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Autonics sensors & controllers

Autonics
Sensors & Controllers

Standard type temperature controller

TK Series

User Manual

TK Series

Thank you very much for selecting Autonics products.

For your safety, please read the following before using.

Preface

Thank you for purchasing an Autonics product.

Please familiarize yourself with the information contained in the **Safety Precautions** section before using this product.

This user manual contains information about the product and its proper use, and should be kept in a place where it will be easy to access.

User Manual Guide

This user manual contains information about the product and its proper use, it should be kept in a place where it will be easy to access.

- Please familiarize yourself with the information in this manual before using the product.
- This manual provides detailed information on the product's features. It does not offer any guarantee concerning matters beyond the scope of this manual.
- This manual may not be edited or reproduced in either part or whole without permission.
- A user manual is not provided as part of the product package.
  Please visit www.autonics.com to download a copy.
- The manual's content may vary depending on changes to the product's software and other unforeseen developments within Autonics, therefore, the contents of this manual is subject to change without prior notice.

User Manual Symbols

Symbol	Description
 Note	Supplementary information for a particular feature.
 Warning	Failure to follow instructions can result in serious injury or death.
 Caution	Failure to follow instructions can lead to a minor injury or product damage.
 Ex.	An example of the concerned feature's use.
※1	Annotation mark.

Safety Precautions

- Following these safety precautions will ensure the safe and proper use of the product and help prevent accidents, as well as minimizing possible hazards.
- Safety precautions are categorized as Warnings and Cautions, as defined below:

Warning	**Warning**	Failure to follow the instructions may lead to a serious injury or accident.
Caution	**Caution**	Failure to follow the instructions may lead to a minor injury or accident.

Warning

- If using the product to control machines or devices having serious impact potential on lives and/or property (applications in nuclear power plants, medical equipment, vehicles, trains, aviations, combustion systems, entertainment devices, safety devices, etc.), Always use in conjunction with redundant failsafe systems in place.

  It may cause fire, personal injury, and/or property loss if not followed.
- Always install the unit on a panel.

  It may cause an electric shock if not followed.
- Never wire, repair, or inspect the unit while electricity is flowing through it.

  It may cause an electric shock if not followed.
- Check the input power specifications and terminal polarity before connecting the wires.

  It may cause a fire if not followed.
- Only an Autonics technician is authorized to service or modify the product.

  It may cause an electric shock or fire if not followed.

Caution

- Do not use outdoors.

  It may shorten the life of the product and/or cause an electric shock if not followed.
- Always use AWG 20 (0.5 mm^2) or higher when wiring to the relay's output terminals.

  It may pose a fire risk if not followed.
- Always use within the range of rated specifications and performance.

It may shorten the lifespan of the product and/or pose a fire risk if not followed.

- Do not allow loads in excess of the rated switching capacity on relay contacts.

  It may damage the insulation, relay contacts and/or cause a fire or faulty connection if not followed.

- Do not use water or an oil-based solvent to clean the product. Use a dry towel instead.

  It may pose an electric shock or fire risk if not followed.

- Do not use the product in a place where it is exposed to flammable or explosive gases, humidity, direct light, radiant heat, vibration, or impact.

  It may pose a fire or an explosion risk if not followed.

- Do not allow dust or wiring fragments to get inside the product.

  It may pose a fire or a malfunction risk if not followed.

- Check the terminal's polarity first to properly wire the temperature sensor.

  It may pose a fire or an explosion risk if not followed.

◈ Handling Precautions

These handling precautions address issues that can potentially cause the product to malfunction.

Power & Usage Environment

- Use the rated power only.
- Maintain the controller's ambient temperature between -10℃ and 50℃.
- Turn the power on and allow the temperature controller to warm-up for twenty minutes before use.
- A power switch or a circuit-breaker is necessary to supply and cut off power to the product.
- Install the switch or circuit-breaker in the vicinity of the product to facilitate easy access.
- Use the product in a well-ventilated environment. Otherwise, arrange for ventilation if necessary.

- Recommended usage conditions are as follows:

- Indoors
- Under 2,000 m altitude
- Pollution Degree 2
- Installation Category II

Sensor Input

- If using in an environment where the margin of sensor error cannot be avoided, use the Input Bias feature to minimize the error margin.
- If using a thermocouple sensor, make sure to use prescribed compensation wire as extension wire. Failure to do so will produce temperature distortion at the junction between the thermocouple and the extension wire.
- If using a resistance temperature detector (RTD) sensor, always make connection with three-wire configuration. In addition, only use three wires of identical material, thickness and length if you need to extend the line. Variance in wire resistance will lead to temperature distortion.
- When changing an input sensor, first disconnect power to the product and then connect the new sensor. Restore power to the product and update the related parameters either directly from the product or using the PC loader program.
- Always use a line filter on the controller's power line. Also, use shielded wire for the input signal line, provided it is necessary the power line and the input signal line must remain close to one another.

Noise Effect

- Isolate the product's wiring from high-voltage lines and power lines to prevent impulse noise.
- Avoid using the product in the vicinity of high-frequency noise generating devices. Such as: welding machines, sewing machines, high-capacity SCR controllers, and high-capacity motors.
- Avoid using the product in the vicinity of radio, television, and wireless devices that may cause high-frequency interference.

Communication

- Only use twisted pair wires for the communication lines. Attach round ferrules at the ends of the lines to reduce the impact of external noise.
- Do not have the communication lines in close proximity to the AC power line.
- If possible, use a separate power source (24 VDC) for the communication converter (SCM-38I, sold separately).

Table of Contents

1 Product Introduction

1.1 Features

TK series – standard PID temperature controller – realizes more powerful control with super high-speed sampling cycles of 50 ms and ±0.3% display accuracy. It supports diverse control modes including heating/cooling simultaneous control, and automatic/manual control and communication functions. In addition, TK series covers all necessary features for high performance temperature controllers – that is, diverse input sensor support, multi SV setting, SSRP + current output, high resolution display and compact size.

- Super high-speed sampling cycle (10 times faster compared to existing models); 50 ms sampling cycle and ±0.3% display accuracy
- Improved visibility with wide display and high luminance LED
- High performance control with heating/cooling control and automatic/manual control modes
- Communication function supported: RS485 (Modbus RTU type)
- PC parameter setting via USB cable and RS 485 communication (Modbus RTU)

  ; DAQ-MASTER - PC loader program for parameter setting supported

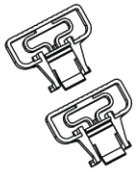
  ; dedicated USB cable – sold separately
- SSRP output/current output
- Heater burn-out alarm (C.T input) (except TK4SP)
- Multi SV setting function (Max. 4) – selectable via digital input terminals
- Space saving mounting possible with compact design

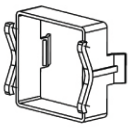
  ; downsized by 38% (depth-based)
- Multi-input/multi-range

1.2 Components and Accessories

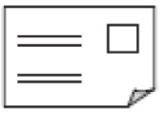
(1) Components

Main Unit





※ TK4S/TK4SP Bracket



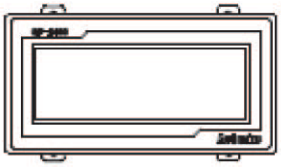
User Manual

Note	· Make sure all of the above components are included with your product package before use. If a component is missing or damaged, please contact Autonics or your distributor. · Visit www.autonics.com to download a copy of the user manual.

(2) Accessories

SCM-US
(RS232↔SERIAL Converter)

SCM-38I
(RS232↔RS485 Converter)



Graphic Panel

Note	· Images of components and accessories may differ from actual products. · For detailed information about any of the above products, please refer to the concerned product's user manual. · Visit www.autonics.com to download copies of the user manuals.

1.3 Model Lineup

TK	4	S	-	1	4	R	R
①	②	③		④	⑤	⑥	⑦

Category			Description
① Item	TK		Temperature/Process controller
② Digit	4		9999(4Digit type)
③ Size	SP		48 mm(W) X 48 mm(H) (Plug Type※4)
	S		48 mm(W) X 48 mm(H) (Terminal Block Type)
	M		72 mm(W) X 72 mm(H)
	W		96 mm(W) X 48 mm(H)
	H		48 mm(W) X 96 mm(H)
	L		96 mm(W) X 96 mm(H)
④ Output Option※1	SP	1	ALARM1 output
	S M W H L	1	ALARM1 output
		2	ALARM1 + ALARM2 output
		R	ALARM1 + Transmission output
		T	ALARM1 + RS485 Comm. output
		A	ALARM1 + ALARM2 + Transmission output
		B	ALARM1+ALARM2+RS485 Comm. output
⑤ Power Supply	4		100 to 240VAC, 50/60Hz
⑥ OUT1 Control Output※2	R		Relay output
	S		SSRP Output
	C		Current output + SSR drive output
⑦ OUT2 Control Output※3	Standard	N	None ※Select in case of standard control (heating or cooling)
	Heating, Cooling	R	Relay output
		C	Current output + SSR drive output

※1: In case of SP series, option control output selection and digital input will be limited due to number of terminals.

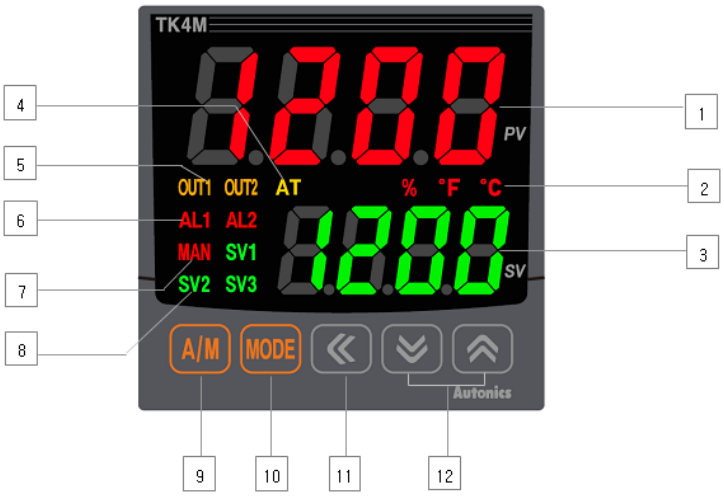
※2: “S” represents SSRP drive voltage output support model which SSR standard/cycle/ phase control are available. “C” represents both current and SSR(standard) output support model.

※3:. Select “R” or “C” type in case of using heating & cooling control. “N” type in case fo using standard control.

※4: 11Pin socket(PG-11, PS-11): Sold separately

Note	・ C.T. (Current Transformer) input is supported by all models. ・ However, TK4SP (11-pin plug) does not support CT input due to its limited number of terminal blocks.

1.4 Parts and Features: Displays and Controls



(1) Displays

No.	Part	Function
1	PV (Present Value) Display	・ (Run mode) Displays the present value (PV) reading. ・ (Setting mode) Displays the internal parameter name.
2	Display Unit (℃/℉/%)	Indicates the display unit for PV (Present Value) and SV (Setting Value).
3	SV (Setting Value) Display	・ (Run mode) Displays the target setting value (SV). ・ (Setting mode) Displays the concerned parameter's setting value.
4	Auto-tuning Indicator	Flashes in 1-second intervals when auto-tuning is executed.
5	Control Output (heating and cooling) Indicator※1	Turns on along with the concerned output.
6	Alarm Output (Alarm1 and 2) Indicator	Turns on along with the concerned output.
7	Manual Control Indicator	Turns on along with an alarm output when the concerned alarm conditions are met.
8	Multi SV Indicator	Indicates which SV is being shown (SV1 through 3).

※1

- Turns on if MV is greater than 5.0% while SSR (Solid State Relay) output is set to cycle or phase output control mode.
- In current output (0-20 mA, DC 4-20 mA) mode:

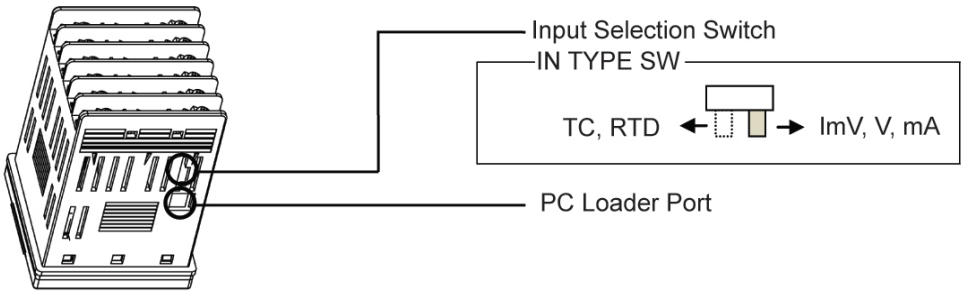
Control	Output Indicator Off	Output Indicator On
Manual Control	Manipulated Variable (MV): 0.0%	Manipulated Variable (MV): > 0.0%
Auto Control	Manipulated Variable (MV): < 2.0%	Manipulated Variable (MV): > 3.0%

(2) Controls

No.	Part	Marking	Function
9	Auto/Manual Control Selection	A/M	Switches between auto control and manual control.
10	Mode Key★[1]	MODE	Setting mode access and parameter selection.
11	Shift Key	◄	SV setting mode access and digit selection.
12	Up/Down Keys	▲/▼	· SV setting mode access and digit value change. · Used to activate the digital input key feature.

★[1]. TK4S and TK4SP (48WX48H) do not feature an A/M key. A/M key functions have been replaced by the MODE key in these models.

(3) Input Selection Switch and Communication Port (underside of the unit)



Note	· Position the switch according to the desired input type. · All models support serial communication via the PC loader port. To configure and monitor the parameters from a PC, connect the loader cable to the PC loader port.

(4) 7-Segment Display Characters

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
0	1	2	3	4	5	6	7	8	9	0	-1	/

2 Specifications

2.1 Ratings

Series		TK4					
		TK4S	TK4SP	TK4M	TK4W	TK4H	TK4L
Power Supply		100-240 VAC, 50/60 Hz					
Allowable voltage range		±10% of rated voltage					
Power Consumption		Max. 8 VA					
Display		7-Segment (red), all other displays (green, amber, red LED)					
Character Size	PV(W x H)	7.0X14.0mm	7.0X14.0mm	9.5X20.0mm	8.5X17.0mm	7.0X14.6mm	11.0X22.0mm
	SV(W x H)	5.0X10.0mm	5.0X10.0mm	7.5X15.0mm	6.0X12.0mm	6.0X12.0mm	7.0X14.0mm
Input Types	RTD	JPT 100 Ω, DPT 100 Ω, DPT 50 Ω, CU 100 Ω, CU 50 Ω, and Nikel 120 Ω (6 types)					
	Thermocouples	K, J, E, T, L, N, U, R, S, B, C, G, and PLII (13 types)					
	Analog	Voltage: 0 to 100mV, 0 to 5V, 1 to 5V, and 0 to 10 V (4 types) Current: 0 to 20mA and 4 to 20mA (2 types)					
Display Accuracy	RTD	※1At room temperature (23℃ ±5℃): PV ± 0.3% or ± 1℃ (whichever is greater) ±1 digit. At all other temperature ranges: PV ± 0.5% or ± 2℃ (whichever is greater) ± 1 digit. In case of TK4SP series, ±1℃ will be added.					
	Thermocouples						
	Analog	At room temperature (23℃ ±5℃): ± 0.3% F.S. ± 1 digit. At all other temperature ranges: ± 0.5% F.S. ± 1 digit.					
	C.T. Input	± 5% F.S. ± 1 digit					
Control Output	Relay	250 VAC 3A 1a					
	SSR	11 VDC ± 2 V 20 mA Max.					
	Current	Choose between DC0 to 20 mA and DC4 to 20 mA (Load 500 Ω Max.)					
Alarm Output		250 VAC 3A 1a 2Contacts(TK4SP-1contact)					
Output Option	Transmission Output	DC4 to 20mA (Load 500 Ω Max. Output Accuracy: ±0.3% F.S)					
	Communication	RS485 Communication Output (Modbus RTU)					
Input Option	C.T.	0.0 to 50.0A (primary heater current reading range) ※1000:1 C.T. Ratio					
	Digital Input	Contact - On: < 2kΩ, Off: > 90kΩ Non-Contact - On: < 1.0 V Residual Voltage, Off: < 0.1mA Leakage Current ※TK4S/M-1ea(due to limited terminal), TK4H/W/L-2ea(except TK4SP)					
Control Type	Heating and Cooling	On/Off, P, PI, PD, and PID Control					
	Heating or Cooling						

Series		TK4					
Hysteresis		RTD/ Thermocouples Resistor: 1 - 100℃/℉ (0.1 - 100.0℃/℉) Variable Analog: 1 to 100 digits					
Proportional Band (P)		0.1 - 999.9℃ (0.1 - 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. (Relay output and SSR output only)					
Manual Reset Value		0.0 - 100.0%					
Sampling Period		50 ms					
Dielectric Strength		2000 VAC 50/60 Hz for 1 min. (between power terminal and input terminal)					
Vibration Resistance		0.75mm amplitude at 5 to 55 Hz (1 min. cycle) in X, Y, and Z directions(2 hours)					
Relay Life Cycle	Mechanical	OUT1/OUT2 : Over 5,000,000 cycles AL1/AL2 : Over 20,000,000 cycles (※TK4H/TK4W/TK4L: over 5,000,000 cycles)					
	Electrical	OUT1/OUT2 : Over 200,000 cycles AL1/AL2 : Over 100,000 cycles (※TK4H/TK4W/TK4L: over 200,000 cycles)					
Insulation Resistance		100MΩ (at 500VDC megger)					
Noise Resistance		Square shaped noise by noise simulator (pulse width 1 μs) ± 2 KV R-phase, S-phase.					
Memory Retention		Approx. 10 years (non-volatile semiconductor memory type)					
Environ -ment	Ambient Temperature	-10 to 50℃, Storage temperature: -20 to 60℃					
	Ambient Humidity	35 to 85% RH, Storage humidity: 35 to 85% RH					
Protection		IP65 (front) ※TK4SP: IP50 (front)					
Insulation type※2		□					
Unit Weight		Approx. 105 g	Approx. 85 g	Approx. 140 g	Approx. 141 g	Approx. 141 g	Approx. 198 g

※1: At room temperature ranges and at all other temperature ranges

- At room Temperature range(23℃ ± 5℃)
  - TC K, J, T, N, E type , below -100℃ / TC L, U, PL II type: (PV ±0.3% or ±2℃, select the bigger one) ± 1Digit
  - TC C, G type / TC R, S type bellow 200℃: (PV ±0.3% or ±3℃, select the bigger one) ± 1 digit
  - TC B type, below 400℃: There is no accuracy standards.

- Out of range of room temperature
  - TC R, S, B, C, G: (PV ±0.5% or ±5℃, select the bigger one) ±1Digit
  - Other: Below -100℃: Within ±5℃
- In case of TK4SP series, ±1℃ will be added.

※2: “ □ ” represents that this unit is double or reinforced insulated.

※Environment resistance is rated at no freezing or condensation.

2.2 Input Type

Input Types				Display	Input Range (℃)	Input Range (℉)
Thermocouple (TC)	K(CA)		1	K.CA.H	-200 - 1350	-328 - 2463
			0.1	K.CA.L	-199.9 - 999.9	-199.9 - 999.9
	J(IC)		1	J.IC.H	-200 - 800	-328 - 1472
			0.1	J.IC.L	-199.9 - 800.0	-199.9 - 999.9
	E(CR)		1	E.CR.H	-200 - 800	-328 - 1472
			0.1	E.CR.L	-199.9 - 800.0	-199.9 - 999.9
	T(CC)		1	T.CC.H	-200 - 400	-328 - 752
			0.1	T.CC.L	-199.9 - 400.0	-199.9 - 752.0
	B(PR)		1	b.Pr	0 - 1800	32 - 3272
	R(PR)		1	r.Pr	0 - 1750	32 - 3182
	S(PR)		1	S.Pr	0 - 1750	32 - 3182
	N(NN)		1	n.nn	-200 - 1300	-328 - 2372
	C(TT)※1		1	C.tt	0 - 2300	32 - 4172
	G(TT)※2		1	G.tt	0 - 2300	32 - 4172
	L(IC)		1	L.IC.H	-200 - 900	-328 - 1652
			0.1	L.IC.L	-199.9 - 900.0	-199.9 - 999.9
	U(CC)		1	U.CC.H	-200 - 400	-328 - 752
			0.1	U.CC.L	-199.9 - 400.0	-199.9 - 752,0
	Platinel II		1	PL.II	0 - 1390	32 - 2534
RTD	CU 50 Ω		0.1	CU.5	-199.9 - 200.0	-199.9 - 392.0
	CU 100 Ω		0.1	CU.10	-199.9 - 200.0	-199.9 - 392.0
	JIS Standards	JPt 100 Ω	1	JPt.H	-200 - 650	-328 - 1202
		JPt 100 Ω	0.1	JPt.L	-199.9 - 650.0	-199.9 - 999.9
	DIN Standards	DPt 50 Ω	0.1	dPt.5	-199.9 - 600.0	-199.9 - 999.9
		DPt 100 Ω	1	dPt.H	-200 - 650	-328 - 1202
		DPt 100 Ω	0.1	dPt.L	-199.9 - 650.0	-199.9 - 999.9
	Nickel 120 Ω		1	ni.12	-80 - 200	-112 - 392
Analog	Voltage	0 to 10 V		Au.1	-1999 - 9999 (Decimal point placement is configurable.)	
		0 to 5 V		Au.2		
		1 to 5 V		Au.3		
		0 to 100mV		An.u.1		
	Current	0 to 20 mA		An.A.1		
		4 to 20 mA		An.A.2		

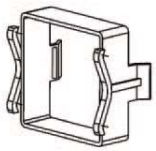
※1: C(TT) 1 : Same temperature sensor as former W5 (TT).

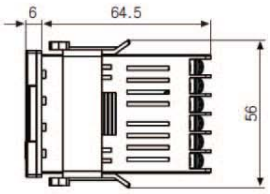
※2: G(TT) : Same temperature sensor as former W (TT).

3 Dimensions

(1) TK4S-Series

● Bracket





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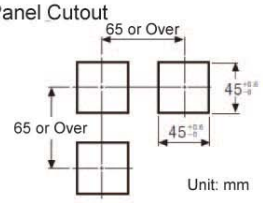
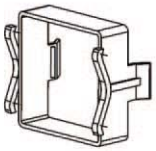
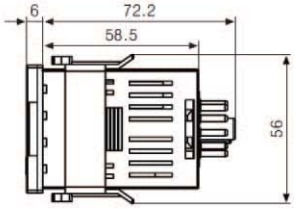


(2) TK4SP-Series

● Bracket





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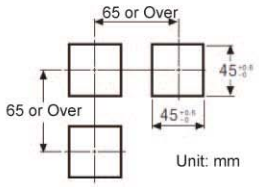
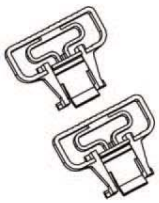
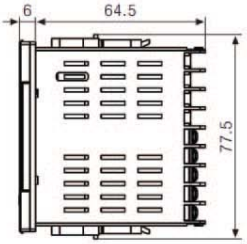


(3) TK4M-Series

● Bracket





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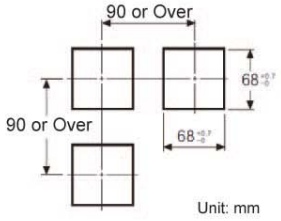
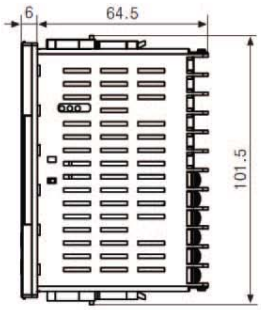
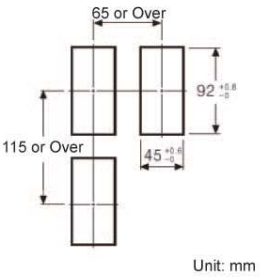


(4) TK4H-Series

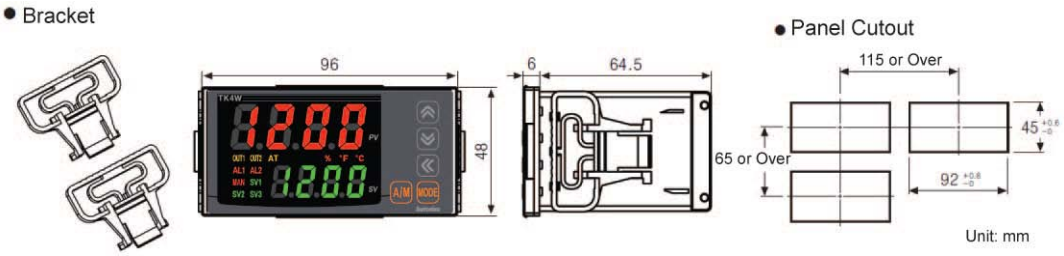
● Bracket



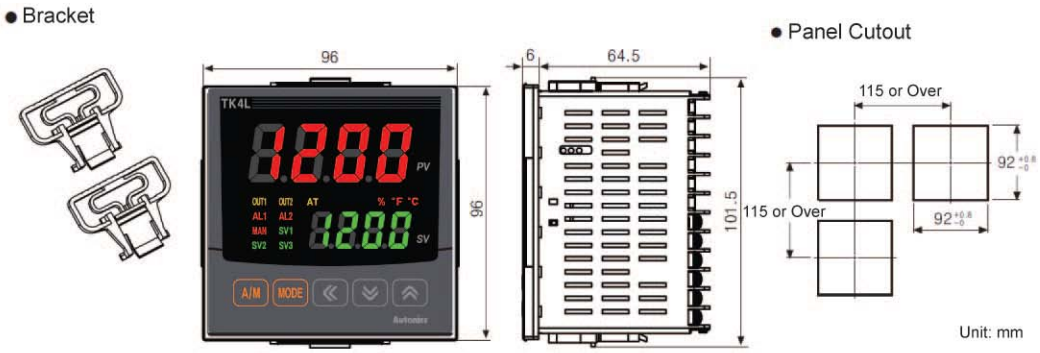
● Panel Cutout



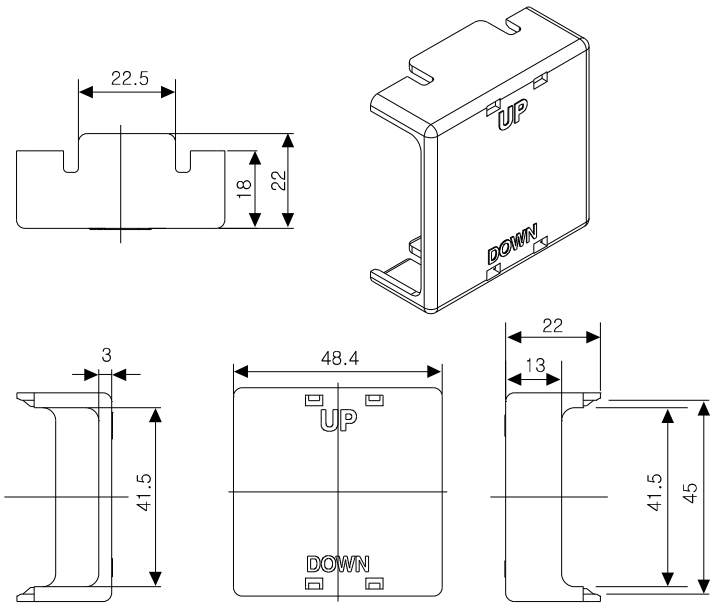
(5) TK4W-Series



(6) TK4L-Series



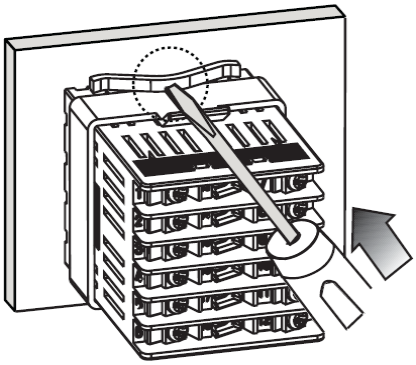
(7) Terminal cover(Sold separately): RSA-Cover(48X48 Size)



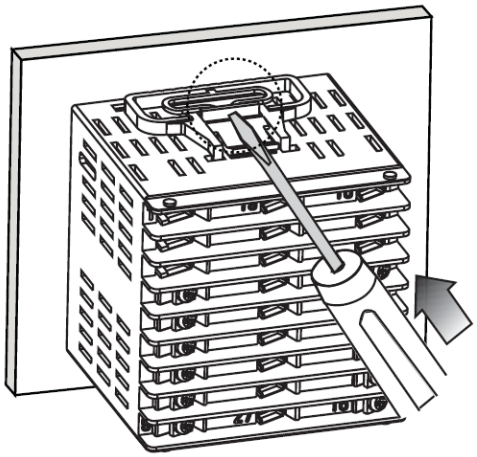
Unit: mm

3.1 Installation

- TK4S-Series and TK4SP-Series (48 mm(W) X 48 mm(H))



- All others

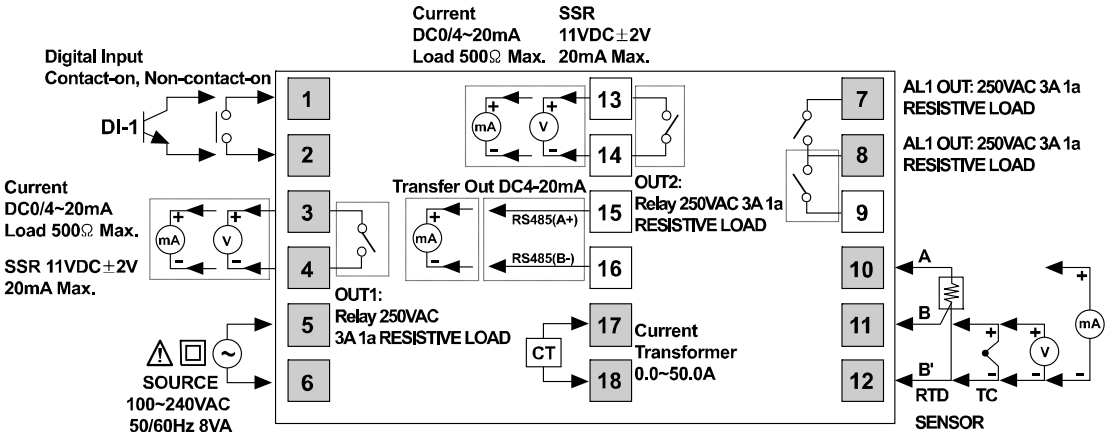


Note	Mount the procuct on the panel and securely push the bracket in using a tool, as shown in the diagram.

