Economical single display type, PID control

**Features**
- Realizes ideal temp. controlling with newly developed PID control algorithm and 100ms high speed sampling
- Built-in relay output or SSR output selectable
  - Enables to phase control and cycle control with SSR drive output (SSRP function)
- Dramatically increased visibility using wide display part
- Mounting space saving with compact design
  - Approx. 38% reduced size compared with existing model (depth-based)
- SV/PV deviation indicatable

**Ordering information**

<table>
<thead>
<tr>
<th>T</th>
<th>C</th>
<th>4</th>
<th>S</th>
<th>1</th>
<th>4</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control output</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Power supply</td>
<td></td>
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<tr>
<td></td>
<td>Alarm output</td>
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<tr>
<td></td>
<td>Size</td>
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<tr>
<td></td>
<td>Digit</td>
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<td></td>
<td>Setting type</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>N</td>
<td>Indicator - Without control output</td>
<td>R</td>
<td>Relay output + SSRP output (AC power)</td>
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<td></td>
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</tr>
<tr>
<td>R</td>
<td>Relay output + SSR output (AC/DC power)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>24-48VDC, 24VAC 50/60Hz</td>
<td>4</td>
<td>100-240VAC 50/60Hz</td>
<td></td>
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</tr>
<tr>
<td>N</td>
<td>No alarm output</td>
<td>1</td>
<td>Alarm1 output</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td>Alarm1 output + Alarm2 output ※1</td>
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<tr>
<td>S</td>
<td>DIN W48×H48mm (Terminal block type)</td>
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<tr>
<td>SP</td>
<td>DIN W48×H48mm (11pin plug type) ※2</td>
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<td>Y</td>
<td>DIN W72×H36mm</td>
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<tr>
<td>M</td>
<td>DIN W72×H72mm</td>
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<td>H</td>
<td>DIN W48×H46mm</td>
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<td>W</td>
<td>DIN W96×H48mm</td>
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<tr>
<td>L</td>
<td>DIN W96×H96mm</td>
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<tr>
<td>4</td>
<td>9999 (4digit)</td>
<td>C</td>
<td>Set by touch switch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>Temperature controller</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

※1. It is unavailable for TC4SP, TC4Y.
※2. 11pin socket (PG-11, PS-11) for TC4SP: sold separately.

**Specifications**

<table>
<thead>
<tr>
<th>Series</th>
<th>TC4S</th>
<th>TC4SP</th>
<th>TC4Y</th>
<th>TC4M</th>
<th>TC4W</th>
<th>TC4H</th>
<th>TC4L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>AC power</td>
<td>100-240VAC 50/60Hz</td>
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<td></td>
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<tr>
<td></td>
<td>AC/DC power</td>
<td>24VAC 50/60Hz, 24-48VDC</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Allowable voltage range</td>
<td>90 to 110% of rated voltage</td>
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<tr>
<td>Power consumption</td>
<td>AC power</td>
<td>Max. 5VA(100-240VAC 50/60Hz)</td>
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<tr>
<td></td>
<td>AC/DC power</td>
<td>Max. 5VA(24VAC 50/60Hz), Max. 3W(24-48VDC)</td>
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</tr>
<tr>
<td>Display method</td>
<td>7Segment(red), Other display part(green, yellow, red) LED method</td>
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<td></td>
<td></td>
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<tr>
<td>Character size (W×H)</td>
<td>7.0×15.0mm</td>
<td>7.4×15.0mm</td>
<td>9.5×20.0mm</td>
<td>9.5×20.0mm</td>
<td>7.0×14.6mm</td>
<td>11.0×22.0mm</td>
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<tr>
<td>Input type</td>
<td>RTD</td>
<td>DPh100Ω, Cu500Ω(allowable line resistance max. 50Ω per a wire)</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Thermocouple</td>
<td>K(CA), J(IC), L(IC)</td>
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<td></td>
<td></td>
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<tr>
<td>Display accuracy※1</td>
<td>RTD</td>
<td>At room temperature(23℃±5℃): (PV ±0.5% or ±1℃, select the higher one) ±1digit</td>
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<tr>
<td></td>
<td>Thermocouple</td>
<td>※1: Thermocouple L(IC) type, RTD Cu500Ω</td>
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<tr>
<td></td>
<td></td>
<td>※2: Out of room temperature range: (PV ±0.5% or ±2℃, select the higher one) ±1digit</td>
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</tbody>
</table>

※1: Thermocouple L(IC) type, RTD Cu500Ω
- At room temperature (23℃±5℃): (PV ±0.5% or ±1℃, select the higher one) ±1digit
- Out of room temperature range: (PV ±0.5% or ±4℃, select the higher one) ±1digit
- In case of TC4SP Series, ±1℃ will be added.
## Specifications

