

# TK Series

## Simultaneous Heating&Cooling Output PID Temperature Controllers

User Manual MCT-TKU1-V3.5-EN

Thank you for purchasing an Autonics 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.

**Autonics**



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# Preface

Thank you for purchasing Autonics products.

Be sure to read and follow the **Safety Precautions** thoroughly before use.

This manual contains information about the product and how to use it properly, so keep it in a place where users can easily find it.



# Manual Guide

- Use the product after fully reading the contents of the manual.
- The manual explains the product functions in detail and does not guarantee the contents other than the manual.
- Any or all of the manual may not be edited or copied without permission.
- The manual is not provided with the product.
- Download and use from our website ([www.autonics.com](http://www.autonics.com)).
- The contents of the manual are subject to change without prior notice according to the improvement of the product's performance, and upgrade notices are provided through our website.
- We put a lot of effort to make the contents of the manual a little easier and more accurate. Nevertheless, if you have any corrections or questions, please feel free to comment through our website.



# Common Symbols in the Manual



Failure to follow instructions may result in serious injury or death.



Failure to follow instructions may result in injury or product damage.



Supplementary explanation of the function



Example of that function



Important information about the feature



# Safety Considerations

- Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.
- Symbol ! indicates caution due to special circumstances in which hazards may occur.



Failure to follow instructions may result in serious injury or death.



Failure to follow instructions may result in injury or product damage.

## **WARNING**

1. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss.(e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.)  
Failure to follow this instruction may result in personal injury, economic loss or fire.
2. Do not use or store the unit in the place where flammable/explosive/corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact or salinity may be present.  
Failure to follow this instruction may result in explosion or fire.
3. Install on a device panel to use.  
Failure to follow this instruction may result in electric shock.
4. Do not connect, repair, or inspect the unit while connected to a power source.  
Failure to follow this instruction may result in fire or electric shock.
5. Check 'Connections' before wiring.  
Failure to follow this instruction may result in fire.
6. Do not disassemble or modify the unit.  
Failure to follow this instruction may result in fire or electric shock.

## CAUTION

1. When connecting the power input and relay output, use AWG 20 (0.50 mm<sup>2</sup>) cable or over, and tighten the terminal screw with a tightening torque of 0.74 to 0.90 N m. When connecting the sensor input and communication cable without dedicated cable, use AWG 28 to 16 cable and tighten the terminal screw with a tightening torque of 0.74 to 0.90 N m.  
Failure to follow this instruction may result in fire or malfunction due to contact failure.
2. Use the unit within the rated specifications.  
Failure to follow this instruction may result in fire or product damage
3. Use a dry cloth to clean the unit, and do not use water or organic solvent.  
Failure to follow this instruction may result in fire or electric shock.
4. Keep the product away from metal chip, dust, and wire residue which flow into the unit.  
Failure to follow this instruction may result in fire or product damage.

## Cautions during Use

1. Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
2. Check the polarity of the terminals before wiring the temperature sensor. For RTD temperature sensor, wire it as 3-wire type, using cables in same thickness and length.  
For thermocouple (TC) temperature sensor, use the designated compensation wire for extending wire.
3. Keep away from high voltage lines or power lines to prevent inductive noise. In case installing power line and input signal line closely, use line filter or varistor at power line and shielded wire at input signal line. Do not use near the equipment which generates strong magnetic force or high frequency noise.
4. Do not apply excessive power when connecting or disconnecting the connectors of the product.
5. Install a power switch or circuit breaker in the easily accessible place for supplying or disconnecting the power.
6. Do not use the unit for other purpose (e.g. voltmeter, ammeter), but temperature controller.
7. When changing the input sensor, turn off the power first before changing. After changing the input sensor, modify the value of the corresponding parameter.
8. Do not overlapping communication line and power line. Use twisted pair wire for communication line and connect ferrite bead at each end of line to reduce the effect of external noise.
9. Make a required space around the unit for radiation of heat. For accurate temperature measurement, warm up the unit over 20 min after turning on the power.

10. Make sure that power supply voltage reaches to the rated voltage within 2 sec after supplying power.
11. Do not wire to terminals which are not used.
12. This unit may be used in the following environments.
  - Indoors (in the environment condition rated in 'Specifications')
  - Altitude Max. 2,000 m
  - Pollution degree 2
  - Installation category II

The specifications, dimensions, etc are subject to change without notice for product improvement  
Some models may be discontinued without notice.

For your safety, read and follow the considerations written in the instruction manual, other manuals  
and Autonics website.



# 1. Simultaneous Heating&Cooling Output PID Temperature Controllers

## 1.1. Features

- 50 ms high-speed sampling rate and  $\pm 0.3\%$  display accuracy
- Simultaneous heating and cooling control function
- Switch between current output and SSR drive output
- SSR drive output (SSRP function) control options : ON/OFF control, cycle control, phase control
- Communication output models available : RS485 (Modbus RTU)
- Parameter configuration via PC (RS485 communication)
  - DAQMaster software included (comprehensive device management software)
  - Communication converter sold separately : SCM-US (USB to serial converter), SCM-38I (RS-232C to RS485 converter), SCM-US48I (USB to RS485 converter)
- User-friendly parameter features
- Heater disconnect alarm function (CT input)
  - Current transformer (CT) sold separately : CSTC-E80LN, CSTC-E200LN, CSTS-E80PP
- SV preset function (up to 4 set values) using digital input terminals
- Available in various DIN sizes : (48×24, 48×48, 72×72, 96×48, 48×96, 96×96 mm)
- Multi-input/multi-range

## 1.2. Ordering Information

This is only for reference, the actual product does not support all combinations.  
For selecting the specified model, follow the Autonics website.

**Model: T K ① ② - ③ ④ ⑤ ⑥**

### ① Digit

4: 4 digit

### ② Size

N: DIN W 48 × H 24 mm

SP: DIN W 48 × H 48 mm (11 pin plug type)

S: DIN W 48 × H 48 mm

M: DIN W 72 × H 72 mm

W: DIN W 96 × H 48 mm

H: DIN W 48 × H 96 mm

L: DIN W 96 × H 96 mm

### ③ Option in/output

Size: N		
PN	OUT2	Function
1	Normal type <sup>01)</sup>	Alarm 1 + CT input
	Heating&Cooling	Alarm 2
2	Normal type	Alarm 1 + Alarm 2
D	Normal type	Alarm 1 + Digital input 1/2
	Heating&Cooling	Digital input 1/2
R	Normal type	Alarm 1 + Transmission output
	Heating&Cooling	Transmission output
T	Normal type	Alarm 1 + RS485 communication
	Heating&Cooling	RS485 communication

Size: S, M, W, H, L	
PN	Function
1	Alarm 1
2	Alarm 1 + Alarm output 2
R	Alarm 1 + Transmission output
T	Alarm 1 + RS485 communication

Size: S, M, W, H, L	
<b>A</b>	Alarm 1 + Alarm 2 + Transmission output
<b>B</b>	Alarm 1 + Alarm 2 + RS485 communication
<b>D</b>	Alarm 1 + Alarm 2 + Digital input 1/2 <sup>02)</sup>

Size: SP	
PN	Function
<b>1</b>	Alarm 1

#### ④ Power supply

2: 24 VAC 50/60 Hz, 24-48 VDC

4: 100-240 VAC 50/60 Hz

#### ⑤ OUT1 Control output

R: Relay

S: SSR drive

C: Selectable current or SSR drive output

#### ⑥ OUT2 Control output

N: Normal type [No OUT2 (Heating or Cooling)]

R: Heating & Cooling type [Relay output] <sup>03)</sup>

C: Heating & Cooling type [Selectable current or SSR drive output] <sup>04)</sup>

01) The CT input model of TK4N can be selected only in the normal type model with alarm output 1. (except TK4SP)

02) Only for TK4S-D, OUT2 output terminal is used as DI-2 input terminal.

03) When operating mode is heating or cooling control, OUT2 can be used as alarm output 3 (except TK4N).

04) When operating mode is heating or cooling control, OUT2 can be used as transmission output 2.

## 1.3. Software: Comprehensive Management Software

### DAQMaster

DAQMaster is comprehensive device management program. It is available for parameter setting, monitoring.

Download the installation file and the manuals from the Autonics website.

## 1.4. Product Components and Sold Separately

### 1.4.1. Product Components

- Product (+ bracket)
- Instruction manual
- [TK4N] Terminal protection cover × 1



Before using the product, check that all of the above components are included. If it is damaged or any component is missing, please contact customer service center.

### 1.4.2. Sold Separately

- Current transformer (CT)
- 11-pin controller socket: PG-11, PS-11 (N)
- Terminal protection cover: RSA / RMA / RHA / RLA-COVER
- Communication Converter: SCM-US / SCM-38I / SCM-US48I / SCM-WF48



The product images of components and optional products may differ slightly from the actual product.

For details on the above product, refer to the instruction manual of the product. Download the instruction manual for the product from our website ([www.autonics.com](http://www.autonics.com)).

## 1.5. Specifications

Series		TK4N	TK4SP	TK4S	TK4M
Power supply	AC type	100-240 VAC 50/60 Hz			
	AC/DC type	-	24 VAC 50/60 Hz, 24-48 VDC		
Permissible voltage range		90 to 110 % of rated voltage			
Power consumption	AC type	≤ 6 VA	≤ 8 VA		
	AC/DC type	-	AC: ≤ 8 VA, DC ≤ 5W		
Display type		7-segment (PV: red, SV: green), other display part (green, yellow, red) LED method			
Character size	PV (W × H)	4.5 × 7.2 mm	7.0 × 14.0 mm	7.0 × 14.0 mm	9.5 × 20.0 mm
	SV (W × H)	3.5 × 5.8 mm	5.0 × 10.0 mm	5.0 × 10.0 mm	7.5 × 15.0 mm
Unit weight (packaged)		≈ 70 g (≈ 140 g)	≈ 85 g (≈ 130 g)	≈ 105 g (≈ 150 g)	≈ 140 g (≈ 210 g)

Series		TK4W	TK4H	TK4L
Power supply	AC type	100-240 VAC 50/60 Hz		
	AC/DC type	24 VAC 50/60 Hz, 24-48 VDC		
Permissible voltage range		90 to 110 % of rated voltage		
Power consumption	AC type	≤ 8 VA		
	AC/DC type	AC: ≤ 8 VA, DC ≤ 5W		
Display type		7-segment (PV: red, SV: green), other display part (green, yellow, red) LED method		
Character size	PV (W × H)	8.5 × 17.0 mm	7.0 × 14.6 mm	11.0 × 22.0 mm
	SV (W × H)	6.0 × 12.0 mm	6.0 × 12.0 mm	7.0 × 14.0 mm
Unit weight (packaged)		≈ 141 g (≈ 211 g)	≈ 141 g (≈ 211 g)	≈ 198 g (≈ 294 g)

<b>Sampling period</b>		50 ms
<b>Input specification</b>		Refer to 1.5.1, “Input Type and Using Range”
<b>Option input</b>	<b>CT</b>	<ul style="list-style-type: none"> <li>• 0.0-50.0 A (primary current measurement range)</li> <li>• CT ratio: 1/1,000</li> <li>• Measurement accuracy: <math>\pm 5\%F.S \pm 1</math>digit</li> </ul>
	<b>Digital input</b>	<ul style="list-style-type: none"> <li>• Contact - ON: <math>\leq 2</math> k<math>\Omega</math>, OFF: <math>\geq 90</math> k<math>\Omega</math></li> <li>• Non contact - residual voltage <math>\leq 1.0</math> V, leakage current <math>\leq 0.1</math> mA</li> <li>• Outflow current: <math>\approx 0.5</math> mA per input</li> <li>• TK4S/M: 1 (TK4S-D□□□: 2, TK4SP: None), TK4N/H/W/L: 2 (except TK4SP)</li> </ul>
<b>Control output</b>	<b>Relay</b>	OUT1, OUT2: 250 VAC 3A 1a
	<b>SSR</b>	Max.11 VDC $\pm 2$ V, $\leq 20$ mA
	<b>Current</b>	DC 4-20 mA or DC 0-20 mA (parameter), Load resistance: $\leq 500$ $\Omega$
<b>Alarm output</b>	<b>Relay</b>	AL1, AL2: 250 VAC 3 A 1a <ul style="list-style-type: none"> <li>• TK4N AL2: 250 VAC 0.5 A 1a (<math>\leq 125</math> VA)</li> </ul>
	<b>Transmission</b>	DC 4 - 20 mA (Load resistance: $\leq 500$ $\Omega$ , Output accuracy: $\pm 0.3\%F.S$ )
<b>Option output</b>	<b>RS485 comm.</b>	Modbus RTU
	<b>Heating, Cooling</b>	ON/OFF, P, PI, PD, PID Control
<b>Heating &amp; Cooling</b>		
<b>Hysteresis</b>		<ul style="list-style-type: none"> <li>• Thermocouple, RTD: 1 to 100 (0.1 to 100.0) <math>^{\circ}C/^{\circ}F</math></li> <li>• Analog: 1 to 100 digit</li> </ul>
<b>Proportional band (P)</b>		0.1 to 999.9 $^{\circ}C/^{\circ}F$ (0.1 to 999.9%)
<b>Integral time (I)</b>		0 to 9,999 sec
<b>Derivative time (D)</b>		0 to 9,999 sec
<b>Control cycle (T)</b>		<ul style="list-style-type: none"> <li>• Relay output, SSR drive output: 0.1 to 120.0 sec</li> <li>• Selectable current or SSR drive output: 1.0 to 120.0 sec</li> </ul>
<b>Manual reset</b>		0.0 to 100.0 %
<b>Relay life cycle</b>	<b>Mechanical</b>	OUT1/2: $\geq 5,000,000$ operations AL1/2: $\geq 20,000,000$ operations (TK4H/W/L: $\geq 5,000,000$ operations)
	<b>Electrical</b>	$\geq 100,000$ operations
<b>Dielectric strength</b>	<b>AC type</b>	Between the charging part and the case: 3,000 VAC 50/60 Hz for 1 minute
	<b>AC / DC type</b>	Between the charging part and the case: 2,000 VAC 50/60 Hz for 1 minute
<b>Vibration</b>		0.75 mm amplitude at frequency of 5 to 55 Hz in each X, Y, Z direction for 2 hours

<b>Insulation resistance</b>	≥ 100 MΩ (500 VDC megger)
<b>Noise immunity</b>	± 2 kV square shaped noise by noise simulator (pulse width: 1 μs) R-phase, S-phase
<b>Memory retention</b>	≈ 10 years (non-volatile semiconductor memory type)
<b>Ambient temperature</b>	-10 to 50 °C, storage: -20 to 60 °C (no freezing or condensation)
<b>Ambient humidity</b>	35 to 85%RH, storage: 35 to 85%RH (no freezing or condensation)
<b>Protection structure</b>	IP65 (Front panel, IEC standards) • TK4SP: IP50 (Front panel, IEC standards)
<b>Insulation type</b>	Double insulation or reinforced insulation (mark:回, dielectric strength between the measuring input part and the power part: 2 kV)
<b>Certification</b>	CE, UKCA, UL, EAC

## 1.5.1. Input Type and Using Range

The setting range of some parameters is limited when using the decimal point display.

### Thermocouple

Input type	Decimal point	Display	Using range (°C)	Using range (°F)
K (CA)	1	℄℄℄℄	-200 to 1,350	-328 to 2,462
	0.1	℄℄℄℄	-199.9 to 999.9	-199.9 to 999.9
J (IC)	1	℄℄℄℄	-200 to 800	-328 to 1,472
	0.1	℄℄℄℄	-199.9 to 800.0	-199.9 to 999.9
E (CR)	1	℄℄℄℄	-200 to 800	-328 to 1,472
	0.1	℄℄℄℄	-199.9 to 800.0	-199.9 to 999.9
T (CC)	1	℄℄℄℄	-200 to 400	-328 to 752
	0.1	℄℄℄℄	-199.9 to 400.0	-199.9 to 752.0
B (PR)	1	℄ ℄ ℄	0 to 1,800	32 to 3,272
R (PR)	1	℄ ℄ ℄	0 to 1,750	32 to 3,182
S (PR)	1	℄ ℄ ℄	0 to 1,750	32 to 3,182
N (NN)	1	℄ ℄ ℄	-200 to 1,300	-328 to 2,372
C (TT) <sup>01)</sup>	1	℄ ℄ ℄	0 to 2,300	32 to 4,172
G (TT) <sup>02)</sup>	1	℄ ℄ ℄	0 to 2,300	32 to 4,172
L (IC)	1	℄ ℄ ℄℄	-200 to 900	-328 to 1,652
	0.1	℄ ℄ ℄℄	-199.9 to 900.0	-199.9 to 999.9
U (CC)	1	℄℄℄℄	-200 to 400	-328 to 752
	0.1	℄℄℄℄	-199.9 to 400.0	-199.9 to 752.0
Platinel II	1	℄℄℄℄	0 to 1,390	32 to 2,534

## RTD

Input type	Decimal point	Display	Using range (°C)	Using range (°F)
Cu50 Ω	0.1	CU5	-199.9 to 200.0	-199.9 to 392.0
Cu100 Ω	0.1	CU10	-199.9 to 200.0	-199.9 to 392.0
JPt100 Ω	1	JPEH	-200 to 650	-328 to 1,202
	0.1	JPEL	-199.9 to 650.0	-199.9 to 999.9
DPT50 Ω	0.1	dPE5	-199.9 to 600.0	-199.9 to 999.9
DPT100 Ω	1	dPEH	-200 to 650	-328 to 1,202
	0.1	dPEL	-199.9 to 650.0	-199.9 to 999.9
Nickel120 Ω	1	nI12	-80 to 200	-112 to 392

## Analog

Input type	Decimal point	Display	Using range
0 to 10 V	Depending on decimal point setting	Ru1	0 to 10 V
0 to 5 V		Ru2	0 to 5 V
1 to 5 V		Ru3	1 to 5 V
0 to 100 mV		Rñu1	0 to 100 mV
0 to 20 mA		RñR1	0 to 20 mA
4 to 20 mA		RñR2	4 to 20 mA

- Allowable line resistance of a resistance thermometer (RTD) per line:  $\leq 5 \Omega$

01) C (TT): Same as existing W5 (TT) type sensor

02) G (TT): Same as existing W (TT) type sensor



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 and do not set over the input range.

### 1.5.1.1. Display accuracy

#### Thermocouple, RTD

##### At room temperature (23°C ±5 °C)

(PV ±0.3 % or ±1 °C higher one) ±1-digit

- Thermocouple K, J, T, N, E below -100 °C and L, U, PLII, RTD Cu50 Ω, DPt50 Ω:  
(PV ±0.3 % or ±2 °C higher one) ±1-digit
- Thermocouple K, J, T, N, E below -100 °C and L, U, PLII, RTD Cu50 Ω, DPt50 Ω:  
(PV ±0.3 % or ±2 °C higher one) ±1-digit
- Thermocouple B below 400 °C: There is no accuracy standards

##### Out of room temperature range

(PV ±0.5 % or ±2 °C higher one) ±1-digit

- RTD Cu50 Ω, DPt50 Ω:  
(PV ±0.5 % or ±3 °C higher one) ±1-digit
- Thermocouple R, S, B, C, G:  
(PV ±0.5 % or ±5 °C higher one) ±1-digit
- Other sensors: ≤ ±5 °C (≤ -100 °C)

#### Analog

##### At room temperature (23°C ±5 °C)

±0.3 %F.S ±1-digit

##### Out of room temperature range

±0.5 %F.S ±1-digit



In case of TK4SP Series, ±1 °C will be added to the degree standard.

