

KT4R/KT8R/KT9R Temperature Controller User's Manual

Preface

Thank you for purchasing the **Panasonic**® Temperature controllers KT4R / KT8R / KT9R. This User's Manual contains instructions for mounting, functions, operations and notes when operating the KT4R, KT8R, KT9R. To prevent accidents arising from the misuse of this controller, please ensure the operator receives this manual.

Abbreviations used in this manual

Abbreviation	Term
PV	Process variable
SV	Desired value
MV	Manipulated variable
DV	Deviation
OUT1	Control output OUT1
OUT2	Control output OUT2
AT	Auto-tuning

Characters used in this manual

Indication	1	0	1	2	3	4	5	6	7	8	9	℃	℉
Number, °C/°F	-1	0	1	2	3	4	5	6	7	8	9	°C	°F
Indication	A	b	c	d	E	F	G	H	I	J	K	L	M
Alphabet	A	B	C	D	E	F	G	H	I	J	K	L	M
Indication	n	o	P	q	r	s	t	U	v	w	x	y	z
Alphabet	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Notes

- This instrument should be used in accordance with the specifications described in the manual.
If it is not used according to the specifications, it may malfunction or cause a fire.
- Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- The contents of this instruction manual are subject to change without notice.
- Care has been taken to ensure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform our company.
- Measures must be taken to ensure that the operator cannot touch power terminals or other high voltage sections.
- Any unauthorized transfer or copying of this document, in part or in whole, is prohibited.
- Panasonic Industrial Devices SUNX Co., Ltd. is not liable for any damage or secondary damage(s) incurred as a result of using this product, including any indirect damage.

Safety Precautions (Be sure to observe these precautions to prevent injury or accidents.)

The safety precautions are classified into 2 categories: "Warning" and "Caution".



Warning

Procedures which may lead to dangerous conditions and cause death or serious injury, if not carried out properly.



Caution

Procedures which may lead to dangerous conditions and cause superficial to medium injury or physical damage or may degrade or damage the product, if not carried out properly.



Warning

- Take safety measures externally to keep the whole system safe in the event of a malfunction of this instrument or any problem due to external factors.
- Avoid using this instrument where it may be exposed to combustible gases. This may cause an explosion.
- Do not dispose of this instrument in a fire. Batteries or electronic components may explode or leak.



Caution

- To ensure safe and correct use, thoroughly read and understand this manual before using this instrument.
- Panasonic Industrial Devices SUNX Co., Ltd. is not liable for any damage or secondary damage(s) incurred as a result of using this product, including any indirect damage.
- External protection devices, such as protective equipment against excessive temperature rise, etc., must be installed to avoid serious damage to the system or injury to personnel if malfunction of this product occurs.
- Install an emergency stop circuit or interlock circuit externally.
- This instrument must be used under the conditions and environment described in this manual.
- To prevent generation of abnormal heat or smoke, allow for some headroom in performance values and guaranteed values, as stated in the instrument's specifications.
- Do not disassemble or modify this instrument. This may cause generation of abnormal heat or smoke.
- Do not touch live terminals. This may cause electric shock.
- Connect the electric wire securely. If it is not securely wired, generation of abnormal heat or smoke may be caused.
- Do not leave foreign objects such as liquid, flammable material or metals in the instrument, as they could cause an abnormal heat or smoke.
- Turn the power supply to the instrument OFF before wiring (connection and removal). Otherwise it may result in electric shock.
- Before cleaning the instrument, be sure to check that the power is switched OFF.
- Use a soft, dry cloth when cleaning the instrument. (Alcohol based substances may tarnish or deface the unit.)
- As the display section is vulnerable, do not strike or scratch it with a hard object or put pressure on it.

Precautions

1. Installation Precautions



Caution

This instrument is intended to be used under the following environmental conditions (IEC61010-1): Overvoltage category II, Pollution degree 2

Ensure the mounting location corresponds to the following conditions:

- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gases
- No mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of -10 to 55°C (14 to 131°F) that does not change rapidly, and no icing
- An ambient non-condensing humidity of 35 to 85%RH
- No large capacity electromagnetic switches or cables through which large current is flowing
- No water, oil or chemicals or where the vapors of these substances can come into direct contact with the unit
- Take note that the ambient temperature of this unit – not the ambient temperature of the control panel – must not exceed 55°C (131°F) if mounted through the face of a control panel, otherwise the life of electronic components (especially electrolytic capacitors) may be shortened.

※ **Avoid setting this instrument directly on or near flammable material even though the case of this instrument is made of flame-resistant resin.**

2. Wiring Precautions



Caution

- Do not leave wire remnants in the instrument, as they could cause a fire or malfunction.
- Use the solderless terminal with an insulation sleeve in which the M3 screw fits when wiring the instrument.
- The terminal block of this instrument is designed to be wired from the left side. The lead wire must be inserted from the left side of the terminal, and fastened with the terminal screw.
- Tighten the terminal screw using the specified torque. If excessive force is applied to the screw when tightening, the terminal screw or case may be damaged.
- When using a terminal cover for the KT4R, pass terminal wires numbered 7 to 12 into the holes of the terminal cover.
- This instrument does not have a built-in power switch, circuit breaker and fuse.
It is necessary to install a power switch, circuit breaker and fuse near the controller.
(Recommended fuse: Time-lag fuse, rated voltage 250 V AC, rated current 2 A)
- For the KT4R with a 24 V AC/DC power source, do not confuse polarity when using direct current (DC).
- Do not apply a commercial power source to the sensor which is connected to the input terminal nor allow the power source to come into contact with the sensor.
- Use a thermocouple and compensating lead wire according to the sensor input specifications of this controller.
- Use the 3-wire RTD according to the sensor input specifications of this controller.
- For DC voltage input, (+) side input terminal number of 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC differs from that of 0 to 1 V DC.

Model	Terminal Number
KT4R	⑨: (+) side of 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC ⑩: (+) side of 0 to 1 V DC
KT8R, KT9R	⑪: (+) side of 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC ⑫: (+) side of 0 to 1 V DC

- When using a relay contact output type, externally use a relay according to the capacity of the load to protect the built-in relay contact.
- When wiring, keep input wires (thermocouple, RTD, etc.) away from AC sources or load wires.

3. Operation and Maintenance Precautions



Caution

- It is recommended that AT be performed on the trial run.
- Do not touch live terminals. This may cause electric shock or problems in operation.
- Turn the power supply to the instrument OFF when retightening the terminal or cleaning.
Working on or touching the terminal with the power switched ON may result in severe injury or death due to electric shock.
- Use a soft, dry cloth when cleaning the instrument.
(Alcohol based substances may tarnish or deface the unit.)
- As the display section is vulnerable, do not strike or scratch it with a hard object or put pressure on it.

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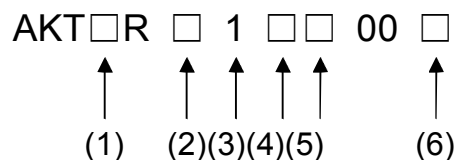
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1. Model Number

1.1 Model Number



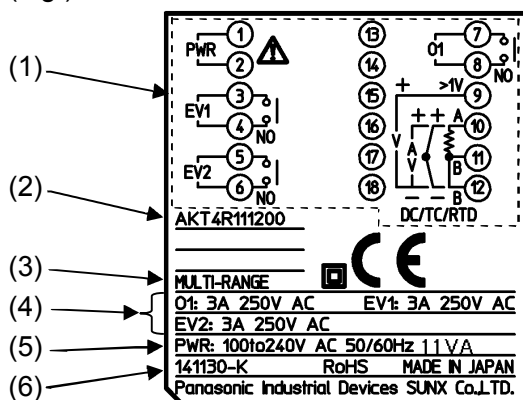
- | | |
|------------------------------|---|
| (1) External dimensions | 4: 48×48×68 (Depth of control panel interior 60) mm (W×H×D)
8: 48×96×68 (Depth of control panel interior 60) mm (W×H×D)
9: 96×96×68 (Depth of control panel interior 60) mm (W×H×D) |
| (2) Supply voltage | 1: 100 to 240V AC, 2: 24V AC/DC (※) |
| (3) Input type | 1: Multi-input (Thermocouple, RTD, Direct current and DC voltage can be selected by key operation.) |
| (4) Control output (OUT1) | 1: Relay contact 2: Non-contact voltage (for SSR drive)
3: Direct current |
| (5) Event output | 1: 1 point (Relay contact 1a), 2: 2 points (Relay contact 1a) |
| (6) Serial communication (*) | Blank: Not available 1: RS-485 Serial communication |
- (※) Only for the KT4R model

1.2 How to Read the Rated Label

The rated label is attached to the case.

KT4R

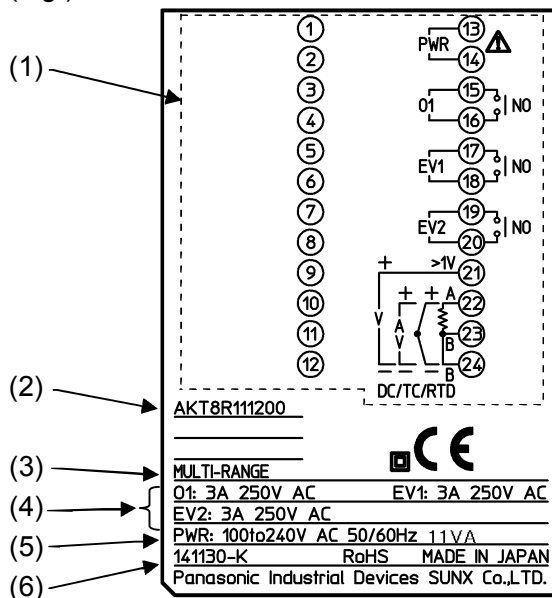
(e.g.) AKT4R111200



(Fig. 1.2-1)

KT8R, KT9R

(e.g.) AKT8R111200

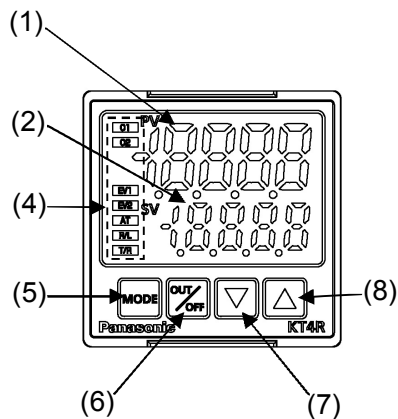


(Fig. 1.2-2)

No.	Explanation	Indication Example
(1)	Terminal arrangement	Terminal arrangement for the AKT4R111200, AKT8R111200
(2)	Model number	AKT4R111200, AKT8R111200
(3)	Input	MULTI-RANGE (Multi-range input)
(4)	Control output, Event output	O1: 3 A 250 V AC (Control output OUT1) EV1: 3 A 250 V AC (Event output EV1) EV2: 3 A 250 V AC (Event output EV2)
(5)	Supply voltage, Power consumption	100 to 240 V AC 50/60 Hz 11 VA
(6)	Lot number	141130-K

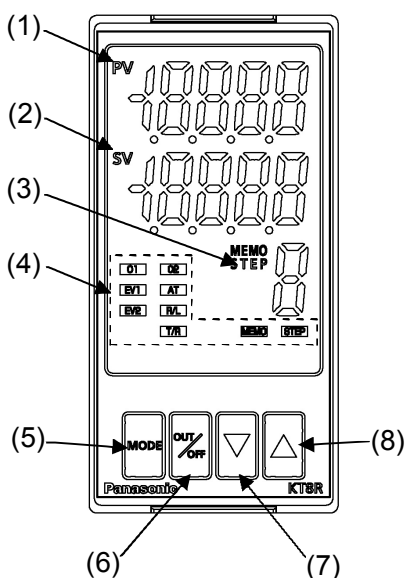
2. Names and Functions of Sections

KT4R



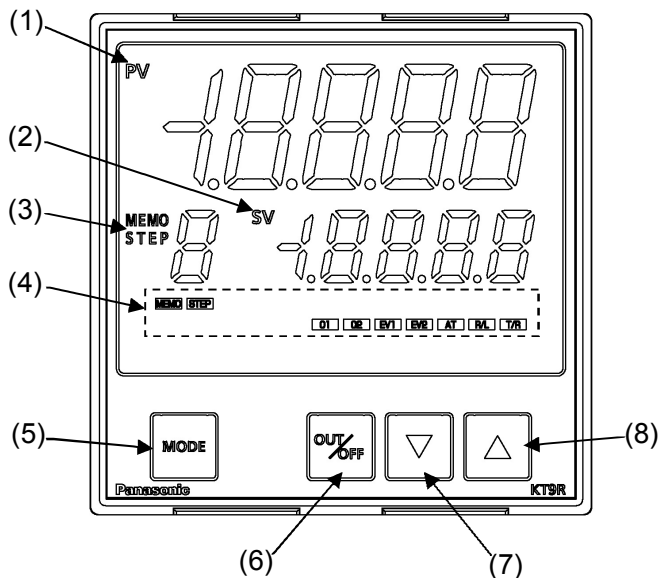
(Fig. 2-1)

KT8R



(Fig. 2-2)

KT9R





(Fig. 2-3)

Display


Display

No.	Name	Description						
(1)	PV Display	Indicates PV. Indicates setting characters in each setting mode.						
(2)	SV Display	Indicates SV. Indicates set data in each setting mode. In Monitor mode, indicated contents differ depending on the model number as follows.						
		<table><tr><th>Model Number</th><th>Indicated Contents</th></tr><tr><td>KT4R</td><td>Indicates MV, Remaining time (Program control) or Step number (Program control)</td></tr><tr><td>KT8R, KT9R</td><td>Indicates MV or Remaining time (Program control).</td></tr></table>	Model Number	Indicated Contents	KT4R	Indicates MV, Remaining time (Program control) or Step number (Program control)	KT8R, KT9R	Indicates MV or Remaining time (Program control).
		Model Number	Indicated Contents					
		KT4R	Indicates MV, Remaining time (Program control) or Step number (Program control)					
KT8R, KT9R	Indicates MV or Remaining time (Program control).							
(3)	STEP Display	Indicates Step number (Program control). (For KT8R, KT9R)						

Action Indicators

No.	Name	Description
(4)	O1 (Green)	Lit when control output OUT1 is ON. For direct current output type, flashes corresponding to the MV in 125 ms cycles.
	O2 (Yellow)	Lit when control output OUT2 is ON. When  (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation]
	EV1 (Red)	Lit when Event output 1 is ON.
	EV2 (Red)	Lit when Event output 2 is ON. Unlit if  (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation].
	AT (Yellow)	Flashes while AT, 'AT on startup' or Auto-reset is performing.
	T/R (Yellow)	Lit during Serial communication TX (transmitting) output.
	STEP (Green)	Lit when a step number (Program control) is indicated. (For KT8R, KT9R)

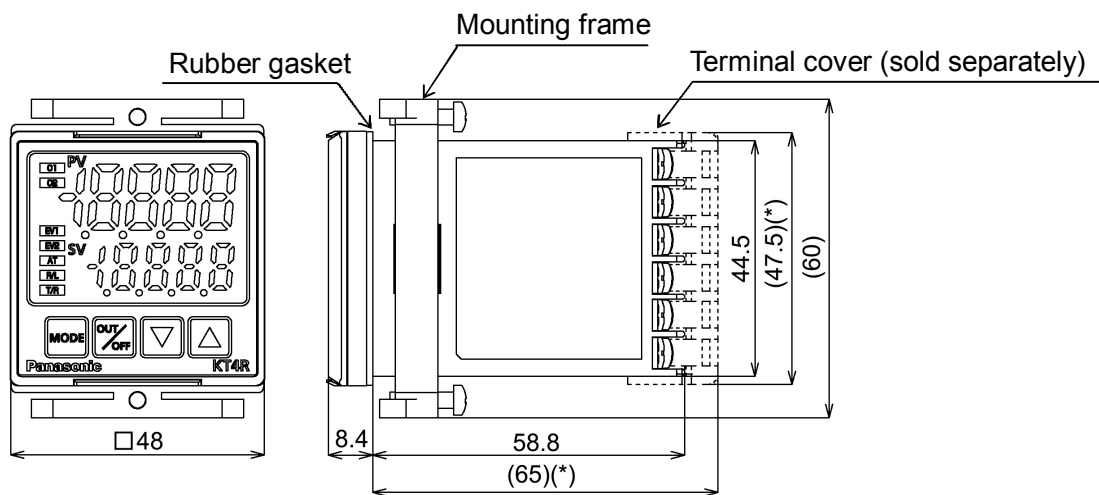
Key

No.	Name	Description	
(5)	MODE key	Switches a setting mode, and registers the set data. By pressing this key for 3 seconds during RUN mode, the unit enters Monitor mode.	
(6)	OUT/OFF key	By pressing the  key for approx. 1 second, one of the following items selected in [OUT/OFF key function] is activated.	
		OUT/OFF Key Function	Description
		Control output OFF function	Turns control output ON or OFF.
		Auto/Manual control	Switches the Auto/Manual control.
		Program control	Starts or Stops the Program control.
(7)	DOWN key	Decreases the numeric value.	
(8)	UP key	Increases the numeric value. By pressing this key for 1 second during Program control, the performing step is interrupted, proceeding to the beginning of the next step. (Advance function)	

3. Mounting to the Control Panel

3.1 External Dimensions (Scale: mm)

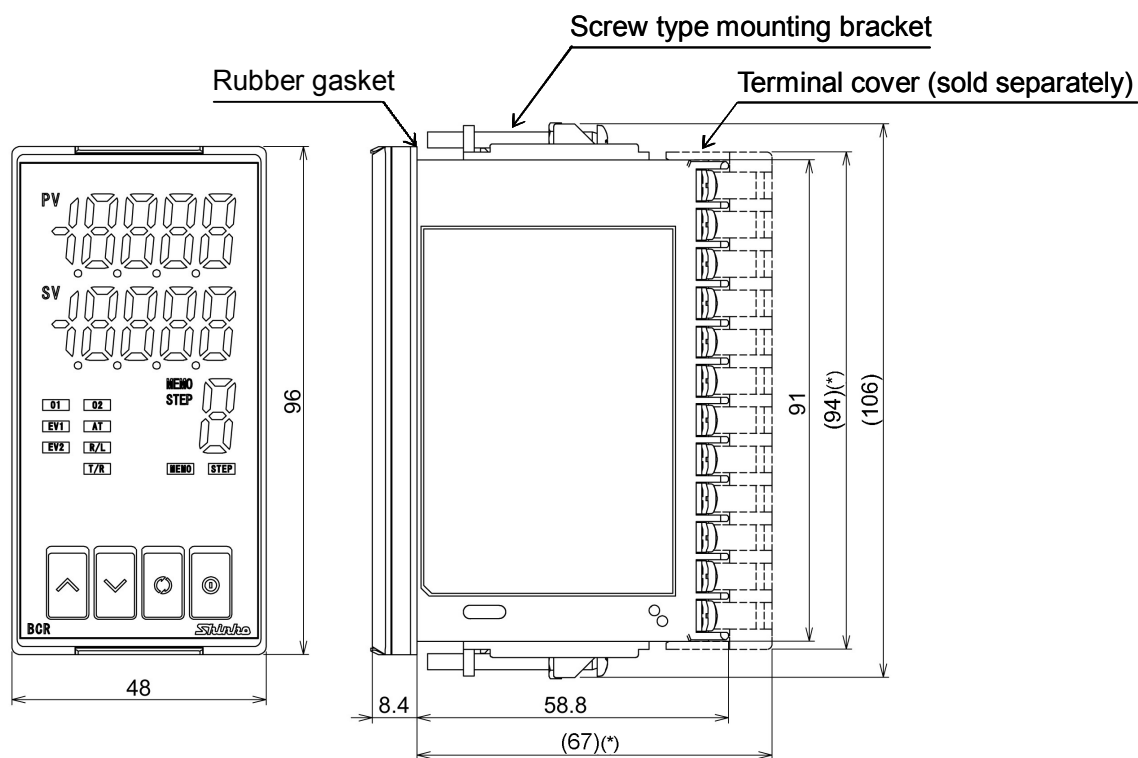
KT4R



(*) When the terminal cover is used.

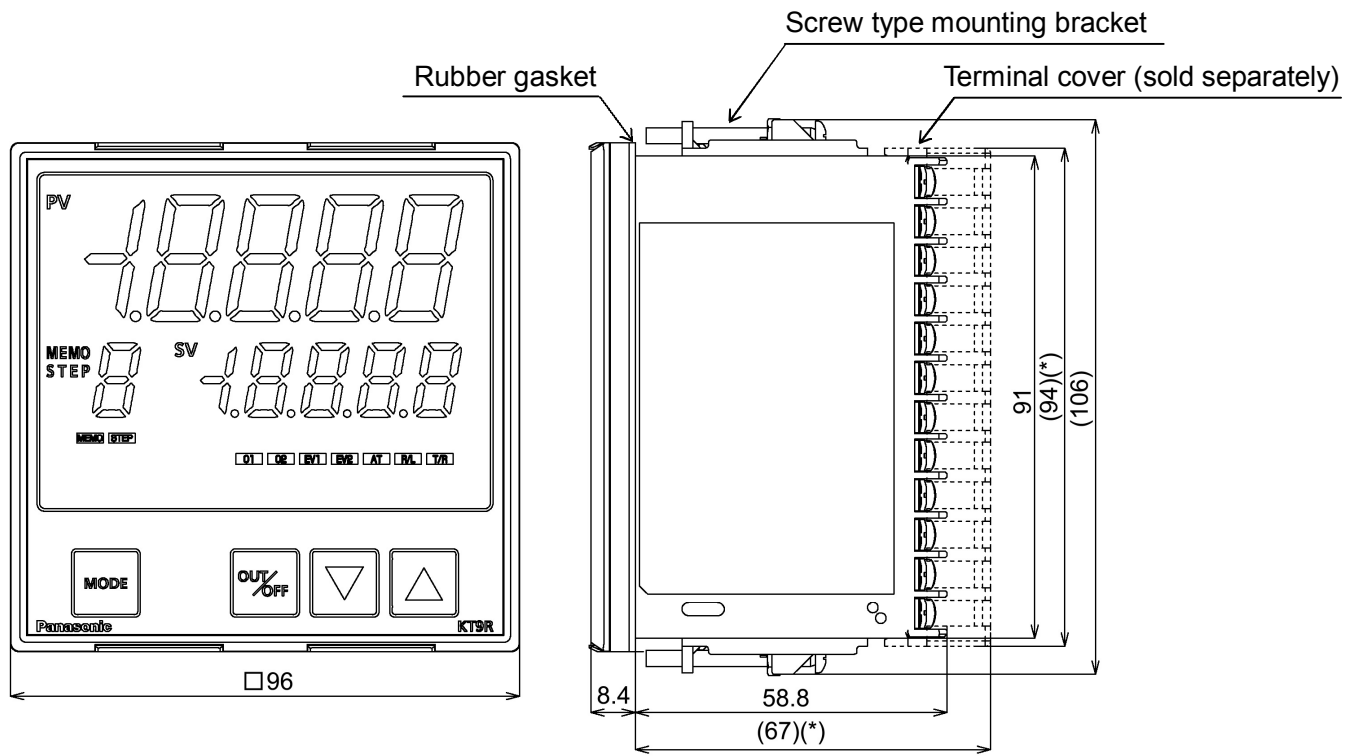
(Fig. 3.1-1)

KT8R



(*) When the terminal cover is used.

(Fig. 3.1-2)



(*) When terminal covers are used.

(Fig. 3.1-3)

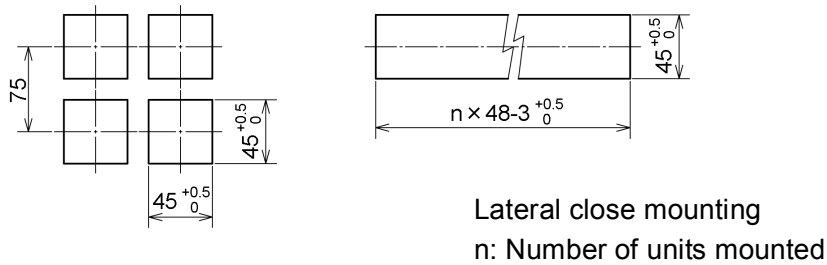
3.2 Panel Cutout (Scale: mm)



Caution

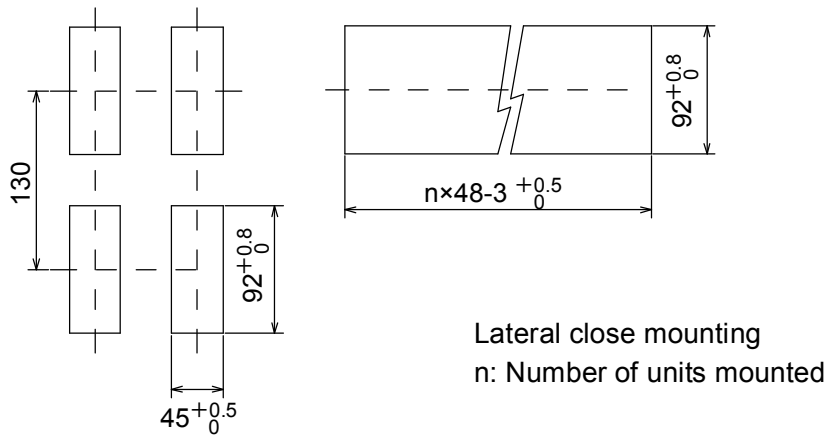
If lateral close mounting is used for the unit, IP66 specification (Water-proof/Dust-proof) may be compromised, and all warranties will be invalidated.

KT4R



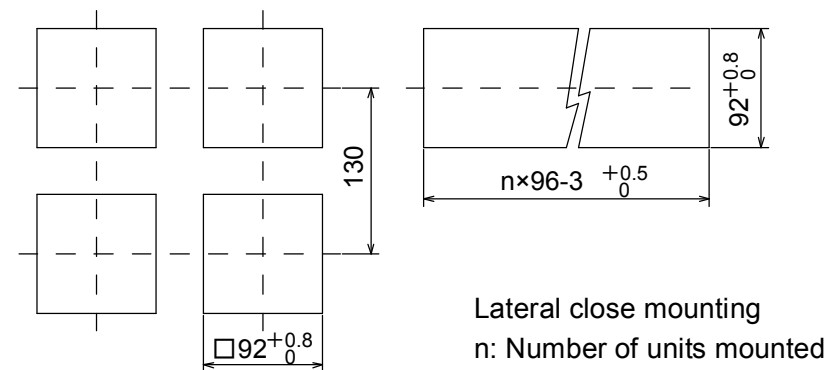
(Fig. 3.2-1)

KT8R



(Fig. 3.2-2)

KT9R



(Fig. 3.2-3)

3.3 Mounting to, and Removal from, the Control Panel



Caution

As the mounting frame of the KT4R is made of resin, do not use excessive force while tightening screws, or the mounting frame could be damaged.

Tighten screws with one rotation upon the screw tips touching the panel.

The torque is 0.15 N•m.

For the KT8R, KT9R, the torque should be 0.1 N•m.

3.3.1 How to Mount the Unit

KT4R

Mount the controller vertically to the flat, rigid panel to ensure it adheres to the Water-proof/Dust-proof specification (IP66).

If the lateral close mounting is used for the controller, IP66 specification (Water-proof/Dust-proof) may be compromised, and all warranties will be invalidated.

Mountable panel thickness: 1 to 5 mm

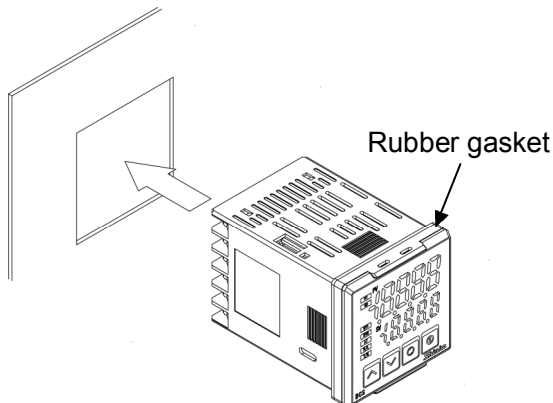
- (1) Insert the controller from the front side of the control panel. (Fig. 3.3.1-1)

If the Water-proof/Dust-proof specification (IP66) is not necessary, the rubber gasket may be removed (please keep in mind the warranty is void if the rubber gasket is removed).

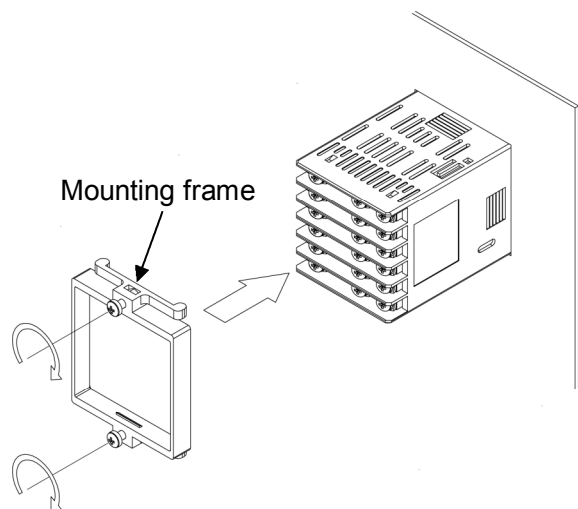
- (2) Insert the mounting frame until it comes into contact with the panel, and fasten with screws. (Fig. 3.3.1-2)

Tighten screws with one rotation upon the screw tips touching the panel. (Fig. 3.3.1-2)

The torque is approximately 0.15 N•m.



(Fig. 3.3.1-1)



(Fig. 3.3.1-2)

KT8R, KT9R

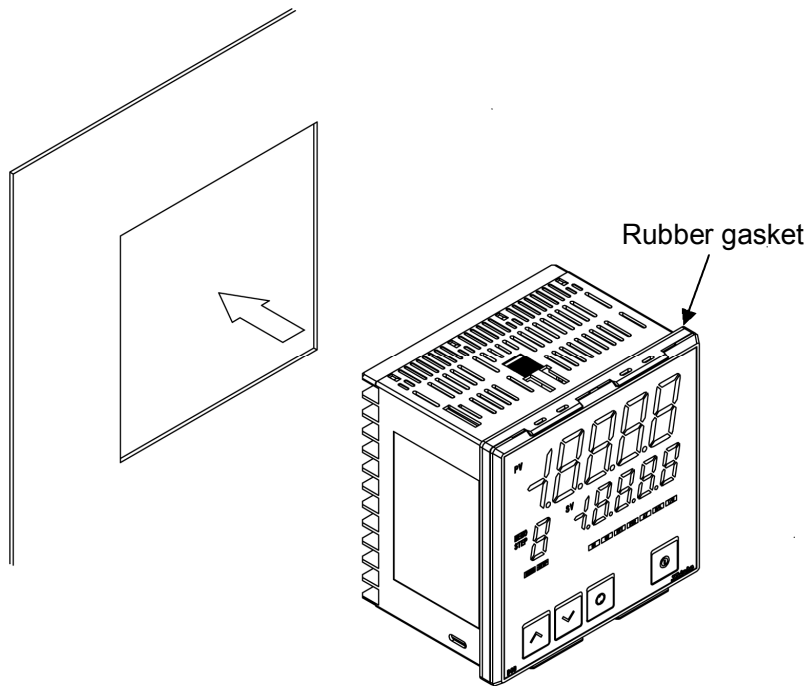
Mount the controller vertically to the flat, rigid panel to ensure it adheres to the Water-proof/Dust-proof specification (IP66).

If the lateral close mounting is used for the controller, IP66 specification (Water-proof/Dust-proof) may be compromised, and all warranties will be invalidated.

Mountable panel thickness: 1 to 7 mm

- (1) Insert the controller from the front side of the control panel. (Fig. 3.3.1-3)

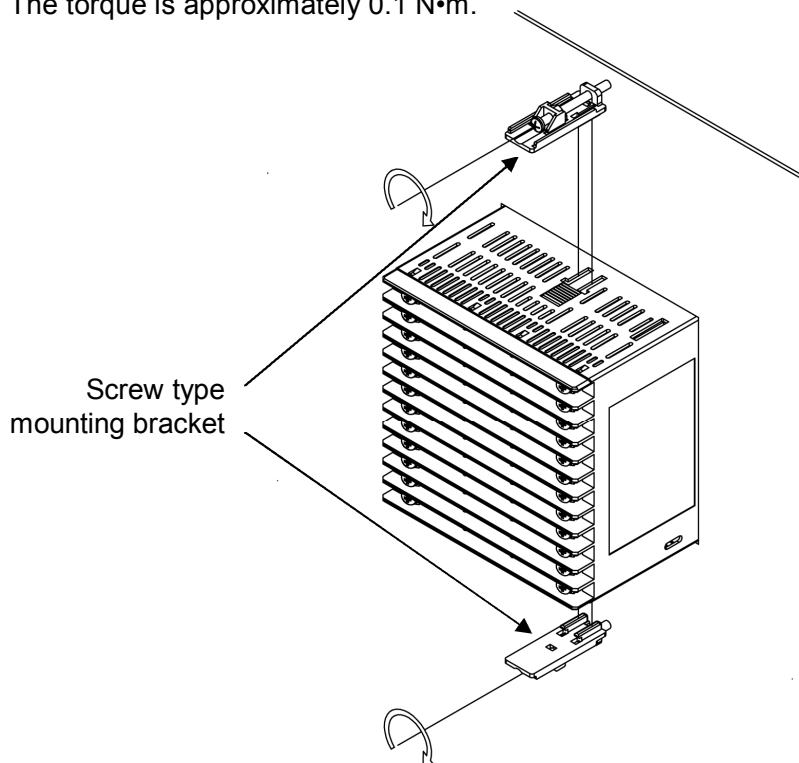
If the Water-proof/Dust-proof specification (IP66) is not necessary, the rubber gasket may be removed (please keep in mind the warranty is void if the rubber gasket is removed).



(Fig. 3.3.1-3)

- (2) Attach the mounting brackets by the holes at the top and bottom of the case, and secure the controller in place with the screws.

The torque is approximately 0.1 N·m.