<table>
<thead>
<tr>
<th>Series</th>
<th>TC4S</th>
<th>TC4SP</th>
<th>TC4Y</th>
<th>TC4M</th>
<th>TC4W</th>
<th>TC4H</th>
<th>TC4L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control output</td>
<td>Relay 250VAC 3A 1a</td>
<td>SSR 12VDC ±2V 20mA Max.</td>
<td>Relay 250VAC 1A 1a</td>
<td>Relay 250VAC 1A 1a</td>
<td>Relay 250VAC 1A 1a</td>
<td>Relay 250VAC 1A 1a</td>
<td>Relay 250VAC 1A 1a</td>
</tr>
<tr>
<td>Sub output</td>
<td>AL1, AL2 relay output: 250VAC 1A 1a(※TC4SP, TC4Y have AL1 only.)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Control method</td>
<td>ON/OFF and P, PI, PD, PID control</td>
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<td></td>
<td></td>
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<tr>
<td>Hysteresis</td>
<td>1 to 100°C/°F (0.1 to 50.0°C/°F) variable</td>
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<tr>
<td>Proportional band (P)</td>
<td>0.1 to 999.9°C/°F</td>
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<tr>
<td>Integral time (I)</td>
<td>0 to 9999 sec.</td>
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<tr>
<td>Derivative time (D)</td>
<td>0 to 9999 sec.</td>
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<tr>
<td>Control period (T)</td>
<td>0.5 to 120.0 sec.</td>
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<tr>
<td>Manual reset</td>
<td>0.0 to 100.0%</td>
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<tr>
<td>Sampling period</td>
<td>100ms</td>
<td></td>
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<tr>
<td>Dielectric strength</td>
<td>AC power 2,000VAC 50/60Hz for 1min.(between input terminal and power terminal)</td>
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<tr>
<td></td>
<td>AC/DC power 1,000VAC 50/60Hz for 1min.(between input terminal and power terminal)</td>
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<tr>
<td>Vibration</td>
<td>0.75mm amplitude at frequency of 5 to 55Hz(for 1 min.) in each of X, Y, Z directions for 2 hours</td>
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<tr>
<td>Relay life cycle</td>
<td>Mechanical OUT: Over 5,000,000 times, AL1/2: Over 5,000,000 times</td>
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<tr>
<td></td>
<td>Electrical OUT: Over 200,000 times(250VAC 3A resistive load)</td>
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<tr>
<td></td>
<td>AL1/2: Over 300,000 times(250VAC 1A resistive load)</td>
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<td></td>
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<tr>
<td>Insulation resistance</td>
<td>Min. 100MΩ(at 500VDC megger)</td>
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<tr>
<td>Noise resistance</td>
<td>±2kV R-phase, S-phase the square wave noise (pulse width: 1us) by the noise simulator</td>
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<tr>
<td>Memory retention</td>
<td>Approx. 10 years (when using non-volatile semiconductor memory type)</td>
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</tr>
<tr>
<td>Environment</td>
<td>Ambient temperature -10 to 50°C, storage: -20 to 60°C</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Ambient humidity 35 to 85%RH, storage: 35 to 85%RH</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Insulation type</td>
<td>Double insulation or reinforced insulation (mark: )</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Approval</td>
<td>(Except for AC/DC power type)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Unit weight</td>
<td>Approx. 97g</td>
<td>Approx. 84g</td>
<td>Approx. 127g</td>
<td>Approx. 127g</td>
<td>Approx. 118g</td>
<td>Approx. 118g</td>
<td>Approx. 172g</td>
</tr>
</tbody>
</table>

※Environment resistance is rated at no freezing or condensation.

## Connections

※TC4 Series has selectable control output; Relay output, and SSRP output. AC/DC power type has Relay output and SSR output and it is selectable.

### TC4S

- SSR OUT: 12VDC ±2V 20mA Max.
- AL1 OUT: 250VAC 1A 1a
- AL2 OUT: 250VAC 1A 1a

### TC4SP

- Relay OUT: 250VAC 3A 1a
- SSR OUT: 12VDC ±2V 20mA Max.
- SOURCE: 100-240VAC 5VA 50/60Hz, 24VAC 5VA 50/60Hz, 24-48VDC 3W

### TC4W

- AL1 OUT: 250VAC 1A 1a
- AL2 OUT: 250VAC 1A 1a
- Relay OUT: 250VAC 3A 1a
- SOURCE: 100-240VAC 5VA 50/60Hz, 24VAC 5VA 50/60Hz, 24-48VDC 3W

※1: AC power: 100-240VAC 5VA 50/60Hz
AC/DC power: 24VAC 5VA 50/60Hz, 24-48VDC 3W
TC Series

