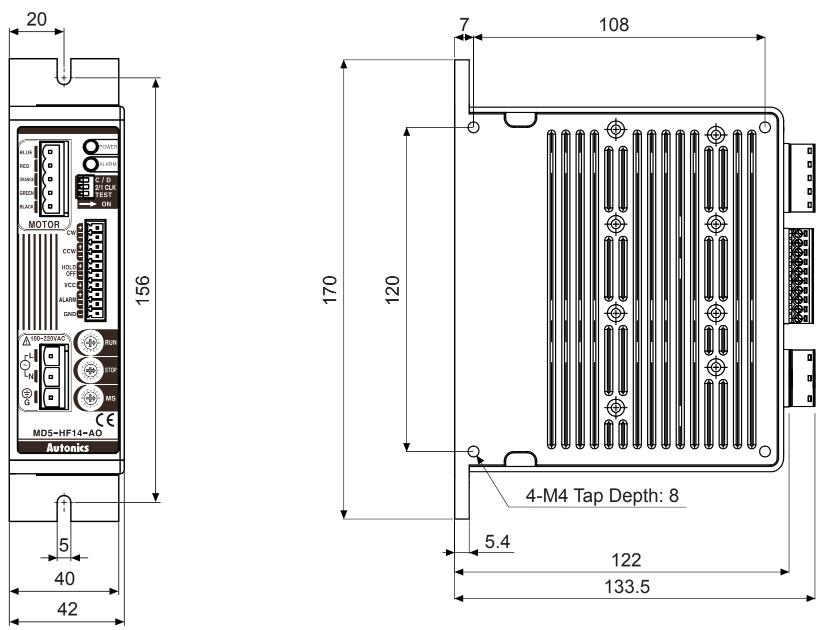
■ Connections



※Please refer to Q-40 for standard wiring.

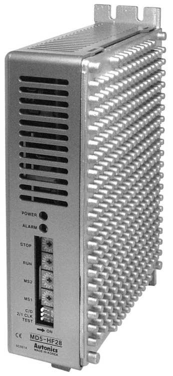
■ Dimensions

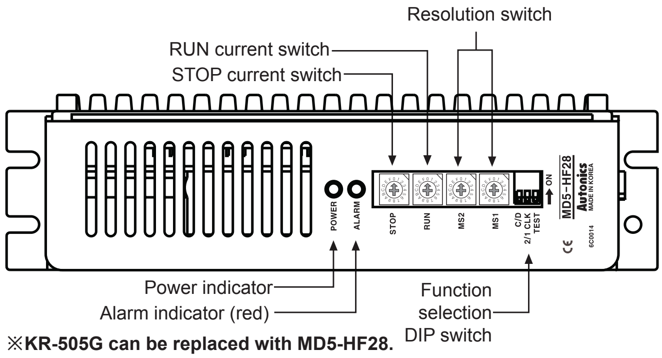
(unit: mm)



5-Phase Microstep Motor Driver [MD5-HF28]

▣ Unit Description





※**KR-505G can be replaced with MD5-HF28.**
※**Power supply 100-220VAC and socket type wire terminal blocks are upgraded comparing to KR Series.**

※Refer to page Q-3 for the specifications.

◎ Function selection DIP switch

	No.	Name	Function	Switch position	
				ON	OFF (default)
1 2 3 ON	1	TEST	Self diagnosis function	30rpm rotation	Not use
	2	2/1 CLK	Pulse input method	1-pulse input method	2-pulse input method
	3	C/D	Auto Current Down	Not use	Use

● **TEST**
- Self diagnosis function is for motor and driver test.
- This function makes the motor rotate with 30rpm in full step. Rotation speed varies with resolution settings.
- Rotation speed = 30rpm/resolution
- In 1-pulse input method, it rotates to CCW, and in 2-pulse input method, it rotates to CW.

※Be sure that the TEST switch is OFF before supplying the power.
If the TEST switch is ON, the motor operates immediately and it may be dangerous.

● **2/1 CLK**
- 2/1 CLK switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

● **C/D (auto current down)**
- This function is to reduce the current provided for motor automatically for preventing severe motor's heat when motor stops.
- If motor RUN pulse is not applied, the current provided for motor reduces as the set STOP current.

※Be sure that when motor RUN current is reduced, the stop torque of motor also reduced.
※Set the STOP current by the STOP current switch.

◎ RUN current

	Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	Current (A/Phase)	1.14	1.25	1.36	1.50	1.63	1.74	1.86	1.97	2.10	2.20	2.30	2.40	2.50	2.60	2.78	2.88

- RUN current setting is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※Change RUN current only when the motor stops.

◎ STOP current

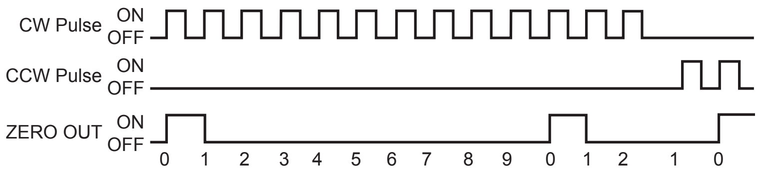
	Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

- STOP current setting is for the current provided for motor when the motor stops for preventing severe motor's heat.
- This setting is applied when using C/D (current down) function.
- Setting value of STOP current is percentage (%) ratio of the set RUN current.
  E.g.) Set RUN current as 2.5A and STOP current as 40%.
  STOP current is set as 2.5A×0.4=1A

※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

◎ Zero point excitation output signal (ZERO OUT)



- This output indicates the initial step of excitation order of stepper motor and rotation position of motor axis .
- This signal outputs every 7.2° of rotation of the motor axis regardless of resolution.
  (50 outputs per 1 rotation of the motor.)
  E.g.) Full step: outputs one time by 10 pulses input, 20-division: outputs one time by 200 pulses input.

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to ▣ I/O Circuit and Connections.

◎ Microstep (microstep: resolution)

	Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	Resolution	1	2	4	5	8	10	16	20	25	40	50	80	100	125	200	250
	Step angle	0.72°	0.36°	0.18°	0.144°	0.09°	0.072°	0.045°	0.036°	0.0288°	0.018°	0.0144°	0.009°	0.0072°	0.00576°	0.0036°	0.00288°

● **Resolution (same as MS1, MS2)**

- The MS1, MS2 switches is for resolution setting.
- Select MS2 or MS2 by DIVISION SELECTION signal ([L]: MS1, [H]: MS2)
- Select the step angle (motor rotation angle per 1 pulse).
- The set step angle is dividing basic step angle (0.72°) of 5-phase stepper motor by setting value.
- The calculation formula of divided step angle is as follow.

$$\text{Set step angle} = \frac{\text{Basic step angle (0.72°)}}{\text{Resolution}}$$

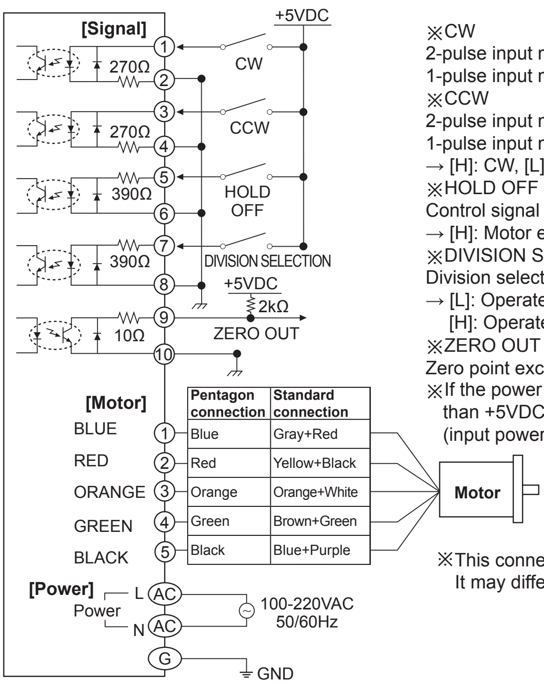
- When using geared type motor, the angle is step angle divided by gear ratio.
  Step angle / gear ratio = Step angle applied gear E.g) 0.72° / 10 (1:10) = 0.072°

※Must stop the motor before changing the resolution.

◎ Alarm output function

- Overheat: When the temperature of driver base is over 80℃, alarm indicator (red) turns ON and motor stops with holding the excision. Turn OFF the power and remove the causes. Turn ON the power and alarm output is OFF.
- Overcurrent: When overcurrent is applied from motor damage by burn, driver damage, or error, alarm LED (red) is flashed. When overcurrent occurs, the motor becomes HOLD OFF. Turn OFF the power and remove the causes to normal operation.

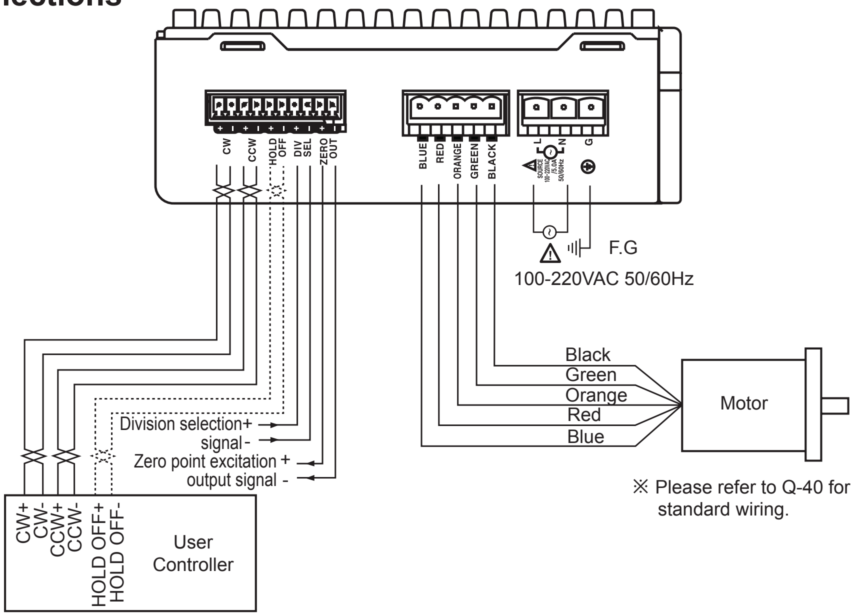
▣ I/O Circuit and Connections



※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)
※CCW
2-pulse input method (CCW rotation signal input)
1-pulse input method (rotation direction signal input)
→ [H]: CW, [L]: CCW
※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF
※DIVISION SELECTION
Division selection signal
→ [L]: Operated by switch MS1
[H]: Operated by switch MS2
※ZERO OUT
Zero point excitation output signa → Zero point status ON
※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside. (input power max. 24VDC, input current 10-20mA)

※This connection cable color is only for Autonics motors. It may different cable color when using other motors.

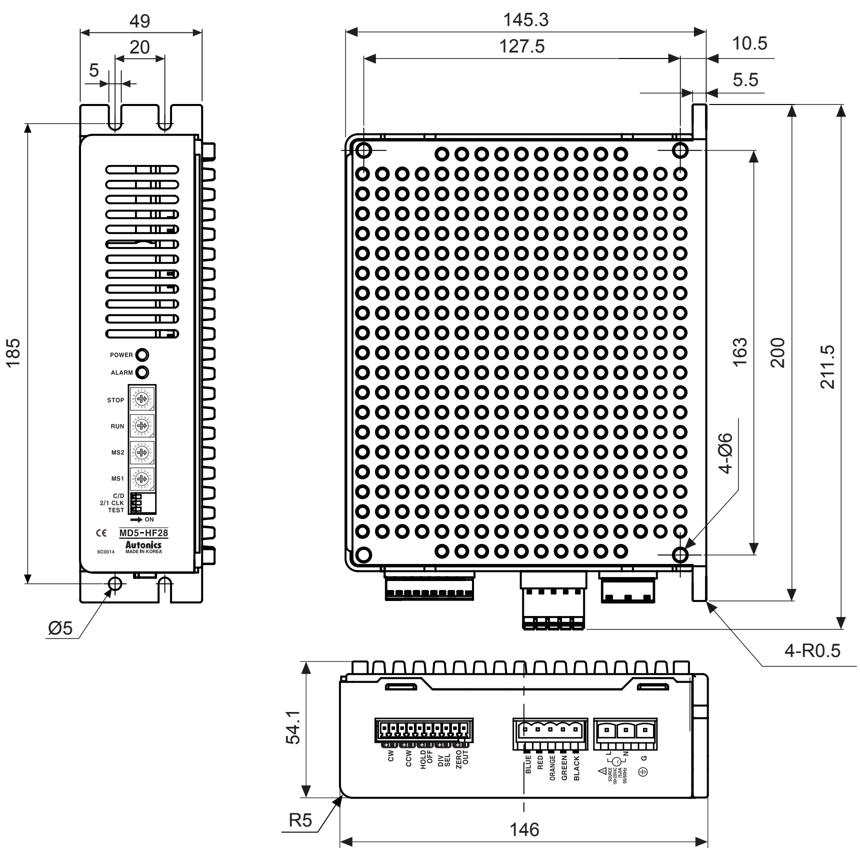
■ Connections



※ Please refer to Q-40 for standard wiring.

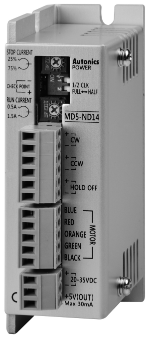
■ Dimensions

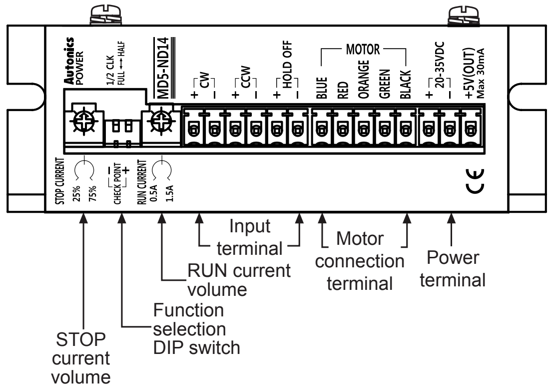
(unit: mm)



5-Phase Stepper Motor Driver [MD5-ND14]

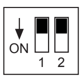
▣ Unit Description





※Refer to page Q-3 for the specifications.

◎ Function selection DIP switch

	No.	Nameplate	Function	Switch position	
				ON	OFF (default)
	1	1/2 CLK	Pulse input method	1-pulse input method	2-pulse input method
	2	FULL↔HALF	Select resolution	1-division (0.72°)	2-division (0.36°)

※Changing pulse input method or resolution is available only when stepper motor stops.
If changing the resolution during operation, the motor may be out of phase.

● 1/2 CLK

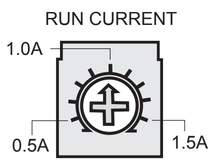
- 1/2 CLK switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

● FULL ↔ HALF

- FULL ↔ HALF switch is to set basic step angle for 5 phase stepper motor.

※Change resolution only when the motor stops.

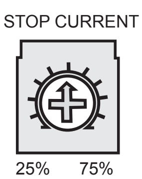
◎ RUN current



- RUN current setting is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※Change RUN current only when the motor stops.

◎ STOP current



- STOP current setting is for the current provided for motor when the motor stops.
- Setting value of STOP current is percentage (%) ratio of the set RUN current.
  E.g.) Set RUN current as 1.4A and STOP current as 40%.
  STOP current is set as 1.4A×0.4=0.56A.

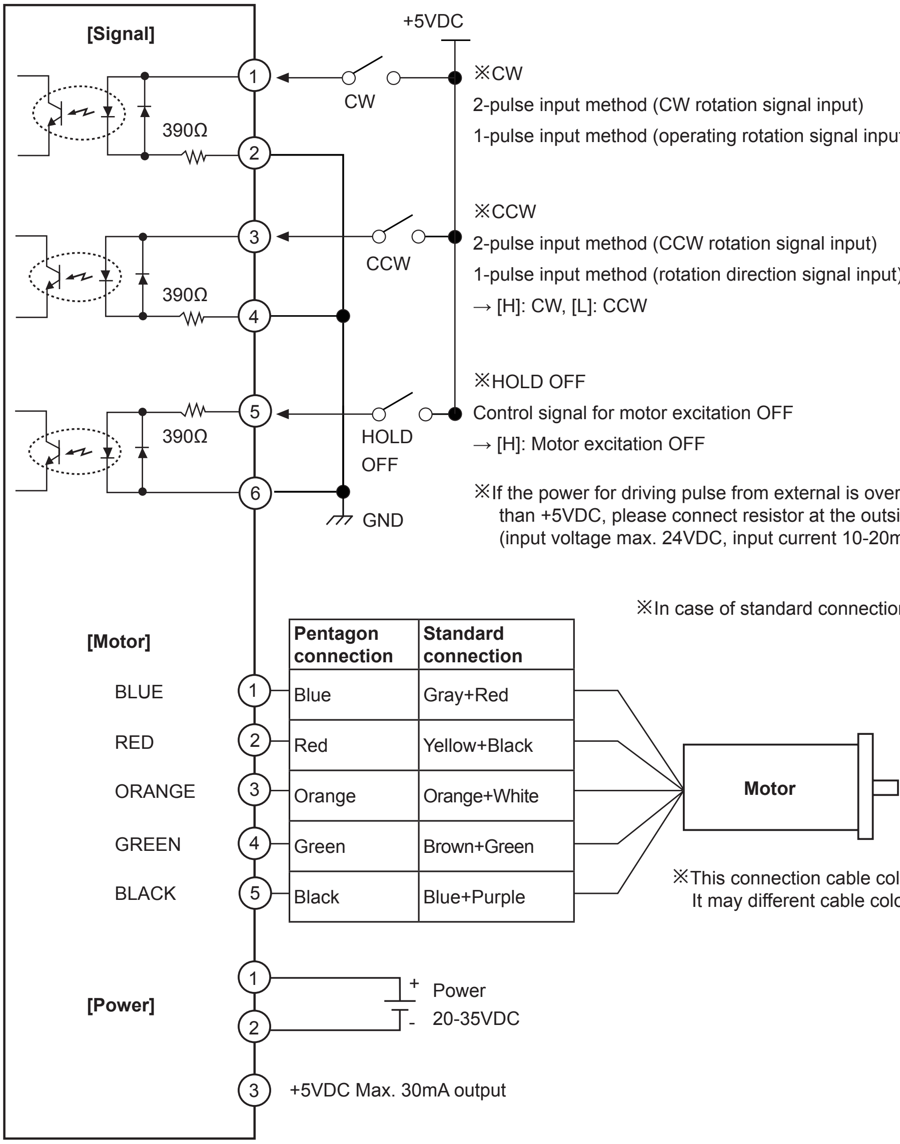
※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to ▣ I/O Circuit and Connections.

■ I/O Circuit and Connections



※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)

※CCW
2-pulse input method (CCW rotation signal input)
1-pulse input method (rotation direction signal input)
→ [H]: CW, [L]: CCW

※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF

※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside. (input voltage max. 24VDC, input current 10-20mA)

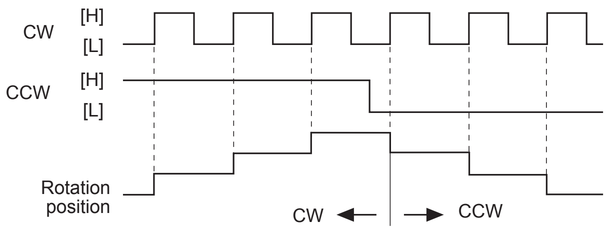
※In case of standard connection, refer to Q-40 page.

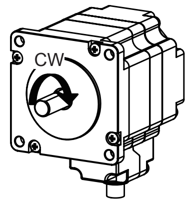
Pentagon connection	Standard connection
Blue	Gray+Red
Red	Yellow+Black
Orange	Orange+White
Green	Brown+Green
Black	Blue+Purple

※This connection cable color is only for Autonics motors. It may different cable color when using other motors.

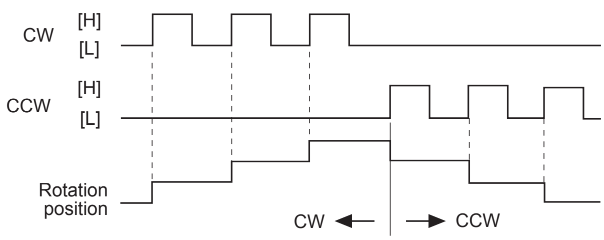
■ Time Chart

◎ 1-pulse input method





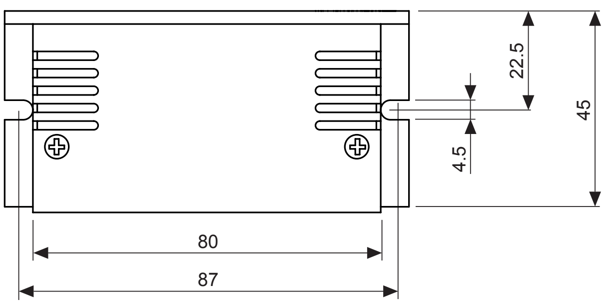
◎ 2-pulse input method

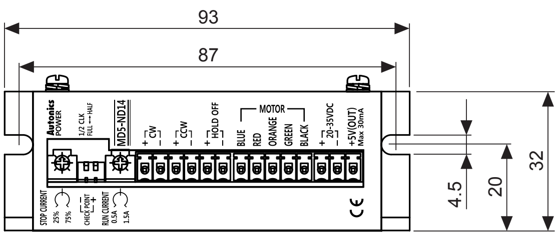


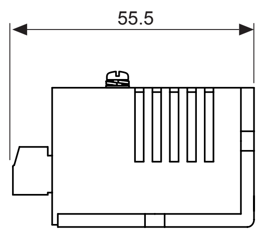
※Do not input CW, CCW signals at the same time in 2-pulse input method.
It may not operate properly if another direction signal is inputted when one of CW or CCW is [H].

■ Dimensions

(unit: mm)



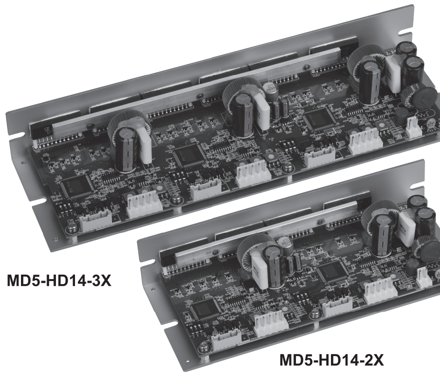




Low Noise, Low Vibration Multi Axis 5-Phase Stepper Motor Driver

■ Features

- **Simultaneous operation of 2, 3-axis by single power supply 20-35VDC**
- Small, light weight and advanced quality by custom IC and surface mounted circuit
- Realizing low noise, low vibration rotation with microstep-driving
- Low speed rotation and high accuracy controlling with microstep-driving
- Max. resolution - 250 division: In case of 5-phase stepper motor of which basic step angle is 0.72°, it enables to control up to 0.00288° per pulse
- Includes auto current down and self-diagnosis function
- Photocoupler input insulation method to minimize the effects from external noise



MD5-HD14-3X

MD5-HD14-2X

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ Ordering Information

MD 5 – H D 14 – 2X

Code position	Code	Description
Axis	2X	2-axis
	3X	3-axis※1
RUN current	14	1.4A/Phase
Power supply	D	20-35VDC
Step type (resolution)	H	Micro step (250-division)
Motor phase	5	5-Phase
Item	MD	Motor Driver

※1: Built-in zero point excitation output signal is optional.

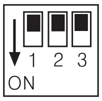
■ Specifications

Model		MD5-HD14-2X	MD5-HD14-3X
Power supply※1		20-35VDC	
Allowable voltage fluctuation range		90 to 110% of the rated voltage	
Max. current consumption※2		5A	7A
RUN current※3		0.4-1.4A/Phase	
STOP current		27 to 90% of RUN current (set by STOP current switch)	
Drive method		Bipolar constant current pentagon drive	
Basic step angle		0.72°/Step	
Resolution		1, 2, 4, 5, 8, 10, 16, 20, 25, 40, 50, 80, 100, 125, 200, 250-division (0.72° to 0.00288°/Step)	
Input pulse characteristic	Pulse width	Min. 1μs (CW, CCW), Min. 1ms (HOLD OFF)	
	Duty rate	50% (CW, CCW)	
	Rising/Falling time	Below 130ns (CW, CCW)	
	Pulse input voltage	[H]: 4-8VDC, [L]: 0-0.5VDC	
	Pulse input current	7.5-14mA (CW, CCW), 10-16mA (HOLD OFF, ZERO OUT)	
	Max. input pulse frequency※4	Max. 500kHz (CW, CCW)	
Input resistance		270Ω (CW, CCW), 390Ω (HOLD OFF), 10Ω (ZERO OUT)	
Insulation resistance		Over 100MΩ (at 500VDC megger, between all terminals and base)	
Dielectric strength		1,000VAC 50/60Hz for 1min (between all terminals and base)	
Noise immunity		±500V the square wave noise (pulse width: 1μs) by the noise simulator	
Vibration	Mechanical	1.5mm amplitude at frequency of 5 to 60Hz (for 1 min) in each X, Y, Z direction for 2 hours	
	Malfunction	1.5mm amplitude at frequency of 5 to 60Hz (for 1 min) in each X, Y, Z direction for 10 min	
Environ-ment	Ambient temp.	0 to 40℃, Storage: -10 to 60℃	
	Ambient humi.	35 to 85%RH, Storage: 35 to 85%RH	
Approval		CE	
Weight※5		Approx. 446g (approx. 292g)	Approx. 597g (approx. 411g)

※1: When using over 30VDC power supply, torque characteristics are improved but the driver temperature raise. The unit should be installed at the well ventilation environment.
※2: Based on ambient temperature 25℃, ambient humidity 55%RH.
※3: RUN current varies depending on the input RUN frequency and max. RUN current at the moment varies also varies depending on the load.
※4: Max. input pulse frequency is max. frequency to be input and is not same as max. pull-out frequency or max. slewing frequency.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Functions

◎ Function selection DIP switch

	No.	Name	Function	Switch position	
				ON	OFF (default)
	1	TEST	Self diagnosis function	30rpm rotation	Not use
	2	1/2 CLK	Pulse input method	1-pulse input method	2-pulse input method
	3	C/D	Auto Current Down	Not use	Use

● TEST

- Self diagnosis function is for motor and driver test.
- This function makes the motor rotate with 30rpm in full step. Rotation speed varies with resolution settings.
- Rotation speed = 30rpm/resolution
- In 1-pulse input method, it rotates to CCW, and in 2-pulse input method, it rotates to CW.

※Be sure that the TEST switch is OFF before supplying the power.
If the TEST switch is ON, the motor operates immediately and it may be dangerous.

● 1/2 CLK

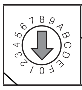
- 1/2 CLK switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

● C/D (auto current down)

- This function is to reduce the current provided for motor automatically for preventing severe motor's heat when motor stops.
- If motor RUN pulse is not applied, the current provided for motor reduces as the set STOP current.

※Be sure that when motor RUN current is reduced, the stop torque of motor also reduced.
※Set the STOP current by the STOP current setting switch.

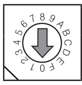
◎ RUN current

	Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	Current (A/Phase)	0.4	0.5	0.57	0.63	0.71	0.77	0.84	0.9	0.96	1.02	1.09	1.15	1.22	1.27	1.33	1.4

- RUN current setting is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※Change RUN current only when the motor stops.

◎ STOP current

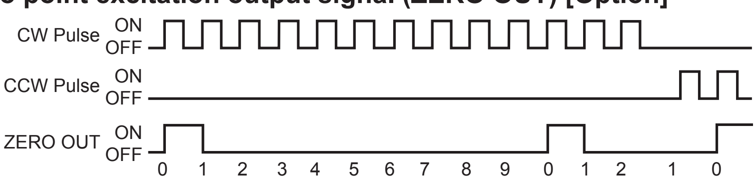
	Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

- STOP current setting is for the current provided for motor when the motor stops.
- This setting is applied when using C/D (current down) function.
- Setting value of STOP current is percentage (%) ratio of the set RUN current.

E.g.) Set RUN current as 1.4A and STOP current as 40%.
STOP current is set as 1.4A×0.4=0.56A

※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

◎ Zero point excitation output signal (ZERO OUT) [Option]



- This output indicates the initial step of excitation order of stepper motor and rotation position of motor axis.
- This signal outputs every 7.2° of rotation of the motor axis regardless of resolution.
(50 outputs per 1 rotation of the motor.)
E.g.) Full step: outputs one time by 10 pulses input,
20-division: outputs one time by 200 pulses input.

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to ▣ I/O Circuit And Connections.

◎ Microstep (microstep: resolution)

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Resolution	1	2	4	5	8	10	16	20	25	40	50	80	100	125	200	250
Step angle	0.72°	0.36°	0.18°	0.144°	0.09°	0.072°	0.045°	0.036°	0.0288°	0.018°	0.0144°	0.009°	0.0072°	0.00576°	0.0036°	0.00288°

● **Resolution (MS1)**

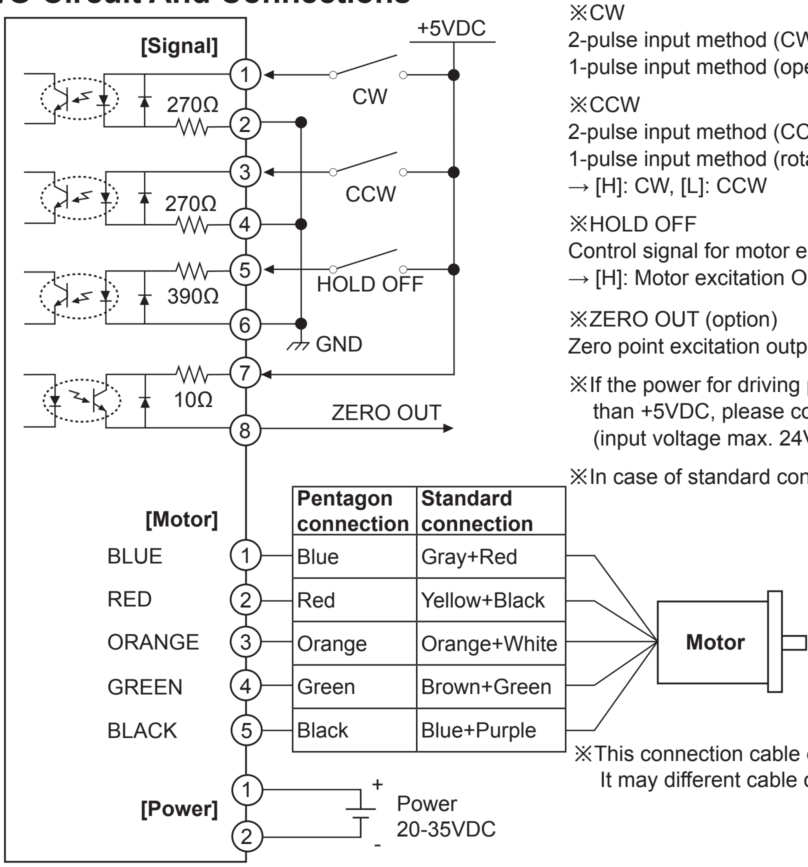
- The set step angle is dividing basic step angle (0.72°) of 5-phase stepper motor by setting value.
- The calculation formula of divided step angle is as below.

$$\text{Set step angle} = \frac{\text{Basic step angle } (0.72°)}{\text{Resolution}}$$

- When using geared type motor, the angle is step angle divided by gear ratio.
  Step angle/gear ratio = Step angle applied gear
  E.g) 0.72°/10 (1:10) = 0.072°

※Must stop the motor before changing the resolution.

■ I/O Circuit And Connections



Pentagon connection	Standard connection
Blue	Gray+Red
Red	Yellow+Black
Orange	Orange+White
Green	Brown+Green
Black	Blue+Purple

※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)

※CCW
2-pulse input method (CCW rotation signal input)
1-pulse input method (rotation direction signal input)
→ [H]: CW, [L]: CCW

※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF

※ZERO OUT (option)
Zero point excitation output signal → Zero point status ON

※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside. (input voltage max. 24VDC, input current 10-20mA)

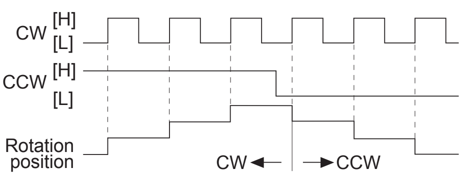
※In case of standard connection, refer to Q-40 page.

※This connection cable color is only for Autonics motors. It may different cable color when using other motors.

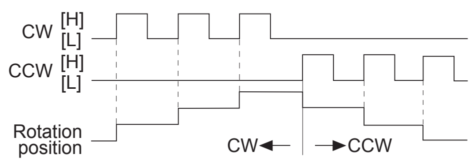
※Power input of 2/3-axis are used as same and I/O terminals are proportional to the number of axes.

■ Time Chart

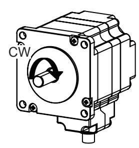
◎ 1-pulse input method



◎ 2-pulse input method



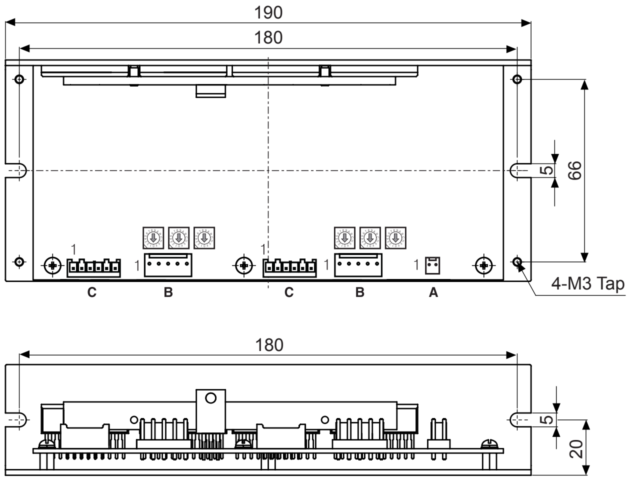
※Do not input CW, CCW signals at the same time in 2-pulse input method.
It may not operate properly if another direction signal is inputted when one of CW or CCW is [H].

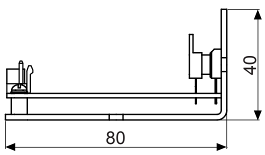


■ Dimensions

◎ MD5-HD14-2X

(unit: mm)

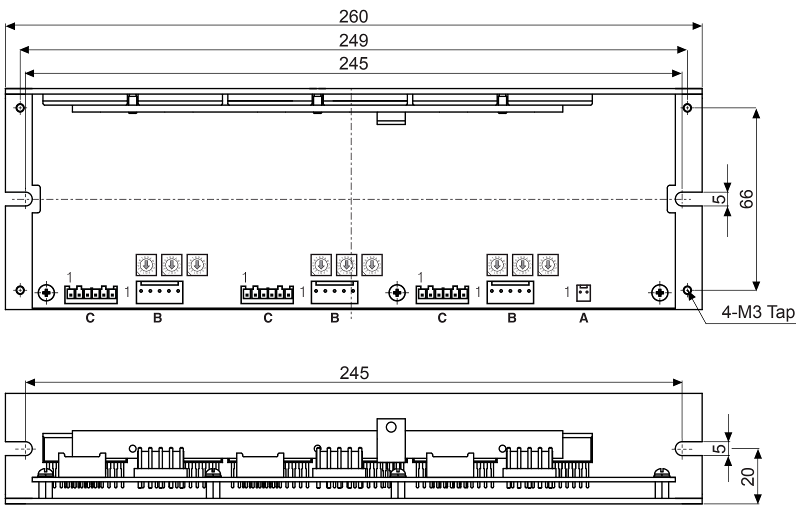


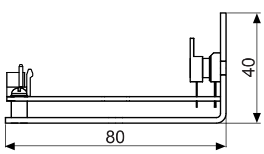


※Accessory connector specification

Accessory		Connector		Qty.
		Manufacturer	Model No.	
A	Power 2P housing	Yeonho electronics	YH396-02V	1
B	Motor 5P housing	Yeonho electronics	YH396-05V	2
C	Signal 6P housing	JST	XAP-06V-1	2
—	Power/Motor terminal pin	Yeonho electronics	YT396	12
—	Signal terminal pin	JST	SXA -001T-P0.6	12

◎ MD5-HD14-3X





※Accessory connector specification

Accessory		Connector		Qty.
		Manufacturer	Model No.	
A	Power 2P housing	Yeonho electronics	YH396-02V	1
B	Motor 5P housing	Yeonho electronics	YH396-05V	3
C	Signal 6P housing	JST	XAP-06V-1	3
—	Power/Motor terminal pin	Yeonho electronics	YT396	17
—	Signal terminal pin	JST	SXA -001T-P0.6	18

■ Cautions During Use (common Specifications of 5-Phase Stepper Motor Driver)

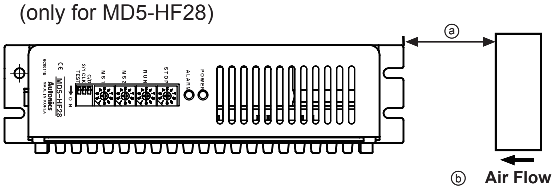
1. For signal input
①Do not input CW, CCW signal at the same time in 2-pulse input method. Failure to follow this instruction may result in malfunction. It may not operate properly if another direction signal is inputted when one of CW or CCW is [H].
②When the signal input voltage is exceeded the rated voltage, connect additional resistance at the outside.

2. For RUN current, STOP current setting
①Set RUN current within the range of motor's rated current. Failure to follow this instruction may result in severe heat of motor or motor damage.
②If motor stops, switching for STOP current executed by the current down function. When hold off signal is [H] or current down function is OFF, the switching does not execute. (except MD5-ND14)
③Use the power for supplying sufficient current to the motor.
④Check the polarity of power before operating the unit. (only for MD5-HD14, HD14-2X/3X, ND14)

3. For rotating motor
(only for MD5-HD14, HD14-2X/3X, ND14)
①For rotating the motor when driver power turns OFF, separate the motor from the driver. (if not, the driver power turns ON)
②For rotating the motor when driver power turns ON, use Hold OFF function.

4. For cable connection
①Use twisted pair (over 0.2mm^2) for the signal cable which should be shorter than 2m.
②The thickness of cable should be same or thicker than the motor cable's when extending the motor cable.
③Must separate between the signal cable and the power cable over 10cm.

5. For installation
①**The unit must be installed with heat protection. The conditions of ②, ③ should be satisfied. (※MD5-ND14)**
②In order to increase heat protection efficiency of the driver, must install the heat sink close to metal panel and keep it well-ventilated.
③Excessive heat generation may occur on driver. Keep the heat sink under 80℃ when installing the unit. (at over 80℃, forcible cooling shall be required.)
④If the unit is installed in distribution panel, enclosed space or place with heat, it may cause product damage by heat. Install a ventilation. (only for MD5-HF28)
⑤For heat radiation of driver, install a fan as below figure. (distance between the ⓐ fan and the unit: approx. within 70mm, ⓑ min. airflow: 0.71m^3/min at least) (only for MD5-HF28)



6. For using function selection DIP switches
①Be sure that the TEST switch is OFF before supplying the power. If the TEST switch is ON, the motor operates immediately and it may be dangerous. (except MD5-ND14)
②Do not change the pulse input method during the operation. It may cause danger as the revolution way of the motor is changed conversely.

7. This product may be used in the following environments.
① Indoor
② Altitude under 2,000m
③ Pollution degree 2
④ Installation category II

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Ordering Information

● Application model: Shaft type, Hollow shaft type, Shaft type+Built-in brake type

A □ 8K – M 5 6 6 □ – □ B

Item	Code	Description
Built-in brake type	**No-mark**	Standard type
	B※1	Built-in brake type
Wire connection	**No-mark**	Pentagon
	S※2	Standard
Shaft type	**No-mark**※1	Single shaft
	W	Dual shaft
Motor length (frame 2: 24mm×24mm)	**3**	30.5mm
	5	46.5mm
Motor length (frame 4: 42mm×42mm)	**3**	33mm
	4	39mm
	5	47mm
Motor length (frame 6: 60mm×60mm)	**4**	48.5mm
	6	59.5mm
	9	89mm
Motor length (frame 9: 85mm×85mm)	**6**	68mm
	9	98mm
	13	128mm
Motor frame size (width×height)	**2**	24mm×24mm
	4	42mm×42mm
	6	60mm×60mm
	9	85mm×85mm
Motor phase	**5**	5 phase
Rated current	**S**	0.75 A/Phase
	M	1.4 A/Phase
	G	2.8 A/Phase
Max. Holding torque	**Square**	kgf·cm (refer to motor specifications)
Motor type	**No-mark**	Shaft type
	H	Hollow shaft type
	A	Autonics motor

※1: Built-in brake type provides single shaft type only.
※2: Standard wiring is optional. (except frame size 24mm motor, A4K-G564(W), A8K-G566(W))

■ Ordering Information

● Application model: Geared type, Geared+Built-in brake type, Rotary actuator type, Rotary actuator+Built-in brake type

A □ – M 5 □ □ □ – □ □

Item	Code	Description
Gear ratio	**5**	1:5
	7.2	1:7.2
	10	1:10
Motor type	**G**	Geared type
	GB※1	Geared+Built-in brake type
	R	Rotary actuator type
	RB※1	Rotary actuator+Built-in brake type
Shaft type	**No-mark**※1	Single shaft
	W	Dual shaft
Motor length	**5**	47mm
	6	59.5mm
	9	98mm
Motor frame size (width×height)	**4**	42mm×42mm
	6	60mm×60mm
	9	85mm×85mm
Motor phase	**5**	5 Phase
Rated current	**S**	0.75 A/Phase
	M	1.4 A/Phase
	G	2.8 A/Phase
Max. Holding torque	**10**	10 kgf·cm
	15	15 kgf·cm
	35	35 kgf·cm
	40	40 kgf·cm
	50	50 kgf·cm
	140	140 kgf·cm
	200	200 kgf·cm
	A	Autonics motor

※1: Built-in brake type provides single shaft type only.

■ Specifications

Motor		Model	Rated current (A/Phase)	Max. holding torque (kgf·cm)	Max. allowable torque (kgf·cm)	Moment of rotor inertia (g·cm²)	Winding resistance (Ω)	Motor length (mm)
Frame size	Type							
24mm	Shaft type	**02K-S523(W)**	0.75	0.18	—	4.2	1.1	30.5
		04K-S525(W)	0.75	0.28	—	8.2	1.7	46.5
42mm	Shaft type / Shaft + Built-in brake type	**A1K-S543(W)-B**	0.75	1.3	—	35	1.7	33/56
		A2K-S544(W)-B	0.75	1.8	—	54	2.2	39/62
		A2K-M544(W)	1.4	1.8	—	54	2.2	39
		A3K-S545(W)-B	0.75	2.4	—	68	2.2	47/70
	Hollow shaft type	**AH1K-S543**	0.75	1.3	—	35	1.7	33
		AH2K-S544	0.75	1.8	—	54	2.2	39
		AH3K-S545	0.75	2.4	—	68	2.2	47
	Geared type	**A10K-S545(W)-G5**	0.75	—	10	68	2.2	74.5
		A15K-S545(W)-G7.2	0.75	—	15	68	2.2	74.5
		A15K-S545(W)-G10	0.75	—	15	68	2.2	74.5
	Geared + Built-in brake type	**A10K-S545-GB5**	0.75	—	10	68	2.2	97.5
		A15K-S545-GB7.2	0.75	—	15	68	2.2	97.5
		A15K-S545-GB10	0.75	—	15	68	2.2	97.5
60mm	Shaft type / Shaft + Built-in brake type	**A4K-S564(W)-B**	0.75	4.2	—	175	2.6	48.5/75
		A4K-M564(W)-B	1.4	4.2	—	175	0.8	48.5/75
		A4K-G564(W) Line-up	2.8	4.2	—	175	0.26	48.5
		A8K-S566(W)-B	0.75	8.3	—	280	4.0	59.5/86
		A8K-M566(W)-B	1.4	8.3	—	280	1.1	59.5/86
		A8K-G566(W) Line-up	2.8	8.3	—	280	0.35	59.5
		A16K-M569(W)-B	1.4	16.6	—	560	1.8	89/115.5
		A16K-G569(W)-B	2.8	16.6	—	560	0.56	89/115.5
	Hollow shaft type	**AH4K-S564(W)**	0.75	4.2	—	175	2.6	48.5
		AH4K-M564(W)	1.4	4.2	—	175	0.8	48.5
		AH8K-S566(W)	0.75	8.3	—	280	4.0	59.5
		AH8K-M566(W)	1.4	8.3	—	280	1.1	59.5
		AH16K-M569(W)	1.4	16.6	—	560	1.8	89
		AH16K-G569(W)	2.8	16.6	—	560	0.56	89
	Geared type	**A35K-M566(W)-G5**	1.4	—	35	280	1.1	94.5
		A40K-M566(W)-G7.2	1.4	—	40	280	1.1	94.5
		A50K-M566(W)-G10	1.4	—	50	280	1.1	94.5
	Geared + Built-in brake type	**A35K-M566-GB5**	1.4	—	35	280	1.1	121
		A40K-M566-GB7.2	1.4	—	40	280	1.1	121
		A50K-M566-GB10	1.4	—	50	280	1.1	121
	Rotary actuator type	**A35K-M566(W)-R5**	1.4	—	35	280	1.1	93.5
		A40K-M566(W)-R7.2	1.4	—	40	280	1.1	93.5
		A50K-M566(W)-R10	1.4	—	50	280	1.1	93.5
	Rotary actuator + Built-in brake type	**A35K-M566-RB5**	1.4	—	35	280	1.1	120
		A40K-M566-RB7.2	1.4	—	40	280	1.1	120
		A50K-M566-RB10	1.4	—	50	280	1.1	120
85mm	Shaft type / Shaft + Built-in brake type	**A21K-M596(W)-B**	1.4	21	—	1400	1.76	68/103
		A21K-G596(W)-B	2.8	21	—	1400	0.4	68/103
		A41K-M599(W)-B	1.4	41	—	2700	2.6	98/133
		A41K-G599(W)-B	2.8	41	—	2700	0.58	98/133
		A63K-M5913(W)-B	1.4	63	—	4000	3.92	128/163
		A63K-G5913(W)-B	2.8	63	—	4000	0.86	128/163
	Hollow shaft type	**AH21K-M596(W)**	1.4	21	—	1400	1.76	68
		AH21K-G596(W)	2.8	21	—	1400	0.4	68
		AH41K-M599(W)	1.4	41	—	2700	2.6	98
		AH41K-G599(W)	2.8	41	—	2700	0.58	98
		AH63K-M5913(W)	1.4	63	—	4000	3.92	128
		AH63K-G5913(W)	2.8	63	—	4000	0.86	128
	Geared type	**A140K-M599(W)-G5**	1.4	—	140	2700	2.6	145
		A140K-G599(W)-G5	2.8	—	140	2700	0.58	145
		A200K-M599(W)-G7.2	1.4	—	200	2700	2.6	145
		A200K-G599(W)-G7.2	2.8	—	200	2700	0.58	145
		A200K-M599(W)-G10	1.4	—	200	2700	2.6	145
		A200K-G599(W)-G10	2.8	—	200	2700	0.58	145
	Geared + Built-in brake type	**A140K-M599-GB5**	1.4	—	140	2700	2 6	180
		A140K-G599-GB5	2.8	—	140	2700	0.58	180
		A200K-M599-GB7.2	1.4	—	200	2700	2.6	180
		A200K-G599-GB7.2	2.8	—	200	2700	0.58	180
		A200K-M599-GB10	1.4	—	200	2700	2.6	180
		A200K-G599-GB10	2.8	—	200	2700	0.58	180

※(W) stands for dual shaft of motor. (The built-in brake type provides single shaft type only.)
※Motor length is measured without shaft.
※Hollow shaft type with standard wiring is optional. (except frame size 24mm motor.)

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Specifications

● Frame size 24mm

Model		**02K-S523(W)**	**04K-S525(W)**
Max. Holding torque		0.18kgf·cm (0.018N·m)	0.28kgf·cm (0.027N·m)
Rotor moment of inertia		4.2g·cm^2 (4.2×10^{-7}kg·m^2)	8.2g·cm^2 (8.2×10^{-7}kg·m^2)
Rated current		0.75A/Phase	
Standard step angle		0.72°/ 0.36° (full/half step)	
Insulation class		B type (130℃)	
Insulation resistance		Over 100MΩ (at 500VDC megger) between motor coil-case	
Dielectric strength		0.5kVAC 50/60Hz for 1 minute between motor coil-case	
Environment	Ambient temp.	-10 to 50℃, storage: -25 to 85℃	
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH	
Protection structure		IP30 (IEC34-5 standard)	
Weight※1		Approx. 0.10kg (approx. 0.08kg)	Approx. 0.16kg (approx. 0.12kg)
Reference		**Q-29 to 31**	

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

● Frame size 42mm

Model	Shaft type	**A1K-S543(W)**	**A2K-S544(W)**	**A2K-M544(W)**	**A3K-S545(W)**	—	—	—
	Hollow shaft type	**AH1K-S543**	**AH2K-S544**	—	**AH3K-S545**	—	—	—
	Shaft type + Built-in brake type	**A1K-S543-B**	**A2K-S544-B**	—	**A3K-S545-B**	—	—	—
	Shaft type+ Geared type	—	—	—	—	**A10K-S545(W)-G5**	**A15K-S545(W)-G7.2**	**A15K-S545(W)-G10**
	Geared + Built-in brake type	—	—	—	—	**A10K-S545-GB5**	**A15K-S545-GB7.2**	**A15K-S545-GB10**
Max. allowable torque		—	—	—	—	10 kgf·cm (1.0 N·m)	15 kgf·cm (1.5 N·m)	15 kgf·cm (1.5 N·m)
Max. Holding torque		1.3 kgf·cm (0.13 N·m)	1.8 kgf·cm (0.18 N·m)		2.4 kgf·cm (0.24 N·m)	—	—	—
Rotor moment of inertia		35g·cm^2 (35×10^{-7}kg·m^2)	54g·cm^2 (54×10^{-7}kg·m^2)		68g·cm^2 (68×10^{-7}kg·m^2)	68g·cm^2 (68×10^{-7}kg·m^2)		
Rated current		0.75A/Phase		1.4A/Phase	0.75A/Phase			
Standard step angle		0.72°/ 0.36° (full/half step)				0.144°/ 0.072° (full/half step)	0.1°/ 0.05° (full/half step)	0.072°/ 0.036° (full/half step)
Gear ratio		—				1:5	1:7.2	1:10
Allowable speed range		—				0 to 360rpm	0 to 250rpm	0 to 180rpm
Backlash [min]		—				±35' (0.58°)		
Electromagnetic brake	Rated excitation voltage	24VDC ±10% (non-polarity)						
	Rated excitation current	0.2A						
	Static friction torque	1.8kgf·cm						
	Rotation part inertia moment	3.0×10^{-7}kg·cm^2						
	Operating time	Max. 25ms						
	Releasing time	Max. 15ms						
Insulation class		B type (130℃)						
Insulation resistance		Over 100MΩ (at 500VDC megger) between motor coil-case						
Dielectric strength		1kVAC (at 0.75 A/Phase is 0.5kVAC) 50/60Hz for 1 minute between motor coil-case						
Environment	Ambient temp.	-10 to 50℃, storage: -25 to 85℃						
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH						
Protection structure		IP30 (IEC34-5 standard)						
Weight※1		Shaft type: Approx. 0.34kg (approx. 0.25kg), Hollow shaft type: Approx. 0.35kg (approx. 0.25kg), Built-in brake type: Approx. 0.44kg (approx. 0.39kg)	Shaft type: Approx. 0.39kg (approx. 0.3kg), Hollow shaft type: Approx. 0.4kg (approx. 0.3kg), Built-in brake type: Approx. 0.49kg (approx. 0.44kg)		Shaft type: Approx. 0.49kg (approx. 0.4kg) Hollow shaft type: Approx. 0.5kg (approx. 0.4kg), Built-in brake type: Approx. 0.59kg (approx. 0.54kg)	Geared type: Approx. 0.68kg (approx. 0.58kg), Geared+Built-in brake type: Approx. 0.78kg (approx. 0.72kg)		
Reference		**Q-29 to 39**						

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Specifications

● Frame size 60mm

Model	Shaft type	**A4K-S564(W)**	**A4K-M564(W)**	**A4K-G564(W)**	**A8K-S566(W)**	**A8K-M566(W)**	**A8K-G566(W)**	**A16K-M569(W)**	**A16K-G569(W)**
	Hollow shaft type	**AH4K-S564(W)**	**AH4K-M564(W)**	—	**AH8K-S566(W)**	**AH8K-M566(W)**	—	**AH16K-M569(W)**	**AH16K-G569(W)**
	Shaft type+ Built-in brake type	**A4K-S564-B**	**A4K-M564-B**	—	**A8K-S566-B**	**A8K-M566-B**	—	**A16K-M569-B**	**A16K-G569-B**
Max. Holding torque		4.2kgf·cm (0.41N·m)			8.3kgf·cm (0.81N·m)			16.6kgf·cm (1.63N·m)	
Rotor moment of inertia		$175g\cdot cm^2$ ($175\times10^{-7}kg\cdot m^2$)			$280g\cdot cm^2$ ($280\times10^{-7}kg\cdot m^2$)			$560g\cdot cm^2$ ($560\times10^{-7}kg\cdot m^2$)	
Rated current		0.75A/Phase	1.4A/Phase	2.8A/Phase	0.75A/Phase	1.4A/Phase	2.8A/Phase	1.4A/Phase	2.8A/Phase
Standard step angle		0.72°/ 0.36° (full/half step)							
Electromagnetic brake	Rated excitation voltage	24VDC ±10% (non-polarity)							
	Rated excitation current	0.33A							
	Static friction torque	8kgf·cm							
	Rotation part inertia moment	$29\times10^{-7}kg\cdot cm^2$							
	Operating time	Max. 25ms							
	Releasing time	Max. 20ms							
Insulation class		B type (130℃)							
Insulation resistance		Over 100MΩ (at 500VDC megger) between motor coil-case							
Dielectric strength		1kVAC (at 0.75 A/Phase is 0.5kVAC) 50/60Hz for 1 minute between motor coil-case							
Environment	Ambient temp.	-10 to 50℃, storage: -25 to 85℃							
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH							
Protection structure		IP30 (IEC34-5 standard)							
Weight※1		Standard type: Approx. 0.85kg (approx. 0.6kg), Hollow shaft type: Approx. 0.87kg (approx. 0.6kg), Built-in brake type: Approx. 1.03kg (approx. 0.95kg)			Standard type: Approx. 1.05kg (approx. 0.8kg), Hollow shaft type: Approx. 1.07kg (approx. 0.8kg), Built-in brake type: Approx. 1.33kg (approx. 1.25kg)			Standard type: Approx. 1.55kg (approx. 1.3kg), Hollow shaft type: Approx. 1.57kg (approx. 1.3kg), Built-in brake type: Approx. 1.73kg (approx. 1.65kg)	
Reference		**Q-29 to 35**							

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

● Frame size 60mm

Model	Shaft type+ Geared type	**A35K-M566(W)-G5**	**A40K-M566(W)-G7.2**	**A50K-M566(W)-G10**
	Geared type+ Built-in brake type	**A35K-M566-GB5**	**A40K-M566-GB7.2**	**A50K-M566-GB10**
	Rotary actuator type	**A35K-M566(W)-R5**	**A40K-M566(W)-R7.2**	**A50K-M566(W)-R10**
	Rotary actuator+ Built-in brake type	**A35K-M566-RB5**	**A40K-M566-RB7.2**	**A50K-M566-RB10**
Max. Holding torque		35kgf·cm (3.4N·m)	40kgf·cm (3.9N·m)	50kgf·cm (4.9N·m)
Rotor moment of inertia		$280g\cdot cm^2$ ($280\times10^{-7}kg\cdot m^2$)		
Rated current		1.4A/Phase		
Standard step angle		0.144°/ 0.072° (full/half step)	0.1°/ 0.05° (full/half step)	0.072°/ 0.036° (full/half step)
Gear ratio		1:5	1:7.2	1:10
Allowable speed range		0 to 360rpm	0 to 250rpm	0 to 180rpm
Backlash[min]		±20' (0.33°)		
Electromagnetic brake	Rated excitation voltage	24VDC ±10% (non-polarity)		
	Rated excitation current	0.33A		
	Static friction torque	Min. 8kgf·cm		
	Rotation part inertia moment	$2.9\times10^{-6}kgf\cdot cm^2$		
	Operating time	Max. 20ms		
	Releasing time	Max. 25ms		
Absolute position error※1		±20 minute (0.33°)		
Lost motion※1		±20 minute (0.33°)		
Insulation class		B type (130℃)		
Insulation resistance		Over 100MΩ (at 500VDC megger) between motor coil-case		
Dielectric strength		1kVAC 50/60Hz for 1 minute between motor coil-case		
Environment	Ambient temp.	-10 to 50℃, storage: -25 to 85℃		
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH		
Protection structure		IP30 (IEC34-5 standard)		
Weight※2		Geared type: Approx. 1.57kg (approx. 1.3kg), Geared+Built-in brake type: Approx. 1.65kg (approx. 1.57kg), Rotary actuator type: Approx. 1.4kg (approx. 1.3kg), Rotary actuator+Built-in brake type: Approx. 1.7kg (approx.1.6kg)		
Reference		**Q-36 to 39**		

※1: It is only available for rotary actuator type.
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

5-Phase Stepper Motor

■ Specifications

● Frame size 85mm

Model	Shaft type	**A21K-M596(W)**	**A21K-G596(W)**	**A41K-M599(W)**	**A41K-G599(W)**	**A63K-M5913(W)**	**A63K-G5913(W)**
	Hollow shaft type	**AH21K-M596(W)**	**AH21K-G596(W)**	**AH41K-M599(W)**	**AH41K-G599(W)**	**AH63K-M5913(W)**	**AH63K-G5913(W)**
	Shaft type+ Built-in brake type	**A21K-M596-B**	**A21K-G596-B**	**A41K-M599-B**	**A41K-G599-B**	**A63K-M5913-B**	**A63K-G5913-B**
Max. Holding torque		21kgf·cm (2.1N·m)		41kgf·cm (4.0N·m)		63kgf·cm (6.2N·m)	
Rotor moment of inertia		1400g·cm^2 (1400×10^{-7}kg·m^2)		2700g·cm^2 (2700×10^{-7}kg·m^2)		4000g·cm^2 (4000×10^{-7}kg·m^2)	
Rated current		1.4A/Phase	2.8A/Phase	1.4A/Phase	2.8A/Phase	1.4A/Phase	2.8A/Phase
Standard step angle		0.72°/ 0.36° (full/half step)					
Electromagnetic brake	Rated excitation voltage	24VDC ±10% (non-polarity)					
	Rated excitation current	0.62A					
	Static friction torque	40kgf·cm					
	Rotation part inertia moment	153×10^{-7}kg·cm^2					
	Operating time	Max. 60ms					
	Releasing time	Max. 15ms					
Insulation class		B type (130℃)					
Insulation resistance		Over 100MΩ (at 500VDC megger) between motor coil-case					
Dielectric strength		1kVAC 50/60Hz for 1 minute between motor coil-case					
Environment	Ambient temp.	-10 to 50℃, storage: -25 to 85℃					
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH					
Protection structure		IP30 (IEC34-5 standard)					
Weight※1		Shaft type: Approx. 2.15kg (approx. 1.7kg), Hollow shaft type: Approx. 2.18kg (approx. 1.7kg), Built-in brake type: Approx. 2.74kg (approx. 2.64kg)		Shaft type: Approx. 3.25kg (approx. 2.8kg), Hollow shaft type: Approx. 3.28kg (approx. 2.8kg), Built-in brake type: Approx. 3.84kg (approx. 3.74kg)		Shaft type: Approx. 4.25kg (approx. 3.8kg), Hollow shaft type: Approx. 4.28kg (approx. 3.8kg), Built-in brake type: Approx. 4.84kg (approx. 4.74kg)	
Reference		**Q-29 to 35**					

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

● Frame size 85mm

Model	Shaft type+ Geared type	**A140K-M599(W)-G5**	**A140K-G599(W)-G5**	**A200K-M599(W)-G7.2**	**A200K-G599(W)-G7.2**	**A200K-M599(W)-G10**	**A200K-G599(W)-G10**
	Geared+ Built-in brake type	**A140K-M599-GB5**	**A140K-G599-GB5**	**A200K-M599-GB7.2**	**A200K-G599-GB7.2**	**A200K-M599-GB10**	**A200K-G599-GB10**
Max. Holding torque		140kgf·cm (13.7N·m)		200kgf·cm (19.6N·m)		200kgf·cm (19.6N·m)	
Rotor moment of inertia		2700g·cm^2 (270×10^{-7}kg·m^2)					
Rated current		1.4A/Phase	2.8A/Phase	1.4A/Phase	2.8A/Phase	1.4A/Phase	2.8A/Phase
Standard step angle		0.144°/ 0.072° (full/half step)		0.1°/ 0.05° (full/half step)		0.072°/ 0.036° (full/half step)	
Gear ratio		1:5		1:7.2		1:10	
Allowable speed range		0 to 360rpm		0 to 250rpm		0 to 180rpm	
Backlash[min]		±15' (0.25°)					
Electromagnetic brake	Rated excitation voltage	24VDC ±10% (non-polarity)					
	Rated excitation current	0.62A					
	Static friction torque	40kgf ·cm					
	Rotation part inertia moment	15.3×10^{-6}kgf·cm^2					
	Operating time	Max. 15ms					
	Releasing time	Max. 60ms					
Insulation class		B type (130℃)					
Insulation resistance		Over 100MΩ (at 500VDC megger) between motor coil-case					
Dielectric strength		1kVAC 50/60Hz for 1 minute between motor coil-case					
Environment	Ambient temp.	-10 to 50℃, storage: -25 to 85℃					
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH					
Protection structure		IP30 (IEC34-5 standard)					
Weight※1		Geared type: Approx. 4.88kg (approx. 4.4kg), Geared+Built-in brake type: Approx. 5.5kg (approx. 5.2kg)					
Reference		**Q-36 to 39**					

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

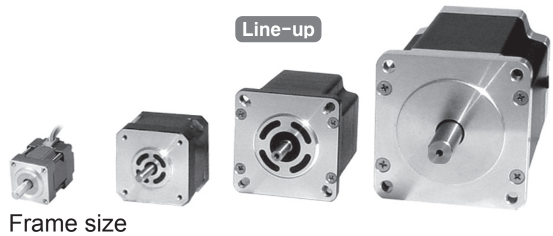
Frame Size 24mm/42mm/60mm/85mm Shaft Type Motor
Frame Size 42mm/60mm/85mm Shaft Type+Built-in brake type Motor