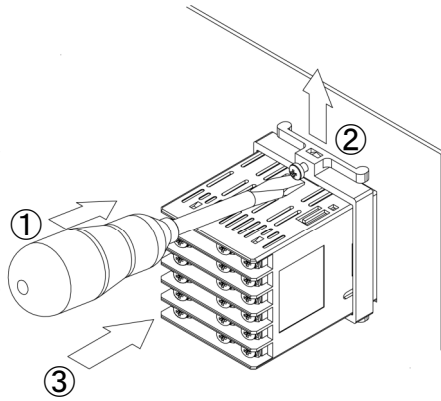


(Fig. 3.3.1-4)

3.3.2 How to Remove the Mounting Frame and Unit

KT4R (Fig. 3.3.2-1)

- (1) Turn the power to the unit OFF, and disconnect all wires before removing the mounting frame.
 - (2) Insert a flat blade screwdriver between the mounting frame and unit (①).
 - (3) Slowly push the frame upward using the screwdriver (②), while pushing the unit toward the panel (③).
 - (4) Repeat step (2) and slowly push the frame downward using the screwdriver for the other side.
- The frame can be removed little by little by repeating these steps.



(Fig. 3.3.2-1)

KT8R, KT9R

- (1) Turn the power to the unit OFF, and disconnect all wires before removing the unit.
- (2) Loosen the screws of the mounting brackets, and remove the mounting brackets.
- (3) Pull the unit out from the front of the control panel.

4. Wiring



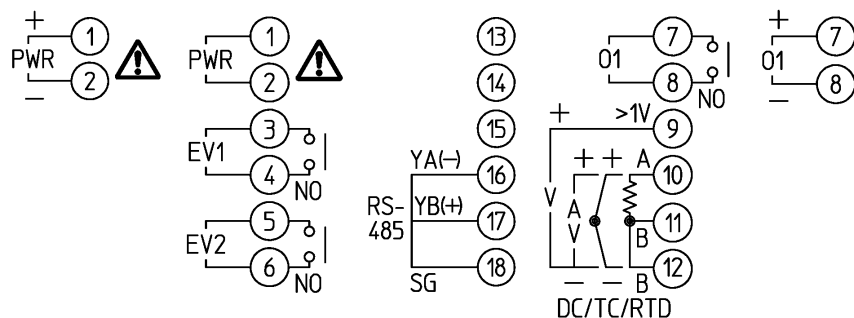
Warning

Turn the power supply to the instrument off before wiring or checking.

Working on or touching the terminal with the power switched on may result in severe injury or death due to electric shock.

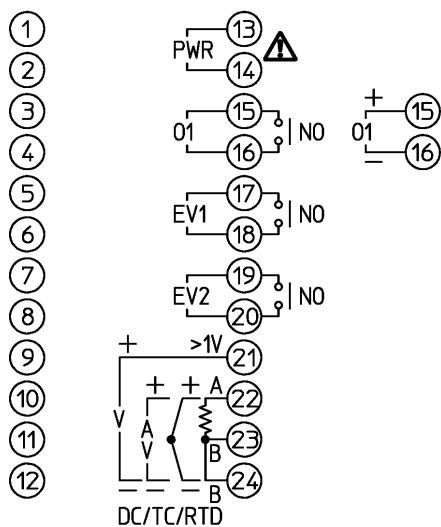
4.1 Terminal Arrangement

KT4R



(Fig. 4.1-1)

KT8R, KT9R



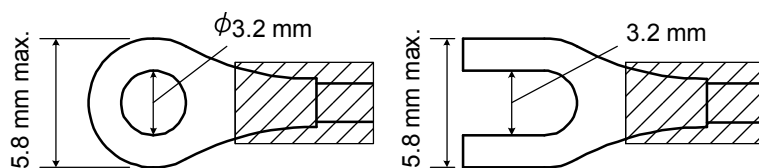
(Fig. 4.1-2)

Terminal	Description	
PWR	100 to 240 V AC or 24 V AC/DC For a 24 V AC/DC power source, do not confuse polarity when using direct current (DC). 24 V AC/DC: Only for the KT4R model	
EV1	Event output EV1	
EV2	Event output EV2	
O1	Control output OUT1	
RTD	RTD input	
TC	Thermocouple input	
DC	Direct current, DC voltage inputs For DC voltage input, (+) side input terminal number of 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC differs from that of 0 to 1 V DC.	
	Model Number	Terminal Number
	KT4R	⑨: + side of 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC ⑩: + side of 0 to 1 V DC
	KT8R, KT9R	⑲: + side of 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC ⑳: + side of 0 to 1 V DC
RS-485	Serial communication RS-485 Serial communication can be specified only for the KT4R model.	

4.2 Lead Wire Solderless Terminal

Use a solderless terminal with an insulation sleeve in which an M3 screw fits as shown below.
The torque should be 0.63 N•m.

Solderless Terminal	Manufacturer	Model	Tightening Torque
Y-type	Nichifu Terminal Industries Co., Ltd.	TMEV1.25Y-3	0.63 N•m
	Japan Solderless Terminal MFG Co., Ltd.	VD1.25-B3A	
Ring-type	Nichifu Terminal Industries Co., Ltd.	TMEV1.25-3	
	Japan Solderless Terminal MFG Co., Ltd.	V1.25-3	



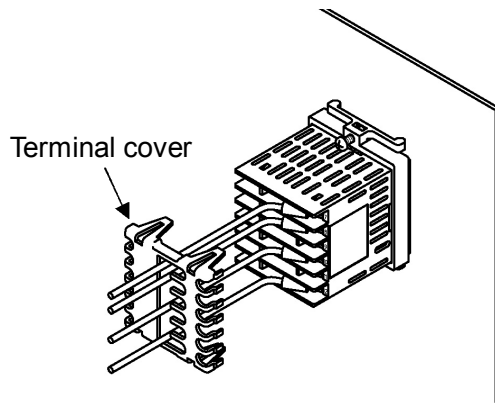
(Fig. 4.2-1)

4.3 Terminal Cover

KT4R

When using a terminal cover (sold separately), make sure the longer side is on the back right side of the case.

Pass the wires from terminals 7 to 12 into the holes of the terminal cover.

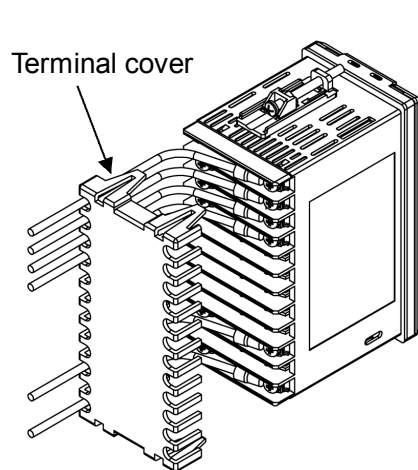


(Fig. 4.3-1)

KT8R

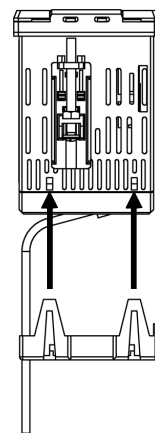
When using a terminal cover (sold separately), make sure the longer side is on the back right side of the case.

Pass the wires from terminals 13 to 24 through the left side of the terminal cover.



(Fig. 4.3-2)

Top of KT8R



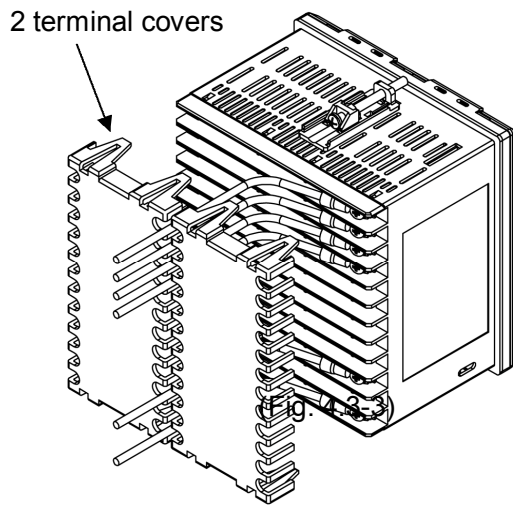
Mount the longer side of the cover to the back right.

(Fig. 4.3-3)

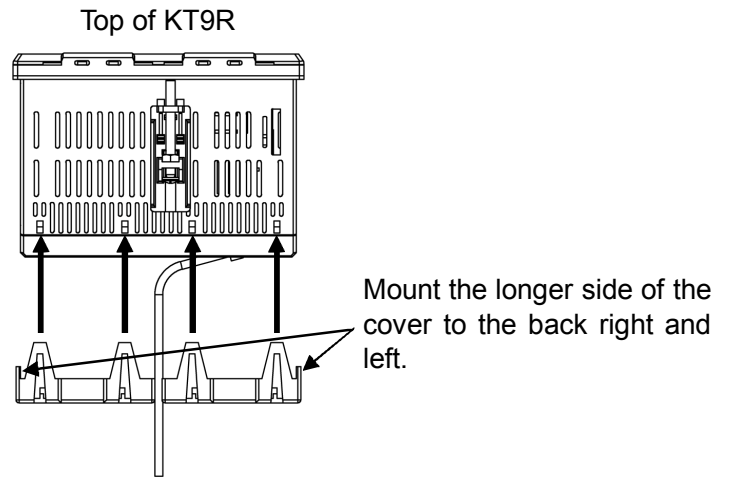
KT9R

When using terminal covers (sold separately), make sure the longer side is on the back right and left sides of the case.

Pass the wires from terminals 13 to 24 through between covers.



(Fig. 4.3-4)



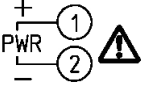
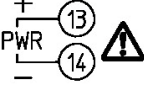
(Fig. 4.3-5)

4.4 Wiring

For the terminal arrangement, refer to Section '4.1 Terminal Arrangement' (p.16).

4.4.1 Power Supply

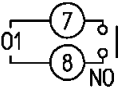
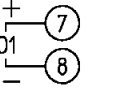
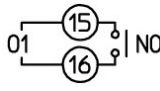
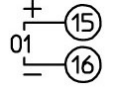
Power supply voltage is 100 to 240 V AC or 24 V AC/DC.
For a 24 V AC/DC power source, ensure polarity is correct when using direct current (DC).
24 V AC/DC is available only for the KT4R model.

KT4R	KT8R, KT9R
	

4.4.2 Control Output OUT1

Specifications of Control output OUT1 are shown below.

Relay contact	1a Control capacity: 3 A 250 V AC (resistive load), 1 A 250 V AC (inductive load $\cos\phi=0.4$) Electrical life: 100,000 cycles Minimum applicable load: 10 mA 5 V DC
Non-contact voltage (for SSR drive)	12 V DC $\pm 15\%$ Max. 40 mA (short circuit protected)
Direct current	4 to 20 mA DC Load resistance: Max. 550 Ω

KT4R		KT8R, KT9R	
Relay contact	Non-contact voltage, Direct current	Relay contact	Non-contact voltage, Direct current
			

4.4.3 Input

Each input wiring is shown below.

For DC voltage input, (+) side input terminal number of 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC differs from that of 0 to 1 V DC.

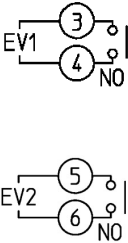
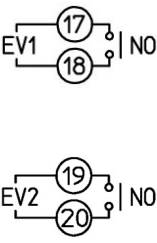
KT4R			
Thermocouple	RTD	Direct current (4 to 20 mA, 0 to 20mA), DC voltage (0 to 1 V)	DC voltage (0 to 5 V, 1 to 5 V, 0 to 10 V)

KT8R, KT9R			
Thermocouple	RTD	Direct current (4 to 20 mA, 0 to 20mA), DC voltage (0 to 1 V)	DC voltage (0 to 5 V, 1 to 5 V, 0 to 10 V)

4.4.4 Event Output 1, 2

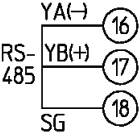
Specifications of Event output 1, 2 are shown below.

Relay contact	1a Control capacity: 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load $\cos\phi=0.4$) Electrical life: 100,000 cycles Minimum applicable load: 10 mA 5 V DC
---------------	--

KT4R	KT8R, KT9R
	

4.4.5 Serial Communication

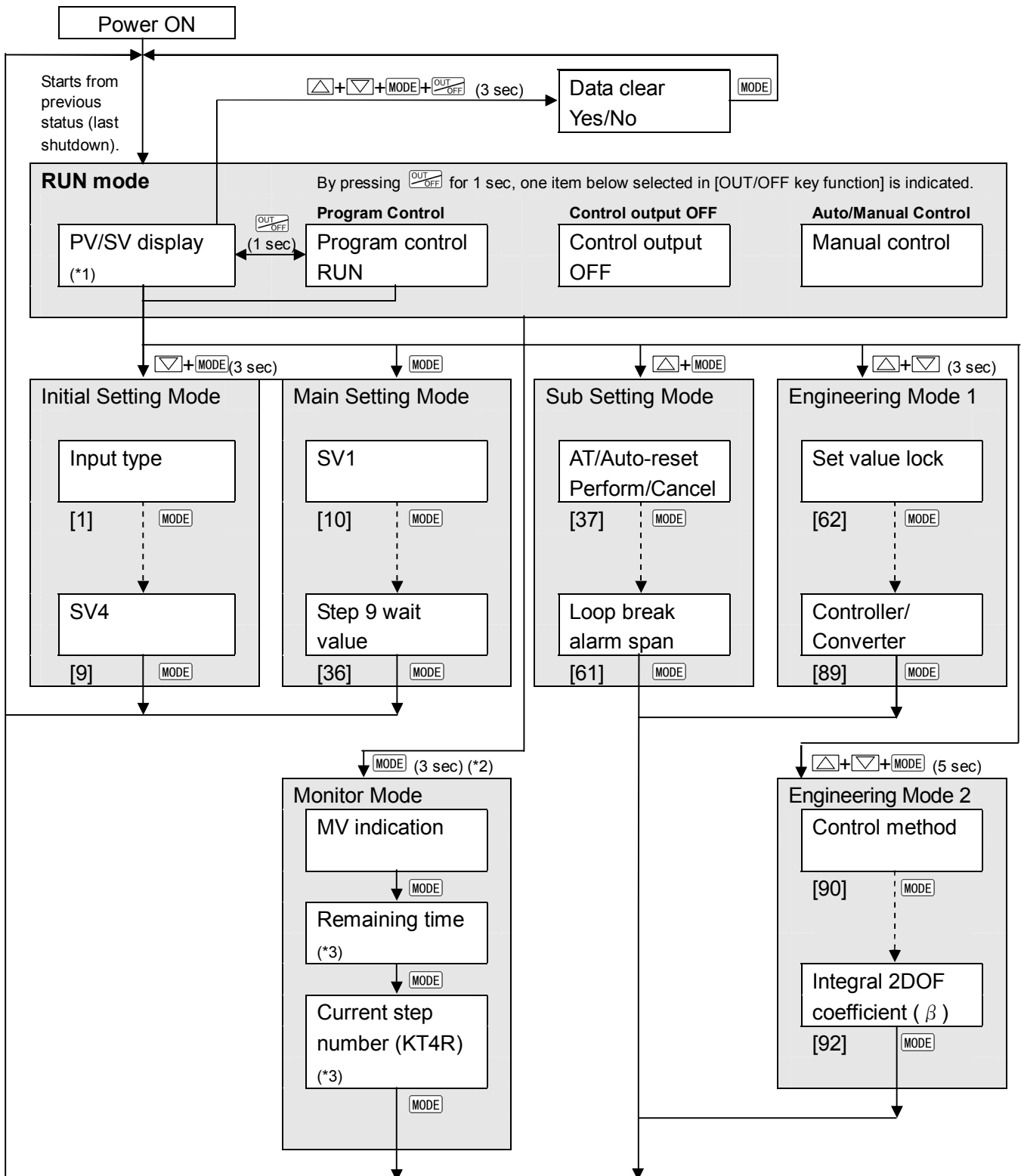
Serial communication can be specified only for the KT4R model.

KT4R


5. Outline of Key Operation and Each Mode

5.1 Key Operation

Setting item numbers such as [1], [9] are the same as those on Section “14. Key Operation Flowchart” (p.131).



(*1) If 'Program control' is selected in [OUT/OFF key function], the unit enters Standby mode (program control waiting).

(*2) The unit cannot proceed to Monitor mode if it is in Standby of program control.

(*3) Available only when 'Program control' is selected in [OUT/OFF key function].

- + + + (3 sec): Press and hold the , , , keys (all keys) (in that order) together for approx. 3 sec.
- + (3 sec): Press and hold the , keys (in that order) together for approx. 3 sec.
- + : Press and hold the , keys (in that order) together.
- + (3 sec): Press and hold the , keys (in that order) together for approx. 3 sec.
- + + (5 sec): Press and hold the , , keys (in that order) together for approx. 5 sec.
- Set (or select) each item with the or key, and register the value with the key.
- + : If the key is pressed, the unit will proceed to the next setting item, illustrated by an arrow.

Pressing the key moves back to the previous item.














- To revert to RUN mode, press and hold the key for approx. 3 sec while in any mode.
- To revert to RUN mode, press and hold the key for approx. 3 sec while in any mode.

If 'Control output OFF function' is selected in [OUT/OFF key function], the unit will enter Control output OFF status.

If 'Auto/Manual control' is selected in [OUT/OFF key function], the unit will enter Manual control status.

If 'Program control' is selected in [OUT/OFF key function], the unit will enter 'Program control RUN' or Standby mode.

5.2 Modes

Mode	Description	
RUN mode	When power is turned ON, the unit enters RUN mode. The PV Display indicates PV, and the SV Display indicates SV. Control starts from previous status (last shutdown). By pressing the  key for approx. 1 sec, one of the following functions selected in [OUT/OFF key function] is activated.	
	OUT/OFF Key Function	Description
	Control output OFF function	Turns the control output ON or OFF.
	Auto/Manual control	Switches the Auto/Manual control.
	Program control	Starts/Stops the Program control.
Monitor mode	By pressing the  key for approx. 3 sec in RUN mode, the unit enters Monitor mode. The PV Display indicates PV, and the SV Display indicates MV. Every time the  key is pressed, the following is indicated. Indicated contents differ depending on the model number.	
	Model number	Indicated Contents
	KT4R	Indicates MV, Remaining time (Program control) or Step number (Program control).
	KT8R, KT9R	Indicates MV or Remaining time (Program control).
Initial setting mode	By pressing the  and  keys (in that order) together for approx. 3 sec in RUN mode, the unit enters Initial setting mode. The following items can be set: Input type, Scaling high limit/low limit, Event output EV1/EV2 allocation, SV1, etc.	
Main setting mode	By pressing the  key in RUN mode, the unit enters Main setting mode. SV can be set. If 'Program control' is selected in [OUT/OFF key function], SV, Time and Wait value for Steps 1 to 9 can be set.	
Sub setting mode	By pressing the  and  keys (in that order) together in RUN mode, the unit enters Sub setting mode. The following items can be set: AT Perform, P, I, D, Direct/Reverse action, Event output EV1/EV2, etc.	
Engineering mode 1	By pressing the  and  keys (in that order) together for approx. 3 sec in RUN mode, the unit enters Engineering mode 1. The following items can be set: Set value lock, Event output EV1/EV2 allocation, Sensor correction, PV filter time constant, Program control, OUT/OFF key function, Controller/Converter, etc.	
Engineering mode 2	By pressing the  ,  ,  keys (in that order) together for approx. 5 sec in RUN mode, the unit enters Engineering mode 2. The following items can be set: Control method, Proportional gain 2DOF coefficient (α), Integral 2DOF coefficient (β)	

5.3 Basic Operation after Power-ON

After the unit is mounted to the control panel and wiring is completed, operate the unit following the procedures below.

(1) Turn the unit power supply ON

※After confirming the rated voltage, polarity and wiring, turn the power ON via contacts such as switch or relay. If any mistakes are made, an electric shock, malfunction or errors may be caused.

After the power is turned ON, the PV Display indicates the input type, and the SV Display indicates the Input range high limit value (for thermocouple, RTD inputs) or Scaling high limit value (for DC voltage, current inputs) for approximately 3 seconds. (Table 5.3-1)

During this time, all outputs and the indicators are in OFF status.

Control will then start, indicating the PV in the PV Display and SV in the SV Display.

While the control output OFF function is working, the PV Display indicates [OFF].

Indication differs depending on the selection in [Indication when control output OFF].

(Table 5.3-1)

Sensor Input	°C		°F	
	PV Display	SV Display	PV Display	SV Display
K	ℓ□□℃	1370	ℓ□□ℱ	2498
	ℓ□.℃	4000	ℓ□.ℱ	7520
J	ℓ□□℃	1000	ℓ□□ℱ	1832
R	ℓ□□℃	1760	ℓ□□ℱ	3200
S	ℓ□□℃	1760	ℓ□□ℱ	3200
B	ℓ□□℃	1820	ℓ□□ℱ	3308
E	ℓ□□℃	□800	ℓ□□ℱ	1472
T	ℓ□.℃	4000	ℓ□.ℱ	7520
N	ℓ□□℃	1300	ℓ□□ℱ	2372
PL-II	PL2℃	1390	PL2ℱ	2534
C(W/Re5-26)	ℓ□□℃	23 15	ℓ□□ℱ	4 199
Pt100	ℓℓ.℃	8500	ℓℓ.ℱ	15620
JPt100	ℓℓℓ.℃	5000	ℓℓℓ.ℱ	9320
Pt100	ℓℓ□℃	□850	ℓℓ□ℱ	1562
JPt100	ℓℓℓ.℃	□500	ℓℓℓ.ℱ	□932
4 to 20 mA DC	420A	Scaling high limit value		
0 to 20 mA DC	020A			
0 to 1 V DC	0□ 1℔			
0 to 5 V DC	0□5℔			
1 to 5 V DC	1□5℔			
0 to 10 V DC	0 10℔			

When power is turned ON, and any errors are found, the following error codes are indicated in the PV Display.

To cancel the error code, press the [MODE] key.

Error Code	Error Contents
Er01	Non-volatile IC memory is defective.
Er02	Data writing (in non-volatile IC memory) error when power failure occurs.

(2) Enter each value.

Refer to Sections '6. Initial Settings' (p.29), '7. Settings (p.42)' and '8. Operation and Settings of Standard Functions' (p.66).

Enter each value: Input type, Control method, Direct/Reverse action, SV, PID constants, Event output EV1 allocation, etc.

(3) Turn the load circuit power ON

Control starts, so as to reach, and then maintain the control target at the SV.

Error codes during operation

If errors occur during operation, error codes below are indicated in the PV Display.

Error Code	Error Contents
$E-05$	PV has exceeded Input range high limit value (scaling high limit value for DC voltage, current inputs).
$E-06$	PV has dropped below Input range low limit value (scaling low limit value for DC voltage, current inputs).
$E-07$	Input burnout, or PV has exceeded the Indication range and Control range.
$E-10$	Hardware malfunction

Indication Range and Control Range

Input Type	Indication Range and Control Range
Thermocouple	[Input range low limit – 50°C (100°F)] to [Input range high limit + 50°C (100°F)]
RTD	[Input range low limit – Input span x 1%] to [Input range high limit + 50°C (100°F)]
DC voltage, Direct current	[Scaling low limit value – Scaling span x 1%] to [Scaling high limit value + Scaling span x 10%]

Input error (Overscale, Underscale)

Overscale occurs if PV has exceeded Input range high limit value (Scaling high limit value for DC voltage, current inputs). PV and error code [$E-05$] are indicated in the PV Display alternately.

Underscale occurs if PV has dropped below Input range low limit value (Scaling low limit value for DC voltage, current inputs). PV and error code [$E-06$] are indicated in the PV Display alternately.

For manual control, the preset MV is output.

Burnout

If PV has exceeded Indication range and Control range, [— — —] and [$E-07$] are alternately indicated in the PV Display.

If PV has dropped below Indication range and Control range, [— — —] and [$E-07$] are alternately indicated in the PV Display.

If thermocouple or RTD input is burnt out, or if DC voltage (0 to 1 V DC) input is disconnected, [— — —] and [$E-07$] are alternately indicated in the PV Display.

If DC voltage or current input is disconnected:

For 4 to 20 mA DC, 1 to 5 V DC inputs, the PV Display indicates [— — —] and [$E-07$] alternately.

For 0 to 20 mA DC, 0 to 5 V DC and 0 to 10 V DC inputs, the PV Display indicates the value corresponding with 0 mA DC or 0 V DC input.

OUT1 and OUT2 are turned OFF (OUT1 low limit value for Direct current output).

For manual control, the preset MV is output.

If Alarm or Loop break alarm is selected in [Event output EV1/EV2 allocation], Event output will be turned ON under the alarm active conditions.

Burnout is enabled even in standby (program control waiting) mode in Program control

[Output status when input errors occur] can be used only for controllers using Direct current input and voltage input, and Direct current output.

Output status differs depending on selection in [Output status when input errors occur].

Output status when input errors occur	Contents, Indication	Output Status			
		OUT1		OUT2	
		Direct (Cooling) action	Reverse (Heating) action	Direct (Cooling) action	Reverse (Heating) action
ON	Indicates [] and [] alternately.	ON (20mA) or OUT1 high limit value (*)	OFF (4mA) or OUT1 low limit value	OFF	ON (*)
OFF		OFF (4mA) or OUT1 low limit value			OFF
ON	Indicates [] and [] alternately.	OFF (4mA) or OUT1 low limit value	ON (20mA) or OUT1 high limit value (*)	ON (*)	OFF
OFF			OFF (4mA) or OUT1 low limit value	OFF	

(*) Outputs a value between OFF (4mA) and ON (20mA) or between OUT1 low limit value and OUT1 high limit value, depending on deviation.

6. Initial Settings

Setup (setting the Input type, Event output allocation, SV, etc.) should be done before using this controller, according to the user's conditions.

Perform setup in Initial setting mode.

Setting items in Initial setting mode are shown in (Table 6.1).

If the user's specification is the same as the factory default value of this instrument, or if user's instrument has already been installed in a system, initial settings are not necessary.

Proceed to Section '7. Settings' (p.42).

(Table 6.1)

Setting Items in Initial Setting Mode	Factory Default
Input type	K -200 to 1370℃
Scaling high limit	1370℃
Scaling low limit	-200℃
Decimal point place	No decimal point
Event output EV1 allocation	No event
EV1 alarm value 0 Enabled/Disabled	Disabled
EV1 alarm value	0℃
EV1 high limit alarm value	0℃
EV1 alarm hysteresis	1.0℃
EV1 alarm delay time	0 sec
EV1 alarm Energized/De-energized	Energized
Event output EV2 allocation	No event
EV2 alarm value 0 Enabled/Disabled	Disabled
EV2 alarm value	0℃
EV2 high limit alarm value	0℃
EV2 alarm hysteresis	1.0℃
EV2 alarm delay time	0 sec
EV2 alarm Energized/De-energized	Energized
Loop break alarm time	0 minutes
Loop break alarm span	0℃
SV1	0℃

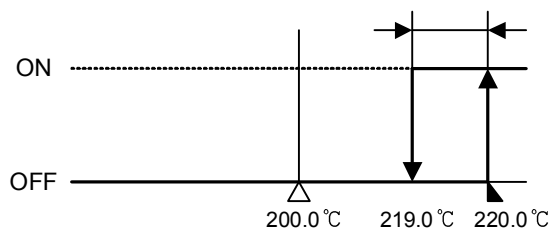
6.1 Example of Initial Settings

(e.g.) AKT4R111100

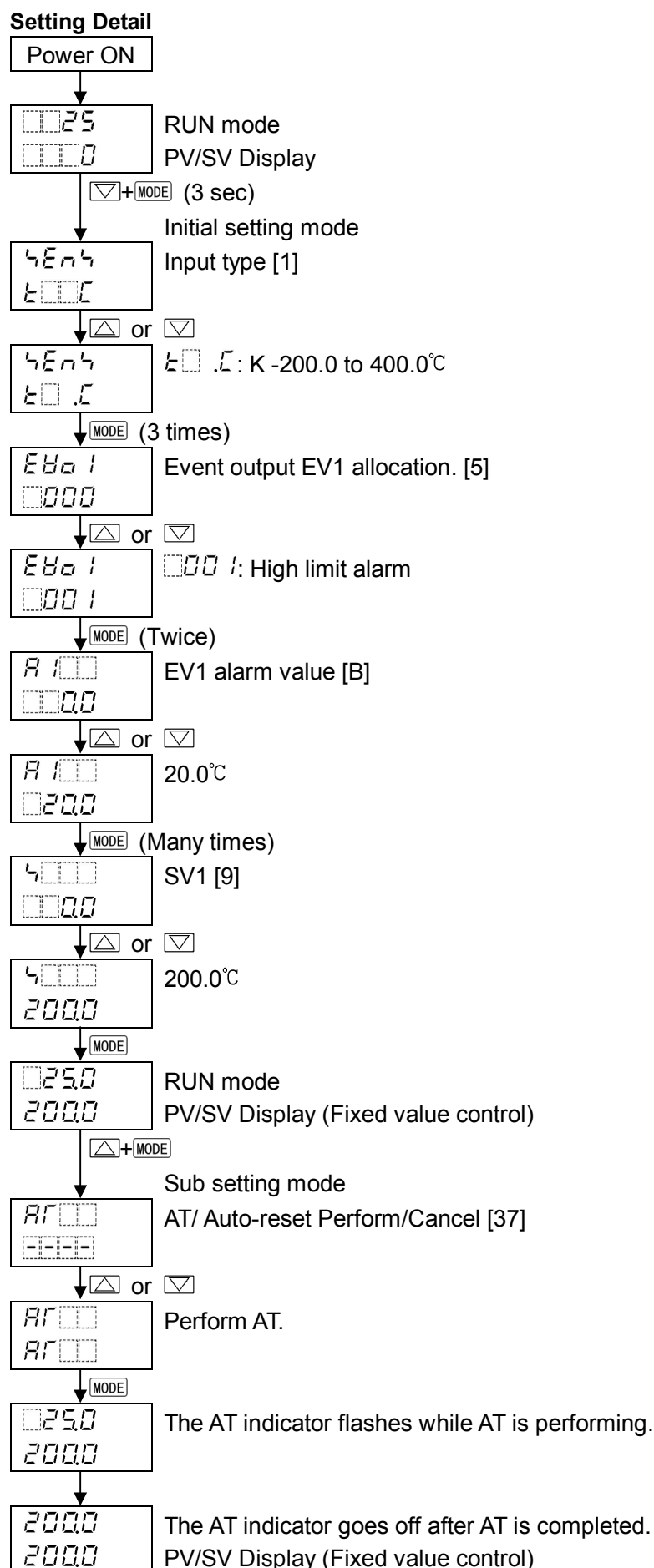
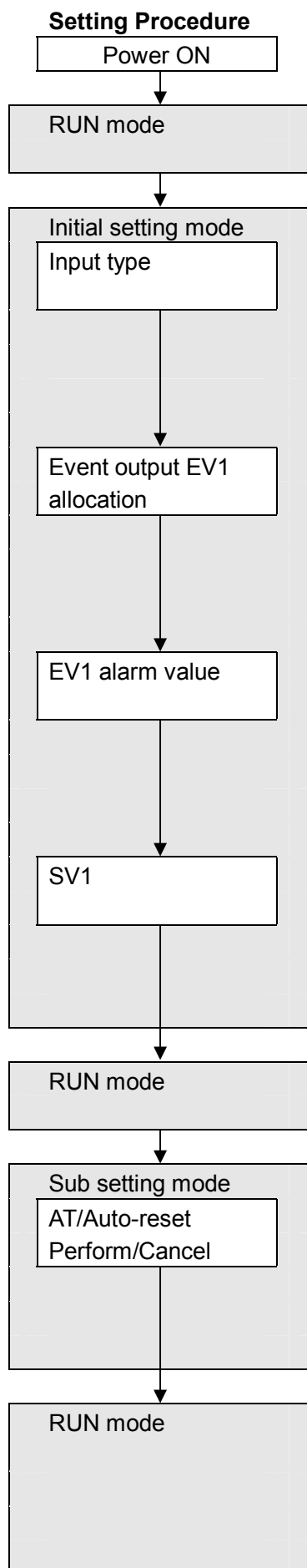
Initial Setting Items	Example
Input type	K -200.0 to 400.0℃
Event output EV1 allocation	High limit alarm
EV1 alarm value	20.0℃ (Deviation setting from SV)
SV	200.0℃ (Fixed value control)

PID control is performed. PID constants are calculated by performing AT.



Alarm action






(Fig. 6.1-1)



6.2 Initial Setting Mode

To enter Initial setting mode, press and hold the  and  keys (in that order) for 3 seconds in RUN mode.

To set (or select) each setting item, use the  or  key.

To register each setting item, press the  key.

Explanation of setting item:

- Upper left: PV Display: Indicates setting characters.
- Lower left: SV Display: Indicates factory default.
- Right side: Indicates the setting item, explanation of its function, and setting range (or selection item).

Setting characters	Setting item name, function, setting range (or selection item)
[1] 4E n 4 t 0 0 C	Input type • Selects an input type from thermocouple (10 types), RTD (2 types), Direct current (2 types) and DC voltage (4 types), and the unit °C/°F.
Factory default value	

Setting item numbers such as [1], [2] are the same as those on Section “14. Key Operation Flowchart” (p.131).