## 1.5.2. Communication Interface

### RS485

<b>Comm. protocol</b>	Modbus RTU
<b>Connection type</b>	RS485
<b>Application standard</b>	EIA RS485 compliance with
<b>Maximum connection</b>	31 units (address: 01 to 99)
<b>Synchronous method</b>	Asynchronous
<b>Comm. Method</b>	Half Duplex
<b>Comm. effective range</b>	≤ 800 m
<b>Comm. speed</b>	2,400 / 4,800 / 9,600 (default) / 19,200 / 38,400 bps (parameter)
<b>Response time</b>	5 to 99 ms (default: 20 ms)
<b>Start bit</b>	1 bit (fixed)
<b>Data bit</b>	8 bit (fixed)
<b>Parity bit</b>	None (default), Even, Odd
<b>Stop bit</b>	1 / 2 (default) bit
<b>EEPROM life cycle</b>	≈ 1,000,000 operations (Erase / Write)



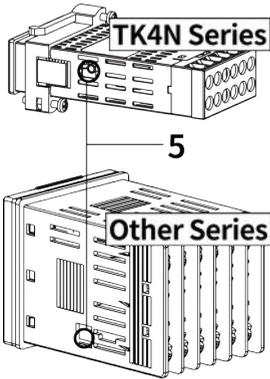
You could modify the parameter (first in, first out) using keys during communication connection, but this may lead to errors and malfunctions.



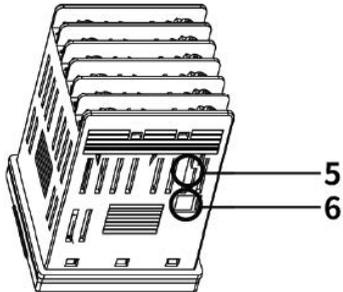
It is recommended to use Autonics communication converter. Please use twisted pair wire, which is suitable for RS485 communication.

# 1.6. Unit Descriptions

- The below is based on TK4L series.
- The shape and function of each part may be different depending on the series.



The previous model



### 1. PV display part (Red)

- Run mode: Displays PV (Present value).
- Setting mode: Displays parameter name.

### 2. SV display part (Green)

- Run mode: Displays SV (Setting value).
- Setting mode: Displays parameter setting value.

### 3. Input key

- **A/M**: It is used when switching auto control to manual control.
- **MODE**: It is used when entering parameter group, returning to RUN mode, moving parameter, saving the set value.
- **◀, ▼, ▲**: It is used when entering the set value changing mode and moving or changing up/down digit.



TK4N/S/SP do not have the **A/M** key. The **MODE** key operates switching simultaneously.

### 4. Indicator

Display	Name	Description
°C, %, °F	Unit	Displays selected unit (parameter)
AT	Auto tuning	Flashes during auto tuning every 1 sec
OUT1/2	Control output	Turns ON when the control output is ON <ul style="list-style-type: none"><li>• SSR output (cycle/phase control)</li><li>MV over 5 % ON</li><li>• Current output</li></ul> Manual control: 0 % OFF, over ON Auto control: below 2 % OFF, over 3 % ON
AL1/2	Alarm output	Turns ON when the alarm output is ON
MAN	Manual control	Turns ON during manual control
SV1/2/3	Multi SV	The SV indicator is ON which is currently displayed. (When using multi SV function)

### 5. PC loader port

It is the PC loader port for serial communication to set parameter and monitoring by DAQMaster installed in PC. Use this for connecting communication converter SCM Series.

### 6. Input selection switch

Used when switching sensor (TC, RTD) input ↔ analog input(mV, V, mA) (only the previous models)

## 1.7. Errors

### OPEN

- **Input: Temperature sensor**

Description: Flashes at 0.5 sec. intervals in the event of an input disconnection.

Output: 'Sensor error, MV' parameter setting value

Troubleshooting: Check input sensor status.

- **Input: Analog**

Description: Flashes at 0.5 sec. intervals if F.S. is over  $\pm 10\%$ .

Output: 'Sensor error, MV' parameter setting value

Troubleshooting: Check analog input status.

### HHHH

- **Input: Temperature sensor**

Description: Flashes at 0.5 sec intervals if the input value is above the input range. <sup>01)</sup>

Output: Heating: 0 %, Cooling: 100 %

Troubleshooting: When input is within the rated input range, this display disappears.

- **Input: Analog**

Description: Flashes at 0.5 sec intervals if the input value is over 5 to 10 % of high limit or low limit value.

Output: Normal output

Troubleshooting: When input is within the rated input range, this display disappears.

### LLLL

- **Input: Temperature sensor**

Description: Flashes at 0.5 sec. intervals if the input value is below the input range. <sup>01)</sup>

Output: Heating: 100 %, Cooling: 0 %

Troubleshooting: When input is within the rated input range, this display disappears.

- **Input: Analog**

Description: Flashes at 0.5 sec intervals if the input value is over 5 to 10 % of low limit or high limit value.

Output: Normal output

Troubleshooting: When input is within the rated input range, this display disappears.

### ERR

Description: Flashes at 0.5 sec intervals if there is error for setting and it returns to the error-before screen.

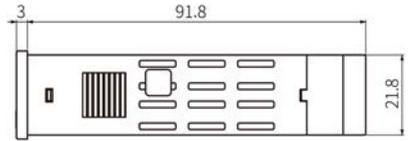
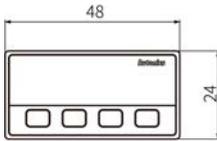
Troubleshooting: Check setting method.

<sup>01)</sup> Be careful that when HHHH / LLLL error occurs, the control output may occur by recognizing the maximum or minimum input depending on the control type.

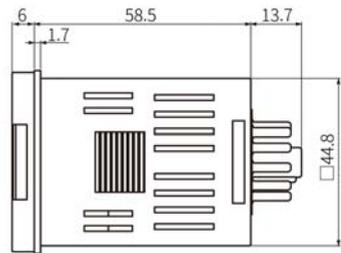
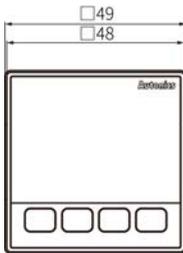
## 1.8. Dimensions

- Unit: mm

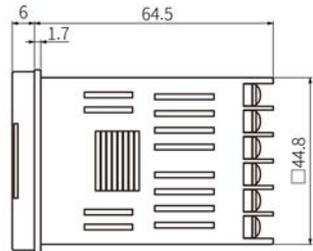
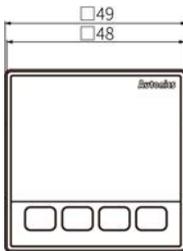
TK4N



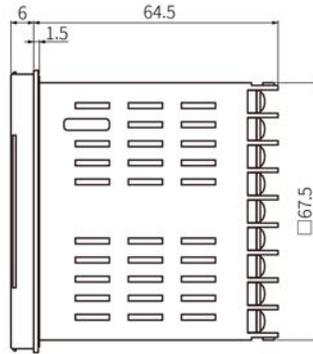
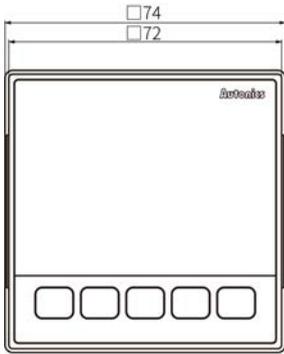
TK4SP



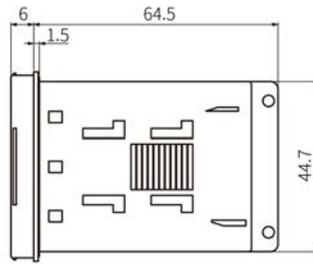
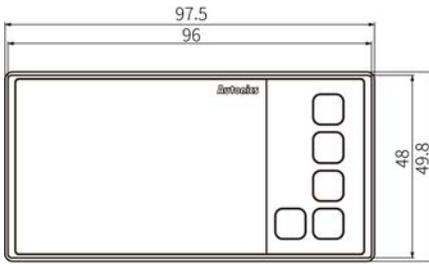
TK4S



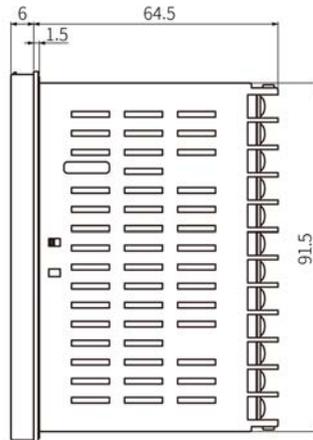
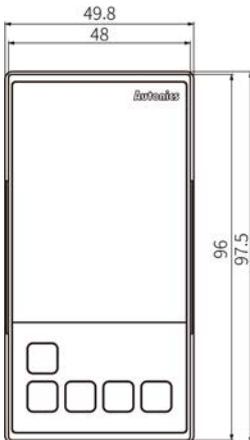
### TK4M



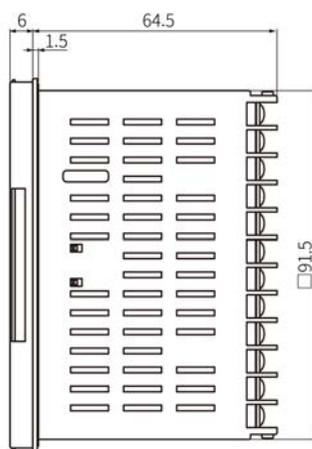
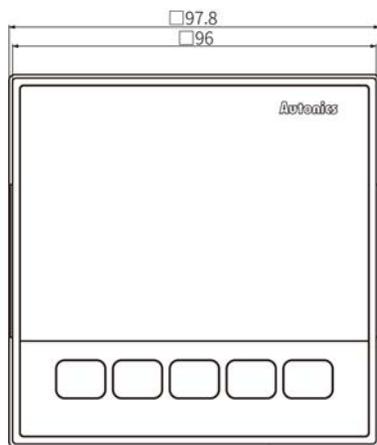
### TK4W



### TK4H

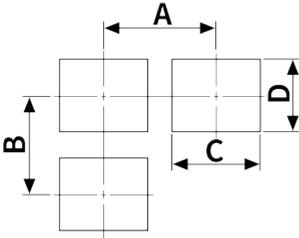


# TK4L



### 1.8.1. Panel cut-out

• Unit: mm

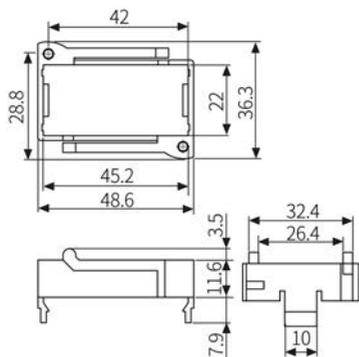


	A	B	C	D
<b>TK4N</b>	$\geq 55$	$\geq 37$	$45^{+0.6}_0$	$22.2^{+0.3}_0$
<b>TK4S</b>	$\geq 65$	$\geq 65$	$45^{+0.6}_0$	$45^{+0.6}_0$
<b>TK4SP</b>	$\geq 65$	$\geq 65$	$45^{+0.6}_0$	$45^{+0.6}_0$
<b>TK4M</b>	$\geq 90$	$\geq 90$	$68^{+0.7}_0$	$68^{+0.7}_0$
<b>TK4W</b>	$\geq 115$	$\geq 65$	$92^{+0.8}_0$	$45^{+0.6}_0$
<b>TK4H</b>	$\geq 65$	$\geq 115$	$45^{+0.6}_0$	$92^{+0.8}_0$
<b>TK4L</b>	$\geq 115$	$\geq 115$	$92^{+0.8}_0$	$92^{+0.8}_0$

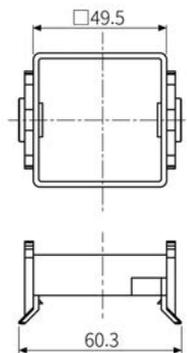
## 1.8.2. Bracket

- Unit: mm

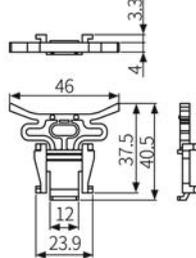
### TK4N



### TK4S/SP



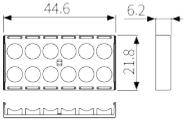
### Other Series



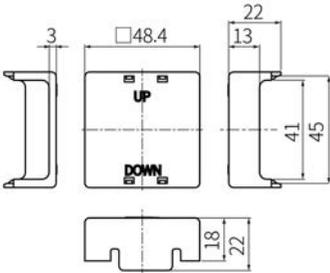
### 1.8.3. Terminal protection cover

• Unit: mm

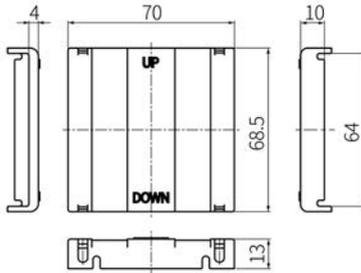
#### TK4N COVER (48×24 mm)



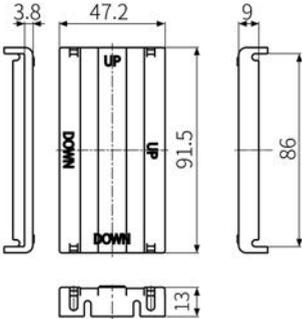
#### RSA-COVER: DIN W48 × H48



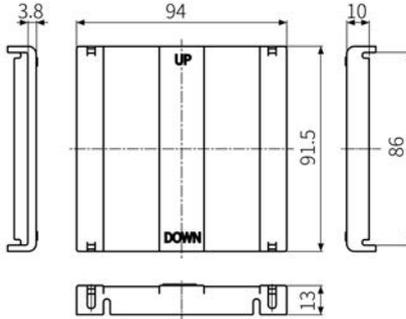
#### RMA-COVER: DIN W72 × H72



#### RHA-COVER: DIN W48 × H96



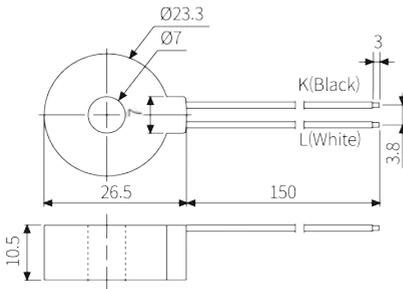
#### RLA-COVER: DIN W96 × H96



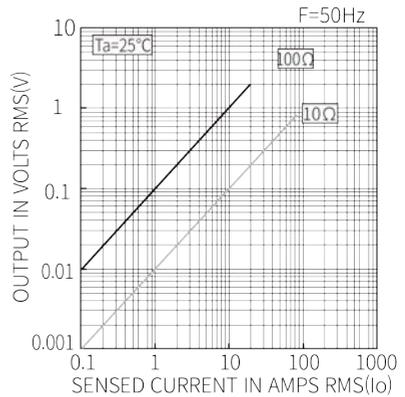
## 1.8.4. Current Transformer

- Unit: mm
- The current for above CTs is 50A same but inner hole sizes are different. Please use this for your environment.
- Do not supply primary current in case that CT output is open. High voltage will be generated in CT output.

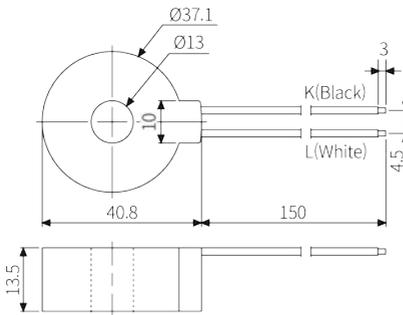
### ■ CSTC-E80LN



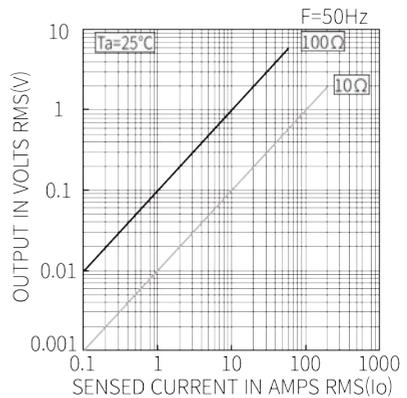
- Max. load current: 80A (50/60Hz)
- Current ratio: 1/1000
- Wire wounded resistance:  $31\Omega \pm 10\%$



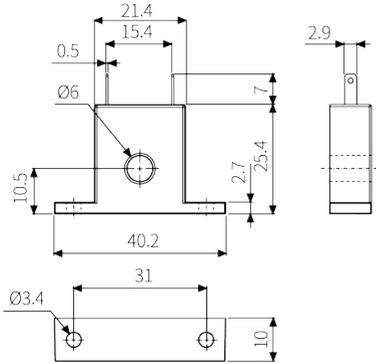
### ■ CSTC-E200LN



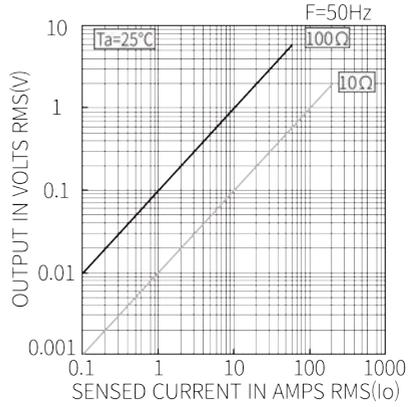
- Max. load current: 200A (50/60Hz)
- Current ratio: 1/1000
- Wire wounded resistance:  $20\Omega \pm 10\%$



■ CSTS-E80PP



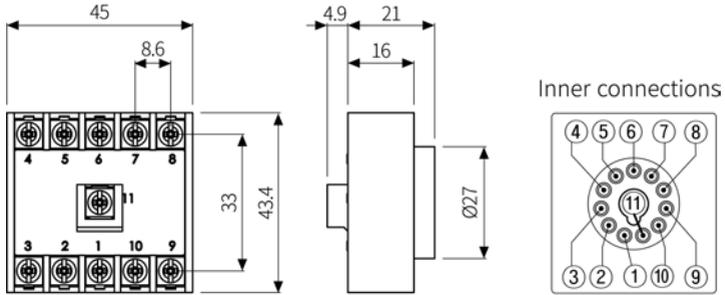
- Max. load current: 80A (50/60Hz)
- Current ratio: 1/1000
- Wire wound resistance  $31\Omega \pm 10\%$



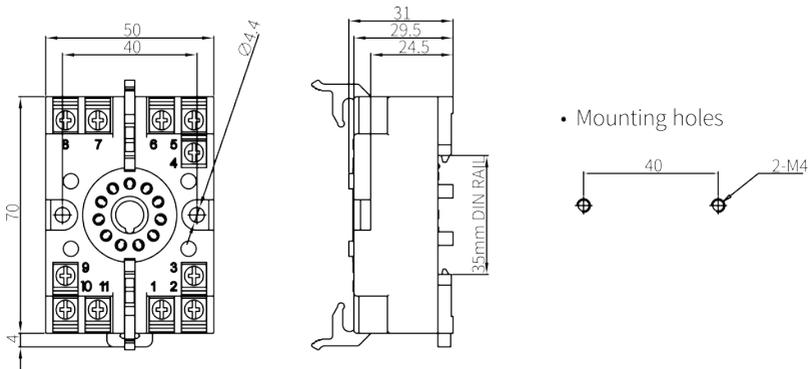
### 1.8.5. 11-pin Controller Socket (for TK4SP)

• Unit: mm

#### ■ PG-11

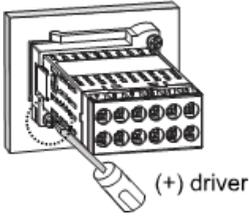


#### ■ PS-11(N)



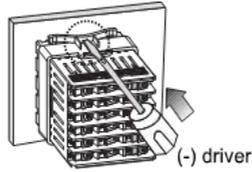
# 1.9. Installation Method

TK4N



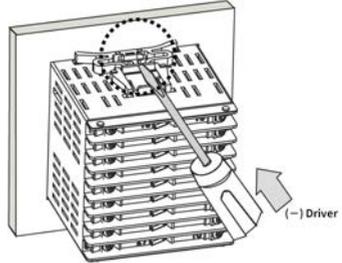
After mounting the product to panel with bracket, fasten the bolts by using screwdriver.