■ Features

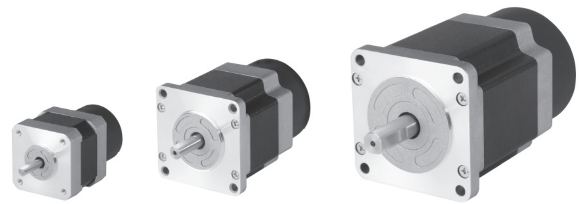
- Compact design and light weight with high accuracy, speed and torque
- Suitable for small-sized equipment applications
- Frame size 42mm/60mm/85mm built-in brake of shaft type for compact equipment (AK-B Series)
- Brake force is released (AK-B Series) when applying power on brake wire
- Cost-effective

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE



Frame size
24mm **42mm** **60mm** **85mm**



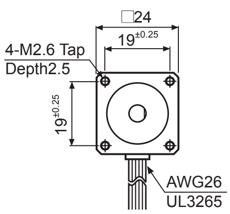
Frame size
42mm Brake built-in type **60mm Brake built-in type** **85mm Brake built-in type**

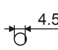
■ Dimensions

※These dimensions are for dual shaft models. Single shaft models do not include shafts indicated in the dotted lines.
※For flexible coupling (ERB Series) information, refer to F-80. (frame size 24mm, 48mm, 60mm (Shaft type))
※Brake is non-polar and be sure to observe rated excitation voltage (24VDC). (Except frame size 24mm)
SW1 ON : Brake Release / SW1 OFF : Brake Execute

◎ Frame size 24mm

(unit: mm)





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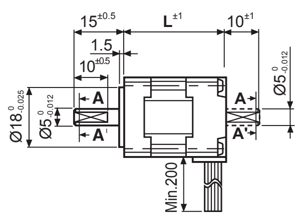
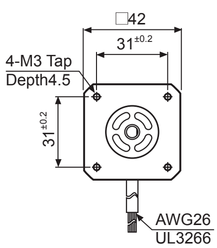
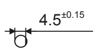


(unit: mm)

Model	L
02K-S523(W)	30.5
04K-S525(W)	46.5

◎ Frame size 42mm





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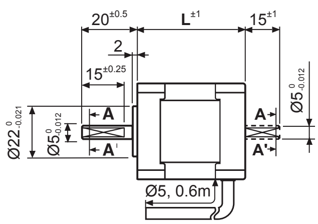
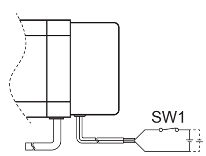
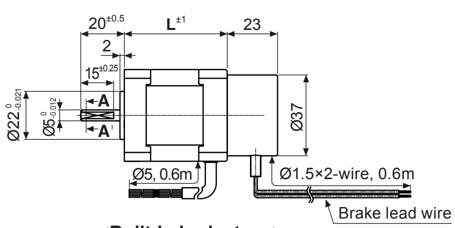


<Standard type>

(unit: mm)

Model	L
A1K-S543(W)-B	33
A2K-□544(W)-B	39
A3K-S545(W)-B	47





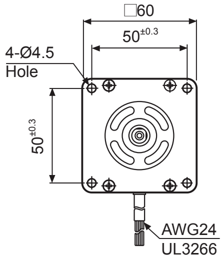
<Built-in brake type>

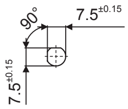
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Dimensions

◎ Frame size 60mm

(unit: mm)





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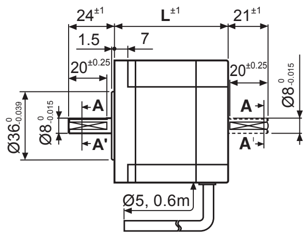
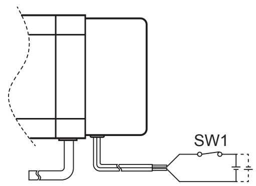
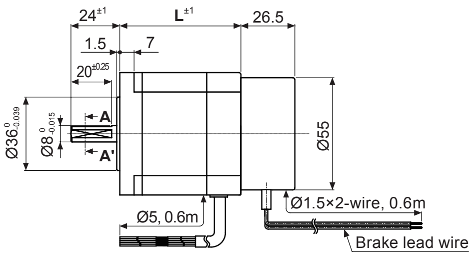


<Standard type>

(unit: mm)

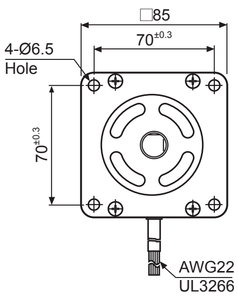
Model	L
A4K-□564(W)-B	48.5
A8K-□566(W)-B	59.5
A16K-□569(W)-B	89

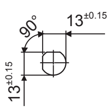




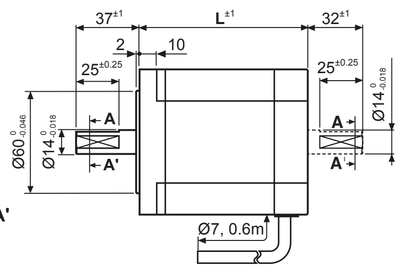
<Built-in brake type>

◎ Frame size 85mm





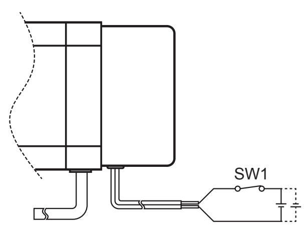
Sectioned A-A'

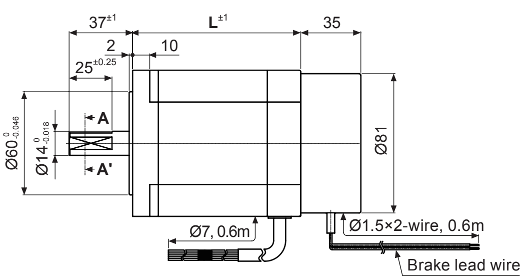


<Standard type>

(unit: mm)

Model	L
A21K-□596(W)-B	68
A41K-□599(W)-B	98
A63K-□5913(W)-B	128

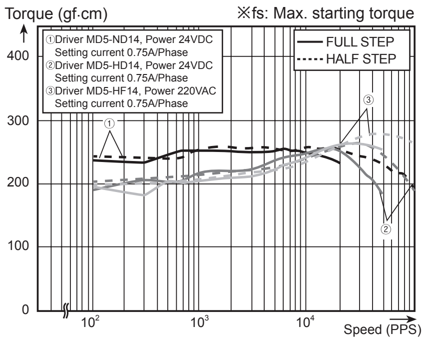




<Built-in brake type>

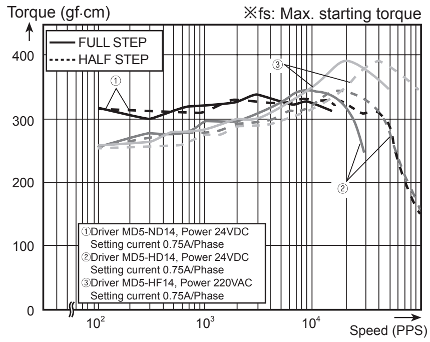
■ Characteristic

● 02K-S523



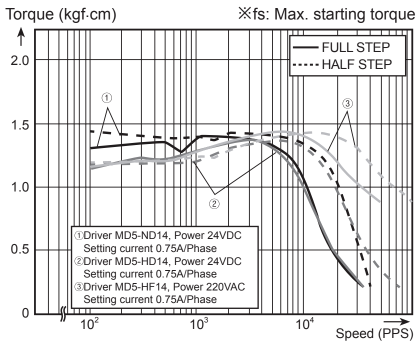
① fs Full Step: 3.6kpps, Half Step: 7.1kpps
② fs Full Step: 3.7kpps, Half Step: 7.2kpps
③ fs Full Step: 3.8kpps, Half Step: 7.5kpps

● 04K-S525



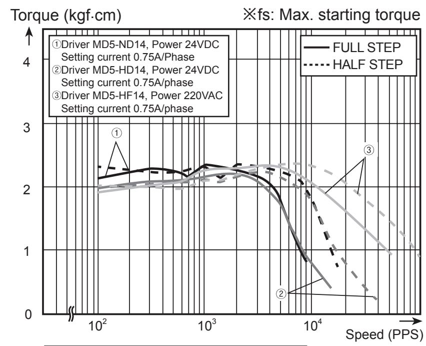
①fs Full Step: 3.1kpps, Half Step: 6.1kpps
②fs Full Step: 3.2kpps, Half Step: 6.3kpps
③fs Full Step: 3.3kpps, Half Step: 6.5kpps

● A1K-S543 / A1K-S543-B



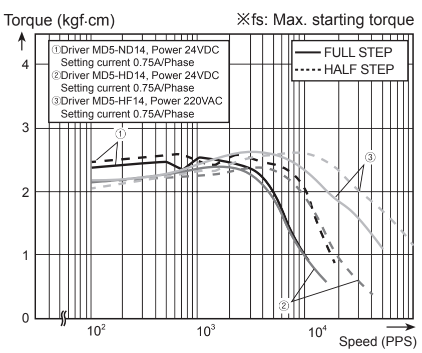
①fs Full Step: 3.3kpps, Half Step: 6.6kpps
②fs Full Step: 3.4kpps, Half Step: 6.7kpps
③fs Full Step: 3.5kpps, Half Step: 6.8kpps

● A2K-□544 / A2K-□544-B



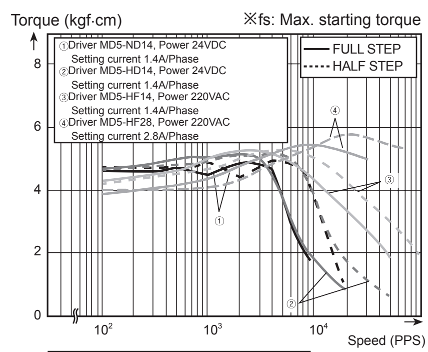
①fs Full Step: 3.2kpps, Half Step: 6.3kpps
②fs Full Step: 3.3kpps, Half Step: 6.5kpps
③fs Full Step: 3.4kpps, Half Step: 6.7kpps

● A3K-S545 / A3K-S545-B



①fs Full Step: 3kpps, Half Step: 5.9kpps
②fs Full Step: 3.1kpps, Half Step: 6.1kpps
③fs Full Step: 3.2kpps, Half Step: 6.4kpps

● A4K-□564 / A4K-M564-B

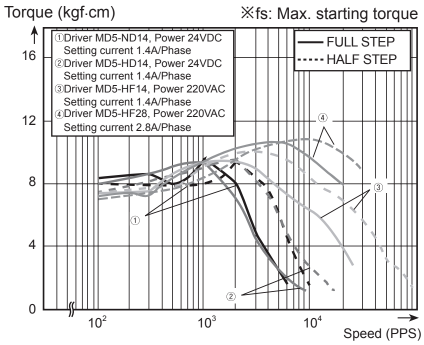


①fs Full Step: 2.7kpps, Half Step: 5.3kpps
②fs Full Step: 2.7kpps, Half Step: 5.8kpps
③fs Full Step: 3.7kpps, Half Step: 7.2kpps
④fs Full Step: 3.4kpps, Half Step: 6.8kpps

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

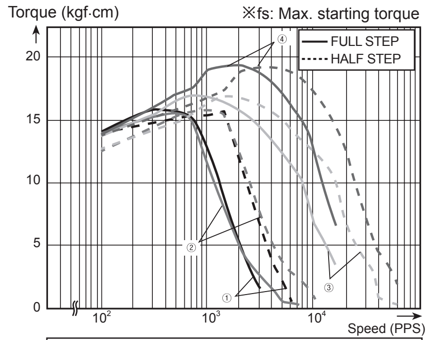
■ Characteristic

● A8K-□566 / A8K-M566-B



①fs Full Step: 2.1kpps, Half Step: 4.1kpps
②fs Full Step: 2.1kpps, Half Step: 4.2kpps
③fs Full Step: 3.2kpps, Half Step: 6.3kpps
④fs Full Step: 3.3kpps, Half Step: 6.6kpps

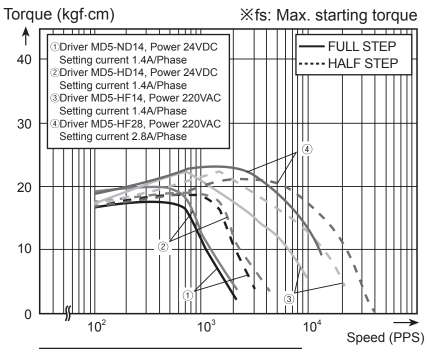
● A16K-□569 / A16K-□569-B



①Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
②Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
④Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

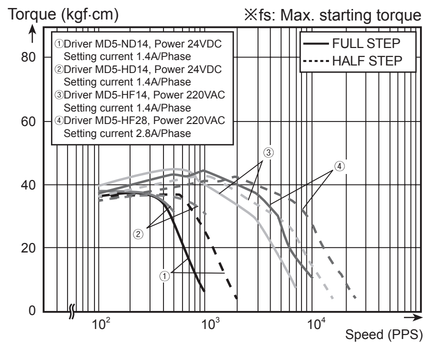
①fs Full Step: 1.8kpps, Half Step: 3.5kpps
②fs Full Step: 1.9kpps, Half Step: 3.5kpps
③fs Full Step: 2.6kpps, Half Step: 5.2kpps
④fs Full Step: 3.4kpps, Half Step: 6.8kpps

● A21K-□596 / A21K-□596-B



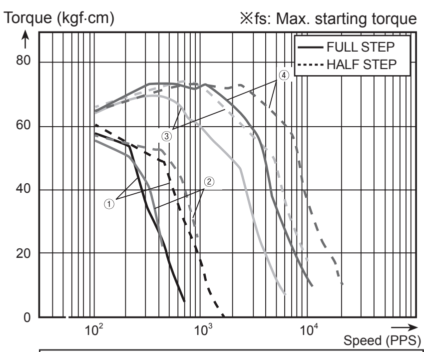
①fs Full Step: 1.5kpps, Half Step: 2.9kpps
②fs Full Step: 1.6kpps, Half Step: 3.1kpps
③fs Full Step: 2.2kpps, Half Step: 4.4kpps
④fs Full Step: 2.3kpps, Half Step: 4.6kpps

● A41K-□599 / A41K-□599-B



①fs Full Step: 1.4kpps, Half Step: 2.7kpps
②fs Full Step: 1.5kpps, Half Step: 2.9kpps
③fs Full Step: 1.8kpps, Half Step: 3.6kpps
④fs Full Step: 2.1kpps, Half Step: 4.3kpps

● A63K-□5913 / A63K-□5913-B



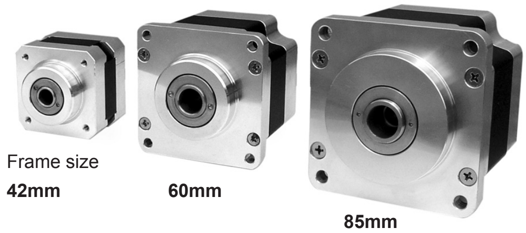
①Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
②Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
④Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

①fs Full Step: 1kpps, Half Step: 2.1kpps
②fs Full Step: 1.1kpps, Half Step: 2.2kpps
③fs Full Step: 1.8kpps, Half Step: 3.6kpps
④fs Full Step: 1.9kpps, Half Step: 3.8kpps

Frame Size 42mm/60mm/85mm Hollow Shaft Type Motor

■ Features

- Removable coupling connecting Ball-screw, TM-screw directly
- Remove resonance (vibration, noise) without coupling
- Compact design and light weight with high accuracy, speed and torque
- Suitable for small-sized equipment applications
- Cost-effective



⚠ Please read "Caution for your safety" in operation manual before using.

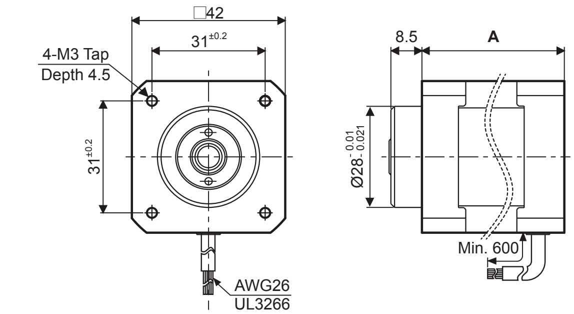
CE

■ Dimensions

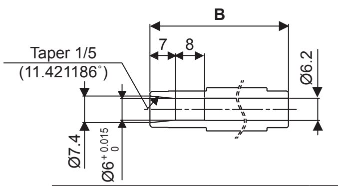
※Depending on processing of shaft to be assembled, hollow shaft type can be used both single and dual shaft.

◎ Frame size 42mm

(unit: mm)



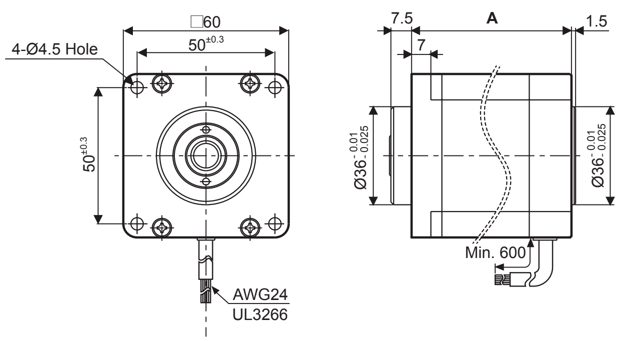
● **Hole dimensions**



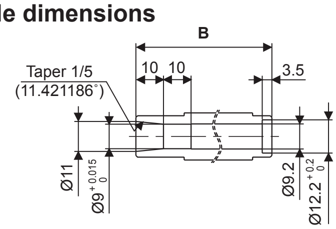
Model	A	B
AH1K-S543-□	33	38
AH2K-S544-□	39	44
AH3K-S545-□	47	52

◎ Frame size 60mm

(unit: mm)



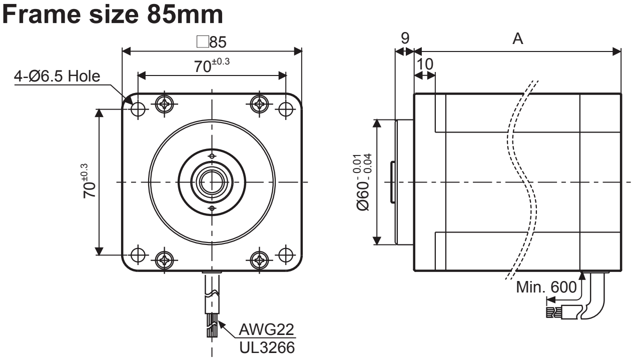
● **Hole dimensions**



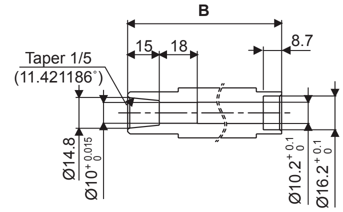
Model	A	B
AH4K-□564(W)-□	48.5	49.3
AH8K-□566(W)-□	59.5	60.3
AH16K-□569(W)-□	89	89.8

◎ Frame size 85mm

(unit: mm)



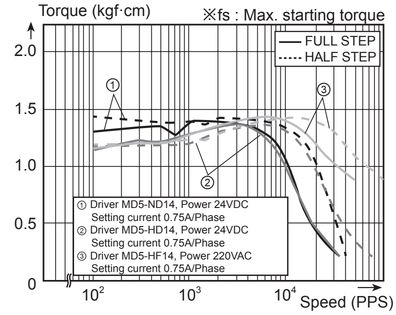
● **Hole dimensions**



Model	A	B
AH21K-□596(W)-□	68	73
AH41K-□599(W)-□	98	102.5
AH63K-□5913(W)-□	128	133

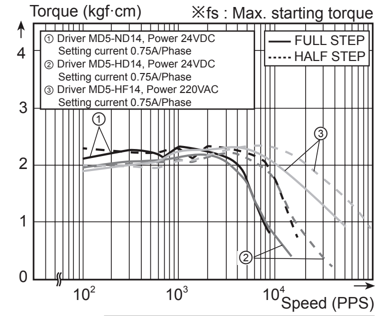
■ Characteristic

● AH1K-S543-□



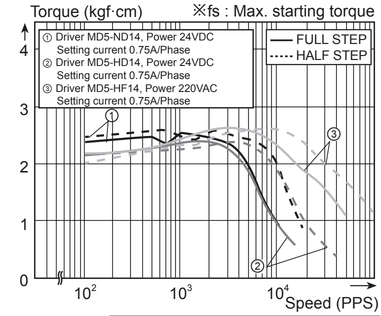
① fs Full Step: 3.3kpps, Half Step: 6.6kpps
② fs Full Step: 3.4kpps, Half Step: 6.7kpps
③ fs Full Step: 3.5kpps, Half Step: 6.8kpps

● AH2K-S544-□



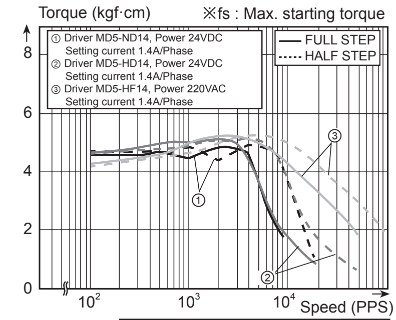
① fs Full Step: 3.2kpps, Half Step: 6.3kpps
② fs Full Step: 3.3kpps, Half Step: 6.5kpps
③ fs Full Step: 3.4kpps, Half Step: 6.7kpps

● AH3K-S545-□



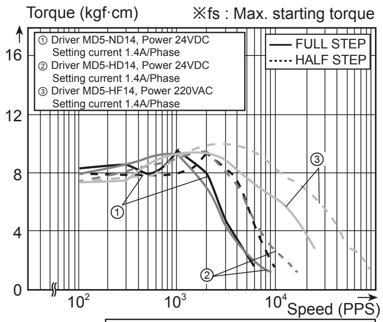
① fs Full Step: 3kpps, Half Step: 5.9kpps
② fs Full Step: 3.1kpps, Half Step: 6.1kpps
③ fs Full Step: 3.2kpps, Half Step: 6.4kpps

● AH4K-S(M)□564(W)-□



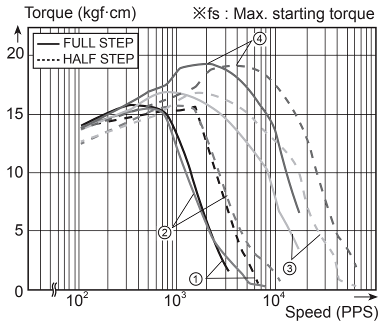
① fs Full Step: 2.7kpps, Half Step: 5.3kpps
② fs Full Step: 2.7kpps, Half Step: 5.8kpps
③ fs Full Step: 3.7kpps, Half Step: 7.2kpps

● AH8K-S(M)□566(W)-□



① fs Full Step: 2.1kpps, Half Step: 4.1kpps
② fs Full Step: 2.1kpps, Half Step: 4.2kpps
③ fs Full Step: 3.2kpps, Half Step: 6.3kpps

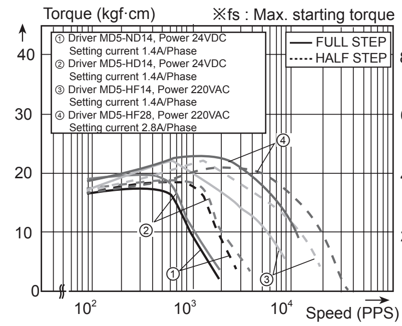
● AH16K-M(G)□569(W)-□



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
④ Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

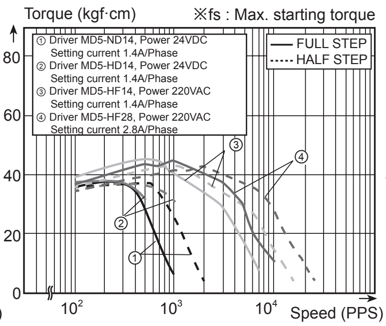
① fs Full Step: 1.8kpps, Half Step: 3.5kpps
② fs Full Step: 1.9kpps, Half Step: 3.5kpps
③ fs Full Step: 2.6kpps, Half Step: 5.2kpps
④ fs Full Step: 3.4kpps, Half Step: 6.8kpps

● AH21K-M(G)□596(W)-□



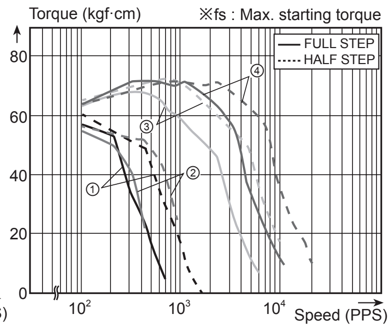
① fs Full Step: 1.5kpps, Half Step: 2.9kpps
② fs Full Step: 1.6kpps, Half Step: 3.1kpps
③ fs Full Step: 2.2kpps, Half Step: 4.4kpps
④ fs Full Step: 2.3kpps, Half Step: 4.6kpps

● AH41K-M(G)□599(W)-□



① fs Full Step: 1.4kpps, Half Step: 2.7kpps
② fs Full Step: 1.5kpps, Half Step: 2.9kpps
③ fs Full Step: 1.8kpps, Half Step: 3.6kpps
④ fs Full Step: 2.1kpps, Half Step: 4.3kpps

● AH63K-M(G)5913(W)-□



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
④ Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

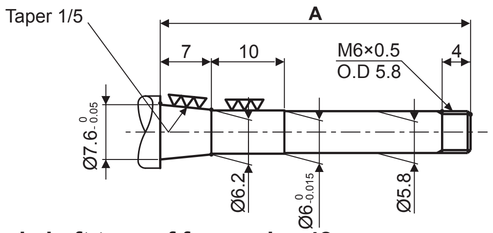
① fs Full Step: 1kpps, Half Step: 2.1kpps
② fs Full Step: 1.1kpps, Half Step: 2.2kpps
③ fs Full Step: 1.8kpps, Half Step: 3.6kpps
④ fs Full Step: 1.9kpps, Half Step: 3.8kpps

■ Processing Example For Shaft Assembly

In order to assemble external shafts into Autonics motors, the shafts must be processed as shown in the figures below.

(unit: mm)

● Single shaft type of frame size 42mm

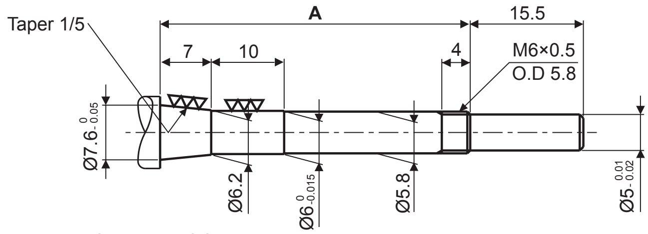


(unit: mm)

Model	A
AH1K-S543-□	42.5
AH2K-S544-□	48.5
AH3K-S545-□	56.5

※Lock nut is included.

● Dual shaft type of frame size 42mm

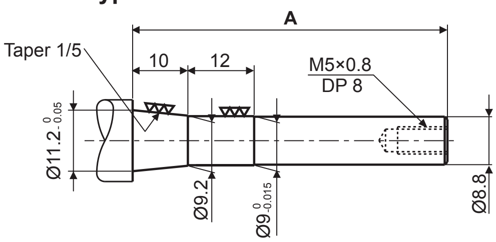


(unit: mm)

Model	A
AH1K-□543W-□	42.5
AH2K-□544W-□	48.5
AH3K-□545W-□	56.5

※Lock nut is included.

● Single shaft type of frame size 60mm

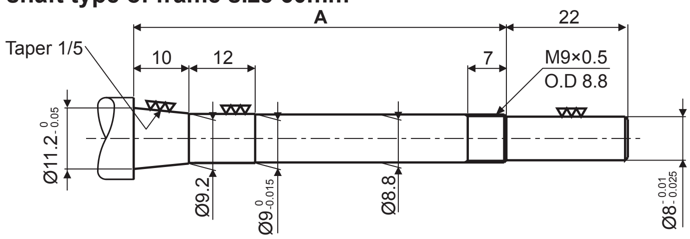


(unit: mm)

Model	A
AH4K-□564-□	46
AH8K-□566-□	57
AH16K-□569-□	86.5

※Hexagon wrench bolt, flat washer, spring washer and lock washer are included.

● Dual shaft type of frame size 60mm

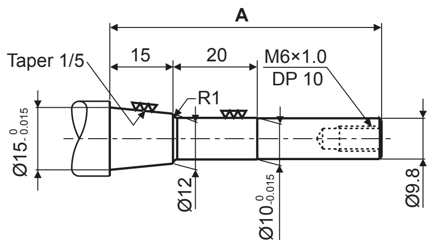


(unit: mm)

Model	A
AH4K-□564W-□	56.5
AH8K-□566W-□	67.5
AH16K-□569W-□	97

※Lock nut is included.

● Single shaft type of frame size 85mm

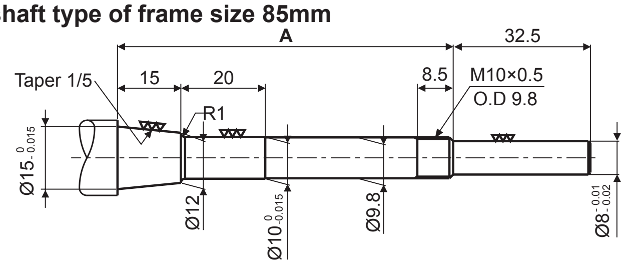


(unit: mm)

Model	A
AH21K-□596-□	64.5
AH41K-□599-□	94
AH63K-□5913-□	124.5

※Hexagon wrench bolt, flat washer, spring washer and lock washer are included.

● Dual shaft type of frame size 85mm



(unit: mm)

Model	A
AH21K-□596W-□	79.5
AH41K-□599W-□	109.5
AH63K-□5913W-□	139.5

※Lock nut is included.

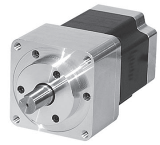
Frame Size 42mm/60mm/85mm Geared type /Geared+Built-in brake type Motor Frame Size 60mm Rotary Actuator Type /Rotary Actuator+Built-in brake type Motor

■ Features

- Compact design and light weight with high accuracy, speed and torque
- Cost-effective
- Backlash
  Frame size 42mm: ±35' (0.58°),
  60mm: ±20' (0.33°), 85mm: ±15' (0.25°)
- Brake force is released when applying 24VDC on brake wire
- Basic step angle
  1:5→ 0.144°, 1:7.2→ 0.1°, 1:10→ 0.072°
- Allowable speed
  1:5→ 0 to 360rpm, 1:7.2→ 0 to 250rpm
  1:10→ 0 to 180rpm

Frame size
42mm
Geared type

60mm
Geared type

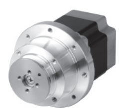


85mm
Geared type

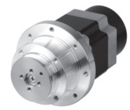
Frame size
42mm Geared+
Built-in brake type

60mm Geared+
Built-in brake type

85mm Geared+
Built-in brake type



Frame size
60mm Rotary
Actuator type



60mm Rotary Actuator+
Built-in brake type

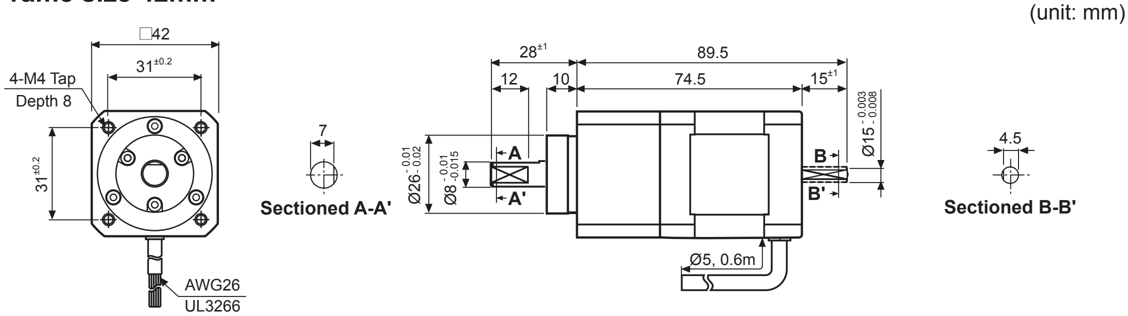
⚠ **Please read "Caution for your safety" in operation manual before using.**

■ Dimensions

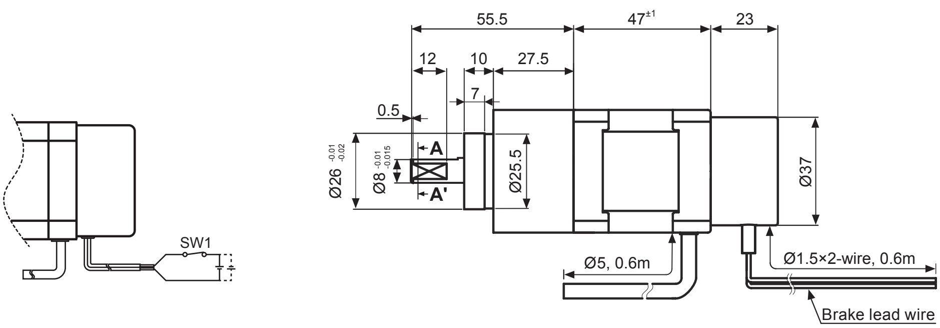
※These dimensions are for dual shaft models. Single shaft models do not include shafts indicated in the dotted lines.
※For flexible coupling (ERB Series) information, refer to F-80.
(frame size 60mm, 85mm: Geared type, Geared+Built-in brake type)
※Brake is non-polar and be sure to observe rated excitation voltage (24VDC).
※SW1 ON: Brake Release / SW1 OFF: Brake Execute

◎ Frame size 42mm

(unit: mm)



<Geared type>

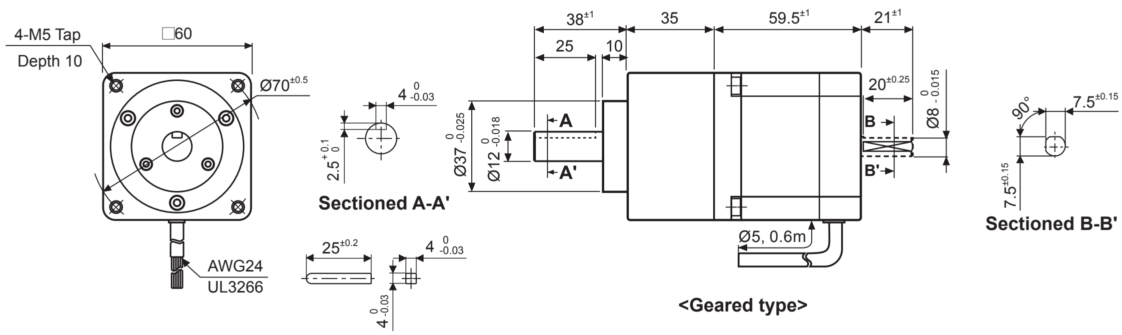


<Geared+Built-in brake type>

■ Dimensions

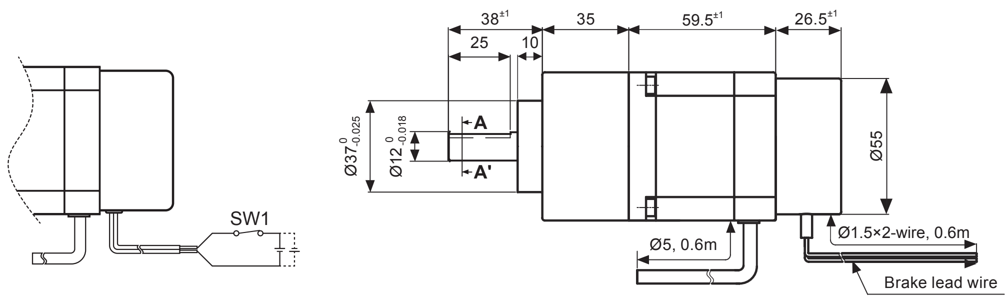
◎ Frame size 60mm

(unit: mm)

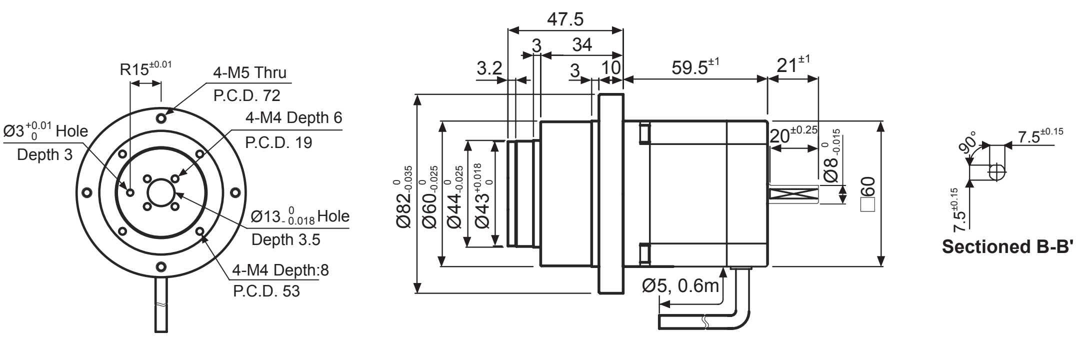


Parallel key

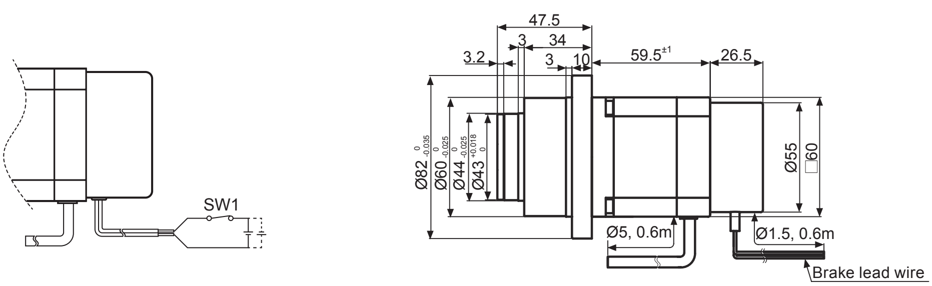
<Geared type>



<Geared+Built-in brake type>



<Rotary actuator type>

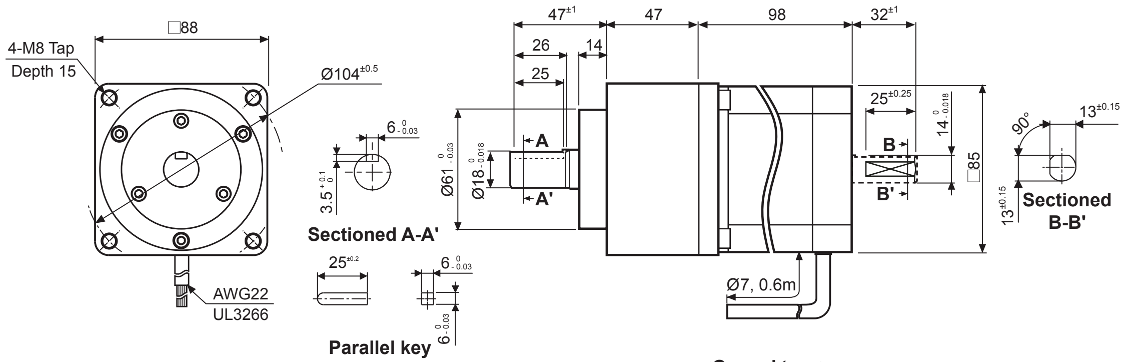


<Rotary actuator+Built-in brake type>

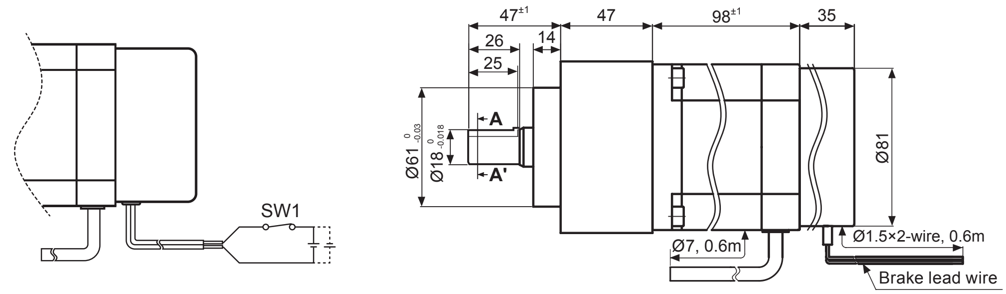
■ Dimensions

◎ Frame size 85mm

(unit: mm)



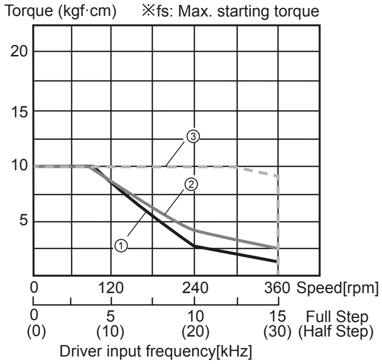
<Geared type>



<Geared+Built-in brake type>

■ Characteristic

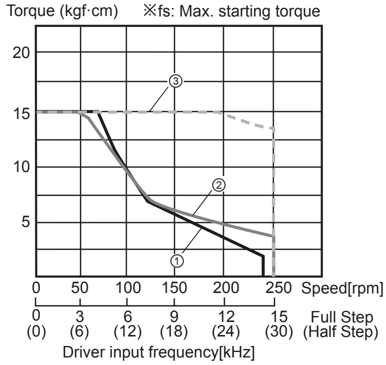
● A10K-S545(W)-G5
A10K-S545-GB5



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase

① fs:3.1kpps
② fs:3.2kpps
③ fs:3.2kpps

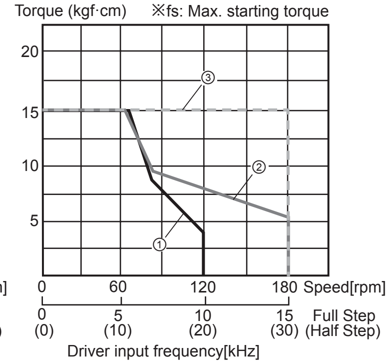
● A15K-S545(W)-G7.2
A15K-S545-GB7.2



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase

① fs:3.2kpps
② fs:3.3kpps
③ fs:3.4kpps

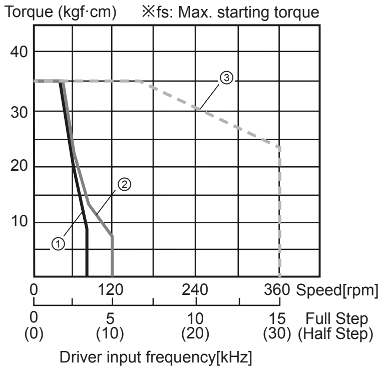
● A15K-S545(W)-G10
A15K-S545-GB10



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase

① fs:3.3kpps
② fs:3.3kpps
③ fs:3.4kpps

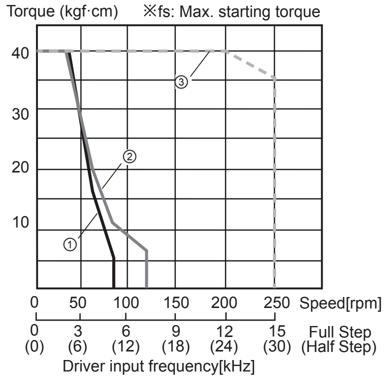
● A35K-M566(W)-□5
A35K-M566-□B5



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase

① fs:2.3kpps
② fs:2.3kpps
③ fs:2.6kpps

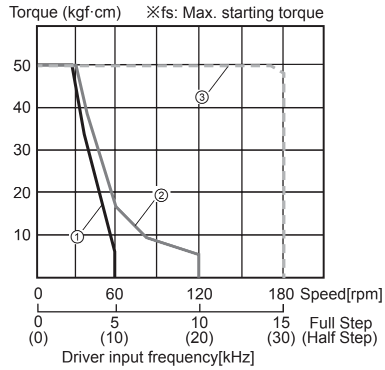
● A40K-M566(W)-□7.2
A40K-M566-□B7.2



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase

① fs:2.2kpps
② fs:2.3kpps
③ fs:2.6kpps

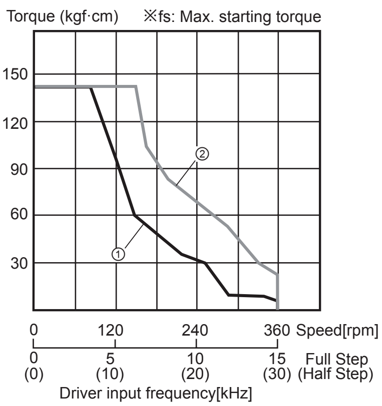
● A50K-M566(W)-□10
A50K-M566-□B10



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase

① fs:2.3kpps
② fs:2.3kpps
③ fs:2.8kpps

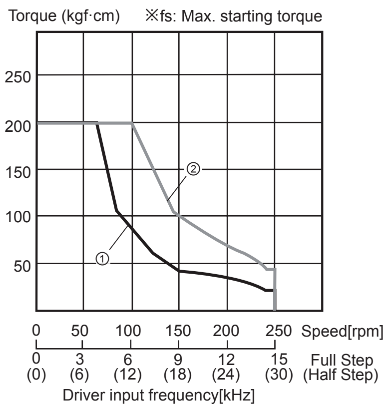
● A140K-□599(W)-G5
A140K-□599-GB5



① Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
② Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

① fs:1.8kpps
② fs:2.1kpps

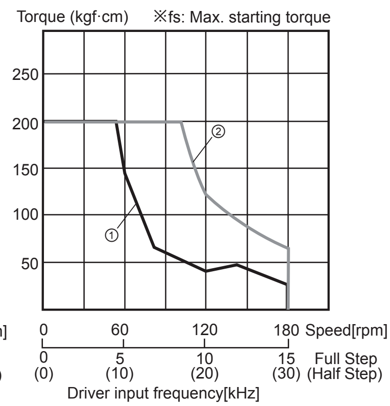
● A200K-□599(W)-G7.2
A200K-□599-GB7.2



① Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
② Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

① fs:1.8kpps
② fs:2.1kpps

● A200K-□599(W)-G10
A200K-□599-GB10



① Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
② Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

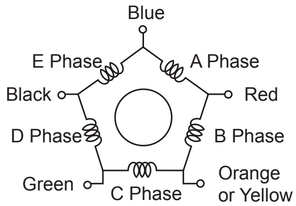
① fs:1.9kpps
② fs:2.1kpps

5-Phase Stepper Motor

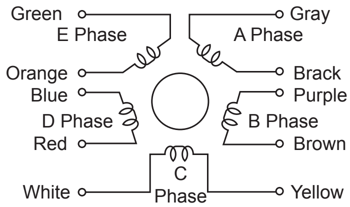
▣ Connection Diagram

Refer to the below for correlations of motor's each phase(coil) and the color of lead wire.
Note that Pentagon connection type is a standard model. (Standard connection type is an option model.)

● Pentagon wiring (Standard)



● Standard wiring (Option)



In case of connecting standard connection type models to motor drivers, make sure that motor's lead wire connection must be made as specified in the table.

Lead wire color for standard connection type	Lead wire color for pentagon connection type
Gray+Red	Blue
Yellow+Black	Red
Orange+White	Orange
Brown+Green	Green
Blue+Purple	Black

▣ Motor Installation

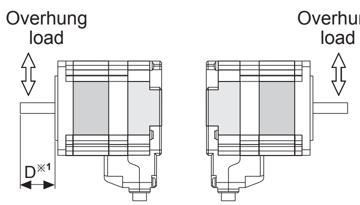
◎ Shaft type, hollow shaft type, geared type stepper motor

● Motor installation direction

The motor can be installed in any direction horizontally, or vertically. Please take careful consideration of shaft overhung load and thrust load under all conditions.

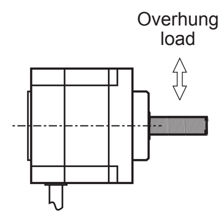
1) Overhung load: A type of load to be applied in vertical directions on the shaft having effect on output shaft and bearings to shorten its life cycle. In case excessive overhung load is applied on the shaft, it may cause bearing damage, output shaft bending or fatigue failure caused by repeatedly applied excessive load.
2) Thrust load: A type of load to be applied in parallel directions on the shaft having direct effect on output shaft and bearings to shorten its life cycle. In case excessive thrust load is applied on the shaft, it may cause bearing damage, output shaft bending or fatigue failure caused by repeatedly applied excessive load.

● Horizontal

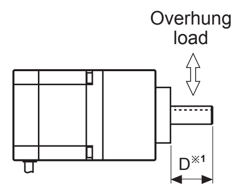


< Shaft type >

※1: The distance from the shaft in front (mm)

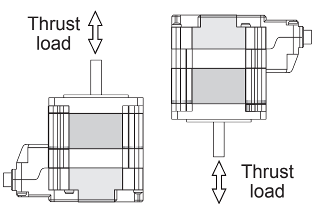


< Hollow shaft type >



< Geared type >

● Vertical facing up, down



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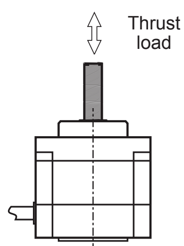

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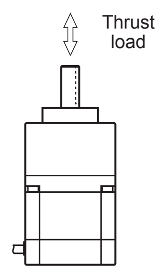


< Geared type >

Refer to the table below for allowable overhung load / thrust load for shaft type stepper motor.

Motor frame size	Permissible overhung load [kgf(N)] by distance from shaft tip (mm)					Permissible thrust load
	D=0	D=5	D=10	D=15	D=20	
24mm	2(20)	2.5(25)	3.4(33)	—	—	Under the load of motor
42mm	2(20)	2.5(25)	3.4(33)	5.2(51)	—	
60mm	6.3(62)	7.5(74)	9.5(93)	13(127)	19(186)	
85mm	26(255)	29(284)	34(333)	39(382)	48(470)	

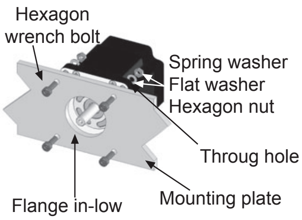
Refer to the table below for allowable overhung load / thrust load for geared type stepper motor.

Motor frame size	Permissible overhung load [kgf(N)] by distance from shaft tip (mm)					Permissible thrust load
	D=0	D=5	D=10	D=15	D=20	
42mm	7.3(72)	8.4(82)	10(98)	12.3(121)	—	5(49)
60mm	25(245)	27(265)	30(294)	34(333)	39(382)	10(98)
85mm	48(471)	54(530)	60(588)	68(667)	79(775)	30(294)

● Motor installation method

When installing the motor, carefully consider heat radiation and vibration resistance. Mount the unit tightly on the surface of a metal with high thermal conductivity. (steel, aluminum, etc.) Use hexagon bolts, spring washers and flat washers when installing the motor. Please refer to the table below for mounting plate thickness and bolt types.

• Through hole type



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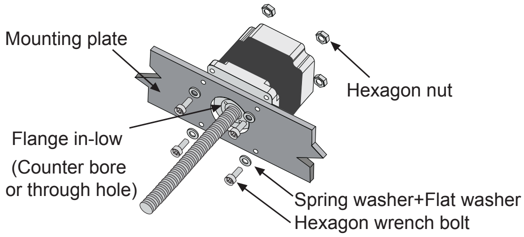
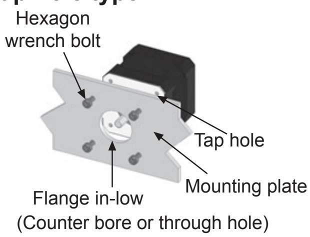
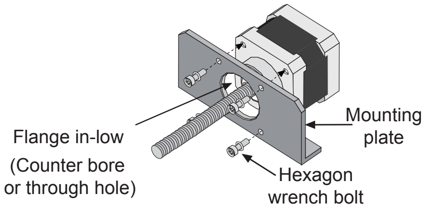


< Hollow shaft type >

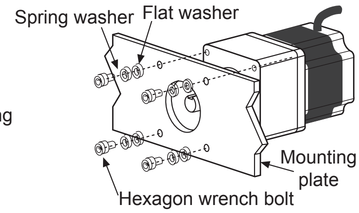
• Tap hole type



< Shaft type >



< Hollow shaft type >



< Geared type >

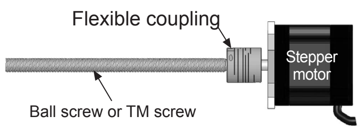
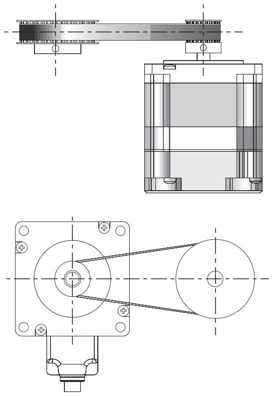
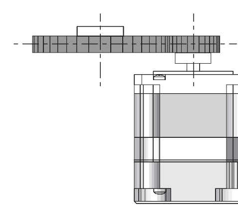
Motor frame size	Mounting plate thickness	Applied bolt
24mm	Min. 3mm	M2.6
42mm	Min. 4mm	M3
60mm	Min. 5mm	M4
85mm	Min. 8mm	M6

Motor frame size	Mounting plate thickness	Applied bolt
42mm	Min. 4mm	M3
60mm	Min. 5mm	M4
85mm	Min. 8mm	M6

Motor frame size	Mounting plate thickness	Applied bolt
42mm	Min. 5mm	M4
60mm	Min. 8mm	M5
85mm	Min. 12mm	M8

● Connection with load (shaft type, geared type stepper motor)

When connecting the load, be sure of the center, tension of the belt, and parallel of the pulley. When connecting the load such as a pulley, a belt, be sure of the allowable thrust load, radial load, and shock. Tighten the screw for a coupling or a pulley not to be unscrewed. When connecting a coupling or a pulley on the motor shaft, be sure of damage of the motor shaft and the motor shaft bearing. Do not disassemble or modify the motor shaft to connect with the load.

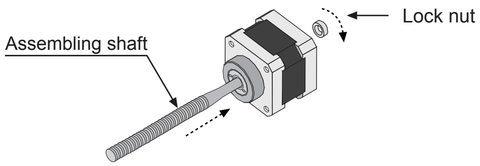
Direct load connection with coupling	Load connection with pulley, belt, and wire	Load connection with gear
 ※Use Autonics flexible coupling (ERB Series).		
When connecting the load directly (ball screw, TM screw, etc) to the motor shaft, use a flexible coupling as shown in the above figure. If the center of the load is not matched to that of shaft, it may cause severe vibration, shaft damage or shortened life cycle of the shaft bearing.	The motor shaft and the load shaft should be parallel. Connect the motor shaft and the line which connects the center of two pulleys to a right angle.	The motor shaft and the load shaft should be parallel. Connect the motor shaft to the center of gear teeth side to be interlocked.

● **Shaft assembly for hollow shaft type motor**

Make sure that external shaft assembly into motors must be made as sturdy as possible. If not, motor's torque might not be thoroughly transmitted to the shaft. In case no additional shaft assembly changes would be made, it is recommended to apply adhesives on bolt fixing part.

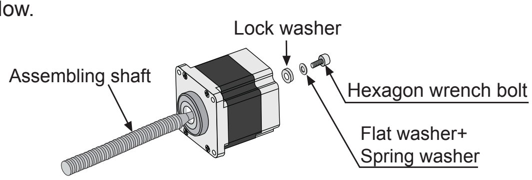
1. Tap hollow shaft type motor

Use pliers to fasten lock nut tightly as shown in the figure below.



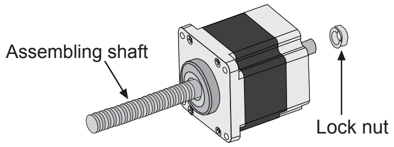
2. Through hole type motor with single shaft

Use hexagon wrench bolt, spring washer, flat washer and lock washer to fasten the shaft tightly as shown in the figure below.



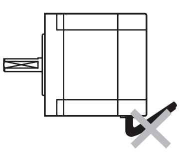
3. Through hole type motor with dual shaft

Use a lock nut to fasten the shaft tightly as shown in the figure below.

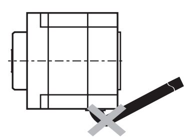


● **Caution during install the motor**

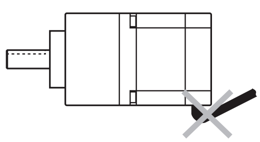
Do not apply excessive force on motor cable when mounting motors.
Do not forcibly pull or insert the cable. It may cause poor connection or disconnection of the cable.
In case of frequent cable movement required application, proper safety countermeasures must be ensured.



< Shaft type >



< Hollow shaft type >



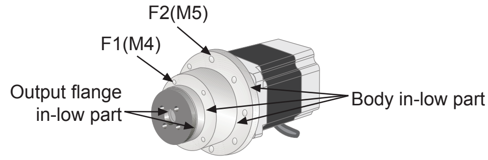
< Geared type >

◎ Rotary actuator type stepper motor

● **Motor installation method**

①With considering heat radiation and vibration isolation, make sure the motor's in-low to be kept as close as possible against a metal panel having high thermal conductivity such as iron or aluminum. Make sure to use mounting plates with thickness more than 8mm.

②As shown in the figure below, total 4 mounting TAP holes on F1 and F2 are used to fix rotary actuator. In case of using M4, screw tightening torque is 2N·m and 4.4N·m when using M5.



③Do not apply excessive force on motor cable when installing rotary actuators. Do not forcibly pull or insert the cable. It may cause poor connection or disconnection of the cable. In case of frequent cable movement required application, proper safety countermeasures must be ensured.

● **Motor operation**

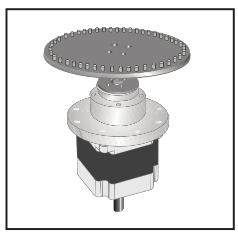
Observe the rated product specification.
① Do not apply rotational load on the motor while it stops.
② Do not apply excessive load on the motor while driving. It may cause motors to miss a step.
③ Use a sensor for home searching or division completed position detecting.

● **Installation of accessories (index table, arm, etc.)**

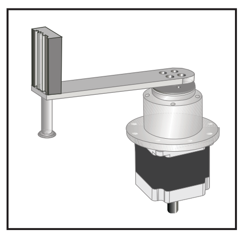
① Mount the accessory (index table or arm) on output axis flange using M4 screw. Note that Ø13 in-low part is processed with C0.3. It is necessary to process the accessory under C0.2 to mount. Place a positioning pin on flange's positioning hole and push it in. Make sure not to place the pin on output flange.
② Do not use a hammer to mount the accessory (table or arm). It may cause product damage. Mount the accessory with hands in a gentle manner.
③ Make sure that accessory mounted on output axis to be fixed as tight as possible. It may cause an accident if an actuator is detached from the motor while driving.

● **Application example**

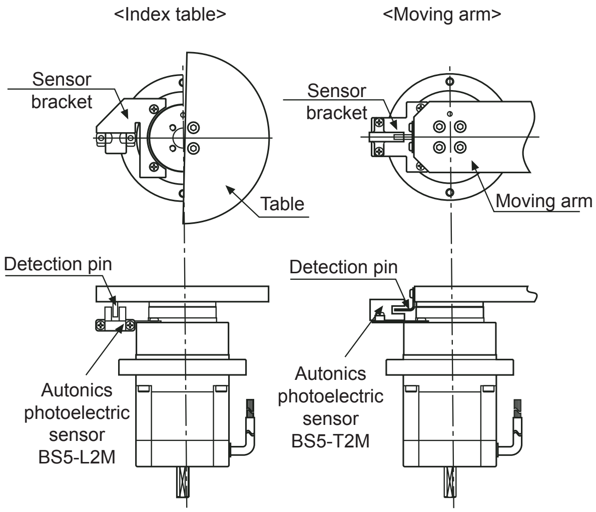
<Index table>



<Moving arm>



● **Examples of installed sensor**



※Install an additional sensor to detect home position and to ensure motor's positioning, number of rotation and its speed.

▣ Installation Conditions

Install the motor in a place that meets certain conditions specified below. It may cause product damage if instructions are not following.

①The inner housing installed indoor (This unit is manufactured for attaching to equipment. Install a ventilation device.)
②Within -10 to 50℃ (at non-freezing status) of ambient temperature
③Within 35 to 85%RH (at non-dew status) of ambient humidity
④The place without explosive, flammable and corrosive gas
⑤The place without direct ray of light
⑥The place where dust or metal scrap is not entered into the unit
⑦The place where water, oil, or other liquid are not touched
⑧The place where strong alkali or acidity does not exist closely
⑨The place where easy heat dissipation could be made
⑩The place where no continuous vibration or severe shock
⑪The place with less salt content
⑫The place with less electronic noise occurs by welding machine, motor, etc.
⑬The place where no radioactive substances and magnetic fields exist. It shall be no vacuum status as well.

▣ Cautions During Use

● **Do not disassemble or modify the product.**
It may cause malfunction due to small dregs. Once disassembling the motor, its performance would significantly decline.

● **Do not impact the motor.**
The air-gap, the distance between rotator and stator is processed as 0.05mm, but if it is impacted, the balance of air-gap can be broken and it may cause a malfunction. This encoder consists of precision components. Therefore, if it is dropped or has strong shock, it may lose the function or generates wrong output pulses.

● **Use the motor within the rated torque range.**
The rated torque range indicates the maximum value of mechanical strength of gear part and the total of ac/deceleration torque of start/stop and friction torque shall not be exceed the rated torque range, or, it may cause the breakdown of gear.

● **Use the motor within the rated speed range.**
The rated speed range includes the revolution number of gear and pulse speed of motor. Use the motor within the rated speed range, or, it may shorten the life cycle of gear part. (Backlash is increased.)

● **Be careful of backlash when positioning the motors in both CW/CCW directions.**
Backlash refers to the displacement occurred on motor's output shaft while gear's input axis is fixed. Geared type stepper motors are to realize high accuracy and low backlash. When positioning the motors in both CW/CCW directions, however, backlash may possibly occur. Therefore, make sure that motor positioning will be made in one single direction in case of geared type motors.

● **Temperature rise**
The surface temperature of motor shall be under 100℃ and it can be significantly increased in case of running motor by constant current drive. In this case, use the fan to lower the temperature forcedly.

● **Using at low temperature.**
Using motors at low temperature may cause reducing maximum starting / driving characteristics of the motor as ball bearing's grease consistency decreases due to low temperature. (Note that the lower the bearing's grease consistency, the higher the bearing's friction torques.) Start the motor in a steady manner since motor's torque is not to be influenced.

● **Clack sound when using electromagnetic brake**
In case of Built-in brake type motors, there occurs certain sound while turning on/off the power to the motor. This is not a product failure symptom. Do not strike or disassemble the product for this.

● **Using electromagnetic brake**
Release brake force first by supplying the power to brake before starting the motor. If not, it may cause product malfunction and shortened life cycle of brake due to brake pad wear-out.