Characters, Factory Default	Setting Item, Function, Setting Range					
[1] 4E n 4 t00C	Input type <ul style="list-style-type: none">• Selects an input type from thermocouple (10 types), RTD (2 types), Direct current (2 types) and DC voltage (4 type), and the unit °C/°F.• When changing the input from DC voltage to other inputs, remove the sensor connected to this controller first, then change the input. If the input is changed with the sensor connected, the input circuit may break.• When changing an input type, refer to Section “8.10 Items to be Initialized by Changing Settings” (p.84).• Selection item:					
	t00C	K	-200 to 1370°C	t00F	K	-328 to 2498°F
	t0.C	K	-200.0 to 400.0°C	t0.F	K	-328.0 to 752.0°F
	J00C	J	-200 to 1000°C	J00F	J	-328 to 1832°F
	r00C	R	0 to 1760°C	r00F	R	32 to 3200°F
	400C	S	0 to 1760°C	400F	S	32 to 3200°F
	b00C	B	0 to 1820°C	b00F	B	32 to 3308°F
	E00C	E	-200 to 800°C	E00F	E	-328 to 1472°F
	r0.C	T	-200.0 to 400.0°C	r0.F	T	-328.0 to 752.0°F
	n00C	N	-200 to 1300°C	n00F	N	-328 to 2372°F
	PL2C	PL-II	0 to 1390°C	PL2F	PL-II	32 to 2534°F
	c00C	C(W/Re5-26)	0 to 2315°C	c00F	C(W/Re5-26)	32 to 4199°F
	Pt.C	Pt100	-200.0 to 850.0°C	Pt.F	Pt100	-328.0 to 1562.0°F
	JPt.C	JPt100	-200.0 to 500.0°C	JPt.F	JPt100	-328.0 to 932.0°F
	Pt0C	Pt100	-200 to 850°C	Pt0F	Pt100	-328 to 1562°F
	JPt0C	JPt100	-200 to 500°C	JPt0F	JPt100	-328 to 932°F
	420A	4 to 20 mA DC -2000 to 10000				
	020A	0 to 20 mA DC -2000 to 10000				
	001V	0 to 1 V DC -2000 to 10000				
	005V	0 to 5 V DC -2000 to 10000				
	105V	1 to 5 V DC -2000 to 10000				
	010V	0 to 10 V DC -2000 to 10000				

Characters, Factory Default	Setting Item, Function, Setting Range	
[2] 4FLH 1370	Scaling high limit <ul style="list-style-type: none"> • Sets scaling high limit value. • Setting range: Scaling low limit value to Input range high limit value DC voltage, current inputs: -2000 to 10000 (*1) 	
[3] 4FL L -200	Scaling low limit <ul style="list-style-type: none"> • Sets scaling low limit value. • Setting range: Input range low limit value to Scaling high limit value DC voltage, current inputs: -2000 to 10000 (*1) 	
[4] dP□□ □□□□	Decimal point place <ul style="list-style-type: none"> • Selects decimal point place. • Selection item: 	
	□□□□	No decimal point
	□□□□	1 digit after decimal point
	□□□□	2 digits after decimal point
	□□□□	3 digits after decimal point
	Available only for DC voltage and current inputs	
[5] EVo 1 □□□□	Event output EV1 allocation <ul style="list-style-type: none"> • Selects Event output EV1 from the Event Output Allocation Table below. • When changing Event output EV1, refer to Section “8.10 Items to be Initialized by Setting Changes” (p.84). • Selection item: 	
	Event Output Allocation Table	
	□□□□	No event
	□□□ 1	Alarm output, High limit alarm
	□□□ 2	Alarm output, Low limit alarm
	□□□ 3	Alarm output, High/Low limits alarm
	□□□ 4	Alarm output, High/Low limits independent alarm
	□□□ 5	Alarm output, High/Low limit range alarm
	□□□ 6	Alarm output, High/Low limit range independent alarm
	□□□ 7	Alarm output, Process high alarm
	□□□ 8	Alarm output, Process low alarm
	□□□ 9	Alarm output, High limit with standby alarm
	□□ 10	Alarm output, Low limit with standby alarm
	□□ 11	Alarm output, High/Low limits with standby alarm
	□□ 12	Alarm output, High/Low limits with standby independent alarm
	□□ 14	Loop break alarm output
	□□ 15	Time signal output
	□□ 16	Output during AT
	□□ 17	Pattern end output

(*1)The placement of the decimal point follows the selection.

Characters, Factory Default	Setting Item, Function, Setting Range		
	0018	Output by communication command	Turns OFF or ON by communication command 00E4H during Serial communication. B0 EV1 output 0: OFF 1: ON B1 EV2 output 0: OFF 1: ON
[A] R12R no00	EV1 alarm value 0 Enabled/Disabled • When EV1 alarm value is 0 (zero), alarm action can be Enabled or Disabled. • Selection item:		
	no00	Disabled	
	4E40	Enabled	
	Available when 0001 (Alarm output, High limit alarm) to 0006 (Alarm output, High/Low limit range independent alarm), 0009 (Alarm output, High limit with standby alarm) to 0012 (Alarm output, High/Low limits with standby independent alarm) are selected in [Event output EV1 allocation].		
[B] R100 0000	EV1 alarm value • Sets EV1 alarm value. EV1 alarm value matches EV1 low limit alarm value in the following cases: 0004 (Alarm output, High/Low limits independent alarm), 0006 (Alarm output, High/Low limit range independent alarm), or 0012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation]. • Setting range:		
	High limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)	
	Low limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)	
	High/Low limits alarm	0 to Input span °C (°F) (*1) (*2)	
	High/Low limits independent alarm	0 to Input span °C (°F) (*1) (*2)	
	High/Low limit range alarm	0 to Input span °C (°F) (*1) (*2)	
	High/Low limit range independent alarm	0 to Input span °C (°F) (*1) (*2)	
	Process high alarm	Input range low limit to Input range high limit (*1) (*3)	
	Process low alarm	Input range low limit to Input range high limit (*1) (*3)	
	High limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)	
	Low limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)	
	High/Low limits with standby alarm	0 to Input span °C (°F) (*1) (*2)	
	High/Low limits with standby independent alarm	0 to Input span °C (°F) (*1) (*2)	
	Available when any alarm from 0001 (Alarm output, High limit alarm) to 0012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation].		
[C] R140 0000	EV1 high limit alarm value • Sets EV1 high limit alarm value. This value is available only for the following cases. 0004 (Alarm output, High/Low limits independent alarm), 0006 (Alarm output, High/Low limit range independent alarm), or 0012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation]. • Setting range: Same as those of EV1 alarm value		

(*1) The placement of the decimal point follows the selection.

(*2) For DC voltage, current inputs, the input span is the same as the scaling span.

(*3) For DC voltage, current inputs, input range low (or high) limit value is the same as scaling low (or high) limit value.

Characters, Factory Default	Setting Item, Function, Setting Range	
[D] R 144 □□ 10	EV1 alarm hysteresis <ul style="list-style-type: none">Sets EV1 alarm hysteresis.Setting range: 0.1 to 1000.0℃ (°F) DC voltage, current inputs: 1 to 10000 (*1) Available when any alarm from □□□ 1 (Alarm output, High limit alarm) to □□ 12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation].	
[E] R 124 □□□	EV1 alarm delay time <ul style="list-style-type: none">Sets EV1 alarm action delay time.When setting time has elapsed after the input enters the alarm output range, the alarm is activated.Setting range: 0 to 10000 seconds Available when any alarm from □□□ 1 (Alarm output, High limit alarm) to □□ 12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation].	
[F] R 1L ñ noñL	EV1 alarm Energized/De-energized <ul style="list-style-type: none">Selects Energized/De-energized status for EV1 alarm.(Refer to ‘EV1/EV2 Energized/De-energized’ on p.40.)Selection item:	
	noñL	Energized
	rEB4	De-energized
	Available when any alarm from □□□ 1 (Alarm output, High limit alarm) to □□ 12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation].	
[G] F4 14 □□□ 1	TS1 output step number <ul style="list-style-type: none">Sets the step number at which Time signal output TS1 will be turned OFF or ON during Program control.(Refer to ‘Time Signal Output’ on p.41.)Setting range: 1 to 9 Available only when □□ 15 (Time signal output) is selected in [Event output EV1 allocation].	
[H] F4 1F 0000	TS1 OFF time <ul style="list-style-type: none">Sets Time signal output TS1 OFF time.(Refer to ‘Time Signal Output’ on p.41.)Setting range: 00:00 to 99:59 (*4) Available only when □□ 15 (Time signal output) is selected in [Event output EV1 allocation].	
[I] F4 1a 0000	TS1 ON time <ul style="list-style-type: none">Sets Time signal output TS1 ON time.(Refer to ‘Time Signal Output’ on p.41.)Setting range: 00:00 to 99:59 (*4) Available only when □□ 15 (Time signal output) is selected in [Event output EV1 allocation].	

(*1)The placement of the decimal point follows the selection.

(*4) Time unit follows the selection from [Step time unit].

Characters, Factory Default	Setting Item, Function, Setting Range	
[6] EV2 000	Event output EV2 allocation <ul style="list-style-type: none"> • Selects Event output EV2 from the Event Output Allocation Table below. • When changing Event output EV2, refer to Section “8.10 Items to be Initialized by Changing Settings” (p.84). • Selection item: Event Output Allocation Table	
	000	No event
	001	Alarm output, High limit alarm
	002	Alarm output, Low limit alarm
	003	Alarm output, High/Low limits alarm
	004	Alarm output, High/Low limits independent alarm
	005	Alarm output, High/Low limit range alarm
	006	Alarm output, High/Low limit range independent alarm
	007	Alarm output, Process high alarm
	008	Alarm output, Process low alarm
	009	Alarm output, High limit with standby alarm
	010	Alarm output, Low limit with standby alarm
	011	Alarm output, High/Low limits with standby alarm
	012	Alarm output, High/Low limits with standby independent alarm
	014	Loop break alarm output
	015	Time signal output
		Turns OFF or ON during Program control, by setting OFF and ON times within the step set in [Step number].
	016	Output during AT
		Turns ON during AT.
	017	Pattern end output
		Turns ON when Program control ends, and remains ON until turned OFF by pressing the [MODE] key.
	018	Output by communication command
		Turns OFF or ON by communication command 00E4H during Serial communication. B0 EV1 output 0: OFF 1: ON B1 EV2 output 0: OFF 1: ON
	019	Heating/Cooling control relay contact output
		Works as Control output OUT2 (Heating/Cooling control).
	Available only when Event output EV2 is specified.	
[A] A2=A no	EV2 alarm value 0 Enabled/Disabled <ul style="list-style-type: none"> • When EV2 alarm value is 0 (zero), alarm action can be Enabled or Disabled. • Selection item: 	
	no	Disabled
	YE4	Enabled
	Available only when Event output EV2 is specified. Available when 001 (Alarm output, High limit alarm) to 006 (Alarm output, High/Low limit range independent alarm), 009 (Alarm output, High limit with standby alarm) to 012 (Alarm output, High/Low limits with standby independent alarm) are selected in [Event output EV2 allocation].	

Characters, Factory Default	Setting Item, Function, Setting Range																								
[B] R2□□ □□□□	<p>EV2 alarm value</p> <ul style="list-style-type: none"> Sets EV2 alarm value. <p>EV2 alarm value matches EV2 low limit alarm value in the following cases: □□□4 (Alarm output, High/Low limits independent alarm), □□□5 (Alarm output, High/Low limit range independent alarm), or □□12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].</p> <ul style="list-style-type: none"> Setting range: <table> <tr> <td>High limit alarm</td><td>-(Input span) to Input span °C (°F) (*1) (*2)</td></tr> <tr> <td>Low limit alarm</td><td>-(Input span) to Input span °C (°F) (*1) (*2)</td></tr> <tr> <td>High/Low limits alarm</td><td>0 to Input span °C (°F) (*1) (*2)</td></tr> <tr> <td>High/Low limits independent alarm</td><td>0 to Input span °C (°F) (*1) (*2)</td></tr> <tr> <td>High/Low limit range alarm</td><td>0 to Input span °C (°F) (*1) (*2)</td></tr> <tr> <td>High/Low limit range independent alarm</td><td>0 to Input span °C (°F) (*1) (*2)</td></tr> <tr> <td>Process high alarm</td><td>Input range low limit to Input range high limit (*1) (*3)</td></tr> <tr> <td>Process low alarm</td><td>Input range low limit to Input range high limit (*1) (*3)</td></tr> <tr> <td>High limit with standby alarm</td><td>-(Input span) to Input span °C (°F) (*1) (*2)</td></tr> <tr> <td>Low limit with standby alarm</td><td>-(Input span) to Input span °C (°F) (*1) (*2)</td></tr> <tr> <td>High/Low limits with standby</td><td>0 to Input span °C (°F) (*1) (*2)</td></tr> <tr> <td>High/Low limits with standby independent alarm</td><td>0 to Input span °C (°F) (*1) (*2)</td></tr> </table> <p>Available only when Event output EV2 is specified. Available when any alarm from □□□1 (Alarm output, High limit alarm) to □□12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].</p>	High limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)	Low limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)	High/Low limits alarm	0 to Input span °C (°F) (*1) (*2)	High/Low limits independent alarm	0 to Input span °C (°F) (*1) (*2)	High/Low limit range alarm	0 to Input span °C (°F) (*1) (*2)	High/Low limit range independent alarm	0 to Input span °C (°F) (*1) (*2)	Process high alarm	Input range low limit to Input range high limit (*1) (*3)	Process low alarm	Input range low limit to Input range high limit (*1) (*3)	High limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)	Low limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)	High/Low limits with standby	0 to Input span °C (°F) (*1) (*2)	High/Low limits with standby independent alarm	0 to Input span °C (°F) (*1) (*2)
High limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)																								
Low limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)																								
High/Low limits alarm	0 to Input span °C (°F) (*1) (*2)																								
High/Low limits independent alarm	0 to Input span °C (°F) (*1) (*2)																								
High/Low limit range alarm	0 to Input span °C (°F) (*1) (*2)																								
High/Low limit range independent alarm	0 to Input span °C (°F) (*1) (*2)																								
Process high alarm	Input range low limit to Input range high limit (*1) (*3)																								
Process low alarm	Input range low limit to Input range high limit (*1) (*3)																								
High limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)																								
Low limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)																								
High/Low limits with standby	0 to Input span °C (°F) (*1) (*2)																								
High/Low limits with standby independent alarm	0 to Input span °C (°F) (*1) (*2)																								
[C] R2H□ □□□□	<p>EV2 high limit alarm value</p> <ul style="list-style-type: none"> Sets EV2 high limit alarm value. <p>This value is available only for the following cases: □□□4 (Alarm output, High/Low limits independent alarm), □□□5 (Alarm output, High/Low limit range independent alarm), or □□12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].</p> <ul style="list-style-type: none"> Setting range: Same as those of EV2 alarm value <p>Available only when Event output EV2 is specified.</p>																								
[D] R2H4 □□1□	<p>EV2 alarm hysteresis</p> <ul style="list-style-type: none"> Sets EV2 alarm hysteresis. <ul style="list-style-type: none"> Setting range: 0.1 to 1000.0°C (°F), DC voltage, current inputs: 1 to 10000 (*1) <p>Available only when Event output EV2 is specified. Available when any alarm from □□□1 (Alarm output, High limit alarm) to □□12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].</p>																								
[E] R2d4 □□□□	<p>EV2 alarm delay time</p> <ul style="list-style-type: none"> Sets EV2 alarm action delay time. <p>When setting time has elapsed after the input enters the alarm output range, the alarm is activated.</p> <ul style="list-style-type: none"> Setting range: 0 to 10000 seconds <p>Available only when Event output EV2 is specified. Available when any alarm from □□□1 (Alarm output, High limit alarm) to □□12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].</p>																								


(*1) The placement of the decimal point follows the selection.

(*2) For DC voltage, current inputs, the input span is the same as the scaling span.

(*3) For DC voltage, current inputs, input range low (or high) limit value is the same as scaling low (or high) limit value.

Characters, Factory Default	Setting Item, Function, Setting Range				
[F] R2L ₁ na ₁ L	EV2 alarm Energized/De-energized <ul style="list-style-type: none"> • Selects Energized/De-energized status for EV2 alarm. (Refer to 'EV1/EV2 Energized/De-energized' on p.40.) • Selection item: <table> <tr> <td>na₁L</td><td>Energized</td></tr> <tr> <td>rE₁L</td><td>De-energized</td></tr> </table> <p>Available only when Event output EV2 is specified. Available when any alarm from <input type="checkbox"/>00 1 (Alarm output, High limit alarm) to <input type="checkbox"/>0 12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].</p>	na ₁ L	Energized	rE ₁ L	De-energized
na ₁ L	Energized				
rE ₁ L	De-energized				
[G] r42 ₁ <input type="checkbox"/> 00 1	TS2 output step number <ul style="list-style-type: none"> • Sets the step number at which Time signal output TS2 will be turned OFF or ON during Program control. (Refer to 'Time Signal Output' on p.41.) • Setting range: 1 to 9 <p>Available only when <input type="checkbox"/>0 15 (Time signal output) is selected in [Event output EV2 allocation].</p>				
[H] r42F 0000	TS2 OFF time <ul style="list-style-type: none"> • Sets Time signal output TS2 OFF time. (Refer to 'Time Signal Output' on p.41.) • Setting range: 00:00 to 99:59 (*4) <p>Available only when <input type="checkbox"/>0 15 (Time signal output) is selected in [Event output EV2 allocation].</p>				
[I] r42o 0000	TS2 ON time <ul style="list-style-type: none"> • Sets Time signal output TS2 ON time. (Refer to 'Time Signal Output' on p.41.) • Setting range: 00:00 to 99:59 (*4) <p>Available only when <input type="checkbox"/>0 15 (Time signal output) is selected in [Event output EV2 allocation].</p>				
[7] LP_r <input type="checkbox"/> 00	Loop break alarm time <ul style="list-style-type: none"> • Sets the time to assess the Loop break alarm. Refer to 'Loop Break Alarm' on p.40. • Setting range: 0 to 200 minutes Setting to 0 (zero) disables the alarm. 				
[8] LP_H <input type="checkbox"/> 00	Loop break alarm span <ul style="list-style-type: none"> • Sets the temperature to assess the Loop break alarm. Refer to 'Loop Break Alarm' on p.40. • Setting range: 0 to 150°C (°F), or 0.0 to 150.0°C (°F) DC voltage, current inputs: 0 to 1500 (*1) Setting to 0 (zero) disables the alarm. 				

(*4) Time unit follows the selection from [Step time unit].

Characters, Factory Default	Setting Item, Function, Setting Range
[9] 	SV1 <ul style="list-style-type: none"> • Sets SV1. • Setting range: Scaling low limit to Scaling high limit (*1) Available when Control output OFF function or Auto/Manual control is selected in [OUT/OFF key function].

(*1) The placement of the decimal point follows the selection.

[EV1/EV2 Energized/De-energized]

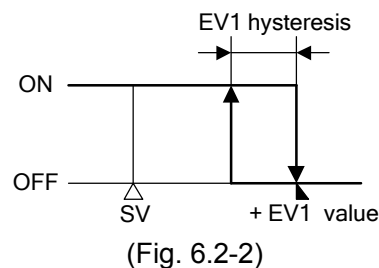
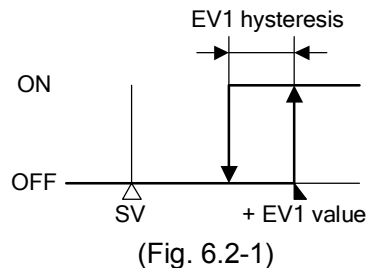
When **energized** (Energized) is selected, Event output 1 or 2 is conductive (ON) while the EV1/EV2 indicator is lit.

Event output 1 or 2 is not conductive (OFF) while the EV1/EV2 indicator is not lit.

When **de-energized** (De-energized) is selected, Event output 1 or 2 is not conductive (OFF) while the EV1/EV2 indicator is lit.

Event output 1 or 2 is conductive (ON) while the EV1/EV2 indicator is not lit.

High limit alarm (when Energized is set) High limit alarm (when De-energized is set)



EV1 value and EV1 hysteresis represent EV1 alarm value and EV1 alarm hysteresis respectively.
For EV2, substitute EV1 with EV2.

[Loop Break Alarm]

When the control action is Reverse (Heating) control:

- If the PV does not **reach** the Loop break alarm span setting within the time allotted to assess the Loop break alarm (after the MV has reached 100% or the OUT high limit value), the alarm will be activated.
- Likewise, if the PV does not **drop to** the Loop break alarm span setting within the time allotted to assess the Loop break alarm (after the MV has reached 0% or the OUT low limit value), the alarm will be activated.

When the control action is Direct (Cooling) control:

- If the PV does not **drop to** the Loop break alarm span setting within the time allotted to assess the Loop break alarm (after the MV has reached 100% or the OUT high limit value), the alarm will be activated.
 - Likewise, if the PV does not **reach** the Loop break alarm span setting within the time allotted to assess the Loop break alarm (after the MV has reached 0% or the OUT low limit value), the alarm will be activated.
- If Serial communication is specified, status can be read by reading Status flag 1.
Serial communication can be specified only for the KT4R model.

[Time Signal Output]

Time signal output activates during Time signal output ON time within the step for which step number is set.

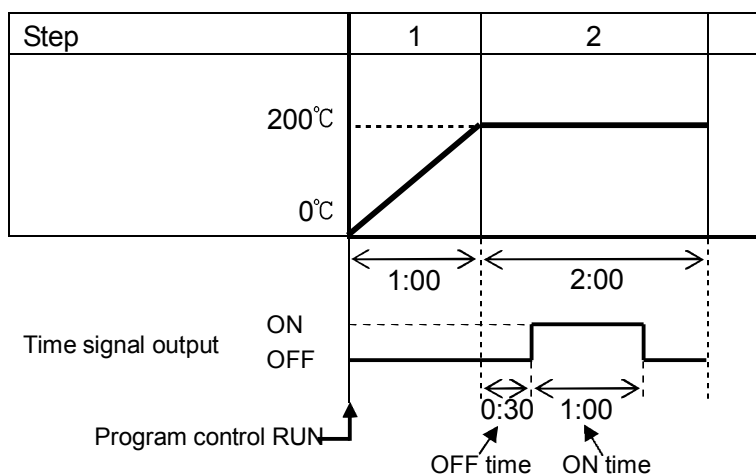
Time signal output ON time follows Time signal output OFF time after the program control starts.

The following program pattern shows that the temperature rises to 200°C for 1 hour, and stays at 200°C for 2 hours after Program control starts.

Step	1	2
Step SV	200°C	200°C
Step time	1:00	2:00

Time signal output (Fig. 6.2-4) is shown when set as follows.

- TS1/TS2 output step number: 2
- TS1/TS2 OFF time: 0:30
- TS1/TS2 ON time: 1:00



(Fig. 6.2-4)

Time signal output is effective within the step set in [TS1/TS2 output step number]. For example, if TS1/TS2 ON time is set to “2:00” at the above, Time signal output is turned OFF at the moment when Step 2 is completed.

7. Settings

In this section, Main setting, Sub setting and Engineering mode 1 and 2 will be explained.

7.1 Main Setting Mode

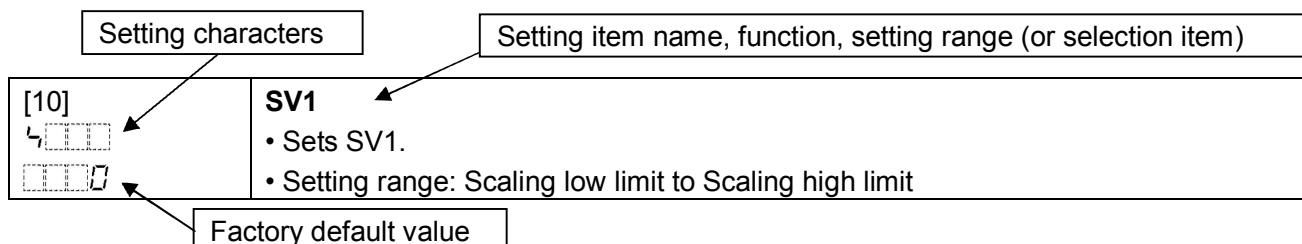
To enter Main setting mode, press the **MODE** key in RUN mode.

Use the **▲** or **▼** key for settings (or selections).

To register the set data, use the **MODE** key.

Explanation of setting items:











- Upper left: PV Display: Indicates setting characters.
- Lower left: SV Display: Indicates factory default value.
- Right side: Indicates the setting item, explanation of its function and setting range (or selection item).



Setting item numbers such as [10], [11] are the same as those on Section “14. Key Operation Flowchart” (p.131).

Characters, Factory Default	Setting Item, Function, Setting Range
[10] 4.00 0.00	SV1 <ul style="list-style-type: none"> • Sets SV1. • Corresponds to [SV1] in Initial setting mode. If Program control is selected in [OUT/OFF key function], this will become Step 1 SV. • Setting range: Scaling low limit to Scaling high limit (*1)
[11] 1.00 0000	Step 1 time <ul style="list-style-type: none"> • Sets Step 1 time. • Setting range: 0.00, or 00:00 to 99:59 If 0.00 is set, Step 1 time will be held, and Fixed value control will be performed using Step 1 SV. <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[12] 1.00 0.00	Step 1 wait value <ul style="list-style-type: none"> • Sets Step 1 wait value. • Setting range: 0 to Converted value of 20% of the input span DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1) Setting the value to 0 disables this Wait function. <p>Available only when Program control is selected in [OUT/OFF key function].</p>

(*1) The placement of the decimal point follows the selection.

Characters, Factory Default	Setting Item, Function, Setting Range
[13] 	SV2 <ul style="list-style-type: none"> • Sets SV2. • Corresponds to [SV2] in Initial setting mode. <p>If Program control is selected in [OUT/OFF key function], this will become Step 2 SV.</p> <ul style="list-style-type: none"> • Setting range: Scaling low limit to Scaling high limit (*1) <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[14] 	Step 2 time <ul style="list-style-type: none"> • Sets Step 2 time. • Setting range: , or 00:00 to 99:59 <p>If  is set, Step 2 time will be held, and Fixed value control will be performed using Step 2 SV.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[15] 	Step 2 wait value <ul style="list-style-type: none"> • Sets Step 2 wait value. • Setting range: 0 to Converted value of 20% of the input span <p>DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)</p> <p>Setting the value to 0 disables Wait function.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[16] 	SV3 <ul style="list-style-type: none"> • Sets SV3. • Corresponds to [SV3] in Initial setting mode. <p>If Program control is selected in [OUT/OFF key function], this will become Step 3 SV.</p> <ul style="list-style-type: none"> • Setting range: Scaling low limit to Scaling high limit (*1) <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[17] 	Step 3 time <ul style="list-style-type: none"> • Sets Step 3 time. • Setting range: , or 00:00 to 99:59 <p>If  is set, Step 3 time will be held, and Fixed value control will be performed using Step 3 SV.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[18] 	Step 3 wait value <ul style="list-style-type: none"> • Sets Step 3 wait value. • Setting range: 0 to Converted value of 20% of the input span <p>DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)</p> <p>Setting the value to 0 disables Wait function.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>

(*1) The placement of the decimal point follows the selection.

Characters, Factory Default	Setting Item, Function, Setting Range
[19] 44.00 0000	SV4 <ul style="list-style-type: none"> Sets SV4. Corresponds to [SV4] in Initial setting mode. <p>If Program control is selected in [OUT/OFF key function], this will become Step 4 SV.</p> <ul style="list-style-type: none"> Setting range: Scaling low limit to Scaling high limit (*1) <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[20] 10.4 0000	Step 4 time <ul style="list-style-type: none"> Sets Step 4 time. Setting range: 00:00 to 99:59 <p>If 00:00 is set, Step 4 time will be held, and Fixed value control will be performed using Step 4 SV.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[21] 10.4 0000	Step 4 wait value <ul style="list-style-type: none"> Sets Step 4 wait value. Setting range: 0 to Converted value of 20% of the input span <p>DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)</p> <p>Setting the value to 0 disables Wait function.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[22] 45.00 0000	Step 5 SV <ul style="list-style-type: none"> Sets Step 5 SV. Setting range: Scaling low limit to Scaling high limit (*1) <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[23] 10.5 0000	Step 5 time <ul style="list-style-type: none"> Sets Step 5 time. Setting range: 00:00 to 99:59 <p>If 00:00 is set, Step 5 time will be held, and Fixed value control will be performed using Step 5 SV.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[24] 10.5 0000	Step 5 wait value <ul style="list-style-type: none"> Sets Step 5 wait value. Setting range: 0 to Converted value of 20% of the input span <p>DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)</p> <p>Setting the value to 0 disables Wait function.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>

(*1) The placement of the decimal point follows the selection.

Characters, Factory Default	Setting Item, Function, Setting Range
[25] 46.00 0000	Step 6 SV <ul style="list-style-type: none"> Sets Step 6 SV. Setting range: Scaling low limit to Scaling high limit (*1) <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[26] 10.6 0000	Step 6 time <ul style="list-style-type: none"> Sets Step 6 time. Setting range: 00:00 to 99:59 <p>If 00:00 is set, Step 6 time will be held, and Fixed value control will be performed using Step 6 SV.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[27] 50.6 0000	Step 6 wait value <ul style="list-style-type: none"> Sets Step 6 wait value. Setting range: 0 to Converted value of 20% of the input span <p>DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)</p> <p>Setting the value to 0 disables Wait function.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[28] 47.00 0000	Step 7 SV <ul style="list-style-type: none"> Sets Step 7 SV. Setting range: Scaling low limit to Scaling high limit (*1) <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[29] 10.7 0000	Step 7 time <ul style="list-style-type: none"> Sets Step 7 time. Setting range: 00:00 to 99:59 <p>If 00:00 is set, Step 7 time will be held, and Fixed value control will be performed using Step 7 SV.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[30] 50.7 0000	Step 7 wait value <ul style="list-style-type: none"> Sets Step 7 wait value. Setting range: 0 to Converted value of 20% of the input span <p>DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)</p> <p>Setting the value to 0 disables Wait function.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>



(*1) The placement of the decimal point follows the selection.

Characters, Factory Default	Setting Item, Function, Setting Range
[31] 48.0 0000	Step 8 SV <ul style="list-style-type: none"> Sets Step 8 SV. Setting range: Scaling low limit to Scaling high limit (*1) <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[32] 1.8 0000	Step 8 time <ul style="list-style-type: none"> Sets Step 8 time. Setting range: 00:00 to 99:59 <p>If 00:00 is set, Step 8 time will be held, and Fixed value control will be performed using Step 8 SV.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[33] 50.8 0000	Step 8 wait value <ul style="list-style-type: none"> Sets Step 8 wait value. Setting range: 0 to Converted value of 20% of the input span <p>DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)</p> <p>Setting the value to 0 disables Wait function.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[34] 49.0 0000	Step 9 SV <ul style="list-style-type: none"> Sets Step 9 SV. Setting range: Scaling low limit to Scaling high limit (*1) <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[35] 1.9 0000	Step 9 time <ul style="list-style-type: none"> Sets Step 9 time. Setting range: 00:00 to 99:59 <p>If 00:00 is set, Step 9 time will be held, and Fixed value control will be performed using Step 9 SV.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>
[36] 50.9 0000	Step 9 wait value <ul style="list-style-type: none"> Sets Step 9 wait value. Setting range: 0 to Converted value of 20% of the input span <p>DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)</p> <p>Setting the value to 0 disables Wait function.</p> <p>Available only when Program control is selected in [OUT/OFF key function].</p>

(*1) The placement of the decimal point follows the selection.

7.2 Sub Setting Mode

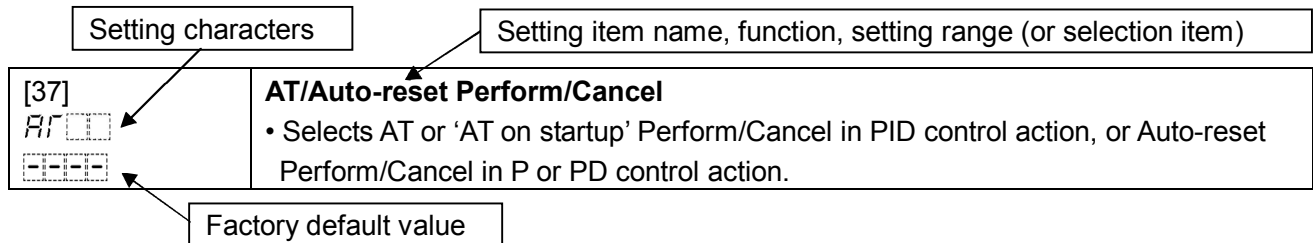
To enter Sub setting mode, press the  and  keys (in that order) together in RUN mode.

Use the  or  key for settings (or selections).

To register the set data, use the  key.

Explanation of setting items:

- Upper left: PV Display: Indicates setting characters.
- Lower left: SV Display: Indicates factory default value.
- Right side: Indicates the setting item, explanation of its function and setting range (or selection item).

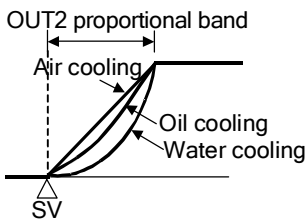


Setting item numbers such as [37], [38] are the same as those on Section “14. Key Operation Flowchart” (p.131).

Characters, Factory Default	Setting Item, Function, Setting Range								
[37] AT ---	AT/Auto-reset Perform/Cancel <ul style="list-style-type: none"> • Selects AT or 'AT on startup' Perform/Cancel in PID control action, or Auto-reset Perform/Cancel in P or PD control action. Refer to Sections '8.5 Setting PID Constants (by Performing AT)' (p.70), and '8.6 Performing Auto-reset' (p. 73). • Selection item: <table border="1"> <tr> <td>---</td><td>AT/AT on startup/Auto-reset Cancel</td></tr> <tr> <td>AT</td><td>AT Perform</td></tr> <tr> <td>AT _ 4</td><td>'AT on startup' Perform</td></tr> <tr> <td>r 4Er</td><td>Auto-reset Perform</td></tr> </table> <p>Not available for ON/OFF control or PI control.</p>	---	AT/AT on startup/Auto-reset Cancel	AT	AT Perform	AT _ 4	'AT on startup' Perform	r 4Er	Auto-reset Perform
---	AT/AT on startup/Auto-reset Cancel								
AT	AT Perform								
AT _ 4	'AT on startup' Perform								
r 4Er	Auto-reset Perform								
[38] P 10	OUT1 proportional band <ul style="list-style-type: none"> • Sets OUT1 proportional band. • Setting range: 0 to Input span °C (°F) DC voltage, current inputs: 0.0 to 1000.0% OUT1 becomes ON/OFF control when set to 0 or 0.0. 								
[39] I 200	Integral time <ul style="list-style-type: none"> • Sets the integral time. Auto-reset can be performed when PD is control action (I = 0). • Setting range: 0 to 3600 seconds Setting the value to 0 disables integral action. Not available if OUT1 is in ON/OFF control. 								
[40] d 50	Derivative time <ul style="list-style-type: none"> • Sets the derivative time. • Setting range: 0 to 1800 seconds Setting the value to 0 disables derivative action. Not available if OUT1 is in ON/OFF control. 								