**TC4M**

1. SSR OUT: 12VDC ±2V 20mA Max.
2. AL1 OUT: 250VAC 1A 1a
3. Relay OUT: 250VAC 3A 1a

**TC4H/L**

1. SSR OUT: 12VDC ±2V 20mA Max.
2. AL1 OUT: 250VAC 1A 1a
3. Relay OUT: 250VAC 1A 1a

**Dimensions** (unit: mm)

**TC4S**

- Panel cut-out: Min. 65
- Terminal cover: Min. 65

**TC4SP**

- Panel cut-out: Min. 65

**TC4Y**

- Panel cut-out: Min. 91

**TC4M**

- Panel cut-out: Min. 90

※1: • AC power: 100-240VAC 5VA 50/60Hz
• AC/DC power: 24VAC 5VA 50/60Hz, 24-48VDC 3W

SOURCE: 100-240VAC 5VA 50/60Hz, 24VAC 5VA 50/60Hz, 24-48VDC 3W

SOURCE: 100-240VAC 5VA 50/60Hz, 24VAC 5VA 50/60Hz, 24-48VDC 3W

SOURCE: 100-240VAC 5VA 50/60Hz, 24VAC 5VA 50/60Hz, 24-48VDC 3W

SOURCE: 100-240VAC 5VA 50/60Hz, 24VAC 5VA 50/60Hz, 24-48VDC 3W
Economical PID Control

● TC4W
   <Bracket>

● TC4H
   <Bracket>

● TC4L
   <Bracket>

● Terminal cover(sold separately)
   ● RSA-COVER (48×48mm)
   ● RMA-COVER (72×72mm)
   ● RHA-COVER (48×96mm)
   ● RLA-COVER (96×96mm)

Product mounting
● TC4S/SP(48×48mm) Series  ● TC4Y(72×36mm) Series  ● Other Series

※Mount the product on the panel, fasten bracket by pushing with tools as shown above.
(In case of TC4Y, fasten bolts for bracket.)
1. **Present temperature (PV) display**
   - **RUN mode**: Present temperature (PV) display.
   - **Parameter setting mode**: Parameter or parameter setting value display.

2. **Deviation indicator, Auto-tuning indicator**
   It shows current temperature (PV) deviation based on set temperature (SV) by LED.
   
<table>
<thead>
<tr>
<th>No</th>
<th>PV deviation temp.</th>
<th>Deviation display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Over 2°C</td>
<td>▲ lamp on</td>
</tr>
<tr>
<td>2</td>
<td>Below ±2°C</td>
<td>■ lamp on</td>
</tr>
<tr>
<td>3</td>
<td>Under -2°C</td>
<td>▼ lamp on</td>
</tr>
</tbody>
</table>
   
   Deviation indicator (▲, ■, ▼) is flashed by every 1 sec when operating auto tuning.

3. **Set temperature (SV) indicator**
   Press any front key once to check or change current set temperature (SV), set temperature (SV) indicator is on and preset set value is flashed.

4. **Temperature unit (°C/°F) indicator**
   It shows current temperature unit.

5. **Control/alarm output indicator**
   - **OUT**: It will turn ON when control output (Main Control Output) is ON.
   - In case of CYCLE/PHASE control of SSR drive output, it will turn ON when MV is over 3.0%. (only for AC voltage type)
   - **AL1/AL2**: It will light up when alarm output Alarm1/Alarm2 are on.

6. **Mode key**
   Used when entering into parameter setting group, returning to RUN mode, moving parameter, and saving setting values.

7. **Adjustment**
   Used when entering into set value change mode, digit moving and digit up/down.

8. **FUNCTION key**
   Press the + keys for 3 sec. to operate function (RUN/STOP, alarm output cancel) set in inner parameter [DI-K].
   - Press the + keys at the same time in set value operation to move digit. (only for TC4Y Series)

### Input type and range

<table>
<thead>
<tr>
<th>Input sensor</th>
<th>Display</th>
<th>Input range (°C)</th>
<th>Input range (°F)</th>
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</thead>
<tbody>
<tr>
<td>Thermocouple</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>K(CA)</td>
<td>-50 to 1200</td>
<td>-58 to 2192</td>
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<tr>
<td>J(IC)</td>
<td>-30 to 500</td>
<td>-22 to 932</td>
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</tr>
<tr>
<td>L(IC)</td>
<td>-40 to 800</td>
<td>-40 to 1472</td>
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<tr>
<td>RTD</td>
<td></td>
<td></td>
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<tr>
<td>DPH100Ω</td>
<td>-100 to 400</td>
<td>-148 to 752</td>
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<tr>
<td>Cu50Ω</td>
<td>-50 to 200</td>
<td>-58 to 392</td>
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### Factory default