TK4S/SP



Insert the unit into a panel, fasten the bracket by pushing with a flathead screwdriver.

Other Series



Insert the unit into a panel, fasten the bracket by pushing with a flathead screwdriver.

# 1.10. Connections

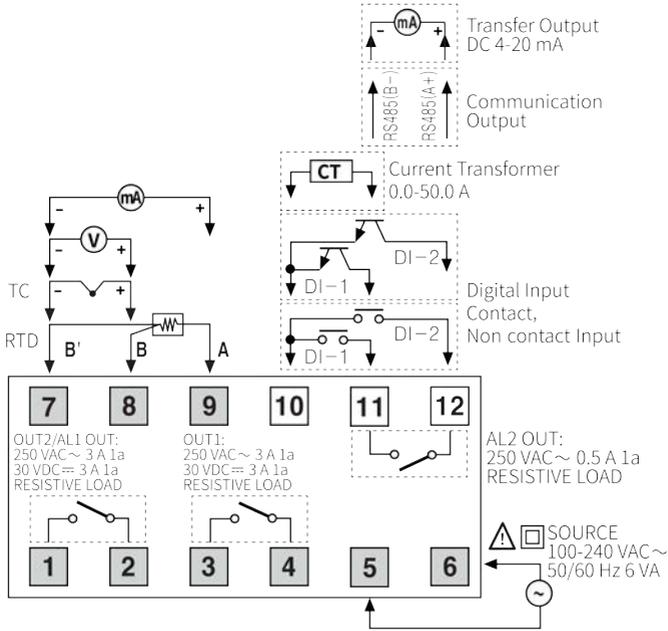
Be sure that the polarity for input connecting a temperature sensor or analog input.

Standard model has shaded terminals only.

When the operation mode of heating&cooling OUT2 relay output model is heating or cooling control, the OUT2 is usable as alarm output 3(except TK4N).

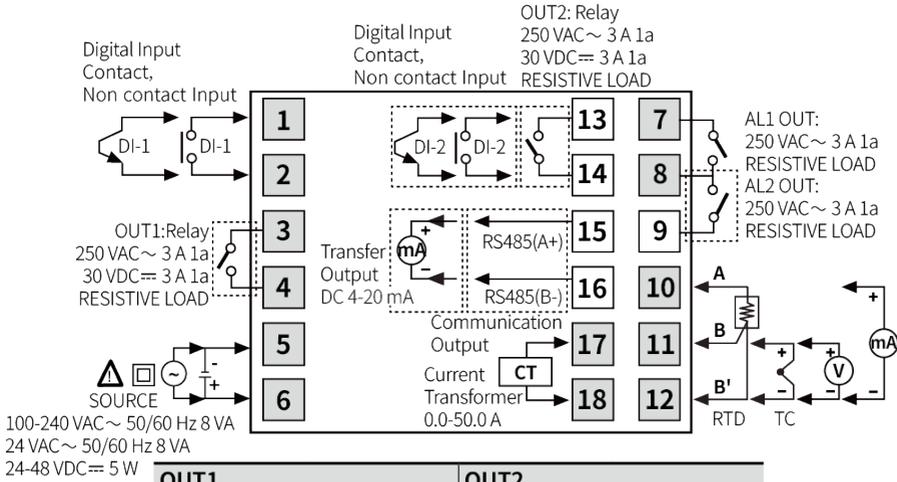
When the operation mode of heating & cooling OUT2 current model is heating or cooling control, the OUT2 is usable as transmission output 2.

## (1) TK4N



OUT 1	SSR	3	+	V	11 VDC = ±2V 20 mA Max.
	SSR	4	-	V	
OUT 1	CURR	3	+	mA	11 VDC = ±2V 20 mA Max.
	CURR	4	-	mA	
OUT 2	SSR	1	+	V	11 VDC = ±2V 20 mA Max.
	SSR	2	-	V	
OUT 2	CURR	1	+	mA	11 VDC = ±2V 20 mA Max.
	CURR	2	-	mA	

## (2) TK4S

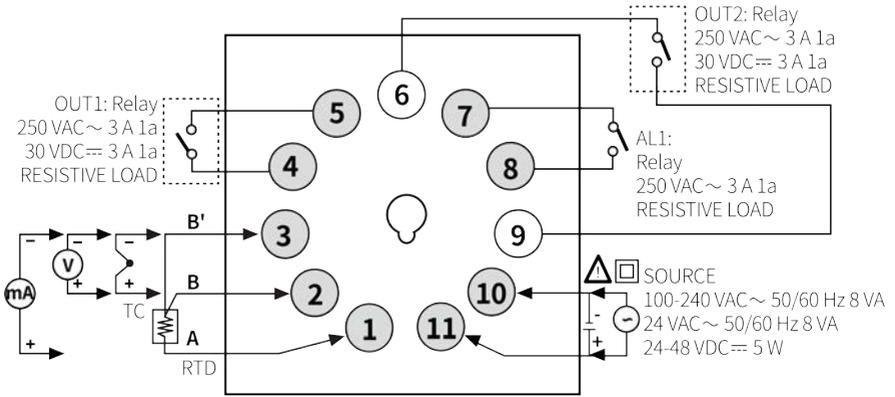


OUT1		OUT2	
SSR	Current	SSR	Current
11 VDC = ±2V 20 mA Max.	DC 0/4-20 mA Load 500Ω Max.	11 VDC = ±2V 20 mA Max.	DC 0/4-20 mA Load 500Ω Max.



Features one digital input terminal (DI-1) due to limited number of terminal blocks.  
Supports two multi SVs (SV1 and SV2) only.

### (3) TK4SP

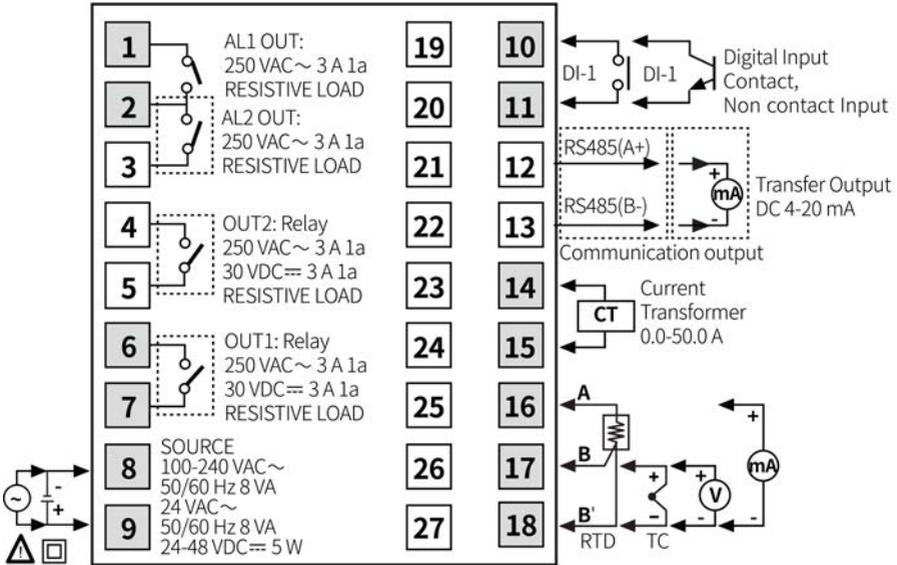


OUT1		OUT2	
SSR	Current	SSR	Current
11 VDC = ±2V 20 mA Max.	DC 0/4-20 mA Load 500 Ω Max.	11 VDC = ±2V 20 mA Max.	DC 0/4-20 mA Load 500 Ω Max.



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

#### (4) TK4M



OUT1		OUT2	
SSR	Current	SSR	Current
11 VDC = ±2V 20 mA Max.	DC 0/4-20 mA Load 500 Ω Max.	11 VDC = ±2V 20 mA Max.	DC 0/4-20 mA Load 500 Ω Max.

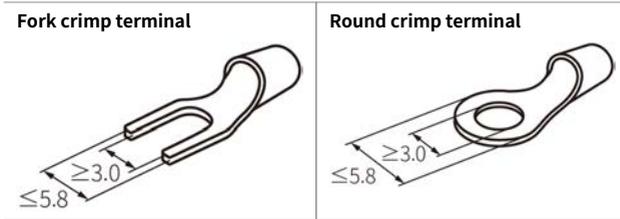


Features one digital input terminal (DI-1) due to limited number of terminal blocks.  
Supports two multi SVs (SV1 and SV2) only.



## 1.11. Crimp Terminal Specifications

- Unit: mm, Use the crimp terminal of follow shape.



## 1.12. Precautions for wiring

### 1.12.1. Terminals

- 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 observe correct polarity of power source terminals. (+ and -).
- Make sure to connect correct polarity of temperature sensor and analog input.

### 1.12.2. Sensor

- Compensation Wire Connection

For thermocouple sensors, use compensation 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.

- Measurement Error

Do not mix up the direction of the input sensor connector.

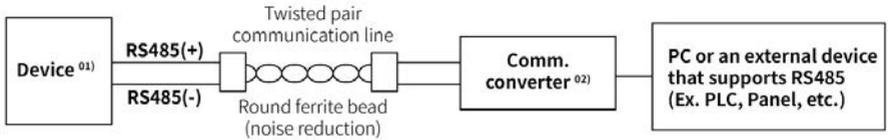
Carefully adjust both load and sensor positions.

Make sure the sensor is securely attached to the input connector.

- AC Power Cable and Wiring

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

### 1.12.3. Communication



01) Connect to a PC using a communication converter(SCM-US, sold separately) on the PC loader port.

02) Communication Converters: SCM-38I / SCM-US48I (sold separately)

- Pay attention to the direction of A and B terminal of the communication terminal.
- Connect the communication line using a communication converter suitable for your environment.
- Be sure to use twisted pair lines for communication lines and do not exceed 800 m max.
- Do not bundle communication lines and AC power lines together.
- Refer to 7.3, “Communication settings” for details on communication settings.

## 1.13. Display Status When Power On

If no error occurs in the product after turning on the power, the entire front display part lights up for about 1 second. After that, the model name and input specifications are displayed by blinking twice in sequence (every 0.5 sec), and then enters the RUN mode.

- Model Name: TK4N-14RN
- Input specification: K(CA) (decimal point: 1)



Display part	1. Model name	2. Model name	3. Input Specifications	4. RUN mode
PV	8.8.8.8	TK4	TK4	oPEN
SV	8.8.8.8	14rn	CCRH	0

## 1.14. Mode Setting

RUN mode → Enter → Mode Setting → Return → RUN mode

### Password entry

Set a password to prevent misconfiguration.

For more information, refer to 8.10, “Password settings”.

- Enter: If a password has been set, PASS] appears when entering SV settings or parameter group. Enter the password before entering each mode. When the password matches, it enters the mode.
- Password entry  
Shift digits: ◀ key  
Change values: ▲, ▼ key
- Return: **MODE** key
- Re-enter password: If the password does not match, press any key among ◀, ▲, ▼

### SV Settings

- Enter: In case of auto control, press any key among ◀, ▲, ▼
- Set  
Shift digits: ◀ key  
Change values: ▲, ▼ key
- Save and return: **MODE** or when there is no key input for more than 5 seconds, save the set value and return to RUN mode.

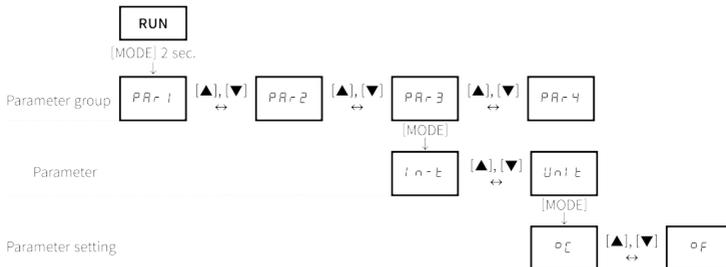
## Parameter group

Refer to 2, Parameter for details of each parameter group.  
Some parameters are enabled/disabled depending on the setting of the model or other parameters.

- Enter: **MODE** key 2 seconds
- Move and set
  - Move between parameter groups: **▲**, **▼** key
  - Enter within parameter group: **MODE** key
  - Move between parameters: **▲**, **▼** key
  - Enter parameter setting: **MODE** key
  - Selection setting value: **▲**, **▼** key / Move set value digits: **◀** key / Change setting value: **▲**, **▼** key
  - Save setting value: **MODE** key
- Return: **◀** key 2 seconds

Example: When setting the temperature unit of the parameter 3 group to change °C → °F

1. In RUN mode, press **MODE** key for 2 seconds to enter parameter setting.
2. The first parameter group is either a user parameter group or parameter 1 group.  
Press **▲**, **▼** to move to the parameter 3 group. Press **MODE** to enter the parameter group.
3. Press **▲**, **▼** to move to the temperature unit parameter.
4. Press **MODE** key to enter the setting mode and selection the desired setting value with the **▲**, **▼** keys.



### Parameter reset

If you selection YES after entering, all parameters are initialized.  
If the password feature is activated, it is required to enter a password to activate this function. Resetting the parameters also resets the password.  
If this parameter reset function is masked, it cannot be used.

- Enter: ◀ + ▲ + ▼ keys 5 seconds
- Change values: ▲, ▼ key
- Save and return: Press the **MODE** key to reset all parameter values as default and to return to run mode.

### MV monitoring / Manual control execution

Refer to 3.1, “Control output MV monitoring”, 8.3, “Auto/Manual control settings” for details.

- Enter: **A/M**<sup>01)</sup> key
- Return: **A/M** key

01) In case of TK4N/S/SP model, short press of **MODE** key replaces **A/M** key function.

### Digital input key

- Enter: ▲ + ▼ keys over 3 sec
- Return: Auto



## 2. Parameter

No.	Parameter group	Display	Link
0	SV setting group	-	3, SV setting group
1	Parameter 1 group	<i>PAR 1</i>	4, Parameter 1 group: <i>PAR 1</i>
2	Parameter 2 group	<i>PAR 2</i>	5, Parameter 2 group: <i>PAR 2</i>
3	Parameter 3 group	<i>PAR 3</i>	6, Parameter 3 group: <i>PAR 3</i>
4	Parameter 4 group	<i>PAR 4</i>	7, Parameter 4 group: <i>PAR 4</i>
5	Parameter 5 group	<i>PAR 5</i>	8, Parameter 5 group: <i>PAR 5</i>



- Some parameters are enabled/disabled depending on the setting of the model or other parameters. Please refer to the description of each description.
- For entering parameter, refer to **1.14, “Mode Setting”**.
- Parameters of each group are connected each other. Therefore, follow the below parameter order.  
Parameter 3 group → Parameter 4 group → Parameter 5 group → Parameter 2 group → Parameter 1 group → SV Setting  
Changing Parameter 3 group's parameters can sometimes reset other associated parameters. Always make sure to check if such parameters have been affected.
- When user parameter group is set in DAQMaster, the user parameter group displays as the first of parameter groups.  
You can directly configure the up to 30 parameters in DAQMaster.  
Refer to the DAQMaster User manual for more details.
- When 5-10 User level: *5 to 10*, \* mark parameters of the each parameter group table only display.

### Parameter change reset parameters

Changed parameter	Description	Reset parameter
IN-T	Input specification	SV-N, AL1.L, AL1.H, AL2.L, AL2.H, AL3.L, AL3.H, SV0 to SV3, DB, H.HYS, H.OST, C.HYS, C.OST, RAMU, RAMD, R.UNT, L-RG, H-RG, DOT, L-SC, H-SC, D.UNT, IN-B, L-SV, H-SV, LBA.T, LBA.B, AO.M1, FS.L1, FS.H1, AO.M2, FS.L2, FS.H2
UNIT	Temperature 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-SV	SV high limit value	When SV>H-SV, SV resets to H-SV
L-SV	SV low limit value	When SV<L-SV, SV resets to L-SV
O-FT	Control output mode	L-MV, H-MV, C-MD, ER.MV, PR.MV, ST.MV
C-MD	Control type	L-MV, H-MV, ER.MV, PR.MV, ST.MV
AL-1, AL-2, AL-3	Alarm output Operation mode	AL1.L, AL1.H, AL2.L, AL2.H, AL3.L, AL3.H

### 3. SV setting group

Description		Display	Default	Set range	Unit	Display condition	
0-1	Set value	5 u	0	L-SV to H-SV	°C/°F/-	Refer to <b>1.14,</b> “ <b>Mode Setting</b> ”	-
0-2	Heating MV	H - n u	-	H 0.0 to H 100 <sup>01)</sup>	%		3-13 Control output mode: HEAT, H-C
0-3	Cooling MV	C - n u	-	C 0.0 to C 100 <sup>01)</sup>	%		3-13 Control output mode: COOL, H-C
0-4	Auto_Manual Control	-	A U t o	AUTO: Auto control mode MAN: Manual control mode	-		-
0-5	Resets parameters	i n i t	n o	NO, YES	-		-

01) Monitoring value range

### 3.1. Control output MV monitoring

Monitors and displays the current control output MV. When in RUN mode, press the **A/M** key (the **MODE** key for TK4N, TK4S, TK4SP model) and it enters MV monitoring mode. The SV display shows H (heating control) or C (cooling control), and shows MV to indicate the start of MV monitoring.

Description		Display	Default	Monitoring value range	Unit	Display condition	
0-2	Heating MV	H - $\bar{n}u$	-	H 0.0 to H 100	%	Refer to <b>1.14</b> , “ <b>Mode Setting</b> ”	3-13 Control output mode: HEAT, H-C
0-3	Cooling MV	C - $\bar{n}u$	-	C 0.0 to C 100	%		3-13 Control output mode: COOL, H-C

**Heating MV**      Displays the current heating MV during heating control or heating & cooling control. Users may manually adjust the MV to control the temperature. Capable of displaying MV with a moving decimal point (H 99.9 → H 100).

**Cooling MV**      Displays the current cooling MV during cooling control or heating & cooling control. Users may manually adjust the MV to control the temperature. Capable of displaying MV with a moving decimal point (C 99.9 → C 100).