Characters, Factory Default	Setting Item, Function, Setting Range
[41] AR 50 50	ARW <ul style="list-style-type: none"> Sets ARW (anti-reset windup). Setting range: 0 to 100% <p>Available only for PID control.</p>
[42] r 4 E F 00	Manual reset <ul style="list-style-type: none"> Sets the reset value manually. Setting range: \pmProportional band value <p>If a value larger than 100.0% is set in [OUT1 proportional band], the setting range will be ± 100.0.</p> <p>Available for P control and PD control.</p>
[43] c 30 30 Factory default: • Relay contact output: 30 sec. • Non-contact voltage output: 3 sec.	OUT1 proportional cycle <ul style="list-style-type: none"> Sets proportional cycle for OUT1. <p>For relay contact output, if the proportional cycle time is decreased, the frequency of the relay action increases, and the life of the relay contact is shortened.</p> <ul style="list-style-type: none"> Setting range: 0.5, or 1 to 120 seconds <p>Not available for Direct current output type, or if OUT1 is in ON/OFF control.</p>
[44] H 4 4 10	OUT1 ON/OFF hysteresis <ul style="list-style-type: none"> Sets ON/OFF hysteresis for OUT1. Setting range: 0.1 to 1000.0°C (°F), DC voltage, current inputs: 1 to 10000 (*1) <p>Available only when OUT1 is in ON/OFF control.</p>
[45] o L H 100	OUT1 high limit <ul style="list-style-type: none"> Sets OUT1 high limit value. Setting range: OUT1 low limit value to 100% (Direct current output type: OUT1 low limit value to 105%) <p>Not available if OUT1 is in ON/OFF control.</p>
[46] o L L 000	OUT1 low limit <ul style="list-style-type: none"> Sets OUT1 low limit value. Setting range: 0% to OUT1 high limit value (Direct current output type: -5% to OUT1 high limit value) <p>Not available if OUT1 is in ON/OFF control.</p>
[47] o r R F 000	OUT1 rate-of-change <ul style="list-style-type: none"> Sets changing value of OUT1 MV for 1 second. <p>See 'OUT1 rate-of-change' on p. 52.</p> <ul style="list-style-type: none"> Setting range: 0 to 100%/second <p>Setting the value to 0 disables this function.</p> <p>Not available if OUT1 is in ON/OFF control.</p>

(*1) The placement of the decimal point follows the selection.

Characters, Factory Default	Setting Item, Function, Setting Range						
[48] c A c r A l r <input type="checkbox"/>	OUT2 cooling method <ul style="list-style-type: none"> Selects OUT2 cooling method from air, oil or water cooling.  <p>(Fig. 7.2-1)</p> <ul style="list-style-type: none"> Selection item: <table border="1"> <tr> <td>A l r <input type="checkbox"/></td><td>Air cooling (linear characteristics)</td></tr> <tr> <td>o i l <input type="checkbox"/></td><td>Oil cooling (1.5th power of the linear characteristics)</td></tr> <tr> <td>w a t <input type="checkbox"/></td><td>Water cooling (2nd power of the linear characteristics)</td></tr> </table> <p>Available only when <input type="checkbox"/> 19 (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation]</p> <p>Not available if OUT2 is in ON/OFF control.</p>	A l r <input type="checkbox"/>	Air cooling (linear characteristics)	o i l <input type="checkbox"/>	Oil cooling (1.5th power of the linear characteristics)	w a t <input type="checkbox"/>	Water cooling (2nd power of the linear characteristics)
A l r <input type="checkbox"/>	Air cooling (linear characteristics)						
o i l <input type="checkbox"/>	Oil cooling (1.5th power of the linear characteristics)						
w a t <input type="checkbox"/>	Water cooling (2nd power of the linear characteristics)						
[49] P _ b <input type="checkbox"/> <input type="checkbox"/> 10	OUT2 proportional band <ul style="list-style-type: none"> Sets the proportional band for OUT2. Setting range: 0 to Input span °C (°F) DC voltage, current inputs: 0.0 to 1000.0% <p>If the proportional band is set to 0 or 0.0, OUT2 becomes ON/OFF control, and the item selected in [OUT2 cooling method] will be disabled.</p> <p>Available only when <input type="checkbox"/> 19 (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation]</p>						
[50] c _ b <input type="checkbox"/> <input type="checkbox"/> 30 Factory default: • Relay contact output: 30 sec. • Non-contact voltage output: 3 sec.	OUT2 proportional cycle <ul style="list-style-type: none"> Sets proportional cycle for OUT2. <p>For relay contact output, if the proportional cycle time is decreased, the frequency of the relay action increases, and the life of the relay contact is shortened.</p> <ul style="list-style-type: none"> Setting range: 0.5, or 1 to 120 seconds <p>Available only when <input type="checkbox"/> 19 (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation]</p> <p>Not available for Direct current output type, or if OUT2 is in ON/OFF control.</p>						
[51] H y h <input type="checkbox"/> 10	OUT2 ON/OFF hysteresis <ul style="list-style-type: none"> Sets ON/OFF hysteresis for OUT2. Setting range: 0.1 to 1000.0°C (°F), DC voltage, current inputs: 1 to 10000 (*1) <p>Available only when <input type="checkbox"/> 19 (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation]</p>						
[52] o L H b <input type="checkbox"/> 100	OUT2 high limit <ul style="list-style-type: none"> Sets OUT2 high limit value. Setting range: OUT2 low limit value to 100% <p>Available only when <input type="checkbox"/> 19 (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation]</p>						

(*1) The placement of the decimal point follows the selection.

Characters, Factory Default	Setting Item, Function, Setting Range	
[53] oLLb 0000	OUT2 low limit <ul style="list-style-type: none"> Sets OUT2 low limit value. Setting range: 0% to OUT2 high limit value <p>Available only when 0019 (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation]</p>	
[54] db00 0000	Overlap/Dead band <ul style="list-style-type: none"> Sets the overlap band or dead band for OUT1 and OUT2. <ul style="list-style-type: none"> + Set value: Dead band – Set value: Overlap band Setting range: -200.0 to 200.0°C (°F), DC voltage, current inputs: -2000 to 2000 (*1) <p>Available only when 0019 (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation]</p>	
[55] conf HEAT	Direct/Reverse action <ul style="list-style-type: none"> Selects either Reverse (Heating) or Direct (Cooling) control action. 	
	HEAT	Reverse (Heating) action
	cool	Direct (Cooling) action
[56] A 00 0000	EV1 alarm value <ul style="list-style-type: none"> Sets EV1 alarm value. <p>Corresponds to [EV1 alarm value] in Initial setting mode.</p> <p>EV1 alarm value matches EV1 low limit alarm value in the following cases: 0004 (Alarm output, High/Low limits independent alarm), 0005 (Alarm output, High/Low limit range independent alarm), or 0012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation].</p> <ul style="list-style-type: none"> Setting range: 	
	High limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	Low limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limits independent alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limit range alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limit range independent alarm	0 to Input span °C (°F) (*1) (*2)
	Process high alarm	Input range low limit to Input range high limit (*1) (*3)
	Process low alarm	Input range low limit to Input range high limit (*1) (*3)
	High limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	Low limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits with standby alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limits with standby independent alarm	0 to Input span °C (°F) (*1) (*2)
	<p>Available when any alarm from 0001 (Alarm output, High limit alarm) to 0012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation].</p>	

(*1) The placement of the decimal point follows the selection.

(*2) For DC voltage, current inputs, the input span is the same as the scaling span.

(*3) For DC voltage, current inputs, input range low (or high) limit value is the same as scaling low (or high) limit value.

Characters, Factory Default	Setting Item, Function, Setting Range
[57] R1H □□□□	EV1 high limit alarm value <ul style="list-style-type: none"> Sets EV1 high limit alarm value. <p>This value is available only for the following cases: □□□4 (Alarm output, High/Low limits independent alarm), □□□6 (Alarm output, High/Low limit range independent alarm), or □□12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation].</p> <p>Corresponds to [EV1 high limit alarm value] in Initial setting mode.</p> <ul style="list-style-type: none"> Setting range: Same as those of EV1 alarm value
[58] R2□ □□□□	EV2 alarm value <ul style="list-style-type: none"> Sets EV2 alarm value. <p>Corresponds to [EV2 alarm value] in Initial setting mode.</p> <p>EV2 alarm value matches EV2 low limit alarm value in the following cases: □□□4 (Alarm output, High/Low limits independent alarm), □□□6 (Alarm output, High/Low limit range independent alarm), or □□12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].</p> <ul style="list-style-type: none"> Setting range: Same as those of EV1 alarm value <p>Available only when □□□1 (Alarm output, High limit alarm) to □□12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].</p>
[59] R2H □□□□	EV2 high limit alarm value <ul style="list-style-type: none"> Sets EV2 high limit alarm value. <p>This value is available only for the following cases: □□□4 (Alarm output, High/Low limits independent alarm), □□□6 (Alarm output, High/Low limit range independent alarm), or □□12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].</p> <p>Corresponds to [EV2 high limit alarm value] in Initial setting mode.</p> <ul style="list-style-type: none"> Setting range: Same as those of EV1 alarm value
[60] LP_L □□□□	Loop break alarm time <ul style="list-style-type: none"> Sets the time to assess the Loop break alarm. <p>Corresponds to [Loop break alarm time] in Initial setting mode.</p> <p>Refer to 'Loop Break Alarm' on p.40.</p> <ul style="list-style-type: none"> Setting range: 0 to 200 minutes <p>Setting to 0 (zero) disables the alarm.</p>
[61] LP_H □□□□	Loop break alarm span <ul style="list-style-type: none"> Sets the temperature to assess the Loop break alarm. <p>Corresponds to [Loop Break alarm span] in Initial setting mode.</p> <p>Refer to 'Loop Break Alarm' on p.40.</p> <ul style="list-style-type: none"> Setting range: 0 to 150°C (°F), 0.0 to 150.0°C (°F) <p>DC voltage, current inputs: 0 to 1500 (*1)</p> <p>Setting to 0 (zero) disables the alarm.</p>

(*1) The placement of the decimal point follows the selection.

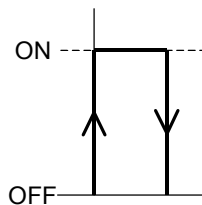
[OUT1 rate-of-change]

For Heating control, if PV is lower than SV, the output is generally turned from OFF to ON as shown in (Fig. 7.2-2).

If OUT1 rate-of-change is set, the output can be changed by the rate-of-change (Fig. 7.2-3).

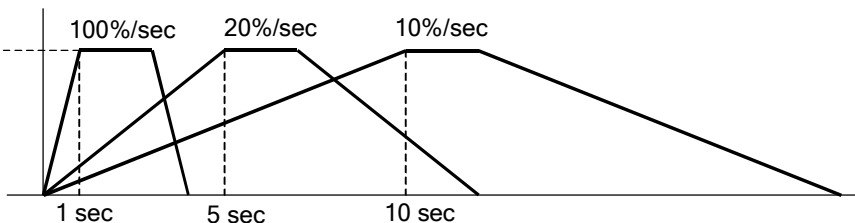
This control is suitable for high temperature heaters (which are made from molybdenum, tungsten or platinum, etc., and used at approx. 1500 to 1800°C) which are easily burnt out from turning on electricity rapidly.

- Usual output





(Fig. 7.2-2)

- Output when Output rate-of-change is set



(Fig. 7.2-3)

7.3 Engineering Mode 1

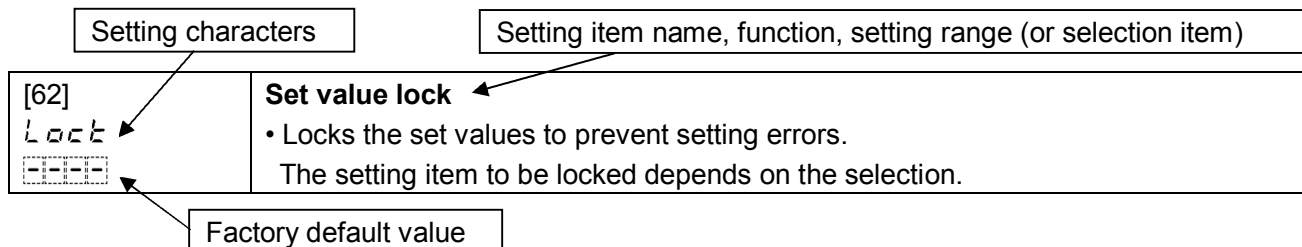
To enter Engineering mode 1, press and hold the  and  keys (in that order) together for 3 seconds in RUN mode.

Use the  or  key for settings (or selections).

To register the set data, use the  key.

Explanation of setting items:

- Upper left: PV Display: Indicates setting characters.
- Lower left: SV Display: Indicates factory default value.
- Right side: Indicates the setting item, explanation of its function and setting range (or selection item).



Setting item numbers such as [62], [63] are the same as those on Section “14. Key Operation Flowchart” (p.131).

Characters, Factory Default	Setting Item, Function, Setting Range		
[62] Lock ---	Set value lock • Locks the set values to prevent setting errors. The setting item to be locked depends on the selection. • Selection item:		
		Change via Keypad	Change via Software Communication
	---	Unlock	All set values can be changed.
	Lock 1	Lock 1	None of the set values can be changed.
	Lock 2	Lock 2	In Fixed value control, only SV and Alarm value can be changed. In Program control, Step SV, Step time and Alarm value can be changed.
	Lock 3	Lock 3	All set values can be changed.
	Lock 4	Lock 4	None of the set values can be changed.
	Lock 5	Lock 5	In Fixed value control, only SV and Alarm value can be changed. In Program control, Step SV, Step time and Alarm value can be changed.

Characters, Factory Default	Setting Item, Function, Setting Range	
[63] EV1 000	Event output EV1 allocation <ul style="list-style-type: none"> • Selects Event output EV1 from the Event Output Allocation Table below. Corresponds to [Event output EV1 allocation] in Initial setting mode. • When changing Event output EV1 allocation, refer to Section “8.10 Items to be Initialized by Changing Settings” (p.84). • Selection item: 	
	Event Output Allocation Table	
	000	No event
	001	Alarm output, High limit alarm
	002	Alarm output, Low limit alarm
	003	Alarm output, High/Low limits alarm
	004	Alarm output, High/Low limits independent alarm
	005	Alarm output, High/Low limit range alarm
	006	Alarm output, High/Low limit range independent alarm
	007	Alarm output, Process high alarm
	008	Alarm output, Process low alarm
	009	Alarm output, High limit with standby
	010	Alarm output, Low limit with standby
	011	Alarm output, High/Low limits with standby alarm
	012	Alarm output, High/Low limits with standby independent alarm
	014	Loop break alarm output
	015	Time signal output
	016	Output during AT
	017	Pattern end output
	018	Output by communication command
		Turns OFF or ON during Program control, by setting OFF and ON times within the step set in [Step number]. Turns ON during AT. Turns ON when Program control ends, and remains ON until turned OFF by pressing the [MODE] key. Turns OFF or ON by communication command 00E4H during Serial communication. B0 EV1 output 0: OFF 1: ON B1 EV2 output 0: OFF 1: ON
[A] A1E no	EV1 alarm value 0 Enabled/Disabled <ul style="list-style-type: none"> • When EV1 alarm value is 0 (zero), alarm action can be Enabled or Disabled. Corresponds to [EV1 alarm value 0 Enabled/Disabled] in Initial setting mode. • Selection item: 	
	no	Disabled
	4E4	Enabled
	Available when 001 (Alarm output, High limit alarm) to 005 (Alarm output, High/Low limit range independent alarm), 009 (Alarm output, High limit with standby alarm) to 012 (Alarm output, High/Low limits with standby independent alarm) are selected in [Event output EV1 allocation].	

Characters, Factory Default	Setting Item, Function, Setting Range
[B] R 1.0 0.00	EV1 alarm value <ul style="list-style-type: none"> Sets EV1 alarm value. Corresponds to [EV1 alarm value] in Initial setting mode. EV1 alarm value matches EV1 low limit alarm value in the following cases: 0004 (Alarm output, High/Low limits independent alarm), 0005 (Alarm output, High/Low limit range independent alarm), or 0012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation]. <ul style="list-style-type: none"> Setting range:
	High limit alarm
	Low limit alarm
	High/Low limits alarm
	High/Low limits independent alarm
	High/Low limit range alarm
	High/Low limit range independent alarm
	Process high alarm
	Process low alarm
	High limit with standby alarm
	Low limit with standby alarm
	High/Low limits with standby alarm
	High/Low limits with standby independent alarm
	Available when any alarm from 0001 (Alarm output, High limit alarm) to 0012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation].
[C] R 1.4 0.00	EV1 high limit alarm value <ul style="list-style-type: none"> Sets EV1 high limit alarm value. This value is available only for the following cases: 0004 (Alarm output, High/Low limits independent alarm), 0005 (Alarm output, High/Low limit range independent alarm), or 0012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation]. Corresponds to [EV1 high limit alarm value] in Initial setting mode. Setting range: Same as those of EV1 alarm value
[D] R 1.4 0.10	EV1 alarm hysteresis <ul style="list-style-type: none"> Sets EV1 alarm hysteresis. Corresponds to [EV1 alarm hysteresis] in Initial setting mode. Setting range: 0.1 to 1000.0°C (°F), DC voltage, current inputs: 1 to 10000 (*1) Available when any alarm from 0001 (Alarm output, High limit alarm) to 0012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation].

(*1) The placement of the decimal point follows the selection.

(*2) For DC voltage and current inputs, the input span is the same as the scaling span.

(*3) For DC voltage and current inputs, input span low (or high) limit value is the same as scaling low (or high) limit value.

Characters, Factory Default	Setting Item, Function, Setting Range	
[E] A 124 0000	EV1 alarm delay time <ul style="list-style-type: none">Sets EV1 alarm action delay time. Corresponds to [EV1 alarm delay time] in Initial setting mode. When setting time has elapsed after the input enters the alarm output range, the alarm is activated.Setting range: 0 to 10000 seconds Available when any alarm from 0001 (Alarm output, High limit alarm) to 0012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation].	
[F] A 1L ã no ãL	EV1 alarm Energized/De-energized <ul style="list-style-type: none">Selects Energized/De-energized status for EV1 alarm. Corresponds to [EV1 alarm Energized/De-energized] in Initial setting mode. (Refer to ‘EV1/EV2 Energized/De-energized’ on p.40.)Selection item:	
	no ãL	Energized
	rEB4	De-energized
	Available when any alarm from 0001 (Alarm output, High limit alarm) to 0012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation].	
[G] F4 14 0001	TS1 output step number <ul style="list-style-type: none">Sets the step number for which Time signal output TS1 is turned OFF or ON during Program control. Corresponds to [TS1 output step number] in Initial setting mode.Setting range: 1 to 9 Available only when 0015 (Time signal output) is selected in [Event output EV1 allocation].	
[H] F4 1F 0000	TS1 OFF time <ul style="list-style-type: none">Sets Time signal output TS1 OFF time. Corresponds to [TS1 OFF time] in Initial setting mode.Setting range: 00:00 to 99:59 (*4) Available only when 0015 (Time signal output) is selected in [Event output EV1 allocation].	
[I] F4 1a 0000	TS1 ON time <ul style="list-style-type: none">Sets Time signal output TS1 ON time. Corresponds to [TS1 ON time] in Initial setting mode.Setting range: 00:00 to 99:59 (*4) Available only when 0015 (Time signal output) is selected in [Event output EV1 allocation].	

(*4) Time unit follows the selection from [Step time unit].

Characters, Factory Default	Setting Item, Function, Setting Range		
[64] EV02 0000	Event output EV2 allocation <ul style="list-style-type: none"> • Selects Event output EV2 from the Event Output Allocation Table below. Corresponds to [Event output EV2 allocation] in Initial setting mode. • When changing Event output EV2, refer to Section “8.10 Items to be Initialized by Changing Settings” (p.84). • Selection item: Event Output Allocation Table		
	0000	No event	
	0001	Alarm output, High limit alarm	
	0002	Alarm output, Low limit alarm	
	0003	Alarm output, High/Low limits alarm	
	0004	Alarm output, High/Low limits independent alarm	
	0005	Alarm output, High/Low limit range alarm	
	0006	Alarm output, High/Low limit range independent alarm	
	0007	Alarm output, Process high alarm	
	0008	Alarm output, Process low alarm	
	0009	Alarm output, High limit with standby alarm	
	0010	Alarm output, Low limit with standby alarm	
	0011	Alarm output, High/Low limits with standby alarm	
	0012	Alarm output, High/Low limits with standby independent alarm	
	0014	Loop break alarm output	
	0015	Time signal output	Turns OFF or ON during Program control, by setting OFF and ON times within the step set in [Step number].
	0016	Output during AT	Turns ON during AT.
	0017	Pattern end output	Turns ON when Program control ends, and remains ON until turned OFF by pressing the [MODE] key.
	0018	Output by communication command	Turns OFF or ON by communication command 00E4H during Serial communication. B0 EV1 output 0: OFF 1: ON B1 EV2 output 0: OFF 1: ON
	0019	Heating/Cooling control relay contact output	Works as Control output OUT2 (Heating/Cooling control).
	Available only when 0019 (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation]		

Characters, Factory Default	Setting Item, Function, Setting Range
[A] R23A no	EV2 alarm value 0 Enabled/Disabled <ul style="list-style-type: none"> When EV2 alarm value is 0 (zero), alarm action can be Enabled or Disabled. Corresponds to [EV2 alarm value 0 Enabled/Disabled] in Initial setting mode. Selection item:
	no Disabled
	YE4 Enabled
	Available only when Event output EV2 is specified. Available when 001 (Alarm output, High limit alarm) to 005 (Alarm output, High/Low limit range independent alarm), 009 (Alarm output, High limit with standby alarm) to 012 (Alarm output, High/Low limits with standby independent alarm) are selected in [Event output EV2 allocation].
[B] R20 000	EV2 alarm value <ul style="list-style-type: none"> Sets EV2 alarm value. Corresponds to [EV2 alarm value] in Initial setting mode. EV2 alarm value matches EV2 low limit alarm value in the following cases: 004 (Alarm output, High/Low limits independent alarm), 005 (Alarm output, High/Low limit range independent alarm), or 012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation]. <ul style="list-style-type: none"> Setting range:
	High limit alarm -(Input span) to Input span °C (°F) (*1) (*2)
	Low limit alarm -(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits alarm 0 to Input span °C (°F) (*1) (*2)
	High/Low limits independent alarm 0 to Input span °C (°F) (*1) (*2)
	High/Low limit range alarm 0 to Input span °C (°F) (*1) (*2)
	High/Low limit range independent alarm 0 to Input span °C (°F) (*1) (*2)
	Process high alarm Input range low limit to Input range high limit (*1) (*3)
	Process low alarm Input range low limit to Input range high limit (*1) (*3)
	High limit with standby alarm -(Input span) to Input span °C (°F) (*1) (*2)
	Low limit with standby alarm -(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits with standby alarm 0 to Input span °C (°F) (*1) (*2)
	High/Low limits with standby independent alarm 0 to Input span °C (°F) (*1) (*2)
	Available only when Event output EV2 is specified. Available when any alarm from 001 (Alarm output, High limit alarm) to 012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].
[C] R24 000	EV2 high limit alarm value <ul style="list-style-type: none"> Sets EV2 high limit alarm value. This value is available only for the following cases: 004 (Alarm output, High/Low limits independent alarm), 005 (Alarm output, High/Low limit range independent alarm), or 012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation]. Corresponds to [EV2 high limit alarm value] in Initial setting mode. <ul style="list-style-type: none"> Setting range: Same as those of EV2 alarm value
	Available only when Event output EV2 is specified.

(*1) The placement of the decimal point follows the selection.

(*2) For DC voltage, current inputs, the input span is the same as the scaling span.

(*3) For DC voltage, current inputs, input range low (or high) limit value is the same as scaling low (or high) limit value.

Characters, Factory Default	Setting Item, Function, Setting Range	
[D] R2HY □□ 10	EV2 alarm hysteresis <ul style="list-style-type: none">Sets EV2 alarm hysteresis. Corresponds to [EV2 alarm hysteresis] in Initial setting mode.Setting range: 0.1 to 1000.0℃ (°F), DC voltage, current inputs: 1 to 10000 (*1) Available only when Event output EV2 is specified. Available when any alarm from □□□ 1 (Alarm output, High limit alarm) to □□□ 12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].	
[E] R2dy □□□□	EV2 alarm delay time <ul style="list-style-type: none">Sets EV2 alarm action delay time. Corresponds to [EV2 alarm delay time] in Initial setting mode. When setting time has elapsed after the input enters the alarm output range, the alarm is activated.Setting range: 0 to 10000 seconds Available only when Event output EV2 is specified. Available when any alarm from □□□□ 1 (Alarm output, High limit alarm) to □□□□ 12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].	
[F] R2Lñ noñL	EV2 alarm Energized/De-energized <ul style="list-style-type: none">Selects Energized/De-energized status for EV2 alarm. Corresponds to [EV2 alarm Energized/De-energized] in Initial setting mode. Refer to 'EV1/EV2 Energized/De-energized' (p.40).Selection item:	
	noñL	Energized
	rEHy	De-energized
	Available only when Event output EV2 is specified. Available when any alarm from □□□□ 1 (Alarm output, High limit alarm) to □□□□ 12 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].	
[G] r424 □□□□ 1	TS2 output step number <ul style="list-style-type: none">Sets the step number for which Time signal output TS2 is turned OFF or ON during Program control. Corresponds to [TS2 output step number] in Initial setting mode.Setting range: 1 to 9 Available only when □□□□ 15 (Time signal output) is selected in [Event output EV2 allocation].	
[H] r42F 0000	TS2 OFF time <ul style="list-style-type: none">Sets Time signal output TS2 OFF time. Corresponds to [TS2 OFF time] in Initial setting mode.Setting range: 00:00 to 99:59 (*4) Available only when □□□□ 15 (Time signal output) is selected in [Event output EV2 allocation].	
[I] r42o 0000	TS2 ON time <ul style="list-style-type: none">Sets Time signal output TS2 ON time. Corresponds to [TS2 ON time] in Initial setting mode.Setting range: 00:00 to 99:59 (*4) Available only when □□□□ 15 (Time signal output) is selected in [Event output EV2 allocation].	

(*1) The placement of the decimal point follows the selection.

(*4) Time unit follows the selection from [Step time unit].

Characters, Factory Default	Setting Item, Function, Setting Range
[65] 4000 1000	Sensor correction coefficient <ul style="list-style-type: none"> Sets sensor correction coefficient. Sets slope of input value from a sensor. $\text{PV after sensor correction} = \text{Current PV} \times (\text{Sensor correction coefficient}) + (\text{Sensor correction value})$ Refer to Section '9.1 Input Value Correction' (p.85). Setting range: -10.000 to 10.000
[66] 4000 1000	Sensor correction <ul style="list-style-type: none"> This corrects the input value from the sensor. When a sensor cannot be set at the exact location where control is desired, the sensor-measured temperature may deviate from the temperature in the controlled location. When using plural controllers, sometimes the measured temperatures do not concur due to differences in sensor accuracy or dispersion of load capacities. In such a case, the control can be set at the desired temperature by adjusting the input value of sensors. $\text{PV after sensor correction} = \text{Current PV} \times (\text{Sensor correction coefficient}) + (\text{Sensor correction value})$ Refer to Section '9.1 Input Value Correction' (p.85). Setting range: -1000.0 to 1000.0°C (°F) DC voltage, current inputs: -10000 to 10000 (*1)
[67] FILL 000	PV filter time constant <ul style="list-style-type: none"> Sets PV filter time constant. If the value is set too high, it affects control results due to the delay of response. Setting range: 0.0 to 10.0 seconds
[68] cñ4L ñodr	Communication protocol <ul style="list-style-type: none"> Selects communication protocol. Selection item:
	ñEUL MEWTOCOL
	ñodr MODBUS ASCII
	ñodr MODBUS RTU
	ñodr MODBUS ASCII (KT command allocation)
	ñodr MODBUS RTU (KT command allocation)
[69] cñno 000	<p>Available only when Serial communication is specified. Serial communication can be specified only for the KT4R model.</p>
	Instrument number <ul style="list-style-type: none"> Sets the instrument number. The instrument numbers should be set one by one when multiple instruments are connected in Serial communication, otherwise communication is impossible. Setting range: 0 to 95 <p>Available only when Serial communication is specified. Serial communication can be specified only for the KT4R model.</p>

(*1) The placement of the decimal point follows the selection.

Characters, Factory Default	Setting Item, Function, Setting Range	
[70] cñ4P □□96	Communication speed • Selects a communication speed equal to that of the host computer. • Selection item:	
	□□96	9600 bps
	□□192	19200 bps
	□□384	38400 bps
	Available only when Serial communication is specified. Serial communication can be specified only for the KT4R model.	
[71] cñFΓ 7E8n	Data bit/Parity • Selects data bit and parity. • Selection item:	
	8non	8 bits/No parity
	7non	7 bits/No parity
	8E8n	8 bits/Even
	7E8n	7 bits/Even
	8odd	8 bits/Odd
	7odd	7 bits/Odd
	Available only when Serial communication is specified. Serial communication can be specified only for the KT4R model.	
[72] cñ4Γ □□1	Stop bit • Selects the stop bit. • Selection item:	
	□□1	1 bit
	□□2	2 bits
	Available only when Serial communication is specified. Serial communication can be specified only for the KT4R model.	
[73] cñd4 □□10	Response delay time • Response from the controller can be delayed after receiving command from the host computer. If Response delay time is changed via software communication, the changed delay time will be reflected immediately. • Setting range: 0 to 1000 ms Available only when Serial communication is specified. Serial communication can be specified only for the KT4R model.	
[74] ñ_4□ ñ! n□	Step time unit • Selects the Step time unit for the Program control. • Selection item:	
	ñ! n□	Hours:Minutes
	4E□□	Minutes:Seconds
	Available only when Program control is selected in [OUT/OFF key function].	

(*1) The placement of the decimal point follows the selection.



Characters, Factory Default	Setting Item, Function, Setting Range	
[75] P_rE_f 4_f0P	Power restore action	
	<ul style="list-style-type: none"> • Selects the program status if a power failure occurs mid-program and it is restored. • Selection item: 	
	4_f0P	Stops after power is restored.
	c_on_f	Continues (resumes) after power is restored.
	H0L_d	Suspends (on hold) after power is restored.
	Available only when Program control is selected in [OUT/OFF key function].	
[76] 4_48 0000	Program start temperature	
	<ul style="list-style-type: none"> • Sets the step temperature when Program control starts. • Setting range: Scaling low limit value to Scaling high limit value (*1) 	
	Available only when Program control is selected in [OUT/OFF key function].	
[77] 4_4L P800	Program control start type	
	<ul style="list-style-type: none"> • Selects the Program control start type. • Selection item: 	
	P800	PV start
	P8r0	PVR start
	4800	SV start
	Available only when Program control is selected in [OUT/OFF key function].	
[78] rEP_r 0000	Number of repetitions	
	<ul style="list-style-type: none"> • Sets the number of repetitions for Program control. • Setting range: 0 to 10000 times 	
	Available only when Program control is selected in [OUT/OFF key function].	
[79] rR44 484f	SV Rise/Fall rate start type	
	<ul style="list-style-type: none"> • When control output is turned from OFF to ON, or switched from Manual to Automatic control, SV start or PV start can be selected for SV rise rate or fall rate action. • When power is turned ON, PV start is adopted for SV Rise/Fall rate action, regardless of the selected type. • Selection item: 	
	484f	SV start
	P84f	PV start
[80] rRrU 0000	SV rise rate	
	<ul style="list-style-type: none"> • Sets SV rise rate (rising value for 1 minute). <p>When the SV is adjusted, it approaches the new SV by the preset rate-of-change (°C/min, °F/min).</p> <p>When the power is turned on, the control starts from the PV, and approaches the SV by the rate-of-change (°C/min, °F/min).</p> <ul style="list-style-type: none"> • Setting range: 0 to 10000°C/min (°F/min) <p>Thermocouple, RTD inputs with a decimal point: 0.0 to 1000.0°C/min (°F/min)</p> <p>DC voltage, current inputs: 0 to 10000/min</p> <p>Setting to 0 or 0.0 disables this function.</p>	


(*1) The placement of the decimal point follows the selection.

Characters, Factory Default	Setting Item, Function, Setting Range								
[81] rARd 0000	SV fall rate <ul style="list-style-type: none"> Sets SV fall rate (falling value for 1 minute). When the SV is adjusted, it approaches the new SV by the preset rate-of-change (°C/min, °F/min). When the power is turned on, the control starts from the PV and approaches the SV by the rate-of-change (°C/min, °F/min). Setting range: 0 to 10000°C/min (°F/min) Thermocouple, RTD inputs with a decimal point: 0.0 to 1000.0°C/min (°F/min) DC voltage, current inputs: 0 to 10000/min Setting to 0 or 0.0 disables this function. 								
[82] P4b oFF	Indication when control output OFF <ul style="list-style-type: none"> Selects the indication when control output is OFF. Selection item: <table> <tr> <td>oFF</td><td>OFF indication</td></tr> <tr> <td>RoFF</td><td>No indication</td></tr> <tr> <td>Pb</td><td>PV indication</td></tr> <tr> <td>PbAL</td><td>PV indication + Any Alarm active</td></tr> </table>	oFF	OFF indication	RoFF	No indication	Pb	PV indication	PbAL	PV indication + Any Alarm active
oFF	OFF indication								
RoFF	No indication								
Pb	PV indication								
PbAL	PV indication + Any Alarm active								
[83] AR_b 0020	AT bias <ul style="list-style-type: none"> Sets bias value for the AT. AT point is automatically determined by the deviation between PV and SV. Refer to Section '8.5 Setting PID Constants (by performing AT)' (p.70). Setting range: 0 to 50°C (0 to 100°F) or 0.0 to 50.0°C (0.0 to 100.0°F) Available only for PID control. Not available for DC voltage, current inputs 								
[84] AR_b 0010	AT gain <ul style="list-style-type: none"> Sets proportional band ratio calculated by performing AT or 'AT on startup'. Setting range: 0.1 to 10.0 times 								
[85] EoUr oFF	Output status when input errors occur <ul style="list-style-type: none"> Selects the output status when input errors occur. Selection item: <table> <tr> <td>oFF</td><td>Output OFF</td></tr> <tr> <td>oN</td><td>Output ON</td></tr> </table> <p>Available for Direct current input and voltage input, and Direct current output.</p>	oFF	Output OFF	oN	Output ON				
oFF	Output OFF								
oN	Output ON								
[86] nARU oFF	OUT/OFF key function <ul style="list-style-type: none"> Selects OUT/OFF key function. Selection item: <table> <tr> <td>oFF</td><td>Control output OFF function</td></tr> <tr> <td>nARU</td><td>Auto/Manual control</td></tr> <tr> <td>PrOG</td><td>Program control</td></tr> </table>	oFF	Control output OFF function	nARU	Auto/Manual control	PrOG	Program control		
oFF	Control output OFF function								
nARU	Auto/Manual control								
PrOG	Program control								
[87] nARU AUro	Auto/Manual after power interruption <ul style="list-style-type: none"> When the power to the controller is turned ON, selects whether the unit starts using Automatic control or Manual control. Selection item: <table> <tr> <td>AUro</td><td>Automatic control</td></tr> <tr> <td>nARU</td><td>Manual control</td></tr> </table> <p>Available only when Auto/Manual control is selected in [OUT/OFF key function].</p>	AUro	Automatic control	nARU	Manual control				
AUro	Automatic control								
nARU	Manual control								

Characters, Factory Default	Setting Item, Function, Setting Range	
[88] FI AE 0000	Indication time <ul style="list-style-type: none">Sets time from no operation status until Displays are switched off. Displays relight by pressing any key while in OFF mode. When input error (Overscale, Underscale) or burnout has occurred, Displays are lit, and error codes are displayed. If errors are cancelled, Displays are unlit after indication time has passed again.Setting range: 00:00 to 60:00 (Minutes:Seconds) When set to 00:00, Displays remain ON.	
[89] Func cntr	Controller/Converter function <ul style="list-style-type: none">Selects either controller or converter function.Selection item:	
	cntr	Controller
	cnvtr	Converter
	Available only when OUT1 is Direct current output.	