#### SV setting

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<th>Parameter</th>
<th>Factory default</th>
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#### Parameter 1 group

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<tr>
<th>Parameter</th>
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<tr>
<td>RL1</td>
<td>1250</td>
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<tr>
<td>RL2</td>
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</tr>
<tr>
<td>P</td>
<td>0.100</td>
</tr>
<tr>
<td>I</td>
<td>00000</td>
</tr>
<tr>
<td>R5k</td>
<td>05000</td>
</tr>
<tr>
<td>HYS</td>
<td>002</td>
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</table>

#### Parameter 2 group

<table>
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<th>Parameter</th>
<th>Factory default</th>
<th>Parameter</th>
<th>Factory default</th>
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<tbody>
<tr>
<td>I_n - t</td>
<td>°C</td>
<td>t</td>
<td>0200</td>
</tr>
<tr>
<td>Unit k</td>
<td>°C</td>
<td>z</td>
<td>R - i</td>
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<td>R³</td>
<td>R³</td>
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<tr>
<td>R³F</td>
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<td>R³ - 2</td>
<td>R³</td>
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<td>L - S</td>
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<td>R³ - 5</td>
<td>R³</td>
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<td>H - S</td>
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<td>LbRb</td>
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<tr>
<td>α - F</td>
<td>HERb</td>
<td>LbRb</td>
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<td>C - Rd</td>
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<td>d¹ - b</td>
<td>5t aP</td>
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<td>oUk</td>
<td>rLY</td>
<td>Er³, aP</td>
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</tbody>
</table>

*AC/DC power type has no SSR drive output method selection [SSrM] function and supports only ON/OFF output when selecting S3r³ in control output setting function [oUt].
Economical PID Control

**SV setting**

※ In case of changing set temperature from 210°C to 250°C.

1. **RUN mode (display a current temperature)**
   - Press any key among MODE.

2. **Set value change mode**
   - Change set value by keys.

3. **Finish the setup.**
   - Press any key among MODE.

4. **Check SV**
   - Press any key among MODE.

**Flow chart for setting group**

1. **Press any key among MODE**
2. **Mode 2 sec.**
3. **Mode 4 sec.**
4. **Mode 3 sec.**
5. **Mode 3 sec.**

- **Run mode**
- **Parameter 1 group [PAR 1]**
- **Parameter 2 group [PAR 2]**

※: Not displayed for AC/DC power type.
※: If no key entered for 30 sec., it returns to RUN mode automatically and the set value of parameter is not be saved.
※: This parameter might not be displayed depending on other parameter settings.

1. Press any key once in RUN mode, it advances to set value setting group.
2. Press MODE key over 2 sec. in RUN mode, it advances to setting group 1.
3. Press MODE key over 4 sec. in RUN mode, it advances to setting group 2.
4. First parameter will be displayed on viewer when it advances to the setting group.
5. Press MODE key over 3 sec. in setting group, it returns to RUN mode.

Exception: Press MODE key once in SV setting group it returns to RUN mode.

※: Press MODE key again within a sec after return to RUN mode by press MODE key over 3 sec., it advances to the first parameter of previous setting group.

※: Parameter setup

- **Parameter 2 group**
- **Parameter 1 group**
- **SV setting**

※: Set parameter as the above considering parameter relation of each setting group.
※: Check parameter set value after change parameter of setting group 2.

※: Indicator type displays shaded parameter([ ]) of setting group 2.

※: AL1, AL2 parameter of setting group 2 is decided whether to display according by alarm output type.

※: AL1 alarm operation mode
- AL2 alarm operation mode
- Control output type
- SSR drive output method
- Control cycle
- AL1 alarm temperature
- AL2 alarm temperature
- Auto tuning ON/OFF
- Proportional band
- Derivative time
- Manual reset (Normal deviation correction)
- Temperature unit
- Input sensor
- Input correction
- Input digital filter
- SV low-limit value
- SV high-limit value
- Control output operation
- Control type
- Control output MV in case of input break error
- Lock
- LBA monitoring time
- LBA detection range
- Control output operation
- Digital key operation
- ON/OFF control hysteresis

H-59
### Parameter 1 group

- **Run mode**
  - Press any key among [S1], [S2], [S3] for 3 sec. to return RUN mode at any parameter.
  - Press [MODE] key for 3 sec. to move to next parameter automatically.

- **AL1 alarm temperature**
  - Set range: Deviation alarm (-[F.S] to [F.S]), Absolute value alarm (temperature range)

- **AL2 alarm temperature**
  - In case alarm operation mode [AL-1, AL-2], AM) / SBa / LBa of setting group 2 is set to [AL-1, AL-2], no parameters is displayed.