4 Wiring Diagrams

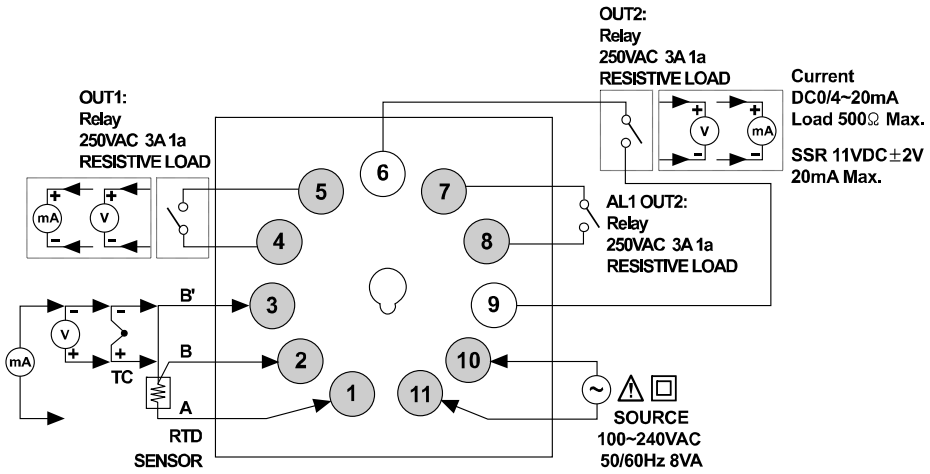
Standard model has shaded terminals only.

4.1 TK4S-Series



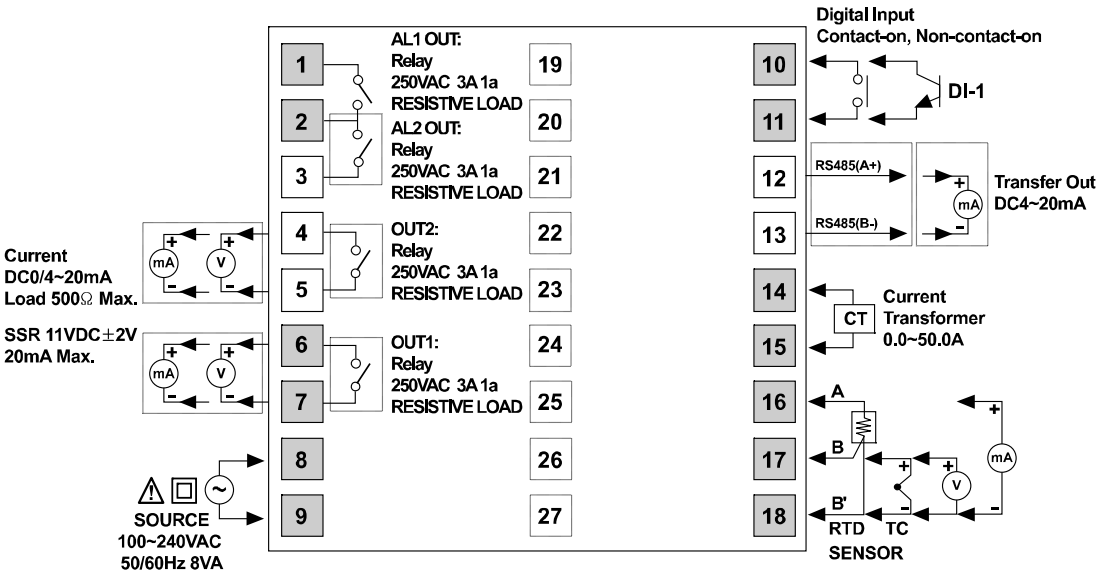
Note	Features one digital input terminal due to limited number of terminal blocks. Supports two multi SVs (SV1 and SV2) only.

4.2 TK4SP-Series



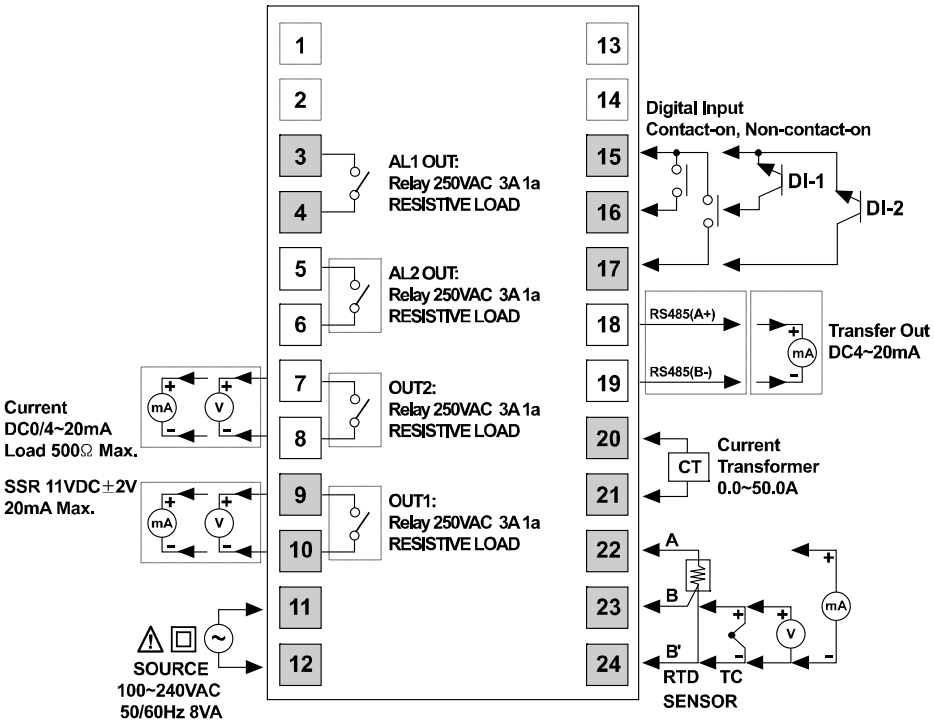
Note	Does not feature any digital input terminal due to limited number of terminal blocks. 11Pin Socket(PG-11, PS-11): Sold separately

4.3 TK4M-Series



Note	Features one digital input terminal due to limited number of terminal blocks. Supports two multi SVs (SV1 and SV2) only.

4.4 TK4W, TK4H, TK4L-Series



4.5 Wiring Precautions

- Mixing up the input terminals with output terminals and vice versa can lead to product damage.
- Use only sensors supported by the product.
- Make sure to connect rated SSRs or loads to the output terminals. Make sure to connect communication cable with correct communication terminals (A, B).
- Make sure to observe correct polarity of power source terminals. (+ and -).

4.5.1 Sensor Connection

4.5.1.1 Compensation Wire Connection

For thermocouple sensors, use compenstion wire of the same specification as input sensors. Using an extension wire of different specifications and/or material will increase inaccuracy of temperature sensing. It is recommended to choose high performance compensation wire for more reliable sensing.

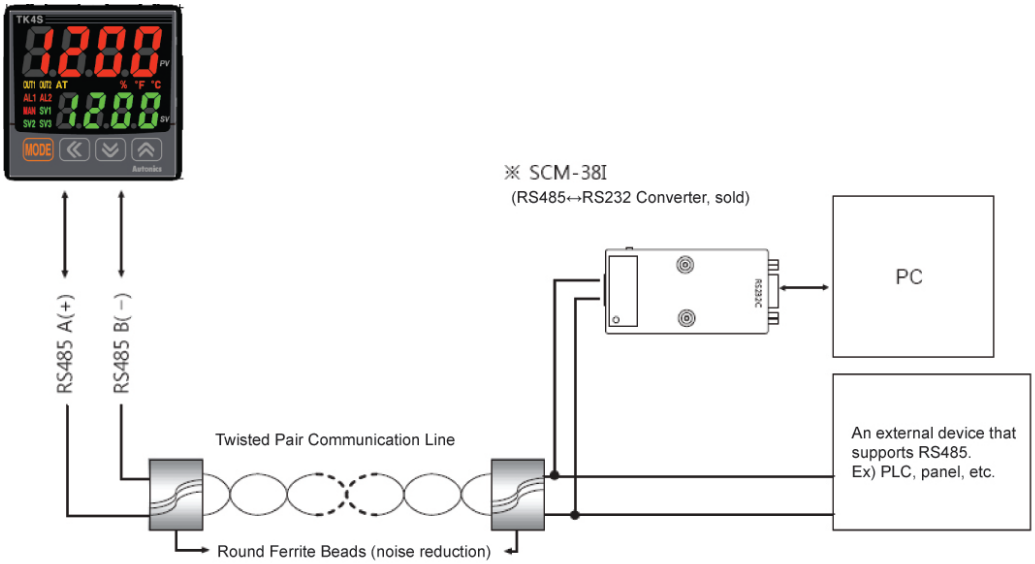
4.5.1.2 Measurement Error

- Do not mix up the direction of the input sensor connector.
- Carefully adjust both load and sensor positions.
- Make sure the sensor is securely attached to the input connector.

4.5.1.3 AC Power Cable and Wiring

Do not put the sensor lines in close proximity of the AC power lines.

4.5.2 Communication Line Wiring

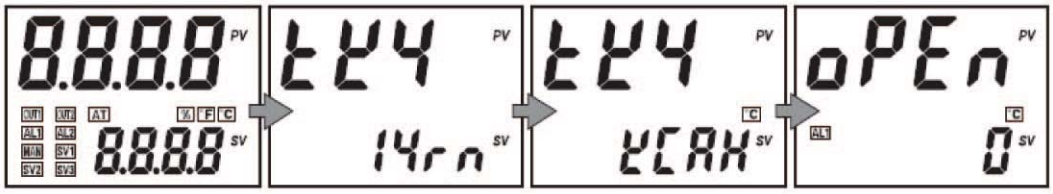


Note	・ Do not tie together with the AC power line. ・ Only use twisted pair wires for the communication lines. ・ Do not allow the communication line to exceed 800m in length. ・ For further details, please refer to 6-6 Communication Features.

5 Preparation and Startup

5.1 Powering On and Initial Display

When powered on and providing no error is present, the unit's front display will turn on for about a second and then twice display the model name, option/main outputs, and input type in sequence at 0.5-second intervals.

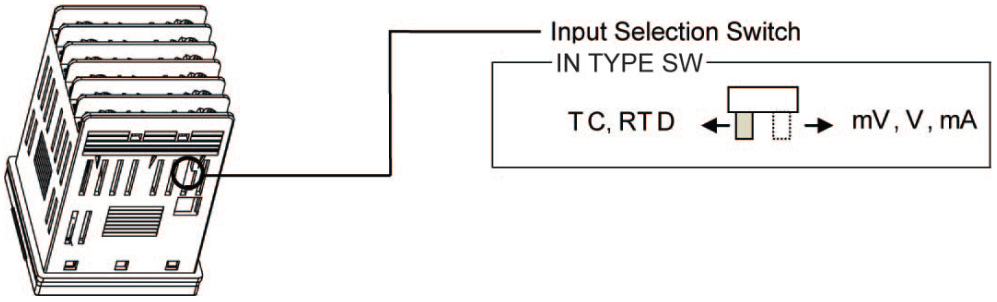


After powering on. Display all (1 second) | Model/Option/Power/Output Partial display (1 second) | Current input type. (Flashes twice) | Run mode

SV Display	Display Category	Information
1, 2, r, t, A, b	Option Output,	ALARM1/2, PV Transmission, RS485 Output
4	Power	100 to 240 VAC, 50/60 Hz
r, 5, C	OUT1 Control Output	Relay Contact, SSRP Output, Current + SSR Output
n, r, C	OUT2 Control Output	None, Relay Contact, Current + SSR Output

5.2 Input Selection Switch

- Before setting the temperature controller's internal parameters, position the input selection switch located at the underside of the unit to the desired input specification.
- Changing the input selection switch position resets temperature sensor input to TCAH and results in display of thermocouple/RTD Input Types only. In the case of analog input, it is reset to Au 1, resulting in display of analog voltage/current Input types only.



5.3 Basic Controls

5.3.1 Parameter Setting Sequence

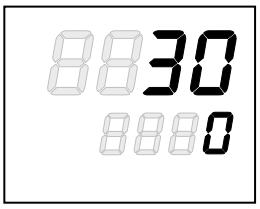
Parameter 3 Setting Group [PAr3] → Parameter 4 Setting Group [PAr4] → Parameter 5 Setting Group [PAr5] → Parameter 2 Setting Group [PAr2] → Parameter 1 Setting Group [PAr 1] → SV Setting Group [SV]

Note	• Parameters from different setting groups are linked to one another; therefore, initial parameterization should be performed in the above sequence. • Changing Parameter 3 Setting Group's parameters can sometimes reset other associated parameters. Always make sure to check if such parameters have been affected.

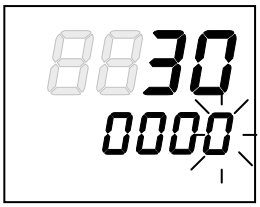
5.3.2 SV Settings

Flow chart for SV setting is as follows:

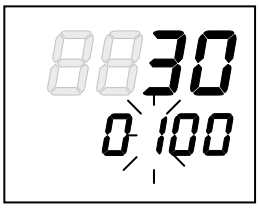
1 While in Run mode, press any ◂, ▾, or ▴.



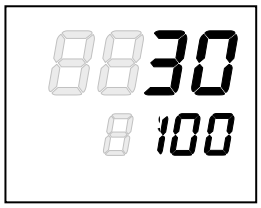
2 Select the desired digit using the ◂ key.



3 Configure the desired numeric value using the ▾/▴ keys.



4 To save, press MODE key or do not make any additional key entries for three seconds.



5.3.3 Changing Parameter Settings

Change parameter settings in the following steps:

1 While in Run mode, press and hold MODE key.

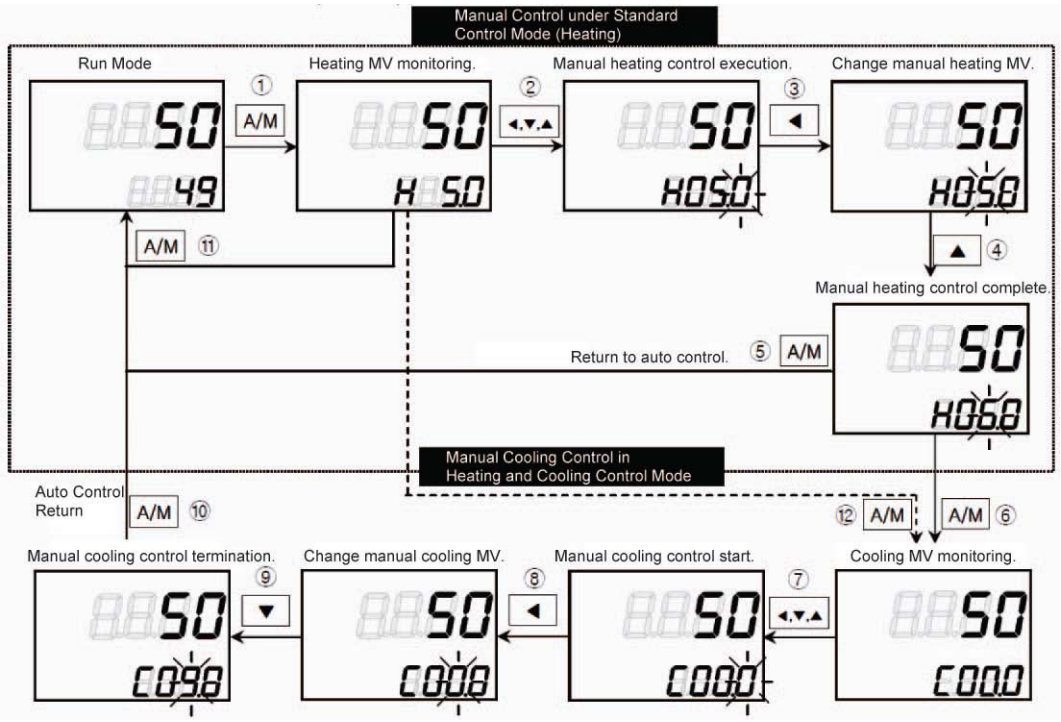
2 Select the desired Parameter Setting Group using the ▼/▲ keys and press MODE key.

3 Select the desired parameter using the MODE key.

4 Configure the desired numeric value using the ◄/▼/▲ keys.

5 To save, press MODE key.

5.3.4 MV Monitoring and Manual Control Setting



① While in Run mode, press A/M key to commence manual control. The SV display will then show H (heating control) or C (cooling control) and simultaneously display the MV to indicate commencement of MV monitoring.

② If ◀, ▼, or ▲ is pressed while MV monitoring is in progress, the MAN lamp will turn on and the last digit will start to flash to indicate activation of manual control.

③ Press the shift (◀) key to change the flashing digit ($10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$).

④ Select the digit and configure the desired MV value using the ▼/▲ keys.

⑤ To end manual control, press A/M key. The MAN lamp will turn off, and the system will revert to auto control mode.

⑥ While in heating and cooling control mode, set the manual heating MV and then press A/M key to see C (cooling control) and the current cooling MV value on the SV display indicating commencement of cooling MV monitoring.

⑦ If ◀, ▼, or ▲ is pressed while MV monitoring is in progress, the MAN lamp turns on and the last digit starts to flash to indicate activation of manual control.

⑧ Press the shift (◀) key to change the flashing digit ($10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$).

⑨ Select the digit and configure desired cooling MV value using the ▼/▲ keys.

⑩ To end manual control, press A/M key. The MAN lamp will turn off, and the system will revert to auto control mode.

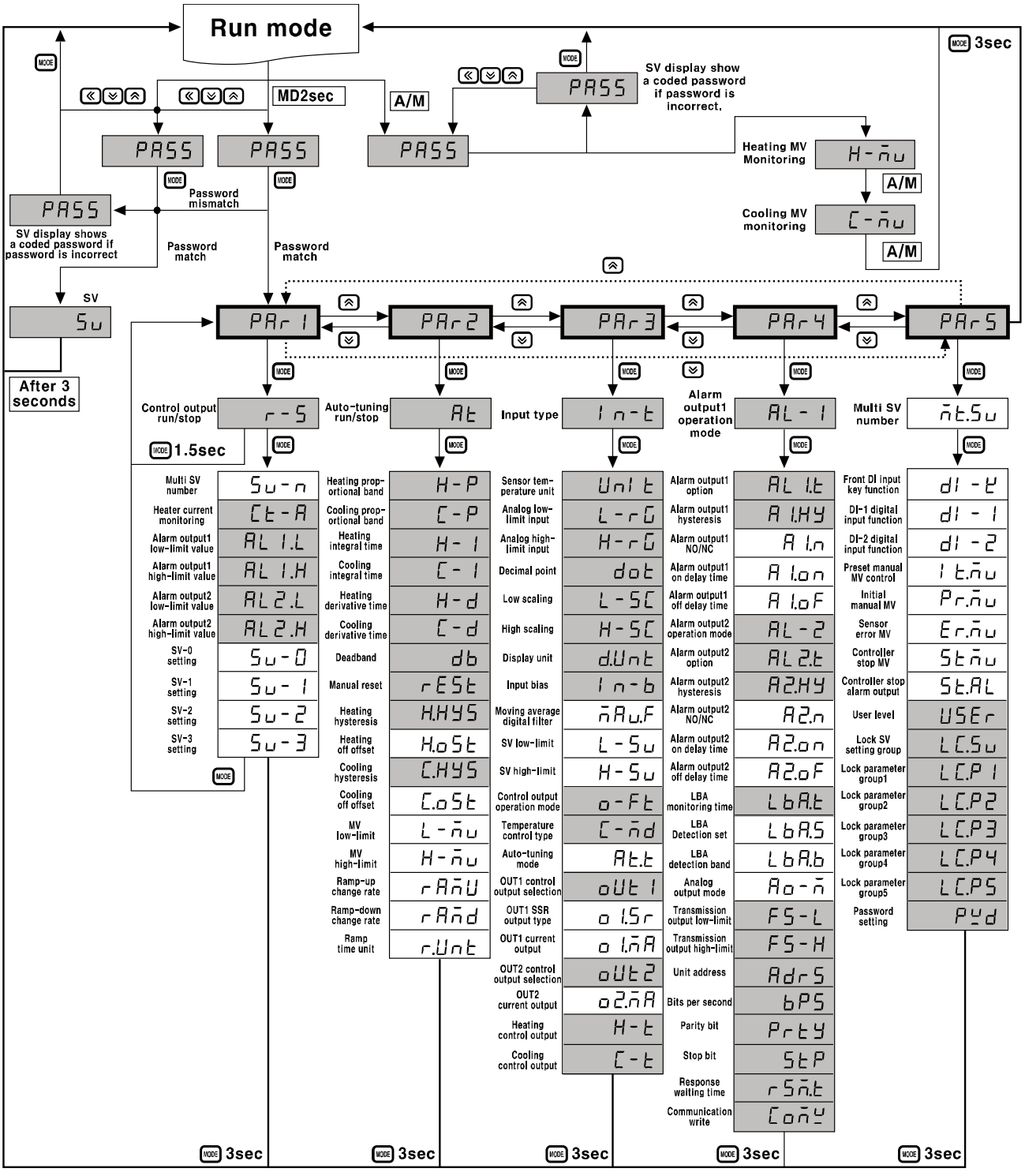
⑪ While in standard control mode (heating control or cooling control), pressing A/M key once from the MV monitoring stage, or any other stage, will revert the system to auto control mode.

⑫ During heating and cooling control mode, pressing A/M key once from the MV monitoring stage, or any other stage, will skip the system to the cooling MV monitoring stage.

Note	· For heating and cooling control, the system reverts to auto control after going through heating monitoring, manual heating control, cooling monitoring, and manual cooling control stages in sequence. · Heating MV remains in effect during cooling monitoring and manual cooling control. · TK4ST/SP (48WX48H) does not feature the A/M key. To switch modes between auto and manual controls, press the MODE key once.

5.4 Parameter Reference Chart

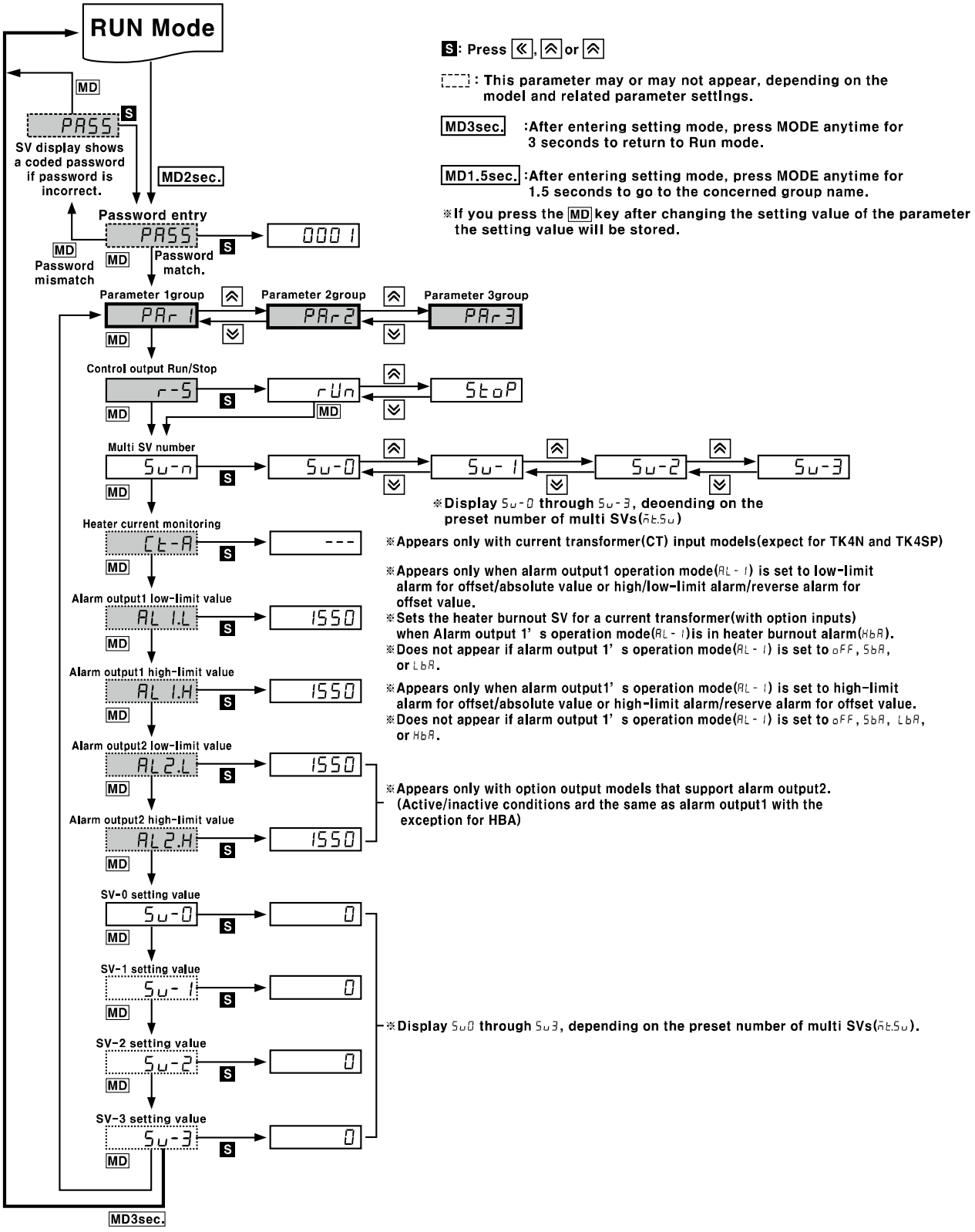
- Shaded parameters are for standard-level users, the others are for high-level users .(You can set the user level in parameter 5 setting group)
- Each parameter has its own Memory Address for communication functions.