7.4 Engineering Mode 2

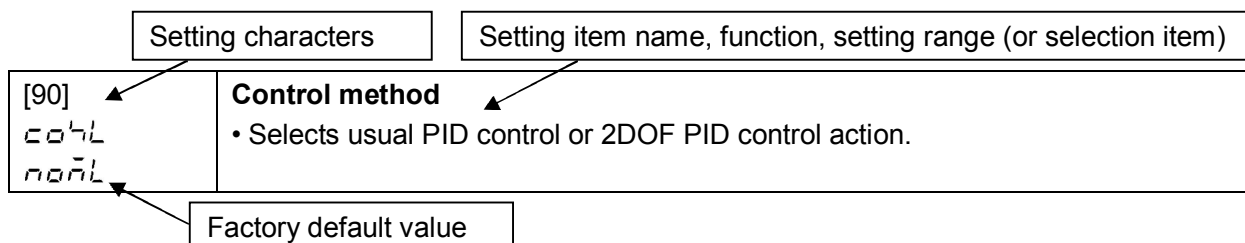
To enter Engineering mode 2, press and hold the ,  and **MODE** keys (in that order) together for approximately 5 seconds in RUN mode.

Use the  or  key for settings (or selections).

To register the set data, use the **MODE** key.

Explanation of setting items:

- Upper left: PV Display: Indicates setting characters.
- Lower left: SV Display: Indicates factory default value.
- Right side: Indicates the setting item, explanation of its function and setting range (or selection item).



Setting item numbers such as [90], [91] are the same as those on Section “14. Key Operation Flowchart” (p.131).

Characters, Factory Default	Setting Item, Function, Setting Range	
[90] c o h L n o n L	Control method • Selects usual PID control or 2DOF PID control action. DOF: Degree(s) of freedom	
	n o n L	PID control
	2 b o F	2DOF PID control
[91] t P R H 0.04	Proportional gain 2DOF coefficient (α) • Sets Proportional gain 2DOF coefficient. • Setting range: 0.00 to 1.00 Available only when 2DOF PID control is selected in [Control method].	
[92] I 1 b F 135	Integral 2DOF coefficient (β) • Sets Integral 2DOF coefficient. • Setting range: 0.00 to 10.00 Available only when 2DOF PID control is selected in [Control method].	

8. Operation and Settings of Standard Functions

8.1 Selecting an input type

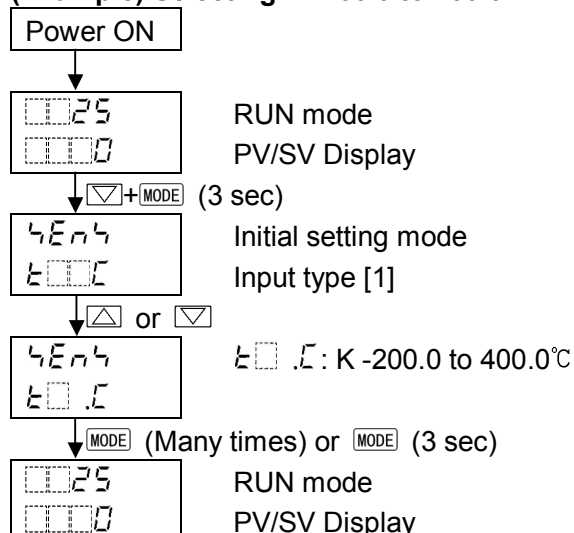
Select an input type in [Input type] in Initial setting mode.

Selection item:

$\text{E} \square \square \square \text{C}$	K	-200 to 1370 °C	$\text{E} \square \square \square \text{F}$	K	-328 to 2498 °F
$\text{E} \square \square \square \text{.C}$	K	-200.0 to 400.0 °C	$\text{E} \square \square \square \text{.F}$	K	-328.0 to 752.0 °F
$\text{J} \square \square \square \text{C}$	J	-200 to 1000 °C	$\text{J} \square \square \square \text{F}$	J	-328 to 1832 °F
$\text{R} \square \square \square \text{C}$	R	0 to 1760 °C	$\text{R} \square \square \square \text{F}$	R	32 to 3200 °F
$\text{S} \square \square \square \text{C}$	S	0 to 1760 °C	$\text{S} \square \square \square \text{F}$	S	32 to 3200 °F
$\text{B} \square \square \square \text{C}$	B	0 to 1820 °C	$\text{B} \square \square \square \text{F}$	B	32 to 3308 °F
$\text{E} \square \square \square \text{C}$	E	-200 to 800 °C	$\text{E} \square \square \square \text{F}$	E	-328 to 1472 °F
$\text{T} \square \square \square \text{.C}$	T	-200.0 to 400.0 °C	$\text{T} \square \square \square \text{.F}$	T	-328.0 to 752.0 °F
$\text{N} \square \square \square \text{C}$	N	-200 to 1300 °C	$\text{N} \square \square \square \text{F}$	N	-328 to 2372 °F
$\text{PL} \square \square \text{C}$	PL-II	0 to 1390 °C	$\text{PL} \square \square \text{F}$	PL-II	32 to 2534 °F
$\text{C} \square \square \square \text{C}$	C(W/Re5-26)	0 to 2315 °C	$\text{C} \square \square \square \text{F}$	C(W/Re5-26)	32 to 4199 °F
$\text{Pt} \square \square \text{.C}$	Pt100	-200.0 to 850.0 °C	$\text{Pt} \square \square \text{.F}$	Pt100	-328.0 to 1562.0 °F
$\text{JPt} \square \square \text{.C}$	JPt100	-200.0 to 500.0 °C	$\text{JPt} \square \square \text{.F}$	JPt100	-328.0 to 932.0 °F
$\text{Pt} \square \square \text{C}$	Pt100	-200 to 850 °C	$\text{Pt} \square \square \text{F}$	Pt100	-328 to 1562 °F
$\text{JPt} \square \square \text{C}$	JPt100	-200 to 500 °C	$\text{JPt} \square \square \text{F}$	JPt100	-328 to 932 °F
$\text{4} \square \square \text{mA}$	4 to 20 mA DC	-2000 to 10000			
$\text{0} \square \square \text{mA}$	0 to 20 mA DC	-2000 to 10000			
$\text{0} \square \square \text{V}$	0 to 1 V DC	-2000 to 10000			
$\text{0} \square \square \text{V}$	0 to 5 V DC	-2000 to 10000			
$\text{1} \square \square \text{V}$	1 to 5 V DC	-2000 to 10000			
$\text{0} \square \square \text{V}$	0 to 10 V DC	-2000 to 10000			

Factory default value is K -200 to 1370°C.

(Example) Selecting K -200.0 to 400.0°C



Now, selection is complete.

8.2 Selecting PID Control or ON/OFF Control

Selects PID or ON/OFF control action.

Select PID or ON/OFF control action in [OUT1 proportional band] in Sub setting mode.

If 'OUT1 proportional band' is set to 0 (zero), the unit performs ON/OFF control action.

Factory default value is PID control.

PID control

Proportional (P) action suppresses overshoot and hunting, Integral (I) action corrects offset, and Derivative (D) action converges rapid temperature change due to disturbance in shorter time.

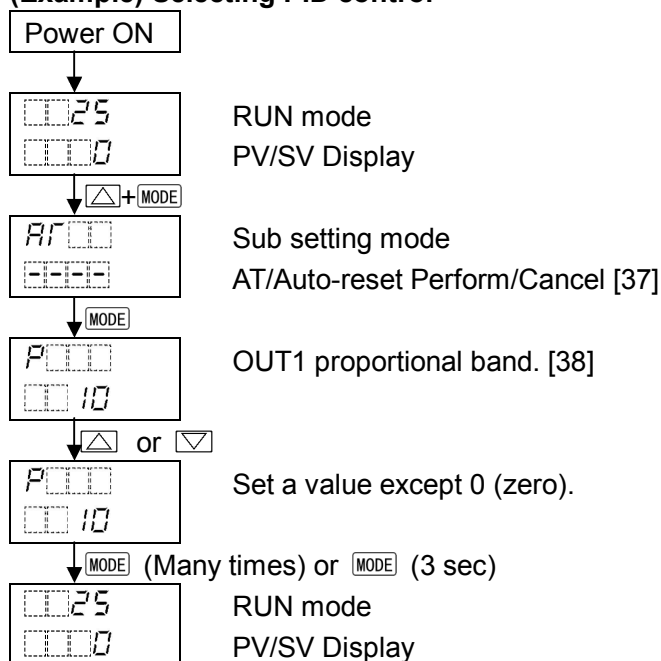
Optimum values of P, I, D, ARW for PID control can be automatically set by performing AT.

ON/OFF control

When PV is lower than the SV, the control output is turned ON, and if PV exceeds the SV, the control output is turned OFF.

Overshoot, undershoot and hunting are generated in ON/OFF control action.

(Example) Selecting PID control



Now, selection is complete.

Reference

- P control action: When [Integral time] and [Derivative time] are set to 0 (zero).
- PD control action: When [Integral time] is set to 0 (zero).
- PI control action: When [Derivative time] is set to 0 (zero).

8.3 Selecting Direct/Reverse Action

Selects Direct or Reverse control action.

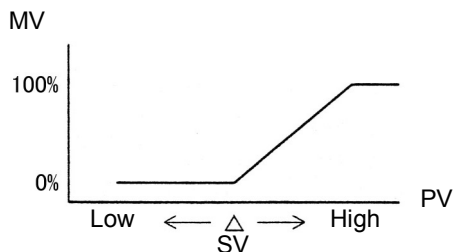
Select Direct or Reverse control action in [Direct/Reverse action] in Sub setting mode.

Factory default value is Reverse action.

Direct action

In Direct action, MV is increased when PV is higher than SV (positive deviation).

Refrigerators, etc. perform Direct action.

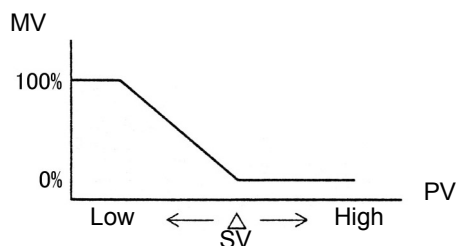


(Fig. 8.3-1)

Reverse action

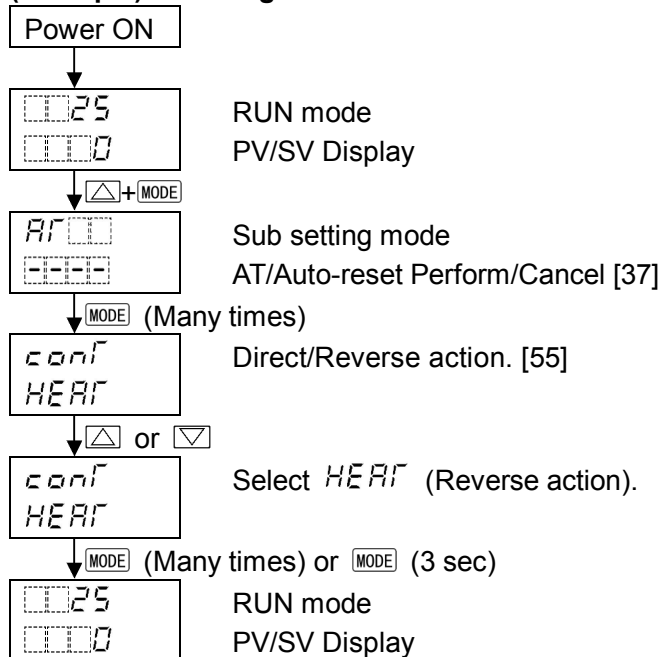
In Reverse action, MV is increased when SV is higher than PV (negative deviation).

Electric furnaces, etc. perform Reverse action.



(Fig. 8.3-2)

(Example) Selecting Reverse action



Now, selection is complete.

8.4 Performing Fixed Value Control

Fixed value control is a typical temperature control action, which reduces deviation from a single SV by comparing with PV.

To perform Fixed value control, set the SV.

There are 2 ways to set the SV.

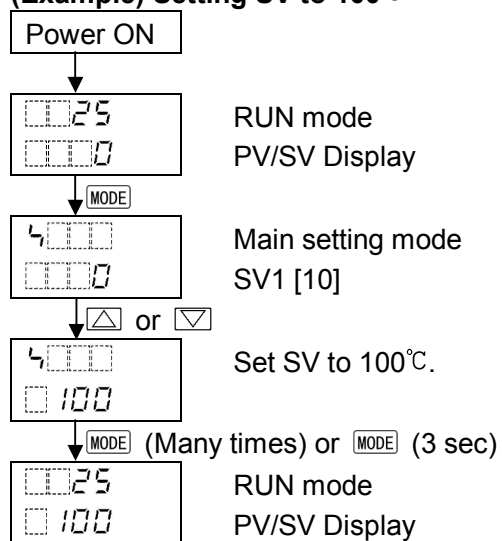
- Set the SV in [SV1] in Initial setting mode.
- Set the SV in [SV1] in Main setting mode.

Setting item [SV1] in Initial setting mode corresponds to [SV1] in Main setting mode.

Therefore, if one SV1 is changed, the other SV1 will also be changed.

Factory default value is 0 (zero).

(Example) Setting SV to 100°C



Now, settings are complete.

8.5 Setting PID Constants (by Performing AT)

Notice

- Perform the AT during the trial run.
- During the AT, none of the setting items can be set.
- If power failure occurs during the AT, the AT stops.
- If AT is cancelled during the process, P, I, D and ARW values revert to the values before AT was performed.
- AT will be forced to stop if it has not been completed within 4 hours.
- Sometimes the AT process will not fluctuate if AT is performed at or near room temperature. Therefore AT might not finish normally.

To set PID constants, perform AT.

There are 2 types of AT.

(1) Usual AT

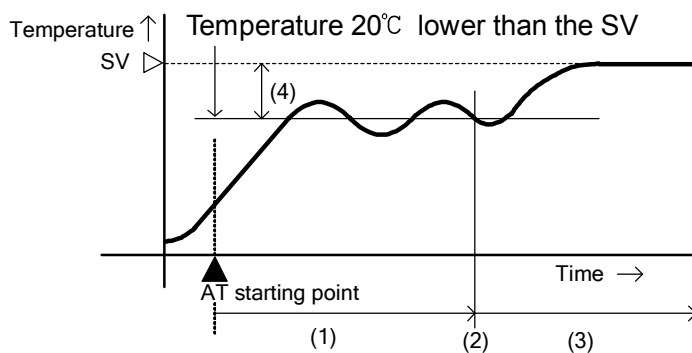
In order to set each value of P, I, D and ARW automatically, the AT process should be made to fluctuate to obtain an optimal value.

For DC voltage, current inputs, the AT process will fluctuate around the SV for conditions of [A], [B] and [C] below.

One of 3 types of fluctuation below is automatically selected depending on the deviation between SV and PV.

[A] If there is a large difference between the SV and PV as the temperature is rising

When AT bias is set to 20°C, the AT process will fluctuate at the temperature 20°C lower than the SV.

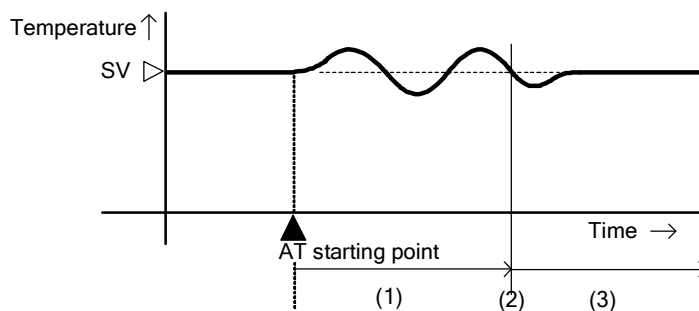


(Fig. 8.5-1)

- (1) Calculating PID constants
- (2) PID constants calculated
- (3) Controlled by the PID constants set by AT.
- (4) AT bias value (Factory default: 20°C)

[B] When the control is stable

The AT process will fluctuate around the SV.

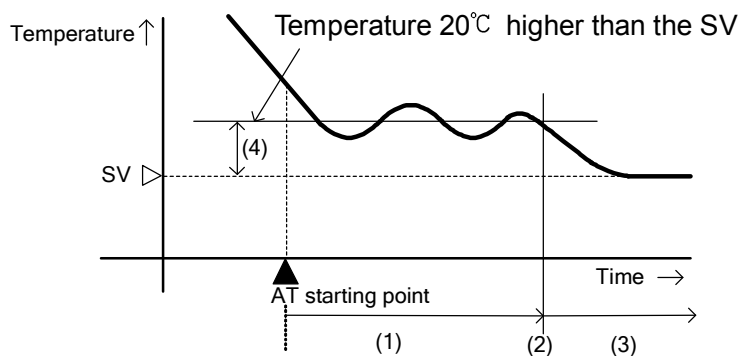


(Fig. 8.5-2)

- (1) Calculating PID constants
- (2) PID constants calculated
- (3) Controlled by the PID constants set by AT.

[C] If there is a large difference between the SV and PV as the temperature is falling

When AT bias is set to 20°C, the AT process will fluctuate at the temperature 20°C higher than the SV.



- (1) Calculating PID constants
- (2) PID constants calculated
- (3) Controlled by the PID constants set by AT.
- (4) AT bias value (Factory default: 20°C)

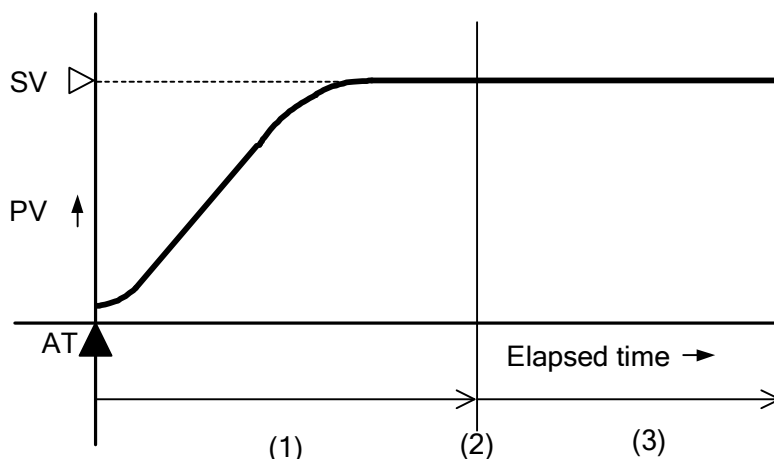
(Fig. 8.5-3)

(2) AT on Startup

When usual AT cannot be performed normally due to temperature interference, P, I, D and ARW values can be calculated only when temperature is rising.

As the selected [AT on startup Perform] is internally memorized, 'AT on startup' is performed whenever the power is turned ON.

To stop 'AT on startup', select 'AT/AT on startup/Auto-reset Cancel' in [AT/Auto-reset Perform/Cancel].



- (1) Calculating AT (from startup, until PV is stabilized at SV)
- (2) PID constants calculated
- (3) Controls with PID constants set by 'AT on startup'

(Fig. 8.5-4)

[Conditions of Performing 'AT on startup']

- When starting 'AT on startup', if deviation between PV and SV exceeds the proportional band by 2 times or more, 'AT on startup' will perform.

When power is turned ON (*), or when the unit reverts to RUN mode after canceling control output OFF, 'AT on startup' performs.

Even after 'AT on startup' is successfully finished, 'AT on startup' has been still selected in [AT/Auto-reset Perform/Cancel].

When power is turned ON again, or when the unit reverts to RUN mode by cancelling Control output OFF, 'AT on startup' performs again under the above performance conditions.

To stop 'AT on startup', select 'AT/AT on startup/Auto-reset Cancel' in [AT/Auto-reset Perform/Cancel].

(*) For Fixed value control, 'AT on startup' can be performed when power is turned ON. It cannot be performed for Program control.

However, if PV slope and delay time cannot be measured normally for P, I, D calculation, the error code below will be indicated in the PV display, and automatically 'AT on startup' will stop.
If an error has occurred, P, I, D and ARW values revert to the previous value at which 'AT on startup' is performed.

Error Code	Error Contents
Er-20	PV slope and delay time cannot be measured normally for P, I, D calculation.

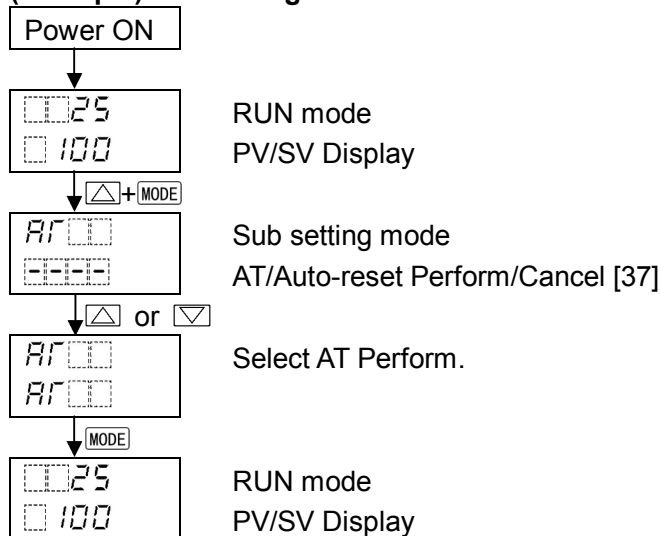
To cancel the error code, press the **MODE** key.

If 'AT on startup' is performed or stopped, the error code will be cancelled.

[Conditions of Cancelling 'AT on startup']

- When Control output OFF is enabled
- When input is burnt out
- When deviation between SV and PV is within 2°C or within 2% of proportional band (even though the set integral time has exceeded when the control is stable)

(Example) Performing Usual AT



Now, selection is complete.

The AT indicator flashes while AT is performing.

After AT is complete, the AT indicator goes off, and control is performed using PID constants calculated by the AT.

If AT does not finish after 4 hours, the error code below will be indicated in the PV Display, and AT will automatically stop.

Error Code	Error Contents
Er-20	If AT or 'AT on startup' does not finish after 4 hours.

To cancel the error code, press the **MODE** key.

The error code will be cancelled in the following cases.

- When Control output OFF function is enabled
- When Program control is stopped and the unit reverts to the Standby (Program control waiting) mode.
- When 'Control output OFF function' or 'Auto/Manual control' is selected in [OUT/OFF key function].
- When 'AT/AT on startup/Auto-reset Cancel' is selected in [AT/Auto-reset Perform/Cancel].

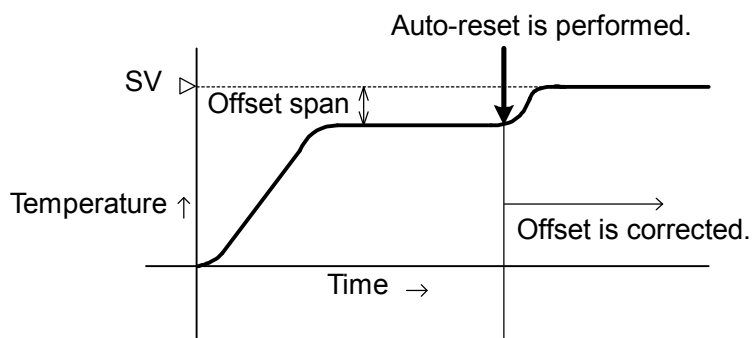
8.6 Performing Auto-reset



Notice

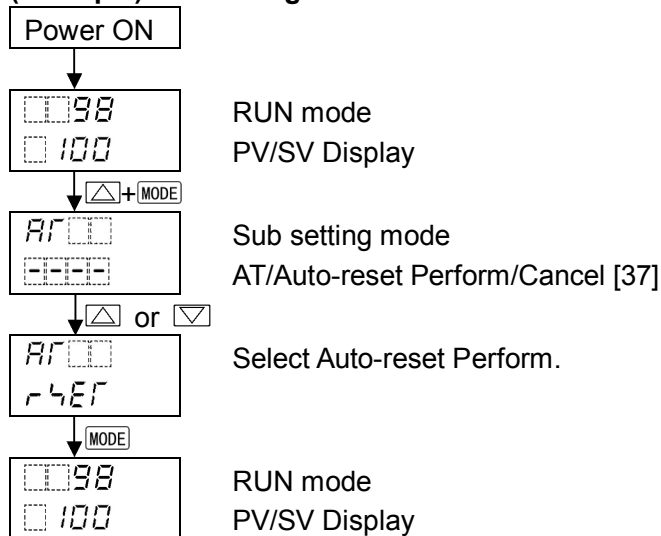
- Auto-reset is cancelled in approximately 4 minutes. It cannot be cancelled while performing this function.
- If input is burnt out, Auto-reset will be forced to stop.

Auto-reset is performed to correct the offset at the point at which PV indication is stabilized within the proportional band during the PD control. Since the corrected value is internally memorized, it is not necessary to perform the Auto-reset again as long as the process is the same. However, when OUT1 proportional band (P) is set to 0 or 0.0, the corrected value is cleared to 0 (zero).



(Fig. 8.6-1)

(Example) Performing Auto-reset



Now, selection is complete.

The AT indicator flashes while Auto-reset is performing.

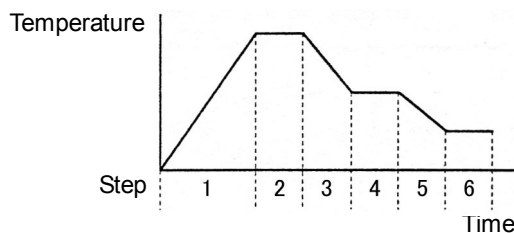
Auto-reset is completed in approximately 4 minutes.

After Auto-reset is complete, the AT indicator goes off, and control is performed using the offset corrected value.

8.7 Performing Program Control

In Program control, SV changes as time elapses, and PV is controlled in order to reach each SV. SV and time can be set for every step, and a maximum of 9 steps can be repeatedly controlled. SV can be set as (Fig. 8.7-1).

(e.g.) Program control of electric furnaces in ceramic manufacture, food machinery, etc.



(Fig. 8.7-1)

Major functions of Program control are shown below.

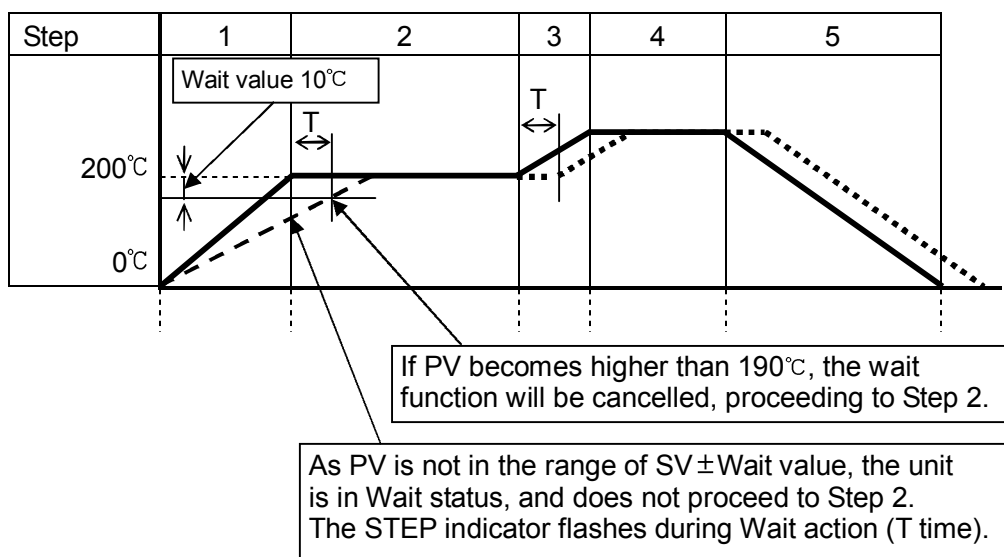
Number of patterns and steps: 1 pattern; 9 steps

[Wait function]

While Program control is running, the program does not proceed to the next step until the deviation between PV and SV enters $SV \pm \text{Wait value}$ at the end of step. The PV Display flashes while the Wait function is working.

The Wait function is cancelled on the condition that:

- When program pattern is rising: PV is higher than $SV - \text{Wait value}$
- When program pattern is falling: PV is lower than $SV + \text{Wait value}$



----- : PV

————— : Program pattern

..... : Program pattern delayed by T due to the Wait function

(Fig. 8.7-2)

Program control Holding/Not holding

During Program control, progress of current step is suspended, and then Fixed value control is performed using the SV from the point of suspension.

Program control Holding/Not holding can be selected by communication command bit operation in Serial communication.

Serial communication can be specified only for the KT4R model.


Advance function

Interrupts current step while Program control is running, and proceeds to the beginning of the next step.

By pressing the  key for approx. 1 second during Program control, Advance function initiates.

Pattern end output

If Pattern end output is selected in [Event output EV1/EV2 allocation], pattern end output is turned ON after Program control is finished, and the SV Display flashes *P.E n d*.

By pressing the  key for approx. 1 second, pattern end output is turned OFF, and the unit enters Standby mode.

Step time unit


Step time unit can be selected: Hours:Minutes, Minutes:Seconds

Factory default value is Hours:Minutes.

Power Restore Action (Program control after power is restored)

If power fails during Program control, selects a status after the power is restored.

Factory default value is 'Stops after power is restored'.

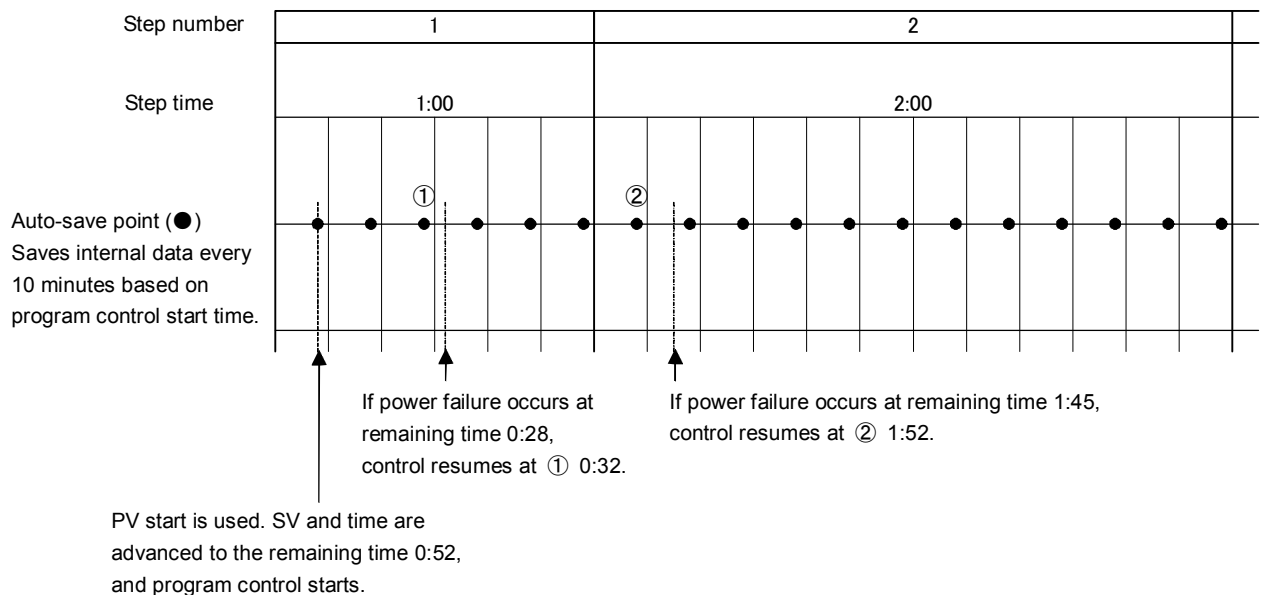
Power Restore Action	Description
Stops after power is restored.	Stops Program control, and returns to Standby (Program control waiting) mode.
Continues after power is restored. (*)	Continues (resumes) Program control.
Suspends after power is restored. (*)	Suspends (on hold) current program, and performs Fixed value control using the SV from the point of suspension. Pressing the  key cancels suspension, and Program control resumes.

(*) Progressing time error when power is restored: 10 minutes

This controller saves internal status every 10 minutes after Program control starts.

Internal status is also saved when step is changed.

When power is restored, the unit starts from the last auto-save point.



(Fig. 8.7-3)

Program start temperature

When Program control starts, it starts from the value set in [Program start temperature].

Factory default value is 0°C.