- **Auto-tuning**
  - It starts to operate auto-tuning when it is ON and set as OFF automatically after finish the operation.
  - Deviation indicator (▲, ■, ▼) will be flashing (cycle: 1 sec.) during auto tuning function.

- **Proportional band**
  - Set range: 0.1 to 999.9℃/℉

- **Integral time**
  - Set range: 0 to 9999 sec.
  - Integral operation will be OFF when set value is "0".

- **Derivation time**
  - Set range: 0 to 9999 sec.
  - Derivative operation will be OFF when set value is "0".

- **Manual reset**
  - Set range: 0.0 to 100.0%
  - It is displayed in P/PD control.

- **Hysteresis**
  - Set range: 1 to 100.0℃/℉ (0.1 to 50.0℃/℉)
  - It is displayed when control type parameter [C-MD] of parameter 2 group is set to PID.

### Parameter 2 group

- **Run mode**
  - Press any key among [S1], [S2], [S3] for 3 sec. to return RUN mode at any parameter.
  - Press [MODE] key for 3 sec. to move to next parameter automatically.

- **Input type**
  - Set range: -999 to 999 (CPtL / CUSL: -199.9 to 999.9)

- **Temperature unit**
  - Front temperature unit indicator will flash when selecting the unit.

- **Input correction**
  - Set range: -999 to 999 (dPtL / CUSL: -199.9 to 999.9)

- **Input digital filter**
  - Set range: 0.1 to 120.0 sec.
  - Set input digital filter time for average input value affected control, and display value.
### Economical PID Control

- **SV low-limit value:** L-SV
- **SV high-limit value:** H-SV
- **Control output operation:** a-Fe
- **Control type:** L-αd
- **Control output type:** rLy
- **SSR drive output method:** Stnd
- **Control cycle:** 0200
- **AL1 alarm operation mode:** RL-1
- **AL2 alarm operation mode:** RL-2
- **Alarm output hysteresis:** RHYS
- **LBA monitoring time:** LbRt
- **LBA detection band:** LBaB
- **Digital input key:** dI-ν
- **Control output MV in case of input break error:** ErLb
- **Lock:** LoL

#### Notes:
- In case of [H-T] input sensor type, low/high-limit setting temperature (SV) is also set as max./min. temperature range of input sensor.
- It is displayed when selecting control output [aLy] as LrLy.
- AC/DC power type has no SSR drive output method setting function.
- Press [x] key to convert alarm operation mode into alarm option.
- Refer to H-62 page.
- Same with the above [RL - 1].
- Set range: 1 to 100°C/Fu (FtL / CbL: 0.1 to 50.0°C)
- Set range: 0 to 9999sec. (Automatically setting with Auto-tunning)
- Set range: 0 to 9999°C/F (FuL / UsL: 0.0 to 999.9°C/F)
- Set range: 0 to 999°C/F (FuL / UsL: 0.0 to 999.9°C/F)
- Set range: 0.0 to 100.0% (0.0/100.0% is displayed when control type parameter [L-αd] of setting group 2 is set as LαF).
- For indicator model (TC4□□□□N), only off, loc 1 are available.
Functions

Alarm [RL - 1 / RL - 2]

There are two alarms which operate individually. You can set combined alarm operation and alarm option. Use digital input key (set as $RL-E$) or turn OFF power and re-start this unit to release alarm operation.

### Alarm operation

<table>
<thead>
<tr>
<th>Mode</th>
<th>Name</th>
<th>Alarm operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mathcal{A}$</td>
<td>—</td>
<td>—</td>
<td>No alarm output</td>
</tr>
<tr>
<td>$\mathcal{A}$</td>
<td>Deviation high-limit alarm</td>
<td>OFF H ON</td>
<td>If deviation between PV and SV as high-limit is higher than set value of deviation temperature, the alarm output will be ON.</td>
</tr>
<tr>
<td>$\mathcal{A}$</td>
<td>Deviation low-limit alarm</td>
<td>ON H OFF</td>
<td>If deviation between PV and SV as low-limit is higher than set value of deviation temperature, the alarm output will be ON.</td>
</tr>
<tr>
<td>$\mathcal{A}$</td>
<td>Deviation high/low-limit alarm</td>
<td>ON H OFF</td>
<td>If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be ON.</td>
</tr>
<tr>
<td>$\mathcal{A}$</td>
<td>Deviation high/low-limit reserve alarm</td>
<td>OFF H OFF</td>
<td>If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be OFF.</td>
</tr>
<tr>
<td>$\mathcal{A}$</td>
<td>Absolute value high limit alarm</td>
<td>OFF H ON</td>
<td>If PV is higher than the absolute value, the output will be ON.</td>
</tr>
<tr>
<td>$\mathcal{A}$</td>
<td>Absolute value low limit alarm</td>
<td>ON H OFF</td>
<td>If PV is lower than the absolute value, the output will be ON.</td>
</tr>
<tr>
<td>$\mathcal{B}$</td>
<td>Sensor break Alarm</td>
<td>—</td>
<td>It will be ON when it detects sensor disconnection.</td>
</tr>
<tr>
<td>$\mathcal{B}$</td>
<td>Loop break Alarm</td>
<td>—</td>
<td>It will be ON when it detects loop break.</td>
</tr>
</tbody>
</table>