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

## 4. Parameter 1 group: PAr 1

Description		Display	Default	Set range	Unit	Display condition	
1-1	Control Output RUN/STOP	r - 5	rUn	RUN: Forced control output run in STOP mode STOP: Forced control output stop in RUN mode	-	-	
1-2	Multi SV selection	50 - n	50 - 0	SV-0, SV-1, SV-2, SV-3	-	-	
1-3	Heater current monitoring	[ E - A	0.0	0.0 to 50.0 (Display range)	A	Displayed only with current transformer (CT) input models (Except for TK4SP)	
1-4	Alarm output <input type="checkbox"/> low limit	AL <input type="checkbox"/> L	1550	Offset Alarm: -F.S. to F.S. Absolute Value Alarm: Within display range	°C/°F	4-1 Alarm output <input type="checkbox"/> Operation mode: JJdU, JdU[, [dU], JJPU	3-1 Input specification: Temp.
			1000	Offset Alarm: -1999 to -F.S to F.S to 9999 Absolute Value Alarm: Within display range			3-1 Input specification: Analog
			000	00.0 to 50.0	A		4-1 Alarm output <input type="checkbox"/> Operation mode: HbA

Description		Display	Default	Set range	Unit	Display condition	
1-5	Alarm output□ high limit	AL □.H	1550	(Temp.) Offset Alarm: -F.S. to F.S. Absolute Value Alarm: Within display range	°C/°F	4-1 Alarm output□ Operation mode: d u l l , ] d u l , [ d u ] , P u l l	3-1 Input specification: Temp.
			1000	Offset Alarm: -1999 to -F.S to F.S to 9999 Absolute Value Alarm: Within display range			3-1 Input specification: Analog
1-6	Multi SV 0*	S u - 0	0000	Between L-SV and H-SV	°C/°F /-	5-1 Multi SV number: 1, 2, 4	
1-7	Multi SV 1	S u - 1	0000	Between L-SV and H-SV	°C/°F /-	5-1 Multi SV number: 2, 4	
1-8	Multi SV 2	S u - 2	0000	Between L-SV and H-SV	°C/°F /-	5-1 Multi SV number: 4	
1-9	Multi SV 3	S u - 3	0000	Between L-SV and H-SV	°C/°F /-	5-1 Multi SV number: 4	

## 4.1. Control Output RUN/STOP

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 (▲ + ▼ 3sec.) and digital input terminals (DI-1 and DI-2) can be assigned to the run/stop feature[STOP]. (regardless of parameter mask)

Description	Display	Default	Set range	Unit	Display condition
1-1 Control Output RUN/STOP	r - 5	r Un	RUN: Forced control output run in STOP mode STOP: Forced control output stop in RUN mode	-	-



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 occurring 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 [STOP], RUN/STOP feature by modifying front keys or parameter is unable.

## 4.2. Multi SV selection

Select the SV to control.

Description		Display	Default	Set range	Unit	Display condition
1-2	Multi SV selection	SV-n	SV-0	SV-0, SV-1, SV-2, SV-3	-	-



The range of figures assigned to each SV (SV No.) varies depending on the **8.1, “Multi SV number”** setting.

## 4.3. Heater current monitoring

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

Description	Display	Default	Set range	Unit	Display condition
1-3 Heater current monitorin g	C E - A	0.0	0.0 to 50.0 (Display range)	A	Displayed only with current transformer (CT) input models (Except for TK4SP)

A current transformer (CT) is used to measure and display the heater's (load) current. Availability of the heater current monitoring function is different by model and control output type.

In case of heating&cooling model, heater current monitoring function can be used in OUT1.



Model	Control output type	Heater current monitoring
TK4□-□□R□ (Relay output)	Relay output	○
TK4□-□□S□ (SSR drive output)	ON/OFF control [STND]	○
	Cycle control [CYCL]	X
	Phase control [PHAS]	X
TK4□-□□C□ (Current or SSR drive output)	Current output [CURR]	X
	SSR drive output [SSR]	○

## 4.4. Alarm output SV settings

You can set alarm output activation values. Depending on the alarm operation selected in **7.1.1**, “Alarm operation”, configuration parameters [AL□.H/AL□.L] will be activated for each setting.

Parameter	Description
AL 1.L	low limit value of alarm output1. Reference value for determining heater burnout.
AL 1.H	high limit value of alarm output1.
AL 2.L	low limit value of alarm output2. Reference value for determining heater burnout.
AL 2.H	high limit value of alarm output2.
AL 3.L	low limit value of alarm output3. Reference value for determining heater burnout.
AL 3.H	high limit value of alarm output3.

Description		Display	Default	Set range	Unit	Display condition	
1-4	Alarm output□ low limit	AL □.L	1550	Offset Alarm: -F.S. to F.S. Absolute Value Alarm: Within display range	°C/°F	4-1 Alarm output□ Operation mode: JJdu, Jdu[, [du], JJPu	3-1 Input specification: Temp.
			1000	Offset Alarm: -1999 to -F.S to F.S to 9999 Absolute Value Alarm: Within display range			3-1 Input specification: Analog
1-5	Alarm output□ high limit	AL □.H	1550	Offset Alarm: -F.S. to F.S. Absolute Value Alarm: Within display range	°C/°F	4-1 Alarm output□ Operation mode: du[[, Jdu[, [du], Pu[[	3-1 Input specification: Temp.
			1000	Offset Alarm: -1999 to -F.S to F.S to 9999 Absolute Value Alarm: Within display range			3-1 Input specification: Analog



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

### 4.4.1. Heater burnout detection settings

Set the alarm output setting value [AL□.L] as the reference value for heater burnout detection. Refer to 7.1.8, “Heater burnout alarm(HBA)” for more details.

$$\text{Heater break value} = \{(\text{normal heater current value}) + (\text{break Heater current value})\} / 2$$

Description	Display	Default	Set range	Unit	Display condition
1-4 Alarm output□ low limit value	AL□.L	00.0	00.0 to 50.0	A	4-1 Alarm output□ Operation mode: H b A

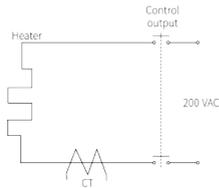


Set to 00.0 for OFF. Set to 50.0 for ON.

- Heater 1 unit (capacity: 200 VAC, 1 Kw, 5 A)
  - Heater current value of normal operation: 5 A
  - Heater break Heater current value: 0 A

$$\text{SV is } (5 \text{ A} + 0 \text{ A}) / 2 = 2.5 \text{ A.}$$

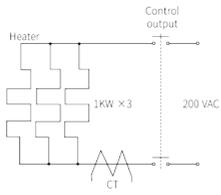
If the measured heater current value is lower than 2.5 A of heater break detection, it determines heater is broken and it outputs break alarm.



- Heater 2 units (capacity: 200 VAC, 1 Kw, 5 A)
  - Heater current value of normal operation: 10 A (5 A × 2 units)
  - If 1 heater is broken, heater current value is 5 A.

$$\text{SV is } (10 \text{ A} + 5 \text{ A}) / 2 = 7.5 \text{ A.}$$

If the measured heater current value is lower than 7.5 A of heater break detection, it determines heater is broken and it outputs break alarm.



## 4.5. Multi SV settings

Designate the value of each SV for Multi SVs.

Description		Display	Default	Set range	Unit	Display condition
1-6	Multi SV 0	SV - 0	0000	Between L-SV and H-SV	°C/°F /-	5-1 Multi SV number: 1, 2, 4
1-7	Multi SV 1	SV - 1	0000	Between L-SV and H-SV	°C/°F /-	5-1 Multi SV number: 2, 4
1-8	Multi SV 2	SV - 2	0000	Between L-SV and H-SV	°C/°F /-	5-1 Multi SV number: 4
1-9	Multi SV 3	SV - 3	0000	Between L-SV and H-SV	°C/°F /-	5-1 Multi SV number: 4



## 5. Parameter 2 group: PAr2

Description		Display	Default	Set range	Unit	Display condition	
2-1	Auto tuning RUN/STOP	AE	OFF	OFF, ON	-	3-14 Control type: PID	
2-2	Heating proportional band	H-P	010.0	000.1 to 999.9	°C/°F, %	3-13 Control output mode: HEAT, H-C	3-14 Control type: PID
2-3	Cooling proportional band	C-P				3-13 Control output mode: COOL, H-C	
2-4	Heating integral time	H-I	0000	0000 to 9999	Sec	3-13 Control output mode: HEAT, H-C	
2-5	Cooling integral time	C-I				3-13 Control output mode: COOL, H-C	
2-6	Heating derivative time	H-d	0000	0000 to 9999	Sec	3-13 Control output mode: HEAT, H-C	
2-7	Cooling derivative time	C-d				3-13 Control output mode: COOL, H-C	
2-8	Dead overlap band	db	0000	-999 to 0999	°C/°F	3-1 Input specification: Temp. H	
			0000	-199.9 to 999.9		3-1 Input specification: Temp. L	
			0000	-99.9 to 099.9	%F.S	3-1 Input specification: Analog	
2-9	Manual reset	RESET	050.0	000.0 to 100.0	%	3-13 Control output mode: HEAT, COOL	3-14 Control type: PID 2-4/5 integral time: 0

Description		Display	Default	Set range	Unit	Display condition	
2-10	Heating hysteresis	H.HYS	002	1 to 100	°C/°F /-	3-13 Control output mode: HEAT, H-C 3-14 Control type: ONOF, ON.ON	3-1 Input specification: Temp. H, Analog
				0.1 to 100.0			3-1 Input specification: Temp. L
2-11	Heating OFF offset	H.o5t	000	0 to 100	°C/°F /-	3-13 Control output mode: HEAT, H-C 3-14 Control type: ONOF, ON.ON	3-1 Input specification: Temp. H, Analog
				0.0 to 100.0			3-1 Input specification: Temp. L
2-12	Cooling hysteresis	C.HYS	002	1 to 100	°C/°F /-	3-13 Control output mode: COOL, H-C 3-14 Control type: ONOF, ON.ON	3-1 Input specification: Temp. H, Analog
				0.1 to 100.0			3-1 Input specification: Temp. L
2-13	Cooling OFF offset	C.o5t	000	000 to 100	°C/°F /-	3-13 Control output mode: COOL, H-C 3-14 Control type: ONOF, ON.ON	3-1 Input specification: Temp. H, Analog
				0.0 to 100.0			3-1 Input specification: Temp. L
2-14	MV low limit	L - MV	0000	000.0 to H-MV - 0.1	%	3-13 Control output mode: HEAT, COOL 3-13 Control output mode: H-C	3-14 Control type: PID
			-0000	-100.0 to 000.0			3-14 Control type: PID
				0.0: OFF, -100.0: ON			3-14 Control type: ONOF

Description	Display	Default	Set range	Unit	Display condition		
2-15 MV high limit	H- $\bar{n}$ u	100.0	L-MV + 0.1 to 100.0	%	3-13 Control output mode: HEAT, COOL	3-14 Control type: PID	
			000.0 to 100.0			3-13 Control output mode: H-C	3-14 Control type: PID
			0.0: OFF, 100.0: ON			3-14 Control type: ONOF	
2-16 RAMP up change rate*	rR $\bar{n}$ U	000	000.0 to 999.9	°C/°F	3-1 Input specification: Temp. L	3-1 Input specification: Temp. H	
			000 to 999			3-1 Input specification: Analog	
			000 to 999	Digit	3-1 Input specification: Analog		
2-17 RAMP down change rate*	rR $\bar{n}$ d	000	000.0 to 999.9	°C/°F	3-1 Input specification: Temp. L	3-1 Input specification: Temp. H	
			000 to 999			3-1 Input specification: Analog	
			000 to 999	Digit	3-1 Input specification: Analog		
2-18 RAMP time unit*	r.U $\bar{n}$ t	$\bar{n}$ l n	SEC, MIN, HOUR	-	-	-	

## 5.1. Auto-tuning start/stop setting

Auto tuning measures the control subject's thermal characteristics and thermal response rate, and then determines the necessary PID time constant. (When control type [C-MD] is set as PID, it is displayed.)

If error [OPEN] occurs during auto tuning, it stops this operation automatically.

To stop auto tuning, change the set as OFF. (It maintains P, I, D values of before auto tuning.)

Description		Display	Default	Set range	Unit	Display condition
2-1	Auto tuning RUN/STOP	AT	OFF	OFF, ON	-	3-14 Control type: PID

- Auto-tuning automatically stores PID time constants upon termination. These PID time constants can then be modified by the user to suit their usage environment.
- When auto-tuning is in progress, the AT indicator located on the front of the controller flashes in 1 sec. intervals. When auto-tuning finishes, the AT indicator automatically goes off and the auto-tuning parameter will return to OFF.
- When auto-tuning is in progress and digital input key [DI-K] is switching RUN/STOP [STOP] or auto-tuning RUN/STOP[AT] is set, and digital input terminal function [DI-1, DI-2] is switching RUN/STOP [STOP] or AUTO/MANUAL control selection[MAN], 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)



Auto-tuning continues to run even if the temperature reading exceeds or falls below the input range.

When auto-tuning is in progress, parameters can only be referenced and not altered.

Auto-tuning is not available in manual control.

## 5.2. Proportional band settings

When present value (PV) 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.

Description		Display	Default	Set range	Unit	Display condition	
2-2	Heating proportional band	H - P	□ 10.0	000.1 to 999.9	°C/°F, %	3-13 Control output mode: HEAT, H-C	3-14 Control type: PID
2-3	Cooling proportional band	C - P				3-13 Control output mode: COOL, H-C	

## 5.3. Integral time settings

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.

Description		Display	Default	Set range	Unit	Display condition	
2-4	Heating integral time	H - I	□ □ □ □	0000 to 9999	Sec	3-13 Control output mode: HEAT, H-C	3-14 Control type: PID
2-5	Cooling integral time	C - I				3-13 Control output mode: COOL, H-C	



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.

## 5.4. Derivative time settings

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.

Description		Display	Default	Set range	Unit	Display condition	
2-6	Heating derivative time	H - d	□□□□	0000 to 9999	Sec	3-13 Control output mode: HEAT, H-C	3-14 Control type: PID
2-7	Cooling derivative time	C - d				3-13 Control output mode: COOL, H-C	



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

## 5.5. Dead band / Overlap band

In heating & cooling control, it is possible to designate a dead band between heating & cooling control bands based on set value(SV).

A dead band forms around the SV when positive (+) value is set. No control occurs in the dead band area. Therefore, heating & cooling MVs become 0.0% in the formed dead band.

An overlap band (simultaneous application of heating & cooling MVs) forms around the SV when negative (-) value is set.

Set as 0 when a dead band or an overlap band is not used.

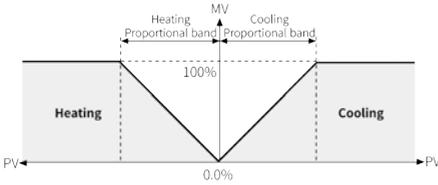
Description		Display	Default	Set range	Unit	Display condition
2-8	Dead overlap band	db	□□□□	-999 to 0999	°C/°F	3-1 Input specification: Temp. H
			□□□□	-199.9 to 999.9		3-1 Input specification: Temp. L
			□□□□	-99.9 to 099.9	%F.S	3-1 Input specification: Analog



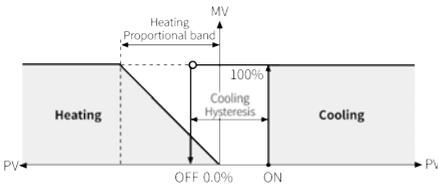
Depends on the set value of the 2-4 heating integration time, 2-5 cooling integration time, actual operation may be different.

# (1) Not used dead/overlap band

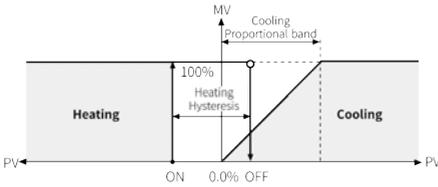
- Heating P - Cooling P control



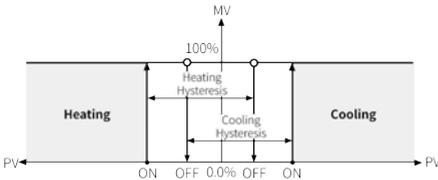
- Heating P - Cooling ON/OFF control



- Heating ON/OFF - Cooling P control

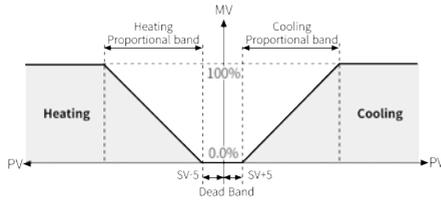


- Heating ON/OFF - Cooling ON/OFF control

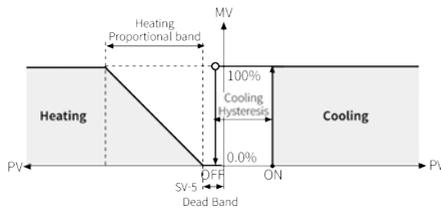


## (2) Used dead band

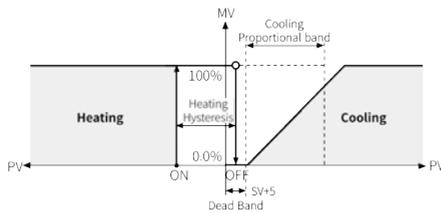
- Heating P - Cooling P control, Dead band 10 °C/°F



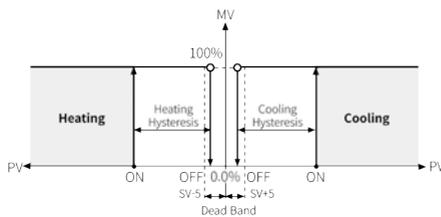
- Heating P - Cooling ON/OFF control, Dead band 10 °C/°F



- Heating ON/OFF - Cooling P control, Dead band 10 °C/°F

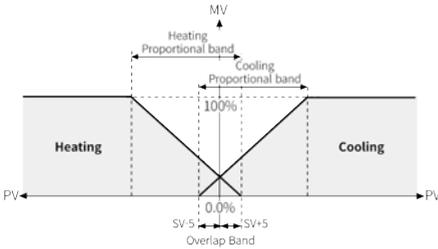


- Heating ON/OFF - Cooling ON/OFF control, Dead band 10 °C/°F

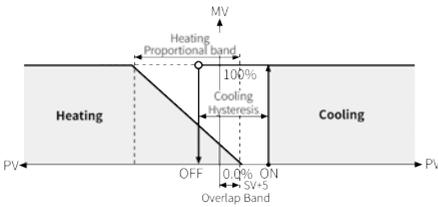


### (3) Used overlap band

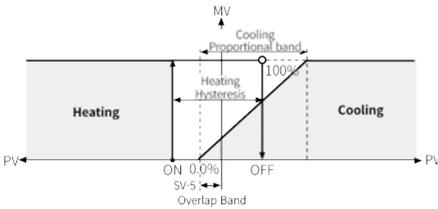
- Heating P - Cooling P control, Overlap band -10 °C/°F



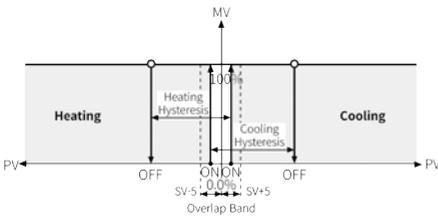
- Heating P - Cooling ON/OFF control, Overlap band -10 °C/°F



- Heating ON/OFF - Cooling P control, Overlap band -10 °C/°F



- Heating ON/OFF - Cooling ON/OFF control, Overlap band -10 °C/°F

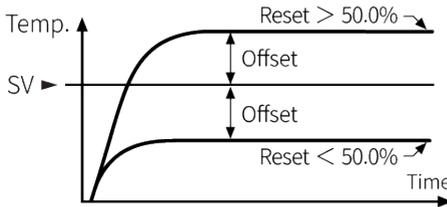


## 5.6. Manual reset

In case of using only proportional control (P, PD control), the rise time and fall time of the heater are different depending on the heat capacity and heater capacity of the control object, so even when the control is stable, a certain amount of deviation occurs. This deviation is called the Offset.

Normal deviation can be set/corrected by manual reset.

When control is stable, if PV and SV are the same, set it to 50%. If PV is lower than SV, increase the setting value to more than 50.0%. Conversely, if PV is higher than SV, set the setting value to less than 50.0%.