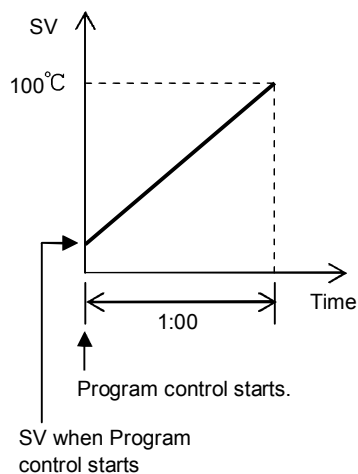
Program control start type

One type can be selected: PV start, PVR start, SV start.

Factory default value is PV start.

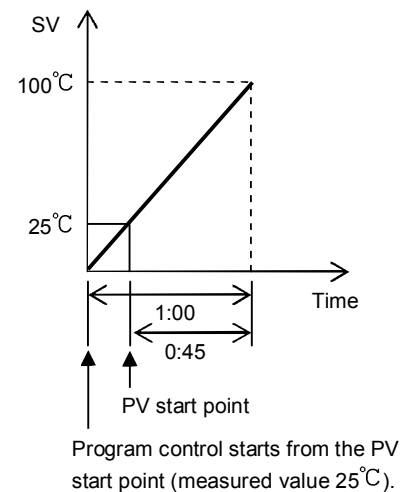
Program control start type	Description
PV start	When Program control starts, the SV and step time are advanced to the PV, then Program control starts. However, if [Program start temperature] at the time of Program control start is higher than the PV when PV start is initiated, then Program control will start from the SV set in [Program start temperature].
PVR start	In pattern repeating, the SV and step time are advanced to the PV, then the Program control starts.
SV start	Program control starts from the SV which has been set in [Program start temperature].

[SV start]



(Fig. 8.7-4)

[PV/PVR start]



(Fig. 8.7-5)

Repeat function

When Program control is finished, control can be repeated from Step 1.

The user determines the number of repetitions.

Factory default value is 0 (zero).

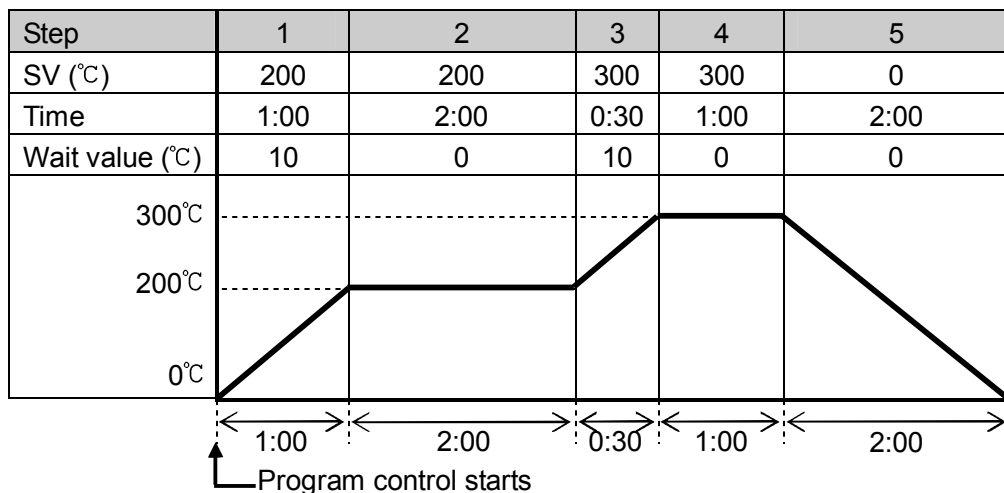
Select 'Program control' in [OUT/OFF key function] in Engineering mode 1.
Factory default value is Control output OFF function.

Set the following items in Engineering mode 1 if necessary:

Step time unit, Power restore action, Program start temperature,
Program control start type, Number of repetitions

Program pattern can be set in Main setting mode.

Example of program pattern setting



(Fig. 8.7-6)

In the above program pattern, control is performed at each step as follows.

Step 1: The SV gradually rises to 200°C for 1 hour.

When step ends, Wait function works so that control cannot proceed to the next step until PV reaches 190°C when step ends.

Step 2: Fixed value control is performed to keep SV at 200°C for 2 hours.

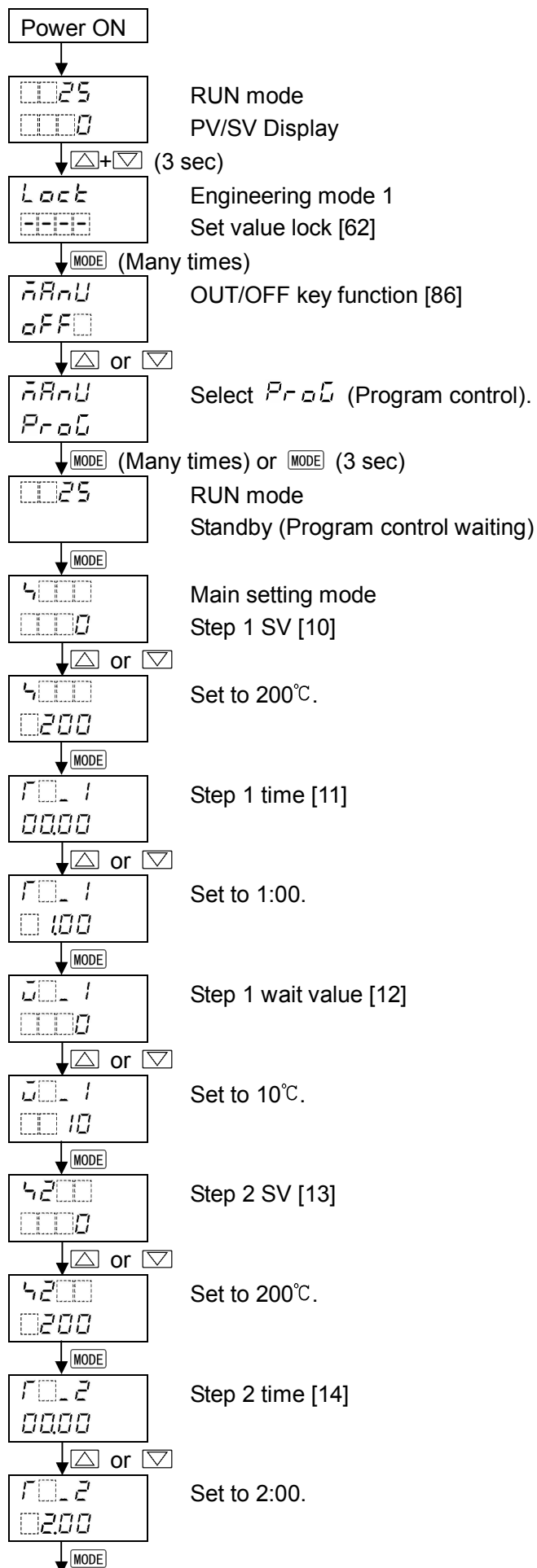
Step 3: Control is performed so that the SV gradually rises to 300°C for 30 minutes.

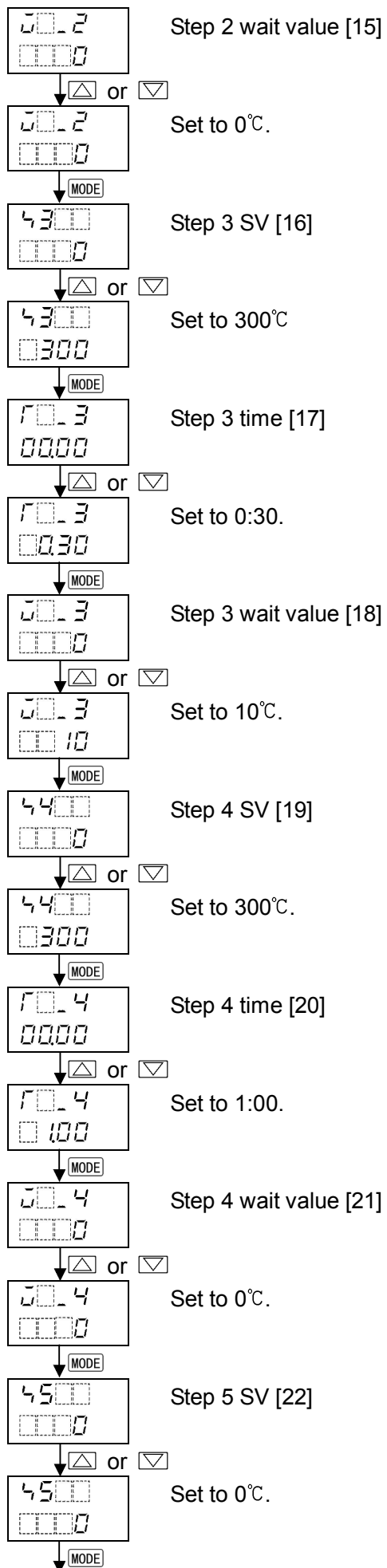
When step is finished, Wait function works so that control cannot proceed to the next step until PV reaches 290°C.

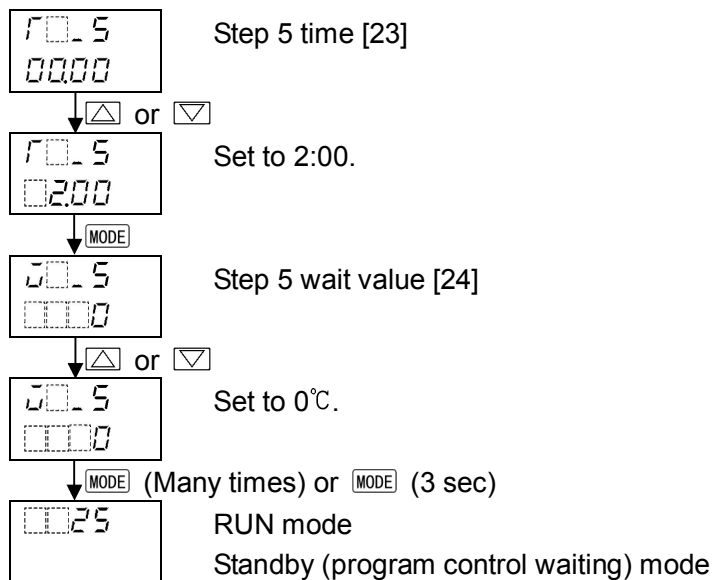
Step 4: Fixed value control is performed to keep SV at 300°C for 1 hour.

Step 5: Control is performed so that the SV gradually falls to 0°C for 2 hours.

(Example) Selecting Program control and Setting program pattern of (Fig. 8.7-6)







Now, selection is complete.

Program control RUN

To perform Program control, press and hold the  key for approx. 1 second in Standby (program control waiting) mode.


Program control starts using the start type selected in [Program control start type].

While Wait function is working, the PV Display flashes.

Program control STOP

To stop Program control, press and hold the  key for approx. 1 second during Program control. Program control will stop, and the unit will revert to Standby (Program control waiting) mode.

Proceeding to the next step during Program control (Advance function)

By pressing the  key for approx. 1 second during Program control, the performing step is interrupted, proceeding to the next step. (Advance function)

While Wait function is working, the Wait function is cancelled, and proceeds to the next step.

8.8 Event Output EV1 Allocation

Selects Event output EV1 allocation.

There are 2 methods in selection of Event output EV1 allocation.

- Select in [Event output EV1 allocation] in Initial setting mode.
- Select in [Event output EV1 allocation] in Engineering mode 1.

Setting item [Event output EV1 allocation] in Initial setting mode corresponds to [Event output EV1 allocation] in Engineering mode 1.

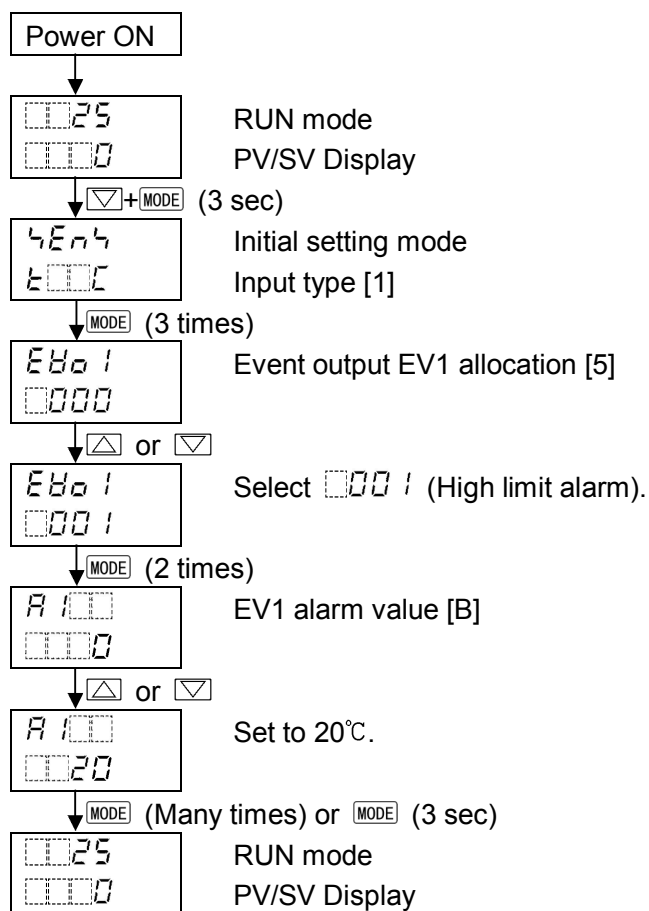
Therefore, if one [Event output EV1 allocation] is changed, the other [Event output EV1 allocation] will also be changed.

Factory default value is No event.

Selection item:

<input type="checkbox"/> 000	No event	
<input type="checkbox"/> 001	Alarm output, High limit alarm	
<input type="checkbox"/> 002	Alarm output, Low limit alarm	
<input type="checkbox"/> 003	Alarm output, High/Low limits alarm	
<input type="checkbox"/> 004	Alarm output, High/Low limits independent alarm	
<input type="checkbox"/> 005	Alarm output, High/Low limit range alarm	
<input type="checkbox"/> 006	Alarm output, High/Low limit range independent alarm	
<input type="checkbox"/> 007	Alarm output, Process high alarm	
<input type="checkbox"/> 008	Alarm output, Process low alarm	
<input type="checkbox"/> 009	Alarm output, High limit with standby alarm	
<input type="checkbox"/> 010	Alarm output, Low limit with standby alarm	
<input type="checkbox"/> 011	Alarm output, High/Low limits with standby alarm	
<input type="checkbox"/> 012	Alarm output, High/Low limits with standby independent alarm	
<input type="checkbox"/> 014	Loop break alarm output	
<input type="checkbox"/> 015	Time signal output	Turns OFF or ON during Program control, by setting OFF time and ON time within the step set in [Step number].
<input type="checkbox"/> 016	Output during AT	Turns ON during AT.
<input type="checkbox"/> 017	Pattern end output	Turns ON when Program control ends, and remains ON until turned OFF by pressing the MODE key.
<input type="checkbox"/> 018	Output by communication command	Turns OFF or ON by communication command 00E4H during Serial communication. B0 EV1 output 0: OFF 1: ON B1 EV2 output 0: OFF 1: ON

(Example) Selecting High limit alarm, and setting EV1 alarm value to 20°C



Now, settings are complete.

8.9 Indicating MV, Remaining Time (Program Control)

In Fixed value control and Program control, MV and remaining time are indicated.

To indicate MV, press and hold the **MODE** key for approx. 3 seconds in PV/SV Display.

The unit enters Monitor mode, and indicates MV.

While MV is indicating, the decimal point flashes.

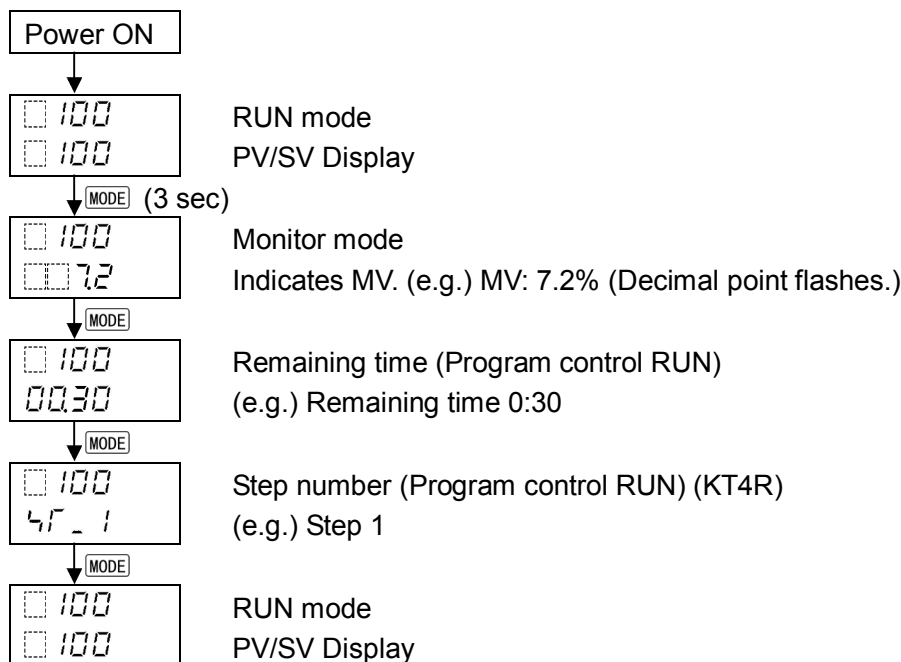
While in Standby (Program control waiting) mode of Program control, the unit cannot move to Monitor mode.

In Monitor mode, the following contents are switched every time the **MODE** key is pressed depending on the model number.

Model Number	Indicated Contents	
KT4R	Fixed value control	Indicates only MV.
	Program control	Indicates MV, Remaining time, Step number (in that order).
KT8R, KT9R	Fixed value control	Indicates only MV. (*)
	Program control	Indicates MV, Remaining time (in that order). (*)

(*) For the KT8R, KT9R, step number (Program control) is indicated in the STEP Display.

Indicating MV, Remaining time



8.10 Items to be Initialized by Changing Settings

If settings are changed, the following items will be initialized.

Yes: Initialized

No: Not initialized

Item to be Initialized \ Setting item to be changed	Input Type	Event output EV1 allocation	Event output EV2 allocation	Transmission output
SV1 to SV9	Yes	No	No	No
Steps 1 to 9 wait value	Yes	No	No	No
AT bias	Yes	No	No	No
OUT1 proportional band	Yes	No	No	No
Manual reset	Yes	No	No	No
SV rise rate	Yes	No	No	No
SV fall rate	Yes	No	No	No
Scaling high limit	Yes	No	No	No
Scaling low limit	Yes	No	No	No
Program start temperature	Yes	No	No	No
EV1 alarm value	Yes	Yes	No	No
EV1 high limit alarm value	Yes	Yes	No	No
Loop bread alarm time	Yes	No	No	No
Loop bread alarm span	Yes	No	No	No
EV2 alarm value	Yes	No	Yes	No
EV2 high limit alarm value	Yes	No	Yes	No
OUT2 proportional band	Yes	No	No	No
EV1 alarm value 0 Enabled/Disabled	No	Yes	No	No
EV1 alarm hysteresis	No	Yes	No	No
EV1 alarm delay time	No	Yes	No	No
EV1 alarm Energized/De-energized	No	Yes	No	No
EV2 alarm value 0 Enabled/Disabled	No	No	Yes	No
EV2 alarm hysteresis	No	No	Yes	No
EV2 alarm delay time	No	No	Yes	No
EV2 alarm Energized/De-energized	No	No	Yes	No
Sensor correction coefficient	Yes	No	No	No
Sensor correction value	Yes	No	No	No

9. Attached Function

9.1 Input Value Correction

Input value can be corrected in [Sensor correction coefficient] and [Sensor correction] in Engineering mode.

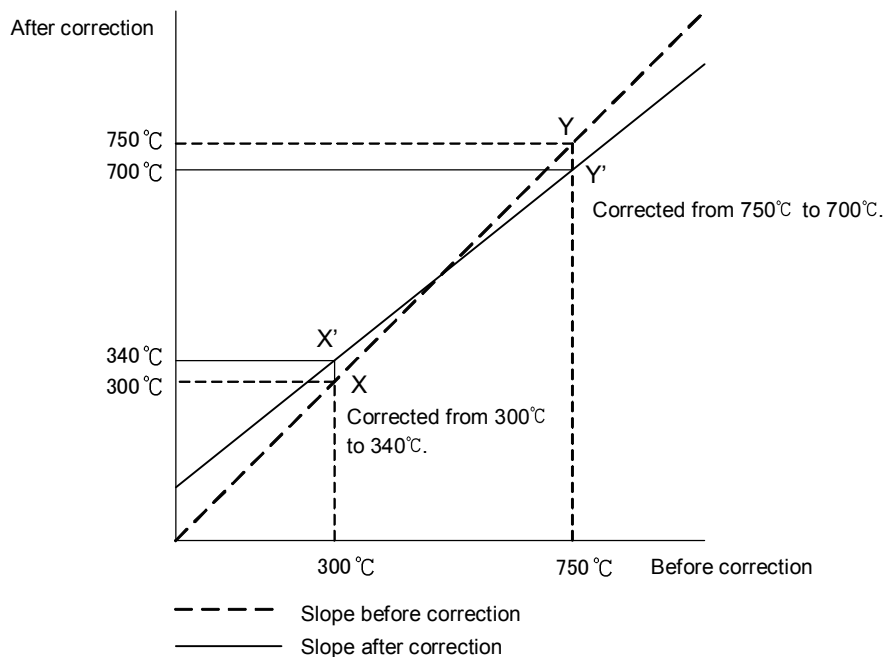
In [Sensor correction coefficient], set the slope of temperature change.

In [Sensor correction], set the difference between temperatures before correction and after correction.

PV after input correction is expressed with the following formula.

PV after input correction = Current PV x Sensor correction coefficient + (Sensor correction value)

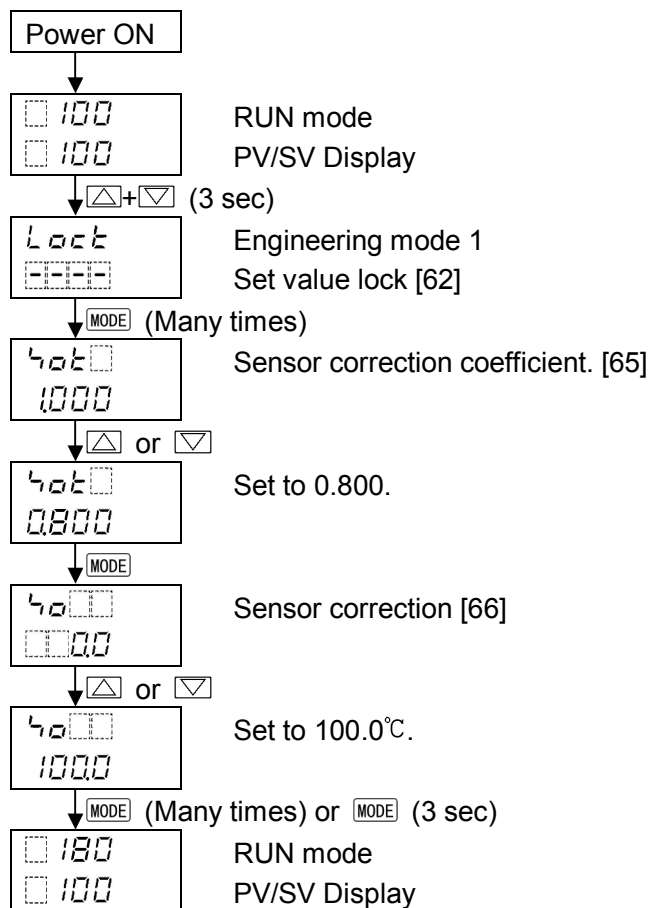
The following shows an example of input value correction using 'Sensor correction coefficient' and 'Sensor correction value'.



(Fig.9.1-1)

- (1) Select any 2 points of PV to be corrected, and determine the PV after correction.
PV before correction: 300°C → PV after correction: 340°C
PV before correction: 750°C → PV after correction: 700°C
- (2) Calculate Sensor correction coefficient from Step (1).
 $(Y' - X') / (Y - X) = (700 - 340) / (750 - 300) = 0.8$
- (3) Enter a PV value of 300°C using an mV generator or dial resistor.
- (4) Set Step (2) value as a Sensor correction coefficient.
- (5) Read the PV.
240°C will be indicated.
- (6) Calculate the sensor correction value.
Calculate the difference between 'PV after correction' and Step (5) PV.
 $340°C - 240°C = 100°C$
- (7) Set Step (6) value as a Sensor correction value.
- (8) Enter an electromotive force or resistance value equivalent to 750°C using an mV generator or dial resistor.
- (9) Read the PV, and confirm that 700°C is indicated.

(Example) Setting Sensor correction coefficient to 0.800, and Sensor correction to 100.0°C



Now, settings are complete.

9.2 Set Value Lock

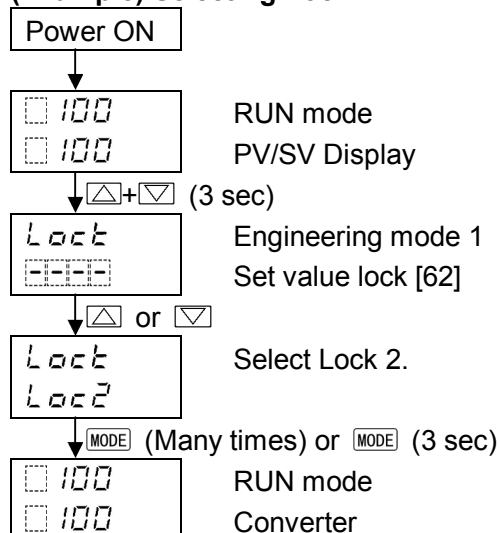
Locks the set values to prevent setting errors.

Make a selection in [Set value lock] in Engineering mode 1.

The setting item to be locked depends on the selection.

Selection Item	Change via Keypad	Change via Software Communication
Unlock	All set values can be changed.	All set values can be changed.
Lock 1	None of the set values can be changed.	
Lock 2	In Fixed value control, only SV and Alarm value can be changed. In Program control, Step SV, Step time and Alarm value can be changed.	
Lock 3	All set values can be changed.	Setting items – except Input type, Controller/Converter – can be changed temporarily via software communication. However, if power is turned ON again, the setting values revert to the values before Lock 3, 4 or 5 was selected.
Lock 4	None of the set values can be changed.	
Lock 5	In Fixed value control, only SV and Alarm value can be changed. In Program control, Step SV, Step time and Alarm value can be changed.	

(Example) Selecting Lock 2



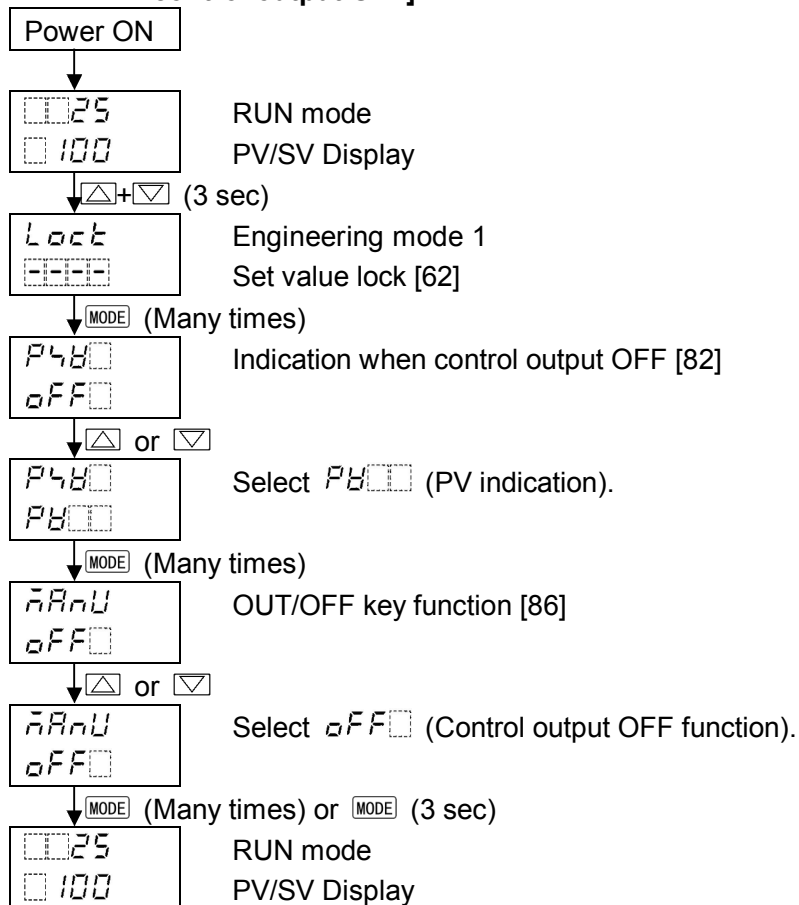
Now, selection is complete.

9.3 Control Output OFF Function


The control action and output of an instrument (or instruments) can be turned OFF without turning OFF their power supplies using this function.

Select 'Control output OFF function' in [OUT/OFF key function] in Engineering mode 1.
Factory default value is Control output OFF function.

(Example) Selecting 'Control output OFF function', and 'PV indication' in [Indication when control output OFF]

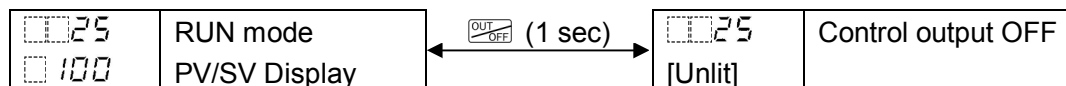


Now, selection is complete.

To turn the control output OFF, press the  key for approximately 1 second in PV/SV Display. PV is indicated in the PV Display. Indication differs depending on the selection in [Indication when control output OFF].

Once the control output OFF function is enabled, the function cannot be cancelled even if the power to the instrument is turned OFF and ON again.

To cancel the function, press the  key again for approx. 1 second.



9.4 Switching Auto/Manual Control (Auto/Manual Control Function)

Control action can be switched from automatic to manual and vice versa.

When power to the controller is turned ON, Automatic or Manual control is selectable.

Select 'Auto/Manual control' in [OUT/OFF key function] in Engineering mode 1.

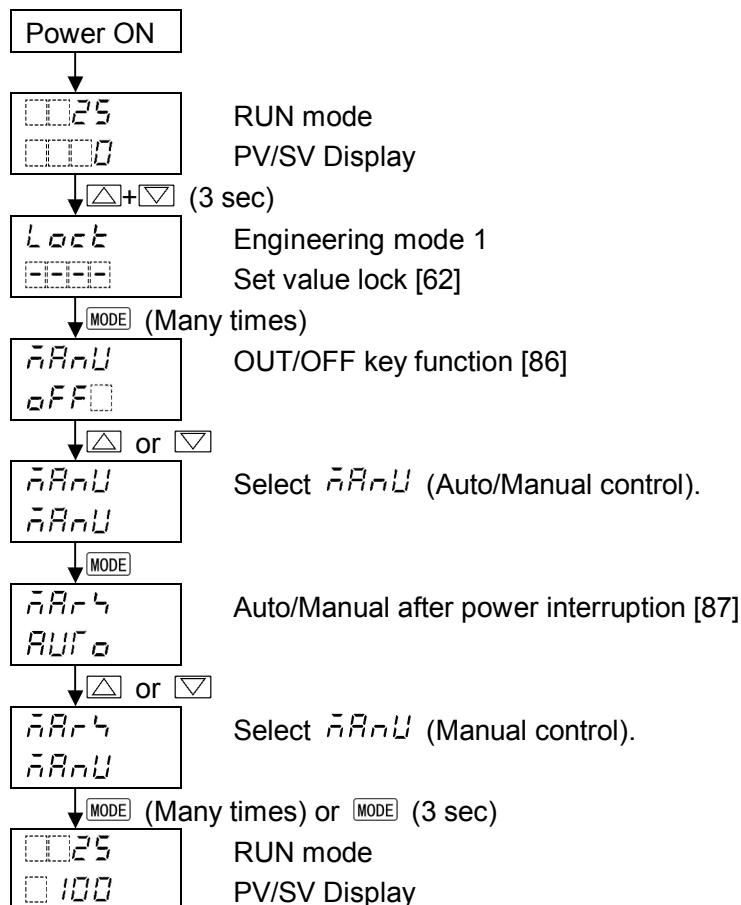
Factory default value is Control output OFF function.

Select 'Automatic control' or 'Manual control' in [Auto/Manual after power interruption]


in Engineering mode 1.

Factory default value is Automatic control.

(Example) Selecting 'Auto/Manual control' and 'Manual control' after power interruption





Now, selection is complete.

By pressing the  key in PV/SV Display for approx. 1 second, Auto/Manual control function can be switched.

If control action is switched from automatic to manual and vice versa, balanceless-bumpless function works to prevent a sudden change in the MV.

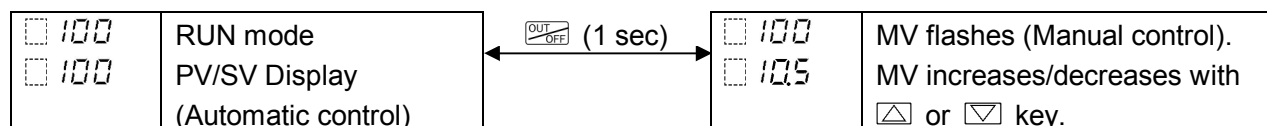
When automatic control is switched to manual control, MV flashes in the SV display.

The MV in the SV Display can be increased or decreased by pressing the  or  key.

Data is saved 1 second after MV is changed, and manual control is performed.

When power is turned ON after interruption, control resumes using the previously saved MV (if manual control is selected in [Auto/Manual after power interruption]).

By pressing the key again for approx. 1 second, the unit reverts to automatic control.



9.5 Using as a Converter

This instrument can be used as a simplified converter.

Converts each input value (thermocouple, RTD, DC voltage and current inputs) to '4 to 20 mA DC', and outputs it.

When OUT1 is Direct current output, the controller can be used as a converter.

Select 'Converter' in [Controller/Converter] in Engineering mode 1.

Factory default value is Controller.

When this instrument is switched from controller to converter, values in the table below (Table 9.5-1) are automatically set. The SV Display indicates nothing.