### Alarm option

<table>
<thead>
<tr>
<th>Mode</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mathcal{A}$</td>
<td>Standard alarm</td>
<td>If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.</td>
</tr>
<tr>
<td>$\mathcal{B}$</td>
<td>Alarm latch</td>
<td>If it is an alarm condition, alarm output is ON and maintains ON status.</td>
</tr>
<tr>
<td>$\mathcal{C}$</td>
<td>Standby sequence1</td>
<td>First alarm condition is ignored and from second alarm condition, standard alarm operates.</td>
</tr>
<tr>
<td>$\mathcal{D}$</td>
<td>Alarm latch and standby sequence1</td>
<td>If it is an alarm condition, it operates both alarm latch and standby sequence. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, standard alarm operates.</td>
</tr>
<tr>
<td>$\mathcal{E}$</td>
<td>Standby sequence2</td>
<td>First alarm condition is ignored and from second alarm condition, standard alarm operates. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, standard alarm operates.</td>
</tr>
<tr>
<td>$\mathcal{F}$</td>
<td>Alarm latch and standby sequence2</td>
<td>Basic operation is same as alarm latch and standby sequence1. It operates not only by power ON/OFF, but also alarm setting value, or alarm option changing. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, alarm latch operates.</td>
</tr>
</tbody>
</table>

Condition of re-applied standby sequence for standby sequence 1, alarm latch and standby sequence 1: Power ON
Condition of re-applied standby sequence for standby sequence 2, alarm latch and standby sequence 2: Power ON, changing set temperature, alarm temperature[RL 1, RL 2] or alarm operation[RL - 1, RL - 2], switching STOP mode to RUN mode.

Sensor break alarm

The function that alarm output will be ON when sensor is not connected or when sensor’s disconnection is detected during temperature controlling. You can check whether the sensor is connected with buzzer or other units using alarm output contact. It is selectable between standard alarm [SBaA], or alarm latch [SBaB].
Economical PID Control

◎ Loop break alarm (LBA)

It checks control loop and outputs alarm by temperature change of the subject. For heating control (cooling control), when control output MV is 100% (0% for cooling control) and PV is not increased over than LBA detection band \([LBaB]\) during LBA monitoring time \([LBaT]\), or when control output MV is 0% (100% for cooling control) and PV is not decreased below than LBA detection band \([LBaB]\) during LBA monitoring time \([LBaT]\), alarm output turns ON.

Start control to ①: When control output MV is 0% and PV is not decreased below than LBA detection band \([LBaB]\) during LBA monitoring time \([LBaT]\).

① to ②: The status of changing control output MV (LBA monitoring time is reset.)

② to ③: When control output MV is 0% and PV is not decreased below than LBA detection band \([LBaB]\) during LBA monitoring time \([LBaT]\), loop break alarm (LBA) turns ON after LBA monitoring time.

③ to ④: Control output MV is 0% and loop break alarm (LBA) turns and maintains ON.

④ to ⑤: The status of changing control output MV (LBA monitoring time is reset.)

⑤ to ⑥: When control output MV is 100% and PV is not increased over than LBA detection band \([LBaB]\) during LBA monitoring time \([LBaT]\), loop break alarm (LBA) turns ON after LBA monitoring time.

⑥ to ⑦: When control output MV is 100% and PV is increased over than LBA detection band \([LBaB]\) during LBA monitoring time \([LBaT]\), loop break alarm (LBA) turns OFF after LBA monitoring time.

⑦ to ⑧: The status of changing control output MV (LBA monitoring time is reset.)

※When executing auto-tuning, LBA detection band \([LBaB]\) and LBA monitoring time are automatically set based on auto tuning value. When alarm operation mode \([RL1, RL2]\) is set as loop break alarm (LBA) \([LBaT]\), LBA detection band \([LBaB]\) and LBA monitoring time \([LBaT]\) parameter is displayed.

◎ SSR drive output function (SSRP function) \([SSr\_\_\_]\)

- Realizing high accuracy and cost effective temperature control with both current output (4-20mA) and linear output (cycle control and phase control)
- SSRP output is selectable one of standard ON/OFF control, cycle control, phase control by utilizing standard SSR drive voltage output.
- Select one of standard ON/OFF control \([STND]\), cycle control \([CYCL]\), phase control \([PHAS]\) at \([SSr\_\_\_]\) parameter of setting 2 group. For cycle control, connect zero cross turn-on SSR (random turn-on SSR is also available). For phase control, connect random turn-on SSR.