Description		Display	Default	Set range	Unit	Display condition	
2-9	Manual reset	r E 5 t	0 5 0 0	000.0 to 100.0	%	3-13 Control output mode: HEAT, COOL <sup>01)</sup>	3-14 Control type: PID 2-4/5 integral time: 0 <sup>02)</sup>

01) In case of 3-13 Control output mode: H-C, Heating/Cooling operates as 0% automatically. If changing 3-13 Control output mode setting, Manual reset operates as the previous value.

02) If changing 2-4/5 integral time setting, Manual reset operates as the previous value.

## 5.7. Heating/Cooling hysteresis and offset

Set the output change time of ON/OFF items based on a specific value, such as ON/OFF control or alarm.

If the output change operates only at the set value, the output is easily oscillated or affected by noise, so the ON/OFF operation is performed within the interval with hysteresis.

Setting the hysteresis too small can cause hunting due to disturbances (noise, chattering, etc.).

Consider the environment and set it to a value that minimizes the occurrence of hunting.

Description		Display	Default	Set range	Unit	Display condition	
2-10	Heating hysteresis	H.HYS	000	001 to 100	°C/°F /-	3-13 Control output mode: HEAT, H-C, 3-14 Control type: ONOF, ON.ON	3-1 Input specification: Temp. H, Analog
				0.1 to 100.0			3-1 Input specification: Temp. L
2-11	Heating OFF offset	H.o5t	000	000 to 100	°C/°F /-		3-1 Input specification: Temp. H, Analog
				0.0 to 100.0			3-1 Input specification: Temp. L
2-12	Cooling hysteresis	C.HYS	000	001 to 100	°C/°F /-	3-13 Control output mode: COOL, H-C, 3-14 Control type: ONOF, ON.ON	3-1 Input specification: Temp. H, Analog
				0.1 to 100.0			3-1 Input specification: Temp. L
2-13	Cooling OFF offset	C.o5t	000	000 to 100	°C/°F /-		3-1 Input specification: Temp. H, Analog
				0.0 to 100.0			3-1 Input specification: Temp. L

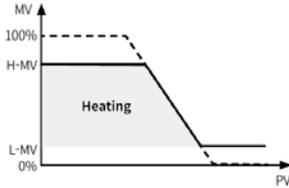
## 5.8. MV high/low-limit value

Set the MV high/low-limit value of the control output to limit the MV range. If the MV calculated by the temperature controller is out of the range, the MV is limited to high/low-limit values.

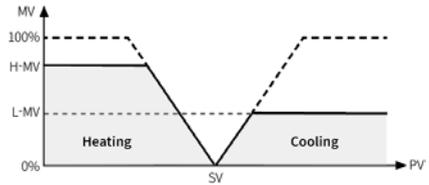
During heating-cooling control, cooling MV is displayed as - value.

High-limit value is set to + value for heating, and low-limit value is set to - value for cooling.

**Standard Control**



**Heating & Cooling Control**



Description	Display	Default	Set range	Unit	Display condition
2-14 MV low limit	L - $\bar{n}u$	000.0	000.0 to H-MV - 0.1	%	3-13 Control output mode: HEAT, COOL
		-100.0	-100.0 to 000.0		3-13 Control output mode: H-C
		0.0: OFF, -100.0: ON			
2-15 MV high limit	H - $\bar{n}u$	100.0	L-MV + 0.1 to 100.0	%	3-13 Control output mode: HEAT, COOL
		100.0	000.0 to 100.0		3-13 Control output mode: H-C
		0.0: OFF, 100.0: ON			



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).

## 5.9. Ramp

Ramp function is to set the change temperature per unit time reaching the set value (SV).

The rapid temperature change (heating or cooling) of the control object is limited the rate of change of the set value (SV) during control.

Ramp function is mainly used in the field where a problem may be caused to the control object by rapid temperature control (heating or cooling).

The temperature control of the control object is based on the SV (hereinafter referred to as RAMP SV) that is changed based on the set rate of change (change temperature per unit time).

Ramp up change rate and ramp down change rate can be set independently.

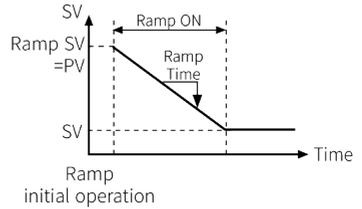
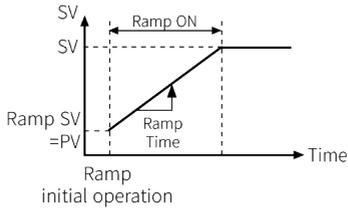
During ramp operation, the alarm operates based on the final SV.

Displays the RAMP SV of the front SV display during ramp operation.

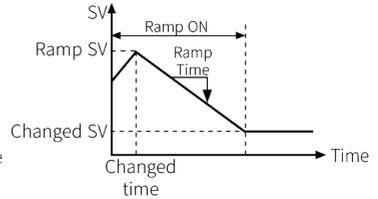
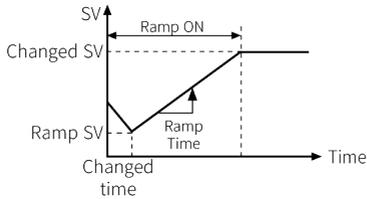
Description	Display	Default	Set range	Unit	Display condition
2-16 RAMP up change rate*	r.A.n.U	000	000.0 to 999.9	°C/°F	3-1 Input specification: Temp. L
			000 to 999		3-1 Input specification: Temp. H
			000 to 999	Digit	3-1 Input specification: Analog
2-17 RAMP down change rate*	r.A.n.d	000	000.0 to 999.9	°C/°F	3-1 Input specification: Temp. L
			000 to 999		3-1 Input specification: Temp. H
			000 to 999	Digit	3-1 Input specification: Analog
2-18 RAMP time unit*	r.U.n.t	n / n	SEC, MIN, HOUR	-	-

Status	RAMP RATE	RAMP function
OPEN, HHHH, LLLL, Auto-Tuning, Auto → Manual, RUN → STOP, After Auto-tuning end, PV = SV	Regardless conditions	Not operated
Power supply, SV change, STOP → RUN, Manual → Auto, Changing Ramp rate during ramp	≠ 0	Operates

- Ramp ON at not operated Ramp operation



- SV or Ramp parameter changing during Ramp operation





## 6. Parameter 3 group: PAr3

Description		Display	Default	Set range	Unit	Display condition
3-1	Input specification*	In-t	ECRH	Refer to <b>1.5.1</b> , “Input Type and Using Range”	-	-
3-2	Temperature unit	Unit	°C	°C, °F	-	3-1 Input specification: Temp.
3-3	Analog low limit	L-RG	00.00	Minimum range to H-RG-F.S.10 %	Digit	3-1 Input specification: Analog
3-4	Analog high limit	H-RG	10.00	L-RG+F.S.10 % to Maximum range	Digit	
3-5	Scaling decimal point	dot	0.0	0, 0.0, 0.00, 0.000	-	
3-6	Low limit scale	L-SC	0000.0	-1999 to 9999	-	
3-7	High limit scale	H-SC	1000.0	-1999 to 9999	-	
3-8	Display unit	dUnit	°C	°C, °F, %, OFF	-	
3-9	Input correction*	In-b	0000	-999 to 0999	°C/°F /-	3-1 Input specification: Temp. H, Analog
				-199.9 to 999.9		3-1 Input specification: Temp. L
3-10	Input digital filter*	nRAF	000.1	000.1 to 120.0	Sec	-
3-11	SV low limit value*	L-SV	-200	Min. value of temp. sensor to H-SV - 1 digit (< H-SV)	°C/°F /%	3-1 Input specification: Temp.
			000.0	Analog L-SC to H-SV - 1 digit (< H-SV)		3-1 Input specification: Analog

Description		Display	Default	Set range	Unit	Display condition
3-12	SV high limit value`	H-SV	1350	L-SV + 1 digit to Max. value of temp. sensor (> L-SV)	°C/°F /%	3-1 Input specification: Temp.
			1000	L-SV + 1 digit to Analog H-SC (> L-SV)		3-1 Input specification: Analog
3-13	Control output mode`	O-FE	HEAT	[Normal type] HEAT, COOL	-	-
			H-C	[Heating&Cooling type] HEAT, COOL, H-C		
3-14	Control type`	E-nd	PID	PID, ONOF: ON/OFF	-	3-13 Control output mode: HEAT, COOL
			P.P	P.P:PID-PID P.ON: PID-ON/OFF ON.P: ON/OFF-PID ON.ON: ON/OFF-ON/OFF		3-13 Control output mode: H-C
3-15	Auto tuning mode	AEK	TUN1	TUN1,TUN2	-	3-14 Control type: PID control
3-16	OUT1 control output selection	OUT1	CURR	[OUT1: Current output model] SSR, CURR	-	-
3-17	OUT1 SSR drive output type	OUT1	STND	[OUT1: SSR drive output model] STND, CYCL, PHAS	-	-
3-18	OUT1 current output range	OUT1	4-20	[OUT1: Current output model] 4-20, 0-20	-	3-16 OUT1 control output selection: CURR
3-19	OUT2 control output selection	OUT2	CURR	[OUT2: Current output model] SSR, CURR	-	-

Description		Display	Default	Set range	Unit	Display condition	
3-20	OUT2 current output range	02.nA	4-20	[OUT2: Current output model] 4-20, 0-20	-	3-19 OUT2 control output selection: CURR	
3-21	Heating control cycle	H-t	000.0	[Relay output model] 000.1 to 120.0	Sec	3-14 Control type: PID control	-
			000.0	[SSR drive output model] 000.1 to 120.0			3-17 OUT1 SSR drive output type: STND
			000.0	[Current output model] 001.0 to 120.0			3-16/19 OUT□ control output selection: SSR
3-22	Cooling control cycle	C-t	000.0	[Relay output model] 000.1 to 120.0	Sec	3-14 Control type: PID control	-
			000.0	[SSR drive output model] 000.1 to 120.0			3-17 OUT1 SSR drive output type: STND
			000.0	[Current output model] 001.0 to 120.0			3-16/19 OUT□ control output selection: SSR



- In case that OUT1, OUT2 output is relay output type:  
00t1, 015r, 01nA, 00t2, 025r, 02.nA parameters are not displayed.
- In case that OUT1, OUT2 output is current + SSR drive output type, when OUT1, OUT2 output is set to SSR:  
Output method of 015r, 025r is held in Stnd and parameter is not displayed.
- In case that OUT1, output is SSR drive output model of SSRP function and OUT2 output is current + SSR drive output:

- $\alpha_{UL}$ ,  $\alpha_{LH}$  are not displayed.
- $\alpha_{Lr}$  can set to  $5E_{nd}$ ,  $CYCL$ ,  $PHRS$
- When  $\alpha_{2.5r}$  is set to  $55r$  it is held in  $5E_{nd}$  and parameter is not displayed.

## 6.1. Input specification

This product supports multiple Input specifications, 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/low-limits are automatically set to the new specification's max/min values for temperature sensors. As for analog inputs, analog upper/lower input values are set to the max/min temperature range and the SV upper/low-limits set to upper/lower scale values. Therefore, you need to reconfigure the settings.

Description	Display	Default	Set range	Unit	Display condition
3-1 Input specification	Input	TEMP	Refer to <b>1.5.1</b> , “Input Type and Using Range”	-	-

## 6.2. Temperature unit

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

Description	Display	Default	Set range	Unit	Display condition
3-2 Temperature unit	Unit	°C	°C, °F	-	3-1 Input specification: Temp.



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

## 6.3. Analog input/scale value

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.

### 6.3.1. Analog High/Low-limit input value

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

The decimal point positions remain fixed when configuring the high/low limit input values. You can change the input values at AV1: 00.00, AV2/AV3: 0.000, AMV1: 000.0, AMA1/ AMA2: 00.00 decimal points.

Description		Display	Default	Set range	Unit	Display condition
3-3	Analog low limit	L - r G	00.00	Minimum range to H-RG-F.S.10 %	Digit	3-1 Input specification: Analog
3-4	Analog high limit	H - r G	10.00	L-RG+F.S.10 % to Maximum range	Digit	

### 6.3.2. Scaling decimal point

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

Description		Display	Default	Set range	Unit	Display condition
3-5	Scaling decimal point	d o t	0.0	0, 0.0, 0.00, 0.000	-	3-1 Input specification: Analog

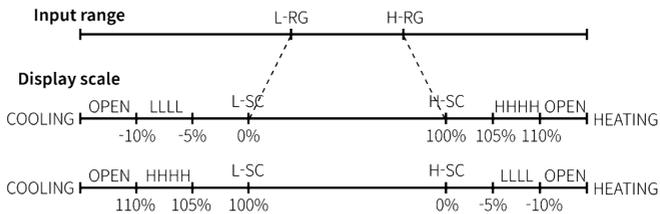
### 6.3.3. High/Low-limit scale value

You can set the display scales of high/low-limit values for analog input. (Based on the decimal point position setting.)

If the high and lower limit scale settings are identical, [ERR] flashes twice and setting mode is displayed.

Description	Display	Default	Set range	Unit	Display condition	
3-6	Low limit scale	L-SC	0000	-1999 to 9999	-	3-1 Input specification: Analog
3-7	High limit scale	H-SC	1000	-1999 to 9999	-	

- Based on 3-3/4 Analog high/low-limit value,  $\pm 5\%$  of the input range is extended to the high/low limit, and the output range is also extended by  $\pm 5\%$  in proportion to the set value.



- When PV is over the range of 3-6/7 Analog high/low-limit scale value, it displays as below.
  - Extended by  $\pm 5\%$ : Flashes PV
  - $\pm 5$  to 10 %: Flashes HHHH/LLLL
  - Over  $\pm 10\%$ : Flashes OPEN

## 6.4. Display unit

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

Description		Display	Default	Set range	Unit	Display condition
3-8	Display unit	<i>d.Unt</i>	°C	°C: Sets the display unit to °C and turns on the °C of front unit indicator. °F: Sets the display unit to °F and turns on the °F of front unit indicator. %: Sets the display unit to % and turns on the % of front unit indicator. OFF: Sets the display unit to an undefined unit. The LED unit indicator will not turn on.	-	3-1 Input specification: Analog

## 6.5. Input correction

This feature is used to compensate for input correction produced by thermocouples, RTDs, or analog input devices, NOT by the controller itself.

The Input correction 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.

Description	Display	Default	Set range	Unit	Display condition
3-9 Input correction*	I n - b	0000	-999 to 0999	°C/°F /-	3-1 Input specification: Temp. H, Analog
			-199.9 to 999.9		3-1 Input specification: Temp. L



If the controller displays 78°C when the actual temperature is 80°C, set the input correction [IN-B] as '002' in order to adjust the controller's display temperature to 80°C.

If present value after input correction is out of the input range by each input sensor, it displays 'HHHH' or 'LLLL'



Make sure that an accurate temperature variance measurement is taken before set values of input correction. 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 correction for input correction feature in order to ensure higher accuracy in temperature reading.

## 6.6. Input digital filter

It is not possible to perform stable control if the present value (PV) fluctuates because of fast changes of input signal. Using the Input digital Filter function can stabilize PV to realize more reliable control.

Description	Display	Default	Set range	Unit	Display condition
3-10 Input digital filter	$\bar{n}P\omega.F$	000.1	000.1 to 120.0	Sec	-



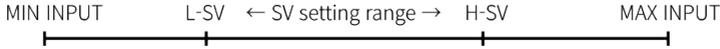
If the input digital filter is set to 0.4 sec., digital filtering is applied to a sampling value collected over 0.4 sec. (400 ms).



When the input digital filter is used, present value (PV) can vary from the actual input value.

## 6.7. SV high/low-limit value

By limiting the setting range of SV within the use range of temperature sensor/analog input, it is possible to protect the system and prevent control with the setting value that is not appropriate for the system.



Description	Display	Default	Set range	Unit	Display condition
3-11 SV low limit value*	L - 5 u	- 200	Min. value of temp. sensor to H-SV - 1 digit (< H-SV)	°C/°F /%	3-1 Input specification: Temp.
		0000	Analog L-SC to H-SV - 1 digit (< H-SV)		3-1 Input specification: Analog
3-12 SV high limit value*	H - 5 u	1350	L-SV + 1 digit to Max. value of temp. sensor (> L-SV)	°C/°F /%	3-1 Input specification: Temp.
		1000	L-SV + 1 digit to Analog H-SC (> L-SV)		3-1 Input specification: Analog



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.

## 6.8. Control output mode

Control output modes for general temperature control include heating, cooling, and heating & 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.

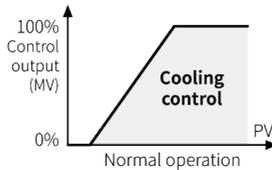
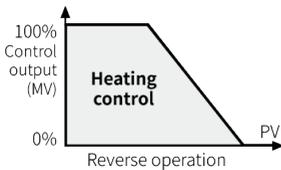
Description	Display	Default	Set range	Unit	Display condition
3-13 Control output mode	□ - F t	HEAT	[Normal type] HEAT: Heating control COOL: Cooling control	-	-
		H - C	[Heating&Cooling type] HEAT: Heating control COOL: Cooling control H-C: Heating (OUT1) - Cooling (OUT2) control		

### Heating control

In case of  $PV < SV$ , power is applied to the load.

### Cooling control

In case of  $PV > SV$ , power is applied to the load.



### Heating (OUT1) - Cooling (OUT2) control

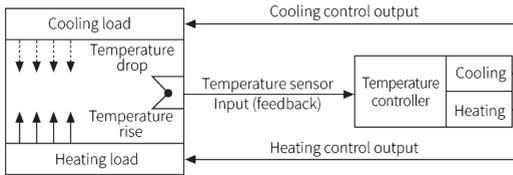
Heating & Cooling control mode: heating & cooling with a single temperature controller when it is difficult to control subject temperature with only heating or cooling.

Heating & Cooling control mode controls the object using different PID time constants for each heating & Cooling.

It is also possible to set heating & cooling control in both PID control or ON/OFF control mode.

Heating/cooling output can be selected among Relay output, SSR drive output and current output

depending on model types chosen according to your application environment. (Note that SSR drive output of OUT2 operates standard control.)