When this instrument is switched from converter to controller, the PV Display indicates $\frac{1}{s}$ for 1 second, and factory default values are set.

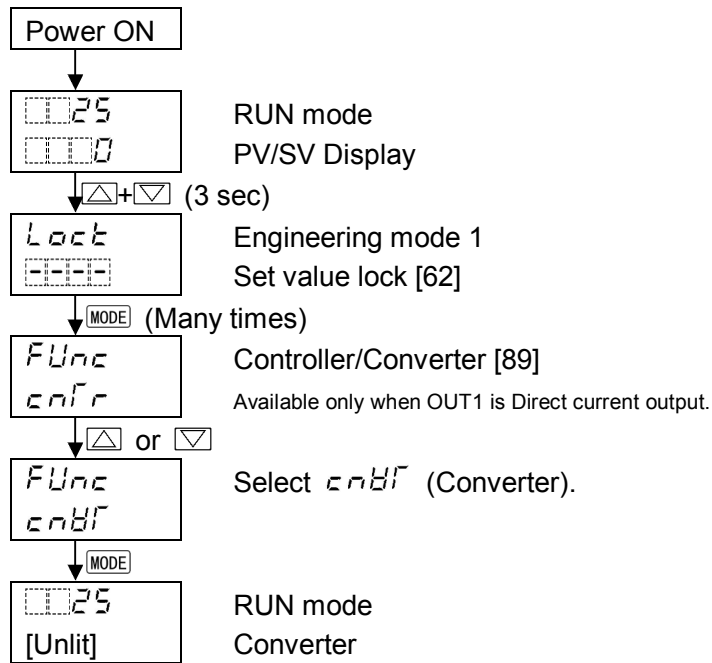
(Table 9.5-1)

Setting Item	Set Value (or Selection)
SV1 (*1)	Scaling low limit value
AT/Auto-reset Perform/Cancel (*2)	AT/At on startup/Auto-reset Cancel
OUT1 proportional band (*1)	Scaling span Direct current, voltage inputs: 100.0%
Integral time	0
Derivative time	0
Reset	0 (Reset value, calculated by Auto-reset function)
OUT1 high limit	100
OUT1 low limit	0
OUT1 rate-of-change	0
OUT2 proportional band (*1)	Scaling span Direct current, voltage inputs: 100.0%
Direct/Reverse action	Direct action
EV1/EV2 alarm value 0 Enabled/Disabled	Disabled
EV1/EV2 alarm value	0 or Input range low limit value (Scaling low limit value)
EV1/EV2 high limit alarm value	0 or Input range low limit value (Scaling low limit value)
EV1/EV2 alarm hysteresis	1.0
EV1/EV2 alarm delay time	0
EV1/EV2 alarm Energized/De-energized	Energized
Loop break alarm time	0
Loop break alarm span	0
Event output EV1 allocation	No event
Event output EV2 allocation	No event
SV rise rate	0
SV fall rate	0
OUT/OFF key function	Control output OFF function

(*1) When input range is changed while this instrument is used as a converter, SV1 to SV4, OUT1 and OUT2 proportional bands will be automatically set to values corresponding to the input range.

(*2) If "AT on startup" is successfully completed and "AT on startup Perform" has been still selected, "AT on startup" will be stopped (AT/AT on startup/Auto-reset Cancel).

(Example) Selecting Converter



Now, selection is complete.

9.6 Clearing Data

If data is cleared, data will revert to factory default values.

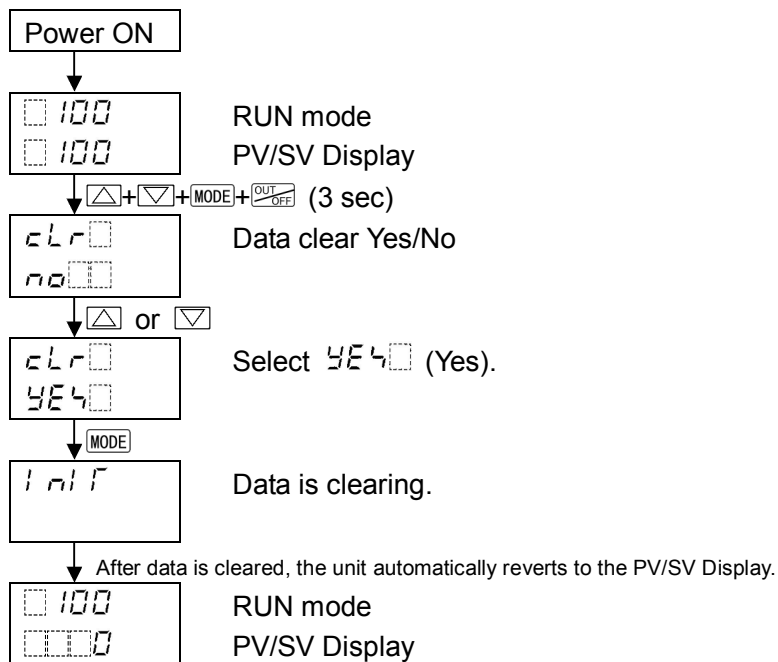
To clear data, press and hold , , **MODE**,  (in that order) together for approx. 3 seconds in the PV/SV Display.

The unit enters [Data clear Yes/No] mode.

Select 'Yes', and press the **MODE** key. Data will be cleared.

While data is clearing, *l n l f* is indicated in the PV Display.

Executing data clear



10. Action Explanation

10.1 OUT1 Action

	Reverse (Heating) action	Direct (Cooling) action
Control action		
Relay contact output		
Non-contact voltage output		
Direct current output		
Indicator (O1) Green		

: Turns ON (lit) or OFF (unlit).

OUT1 terminal numbers of the KT8R, KT9R: 15, 16

10.2 OUT1 ON/OFF Control Action

	Reverse (Heating) action	Direct (Cooling) action
Control action		
Relay contact output		
Non-contact voltage output		
Direct current output		
Indicator (O1) Green		

: Turns ON (lit) or OFF (unlit).

OUT1 terminal numbers of the KT8R, KT9R: 15, 16

10.3 Alarm Action

	High limit alarm	Low limit alarm
Alarm action		
Alarm output	+side - side	+side - side
	High/ Low limits alarm	High/ Low limits independent alarm
Alarm action		
Alarm output		
	High/ Low limit range alarm	High/ Low limit range independent alarm
Alarm action		
Alarm output		
	Process high alarm	Process low alarm
Alarm action		
Alarm output		

	High limit with standby alarm	Low limit with standby alarm
Alarm action		
Alarm output	+ side - side	+ side - side
	High/Low limits with standby alarm	H/L limits with standby independent alarm
Alarm action		
Alarm output		

- : Event output 1 terminals 3 and 4: ON (closed).
- : Event output 1 terminals 3 and 4: ON (closed) or OFF (open).
- : Event output 1 terminals 3 and 4: OFF (open).
- : Alarm output is in Standby.

- EV1 value, EV1 high limit value, and EV1 hysteresis represent EV1 alarm value, EV1 high limit alarm value and EV1 alarm hysteresis respectively.
For EV2, substitute EV1 with EV2.
- EV1 indicator lights when Event output 1 terminals 3 and 4 are ON, and goes off when their output terminals 3 and 4 are OFF.
EV2 indicator lights when Event output 2 terminals 5 and 6 are ON, and goes off when their output terminals 5 and 6 are OFF.
- KT8R, KT9R: Event output 1 terminal numbers: 17, 18
Event output 2 terminal numbers: 19, 20

10.4 OUT2 (Heating/Cooling Control) Action

Control action			
Relay contact output (OUT1)	<p>Cycle action is performed according to deviation</p>		
Non- contact voltage output (OUT1)	<p>Cycle action is performed according to deviation</p>		
Direct current output (OUT1)	<p>Changes continuously according to deviation.</p>		
Relay contact output (OUT2)	<p>Cycle action is performed according to deviation</p>		
Indicator (O1)	<p>Lit Unlit</p>		
Indicator (O2)	<p>Unlit Lit</p>		

: Turns ON (lit) or OFF (unlit).

— : Represents Heating control action.

- - - : Represents Cooling control action.

10.5 OUT2 (Heating/Cooling Control) Action (When Setting Dead Band)

Control action	<p>ON ——— Heating control ——— ON OFF ——— (Cooling Control) ——— OFF</p> <p>Heating P-band Dead band (Cooling P-band)</p> <p>SV</p>		
Relay contact output (OUT1)	<p>Cycle action is performed according to deviation</p>		
Non- contact voltage output (OUT1)	<p>+ (7) ——— 12V DC ——— + (7) ——— 12/0V DC ——— + (7) ——— 0V DC ——— - (8) ——— - (8) ——— - (8) ———</p> <p>Cycle action is performed according to deviation</p>		
Direct current output (OUT1)	<p>+ (7) ——— 20 mA DC ——— + (7) ——— 20 to 4 mA DC ——— + (7) ——— 4 mA DC ——— - (8) ——— - (8) ——— - (8) ———</p> <p>Changes continuously according to deviation.</p>		
Relay contact output (OUT2)	<p>Cycle action is performed according to deviation</p>		
Indicator (O1)	<p>Lit Unlit</p>		
Indicator (O2)	<p>Unlit Lit</p>		

: Turns ON (lit) or OFF (unlit).

——— : Represents Heating control action.

- - - - : Represents Cooling control action.

10.6 OUT2 (Heating/Cooling Control) Action (When Setting Overlap Band)

Control action	
Relay contact output (OUT1)	<p>Cycle action is performed according to deviation</p>
Non-contact voltage output (OUT1)	<p>Cycle action is performed according to deviation</p>
Direct current output (OUT1)	<p>Changes continuously according to deviation</p>
Relay contact output (OUT2)	<p>Cycle action is performed according to deviation</p>
Indicator (O1)	
Indicator (O2)	

: Turns ON (lit) or OFF (unlit).

— : Represents Heating control action.

- - - : Represents Cooling control action.



11. Specifications

11.1 Standard Specifications

Rating

Rated scale		Input	Scale Range		Resolution	
		K	-200 to 1370 °C	-328 to 2498 °F	1 °C(°F)	
			-200.0 to 400.0 °C	-328.0 to 752.0 °F	0.1 °C(°F)	
		J	-200 to 1000 °C	-328 to 1832 °F	1 °C(°F)	
		R	0 to 1760 °C	32 to 3200 °F	1 °C(°F)	
		S	0 to 1760 °C	32 to 3200 °F	1 °C(°F)	
		B	0 to 1820 °C	32 to 3308 °F	1 °C(°F)	
		E	-200 to 800 °C	-328 to 1472 °F	1 °C(°F)	
		T	-200.0 to 400.0 °C	-328.0 to 752.0 °F	0.1 °C(°F)	
		N	-200 to 1300 °C	-328 to 2372 °F	1 °C(°F)	
		PL-Ⅱ	0 to 1390 °C	32 to 2534 °F	1 °C(°F)	
		C(W/Re5-26)	0 to 2315 °C	32 to 4199 °F	1 °C(°F)	
		Pt100	-200.0 to 850.0 °C	-328.0 to 1562.0 °F	0.1 °C(°F)	
			-200 to 850 °C	-328 to 1562 °F	1 °C(°F)	
		JPt100	-200.0 to 500.0 °C	-328.0 to 932.0 °F	0.1 °C(°F)	
			-200 to 500 °C	-328 to 932 °F	1 °C(°F)	
		4 to 20 mA	-2000 to 10000 (*)			1
		0 to 20 mA	-2000 to 10000 (*)			1
		0 to 1 V	-2000 to 10000 (*)			1
		0 to 5 V	-2000 to 10000 (*)			1
		1 to 5 V	-2000 to 10000 (*)			1
		0 to 10 V	-2000 to 10000 (*)			1
		(*) Scaling and decimal point place selection are possible.				
Input	Thermocouple	K, J, R, S, B, E, T, N, PL-Ⅱ, C(W/Re5-26) External resistance: 100 Ω max. However, for B input, External resistance: 40 Ω max.				
	RTD	Pt100, JPt100 3-wire type Allowable input lead wire resistance: 10 Ω max. per wire				
	Direct current	0 to 20 mA DC, 4 to 20 mA DC Input impedance: 50 Ω Allowable input current: 50 mA max.				
	DC voltage	0 to 1 V DC Input impedance: 1 MΩ min. Allowable input voltage: 5 V DC max. Allowable signal source resistance: 2 kΩ max.				
0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC Input impedance: 100 kΩ min. Allowable input voltage: 15 V DC max. Allowable signal source resistance: 100 Ω max.						
Power supply voltage	100 to 240 V AC 50/60 Hz 24 V AC/DC 50/60 Hz (24 V AC/DC can be specified only for the KT4R model.)					
Allowable voltage fluctuation	85 to 264 V AC 20 to 28 V AC/DC					

General Structure

External dimensions	KT4R	48 x 48 x 68 mm (W x H x D) (Depth of control panel interior: 60)	
	KT8R	48 x 96 x 68 mm (W x H x D) (Depth of control panel interior: 60)	
	KT9R	96 x 96 x 68 mm (W x H x D) (Depth of control panel interior: 60)	
Mounting		Flush	
Case		Flame-resistant resin, Black	
Front panel		Membrane sheet	
Water-proof/Dust-proof		Front panel: IP66, Rear case: IP20, Terminal section: IP00	
Standards	EN	EN61010-1 (Pollution degree 2, Overvoltage category II)	
Indication structure	PV Display	Indicates PV. 7-segment Red LED display	
		KT4R	Character size: 12.4 x 5.8 mm (H x W)
		KT8R	Character size: 14 x 5.8 mm (H x W)
		KT9R	Character size: 24 x 11 mm (H x W)
	SV Display	Indicates SV. 7-segment Green LED display	
		KT4R	Character size: 8.8 x 3.9 mm (H x W)
		KT8R	Character size: 14 x 5.8 mm (H x W)
		KT9R	Character size: 14 x 7 mm (H x W)
	STEP Display (KT8R, KT9R)	Indicates Step number (Program control). 7-segment Green LED display	
		KT8R	Character size: 14 x 5.8 mm (H x W)
		KT9R	Character size: 14 x 7 mm (H x W)
	Action indicators	O1 (Green)	Lit when control output OUT1 is ON. For direct current output type, flashes corresponding to the MV in 125 ms cycles.
		O2 (Yellow)	Lit when control output OUT2 is ON. When  (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation]
		EV1 (Red)	Lit when Event output 1 is ON.
		EV2 (Red)	Lit when Event output 2 is ON. Unlit if  (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation].
		AT (Yellow)	Flashes while AT, 'AT on startup' or Auto-reset is performing.
		T/R (Yellow)	Lit during Serial communication TX (transmitting) output.
		STEP (Green)	Lit when a step number (Program control) is indicated. (KT8R, KT9R)

Setting Structure

Function key	UP key	Increases the numeric value. By pressing this key for 1 second during Program control, the performing step is interrupted, proceeding to the beginning of the next step. (Advance function)	
	DOWN key	Decreases the numeric value.	
	MODE key	Selects a setting mode, or registers the set data. By pressing this key for 3 seconds during RUN mode, the unit enters Monitor mode.	
	OUT/OFF key	The following function can be selected in [OUT/OFF key function].	
		Selection Item	Action
		Control output OFF function	Turns the control output ON or OFF.
		Auto/Manual control	Switches the Auto/Manual control.
		Program control	Starts/Stops the Program control.

Indication Performance

Accuracy	At ambient temperature 23°C (for a single unit mounting)	
	Thermocouple	Within $\pm 0.2\%$ of each input span ± 1 digit However R, S inputs, 0 to 200°C (32 to 392°F): Within $\pm 6^\circ\text{C}$ (12°F) B input, 0 to 300°C (0 to 572°F): Accuracy is not guaranteed. K, J, E, T, N inputs, Less than 0°C (32°F): Within $\pm 0.4\%$ of input span ± 1 digit
	RTD	Within $\pm 0.1\%$ of each input span ± 1 digit
	Direct current, DC voltage	Within $\pm 0.2\%$ of each input span ± 1 digit
Effect of ambient temperature		Within 50 ppm/°C of each input span
Input sampling period		125 ms
Time accuracy		Within $\pm 1.0\%$ of setting time

Control Performance

Control action	<ul style="list-style-type: none"> • PID control (with AT function) • PI control: When derivative time is set to 0 • PD control (with Auto-reset, Manual reset function): When integral time is set to 0 • P control (with Auto-reset, Manual reset function): When derivative and integral times are set to 0. • ON/OFF control: When proportional band is set to 0 (or 0.0) 	
	OUT1 proportional band	Thermocouple, RTD inputs without decimal point: 0 to Input span Thermocouple, RTD inputs with decimal point: 0.0 to Input span Direct current, voltage inputs: 0.0 to 1000.0%
	Integral time	0 to 3600 sec
	Derivative time	0 to 1800 sec
	OUT1 proportional cycle	0.5, or 1 to 120 sec
	ARW	0 to 100%
	Manual reset	\pm Proportional band value
	OUT1 ON/OFF hysteresis	Thermocouple, RTD inputs: 0.1 to 1000.0°C (°F) Direct current, voltage inputs: 1 to 10000 (The placement of the decimal point follows the selection.)
	OUT1 high limit, OUT1 low limit	0 to 100% (Direct current: -5 to 105%)

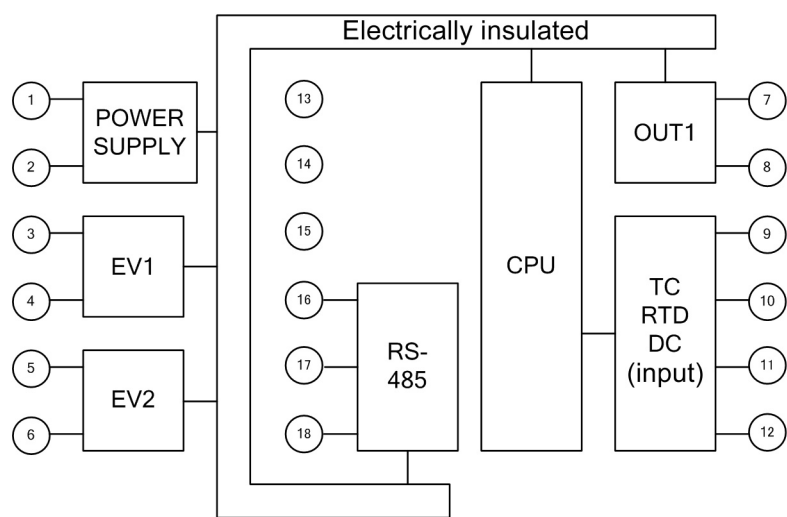
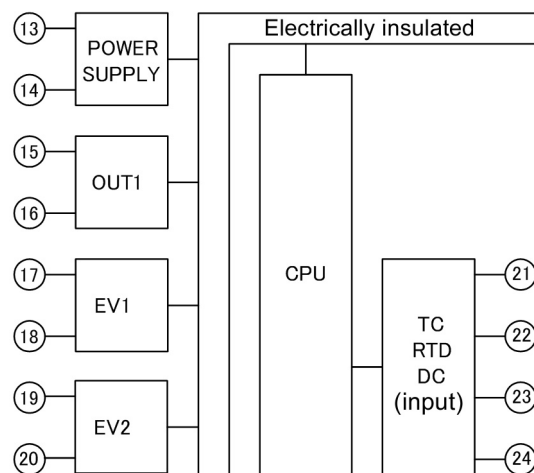
Control output	Relay contact 1a	Control capacity: 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load $\cos\phi=0.4$) Electrical life: 100,000 cycles Minimum applicable load: 10 mA 5 V DC
	Non-contact voltage (For SSR drive)	12 V DC $\pm 15\%$ Max 40 mA (short circuit protected)
	Direct current	4 to 20 mA DC Resolution: 12000 Load resistance: Max 550 Ω Accuracy: $\pm 0.2\%$ Effect of ambient temperature: $\pm 0.015\%/^{\circ}\text{C}$

Standard Function

EV1 output		The output is turned ON or OFF depending on the conditions selected in [Event output EV1 allocation]. Relay contact 1a Control capacity: 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load $\cos\phi=0.4$) Electrical life: 100,000 cycles Minimum applicable load: 10 mA 5 V DC
Alarm action		When an alarm type and Energized action are selected in [Event output EV1 allocation] or [Event output EV2 allocation]: The alarm action point is set by \pm deviation from the SV (excluding Process alarm) and if PV goes outside the range, alarm output is turned ON or OFF (High/Low limit range alarm). When De-energized action is selected, alarm is activated conversely.
	Type	High limit alarm, Low limit alarm, High/Low limits alarm, High/Low limits independent alarm, High/Low limit range alarm, High/Low limit range independent alarm, Process high alarm, Process low alarm, High limit with standby alarm, Low limit with standby alarm, High/Low limits with standby alarm, High/Low limits with standby independent alarm. Energized/De-energized action are applied to the above alarms, totaling 24 alarm types. No alarm action can also be selected.
	Action	ON/OFF action
	Hysteresis	Thermocouple, RTD inputs: 0.1 to 1000.0 $^{\circ}\text{C}$ ($^{\circ}\text{F}$) Direct current, voltage inputs: 1 to 10000 (The placement of the decimal point follows the selection.)
	Output	EV1, EV2 outputs for which Alarm output (001 to 012) is selected in [Event output EV1/EV2 allocation].
	Alarm value 0 Enabled/ Disabled	If 'Enabled' is selected in [Alarm value 0 Enabled/Disabled], the following alarm type activates even if alarm value is set to 0 (zero). High limit alarm, Low limit alarm, High/Low limits alarm, High/Low limits independent alarm, High/Low limit range alarm, High/Low limit range independent alarm, High limit with standby alarm, Low limit with standby alarm, High/Low limits with standby alarm, High/Low limits with standby independent alarm.
Loop break alarm		Detects heater burnout, sensor burnout and actuator trouble. EV1 or EV2 output for which Loop break alarm (014) is selected in [Event output EV1/EV2 allocation].



Simplified converter function	If 'Converter' is selected in [Controller/Converter], this instrument can be used as a converter, by setting the following items.	
	Setting Item	Values or Selection
	SV1	Scaling low limit value
	AT/Auto-reset Perform/Cancel	AT/AT on startup/Auto-reset Cancel
	OUT1 proportional band	Scaling span Direct current, voltage inputs: 100.0%
	Integral time	0
	Derivative time	0
	Reset	0 (Reset value, calculated by Auto-reset function)
	OUT1 high limit	100
	OUT1 low limit	0
	OUT1 rate-of-change	0
	OUT2 proportional band	Scaling span Direct current, voltage inputs: 100.0%
	Direct/Reverse action	Direct control action
	EV1/EV2 alarm value 0 Enabled/Disabled	Disabled
	EV1/EV2 alarm value	0 or Input range low limit value (Scaling low limit value)
	EV1/EV2 high limit alarm value	0 or Input range low limit value (Scaling low limit value)
	EV1/EV2 alarm hysteresis	1.0
	EV1/EV2 alarm delay time	0
	EV1/EV2 alarm Energized/ De-energized	Energized
	Loop break alarm time	0
	Loop break alarm span	0
	Event output EV1 allocation	No event
	Event output EV2 allocation	No event
	SV rise rate	0
	SV fall rate	0
	OUT/OFF key function	Control output OFF function
	4 to 20 mA DC Load resistance: Max 550 Ω	

Insulation, Dielectric Strength

Circuit insulation configuration	KT4R	
		
	KT8R, KT9R	
		
	Insulation resistance: 10 MΩ or more, at 500 V DC	
Dielectric strength	Between input terminal and power terminal: 1.5 kV AC for 1 minute Between output terminal and power terminal: 1.5 kV AC for 1 minute	
Power consumption	100 to 240 V AC	Approx. 8 VA max. (11VA max. when EV2 and Serial communication are added)
	24 V AC	Approx. 5 VA max. (8 VA max. when EV2 and Serial communication are added) (*)
	24 V DC	Approx. 5 W max. (8 W max. when EV2 and Serial communication are added) (*)
	(*) 24 V AC/DC can be specified only for the KT4R model.	

Rush current	100 to 240 V AC		Max. 14 to 34 A
	24 V AC		Max. 34 A (*)
	24 V DC		Max. 34 A (*)
	(*) 24 V AC/DC can be specified only for the KT4R model.		
Ambient temperature		-10 to 55°C (Non-condensing, No icing)	
Ambient humidity		35 to 85%RH (Non-condensing)	
Weight	KT4R	Approx. 110 g	
	KT8R	Approx. 160 g	
	KT9R	Approx. 220 g	
Accessories included		Mounting frame: 1 piece (KT4R) Screw type mounting bracket: 1 set (KT8R, KT9R) Installation Instructions (excerpt): 1 copy	
Accessories sold separately		Terminal cover	
Environmental specification		RoHS directive compliant	

Attached Functions

Sensor correction coefficient		Sets slope of input value from a sensor.
Sensor correction		Corrects the input value from a sensor.
Set value lock		Locks the set values to prevent setting errors.
Auto/Manual control switching		Switches Auto/Manual control. In Manual control, sets MV with the  or  key.
Balanceless-bumpless function		When control is changed from automatic to manual and vice versa, the balanceless-bumpless function works to prevent sudden change of the MV.
SV ramp function		When the SV is adjusted, it approaches the new SV by the preset rate-of-change. Set SV rise rate and SV fall rate respectively.
SV Rise/Fall rate start type		When control output is turned from OFF to ON, or switched from Manual to Automatic control, SV start or PV start can be selected for SV rise rate or fall rate action.
Program control		1 pattern; 9 steps
Power failure countermeasure		The setting data is backed up in the non-volatile IC memory.
Self-diagnosis		The CPU is monitored by a watchdog timer, and if an abnormal status occurs, the controller is switched to warm-up status, turning all outputs OFF.
Automatic cold junction temperature compensation		This detects the temperature at the connecting terminal between the thermocouple and the instrument, and always maintains it at the same status as if the reference junction location temperature was at 0°C (32°F).
Indication range, Control range	Thermocouple	[Input range low limit value - 50°C (100°F)] to [Input range high limit value + 50°C (100°F)]
	RTD	[Input range low limit value - (Input span x 1%)] to [Input range high limit value + 50°C (100°F)]
	DC voltage, Direct current	[Scaling low limit value - (Scaling span x 1%)] to [Scaling high limit value + Scaling span x 10%]

Input error	Overscale	PV has exceeded Input range high limit value (Scaling high limit value for DC voltage, current inputs). PV and [E-05] are alternately indicated in the PV Display. For Manual control, the preset MV is output.																																			
	Underscale	PV has dropped below Input range low limit value (Scaling low limit value for DC voltage, current inputs). PV and [E-05] are alternately indicated in the PV Display. For Manual control, the preset MV is output.																																			
Burnout		<p>If PV has exceeded Indication range, Control range, the PV Display indicates [- - -] and [E-07] alternately.</p> <p>If PV has dropped below Indication range, Control range, the PV Display indicates [- - -] and [E-07] alternately.</p> <p>If thermocouple, RTD or DC voltage (0 to 1 V DC) input is burnt out or disconnected, the PV Display indicates [- - -] and [E-07] alternately.</p> <p>If DC voltage or current input is disconnected:</p> <p>For 4 to 20 mA DC, 1 to 5 V DC inputs, the PV Display indicates [- - -] and [E-07] alternately.</p> <p>For 0 to 20 mA DC, 0 to 5 V DC and 0 to 10 V DC inputs, the PV Display indicates the value corresponding with 0 mA DC or 0 V DC input.</p> <p>OUT1 and OUT2 are turned OFF (OUT1 low limit value for Direct current output type).</p> <p>For Manual control, the preset MV is output.</p> <p>If Alarm or Loop break alarm is selected in [Event output EV1/EV2 allocation], Event output will be turned ON under the alarm active conditions.</p> <p>In Program control, Burnout is enabled even in standby (program control waiting) mode.</p> <p>[Output status when input errors occur] can be used only for controllers using Direct current input and voltage input, and Direct current output.</p> <p>For manual control, the preset MV is output.</p> <table><tr><th rowspan="3">Output status when input errors occur</th><th rowspan="3">Contents and Indication</th><th colspan="4">Output status</th></tr><tr><th colspan="2">OUT1</th><th colspan="2">OUT2</th></tr><tr><th>Direct(Cooling) action</th><th>Reverse(Heating) action</th><th>Direct(Cooling) action</th><th>Reverse(Heating) action</th></tr><tr><td>on</td><td rowspan="2">Indicates [- - -] and [E-07] alternately.</td><td>ON (20mA) or OUT1 high limit value (*)</td><td rowspan="2">OFF (4mA) or OUT1 low limit value</td><td rowspan="2">OFF</td><td>ON (*)</td></tr><tr><td>off</td><td>OFF (4mA) or OUT1 low limit value</td><td>OFF</td></tr><tr><td>on</td><td rowspan="2">Indicates [- - -] and [E-07] alternately.</td><td rowspan="2">OFF (4mA) or OUT1 low limit value</td><td>ON (20mA) or OUT1 high limit value (*)</td><td>ON (*)</td><td rowspan="2">OFF</td></tr><tr><td>off</td><td>OFF (4mA) or OUT1 low limit value</td><td>OFF</td></tr></table> <p>(*) Outputs a value between OFF (4mA) and ON (20mA) or between OUT1 low limit value and OUT1 high limit value, depending on deviation.</p>				Output status when input errors occur	Contents and Indication	Output status				OUT1		OUT2		Direct(Cooling) action	Reverse(Heating) action	Direct(Cooling) action	Reverse(Heating) action	on	Indicates [- - -] and [E-07] alternately.	ON (20mA) or OUT1 high limit value (*)	OFF (4mA) or OUT1 low limit value	OFF	ON (*)	off	OFF (4mA) or OUT1 low limit value	OFF	on	Indicates [- - -] and [E-07] alternately.	OFF (4mA) or OUT1 low limit value	ON (20mA) or OUT1 high limit value (*)	ON (*)	OFF	off	OFF (4mA) or OUT1 low limit value	OFF
Output status when input errors occur	Contents and Indication	Output status																																			
		OUT1		OUT2																																	
		Direct(Cooling) action	Reverse(Heating) action	Direct(Cooling) action	Reverse(Heating) action																																
on	Indicates [- - -] and [E-07] alternately.	ON (20mA) or OUT1 high limit value (*)	OFF (4mA) or OUT1 low limit value	OFF	ON (*)																																
off		OFF (4mA) or OUT1 low limit value			OFF																																
on	Indicates [- - -] and [E-07] alternately.	OFF (4mA) or OUT1 low limit value	ON (20mA) or OUT1 high limit value (*)	ON (*)	OFF																																
off			OFF (4mA) or OUT1 low limit value	OFF																																	
Warm-up indication		After the power supply to the instrument is turned on, the PV Display indicates the input type, and SV Display indicates input range high limit value (for thermocouple, RTD inputs) or scaling high limit value (for Direct current and voltage inputs) for approximately 3 seconds.																																			

11.2 Specified Specifications

Event output EV2	<p>Output will be turned ON or OFF depending on the Event conditions selected in [Event output EV2 allocation].</p> <p>Relay contact, 1a</p> <p>Control capacity: 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load, $\cos\phi=0.4$)</p> <p>Electric life: 100,000 cycles</p> <p>Minimum applicable load: 10 mA 5 V DC</p>
Heating/Cooling control	<p>When <input type="checkbox"/> 19 (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation], performs Heating/Cooling control. (Specifications of Heating side are the same as those of OUT1.)</p> <p>OUT2 proportional band:</p> <p>Thermocouple, RTD inputs without decimal point: 0 to Input span Thermocouple, RTD inputs with decimal point: 0.0 to Input span DC voltage, current inputs: 0.0 to 1000.0%</p> <p>OUT2 integral time: Same as OUT1 integral time</p> <p>OUT2 derivative time: Same as OUT1 derivative time</p> <p>OUT2 proportional cycle: 0.5, or 1 or 120 seconds</p> <p>Overlap/Dead band setting range:</p> <p>Thermocouple, RTD inputs: -200.0 to 200.0°C (°F) DC voltage, current inputs: -2000 to 2000 (The placement of the decimal point follows the selection.)</p> <p>OUT2 ON/OFF hysteresis:</p> <p>Thermocouple, RTD inputs: 0.1 to 1000.0°C (°F) DC voltage, current inputs: 1 to 10000 (The placement of the decimal point follows the selection.)</p> <p>OUT2 high limit: 0 to 100%</p> <p>OUT2 low limit: 0 to 100%</p> <p>OUT2 cooling method:</p> <p>One cooling method can be selected from Air cooling (linear characteristics), Oil cooling (1.5th power of the linear characteristics) and Water cooling (2nd power of the linear characteristics) by keypad operation.</p> <p>Cooling output (OUT2):</p> <p>Relay contact 1a (EV2)</p> <p>Control capacity: 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load, $\cos\phi=0.4$)</p> <p>Electric life: 100,000 cycles</p>


Serial communication	<p>The following operations can be carried out from an external computer.</p> <p>(1) Reading and setting of the SV, PID values and various set values</p> <p>(2) Reading of the PV and action status</p> <p>(3) Function change</p> <p>Cable length: Max 1.2km, Cable resistance: Within 50 Ω (Terminators are not necessary, but if used, use 120 Ω max. on both sides.)</p> <p>Communication line: EIA RS-485</p> <p>Communication method: Half-duplex communication</p> <p>Synchronization method: Start-stop synchronization</p> <p>Communication speed: 9600/19200/38400 bps (Selectable by keypad)</p> <p>Data bit/Parity: 7 bits, 8 bits/Even, Odd, No parity (Selectable by keypad)</p> <p>Stop bit: 1 bit, 2 bits (Selectable by keypad)</p> <p>Communication protocol: MEWTOCOL/MODBUS ASCII/MODBUS RTU (Selectable by keypad)</p> <p>Data format:</p>		
	Communication protocol	MEWTOCOL	MODBUS ASCII
	Start bit	1	1
	Data bit	7	7 or 8
	Parity	Yes (Even)	Yes (Even, Odd), No parity
	Stop bit	1	1 or 2
	<p>Number of connectable units: Maximum 31 units to 1 host computer</p> <p>Communication error detection: Parity, LRC (Modbus ASCII), CRC-16 (Modbus RTU)</p>		

12. Troubleshooting

If any malfunctions occur, refer to the following items after checking that power is being supplied to the controller.