※When selecting phase or cycle control mode, the power supply for load and temperature controller must be the same.

※In case of selecting PID control type and phase \([PHAS]\) / cycle \([CYCL]\) control output modes, control cycle \([e]\) is not allowed to set.

※For AC/DC power model (TC4□□□2R), this parameter is not displayed and it is available only standard control by relay or SSR.
TC Series

- **Standard ON/OFF control mode [STND]**
  A mode to control the load in the same way as Relay output type.
  (ON: output level 100%, OFF: output level 0%)

- **Cycle control mode [CYCL]**
  A mode to control the load by repeating output ON / OFF according to the rate of output within setting cycle.
  Having improved ON / OFF noise feature by Zero Cross type.

- **Phase control mode [PHAS]**
  A mode to control the load by controlling the phase within AC half cycle. Serial control is available.
  RANDOM Turn-on type SSR must be used for this mode.

**Auto tuning [AT]**
- When setting AT parameter to ON, front temperature unit display(°C or °F) lamp will be flickering during Auto tuning. After completing auto tuning, temperature unit display lamp returns to normal operation and AT parameter automatically becomes [OFF → OFF].
- Set as OFF to stop auto tuning.
- If SV is changed during auto tuning mode, auto tuning is stopped.
- PID time constants figured out through auto tuning function can be changed.
- If control method [C-MD] is set to ONOFF, no parameters are displayed.
- Finish auto tuning when [OFF] error occurs during the operation.
- In case of [OFF] error, auto tuning operation is not applicable.

**Input correction [IN-B]**
- Input correction is to correct deviation occurred from temperature sensor such as thermocouples, RTD etc. If you check the deviation of every temperature sensor precisely, it can measure temperature accurately.
- Use this mode after measuring deviation occurred from temperature sensor exactly. Because if measured deviation value is not corrected, displayed temperature may be too high or too low.
- When you set the Input revise value, you may need to record it, because it will be useful when performing maintenance.

**Input digital filter [MAvF]**
- A function to filter input signals for more stable PV display in order to provide stable control output. If noise occurs on input signals or PV value keeps changing, it gets difficult to perform high accuracy control since PV has a direct effect on output level.

**Control method selection [C-MD]**
- It is selectable PID, ON/OFF control.
- In case of ON/OFF [ONOFF] mode, Hysteresis [HYS] parameter is displayed.
- In case of PID [PID] mode, Proportional band [P], Integral time [I], and Derivative time [D] parameters are displayed.

**Hysteresis [HYS]**
- Set control output ON / OFF interval in ON / OFF control mode.
- If Hysteresis is too narrow, hunting(oscillation, chattering) could occur due to external noise.
- In case of ON / OFF control mode, even if PV reaches stable status, there still occurs hunting. It could be due to Hysteresis [HYS] SV, load’s response characteristics or sensor’s location. In order to reduce hunting to a minimum, it is required to take into following factors consideration when designing temp. controlling: proper Hysteresis [HYS], heater’s capacity, thermal characteristics, sensor’s response and location.

**Temperature unit selection [UNIT]**
- A function to select display temperature unit.
- Unit display lamp will be ON when converting temperature unit.
**Economical PID Control**

**Manual reset [ r E S t ]**
When selecting P/PD control mode, certain temperature difference exists even after PV reaches stable status because heater’s rising and falling time is inconsistent due to thermal characteristics of controlled objects, such as heat capacity, heater capacity. This temperature difference is called offset and manual reset [ r E S t ] function is to set/ correct offset.

- When PV and SV are equal, reset value is 50.0%. After control is stable, PV is lower than SV, reset value is over 50.0% or PV is higher than SV, reset value is below 50.0%.
- Manual reset [ r E S t ] by control result

![Set below 50.0 as reset value](image)

※Manual reset function is applicable only to P / PD control mode.

**Cool / Heat function [ O - F t ]**
Generally there are two ways to control temperature, one (Heat-function) is to heat when PV is getting down(Heater). The other(Cool-function) is to cool when PV is getting higher (Freezer).

These functions are operating oppositely when it is ON/ OFF control or proportional control. But in this case PID time constant will be different due to PID time constant will be decided according to control system when it is PID control.

- Cool-function [ C o o l ] and heat-function [ H E a t ] must be set correctly according to the application, if set as opposite function, it may cause a fire. (If set cool-function [ C o o l ] at heater, it will be maintained ON and it may cause a fire.)
- Avoid changing heat-function to cool-function or cool-function to heat-function when the unit is operating.
- It is impossible to operate both function at once in this unit. Therefore, only one function should be selected only.