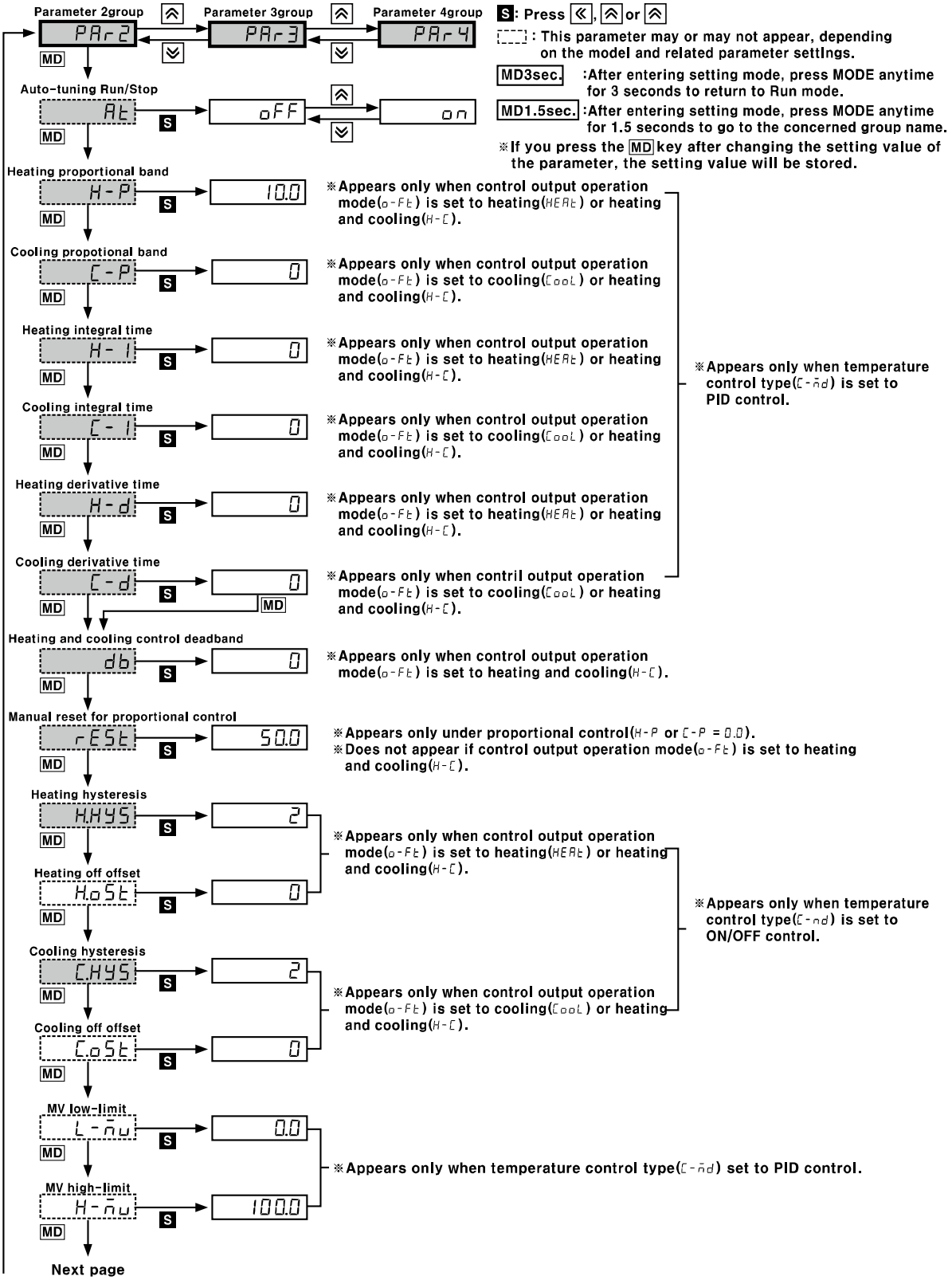
Note	・ While in Run mode, press and hold MODE key for 2 seconds to enter setting mode. ・ After entering setting mode, pressing and holding MODE key for 1.5 seconds at any time will return the system to the initial Parameter Group screen. ・ After entering setting mode, pressing and holding MODE key for 3 seconds will return the system to Run mode. ・ From the lowest parameter of the concerned group, press MODE key to access the concerned Parameter Group's initial screen and access other Parameter Groups. ・ With no key input for 30 seconds while in Setting mode, the system will keep the initial settings and automatically revert to Run mode.

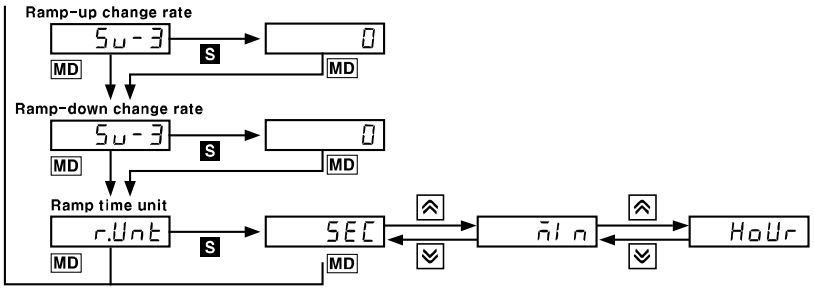
5.5 Parameter Setting Groups

5.5.1 Parameter 1 Setting Group [PAr 1]

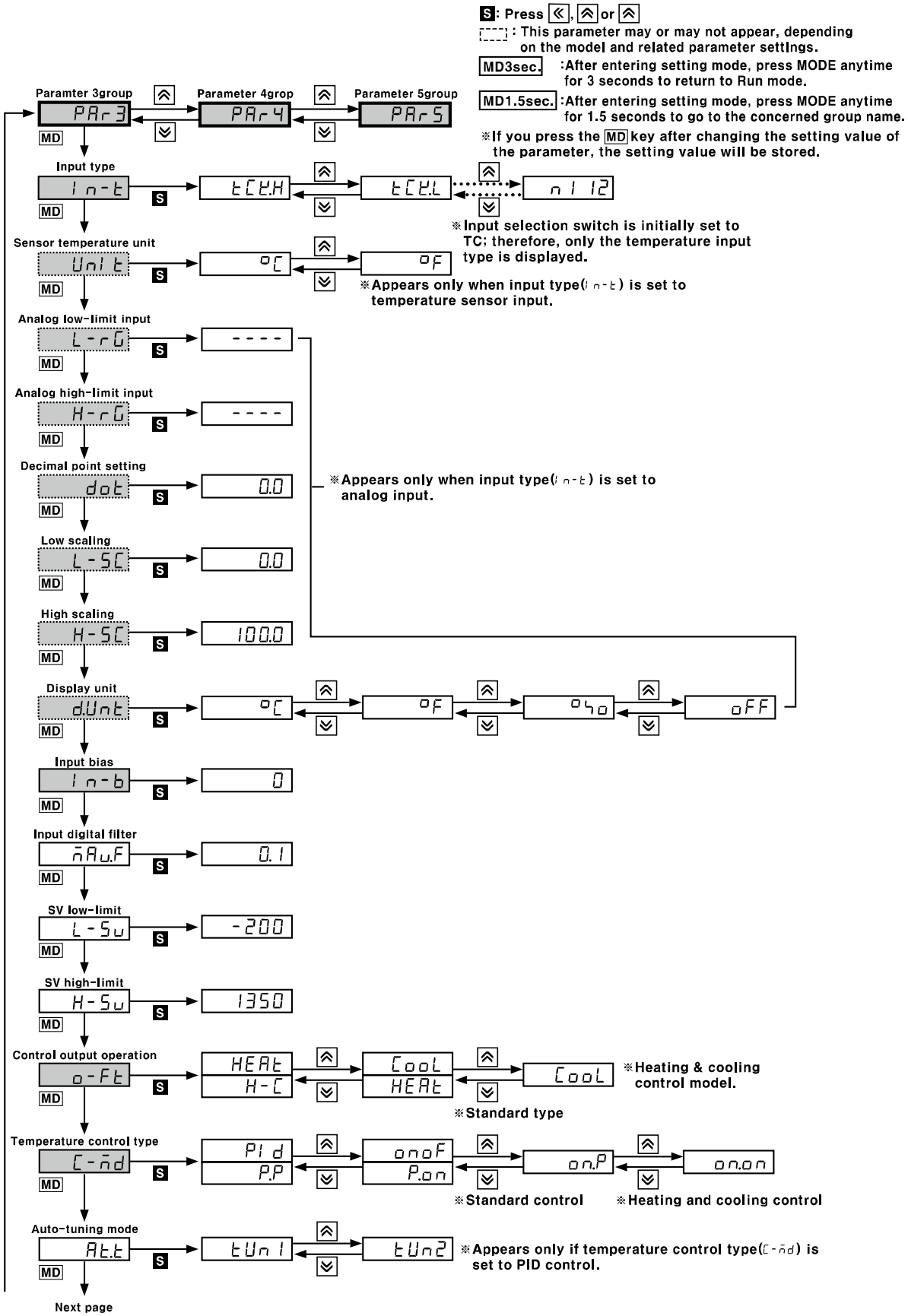


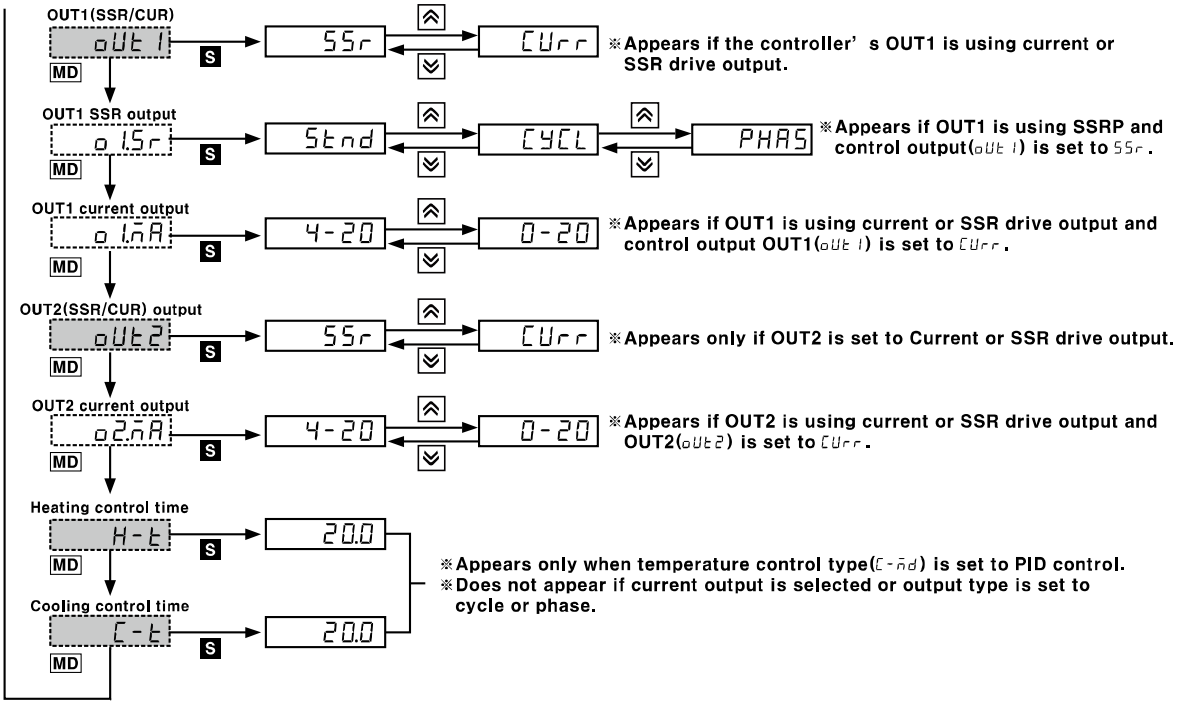
5.5.2 Parameter 2 Setting Group [PAr2]





5.5.3 Parameter 3 Setting Group [PAr3]

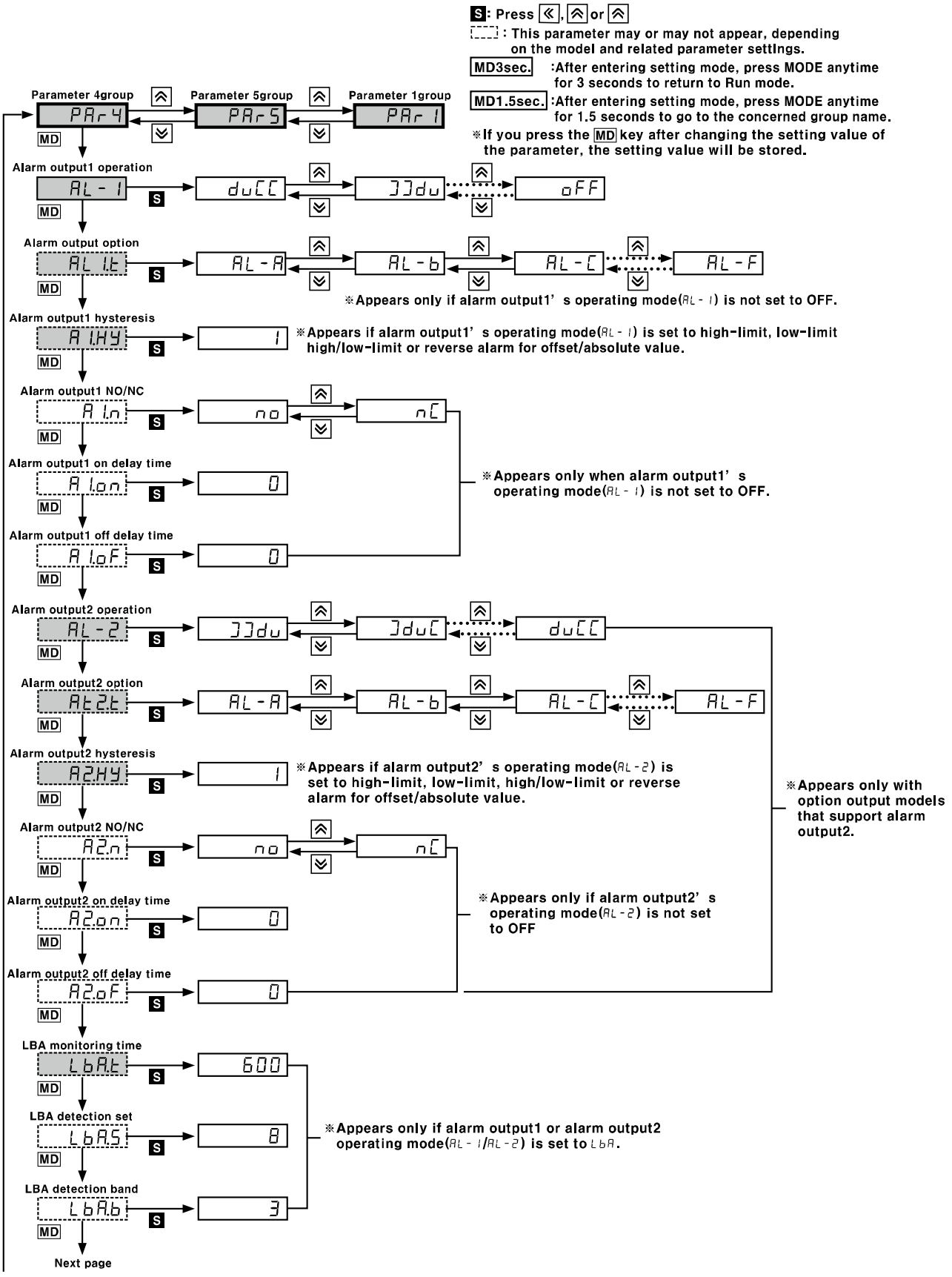


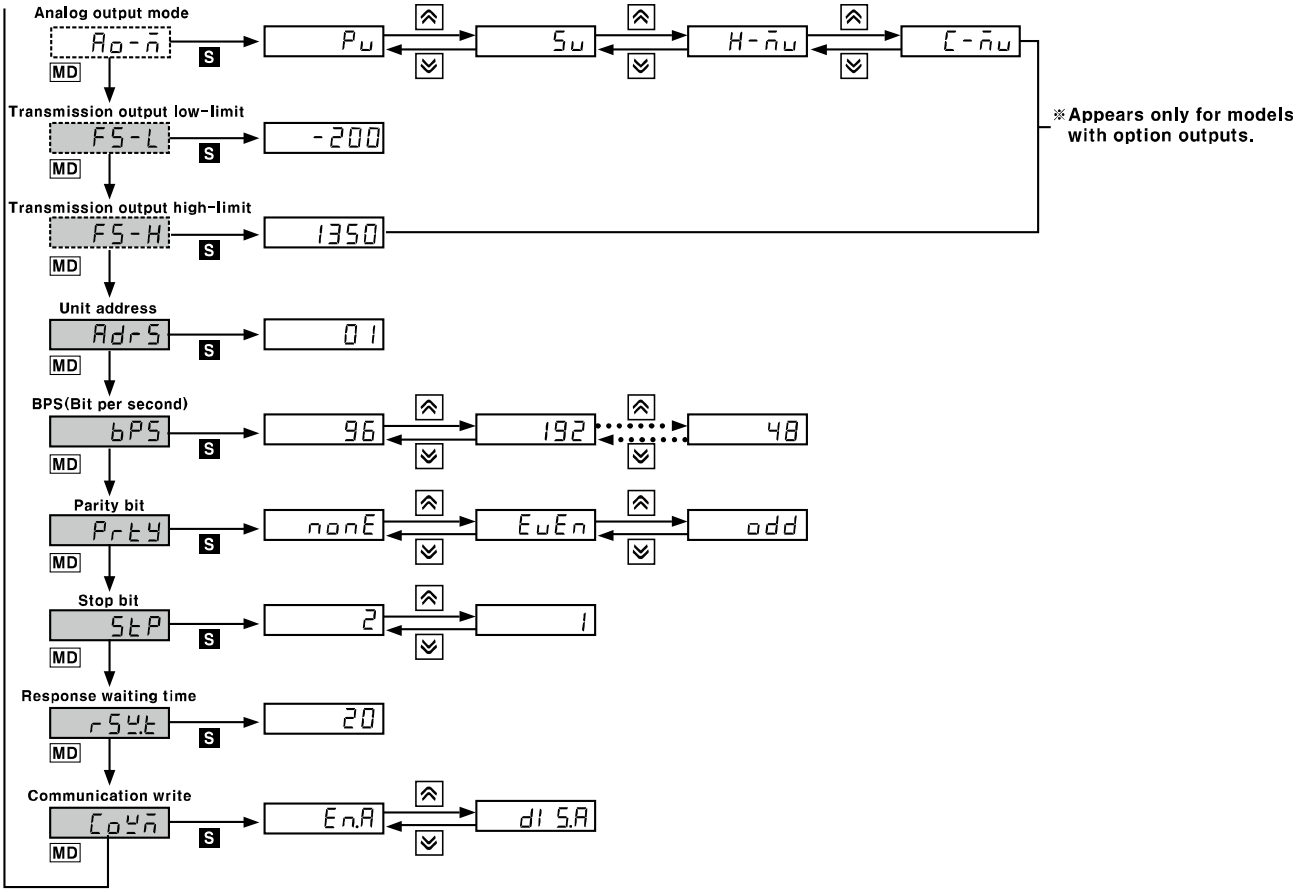


OUT1 and OUT2 Outputs

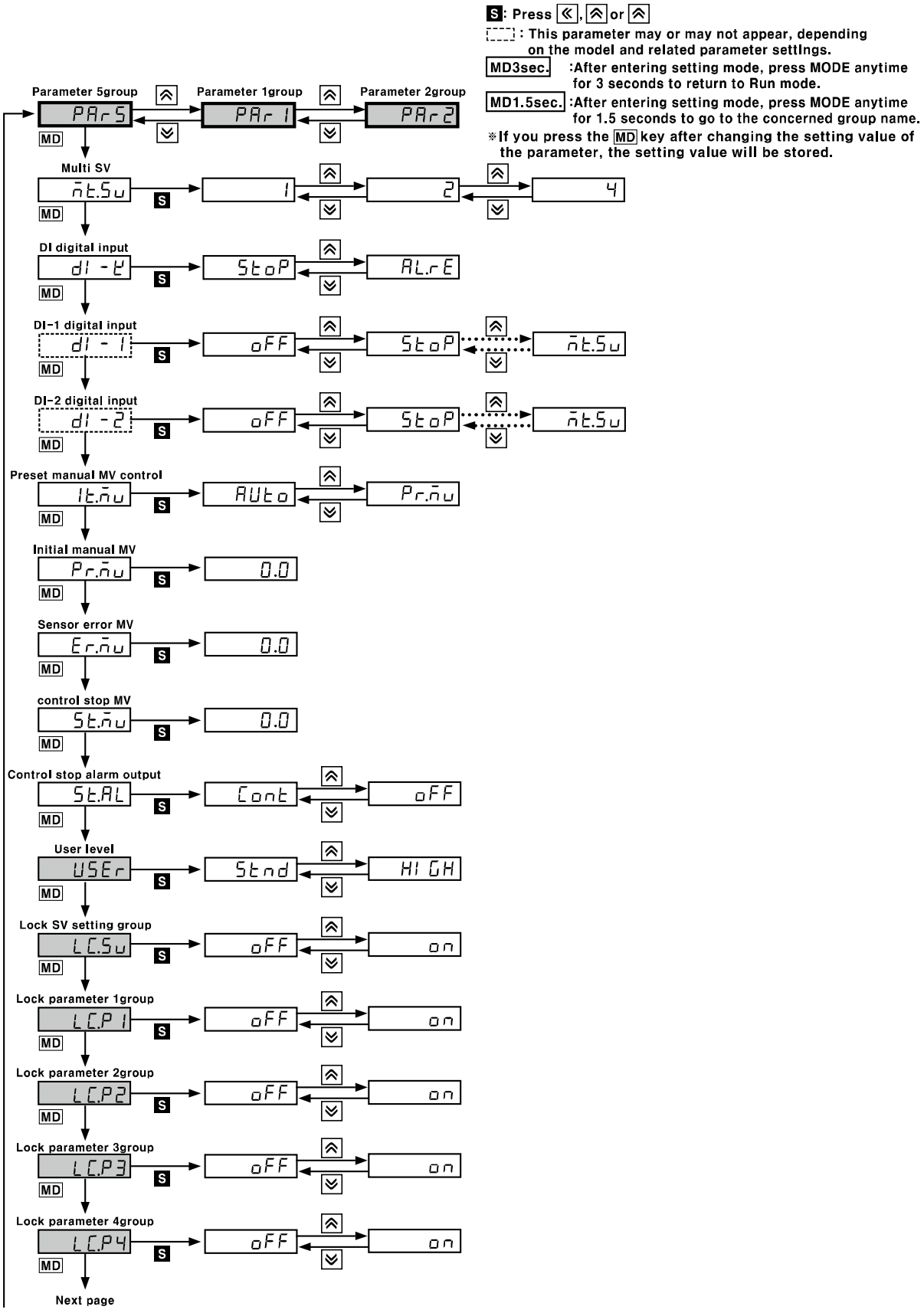
- If OUT1 and OUT2 outputs are Relay outputs:
  - oUt1 o1Sr o1mA oUt2 o2Sr o2mA parameters will not be shown.
- If OUT1 and OUT2 outputs are CUR + SSR outputs and oUt1 oUt2 is set to SSr:
  - o1Sr o2Sr's output method is fixed to Stnd, and parameter will not be shown.
- If OUT1 output is SSRP output and OUT2 output is CUR + SSR:
  - oUt1 o1mA will not be shown.
  - It will be possible to select Stnd CYCL PHAS in o1Sr.
  - If selecting SSr in o2Sr., it is fixed to Stnd. and parameter will not be shown.

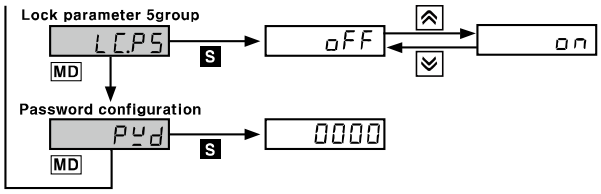
5.5.4 Parameter 4 Setting Group [PAr4]





5.5.5 Parameter 5 Setting Group [PAr5]





6 Parameter Settings and Functions

6.1 Input

6.1.1 Input Types and Temperature Ranges

Input Types			Display	Temperature Range (℃)	Temperature Range (℉)
Thermocouple (TC)	K (CA)	1	ꓘCAH	-200 ~ 1350	-328 ~ 2463
		0.1	ꓘCAL	-199.9 ~ 999.9	-199.9 ~ 999.9
	J (IC)	1	JI CH	-200 ~ 800	-328 ~ 1472
		0.1	JI CL	-199.9 ~ 800.0	-199.9 ~ 999.9
	E (CR)	1	ECrH	-200 ~ 800	-328 ~ 1472
		0.1	ECrL	-199.9 ~ 800.0	-199.9 ~ 999.9
	T (CC)	1	tCCH	-200 ~ 400	-328 ~ 752
		0.1	tCCL	-199.9 ~ 400.0	-199.9 ~ 752.0
	B (PR)	1	b Pr	0 ~ 1800	32 ~ 3272
	R (PR)	1	r Pr	0 ~ 1750	32 ~ 3182
	S (PR)	1	S Pr	0 ~ 1750	32 ~ 3182
	N (NN)	1	n nn	-200 ~ 1300	-328 ~ 2372
	C (TT)※1	1	C tt	0 ~ 2300	32 ~ 4172
	G (TT)※2	1	G tt	0 ~ 2300	32 ~ 4172
	L (IC)	1	LI CH	-200 ~ 900	-328 ~ 1652
		0.1	LI CL	-199.9 ~ 900.0	-199.9 ~ 999.9
	U (CC)	1	UCCH	-200 ~ 400	-328 ~ 752
		0.1	UCCL	-199.9 ~ 400.0	-199.9 ~ 752,0
	Platinel II	1	PLI I	0 ~ 1390	32 ~ 2534
RTD	CU 50 Ω	0.1	CU S	-199.9 ~ 200.0	-199.9 ~ 392.0
	CU 100 Ω	0.1	CU 10	-199.9 ~ 200.0	-199.9 ~ 392.0

Input Types				Display	Temperature Range (℃)	Temperature Range (℉)
	JIS Standards	JPt 100 Ω	1	JPtH	-200 ~ 650	-328 ~ 1202
		JPt 100 Ω	0.1	JPtL	-199.9 ~ 650.0	-199.9 ~ 999.9
	DIN Standards	DPt 50 Ω	0.1	dPt5	-199.9 ~ 600.0	-199.9 ~ 999.9
		DPt 100 Ω	1	dPtH	-200 ~ 650	-328 ~ 1202
		DPt 100 Ω	0.1	dPtL	-199.9 ~ 650.0	-199.9 ~ 999.9
	Nickel 120 Ω		1	nI 12	-80 ~ 200	-112 ~ 392
Analog	Voltage		0 to 10 V	Au 1	-1999 ~ 9999 (Decimal point placement is configurable.)	
			0 to 5 V	Au2		
			1 to 5 V	Au3		
			0 to 100 mV	Ãu 1		
	Current		0 to 20 mA	AñA 1		
			4 to 20 mA	AñA2		

※1: C (TT): Same temperature sensor as former W5 (TT).