Compact And High-Performance Of 2-Phase Stepper Motor Driver

■ Features

- Unipolar constant current drive type
- Enable to brake when it stops by STOP current adjustment
- Low speed and precise control with microstep (MD2U-MD20)
- Insulate using photocoupler to minimize the influence by external noise
- Power supply: 24-35VDC

⚠ Please read "Caution for your safety" in operation manual before using.

CE

MD2U-MD20　　MD2U-ID20

■ Ordering Information

MD | 2 | U – M | D | 20

Position	Code	Description
RUN current	20	2A/Phase
Power supply	D	24-35VDC
Step method (resolution)	M	Micro Step (20-division)
	I	Intelligent type
Drive method	U	Unipolar drive
Motor phase	2	2-Phase
Item	MD	Motor Driver

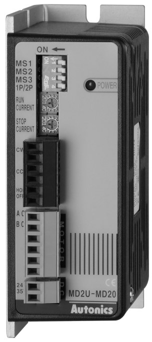
■ Specifications

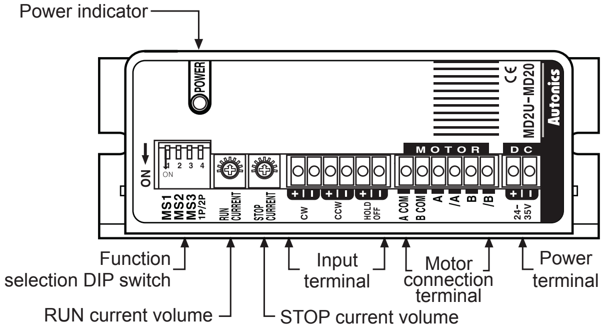
Model		**MD2U-MD20**	**MD2U-ID20**
Power supply※1		24-35VDC	
Allowable voltage range		90 to 110% of the rated voltage	
Max. current consumption※2		3A	
RUN current※3		0.5-2A/Phase	
STOP current		20 to 70% of RUN current (set by STOP current volume)	
Drive method		Unipolar constant current drive type	
Basic step angle		1.8˚/Step	
Resolution		1, 2, 4, 5, 8, 10, 16, 20-division (1.8˚ to 0.09˚/Step)	
Input pulse characteristic	Input pulse width	Min. 10µs (CW, CCW), Min. 1ms (HOLD OFF)	—
	Duty rate	50% (CW, CCW)	
	Rising/Falling time	Max. 0.5µs (CW, CCW)	
	Pulse input voltage	[H]: 4-8VDC, [L]: 0-0.5VDC	
	Max. input current	4mA (CW, CCW), 10mA (HOLD OFF)	
	Max. input pulse freq.※4	Max. 50kHz (CW, CCW)	
Input resistance		300Ω (CW, CCW), 390Ω (HOLD OFF)	3.3kΩ (CW/CCW, RUN/STOP, HOLD OFF)
Insulation resistance		Over 200MΩ (at 500VDC megger, between all terminals and case)	
Dielectric strength		1000VAC 50/60Hz for 1 minute (between all terminals and case)	
Noise immunity		±500V the square wave noise (pulse width: 1µs) by the noise simulator	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock	Vibration	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times	
Environment	Ambient temp.	0 to 50℃, storage: -10 to 60℃	
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH	
Approval		CE	
Weight※5		Approx. 295g (approx. 180g)	Approx. 303g (approx. 190g)

※1: When using over 30VDC power supply, torque characteristics are improved but the driver temperature raise. The unit should be installed at the well ventilation environment.
※2: Based on ambient temperature 25℃, ambient humidity 55%RH.
※3: RUN current varies depending on the input RUN frequency and max. RUN current at the moment also varies depending on the load.
※4: Max. input pulse frequency is max. frequency to be input and is not same as max. pull-out frequency or max. slewing frequency.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

2-Phase Micro Stepper Driver [MD2U-MD20]

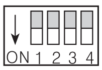
■ Unit Descriptions





◎ Function selection DIP switch

● Microstep, pulse input method setting

<table>
<tr><td rowspan="5"></td><td rowspan="2">No.</td><td rowspan="2">Name</td><td rowspan="2">Function</td><td colspan="2">Switch position</td></tr>
<tr><td>ON</td><td>OFF</td></tr>
<tr><td>1</td><td>MS1</td><td rowspan="3">Microstep setting</td><td colspan="2" rowspan="3">
<table>
<tr><td>MS1</td><td>MS2</td><td>MS3</td><td>Resolution</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>1 (Full-step)</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>2-division</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>4-division</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>5-division</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>8-division</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>10-division</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>16-division</td></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>20-division</td></tr>
</table>
</td></tr>
<tr><td>2</td><td>MS2</td></tr>
<tr><td>3</td><td>MS3</td></tr>
<tr><td></td><td>4</td><td>1P/2P</td><td>Pulse input method</td><td>1-pulse input method</td><td>2-pulse input method</td></tr>
</table>

● Resolution setting (MS1/ MS2/ MS3)

- Select the step angle (motor rotation angle per 1 pulse).
- The set step angle is dividing basic step angle(1.8°) of 2-phase stepping motor by setting value.

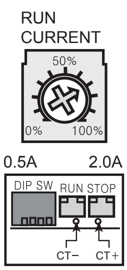
E.g.) Set step angle = $\frac{\text{Basic angle (1.8°)}}{\text{Resolution}}$

※Must stop the motor before changing the resolution.

● 1P/2P

- The switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

◎ Setting RUN current



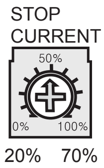
- RUN current setting is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※RUN current setting range: 0.5 to 2.0A
※RUN current setting method: Measure the voltage by connecting a DC voltage meter to both CT+ and CT- terminals while the motor is running (max. 150rpm)

E.g.) Input voltage (3V) × $\frac{2}{3}$ = 2A (motor excitation current)

※Change RUN current only when the motor stops.

◎ Setting STOP current



- STOP current setting is for the current provided for motor when the motor stops for preventing severe motor's heat.
- This function is for reducing the heat by variable resistance ratio setting within 0 to 100% of RUN current setting range (actual setting range: 20 to 70%) .
  E.g.) In case of RUN current setting value is 2A and
  STOP current setting value is 0% (actual setting range: 20%),
  STOP current 0.4A = 2A × 0.2

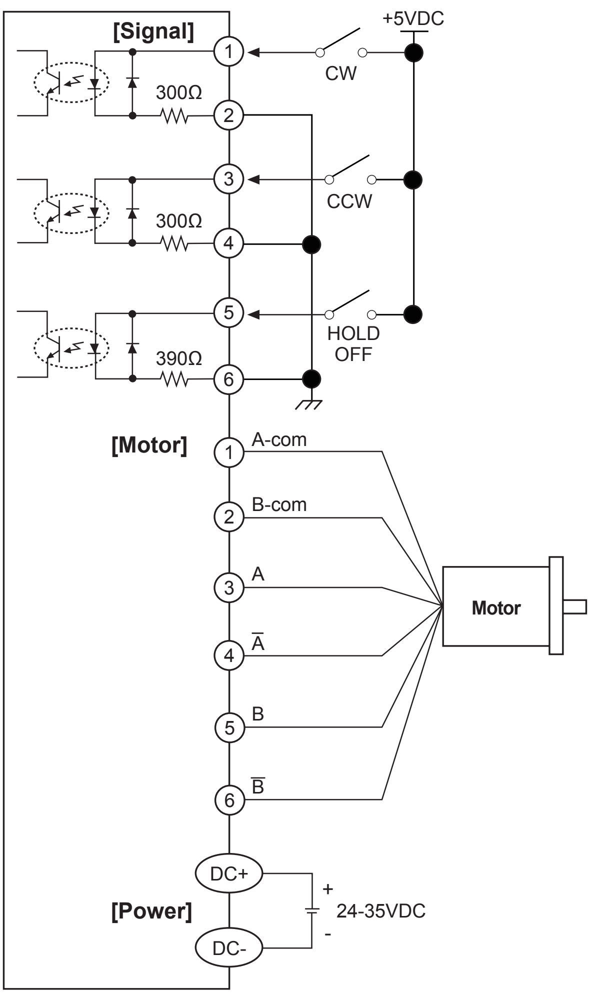
※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to I/O Circuit and Connections.

▣ I/O Circuit and Connections



※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)

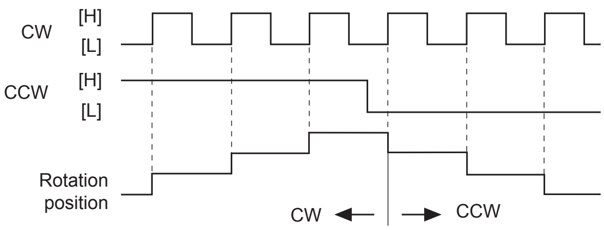
※CCW
2-pulse input method (CCW rotation signal input)
1-pulse input method (rotation direction signal input)
→[H]: CW, [L]: CCW

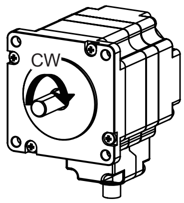
※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF

※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside.
(input power max. 24VDC, input current 10-20mA)

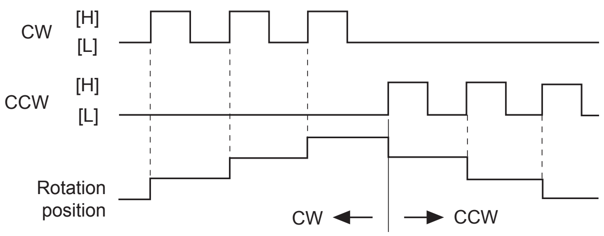
■ Time Chart

● 1 pulse input method





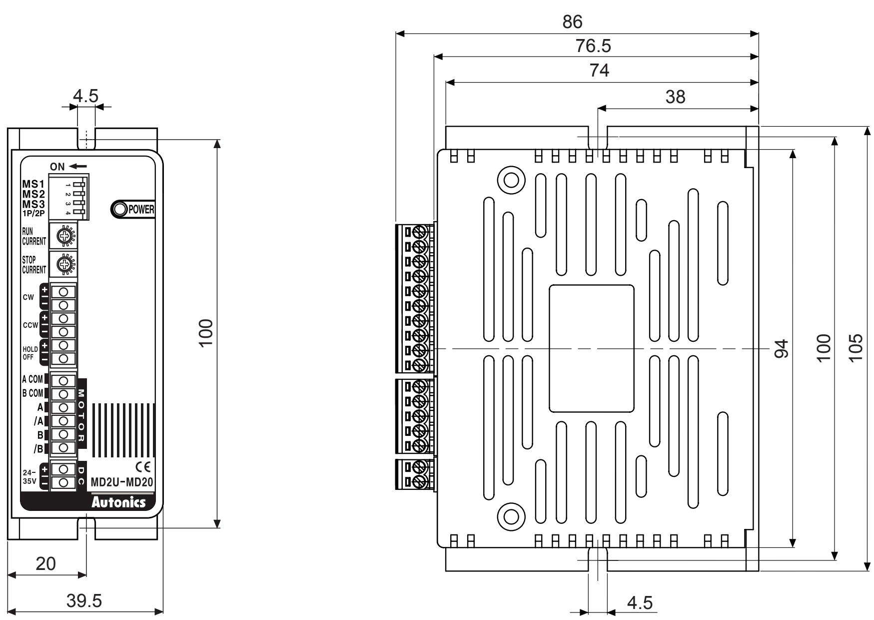
● 2 pulse input method



※Do not input CW, CCW signals at the same time in 2-pulse input method.
It may not operate properly if another direction signal is inputted when one of CW or CCW is [H].

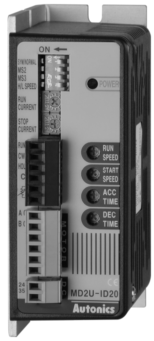
■ Dimensions

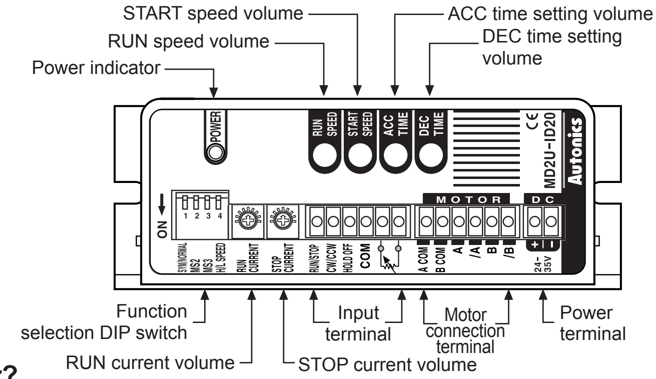
(unit: mm)



2-Phase Intelligent Stepper Motor Driver [MD2U-ID20]

▣ Unit Descriptions





◎ Intelligent type stepper motor driver?

MD2U-ID20 is an intelligent type stepper motor driver including all features to control 2-phase stepper motors so that no controllers are required.

- Realizing AC motor's driving features to stepper motors
- Controlling START speed, RUN speed and ACC/DEC speed
- User-friendly design to realize various functions (front switch and volume)

◎ Function selection DIP switch

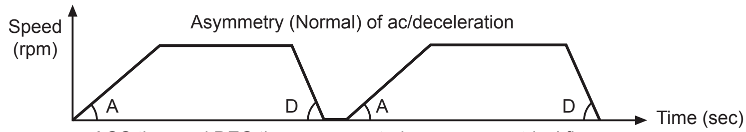
<table>
<tr><td rowspan="7">ON 1 2 3 4</td><td rowspan="2">No.</td><td rowspan="2">Name</td><td rowspan="2">Function</td><td colspan="4">Switch position</td></tr>
<tr><td colspan="2">ON</td><td colspan="2">OFF</td></tr>
<tr><td>1</td><td>SYM/ NORMAL</td><td>SYM/NORMAL</td><td colspan="2">Symmetry</td><td colspan="2">Asymmetry</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">MS2</td><td rowspan="4">Max. speed</td><td>MS2</td><td>MS3</td><td>H/L SPEED</td><td>Max. speed (rpm)</td></tr>
<tr><td>ON</td><td>ON</td><td rowspan="4">ON: High speed</td><td>1500</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">MS3</td><td>ON</td><td>OFF</td><td>1350</td></tr>
<tr><td>OFF</td><td>ON</td><td>1000</td></tr>
<tr><td></td><td rowspan="2">4</td><td rowspan="2">H/L SPEED</td><td rowspan="2">High/Low speed</td><td>OFF</td><td>OFF</td><td>500</td></tr>
<tr><td></td><td>D※1</td><td>D※1</td><td>OFF: Low speed</td><td>150</td></tr>
</table>

※1: D=Don't care

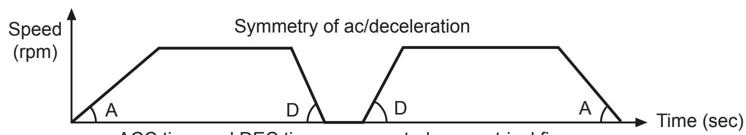
※Reset the power after changing function selection switch operations.

◎ Selection of Symmetry/Asymmetry

※The function to make the ACC/DEC time of run-speed as asymmetry or symmetry using DIP switch No. 1.



ACC time and DEC time are repeated as a asymmetrical figure



ACC time and DEC time are repeated symmetrical figure

※It is able to set the gradient (acceleration and deceleration time) as ACC/DEC time.

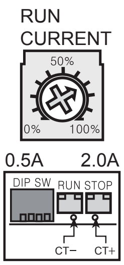
◎ Selection of max. speed (MS2, MS3)

※The function to select the max. speed of motors.
※The max. speed of stepper motor is changed by MS2/MS3 and Hi/Low speed.
※The features of run and vibration are able to change depending on MS2, MS3.
※Lower the max. speed to run a motor smoothly.

◎ Selection of H/L SPEED

※H/L SPEED mode selection switch: Ac.deceleration control is not available in Low speed mode since all sections are included in Pull-in range.
※Low speed mode: It is able to drive a motor up to 150rpm of max. drive speed.
※High speed mode: It is able to drive a motor up to 1500rpm of max. drive speed.

◎ Setting RUN current



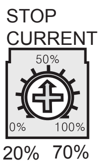
- RUN current setting is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※RUN current setting range: 0.5 to 2.0A
※RUN current setting method: Measure the voltage by connecting a DC voltage meter to both CT+ and CT- terminals while the motor is running (Max. 150rpm)

E.g.) Input voltage (3V) × $\frac{2}{3}$ = 2A (motor excitation current)

※Change RUN current only when the motor stops.

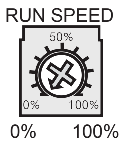
◎ Setting STOP current



- STOP current setting is for the current provided for motor when the motor stops for preventing severe motor's heat.
- This function is for reducing the heat by variable resistance ratio setting within 0 to 100% of RUN current setting range (actual setting range: 20 to 70%) .
  E.g.) In case of RUN current setting value is 2A and
  STOP current setting value is 0%(actual setting range: 20%),
  STOP current 0.4A = 2A × 0.2

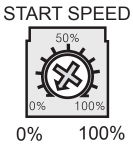
※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

◎ Setting RUN speed



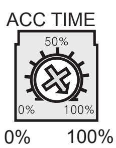
※It sets max. RUN speed.
※Max. RUN speed can be different depending on max. speed setting (MS2, MS3) and driving mode setting (Hi/Low speed).
※Consider motor type and its RUN current when setting max. RUN speed. Missing step could occur due to max. input pulse frequency of motors.
※Set the value when the motor stops.

◎ START speed setting



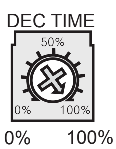
※It sets desired START speed.
※Max. START speed value is same with RUN speed value.
※START speed must be set within max. starting frequency. It is recommended to set up START speed within 0 to 50% for stable driving.
※Set the value when the motor stops.

◎ Setting ACC time



※It sets the acceleration time from START speed to max. driving speed.
※AT_1 operation mode when ACC time is under 33.3%, AT_2 operation mode when ACC time is under 66.6% and AT_3 operation mode when ACC time is over 66.6%.
※AT_1 is 0.5 sec. when RUN speed=100%, START speed=0%.
※AT_2 is 1 sec. when RUN speed=100%, START speed=0%.
※AT_3 is 2 sec. when RUN speed=100%, START speed=0%.
※Set the value when the motor stops.

◎ Setting DEC time



※It sets the deceleration time from max. RUN speed to STOP.
※DT_1 operation mode when DEC time is under 33.3%, DT_2 operation mode when DEC time is under 66.6% and DT_3 operation mode when DEC time is over 66.6%.
※DT_1 is 0.5 sec. when RUN speed=100%, START speed=0%.
※DT_2 is 1 sec. when RUN speed=100%, START speed=0%.
※DT_3 is 2 sec. when RUN speed=100%, START speed=0%.
※Set the value when the motor stops.

※ACC Time and DEC Time are declined in proportion to the setting value of START speed.
※The figures above indicate the factory default for each value.

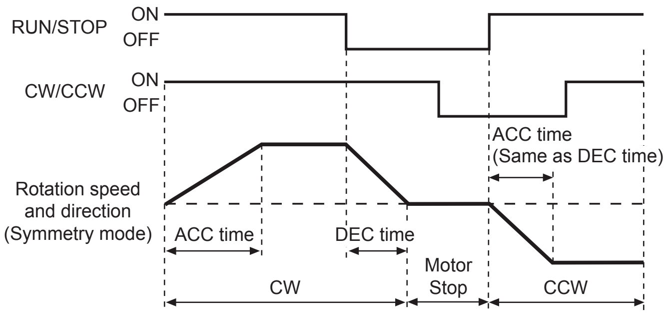
◎ HOLD OFF function

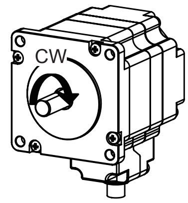
- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to I/O Circuit and Connections.

▣ Time Chart

● High speed mode



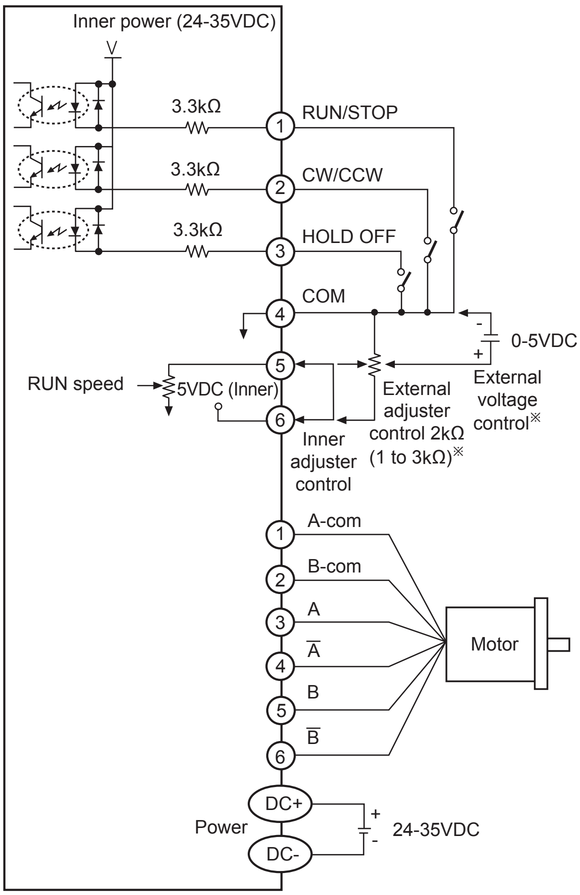


It accelerates up to RUN speed during ACC time after RUN signal is ON and decelerates during DEC time after it is OFF. It is disable to change the direction during the signal is ON and it takes 0.5sec. for deceleration when DEC time is "0%".

● Low speed mode

Max. RUN speed is 150rpm and ACC and DEC time are not available.
It is same with High speed to change RUN/STOP and direction.

▣ I/O Circuit and Connections



※Inner adjuster is correlated to external adjuster control and external voltage control. Make sure that inner adjuster must be set to maximum in order to set maximum RUN speed using external adjuster and external voltage.

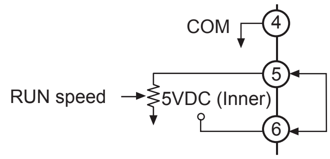
RUN/STOP signal input
→ [ON]: RUN, [OFF]: STOP

Direction signal input
→ [ON]: CW, [OFF]: CCW

HOLD OFF signal iuput
→ [ON]: HOLD OFF, [OFF]: HOLD ON

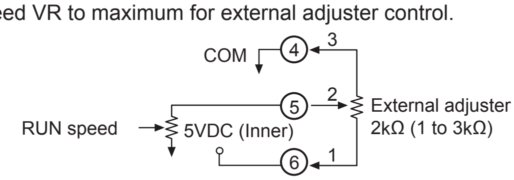
● Inner adjuster control (Adjusting RUN speed with front VR)

Make the connection between terminal No.5 and No.6.



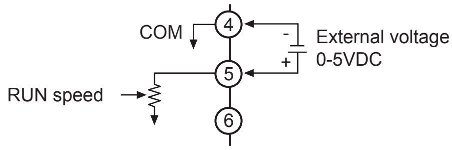
● External adjuster control (Adjusting RUN speed with connecting external variable resistance)

Connect variable resistance 2kΩ (1 to 3kΩ) for external adjuster control. If variable resistance is too low, full range setting might not be possible. Make sure to adjust RUN speed VR to maximum for external adjuster control.



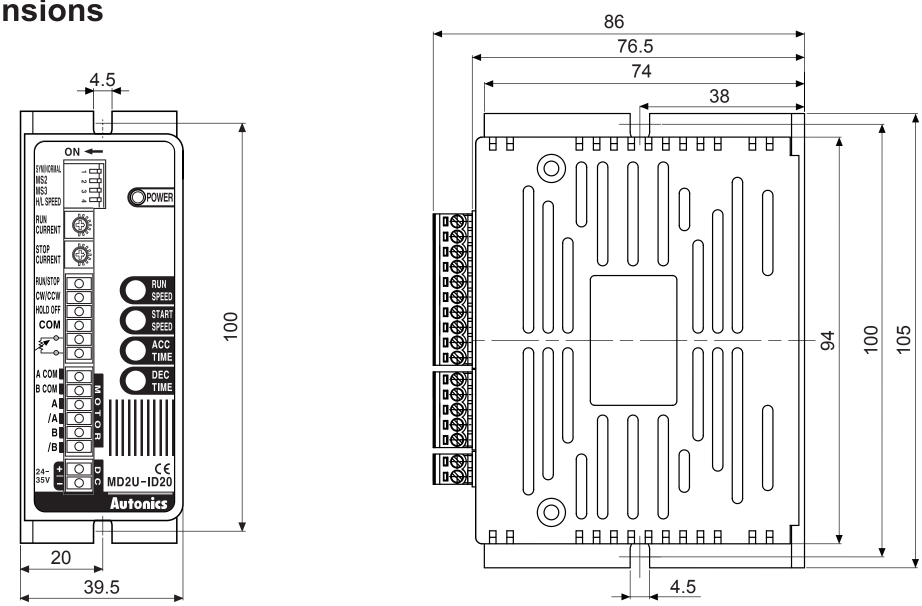
● External voltage control (Adjusting RUN speed with external voltage input)

Make sure to adjust RUN speed VR to maximum external voltage control.



▣ Dimensions

(unit: mm)



▣ Proper Usage

◎ Failure diagnosis and management

- Check the connection of controller and driver, if motor does not rotate.
- Check the DIR input of driver, if motor rotates as a reverse direction, it is CW for [ON] and CCW for [OFF].
- If motor does not work properly,
  - Check the connection of driver and motor.
  - Check driver output current and RUN current of motor depending on current adjuster are correct.

◎ Cautions during use

1. For signal input

①Do not input CW, CCW signal at the same time in 2-pulse input method. Failure to follow this instruction may result in malfunction. (MD2U-MD20)

②Direction cannot be changed during the operation. (MD2U-ID20)

③When the signal input voltage is exceeded the rated voltage, connect additional resistance at the outside.

2. For RUN current, STOP current setting

①Set RUN current within the range of motor's rated current. Failure to follow this instruction may result in severe heat of motor or motor damage.

②Use the power for supplying sufficient current to the motor.

3. For ratating motor

①For rotating the motor when driver power turns OFF, separate the motor from the driver. (if not, the driver power turns ON)

②For rotating the motor when driver power turns ON, use Hold OFF function.

4. For cable connection

①Use twisted pair (over 0.2mm^2) for the signal cable which should be shorter than 2m.

②The thickness of cable should be same or thicker than the motor cable's when extending the motor cable.

③Must separate between the signal cable and the power cable over 10cm.

5. For installation

①In order to increase heat protection efficiency of the driver, must install the heat sink close to metal panel and keep it well-ventilated.

②Excessive heat generation may occur on driver. Keep the heat sink under 80℃ when installing the unit. (at over 80℃, forcible cooling shall be required.)

6. For using function selection DIP switches

①Do not change the pulse input method during the operation. It may cause danger as the revolution way of the motor is changed conversely.

7. Motor vibration and noise can occur in specific frequency period.

①Motor vibration and noise can be lowered by changing motor installation or attaching damper.

②Use the unit in a range without vibration and noise by changing RUN speed or resolution.

8. This product may be used in the following environments.

① Indoor
② Altitude under 2000m
③ Pollution degree 2
④ Installation category II

1·2-Axis High Speed Programmable Motion Controller

■ Features

- Max. 4Mpps high-speed operation
- 4 operation modes: Jog, Continuous, Index, Program mode
- 12 control command and 64 steps of operations
- Parallel I/O terminal built in which is connectable on PLC
- Operation program by exclusive switch, making and editing parameter
- Easy to operation of X, Y stage with joy stick
- RS232C port for all types
- Teaching and monitoring function by using teaching unit (PMC-2TU-232)

PMC-1HS (USB) **PMC-1HS (232)** **PMC-2HS (USB)** **PMC-2HS (232)**

⚠ **Please read "Caution for your safety" in operation manual before using.**

PMC-2TU-232

■ User Manuals

- For more information about motion controller, refer the user manual.
- Visit our website (www.autonics.com) to download user manual and the dedicated software[PMC].
- User manual describes for specifications and function about software installations, parameter settings, program settings, RUN mode selection, multi-axis drive method, etc.

■ Ordering Information

PMC – 2HS – USB

	Code	Description
Communication type	232	RS232C
	USB	USB / RS232C
Axis/Type	1HS	1-Axis high speed stand-alone
	2HS	2-Axis high speed stand-alone
Item	PMC	Programmable Motion Controller

■ Specifications

Model		PMC-1HS-232	PMC-1HS-USB	PMC-2HS-232	PMC-2HS-USB
Control axis		1-Axis		2-Axis (each axis can be independently programmed)	
Motor for control		Pulse string input stepper motor or servo motor			
Power supply		24VDC ±10%			
Power consumption		Max. 6W			
Operation mode		Jog / Continuous / Index / Program mode			
Positioning type		Absolute position / Incremental position			
Index step numbers		64 steps per each axis			
Positioning range		-8,388,608 to 8,388,607 (available pulse scaling function)			
Drive speed numbers		4			
Drive speed		1 pps to 4 Mpps (1 to 8,000 × Magnification 1 to 500)			
Pulse output method		2 Pulse output (line driver output)			
Home search mode		High speed near home search (step1) → Low speed home search (step2) → Low speed encoder Z-phase search (step3) → High speed offset movement (step4) Configuring the detection method and Enable/Disable in each step.			
Program function	Memory	EEPROM			
	Step	64 steps			
	Control	ABS, INC, HOM, IJP, OUT, OTP, JMP, REP, RPE, END, TIM, NOP (12)			
	Start	Power ON program auto-start function			
	Home search	Power ON home search auto-start function			

1·2-Axis High Speed Programmable Motion Controller

■ Specifications

Model		PMC-1HS-232	PMC-1HS-USB	PMC-2HS-232	PMC-2HS-USB
Teaching unit (sold separately)		Adding operation mode, parameter, program drive handling (jog operation, program execution, home search, etc are available)			
Common output		1 point		2 point	
Control interface		Parallel I/F			
Environ -ment	Ambient temperature	0 to 45℃			
	Ambient humidity	35 to 85%RH			
Accessory	Common	User manual & CD			
	Power connector	CN1: MC1,5/2-ST-3.5 (PHOENIX): 1			
	RS232C connector	CN2: RS-232C communication cable (1.5m): 1			
	P I/F connector	CN3: 20P MIL standard, 2.54mm connector: 1			
	X axis input/output connector	CN4: 16P MIL standard, 2.54mm connector: 1 (2HS: 2)			
	Y axis input/output connector	—		CN5: 16P MIL standard, 2.54mm connector 1	
	USB connector	—	USB communication cable (1m): 1	—	USB communication cable (1m): 1
Weight※1		Approx. 386g (approx. 96.8g)	Approx. 421.6g (approx. 96.9g)	Approx. 393.6g (approx. 100.2g)	Approx. 432.2g (approx. 100.4g)

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing of condensation.

■ Standard Operation Method

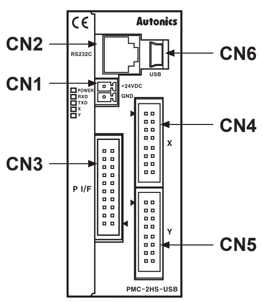
There are four methods to operate the motion controller.

- Operation by PC
  Connect a PC and the controller with communication cable and run dedicated program (PMC).
- Operation by Parallel I/F
  Connect a sequence controller or switch to Parallel I/F.
- Operation by teaching unit (PMC-2TU-232)
  Connect a teaching unit cable and install JOG output, HOME search and program by an operation button.
- Operation by serial communication (dedicated communication protocol)
  Using serial communication protocol, operate according to program writing by user.

■ Program Commands

Command type	Code	Description
Drive commands	ABS	Move absolute position
	INC	Move incremental position
	HOM	Home search
I/O commands	IJP	Jump input condition
	OUT	ON/OFF of output port
	OTP	ON pulse from output port
Program control commands	JMP	Jump
	REP	Start repetition
	RPE	End repetition
	END	End program
Others	TIM	Timer
	NOP	No operation

■ Unit Descriptions



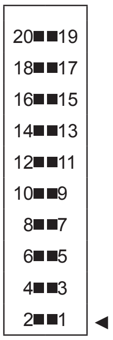
Connector No.	Description
CN1	Power connector
CN2	RS232C connector (Connect to PMC-2TU-232)
CN3	Parallel I/F connector
CN4	X-Axis I/O connector
CN5	Y-Axis I/O connector
CN6	USB connector

※PMC-1HS type does not have I/O connector (CN5) of Y axis.

▣ Power Connector (CN1)

Pin No.	Signal name
1	24VDC
2	GND (0V)

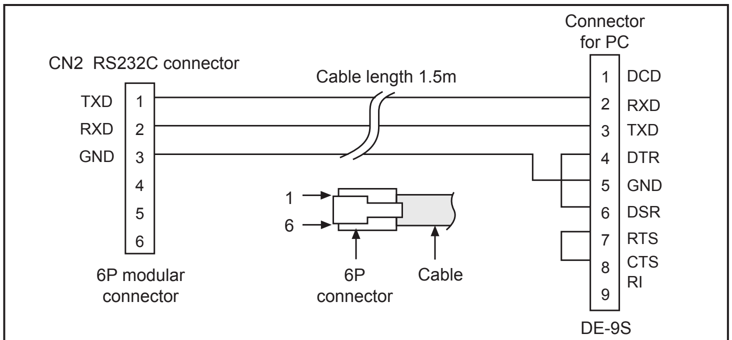
<CN3 Pin No.>



▣ RS232C Serial I/F Connector (CN2)

Pin No.	Signal name	Input/Output	Description
1	TXD	Output	Receiving data
2	RXD	Input	Transmitting data
3	GND	—	Ground
4	—	—	No-connection
5	—	—	No-connection
6	—	—	No-connection

※The internal connection diagram of RS232C communication cable is shown as below.



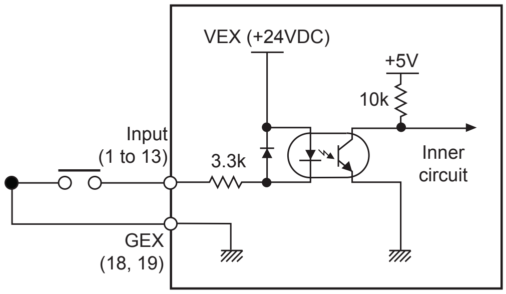
< Internal connection diagram of RS232C communication cable>

▣ Parallel I/F Connector (CN3)

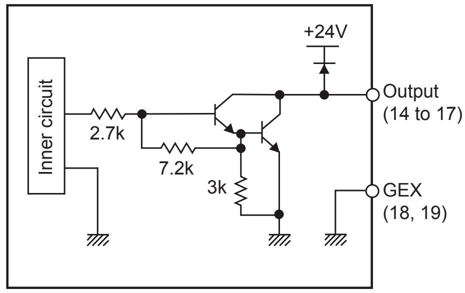
The Parallel I/F connector which is connected with a sequencer or mechanical contacts operates motion controller same as PC program. When input signal is ON, the input signal terminal and GEX terminal are connected by mechanical contacts or open collector output etc. and open collector output transistor is ON when the output signal is ON.

Pin No.	Signal name	Input/Output	Description
1	RESET	Input	Reset
2	HOME	Input	Home search start
3	STROBE	Input	Drive start
4	X/JOG Y+	Input	X-axis designate/JOG 2 mode Y+
5	Y/JOG Y-	Input	Y-axis designate/JOG 2 mode Y-
6	STEPSL0/RUN+/JOG X+	Input	Step designate 0/Run+/JOG 2 mode X+
7	STEPSL1/RUN-/JOG X-	Input	Step designate 1/Run-/JOG 2 mode X-
8	STEPSL2/SPD0	Input	Step designate 2/Drive speed designate 0
9	STEPSL3/SPD1	Input	Step designate 3/Drive speed designate 1
10	STEPSL4/JOG	Input	Step designate 4/JOG designate
11	STEPSL5/STOP	Input	Step designate 5/Drive stop
12	MODE0	Input	Operation mode designate 0
13	MODE1	Input	Operation mode designate 1
14	X DRIVE/END	Output	X-axis drive/Drive end pulse
15	Y DRIVE/END	Output	Y-axis drive/Drive end pulse
16	X ERROR	Output	X-axis error
17	Y ERROR	Output	Y-axis error
18	GEX	0V	Ground
19	GEX	0V	Ground
20	VEX	+24V	Power supply for sensor (24VDC, max. 100mA)

■ Input/Output Connections (CN3)



< CN3 control input connections >



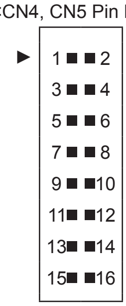
< CN3 control output connections >

■ X, Y-Axis Input/Output Connector (CN4, CN5)

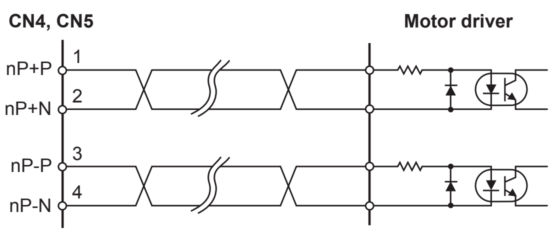
CN4 and CN5 are I/O signals for X-Axis and Y-Axis respectively. The pin arrangement of CN4 and CN5 are equal. PMC-1HS does not have CN5. 'n' in the table means X for CN4 and Y for CN5.

Pin No.	Signal name	Input/Output	Description
1	nP+P	Output	Drive pulse in the CW + direction
2	nP+N	Output	Drive pulse in the CW + direction
3	nP-P	Output	Drive pulse in the CCW - direction
4	nP-N	Output	Drive pulse in the CCW - direction
5	n OUT0	Output	General output 0/DCC
6	n INPOS	Input	Finish the servo inposition
7	n ALARM	Input	Servo alarm
8	GEX	0V	Ground
9	n STOP2	Input	Encoder Z-phase
10	n STOP1	Input	Home
11	n STOP0	Input	Near Home
12	n LMT+	Input	+ direction limit
13	n LMT-	Input	- direction limit
14	EMG	Input	Emergency stop
15	GEX	0V	Ground
16	VEX	+24V	Power supply for sensor (24VDC, Max. 100mA)

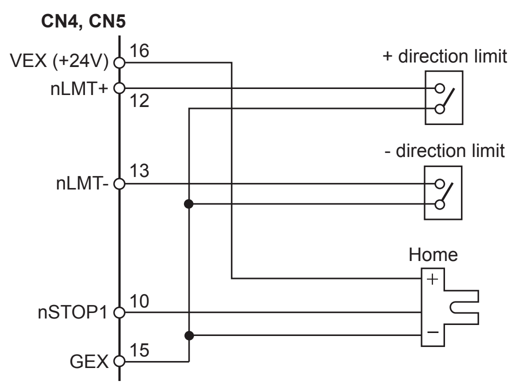
<CN4, CN5 Pin No.>



※CN4, 5 input/output is same as CN3 input/output connections.
Drive pulse output of motion controller which is input to motor driver is line driver output.

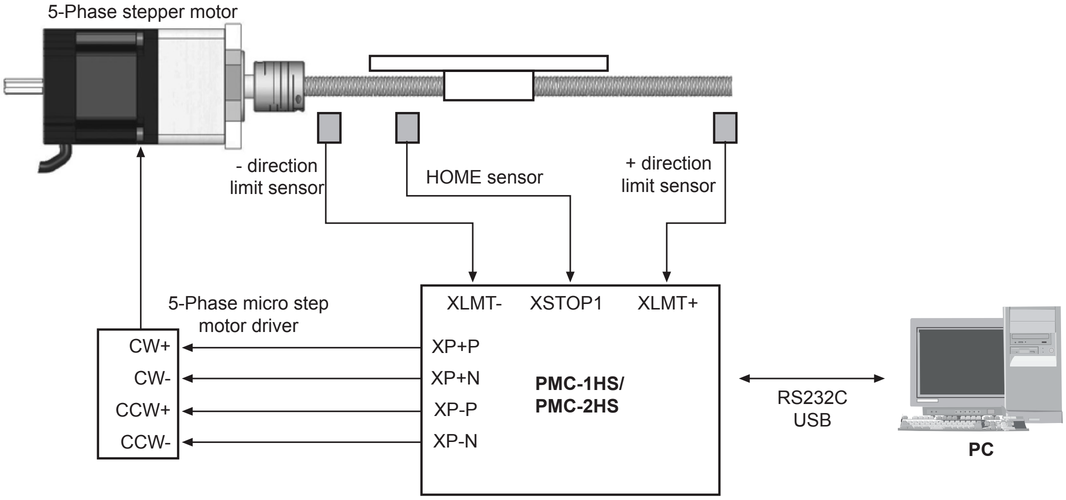


< Example of motor driver connection >



< Example of limit and HOME sensor connection >

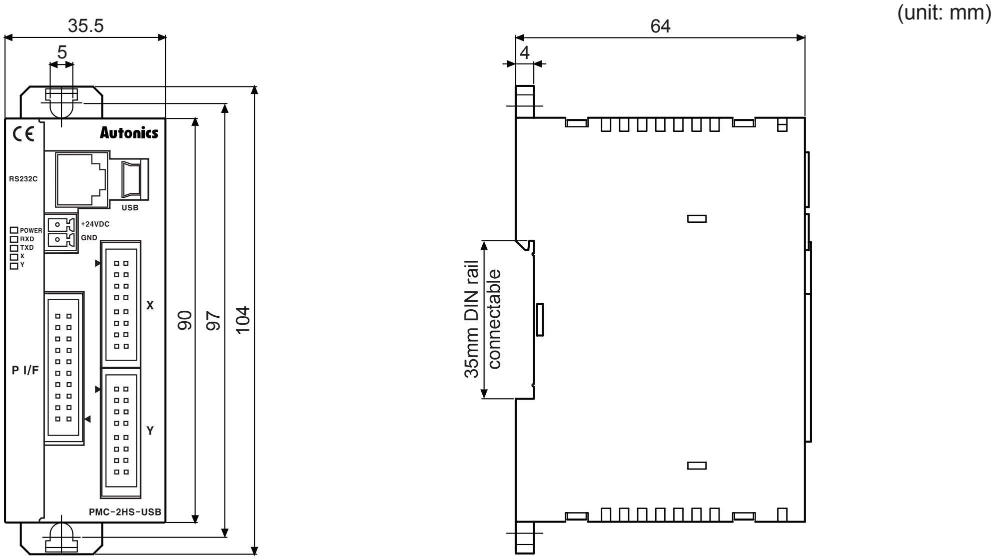
■ Connections



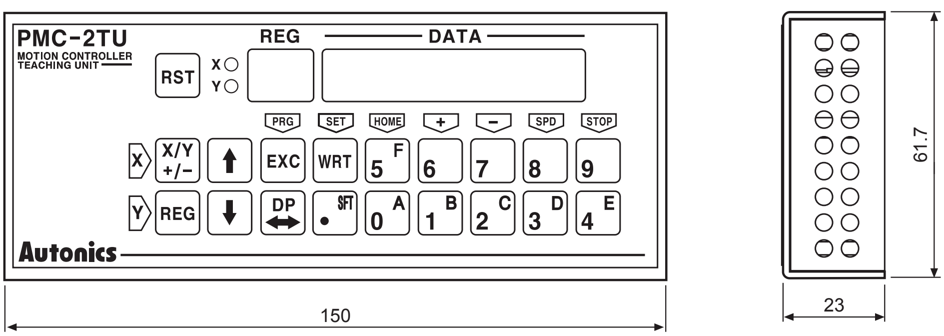
< Basic configuration of the motion controller (configuration only for X-axis) >

■ Dimensions

(unit: mm)

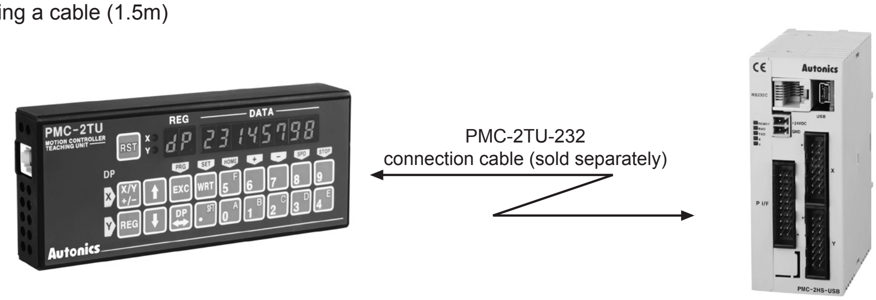


■ **Teaching unit PMC-2TU-232 (sold separately)**



▣ Teaching Unit PMC-2TU-232 (sold separately)

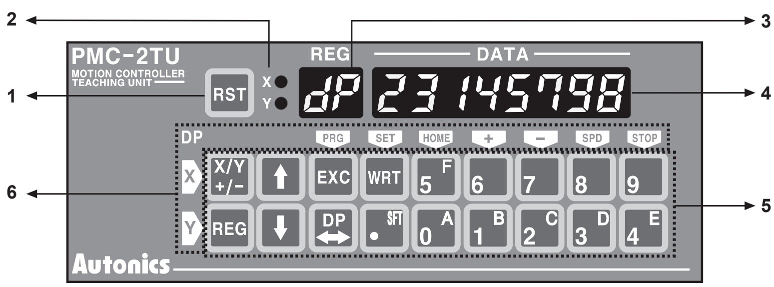
Teaching unit (PMC-2TU-232) is a device to arrange the operation mode, parameter and operation program without PC and it is also able to install start the operation program, HOME search and JOG operation. Connect to RS232C connector (CN2) using a cable (1.5m)



Teaching unit consists of data edit mode and drive operation mode. The register number is displayed on REG of data edit mode and dp (drive operation) is displayed in drive operation mode and it will be a drive operation status when applying power. Use DP key to convert the status of data edit mode and drive operation mode.

Mode	Operation	REG display
Data edit	• Record operation mode parameter and operation program • Installation of index drive	Register number
Drive handling	• Displaying the current position • JOG operation • HOME search • Installation of program	dP (drive operation)

The front panel of the teaching unit shown as below;



1. Reset: Reset the controller and teaching unit.
2. X/Y display: Display the current axis.
3. Register number display/dp: Display the current register number when editing data and dp when operating drive.
4. Data display: Display the data of each register when data editing and the current position of the axis when operating drive.
5. Input key
- X/Y: Convert the axis and the sign of input value and it is used to change mode data when inputting mode.
- REG: Input the register number to display and it is returned to previous step pressing a key during data input.
- ↑↓: Increase or decrease the current register number.
- EXC: Install the current command, but, ABS, INC, OUT, OTP, HOM1 to 4 are only valid.
- DP: Convert the status of driver operation and data edit.
- WRT: Enter a value when editing data.

6. Display the key for drive operation:
Display the key function on a left and upside of the key as a yellow letter and the upper part operates X axis and the lower part operates Y axis.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

2-Axis High Speed Interpolation/Normal Motion Controller

■ Features

- Independent 2-Axis controlling with high operating speed of max. 4Mpps
- Linear/Circular interpolation control (PMC-2HSP)
- Realizing a wide variety of operation up to 200 steps using 17 control commands combination (13 commands except circular/linear interpolation command for PMC-2HSN series)
- Various control interface available (USB, RS232C, RS485, Parallel I/F)
- Controlling up to 32 axes (16 units) via RS485 serial communication (Modbus RTU)
- 4 operation modes: Jog, Continuous, Index, Program mode
- Symmetrical/asymmetrical trapezoid, S-shaped de/acceleration driving function

PMC-2HS□-USB PMC-2HS□-485

⚠ Please read "Caution for your safety" in operation manual before using.

(except for PMC-2HS□-485)

■ User Manual

- Please refer to user manual for detailed instructions and specifications.
- Visit our web site (www.autonics.com) to download user manual and software [MotionStudio].
- User manual describes installing software, setting parameter and program, operation mode, and multi- axis operation, etc. to operate motion controller.

■ Software (MotionStudio)

MotionStudio is the windows software designed to operate motion control for PMC-2HSP/2HSN series.

- Compatible Microsoft Windows 98, NT, 2000, XP (32-bit, 64-bit), Vista (32-bit, 64-bit) and 7 (32-bit, 64-bit)
- Supports 9,600, 19,200, 38,400, 57,600, 115,200 bps transmission speeds
- Available to use on all OS supported COM ports (COM1 to COM256)
- Multilingual support (korean, english)
- Provides a calculator for convenience (calculates PPS, center of interpolation, end coordinates)

■ Ordering Information

PMC – 2HSP – USB

	Code	Description
Communication type	485	RS485 / RS232C
	USB	USB / RS232C
Axis/Type	2HSP	2-Axis high speed interpolation
	2HSN	2-Axis high speed normal
Item	PMC	Programmable Motion Controller

■ Specifications

Model		PMC-2HSP-USB	PMC-2HSP-485	PMC-2HSN-USB	PMC-2HSN-485
Control axis		2-Axis			
Motor for control		Pulse string input stepper motor or servo motor			
Power supply		24VDC			
Power consumption		Max. 6W			
Inposition range		-8,388,608 to 8,388,607 (selectable absolute/relative value, available pulse-scaling function)			
Range for the drive speed		1 pps to 4 Mpps (1 to 8,000pps × Magnification 1 to 500)			
Pulse output mode		1 Pulse/2 Pulse output (line driver output)			
Operation mode		Jog / Continuous / Index / Program			
Index step numbers		64 steps per each axis			
Program function	Step	200 steps			
	Control	ABS, INC, HOM, LID※1, CID※1, FID※1, RID※1, TIM, JMP, REP, RPE, ICJ, IRD, OPC, OPT, NOP, END			
	Start	Power On program auto-start function			
	Home search	Power On home search auto-start function			
Home search mode		High speed near home search (step 1) → Low speed home search (step 2) → Encoder Z phase search (step 3) → Offset move (step 4)			
I/O		• Parallel I/F (CN3): 13 inputs, 4 outputs • X-axis (CN 4) / Y-axis (CN 5): 8 inputs, 6 outputs (general-purpose I/O, two of each)			
Environ -ment	Ambient temperature	0 to 45℃, storage: -15 to 70℃			
	Ambient humidity	20 to 90%RH			
Accessory		• [Common] Power connector, I/O connector (PI/F, X-axis, Y-axis), RS232C communication cable (1.5m): 1, User Manual • [USB type] USB communication cable 1m: 1 •[RS485 type] RS485 connector: 1			
Weight※2		Approx. 344g (approx. 101.5g)	Approx. 308.7g (approx. 101.6g)	Approx. 344g (approx. 101.5g)	Approx. 308.7g (approx. 101.6g)

※1: These commands are only for PMC-2HSP series. ※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing of condensation.

■ Standard Operation Method

There are three methods to operate the motion controller.

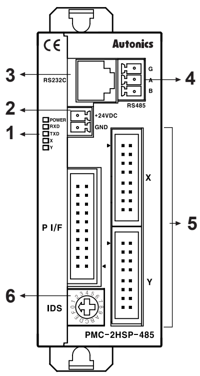
- Operation by PC
  Connect a PC and the controller with communication cable and run dedicated program (MotionStudio).
- Operation by Parallel I/F
  Connect a sequence controller or switch to Parallel I/F.
- Operation by serial communication (dedicated communication protocol)
  Using serial communication protocol, operate according to program writing by user.

■ Program Commands

Command type	Code	Description
Drive commands	ABS	Move absolute position
	INC	Move relative position
	HOM	Home search
	LID	2-Axis linear interpolation※1
	CID	2-Axis CW circular interpolation※1
	FID	2-Axis CW arc interpolation※1
	RID	2-Axis CCW arc interpolation※1
I/O commands	ICJ	Jump input condition
	IRD	Stand-by external input
	OPC	ON/OFF output port
	OPT	ON pulse from output port (period)
Program control commands	JMP	Jump
	REP	Start repetition
	RPE	End repetition
	END	End program
Others	TIM	Timer
	NOP	No operation

※1: These commands are only for PMC-2HSP series.

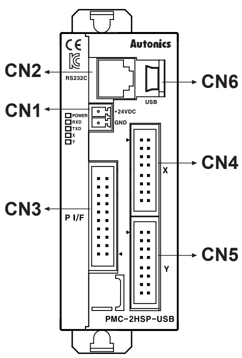
■ Unit Descriptions



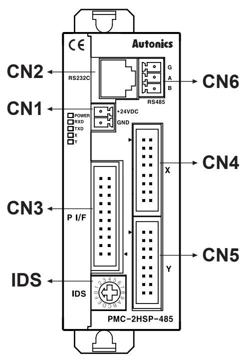
1. **Power / Status indicator**
   Used to indicate power, controller's communication status and operation status for each axis
2. **Power connector terminal**
   Used to connect power for controller
3. **RS232C connector terminal**
   Used to connect RS232 serial (RJ12-DSUB9) connection cable
4. **USB/RS485 connector terminal**
   Used to connect USB and RS485 connection cable
5. **External I/O connector terminal**
   Used to operate various drives through input and output of Parallel I/F, X, Y
6. **ID select switch**
   Used to set unique ID for each node in case of RS485 communication

◎ I/O terminal

- **PMC-2HS□-USB**



- **PMC-2HS□-485**

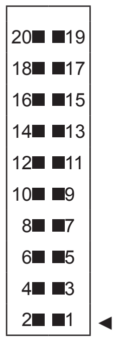


Connector No.	Description
CN1	Power connector
CN2	RS232C connector
CN3	Parallel I/F connector
CN4	X-Axis I/O connector
CN5	Y-Axis I/O connector
CN6	PMC-2HSP/2HSN-USB: USB connector
	PMC-2HSP/2HSN-485: RS485 connector
IDS	ID selection switch

■ Power Connector (CN1)

Pin No.	Signal name
1	24VDC
2	GND (0V)

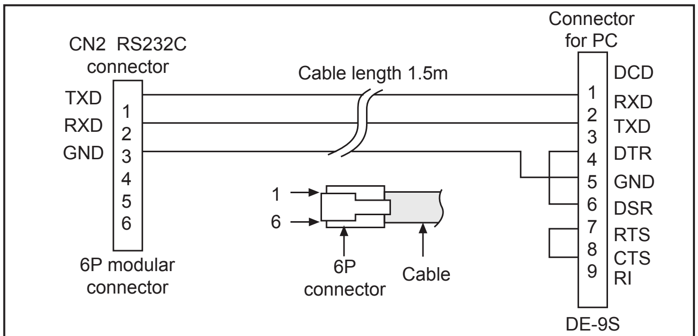
<CN3 Pin No.>



■ RS232C Connector (CN2)

Pin No.	Signal name	Input/Output	Description
1	TXD	Output	Receiving data
2	RXD	Input	Transmitting data
3	GND	—	Ground
4	—	—	No-connection
5	—	—	No-connection
6	—	—	No-connection

※The internal connection diagram of RS232C communication cable is shown as below.



< Internal connection diagram of RS232C communication cable>

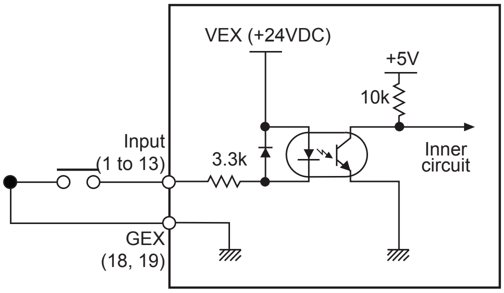
■ Parallel I/F Connector (CN3)

The Parallel I/F connector which is connected with a sequencer or mechanical contacts operates motion controller same as PC program. When input signal is ON, the input signal terminal and GEX terminal are connected by mechanical contacts or open collector output and open collector output transistor is ON when the output signal is ON.

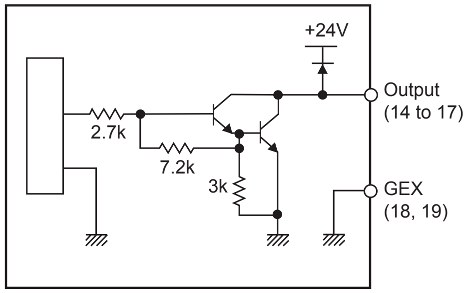
Pin No.	Signal name	Input/Output	Description
1	RESET	Input	Reset
2	HOME	Input	Home search start command
3	STROBE	Input	Drive start command
4	X/JOG Y+	Input	X-axis designate/Jog Y+
5	Y/JOG Y-	Input	Y-axis designate/Jog Y-
6	STEPSL0/RUN+/JOG X+	Input	Register designate 0/Run+/Jog X+
7	STEPSL1/RUN-/JOG X-	Input	Register designate 1/Run-/JogX-
8	STEPSL2/SPD0	Input	Register designate 2/Drive speed designate 0
9	STEPSL3/SPD1	Input	Register designate 3/Drive speed designate 1
10	STEPSL4/JOG	Input	Register designate 4/Jog designate
11	STEPSL5/STOP	Input	Register designate 5/Drive stop
12	MODE0	Input	Operation mode designate 0
13	MODE1	Input	Operation mode designate 1
14	X DRIVE/END	Output	X-axis drive/Drive end pulse
15	Y DRIVE/END	Output	Y-axis drive/Drive end pulse
16	X ERROR	Output	X-axis error
17	Y ERROR	Output	Y-axis error
18	GEX	0V	Ground
19	GEX	0V	Ground
20	VEX	+24V	Power supply for sensor (24VDC, Max. 100mA)

2-Axis High Speed Interpolation/Normal Motion Controller

■ Input/Output Connections (CN3)



< CN3 control input connections >



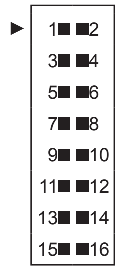
< CN3 control output connections >

■ X, Y-Axis Input/Output Connector (CN4, CN5)

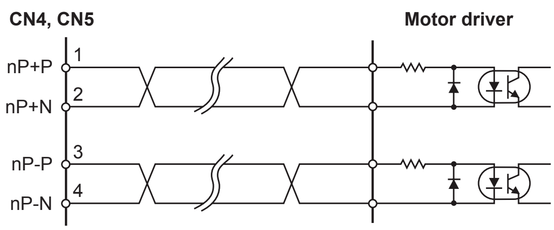
CN4 and CN5 are I/O signals for X-Axis and Y-Axis respectively.
The pin arrangement of CN4 and CN5 are equal. 'n' in the table means X for CN4 and Y for CN5.

Pin No.	Signal name	Input/Output	Description
1	n P+P	Output	Drive pulse in the CW + direction
2	n P+N	Output	Drive pulse in the CW + direction
3	n P-P	Output	Drive pulse in the CCW - direction
4	n P-N	Output	Drive pulse in the CCW - direction
5	n OUT0	Output	General output 0
6	n OUT1	Output	General output 1
7	n IN0	Input	General input 0
8	n IN1	Input	General input 1
9	n STOP2	Input	Encoder Z-phase
10	n STOP1	Input	Home
11	n STOP0	Input	Near Home
12	n LMT+	Input	+ direction limit
13	n LMT-	Input	- direction limit
14	EMG	Input	Emergency stop
15	GEX	0V	Ground
16	VEX	+24V	Power supply for sensor (24VDC, Max. 100mA)

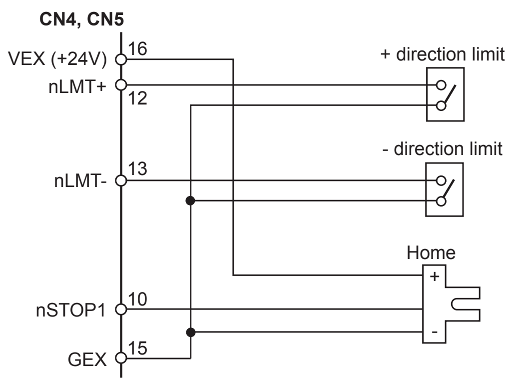
<CN4, CN5 Pin No.>



※CN4, 5 input/output is same as CN3 input/output connections.
Drive pulse output of motion controller which is inputted to motor driver is line driver output.



< Example of Motor driver connection >

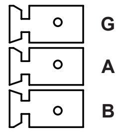


< Example of limit and HOME sensor connection >

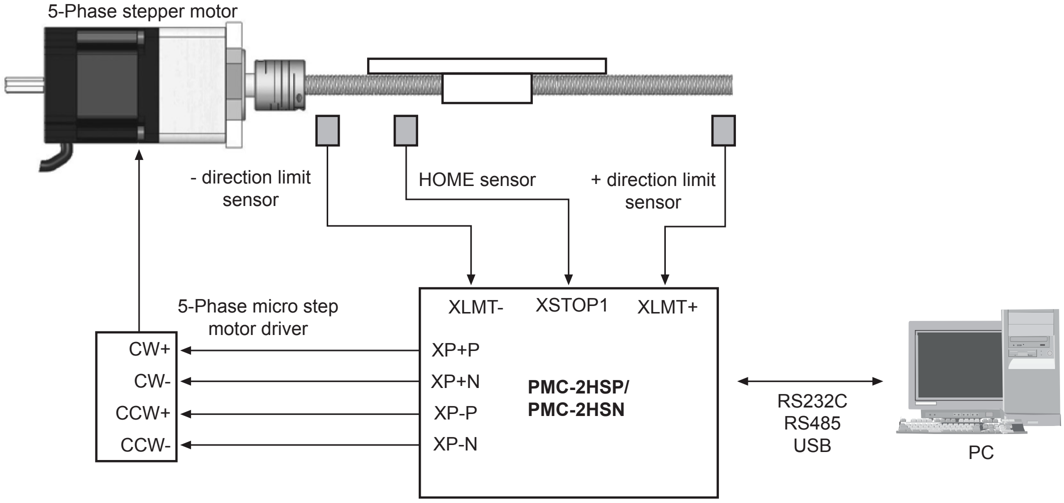
RS485 Connector (CN6)

Pin No.1	Signal name	Input/Output	Description
1	B (-)	I/O	Transmitting / Receiving data
2	A (+)	I/O	Transmitting / Receiving data
3	G	—	※1

※1: Connect the ground when it is required depending on communication environments.