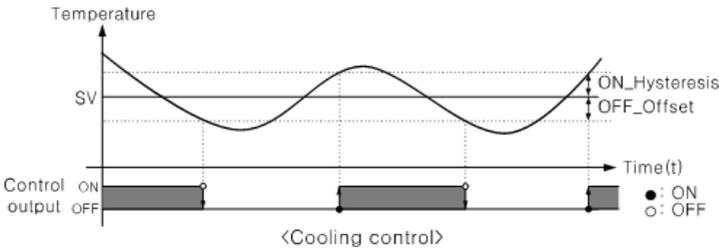
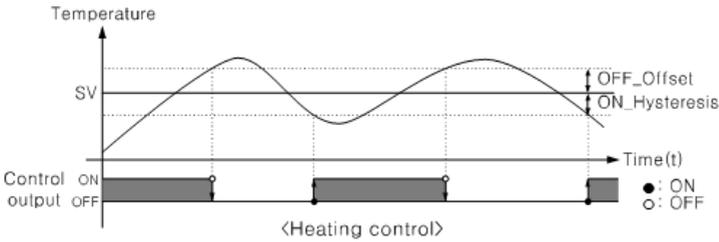


## 6.9. Control type

Description	Display	Default	Set range	Unit	Display condition
3-14 Control type <sup>1</sup>	$\bar{E} - \bar{n} d$	PID	PID, ONOF: ON/OFF	-	3-13 Control output mode: HEAT, COOL
		P.P	P.P:PID-PID P.ON: PID-ON/OFF ON.P: ON/OFF-PID ON.ON: ON/OFF-ON/OFF		3-13 Control output mode: H-C

### 6.9.1. ON/OFF control

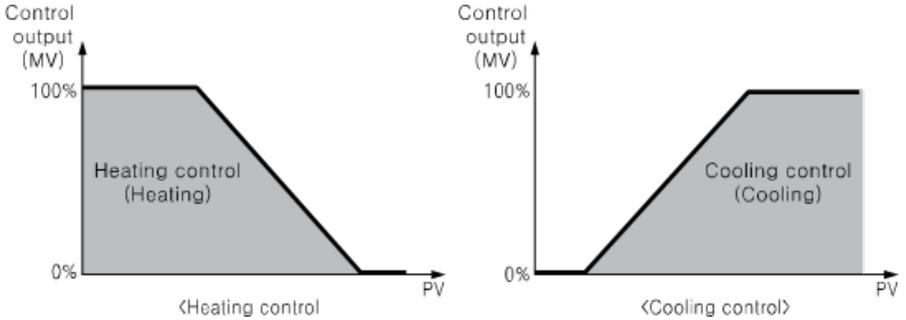
Controls the temperature by comparing present value (PV) with set value(SV) and turning power to the load on or off.



## 6.9.2. PID control

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): Smooth control without hunting
- Integral action (I): Automatically correct offset
- Differential action (D): Fast response to disturbances



### 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.

## 6.10. Auto tuning mode settings

Auto-tuning is available in TUN1 mode (based on SV) or TUN2 mode (based on 70% of SV), depending on the baseline value used.

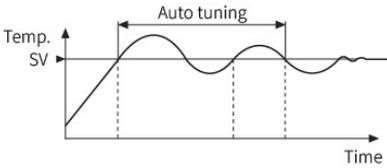
### TUNE 1 mode

Auto-tunes and derives a PID time constant based on set value(SV).

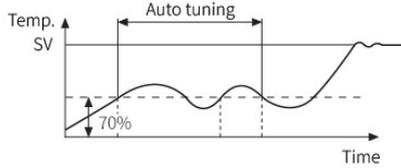
### TUNE 2 mode

Auto-tunes and derives a PID time constant based on 70% of set value(SV).

<TUN1>



<TUN2>



Description	Display	Default	Set range	Unit	Display condition
3-15 Auto tuning mode	Auto	TUN1	TUN1,TUN2	-	3-14 Control type: PID control



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

## 6.11. Output settings

### 6.11.1. Control output (OUT1/OUT2) selection

In case of selecting the Models with current control output, both current and SSR drive outputs are available. You can therefore choose the right output type depending on application environments.

Description	Display	Default	Set range	Unit	Display condition
3-16 OUT1 control output selection	OUT1	CURR	[OUT1: Current output model] SSR, CURR	-	-
3-19 OUT2 control output selection	OUT2	CURR	[OUT2: Current output model] SSR, CURR	-	-

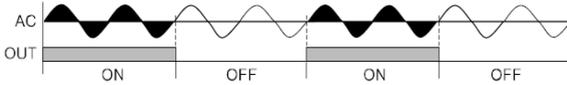
### 6.11.2. SSRP function

SSRP function of SSR drive output is selectable one of standard ON/OFF control, cycle, phase control. By parameter setting, standard SSR drive is available. Also, cycle control connecting with a zero cross turn-on method SSR, phase control Connecting with a random turn-on method SSR are available. Realizing high accuracy and cost effective temperature control with both current output (4-20 mA) and linear output(cycle control and phase control).

Description	Display	Default	Set range	Unit	Display condition
3-17 OUT1 SSR drive output type	SSR	STND	[OUT1: SSR drive output model] STND: Standard ON/OFF control CYCL: Cycle control PHAS: Phase control	-	-

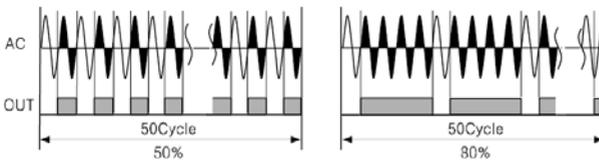
### Standard ON/OFF control (STND)

A mode to control the load in the same way as Relay output type.(ON: output level 100%, OFF: output level 0%)



### Cycle control (CYCL)

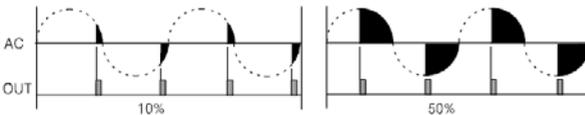
A mode to control the load by repeating output ON/OFF according to the rate of output within setting cycle. Having improved ON/OFF noise feature by Zero Cross type.



### Phase control (PHAS)

A mode to control the load by controlling the phase within AC half cycle. Serial control is available.

**Random turn-on SSR must be used for this mode.**



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

### 6.11.3. Current output range settings

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

Description	Display	Default	Set range	Unit	Display condition
3-18 OUT1 current output range	□ 1.ñA	4-20	[OUT1: Current output model] 4- 20, 0-20	-	3-16 OUT1 control output selection: CURR
3-20 OUT2 current output range	□ 2.ñA	4-20	[OUT2: Current output model] 4- 20, 0-20	-	3-19 OUT2 control output selection: CURR

### 6.11.4. Control period settings

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 drive output has a faster response than that of relay output. Therefore, by configuring a shorter control period, more responsive temperature control is achieved.

Description	Display	Default	Set range	Unit	Display condition	
3-21 Heating control cycle	H - t	000.0	[Relay output model] 000.1 to 120.0	Sec	3-14 Control type: PID control	-
		002.0	[SSR drive output model] 000.1 to 120.0			3-17 OUT1 SSR drive output type: STND
		002.0	[Current output model] 001.0 to 120.0			3-16/19 OUT□ control output selection: SSR

Description		Display	Default	Set range	Unit	Display condition	
3-22	Cooling control cycle	C - t	000.0	[Relay output model] 000.1 to 120.0	Sec	3-14 Control type: PID control	-
			002.0	[SSR drive output model] 000.1 to 120.0			3-17 OUT1 SSR drive output type: STND
			002.0	[Current output model] 001.0 to 120.0			3-16/19 OUT□ control output selection: SSR



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

## 7. Parameter 4 group: PAr 4

Description		Display	Default	Set range	Unit	Display condition
4-1	Alarm output1 Operation mode	AL - 1	ducc	OFF: Not used ducc: Deviation high-limit alarm ]]du: Deviation low-limit alarm ]]duc: Deviation high/low-limit alarm [du]: Deviation high/low-limit reverse alarm Pucc: Absolute value high-limit alarm ]]Pu: Absolute value low-limit alarm LbA: Loop break alarm SbA: Sensor break alarm HbA: Heater break alarm	-	-
4-2	Alarm output1 Option	AL LE	AL - A	AL-A: Standard alarm AL-B: Alarm latch AL-C: Standby alarm 1 AL-D: Standby alarm latch 1 AL-E: Standby alarm 2 AL-F: Standby alarm latch 2	-	4-1 Alarm output1 Operation mode: OFF the others

Description		Display	Default	Set range	Unit	Display condition	
4-3	Alarm output1 Hysteresis	A LHY	001	001 to 100	°C/°F	4-1 Alarm output1 Operation mode: LBA, SBA the others	3-1 Input specification: Temp. H
				000.1 to 100.0			3-1 Input specification: Temp. L
				001 to 100	Digit		3-1 Input specification: Analog
4-4	Alarm output1 contact type	A LN	no	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.	-	4-1 Alarm output1 Operation mode: OFF the others	
4-5	Alarm output1 ON delay time	A Lon	0000	0000 to 3600	Sec	4-1 Alarm output1 Operation mode: OFF the others	
4-6	Alarm output1 OFF delay time	A LOF	0000	0000 to 3600	Sec	4-1 Alarm output1 Operation mode: OFF the others	

Description	Display	Default	Set range	Unit	Display condition
4-7 Alarm output2 Operation mode	RL - 2	]]du	OFF: Not used duC: Deviation high-limit alarm ]]du: Deviation low-limit alarm ]duC: Deviation high/low-limit alarm [du]: Deviation high/low-limit reverse alarm PCC: Absolute value high-limit alarm ]]P: Absolute value low-limit alarm LbA: Loop break alarm SbA: Sensor break alarm HbA: Heater break alarm	-	-
4-8 Alarm output2 Option	RL 2L	RL - A	AL-A: Standard alarm AL-B: Alarm latch AL-C: Standby alarm 1 AL-D: Standby alarm latch 1 AL-E: Standby alarm 2 AL-F: Standby alarm latch 2	-	4-7 Alarm output2 Operation mode: OFF the others

Description		Display	Default	Set range	Unit	Display condition	
4-9	Alarm output2 Hysteresis	R2.HY	001	001 to 100	°C/°F	4-7 Alarm output2 Operation mode: LBA, SBA the others	3-1 Input specification: Temp. H
				000.1 to 100.0			3-1 Input specification: Temp. L
				001 to 100	Digit		3-1 Input specification: Analog
4-10	Alarm output2 contact type	R2.n	no	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.	-	4-7 Alarm output2 Operation mode: OFF the others	
4-11	Alarm output2 ON delay time	R2.ON	0000	0000 to 3600	Sec	4-7 Alarm output2 Operation mode: OFF the others	
4-12	Alarm output2 OFF delay time	R2.OF	0000	0000 to 3600	Sec	4-7 Alarm output2 Operation mode: OFF the others	

Description	Display	Default	Set range	Unit	Display condition
4-13 Alarm output3 Operation mode	AL - 3	OFF	OFF: Not used d u C C : Deviation high-limit alarm ] ] d u : Deviation low-limit alarm ] d u C : Deviation high/low-limit alarm [ d u ] : Deviation high/low-limit reverse alarm P u C C : Absolute value high-limit alarm ] ] P u : Absolute value low-limit alarm L b A : Loop break alarm S b A : Sensor break alarm H b A : Heater break alarm	-	-
4-14 Alarm output3 Option	AL 3L	AL - A	AL-A: Standard alarm AL-B: Alarm latch AL-C: Standby alarm 1 AL-D: Standby alarm latch 1 AL-E: Standby alarm 2 AL-F: Standby alarm latch 2	-	4-13 Alarm output3 Operation mode: OFF the others

Description		Display	Default	Set range	Unit	Display condition	
4-15	Alarm output3 Hysteresis	A3.H4	001	001 to 100	°C/°F	4-13 Alarm output3 Operation mode: LBA, SBA the others	3-1 Input specification: Temp. H
				000.1 to 100.0			3-1 Input specification: Temp. L
				001 to 100	Digit		3-1 Input specification: Analog
4-16	Alarm output3 contact type	A3.n	no	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.	-	4-13 Alarm output3 Operation mode: OFF the others	
4-17	Alarm output3 ON delay time	A3.on	0000	0000 to 3600	Sec	4-13 Alarm output3 Operation mode: OFF the others	
4-18	Alarm output3 OFF delay time	A3.of	0000	0000 to 3600	Sec	4-13 Alarm output3 Operation mode: OFF the others	
4-19	LBA time	LbA.t	0000	0000 to 9999	Sec	4-1/7/13 Alarm output□ Operation mode: LBA	
4-20	LBA band	LbA.b	002	000 to 999	°C/°F	3-1 Input specification: Temp. H	4-1/7 Alarm output1/2 Operation mode: LBA
			002.0	000.0 to 999.9			
			000.2	000.0 to 100.0	%		

Description	Display	Default	Set range	Unit	Display condition	
4-21	Analog Transmissi on output1 Mode	<i>Auto 1</i>	<i>Pu</i>	PV, SV, H-MV, C-MV	-	
4-22	Transmissi on output1 low limit	<i>F5.L 1</i>	<i>-200</i>	F.S	-	
4-23	Transmissi on output1 high limit	<i>F5.H 1</i>	<i>1350</i>	F.S	-	
4-24	Analog Transmissi on output2 Mode	<i>Auto 2</i>	<i>Pu</i>	PV, SV, H-MV, C-MV	-	
4-25	Transmissi on output2 low limit	<i>F5.L 2</i>	<i>-200</i>	F.S	-	
4-26	Transmissi on output2 high limit	<i>F5.H 2</i>	<i>1350</i>	F.S	-	
4-27	Communi cation address	<i>Adr 5</i>	<i>01</i>	01 to 99	-	
4-28	Communi cation speed	<i>bP5</i>	<i>96</i>	24, 48, 96, 192, 384	(×100)bps	
4-29	Comm. parity bit	<i>Prty</i>	<i>none</i>	NONE, EVEN, ODD	-	
4-30	Comm. stop bit	<i>StP</i>	<i>2</i>	1, 2	bit	
4-31	Response time	<i>rStt</i>	<i>20</i>	5 to 99	ms	

Description		Display	Default	Set range	Unit	Display condition
4-32	Comm. write	EN.A	EN.A	EN.A, DIS.A	-	



- 4-7 to 4-12: Displayed only with option output models that support alarm output2.
- 4-13 to 4-18: Displayed only when Relay OUT2 model and 3-13 Control output mode is set HEAT or COOL. (except TK4N)
- 4-21 to 4-26: Displayed only when Current OUT2 model and 3-13 Control output mode is set HEAT or COOL.

## 7.1. Alarm

There are three alarms which operate individually. You can set combined qoralarm operation and alarm option. Use digital input setting as [AIRE] or turn OFF power and re-start this unit to release alarm operation.

### 7.1.1. Alarm operation

Select the desired Alarm output Operation mode.

Mode	Name	Alarm operation	Description
OFF	-	-	Not used
d u C C	Deviation high-limit alarm	<p>High-limit Deviation: Set as 10 °C</p>	If the deviation of PV and SV is high-limit and higher than the deviation SV, alarm output turns ON.
		<p>High-limit Deviation: Set as -10 °C</p>	
] ] d u	Deviation low-limit alarm	<p>Low-limit Deviation: Set as 10 °C</p>	If the deviation of PV and SV is low-limit and higher than deviation SV, alarm output turns ON.
		<p>Low-limit Deviation: Set as -10 °C</p>	
] d u C	Deviation high/low-limit alarm	<p>High/low-limit Deviation: Set as 10 °C</p>	If the deviation of PV and SV is higher than the deviation SV in high-limit or low-limit, alarm output turns ON.
[ d u ]	Deviation high/low-limit reverse alarm	<p>High/Low-limit Deviation: Set as 10 °C</p>	If deviation between PV and SV is higher than the lower limit deviation set value and less than the upper limit deviation set value, the alarm output will be ON.

Mode	Name	Alarm operation	Description	
<i>P u C C</i>	Absolute value high-limit alarm	<p>Alarm absolute value: Set as 90°C</p>	<p>Alarm absolute value: Set as 110°C</p>	If PV is higher than alarm absolute value, alarm output turns ON.
<i>J J P U</i>	Absolute value low-limit alarm	<p>Alarm absolute value: Set as 90°C</p>	<p>Alarm absolute value: Set as 110°C</p>	If PV is lower than alarm absolute value, alarm output turns ON.
<i>L b R</i>	Loop break alarm	-	Loop break detection, alarm output turns ON.	
<i>S b R</i>	Sensor break alarm	-	Sensor break detection, alarm output turns ON.	
<i>H b R</i>	Heater break alarm	-	It will be ON when CT detects heater break.	

\* H: Alarm output Hysteresis

Description		Display	Default	Set range	Unit	Display condition
4-1	Alarm output1 Operation mode	RL - 1	ducc	oFF: Not used ducc: Deviation high-limit alarm ]]du: Deviation low-limit alarm ]du: Deviation high/low-limit alarm	-	-
4-7	Alarm output2 Operation mode	RL - 2	]]du	[du]: Deviation high/low-limit reverse alarm Pucc: Absolute value high-limit alarm ]]Pu: Absolute value low-limit alarm		
4-13	Alarm output3 Operation mode	RL - 3	oFF	LbA: Loop break alarm SbA: Sensor break alarm HbA: Heater break alarm		

## 7.1.2. Alarm output options

Users can select the desired alarm output options.

Description		Display	Default	Set range	Unit	Display condition
4-2	Alarm output1 Option	AL 1E	AL - A	AL-A: Standard alarm AL-B: Alarm latch AL-C: Standby alarm 1	-	4-1 Alarm output1 Operation mode: OFF the others
4-8	Alarm output2 Option	AL 2E		AL-D: Standby alarm latch 1 AL-E: Standby alarm 2		
4-14	Alarm output3 Option	AL 3E		AL-F: Standby alarm latch 2		



If alarm operation is set as loop break alarm [LBA], sensor break alarm [SBA], or heater break alarm[HBA], only standard alarm [AL-A] and alarm latch [AL-B] of alarm option are displayed.

Setting	Mode	Description
AL-A	Standard Alarm	If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.
AL-B	Alarm latch ※1	If it is an alarm condition, alarm output is ON and maintains ON status.
AL-C	Standby sequence1※2	First alarm condition is ignored and from second alarm condition, standard alarm operates. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, standard alarm operates.
AL-D	Alarm latch and standby sequence1	If it is an alarm condition, it operates both alarm latch and standby sequence. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, alarm latch operates.
AL-E	Standby sequence2	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.

Setting	Mode	Description
AL-F	Alarm latch and standby sequence2	Basic operation is same as alarm latch and standby sequence1. It operates not only by power ON/OFF, but also alarm set value, or alarm option changing. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, alarm latch operates.

- Condition of re-applied standby sequence for standby sequence 1, alarm latch and standby sequence 1: Power ON
- Condition of re-applied standby sequence for standby sequence 2, alarm latch and standby sequence 2: Power ON, changing set temperature, alarm temperature[AL1, AL2, AL3] or alarm operation[AL-1, AL-2, AL-3], switching STOP mode to RUN mode.

### 7.1.3. Alarm output Hysteresis

7.1.1, “Alarm operation” “H” from alarm operation 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).

Description		Display	Default	Set range	Unit	Display condition	
4-3	Alarm output1 Hysteresis	A LHY	001	001 to 100	°C/°F	4-1 Alarm output1 Operation mode: LBA, SBA the others	3-1 Input specification: Temp. H
				000.1 to 100.0			3-1 Input specification: Temp. L
				001 to 100	Digit		3-1 Input specification: Analog
4-9	Alarm output2 Hysteresis	A2HY	001	001 to 100	°C/°F	4-7 Alarm output2 Operation mode: LBA, SBA the others	3-1 Input specification: Temp. H
				000.1 to 100.0			3-1 Input specification: Temp. L
				001 to 100	Digit		3-1 Input specification: Analog
4-15	Alarm output1 Hysteresis	A3HY	001	001 to 100	°C/°F	4-13 Alarm output3 Operation mode: LBA, SBA the others	3-1 Input specification: Temp. H
				000.1 to 100.0			3-1 Input specification: Temp. L
				001 to 100	Digit		3-1 Input specification: Analog



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.