※2: G(TT): Same temperature sensor as former W (TT).

- Temperature sensors are to convert subject temperature to electrical signals for the temperature controller allowing it to control output.
- SV (Setting Value) can only be set within the input range.

Note	If SV (Setting Value) is set beyond the input range, values exceeding the input range are ignored.

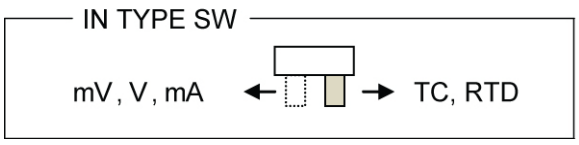
6.1.2 Input Type Settings [PAr3 → In-t]

- This product supports multiple input types, making it possible for the user to choose from thermocouples, resistors, and analog voltage/current.
- If you change the input specification, the SV's upper/lower limits are automatically set to the new specification's max/min values for temperature sensors. As for analog inputs, upper/lower input values are set to the max/min temperature range and the SV upper/lower limits set to upper/lower scale values. Therefore, you need to reconfigure the settings.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	In-t	Refer to section 6.1.1.	K.CA.H	-

Note

- If you change the input selection switch position, the temperature sensor input is reset to K.CA.H. Only the input types of thermocouple/RTD are displayed. In addition, analog input is reset to AV1 and only the input types of analog voltage/current are displayed. Make sure to reconfigure the input types after changing the input selection switch position.
- The scope of Setting Values will be limited depending on the setting of the input selection switch, which is located on the underside of the product.



6.1.3 Temperature Unit Settings for Input Temperature Sensor [PAr3 → Unit]

When selecting the input temperature sensor, you can set the desired units of temperature/scale value to be displayed.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	Unit	°C / °F	°C	-

Note This parameter will not be displayed if analog input has been selected.

6.1.4 Analog Input/Scale Settings

- With analog input selected, you can set the analog input range (high/low limit input values) and the display scale (high/low limit scale values) within the designated input range.
- The decimal point positions will remain fixed when configuring the upper/lower limit input values. You can change the input values at Au 1: 00.00, Au2/Au3: 0.000, AnU 1: 000.0, and AnA 1/ AnA2: 00.00 decimal points.
- If the upper and lower limit scale settings are identical, an Err message flashes twice and setting mode is displayed.

Note	This parameter will not be displayed if temperature sensor input is selected.

6.1.4.1 Low-limit Input Value Settings [PAr3 → L-rG]

You can set the low limit input values for actual use within the analog input range.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	L-rG	Minimum Temperature Range to High-limit Input Value (H-rG) - F.S. 10%	00.00	-

6.1.4.2 High-limit Value Settings [PAr3 → H -rG]

You can set high limit input values for actual use within the analog input range.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	H-rG	Low-limit Input Value (L-rG) + F.S. 10% to Maximum Temperature Range	10.00	-

6.1.4.3 Decimal Point Position Settings [PAr3 → dot]

You can set the decimal point positions for PV (Present Value) and SV (Setting Value) within high and low limit scale values.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	dot	0 / 0.0/ 0.00 / 0.000	0.0	-

6.1.4.4 Low-limit Scale Value Settings [PAr3 → L-SC]

You can set the display scales of lower limit values for analog input (L-rG). (Based on the decimal point position setting.)

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	L-SC	-1999 ~ 9999	000.0	-

6.1.4.5 High-limit Scale Value Settings [PAr3 → H-SC]

You can set the display scales of upper limit values for analog input (L-rG). (Based on the decimal point position setting.)

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	H-SC	-1999 ~ 9999	100.0	-

6.1.4.6 Display Unit Settings for Front Panel [PAr3 → d.Unt]

When you select an analog input type, you can set the display units.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	d.Unt	°C / °F / °r o / oFF	°r o	-

Setting	Parameter Description
°C	Sets the display unit to ℃ and turns on the ℃ indicator.
°F	Sets the display unit to ℉ and turns on the ℉ indicator.
°r o	Sets the display unit to % and turns on the % indicator.
oFF	Sets the display unit to an undefined unit. The LED unit indicator will not turn on.

6.1.5 Input Bias Adjustments [PAr3 → I n-b]

- This feature is used to compensate for input bias produced by thermocouples, RTDs, or analog input devices, NOT by the controller itself.
- The Input Bias Adjustments function is mainly used when the sensor cannot be attached directly to controlled objects. It is also used to compensate for temperature variance between the sensor's installation point and the actual measuring point.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	I n-b	-999 to 0999 (Temperature H, Analog) -199.9 to 999.9 (Temperature L)	0000	℃/℉/-

Ex.	If the controller displays 78℃ when the actual temperature is 80℃, set the input bias (I n-b) to 2 in order to adjust the controller's display temperature to 80℃.

Note	· Make sure that an accurate temperature variance measurement is taken before setting values of Input Bias. An inaccurate initial measurement can lead to greater variance. · Many of today's temperature sensors are graded by their sensitivity. Since higher accuracy usually comes at a higher cost, most people tend to choose sensors with medium sensitivity. Measuring each sensor's sensitivity bias for Input Bias feature in order to ensure higher accuracy in temperature reading.

6.1.6 Input Digital Filter [PAr3 → nAu.F]

It is not possible to perform high accuracy control if the PV (Present Value) fluctuates because of noise elements, disturbance, or instabilities in the input signal. Using the Input Digital Filter function can stabilize PV to realize more reliable control.

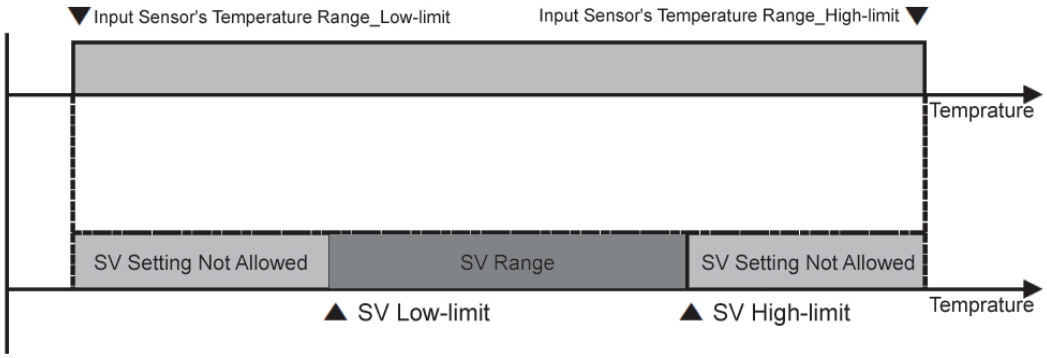
Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	nAu.F	000.1 ~ 120.0	0.1	Sec

Ex.	If the Input Digital Filter is set to 0.4 seconds, digital filtering is applied to a sampling value collected over 0.4 seconds (400 ms).

Note	When the Input Digital Filter is used, PV (Present Value) can vary from the actual input value.

6.1.7 High and Low-limit of SV (Setting Value) [PAr3 → H-Su/L-Su]

You can limit the SV (Setting Value) range within the temperature range of the sensor or analog input type in order to prevent the system from controlling with improper SV.



Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	H-Su	SV Low-limit + 1 digit to Sensor Input High-limit or Analog High-limit Scale Value	1350 (Temperature)	℃/℉
			000.0 (Analog)	
	L-Su	Sensor Low-limit or Analog Low-limit Scale Value to SV High-limit -1 digit	-200 (Temperature)	℃/℉
			100.0 (Analog)	

□ Parameter	Parameter Description
L-Su	SV (Setting Value) Low-limit
H-Su	SV (Setting Value) High-limit

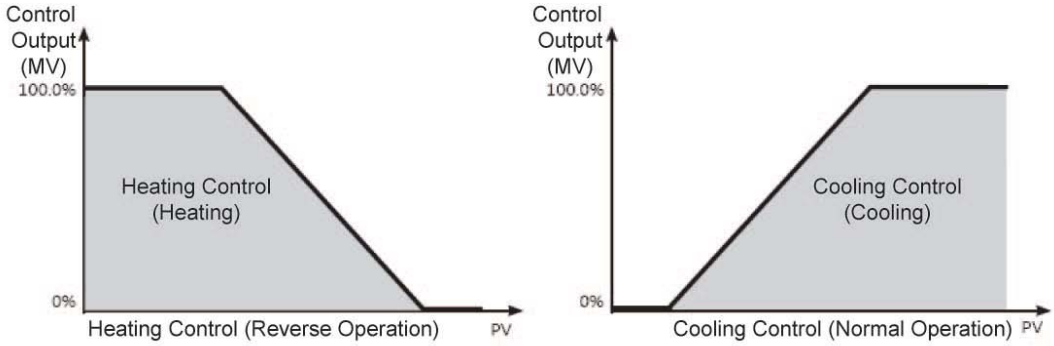
Note

- Attempts to set the limits outside the min/max input range, or analog's high/low-limits, are not accepted. Instead, the previous settings are retained.
- SV (Setting Value) can only be set within the SV low-limit (L-Su) and SV high-limit (H-Su) range.
- SV lower-limit (L-Su) cannot exceed SV high-limit (H-Su).
- Changing the input sensors automatically changes the SV high/low-limit settings to max/min values of the changed input sensor's specification (temperature sensor input), or to high/low-limit scale values (analog input). The user is required to reset related.

6.2 Control Output

6.2.1 Control Output Mode [PAr3 → 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	-

6.2.1.1 Heating Control [PAr3 → o-Ft → 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 (Setting Value).

6.2.1.2 Cooling Control [PAr3 → o-Ft → CooL]

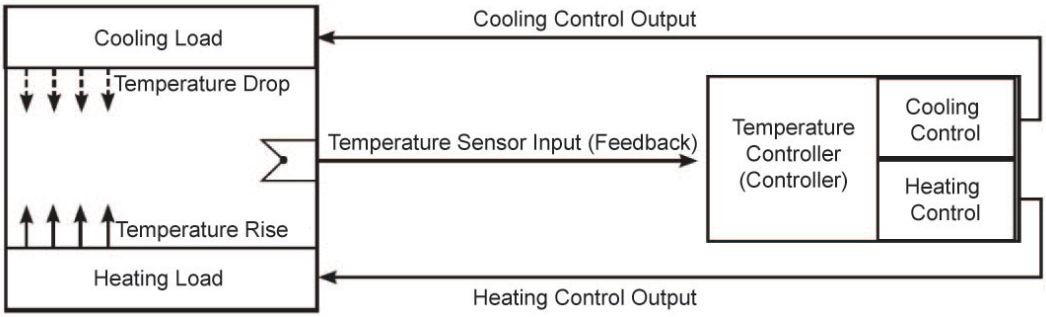
Cooling control mode: the output will be provided in order to supply power to the load (cooler) if PV (Present Value) rises above SV (Setting Value).

6.2.1.3 Heating and Cooling Control [PAr3 → o-Ft → 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 output and current output depending on model types choosen according to your application environment. (Note that only standard SSR control is available for SSR output in OUT2.)



Note	For heating and cooling control, OUT1 control output is dedicated to heating control and OUT2 control output to cooling control.

6.2.1.3.1. Dead band/Overlap Band [PAr2 → db]

- In heating and cooling control, it is possible to designate a dead band between heating and cooling control bands based on SV (Setting Value).
- A dead band forms around the SV when db is set to a positive value. No control occurs in the dead band area. Therefore, heating and cooling MVs become 0.0% in the formed dead band.
- An overlap band (simultaneous application of heating and cooling MVs) forms around the SV when db is set to a negative value.
- Set db to 0 when a dead band or an overlap band is not used.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr2	db	See below.	See below.	

- PID/PID, PID/ON-OFF, and ON-OFF/PID Control
  - Setting Range (Temperature): -(Proportional Band) to +(Proportional Band) (the lower value when using different proportional bands)

- Setting Range (Analog): -99.9 ~ 099.9
- Factory Default: 0000 (Temperature H), 000.0 (Temperature L, Analog), (Unit: Temperature ℃/℉, Analog % F.S.)

▪ ON-OFF/ON-OFF Control

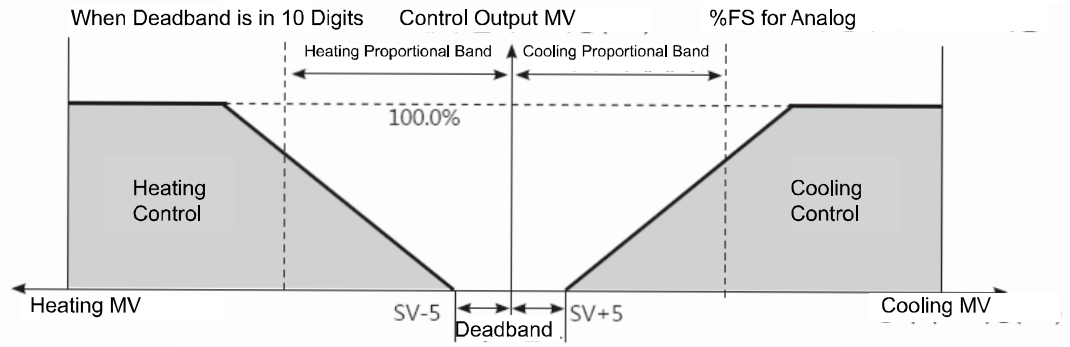
- Setting Range (Temperature):

  -999 (overlap band) to 0000 (not used) to 0999 (dead band) (Temperature H)

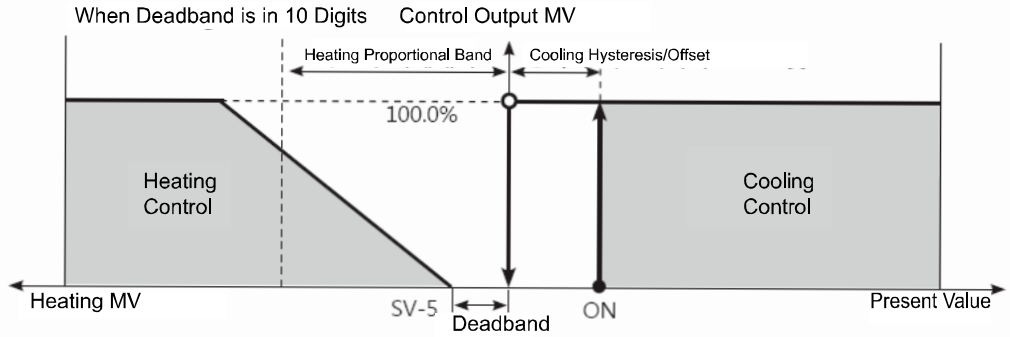
  199.9 (overlap band) to 000.0 (not used) to 999.9 (dead band) (Temperature L)

- Setting Range (Analog): -99.9 (overlap band) to 000.0 (not used) to 099.9 (dead band)
- Factory Default: 0000 (Temperature H), 000.0 (Temperature L, Analog), (Unit: Temperature ℃/℉, Analog % F.S.)

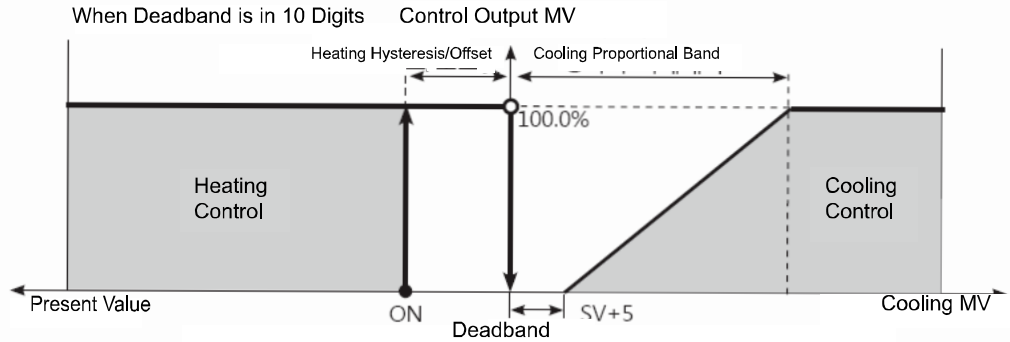
6.2.1.3.1.1. Using a Deadband



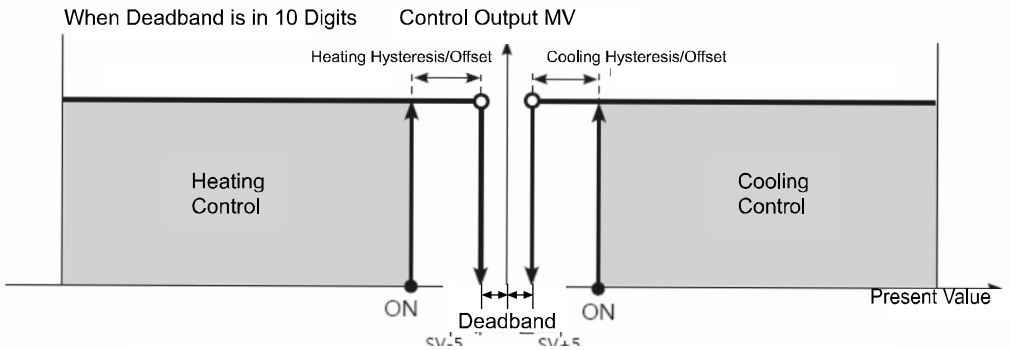
<PID-PID Control with Heating and Cooling Control>



<PID-ON/OFF Control with Heating and Cooling Control>

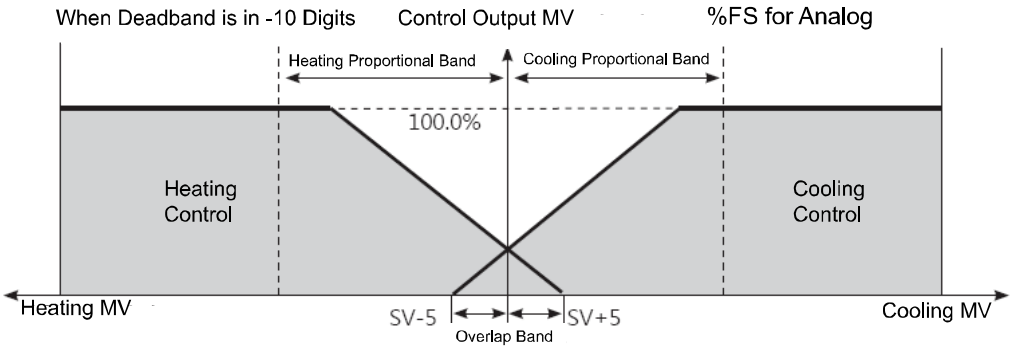


<ON/OFF-PID Control with Heating and Cooling Control>

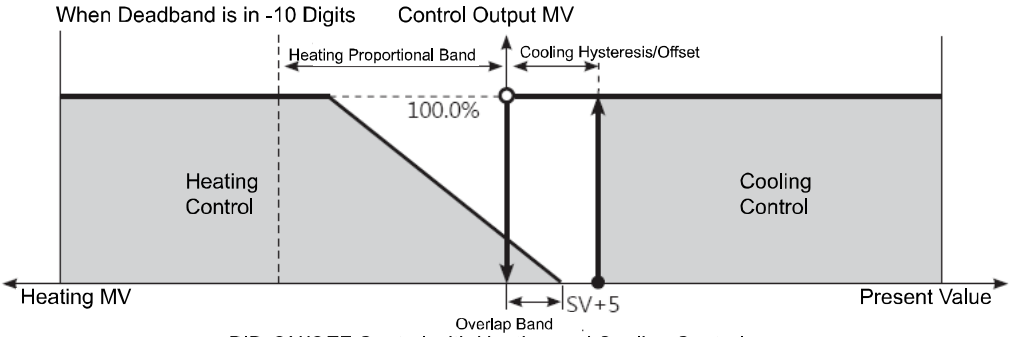


<ON/OFF-ON/OFF Control with Heating and Cooling Control>

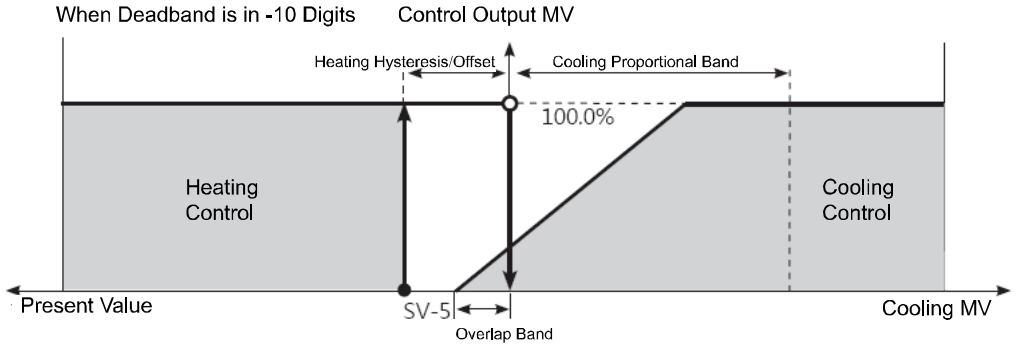
6.2.1.3.1.2. Using an Overlap Band



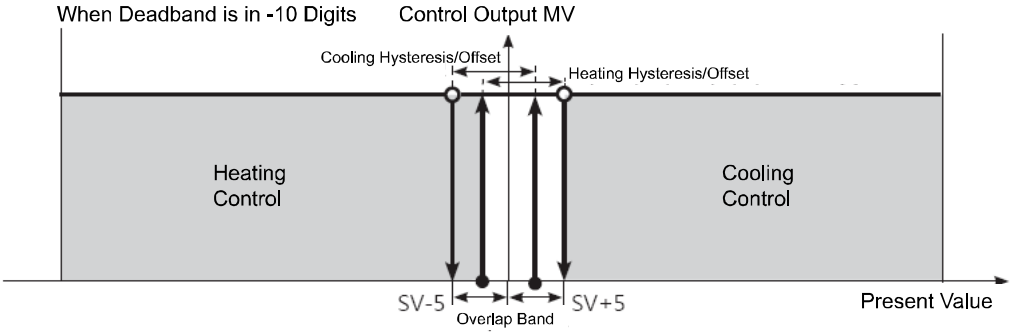
<PID-PID Control with Heating and Cooling Control>



<PID-ON/OFF Control with Heating and Cooling Control>

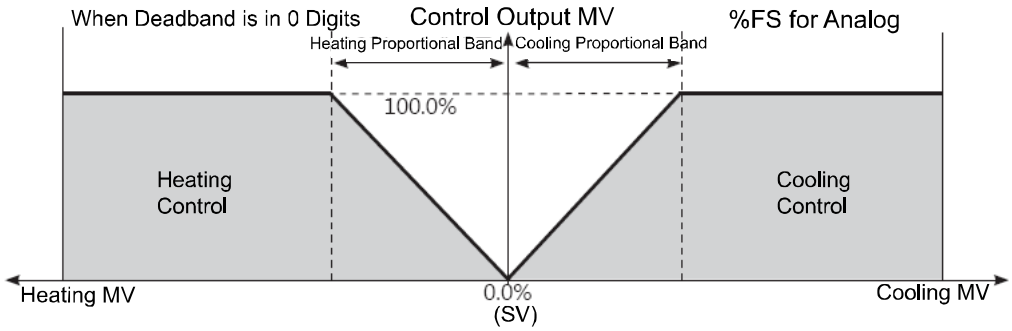


<ON/OFF-PID Control with Heating and Cooling Control>

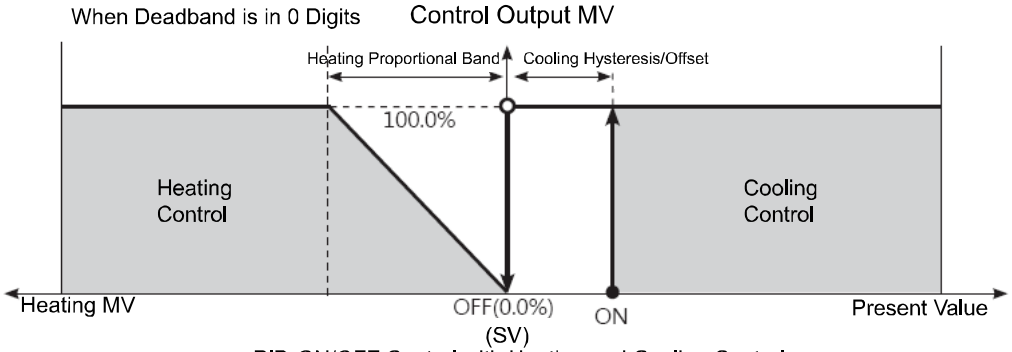


<ON/OFF-ON/OFF Control with Heating and Cooling Control>

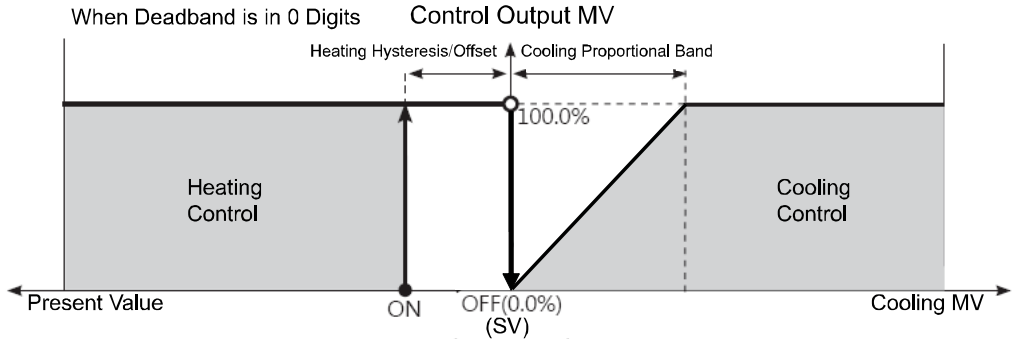
6.2.1.3.1.3. Using neither a Dead band nor an Overlap Band



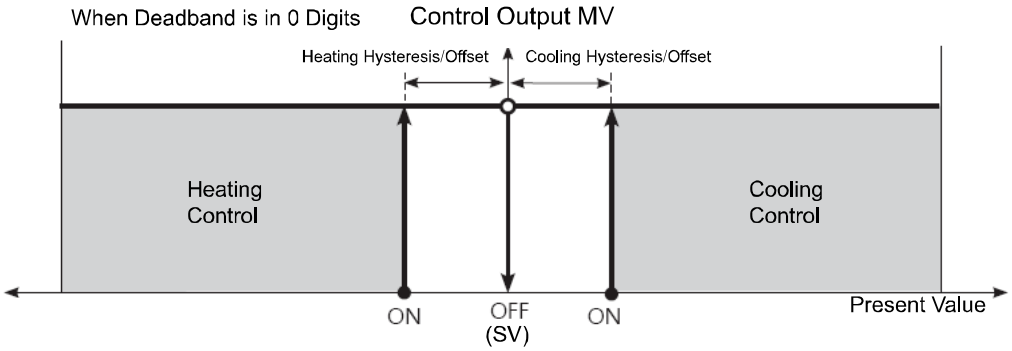
<PID-PID Control with Heating and Cooling Control>



<PID-ON/OFF Control with Heating and Cooling Control>



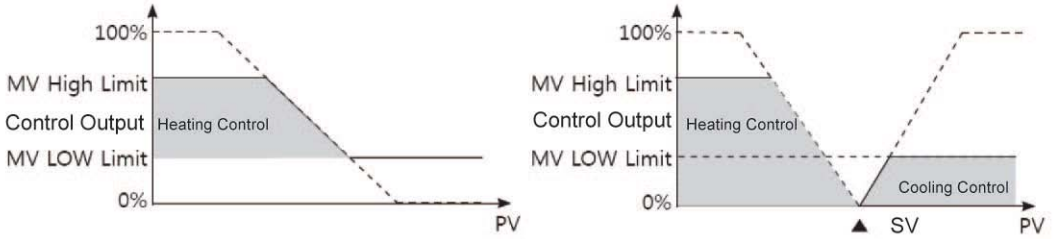
<ON/OFF-PID Control with Heating and Cooling Control>



<ON/OFF-ON/OFF Control with Heating and Cooling Control>

6.2.2 MV High / Low-limit Settings [PAr2 → H-ou / L-ou]

- MV high/low-limit values (H-ou / L-ou) for control output can be configured to the actual MV, provided the temperature controller's MV calculation exceeds the limits.
- During heating and cooling control, cooling MV carries a "-" prefix. Therefore, the high-limit is expressed as a + value on the heating side and the lower limit as a - value on the cooling side.