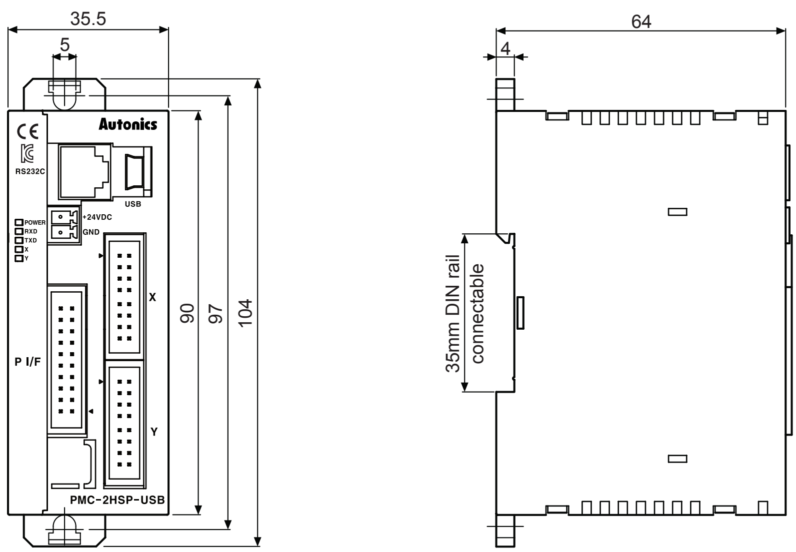
Connections



< Basic configuration of the motion controller (Configuration only for X-axis) >

Dimensions

(unit: mm)

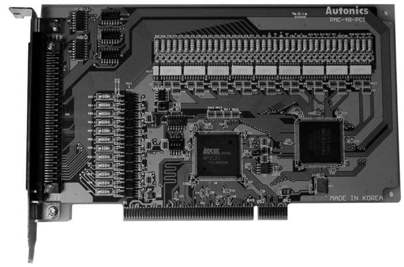


4-Axis Board Type Programmable Motion Controller

■ Features

- Available to control 4-Axis independent AC servo motor and stepper motor
- PC-PCI card
- Auto home search and synchronous operation
- Interpolation on circular/linear, bit pattern/continuous/ ac/deceleration drive
- 2/3-Axis constant linear velocity.
- Compatible with windows 98, NT, 2000, XP, 7
- Supports Labview library and help, C language library and examples (download at Autonics website)

⚠ **Please read "Caution for your safety" in operation manual before using.**



※**Visit our website (www.autonics.com) to download the user manual.**

■ Ordering Information

PMC – 4B – PCI

Connection type	PCI	PCI
Axis/Type	4B	4-Axis board type
Item	PMC	Programmable motion controller

■ Specifications

Model		**PMC-4B-PCI**
Control axis		4-Axis
Power supply		5VDC (uses PC inner power)
External power supply		12-24VDC
Allowable voltage range		90 to 110% of rated voltage
CPU data bus		8/16-bit selectable
2/3-Axis linear interpolation	Interpolation range	-2,147,483,648 to 2,147,483,647 for each axis
	Interpolation speed	1pps to 4 Mpps
	Shortcut position accuracy	Max. ±0.5LSB (within all interpolation range)
Circular interpolation	Interpolation range	Uses PC inner power
	Interpolation speed	1pps to 4 Mpps
	Shortcut position accuracy	Max. ±1 LSB (within all interpolation range)
2/3-Axis bit pattern interpolation speed		1 to 4Mpps (depends on CPU data setup)
Other interpolations		Selectable the axis, constant linear velocity, consecutive interpolation, interpolation step transmission (command, external signal)
Driver pulse output (X, Y-axis common specifications)		Output speed range: 1 pps to 4 Mpps
		Output speed accuracy: Max ±0.1% (for setting value)
		Speed magnification: 1 to 500
		S jerk speed: 954 to 62.5×10^6pps/sec (mag.=1) (accel/decel increase rate) 477×10^3 to 31.25×10^9pps/sec (mag.=500)
		Accel/Decel: 125 to 1×10^6pps/sec (mag.=1) 62.5×10^3 to 500×10^6pps/sec (mag.=500)
		Initial velocity: 1 to 8,000pps (mag.=1)/500 to 4×10^6pps (mag.=500)
		Drive speed: 1 to 8,000pps (mag.=1) / 500 to 4×10^6pps (mag.=500)
		Number of output pulses: 0 to 4,294,967,295 (fixed pulse drive)
		Speed curve: Constant speed/Symmetric, Asymmetric linear accel/decel/Parabola S curve drive
		Fixed pulse drive deceleration mode auto deceleration (asymmetric linear accel/decel function)/ Manual deceleration
		Changeable output pulse for driving, drive speed
		Selectable individual 2-pulse/1-pulse direction method
		Selectable drive pulse logic level, changeable output terminal
Encoder input pulse		Inputtable 2-phase pulse/Up-Down pulse, Selectable 2-phase pulse 1, 2, 4 multiply

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

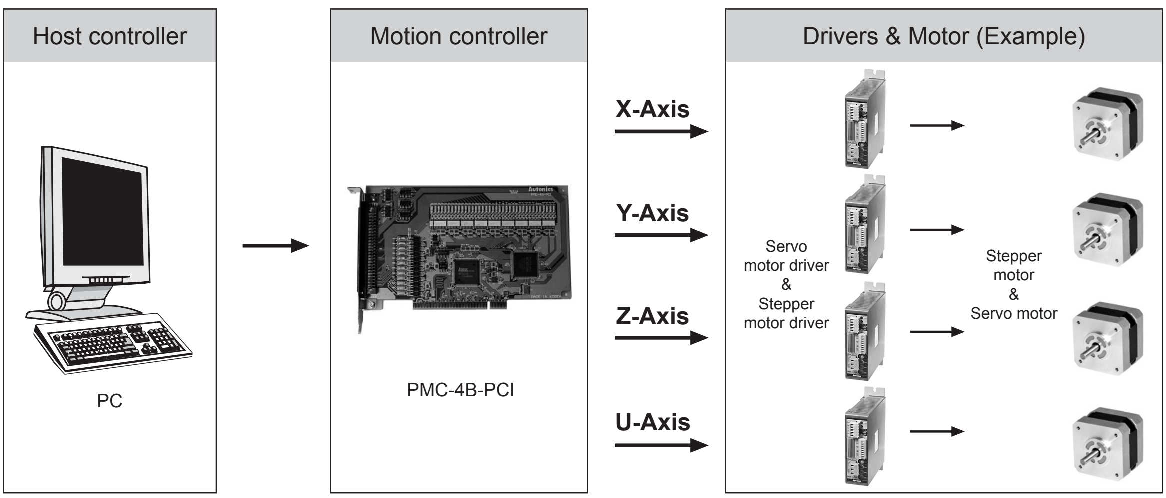
PMC-4B-PCI

■ Specifications

Position counter		Logic position counter (for output pulse) count range: -2,147,483,648 to +2,147,483,647 Actual position counter (for input pulse) count range: -2,147,483,648 to 2,147,483,647
Compare register		Comp.+ register position compare range: -2,147,483,648 to +2,147,483,647
		Comp.- register position compare range: -2,147,483,648 to +2,147,483,647
		Output/Signal output when it is same value by comparing the present value of the counter and the user position counter
		Enables to operate as software limit
Auto home search		Step 1 (high speed near home search) → Step 2 (low speed near home search)
Interrupt function (Except interpolation)		1 drive pulse output When changes position counter ≥ COMP-, When changes position counter ≥ COMP+ When changes position counter < COMP-, When changes position counter < COMP+ When starting constant speed in accel/decel drive, when ending constant speed in accel/decel drive when ending drive, when ending auto home search, Synchronous operation
Drive adjustment by external signal		Enable to fixed/continuous pulse drive of +/- direction by EXP+/EXP- signal
		Enable to drive 2-phase encoder signal mode (encoder input)
External deceleration stop/ immediate stop signal		IN 0 to 3 each axis 4-point
		Selectable signal valid/invalid and logical level, usable as general input
Input signal for servo motor		Selectable alarm, INPOS signal valid/invalid and logic level
General output signal		OUT4 to 7 each axis 4-point (uses same terminal with drive status output signal)
Drive status signal output		ASND (accelerating), DSND (decelerating)
Overrun limit signal input		Selectable + direction, - direction each 1-point and logic level
		At active, selectable immediate stop/decelerate stop
Emergency stop signal input		EMG 1-point, stops drive pulse of all axes by low level
Integral filter		Built-in integral filter at each input signal input terminal, selectable pass time (8 types)
Others		Selectable the axis, constant linear velocity, consecutive interpolation, interpolation step transmission (command, external signal)
Environ-ment	Ambient temperature	0 to 45℃, storage: -10 to 55℃
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Approval		CE
Weight※1		Approx. 654.4g (approx. 100.4g)

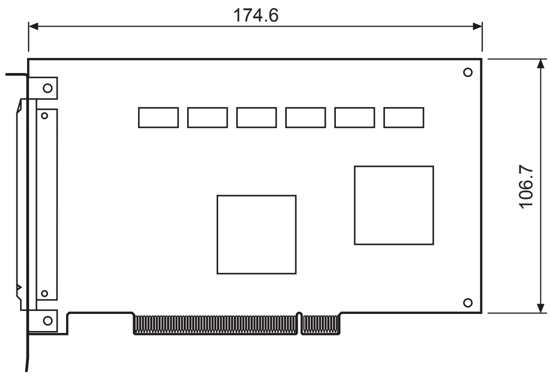
※1: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing of condensation.

■ System



■ Dimensions

(unit: mm)

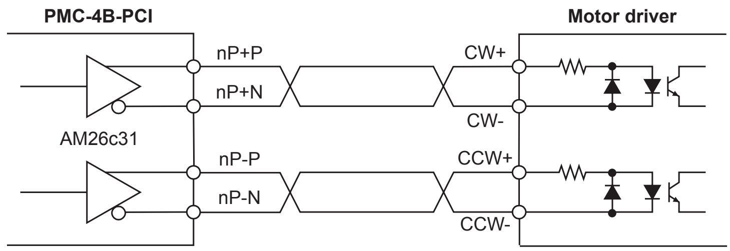


■ Connections

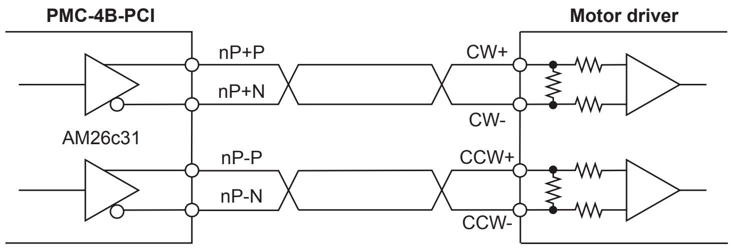
◎ Connection of pulse output signal for operating driver (nP+P/N, nP-P/N)

PMC-4B-PCI outputs pulse for operating driver as +/- of CW/CCW output using Line driver (AM26c31) and refer to the follows connections of motor driver with photocoupler and line driver input.

● Connection to motor driver with photocoupler



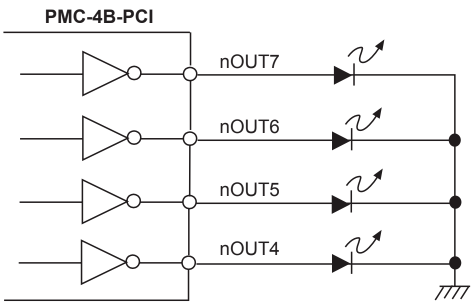
● Connection to motor driver with line driver



※It is recommended to use twisted pair shield wire for pulse output signal of driver operation regarding EMC.

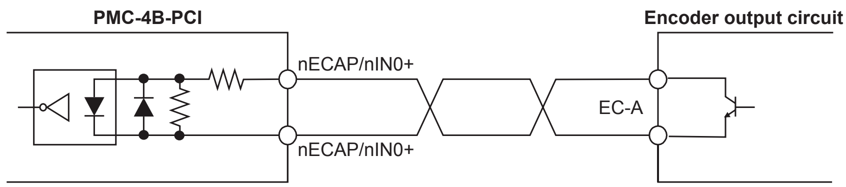
◎ Connection of common output signal (nOUT4 to 7)

Output signal is outputted by buffer (74LS06), and all outputs are OFF after reset.



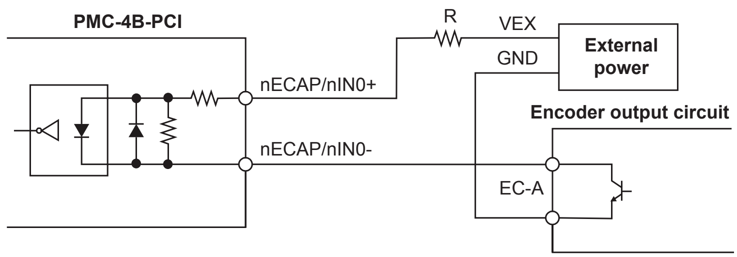
◎ Connection of encoder input signal (nECAP/N, nECBP/N) and nINO+/- signal

● Connection of encoder input signal and auto output line driver



※Encoder A, B, Z phase are same connection.

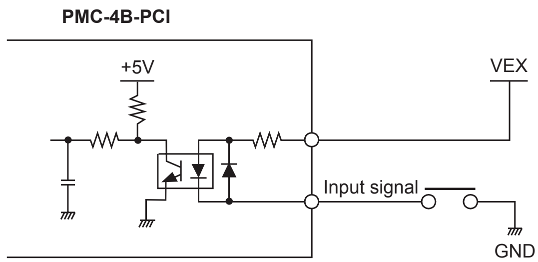
● Example for the connection of encoder input signal and NPN open collector output encoder



External power supply	Resistance (**R**)
5V	0
12V	820Ω 1/4W
24V	2kΩ 1W

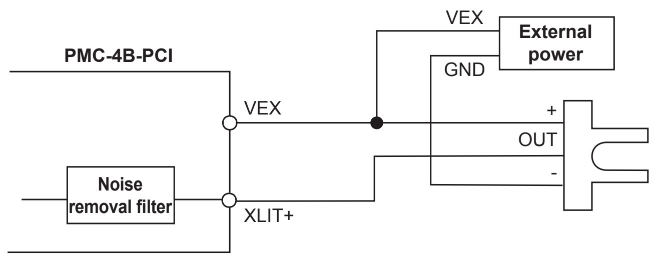
※Encoder A, B, Z phase are same connection.

◎ Connection of input signal (nIN1 to 3, nINPOS, nALRAM, nEXP+/-, EMG)

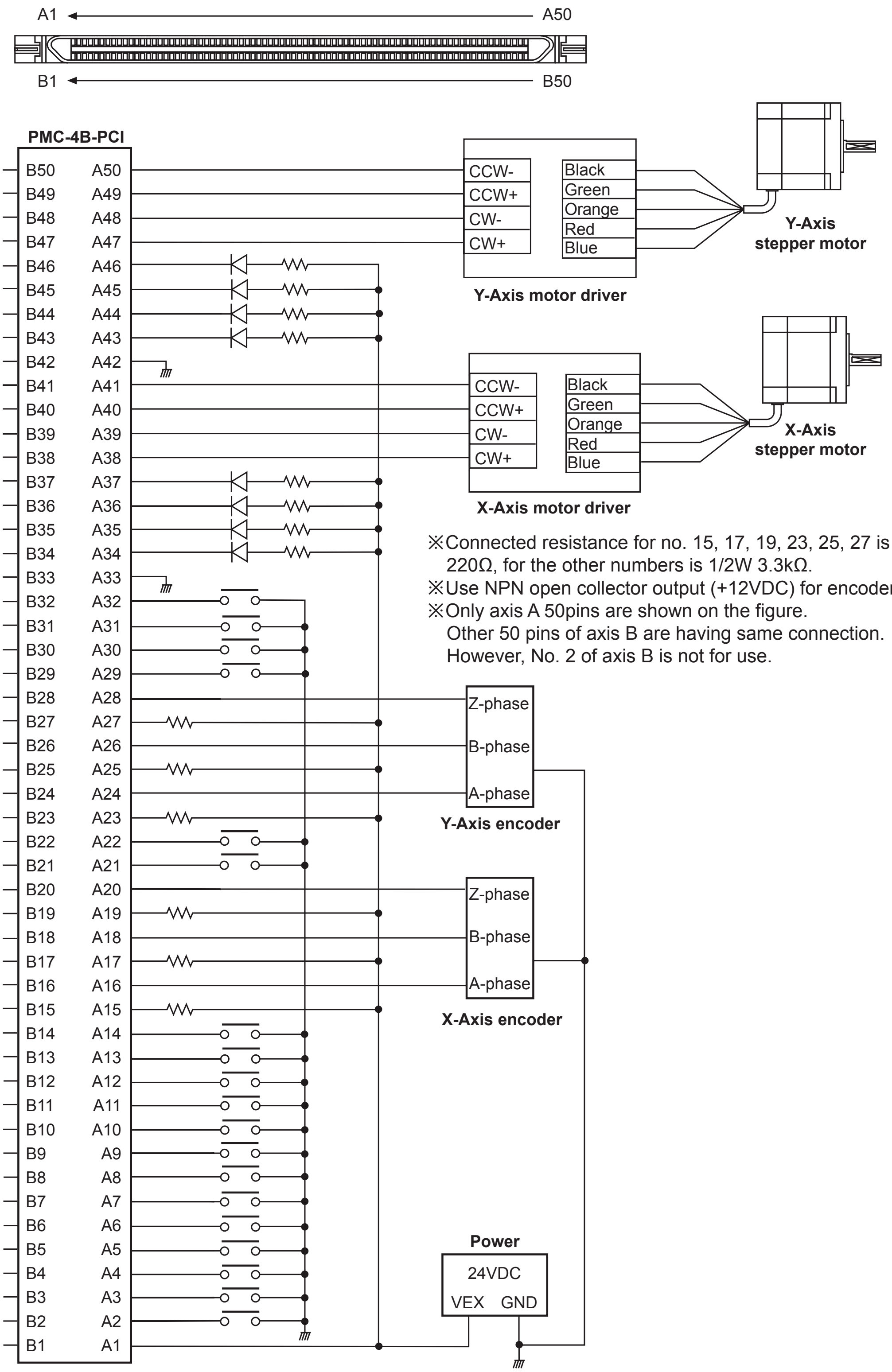


◎ Connection of limit input signal (nLMIT+/-)

The outgoing cable of limit signal can be affected by noise, it can not be removed only with photocoupler, so, the filter circuit is built in and set enough passing time. (FL=2, 3)



■ Entire I/O Connections



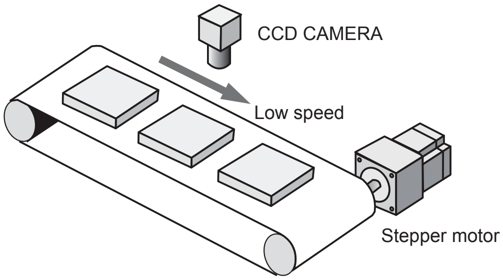
※Connected resistance for no. 15, 17, 19, 23, 25, 27 is 1/2W 220Ω, for the other numbers is 1/2W 3.3kΩ.
※Use NPN open collector output (+12VDC) for encoder.
※Only axis A 50pins are shown on the figure.
Other 50 pins of axis B are having same connection.
However, No. 2 of axis B is not for use.

▣ I/O Specifications

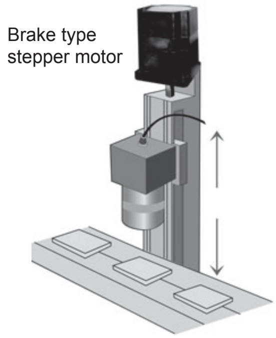
Pin No.	Signal	Description	Pin No.	Signal	Pin description
A1	VEX	12-24VDC	B1	VEX	12-24VDC
A2	EMG	Emergency stop (4-axis stop)	B2	-	-
A3	XLMIT+	X-axis + direction limit	B3	ZLMIT+	Z-axis + direction limit
A4	XLMIT-	X-axis - direction limit	B4	ZLMIT-	Z-axis – direction limit
A5	XIN1	X-axis input signal (home signal)	B5	ZIN1	Z-axis input signal (home signal)
A6	XIN0	X-axis input signal (near home signal)	B6	ZIN0	Z-axis input signal (near home signal)
A7	XIN3	X-axis input signal (Encoder Z phase signal)	B7	ZIN3	Z-axis input signal (Encoder Z phase signal)
A8	YLMIT+	Y-axis + direction limit	B8	ULMIT+	U-axis +direction limit
A9	YLMIT-	Y-axis - direction limit	B9	ULMIT-	U-axis -direction limit
A10	YIN1	Y-axis input signal (home signal)	B10	UIN1	U-axis input signal (home signal)
A11	YIN0	Y-axis input signal (near home signal)	B11	UIN0	U-axis input signal (near home signal)
A12	YIN3	Y-axis input signal (Encoder Z phase signal)	B12	UIN3	U-axis input signal (Encoder Z phase signal)
A13	XINPOS	X-axis inposition input	B13	ZINPOS	Z-axis inposition input
A14	XALRAM	X-axis alarm input	B14	ZALRAM	Z-axis alarm input
A15	XECAP	X-axis Encoder A phase+	B15	ZECAP	Z-axis Encoder A phase+
A16	XECAN	X-axis Encoder A phase-	B16	ZECAN	Z-axis Encoder A phase-
A17	XECBP	X-axis Encoder B phase+	B17	ZECBP	Z-axis Encoder B phase+
A18	XECBN	X-axis Encoder B phase-	B18	ZECBN	Z-axis Encoder B phase-
A19	XECZP	X-axis Encoder Z phase+	B19	ZECZP	Z-axis Encoder Z phase+
A20	XECZN	X-axis Encoder Z phase-	B20	ZECZN	Z-axis Encoder Z phase-
A21	YINPOS	Y-axis inposition input	B21	UINPOS	U-axis inposition input
A22	YALARM	Y-axis alarm input	B22	UALARM	U-axis alarm input
A23	YECAP	Y-axis Encoder A phase+	B23	UECAP	U-axis Encoder A phase+
A24	YECAN	Y-axis Encoder A phase-	B24	UECAN	U-axis Encoder A phase-
A25	YECBP	Y-axis Encoder B phase+	B25	UECBP	U-axis Encoder B phase+
A26	YECBN	Y-axis Encoder B phase-	B26	UECBN	U-axis Encoder B phase-
A27	YECZP	Y-axis Encoder Z phase+	B27	UECZP	U-axis Encoder Z phase+
A28	YECZN	Y-axis Encoder Z phase-	B28	UECZN	U-axis Encoder Z phase-
A29	XEXP+	X-axis manual + drive	B29	ZEXP+	Z-axis manual + drive
A30	XEXP-	X-axis manual - drive	B30	ZEXP-	Z-axis manual - drive
A31	YEXP+	Y-axis manual + drive	B31	UEXP+	U-axis manual + drive
A32	YEXP-	Y-axis manual - drive	B32	UEXP-	U-axis manual - drive
A33	GND	GND	B33	GND	GND
A34	XOUT4/CMPP	X-axis general output	B34	ZOUT4/CMPP	Z-axis general output
A35	XOUT5/CMPM	X-axis general output	B35	ZOUT5/CMPM	Z-axis general output
A36	XOUT6/ASND	X-axis general output	B36	ZOUT6/ASND	Z-axis general output
A37	XOUT7/DSND	X-axis general output	B37	ZOUT7/ DSND	Z-axis general output
A38	XP+P	X-axis +direction +drive signal output	B38	ZP+P	Z-axis +direction +drive signal output
A39	XP+N	X-axis +direction -drive signal output	B39	ZP+N	Z-axis +direction -drive signal output
A40	XP-P	X-axis -direction +drive signal output	B40	ZP-P	Z-axis -direction +drive signal output
A41	XP-N	X-axis -direction -drive signal output	B41	ZP-N	Z-axis -direction -drive signal output
A42	GND	GND	B42	GND	GND
A43	YOUT4/CMPP	Y-axis general output	B43	UOUT4/CMPP	U-axis general output
A44	YOUT5/CMPM	Y-axis general output	B44	UOUT5/CMPM	U-axis general output
A45	YOUT6/ASND	Y-axis general output	B45	UOUT6/ASND	U-axis general output
A46	YOUT7/DSND	Y-axis general output	B46	UOUT7/DSND	U-axis general output
A47	YP+P	Y-axis +direction +drive signal output	B47	UP+P	U-axis +direction +drive signal output
A48	YP+N	Y-axis +direction -drive signal output	B48	UP+N	U-axis +direction -drive signal output
A49	YP-P	Y-axis -direction +drive signal output	B49	UP-P	U-axis -direction +drive signal output
A50	YP-N	Y-axis -direction -drive signal output	B50	UP-N	U-axis -direction -drive signal output

■ Applications

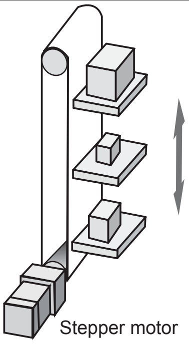
Inspection facilities



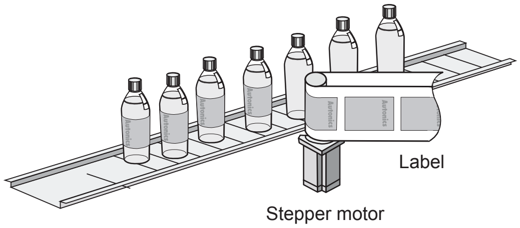
Inspection facilities



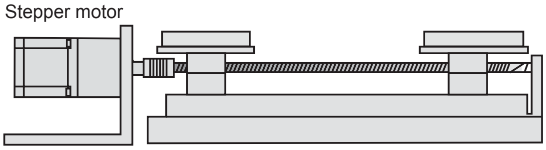
Belt drive



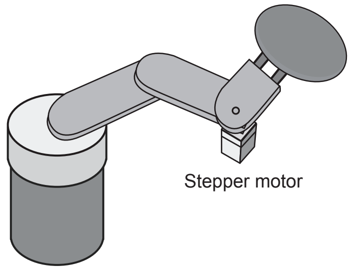
Label position control in packaging machine



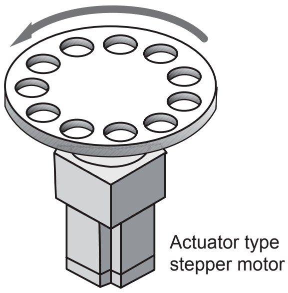
Ball screw drive



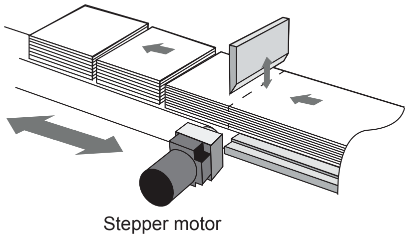
Wafer transfer robot control



Index Table



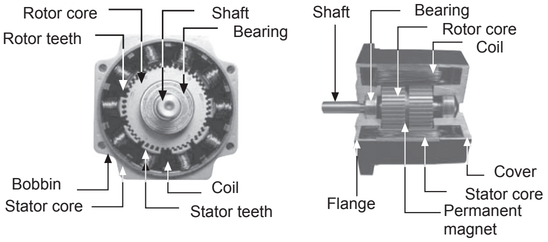
Cutting position control



Technical Description

▣ Overview

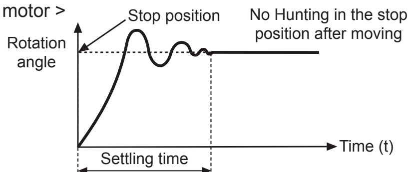
Stepper motor is a high accuracy position control motor which digital control rotating by a set mechanical angle decided by input pulses is available. It is available to control a rotation angle and speed accurately and it has lots of proper applications to be used. We have hybrid stepper motor with high characteristic such as a high accuracy and torque, which is used in a wide range of FA to OA field. Also, we have the driver (MD5/MD2U Series) and controllers (PMC Series) in order to get a high efficiency with our stepper motor.



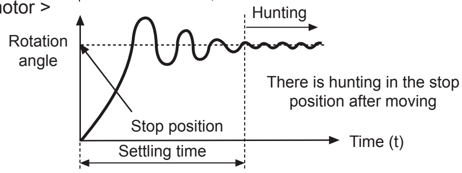
▣ Features

- It is available to control a rotation angle and speed easily.
  5-phase stepper motor is available to control the rotation angle and speed easily by electrical pulse (digital) signal as it is the motor rotating by a set mechanical angle decided by input pulse (digital) signal.
- It is a high torque and response motor.
  Stepper motor is small & light and can get a high torque. Also, rapid starting/stopping and reversing are available due to rapid acceleration as it has a stopping and starting torque.
- It is available to control a position in a high resolution and accuracy.
  Our 5-phase hybrid stepper motor rotates by 0.72°/ pulse and it is a high-resolution motor, which is available to rotate by 0.00288°/pulse when using micro step driver with 250 division. And, it stops in a high accuracy of ±3min (0.05° at non-load) when driving by 0.72°/pulse.
- It has a self-holding torque.
  5-phase stepper motor has a high holding torque when stopped in power on.
  Therefore, it is available to hold a stop position without mechanical break or control signal.
- Settling time is short and there is no hunting status when stopped.
  Settling time which motor axis is stopped after normal and reverse rotation by load inertia is short when motor is stopped at a stop position. There is no hunting which motor axis is stopped with delicate normal and reverse rotation when holding a stop position after settling time.

< Stepper motor >



< Servo motor >

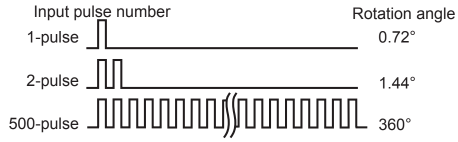


▣ Usage Of Stepper Motor

Stepper motor can control a rotation angle and speed easily by number and speed of input pulse as follows.

- Rotation angle control

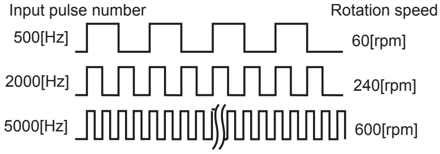
Rotation angle[°]=Step angle[°]×Pulse number



< Full step operation of 5-phase stepper motor (0.72°) >

- Rotation speed control

$$\text{Rotation speed[rpm]}=\frac{\text{Pulse speed[Hz]}}{360°/\text{Stop angle[°]}}\times 60\text{[Sec]}$$



< Full step operation of 5-phase stepper motor (0.72°) >

A driver only for the stepper motor and the controller only for controlling the driver are necessary in order to drive the stepper motor.

- **Stepper motor**

Autonics has various stepper motor to meet customer's needs.

- **5-phase stepper motor**

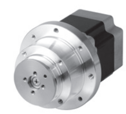

Shaft type
AK-Series


Hollow shaft type
AHK-Series


Geared type
AK-G Series


Built-in brake type
AK-B Series


Geared + Built-in brake type
AK-GB Series


Rotary actuator type
AK-R Series


Rotary actuator +
Built-in brake type
AK-RB Series

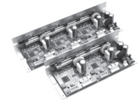
- **Driver**

It is an exclusive driving circuit to drive the stepper motor and provides power to the motor in the order of the motor phase. We have the dedicated drivers for stepper motor.

- **5-phase stepper motor driver**


MD5-ND14


MD5-HD14


MD5-HD14
-2X/3X


MD5-HF14


MD5-HF28

- **2-phase stepper motor driver**


MD2U-MD20

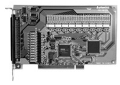

MD2U-ID20

● **Controller**

It controls a rotation angle and speed etc. of the stepper motor. We have the dedicated controllers.

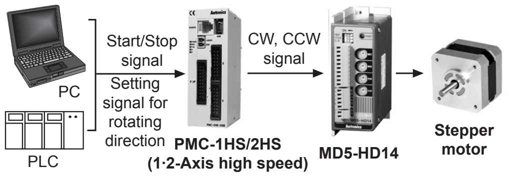
PMC-1HS/2HS (1/2-Axis high speed)

PMC-2HSP/2HSN (2-Axis high speed Interpolation Normal)



PMC-4B-PCI (4-Axis board type)

● **Stepper motor driving system**



▣ Micro Step?

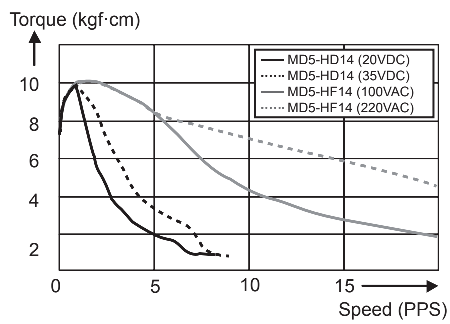
Micro step is a way to divide the basic step angle of the motor into smaller steps by decreasing the current to one phase. Micro step has the better resonance and vibration characteristics. It realizes high-accuracy controlling with smaller step angles divided by controlling coil current.

- Realizing low-speed / low-vibration and low noise driving
- Dividing motor's basic step angle into 250 divisions (0.72° to 0.00288°)

▣ DC Power Driver Vs AC Power Driver

◎ Characteristics

- In case of AC power supply, the higher speed, the better torque characteristics than DC power.
- Under the same driver conditions, the higher the power supply, the better torque characteristics motors can have. Proper safety countermeasures must be ensured when supplying high power supply. It may cause high heat generation.



DC Power Driver		AC Power Driver
● 20 to 35VDC ● Relatively low torque characteristics ● Simple circuit structure ● Cost effective	vs	● 100 to 220VAC ● High torque characteristics ● Relatively complex circuit structure due to DC to AC conversion circuit ● Expensive

▣ Failure Diagnosis and Countermeasures

◎ Resonance

The motor may cause resonance within the specific frequency area. Take the measurement before driving the motor.

- 5-phase stepper motor driver resonance area: Approx. 300 to 500pps
- 2-phase stepper motor driver resonance area: Approx. 200pps

● How to improve vibration characteristics

- Adjusting RUN current
- Changing input pulse frequency
- Applying micro step function
- Selecting geared type motors
- Using DAMPER
- Using anti-vibration rubber
- Using elastic couplings

◎ Heat generation

Possible causes for heat generation include applying higher power supply, driving with higher RUN current than rated current and long time & continuous driving without stops.

● How to improve heat generation characteristics

- Adjusting RUN current
- Adjusting RUN DUTY ratio (Setting STOP time longer than RUN time.)
- Mounting heat prevention panels
- Applying Auto current down, HOLD OFF functions
- Using a fan

◎ Missing step

A phenomenon that a stepper motor is incapable of rotating as the frequency of input pulse .

Major Causes	Troubleshooting
Motor failure	Change a motor
Rapid De/Acceleration of Motor	Reduce driving speed / Make motor's acceleration time longer
Improper motor torque selecting for load	Change a motor having high torque. Select a geared type motor
Wrong driving speed setting (lower than max. starting frequency)	Drive a motor within starting frequency band. (Refer to motor's characteristics.)
Low input current	Increase input current

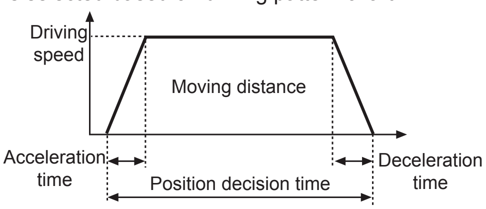
(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Calculation Method For Selecting Stepper Motor

It shows calculation method required in the selecting order. In real calculation it is impossible to get mechanical constant in many cases. Therefore, simple calculations are shown herewith.

◎ Decision of driving pattern

It is shown as the drawing converting the operation of the driving equipment to the rotating operation of the motor in the equipment using stepper motor. The below chart by starting speed acceleration /deceleration time, driving speed and position decision time of motor. The stepper motor is selected based on driving pattern chart.



< Driving Pattern >

● Calculation of Necessary pulse number

It is the number of the pulse that should be input to stepper motor in order to transfer an object from starting position to target position by the carrying equipment. It is calculated as follows.

Necessary pulse number

$$= \frac{\text{Moving distance of object}}{\text{Moving distance for 1 revolution}} \times \frac{360°}{\text{Step angle}}$$

● Calculation of the Driving pulse speed

It is the necessary pulse speed in order to rotate as much as the necessary pulse number in the set position decision time.

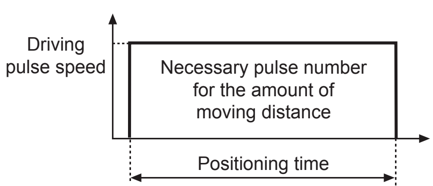
The necessary pulse number, the position decision time and the acceleration/deceleration time calculate the driving pulse speed.

1)For start-stop driving

Start-stop driving is what the stepper motor stops after revolving as much as the necessary pulse number for the position decision time operating in the driving pulse speed without acceleration/ deceleration on the motor driving. Start-stop driving is used when driving a motor in low speed. Also, it needs high acceleration/deceleration torque as it needs a rapid speed change. The driving pulse speed of start-stop driving is calculated as follows:

Driving pulse speed[Hz]

$$= \frac{\text{Necessary pulse number[Pulse]}}{\text{Positioning time[sec]}}$$



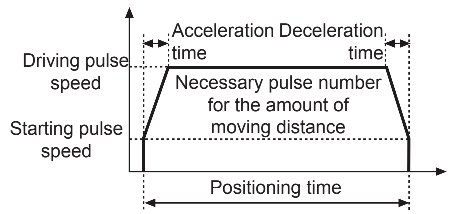
< Start-stop driving pattern >

2)For acceleration/deceleration driving

Acceleration/deceleration driving is what stepper motor stops decelerating the speed into the starting region after driving at the pulse speed for certain time when driving in accelerating the rotation speed of the motor by changing slowly the driving pulse speed in the starting region for the positioning time. Acceleration/deceleration time should be set properly depending on the carrying distance/speed and positioning time. In case of acceleration/deceleration driving it needs lower acceleration/deceleration torque than self-start driving as its speed changes gently. The driving pulse speed of acceleration /deceleration is calculated as below.

Driving pulse speed[Hz]

$$= \frac{\text{Necessary pulse number-Starting pulse speed [Hz]} \times \text{Acceleration·Deceleration time[sec]}}{\text{Positioning time[sec]} - \text{Acceleration·Deceleration time[sec]}}$$



< Acceleration·Deceleration driving pattern >

◎ Simple calculation of the necessary motor torque

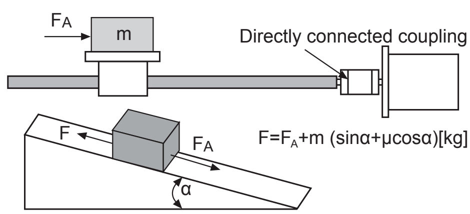
The necessary motor torque=
(Load torque + Acceleration·Deceleration torque)
× Safety rate

● Calculation of load torque (T_L)

Load torque indicates the friction power of a contacting part of the carrying equipment and this torque is always needed when the motor is driving.

Load torque is changed by the kinds of carrying equipment and the weight of an object. The calculation of load torque according to the kinds of carrying equipment is as below. Simple calculations without considering the constant are shown as below because it is impossible to get mechanical constant in many cases. Load torque can be calculated referring to below figures and numerical formulas.

1) Ball-Screw driving



※Calculation of load torque

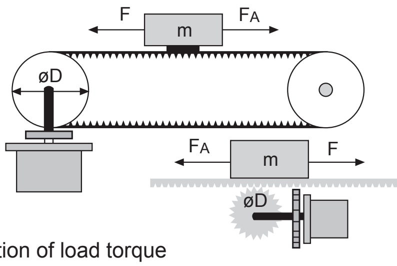
$$T_L = \left(\frac{F \cdot P_B}{2\pi\eta} + \frac{\mu_0 F_0 P_B}{2\pi} \right) \times \frac{1}{i} \text{ [kgf·cm]}$$

※Simple calculation of load torque

$$T_L = \frac{m \cdot P_B}{2\pi\eta} \times \frac{1}{i} \text{ [kgf·cm] (horizontal load)}$$

$$T_L = \frac{m \cdot P_B}{2\pi\eta} \times \frac{1}{i} \times 2 \text{ [kgf·cm] (vertical load)}$$

2) Wire-Belt/Rack-Pinion driving



※Calculation of load torque

$$T_L = \frac{F}{2\pi\eta} \times \frac{\pi D}{i} = \frac{FD}{2\eta i} \text{ [kgf·cm]}$$

$$F = F_A + m\,(\sin + \mu\cos\alpha) \text{ [kg]}$$

※Simple calculation of load torque

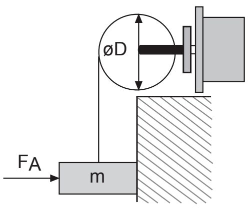
$$T_L = \frac{D}{2} \times m \times \frac{1}{\eta} \times \frac{1}{i} \text{ [kgf·cm] (horizontal load)}$$

$$T_L = \frac{D}{2} \times m \times \frac{1}{\eta} \times \frac{1}{i} \times 2 \text{ [kgf·cm] (vertical load)}$$

3) Pulley driving

※Calculation of load torque

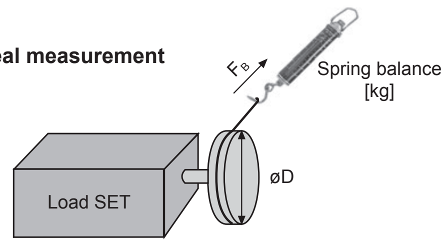
$$T_L = \frac{\mu F_A + m}{2\pi} \times \frac{\pi D}{i} = \frac{(\mu F_A + m)D}{2i} \text{ [kgf·cm]}$$



※Simple calculation of load torque

$$T_L = \frac{D}{2} \times m \times \frac{1}{i} \text{ [kgf·cm]}$$

4) By real measurement



It is the calculation method by reading the scale mark of the spring balance at the time when the pulley is rotated when drawing the spring balance slowly. It is available to get more accuracy load torque than by the calculation.
It is available to calculate the load torque as follows with the value (F_B) calculated by the spring balance.

$$T_L = \frac{F_B D}{2\pi} \text{ [kgf·cm]}$$

[Index]

- F : Load of axis direction[kg]
- η : Efficiency ratio (0.85 to 0.95)
- F_A : External force[kg]
- μ : Friction coefficient
- μ_0 : Internal friction coefficient of pre-pressure NUT (0.1 to 0.3)
- P_B : Ball-screw pitch[cm/rev]
- F_B : The force when starting the revolution of main shaft[kg]
- D : Outside diameter of pulley
- F_0 : Pre-pressure load [kg] (≅ 1/3 F)
- i : Deceleration rate
- m : The total weight of work and table[kg]
- α : Slop angle[°]

● Calculation of Acceleration/Deceleration torque (Ta)

Acceleration·Deceleration torque is for accelerating or decelerating the carrying equipment connected to the motor. It changes largely depending on the time of acceleration·deceleration and the value of load inertia moment of the carrying equipment. Therefore, the torque between self-start driving and acceleration·deceleration driving will show a big difference. Acceleration·Deceleration Torque is calculated as follows:

※For start-stop driving (high acceleration·deceleration torque is required)

Acceleration·Deceleration Torque[kg·cm] =

$$\frac{\text{Rotator inertia moment[kgf·m}^2\text{] + Load inertia moment[kg·m}^2\text{]}}{\text{Gravitational acceleration[cm/sec}^2\text{]}} \times \frac{\pi \times \text{Step angle[°]} \times \text{Driving frequency}^2\text{[Hz]}}{180 \ \times 3.6° \,/\, \text{Step angle[°]}}$$

※Acceleration/Deceleration driving

Acceleration·Deceleration Torque[kgf·cm] =

$$\frac{\text{Rotator inertia moment[kg·m}^2\text{] + Load inertia moment[kg·m}^2\text{]}}{\text{Gravitational acceleration[cm/sec}^2\text{]}} \times \frac{\pi \times \text{Step angle[°]}}{180°} \times \frac{\text{Driving frequency[Hz]-Starting frequency[Hz]}}{\text{Acceleration·Deceleration time[sec]}}$$

▣ Calculation Example For Motor Selection

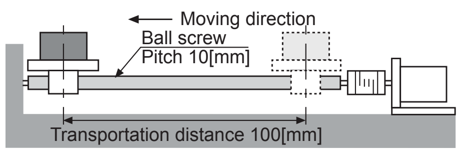
◎ Calculation of the number of the necessary pulse and the speed of the driving pulse.

These are practical examples for the number of the necessary pulse and the speed of the driving pulse with 5-phase stepper motor as below.

● When driving ball-screw

When carrying an object as follow figure for 1sec. by using 5-phase stepper motor (0.72°/step), the number of the necessary pulse and the speed of the driving pulse are calculated as follows:

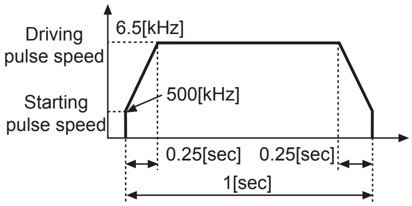
$$\text{Necessary pulse number} = \frac{100}{10} \times \frac{360°}{0.72°} = 5{,}000\text{[Pulse]}$$



If it executes start-stop driving for a second the speed of the driving pulse is calculated as 5,000[Pulse]/1[sec]=5[kHz] but, the start-stop driving is impossible at 5[kHz] and it should be driven with acceleration·deceleration driving. If calculating with setting the acceleration ·deceleration time as 25% of the position decision time and 500[Hz] of the starting pulse speed, it will be calculated as follows:

$$\text{Driving pulse speed[Hz]} = \frac{500\text{[Pulse]} - 500\text{[Hz]} \times 0.25\text{[sec]}}{1\text{[sec]} - 0.25\text{[sec]}} = 6.5\text{[kHz]}$$

It will be figured as follows:

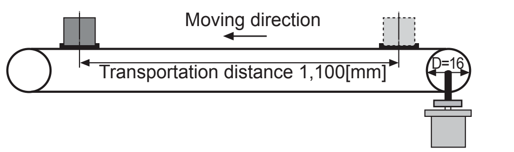


<Acceleration·Deceleration driving pattern >

● When driving the timing belt

When carrying an object as following figure for 1sec. by using 5-phase stepper motor (0.72°/step), the moving distance/revolution is approx. 50[mm] by 2πr as the circumference of the pulley. As the moving distance/revolution is 50[mm] the number of the necessary pulse is calculated as follows:

$$\text{Necessary pulse number} = \frac{1{,}100}{50} \times \frac{360°}{0.72°} = 11{,}000[\text{Pulse}]$$

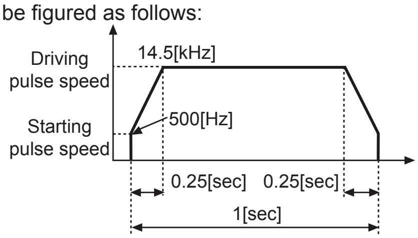


If driving with acceleration·deceleration like the example of a ball-screw the driving pulse speed is calculated as follows:

$$\text{Driving pulse speed[Hz]} = \frac{11{,}000[\text{Pulse}] - 500[\text{Hz}] \times 0.25[\text{sec}]}{1[\text{sec}] - 0.25[\text{sec}]}$$

$$= 14.5[\text{kHz}]$$

It will be figured as follows:



<Acceleration·Deceleration driving pattern >

◎ Calculation example of load torque (T_L)

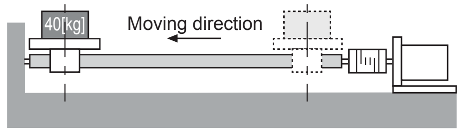
It is a real calculation example of load torque by using 5-phase stepper motor by simple numerical formulas.

● When using ball-screw for driving horizontal load

When carrying an object by using a ball-screw with 90[%] of efficiency and 40[kg] of the load weight as following figure, the load torque is calculated as follows;

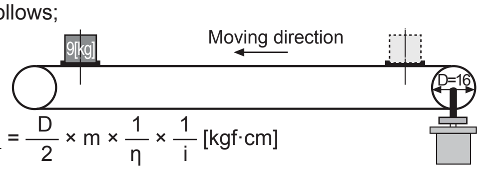
$$T_L = \frac{m \cdot P_B}{2\pi\eta} \times \frac{1}{i} \ [\text{kgf}\cdot\text{cm}]$$

$$T_L = \frac{40[\text{kg}] \times 1[\text{cm}]}{2\pi \times 0.9} \times \frac{1}{1} \fallingdotseq 7.07[\text{kgf}\cdot\text{cm}]$$



● When using timing belt for driving horizontal load

When carrying an object by using a timing belt with 90[%] of efficiency, 16[mm] diameter of pulley and 9[kg] of the load weight as following figure, the load torque is calculated as follows;

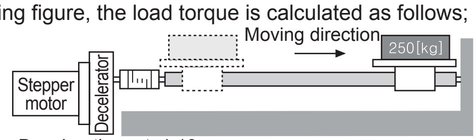


$$T_L = \frac{D}{2} \times m \times \frac{1}{\eta} \times \frac{1}{i} \ [\text{kgf}\cdot\text{cm}]$$

$$T_L = \frac{1.6[\text{cm}]}{2} \times 9[\text{kg}] \ \frac{1}{0.9} \times \frac{1}{1} = 8[\text{kgf}\cdot\text{cm}]$$

● When using ball-screw and decelerator for driving horizontal load

When carrying an object by using a ball screw with 5[mm] pitch, 90[%] of efficiency and 250[kg] of the load weight as following figure, the load torque is calculated as follows;



Deceleration rate1:10

$$T_L = \frac{m \cdot P_B}{2\pi\eta} \times \frac{1}{i} \ [\text{kgf}\cdot\text{cm}]$$

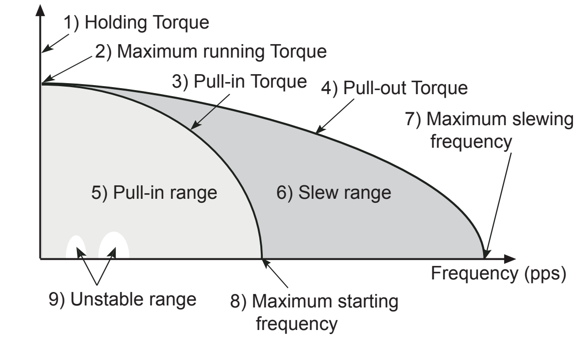
$$T_L = \frac{250[\text{kg}] \times 0.5[\text{cm}]}{2\pi \times 0.9} \times \frac{1}{10} = 2.21[\text{kgf}\cdot\text{cm}]$$

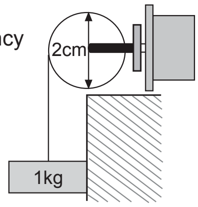
The calculation result is for a horizontal load. Vertical load torque is 2 times of the horizontal load torque. Its result is only for load torque.

Acceleration·Deceleration torque should be added for real necessary torque of the motor. But, it is very difficult to get the moment of load inertia in the calculation.

In order to solve the difficulty it will be easy to calculate applying the start-stop driving or a large safety rate when acceleration·deceleration is rapid at the calculated load torque.

■ Glossary





- Torque

Torque, moment of force, is the tendency of a force to rotate an object.
※Torque unit: N·m or kgf·cm
(1 N·m = 10.1972 kgf·cm)
※Required torque to rotate a rotator of which radius is 1cm in case of 1kg weight is applied.

- Refer to torque-frequency reference below. 1) to 6) have direct effect on driver's performance.

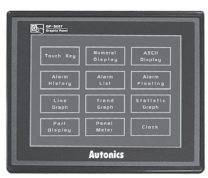
1) Holding torque
The amount of torque the motors produce at standstill while rated current is applied to the motors. In general, it is referred to as stepper motor's driving capacity.
2) Maximum running Torque
Max. torque when running stepper motor with low speed (10pps)
3) Pull-in torque
Max. torque to drive a load within starting frequency range.
4) Pull-out torque
Max. torque required for a stepper motor to drive without pull-out within maximum starting frequency.
5) Pull-in range (Max. starting range)
Max. torque range that a stepper motor can drive a load with a certain frequency lower than max. starting frequency. It is allowed for the load to start & stop and forward & reverse rotation without de/acceleration within pull-in range. In case of driving a motor out of pull-in range, start a motor within pull-in range and do de/acceleration driving.
6) Slew range (Pull-out range)
Max. torque range required for a stepper motor to drive without pull-out within maximum starting frequency
7) Maximum slewing frequency
Max. frequency at which a stepper motor can rotate without fail to synchronize when driving a motor within max. starting frequency range in order to increase input frequency.
8) Maximum starting frequency
Maximum frequency is required for stepper motors to start & stop and forward & reverse rotation without de/acceleration in the state of no load. If it is required to drive a motor with higher frequency than max. starting frequency, drive a motor from max. starting frequency and do de/acceleration driving.
9) Unstable range
Within low speed area, resonance may occur.
Drive the motor after taking the measurement for resonance area.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

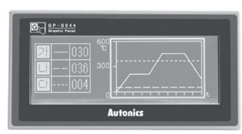
(R) Graphic Panels / Logic Panels

Graphic Panel
GP-S070

Graphic Panel
GP-S057

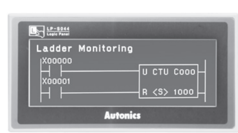


Graphic Panel
GP-S044



Logic Panel
LP-S070

Logic Panel
LP-S044



(A) Photoelectric Sensors
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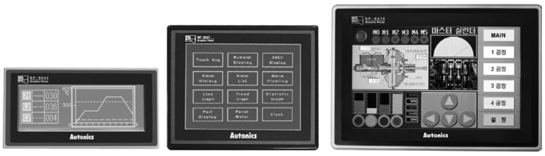
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

General Features

▣ GP (Graphic Panel)?



GP-S044 GP-S057 GP-S070

Graphic panel is HMI (Human Machine Interface) device that parameter monitors or changes via graphic interface by communication with PLCs, temperature controllers or other control units.
Graphic interface of GP is very effective to indicate value or status of parameter with visual interface that enables the communication between controllers and users.
GP is able to monitor parameters virtually with LCD screen, switch screen by touching screen, set or change parameters. GP connecting with controller via serial communication method translates data and displays various control parameters with graphic.
For example, in case of the target of parameters is the temperature, the numerical value of temperature is shown with a tag and the change in temperature for time can be monitored on the screen.

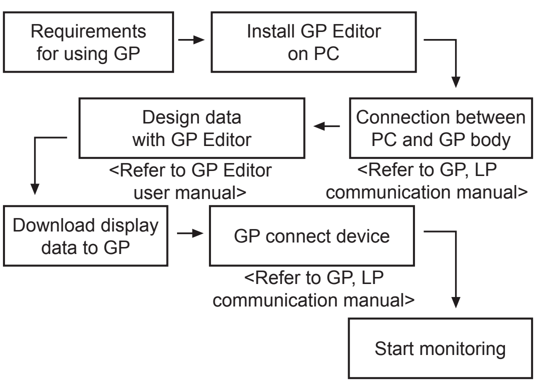
▣ Preparation For Using GP

The numerical value of temperature

Graph of temperature

1) GP body
2) PC
3) GP Editor
   - Software for drawing GP screen
4) Manual
   - GP editor user manual
   - LP, GP Communication manual
   - GP-S044/S057, GP-S070 user manual
5) Communication cable
   - Communication cable for PC connection
   - Communication cable for controller connection
6) Access devices
   (PLC or controller built in communication ports)

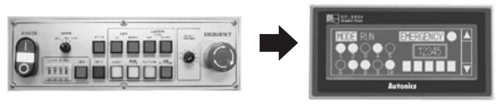
▣ Basic operation flow



▣ Advantages Of Using GP

◎ Simplifying complicated environment of operation and control parts

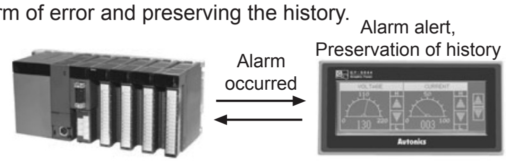
It visualizes mechanical control components such as buttons, switches and lamps so that saves cost and space and improves the preservation of devices.



Control part GP-S044

◎ Easy setting and change of production process

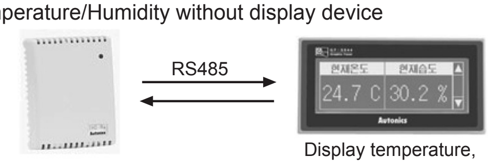
It memorizes the set conditions (recipe) of process in GP, and it sets or changes commands to PLC without PC. It enhances reliability of product line with fast corresponding alarm of error and preserving the history.



PLC GP-S044

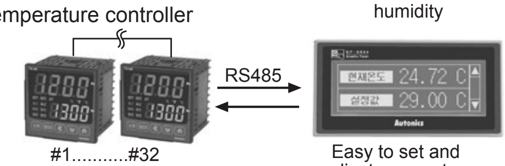
◎ Convenient setting by user

It sets complicated or non-displaying controller (Thermometer/hygrometer, temperature controller etc).
1)Temperature/Humidity without display device



Display temperature, humidity

2)Temperature controller



Easy to set and adjust parameter.

◎ Effective data control

It prints alarm history of controller using printer. It reads the data from barcode reader and save it in PLC.
1)PLC/Printer

PLC GP-S044 Printer

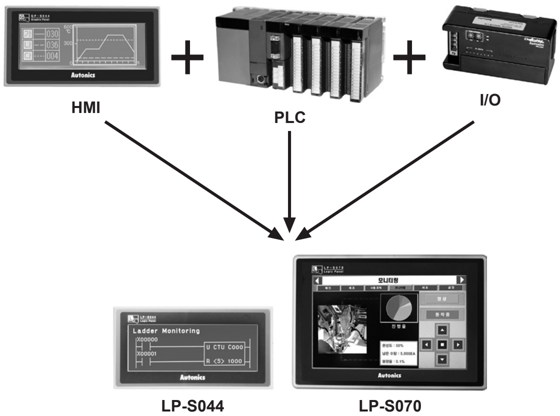
2)Barcode reader/PLC

GP-S044 PLC

◎ Communication between heterogeneous controllers

PLC GP-S044 Thermometer/ hygrometer

▣ LP (Logic Panel)?



Logic Panels are designed for being used as an integrated control panel which used to consist of HMI, PLC and I/O. Through one single integrated logic panel, it realizes cost saving, reduced wire works, space saving, and easy operation. The logic panel perfectly supports serial communication and editing display with GP Editor and about 250 commands from SmartStudio, dedicated logic programs, allowing accelerating product development and designing. And also this device can control and monitor various output devices (sensors, buttons, etc.) and output devices (solenoids, lamps, motors, etc.) individually.

▣ Preparations For Using LP

1) LP body
2) PC
3) Software
   ① GP Editor
   - Software for drawing LP screen
   ② SmartStudio
   - Software for logic program
4) Manual
   - GP Editor user manual
   - GP,LP Communication manual
   - SmartStudio user manual
   - SmartStudio programming manual
   - LP-S044, LP-S070 user manual
   - LP Series command manual
5) Communication cable
   - Communication cable for PC connection
   - Communication cable for controller connection
6) Access device
   (PLC or controller built in communication ports)

▣ Basic Operation Flow

Requirements for using LP

↓

<Refer to GP Editor user manual and SmartStudio>

Install drawing program (GP Editor) and logic program (Smart Studio) on PC

↓

<Refer to communication manual>

Connection PC with LP body
※When LP turns on, RUN/STOP switch holds STOP position.

↓

<Refer to the SmartStudio programming manual>

Make Logic program with SmartStudio

↓

Download logic data to LP body

↓

Disconnect Smart Studio with LP body/
Connect GP Editor with LP body

↓

Create screen or download to LP body

↓

Test
※RUN/STOP switch holds RUN position.

↓

Debugging or editing program

↓

Control or start monitoring

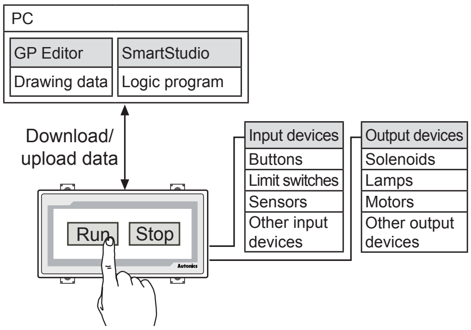
※Refer to the manual for details on website (www.autonics.com) resources.

General Features

▣ System Configurations

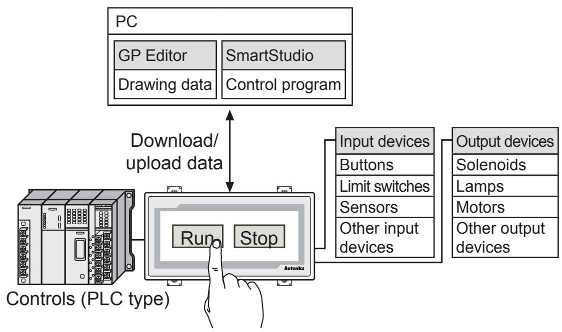
◎ Stand alone (LP Series)

Stand alone system in LP Series controls a variety of I/O without adding other devices and monitors and control operation element through direct screen touch. (device, parameter, etc.)



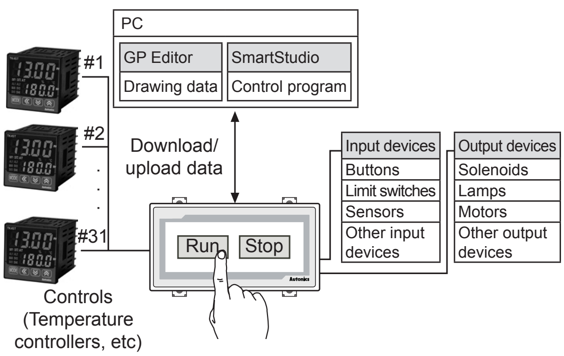
◎ 1:1 configuration (GP/LP Series)

The device function makes it possible to monitor the operation data (device, parameter, etc.)



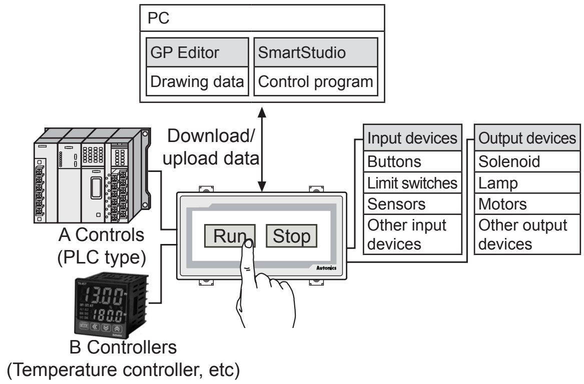
◎ 1:N configuration (GP/LP Series)

The device function makes it possible to monitor the operation element (device, parameter, etc.) by connecting in a 1:N configuration (Up to 32 units)



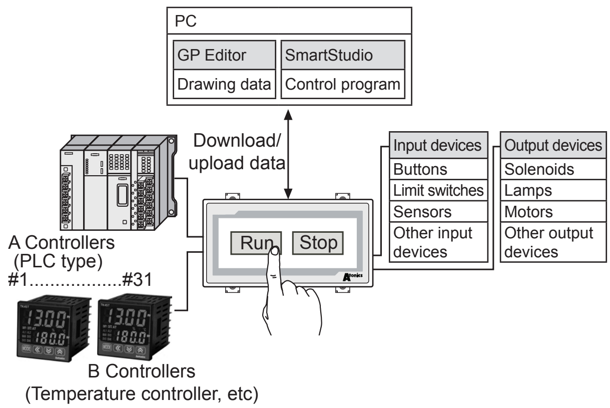
◎ 1:1:1 configuration (GP/LP Series)

The device function makes it possible to monitor, control and the operation element (device, parameter, etc.) between different devices using two separate communication port.