**SV High/Low limit [ L - 5 u / H - 5 u ]**
- It sets SV high/low limit Limit range of using temperature within temperature range for each sensor, user can set/ change set temperature(SV) within SV high limit [ H - 5 u ] to SV low limit [ L - 5 u ]. (※ L - 5 u > H - 5 u cannot be set.)
- When changing input type [ t n - t ], SV high limit [ H - 5 u ] and SV low limit [ L - 5 u ] of using temperature will be initialized as max./min. value of sensor temperature range automatically.

**Digital input key( + 3sec.) [ d l - b ]**
Press ( + ) keys for 3 sec. at the same time and it operates RUN/STOP function[ S t o p ] which is set at d l - b or alarm clear function[ R e s t ].

**RUN/STOP function [ S t o p ]**
It is allowed for users to select RUN / STOP in RUN mode.
- When it is required to stop control output temporarily (e.g., during maintenance work), use S t o p command to stop control output.(auxiliary output is normally provided as setting values.)
- In case of STOP mode, S t o p parameter and PV value is flashing in turn on display part.
- When power is off in "STOP" mode, ‘STOP’ mode will be kept after Power is supplied again. (in order to return to normal control operation, make ‘STOP’ mode OFF using front keys.)

**Alarm reset [ R e s t ]**
A function to reset or initialize alarm output by force while alarm output is ON. Applicable only to Alarm latch[ A l r a y ] and Alarm latch and standby sequence[ A l r e ] mode.
※If PV value is within alarm output range, this function is not available.

**Lock setting [ L o c ]**
A function to prevent changing SV and parameters of each setting group. Parameter setting values are still possible to check while Lock mode is ON.

**Error**

![Diagram](image)

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
<th>Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>oPEn</td>
<td>Flashes if input sensor is disconnected or sensor is not connected.</td>
<td>Check input sensor state.</td>
</tr>
<tr>
<td>HHHHH</td>
<td>Flashes if measured sensor input is higher than temperature range.</td>
<td>When input is within the rated temperature range, this display disappears.</td>
</tr>
<tr>
<td>LLLL</td>
<td>Flashes if measured sensor input is lower than temperature range.</td>
<td></td>
</tr>
</tbody>
</table>
TC Series

Output connections

See H-139 page for output.

Application of relay output type

Keep A length as long as possible when wiring the temperature controller and the load. If wire length of A is short, counter electromotive force which occurs from a coil of magnet switch & power relay may flow in power line of the unit, and it may cause malfunction.

If wire length of A is short, please connect mylar condensers 104(630V) on both ends of "©" (magnet coil) to protect electromotive force.

Application of SSR drive output method

※ SSR should be selected by the capacity of load, otherwise, it may short-circuit and result in a fire. Indirect heated should be used with SSR for efficient working.
※ Please use a cooling plate or it may cause the capability deterioration, breakdown of SSR for a long usage.
※ Refer to the H-63 page for phase/cycle control connections.

Proper usage

Simple "error" diagnosis

● When the load (Heater etc) is not operated

Please check operation of the OUT lamp located in front panel of the unit.
If the OUT lamp does not operate, please check the parameter of all programmed mode.
If lamp is operating, please check the output(Relay, SSR drive voltage) after separating output line from the unit.

● When it displays OPEN during operation

This is a warning that external sensor is open.
Please turn off the power and check the wire state of the sensor. If sensor is not open disconnect sensor line from the unit and short the input +, - terminal. Turn on the power of the unit and check the controller displays room temperature.
If this unit cannot display room temperature, this unit is broken. Please remove this unit and contact our service center. (When the input mode is thermocouple, it is available to display room temperature.)

Caution for using

● The connection wire of this unit should be separated from the power line and high voltage line in order to prevent from inductive noise.

● For crimp terminal, select following shaped terminal (M3)

● Please install power switch or circuit-breaker in order to cut power supply off.

● The switch or circuit-breaker should be installed near by users.

● This unit is designed for temperature controlling only. Do not apply this unit as a voltage meter or a current meter.

● In case of using RTD sensor, 3-wire type must be used.
If you need to extend the line, 3-wires must be used with the same thickness as the line. It might cause temperature difference if the resistance of line is different.

● In case of making power line and input signal line close, line filter for noise protection should be installed at power line and input signal line should be shielded.

● Keep away from the high frequency instruments.(High frequency welding machine & sewing machine, big capacitive SCR controller)

● When supplying measured input, if HHHH or LLLL is displayed, measured input may have problem. Turn off the power and check the line.

● Installation environment
  • It shall be used indoor.
  • Altitude Max. 2000m.
  • Pollution Degree 2
  • Installation Category II.