## 7.1.4. Alarm output contact type

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

Description		Display	Default	Set range	Unit	Display condition
4-4	Alarm output1 contact type	$R1.n$	$no$	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.	-	4-1/7/13 Alarm output <input type="checkbox"/> Operation mode: OFF the others
4-10	Alarm output2 contact type	$R2.n$				
4-16	Alarm output3 contact type	$R3.n$				

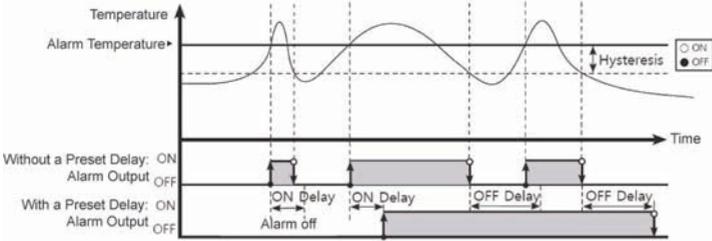
### Front LED Indicators

Change	Alarm trigger	Alarm output	Front LED
NO(Normally Open)	OFF	Open	<input type="checkbox"/> OFF
	ON	Close	<input checked="" type="checkbox"/> ON
NC(Normally Closed)	OFF	Close	<input type="checkbox"/> OFF
	ON	Open	<input checked="" type="checkbox"/> ON

### 7.1.5. Alarm output delay time

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 sec. intervals.



#### Alarm output ON delay time

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.

#### Alarm output OFF delay time

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.

Description		Display	Default	Set range	Unit	Display condition
4-5	Alarm output1 ON delay time	<i>A 1.o n</i>	0000	0000 to 3600	Sec	4-1/7/13 Alarm output <input type="checkbox"/> Operation mode: OFF the others
4-6	Alarm output1 OFF delay time	<i>A 1.o F</i>				
4-11	Alarm output2 ON delay time	<i>A 2.o n</i>				
4-12	Alarm output2 OFF delay time	<i>A 2.o F</i>				
4-17	Alarm output3 ON delay time	<i>A 3.o n</i>				
4-18	Alarm output3 OFF delay time	<i>A 3.o F</i>				

## 7.1.6. Loop break alarm(LBA)

Diagnoses the control loop by monitoring the control subject's temperature changes and sends out alarms if necessary.

- Heating control: When control output MV is 100% or high limit [H-MV] and PV is not increased over than LBA detection band [LBaB] during LBA monitoring time [LBaT], or when control output MV is 0% or low limit [L-MV] and PV is not decreased below than LBA detection band [LBaB] during LBA monitoring time [LBaT], alarm output turns ON.
- Cooling control: When control output MV is 0% or low limit [L-MV] and PV is not increased over than LBA detection band [LBaB] during LBA monitoring time [LBaT], or when control output MV is 100% or high limit [H-MV] and PV is not decreased below than LBA detection band [LBaB] during LBA monitoring time [LBaT], alarm output turns ON.

### 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.

If it is not as sensor break/HHHH/LLLL, during auto-tuning/manual control/control STOP/ramp function operation, loop break alarm does not operate.

Type	LBA monitoring time	Alarm output	
		Standard alarm	Alarm latch
Initializing Alarm, changing control output operation mode, setting LBA monitoring time/band as 0	Initialize	OFF	OFF
Changing input correction value, set value		Maintains the present alarm	Maintains the present alarm
Changing MV, stopping control, running auto-tuning		OFF	Maintains the present alarm
Occurring sensor break alarm, HHHH, LLLL		ON	ON



Set alarm operation[AL-□] as loop break alarm [LBA] and you can use loop break alarm.

When executing auto-tuning, LBA detection band and LBA monitoring time is automatically set based on auto-tuning value.

When alarm reset is input, it initializes LBA monitoring start time.

### 7.1.6.1. LBA monitoring time

You can set the LBA monitoring time to check changes in the control subject's temperature. Automatically setting with auto-tuning.

- Regardless of alarm operation [AL-□] (including LBA monitoring time as "0"), after running auto-tuning, the integration time×2 value is saved automatically.  
(If SV is out of the range of auto setting, it is set as max. or min. value of auto setting.)
- Except input type changing, re-running auto-tuning, manual setting of LBA monitoring time, it maintains the present SV.
- Auto setting range: 0020 to 9999

Description	Display	Default	Set range	Unit	Display condition	
4-19	LBA time	L B A T	□□□□	0000 to 9999	Sec	4-1/7/13 Alarm output□ Operation mode: LBA

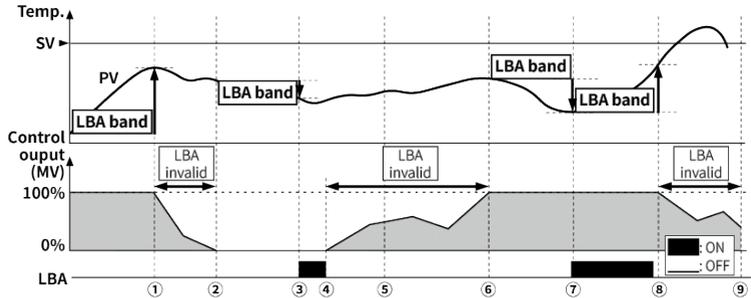
### 7.1.6.2. LBA detection band

You can set the minimum value of deviation change to decrease during LBA monitoring time. Automatically setting with auto-tuning.

- Except input type changing, re-running auto-tuning, manual setting of LBA monitoring time, it maintains the present SV.
- Regardless of alarm operation [AL-□] (including LBA monitoring time as “0”), after running auto-tuning, the integration time×2 value is saved automatically.  
(If SV is out of the range of auto setting, it is set as max. or min. value of auto setting.)
- Auto setting range  
 Temperature L: 002.0 to 100.0 (unit: °C/°F)  
 Temperature H: 0002 to 010.0 (unit: °C/°F)  
 Analog: 000.2 to 010.0 (unit: %F.S.)

Description		Display	Default	Set range	Unit	Display condition	
4-20	LBA band	L b R.b	□□□	000 to 999	°C/°F	3-1 Input specification: Temp. H	4-1/7 Alarm output1/2 Operation mode: LBA
			□□□.□	000.0 to 999.9		3-1 Input specification: Temp. L	
			□□□.□	000.0 to 100.0	%	3-1 Input specification: Analog	

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 during LBA monitoring time, or when control output MV is 0%(100% for cooling control) and PV is not decreased below than LBA detection band during LBA monitoring time, alarm output turns ON.



Start to ①	When control output MV is 100%, PV is increased over than LBA detection band during LBA monitoring time.
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 during LBA monitoring time, loop break alarm (LBA) turns ON after LBA monitoring time.
③ to ④	Control output MV is 0% and loop break alarm (LBA) turns and maintains ON.
④ to ⑥	The status of changing control output MV (LBA monitoring time is reset.)
⑥ to ⑦	When control output MV is 100% and PV is not increased over than LBA detection band during LBA monitoring time, loop break alarm (LBA) turns ON after LBA monitoring time.
⑦ to ⑧	When control output MV is 100% and PV is increased over than LBA detection band during LBA monitoring time, loop break alarm (LBA) turns OFF after LBA monitoring time.
⑧ to ⑨	The status of changing control output MV (LBA monitoring time is reset.)

### 7.1.7. Sensor break alarm(SBA)

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.

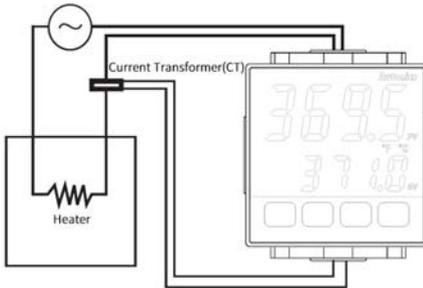
Setting alarm operation [AL-□] to [SBA] will activate Sensor Break Alarm.



Alarm output option can be set to standard alarm [AL-A] or alarm latch [AL-B].

### 7.1.8. Heater burnout alarm(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 (CT), which converts the current to the heater to a specific ratio (CT ratio) for monitoring. If the heater current value [CT-A] measured by the CT is less than the heater detection set value [AL□.L], the heater burnout alarm will activate.



- 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.
- Availability of the heater burnout alarm function is different by model and control output type.  
In case of heating&cooling model, heater burnout alarm function can be used in OUT1.

Model	Control output type	Heater burnout alarm
TK4□-□□R□ (Relay output)	Relay output	○
TK4□-□□S□ (SSR drive output)	ON/OFF control [STND]	○
	Cycle control [CYCL]	X
	Phase control [PHAS]	X
TK4□-□□C□ (Current or SSR drive output)	Current output [CURR]	X
	SSR drive output [SSR]	○

- 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 50A).
- 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.

## 7.1.9. Alarm output deactivation

Available only if alarm output option is set to alarm latch or alarm latch and standby sequence<sup>1</sup>, alarm latch and standby sequence<sup>2</sup>. 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 [DI-K] or the digital input terminals [DI-1/DI-2] for the alarm output deactivation feature [AL.RE].(regardless of parameter mask)

### (1) Deactivating alarm output using digital input key

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

### (2) Deactivation of alarm output using digital input (DI) terminal

When the digital input (DI) terminal [DI-1/DI-2] is assigned to alarm output deactivation [AIRE], the alarm output will deactivate when digital input (DI) terminal goes into the on state (close). (the MAN indicator turns ON).

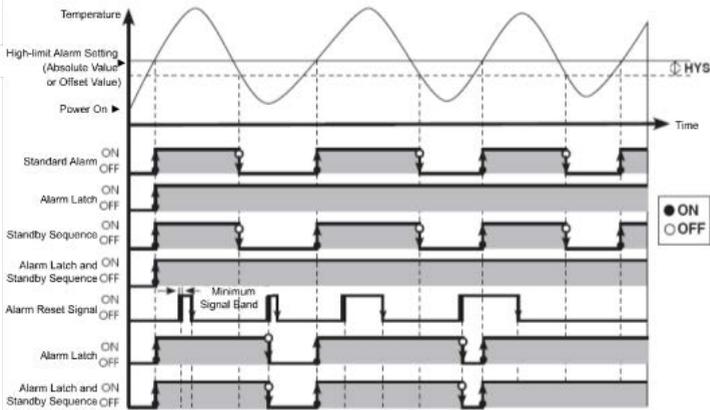


For detailed information on digital input key settings, see **8.2.1, “Digital input key”**.  
For detailed information on digital Input (DI) terminal configuration, see **8.2.2, “Digital input terminal”**.

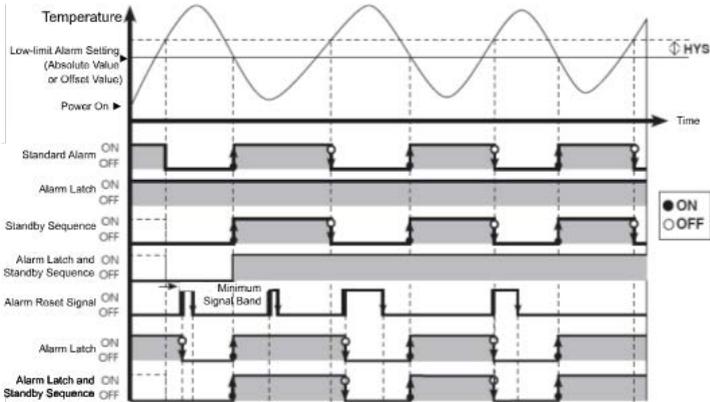
After deactivating the alarm output, it will function normally for the next alarm output occurrence.

## 7.1.10. Alarm output examples

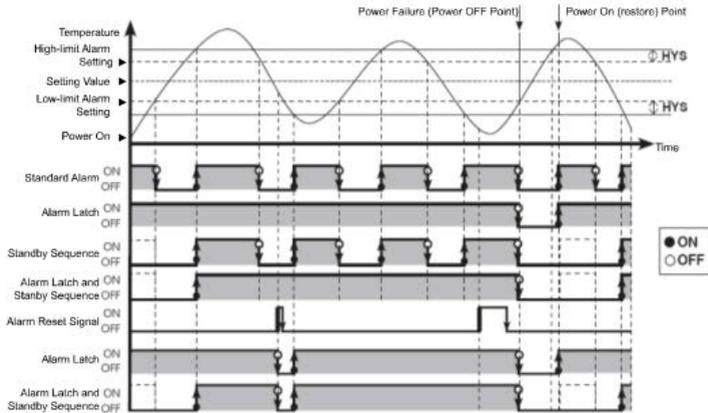
### (1) Absolute value high-limit alarm, Deviation high-limit alarm



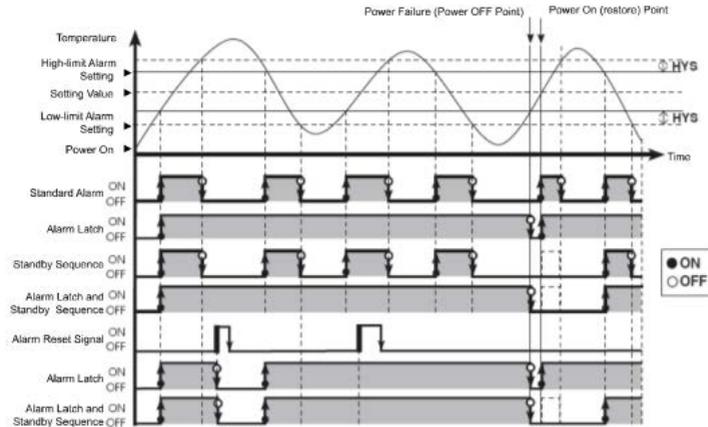
### (2) Absolute value low-limit alarm, Deviation low-limit alarm



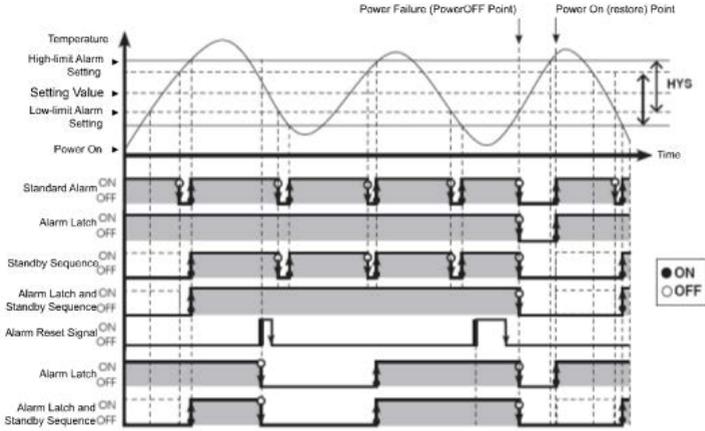
### (3) Deviation high/low-limit alarm



### (4) Deviation high/low-limit reverse alarm



### (5) Deviation high/low-limit alarm (hysteresis overlap)



## 7.2. Analog transmission

### 7.2.1. Analog transmission output

Transmission output is a type of auxiliary output that converts the controller's present value, set value, heating MV, cooling MV to analog current (DC 4 to 20 mA) for external transmission.

Description	Display	Default	Set range	Unit	Display condition
4-21 Analog Transmissi on output1 Mode	$P_{a.n} 1$	$P_u$	PV: PV transmission output SV: SV transmission output H-MV: Heating MV transmission output C-MV: Cooling MV transmission output	-	
4-24 Analog Transmissi on output2 Mode	$P_{a.n} 2$				



When using standard control mode of OUT2 current output model, OUT2 current output is available as transmission output 2. For transmission output model, [AO.M1] is activated. For standard control mode of OUT2 current output model, [AO.M2] is activated.

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.

## 7.2.2. Transmission output high/low-limit value

If the transmission output value [AO.M□] is below the transmission output low-limit [FS.L□], 4 mA output will be provided. If the transmission output is between the low-limit [FS.L□] and high-limit [FS.H□], a certain proportional output within the range 4 mA and 20 mA will be provided. If it is above the high-limit [FS.H□], 20 mA output will be provided.

**Transmission output low limit[FS.L□]** Sets the low-limit of transmission output (4 mA)

**Transmission output high limit[FS.H□]** Sets the high-limit of transmission output (20 mA)

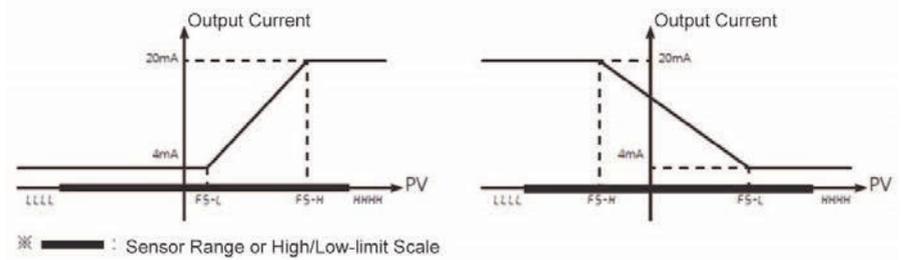
Description		Display	Default	Set range	Unit	Display condition	
4-22/25	Transmission output□ low limit	F5.L□	-200	usage range	-	3-1 Input specification: Temp.	4-21/24 Analog Transmission output□ Mode: PV
				L-SC to H-SC			
				L-SV to H-SV		4-21/24 Analog Transmission output□ Mode: SV	
				0 to 1000 (000.0 to 100.0)			4-21/24 Analog Transmission output□ Mode: H-MV, C-MV
4-23/26	Transmission output□ high limit	F5.H□	1350	usage range	-	3-1 Input specification: Temp.	4-21/24 Analog Transmission output□ Mode: PV
				L-SC to H-SC			
				L-SV to H-SV		4-21/24 Analog Transmission output□ Mode: SV	
				0 to 1000 (000.0 to 100.0)			4-21/24 Analog Transmission output□ Mode: H-MV, C-MV



If transmission output high-limit [FS.H□] is transmission output low-limit [FS.L□], the transmission output is 4 mA.

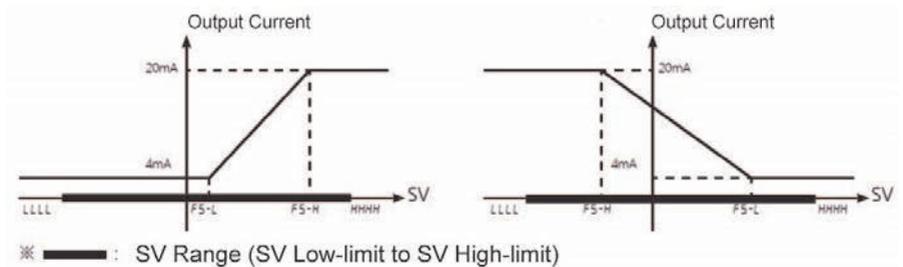
### (1) Present value (PV) transmission output

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



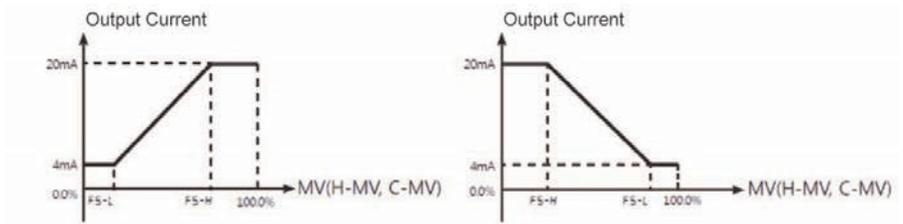
### (2) Set value (SV) transmission output

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



### (3) Heating MV/Cooling MV transmission output

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



## 7.3. 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 twisted pair that supports RS485.

### 7.3.1. Unit address settings

You can assign individual addresses to data units.

Description	Display	Default	Set range	Unit	Display condition
4-27 Communication address	<i>Adr 5</i>	<i>01</i>	01 to 99	-	-

### 7.3.2. BPS (bits per second) settings

You can set the rate of data transmission.

Description	Display	Default	Set range	Unit	Display condition
4-28 Communication speed	<i>bP 5</i>	<i>96</i>	24: 2400 48: 4800 96: 9600 192: 19200 384: 38400	bps	-

### 7.3.3. Comm. parity bit

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.