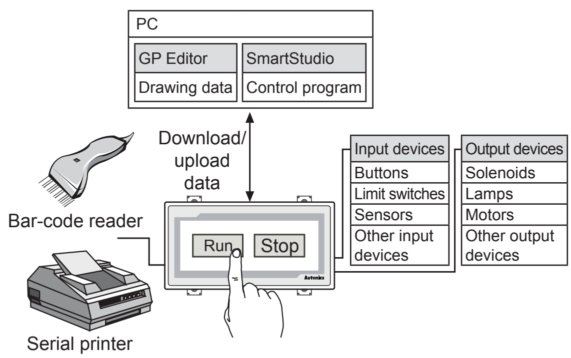
◎ 1:1 N configuration (GP/LP Series)

The device function makes it possible to monitor, control and the operation element (device, parameter, etc.) between different devices using two separate communication port.. In case of RS-422 port, 1:N is available only. (Up to 31 units).



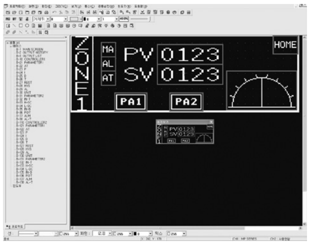
◎ Bar-code, printer connection (GP/LP Series)

It can read bar-code and print a history using printer.



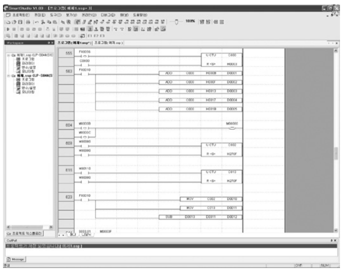
▣ Software

◎ GP Editor (Drawing program)



- This drawing software is for GP/LP Series.
- GP Editor is the software that allows creating a screen and designs a tag layout, and then transfers the data from screen to GP/LP. After download, GP/LP starts monitoring according to your screen data.

◎ SmartStudio (Logic program)



- Logic software is for LP Series.
- Support multi-project
  : It is possible to open maximum 5 projects at the same time.
- Easy program editing
  : Block of cell units can be edited.
  Split-screen editing is available.
  It provides various editing screens such as variable screen, describe screen, variable /describe screen, etc,.
- Various monitor functions
  : It provides monitor functions such as variable monitor, device monitor and system monitor, time chart.
- Comfortable user interface
  : It ensures easy operation with Microsoft windows layout.
- Wide range of Message windows
  : It supports various message windows to edit and check program.
- Real time convert ladder to mnemonic
  : Ladder and mnemonic can be written and read to edit simultaneously.

Visit our website (www.autonics.com) and download software or manuals.

< Computer specification for using software>

Item	Minimum requirements
System	IBM PC compatible computer with Pentium Dual Core or above
Operations	Microsoft Windows 98/NT/XP/7
Memory	1G+
Hard disk	5GB+ of available hard disk space
VGA	1028×1024 or higher resolution display
Others	• GP/LP-S044, S057: RS232C port • GP/LP-S070: RS232C port, USB port, ETHERNET port

▣ Manual

◎ GP/LP common manual

- GP Editor user manual
  This section describes how to make screen data and use HMI function with GP Editor.
- Communication manual
  For more information of serial connection with external devices such as PLC, refer to manual before connecting.
- GP-S044/S057, GP-S070 user manual
  The manual describes installation and system organization and menus.

◎ LP manual

- SmartStudio manual
  This section describes how to install and use SmartStudio.
- Programming manual
  The manual has command and instruction.
- LP-S044, LP-S070 user manual
  The manual describes installation and system organization and menus.
- LP Series instruction manual
  The manual has LP installation, system configuration and instruction.

▣ Precaution For Using

- Do not press touch panel with hard and sharp object.
- Please store the device in the recommended temperature range, or LCD panel can be damaged.
- Please check pin number shown in "Communication manual" when connect communication port
- Do not block the ventilating opening of this product.
- Do not use or store it in a place with direct ray of light or dust.
- Do not use or store it in a place with shock or vibration.
- The ground wire of GP/LP should be grounded separately.
  The ground resistance should be max. 100Ω, please use the wire of min. 1.25mm² dimension.
- Please check the pin number and connect to GP/LP communication port.
- Please tighten bolt on terminal block with specified tightening torque.
- When liquid crystal from the broken LCD is smeared on your skin, wash it for 15 minutes. If it is gotten in your eye, wash it for 15 minutes and contact a medical specialist for more information.
- Do not inflow dust or wire dregs into the unit.
- For cleaning, do not use water or an oil-based detergent, use dry towels.
- It should be done away regarded as an industrial waste.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
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(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

General Features

■ Connectable Devices With GP/LP

Series	Connectable device	Connection type	GP-S057	GP/LP-S044	GP/LP-S070
LS Master-K	MK-10S1	CPU direct connection loader	○	○	○
	MK-80S	CPU direct connection loader	○	○	○
	MK-120S	CPU direct connection loader	○	○	○
	MK-200S	CPU direct connection loader	○	○	○
	MK-300S	CPU direct connection loader	○	○	○
	MK-1000S	CPU direct connection loader	○	○	○
LS Glofa	GM4	CPU direct connection loader	○	○	○
	GM6	CPU direct connection loader	○	○	○
	GM7U	CPU direct connection loader	○	○	○
LS CNET (Cnet integrated CPU)	MK-80S	Cnet	○	○	○
	MK-120S	Cnet	○	○	○
	MK-200S	Cnet	○	○	○
LS CNET (For Cnet unit)	MK-80S	Cnet	○	○	○
	MK-120S	Cnet	○	○	○
	MK-200S	Cnet	○	○	○
	MK-300S	Cnet	○	○	○
	MK-1000S	Cnet	○	○	○
LS XGT (For Cnet unit)	XGK- PUS	Cnet	○	○	○
LS XGB (Cnet integrated CPU)	XBM	Cnet	○	○	○
	XBC	Cnet	○	○	○
LS XGB (For Cnet unit)	XBM	Cnet	○	○	○
	XBC	Cnet	○	○	○
OEMAX (SAMSUNG)	N70	Cnet	○	○	○
	N70Plus	Cnet	○	○	○
OEMAX FARA	NX7	CPU direct connection loader	○	○	○
	NX70	CPU direct connection loader	○	○	○
MITSUBISHI FX	FX1S	CPU direct connection loader	○	○	○
	FX1N	CPU direct connection loader	○	○	○
	FX2N	CPU direct connection loader	○	○	○
	FX2NC	CPU direct connection loader	○	○	○
	FX3U	CPU direct connection loader	○	○	○
MITSUBISHI Q (For Cnet unit)	Q00J	Cnet	○	○	○
	Q00	Cnet	○	○	○
	Q01	Cnet	○	○	○
	Q02	Cnet	○	○	○
	Q02H	Cnet	○	○	○
	Q06H	Cnet	○	○	○
	Q12H	Cnet	○	○	○
	Q25H	Cnet	○	○	○
NAIS FP	FP0-C10	CPU direct connection loader	○	○	○
	FP0-C14	CPU direct connection loader	○	○	○
	FP0-C16	CPU direct connection loader	○	○	○
	FP0-C32	CPU direct connection loader	○	○	○
	FPG- C24R2	CPU direct connection loader	○	○	○
	FPG- C32T	CPU direct connection loader	○	○	○
	FPG- C32T2	CPU direct connection loader	○	○	○
	FP0R-C10	CPU direct connection loader	○	○	○
	FP0R-C14	CPU direct connection loader	○	○	○
	FP0R-C1	CPU direct connection loader	○	○	○
	FP0R-C32	CPU direct connection loader	○	○	○
	FP0R-T32	CPU direct connection loader	○	○	○
	FP0R-F32	CPU direct connection loader	○	○	○
SIEMENS SIMATIC S7-200	CPU221	CPU direct connection loader	○	○	○
	CPU222	CPU direct connection loader	○	○	○
	CPU224	CPU direct connection loader	○	○	○
	CPU224XP	CPU direct connection loader	○	○	○
	CPU224XPsi	CPU direct connection loader	○	○	○
	CPU226	CPU direct connection loader	○	○	○

■ Connectable Devices With GP/LP

Series	Connectable device	Connection type	GP-S057	GP/LP-S044	GP/LP-S070
SIEMENS SIMATIC S7-300	CPU312	CPU direct connection loader	○	○	○
	CPU312C	CPU direct connection loader	○	○	○
	CPU313C	CPU direct connection loader	○	○	○
	CPU313C-2	CPU direct connection loader	○	○	○
	CPU314	CPU direct connection loader	○	○	○
	CPU314C-2	CPU direct connection loader	○	○	○
	CPU315-2	CPU direct connection loader	○	○	○
	CPU317-2	CPU direct connection loader	○	○	○
	CPU319-3	CPU direct connection loader	○	○	○
Allen-Bradley	MicroLogicx 1000	CPU direct connection loader	○	○	○
	MicroLogicx 1200	CPU direct connection loader	○	○	○
	MicroLogicx 1500	CPU direct connection loader	○	○	○
OMRON SYSMAC C	CPM 1A	CPU direct connection loader	○	○	○
OMRON Temperature controller	E5AN	Modbus	○	○	○
	E5AR	Modbus	○	○	○
	E5CN	Modbus	○	○	○
	E5EN	Modbus	○	○	○
	E5ER	Modbus	○	○	○
AUTONICS	MT Series	Private communication	○	○	○
		Modbus	○	○	×
		Modbus (TYPE A)	○	○	○
	MP Series	Private communication	○	○	○
	THD Series	Modbus	○	○	×
		Modbus (TYPE A)	○	○	○
	TZ Series	Private communication	○	○	○
	TK Series	Modbus	○	○	×
		Modbus (TYPE A)	○	○	○
	TM Series	Modbus	○	○	×
		Modbus (TYPE A)	○	○	○
	CT Series	Modbus	○	○	×
		Modbus (TYPE A)	○	○	○
	DS/DA Series	Modbus (TYPE A)	○	○	○
	ARM Series	Modbus (TYPE A)	○	○	○
	LP-S044, LP-S070	CPU	○	○	○
			○	○	○
	DPU Series	Modbus	○	○	×
		Modbus (TYPE A)	○	○	○
	KRN1000	Modbus	○	○	×
		Modbus (TYPE A)	○	○	○
	KRN100	Modbus	○	○	×
		Modbus (TYPE A)	○	○	○
	KRN50	Modbus	○	○	×
		Modbus (TYPE A)	○	○	○
DELTA	DTB Series	Modbus	○	○	×
		Modbus (TYPE A)	○	○	○
DANFOSS	FC Series	Modbus	×	×	×
		Modbus (TYPE A)	○	○	○
UNIVERSAL	UNIVERSAL	Modbus (Slave)	○	○	○
MODBUS MASTER	MODBUS MASTER	Modbus (Master)	○	○	○

※GP/LP connectable device list will keep updated according to the upgrade of GP Editor or additional patch. It is recommended to use the latest version of Editor.

※Applicable GP/LP firmware version is determined by GP Editor version. Whole GP system goes down if non-compatible firmware version is used.

※Visit our website (www.autonics.com) to check update of latest GP Editor and GP/LP firmware and to get more detailed instructions.

※Refer to the user manual to select proper communication cable between GP and controllers. (Sold separately)

Product Overview

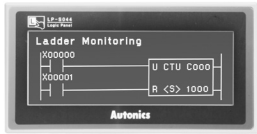
Graphic Panel

Model		GP-S044-S1D0	GP-S044-S1D1	GP-S057-S1D0	GP-S057-S1D1
Appearances & Dimensions		 [W145×H75×L38mm] **4.4 inch MONO**		 [W156×H132×L35.5mm] **5.7 inch MONO**	
Power supply		24VDC			
Power consumption		Max. 3.6W			
Serial interface		Each port of RS232C, RS422 (asynchronous method)	Two ports of RS232C (asynchronous method)	Each port of RS232C, RS422 (asynchronous method)	Two ports of RS232C (asynchronous method)
Display performance	LCD type	4.4 inch STN Blue Negative		5.7 inch STN Blue Negative	
	Resolution	240×80 dot		320×240 dot	
	Display area	112.8×37.6mm		119×91mm	
	Color	MONO (Blue, White)			
Graphic drawing performance	Text	Up to 400 characters		Up to 1590 characters	
	Graphic drawing memory	512KB			
	Number of user screen	500 pages			
	Touch switch	Width 15×Height 4=60		Width 16×Height 12=192	
Reference		**R-10 to 12**		**R-13 to 16**	

Graphic Panel

Model		GP-S070-T906	GP-S070-T907
Appearances & Dimensions		 [W194×H134×L35mm] **7 inch TFT Color LCD**	
Power supply		24VDC	
Power consumption		Max. 7.2W	
Serial interface		Each port of RS232C, RS422 (asynchronous method)	Two ports of RS232C (asynchronous method)
USB interface		Each of USB HOST, USB Device (Version 1.1)	
Ethernet interface		IEEE802.3 (U), 10/100Base-T	
Display performance	LCD type	7 inch TFT Color LCD	
	Resolution	800×480 dots	
	Display area	152.4×91.44mm	
	Color	16,777,216 color	
Graphic drawing performance	Text	•Vector font •6×8, 8×8 ASCII character, High quality view of numbers •8×16 ASCII characters, 16×16 character by each country (1 to 8 times bigger for width, 0.5 to 5 times bigger for height)	
	Graphic drawing memory	16MB	
	Number of user Screen	500 pages	
	Touch switch	Analog touch	
Reference		**R-17 to 20**	

Logic Panel

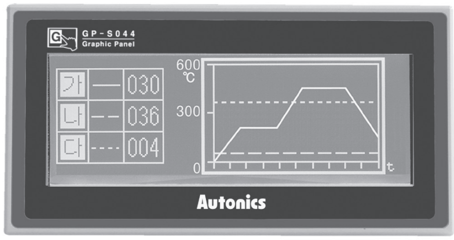
Model		LP-S044-S1DO-C5T-A	LP-S044-S1DO-C5R-A	LP-S044-S1D1-C5T-A	LP-S044-S1D1-C5R-A
Appearances & Dimensions		CE KC  [W145×H75×L54.5mm] **4.4 inch MONO**			
Power supply		24VDC ±10%			
Power consumption		Max. 3.6W			
Serial interface		Each port of RS232C, RS422 (asynchronous method)		Two ports of RS232C (asynchronous method)	
Display performance	LCD type	4.4 inch STN Blue Negative			
	Resolution	240×80 dot			
	Display area	112.8×37.6mm			
	Color	MONO (blue, white)			
Graphic drawing performance	Text	Up to 400 characters			
	Graphic drawing memory	384KB			
	Number of user screen	500 pages			
	Touch switch	Width 15×Height 4=60			
Control performance	Command	Basic command: 28, application command: 220			
	Program capacity	8K step			
	Processing time	Average 6 to 7μs/step			
Input/Output performance	I/O point	Input 16-point/Output 16-point			
	I/O connector type	Terminal block connector	Ribbon cable connector	Terminal block connector	Ribbon cable connector
Reference		**R-21 to 25**			

Logic Panel

Model		LP-S070-T9D6-C5T	LP-S070-T9D6-C5R	LP-S070-T9D7-C5T	LP-S070-T9D7-C5R
Appearances & Dimensions		CE KC  [W194×H134×L35mm] **7 inch TFT Color LCD**			
Power supply		24VDC			
Power consumption		Max. 7.2W			
Serial interface		Each port of RS232C, RS422 (asynchronous method)		Two ports of RS232C (asynchronous method)	
USB interface		Each of USB Host, USB Device (Version 1.1)			
Ethernet interface		IEEE802.3 (U), 10/100Base-T			
Display performance	LCD type	7 inch TFT Color LCD			
	Resolution	800×480 dots			
	Display area	152.4×91.44mm			
	Color	16,777,216 color			
Graphic drawing performance	Text	• Vector font • 6×8, 8×8 ASCII character, High quality view of numbers • 8×16 ASCII characters, 16×16 character by each country (1 to 8 times bigger for width, 0.5 to 5 times bigger for height)			
	Graphic drawing memory	16MB			
	Number of user screen	500 pages			
	Touch switch	Analog touch			
Control performance	Command	Basic command: 28, application command: 233			
	Program capacity	8K step			
	Processing time	Average: Approx. 2us/basic command, application command			
	Special function	Positioning function ※ Refer to the 'LP-S070 user manual'			
Input/Output performance	Input/output point	Input 16 point/Output 16 point			
	I/O connector type	Terminal block connector	Ribbon cable connector	Terminal block connector	Ribbon cable connector
Reference		**R-26 to 30**			

38mm Slim Design, Touch Screen, And Better Reliability Graphic Panel, GP-S044

4.4 inch
MONO



■ Features

- Displays max. 400 characters
- Enables to save max. 500 pages of user screen
- Easy software upgrade available on website
  (1) GP firmware file
  (2) GP Editor (drawing program)
  (3) Additional protocol
- Different devices monitoring function
  : Allows to monitor and control the variables of additionally connected controllers(such as PLC) with external communication port
- Supports multilingual
  : Supports Korean, Japanese, English, Chinese, Russian, Vietnamese and Portuguese. Additional languages will be available by firmware.
- Supports multi-font
  : It provides various bitmap and user-selected fonts.
- Various multi-communication port
  : Both RS232C 2 port and RS232C/RS422 compound port are provided.
- Device monitoring function
  : It enables to monitor GP devices and connected controller devices by GP without graphic design data.
- Printer and barcode reader connection
  : It enables to print alarm history connecting a printer and read barcode connecting a barcode reader.
- Compact design
- Various display function
  : It displays data by various tags.

⚠ Please read "Caution for your safety" in operation manual before using.

※**GP-S044 Series is a replacement of GP-2480 Series, discontinued product.**

■ Manual

Visit our webwite (www.autonics.com) to download 'GP Editor user manual' or 'GP, LP user manual for communication', 'GP-S044/S057 user manual'.

- **GP Editor user manual**
  It describes how to write screen data, and is about related usage of GP-S044 HMI function.
- **GP, LP user manual for communication**
  It describes connection for external devices such as PLC.
- **GP-S044/S057 user manual**
  It describes general information on the installation and usage of GP-S044 and system contents.

■ Ordering Information

Model	Item	Series	Monitor size	Display unit	Color	Power supply	Interface
GP-S044-S1D0	Graphic panel	S series	4.4 inch	STN LCD	MONO (blue, white)	24VDC	Each port of RS232C, RS422
GP-S044-S1D1							Two ports of RS232C

■ Specifications

Model		GP-S044-S1D0	GP-S044-S1D1
Power supply		24VDC	
Allowable voltage range		90 to 110% of power supply	
Power consumption		Max. 3.6W	
Display performance	LCD type	4.4 inch STN Blue Negative	
	Resolution	240×80 dots	
	Display area	112.8×37.6mm	
	Color	MONO (blue, white)	
	LCD view angle	Top/Bottom/Left/Right within 30° in each direction	
	Backlight	White LED	
	Brightness	Adjustable by software	
Graphic drawing performance	Language※1	English, Korean, Japanese, Chinese, Russian, Vietnamese, Portuguese	
	Text	• High resolution display up to 400 letters (6×8 font) • 6×8, 8×8 ASCII characters, high definition numbers • 8×16 ASCII characters, 16×16 character by each country (1-8 times bigger for width, 0.5-5 times bigger for height)	
	Graphic drawing memory	512 KB	
	Number of user screen	500 pages	
	Touch switch	Width 15×Height 4 = 60	
Serial interface		Each port of RS232C, RS422 (asynchronous method)	Two ports of RS232C (asynchronous method)
Real-time controller		RTC embedded	
Battery life cycle		Approx. 3 years at 25℃	
Insulation resistance		Over 100MΩ (at 500VDC megger)	
Ground		3rd grounding (max. 100Ω)	
Noise immunity		± 0.5kV the square wave noise (pulse width: 1µs) by the noise simulator	
Dielectric strength		500VAC (50/60Hz) for 1 min	
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour	
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min	
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times	
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Environ-ment	Ambient temperature	0℃ to 50℃, storage: -20℃ to 60℃	
	Ambient humidity	35 to 85% RH, storage: 35 to 85% RH	
Protection structure		IP65F (for front panel)	
Accessory		Fixing bracket: 4, Rubber waterproof ring, Battery (included)	
Approval		CE	
Weight※2		Approx. 413g (approx. 284g)	

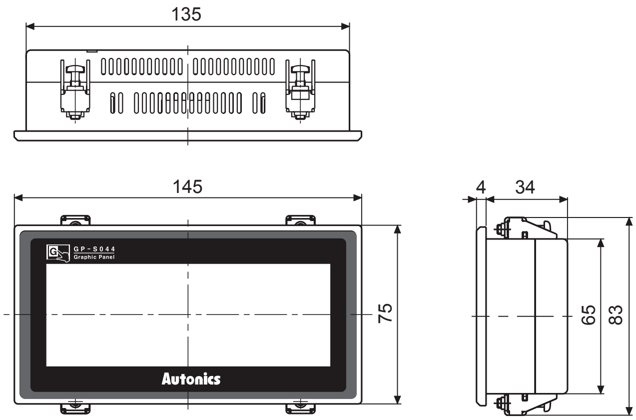
※1: Language could be added in the future ※2: This weight is with packaging and the weight in parentheses is only unit weight.
※Environment resistance is rated at no freezing or condensation.

■ Functions

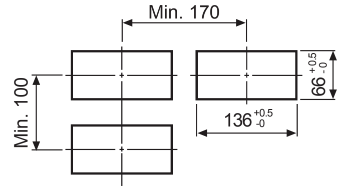
Figure display		Line, rectangle, circle, text, bitmap
Tags	Numeral display	Displays the designated device as numerical value. (decimal, hexadecimal, octal, binary, real number)
	ASCII display	Displays the designated device value as ASCII character.
	Time display	Displays current time or date.
	Alarm history	Registers alarm history.
	Alarm list	Displays generated (not recovered) alarm.
	Comment display	Displays the designated comment as device status or value.
	Lamp	Displays lamp as device status.
	Part display	Displays the designated parts as device status and value.
	Line graph	Displays several device values with a graph of broken line.
	Trend graph	Displays change of device value for time with a graph of broken line.
	Bar graph	Displays a device value with a bar graph.
	Statistic graph	Displays a ratio of several device values with pie graph.
	Panel meter	Displays a device value as panel meter.
	Touch key	Screen is switched, word/bit device values are set when it touched.
	Numeral input	Configures user input value in device.
	ASCII input	Configures user input ASCII code value in device.
System information function		Monitors/Controls GP operation from PLC.
Recipe function		Reads/Writes several PLC device collectively.
Security function		Only acceptable user can observe/operate important data.
Barcode read function		Connects barcode reader, read barcode.
Floating alarm function		Warning message is floated when alarm is generated.
Time operation		Specific bit device is ON/OFF for designated day and time.
Overlap window		Available to form dynamically overlapping another base screen on the base one.
Observe status function		Changes PLC device status/value of PLC when trigger is generated.

■ Dimensions

(unit: mm)

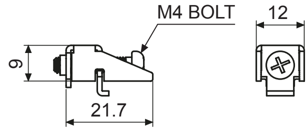


● **Panel cut-out**

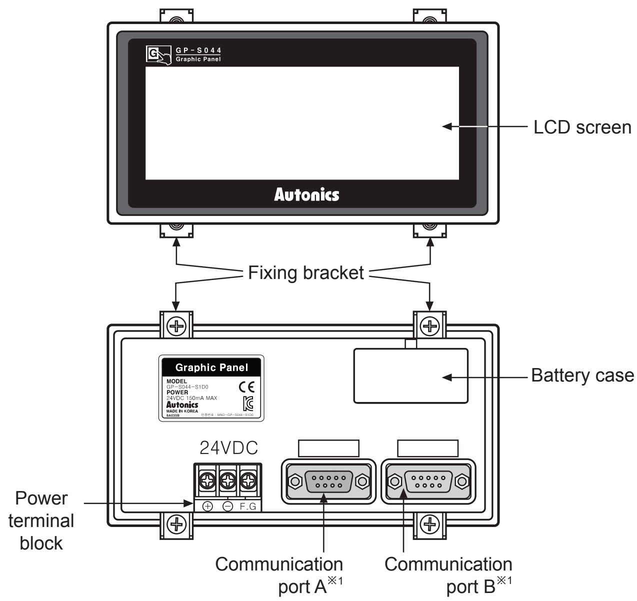


※Panel thickness: Max. 4mm

● **Fixing bracket**



■ Unit Description



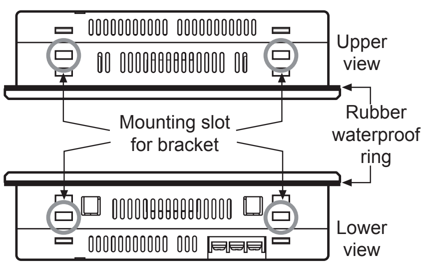
※1: Communication port

Model \ Communication port	Port A	Port B
GP-S044-S1D0	RS422	RS232C
GP-S044-S1D1	RS232C-A	RS232C-B

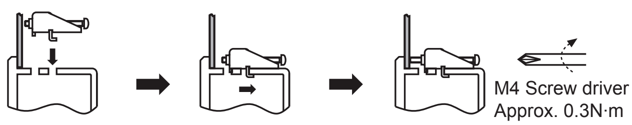
※For more information, refer to page R-31 and '■ Serial Interface' of GP/LP Common Features.

■ Installation

1. Set a rubber waterproof ring after placing the ring's joining part under the GP-S044.
2. Adhere closely between each edge of the GP-S044 and the rings.
3. Set GP-S044 in panel.
4. Set the fix bracket to 4 bracket slots and fix them with bracket's screws.



● **Mounting bracket**

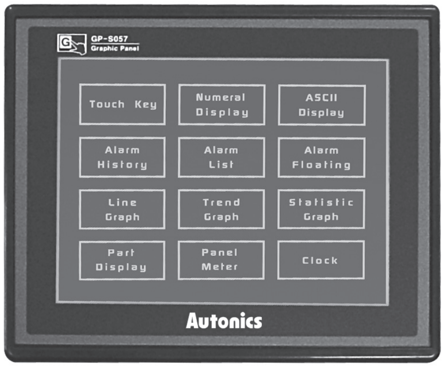


■ Sold Separately

Transmission cables connectable with external devices such as PLC are sold separately. (refer to page R-32 for "GP/LP Communication Cables".)

High Visibility With 5.7 Inch Wide Screen And Extended Data Utility Range Graphic Panel GP-S057

■ Features



5.7 inch MONO

- Displays max. 1590 characters
- Enables to save max. 500 pages of user screen
- Easy software upgrade available on website
  (1) GP firmware file
  (2) GP Editor (drawing program)
  (3) Additional protocol
- Different devices monitoring function
  : Allows to monitor and control the variables of additionally connected controllers(such as PLC) with external communication port
- Supports multilingual
  : Supports Korean, Japanese, English, Chinese, Russian, Vietnamese and Portuguese.
  Additional languages will be available by firmware.
- Supports multi-font
  : It provides various bitmap and user-selected fonts.
- Various multi-communication port
  : Both RS232C 2 port or RS232C/RS422 compound port are provided.
- Device monitoring function
  : It enables to monitor GP devices and connected controller devices by GP without graphic design data.
- Printer and barcode reader connection
  : It enables to print alarm history connecting a printer and read barcode connecting a barcode reader.
- Compact design
  : Minimizes module size and installation places by 5.7 inch display area
- Various display function
  : It displays data by various tags.

⚠ Please read "Caution for your safety" in operation manual before using.

■ Manual

Visit our webwite (www.autonics.com) to download 'GP Editor user manual' or 'GP, LP user manual for communication', 'GP-S044/S057 user manual'.

- **GP Editor user manual**
  It describes how to write screen data, and is about related usage of GP-S057 HMI function.
- **GP, LP user manual for communication**
  It describes connection for external devices such as PLC.
- **GP-S044/S057 user manual**
  It describes general information on the installation and usage of GP-S057 and system contents.

■ Ordering Information

Model	Item	Series	Monitor size	Display unit	Color	Power supply	Interface
GP-S057-S1D0	Graphic panel	S series	5.7 inch	STN LCD	MONO (blue, white)	24VDC	Each port of RS232C, RS422
GP-S057-S1D1							Two ports of RS232C

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

■ Specifications

Model		GP-S057-S1D0	GP-S057-S1D1
Power supply		24VDC	
Allowable voltage range		90 to 110% of power supply	
Power consumption		Max. 3.6W	
Display performance	LCD type	5.7 inch STN blue negative	
	Resolution	320×240 dots	
	Display area	119×91mm	
	Color	MONO (blue, white)	
	LCD view angle	Top/Bottom/Left/Right within 30°in each direction	
	Backlight	White LED	
	Brightness	Adjustable by software	
Graphic drawing performance	Language※1	English, Korean, Japanese, Chinese, Russian, Vietnamese, Portuguese	
	Text	• High resolution display up to 1590 letters (6×8 font) • 6×8, 8×8 ASCII character, high definition numbers • 8×16 ASCII characters, 16×16 character by each country (1-8 times bigger for width, 0.5-5 times bigger for height)	
	Graphic drawing memory	512 KB	
	Number of user screen	500 pages	
	Touch switch	Width 16×Height 12 = 192	
Serial interface		Each port of RS232C, RS422 (asynchronous method)	Two ports of RS232C (asynchronous method)
Real-time controller		RTC embedded	
Battery life cycle		Approx. 3 years at 25℃	
Insulation resistance		Over 100MΩ (at 500VDC megger)	
Ground		3rd grounding (max. 100Ω)	
Noise immunity		± 0.5kV the square wave noise (pulse width: 1μs) by the noise simulator	
Dielectric strength		500VAC (50/60Hz) for 1 min	
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour	
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min	
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times	
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Environ-ment	Ambient temperature	0 to 50℃, storage: -20 to 60℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Protection structure		IP65F (for front panel)	
Accessory		Fixing bracket: 4, Rubber waterproof ring, Battery (included)	
Approval		CE	
Weight※2		Approx. 555g (approx. 376g)	

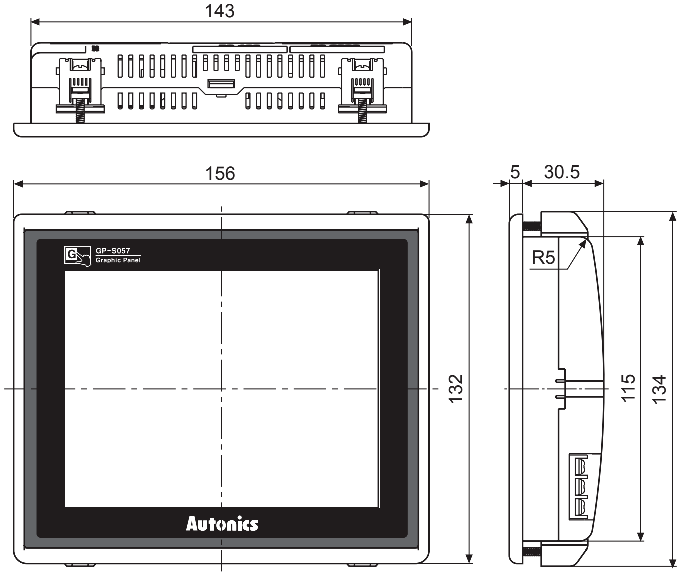
※1: Language could be added in the future. ※2: The weight includes packaging. The weight in parentheses is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Functional Description

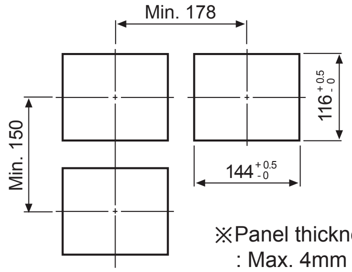
Figure display		Line, rectangle, circle, text, bitmap
Tags	Numeral display	Displays the designated device as numerical value. (decimal, hexadecimal, octal, binary, real number)
	ASCII display	Displays the designated device value as ASCII character.
	Time display	Displays current time or date.
	Alarm history	Registers alarm history.
	Alarm list	Displays generated (not backed up) alarm.
	Comment display	Displays the designated comment as device status or value.
	Lamp	Displays lamp as device status.
	Part display	Displays the designated parts as device status and value.
	Line graph	Displays several device values with a graph of broken line.
	Trend graph	Displays change of device value for time with a graph of broken line.
	Bar graph	Displays a device value with a bar graph.
	Statistic graph	Displays a ratio of several device values with pie graph.
	Panel meter	Displays a device value as panel meter.
	Touch key	Screen is switched, word/bit device values are set when it touched.
	Numeral input	Configures user input value in device.
	ASCII input	Configures user input ASCII code value in device.
System information function		Monitors/Controls GP operation from PLC.
Recipe function		Reads/Writes several PLC device collectively.
Security function		Only acceptable user can observe/operate important data.
Barcode read function		Connects barcode reader, read barcode.
Floating alarm function		Warning message is floated when alarm is generated.
Time operation		Specific bit device is ON/OFF for designated day and time.
Overlap window		Available to form dynamically overlapping another base screen on the base one.
Observe status function		Changes PLC device status/value of PLC when trigger is generated.

■ Dimensions

(unit: mm)

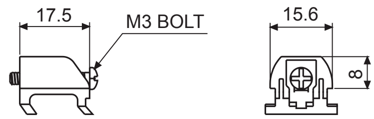


● Panel cut-out

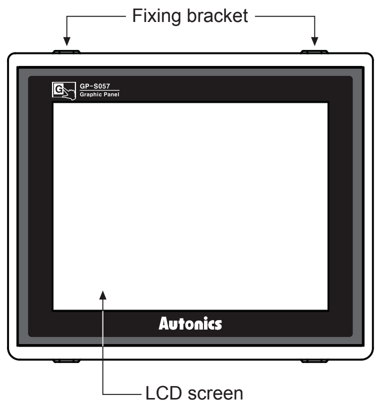


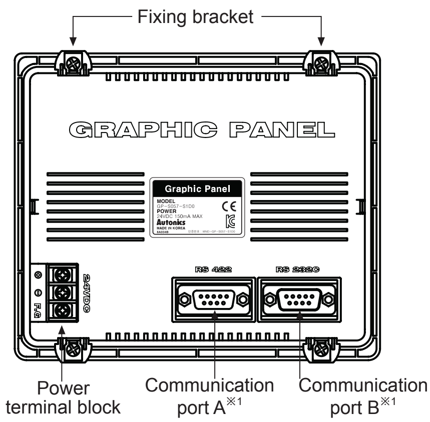
※Panel thickness
: Max. 4mm

● Fixing bracket



■ Unit Description





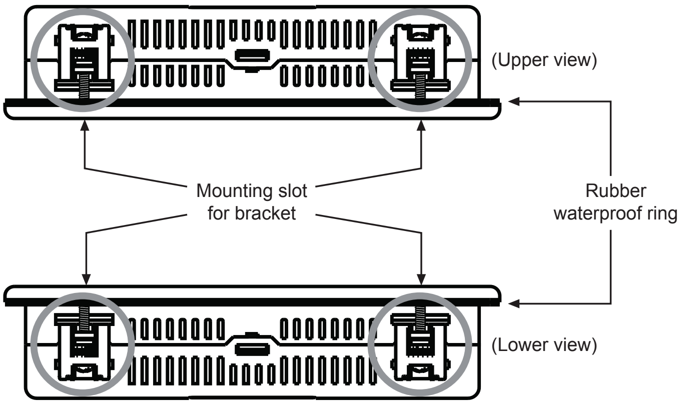
※1: Communication port

Communication port / Model	Port A	Port B
GP-S057-S1D0	RS422	RS232C
GP-S057-S1D1	RS232C-A	RS232C-B

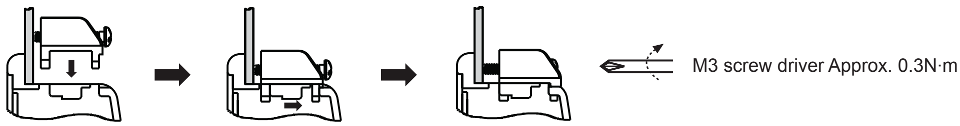
※For more information, refer to page R-32 and '■ Serial Interface' of GP/LP Common Features.

Installation

1. Set a rubber waterproof ring after placing the ring's joining part under the GP-S057.
2. Adhere closely between each edge of the GP-S057 and the rings.
3. Set GP-S057 in panel.
4. Set the fix bracket to 4 bracket slots and fix them with bracket's screws.



● **Mounting bracket**

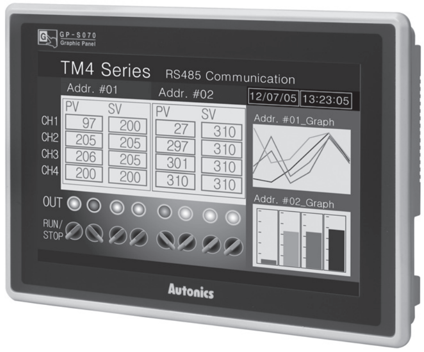


Sold Separately

Transmission cables connectable with external devices such as PLC are sold separately. (refer to page R-32 for "GP/LP Communication Cables".)

7 Inch Wide Screen, TFT Color LCD Type Graphic Touch Panel GP-S070

■ Features



7 inch TFT Color LCD

- Adopts 7 inch wide TFT LCD for realizing True Color with 16,777,216 colors
- Analog touch method
  : Free tag arrangement
- Data logger function
  : Supports data gathering and backup of controller
- Supports variable image library
- Enables to monitor multi stations and multi channels at the same time
- Supports several interface
  : Supports USB Host/Device to high speed download and manage files
  : Easy to connect various external devices with RS232C 2 ports and RS232C/RS422 multi-communication port
- Supports several fonts: Supports window true type and several bitmap fonts (selectable)
- Device monitoring function
  : Enables to monitor/control variable of connected control through communication port
- Easy S/W upgrade available on website
  (1) GP firmware file
  (2) GP Editor (drawing program)
  (3) Additional protocol
  (4) Language and font, etc
- Connects printer/barcode reader: Enables to print out alarm history, to read barcode

⚠ Please read "Caution for your safety" in operation manual before using.

■ Manual

Visit our webwite (www.autonics.com) to download 'GP Editor user manual' or 'GP, LP user manual for communication', 'GP-S070 user manual'.

- **GP Editor user manual**
  It describes how to write screen data, and is about related usage of GP-S070 HMI function.
- **GP, LP user manual for communication**
  It describes connection for external devices such as PLC.
- **GP-S070 user manual**
  It describes general information of the installation and usage of GP-S070 and system contents.

■ Ordering Information

Model	Item	Series	Monitor size	Display unit	Color	Power supply	Interface
GP-S070-T9D6	Graphic panel	S series	7 inch	TFT Color LCD	16,777,216 color	24VDC	RS232C, RS422, USB HOST, USB DEVICE, Ethernet
GP-S070-T9D7							RS232C (2EA), USB HOST USB DEVICE, Ethernet

GP-S070

■ Specifications

Model		GP-S070-T9D6	GP-S070-T9D7
Power supply		24VDC	
Allowable voltage range		90 to 110% of power supply	
Power consumption		Max. 7.2W	
Display performance	LCD type	7 inch TFT Color LCD	
	Resolution	800×480 dots	
	Display area	152.4×91.44mm	
	Color	16,777,216 color	
	LCD view angle	Within each 60°/ 45°/ 60°/ 60°of top/bottom/left/right	
	Backlight	White LED	
	Brightness	Adjustable by software	
Graphic drawing performance	Language※1	English, Korean	
	Text	• Vector font • 6×8, 8×8 ASCII character, high definition numbers • 8×16 ASCII characters, 16×16 character by each country (1 to 8 times bigger for width, 0.5 to 5 times bigger for height)	
	Graphic drawing memory	16MB	
	Number of user screen	500 pages	
	Touch switch	Analog touch	
Serial interface		Asynchronous method: Each port of RS232C, RS422	
		Each port of RS232C, RS422	Two ports of RS232C
USB interface		Each of USB HOST, USB Device (Version 1.1)	
Ethernet interface		IEEE802.3 (U), 10/100Base-T	
Real-time controller		RTC embedded	
Battery life cycle		Approx. 3 years at 25℃	
Insulation resistance		Over 100MΩ (at 500VDC megger)	
Ground		3rd grounding (max. 100Ω)	
Noise immunity		± 0.5kV the square wave noise (pulse width: 1μs) by the noise simulator	
Withstanding voltage		500VAC 50/60Hz for 1 min	
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour	
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min	
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times	
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Environ-ment	Ambient temperature	0 to 50℃, storage: -20 to 60℃	
	Ambient humidity	35 to 85% RH, storage: 35 to 85%RH	
Protection structure		IP65F for front panel	
Accessory		Fixing bracket: 4, Battery (included)	
Approval		CE	
Unit weight		Approx. 520g	

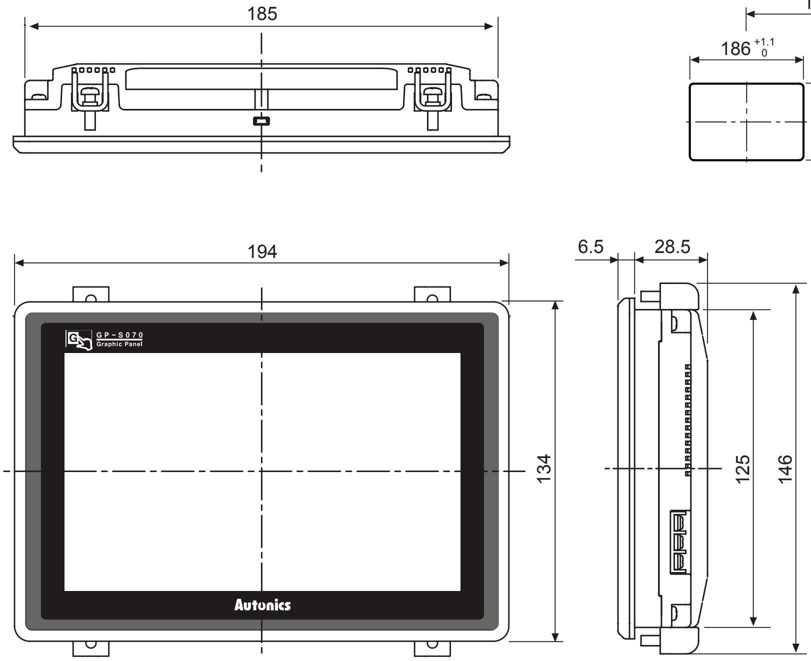
※1: Language could be added in the future. ※Environment resistance is rated at no freezing or condensation.

■ Functional Description

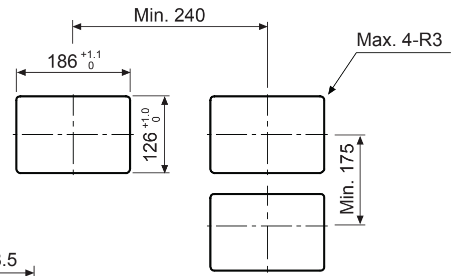
Figure display		Line, rectangle, circle, text, bitmap
Tags	Numeral display	Displays the designated device as numerical value. (decimal, hexadecimal, octal, binary, real number)
	ASCII display	Displays the designated device value as ASCII character.
	Time display	Displays current time or date.
	Alarm history	Registers alarm history.
	Alarm list	Displays generated (not backed up) alarm.
	Comment display	Displays the designated comment as device status or value.
	Lamp	Displays lamp as device status.
	Part display	Displays the designated parts as device status and value.
	Line graph	Displays several device values with a graph of broken line.
	Trend graph	Displays change of device value for time with a graph of broken line.
	Bar graph	Displays a device value with a bar graph.
	Statistic graph	Displays a ratio of several device values with pie graph.
	Panel meter	Displays a device value as panel meter.
	Touch key	Screen is switched, word/bit device values are set when it touched.
	Numeral input	Configures user input value in device.
	ASCII input	Configures user input ASCII code value in device.
System information function		Monitors/Controls GP operation from PLC.
Recipe function		Reads/Writes several PLC device collectively.
Security function		Only acceptable user can observe/operate important data.
Barcode read function		Connects barcode reader, read barcode.
Floating alarm function		Warning message is floated when alarm is generated.
Time operation		Specific bit device is ON/OFF for designated day and time.
Overlap window		Available to form dynamically overlapping another base screen on the base one.
Observe status function		Changes PLC device status/value of PLC when trigger is generated.

■ Dimensions

(unit: mm)

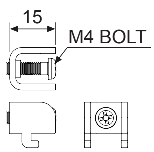


● **Panel cut-out**

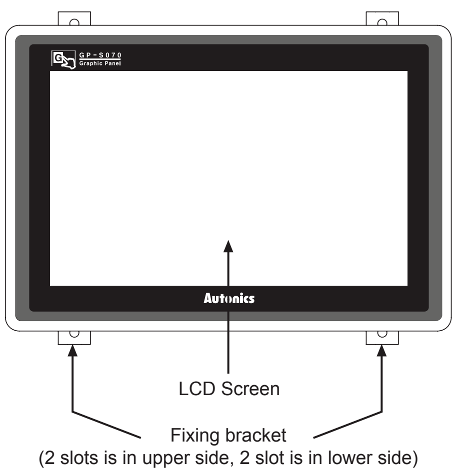


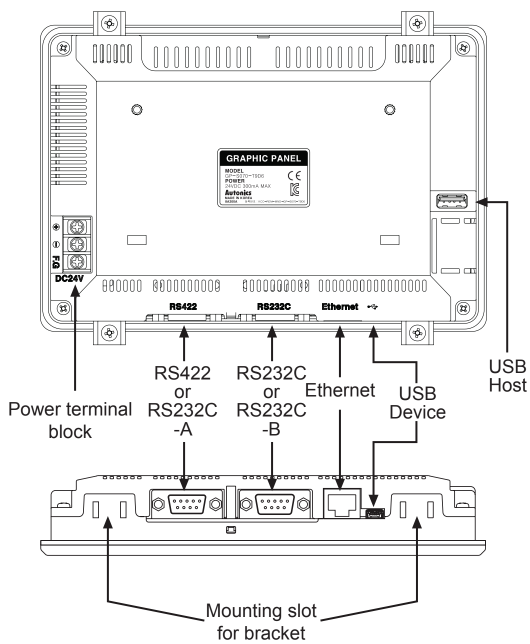
※Panel thickness
: Max. 4mm

● **Fixing bracket**



■ Unit Description

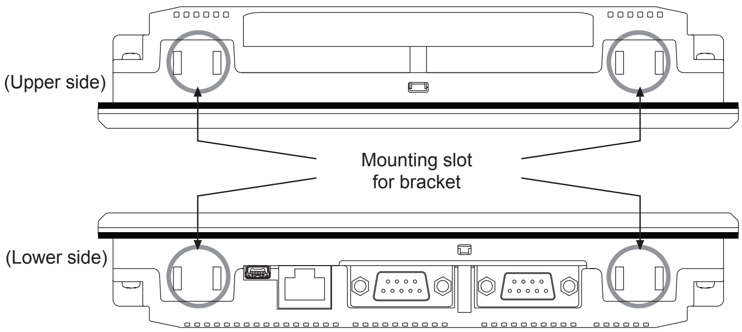




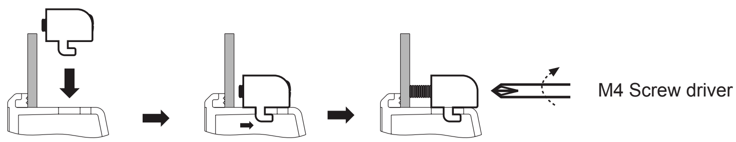
● Ethernet Port: For connecting LAN cable and hub, use direct cable, and for connecting PC directly, use cross cable.
● USB Device: It is used to upload and download project (it is required to install USB driver on PC), and when connecting to PC, it can be used as a USB memory (PC recognizes it as a removable disk).
● USB Host: It is used to manage data and upgrade firmware.
● RS232C, RS422 ports: For more information, refer to page R-32 and '■ Serial Interface' of GP/LP Common Features.

Installation

1. Set GP-S070 in panel.
2. Set fixing brackets in 4 slots (2 slots is in upper side, 2 slots is in lower side).



3. Tighten fixing bracket with M4 Screw driver and tightening torque is 0.3 to 0.5N·m.



Sold Separately

Transmission cables connectable with external devices such as PLC are sold separately. (refer to page R-32 for "GP/LP Communication Cables".)

Graphic Panel + PLC Function Logic Panel LP-S044

■ Features

4.4 inch MONO

[Terminal block connector type]

[Ribbon cable connector type]

● Compact structure
: **Reducing cost, space saving and easy operation through PLC+HMI+Input/ output integration**
● Improved compatibility with logic
: 8000-step program capacity
(the average processing speed 6 to 7μs/step)
basic command 28,
application command 220
● Wide device range
: Peripheral device 10K word, data device 10K word, and other various devices
● Sufficient external I/O
: Input 16-point, output 16-point (basic)
● Various expansion function
: External interrupt, 16-key input, 7 Seg. time-sharing display and synchronous communication output.
● Easy software upgrade available on website
(1) LP firmware file
(2) GP Editor (drawing program)
(3) Smart Studio (logic program)
(4) Additional protocol
● Displays max. 400 characters
● Enables to save max. 500 pages of user screen
● Different devices monitoring function
: allows to monitor and control the variables of additionally connected controllers(such as PLC) with external communication port
● Supports multilingual
: Supports for Korean, Japanese, English, Chinese, Russian, Vietnamese and Portuguese. Additional languages will be available by firmware.
● Supports multi-font
: It provides various bitmap and user-selected fonts.
● Various multi-communication ports
: Both RS232 2 port and RS232/RS422 compound port are provided.
● Device monitoring function
: It enables to monitor LP device and connected controller devices by LP without graphic design data.
● Printer and barcode reader connection
: It enables to print alarm history connecting a printer and read barcode connecting a barcode reader.

Please read "Caution for your safety" in operation manual before using.

■ Manual

Visit our webwite (www.autonics.com) to download 'GP Editor user manual' or 'SmartStudio user manual', 'SmartStudio programing manual', 'LP Series command manual', 'LP-S044 user manual', 'GP, LP user manual for communication'.

● **GP Editor user manual**
It describes how to write screen data, and is about related usage of LP-S044 HMI function.
● **SmartStudio user manual, SmartStudio programming manual, LP Series command manual**
It contains install method and usage, commands, etc of SmartStudio.
● **GP, LP user manual for communication:** It describes connection for external devices such as PLC.
● **LP-S044 user manual:** It describes general information on the installation and usage of LP-S044 and system contents.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

LP-S044

■ Ordering Information

Model	Item	Series	Monitor size	Display unit	Color	Power supply	Interface	Module	I/O composition	I/O connector	Expansion function type
LP-S044-S1D0-C5T-A	Logic panel	S series	4.4 inch	STN LCD	MONO (blue, white)	24VDC	Each port of RS232C, RS422	All-in-one type	IN: 16-point OUT: 16-point	Terminal block connector	Supports type A
LP-S044-S1D0-C5R-A										Ribbon cable connector	
LP-S044-S1D1-C5T-A							Two ports of RS232C			Terminal block connector	
LP-S044-S1D1-C5R-A										Ribbon cable connector	

■ Specifications

Model		**LP-S044-S1D0-C5T-A**	**LP-S044-S1D0-C5R-A**	**LP-S044-S1D1-C5T-A**	**LP-S044-S1D1-C5R-A**
I/O connector type		Terminal block connector	Ribbon cable connector	Terminal block connector	Ribbon cable connector
Power supply		24VDC			
Allowable voltage range		90 to 110% of power supply			
Power consumption		Max. 3.6W			
Display performance	LCD type	4.4 inch STN Blue Negative			
	Resolution	240×80 dots			
	Display area	112.8×37.6mm			
	Color	MONO (blue, white)			
	LCD view angle	Top/Bottom/Left/Right within 30° in each direction			
	Backlight	White LED			
	Brightness	Adjustable by software			
Graphic drawing performance	Language※1	English, Korean, Japanese, Chinese, Russian, Vietnamese, Portuguese			
	Text	• High resolution display up to 400 letters • 6×8, 8×8 ASCII character, high definition numbers • 8×16 ASCII characters, 16×16 character by each country (1 to 8 times bigger for width, 0.5 to 5 times bigger for height)			
	Graphic drawing memory	384 KB			
	Number of user screen	500 pages			
	Touch switch	Width 15×Height 4 = 60			
Control performance	Command	Basic command: 28, application command: 220			
	Program capacity	8K step			
	Processing time	Average: 6 to 7μs/step			
	I/O control type	Batch processing			
	Computer control mode	Repeated-doubling method, interrupt processing			
	Device range	*Refer to LP-S044 user manual			
Serial interface		Each port of RS232C, RS422 (asynchronous method)		Two ports of RS232C (asynchronous method)	
Real-time controller		RTC embedded			
Battery life cycle		Approx. 3 years at 25℃			
Insulation resistance		Over 100MΩ (at 500VDC megger)			
Ground		3rd grounding (max. 100Ω)			
Noise immunity		± 0.5kV the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength		500VAC (50/60Hz) for 1 min			
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour			
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min			
Shock	Mechanical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times			
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times			
Environ-ment	Ambient temperature	0 to 50℃, storage: -20 to 60℃			
	Ambient humidity	35 to 85% RH, storage: 35 to 85% RH			
Protection structure		IP65F (for front panel)			
Accessory		Fixing bracket: 4, Rubber waterproof ring, Battery included			
Approval		CE			
Weight※2		Approx. 454g (approx. 312g)			

※1: Language could be added in the future.
※2: The weight includes packaging. The weight in parentheses is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Input/Output Performance

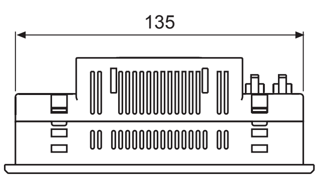
Input performance		Output performance	
Input point	16-point	Output point	16-point
Insulation method	Photo coupler insulation	Insulation method	Photo coupler insulation
Voltage range	19.2 to 28.8VDC	Voltage range	19.2 to 28.8VDC
Rated input voltage	24VDC	Rated input voltage	24VDC
Rated input current	Approx. 4mA	Max. load current	0.1A/1point, 1A/1COM
Input resistance	5.6kΩ	Max. voltage falling when ON	Max. 0.2VDC
Response time	1ms	Response time	1ms
Common method	16-point/1COM	Common method	16-point/1COM

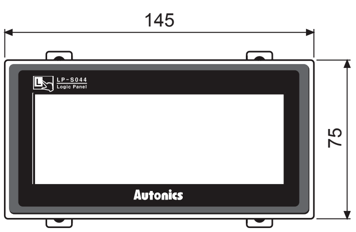
■ Functional Description

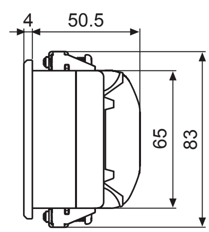
Figure display		Line, rectangle, circle, text, bitmap
Tags	Numeral display	Displays the designated device as numerical value. (decimal, hexadecimal, octal, binary, real number)
	ASCII display	Displays the designated device value as ASCII character.
	Time display	Displays current time or date.
	Alarm history	Registers alarm history.
	Alarm list	Displays generated (not backed up) alarm.
	Comment display	Displays the designated comment as device status or value.
	Lamp	Displays lamp as device status.
	Part display	Displays the designated parts as device status and value.
	Line graph	Displays several device values with a graph of broken line.
	Trend graph	Displays change of device value for time with a graph of broken line.
	Bar graph	Displays a device value with a bar graph.
	Statistic graph	Displays a ratio of several device values with pie graph.
	Panel meter	Displays a device value as panel meter.
	Touch key	Screen is switched, word/bit device values are set when it touched.
	Numeral input	Configures user input value in device.
	ASCII input	Configures user input ASCII code value in device.
System information function		Monitors/Controls LP operation from PLC.
Recipe function		Reads/Writes several PLC device collectively.
Security function		Only acceptable user can observe/operate important data.
Barcode read function		Connects barcode reader, read barcode.
Floating alarm function		Warning message is floated when alarm is generated.
Overlap window		Specific bit device is ON/OFF for designated day and time.
Observe status function		Available to form dynamically overlapping another base screen on the base one.

■ Dimensions

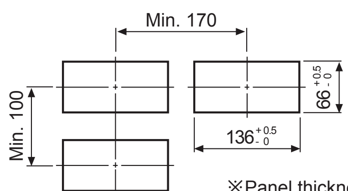
(unit: mm)





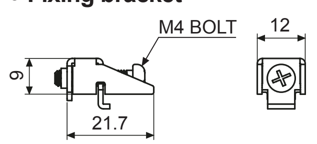


● **Panel cut-out**

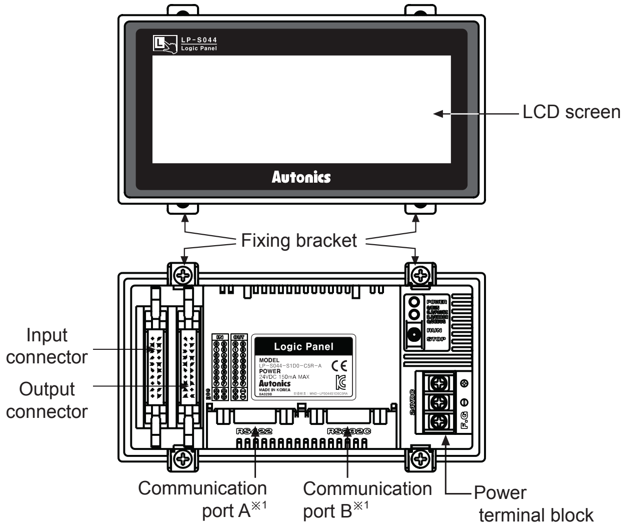


※Panel thickness
: Max. 4mm

● **Fixing bracket**



▣ Unit Description



※1: Communication port

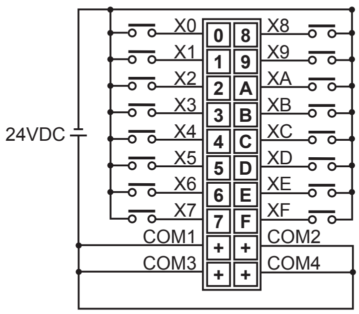
Model \ Communication port	Port A	Port B
LP-S044-S1D0-C5T (R)	RS422	RS232C
LP-S044-S1D1-C5T (R)	RS232C-A	RS232C-B

※For more information, refer to page R-32 and '▣ Serial Interface' of GP/LP Common Features.

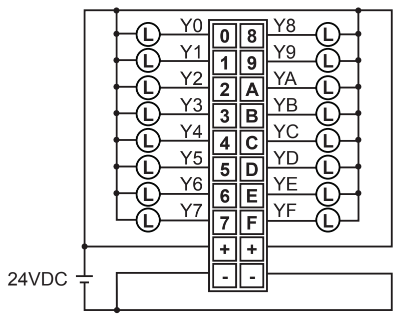
▣ Input·Output Wiring

◎ LP-S044-S1D0 (1)-C5R

● Input wiring (source type input module)

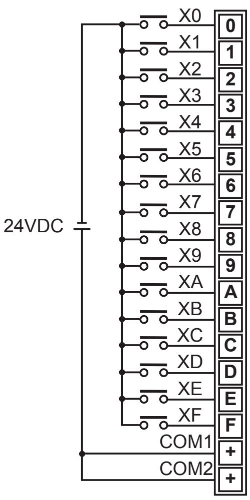


● Output wiring (sink type output module)

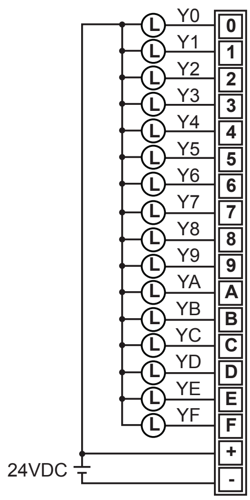


◎ LP-S044-S1D0 (1)-C5R

● Input wiring (source type input module)



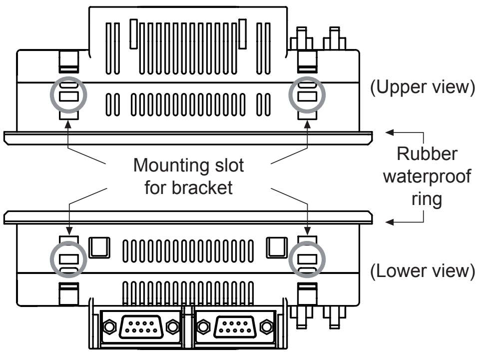
● Output wiring (sink type output module)



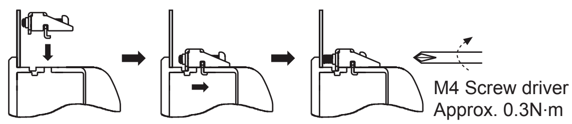
※Check the pin number of the case before wiring.

■ Installation

1. Set a rubber waterproof ring after placing the ring's joining part under the LP-S044
2. Adhere closely between each edge of the LP-S044 and the rings.
3. Set LP-S044 in panel.
4. Set the fix bracket to 4 bracket slots and fix them with bracket's screws.



● Mounting bracket



■ Sold Separately

◎ I/O terminal block and I/O cable

Suitable I/O terminal block	INPUT/OUTPUT	Suitable I/O cable
AFS-H20 (Interface terminal block)	INPUT	CJ-HPHP20-V1N□-1ANR
	OUTPUT	
ABS-H16PA (TN)-NN (Relay terminal block)	OUTPUT	CJ-HPHP20-V1N□-1APR
AFE4-H20-16LF (Sensor connector terminal block)	INPUT	CJ-HPHP20-V1N□-1BNR
	OUTPUT	CJ-HPHP20-V1N□-1APR
—	—	CJ-HP20-VP□-R (OPEN type cable)
		CJ-HP20-VP□-L (OPEN type cable)

※It is only for ribbon cable connector (hirose connector) type.
※"□" is cable length. (Basic specification **010**: 1m, **020**: 2m, the others are option)
※For more information, refer to **"I/O terminal block & cable catalog"**.

◎ Communication cable (RS232C, RS422 port)

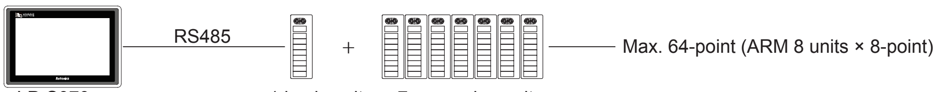
For serial connectable cable to connect PLC and external devices, refer to page R-32 for "GP/LP Communication Cables".