<Standard Control (Heating Control)> <Heating and Cooling Control>

Parameter	Description
L-ou	MV Low-limit setting
H-ou	MV High-limit setting

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr2	H-ou	Standard Control: MV Low-limit (L-ou) + 0.1 to 100.0	100.0	%
		Heating and Cooling Control: 000.0 to 100.0 (PID Control) 0.0 (OFF)/ 100.0 (ON) (ON/OFF Control)	100.0	%
	L-ou	Standard Control: 000.0 to MV High-limit (H-ou) – 0.1	0.0	%
		Heating and Cooling Control: - 100.0 to 000.0 (PID Control), -100.0 (ON)/0.0 (OFF) (ON/OFF Control)	-100.0	%

Note

- Same MV limits applied during auto-tuning.
- MV limits are not applied to manual control, MV upon control stop, MV upon a sensor error, and initial manual control MV.
- MV high/low-limit configuration is not available for ON/OFF control in standard control mode (heating or cooling control).

6.2.3 Ramp Settings [PAr2 → rAnU/ rAnd/ r.Unt]

- Ramp is a feature used to configure the slope toward SV (Setting Value). The feature limits change rate of SV and thereby restricts sudden temperature changes (increase and decrease) in the control subject.
- Ramp is commonly used in applications where rapid temperature changes (increase and decrease) could impact negatively on the control subject.

Parameter	Description
rAnU	Settings for RAMP-Up Change Rate.
rAnd	Settings for RAMP-Down Change Rate.
r.Unt	Settings for RAMP Time Unit.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr2	rAnU	000 to 999 (Temperature H, analog), 000.0 to 999.9 (Temperature L)	000	
	rAnd	000 to 999 (Temperature H, analog), 000.0 to 999.9 (Temperature L)	000	
	r.Unt	SEC (seconds), MIn (minutes), HoUr (hours)	MIn	-

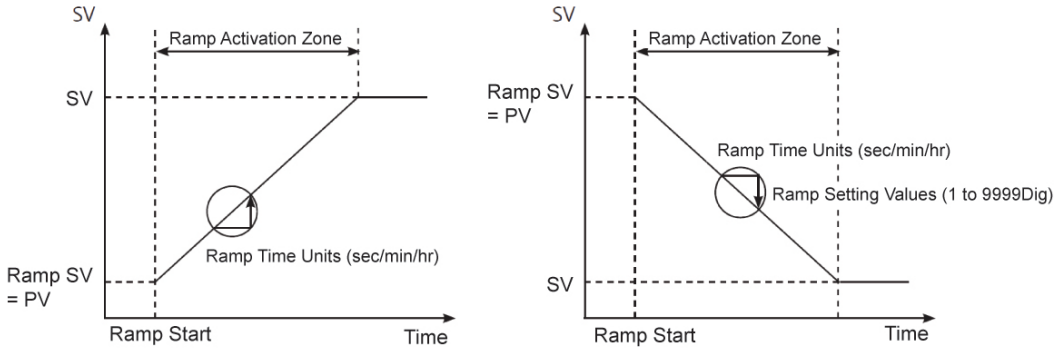
Note

- Activating the ramp feature when the ramp is not in operation limits the change rate of SV (Setting Value) based on PV (Present Value). Changing SV or ramp parameters while the ramp is in operation limits the change rate of SV based on SV at the point of the change.
- Control will be carried out based on changed SV (hereinafter referred to as RAMP SV) - changed by preset change rate (slope). RAMP-Up Change Rate and RAMP-Down Change Rate can be configured independently.
- Alarm operation during RAMP will be made based on final SV.
- Setting the rate of ramp change to 0 deactivates the ramp feature.
- If the ramp feature has been activated, RAMP SV will be displayed on SV display part.

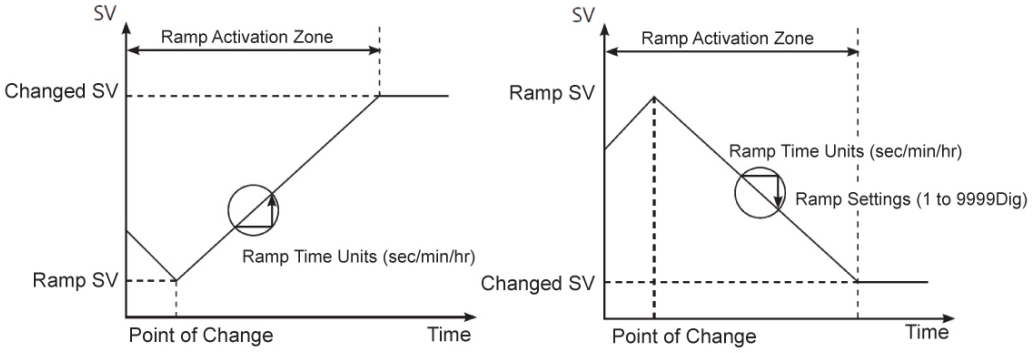
Ramp depending on operation status

Operation Status	Ramp Up/Down	Ramp
All operations	When it is 0.	Inactive
oPEn, HHHH, LLLL, Auto-tuning, Switching from Auto to Manual, Switching from Run to Stop	Irrespective of conditions.	Inactive
oPEn, HHHH, LLLL, After Auto-tuning completed, PV = SV	Irrespective of conditions.	Inactive
Power On, SV Change, Switching from Stop to Run, Switching from Manual to Auto, Ramp Rate Change	When it is not 0.	Active

Ramp Graph



<Activating Ramp when Ramp is not in operation>



<Changing SV or Ramp Parameter when Ramp is in operation>

6.2.4 Auto/Manual Control Settings

- Auto Control

  This mode is to make temperature reach SV with MV calculated by PID control.

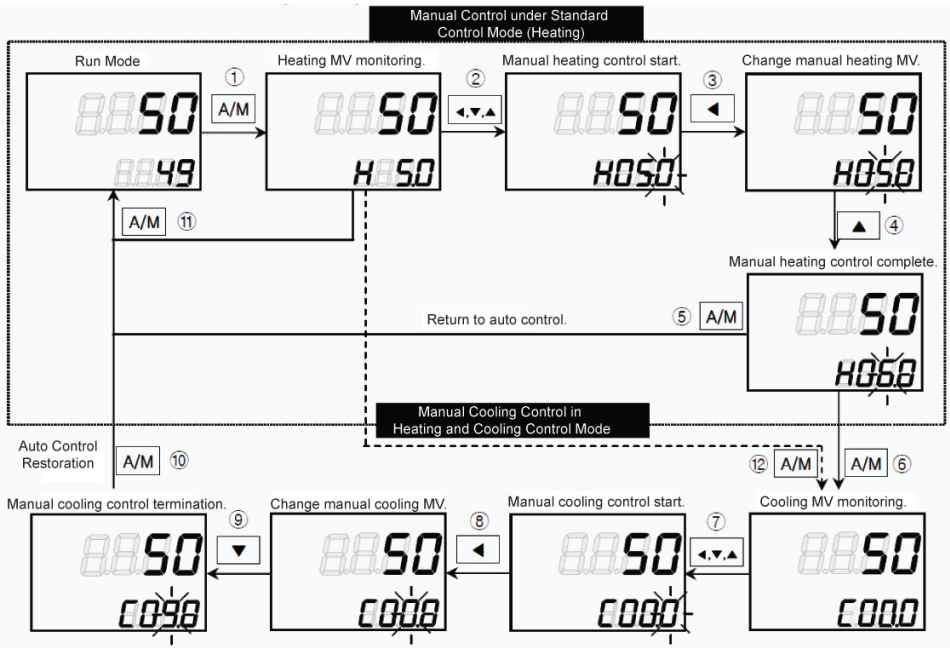
- Manual Control

  This mode is to make temperature reach SV with user's defined MV.

Note	· When in manual control mode, parameter settings can only be viewed and cannot be modified (except for lock parameters). · When the unit is powered on following a power interruption or shutdown, previous control mode (auto or manual) will be maintained. · If switching to manual control during Auto-tuning, Auto-tuning will be terminated. · It is still possible to switch to manual control mode while in STOP. · When a SBA (Sensor Break Alarm) occurs in standard control mode, the sensor error MV (Er.MV) is applied. In this state, manual and auto control MV settings can be modified. · It is still possible to switch auto/manual control mode while in controlling operation. · Operation Priority: Manual Control > Stop > Open (Sensor Disconnection)

6.2.4.1 Manual/Auto Control Switching

6.2.4.1.1. Auto/Manual Control Switching with Front Keys



① When in Run mode, press A/M key to start manual control. The SV display shows H (heating control) or C (cooling control), and shows MV to indicate the start of MV monitoring.

② If ◄, ▼, or ▲ is pressed when MV monitoring is in progress, the MAN lamp comes on and the lowest digit starts to flash, indicating activation of manual control.

③ Press shift (◄) key to change the flashing digit ($10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$).

④ Select the digit and configure the desired MV value using the ▼/▲ keys.

⑤ Press A/M key to end manual control. The MAN lamp goes off and the system reverts to auto control mode.

⑥ In heating and cooling control mode, set the manual heating MV and press A/M key.The SV display shows C (cooling control) and the current cooling MV to indicate the start of cooling MV monitoring.

⑦ If ◄, ▼, or ▲ is pressed When MV monitoring is in progress, the MAN lamp goes on and the last digit starts to flash, indicating activation of manual control.

⑧ Press the shift (◄) key to change the flashing digit ($10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$).

⑨ Select the digit, and configure desired cooling MV value using the ▼/▲ keys.

⑩ Press A/M key to end manual control. The MAN lamp goes off, and the system reverts to auto control mode.

⑪ When in standard control mode (heating control or cooling control), press A/M key once (in the MV monitoring stage or any other stages) to revert the system to auto control mode.

⑫ When in heating and cooling control mode, press A/M key once (in the MV monitoring stage or any other stage) to skip the system to the cooling MV monitoring stage.

Note	▪ After heating and cooling control, the system reverts to auto control in sequence of heating monitoring, manual heating control, cooling monitoring, and manual cooling control. ▪ Heating MV remains in effect during cooling monitoring and manual cooling control. ▪ TK4ST/SP (48WX48H) does not have an A/M key. Press the MODE key once to change between auto and manual controls. ▪ If the Digital Input (di - 1, di - 2) feature has been set for AUTO/MANUAL, A/M (MODE for S and SP models) key located on the front and automatic/manual control functions via communication do not act.

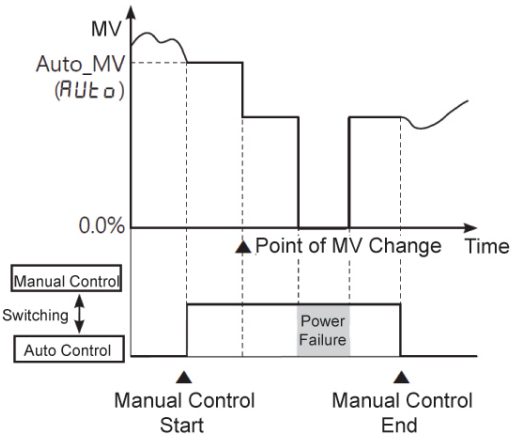
6.2.4.1.2. Manual/Auto Control Switching with the Digital Input (DI) Terminal

If the Digital Input (DI) feature has been configured for manual/auto control switching, turn on the DI to activate manual control (MAN lamp goes on) and turn off the DI to activate auto control. If the Digital Input feature is automatic control status, you can be only to monitor. In case it is manual control status, modifying MV and monitoring are possible.

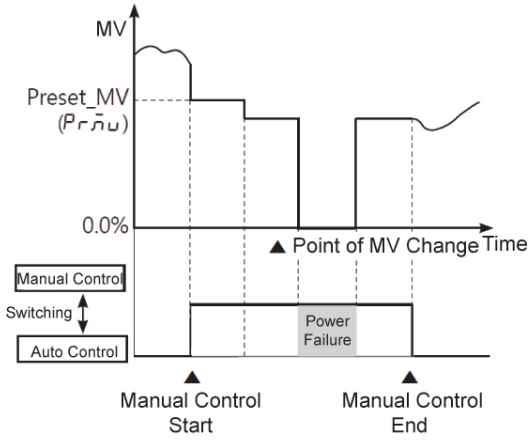
Note	See 6-7-4-1. Digital Input Terminal, for detailed information on Digital Input (DI) terminal settings.

6.2.4.2 Baseline MV for Manual Control [PAr5 → I t.mU]

- When switching from auto control to manual control you can set the initial MV.
- AUto: Controlling with auto control MV as an initial MV for manual control
- Pr.mU: Controlling with preset manual MV as an initial MV.



<Auto-MV (AUto)>



<PRESET-MV (Pr.mU)>

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr5	I t.mU	AUto / Pr.mU	AUto	-

6.2.4.3 Initial MV for Manual Control [PAr5 → Pr.mu]

If the baseline MV for manual control is configured to Pr.mu (Preset Manual MV), you can set the initial MV for manual control.

Setting Group	Parameter	Setting Range			Factory Default	Unit
PAr5	Pr.mu	Standard Control	ON/OFF Control	000.0 (OFF)/ 100.0 (ON)	000.0	%
			PID Control	000.0 ~ 100.0		
		Heating and Cooling Control	ON/OFF Control	- 100.0 (Cooling On) / 000.0 (OFF)/ 100.0 (Heating ON)		
			PID Control	- 100.0 (Cooling) to 000.0 (OFF) ~ 100.0 (Heating)		

Note	When in heating and cooling control mode, a setting between 0.1 and 100.0 will be applied as heating MV and a setting between 0.1 and -100.0 will be applied as cooling MV.

6.2.5 Output Settings

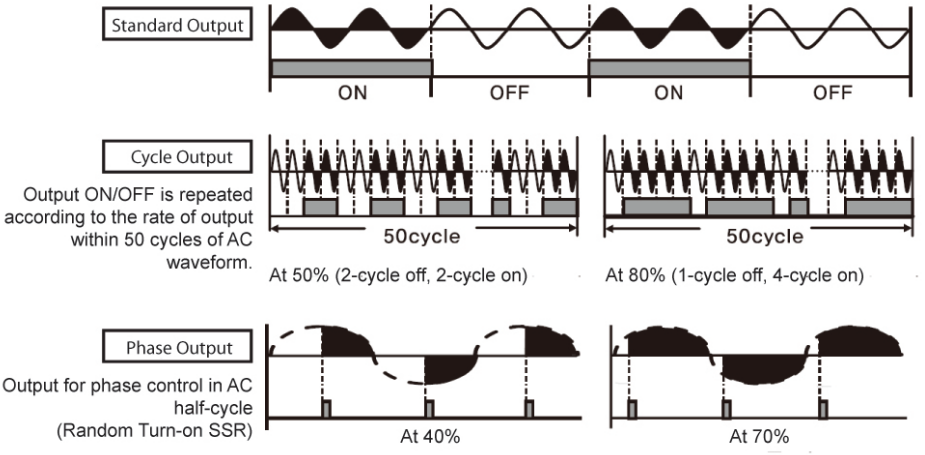
6.2.5.1 Control Output (OUT1/OUT2) Selection [PAr3 → oUt1/oUt2]

- In case of selecting the Models with current control output, both current and SSR 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	SSr / CUrr	SSr	-
	oUt2			

6.2.5.2 SSR Output Type Selection [PAr3 → o 1.5r]

In case of selecting SSRP type model for out1 control, users can select SSR output type among standard, cycle or phase control.



Setting	Description
Stnd	**Standard Output** Controlling the load with ON/OFF output, identical to relay output.
CYCL	**Cycle Output** • Controlling the load by repeating output ON/OFF according to the rate of output within a certain cycle • Having improved switching noise characteristics by always conducting ON/OFF at zero.
PHAS	**Phase Output** Controlling the load via phase control within periodic half cycle (Random cross SSR must be used.).

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	U 1.5r	Stnd / CYCL / PHAS	Stnd	-

Note

- Make sure that SSRP is not available for OUT2. In case of current type models, SSR is fixed to standard output only. (Stnd).
- (PHAS) (CYCL) When selecting phase output (PHAS) or cycle output (CYCL), the power supply for the load and temperature controllers must be the same.
- In case of selecting phase output or cycle output with PID control type, control cycle is not available to set.

6.2.5.3 Current Output Range Settings [PAr3 → o1mA/o2mA]

If the control output is set to current output, you can select upper and lower limit range for the current output as either 4-20 mA or 0-20 mA.

Parameter	Description
o1mA	Sets OUT1's current output range.
o2mA	Sets OUT2's current output range.

Note	This parameter is only available on models supporting current output (oUt1, oUt2).

6.3 Temperature Control

6.3.1 Temperature Control Mode [PAr3 → C-md]

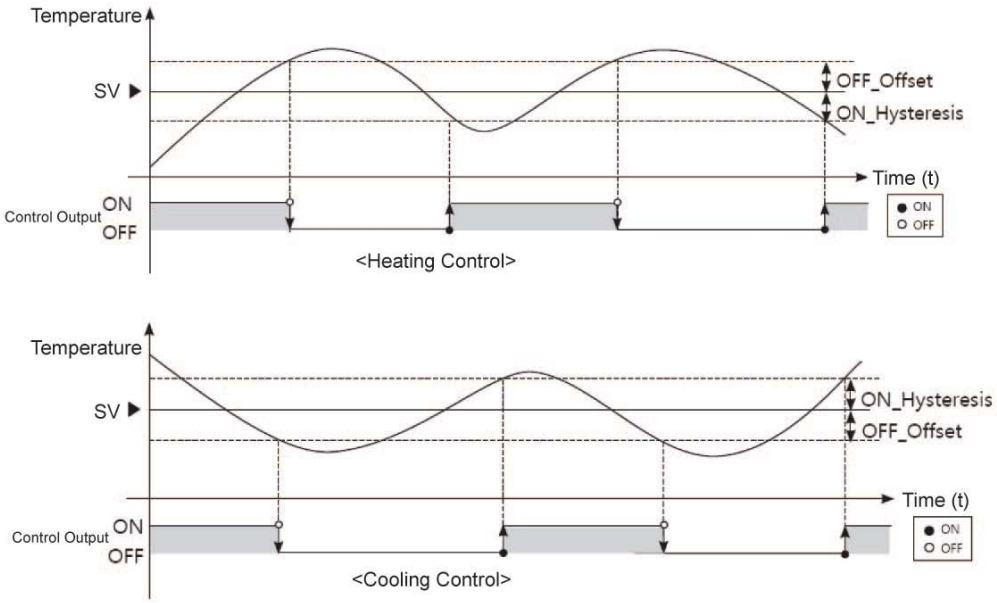
You can choose the type of temperature control method.

Setting		Description	
		Heating	Cooling
Standard Control	PId	PID Control	
	onoF	ON/OFF Control	
Heating and Cooling Control	P.P	PID Control	PID Control
	P.on	PID Control	ON/OFF Control
	on.P	ON/OFF Control	PID Control
	on.on	ON/OFF Control	ON/OFF Control

Setting Group	Parameter	Setting Range		Factory Default	Unit
PAr3	C-md	Standard Control	PId / onoF	PId	-
		Heating and Cooling Control	P.P / P.on / on.P / on.on	P.P	

6.3.2 On/Off Control [PAr3 → C-nd → onoF]

Controls the temperature by comparing PV (Present Value) with SV (Setting Value) and turning power to the load on or off.



6.3.2.1 Hysteresis [PAr2 → HHYS/HoFt/CHYS/CoFt]

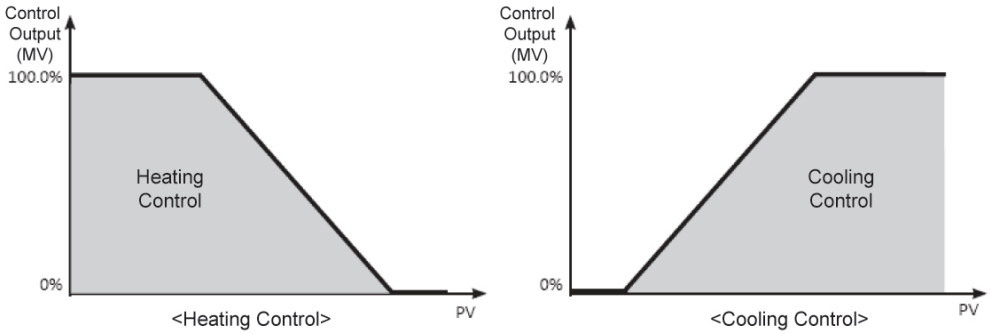
- Hysteresis is to adjust control output ON/OFF point in ON/OFF control mode. ON_Hysteresis sets the output on point and OFF_Offset sets the off point.
- Setting hysteresis too low can result in hunting induced by disturbance (noise, chattering, etc.). To minimize hunting, set ON_Hysteresis and OFF_Offset values with consideration to the heater or cooler's capacity and thermal characteristics, the control subject's response characteristics, the sensor's response characteristics and installation conditions, and other defining factors.

Parameter	Description
H.HYS	Configures ON_Hysteresis for heating control.
H.oFt	Configures OFF_Offset for heating control.
C.HYS	Sets ON_Hysteresis for cooling control.
C.oFt	Sets OFF_Offset for cooling control.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr2	H.HYS	Temperature H, Analog: 001 ~ 100 Temperature L: 00.1 ~ 10.0	002	℃/℉/-
	C.HYS			
	H.oFt	Temperature H, Analog: 001 ~ 100 Temperature L: 00.1 ~ 10.0	000	
	C.oFt			

6.3.3 PID Control [PAr3 → C-nd → PId]

- PID control is a combination of proportional (P), integral (I), and derivative (D) controls and offers superb control over the control subjects, even with a delay time.
- Proportional control (P) implements smooth, hunting-free control; integral control (I) automatically corrects offsets; and derivative control (D) speeds up the response to disturbance. Through these actions, PID control realizes ideal temperature control.



Note	Applied PID Control Technique · Proportional Control (P): Select PID control and set the integral and derivative time to 0000. · Proportional Integral Control (PI): Select PID control and set the derivative time to 0000. · Proportional Derivative Control (PD): Select PID control and set the integral time to 0000. · Multi SV: Use the same PID time constant for the values of SV0 to SV3.

6.3.3.1 Proportional Band Settings [PAr2 → H-P/C-P]

When PV (Present Value) is within the Proportional Band (P), the ON/OFF ratio needs to be adjusted during the proportional period (T). The defined proportional control (time proportional control) section is called as the proportional band.

Parameter	Description
H-P	Heating Proportional Band
C-P	Cooling Proportional Band

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr2	H-P	000.1 ~ 999.9	010.0	Temperature: ℃/℉ Analog: %
	C-P			

6.3.3.2 Integral Time Settings [PAr2 → H-I /C-I]

MVs from integral and proportional operation become the same when deviation is consistent. The time taken for the two MVs to match is called the integral time.

Parameter	Description
H-I	Heating Integral Time
C-I	Cooling Integral Time

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr2	H-I	0000 ~ 9999	0000	Sec
	C-I			

Note	
	· Integral control is not conducted if the integral time is set to 0. · Setting the integral time too short can intensify Correction Movements and cause hunting.

6.3.3.3 Derivative Time Settings [PAr2 → H-d/C-d]

In accordance with the deviation of the ramp, the time taken for the MV gained from derivative operation to reach the MV gained from proportional control is called the derivative time.

Parameter	Description
H-d	Heating Derivative Time
C-d	Cooling Derivative Time

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr2	H-d	0000 ~ 9999	0000	Sec
	C-d			

Note	
	Derivative control is not conducted if the derivative time is set to 0.

6.3.3.4 Control Period Settings [PAr3 → H-t/C-t]

- If relay or SSR is used to output MV under proportional control, the output is on for a fixed amount of time (within the control period, as a percentage of the MV) and then remains off for the rest of the time. The preset period when output ON/OFF takes place is called the proportional control period.
- Control with SSR output has a faster response than that of relay output. Therefore, by configuring a shorter control period, more responsive temperature control is achieved.

Parameter	Description
H-t	Heating Control Period
C-t	Cooling Control Period

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	H-t C-t	00.1 ~ 120.0	Relay Output: 020.0 SSR Output: 002.0	Sec

Note	If using heating and cooling control, configure each control period separately for heating and cooling.