Description	Display	Default	Set range	Unit	Display condition	
4-29	Comm. parity bit	<i>Prty</i>	<i>none</i>	NONE: Disables parity bit. EVEN: 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.	-	-

### 7.3.4. Communication stop bit settings

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

Description	Display	Default	Set range	Unit	Display condition	
4-30	Comm. stop bit	<i>StP</i>	<i>2</i>	1: Sets end of data string to 1 bit. 2: Sets end of data string to 2 bits.	bit	-

### 7.3.5. Response wait time settings

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.

Description	Display	Default	Set range	Unit	Display condition	
4-31	Response time	<i>rStt</i>	<i>20</i>	5 to 99	ms	-



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

### 7.3.6. Enable/Disable communication write

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

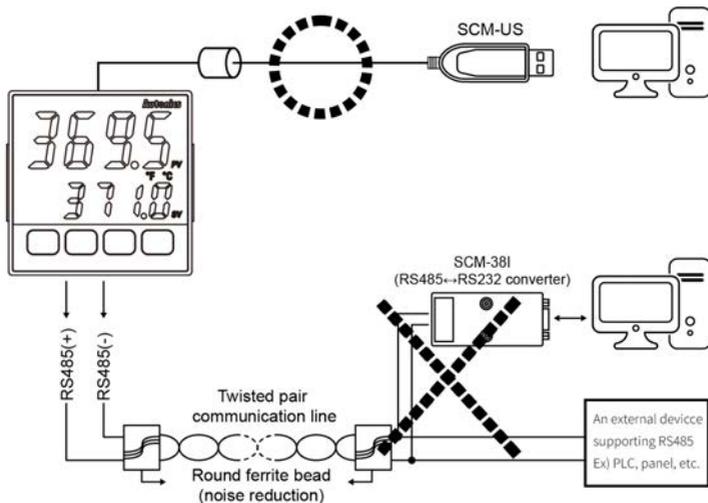
Description	Display	Default	Set range	Unit	Display condition
4-32 Comm. write	読 書 許 否	読 書 許	EN.A:Parameter set/change enable via communication. DIS.A:Prohibit parameter setting or modification via communication.	-	-



Reading parameter settings is available even though prohibit parameter setting.

### 7.3.7. USB to Serial communication connection

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





## 8. Parameter 5 group: PAr 5

Description		Display	Default	Set range	Unit	Display condition	
5-1	Multi SV number <sup>*</sup>	ñt.5u	1	1, 2, 4	EA	-	
5-2	Digital input key <sup>*</sup>	dl - 2	5toP	STOP, AL.RE, AT, OFF	-	-	
5-3	Digital input1 Terminal Function	dl - 1	oFF	OFF, STOP, AL.RE, MAN, MT.SV	-	-	
5-4	Digital input2 Terminal Function	dl - 2	oFF	OFF, STOP, AL.RE, MAN, MT.SV	-	-	
5-5	Manual control, initial MV <sup>(1)</sup>	1t.ñu	AUTO	AUTO: Controlling with auto control MV as an initial MV for manual control PR.MV: Controlling with preset manual MV [PR.MV] as an initial MV	-	-	
5-6	Manual control, preset MV <sup>(2)</sup>	Pr.ñu	000.0	000.0: OFF 100.0: ON	%	3-13 Control output mode: HEAT, COOL	3-14 Control type: ONOF
				000.0 to 100.0			3-14 Control type: PID
				-100.0: Cooling ON 000.0: OFF 100.0: Heating ON		3-13 Control output mode: H-C	3-14 Control type: ONOF
				-100.0 to 100.0			3-14 Control type: PID

Description		Display	Default	Set range	Unit	Display condition	
5-7	Sensor error MV	Err.u	0000	000.0: OFF 100.0: ON	%	3-13 Control output mode: HEAT, COOL	3-14 Control type: ONOF
				000.0 to 100.0			3-14 Control type: PID
				-100.0: Cooling ON 000.0: OFF 100.0: Heating ON		3-13 Control output mode: H-C	3-14 Control type: ONOF
				-100.0 to 100.0			3-14 Control type: PID
5-8	Control stop MV	St.u	0000	000.0: OFF 100.0: ON	%	3-13 Control output mode: HEAT, COOL	3-14 Control type: ONOF
				000.0 to 100.0			3-14 Control type: PID
				-100.0: Cooling ON 000.0: OFF 100.0: Heating ON		3-13 Control output mode: H-C	3-14 Control type: ONOF
				-100.0 to 100.0			3-14 Control type: PID
5-9	Control stop alarm output	St.AL	Cont	CONT, OFF	-	-	
5-10	User level	USER	Stnd	STND, HIGH	-	-	
5-11	SV setting lock	LSu	OFF	ON, OFF	-	-	
5-12	Parameter 1 group lock	LP1	OFF	ON, OFF	-	-	
5-13	Parameter 2 group lock	LP2	OFF	ON, OFF	-	-	

Description	Display	Default	Set range	Unit	Display condition
5-14 Parameter 3 group lock`	LC.P3	OFF	ON, OFF	-	-
5-15 Parameter 4 group lock`	LC.P4	OFF	ON, OFF	-	-
5-16 Parameter 5 group lock`	LC.P5	OFF	ON, OFF	-	-
5-17 Password setting`	Pyd	0000	<b>Please set it twice.</b> 0000: OFF 0001: Read only 0002 to 9999	-	-

## 8.1. Multi SV number

Multi SV function allows users to set multiple SVs and save each setting in SV0 to SV3. Users can change SV-N or select desired SV using external digital input terminal (digital input, DI-1, DI-2) function. Refer to **4.2, “Multi SV selection”**, **4.5, “Multi SV settings”** for more details.

This feature supports up to four SVs which can be independently configurable.

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

Description		Display	Default	Set range	Unit	Display condition
5-1	Multi SV number	$\bar{n} \text{ E.5} \cup$	1	1, 2, 4	EA	-



If the digital Input (DI-1, DI-2) feature has been set for multi SV [MtSV], the number of Multi SV is not modified through pressing key or communication.(regardless of parameter mask)

## 8.2. Digital input

### 8.2.1. Digital input key

With digital input key enabled in RUN mode, press and hold ▲, ▼ keys at the same time for 3 sec. to activate the preset function.

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 [MT.SV] of digital input terminals.)

Digital input key functions operate irrespective of 8.10, "Password settings", parameter mask.

Description		Display	Default	Set range	Unit	Display condition
5-2	Digital input key	di - P	St oP	STOP: RUN/STOP AL.RE: Forced alarm output deactivation AT: Auto-tuning RUN/OFF(in case of control method is PID control) OFF: Not used	-	-



If the digital input key and the digital input terminal set equally, the digital input key does not act.

## 8.2.2. Digital input terminal

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

Description	Display	Default	Set range	Unit	Display condition
5-3 Digital input1 Terminal Function	<i>di - 1</i>	<i>OFF</i>	OFF: Not used STOP: Run/Stop AL.RE: Alarm output deactivation	-	-
5-4 Digital input2 Terminal Function	<i>di - 2</i>		MAN: Auto/manual control selection MT.SV: Multi SV selection		

In the case one of DI-1 or DI-2 being set for Multi SV[MtSV], SV-0 is selected as the SV if the terminal's external contact signal is off and SV-1 is selected if the signal is on.

If both DI-1 and DI-2 are configured for Multi SV[MtSV], you can select the SV using combinational logic of the terminals. If multi SV [MtSV] 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	SV-0
ON	OFF	SV-1
OFF	ON	SV-2
ON	ON	SV-3

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.

The TK4S, M Series has a limited number of terminal blocks. Therefore, the digital input terminal1 (DI-1) is available. (In case of TK4S-D4 □□, only DI-1, DI-2 are available)

Digital input terminal function operates irrespective of **8.8, "SV group lock"**, **8.10, "Password settings"**, parameter mask.

## 8.3. Auto/Manual control settings

<b>Auto control mode</b>	Auto control mode is to make temperature reach SV with MV calculated by PID control.
<b>Manual control mode</b>	Manual control mode is to make temperature reach SV with user's defined MV.

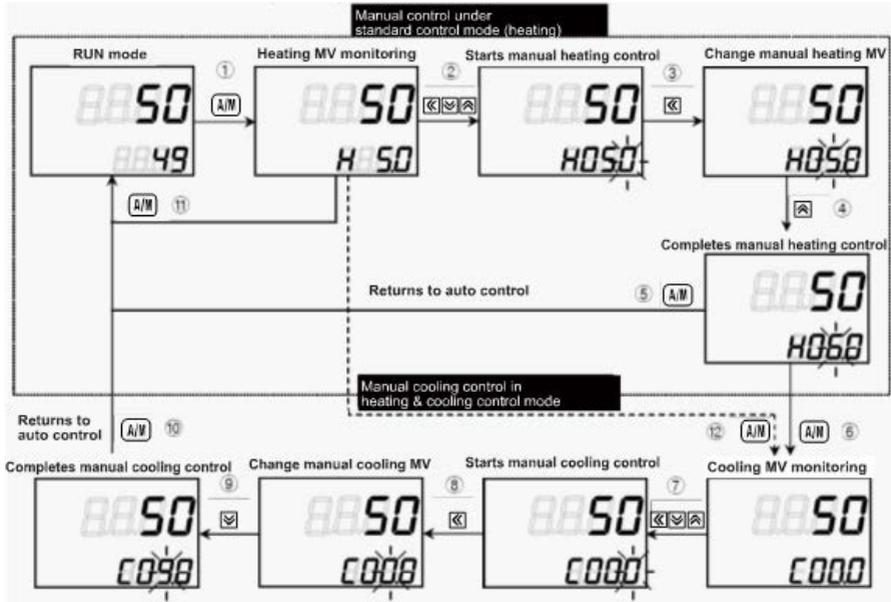


When in manual control mode, parameter settings can only be viewed and cannot be modified (except for lock parameters). When digital input terminal function[DI-1/DI-2] is set as Auto/Manual control [MAN], the **A/M** key (the **MODE** key for TK4N, TK4S, TK4SP) and the Auto/Manual switching by communication do not operate. 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 sensor break alarm [SBA] 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)

### 8.3.1. Manual/Auto control switching



#### (1) Manual control switching for standard control (heating or cooling control)

- ①, ⑤: When in RUN mode, press the **A/M** key (the **MODE** key for TK4N, TK4S, TK4SP model) and it enters MV monitoring mode. The SV display shows H (heating control) or C (cooling control), and shows MV to indicate the start of MV monitoring.
- ②, ⑥: If the **◀**, **▶**, **▼** is pressed when MV monitoring is in progress, the MAN indicator comes on and the lowest digit (100 digit) starts to flash, indicating activation of manual control.
- ③, ⑦: Press the **◀** key to change the flashing digit ( $10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$ ).
- ④, ⑧: Select the digit and configure the desired MV value using the **◀**, **▶**, **▼** keys moving to 0→1→2→3→4→5→6→7→8→9→0 by the **▶**, **▼** keys.
- ⑨: In ① to ⑧ status, press the **A/M** key (the **MODE** key for TK4N, TK4S, TK4SP model) to end manual control. The MAN indicator goes off and the system reverts to auto control mode.

## (2) Manual control switching for heating & cooling control

- ①: When in RUN mode, press the **A/M** key (the **MODE** key for TK4N, TK4S, TK4SP model) and it enters heating MV monitoring mode. The SV display shows 'H' and shows MV to indicate the start of heating MV monitoring.
- ②: If the **◀**, **▲**, **▼** is pressed when heating MV monitoring is in progress, the MAN indicator comes on and the lowest digit (100 digit) starts to flash, indicating activation of manual control.
- ③: Press the **◀** 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 moving to 0→1→2→3→4→5→6→7→8→9→0 by the **▲**, **▼** keys.
- ⑤: In ① to ④ status, press the **A/M** key (the **MODE** key for TK4N, TK4S, TK4SP model) and it enters cooling MV monitoring mode. The SV display shows 'C' and shows MV to indicate the start of cooling MV monitoring.
- ⑥: If the **◀**, **▲**, **▼** is pressed when cooling MV monitoring is in progress, the lowest digit (100 digit) starts to flash.
- ⑦: Press the **◀** key to change the flashing digit ( $10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$ ).
- ⑧: Select the digit and configure the desired MV value using the **◀**, **▲**, **▼** keys moving to 0→1→2→3→4→5→6→7→8→9→0 by the **▲**, **▼** keys.
- ⑨: In ⑤ to ⑧ status, press the **A/M** key (the **MODE** key for TK4N, TK4S, TK4SP model) to end manual control. The MAN indicator goes off and the system reverts to auto control mode.



After heating & 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. TK4N/S/SP (W48 × H48mm) does not have the **A/M** key. Press the **MODE** key once to change between auto and manual controls.

If the digital input feature [DI-1/DI-2] has been set for AUTO/MANUAL[MAN], the **A/M** key (the **MODE** key for TK4N, TK4S and TK4SP model) key located on the front and automatic/manual control functions via communication do not act.

### (3) Manual/Auto Control switching with the digital input (DI) terminal

If the digital input feature[DI-1/DI-2] has been set for AUTO/MANUAL control switching[MAN], turn on the DI to activate manual control (MAN indicator 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.



See **8.2, “Digital input”**, for detailed information on digital Input (DI) terminal settings.

When MV parameter is masked, MV parameter cannot be monitored and changed.

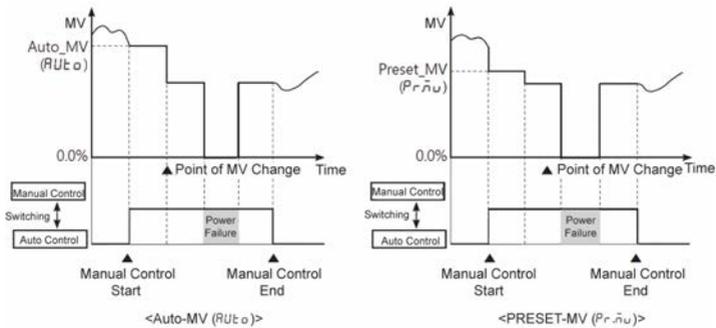
### 8.3.2. Baseline MV for manual control

When switching from auto control [AUTO] to manual control [PR.MV] you can set the initial MV.

Description	Display	Default	Set range	Unit	Display condition	
5-5 Manual control, initial MV <sup>01)</sup>	$RU\bar{U}t\bar{o}$	$RU\bar{U}t\bar{o}$	AUTO: Controlling with auto control MV as an initial MV for manual control PR.MV: Controlling with preset manual MV [PR.MV] as an initial MV	-	-	
5-6 Manual control, preset MV <sup>02)</sup>	$Pr.\bar{n}\bar{u}$	$000.0$	000.0: OFF 100.0: ON	%	3-13 Control output mode: HEAT, COOL	3-14 Control type: ONOF
			000.0 to 100.0			3-14 Control type: PID
			-100.0: Cooling ON 000.0: OFF 100.0: Heating ON		3-13 Control output mode: H-C	3-14 Control type: ONOF
			-100.0 to 100.0			3-14 Control type: PID

01) When re-supplying the power, it controls with the MV which is at the power OFF.

02) When in heating & 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.



## 8.4. MV Settings upon sensor break error

In the event of a sensor open error (OPEN) 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.

Description		Display	Default	Set range	Unit	Display condition	
5-7	Sensor error MV	E r. n u	0000	000.0: OFF	%	3-13 Control output mode: HEAT, COOL	3-14 Control type: ONOF
				100.0: ON			3-14 Control type: PID
				000.0 to 100.0		3-13 Control output mode: H-C	3-14 Control type: ONOF
				-100.0: Cooling ON			3-14 Control type: PID
000.0: OFF							
				100.0: Heating ON			
				-100.0 to 100.0			

## 8.5. Stop control output settings

This parameter sets the control output value when in the stop state.

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

Description		Display	Default	Set range	Unit	Display condition	
5-8	Control stop MV	5t.nu	000.0	000.0: OFF	%	3-13 Control output mode: HEAT, COOL	3-14 Control type: ONOF
				100.0: ON			3-14 Control type: PID
				000.0 to 100.0		3-13 Control output mode: H-C	3-14 Control type: ONOF
				-100.0: Cooling ON 000.0: OFF 100.0: Heating ON			3-14 Control type: PID
-100.0 to 100.0							

## 8.6. Stop alarm output

Enable or disable alarm output upon a stop.

Description		Display	Default	Set range	Unit	Display condition
5-9	Control stop alarm output	5t.AL	CONT	CONT: Alarm output continues regardless of control operation. OFF: Alarm output ceases along with a stop under all conditions. <sup>01)</sup>	-	-

01) Reverting to RUN mode after a stop in alarm latch or alarm latch and standby sequence restores the alarm output to the previous state.

## 8.7. User level

Description	Display	Default	Set range	Unit	Display condition
5-10	User level*	<i>USER</i>	<i>STND</i>		
			STND: Activates standard user parameters <sup>01)</sup> HIGH: Activates all parameters	-	-

01) \* mark parameters of the each parameter group table only display.

## 8.8. SV group lock

You can restrict SV parameter modification by locking SV group parameters, which include SV selection, digital input key (▲ + ▼ keys for 3 sec.), A/M (the **MODE** key for TK4N, TK4S, TK4SP model) key for monitoring and manual control, parameter reset [INIT], etc.

Description	Display	Default	Set range	Unit	Display condition
5-11 SV setting lock	L L.5 u	OFF	ON: Activates SV group lock. OFF: Deactivates SV group lock.	-	-

## 8.9. Parameter group lock

Lock or unlock individual parameter groups from parameter 1 group (*PAR 1*) to parameter 5 group (*PAR 5*).

Even with parameter group lock in place, you can still read parameter settings.

In Parameter 5's (*PAR 5*) case, the settings can still be modified even with a lock [LC.SV/LC.P□] initiated.

Description	Display	Default	Set range	Unit	Display condition
5-12 Parameter 1 group lock	LC.P 1	OFF	ON: Lock parameter group OFF: Unlock parameter group	-	-
5-13 Parameter 2 group lock	LC.P 2				
5-14 Parameter 3 group lock	LC.P 3				
5-15 Parameter 4 group lock	LC.P 4				
5-16 Parameter 5 group lock	LC.P 5				

## 8.10. Password settings

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 PWD parameter with the read-only password displays a coded form of the setting.

When entering SV setting or parameter group in operation state, PASS parameter is displayed. You must enter your password to enter.

If the password is wrong, the code that encrypted the preset password and ERR are displayed on the front SV display by blinking repeatedly at 1 second intervals.

### Settings

1. When in RUN mode, press and hold the **MODE** key.
2. Use the **▲**, **▼** keys to select PAR5 and then press the **MODE** key.
3. Press the **MODE** key to search PWD.
4. Select the desired digit using the **◀** key.
5. Use the **▲**, **▼** keys to set the password (0000, 0002 to 9999) then press the **MODE** key to set the password.
6. Repeat steps 4 and 5 and enter the preset password.
7. Press the **MODE** key or do not make any additional key entry for 3 sec. to save the password.

Description	Display	Default	Set range	Unit	Display condition
5-17 Password setting	PWD	0000	<b>Please set it twice.</b> 0000: OFF 0001: Read only 0002 to 9999	-	-

#### If you forgot your password

If the password is entered incorrectly, the password encrypted code is displayed. Please notice Autonics your encryption code. Autonics can find the password saved by the user by using a code cracking program.

# Autonics

Dimensions or specifications on this manual are subject to change and some models may be discontinued without notice.

[www.autonics.com](http://www.autonics.com)