7 inch Wide Screen, TFT Color LCD Type Graphic Panel + PLC Function Logic Panel LP-S070

Features

- **Supports cost reducing, space saving, easy control by PLC+HMI+I/O module integration**
- **Adopts 7 inch wide TFT LCD for realizing True Color with 16,777,216 colors**
- **Analog touch method**
  : Free tag arrangement than matrix touch method
- Supports basic I/O of input 16-point, output 16-point
- Supports several device
  (auxiliary device 10K Word, data device 10K Word, etc)
- Built-in large capacity memory
  (program memory: 8,000 step, drawing memory: 16MB)
- Built-in position control function
  : Provides simultaneous output for max. 100kHz pulse 2-point
- Easy software upgrade available on website
  (1) LP firmware file (2) GP Editor (drawing program)
  (3) SmartStudio (Logic program) (4) Additional protocol
  (5) Language and font, etc
- Data logger function
  : Supports data gathering and backup of controller
- Supports variable image library
- Enables to monitor multi stations and multi channels at the same time
- **Supports several interface**
  : Easy to connect various external devices with RS232C 2 ports and RS232C/RS422 multi communication ports
  : Enables to extend additional external I/O (when connecting Autonics ARM Series, one communication cable enables to extend 64-point per address, up to 31 address)

7 inch TFT Color LCD



- Supports several fonts: Supports window true type and several bitmap font (Selectable)
- Device monitoring function: Enables to monitor/control variable of connected control through communication port
- Printer/Barcode reader connection: Enables to print out alarm history, to read barcode

Please read "Caution for your safety" in operation manual before using.

Manual

Visit our webwite (www.autonics.com) to download 'GP Editor user manual' or 'SmartStudio user manual', 'SmartStudio programing manual', 'LP Series command manual', 'LP-S070 user manual', 'GP, LP user manual for communication'.

- **GP Editor user manual**
  It describes how to write screen data, and is about related usage of LP-S070 HMI function.
- **SmartStudio user manual, SmartStudio programming manual, LP Series command manual**
  It contains install method and usage, commands, etc of SmartStudio.
- **GP, LP user manual for communication:** It describes connection for external devices such as PLC.
- **LP-S070 user manual:** It describes general information of the installation and usage of LP-S070 and system Contents.

Ordering Information

Model	Item	Series	Monitor size	Display unit	Color	Power supply	Interface	Module	I/O composition	I/O connector
LP-S070-T9D6-C5T	Logic panel	S series	7 inch	TFT Color LCD	16,777,216 color	24VDC	RS232C, RS422, USB HOST USB DEVICE, Ethernet	All-in-one type	IN: 16-point, OUT: 16-point	Terminal block connector
LP-S070-T9D6-C5R										Ribbon cable connector
LP-S070-T9D7-C5T							RS232C (2), USB HOST USB DEVICE, Ethernet			Terminal block connector
LP-S070-T9D7-C5R										Ribbon cable connector

■ Specifications

Model		LP-S070-T9D6-C5T	LP-S070-T9D6-C5R	LP-S070-T9D7-C5T	LP-S070-T9D7-C5R
I/O connector type		Terminal block connector	Ribbon cable connector	Terminal block connector	Ribbon cable connector
Power supply		24VDC			
Allowable voltage range		90 to 110% of power supply			
Power consumption		Max. 7.2W			
Graphic drawing performance	LCD type	7 inch TFT Color LCD			
	Resolution	800×480 dots			
	Display area	152.4×91.44mm			
	Color	16,777,216 color			
	LCD view angle	Within each 60°/ 45°/ 60°/ 60° of top/bottom/left/right			
	Backlight	White LED			
	Brightness	Adjustable by software			
Graphic drawing performance	Language※1	English, Korean			
	Text	• Vector font • 6×8, 8×8 ASCII character, high definition numbers • 8×16 ASCII characters, 16×16 character by each country (1 to 8 times bigger for width, 0.5 to 5 times bigger for height)			
	Graphic drawing memory	16MB			
	Number of user screen	500 pages			
	Touch switch	Analog touch			
Control performance	Command	Basic command: 28, application command: 233			
	Program capacity	8K step			
	Processing time	Average: Approx. 2us/basic command, application command			
	I/O control type	Batch processing			
	Computer control mode	Repeated-doubling method, interrupt processing			
	Device range	*Refer to LP-S070 user manual			
	Special function	Positioning function *Refer to LP-S070 user manual			
Serial interface		Asynchronous method: Each port of RS232C, RS422			
		Each port of RS232C, RS422		Two ports of RS232C	
USB interface		Each of USB Host, USB Device (Version 1.1)			
Ethernet interface		IEEE802.3 (U), 10/100Base-T			
Real-time controller		RTC embedded			
Battery life cycle		Approx. 3 years at 25℃			
Insulation resistance		Over 100MΩ (at 500VDC megger)			
Ground		3rd grounding (max. 100Ω)			
Noise immunity		The squre wave noise (pulse width 1μs) by the noise simulator with ± 0.5kV			
Withstanding voltage		500VAC 50/60Hz for 1 min			
Vibra-tion	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour			
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min			
Shock	Mechnical	300m/s² (approx. 30G) in each X, Y, Z direction for 3 times			
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times			
Environ-ment	Ambient temperature	0 to 50℃, storage: -20 to 60℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection		IP65F (for front panel)			
Accessory		Fixing bracket: 4, Battery (included)			
Approval		CE, KC			
Unit weight		Approx. 540g			

※1: Language could be added in the future. ※Environment resistance is rated at no freezing or condensation.

■ Input/Output Performance

Input performance		Output performance	
Input point	16-point	Output point	16-point
Insulation method	Photo coupler insulation	Insulation method	Photo coupler insulation
Voltage range	19.2 to 28.8VDC	Voltage range	19.2 to 28.8VDC
Rated input voltage	24VDC	Rated input voltage	24VDC
Input resistance	Contact X0 to X5: Approx. 10mA Contact X6 to XF: Approx. 4mA	Max. load current	0.1A/1point, 1.6A/1COM
Input resistance	Contact X0 to X5: 2.2kΩ, Contact X6 to XF: 5.6kΩ	Max. voltage falling when ON	Max. 0.2VDC
Response time	1ms	Response time	1ms
Common method	16-point/1COM	Common method	16-point/1COM
Acceptable wire	0.3 to 0.7mm²	Acceptable wire	0.3 to 0.7mm²

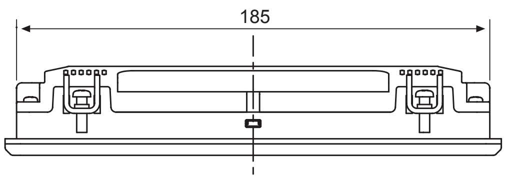
LP-S070

▣ Functional Description

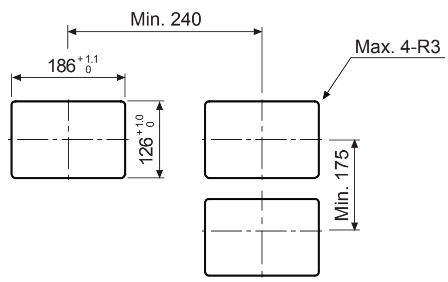
Figure display		Line, rectangle, circle, text, bitmap
Tags	Numeral display	Displays the designated device as numerical value. (decimal, hexadecimal, octal, binary, real number)
	ASCII display	Displays the designated device value as ASCII character.
	Time display	Displays current time or date.
	Alarm history	Registers alarm history.
	Alarm list	Displays generated (not backed up) alarm.
	Comment display	Displays the designated comment as device status or value.
	Lamp	Displays lamp as device status.
	Part display	Displays the designated parts as device status and value.
	Line graph	Displays several device values with a graph of broken line.
	Trend graph	Displays change of device value for time with a graph of broken line.
	Bar graph	Displays a device value with a bar graph.
	Statistic graph	Displays a ratio of several device values with pie graph.
	Panel meter	Displays a device value as panel meter.
	Touch key	Screen is switched, word/bit device values are set when it touched.
	Numeral input	Configures user input value in device.
	ASCII input	Configures user input ASCII code value in device.
System information function		Monitors/Controls LP operation from PLC.
Recipe function		Reads/Writes several PLC device collectively.
Security function		Only acceptable user can observe/operate important data.
Barcode read function		Connects barcode reader, read barcode.
Floating alarm function		Warning message is floated when alarm is generated.
Time operation		Specific bit device is ON/OFF for designated day and time.
Overlap window		Available to form dynamically overlapping another base screen on the base one.

▣ Dimensions

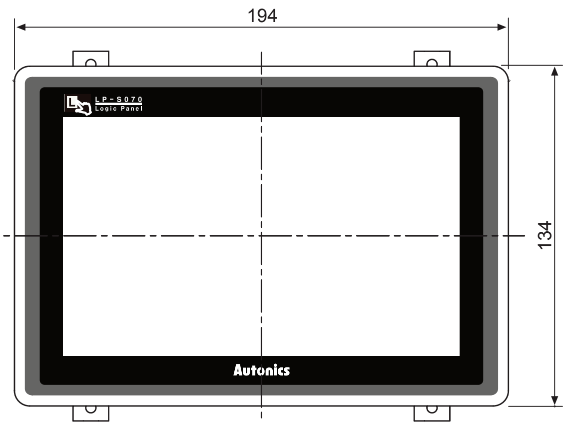
(unit: mm)

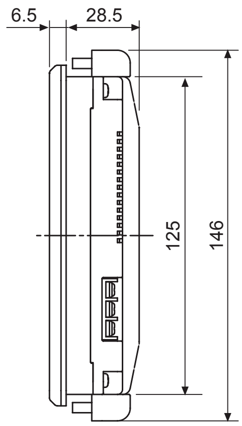


● **Panel cut-out**

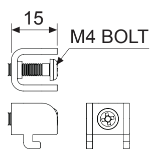


※ Panel thickness
: Max. 4mm

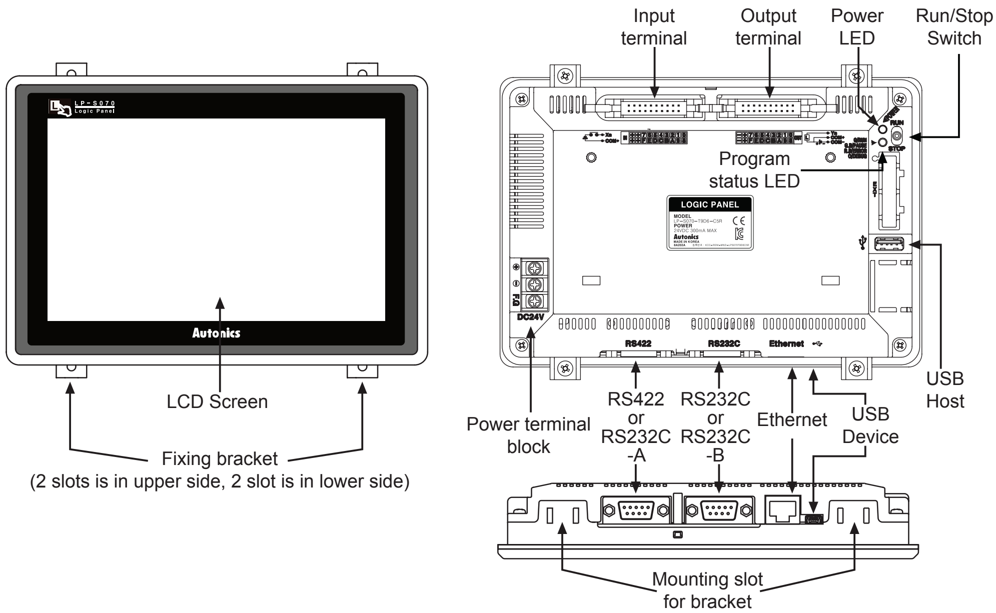




● **Fixing bracket**



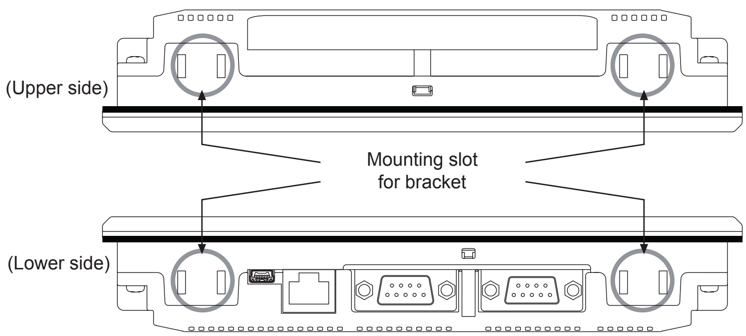
■ Unit Description



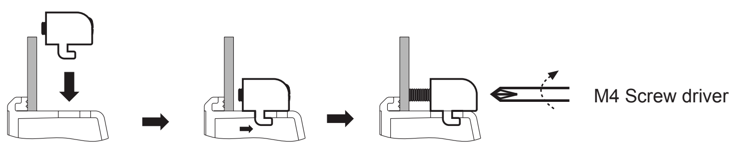
● Ethernet port: For connecting LAN cable and hub, use direct cable, and for connecting PC directly, use cross cable.
● USB Device: It is used to upload and download project (It is required to install USB driver on PC), and when connecting to PC, it can be used as a USB memory (PC recognizes it as a removable disk).
● USB Host: It used to manage data and upgrade firmware.
● RS232C, RS422 port: For more information, refer to page R-32 and '■ Serial Interface' of GP/LP Common Features.

■ Installation

1. Set LP-S070 in panel.
2. Set fixing brackets in 4 slots (2 slots is in upper side, 2 slots is in lower side).



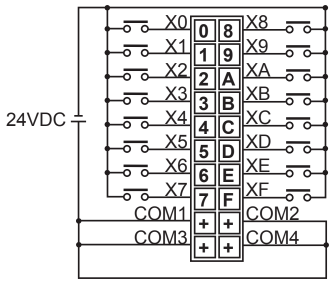
3. Tighten fixing bracket with M4 screw driver and tightening torque is 0.3 to 0.5N·m.



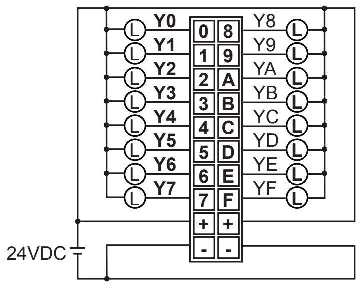
■ Input·Output Wiring

◎ LP-S070-T9D6 (7)-C5R

● **Input wiring (source type input module)**

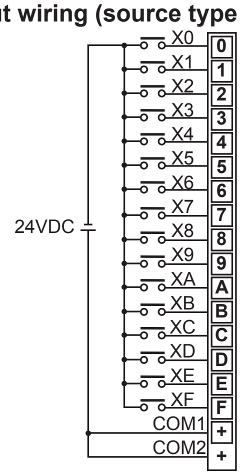


● **Output wiring (sink type output module)**

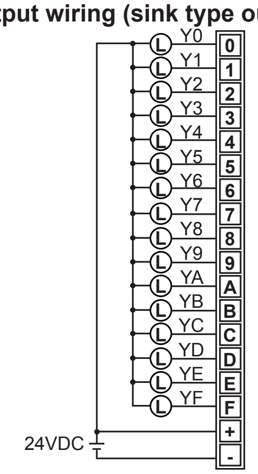


◎ LP-S070-T9D6 (7)-C5T

● **Input wiring (source type input module)**



● **Output wiring (sink type output module)**



※Check the pin number of the case before wiring.

■ Sold Separately

◎ I/O terminal block and I/O cable

Suitable I/O terminal block	INPUT/OUTPUT	Suitable I/O cable
AFS-H20 (Interface terminal block)	INPUT	CJ-HPHP20-V1N□-1ANR
	OUTPUT	
ABS-H16PA (TN)-NN (Relay terminal block)	OUTPUT	CJ-HPHP20-V1N□-1APR
AFE4-H20-16LF (Sensor connector terminal block)	INPUT	CJ-HPHP20-V1N□-1BNR
	OUTPUT	CJ-HPHP20-V1N□-1APR
—	—	CJ-HP20-VP□-R (OPEN type cable)
		CJ-HP20-VP□-L (OPEN type cable)

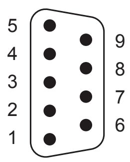
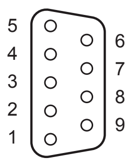
※It is only for ribbon cable connector (hirose connector) type.
※"□" is cable length. (Basic specification **010**: 1m, **020**: 2m, the others are option)
※For more information, refer to "**I/O Terminal Blocks & Cables Catalog**".

◎ Communication cable (RS232C, RS422 port)

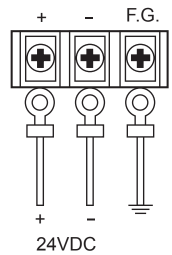
For serial connectable cable to connect PLC and external devices, refer to page R-32 for "GP/LP Communication Cables".

■ Serial Interface

- All devices are connectable with LP-S044 including PC, PLC, serial printer, barcode reader and dedicated connectors can be connected with both RS232C and RS422 ports.
- Device must be set for the port in system setting for LP-S044, LP-S070. For details, refer to "GP user manual".
- Use the dedicated communication cable for the each connected device.
  (Refer to the "GP/LP Communication Cables" of page R-32)
- For the method of wiring external devices like PLC, refer to "GP/LP communication manual".

Port	NO.	Pin (GP-S044, GP-S057, GP-S070)	Pin (LP-S044, LP-S070)
RS232C	1	Not used	Not used
	2	RXD	RXD
	3	TXD	TXD
	4	DTR	DTR
	5	SG	SG
	6	DSR	DSR
	7	Not used	Not used
D-Sub 9-pin Male	8	Not used	Not used
	9	Not used	Not used
RS422	1	TXD+	TXD+
	2	RXD+	RXD+
	3	Not used	Not used
	4	Not used	Not used
	5	SG	SG
	6	TXD-	TXD-
	7	RXD-	RXD-
D-Sub 9-pin Female	8	Not used	Not used
	9	Not used	Not used

■ Power Wiring



- For power supply, use the wire of which cross section is at least 0.75mm² and use the wire of which cross section is at least 1.25mm² for grounding.
- Use crimp-on type terminal with at least 3mm of internal diameter and less than 6mm of external diameter.
- Do not apply power before power line connection.
- Check power polarity.
- Tighten the terminal screw with 0.5 to 0.8N·m torque.
- Ground resistance should be less than 100Ω and ground it separately.

■ Battery Replacement

Please contact out distributor to replace battery.
It may cause an explosion or a fire when improper battery is used.

■ Caution During Use

- Use communication cable after checking whether there is break, short.
- Please install power switch or circuit-breaker in order to cut power supply off.
- Separate this unit from high voltage line, power line to avoid inductive noise.
- Do not use this product at below places.
  - Place where there is severe vibration or impact
  - Place where dust exists, or corrosion causing environments.
  - Place where strong magnetic field or electric noise are generated
  - Place where is temperature/humidity is beyond the specification
  - Place where strong alkalis or vibration or impact
  - Place where there are direct ray of the sun
- This product may be used in the following environments.
  - It shall be used indoor.
  - Altitude up to 2,000m
  - Pollution degree 2
  - Installation category II

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

GP/LP Communication Cables

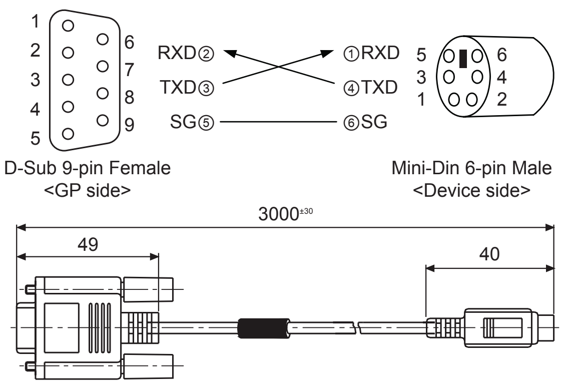
■ Ordering Information

C | 3M | 5P | 00 – D | 9 | M | 0 – D | 9 | * | 0

Code position	Item	Code	Description
0	Serial number	0	Number
*	Connector division	M	Male
		F	Female
		Y	Y-Terminal
		*	Cable
9	Connector pin no. or wiring no.	0	Number
D	Connector type on device	D	D-Sub
		M	Mini-Din
		T	Terminal
		W	Wire
0	Serial number	0	Number
M	Connector division	M	Male
		F	Female
9	Connector pin no.	9	Number
D	Connector type on GP	D	D-Sub
00	Serial number	00	Number
5P	Cable thickness	5P	Ø5
3M	Cable length	3M	3m
C		C	Cable

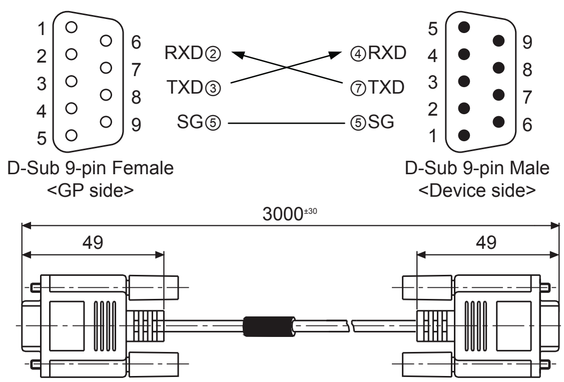
■ Communication Cable Wiring And Dimensions

1. C3M5P00-D9F0-M6M0



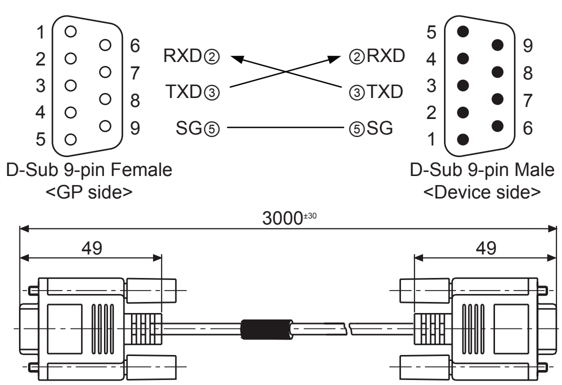
(unit: mm)

3. C3M5P02-D9F0-D9M0



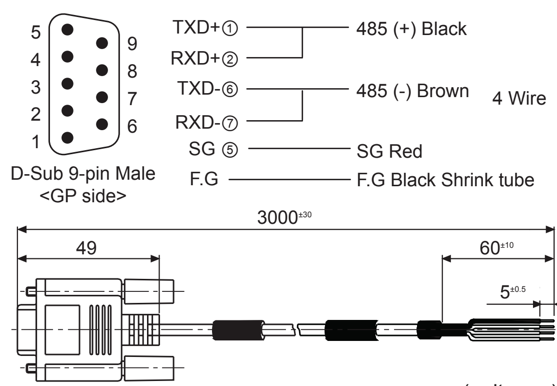
(unit: mm)

2. C3M5P01-D9F0-D9M0



(unit: mm)

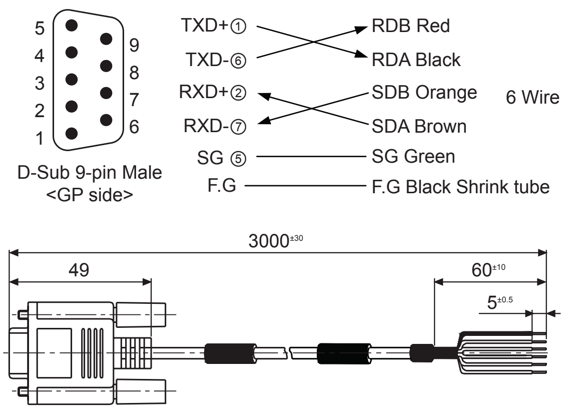
4. C3M5P03-D9M0-W4*0



(unit: mm)

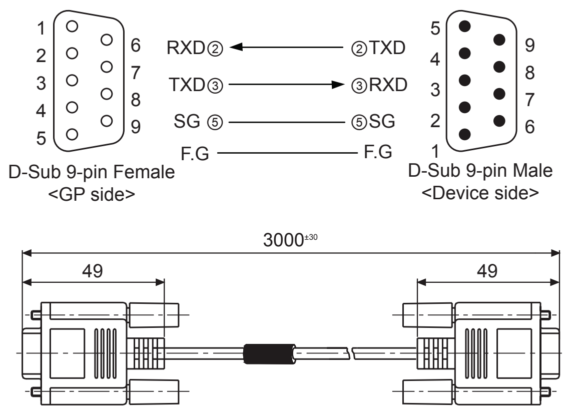
■ Communication Cable Wiring And Dimensions

5. C3M5P04-D9M0-W6*0



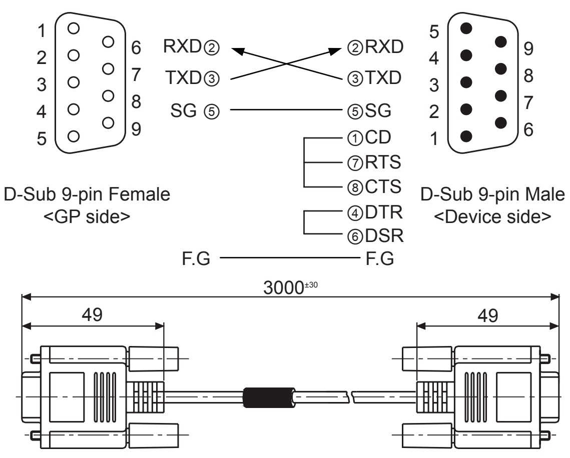
(unit: mm)

8. C3M5P07-D9F0-D9M0



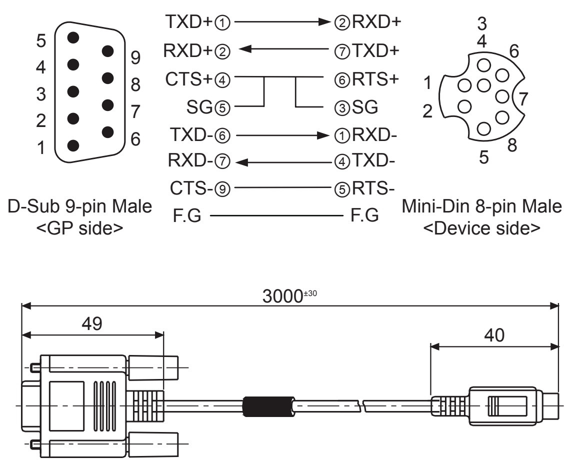
(unit: mm)

6. C3M5P05-D9F0-D9M0



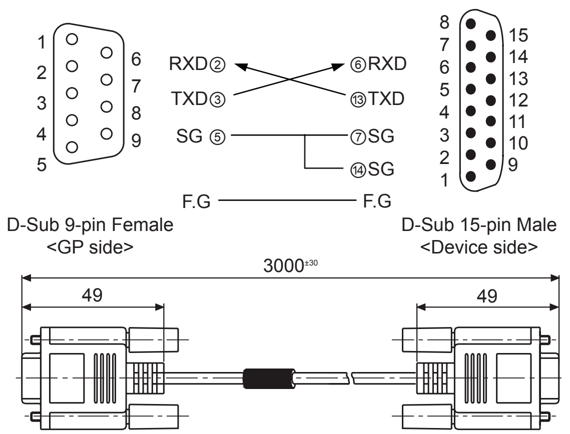
(unit: mm)

9. C3M5P08-D9M0-M8M0



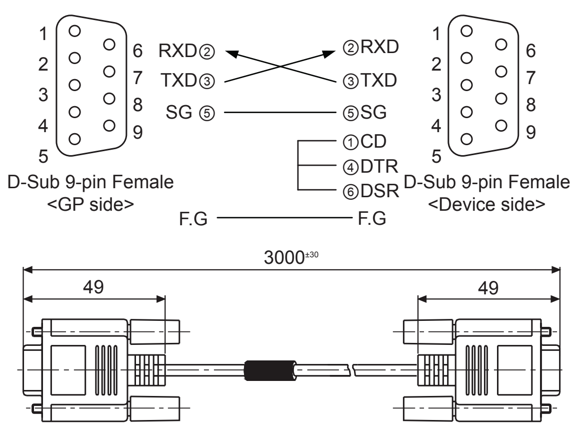
(unit: mm)

7. C3M5P06-D9F0-D15M0



(unit: mm)

10. C3M5P09-D9F0-D9F0

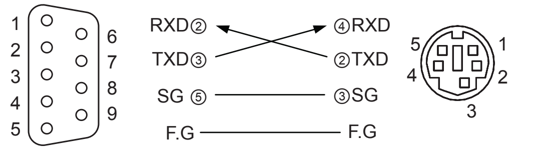


(unit: mm)

GP/LP Communication Cables

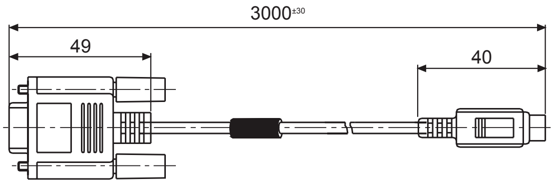
▣ Communication Cable Wiring And Dimensions

11. C3M5P10-D9F0-M5M0



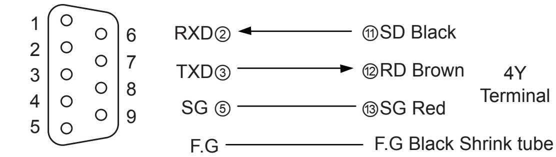
D-Sub 9-pin Female <GP side>

Mini-Din 5-pin Male <Device side>

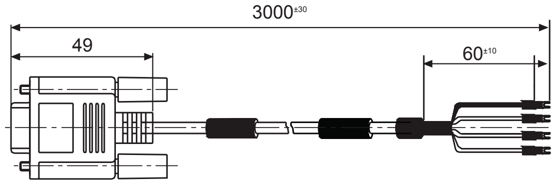


(unit: mm)

14. C3M5P13-D9F0-T4Y0

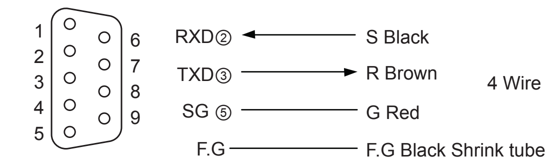


D-Sub 9-pin Female <GP side>

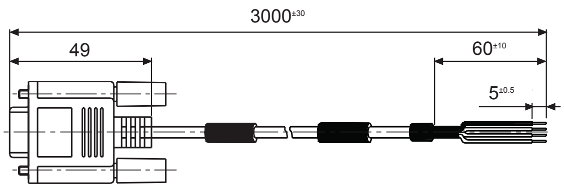


(unit: mm)

12. C3M5P11-D9F0-W4*0

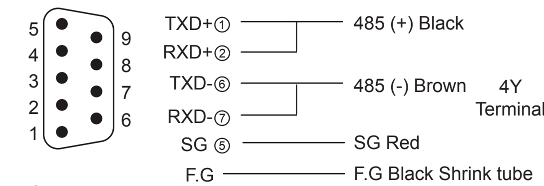


D-Sub 9-pin Female <GP side>

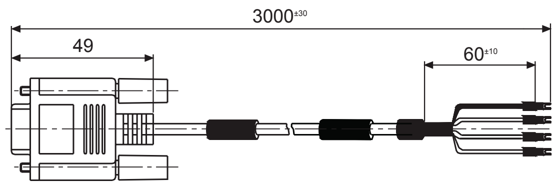


(unit: mm)

15. C3M5P03-D9M0-T4Y0

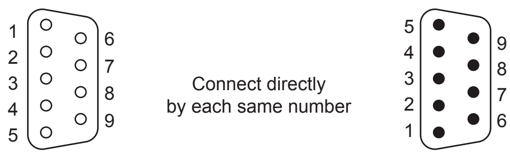


D-Sub 9-pin Male <GP side>



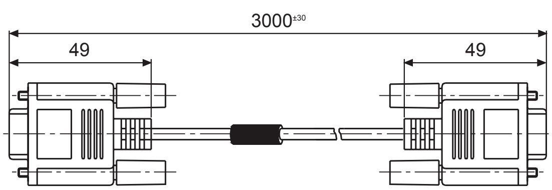
(unit: mm)

13. C3M5P12-D9F0-D9M1



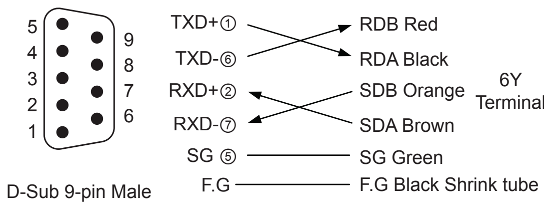
D-Sub 9-pin Female <GP side>

D-Sub 9-pin Male <Device side>

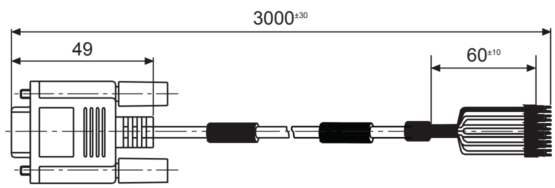


(unit: mm)

16. C3M5P04-D9M0-T6Y0



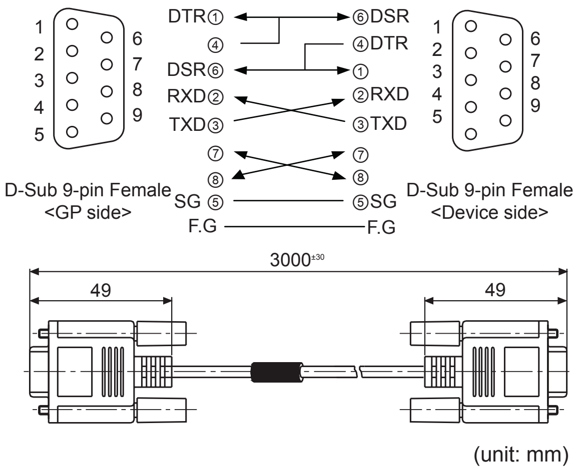
D-Sub 9-pin Male <GP side>



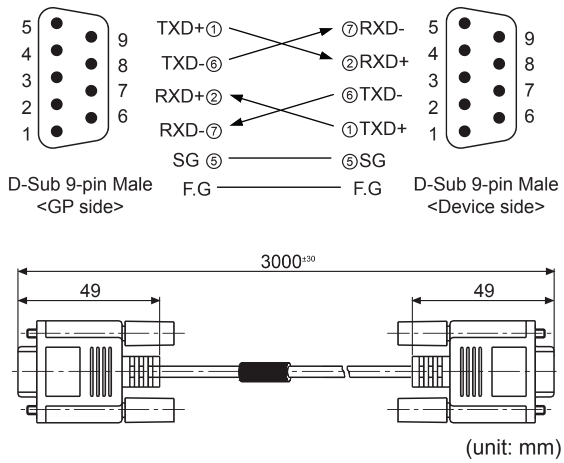
(unit: mm)

Communication Cable Wiring And Dimensions

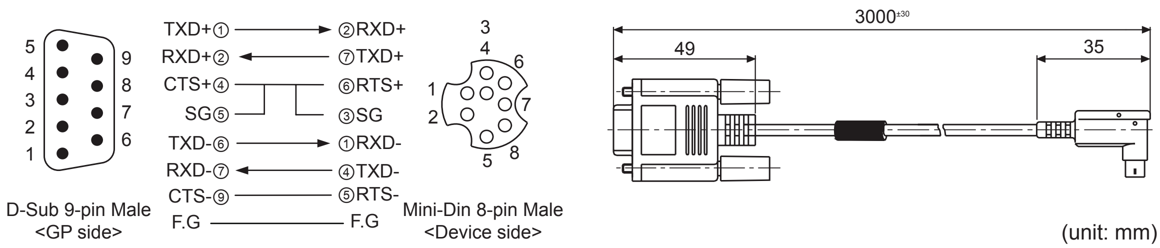
17. C3M5P14-D9F0-D9F0



18. C3M5P15-D9M0-D9M0



19. C3M5P08-D9M0-M8M1



Communication Cable Able To Connect With GP/LP

Series	Connectable device	Connectable module	Connection type	Communication cable model	Connection diagram no.
LS Master-K	MK-10S1	CPU	RS232C	C3M5P00-D9F0-M6M0	1
	MK-80S	CPU	RS232C	C3M5P01-D9F0-D9M0	2
	MK-120S	CPU	RS232C	C3M5P01-D9F0-D9M0	2
	MK-200S	CPU	RS232C	C3M5P01-D9F0-D9M0	2
	MK-300S	CPU	RS232C	C3M5P01-D9F0-D9M0	2
	MK-1000S	CPU	RS232C	C3M5P01-D9F0-D9M0	2
LS Glofa	GM4	CPU	RS232C	C3M5P01-D9F0-D9M0	2
	GM6	CPU	RS232C	C3M5P01-D9F0-D9M0	2
	GM7U	CPU	RS232C	C3M5P01-D9F0-D9M0	2
LS Master-K CNET	MK-80S	Cnet module (G7L-CUEB)	RS232C	C3M5P05-D9F0-D9M0	6
		Cnet module (G7L-CUEC)	RS422	C3M5P04-D9M0-T6Y0	16
	MK-120S	CPU	RS232C	C3M5P02-D9F0-D9M0	3
		CPU	RS485	C3M5P03-D9M0-W4*0	4
		Cnet module (G7L-CUEA)	RS232C	C3M5P05-D9F0-D9M0	6
		Cnet module (G7L-CUEC)	RS422	C3M5P04-D9M0-T6Y0	16
	MK-200S	CPU	RS232C	C3M5P02-D9F0-D9M0	3
		CPU	RS422	C3M5P04-D9M0-W6*0	5
		CPU	RS485	C3M5P03-D9M0-W4*0	4
		Cnet module (G6L-CUEA)	RS232C	C3M5P05-D9F0-D9M0	6
		Cnet module (G6L-CUEC)	RS422	C3M5P04-D9M0-T6Y0	16
	MK-300S	G4L-CUEA	RS232C	C3M5P05-D9F0-D9M0	6
			RS422	C3M5P04-D9M0-T6Y0	16
	MK-1000S	G3L-CUEA	RS232C	C3M5P05-D9F0-D9M0	6
			RS422	C3M5P04-D9M0-T6Y0	16
LS XGT CNET	XGK-CPUS	XGL-C22A	RS232C	C3M5P01-D9F0-D9M0	2
		XGL-CH2A	RS232C	C3M5P01-D9F0-D9M0	2
			RS422	C3M5P04-D9M0-T6Y0	16
		XGL-C42A	RS422	C3M5P04-D9M0-T6Y0	16

GP/LP Communication Cables

■ Communication Cables By Connectable Devices

Series	Connectable device	Connectable module	Connection type	Communication cable model	Connection diagram no.
LS XGB CNET	XBM	CPU	RS232C	C3M5P13-D9F0-T4Y0	14
			RS485	C3M5P03-D9M0-T4Y0	15
	XBC	CPU	RS232C	C3M5P13-D9F0-T4Y0	14
			RS485	C3M5P03-D9M0-T4Y0	15
OEMAX (SAMSUNG)	N70	CPU	RS232C	C3M5P06-D9F0-D15M0	7
	N70 Plus	CPU	RS232C	C3M5P07-D9F0-D9M0	8
OEMAX FARA	NX7	CPU	RS232C	C3M5P07-D9F0-D9M0	8
	NX70	CPU	RS232C	C3M5P07-D9F0-D9M0	8
MITSUBISHI FX	FX1S	CPU	RS422	C3M5P08-D9M0-M8M0	9
		RS232C module (FX1S-232-BD)	RS232C	C3M5P09-D9F0-D9F0	10
	FX1N	CPU	RS422	C3M5P08-D9M0-M8M0	9
		RS232C module (FX1N-232-BD)	RS232C	C3M5P09-D9F0-D9F0	10
	FX2NC	CPU	RS422	C3M5P08-D9M0-M8M0	9
	FX2N	CPU	RS422	C3M5P08-D9M0-M8M0	9
		RS232C module (FX2N-232-BD)	RS232C	C3M5P09-D9F0-D9F0	10
	FX3U	CPU	RS422	C3M5P08-D9M0-M8M1	19
MITSUBISHI Q	Q00J	Expansion module (QJ71C24N)	RS232C	C3M5P05-D9F0-D9M0	6
			RS422	C3M5P04-D9M0-W6*0	5
		Expansion module (QJ71C24N-R2)	RS232C	C3M5P05-D9F0-D9M0	6
		Expansion module (QJ71C24N-R4)	RS422	C3M5P04-D9M0-W6*0	5
	Q00	Expansion module (QJ71C24N)	RS232C	C3M5P05-D9F0-D9M0	6
			RS422	C3M5P04-D9M0-W6*0	5
		Expansion module (QJ71C24N-R2)	RS232C	C3M5P05-D9F0-D9M0	6
		Expansion module (QJ71C24N-R4)	RS422	C3M5P04-D9M0-W6*0	5
	Q01	Expansion module (QJ71C24N)	RS232C	C3M5P05-D9F0-D9M0	6
			RS422	C3M5P04-D9M0-W6*0	5
		Expansion module (QJ71C24N-R2)	RS232C	C3M5P05-D9F0-D9M0	6
		Expansion module (QJ71C24N-R4)	RS422	C3M5P04-D9M0-W6*0	5
	Q02	Expansion module (QJ71C24N)	RS232C	C3M5P05-D9F0-D9M0	6
			RS422	C3M5P04-D9M0-W6*0	5
		Expansion module (QJ71C24N-R2)	RS232C	C3M5P05-D9F0-D9M0	6
		Expansion module (QJ71C24N-R4)	RS422	C3M5P04-D9M0-W6*0	5
	Q02H	Expansion module (QJ71C24N)	RS232C	C3M5P05-D9F0-D9M0	6
			RS422	C3M5P04-D9M0-W6*0	5
		Expansion module (QJ71C24N-R2)	RS232C	C3M5P05-D9F0-D9M0	6
		Expansion module (QJ71C24N-R4)	RS422	C3M5P04-D9M0-W6*0	5
	Q06H	Expansion module (QJ71C24N)	RS232C	C3M5P05-D9F0-D9M0	6
			RS422	C3M5P04-D9M0-W6*0	5
		Expansion module (QJ71C24N-R2)	RS232C	C3M5P05-D9F0-D9M0	6
		Expansion module (QJ71C24N-R4)	RS422	C3M5P04-D9M0-W6*0	5
	Q12H	Expansion module (QJ71C24N)	RS232C	C3M5P05-D9F0-D9M0	6
			RS422	C3M5P04-D9M0-W6*0	5
		Expansion module (QJ71C24N-R2)	RS232C	C3M5P05-D9F0-D9M0	6
		Expansion module (QJ71C24N-R4)	RS422	C3M5P04-D9M0-W6*0	5
	Q25H	Expansion module (QJ71C24N)	RS232C	C3M5P05-D9F0-D9M0	6
			RS422	C3M5P04-D9M0-W6*0	5
		Expansion module (QJ71C24N-R2)	RS232C	C3M5P05-D9F0-D9M0	6
		Expansion module (QJ71C24N-R4)	RS422	C3M5P04-D9M0-W6*0	5
NAIS FP	FP0-C16	CPU (Tool port)	RS232C	C3M5P10-D9F0-M5M0	11
		CPU (COM port)	RS232C	C3M5P11-D9F0-W4*0	12
	FP0-C32	CPU (Tool port)	RS232C	C3M5P10-D9F0-M5M0	11
		CPU (COM port)	RS232C	C3M5P11-D9F0-W4*0	12
	FP0-T32C	CPU (Tool port)	RS232C	C3M5P10-D9F0-M5M0	11
		CPU (COM port)	RS232C	C3M5P11-D9F0-W4*0	12
	FPG-C24R2	CPU (Tool port)	RS232C	C3M5P10-D9F0-M5M0	11
		CPU (COM port)	RS232C	C3M5P11-D9F0-W4*0	12
	FPG-C32T	CPU (Tool port)	RS232C	C3M5P10-D9F0-M5M0	11
		CPU (COM port)	RS232C	C3M5P11-D9F0-W4*0	12
	FPG-C32T2	CPU (Tool port)	RS232C	C3M5P10-D9F0-M5M0	11
		CPU (COM port)	RS232C	C3M5P11-D9F0-W4*0	12
	FP0R-C10	CPU (Tool port)	RS232C	C3M5P10-D9F0-M5M0	11
		CPU (COM port)	RS232C	C3M5P11-D9F0-W4*0	12

■ Communication Cables By Connectable Devices

Series	Connectable device	Connectable module	Connection type	Communication cable model	Connection diagram no.
NAIS FP	FP0R-C14	CPU (Tool port)	RS232C	C3M5P10-D9F0-M5M0	11
		CPU (COM port)	RS232C	C3M5P11-D9F0-W4*0	12
	FP0R-C16	CPU (Tool port)	RS232C	C3M5P10-D9F0-M5M0	11
		CPU (COM port)	RS232C	C3M5P11-D9F0-W4*0	12
	FP0R-C32	CPU (Tool port)	RS232C	C3M5P10-D9F0-M5M0	11
		CPU (COM port)	RS232C	C3M5P11-D9F0-W4*0	12
	FP0R-T32	CPU (Tool port)	RS232C	C3M5P10-D9F0-M5M0	11
		CPU (COM port)	RS232C	C3M5P11-D9F0-W4*0	12
	FP0R-F32	CPU (Tool port)	RS232C	C3M5P10-D9F0-M5M0	11
		CPU (COM port)	RS232C	C3M5P11-D9F0-W4*0	12
SIEMENS SIMATIC S7-200	CPU221	CPU	RS485	Exclusive cable for SIEMENS	*
	CPU222	CPU	RS485	Exclusive cable for SIEMENS	*
	CPU224	CPU	RS485	Exclusive cable for SIEMENS	*
	CPU224XP	CPU	RS485	Exclusive cable for SIEMENS	*
	CPU224XPsi	CPU	RS485	Exclusive cable for SIEMENS	*
	CPU226	CPU	RS485	Exclusive cable for SIEMENS	*
SIEMENS SIMATIC S7-300	CPU312	CPU	RS485	Exclusive cable for SIEMENS	*
	CPU312C	CPU	RS485	Exclusive cable for SIEMENS	*
	CPU313C	CPU	RS485	Exclusive cable for SIEMENS	*
	CPU313C-2	CPU	RS485	Exclusive cable for SIEMENS	*
	CPU314	CPU	RS485	Exclusive cable for SIEMENS	*
	CPU314C-2	CPU	RS485	Exclusive cable for SIEMENS	*
	CPU315-2	CPU	RS485	Exclusive cable for SIEMENS	*
	CPU317-2	CPU	RS485	Exclusive cable for SIEMENS	*
	CPU319-3	CPU	RS485	Exclusive cable for SIEMENS	*
Allen-Bradley	MicroLogicx 1000	CPU	RS485	Exclusive cable for Allen-Bradley	*
	MicroLogicx 1200	CPU	RS485	Exclusive cable for Allen-Bradley	*
	MicroLogicx 1500	CPU	RS232C	Exclusive cable for Allen-Bradley	*
OMRON SYSMAC C	CPM1A	CPU	RS232C	For communicate GP, OMRON CQM1-CIF02	*
				For extension cable, C3M5P12-D9F0-D9M1	13
OMRON temperature controller	E5AN	CPU direct	RS232C	C3M5P13-D9F0-T4Y0	14
			RS485	C3M5P03-D9M0-T4Y0	15
	E5AR	CPU direct	RS485	C3M5P03-D9M0-T4Y0	15
	E5CN	CPU direct	RS485	C3M5P03-D9M0-T4Y0	15
	E5EN	CPU direct	RS232C	C3M5P13-D9F0-T4Y0	14
			RS485	C3M5P03-D9M0-T4Y0	15
	E5ER	CPU direct	RS485	C3M5P03-D9M0-T4Y0	15
Autonics	MT Series	COM port	RS485	C3M5P03-D9M0-W4*0	4
	MP Series	COM port	RS485	C3M5P03-D9M0-W4*0	4
	THD Series	COM port	RS485	C3M5P03-D9M0-W4*0	4
	TZ Series	COM port	RS485	C3M5P03-D9M0-T4Y0	15
	TK Series	COM port	RS485	C3M5P03-D9M0-T4Y0	15
	TM Series	COM port	RS485	C3M5P03-D9M0-T4Y0	15
	CT Series	COM port	RS485	C3M5P03-D9M0-T4Y0	15
	DS/DA Series	COM port	RS485	C3M5P03-D9M0-W4*0	4
	Remote I/O ARM Series	COM port	RS485	C3M5P03-D9M0-W4*0	4
	LP-S044, LP-S070	CPU	RS232C	C3M5P14-D9F0-D9F0	17
			RS422	C3M5P15-D9M0-D9M0	18
	DPU Series	COM port	RS485	C3M5P03-D9M0-W4*0	4
	KRN1000 Series	COM port	RS422/485	C3M5P04-D9M0-T6Y0	16
	KRN100 Series	COM port	RS485	C3M5P03-D9M0-W4*0	4
	KRN50 Series	COM port	RS485	C3M5P03-D9M0-W4*0	4
DELTA	DTB Series	COM port	RS485	C3M5P03-D9M0-T4Y0	15
DANFOSS	FC 200	COM port	RS485	C3M5P03-D9M0-T4Y0	15
GP firmware download cable	COMPUTER	*	RS232C	C3M5P14-D9F0-D9F0	17

(S) Field Network Devices

Modbus
Sensor Connector Type
Digital Remote I/O
ARM Series

DeviceNet
Standard Terminal Type
Analog Remote I/O
ARD-A Series

USB To RS485 Converter
SCM-US48I

RS232 To RS485 Converter
SCM-38I

USB To Serial Converter
SCM-US

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Product Overview

DeviceNet Digital Remote I/O, Standard Terminal Block Type

Model	Basic unit	**ARD-DI08A**	**ARD-DI16N**	**ARD-DI16P**	**ARD-DO08R**	**ARD-DO08S**	**ARD-DO16N**	**ARD-DO16P**	**ARD-DX16N**	**ARD-DX16P**
	Expansion unit	**ARD-DI08AE**	**ARD-DI16NE**	**ARD-DI16PE**	**ARD-DO08RE**	**ARD-DO08SE**	**ARD-DO16NE**	**ARD-DO16PE**	**ARD-DX16NE**	**ARD-DX16PE**
Appearances & Dimensions		 [W105×H52×L38.5mm]								
Power supply		24VDC (allowable voltage range: 12-28VDC)								
Power consumption		Max. 3W								
I/O points		AC input 8 points	NPN input 16 points	PNP input 16 points	Relay output 8 points	SSR output 8 points	NPN output 16 points	PNP output 16 points	NPN input 8 + output 8 points	PNP input 8 + output 8 points
Control I/O	Voltage	75-250VAC	10-28VDC		Normally open (N.O.) 250VAC 2A 1a	30-250VDC	10-28VDC (voltage drop : Max. 0.5V)			
	Current	13mA / Point	10mA /Point			1A / Point	0.5A / Point (leakage current: Max. 0.5mA)		Input : 10mA, Output : 0.5A / Point (leakage current: Max. 0.5mA)	
	COMMON method	8 points, Common			1point, 1COM	8 points, Common				
Protection circuit		Surge, Reverse polarity protection circuit (common) Transistor output type - Overcurrent protection circuit (NPN type: operated from 1.9A → power is reapplied in overcurrent status, PNP type : Operated at min. 0.7A), Overheating protection (min. 165℃), Short-circuit protection								
Indicator		Network status LED (green, red), Module status LED (green, red), I/O status LED								
Material		Front case : PC, Body case : PC, Rubber cap : NBR								
Mounting		DIN rail or screw lock type								
Isolation type		I/O and inner circuit: insulated, DeviceNet and inner circuit: non-insulated, Power and DeviceNet: non-insulated								
Reference		**S-5 to 12**								

DeviceNet Digital Remote I/O, Sensor Connector Type

Model	Basic unit	**ARD-DI08N-4S**	**ARD-DI08P-4S**	**ARD-DO08N-4S**	**ARD-DO08P-4S**
	Expansion unit	**ARX-DI08N-4S**	**ARX-DI08P-4S**	**ARX-DO08N-4S**	**ARX-DO08P-4S**
Appearances & Dimensions		 [W31×H81.8×L58mm]			
Power supply		24VDC (allowable voltage range: 12-28VDC)			
Power consumption		Max. 3W			
Isolation type		Photocoupler isolated			
I/O points		NPN input 8 points	PNP input 8 points	NPN output 8 points	PNP output 8 points
Control I/O	Voltage	10-28VDC		10-28VDC (voltage drop : max. 0.5V)	
	Current	10mA/point (sensor current: 150mA/point)		Output: 0.3A/point (leakage current: max. 0.5mA)	
	COMMON method	8 points Common			
Protection circuit		Surge, Short-circuit, Overheating and ESD protection, Reverse polarity protection circuit			
		Overcurrent protection circuit (operated at min. 0.17A)		Overcurrent protection circuit (operated at min. 0.7A)	
Indicator		Network status (NS) LED (green, red), Unit status (MS) LED (green, red) I/O status LED (input: green, output: red)			
Material		Front Case: PC, Body Case: PC			
Mounting		DIN rail or Screw lock type			
Isolation type		I/O and inner circuit: insulated, DeviceNet and inner circuit: non-insulated, Power and DeviceNet: non-insulated			
Reference		**S-5 to 12**			

DeviceNet Analog Remote I/O, Standard Terminal Block Type

Model		ARD-AI04	ARD-AO04
Appearances & Dimensions		CE  [W105×H52×L38.5mm] DeviceNet CONFORMANCE TESTED (only for ARD-AI04, other models are compatible)	
Power supply		24VDC (allowable voltage range: 12-28VDC)	
Power consumption		Max. 3W	
I/O points		Input 4 points (switchable voltage/current)	Output 4 points (voltage 2CH, current 2CH)
Control I/O	Voltage	0-10VDC, -10-10VDC, 0-5VDC, 1-5VDC, -5-5VDC (input impedance: min. 1MΩ)	0-10VDC, -10-10VDC, 0-5VDC, 1-5VDC, -5-5VDC (load resistance: min. 1kΩ)
	Current	DC4-20mA, DC0-20mA (input impedance: 250Ω)	DC4-20mA, DC0-20mA (load resistance: max. 600Ω)
	Max. allowable range	±5% for rated input range	±5% for rated output range
	Resolution	14bit, 1/16,000	
	Accuracy	● At room temperature (25±5℃) range: ±0.3% F.S. ● Out of room temperature range: ±0.6% F.S.	
Protection circuit		Surge, Static electricity, Reverse polarity protection circuit	
Indicator		Network status (NS) LED (green, red), Unit status (MS) LED (green, red)	
Material		Front Case: PC, Body Case: PC	
Mounting		DIN rail or Screw lock type	
Isolation type		I/O and inner circuit: non-insulated, DeviceNet and inner circuit: insulated, Power and DeviceNet: insulated	
Reference		**S-13 to 24**	

Modbus Digital Remote I/O, Sensor Connector Type

Model	Basic unit	**ARM-DI08N-4S**	**ARM-DI08P-4S**	**ARM-DO08N-4S**	**ARM-DO08P-4S**
	Expansion unit	**ARX-DI08N-4S**	**ARX-DI08P-4S**	**ARX-DO08N-4S**	**ARX-DO08P-4S**
Appearances & Dimensions		CE  [W31×H81.8×L58mm]			
Power supply		Rated voltage: 24VDC (allowable voltage range: 12-28VDC)			
Power consumption		Max. 3W			
I/O points		NPN input 8 points	PNP input 8 points	NPN output 8 points	PNP output 8 points
Control I/O	Voltage	10-28VDC		10-28VDC (voltage drop : Max. 0.5V)	
	Current	10mA/points (sensor current: 150mA/points)		0.3A/point (leakage current: Max.0.5mA)	
	COMMON method	8 points Common			
Protection circuit		Surge, Short-circuit, Overheating and ESD protection, Reverse polarity protection circuit			
		Overcurrent protection circuit (operated at Min. 0.17A)		Overcurrent protection circuit (operated at Min. 0.7A)	
Indicator		Network status (NS) LED (green, red), Unit status (MS) LED (green, red), I/O status LED (input: green, output: red)			
Material		Front Case: PC, Body Case: PC			
Mounting		DIN rail or Screw lock type			
Isolation type		I/O and inner circuit: insulated, Modbus and inner circuit: non-insulated, unit power: non-insulated			
Reference		**S-25 to 29**			

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

Product Overview

Communication Converter
(RS232C to RS485 converter / USB to RS485 converter)

Series		**SCM-US48I**	**SCM-38I**
Appearances & Dimensions		CE KC  [W39×H23.5×L75.5mm]	CE KC  [W39×H23.5×L75.5mm]
Power supply		5VDC USB bus power※1	12-24VDC
Power consumption		Max. 1W	Max. 1.7W
Communication speed※2		1,200 to 115,200bps (recommended: 9,600bps)	
Communication type		Half duplex type	
Available communication distance		USB: Max. 1m± 30% RS485: Max. 1.2km	Max. 1.2km
Multi-drop		Max. 31 multi-drop	
Data type	Data bit	5-bit, 6-bit, 7-bit, 8-bit	
	Stop bit	1-bit, 2-bit	
	Parity bit	None, Even, Odd	
Connection type		USB: USB 2.0 B type (male)	RS232C: D-sub 9-pin
		RS485: 4-wire screw terminal (2-wire communication type)	
Accessory		USB 2.0 AB type connector (length: 1m)	—
Reference		**S-30 to 41**	

※1: USB bus power is supplied from PC or USB host controller.
※2: Protocol and communication speed are set by Hyper terminal. DAQMaster, ParaSet, Modbus Poll.
When communicating with Autonics products, set communication speed to 9,600bps.
※There might be some differences in the specification above depending on PC environment.

Communication Converter
(USB to Serial converter)

Series	**SCM-US**
Appearances & Dimensions	CE KC  ※**Cable length 1.5m** [W52×H18×L8mm]
Power supply※1	5VDC USB bus power
Power consumption	Max. 1W
Communication speed※2	1,200 to 115,200bps (recommended: 9,600bps)
Communication type	Half duplex type
Available communication distance	1.5m (not extension)
Isolation type	Non-isolated
Connector type	USB: USB 2.0 A type (male)
	Earphone jack (4 pole stereo phone plug)※3
Reference	**S-30 to 40**

※1: USB bus power is supplied from PC or USB host controller.
※2: Protocol and communication speed are set by Hyper terminal. DAQMaster, ParaSet, Modbus Poll.
When communicating with Autonics products, set communication speed to 9,600bps.
※3: Some products requires the EXT-US (converter cable, sold separately).
※There might be some differences in the specification above depending on PC environment.

DeviceNet Digital Remote I/O

■ Features

- Automatic communication speed recognition
  : Enables to recognize communication speed automatically when connecting with master
- Network Voltage monitoring
  : If PV is lower than SV, enables to receive error flag for network power monitoring as Explicit message.
- Additional expansion units
  - Standard terminal block type: Connectable up to 3 expansion units
  - Sensor connector type: Connectable up to 7 expansion units
  - Expandable I/O points up to max. 64 points for Standard terminal type, sensor connector type
- Reading the number of expansion units
  : Reads the number of connected expansion units
- Reading model name: Reads the connected model name of connected units (sensor connector type)
- Reading the unit specifications: Reads the specifications of connected units

Standard terminal block type

Sensor connector type

⚠ Please read "Caution for your safety" in operation manual before using.

CE DeviceNet™ CONFORMANCE TESTED

■ Ordering Information

AR D — D I 08 A E — 4S

Item	Code	Description		
Terminal block※2	No-mark	Standard terminal block type		
	4S	Sensor connector type (4pin)		
Structure	No-mark	Basic unit		
	E※4	Expansion unit		
I/O specification※1	A	AC voltage	R	Relay
	N	NPN open collector	S	SSR
	P	PNP open collector		
I/O point	08	8 points type		
	16	16 points type		
I/O type	I	Input type		
	O	Output type		
	X	I/O mixed type		
Digital/Analog	D	Digital type		
	A※5	Analog type		
Network	D	Basic unit (DeviceNet type)		
	X※3	Expansion unit (use in DeviceNet/Modbus)		
Item	AR	Autonics Remote I/O		

※1: Sensor connector type (ARD-☐-4S) model is only for NPN, PNP I/O specifications.
※2: Sensor connector (CNE-P04-☐) is sold separately. It is compatible with e-CON connector.
※3: It is only for an expansion unit of sensor connector type.
※4: It is only for an expansion unit of standard terminal block type.
※5: For ARD-A Series as analog type, refer to S-13 page.

■ Model

Model			Specification
Terminal type	Basic unit	Expansion unit	
Standard terminal block type	ARD-DI08A	ARD-DI08AE	75-250VAC input 8-point (13mA/point)
	ARD-DI16N	ARD-DI16NE	10-28VDC NPN input 16-point (10mA/point)
	ARD-DI16P	ARD-DI16PE	10-28VDC PNP input 16-point (10mA/point)
	ARD-DO08R	ARD-DO08RE	Relay output 8-point (2A/point), Life cycle of contact: 100,000 times
	ARD-DO08S	ARD-DO08SE	SSR output 8-point (1A/point)
	ARD-DO16N	ARD-DO16NE	NPN output 16-point (0.5A/point)
	ARD-DO16P	ARD-DO16PE	PNP output 16-point (0.5A/point)
	ARD-DX16N	ARD-DX16NE	10-28VDC NPN input 8-point (10mA/point), NPN output 8-point (0.5A/point)
	ARD-DX16P	ARD-DX16PE	10-28VDC PNP input 8-point (10mA/point), PNP output 8-point (0.5A/point)
Sensor connector type	ARD-DI08N-4S	ARX-DI08N-4S	10-28VDC NPN input 8-point (10mA/point)
	ARD-DI08P-4S	ARX-DI08P-4S	10-28VDC PNP input 8-point (10mA/point)
	ARD-DO08N-4S	ARX-DO08N-4S	NPN output 8-point (0.3A/point)
	ARD-DO08P-4S	ARX-DO08P-4S	PNP output 8-point (0.3A/point)

■ Specifications

Type		Standard terminal block type								
Model	Basic unit	**ARD-DI08A**	**ARD-DI16N**	**ARD-DI16P**	**ARD-DO08R**	**ARD-DO08S**	**ARD-DO16N**	**ARD-DO16P**	**ARD-DX16N**	**ARD-DX16P**
	Expansion unit	**ARD-DI08AE**	**ARD-DI16NE**	**ARD-DI16PE**	**ARD-DO08RE**	**ARD-DO08SE**	**ARD-DO16NE**	**ARD-DO16PE**	**ARD-DX16NE**	**ARD-DX16PE**
Power supply		Rated voltage: 24VDC, Voltage range: 12-28VDC								
Power consumption		Max. 3W								
I/O points		AC input 8-point	NPN input 16-point	PNP input 16-point	Relay output 8-point	SSR output 8-point	NPN output 16-point	PNP output 16-point	NPN input 8-point + output 8-point	PNP input 8-point + output 8-point
Control I/O	Voltage	75-250VAC	10-28VDC		Normally open (N.O.) 250VAC 2A 1a	30-250VAC	10-28VDC (voltage drop: max. 0.5VDC)			
	Current	13mA/point	10mA/point			1A/point	0.5A/point (leakage current: max. 0.5 mA)		Input: 10mA, Output: 0.5A/point (leakage current: max. 0.5mA)	
	COMMON method	8-point, common			1-point, COM	8-point, common				
Insulation resistance		Over 200MΩ (at 500VDC megger)								
Noise immunity		±240 V the square wave noise (pulse width: 1μs) by the noise simulator								
Dielectric strength		1000 VAC 50/60 Hz for 1 min								
Vibration		1.5 mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours								
Shock		500 m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times								
Environ-ment	Ambient temp.	-10 to 50℃, storage: -25 to 75 ℃								
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH								
Protection structure		IP20 (IEC standard)								
Protection circuit		Surge protection circuit, Reverse polarity protection circuit (common) ●Transistor output type - Overcurrent protection circuit (NPN type: operated at min. 1.9A → re-supply power in overcurrent status, PNP type: operated at min. 0.7A), Overheating protection circuit (min. 165℃), Short-circuit protection circuit								
Indicator		Network status (NS) LED (green, red), Unit status (MS) LED (green, red), I/O status LED (input: green, output: red)								
Material		Front case, Body Case: PC, Rubber cap: NBR								
Mounting		DIN rail or screw lock type								
Insulation type		I/O and inner circuit: insulated, DeviceNet and inner circuit: non-insulated, Power and DeviceNet: non-insulated								
Approval		DeviceNet	CE DeviceNet		DeviceNet		CE DeviceNet			
Unit weight		Approx. 150g	Approx. 140g		Approx. 160g	Approx. 170g	Approx. 140g			

※Environment resistance is rated at no freezing or condensation.