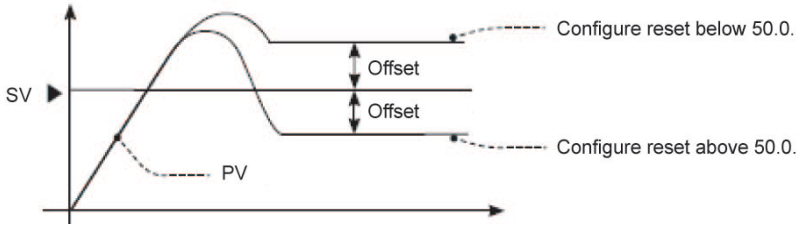
6.3.3.5 Offset Correction/Manual Reset Settings [PAr2 → rESt]

When selecting P / PD control mode, there are certain temperature differences even after PV reaches stable status since heater's rising and falling time is inconsistent due to thermal characteristics of control objects, such as heat capacity and the heater capacity. This temperature difference is called OFFSET. Offset can be corrected using manual reset.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr2	rESt	00.0 ~ 100.0	50.0	%

Manual Reset Adjustments based on Control Results

Under stable control conditions, set the offset to 50% if PV and SV are identical, to over 50.0% if PV is lower than SV, and to below 50.0% if PV is higher than SV.



Note	• The offset correction feature can only be used when proportional control is in effect. If setting the integral value to 0,the manual reset parameter will be displayed. • The user cannot configure the manual reset setting during heating and cooling control. Instead, the setting is automatically set to 0% for both heating and cooling. • Applicable only when integral time is set to 0 (under P control or PD control only). • Switching from heating and cooling control to standard control (P, PD control) automatically configures the reset setting to 50%.

6.3.4 Auto-tuning

In PID control, auto-tuning processes 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.

6.3.4.1 Auto-tuning Start/Stop Setting [PAr2 → At]

- 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 lamp located on the front of the controller flashes in 1-second intervals. When auto-tuning finishes, the AT lamp automatically goes off and the auto-tuning parameter will return to oFF.
- When auto-tuning is in progress and digital input (dI - 1, dI -2) feature is RUN/STOP or AUTO/MANUAL, auto-tuning will be automatically ended, if concerned DI is inputted or a sensor disconnection error occurs. (Restored the PID used prior to the auto-tuning session)_

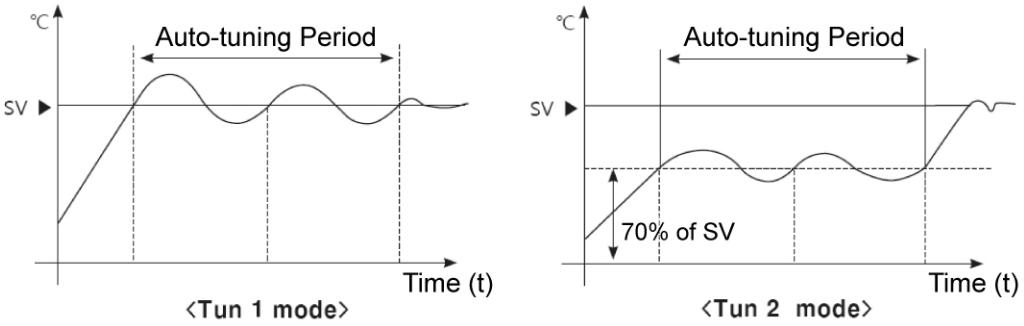
Setting	Description
oFF	Auto-tuning complete.
on	Auto-tuning in progress.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr2	At	oFF/on	oFF	-

Note	• 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.

6.3.4.2 Auto-tuning Mode Settings [PAr3 → At.t]

Auto-tuning is available in Tun1 MODE (SV) or Tun2 MODE (70% of SV), depending on the baseline value used.



Setting	Description
tUn1	**Tun1 Mode** Auto-tunes and derives a PID time constant based on SV (Setting Value).
tUn2	**Tun2 Mode** Auto-tunes and derives a PID time constant based on 70% of SV (Setting Value).

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr3	At.t	tUn1 / tUn2	tUn1	-

Note

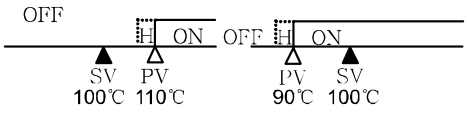
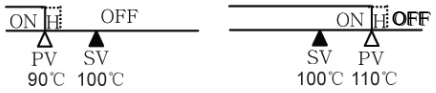
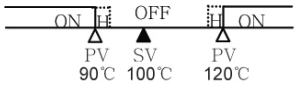
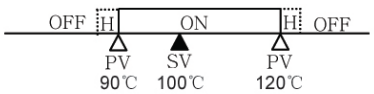
- In cooling control mode, TUN2 Mode calculates 70% based at 0°.
- When SV=-100, tUn2 is performed at -70°.

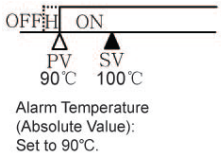
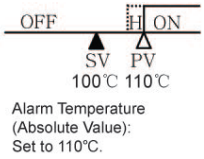
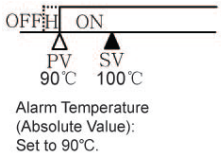
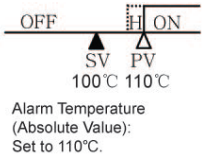
6.4 Alarm Output

- Alarm Output is a Relay output that activates irrespective of control output.
- Alarm output is triggered if the control subject's temperature exceeds or falls below the preset temperature range.
- Alarm temperature setting values are available both with absolute temperature and deviation temperature depending on the alarm output mode.

6.4.1 Alarm Output Mode [PAr4 → AL-1/AL-2]

Select the desired alarm output mode.

Mode	Alarm Output	Description (Factory Default)
oFF	———	· Alarm off.
duCC	 Alarm Temperature (Deviation Temperature): Set to 10℃. Alarm Temperature (DeviationTemperature): Set to -10℃.	· Deviation High-limit Alarm (Temperature, Analog: +F.S.) If PV/SV deviation occurs higher than set value of deviation temperature, alarm output will be ON. High-limit deviation temperature can be set in AL 1.H/AL2.H.
]]du	 Alarm Temperature (Deviation Temperature): Set to 10℃. Alarm Temperature (Deviation Temperature): Set to -10℃.	· Deviation Low-limit Alarm (Temperature, Analog: +F.S.) If PV/SV deviation occurs lower than set value of deviation temperature, alarm output will be ON. Low limit can be set in AL 1.L/AL2.L.
]duC	 Low-limit Alarm Temperature (Deviation Temperature) 10℃ High-limit Alarm Temperature (Deviation Temperature) Set to 20℃	· Deviation high/low limit alarm (Temperature, Analog: +F.S.) If PV/SV deviation occurs higher than high-limit deviation or lower than low-limit deviation, alarm output will be ON.High-limit Deviation Temperature can be set in AL 1.H/AL2.H. Low limit can be set in AL 1.L/AL2.L.
CdU]	 Low-limit Alarm Temperature (Deviation Temperature): 10℃ High-limit Alarm Temperature (Deviation Temperature): Set to 20℃.	· Deviation High and lower limit Reverse Alarm (Temperature, Analog: 0) If PV/SV deviation occurs higher than low-limit deviation or lower than high-limit deviation, alarm output will be ON. High-limit deviation can be set in AL 1.H/AL2.H. Low limit deviation can be set in AL 1.L/AL2.L.

Mode	Alarm Output	Description (Factory Default)
PuCC	 Alarm Temperature (Absolute Value): Set to 90℃.  Alarm Temperature (Absolute Value): Set to 110℃.	· Absolute Value High-limit Alarm (Temperature: High-limit, Analog: H-SC or L-SC, whichever is greater.) If PV is higher than the absolute value of temperature, alarm output will be ON. Alarm's absolute value can be set in AL 1.H/AL2.H.
JJPu	 Alarm Temperature (Absolute Value): Set to 90℃.  Alarm Temperature (Absolute Value): Set to 110℃.	· Absolute Value Low-limit Alarm (Temperature: Low-limit, Analog: H-SC or L-SC, whichever is lower.) If PV is lower than the absolute value of temperature, alarm output will be ON. Alarm's absolute value can be set in AL 1.L/AL2.L.
LbA	On if loop break is detected.	· Loop Break Alarm
SbA	On if sensor break is detected.	· Sensor Break Alarm
HbA	On if current transformer (C.T.) detects heater break.	· Heater Burnout Alarm

Parameter	Description
AL-1	Selects alarm output 1 operation mode.
AL-2	Selects alarm output 2 operation mode.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr4	AL-1	oFF / duCC / JJdu / JduC / CduJ / PuCC / JJPu / SbA / LbA / HbA	duCC	-
	AL-2		JJdu	-

6.4.2 Alarm Output Options [PAr4 → AL 1t/AL2t]

Users can select the desired alarm output options.

Setting	Mode	Description
AL-A	Standard Alarm	If it is an alarm condition, alarm output is ON. Unless an alarm condition, alarm output is OFF.
AL-b	Alarm latch ※1	If it is an alarm condition, alarm output is ON. Before reset the alarm, an ON condition is latched. (Holding the alarm output)
AL-C	Standby sequence1※2	When power is supplied and it is an alarm condition, alarm output does not act. From the second alarm conditions, standard alarm acts..
AL-d	Alarm latch and standby sequence1	When power is supplied and it is an alarm condition, alarm output does not act. From the second alarm conditions, alarm latch acts.
AL-E	Standby sequence2	When Standby sequence※3 and it is an alarm condition, alarm output does not act. After deactivate the alarm condition, standard alarm acts.
AL-F	Alarm latch and standby sequence2	When Standby sequence※3 is repeated and it is an alarm condition, alarm output does not act. After deactivate the alarm condition, alarm latch acts..

※1: Alarm Latch

For deactivating Alarm Output in Alarm Latch mode, Turn off the power or send alarm reset signal.

※2: standby sequence

This option is applied only if PV is in alarm output ON conditions when power is supplied. If not, alarm output will be provided from the first alarm condition same as other alarm operations.

※3: Conditions of repeated Standby sequence: Power ON, Changing SV, Related Alarm(operation mode, option, setting value), Changing Parameter, Changing STOP mode to RUN mode.

Parameter	Description
AL 1.t	Selects the operation mode of alarm output 1.
AL2.t	Selects the operation mode of alarm output 2.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr4	AL 1.t	AL-A / AL-b / AL-C / AL-d / AL-E / AL-F	AL-A	-
	AL2.t		AL-A	-

Note	· You can set alarm outputs (Alarm1 Type/Alarm2 Type) individually. · If alarm output mode has been selected as LbA, SbA, or HbA, AL-C and AL-d modes are not available.

6.4.3 Alarm SV Settings [PAr 1 → AL 1L/AL 1H/AL 2L/AL 2H]

You can set alarm output activation values. According to the selected alarm output mode, configuration parameters (AL □.H/AL □.L) will be activated for each setting.

Parameter	Description
AL 1.L	Low limit value of alarm output 1. Reference value for determining heater burnout.
AL 1.H	High-limit value of alarm output 1.
AL2.L	Low limit value of alarm output 2. Reference value for determining heater burnout.
AL2.H	High-limit value of alarm output 2.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr 1	AL 1.H	- (Temperature) High/Low-limit Deviation: By Individual Input Specification -F.S. to F.S.. - (Temperature) Alarm Absolute Value: By Individual Input Specification within displayed range. - (Analog) High/Low-limit Deviation: -1999 to 9999 Within -F.S. to F.S. - (Analog) Alarm Absolute Value: By Individual Input Specification within displayed range.	Temperature : 1550 Analog : 100.0	-
	AL2.H			-
	AL 1.L			-
	AL2.L			-

Note	Changing the alarm output mode or options resets the settings to the highest or lowest values that will not trigger output in the new mode.

6.4.4 Alarm Output Hysteresis [PAr4 → A1HY/A2HY]

- "6-4-1. "H" from alarm output mode represents the alarm output hysteresis. It is used to set an interval between alarm outputs ON/OFF periods.
- Hysteresis can be set for individual alarm outputs (Alarm 1 Hysteresis/Alarm2 Hysteresis).

Parameter	Description
A1.HY	Sets the ON/OFF interval for alarm output 1.
A2.HY	Sets the ON/OFF interval for alarm output 2.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr4	A1.HY	Temperature H, Analog: 001 ~ 100 Temperature L: 000.1 ~ 100.0	001	Temperature: ℃/℉, Analog: Digit
	A2.HY		001	

Note

- Alarm output hysteresis applies to heater burnout alarm (HbA) in the same manner.
- This parameter does not appear if Loop Break Alarm (LbA) or Sensor Break Alarm (SbA) is selected.

6.4.5 Alarm Output Mode Selection [PAr4 → A1n/A2n]

You can set the relay contact method in the event of an alarm output.

Setting	Description
no	Normally Open Stays open when normal and closes in the event of an alarm.
nC	Normally Closed Stays closed when normal and opens in the event of an alarm.

Parameter	Description
A1.n	Select contact type for alarm output 1.
A2.n	Select contact type for alarm output 2.

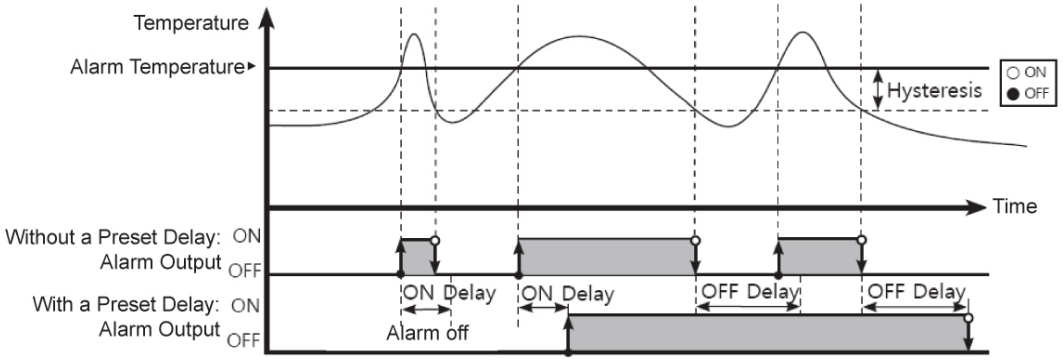
Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr4	A1.n	no / nC	no	-
	A2.n		no	-

Front LED Indicators

Change	Alarm Trigger	Alarm Output	Front LED
no (Normally Open)	OFF	Open	□ OFF
	ON	Close	■ ON
nC (Normally Closed)	OFF	Close	□ OFF
	ON	Open	■ ON

6.4.6 Alarm Output Delay Settings [PAr4 → A1on / A1oF / A2on / A2oF]

- Alarm output delay can be set to prevent false alarms caused by erroneous input signals resulting from disturbances or noise.
- With a preset delay time, alarm output does not turn on for the preset duration. Instead, the concerned alarm indicator on the front will flash in 0.5-second intervals.



Parameter	Description
A1on	Alarm Output 1 On Delay: Stands by for the preset duration upon an alarm event, checks the alarm trigger conditions, and turns on the alarm output if the conditions are still present.
A1oF	Alarm Output 1 Off Delay. Stands by for the preset duration following alarm output off, checks the alarm trigger conditions, and turns off the alarm output if the deactivation conditions are still present.
A2on	Alarm Output 2 On Delay. Stands by for the preset duration upon an alarm event, checks the alarm trigger conditions, and turns on the alarm output if the conditions are still present.
A2oF	Alarm Output 2 Off Delay. Stands by for the preset duration following alarm output off, checks the alarm trigger conditions, and turns off the alarm output if the deactivation conditions are still present.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr4	A1on	0000 ~ 3600	0000	Sec
	A1oF		0000	Sec
	A2on		0000	Sec
	A2oF		0000	Sec

6.4.7 Loop Break Alarm [PAr4 → AL-1/AL-2 → LbA]

- Diagnoses the control loop by monitoring the control subject's temperature changes and sends out alarms if necessary.
- If the |SV-PV| deviation does not decrease below the LBA detection band (LbA.S) during LBA monitoring time (LbA.t) when PV is outside LBA detection range (9LbA.b), control loop will be assumed abnormal and output will be turned on.
- Setting alarm output mode (AL-) to Loop Break Alarm (LbA) to activate.

Common Causes of LBA Output On

- Sensor Error (disconnection, short)
- External Controller Error (magnet, auxiliary relay, etc.)
- External Load Error (heater, cooler, etc.)
- Misconnections and disconnections of external network.

Note	Alarm output option (AL .t) can be set to standard alarm (AL-A) or alarm latch (AL-b).

6.4.7.1 LBA Monitoring Time [PAr4 → LbA.t]

You can set the loop break monitoring time to check changes in the control subject's temperature.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr4	LbA.t	0000 ~ 9999	0000	Sec

6.4.7.2 LBA Detection Values [PAr4 → LbA.S]

In order to confirm the state of temperature control set the maximum temperature change range. Loop Break Alarm triggers when PV is out of the LBA Detection set values.

Setting Group	Parameter	Setting Range		Factory Default	Unit
PAr4	LbA.S	Temperature H	001 ~ 999	008	℃/℉
		Temperature L	000.1 ~ 999.9	008.0	℃/℉
		Analog	00.01 ~ 99.99	10.00	%F.S.

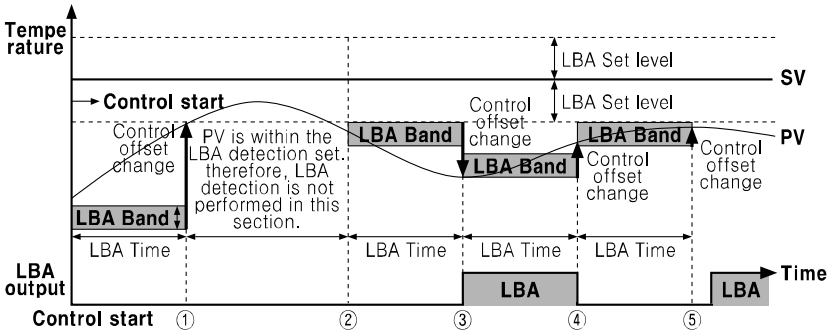
6.4.7.3 LBA Detection Band [PAr4 → LbA.b]

You can set the minimum value of deviation change to decrease during LBA monitoring time.

Setting Group	Parameter	Setting Range		Factory Default	Unit
PAr4	LbA.b	Temperature H	000 ~ 999	003	℃/℉
		Temperature L	000.0 ~ 999.9	003.0	℃/℉
		Analog	00.00 ~ 99.99	00.20	%F.S.

Ex.

When in standard control mode, a loop error will be assumed and the alarm output is turned on if the control deviation |SV-PV| is beyond the LBA Detection Set (LbA.5: LBA Set Level) and does not decrease below the LBA detection band (LbA.b: LBA Band) within the LBA monitoring time (LbA.t: LBA Time).



Control Start ①	After control starts, the LBA output turns off as control deviation |SV-PV| is reduced below the LBA detection band within the LBA detection time.
②	Control deviation |SV-PV| is within LBA Detection Set. LBA is not in operation.
③	Control deviation |SV-PV| does not decrease below the LBA detection band within the LBA monitoring time when PV is out of LBA detection range. LBA output therefore turns on.
④	Control deviation |SV-PV| decreases below the LBA detection band within the LBA monitoring time when PV is out of LBA detection range. LBA output therefore turns off.
⑤	Control deviation |SV-PV| does not decrease below the LBA detection band within the LBA monitoring time when PV is out of LBA detection band. LBA output therefore turns on.

Note

- During AT (Auto-tuning)/manual control/control stop, Loop Break Alarm (LbA) is inactive.
- Alarm reset initializes LBA detection start point.

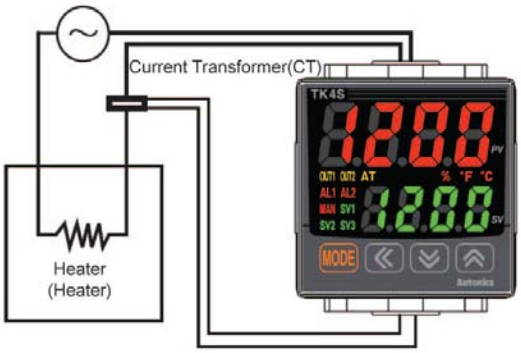
6.4.8 Sensor Break Alarm [PAr-4 → AL- 1/AL-2 → 5bA]

- You can set the controller to send out an alarm when a sensor is not connected or disconnected during temperature control.
- Sensor break can be confirmed through an external alarm output contact, such as a buzzer or similar means.
- Setting alarm output mode (AL-) to 5bA will activate Sensor Break Alarm.

Note	Alarm output option can be set to standard alarm (AL-A) or alarm latch (AL-b).

6.4.9 Heater Burnout Alarm [PAr-4 → AL- 1/AL-2 → HbA]

- When using a heater to raise the temperature of the control subject, the temperature controller can be set to detect heater disconnection and send out an alarm by monitoring power supply to the heater.
- Heater disconnection is detected by the controller using a current transformer (C.T.), which converts the current to the heater to a specific ratio (C.T. ratio) for monitoring. If the heater current value (Ct-A) measured by the C.T. is less than the heater detection setting value (AL .L), the heater burnout alarm will activate.



Note	· Heater burnout detection only takes place when the temperature controller's output is turned on. Otherwise, heater burnout will not be detected by the controller. · Detection is only available in models with switching output (Relay output, SSR standard output). Models with linear output (current, SSR cycle/phase output) are incapable of detection. · Current detection is not performed if OUT1's control output time is less than 250 ms. · It is recommended to use Autonics designated current transformer (for 50 A). · Alarm output option can be set to standard alarm (AL-A) or alarm latch (AL-b). · In the case of TK4SP models, heater burnout alarm (HbA) mode is not available.

6.4.9.1 Heater Burnout Detection Settings [PAr 1 → AL 1.L / AL2.L]

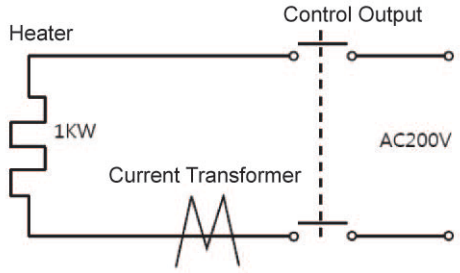
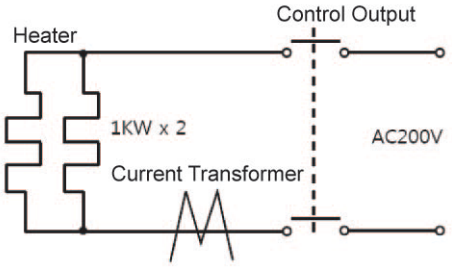
Set the alarm output value (AL .L) as the reference value for heater burnout detection.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr 1	AL 1.L	00.0 ~ 50.0	00.0	A
	AL2.L			

Note	Set to 00.0 for OFF. Set to 50.0 for ON.

Setting Value Calculation

: Heater Burnout Setting Value = {(Normal Heater Current) + (Heater Burnout Current)}/2

Ex.	If using a single output heater (Capacity: 200 VAC, 1 KW, 5 A), normal heater current is 5 A, and burnout heater current is 0 A, the setting value is calculated as (5 A + 0 A)/2 = 2.5 A. Therefore, heater current values less than 2.5 A will be deemed heater burnout and the alarm will activate. 
Ex.	When two output heaters (Capacity: 200 VAC, 1 KW, 5 A) are used, normal heater current is 10 A (5 A X 2 EA). If a single heater burns out, the heater current becomes 5 A. The setting value is calculated as (10 A + 5 A)/2 = 7.5 A). Heater current values of less than 7.5 A are deemed heater burnout and the alarm activates. 

6.4.10 Alarm Output Deactivation [PAr5 → dI -U → AL.rE]

- Available only if alarm output option is set to alarm latch or alarm latch and standby sequence1, alarm latch and standby sequence2. It can be set to turn off alarm output when alarm output is on, alarm output conditions have been removed, or an alarm output deactivation signal that is greater than the minimal signal band is received. (However, alarm output deactivation is unavailable when alarm conditions remain in effect.)
- You can assign the front panel's digital input key or the digital input terminals (DI-1, DI-2) for the alarm output deactivation feature.

(1) Deactivating Alarm Output using Digital Input Key

If the digital input key has been assigned for alarm output deactivation and the alarm output option is set to alarm latch or alarm latch and standby sequence, press and hold the front panel's ▼ and ▲ keys when alarm output is on.

Note	For detailed information on digital input key settings, see 6-7-4-2. Digital Input Key.

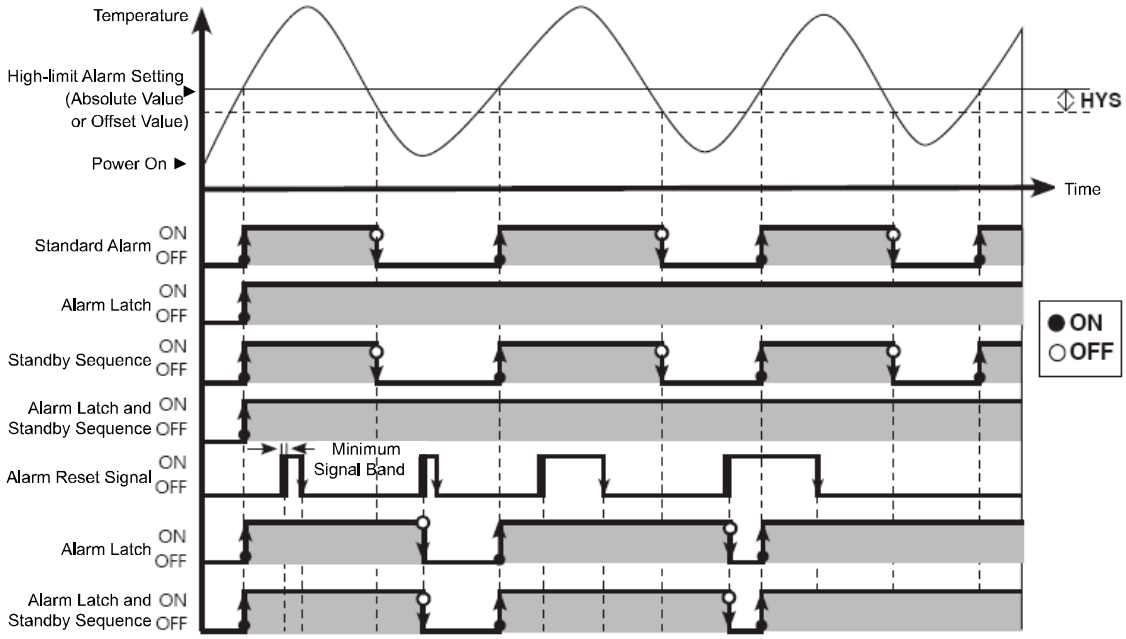
(2) Forced Deactivation of Alarm Output using Digital Input (DI) Terminal

When the digital input (DI) terminal is assigned to forced alarm (output) off, the alarm output will deactivate when digital input (DI) terminal goes into the on state (close). (MAN lamp on).