Type		Sensor connector type			
Model	Basic unit	**ARD-DI08N-4S**	**ARD-DI08P-4S**	**ARD-DO08N-4S**	**ARD-DO08P-4S**
	Expansion unit	**ARX-DI08N-4S**	**ARX-DI08P-4S**	**ARX-DO08N-4S**	**ARX-DO08P-4S**
Power supply		Rated voltage: 24VDC, Voltage range: 12-28VDC			
Power consumption		Max. 3W			
I/O points		NPN input 8-point	PNP input 8-point	NPN output 8-point	PNP output 8-point
Control I/O	Voltage	10-28VDC		10-28VDC (voltage drop: max. 0.5VDC)	
	Current	10mA/point (Sensor current: 150 mA/point)		0.3A/point (leakage current: max.0.5mA)	
	COMMON method	8-point, common			
Insulation resistance		Over 200MΩ (at 500VDC megger)			
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength		1,000VAC 50/60Hz for 1 min (between external terminals and case)			
Vibration		1.5mm amplitude at frequency of 10 to 55 Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s^2 (approx. 50 G) in each X, Y, Z direction for 3 times			
Environ-ment	Ambient temp.	-10 to 50℃, storage: -25 to 75℃			
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP20 (IEC standard)			
Protection circuit		Surge, Short-circuit, Overheating (over 165 ℃) and ESD protection, Reverse polarity protection circuit			
		Overcurrent protection circuit (operated at min. 0.17A)		Over current protection circuit (operated at min. 0.7A)	
Indicator		Network status (NS) LED (green, red), Unit status (MS) LED (green, red), I/O status LED (input: green, output: red)			
Material		Front case, Body Case: PC			
Mounting		DIN rail or screw lock type			
Insulation type		I/O and inner circuit: insulated, DeviceNet and inner circuit: non-insulated, Power and DeviceNet: non-insulated			
Approval		CE DeviceNet			
Unit weight	Basic unit	Approx. 64g	Approx. 64g	Approx. 65g	Approx. 67g
	Expansion unit	Approx. 56g	Approx. 57g	Approx. 58g	Approx. 59g

※Environment resistance is rated at no freezing or condensation.

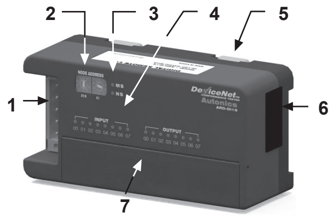
▣ DeviceNet Communication

Item	Specifications
Communication	I/O Slave messaging (Group 2 Only slave) ·Poll command: Yes ·Bit_strobe command: Yes ·Cyclic command: Yes ·COS command: Yes
Communication distance	Max. 500m (125kbps), Max. 250m (250kbps), Max. 100m (500kbps)
NODE ADDRESS setting	Max. 64 nodes (set by the front rotary switch)
Communication speed	125, 250, 500kbps (automatically set when connecting with Master)
Insulation	I/O and inner circuit: Photocoupler isolated, DeviceNet and inner circuit: non-insulation, DeviceNet power: non-isolated
DeviceNet power	·Rated voltage: 24VDC ·Voltage range: 12-28VDC ·Power consumption: Max. 3W
Approval	ODVA Conformance tested

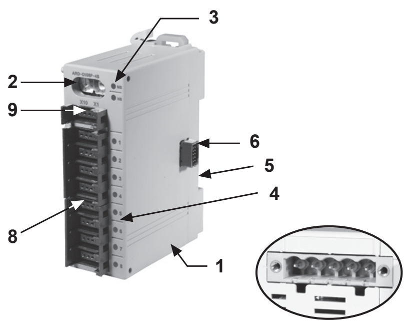
▣ Unit Description

◎ Basic unit

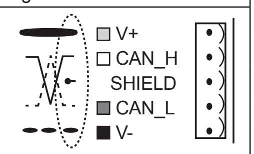
● Standard terminal block type



● Sensor connector type



1. DeviceNet connector

No.	Color	For	Organization
5	Red	24VDC (+)	
4	White	CAN_H	
3	None	Shield	
2	Blue	CAN_L	
1	Black	24VDC (-)	

2. Rotary switch for node address
: Rotary switch for setting node address.
×10 represents tens digit and ×1 represents ones digit.

3. Status LED: It displays the status of unit (MS) and network (NS).

4. I/O status LED: It displays each I/O status.

5. Rail lock: It is used for mounting DIN rail or with screw.

6. Connector output part: It connects an expansion unit.

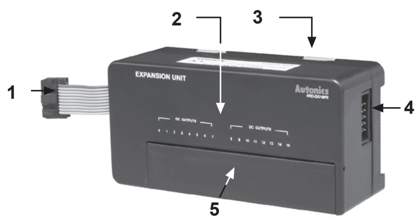
7. I/O terminal block: It is used for connecting external device I/O.

8. Sensor connector: It is used for connecting external device I/O.

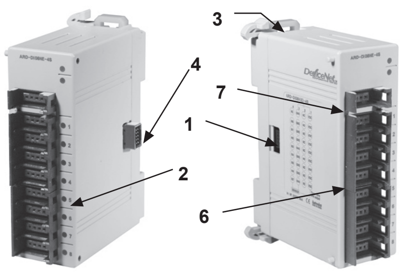
9. External power connector: It is used for supplying external power.

◎ Expansion unit

● Standard terminal block type



● Sensor connector type



1. Connector input part
: It connects expansion unit and is joined into expansion connector output.

2. I/O status LED: It displays each I/O status.

3. Rail lock: It is used for mounting DIN rail or with screw.

4. Connector output part: It connects an expansion unit.

5. I/O terminal block: It is used for connecting external device I/O.

6. Sensor connector: It is used for connecting external device I/O.

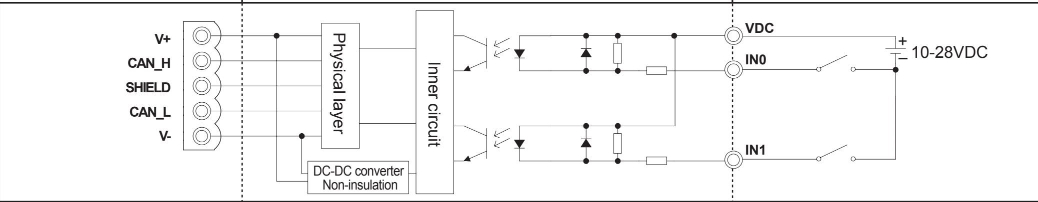
7. External power connector: It is used for supplying external power

■ I/O Circuit Diagram

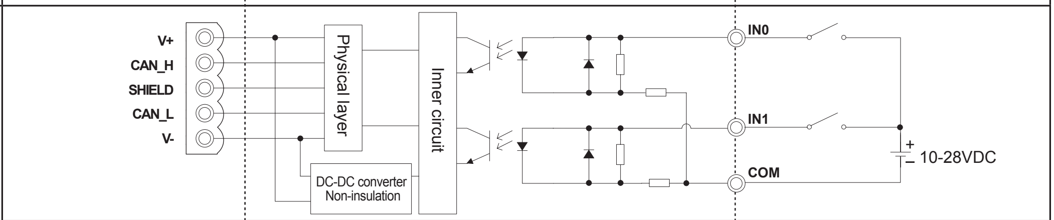
◎ Standard terminal block type

Type | DeviceNet connector | Inner circuit | External connections

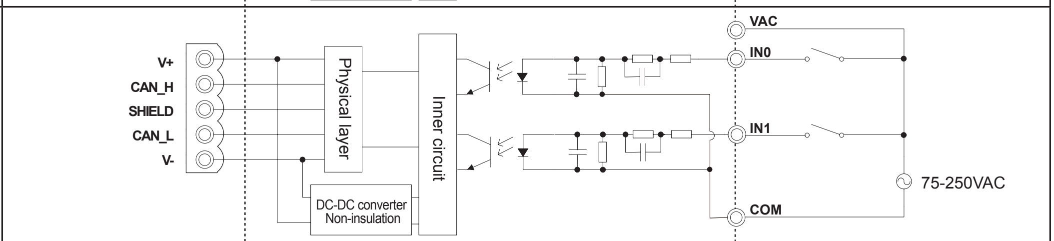
NPN input



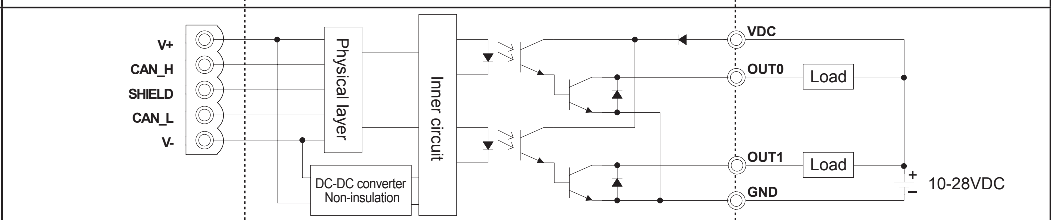
PNP input



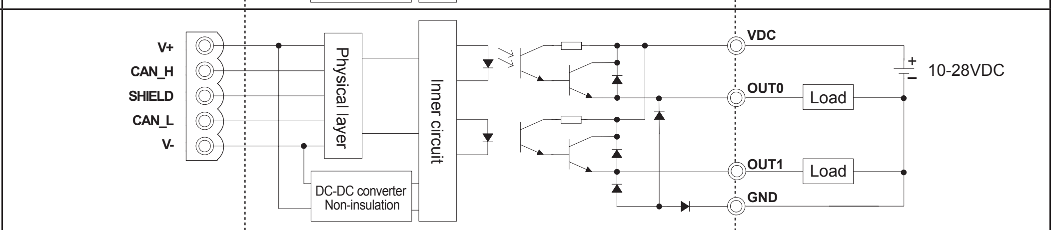
AC input



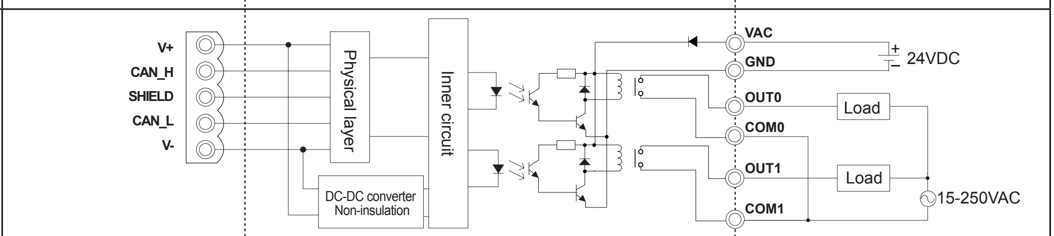
NPN output



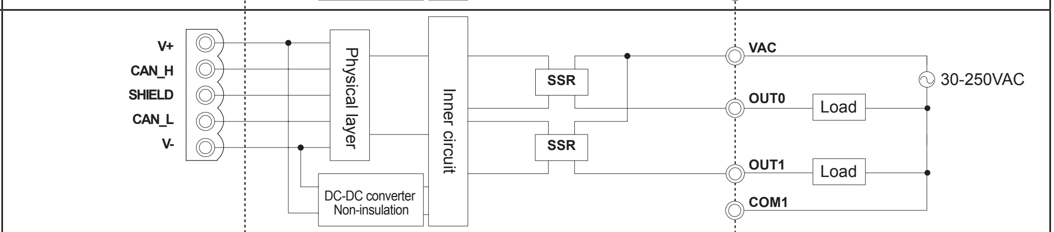
PNP output



Relay output

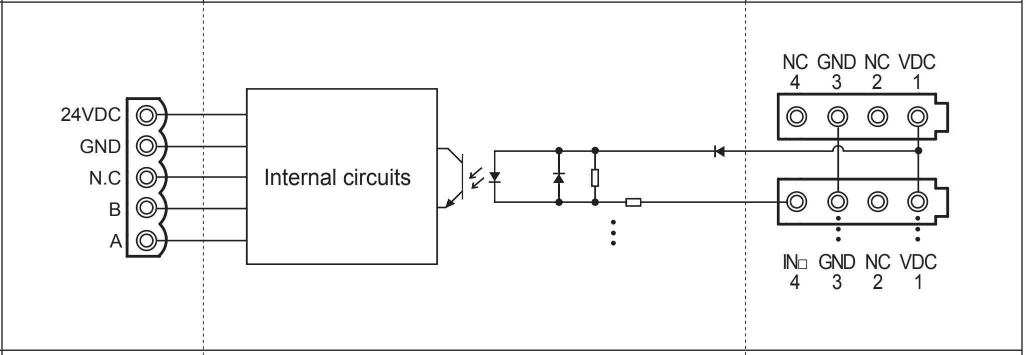
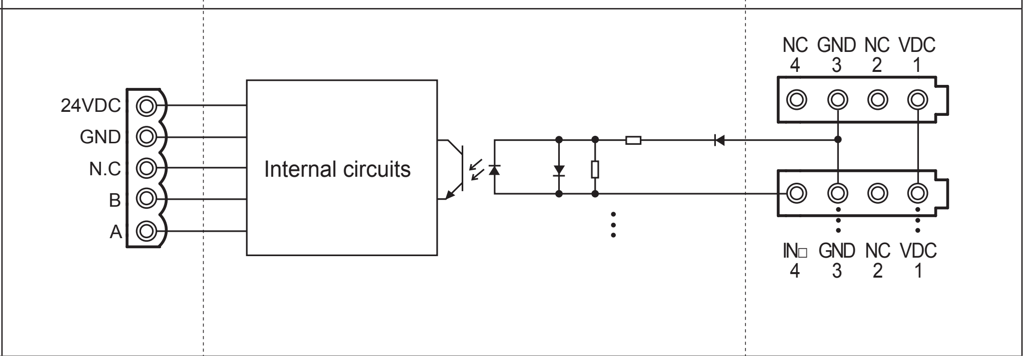
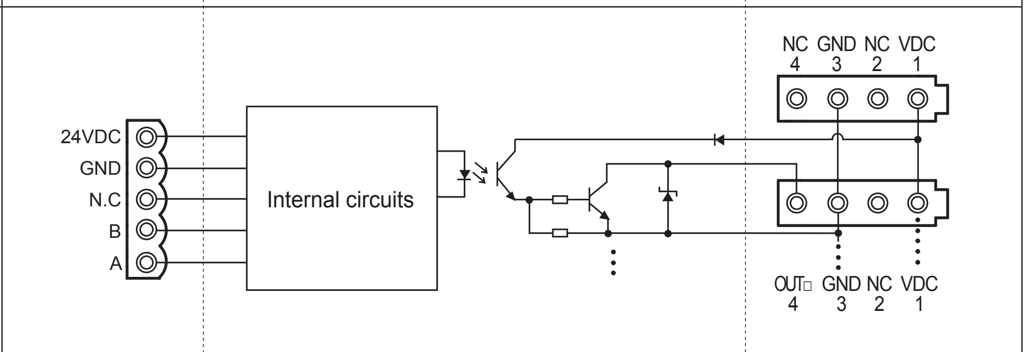
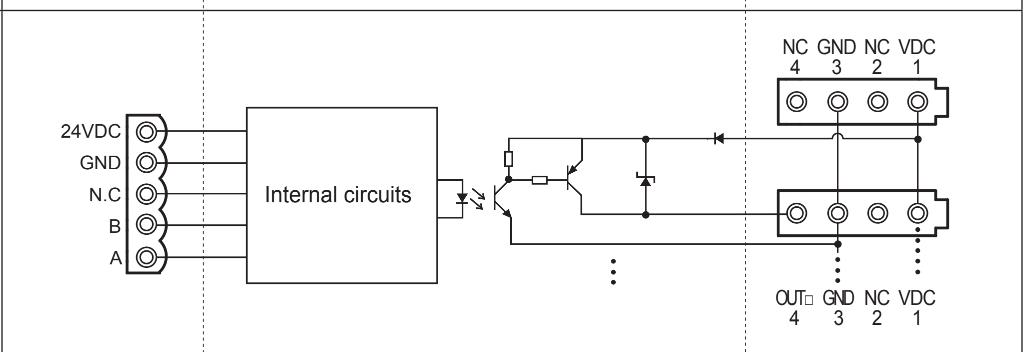


SSR output



■ I/O Circuit Diagram

◎ Sensor connector type

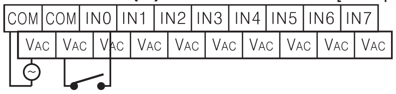
Type	Network connector	Inner circuit	Sensor connector
NPN input			
PNP input			
NPN output			
PNP output			

※IN□: IN0 to IN7, OUT□: OUT0 to OUT7

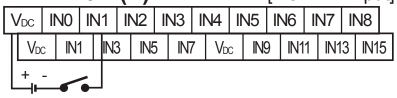
▣ Connections

◎ Standard terminal block type

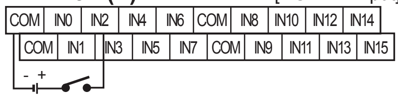
● **ARD-DI08A (E)** [AC input]



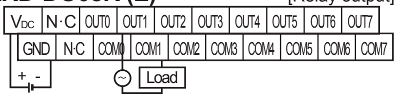
● **ARD-DI16N (E)** [DC NPN input]



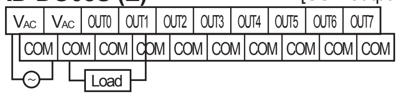
● **ARD-DI16P (E)** [DC PNP input]



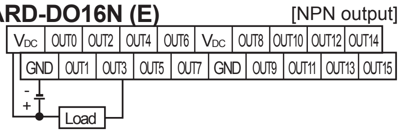
● **ARD-DO08R (E)** [Relay output]



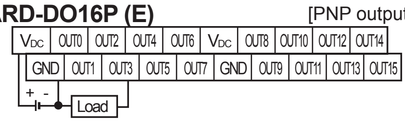
● **ARD-DO08S (E)** [SSR output]



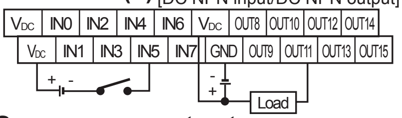
● **ARD-DO16N (E)** [NPN output]



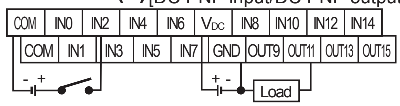
● **ARD-DO16P (E)** [PNP output]



● **ARD-DX16N (E)** [DC NPN input/DC NPN output]

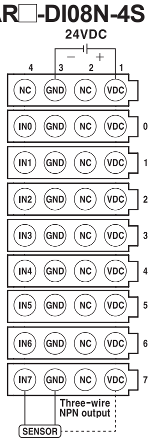


● **ARD-DX16P (E)** [DC PNP input/DC PNP output]



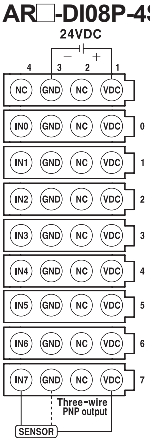
◎ Sensor connector type

● **AR□-DI08N-4S**



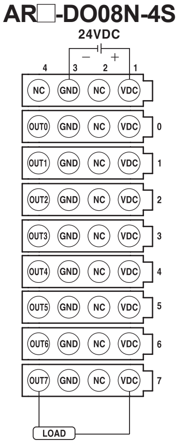
IN (NPN): 8P, 24VDC 10mA

● **AR□-DI08P-4S**



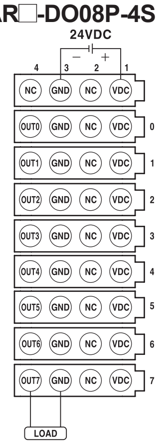
IN (PNP): 8P, 24VDC 10mA

● **AR□-DO08N-4S**



OUT (NPN): 8P, 24VDC 0.3A/Point

● **AR□-DO08P-4S**

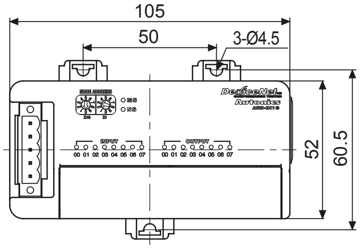


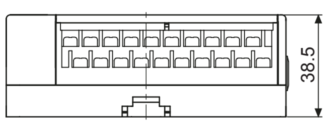
OUT (PNP): 8P, 24VDC 0.3A/Point

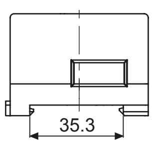
▣ Dimensions

◎ Standard terminal block type

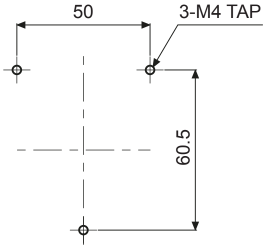
(unit:mm)







● **Panel cut-out**



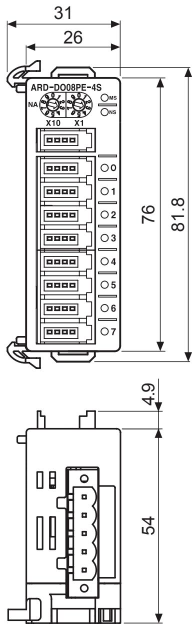
※Tightening torque: 1.8 to 2.5N·m
※Same dimensions are applied to both basic and expansion unit.
※Connecting connectors are included for expansion units.

■ Dimensions

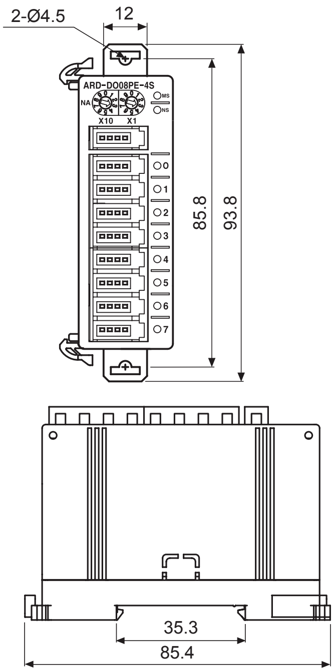
◎ Sensor connector type

(unit: mm)

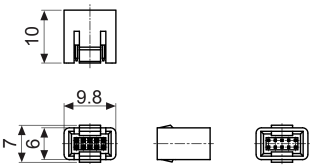
● Mounting on DIN rail



● Mounting with screws



● Connector



※Tightening torque: 1.8 to 2.5N·m

※Same dimensions are applied to both basic and expansion unit.

■ Status LED

(-☼-: ON, -◐-: Flash, ●: OFF)

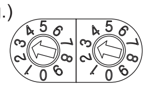
Item	LED status		Description
	Red	Green	
Module status (MS) LED	☼	●	Unrecoverable error
	◐	●	Recoverable error & communication error of expansion unit
	●	☼	Normal operation
	●	●	Power is not supplied
Network status (NS) LED	●	◐	Normal standby
	●	☼	Network On-Line
	☼	●	Duplicate, MAC ID / Bus-Off
	◐	●	Time Out
	●	●	Network Off-Line

■ Setup And Installation

◎ Node address setup

- Two rotary switches are used for setting node address.
  X10 switch represents the 10's multiplier and X10 switch represents the 1's multiplier.
  Node address is settable from 0 to 63.
- Node address is changed when re-supplying the power to the unit.
  After changing node address, must re-supply the power.

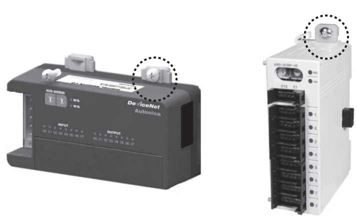
(E.g.)



X10 **X1**

◎ Mounting on panel

① Pull Rail Locks (standard terminal block type: 3, sensor connector type: 2) on the rear part of a unit, there are fixing screw hole.
② Place the unit on a panel to be mounted.
③ Make holes on fixing screw positions.
④ Fasten the screw to fix the unit tightly.
Tightening torque should be below 0.5N·m.



■ Setup and Installation

◎ Mounting on DIN rail

① Pull Rail Locks (standard terminal block type: 3, sensor connector type: 2) on the rear part of unit.
② Place the unit on DIN rail to be mounted.
③ Press Rail Locks to fix the unit tightly.

◎ Connection of basic unit and expansion units (standard terminal block type)

① Turn OFF the power of a Basic unit.
② Place an expansion unit to be installed next to the basic unit.
③ Connect the cable of expansion unit to the connector of a basic unit.
④ Install a connected expansion units as the right figures.
⑤ Supply the power to a Basic unit.
(Re-supply the power of a basic unit and it recognizes expansion units.)

◎ Connection of basic unit and expansion units (sensor connector type)

① Turn OFF the power of the basic unit.
② Remove a cover of connector for extension with nippers, etc.
③ Connect connector input part of an expansion unit and connector output part of a basic unit with a connector which is enclosed with an expansion unit box.
④ Install a connected expansion units as the right figure.
⑤ Supply the power to the Basic unit.
(Re-supply the power of a basic unit and it recognizes expansion units.)

■ Communication Distance

Baud rate	Max. network length	Max. branch line length	Max. extended branch line length
125kbps	500m	6m	156m
250kbps	250m	6m	78m
500kbps	100m	6m	39m

■ Terminating Resistance

● 120Ω ● 1% of metallic film ● 1/4W

※Do not install terminating resistance on the unit, or it may cause network terminating problem (impedance can be too high or low) and trouble.
※Connect terminating resistance on the both ends of the trunk line.

■ Caution During Use

- Turn OFF the power before connecting or disconnecting expansion units.
- Node addresses of connected units on network should not be duplicated. If you change a node address during operation,unit status (MS) red LED fl ashes and it communicates with a previous node address.
  Re-supply power and the changed node address is applied.
- Communication speed which is set on master is set automatically. If you change the communication speed during operation, network status (NS) red LED turns ON and it does not communicate.
  Re-supply power and it operates normally.
- Make sure to use DeviceNet standards communication cables, and taps.
  It may cause communication error if non-standards products are used.
- Make sure to examine disconnection or short-circuit before connecting cables.
- Avoid installing the units where severe dust exists or where corrosion may occur.
- This unit may be used in the following environments.

• Indoor
• Altitude: Under 2,000m
• Pollution degree 2
• Installation category II

DeviceNet Analog Remote I/O

■ Features

- Adopts DeviceNet, standard open Network
  : Communicates other DeviceNet devices without additional installations
  : Configuratable power and communication system only with communication cables
  : Connectable max. 63 units per 1 master unit
- Strong against noise and high accuracy (0.3%) measurement with differential input method (measuring difference between +, - input signal)
- Various I/O range: 0-5VDC, 1-5VDC, 0-10VDC, -5-5VDC, -10-10VDC, DC4-20mA, DC0-20mA
- Scale function: Settable high/low limit scale value for analog I/O range (Setting range: -28,000 to 28,000)
- Various functions
  : Automatic communication speed recognition, Network voltage monitoring, Input digital filter, Peak/Bottom Hold, hysteresis, reading model name and number of units, I/O and status flag monitoring
- Built-in surge, ESD protection, Reverse polarity protection circuit
- Mounting DIN rail method and screw lock method

⚠ Please read "Caution for your safety" in operation manual before using.

(only for ARD-AI04, other models are compatible)

■ Ordering Information

AR D — A I 04

Field	Code	Description
I/O points	04	4-point type
I/O type	I	Input type
	O	Output type
Digital/Analog	A	Analog type
	D※1	Digital type
Network	D	DeviceNet type
Item	AR	Autonics Remote I/O

※1. For digital type ARD-D Series, refer to the S-5 page.

■ Specifications

Model		ARD-AI04	ARD-AO04
Power supply		Rated voltage: 24VDC, Voltage range: 12-28VDC	
Power consumption		Max. 3W	
I/O points		Input 4-point (switchable voltage/current)	Output 4-point (voltage 2CH, current 2CH)
Control I/O	Voltage	0-10VDC, -10-10VDC, 0-5VDC, 1-5VDC, -5-5VDC (input impedance: max. 1MΩ)	0-10VDC, -10-10VDC, 0-5VDC, 1-5VDC, -5-5VDC (load resistance: max. 1kΩ)
	Current	DC4-20mA, DC0-20mA (input impedance: 250Ω)	DC4-20mA, DC0-20mA (load resistance: max. 600Ω)
	Max. allowable range	±5% F.S of rated input range	±5% F.S of rated output range
	Resolution	14bit, 1/16,000	
	Accuracy	● At room temperature (25±5℃) range: ±0.3% F.S. ● Out of room temperature range: ±0.6% F.S.	
Insulation resistance		Over 200MΩ (at 500VDC megger)	
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator	
Dielectric strength		500VAC 50/60Hz for 1 min (between external terminals and case, between I/O and power terminals)	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s^2 (approx. 50 G) in each X, Y, Z direction for 3 times	
Environment	Ambient temperature	-10 to 50℃, storage: -25 to 75℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	

※Environment resistance is rated at no freezing or condensation.

■ Specifications

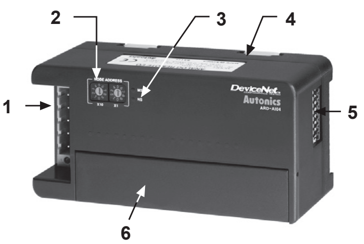
Model	ARD-AI04	ARD-AO04
Protection structure	IP20 (IEC standard)	
Protection circuit	Surge, ESD protection, Reverse polarity protection circuit	
Indicator	Network status (NS) LED (green, red), Unit status (MS) LED (green, red)	
Material	Front case, Body Case: PC	
Mounting	DIN rail or screw lock type	
Isolation type	I/O and inner circuit: non-insulated, DeviceNet and inner circuit: insulated, Power and DeviceNet: insulated	
Approval	CE DeviceNet	CE, DeviceNet compatible
Weight※1	Approx. 210g (approx. 145g)	

※1. The weight includes packaging. The weight in parentheses is for unit only.

■ DeviceNet Communication

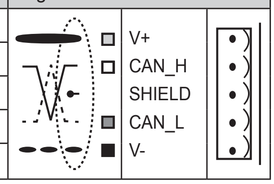
Item	Specifications
Communication	I/O Slave messaging (Group 2 Only slave) ● Poll command: Yes ● Bit_strobe command: Yes ● Cyclic command: Yes ● COS command: Yes
Communication distance	Max. 500m (125kbps), Max. 250m (250kbps), Max. 100m (500kbps)
NODE ADDRESS setting	Max. 64 nodes
Communication speed	·125 kbps ·250 kbps ·500 kbps (automatically set when connecting with Master)
Insulation	I/O and inner circuit: Non-insulation, DeviceNetand inner circuit: Insulation, DeviceNet power: Insulation
Approval	ODVA Conformance conformance: ARD-AI04 ODVA Conformance compatible : ARD-AO04

■ Unit Descriptions



1. DeviceNet connector

No.	Color	For	Organization
5	Red	24VDC (+)	V+
4	White	CAN_H	CAN_H
3	None	SHIELD	SHIELD
2	Blue	CAN_L	CAN_L
1	Black	24VDC (-)	V-

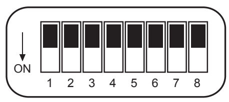


2. Rotary switch for node address : Two rotary switches are used for setting node address.
X10 switch represents the 10's multiplier and X10 switch represents the 1's multiplier.

3. Status LED: It is LED for displaying Unit status (MS) and Network status (NS).

4. Rail Lock: It is used for mounting DIN rail or with screws.

5. DIP switch: It is used for set I/O range. (factory default: all switches are OFF)
(●: ON, -: OFF)



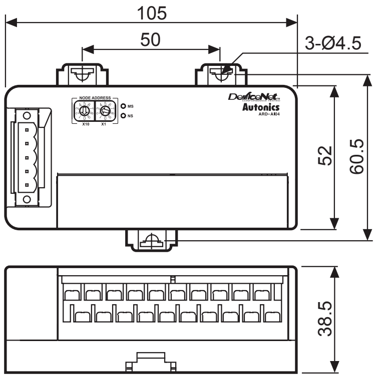
	ARD-AI04 (Input model)						ARD-AO04 (output model)							
	CH0, CH1			CH2, CH3			CH0, CH1			CH2, CH3				
I/O range	SW1	SW2	SW3	SW4	SW5	SW6	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8※1
0-5VDC	—	—	—	—	—	—	—	—	—	Not supported			Not supported (Off Setting)	**ON** Using DIP switch **OFF** Not using DIP switch
1-5VDC	●	—	—	●	—	—	●	—	—					
0-10VDC	—	●	—	—	●	—	—	●	—					
-5-5VDC	●	●	—	●	●	—	●	●	—					
-10-10VDC	—	—	●	—	—	●	—	—	●					
DC4-20mA	●	—	●	●	—	●	Not supported			—	—	—		
DC0-20mA	—	●	●	—	●	●				●	—	—		

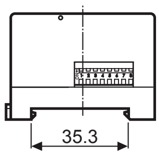
※1: By turning ON SW8, I/O range is set by DIP switches (SW1 to SW6). By turning OFF SW8, I/O range is set by communication.
When setting I/O range by DIP switches, CH0 and CH1 (CH2 and CH3) cannot be set individually.
When setting it by communication, each channel is set individually.

6. I/O Terminal block: It is terminal block for connecting external device I/O.

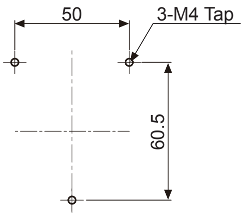
■ Dimensions

(unit: mm)



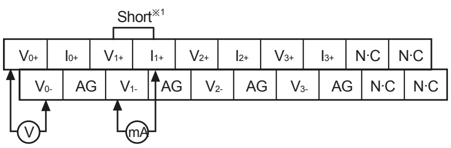


●Panel cut-out



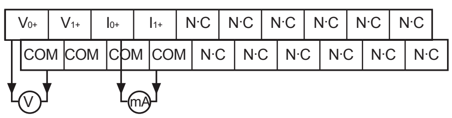
■ Connections

●ARD-AI04



※1: For current input, short between $V_{□+}$ and $I_{□+}$.

●ARD-AO04



Voltage	0-5VDC
	1 to 5VDC
	-5-5VDC
	0-10VDC
	-10-10VDC
Current	DC0-20mA
	DC4-20mA

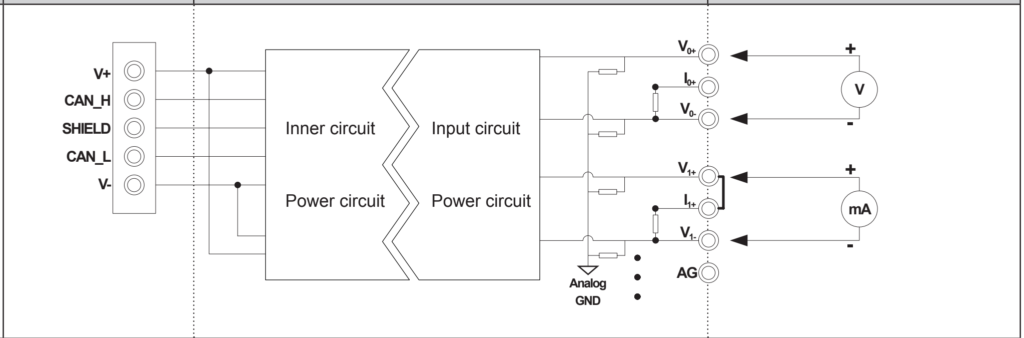
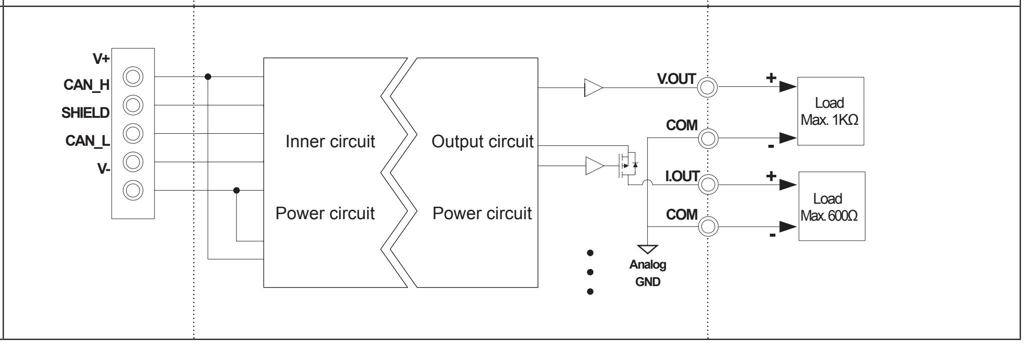
■ Status LED

※Status of MS LED, NS LED

(☼: ON, ◐: Flash, ●: OFF)

No.	Type	LED status	Color	Descriptions	Troubleshooting
1	MS	☼	Green	**Normal operation** I/O communication or message communication is working.	—
	NS	☼	Green		
2	MS	☼	Green	**Standby of duplicated address** The status of standby for receiving message of duplicated address check from master unit.	—
	NS	●	—		
3	MS	☼	Green	**Standby of normal operation** The status of standby for establish connection from master unit.	—
	NS	◐	Green		
4	MS	☼	Red	**Watchdog timer error** The status that DIP switch or another switch setting is invalid.	Change the switch with valid value and re-supply the power.
	NS	●	—		
5	MS	◐	Red	**Switch setting error** The status that DIP switch or another switch setting is invalid.	Change the switch setting to valid value and re-supply the power.
	NS	●	—		
6	MS	◐	Red	**Changed address during normal operation** The status that address is changed during normal operation.	Change the initial address at the power applied at first.
	NS	☼	Green		
7	MS	☼	Green	**Invalid address** The status of setting invalid address	Change the valid address and re-supply the power.
	NS	☼	Red		
8	MS	☼	Red	**Duplicated address** There is duplicated address in the network. **Occuring Bus-Off error** Communication is stopped with Bus-Off.	Change node address not duplicated. Power on the slave unit again. Check master unit, communication, cable, terminating resistance and noise of network.
	NS	☼	Red		
9	MS	☼	Green	**I/O Connection time out**	Check the master setting and the user program.
	NS	◐	Red		

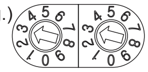
■ I/O Circuit Diagram

Type	DeviceNet connector	Inner circuit	External connections
Analog input			
Analog output			

▣ Setup And Installation

◎ Node address setup

E.g.)



The X10 and X1 switches point "3", the address is "33".

① Two rotary switches are used for setting node address.
X10 switch represents the 10's multiplier and X10 switch represents the 1's multiplier.
Node address is settable from 0 to 63.

② Node address is changed when re-supplying the power to the unit.
After changing node address, must re-supply the power.

◎ Installation

• Mounting on panel

① Pull Rail Locks (3) on the rear part of a unit, there are fixing screw hole.
② Place the unit on a panel to be mounted.
③ Make a hole on a fixing screw position.
④ Fasten the screw to fix the unit tightly.
Tightening torque should be below 0.5N.m.

• Mounting on DIN rail

① Pull two Rail Locks on the rear part of unit.
② Place the unit on DIN rail to be mounted.
③ Press Rail Locks to fix the unit tightly.

◎ I/O cable connection

Refer to the I/O circuit diagram and connections.
Connect a sensor or the signal cable of external I/O device to the terminal block. (tightening torque: 0.5N·m)

◎ DeviceNet cable connection

① For stable system, it is recommended to use the DeviceNet dedicated cable.
② Connect the DeviceNet cable to the DeviceNet connector and tighten the fixed screw of the connector by a driver. (tightening torque: 0.5N·m)
③ Connect the DeviceNet connector to ARD unit and supply the power to Network.

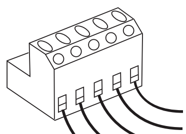
Master unit

PIN No.	Signal
5	V+
4	CAN_H
3	SHIELD
2	CAN_L
1	V-

Red
White
None
Blue
Black

ARD unit

PIN No.	Signal
5	V+
4	CAN_H
3	SHIELD
2	CAN_L
1	V-



◎ Setting of Master unit

① Check the LED status of ARD unit when power is supplied. Normal operation is below.

Type	Status LED	Status descriptions
Unit status (MS) LED	Green LED is ON	When master unit status is communication standby: NS LED flashes When master unit setting is completed: NS LED is ON.
Network status (NS) LED	Green LED is ON/flashes	

② Install the software provided by master unit manufacturing company.
③ Set communication speed and address in the software.
- Baud rate: 125/250/500kbps
- Address of master unit: Usually it is set 00 address.

④ Register connected unit on Network to the master unit.
- There are two ways to register units; automatically register in on-line or manually register in off-line. (Refer to the manual of master unit.)
- I/O assignment of ARD Series: Usually it is automatically assigned by the setting software.
- Setting of operation mode: Select among Poll, COS, Cyclic, Bit Strobe. (Usually set Poll mode.)

◎ Check operating stauts

When installation and setting are complete, unit status (MS) LED and Network status (NS) LED turn ON green.
(Refer to ▣ Status LED.)

▣ Communication Distance

Baud Rate	Max. network length	Max. length of branch line	Allowable expansion length of branch line
125kbps	500m	6m	156m
250kbps	250m	6m	78m
500kbps	100m	6m	39m

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

▣ Terminating Resistance

● 120Ω ● 1% of metallic film ● 1/4W

※Do not install terminating resistance on ARD unit or it may cause network problem (impedance can be too high or low) or malfunction.

※Connect terminating resistance on the both ends of the trunk line.

▣ Functions

<table>
<tr><th colspan="2">Model</th><th>ARD-AI04
(input model)</th><th>ARD-AO04
(output model)</th></tr>
<tr><td rowspan="5">Basic</td><td>Com. speed auto-recognition</td><td colspan="2">●</td></tr>
<tr><td>Network power voltage monitoring</td><td colspan="2">●</td></tr>
<tr><td>Unit power on total time monitoring</td><td colspan="2">●</td></tr>
<tr><td>Unit comment</td><td colspan="2">●</td></tr>
<tr><td>Last maintenance data stored</td><td colspan="2">●</td></tr>
<tr><td rowspan="11">Analog</td><td>Scaling</td><td colspan="2">●</td></tr>
<tr><td>I/O comment</td><td colspan="2">●</td></tr>
<tr><td>Adjustment gradient</td><td colspan="2">●</td></tr>
<tr><td>Adjustment offset</td><td colspan="2">●</td></tr>
<tr><td>Input conversion points setting</td><td>●</td><td>—</td></tr>
<tr><td>Input digital filter</td><td>●</td><td>—</td></tr>
<tr><td>Peak/Bottom hold</td><td>●</td><td>—</td></tr>
<tr><td>Disconnected cable detection</td><td>●</td><td>—</td></tr>
<tr><td>Input comparison</td><td>●</td><td>—</td></tr>
<tr><td>Hysteresis</td><td>●</td><td>—</td></tr>
<tr><td>Output setting for error</td><td>—</td><td>●</td></tr>
</table>

◎ Communication speed auto-recognition

It recognizes communication speed when connecting master. Communication speed is able to change only from master unit.
After changing communication speed, re-supply the network power to apply the changed communication speed.

◎ Network power voltage monitoring

● If network power voltage is lower than the set value, the network power voltage drop flag bit of Status bit is ON. It can be read by Configurator or Explicit message.
● Set monitoring voltage by Explicit message at Network Power voltage (Set Value) of Application Object.
● Setting range: 0 to 255
(factory default: 12V, Allowable range: ±1V)
※ Min. supplied power is 12V for ARD unit.
If network voltage is lower than 12V, the contents of Explicit message reading is not guaranteed.

◎ Unit power on total time monitoring

● When total time for supplying power to the unit becomes the SV, Threshold Run Hours Flag bit of Status Bit turns ON. It can be read by Configurator or Explicit message.
● Set the time by Explicit message at Threshold Run Hour of Application Object.
● Setting range: 0 to 429,496,729 hours
(factory default: 876,000 hours),
Measured unit: 0.1 hours (6 minutes)

◎ Unit comment

● You can set the comments for the unit (product description) on network. It can be read by Configurator or Explicit message.
● Set comment by Explicit message at Unit Comment of Application Object.
● Setting range: max. 32 characters

◎ Last maintenance date

● It saves the last date of maintenance. It can be read/written by Configurator or Explicit message.
● Set maintenance date by Explicit message at I/O Last Maintenance Data Setting of Analog Input Point Object.
E.g.)Data: 0x07DB020E→07DB (2011), 02 (Februray), 0E (14th)

◎ Input conversion points setting

● Conversion cycle is changed by the number of points (point, channel).
(conversion cycle: 1ms/point, when using 4 points, it is 4 ms). It can be read/written by Configurator or Explicit message. After changing the number of conversion points, re-supply the network power.
● Set the number of conversion points by Explicit message at Number of AD Conversion Points Setting of Analog Input Point Object.
● Setting range: 1 to 4-point (factory default: 4-point), conversion cycle: 1 ms/1-point

◎ Display scale

- Set high/low-limit scale value of analog input or output. It can be read by Configurator or Explicit message.

Default Scaling	Function Choice : Scaling Flag bit ON Scaling Type : Default Scaling (factory default)	It is set as 1,000 per 1V (mA). In case of 1-5V, 4-20mA, it is applied from over min. allowable range 0.8V (800), 3.2 (3,200). The below input value is break detection. It outputs as min. allowable range.
None Scaling	Function Choice : Scaling Flag bit OFF Scaling Type : Default Scaling	It is set as default value 0 to 16000 (-8000 to 8000). (0-5V, 1-5V, 0-10V, 4-20mA, 0-20mA: 0 to 16000, -5-5V, -10-10V: -8,000 to 8,000)
User Scaling	Function Choice : Scaling Flag bit ON Scaling Type : User Scaling	Set high/low-limit value to apply at ‘Scaling Point 0%’ and ‘Scaling Point 100%’. Setting range: -28,000 to 28,000

◎ I/O comment

- You can set the comment for I/O. It is able to read/write by Configurator or Explicit message.
- Set I/O comment by Explicit message at I/O Comment of Analog Input Point Object, Analog Output Point Object.
- Setting range: max. 32 characters

◎ Gradient adjustment

- It adjusts the gradient of input/output value or scale value. It is able to read/write by Configurator or Explicit message.
- It is applied when Adjust Gradient Flag bit is set as ON at Function Choice of Analog Input Point Object. Set the range at Adjustment Gradient value.
- Adjustment range: -5 to 5%,
  Setting range: -500 to 500 (factory default: 0)
  E.g.)When input value is 1000, Adjustment Gradient is 500 (+5%) X’=aX, a=1+Adjustment Gradient (0.05), X=1000, X’=1.05×1000=1050

◎ Offset adjustment

- This function is to adjust the error occurring from external analog sensor, etc, not from the unit itself. It is also applied to analog output. It is able to read/write by Configurator or Explicit message.
- It is applied when Adjustment Offset Flag bit is set as ON at Function Choice of Analog Input Point Object. Set the value at Adjustment Offset Value.
- Adjustment range: -5 to 5%,
  Setting range: -500 to 500 (factory default: 0)
  E.g.)When input range is 0 to 10V, Full Scale 0 to 16000, input value is 1600 (1V) and Adjustment Gradient 500 (+5%), X’=X+b, X=1600, b=16000×0.05 (added input value and percentage of Full Scale) X’=1600+800=2400 (1.5V)

◎ Input digital filter

- This function is used when input value vibrates or repeatedly shake by included noise at input signal. Accurate control is available by stable input with this function. It adopts moving average filter method not to affect sampling cycle. It is able to read/write by Configurator or Explicit message.
- It is applied when Moving Average is set as ON at Function Choice of Analog Input Point. Set the number of digital filters at Moving Average Filter of Number.
- Setting range: 0 to 8
  (factory default: 3[Moving Average No_8])

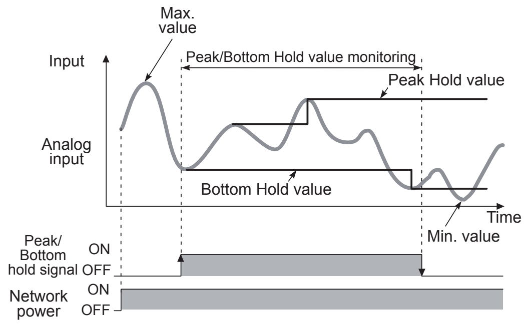
◎ Input min./max. value save

● Min./Max. save when power is ON

It saves min./max. input value from power ON the network. (When network power is OFF, the saved min./max. input value are cleared.)
It is able to read by Configurator or Explicit message.
When Clear Max, Clear Min Flag bit of is ON at Function Choice of Analog Output Point Object, the saved values are cleared and it saves current min./max. value of current input.

● Min./Max. save when Peak/Bottom Hold signal is ON

It memorizes the max./min. value while Peak/Bottom signal is ON. When Peak/Bottom signal is OFF, they are saved.
It is able to read by Configurator or Explicit message.
It is applied when Peak/Bottom is set as ON at Function Choice of Analog Input Point Object. You can check the value of Peak/Bottom at Peak Value and Bottom Value.



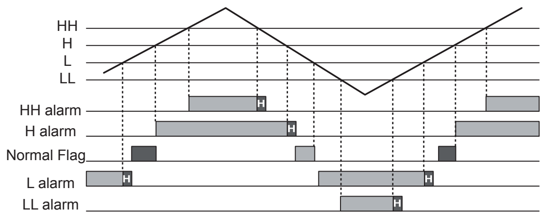
◎ Disconnection detection

- When operating analog input cable (voltage/current input) is disconnected, Broken Wire Flag Bit turns ON at Analog Status Flag Read of Analog Input Point Object. (It operates only for 1-5V, 4-20mA input range.) It is able to read by Configurator or Explicit message.
- If this value is below -5%, it recognizes disconnection and displays ‘32767’ as data value.

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

◎ Input comparison

- It compares analog input value or the operation value and alarm set value (HH, H, L, LL) and Analog Status Bit flag turns ON at Function Choice of Analog Input Point Object. It is able to read by Configurator or Explicit message.
- If the value is within the setting range between 'H' and 'L', it is available to apply by turning ON Pass Signal Flag bit at Analog Status Flag Read of Analog Input Point Object and turning ON/OFF Comparator Flag bit at Function Choice.



◎ Hysteresis

- In case of comparison output, this function is to increase stability of comparison output against vibration of input signal or chattering.
  It is able to read by Configurator or Explicit message.
- It is applied when Compare Bit flag turns ON at Function Choice of Analog Input Point Object.
  Set the value at Hysteresis Value.
- Setting range: 0 to 16,383 (factory default: 0)

◎ Output value setting for com. error

- When communication error occurs, this function is to set output value of output unit by each channel. It is able to read by Configurator or Explicit message.
- Set Fault state at Fault Action of Analog Output Point.
- Setting range: 0 to 3 (factory default: 1)
  0: Hold Last State-maintains the last status
  2: High Limit-outputs max. value
  1: Low Limit-outputs min. value
  3: Zero Count-outputs 0%

◎ Status flag monitoring

- When the network power voltage is lower than the set value or unit operation time is over the set value, monitoring is available by Status Bit of Application Object.
  It is able to read by Configurator or Explicit message.

※ Flag Bit
Bit 0: Reserved
Bit 1: Network Power Voltage Drops (below the set level)
Bit 2: Life State (Unit)
Bit 3: Reserved
Bit 4: Reserved
Bit 5: Reserved
Bit 6: Reserved
Bit 7: Reserved

◎ Analog data allotment

- This function is to allot analog data. Select the desired data to transmit it to the master unit. It is able to read by Configurator or Explicit message.
- Set the allotment at Analog Data 1/2 Allocation selection of Analog Output Point.
- Setting range: 0 to 2 (factory default: 0)
  0: Analog Input Value
  1: Peak Value
  2: Bottom Value

▣ I/O range

Analog I/O specifications

No.	I/O range	Max. allowable I/O range
0	0-5VDC	-0.25-5.25VDC
1	1-5VDC	0.8-5.2VDC
2	0-10VDC	-0.5-10.5VDC
3	-5-5VDC	-5.5-5.5VDC
4	-10-10VDC	-11-11VDC
5	DC4-20mA	DC3.2-20.8mA
6	DC0-20mA	DC0-21mA

▣ Assembly Instance ID assignment

◎ Produced I/O assignment (Input)

It is available to assign I/O data by the selected data at master. When changing Produced I/O data assignment, re-supply the network power of ARD unit to apply the changed assignment.

1) Analog Data1 (Default I/O Data)

Analog Data 1 is assigned as Produced I/O data by Configurator or Explicit message. By property setting, assignment is available as Analog Input Value, Peak Value, Bottom Value.
- Assembly Instance ID: 103, ● Default: 0
- Setting range: 0 to 2 (Analog Input Value: 0, Peak Value: 1, Bottom Value: 2)
- Data type: Word, Data size: 4Word

15 0	15 0
Assigned value to Analog Data 1 of Input point 0	Assigned value to Analog Data 1 of Input point 2
Assigned value to Analog Data 1 of Input point 1	Assigned value to Analog Data 1 of Input point 3

2) Analog Data2

Analog Data 2 is assigned as Produced I/O data by Configurator or Explicit message. By property setting, assignment is available as Analog Input Value, Peak Value, Bottom Value.

- Assembly Instance ID: 104
- Default: 0
- Setting range: 0 to 2 (Analog Input Value: 0, Peak Value: 1, Bottom Value: 2)
- Data type: Word, Data size: 4Word

15 0	15 0
Assigned value to Analog Data 2 of Input point 0	Assigned value to Analog Data 2 of Input point 2
Assigned value to Analog Data 2 of Input point 1	Assigned value to Analog Data 2 of Input point 3

3) Generic Status

Generic Status is assigned as Produced I/O data by Configurator or Explicit message.

- Assembly Instance ID: 100
- Data type: Byte, Data size: 1Byte
- Generic Status

Bit 0: Reserved.
Bit 1: Network Power Voltage Drops.
Bit 2: Life State (Unit)
Bit 3: Reserved.
Bit 4: Reserved.
Bit 5: Reserved.
Bit 6: Reserved.
Bit 7: Reserved.

15	0
—	Generic Status

4) Analog Status

Analog Status is assigned as Produced I/O data by Configurator or Explicit message.

- Assembly Instance ID: 105
- Data type: Byte, Data size: 4Byte
- Analog Status

Bit 0: Low Alarm (LL)
Bit 1: Low Warning (L)
Bit 2: Pass Signal (Nomal)
Bit 3: High Warning (H)
Bit 4: High Alarm (HH)
Bit 5: Broken Wire
Bit 6: Under Range
Bit 7: Over Range

15	0
Analog Status of Input point 1	Analog Status of Input point 0
Analog Status of Input point 3	Analog Status of Input point 2

5) Analog Data1+Analog Data2

Analog Data 1 + Analog Data 2 is assigned as Produced I/O data by Configurator or Explicit message. By property setting, assignment is available as Analog Input Value, Peak Value, Bottom Value.

- Assembly Instance ID: 106
- Default: 0
- Setting range: 0 to 2 (Analog Input Value: 0, Peak Value: 1, Bottom Value: 2)
- Data type: Word, Data size: 8Word

15 0	15 0
Assigned value to Analog Data 1 of Input point 0	Assigned value to Analog Data 1 of Input point 2
Assigned value to Analog Data 2 of Input point 0	Assigned value to Analog Data 2 of Input point 2
Assigned value to Analog Data 1 of Input point 1	Assigned value to Analog Data 1 of Input point 3
Assigned value to Analog Data 2 of Input point 1	Assigned value to Analog Data 2 of Input point 3

6) Analog Status+Generic Status

Analog Status + Generic Status is assigned as Produced I/O data by Configurator or Explicit message.

- Assembly Instance ID: 107
- Data type: Byte, Data size: 5Byte

15	0
Analog Status of Input point 1	Analog Status of Input point 0
Analog Status of Input point 3	Analog Status of Input point 2
—	Generic Status

7) Analog Data+Analog Status

Analog Data 1 + Analog Status is assigned as Produced I/O data by Configurator or Explicit message. By property setting, assignment is available as Analog Input Value, Peak Value, Bottom Value.

- Assembly Instance ID: 108
- Default: 0
- Setting range: 0 to 2 (Analog Input Value: 0, Peak Value: 1, Bottom Value: 2)
- Data type: Byte, Data size: 12Byte

15	0
Assigned value to Analog Data 1 of Input point 0	
Assigned Low Byte at Analog Data 1 of Input point 1	Analog Status of Input point 0
Analog Status of Input point 1	Assigned High Byte at Analog Data 1 of Input point 1
Assigned value to Analog Data 1 of Input point 2	
Assigned Low Byte at Analog Data 1 of Input point 3	Analog Status of Input point 2
Analog Status of Input point 3	Assigned High Byte at Analog Data 1 of Input point 3

▣ Caution During Use

- Node addresses of connected units should not be duplicated. If you change node address during operation, the Unit status (MS) flashes in red and it communicates with the previous node address.
  Re-supply the power and the changed node address is applied.
- Communication speed which is set on Master is set automatically. If you change communication speed during operation, the Network status (NS) LED turns ON in red and it does not communicate.
  Re-supply the power and it operates normally.
- Make sure to use the communication cables, and taps which are DeviceNet standards.
  It may cause communication error if non-standard products are used.
- Make sure to examine disconnection or short-circuit before connecting cables.
- Do not install the unit where severe dust exists or where corrosion may occur.
- This unit may be used in the following environments.

• Indoor
• Altitude: Under 2,000m
• Pollution degree 2
• Installation category II

Modbus Sensor Connector Type Digital Remote I/O

■ Features

- Modbus RTU standard protocol
- Connects with sensor connector, e-CON: saves wiring work (sensor connector, CNE Series, sold separately)
- Compact size
  : Small size with W26×L76×H54mm to install at narrow space
  : Available DIN Rail mounting and screw lock mounting method
- Real-time monitoring by various functions
  : Communication speed auto-recognition, Network power voltage monitoring
  : Reading number of expansion units and specifications, Reading model name of basic and expansion units
  : Monitoring Single byte input/output, Multi byte input/output and status Flag
- Easy expansion
  : Available to connect up to 63 basic units per 1 master unit
  : Available to connect up to 7 expansion units per 1 basic units (controllable input/output for max. 64 points)
  : Combines the desired specifications of input/output by various input/output units
  : Organizes power and communication system by only communication cable lines
- High reliability
  : Built-in surge, short, over-heat, reverse power polarity and static prevention circuits

⚠ Please read "Caution for your safety" in operation manual before using.

CE

■ User Manual For Communication

- Visit our website (www.autonics.com) to download the user manual for communication for Modbus communication.
- The user manual for communication describes for Modbus RTU protocol, Modbus Mapping Table.

■ Ordering Information

AR | M — D | I | 08 | N — 4S

Item	Code	Description
Terminal block	4S	Sensor connector 4-pin socket
I/O specifications	N	NPN open collector
	P	PNP open collector
I/O points	08	8 points type
I/O type	I	Input type
	O	Output type
Digital/Analog	D	Digital type
Network	M	Basic unit (Modbus RTU type)
	X	Expansion unit (Use in DeviceNet/Modbus)
Item	AR	Autonics Remote I/O

■ Model

Model		Specification
Basic unit	Expansion unit	
ARM-DI08N-4S	ARX-DI08N-4S	10-28VDC NPN input 8-point (10mA/point)
ARM-DI08P-4S	ARX-DI08P-4S	10-28VDC PNP input 8-point (10mA/point)
ARM-DO08N-4S	ARX-DO08N-4S	10-28VDC NPN output 8-point (0.3mA/point)
ARM-DO08P-4S	ARX-DO08P-4S	10-28VDC PNP output 8-point (0.3mA/point)

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

ARM Series

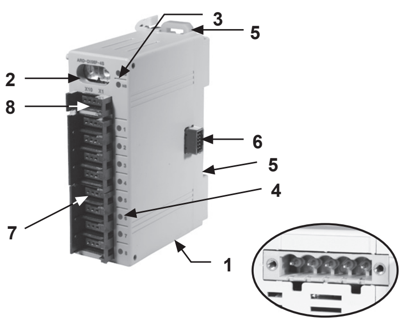
■ Specifications

Model	Basic unit	**ARM-DI08N-4S**	**ARM-DI08P-4S**	**ARM-DO08N-4S**	**ARM-DO08P-4S**
	Expansion unit	**ARX-DI08N-4S**	**ARX-DI08P-4S**	**ARX-DO08N-4S**	**ARX-DO08P-4S**
Power supply		Rated voltage: 24VDC, Voltage range: 12-28VDC			
Power consumption		Max. 3W			
I/O points		NPN input 8 points	PNP input 8 points	NPN output 8 points	PNP output 8 points
Control I/O	Voltage	10-28VDC		10-28VDC Output (voltage drop: Max. 0.5V)	
	Current	10mA/point (sensor current: 150mA/points)		0.3A/point (leakage current: Max. 0.5mA)	
	COMMON method	8 points, common			
Protocol		Modbus RTU			
Media access		POLL			
Application standard		Compliance with EIA RS485			
Communication method		2-wire half duplex			
Communication distance		Max. 800m			
Multi-drop		Max. 32 Multi-Drop			
Data bit		8 bits			
Communication speed		2400, 4800, 9600, 19200, 38400, 57600, 115200bps (default 9600bps)			
Stop bit		1 or 2 bits (default: 2)			
Parity bit		None/Odd/Even (default: None)			
Insulation resistance		Over 200MΩ (at 500VDC megger)			
Noise immunity		±240V the square wave noise (pulse width: 1µs) by the noise simulator			
Dielectric strength		1,000VAC 50/60Hz for 1 minute			
Vibration		1.5mm amplitude or 300m/s² at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in each of X, Y, Z directions for3 times			
Environ-ment	Ambient temperature	-10 to 55℃, storage: -25 to 75℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP20 (IEC standards)			
Protection circuit		Surge, Short-circuit, Overheating and static protection, Reversed polarity protection circuit			
		Over current protection (Operated at min. 0.17A)		Over current protection (Operated at min. 0.7A)	
Indicator		Network status (NS) LED (Green, Red), Module status (MS) LED (Green, Red) I/O status LED (Input: Green, Output: Red)			
Material		Front case: PC, Body case: PC			
Mounting		DIN Rail or Screw lock type			
Isolation type		I/O and inner circuit: insulated, Modbus and inner circuit: non-insulated, unit power: non-insulated			
Approval		CE			
Unit weight	Basic unit	Approx. 66g			
	Expansion unit	Approx. 56g			

※ Environment resistance is rated at no freezing or condensation.

■ Unit Descriptions

◎ Basic unit



1. Network connector

No.	For	Organization
5	24VDC (+)	5: 24VDC 4: GND 3: N·C 2: B 1: A
4	GND	
3	N·C	
2	B	
1	A	

2. Rotary switch for node address
: Two rotary switches are used for setting address.
X10 switch represents the 10's multiplier and X10 switch represents the 1's multiplier.

3. Status LED
: It is LED for displaying Unit status (MS) and Network status (NS).

4. I/O status LED: It is LED for displaying I/O status.

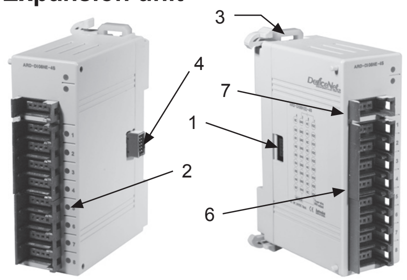
5. Rail Lock: It is used for mounting DIN Rail or with screws.

6. Connnector output part: It is used for connecting an expansion unit.

7. Sensor connector: It is connector for connecting external device I/O.

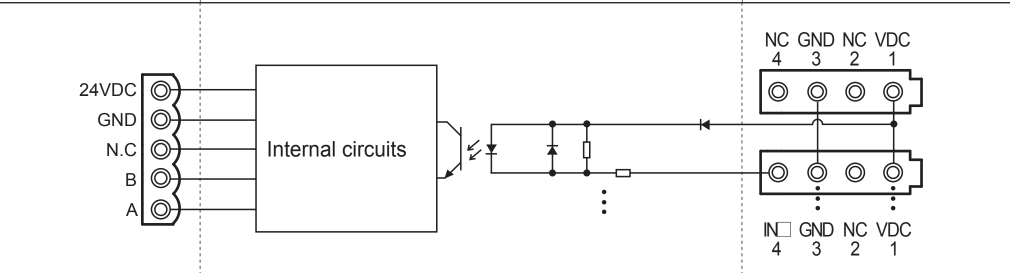
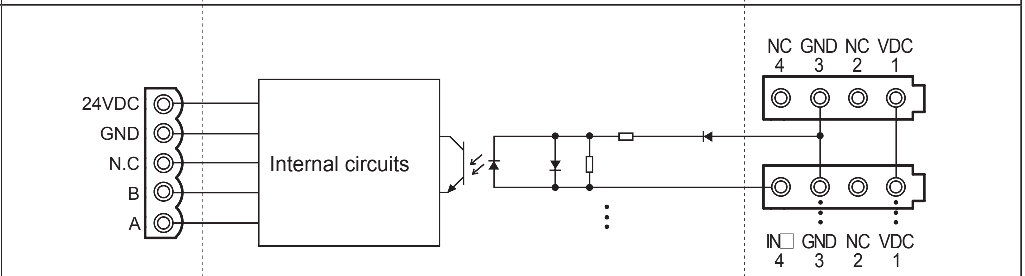
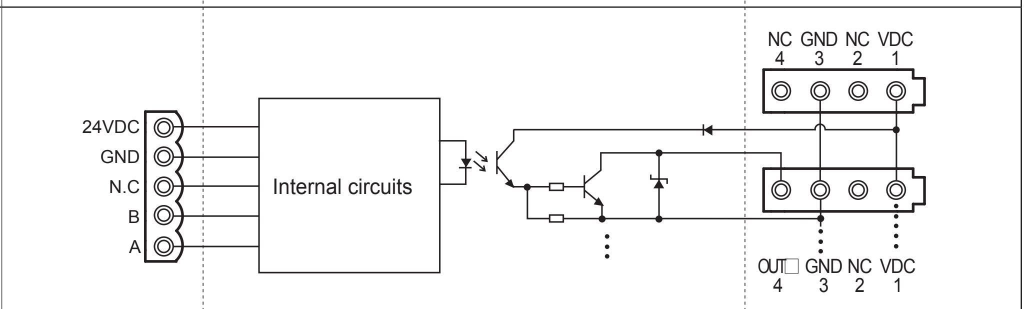
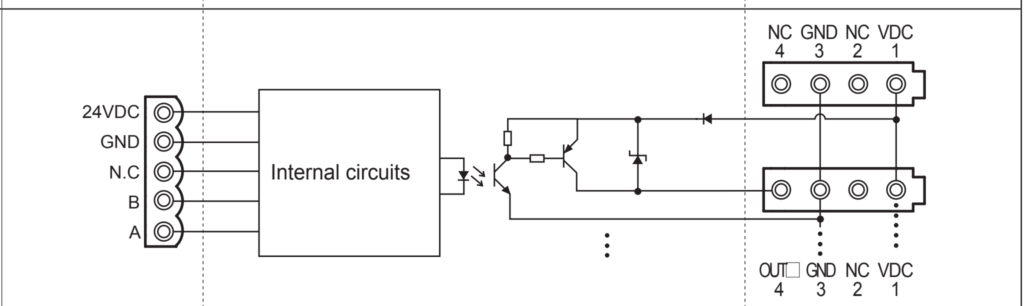
8. External power connector: It is used for supplying external power.

◎ Expansion unit



1. **Connnector input part**
 :It connects an Expansion unit and is joined into the connnector output part.
2. **I/O status LED**: It is LED for displaying I/O status.
3. **Rail Lock**
 : It is used for mounting DIN Rail or with screws.
4. **Connnector output part**: It is used for connecting an expansion unit.
5. **Sensor connector**: It is connector for connecting external device I/O.
6. **External power connector**: It is used for supplying external power.

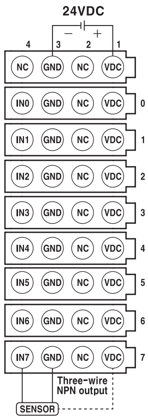
■ I/O Circuit Diagram

Type	Network connector	Inner circuit	Sensor connector
NPN input			
PNP input			
NPN output			
PNP output			

※IN□: IN0 to IN7, OUT□: OUT0 to OUT7

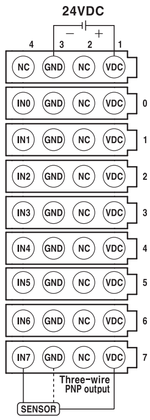
Connections

●ARM-DI08N-4S
●ARX-DI08N-4S



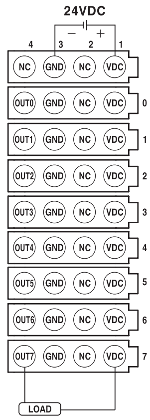
IN (NPN): 8P, 24VDC 10mA

●ARM-DI08P-4S
●ARX-DI08P-4S



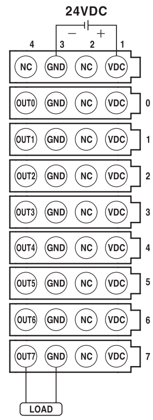
IN (PNP): 8P, 24VDC 10mA

●ARM-DO08N-4S
●ARX-DO08N-4S



OUT (NPN): 8P, 24VDC 0.3A/Point

●ARM-DO08P-4S
●ARX-DO08P-4S

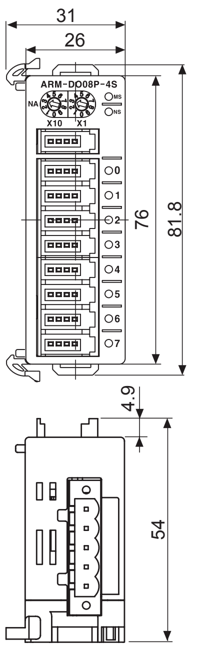


OUT (PNP): 8P, 24VDC 0.3A/Point

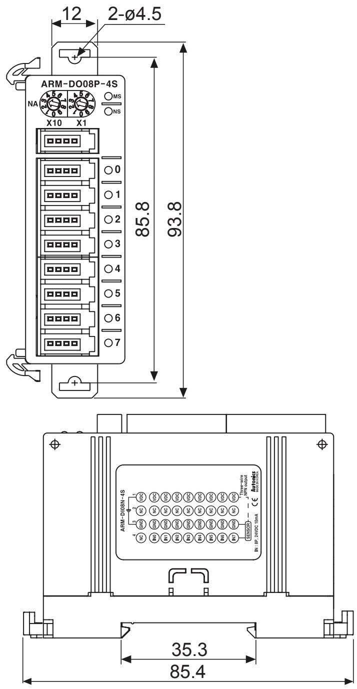
Dimensions

(unit:mm)

● Mounting DIN rail



● Mounting with screws



※ Same dimensions are applied to both basic and expansion unit.

Status LED

(☼: On, ✹: Flash, ●: Off)

Item	LED status		Description
	Red	Green	
Module Status (MS) LED	☼	●	Error of expansion units
	✹	●	Error of MAC ID
	●	☼	Normal operation
	●	●	Power is not supplied
Network Status (NS) LED	☼	●	Not supported communication speed (At auto baud rate)
	✹	●	Error of packet
	●	☼	Normal communication
	●	✹	Communication standby

Setup And Installation

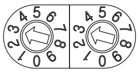
◎ Setting node address

- Setup address is by rotary switches or by inner EEPROM.
- If the rotary swithces are “00”, the address is set by inner EEPROM. The others, the desired number of rotary switches is that address.

● By rotary switch for address

① Two rotary switches are used for setting address.
X10 switch represents the 10’s multiplier and X10 switch represents the 1’s multiplier.
Address is settable from 0 to 99.

(E.g.)



The ×10 and ×1 switches point at '3', the node address is '33'.

②After setting the desired node address, re-supply the unit power for applying the changed address.

● By in the EEPROM for address

①During communicate status with master system (PLC or PL), set the desired address on the 41029 EEPROM MAC ID parameter.

②The set address is changed after unit power is supplied. Re-supply the unit power for applying the changed address.

◎ Unit Installation

● Mounting on panel

① Pull two Rail locks on the rear part of a unit, there is a fixing screw hole.
② Place unit on a panel to be mounted.
③ Make a hole on a fixing screw hole position.
④ Fasten the screw to fix the unit tightly. Please set the tightening torque under 0.5N·m.

● Mounting on DIN rail

①Pull two Rail locks on the rear part of a unit.
②Place the unit on DIN rail to be mounted.
③Press Rail locks to fix the unit tightly.

● Connection of basic and expansion unit

① Turn OFF the power of a basic unit.
② Remove the cover of connector for extension with nippers.
③ Connect connector input part of an expansion unit and connector output part of a basic unit with the connector which is enclosed with an expansion unit box.
④ Connected expansion units are installed as the right figure.
⑤ Supply power to the basic unit.
(re-supply power to the basic unit, and it recognizes expansion units.)

Terminating Resistance

● 120Ω ● 1% of metallic film ● 1/4W

※Connect terminating resistances on the both ends of the network cables. If not connecting terminating resistances, impedance can be too high or low. It may cause network problems.

Caution During Use

● Turn OFF the power before connecting or disconnecting expansion units.
● Addresses of connected units on network should not be duplicated. If you change an address with rotary switch or EEPROM during operation, unit status (MS) red LED flashes and it communicates with a previous node address. Re-supply power and the changed node address is applied.
● Communication speed which is set on upper system (PC, PLC, etc) is set automatically. If you change the communication speed during operation, network status (NS) red LED turns ON and it does not communicate. Re-supply power and it operates normally.
● Make sure to use standards communication cables. It may cause communication error if non-standards cables are used.
● Make sure to examine disconnection or short-circuit before connecting cables.
● Avoid installing the units where severe dust exists or where corrosion may occur.
● This unit may be used in the following environments.
• Indoor
• Altitude: Under 2,000m
• Pollution degree 2
• Installation category II

SCM-US48I

USB to Serial converter (converting signal USB to Serial)

■ Features

- Available to transmit signals to max. 1.2km by converting USB signal to RS485 signal
- Realizing electrical insulation (2500V RMS) between USB port and RS485 port through RS485 transceiver.
- Improved stability and durability with built-in protection circuit
- Easy connections between devices with bus power supplied from USB host controller without external power supply
- Offering USB 2.0 A/B type cable with built-in ferrite core for noise reduction
- Various operating systems supported (Windows 98, 98SE, ME, 2000, Server 2003, XP, Vista, 7)
- User friendly features through compatibility with USB 1.1 and USB 2.0

SCM-38I

RS232C to RS485 converter (converting signal RS232C to RS485)

■ Features

- Built-in surge protection circuit
- The insulation type of signal line (insulating RS232C and RS485)
- Create Tx-Enable signal automatically

SCM-US

USB to Serial converter (converting signal USB to Serial)

■ Features

- Applicable OS: Windows 98, 98SE, ME, 2000, Server 2003, XP, Vista, 7
- Both USB 1.1 and USB 2.0 compatible
- Data transmission / power supply indicating LED
- Easy to connect with PC
  Some products requires the dedicated converter cable (EXT-US, sold separately)
- Built-in protection circuit
- Ferrite core cable for noise reduction
- Non-isolation type

※Specifically designed to connect to particular Autonics and Konics products which support the PC loader port.

⚠ **Please read "Caution for your safety" in operation manual before using.**

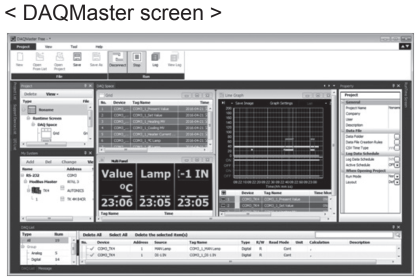
■ Comprehensive Device Management Program (DAQMaster)

DAQMaster is the comprehensive device management program.
Visit our website (www.autonics.com) and download DAQMaster.

< Computer specification for using software >

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operating system	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB or more
Hard disk	More than 1GB of free hard disk space
VGA	1024×768 or higher resolution display
Others	RS-232 serial port (9-pin), USB port

< DAQMaster screen >



■ Specifications

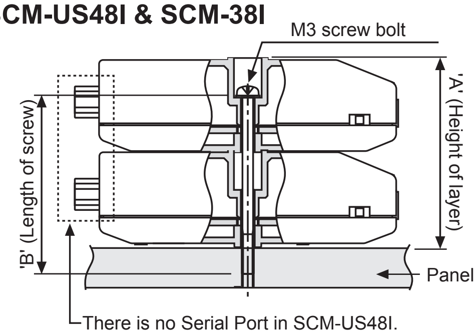
◎ SCM-US48I / SCM-38I / SCM-US

Model		SCM-US48I	SCM-38I	SCM-US
Power supply		5VDC USB bus power[※1]	12-24VDC ± 10%	5VDC USB bus power[※1]
Power consumption		Max. 1W	Max. 1.7W	Max. 1W
Max. com speed[※2]		1,200 to 115,200bps (recommended: 9,600bps)		
Communication type		Half duplex type		
Available com. distance		USB: Max. 1m ± 30% RS485: Max.1.2km	Max. 1.2km	1.5m (not extension)
Multi-drop		Max. 31 multi-drop		—
Protocol[※2]	Data bit	5-bit, 6-bit, 7-bit, 8-bit		—
	Stop bit	1-bit, 2-bit		—
	Parity bit	None, Even, Odd		—
Connection type		USB: USB 2.0 B type (male)	RS232C: D-sub 9-pin	USB: USB 2.0 A type (male)
		RS485: 4-wire screw terminal (2-wire communication type)		Earphone jack (4 pole stereo phone plug)[※3]
Isolation type		Isolation		Non-isolation
Dielectric strength		●Between terminals and case: 2500VAC 50/60Hz for 1 min ●Between USB and RS485: 2500VAC 50/60Hz for 1 min	●Between terminals and case: 2000VAC 50/60Hz for 1 min ●Between RS232C and RS485: 2500VAC 50/60Hz for 1 min	—
Insulation resistance		Over 100MΩ (at 500VDC megger)		—
Noise immunity		±500V the square wave noise (pulse width: 1µs) by the noise simulator		—
Vibration	Mechanical	0.75mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 1 hour		
	Malfunction	0.5mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 10 min		
Shock	Mechanical	$300m/s^2$ (approx. 30G) in each X, Y, Z direction for 3 times		
	Malfunction	$100m/s^2$ (approx. 10G) in each X, Y, Z direction for 3 times		
Environ-ment	Ambient temp.	-10 to 55℃, storage: -20 to 60℃		
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH		
Approval		CE KC		
Accessory		USB 2.0 AB type connector (length: 1m)	—	
Weight[※4]		Approx. 197g (approx. 34.5g)	Approx. 106g (approx. 46g)	Approx. 80g (approx. 41g)

※1: USB bus power is supplied from PC or USB host controller.
※2: Set protocol and communication speed by Hyper terminal, DAQMaster, Modbus Poll.
When communicating with Autonics products, set communication speed to 9,600bps.
※3: Some products requires the EXT-US(converter cable, sold separately).
※4: The weight includes packaging. The weight in parentheses is for unit only.
※There might be some differences in the specification above depending on PC environment.
※Environment resistance is rated at no freezing or condensation.

■ Installations

◎ SCM-US48I & SCM-38I



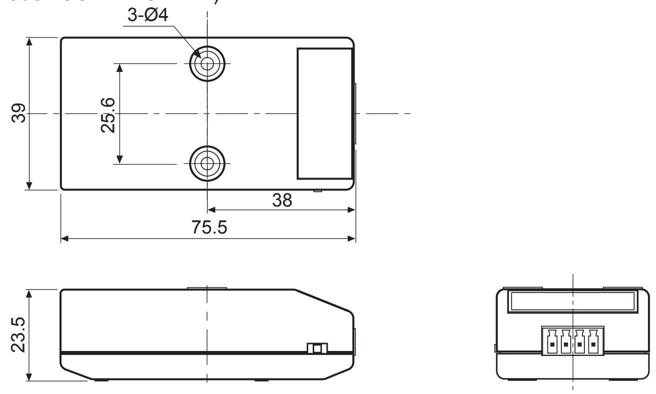
Number of layers (N)	"A" size (23N+0.5)	"B" size (23N-3)
1	23.5mm	20mm
2	46.5mm	43mm
3	69.5mm	66mm
4	92.5mm	89mm

■ Dimensions

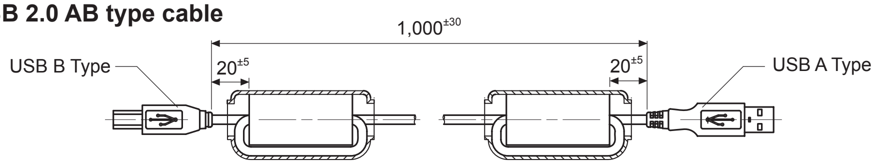
(unit: mm)

◎ SCM-US48I

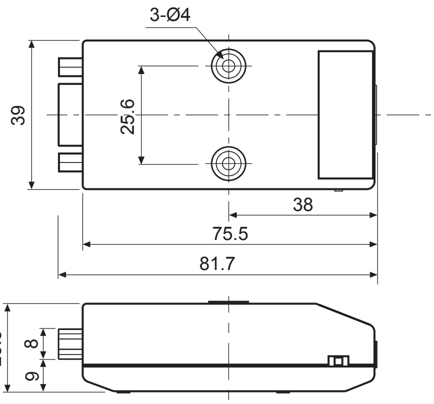
※USB 2.0 AB type cable is including the product and is also sold separately.
(model: USB AB CABLE)



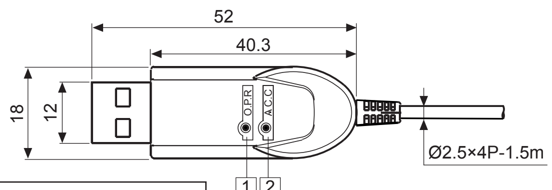
● USB 2.0 AB type cable

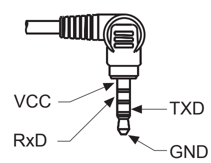


◎ SCM-38I

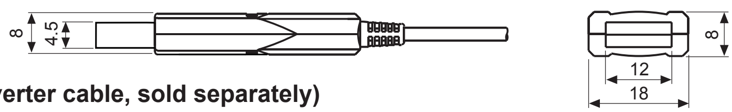


◎ SCM-US

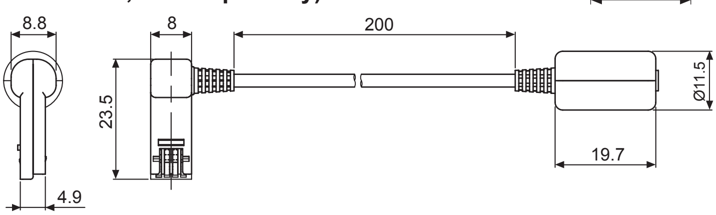




※LED indicator
1. O.P.R: Power
2. A.C.C: Rx/Tx data transmission

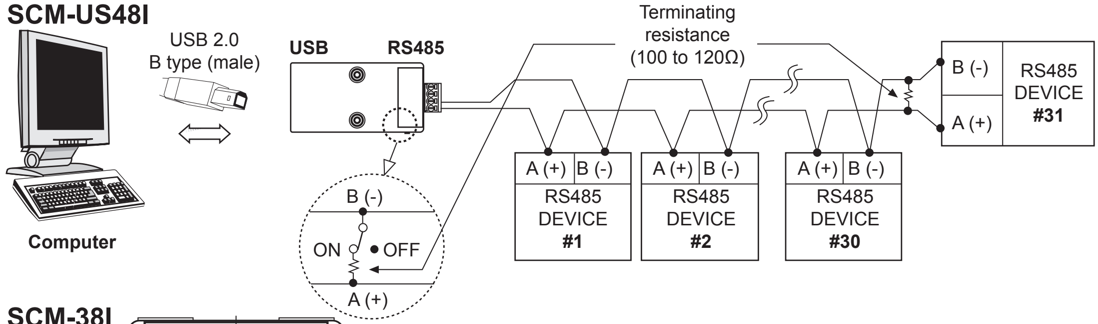


● EXT-US (converter cable, sold separately)

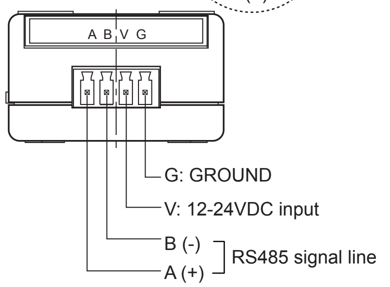


■ Example Of Connections

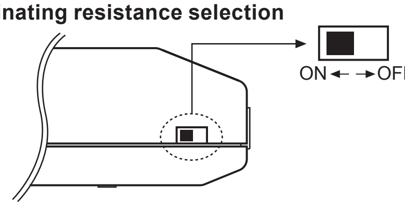
◎ SCM-US48I



◎ SCM-38I

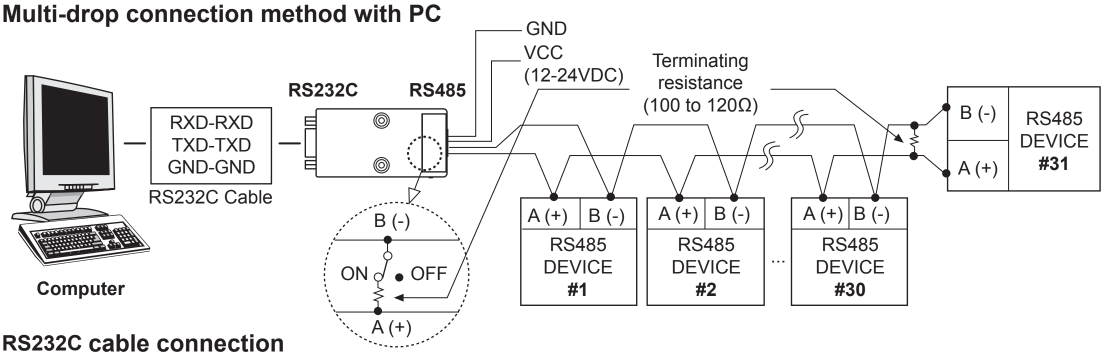


● **Terminating resistance selection**

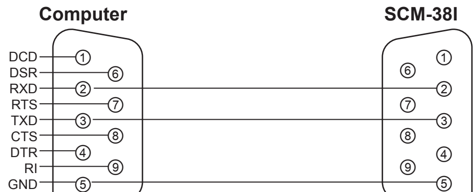


ON: Using terminating resistance
OFF: Not using terminating resistance

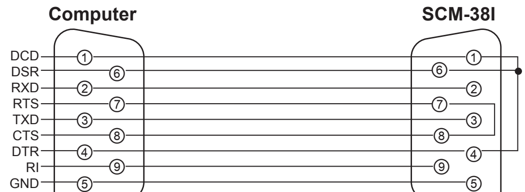
● **Multi-drop connection method with PC**



● **RS232C cable connection**



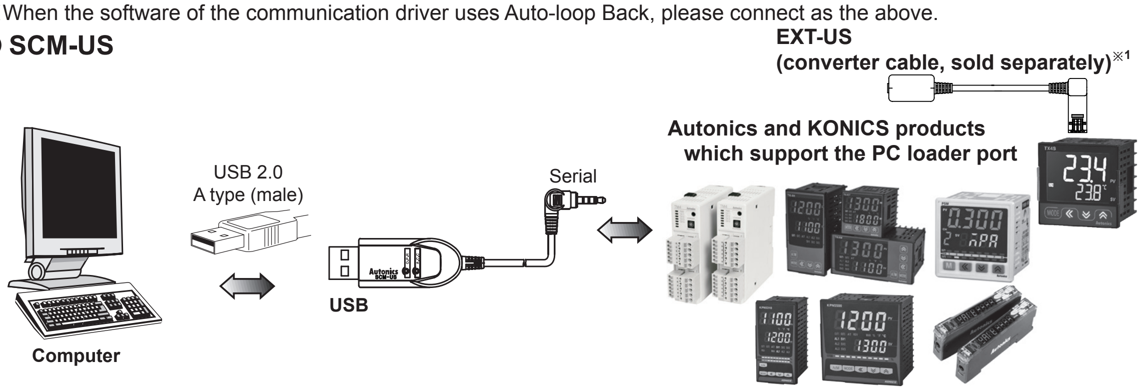
<Standard connection>



<Using Auto-loop Back>

※When the software of the communication driver uses Auto-loop Back, please connect as the above.

◎ SCM-US



※1: Some products requires the dedicated converter cable(EXT-US, sold separately) to connect SCM-US. Do not apply excessive force to the converter cable. It may cause damage to the unit. Do not bend cable and connector part. It may cause damage to the unit.

▣ Driver Installation

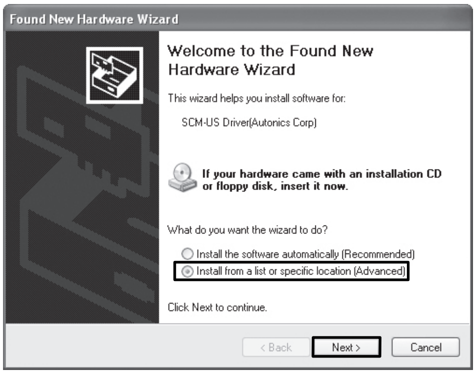
◎ USB Driver Installation

● SCM-US48I, SCM-US

1) Visit our website (www.autonics.com) to download USB Driver.

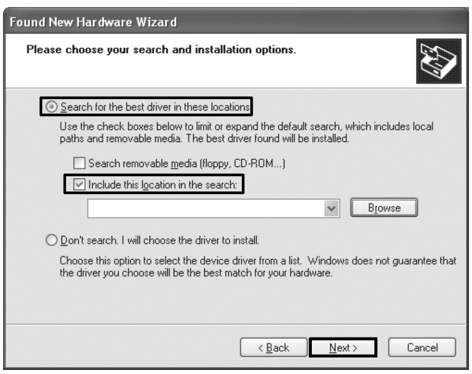
2) Unzip the downloaded 'SCM-US48I.zip', or 'SCM-US.zip' at any directory.

3) When connecting product with USB port, 'Found New Hardware Wizard" will appear automatically. 'Do you want to search software by connecting 'Window Update'?. Click 'No' button and the following window will be displayed to proceed Driver installation.
Select 'Install from a list or specific location' (Advanced)' (S) and click 'Next'.

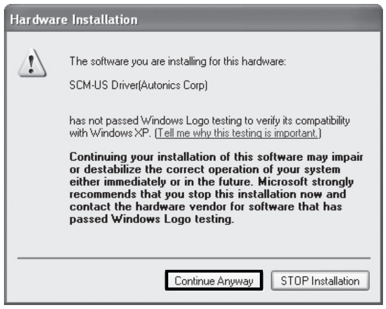


4)Select 'Search for best driver in these locations' and 'include this location in the search' continuously.
Click the 'Browse' button.

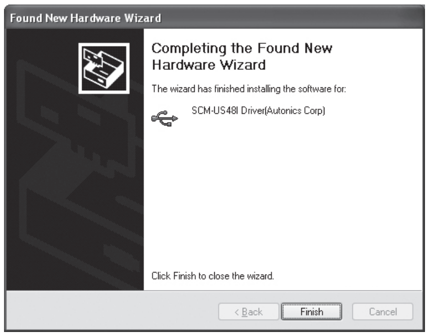
5)When 'Browse Folder' window is displayed, select 'SCM-US\Driver' for SCM-US48I, SCM-US, and click 'Finish'.
Click 'Next' to proceed with the USB Driver installation.



6) Hardware installation message will appear while Found New Hardware Wizard is running. Click 'Continue Anyway' to proceed with installation.



7) The following window will be displayed if the USB Driver is installed properly. Click the 'Finish' button.

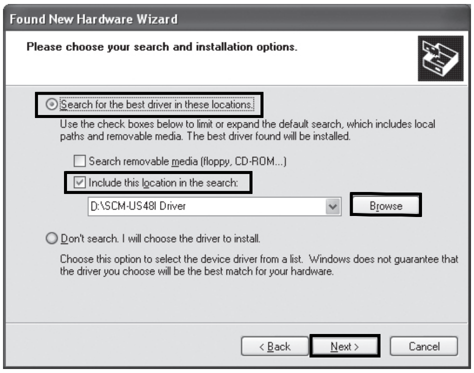


◎ Serial Port Driver Installation

1) After installing USB Driver, Serial Port (COM port), 'Found New Hardware Wizard' will appear (Serial Port Driver installation follows the same procedures described in installing USB Driver).

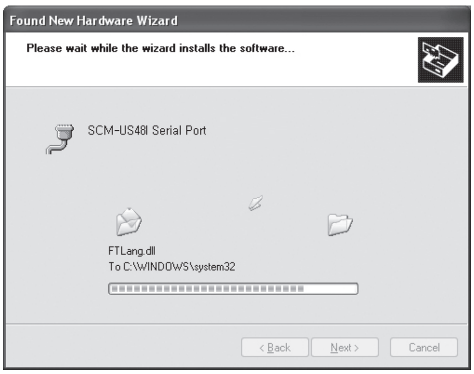
2) After selecting 'Install from a list or specific location (advance)', click 'Next' button. The following window will be displayed for 'Search and installation options'

3) Because a driver location was selected when installing USB driver, click 'Next' button.

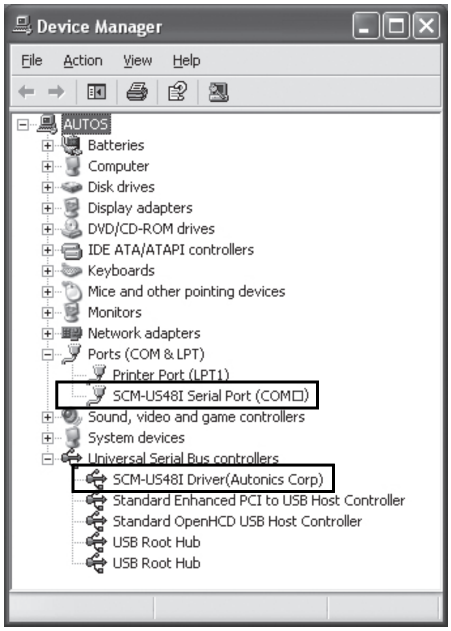


4)Hardware installation message will appear while Found New Hardware Wizard is running. Click 'Continue Anyway' to proceed with installation.

5)'Completing the Found New Hardware wizard' will be displayed if the Serial Port Driver is installed properly. Click the 'Finish' button.



※Verify that drivers were installed properly with the windows Device Manager after finishing USB Driver and Serial Port Driver installation.
Open the folder [My computer], open the system folder (click right), click the hardware tab, and click the Device Manager Button. Then, make sure that 'SCM-US48I Driver (Autonics Corp)' or 'SCM-US Driver (Autonics Corp)' is found in 'Common Serial Bus Controller' category and 'Port (COM and LPT) is found in 'SCM-US48I Serial Port (COM □) or 'SCM-US Serial Port (COM □)'.



※This Driver Installation is described based on the procedure for Windows XP.
There might be some differences in the specification above depending on OS.

▣ Proper Usage

- In case of connecting PC with SCM-US48I or SCM-US, when changing PC USB port and connecting this unit to another (changed) USB port, USB driver will be reinstalled. This is not a malfunction.
- When connecting SCM-US or SCM-US48I communication module, please connect PC first. Then, connect RS485 communication product afterward. When disconnecting the units, remove the unit in reverse order.
- Using the twisted pair cable (AWG24), which is suitable to RS485 communication is recommended. If the twisted pair cable is not used, be sure preserving identically the length of A (+) and B (-) cables.
- After connecting SCM-38I, SCM-US48I with RS485 communication DEVICE, be sure to attach the terminating resistor (100 to 120Ω).
- In case of connect PC with SCM-US48I, or SCM-US , No. of COM Port will be numbered in order.
  This is not a malfunction. (e.g. COM 14, COM 15, ..., COM 256)
- When connecting SCM-US48I or SCM-US with USB cable, check COM port number before communication. It may take some time for computer to detect the cable after the cable is connected. (This is not a malfunction.)
- When connecting PC with SCM-US48I or SCM-US, do not use the extension cable to extend USB cable length. It may cause a malfunctions.
- Be cautious when using SCM-US as non-isolated type.
- Only use Autonics products that are available for SCM-US.
- Observe the rated voltage.
- To avoid malfunctions due to noise, do not place the unit close to a high-voltage power line.
- Proper application environment
  (Avoid following environments for unit to be used.)
  • Where severe vibration or shock exists
  • Where close to a strong alkali or strong acid
  • Where direct rays of light exist
  • Where near facilities generating strong magnetic forces or electric noise.
- Storage
  Keep the unit -20 to 60℃, 35 to 85%RH with avoiding direct rays of light. It is recommended to keep the unit package as it is.
- This unit may be used in the following environments.
  • Indoor
  • Altitude: Under 2,000m
  • Pollution degree 2
  • Installation category II

(T) Software

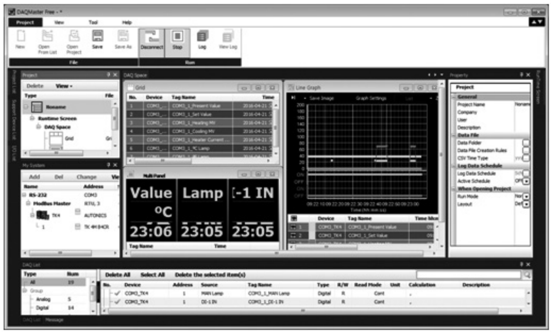
DAQMaster (Comprehensive Device Management Program)

■ DAQMaster Overview

Upgrade

DAQMaster is comprehensive device management program that can be used with Autonics thermometers, panel meters, pulse meters, and counters, etc and with Konics recorders, indicators.
DAQMaster provides GUI control for easy and convenient management of parameters and multiple device data monitoring.

※Visit our website (www.autonics.com) to download the user manual and software.



< DAQMaster screen >

■ Features

- **Multiple Device Support**
  : Simultaneously monitor multiple devices and set parameters. Simultaneously connect units with different addresses in a single device. Multiple RS-233 ports are available for communications using Modbus remote terminal unit.
- **Device Scan**
  : In cases of multiple units (with different addresses) connected together, the unit scan function automatically searches for units.
- **Convenient User Interface**
  : Freely arrange windows for data monitoring, properties, and projects. Saving a project also saves the screen layout.
- **Project Management**
  : You can save added device information, data monitoring screen layouts, and I/O source selection as project files. Opens project files to load the saved settings. Provides a project list for simple and easy project file management.
- **Monitoring Data Log**
  : When monitoring, data log files can be saved as either DAQMaster data files (.ddf) or CSV (.csv) files. Open files saved in .csv format directly from Microsoft Excel. Define log data file naming/saving rules and destination folders to make file management convenient.
- **Data Analysis**
  : Performs grid and graph analyses of data files (*.ddf)using DAQMaster's data analysis feature. Saves grid data as .rtf, .txt, .html, or .csv files in Data Grid.
- **Print Modbus Map Table Report**
  : Print address map reports of registered Modbus devices. Modbus map table reports can be saved as html (*.html) and pdf (*.pdf) formats.
- **Multilingual Support**
  : Supports Korean, English, Japanese, Simplified Chinese. To add a different language, modify the files in the Lang folder rename, and save.
- **Script Support**
  : Uses the Lua Script language and deals with different I/O processes for individual devices.

▣ Installing The Program

◎ System requirements

< Computer specification for using software>

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS-232 serial port (9-pin), USB port

◎ Preparations

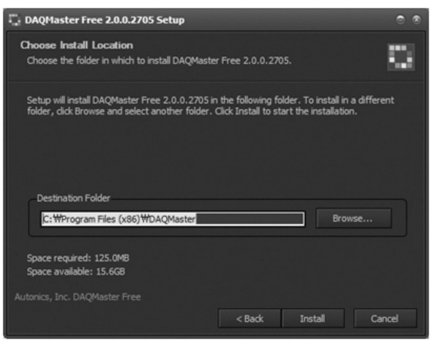
Close all programs before you start DAQMaster installation. Double-click DAQMaster setup.exe to start installation. Installer Language window appears. Select the language and click OK button.

◎ Installation

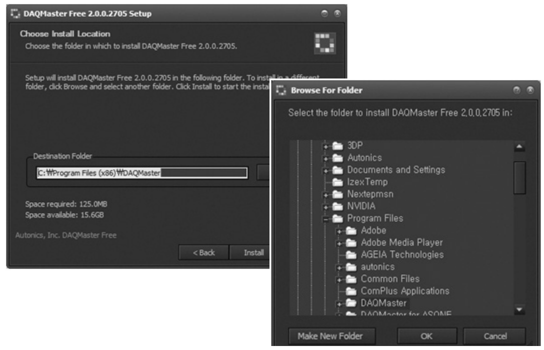
1) Click Next in the installation welcome window.

2) Choose Install Location window appears. Default installation path is C:\Program Files\(x86)\DAQMaster.

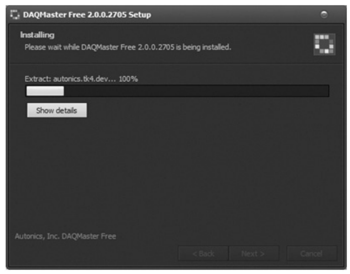
3) Click Install button to choose the default path for installation. Click Browse button to change the installation path.



4) In the Browse Folder window, select the desired destination folder and then click OK to start installation.



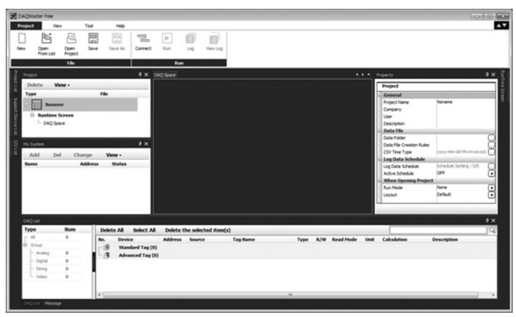
5) Installation progress is displayed in the status window as follows.



6) Installation Complete window appears after installation is completed.

7) If the check box in the Installation Complete window is checked, DAQMaster runs upon completion of installation. You can now run DAQMaster by double-clicking the DAQMaster icon on the desktop.

When running the program for the first time, the initial screen displays the following.



(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Proximity Sensors
(E) Pressure Sensors
(F) Rotary Encoders
(G) Connectors/ Connector Cables/ Sensor Distribution Boxes/ Sockets
(H) Temperature Controllers
(I) SSRs / Power Controllers
(J) Counters
(K) Timers
(L) Panel Meters
(M) Tacho / Speed / Pulse Meters
(N) Display Units
(O) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic/ Logic Panels
(S) Field Network Devices
(T) Software

MotionStudio (Motion Controller Program)

■ MotionStudio Overview

MotionStudio is for controlling a motion controller.
A PC is Master and a motion controller is Slave.
A PC (Master) and a motion controller (Slave) is connected each other by communication.

※Visit our website (www.autonics.com) to download the user manual and software.
※Applied model: PMC-2HSP

<MotionStudio screen>

■ Features

- **Supports various communication speed**
  : 9600, 19200, 38400, 57600, 115200bps
- **Uses all communication ports (COM1 to COM255) which is supported in operation system**
- **Convenient user interface**
  : You can set and check drive, parameter, and device status monitoring at the one screen.
- **COM test**
  : Checks communication status between PC and motion controller
- **Supports English and Korean**
- **Screen layout**
  : Program main menu, connection, node list, I/O status, node information, message window, drive type
- **Supports various instructions**
- **Displays drive and error status at message window**
- **Enables to control individually or simultaneously for the connected devices by communication**
- **Supports calculator for user convenience**
  : Calculates output PPS and circle interpolation, center coordination, manual deceleration point

■ Installing The Program

◎ System requirements

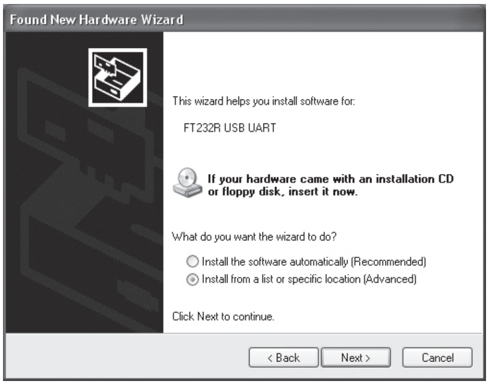
< Computer specification for using software>

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98/NT/XP/Vista/7
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS-232 serial port (9-pin), USB port

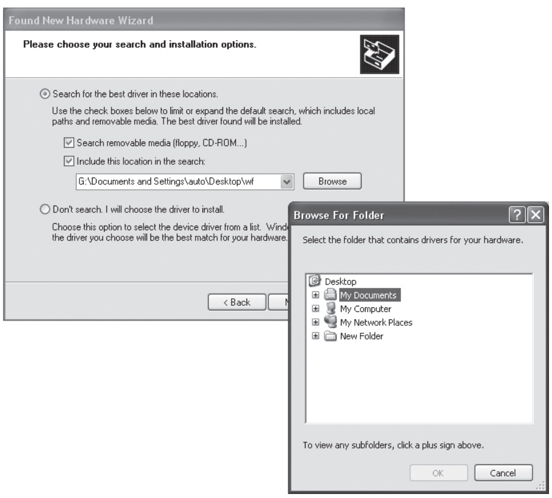
◎ USB driver installation

Install the USB driver at first to use an USB port.

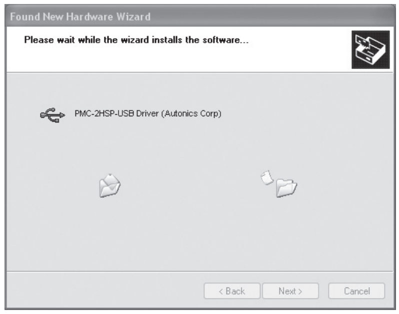
1) Unzip the downloaded FT232R device driver at the desired folder.
2) Connect a PC and a motion controller by a USB communication cable and turn ON the power of a motion controller.
3) 'Found New Hardware Wizard' operates automatically and select ' Install from a list or specific location' and click 'Next'.

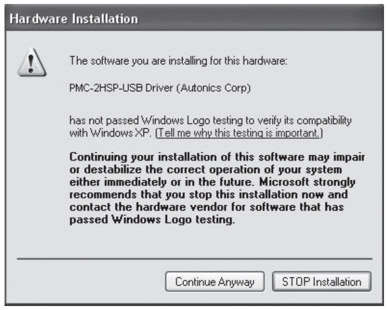


4) Select 'Include this location in the search' and click 'Browse'. 'Browse For Folder' dialog box opens. Designate the folder which has the driver and click 'OK'. When coming back to the Wizard, click 'Next'.

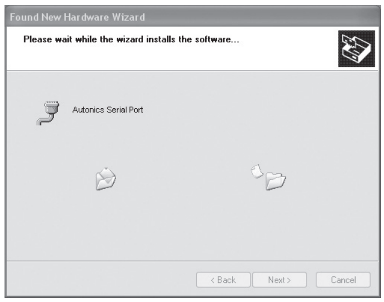


5) Processes installing the FT232R driver.
Click 'Continue Anyway' and it completes to install the driver.





6) After the installing the driver, install the Port. Installation for Serial Port is same as 3), 4) steps.
It processes installing the port. Click 'Continue Anyway' and it completes to install the port.



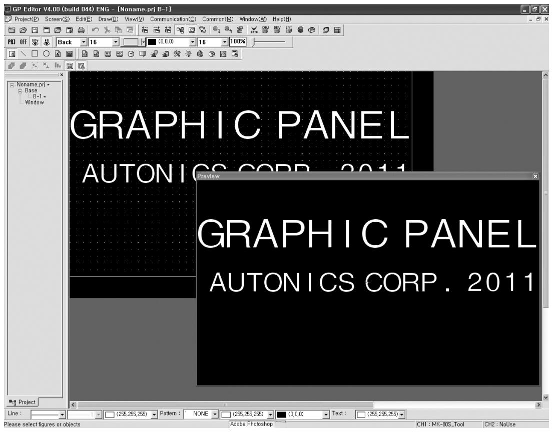
7) Click 'Finish' and complete installing.

GP Editor (Drawing Program)

■ GP Editor Overview

GP Editor which is dedicated software for user defined screen data in GP/LP helps draw screen or edit data. After editing screen data such as tag form, arrangement, and attribution, download these to GP/LP and GP/LP starts to monitor by screen data.

※Visit our website (www.autonics.com) to download the user manual and software.



<GP Editor screen>

■ Features

- **Supports multi-font**
  : It supports windows true type fonts and several bitmap fonts. (It is selectable.)
- **Convenient user interface**
- **Upgrades firmware of GP (GP/LP mono color type: GP-S044, GP-S057, LP-S044)**
- **Screen Layout**
  : Title bar, menu, tools, status bar, edit area, non-edit area, preview
- **Several edit feature (group, alignment, select, draw)**
- **Panel kit/Part library**
  : Panel kit library: Created library by user
  Part library: Supplied basic library by GP Editor
  Part: Registers several numbers or groups of only figure objects (line, rectangle, circle, text, BMP)
- **Supplies diverse image library**
- **Overlap screen for screen edit efficiency and for saving data capacity**
- **Memory**
  : Feature for composing project screen of GP/LP, memory free space, checking firmware version, and delete the desired screen
- **Check data**
  : Automatically executes to check data error when download the data to GP/LP
- **Preview**
  : Shows screen on the device with 100% of enlargement ratio
- **Supplies help information for program usage**

Installing The Program

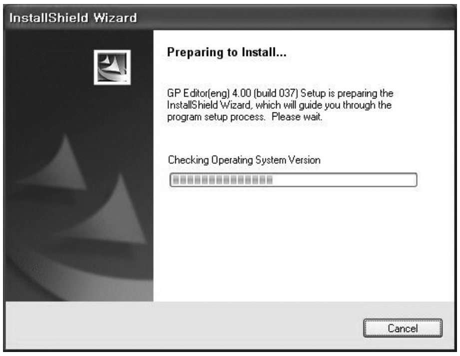
◎ System requirements

< Computer specification for using software>

Item	Minimum requirements
System	IBM PC compatible computer with Pentium Dual Core or above
Operations	Microsoft Windows 98/NT/XP/7
Memory	1G+
Hard disk	5GB+ of available hard disk space
VGA	1028×1024 or higher resolution display
Others	• GP/LP-S044, S057: RS232C port • GP/LP-S070: RS232C port, USB port, ETHERNET port

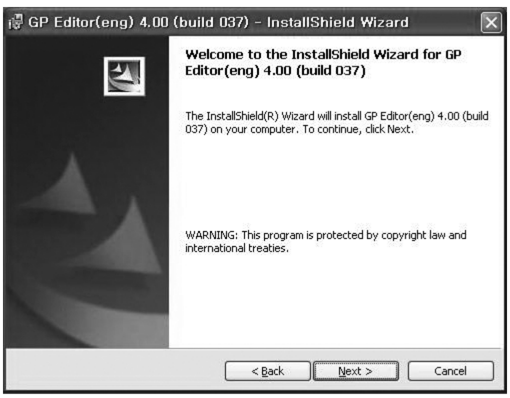
◎ Installation

1) Before installing GP Editor, it is recommended to shut down the other programs. Double-click installation setup file, and installation is start.

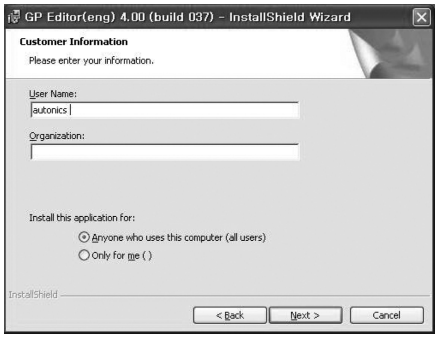


2) Click 'Next' after InstallShield wizard is ready.

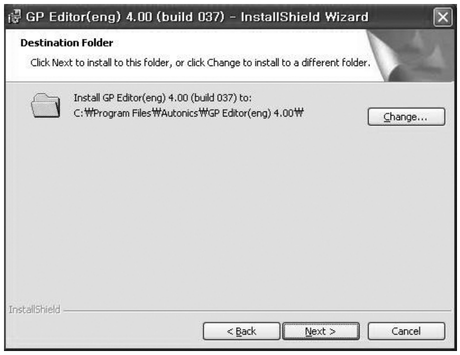
3) Click 'Next' to continue installation.



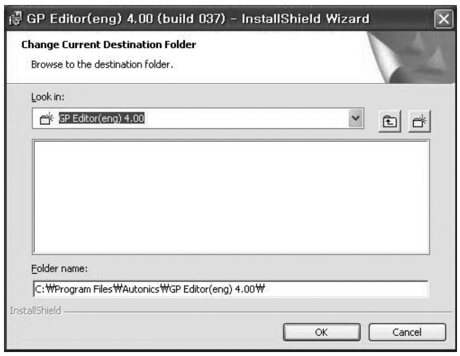
4) Enter your information, and click 'Next'.



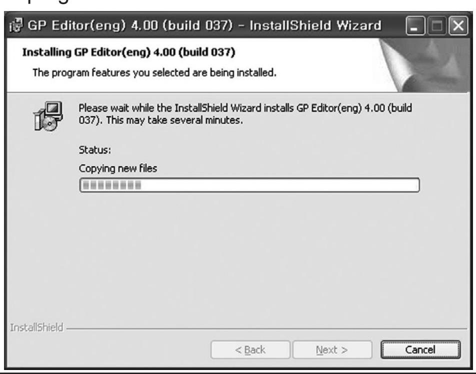
5) Designate installation location, and click 'Next'. (Default installation path is C:\Program Files\Autonics\GP Editor 4.01\)



6) To change the installation location, click 'Change' and select the desired folder and click 'OK'.



7) Installation starts and you can check installation progress at the same time.



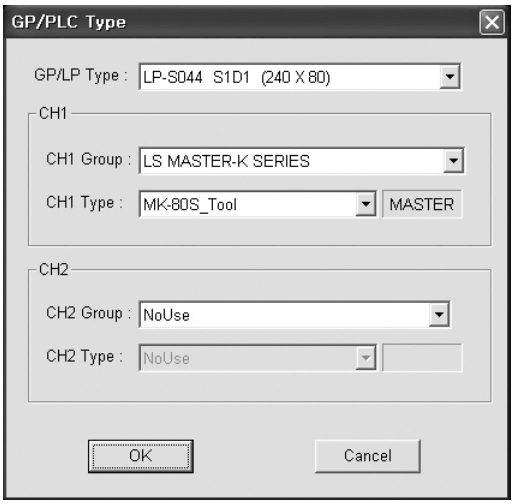
◎ Installation

8) After completing installation, click ‘Finish’ and GP Editor runs. If you do not want to run GP Editor, non-check ‘Launch the program’ and click ‘Finish’.

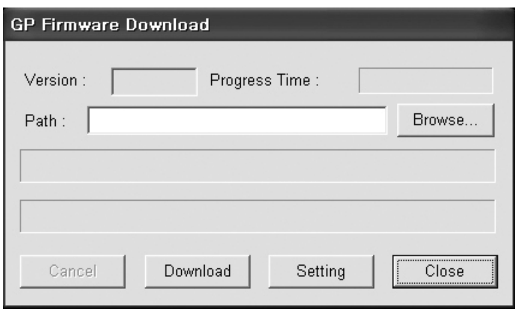
◎ Firmware Download

You can change GP/LP firmware by downloading from GP Editor. GP Editor supports the firmware download only GP/LP mono type (GP-S044, GP-S057, LP-S044).
For GP/LP color type (GP-S070, LP-S070), use USB HOST of GP/LP and firmware upgrade is available.

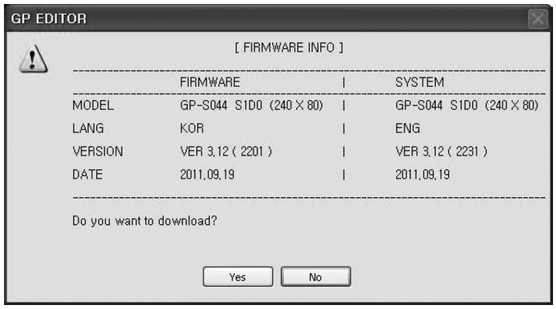
1) You can download only for same firmware GP/LP type with GP/LP type designated at GP Editor.
Select [Common]-[GP/PLC Type] of menu, ‘GP/PLC Type’ dialog box appears. By pull-down menu, designate to be downloaded GP/LP type.



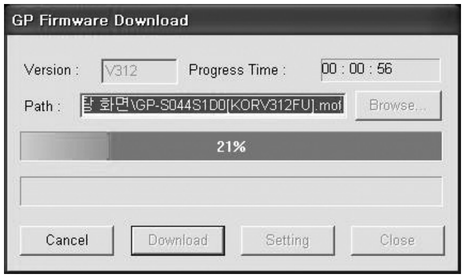
2) Select [Communication]-[GP Firmware Download] of menu and ‘GP Firmware Download’ dialog box appears. Click ‘Browse’ and select firmware file to be downloaded.



3) Click ‘Download’ and the firmware information dialog box for current GP/LP firmware appears and asks whether to download or not. If connected GP is not same as the designated GP type from [Common]-[GP/PLC Type] of menu, error message appears.



4) Click ‘Yes’ and GP/LP screen displays ’GP FIRMWARE UPGRADE’ message. GP Editor displays ‘GP Firmware Download’ dialog box and download progresses.



5)If you want to discontinue download, click ‘Cancel’ and ‘Do you want to interrupt firmware download?’ message appears. Click ‘Yes’ and it discontinues download. For discontinuing download, re-start GP/LP.

6) When completing download successively, GP/LP displays ‘UPGRADE OK PLEASE POWER OFF’ message.
When failing download, GP/LP displays ‘UPGRADE NG PLEASE POWER OFF’ message.
Re-start GP/LP. GP/LP maintains before firmware version and it does not affect to GP/LP operation.

※Note)
The unit which has two RS-232C ports are available to firm-ware download only at the RS-232C B port.
The unit which has each of a RS-422 port and a RS-232C port are available to firmware download only at the RS-232C port.

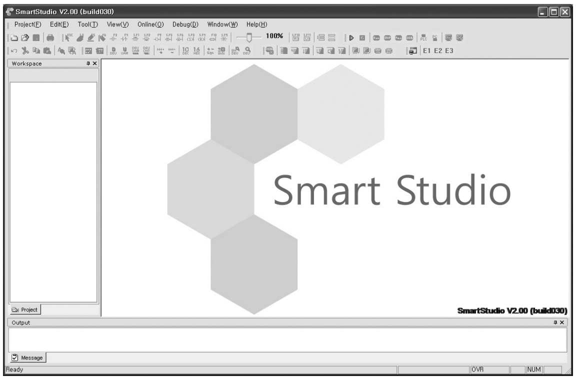
※Caution
After firmware upgrading, all of GP/LP user data are deleted.
Before upgrading firmware, select [Communication]-[Upload] of menu to save the desired data.

Smart Studio (Logic Program)

■ Smart Studio Overview

SmartStudio is the exclusive software to write program and debug for logic panel LP Series. Features and advantages of SmartStudio are as below.

※Visit our website (www.autonics.com) to download the user manual and software.



<Smart Studio screen>

■ Features

- **Supports multi project**
  : You can open up to 5 projects at the same time and write or edit programs.
- **Convenient program edit**
  1)Enables to edit by cell unit
  2)Enables to edit with multi window
  3)You can edit ladder program and mnemonic program at the same time.
- **Several monitor function**
  : Supports several monitor function such as monitoring variable, device, system, or time chart, etc.
- **Supports various viewing function**
  : Supports several view functions such as viewing device name, variable name, or device name & comment, etc to edit program easily
- **Convenient user interface**
  : Easy adaptation for SmartStudio by same basic function of Microsoft window.
- **Various message window**
  : Supports various message window for edit or check program easily.
- **Real time switching ladder and mnemonic program**
  : Switching ladder or mnemonic program in real time and it is available to write or edit at two editors simultaneously.
- **Screen layout**
  : menu, toolbar, workspace, edit window, message window, status bar
- **Program optimization function**
  : Connects the disconnected ladder line and clears NOP instructions
- **Program checking and options**
  : Check program error for dual coil, program error, program capacity
- **Password setting**
  : You can set the password for LP by communication
- **LP firmware upgrade**
- **Supports program instructions, and help**

▣ Installing The Program

◎ System requirements

< Computer specification for using software>

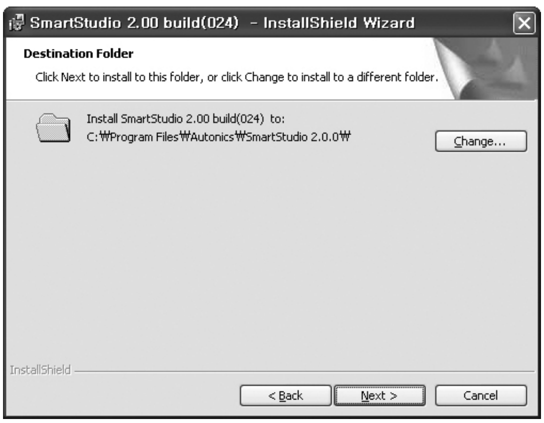
Item	Minimum requirements
System	IBM PC compatible computer with Pentium Dual Core or above
Operations	Microsoft Windows 98/NT/XP/7
Memory	1G+
Hard disk	5GB+ of available hard disk space
VGA	1028×1024 or higher resolution display
Others	• GP/LP-S044, S057: RS232C port • GP/LP-S070: RS232C port, USB port, ETHERNET port

◎ Installation Of SmartStudio

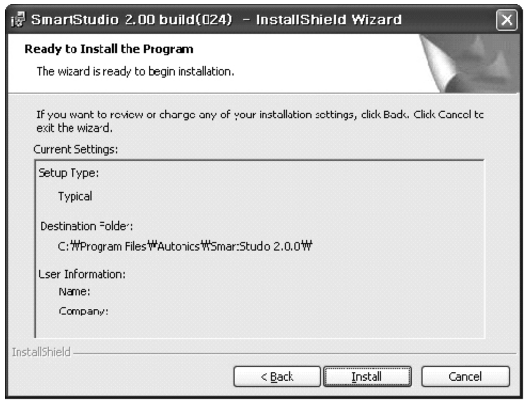
For installing SmartStudio, visit our homepage (www.autonics.com) and download SmartStudio program. Double-click installation setup file, and installation is start as a following figure.

1) Click ‘Next’ to continue installation, or ‘Cancle’ to discontinue installation.

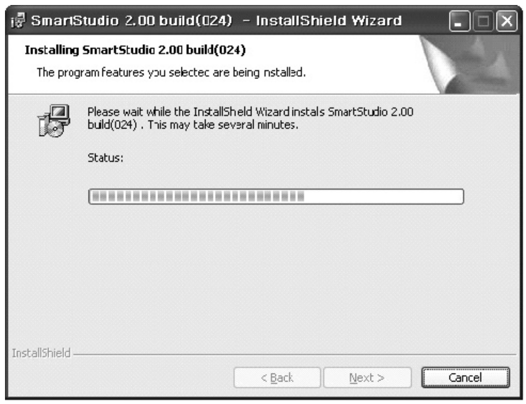
2) Designate installation location, and click ‘Next’. To change the installation location, click ‘Change’ and select the desired folder and click ‘OK’.

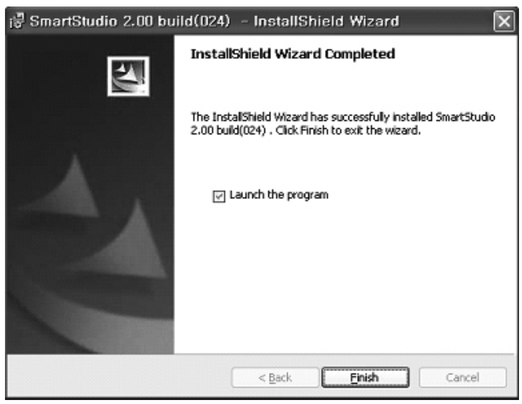


3) Check current settings for installation such as setup type, destination folder, and user information. To change the settings, click ‘Back’. To start installation, click ‘Install’.



4) Installation starts and you can check installation progress at the same time. After completing installation, click ‘Finish’ and SmartStudio runs.





www.autonics.com

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- Area Sensors • Proximity Sensors • Pressure Sensors • Rotary Encoders
- Temperature Controllers • Temperature/Humidity Transducers • SSRs/Power Controllers
- Counters • Timers • Panel Meters • Tachometer/Pulse(Rate) Meters • Connectors/Sockets
- Display Units • Sensor Controllers • I/O Terminal Blocks&Cables
- Switching Mode Power Supplies • Control Switches/Lamps/Buzzers
- Stepper Motors/Drivers/Motion Controllers • Graphic/Logic Panels
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