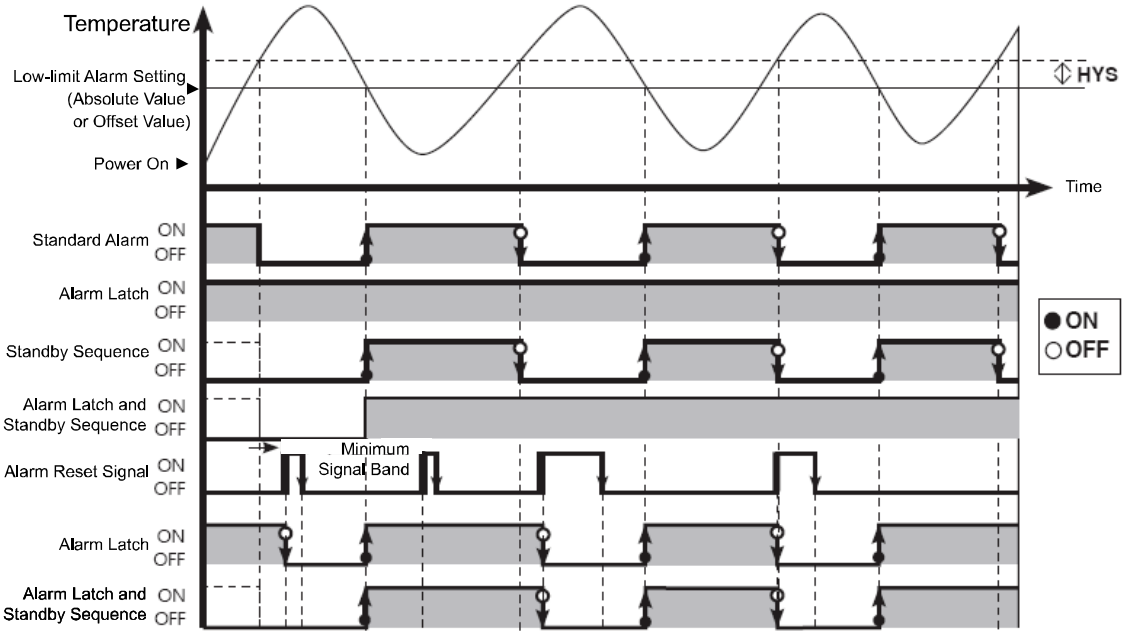
Note	· For detailed information on Digital Input (DI) terminal configuration, see 6-7-4-1. Digital Input Terminal. · After deactivating the alarm output, it will function normally for the next alarm output occurrence.

6.4.11 Alarm Output Examples

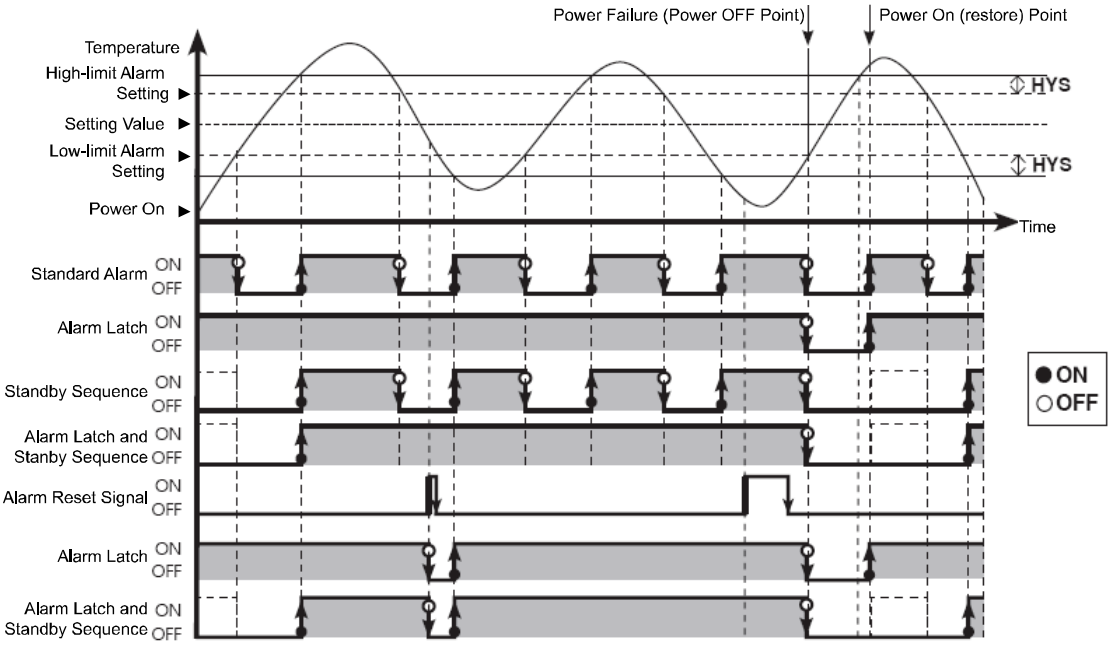
6.4.11.1 Absolute Value High-limit Alarm and Deviation High-limit Alarm



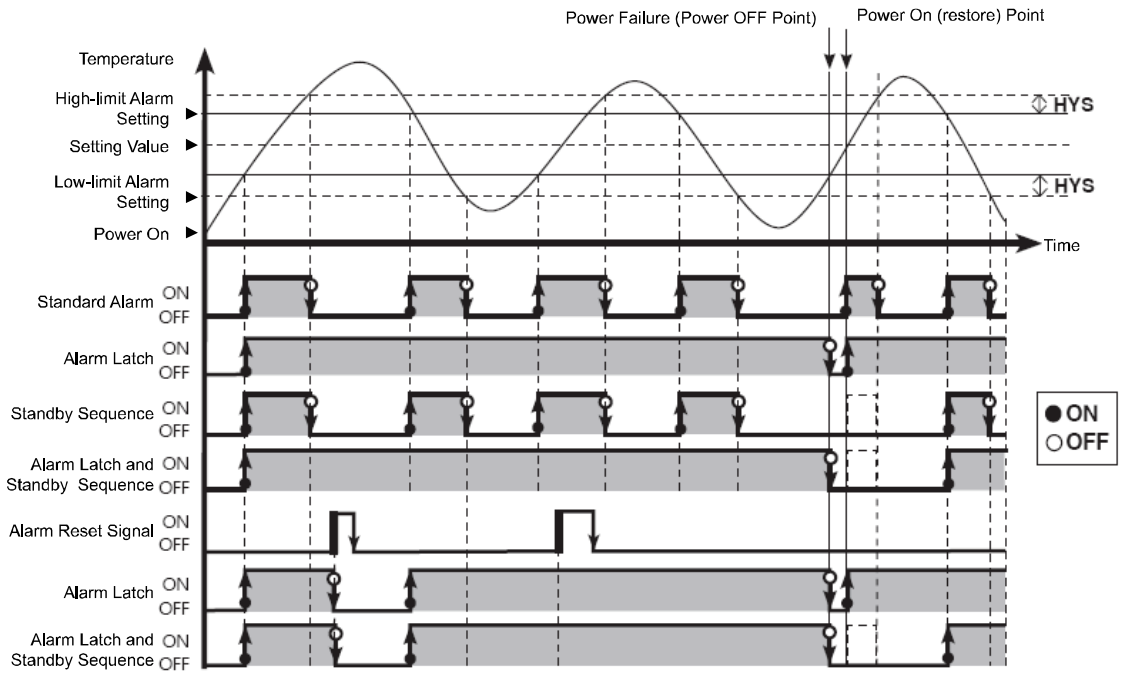
6.4.11.2 Absolute Value Low-limit Alarm and Deviation Low-limit Alarm



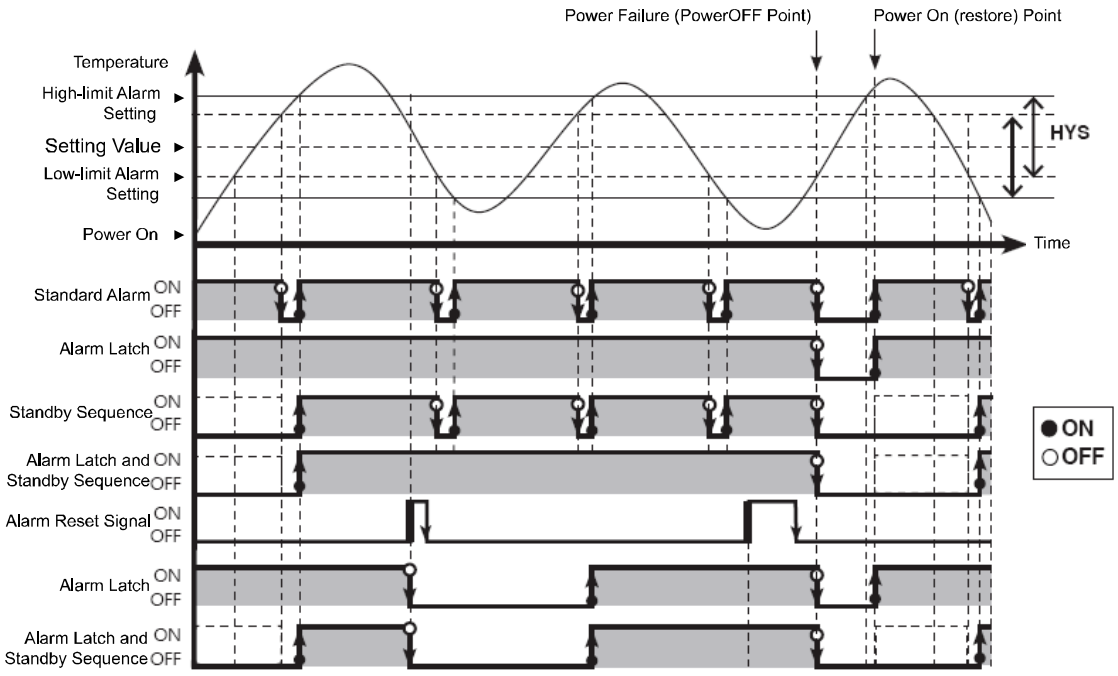
6.4.11.3 Deviation High/Low-limit Alarm



6.4.11.4 Deviation High/Low-limit Reverse Alarm



6.4.11.5 Deviation High/Low-limit Alarm (hysteresis overlap)



6.5 Analog Transmission

6.5.1 Analog Transmission Output Value Settings [PAr4 → Ao-n]

Transmission output is a type of auxiliary output that converts the controller's PV, SV, H-MV, and C-MV to analog current (DC 4 to 20 mA) for external transmission.

Setting	Description
Pu	PV Transmission Output
Su	SV Transmission Output
H-nu	Heating MV Transmission Output
C-nu	Cooling MV Transmission Output

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr4	Ao-n	Pu / Su / H-nu / C-nu	Pu	-

Note

- This parameter is activated in transmission output models only.
- Transmission output is constant current output. Too great a resistance from the load can cause the output value to change.
- There is no optional output below 4 mA or above 20 mA.

6.5.2 Transmission Output High/Low-limit Value Settings[PAr4 → FS-L/FS-H]

If the transmission output value (Ao-n) is below the transmission output lower limit (FS-L), 4 mA output will be provided. If the transmission output is between the lower limit (FS-L) and upper limit (FS-H), a certain proportional output within the range 4 mA and 20 mA will be provided. If it is above the upper limit (FS-H), 20 mA output will be provided.

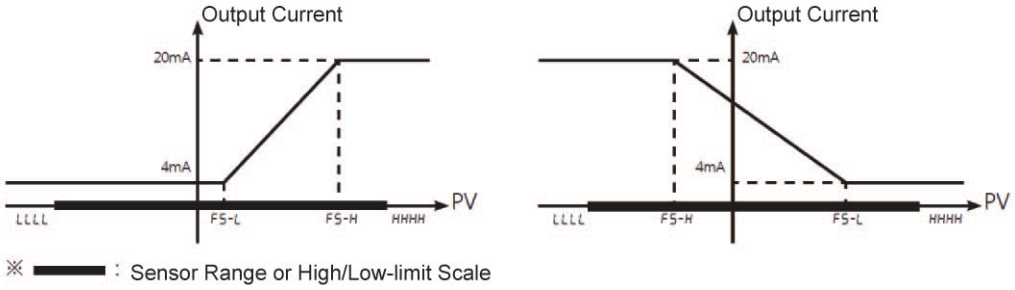
Setting	Description
FS-L	Sets the lower limit of transmission output (4 mA).
FS-H	Sets the upper limit of transmission output (20 mA).

Setting Group	Parameter	Setting Range		Factory Default	Unit
PAr4	FS-L	Pu	Temperature: Usage Range Analog: High/Low Scale Range	-200	Digit
		Su	SV Low-limit (L-Su) to SV High-limit (H-Su)		
		H-nu/C-nu	000.0 ~ 100.0		
	FS-H	Pu	Temperature: Usage Range Analog: High/Low Scale Range	1350	
		Su	SV Low-limit (L-Su) to SV High-limit (H-Su)		
		H-nu/C-nu	000.0 ~ 100.0		

Note If transmission output upper limit (FS-H) is transmission output lower limit (FS-L), the transmission output is 4 mA.

(1) PV Transmission Output

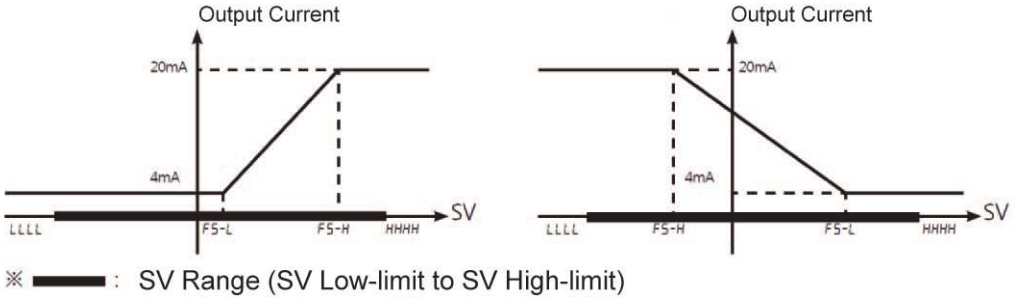
PV within sensor range or upper/lower limit scale can be converted and transmitted as current within the range of 4 mA and 20 mA.



※ ▬▬ : Sensor Range or High/Low-limit Scale

(2) SV Transmission Output

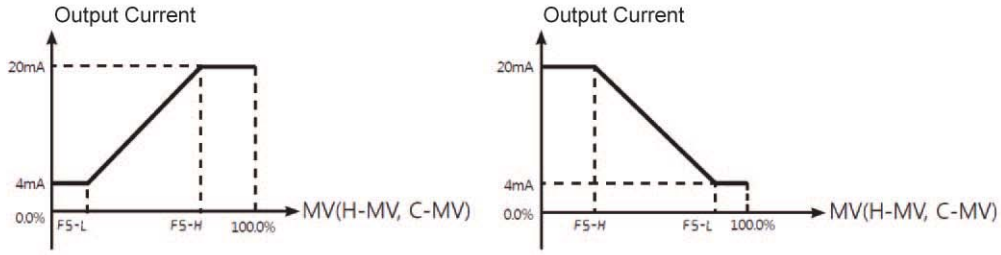
- SV within sensor range or upper/lower limit scale can be converted and transmitted as current within the range of 4 mA and 20 mA.
- When ramp is in effect, ramp SV is transmitted step by step.



※ ▬▬ : SV Range (SV Low-limit to SV High-limit)

(3) H-MV/C-MV Transmission Output

You can convert 0 to 100% of heating (H-MV)/cooling MV (C-MV) into 4 to 20 mA current.



6.6 Communication Settings

- This feature is used for external higher systems (PC, GP, etc.) to set the controller's parameters and to monitor the controller. It can also be used to transmit data to external devices.
- No redundant unit addresses may exist along the same communication line. The communication cable must be a twist pair that supports RS485.

Interface

Category	Description
Standards	EIA RS485-compliant
Max. Connections	31 units (Addresses: 01 through 99)
Communication	Two-wire, half duplex
Synchronization	Asynchronous
Valid Communication Distance	Max. 800 m
BPS (Bits Per Second)	2400, 4800, 9600, 19200, 38400 bps
Response Standby	5 ms to 99 ms
Communication Start Bit	1 bit (fixed)
Data Bit	8 bit (fixed)
Communication Parity Bit	None, Even, Odd
Communication Stop Bit	1, 2 bit
Protocol	Modbus Remote Terminal Unit (★[1] Character = 11 bit as fixed)

Note	You could modify the parameter (first in, first out) using keys during communication connection, but this may lead to errors and malfunctions.

6.6.1 Unit Address Settings [PAr4 → Adr5]

You can assign individual addresses to data units.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr4	Adr5	01~99	01	-

6.6.2 BPS (Bits Per Second) Settings [PAr4 → bPS]

You can set the rate of data transmission.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr4	bPS	24 (2400 bps) / 48 (4800 bps) / 96 (9600 bps) / 192 (19200 bps) / 384 (38400 bps)	96	bps

Note	The higher the BPS (Bits Per Second), the faster the transmission.

6.6.3 Communication Parity Bit [PAr4 → PrtY]

Parity bit is a data communication method that adds an additional bit to each character in transmitted data as an indicator used to verify data loss and corruption. This parameter is used to enable or disable the parity bit option.

Setting	Description
nonE	Disables parity bit.
EuEn	Sets the total bits with signal value of 1 as even numbers.
odd	Sets the total bits with signal value of 1 as odd numbers.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr4	PrtY	nonE / EuEn / odd	nonE	-

6.6.4 Communication Stop Bit Settings [PAr4 → StP]

You can set the number of bits to mark the end of a transmitted data string.

Setting	Description
1	Sets end of data string to 1 bit.
2	Sets end of data string to 2 bits.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr4	StP	1 / 2	2	bit

6.6.5 Response Wait time Settings [PAr4→r54.t]

Set a standby time to mitigate communication errors when communicating with a slow master device (PC, PLC, etc.). Once a standby time is set, the controller will respond after the defined standby time.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr4	r54.t	05 ~ 99	20	ms

Note	Shorter standby times can cause communication errors in the master device.

6.6.6 Enable/disable Communication Write[PAr4→Con4]

This feature can change parameter settings stored in memory through communication with PC, GP, PLC, etc., in order to permit or prohibit writing.

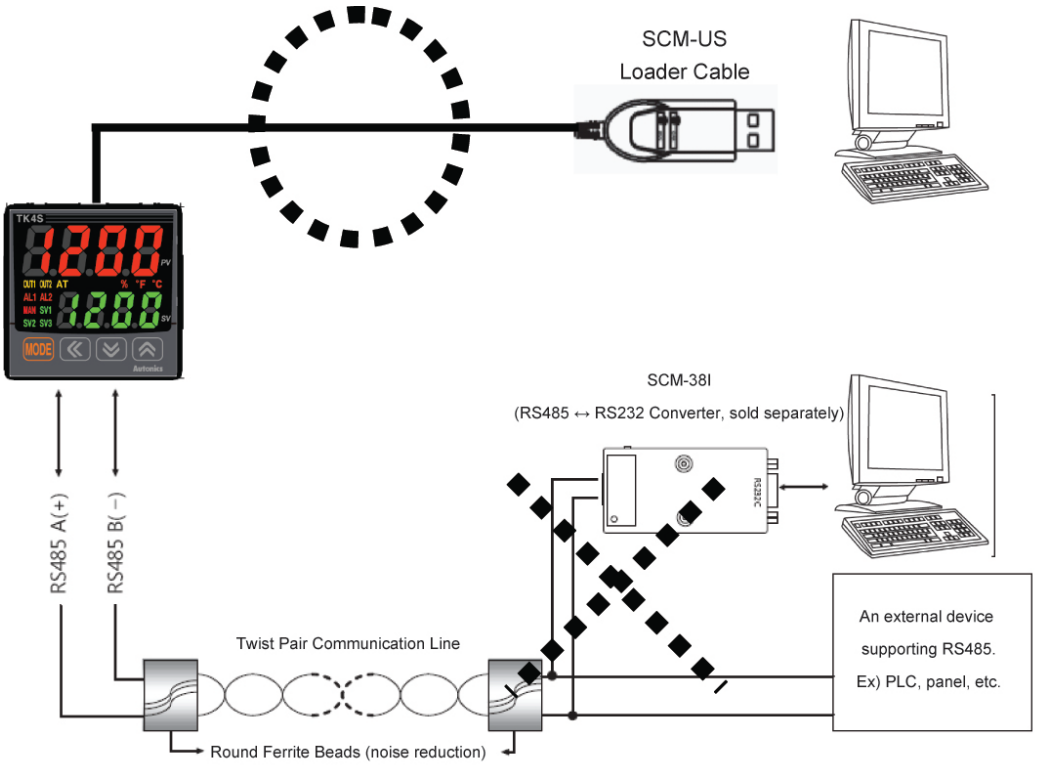
Setting	Description
En.A	Parameter set/change enable via communication.
dI S.A	Prohibit parameter setting or modification via communication.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr4	Con4	En.A / dI S.A	En.A	-

Note	Reading parameter settings is always permitted.

6.6.7 USB-to-Serial Connection

Data can be transmitted via a USB-to-serial connection. However, RS485 communication through a USB-to-serial connection is blocked by hardware.



6.7 Additional Features

6.7.1 Monitoring

Refer to 5-3-4. MV Monitoring and Manual Control Settings.

6.7.1.1 Control Output MV Monitoring

Monitors and displays the current control output MV.

6.7.1.1.1. Heating MV Monitoring

- Displays the current heating MV during heating control or heating and cooling control.
- Users may manually adjust the MV to control the temperature.
- Measurement Range: H 0.0 to H 100 (Unit: %)

Note	Capable of displaying MV with a moving decimal point (H99.9 → H 100).

6.7.1.1.2. Cooling MV Monitoring

- Displays the current cooling MV during cooling control or heating and cooling control.
- Users may manually adjust the MV to control the temperature.
- Measurement Range: C 00 to C 100 (Unit: %)

Note	Capable of displaying MV with a moving decimal point (C99.9 → C 100).

6.7.1.2 Heater Current Monitoring [PAr 1 → Ct-A]

A feature that monitors and displays the current of a heater (load) being controlled by control output.

Setting Group	Parameter	Measurement Range	Unit
PAr 1	Ct-A	0.0 ~ 50.0	A

Note	A current transformer is used to measure and display the heater's (load) current.

6.7.2 Run/Stop [PAr 1 → r-S]

- Users may run or stop control output by force while in Run mode.
- The stop command stops control output. Auxiliary output, however, is not affected by the command.
- This feature can be enabled by configuring parameters. In addition, the front panel's digital input keys (▼ and ▲) and digital input terminals (DI-1 and DI-2) can be assigned to the run/stop feature.

Setting	Description
rUn	Forced control output run in Stop mode.
StoP	Forced control output stop in Run mode.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr 1	r-S	rUn / StoP	rUn	-

Note

- With stop enabled, the front panel's SV display indicates StoP.
- You can change the setting when in the stop state. The stop status will remain in effect after shutting down the controller and powering it back on.
- When stop is in effect, STOP MV will be output. In case of a sensor break occuring while in STOP, STOP MV is output.
- The run/stop setting remains in effect after turning power back on.
- If the Digital Input (di - 1, di -2) feature has been set for RUN/STOP, RUN/STOP feature by modifying front keys or parameter is unable..

6.7.2.1 Stop Control Output Settings [PAr5 → St.ou]

This parameter sets the control output value when in the stop state. With ON/OFF control, select between 100.0 (ON) and 000.0 (OFF). With PID control, the user can adjust the MV between 000.0 and 100.0.

Setting Group	Parameter	Setting Range			Factory Default	Unit
PAr5	St.ou	Standard Control	ON/OFF Control	000.0 (OFF)/ 100.0 (ON)	000.0	%
			PID Control	000.0 ~ 100.0	000.0	
		Heating and Cooling Control	ON/OFF Control	-100.0 (Cooling ON) /000.0 (OFF)/ 100.0 (Heating ON)	000.0	
			PID Control	-100.0 (Cooling) to 100.0 (Heating)	000.0	

Note

Ignores MV from ON/OFF control or PID control and sends out a control value based on the defined MV.

6.7.2.2 Stop Alarm Output [PAr5 → St.AL]

Enable or disable alarm output upon a stop.

Setting	Description
oFF	Alarm output ceases along with a stop under all conditions. (However, reverting to Run mode after a stop in alarm latch or alarm latch and standby sequence restores the alarm output to the previous state.)
Cont	Alarm output continues regardless of control operation.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr 1	r-5	Cont / oFF	Cont	-

6.7.3 Multi SV

- Multi SV function allows users to set multiple SVs and save each setting in SU0~SU3. Users can change SU-n or select desired SV using external DI (Digital Input, DI-1, DI-2) terminals.
- This feature supports up to four SVs which can be independently configurable.

6.7.3.1 Number of Multi SVs [PAr5 → nt.SU]

This parameter sets the number of Multi SVs. Select the number of Multi SVs required by the control subject.

Number of SVs	SV Assignment
1 EA	SV-0
2 EA	SV-0, SV-1
4 EA	SV-0, SV-1, SV-2, SV-3,

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr5	nt.SU	1 / 2 / 4	1	EA

Note	If the Digital Input (di - 1, di -2) feature has been set for multi SV (nt.SU), the number of Multi SV(nt.SU) is not modified through pressing key or communication.

6.7.3.2 Multi SV No. Selection [PAr 1 → Su-n]

Select the SV to control.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr 1	Su-n	Su-0 / Su-1 / Su-2 / Su-3	Su-0	-

Note	The range of figures assigned to each SV (SV No.) varies depending on the number of Multi SVs (nt.Su) setting.

6.7.3.3 Multi SV Value Settings [PAr 1 → Su-0/Su-1/Su-2/Su-3]

Designate the value of each SV for Multi SVs.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr 1	Su-0	Setting Value Low-limit (L-Su) to Setting Value High-limit (L-Su)	0	℃,℉ ,-
	Su-1		0	
	Su-2		0	
	Su-3		0	

6.7.4 Digital Input

6.7.4.1 Digital Input Terminal Settings [PAr5 → dI - 1/dI -2]

By connecting an external input to a digital input terminal, you can perform preset digital input terminal functions.

Setting	Description
oFF	No function.
5toP	Run/Stop
AL.rE	Forced alarm output deactivation.
nAn	Auto/manual control selection.
nt.5u	Multi SV selection.

- In the case one of DI-1 or DI-2 being set for Multi SV(nt.5u), 5u-0 is selected as the SV if the terminal's external contact signal is off and 5u- 1 is selected if the signal is on.
- If both DI-1 and DI-2 are configured for Multi SV(nt.5u), you can select the SV using combinational logic of the terminals. If multi SV (nt .5u) are changed from 4 to 2, DI-2 will be turned OFF automatically, changed from 4 to 1, both DI-1 and DI-2 will be turned OFF or changed from 2 to 1, concerned DI will be OFF.

DI-1	DI-2	Multi SV No.
OFF	OFF	5u-0
ON	OFF	5u- 1
OFF	ON	5u-2
ON	ON	5u-3

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr5	dI - 1	oFF / 5toP / AL.rE / nAn / nt.5u	5toP	-
	dI -2		AL.rE	

Note

- When powered on, the Digital input feature checks always the settings of terminal input.
- Multi SV parameter will be activated only if Multi SV is more than 2.
- The TK4SP series has a limited number of terminal blocks and does not feature a digital input terminal. Therefore, the digital input terminal functions are not available.
- TheTK4S or M series has a limited number of terminal blocks. Therefore, the digital input terminal1 (DI-1) is available.
- Digital input terminal function operates irrespective of 6-7-7. Password Settings.

6.7.4.2 Digital Input Key

With digital input key enabled in Run mode, press and hold ▼ and ▲ keys at the same time for three seconds to activate the preset function.

6.7.4.2.1.1. Digital Input Key Settings [PArS → dI -t]

In order to use the digital input key feature, each function has to be first assigned to the keys.

Setting	Description
StoP	Run/Stop
AL.rE	Forced alarm output deactivation.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PArS	dI -t	StoP / AL.rE	StoP	-

Note	· If the Digital input key and the Digital input terminal set equally, the Digital input key does not act.

6.7.4.2.1.2. Digital Input Key Use

- Press the digital input keys on the front panel to execute the function assigned to the keys.
- When in Run mode, press and hold ▼ and ▲ keys to execute the assigned function (run/stop or alarm output deactivation).

Note	· If the same function is assigned to a digital input key and the digital input terminal, activation takes place as an "or" function and deactivation as an "and" function. (However, this does not apply to the Multi SV feature of digital input terminals.) · Digital input key functions operate irrespective of 6-7-9. Password Settings.

6.7.5 Error Features

The controller diagnoses input signals for errors and displays messages accordingly. These messages inform the user of device problems.

Message	Description
HHHH	Flashes at 0.5-second intervals if the input value is above the input range. → Automatically deactivates and returns to normal operation if the input value returns to the input range.
LLLL	Flashes at 0.5-second intervals if the input value is below the input range. → Automatically deactivates and returns to normal operation if the input value returns to the input range.
oPEn	Flashes at 0.5-second intervals in the event of an input disconnection. → Automatically deactivates and returns to normal operation if input reconnects.
Err	Flashes twice at 0.5-second intervals in the event of an operation error and returns to the previous screen.

Note	• When in heating control mode and powered on, or standard control state, output is 0% if HHHH is displayed and 100% if LLLL is displayed. • When in cooling control and powered on (or standard control state), output is 100% if HHHH is displayed and 0% if LLLL is displayed. • When in heating and cooling control and powered on or standard control state, heating output is 0% and cooling output 100% if HHHH is displayed, and heating output is 100% and cooling output 0% if LLLL is displayed.

6.7.5.1 MV Settings upon Sensor Break Error (Open) [PArS → Er.mu]

- In the event of a sensor open error you can set control output value to predefined MV instead of ON/OFF control or PID control.
- Ignores MV by ON/OFF control or PID control, and sends out a control value based on the defined MV.

Setting Group	Parameter	Setting Range			Factory Default	Unit
PArS	Er.mu	Standard Control	ON/OFF Control	000.0 (OFF)/ 100.0 (ON)	000.0	%
			PID Control	000.0 ~ 100.0	000.0	
		Heating and Cooling Control	ON/OFF Control	-100.0 (Cooling On) /000.0 (OFF)/ 100.0 (Heating On)	000.0	
			PID Control	-100.0 (Cooling) to 100.0 (Heating)	000.0	

6.7.6 User Level Setting [PArS → USEr]

- You can restrict parameter display by setting user level (standard or high).
- When you set as a standard level user, the main function parameters shaded on the entire parameter list(See the 5.4 Parameter Reference Chart), are only displayed.

Parameter	Parameter Description
Stnd	Displays main function parameters only.
HI GH	Displays main function parameters and all advanced function parameters.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PArS	USEr	Stnd / HI GH	Stnd	-

6.7.7 Lock Settings

6.7.7.1 SV Group Lock [PArS → LC.Su]

You can restrict SV parameter modification by locking SV group parameters, which include SV selection, digital input key (dI -P), A/M (MODE for S and SP models) key for monitoring and manual control, parameter reset (INIT), etc.

Setting	Function
on	Activates SV group lock.
oFF	Deactivates SV group lock.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PArS	LC.Su	on / oFF	oFF	-

6.7.7.2 Parameter Group Lock [PArS → LC.P 1/LC.P2/LC.P3/LC.P 4/LC.P5]

- Lock or unlock individual parameter groups from PAr 1 (Parameter 1) to PArS (Parameter 5).
- Even with parameter group lock in place, you can still read parameter settings.

  In Parameter 5's (PArS) case, the settings can still be modified even with a lock (LC.Su/LC.P) initiated.

Parameter	Parameter Description
on	Activates parameter group lock.
oFF	Deactivates parameter group lock.

Parameter	Parameter Description
LC.P 1	Activates Parameter 1 lock.
LC.P2	Activates Parameter 2 lock.
LC.P3	Activates Parameter 3 lock.
LC.P4	Activates Parameter 4 lock.
LC.P5	Activates Parameter 5 lock.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PArS	LC.P 1	on / oFF	oFF	-
	LC.P2		oFF	
	LC.P3		oFF	
	LC.P4		oFF	
	LC.P5		oFF	

6.7.8 Parameter Initialization[InIt]

- This function is to reset all parameters in memory to factory defaults.
- Press and hold the front panel's ◂, ▾, and ▴ keys for five seconds. The InIt parameter will be displayed. Select YES to reset the parameters.

Setting Group	Parameter	Setting Range	Factory Default	Unit
-	InIt	YES / no	no	-

Note	If the password feature is activated, it is required to enter a password to activate this function. Resetting the parameters also resets the password.

6.7.9 Password Settings [PAr5 → PUd]

- Assigning password access to SV group features (excluding digital input key) and Parameter 1 through 5 prevents unauthorized modification to the parameter settings.
- Password setting applies to SV group features (excluding digital input key) and Parameter 1 through 5 comprehensively.
- Changing the password setting automatically activates password protection. Setting the password to 0000, however, disables password protection.
- 0001 is a read-only password. Under this setting, the user may check parameter settings without knowing the password. The user, however, cannot change parameter settings.
- Accessing the PUd parameter with the read-only password displays a coded form of the setting.

Settings

1 When in Run mode, press and hold MODE key.

2 Use the ▼ and ▲ keys to select PAr5 and then press MODE key.

3 Press MODE key to search PUd.

4 Select the desired digit using the ◀ key.

5 Use the ▼ and ▲ keys to set the password (0000, 0002 ~ 9999) then press MODE key to set the password.

6 Repeat steps 4 and 5 and enter the preset password.

7 Press MODE key or do not make any additional key entry for three seconds to save the password.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PAr5	PUd	0000 (Password protection deactivated.) 0002 ~ 9999 (Password protection on.)	0000	-

Note	6-7-4-1. Digital Input Terminal and 6-7-4-2. Digital Input Key features are not affected by password protection settings.

6.7.9.1 Password Entry [PASS]

If password protection is turned on, accessing SV parameters or setting groups when the unit is in Run mode will prompt a password confirmation parameter (PASS). Then, the correct password has to be entered to access the setting parameters.

Settings

1 Access SV parameter or parameter setting group.

2 When prompted with PASS, use the ◂ key to select the desired digit.

3 Use the ▾ and ▴ keys to enter the password (0001 through 9999) and then press MODE key.

- If the correct password is entered, you can access setting parameters.
- If an incorrect password is entered, repeat steps 2 and 3 and enter the correct password.

Setting Group	Parameter	Setting Range	Factory Default	Unit
PArS	PASS	0001 (read-only), 0002 ~ 9999	0001	-

Note	・ If the password is unknown, enter 0001 to access the parameters in read-only mode. ・ This parameter only appears if the setting from 6-7-9. Password Setting is set to a value other than 0000. ・ If an incorrect password has been entered, the SV display section displays a coded form of the password stored by the user and an error message (Err). Then, the error message flashes in one-second intervals.

6.7.9.2 Password Recovery

Entering an incorrect password displays a coded form of the password on the SV display. Submit this code to Autonics to recover your lost password.

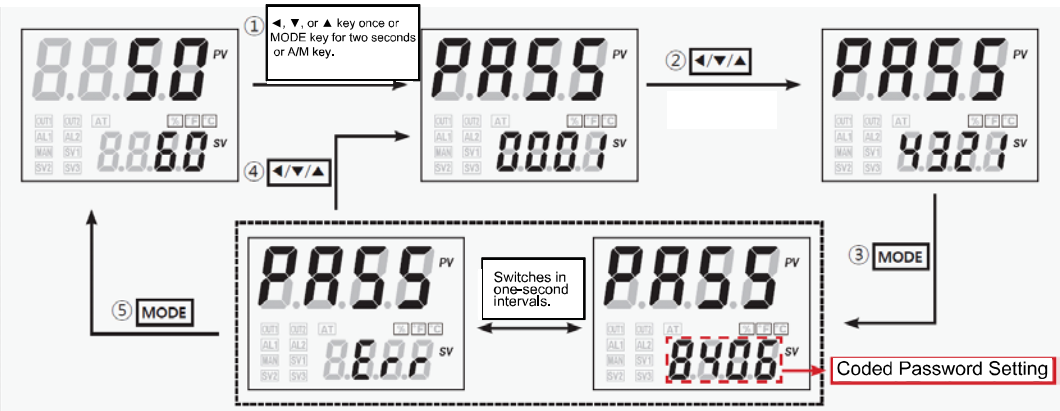
Incorrect Password Entry (For example, the correct password being 1234)

1 Access SV parameter or parameter setting group.

2 When prompted with PASS, use the ◂ key to select the desired digit.

3 Use the ▾ and ▴ keys to select 432 1(Incorrect Password) and then press MODE key.

- Entering an incorrect password displays a coded password on the SV display. An Err message will also appear, flashing at one second intervals.



7 Setting Group Parameter Description

7.1 Setting Group [SU]

Parameter		Description	Setting Range	Unit	Factory Default
SU	Set Value	SV	Between L-SU and H-SU	℃/℉ /-	0
▼+▲ Key	Digital Input Key Execute	Digital input execution key.	Press ▼and ▲ Keys more than 1 second.	-	-
A/M Key	Auto_Manual Monitoring/Control	MV monitoring/manual control execution key.	Press A/M key more than 1 second.	-	-
InIt	Parameter Initialize	Resets parameters to factory defaults.	no / YES	-	no

7.2 MV Monitoring/Manual Control Setting Group [M̄U]

Parameter		Description	Setting Range	Unit	Factory Default
H-M̄U	Heating_MV	Heating MV	H 0.0 to H 100	%	-
C-M̄U	Cooling_MV	Cooling MV	C 0.0 to C 100	%	-

※It is possible to manually control and monitor heating and cooling MVs at the same time.

7.3 Parameter 1 Setting Group [PAr 1]

Parameter		Description	Setting Range	Unit	Factory Default
r-S	RUN_STOP	Control Output Run/Stop	rUn / StoP	-	rUn
Su-n	Multi SV No.	Multi SV number selection.	Su-0 / Su- 1 / Su-2 / Su-3	-	Su-0
Ct-A	Heater Current Monitoring	Heater current monitoring.	00.0 to 50.0 (display range)	A	-
AL 1.L	Alarm1_Low	Alarm output 1's lower limit setting.	Offset Alarm: -F.S. to F.S. Absolute Value Alarm: Within display range.	℃/℉ /-	1550
AL 1.H	Alarm1_High	Alarm output 1's upper limit setting.			1550
AL2.L	Alarm2_Low	Alarm output 2's lower limit setting.			1550
AL2.H	Alarm2_High	Alarm output 2's upper limit setting.			1550
Su-0	SV-0 Setting Value	SV-0 setting.	Between L-Su and H-Su	℃/℉ /-	0000
Su- 1	SV-1 Setting Value	SV-1 setting.	Between L-Su and H-Su	℃/℉ /-	0000
Su-2	SV-2 Setting Value	SV-2 setting.	Between L-Su and H-Su	℃/℉ /-	0000
Su-3	SV-3 Setting Value	SV-3 setting.	Between L-Su and H-Su	℃/℉ /-	0000

7.4 Parameter 2 Setting Group [PAr2]

Parameter		Description	Setting Range	Unit	Factory Default
At	Auto-tuning Execute	Auto-tuning ON/OFF.	oFF/on	-	oFF
H-P	Heating_ Proportional Band	Heating proportional band	000.1 ~ 999.9	℃/℉, %	0 10.0
C-P	Cooling_ Proportional Band	Proportional band in cooling mode			
H-I	Heating_Integral Time	Heating integral time.	0000 ~ 9999	Sec	0000
C-I	Cooling_Integral Time	Cooling integral time.			
H-d	Heating_Derivation Time	Heating derivative time.	0000 ~ 9999	Sec	0000
C-d	Cooling_Derivation Time	Cooling derivative time.			
db	Dead_Overlap Band	Heating and cooling control deadband.	P/P, P/ONOFF, and ONOFF/P Controls -Proportional Band to 0.0 to +Proportional Band (if different, based on whichever is lesser) ONOFF/ONOFF Control -999 to 0999 (Temperature H) -199.9 to 999.9 (Temperature L)	Digit	0000
			-99.9 to 099.9 (Analog)	%F.S.	000.0
rESt	Manual Reset	Manual reset under proportional control.	000.0 ~ 1000	%	050.0
H.HYS	Heating_ON Hysteresis	Heating hysteresis.	001 ~ 100 (000.1 ~ 100.0)	Digit	002 (002.0)
H.oSt	Heating_OFF Offset	Heating off point offset.	000 ~ 100 (000.0 ~ 100.0)	Digit	000
C.HYS	Cooling_ON Hysteresis	Cooling hysteresis.	001 ~ 100 (000.1 ~ 100.0)	Digit	002 (002.0)
C.oSt	Cooling_OFF Offset	Cooling off point offset.	000 ~ 100 (000.0 ~ 100.0)	Digit	000
L-ou	MV Low-limit	MV lower limit setting.	000.0 to H-ou-0.1 (standard control)	%	000.0 -100.0

Parameter		Description	Setting Range	Unit	Factory Default
			-100.0 to 000.0 (heating and cooling control)		
H-ou	MV High-limit	MV upper limit setting.	L-ou+0.1 to 100.0 (standard control) 000.0 to 100.0 (heating and cooling control)	%	1000 1000
rAmU	Ramp_Up Rate	Ramp rise rate.	000 ~ 999 (0000 ~ 9999)	Digit	000
rAmd	Ramp_Down Rate	Ramp down rate.	000 ~ 999 (0000 ~ 9999)	Digit	000
r.Unt	Ramp Time Unit	Ramp time unit.	SEC / mIn / HoUr	-	mIn

7.5 Parameter 3 Setting Group [PAr3]

Parameter		Description	Setting Range		Unit	Factory Default
In-t	Input Type	Input type	See Input Types chart.		-	tC.1
Unit	Unit	Sensor temperature unit.	°C / °F		-	°C
L-rG	Low Input Range	Analog low-limit input value.	Minimum range. ~ H-rG - F.S.10%		Digit	00.00
H-rG	High Input Range	Analog High-limit Input Value.	L-rG+F.S.10%~ Maximum range.		Digit	10.00
dot	Scaling Decimal Point	Decimal point position - scale value.	0 / 0.0 / 0.00 / 0.000		-	0.0
L-SC	Low Scaling	Scale lower limit display value.	-1999 ~ 9999		-	0000
H-SC	High Scaling	Scale upper limit display value.	-1999 ~ 9999		-	100.0
dUnt	Display Unit Lamp	Front unit display.	°C / °F / °r/o / oFF		-	°C
In-b	Input Bias	Input compensation.	-999 ~ 0999 (-1999 ~ 9999)		Digit	0000
nAuF	Input Digital Filter	Moving average digital filter.	000.1 ~ 120.0		Sec	000.1
L-Su	SV Low-limit	SV lower limit setting.	Input Low-limit (L-SC) to H-Su-1 Digit		℃/℉ /%	-200
H-Su	SV High-limit	SV upper limit setting.	L-Su+1Digit to Input High-limit (H-SC)		℃/℉ /%	1350
o-Ft	Control Operating Type	Control output operation mode.	Standard	HEAt / CooL	-	HEAt
			Heating and Cooling Type	HEAt / CooL / H-C		H-C
C-nd	Control Method	Temperature control type.	Standard	PId / onoF	-	PId
			Heating and Cooling Type	P.P / P.on / on.P / on.on		P.P
AtE	Auto-tuning Type	Auto-tuning mode.	tUn1 / tUn2		-	tUn1
oUt1	Output1(SSR_Curr) Type	OUT1 control output type.	SSr / CUrr		-	SSr
o1.Sr	OUT1 SSR Function	OUT1 SSR output Type.	Stnd / CYCL / PHAS		-	Stnd

Parameter		Description	Setting Range	Unit	Factory Default
o1.mA	OUT1 Current Range	OUT1 Current Output Range.	4-20 / 0-20	-	4-20
oUt2	Output2(SSR_Curr) Type	OUT2 control output type.	SSr / CUrr	-	SSr
o2.mA	OUT2 Current Range	OUT2 Current output range.	4-20 / 0-20	-	4-20
H-t	Heating_Conrol Time	Heating control period.	000.1 ~ 120.0	Sec	020.0
C-t	Cooling_Conrol Time	Cooling control period.	000.1 ~ 120.0	Sec	020.0

7.6 Parameter 4 Setting Group [PAr4]

Parameter		Description	Setting Range	Unit	Factory Default
AL-1	Alarm1 Mode	Alarm output 1 operation mode.	oFF / duCC /]]du /]duC [du] / PuCC /]]Pu / LbA SbA / HbA	-	duCC
AL 1.t	Alarm1 Type	Alarm output 1 option/type.	AL-A / AL-b / AL-C / AL-d / AL-E / AL-F	-	AL-A
A 1.HY	Alarm1 Hysteresis	Alarm output 1 hysteresis.	001 ~ 100 (000.1 ~ 100.0)	Digit	001
A 1.n	Alarm1 NO/NC	Alarm output 1 NO/NC.	no / nC	-	no
A 1.on	Alarm1 ON Delay Time	Alarm output 1 on delay.	0000 ~ 3600	Sec	0000
A 1.oF	Alarm1 OFF Delay Time	Alarm output 1 off delay.	0000 ~ 3600	Sec	0000
AL-2	Alarm2 Mode	Alarm output 2 operation mode.	oFF / duCC /]]du /]duC [du] / PuCC /]]Pu / LbA SbA / HbA	-	]]du
AL2.t	Alarm2 Type	Alarm output 2 option/type.	AL-A / AL-b / AL-C / AL-d / AL-E / AL-F	-	AL-A
A2.HY	Alarm2 Hysteresis	Alarm output 2 hysteresis.	001 ~ 100 (000.1 ~ 100.0)	Digit	001
A2.n	Alarm2 NO/NC	Alarm output2 NO/NC.	no / nC	-	no
A2.on	Alarm2 ON Delay Time	Alarm output 2 on delay.	0000 ~ 3600	Sec	0000
A2oF	Alarm2 OFF Delay Time	Alarm output 2 off delay.	0000 ~ 3600	Sec	0000
LbAt	LBA Time	LBA monitoring time.	0000 ~ 9999	Sec	0000
LbAS	LBA Set Level	LBA detection set.	0001 to 999 (H) 000.1 to 999.9 (L) 000.1 to 99.99 (analog)	℃/℉ % %	008 008.0 10.00
LbAb	LBA Band	LBA detection band.	0000 to 999 (H) 000.0 to 99.99 (L) 000.0 to 99.99 (analog)	℃/℉ % %	003 003.0 00.20
Ao-n	Analog Output	Analog output mode	Pu / Su / H-nu / C-	-	Pu

Parameter		Description	Setting Range	Unit	Factory Default
	Mode	value.	nu		
FS-L	Low Out Scale	Transmission output low-limit.	F.S	-	-200
FS-H	High Out Scale	Transmission output upper limit.	F.S	-	1350
AdrS	Unit Address	Unit address.	01 ~ 99	-	01
bPS	Bits Per Second	BPS (Bits Per Second).	24 / 48 / 96 / 192 / 384	-	96
PrtY	Parity Bit	Communication parity bit.	nonE / EuEn / odd	-	nonE
StP	Stop Bit	Stop bit.	1 / 2	-	2
rSUt	Response Waiting Time	Response waiting time	5 ~ 99	ms	20
ConU	Communication Write	Communication write permission.	En.A / dI S.A	-	En.A

7.7 Parameter 5 Setting Group [PAr5]

Parameter		Description	Setting Range	Unit	Factory Default
nt5u	Multi SV	Number of Multi SVs.	1 / 2 / 4	EA	1
dI -E	Digital Input Key Function	DI input key function on the front panel.	StoP / RL.rE	-	StoP
dI - 1	Digital Input 1 Function	DI-1 Digital Input function.	oFF / StoP / RL.rE / nAn / nt.5u	-	StoP
dI -2	Digital Input 2 Function	DI-2 Digital Input function.		-	RL.rE
I tnu	Initial Manual MV	Manual control baseline MV.	AUto / Pr.nu	-	AUto
Pr.nu	Preset Manual MV	Manual control initial MV.	000.0 to 100.0 (standard control) -100.0 to 100.0 (heating and cooling control)	%	000.0
Er.nu	Error MV	Sensor error MV.	000.0 to 100.0 (standard control) -100.0 to 100.0 (heating and cooling control)	%	0000
St.nu	Stop MV	Control stop MV.	000.0 to 100.0 (standard control) -100.0 to 100.0 (heating and cooling control)	%	0000
St.AL	Stop AlarmOut	Control stop alarm output.	Cont / oFF	-	Cont
USEr	User Level	User level.	Stnd / HI GH	-	Stnd.
LC.Su	Lock SV	SV parameter lock.	on / oFF	-	oFF
LC.P 1	Lock Parameter 1	Parameter 1 Group lock.	on / oFF	-	oFF
LC.P2	Lock Parameter 2	Parameter 2 Group lock.	on / oFF	-	oFF
LC.P3	Lock Parameter 3	Parameter 3 Group lock.	on / oFF	-	oFF
LC.P4	Lock Parameter 4	Parameter 4 Group lock.	on / oFF	-	oFF
LC.P5	Lock Parameter 5	Parameter 5 Group lock.	on / oFF	-	oFF
Pyd	Password Setting	Password setting.	0000: Password protection off. 0002 ~ 9999	-	0000

7.8 Password Entry Parameter

Parameter		Description	Setting Range	Unit	Factory Default
PASS	Password	Password entry.	0001 to 9999 (0001: read-only)	-	0001

7.9 Parameter Change Reset Parameters

Changed Parameter	Description	Reset Parameter
In-t	Input types	Su-n, AL 1.L, AL 1.H, AL2.L, AL2.H, Su0 ~ Su3, db, H.HYS, H.oSt, C.HYS, C.oSt, rANU, rAnd, r.Unt, L-rG, H-rG, dot, L-SC, H-SC, d.Unt, In-b, L -Su, H -Su, LbA.t, LbA.S, LbA.b, Ao-n, FS-L, FS-H,
Unit	Temperature input unit	With the exception of L-rG, H-rG, dot, L-SC, H-SC, and d.Unt, Input type does not affect input units.
H-Su	SV high-limit value	When SV>H-Su, SV resets to H-Su.
L-Su	SV low-limit value	When SV<L-Su, SV resets to L-Su.
o-Ft	Control output operation mode	L-nu, H-nu, C-nd, Er.nu, Pr.nu, St.nu
C-nd	Temperature control type	L-nu, H-nu, Er.nu, Pr.nu, St.nu
AL-1 AL-2	Alarm mode/option	AL 1.L, AL 1.H, AL2.L, AL2.H

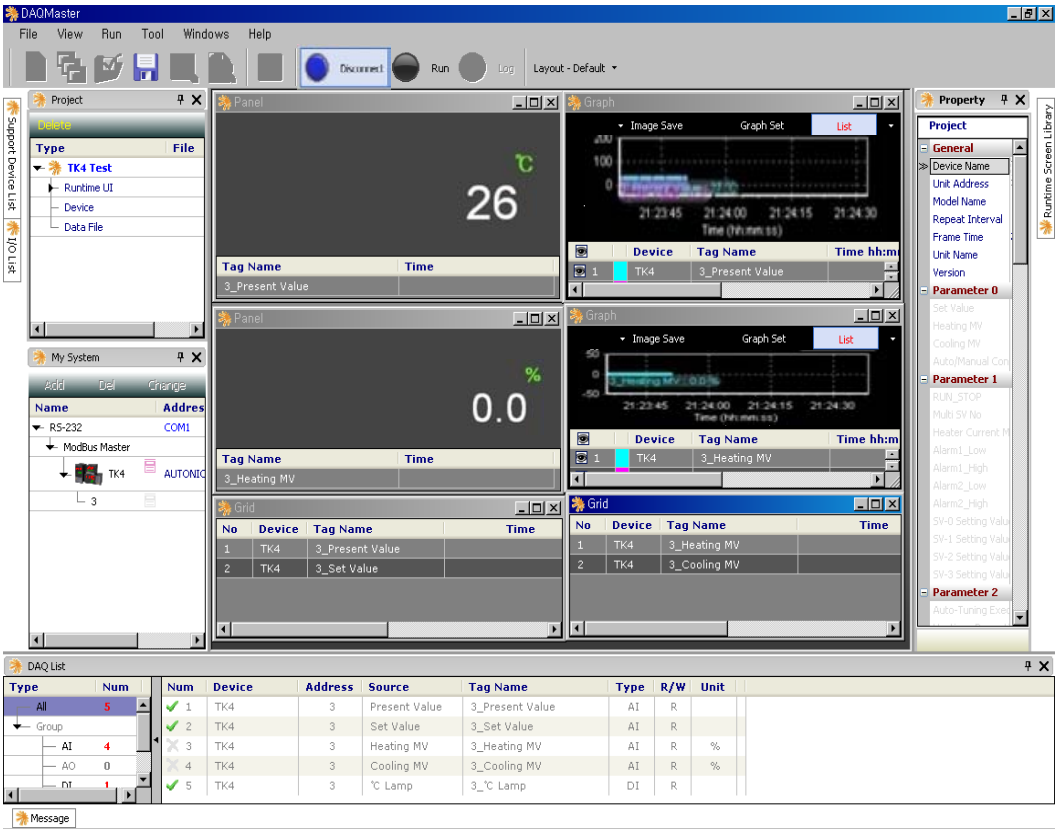
8 DAQMaster (PC Loader)

Note	· For detailed information, please download a copy of the DAQMaster manual from the Autonics website.

8.1 Overview

DAQMaster is a comprehensive device management program that can be used with Autonics temperature controllers, panel meters, and counter products, and with Konics recorder products.

DAQMaster provides GUI control for easy and convenient management of parameters and multiple device data monitoring.



8.2 Major Features

DAQMaster has the following features:

(1) Multiple Device Support

- Simultaneously monitor multiple devices and set parameters.
- Simultaneously connect units with different addresses in a single device.
- Use Modbus Remote Terminal Unit (RTU) to enable the use of multiple RS232 ports.

(2) Device Scan

In cases of multiple units (with different addresses) connected together, use unit scan to automatically search for units.

(3) Convenient User Interface

Freely arrange the windows for data monitoring, attributes, and projects.

Saving a project also saves the screen layout.

(4) Project Management

You can save added device information, data monitoring screen layouts, and I/O source selection as project files. Open project files to load the saved settings.

Provides a project list for simple and easy project file management.

(5) Monitoring Data Log

When monitoring, save data log files as either DAQMaster data files (.ddf) or CSV (.csv) files. Open files saved in the .csv format directly from Microsoft Excel.

Define log data file naming/saving rules and destination folders to make file management convenient.

(6) Data Analysis

- Perform spreadsheet and graph analyses of .ddf data files using DAQMaster's data analysis feature. Save spreadsheet data as .rtf, .txt, .html, or .csv files.

(7) Modbus Map Table Reporting

- Print address map reports of registered Modbus devices. Modbus map table reports can be saved in .html and .pdf formats.

(8) Multilingual Support

- Supports Korean, English, Japanese and Simplified Chinese.

  To add a different language, modify the files in the Lang folder, rename, and save.

(9) Script Support

- Uses the Lua Script language and deals with different I/O processes for individual devices.

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