12.1 Indication

Problem	Possible Cause	Solution
[E r 1] is indicated in the PV Display.	Internal non-volatile IC memory is defective.	Cancel the error code by pressing the MODE key, and perform data clearing. (p.92) If the problem is not still solved, contact our agency or us.
[E r 2] is indicated in the PV Display.	Data writing (in non-volatile IC memory) error when power failure occurs.	Cancel the error code by pressing the MODE key, and perform data clearing. (p.92)
PV and [E r 5] are alternately indicated in the PV Display.	Overscale. PV has exceeded Input range high limit value (scaling high limit value for DC voltage, current inputs).	Check the input signal source.
PV and [E r 6] are alternately indicated in the PV Display.	Underscale. PV has dropped below Input range low limit value (scaling low limit value for DC voltage, current inputs).	Check the input signal source and wiring of input terminals.
[] and [E r 7] are alternately indicated in the PV Display.	PV has exceeded the Indication range and Control range.	Check the input signal source.
	Burnout of thermocouple, RTD or disconnection of DC voltage (0 to 1 V DC)	<p>Replace each sensor.</p> <p>How to check whether the sensor is burnt out</p> <p>[Thermocouple] If the input terminals of the instrument are shorted, and if a value around room temperature is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out.</p> <p>[RTD] If approx. 100 Ω of resistance is connected to the input terminals between A-B of the instrument and between B-B is shorted, and if a value around 0°C (32°F) is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out.</p> <p>[DC voltage (0 to 1 V DC)] If the input terminals of the instrument are shorted, and if a scaling low limit value is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected.</p>
	Check whether the input terminals of thermocouple, RTD or DC voltage (0 to 1 V DC) are securely mounted to the instrument input terminals.	Connect the sensor terminals to the instrument input terminals securely.

Problem	Possible Cause	Solution
[- - -] and [Err 7] are alternately indicated in the PV Display.	PV has dropped below the Indication range and Control range.	Check the input signal source and wiring of input terminals.
	Check whether input signal wire for DC voltage (1 to 5 V DC) or Direct current (4 to 20 mA DC) is disconnected.	How to check whether the input signal wire is disconnected [DC voltage (1 to 5 V DC)] If the input to the input terminals of the instrument is 1 V DC and if a scaling low limit value is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected. [Direct current (4 to 20 mA DC)] If the input to the input terminals of the instrument is 4 mA DC and if a scaling low limit value is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected.
	Check whether input signal wire for DC voltage (1 to 5 V DC) or current (4 to 20 mA DC) is securely connected to the instrument input terminals.	Connect the input signal wire to the terminals of this instrument securely.
	Check if polarity of thermocouple or compensating lead wire is correct. Check whether codes (A, B, B) of RTD agree with the instrument terminals.	Wire them correctly.
[Err 10] is indicated in the PV Display.	Hardware malfunction	Contact our agency or us.
[OFF], nothing or PV is indicated in the PV Display.	Control output OFF function is enabled.	Press the  key for approx. 1 second to cancel the function.
The indication of PV Display is irregular or unstable.	Check whether sensor input or temperature unit (°C or °F) is correct.	Select the sensor input and temperature unit (°C or °F) correctly.
	Sensor correction coefficient or Sensor correction value is unsuitable.	Set them to suitable values.
	Check whether the specification of the sensor is correct.	Use a sensor with appropriate specifications.
	AC leaks into the sensor circuit.	Use an ungrounded type sensor.
	There may be equipment that interferes with or makes noise near the instrument.	Keep the instrument clear of any potentially disruptive equipment.

Problem	Possible Cause	Solution
The PV Display keeps indicating the value set in [Scaling low limit].	Check whether the input signal wire for DC voltage (0 to 5 V DC, 0 to 10 V DC) and Direct current (0 to 20 mA DC) is disconnected.	<p>Check the input signal wires of DC voltage (0 to 5 V DC, 0 to 10 V DC) and Direct current (0 to 20 mA DC).</p> <p>How to check whether the input signal wire is disconnected</p> <p>[DC voltage (0 to 5 V DC, 0 to 10 V DC)] If the input to the input terminal of this controller is 1 V DC, and if a value (converted value from scaling high, low limit setting) corresponding to 1 V DC is indicated, the controller is likely to be operating normally, however, the input signal wire may be disconnected.</p> <p>[Direct current (0 to 20 mA DC)] If the input to the input terminal of this controller is 4 mA DC, and if a value (converted value from scaling high, low limit setting) corresponding to 4 mA DC is indicated, the controller is likely to be operating normally, however, the input signal wire may be disconnected.</p>
	Check whether the input terminals for DC voltage (0 to 5 V DC, 0 to 10 V DC) or Direct current (0 to 20 mA DC) are securely connected to the instrument input terminals.	Connect the input terminals of DC voltage and current to the input terminals of this instrument securely.

12.2 Key Operation

Problem	Possible Cause	Solution
None of the set values can be set.	Set value lock (Lock 1 or Lock 4) is selected.	Release the lock in [Set value lock].
	AT, 'AT on startup' or Auto-reset is performing.	If AT or 'AT on startup' is performing, cancel AT or 'AT on startup'. Please wait until Auto-reset is finished. (It takes approximately 4 minutes until Auto-reset is finished.)
Only SV and Alarm value can be set. Other settings are impossible.	Set value lock (Lock 2 or Lock 5) is selected.	Release the lock in [Set value lock].
The setting indication does not change in the input range, and new values are unable to be set.	Scaling high or low limit value may be set at the point where the value does not change.	Set it to a suitable value.

12.3 Control

Problem	Possible Cause	Solution
Temperature does not rise.	Sensor is out of order.	Replace the sensor.
	Check whether the sensor or control output terminals are securely mounted to the instrument input terminals.	Ensure that the sensor or control output terminals are mounted to the instrument input terminals securely.
	Check whether the wiring of sensor or control output terminals is correct.	Wire them correctly.
The control output remains in an ON status.	OUT1 or OUT2 low limit value is set to 100% or higher.	Set it to a suitable value.
The control output remains in an OFF status.	OUT1 or OUT2 high limit value is set to 0% or less.	Set it to a suitable value.
[Err20] is indicated in the PV display.	AT or 'AT on startup' has not been completed even if approx. 4 hours have elapsed since AT or 'AT on startup' started.	Set P, I, D and ARW values manually
	For 'AT on startup', PV slope and delay time cannot be measured normally for P, I, D calculation.	

For all other malfunctions, please contact our main office or dealers.

13. Character Table

13.1 Error Code

Error codes are indicated in the PV Display.

Error Code	Error Contents
<i>Er01</i>	Internal non-volatile IC memory is defective.
<i>Er02</i>	Data writing (in non-volatile IC memory) error when power failure occurs.
<i>Er05</i>	PV has exceeded Input range high limit value (Scaling high limit value for DC voltage, current inputs).
<i>Er06</i>	PV has dropped below Input range low limit value (Scaling low limit value for DC voltage, current inputs).
<i>Er07</i>	Input burnout or disconnection. Input value is outside of the Indication range and control range.
<i>Er10</i>	Hardware malfunction
<i>Er20</i>	AT or 'AT on startup' has not been completed even if approx. 4 hours have elapsed since AT or 'AT on startup' started. For 'AT on startup', PV slope and delay time cannot be measured normally for P, I, D calculation.

13.2 Run Mode

Character	Indicated Item Name
OFF []	Control output OFF
25 105	Manual control (MV flashes.)

13.3 Monitor Mode

The PV Display indicates PV, and the SV Display indicates setting item value.

Character	Indicated Item Name
25 [MV]	MV (Decimal point flashes.)
25 [Remaining time]	Remaining time is indicated (When Program control is performing)
25 [Step number]	Current step number indicated (When Program control is performing) (KT4R) 4r _ 1 to 4r _ 9

13.4 Initial Setting Mode

The PV Display indicates setting characters, and the SV Display indicates factory default value.

Characters, Factory Default	Setting Item, Setting Range			
4E n 4 E 0 0 0	Input type			
	E 0 0 0	K -200 to 1370 °C	E 0 0 F	K -328 to 2498 °F
	E 0 . 0	K -200.0 to 400.0 °C	E 0 . F	K -328.0 to 752.0 °F
	J 0 0 0	J -200 to 1000 °C	J 0 0 F	J -328 to 1832 °F
	r 0 0 0	R 0 to 1760 °C	r 0 0 F	R 32 to 3200 °F
	4 0 0 0	S 0 to 1760 °C	4 0 0 F	S 32 to 3200 °F
	b 0 0 0	B 0 to 1820 °C	b 0 0 F	B 32 to 3308 °F
	E 0 0 0	E -200 to 800 °C	E 0 0 F	E -328 to 1472 °F
	T 0 . 0	T -200.0 to 400.0 °C	T 0 . F	T -328.0 to 752.0 °F
	n 0 0 0	N -200 to 1300 °C	n 0 0 F	N -328 to 2372 °F
	PL 2 0	PL-II 0 to 1390 °C	PL 2 F	PL-II 32 to 2534 °F
	c 0 0 0	C(W/Re5-26) 0 to 2315 °C	c 0 0 F	C(W/Re5-26) 32 to 4199 °F
	Pt 1 0	Pt100 -200.0 to 850.0 °C	Pt 1 F	Pt100 -328.0 to 1562.0 °F
	JPt 1 0	JPt100 -200.0 to 500.0 °C	JPt 1 F	JPt100 -328.0 to 932.0 °F
	Pt 1 0	Pt100 -200 to 850 °C	Pt 1 F	Pt100 -328 to 1562 °F
	JPt 1 0	JPt100 -200 to 500 °C	JPt 1 F	JPt100 -328 to 932 °F
	4 2 0 A	4 to 20 mA DC -2000 to 10000		
	0 2 0 A	0 to 20 mA DC -2000 to 10000		
	0 1 V	0 to 1 V DC -2000 to 10000		
	0 5 V	0 to 5 V DC -2000 to 10000		
	1 5 V	1 to 5 V DC -2000 to 10000		
	0 1 0 V	0 to 10 V DC -2000 to 10000		
4FLH 1370	Scaling high limit Setting range: Scaling low limit value to input range high limit value DC voltage, current inputs: -2000 to 10000 (*1)			
4FL L -200	Scaling low limit Setting range: Input range low limit value to scaling high limit value DC voltage, current inputs: -2000 to 10000 (*1)			
dP 0 0 0 0 0 0	Decimal point place			
	0 0 0 0	No decimal point		
	0 0 0 0	1 digit after decimal point		
	0 0 0 0	2 digits after decimal point		
	0 0 0 0	3 digits after decimal point		

(*1) The placement of the decimal point follows the selection.

Characters, Factory Default	Setting Item, Setting Range	
E801 0000	Event output EV1 allocation [Event Output Allocation Table]	
	0000	No event
	0001	Alarm output, High limit alarm
	0002	Alarm output, Low limit alarm
	0003	Alarm output, High/Low limits alarm
	0004	Alarm output, High/Low limits independent alarm
	0005	Alarm output, High/Low limit range alarm
	0006	Alarm output, High/Low limit range independent alarm
	0007	Alarm output, Process high alarm
	0008	Alarm output, Process low alarm
	0009	Alarm output, High limit with standby alarm
	0010	Alarm output, Low limit with standby alarm
	0011	Alarm output, High/Low limits with standby alarm
	0012	Alarm output, High/Low limits with standby independent alarm
	0014	Loop break alarm output
	0015	Time signal output
	0016	Output during AT
	0017	Pattern end output
	0018	Output by communication command
A12R no00	EV1 alarm value 0 Enabled/Disabled	
	no00	Disabled
	4E40	Enabled
A100 0000	EV1 alarm value	
	High limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	Low limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limits independent alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limit range alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limit range independent alarm	0 to Input span °C (°F) (*1) (*2)
	Process high alarm	Input range low limit to Input range high limit (*1) (*3)
	Process low alarm	Input range low limit to Input range high limit (*1) (*3)
	High limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	Low limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits with standby alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limits with standby independent alarm	0 to Input span °C (°F) (*1) (*2)
A1H0 0000	EV1 high limit alarm value Setting range: Same as those of EV1 alarm value	

(*1) The placement of the decimal point follows the selection.

(*2) For DC voltage, current inputs, the input span is the same as the scaling span.

(*3) For DC voltage, current inputs, input range low (or high) limit value is the same as scaling low (or high) limit value.

Characters, Factory Default	Setting Item, Setting Range	
<i>A 1H4</i> <i>□□ 10</i>	EV1 alarm hysteresis Setting range: 0.1 to 1000.0°C(°F), DC voltage, current inputs: 1 to 10000 (*1)	
<i>A 1d4</i> <i>□□□ 0</i>	EV1 alarm delay time Setting range: 0 to 10000 seconds	
<i>A 1Lā</i> <i>noāL</i>	EV1 alarm Energized/De-energized	
	<i>noāL</i>	Energized
	<i>rEā4</i>	De-energized
<i>r4 14</i> <i>□□□ 1</i>	TS1 output step number Setting range: 1 to 9	
<i>r4 1F</i> <i>0000</i>	TS1 OFF time Setting range: 00:00 to 99:59 (*4)	
<i>r4 1a</i> <i>0000</i>	TS1 ON time Setting range: 00:00 to 99:59 (*4)	
<i>Eāā2</i> <i>□□□□</i>	Event output EV2 allocation [Event Output Allocation Table]	
	<i>□□□□</i>	No event
	<i>□□□ 1</i>	Alarm output, High limit alarm
	<i>□□□ 2</i>	Alarm output, Low limit alarm
	<i>□□□ 3</i>	Alarm output, High/Low limits alarm
	<i>□□□ 4</i>	Alarm output, High/Low limits independent alarm
	<i>□□□ 5</i>	Alarm output, High/Low limit range alarm
	<i>□□□ 6</i>	Alarm output, High/Low limit range independent alarm
	<i>□□□ 7</i>	Alarm output, Process high alarm
	<i>□□□ 8</i>	Alarm output, Process low alarm
	<i>□□□ 9</i>	Alarm output, High limit with standby alarm
	<i>□□ 10</i>	Alarm output, Low limit with standby alarm
	<i>□□ 11</i>	Alarm output, High/Low limits with standby alarm
	<i>□□ 12</i>	Alarm output, High/Low limits with standby independent alarm
	<i>□□ 14</i>	Loop break alarm output
	<i>□□ 15</i>	Time signal output
	<i>□□ 16</i>	Output during AT
	<i>□□ 17</i>	Pattern end output
	<i>□□ 18</i>	Output by communication command
	<i>□□ 19</i>	Heating/Cooling control relay contact output
<i>A2āA</i> <i>no□□</i>	EV2 alarm value 0 Enabled/Disabled	
	<i>no□□</i>	Disabled
	<i>4E4□</i>	Enabled

(*1) The placement of the decimal point follows the selection.

(*4) Time unit follows the selection from [Step time unit].

Characters, Factory Default	Setting Item, Setting Range	
R2□□ □□□0	EV2 alarm value	
	High limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	Low limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limits independent alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limit range alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limit range independent alarm	0 to Input span °C (°F) (*1) (*2)
	Process high alarm	Input range low limit to Input range high limit (*1) (*3)
	Process low alarm	Input range low limit to Input range high limit (*1) (*3)
	High limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	Low limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits with standby alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limits with standby independent alarm	0 to Input span °C (°F) (*1) (*2)
R2H□ □□□0	EV2 high limit alarm value Setting range: Same as those of EV2 alarm value	
R2H4 □□ 10	EV2 alarm hysteresis Setting range: 0.1 to 1000.0°C (°F), DC voltage, current inputs: 1 to 10000 (*1)	
R2d4 □□□0	EV2 alarm delay time Setting range: 0 to 10000 seconds	
R2L□ no□L	EV2 alarm Energized/De-energized	
	no□L	Energized
	rEH4	De-energized
r424 □□□1	TS2 output step number Setting range: 1 to 9	
r42F 0000	TS2 OFF time Setting range: 00:00 to 99:59 (*4)	
r42o 0000	TS2 ON time Setting range: 00:00 to 99:59 (*4)	
LP_r □□□0	Loop break alarm time Setting range: 0 to 200 minutes	
LP_H □□□0	Loop break alarm span Setting range: 0 to 150°C (°F), or 0.0 to 150.0°C (°F) DC voltage, current inputs: 0 to 1500 (*1)	
4□□□ □□□0	SV1 Setting range: Scaling low limit to Scaling high limit (*1)	

(*1) The placement of the decimal point follows the selection.

(*2) For DC voltage, current inputs, the input span is the same as the scaling span.

(*3) For DC voltage, current inputs, input range low (or high) limit value is the same as scaling low (or high) limit value.

(*4) Time unit follows the selection from [Step time unit].

13.5 Main Setting Mode

The PV Display indicates setting characters, and the SV Display indicates factory default value.

Characters, Factory Default	Setting Item, Setting Range
4000 0000	SV1 Setting range: Scaling low limit to Scaling high limit (*1)
r0.1 0000	Step 1 time Setting range: --:--:-- , or 00:00 to 99:59
20.1 0000	Step 1 wait value Setting range: 0 to Converted value of 20% of the input span DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)
4200 0000	SV2 Setting range: Scaling low limit to Scaling high limit (*1)
r0.2 0000	Step 2 time Setting range: --:--:-- , or 00:00 to 99:59
20.2 0000	Step 2 wait value Setting range: 0 to Converted value of 20% of the input span DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)
4300 0000	SV3 Setting range: Scaling low limit to Scaling high limit (*1)
r0.3 0000	Step 3 time Setting range: --:--:-- , or 00:00 to 99:59
20.3 0000	Step 3 wait value Setting range: 0 to Converted value of 20% of the input span DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)
4400 0000	SV4 Setting range: Scaling low limit to Scaling high limit (*1)
r0.4 0000	Step 4 time Setting range: --:--:-- , or 00:00 to 99:59
20.4 0000	Step 4 wait value Setting range: 0 to Converted value of 20% of the input span DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)
4500 0000	Step 5 SV Setting range: Scaling low limit to Scaling high limit (*1)
r0.5 0000	Step 5 time Setting range: --:--:-- , or 00:00 to 99:59
20.5 0000	Step 5 wait value Setting range: 0 to Converted value of 20% of the input span DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)
4600 0000	Step 6 SV Setting range: Scaling low limit to Scaling high limit (*1)
r0.6 0000	Step 6 time Setting range: --:--:-- , or 00:00 to 99:59
20.6 0000	Step 6 wait value Setting range: 0 to Converted value of 20% of the input span DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)

(*1) The placement of the decimal point follows the selection.

Characters, Factory Default	Setting Item, Setting Range
47.00 00.00	Step 7 SV Setting range: Scaling low limit to Scaling high limit (*1)
70.7 00.00	Step 7 time Setting range: --:--:--, or 00:00 to 99:59
50.7 00.00	Step 7 wait value Setting range: 0 to Converted value of 20% of the input span DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)
48.00 00.00	Step 8 SV Setting range: Scaling low limit to Scaling high limit (*1)
70.8 00.00	Step 8 time Setting range: --:--:--, or 00:00 to 99:59
50.8 00.00	Step 8 wait value Setting range: 0 to Converted value of 20% of the input span DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)
49.00 00.00	Step 9 SV Setting range: Scaling low limit to Scaling high limit (*1)
70.9 00.00	Step 9 time Setting range: --:--:--, or 00:00 to 99:59
50.9 00.00	Step 9 wait value Setting range: 0 to Converted value of 20% of the input span DC voltage, current inputs: 0 to Converted value of 20% of scaling span (*1)

(*1) The placement of the decimal point follows the selection.

13.6 Sub Setting Mode

The PV Display indicates setting characters, and the SV Display indicates factory default value.

Characters, Factory Default	Setting Item, Setting Range	
AT 	AT/Auto-reset Perform/Cancel	
		AT/AT on startup/Auto-reset Cancel
	AT	AT Perform
	AT	AT on startup Perform
	RESET	Auto-reset Perform
P 10	OUT1 proportional band Setting range: 0 to Input span °C (°F) DC voltage, current inputs: 0.0 to 1000.0%	
I 200	Integral time Setting range: 0 to 3600 seconds	
d 50	Derivative time Setting range: 0 to 1800 seconds	
AR 50	ARW Setting range: 0 to 100%	
RESET 00	Manual reset Setting range: ±Proportional band value	
c 30 Factory default: • Relay contact output: 30 sec. • Non-contact voltage output: 3 sec.	OUT1 proportional cycle Setting range: 0.5, or 1 to 120 seconds	
HY 10	OUT1 ON/OFF hysteresis Setting range: 0.1 to 1000.0 °C (°F) DC voltage, current inputs: 1 to 10000 (*1)	
oLH 100	OUT1 high limit Setting range: OUT1 low limit value to 100% (Direct current output type: OUT1 low limit value to 105%)	
oLL 0	OUT1 low limit Setting range: 0% to OUT1 high limit value (Direct current output type: -5% to OUT1 high limit value)	
orAR 0	OUT1 rate-of-change Setting range: 0 to 100%/second	
cAR AR	OUT2 cooling method	
	AR	Air cooling (linear characteristics)
	oL	Oil cooling (1.5th power of the linear characteristics)
	WAR	Water cooling (2nd power of the linear characteristics)
P_b 10	OUT2 proportional band Setting range: 0 to Input span °C (°F) DC voltage, current inputs: 0.0 to 1000.0%	
c_b 30 Factory default: • Relay contact output: 30 sec. • Non-contact voltage output: 3 sec.	OUT2 proportional cycle Setting range: 0.5, or 1 to 120 seconds	
HY 10	OUT2 ON/OFF hysteresis Setting range: 0.1 to 1000.0 °C (°F), DC voltage, current inputs: 1 to 10000 (*1)	

(*1) The placement of the decimal point follows the selection.

Characters, Factory Default	Setting Item, Setting Range	
oLHb □ 100	OUT2 high limit Setting range: OUT2 low limit value to 100%	
oLLb □ □ □ 0	OUT2 low limit Setting range: 0% to OUT2 high limit value	
db□□ □ □ □ 0	Overlap/Dead band Setting range: -200.0 to 200.0°C (°F), DC voltage, current inputs: -2000 to 2000 (*1)	
conf HEAT	Direct/Reverse action	
	HEAT	Reverse (Heating) action
	cool	Direct (Cooling) action
A 1□□ □ □ □ 0	EV1 alarm value	
	High limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	Low limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limits independent	0 to Input span °C (°F) (*1) (*2)
	High/Low limit range alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limit range independent alarm	0 to Input span °C (°F) (*1) (*2)
	Process high alarm	Input range low limit to Input range high limit (*1) (*3)
	Process low alarm	Input range low limit to Input range high limit (*1) (*3)
	High limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	Low limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits with standby	0 to Input span °C (°F) (*1) (*2)
	High/Low limits with standby independent alarm	0 to Input span °C (°F) (*1) (*2)
A 1H□ □ □ □ 0	EV1 high limit alarm value Setting range: Same as those of EV1 alarm value	
A 2□□ □ □ □ 0	EV2 alarm value Setting range: Same as those of EV1 alarm value	
A 2H□ □ □ □ 0	EV2 high limit alarm value Setting range: Same as those of EV1 alarm value	
LP_f □ □ □ 0	Loop break alarm time Setting range: 0 to 200 minutes	
LP_H □ □ □ 0	Loop break alarm span Setting range: 0 to 150°C (°F), 0.0 to 150.0°C (°F) DC voltage, current inputs: 0 to 1500 (*1)	

(*1) The placement of the decimal point follows the selection.

(*2) For DC voltage, current inputs, the input span is the same as the scaling span.

(*3) For DC voltage, current inputs, input range low (or high) limit value is the same as scaling low (or high) limit value.

13.7 Engineering Mode 1

The PV Display indicates setting characters, and the SV Display indicates factory default value.

Characters, Factory Default	Setting Item, Setting Range			
Lock - - - -	Set value lock			
			Change via Keypad	Change via Software Communication
	- - - -	Unlock	All set values can be changed.	All set values can be changed.
	Loc 1	Lock 1	None of the set values can be changed.	
	Loc 2	Lock 2	In Fixed value control, only SV and Alarm value can be changed. In Program control, Step SV, Step time and Alarm value can be changed.	
	Loc 3	Lock 3	All set values can be changed.	Setting items – except Input type, Controller/Converter – can be changed temporarily via software communication. However, if power is turned ON again, the set values revert to the values before Lock 3, 4 or 5 was selected.
	Loc 4	Lock 4	None of the set values can be changed.	
	Loc 5	Lock 5	In Fixed value control, only SV and Alarm value can be changed. In Program control, Step SV, Step time and Alarm value can be changed.	
EV01 0000	Event output EV1 allocation [Event Output Allocation Table]			
	0000	No event		
	0001	Alarm output, High limit alarm		
	0002	Alarm output, Low limit alarm		
	0003	Alarm output, High/Low limits alarm		
	0004	Alarm output, High/Low limits independent alarm		
	0005	Alarm output, High/Low limit range alarm		
	0006	Alarm output, High/Low limit range independent alarm		
	0007	Alarm output, Process high alarm		
	0008	Alarm output, Process low alarm		
	0009	Alarm output, High limit with standby alarm		
	0010	Alarm output, Low limit with standby alarm		
	0011	Alarm output, High/Low limits with standby alarm		
	0012	Alarm output, High/Low limits with standby independent alarm		
	0014	Loop break alarm output		
	0015	Time signal output		
	0016	Output during AT		
	0017	Pattern end output		
0018	Output by communication command			

Characters, Factory Default	Setting Item, Setting Range	
<i>R 13A</i> <i>no</i>	EV1 alarm value 0 Enabled/Disabled	
	<i>no</i>	Disabled
	<i>YE4</i>	Enabled
<i>R 10</i> <i>000</i>	EV1 alarm value	
	High limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	Low limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limits independent alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limit range alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limit range independent alarm	0 to Input span °C (°F) (*1) (*2)
	Process high alarm	Input range low limit to Input range high limit (*1) (*3)
	Process low alarm	Input range low limit to Input range high limit (*1) (*3)
	High limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	Low limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits with standby alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limits with standby independent alarm	0 to Input span °C (°F) (*1) (*2)
<i>R 14</i> <i>0000</i>	EV1 high limit alarm value	
	Setting range: Same as those of EV1 alarm value	

(*1) The placement of the decimal point follows the selection.

(*2) For DC voltage, current inputs, the input span is the same as the scaling span.

(*3) For DC voltage, current inputs, input range low (or high) limit value is the same as scaling low (or high) limit value.

Characters, Factory Default	Setting Item, Setting Range	
<i>A 144</i> <i>□□ 10</i>	EV1 alarm hysteresis Setting range: 0.1 to 1000.0°C (°F), DC voltage, current inputs: 1 to 10000 (*1)	
<i>A 1d4</i> <i>□□□ 0</i>	EV1 alarm delay time Setting range: 0 to 10000 seconds	
<i>A 1Lā</i> <i>noāL</i>	EV1 alarm Energized/De-energized	
	<i>noāL</i>	Energized
	<i>rEā4</i>	De-energized
<i>r4 14</i> <i>□□□ 1</i>	TS1 output step number Setting range: 1 to 9	
<i>r4 1F</i> <i>0000</i>	TS1 OFF time Setting range: 00:00 to 99:59 (*4)	
<i>r4 1a</i> <i>0000</i>	TS1 ON time Setting range: 00:00 to 99:59 (*4)	
<i>Eāā2</i> <i>□□□□</i>	Event output EV2 allocation [Event Output Allocation Table]	
	<i>□□□□</i>	No event
	<i>□□□ 1</i>	Alarm output, High limit alarm
	<i>□□□ 2</i>	Alarm output, Low limit alarm
	<i>□□□ 3</i>	Alarm output, High/Low limits alarm
	<i>□□□ 4</i>	Alarm output, High/Low limits independent alarm
	<i>□□□ 5</i>	Alarm output, High/Low limit range alarm
	<i>□□□ 6</i>	Alarm output, High/Low limit range independent alarm
	<i>□□□ 7</i>	Alarm output, Process high alarm
	<i>□□□ 8</i>	Alarm output, Process low alarm
	<i>□□□ 9</i>	Alarm output, High limit with standby alarm
	<i>□□ 10</i>	Alarm output, Low limit with standby alarm
	<i>□□ 11</i>	Alarm output, High/Low limits with standby alarm
	<i>□□ 12</i>	Alarm output, High/Low limits with standby independent alarm
	<i>□□ 14</i>	Loop break alarm output
	<i>□□ 15</i>	Time signal output
	<i>□□ 16</i>	Output during AT
	<i>□□ 17</i>	Pattern end output
	<i>□□ 18</i>	Output by communication command
	<i>□□ 19</i>	Heating/Cooling control relay contact output
<i>A2āA</i> <i>no□□</i>	EV2 alarm value 0 Enabled/Disabled	
	<i>no□□</i>	Disabled
	<i>4E4□</i>	Enabled

(*1) The placement of the decimal point follows the selection.

(*4) Time unit follows the selection from [Step time unit].

Characters, Factory Default	Setting Item, Setting Range	
R2□□ □□□0	EV2 alarm value	
	High limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	Low limit alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limits independent alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limit range alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limit range independent alarm	0 to Input span °C (°F) (*1) (*2)
	Process high alarm	Input range low limit to Input range high limit (*1) (*3)
	Process low alarm	Input range low limit to Input range high limit (*1) (*3)
	High limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	Low limit with standby alarm	-(Input span) to Input span °C (°F) (*1) (*2)
	High/Low limits with standby alarm	0 to Input span °C (°F) (*1) (*2)
	High/Low limits with standby independent alarm	0 to Input span °C (°F) (*1) (*2)
R2H□ □□□0	EV2 high limit alarm value Setting range: Same as those of EV2 alarm value	
R2H4 □□ 10	EV2 alarm hysteresis Setting range: 0.1 to 1000.0°C (°F), DC voltage, current inputs: 1 to 10000 (*1)	
R2d4 □□□0	EV2 alarm delay time Setting range: 0 to 10000 seconds	
R2L \bar{A} no \bar{n} L	EV2 alarm Energized/De-energized	
	no \bar{n} L	Energized
	rE \bar{B} 4	De-energized
r424 □□□1	TS2 output step number Setting range: 1 to 9	
r42F 0000	TS2 OFF time Setting range: 00:00 to 99:59 (*4)	
r42o 0000	TS2 ON time Setting range: 00:00 to 99:59 (*4)	
4o \bar{t} □ 1000	Sensor correction coefficient Setting range: -10.000 to 10.000	
4o□□ □□00	Sensor correction Setting range: -1000.0 to 1000.0°C (°F) DC voltage, current inputs: -10000 to 10000 (*1)	
F1Lr □□00	PV filter time constant Setting range: 0.0 to 10.0 seconds	
c \bar{n} 4L \bar{n} odR	Communication protocol	
	\bar{n} E \bar{U} r	MEWTOCOL
	\bar{n} odR	MODBUS ASCII
	\bar{n} odr	MODBUS RTU
	t \bar{n} dR	MODBUS ASCII (KT command allocation)
	t \bar{n} dr	MODBUS RTU (KT command allocation)

(*1) The placement of the decimal point follows the selection.

(*2) For DC voltage, current inputs, the input span is the same as the scaling span.

(*3) For DC voltage, current inputs, input range low (or high) limit value is the same as scaling low (or high) limit value.

(*4) Time unit follows the selection from [Step time unit].

Characters, Factory Default	Setting Item, Setting Range	
<i>cñna</i> 0000	Instrument number Setting range: 0 to 95	
<i>cñ4P</i> 0096	Communication speed	
	0096	9600 bps
	0192	19200 bps
	0384	38400 bps
<i>cñFΓ</i> 7E8n	Data bit/Parity	
	8non	8 bits/No parity
	7non	7 bits/No parity
	8E8n	8 bits/Even
	7E8n	7 bits/Even
	8odd	8 bits/Odd
	7odd	7 bits/Odd
<i>cñ4Γ</i> 0001	Stop bit	
	0001	1 bit
	0002	2 bits
<i>cñd4</i> 0010	Response delay time Setting range: 0 to 1000 ms	

(*1) The placement of the decimal point follows the selection.

Characters, Factory Default	Setting Item, Setting Range	
\bar{A}_4 $\bar{A}1n$	Step time unit	
	$\bar{A}1n$	Hours:Minutes
	$4Ec$	Minutes:Seconds
$PrEr$ $4rOP$	Power restore action	
	$4rOP$	Stops after power is restored
	$conr$	Continues (resumes) after power is restored.
	$Hold$	Suspends (on hold) after power is restored.
4_4B 0000	Program start temperature Setting range: Scaling low limit value to Scaling high limit value (*1)	
4_4L $PB0$	Program control start type	
	$PB0$	PV start
	PBr	PVR start
	$4B0$	SV start
$rEPF$ 0000	Number of repetitions Setting range: 0 to 10000 times	
$rR44$ $4B4F$	SV Rise/Fall rate start type	
	$4B4F$	SV start
	$PB4F$	PV start
$rRFU$ 0000	SV rise rate Setting range: 0 to 10000°C/min (°F/min) Thermocouple, RTD inputs with a decimal point: 0.0 to 1000.0°C/min (°F/min) DC voltage, current inputs: 0 to 10000/min	
$rRFd$ 0000	SV fall rate Setting range: 0 to 10000°C/min (°F/min) Thermocouple, RTD inputs with a decimal point: 0.0 to 1000.0°C/min (°F/min) DC voltage, current inputs: 0 to 10000/min	
$P4B$ oFF	Indication when control output OFF	
	oFF	OFF indication
	$RoFF$	No indication
	$PB0$	PV indication
	$PBARL$	PV indication + Any Alarm active
Rf_b 0020	AT bias Setting range: 0 to 50°C (0 to 100°F), or 0.0 to 50.0°C (0.0 to 100.0°F)	
Rf_t 0010	AT gain Setting range: 0.1 to 10.0 times	
$EoUF$ oFF	Output status when input errors occur	
	oFF	Output OFF
	on	Output ON
$\bar{A}AnU$ oFF	OUT/OFF key function	
	oFF	Control output OFF function
	$\bar{A}AnU$	Auto/Manual control
	$ProG$	Program control
$\bar{A}Ar4$ $AUFo$	Auto/Manual after power interruption	
	$AUFo$	Automatic control
	$\bar{A}AnU$	Manual control

(*1) The placement of the decimal point follows the selection.

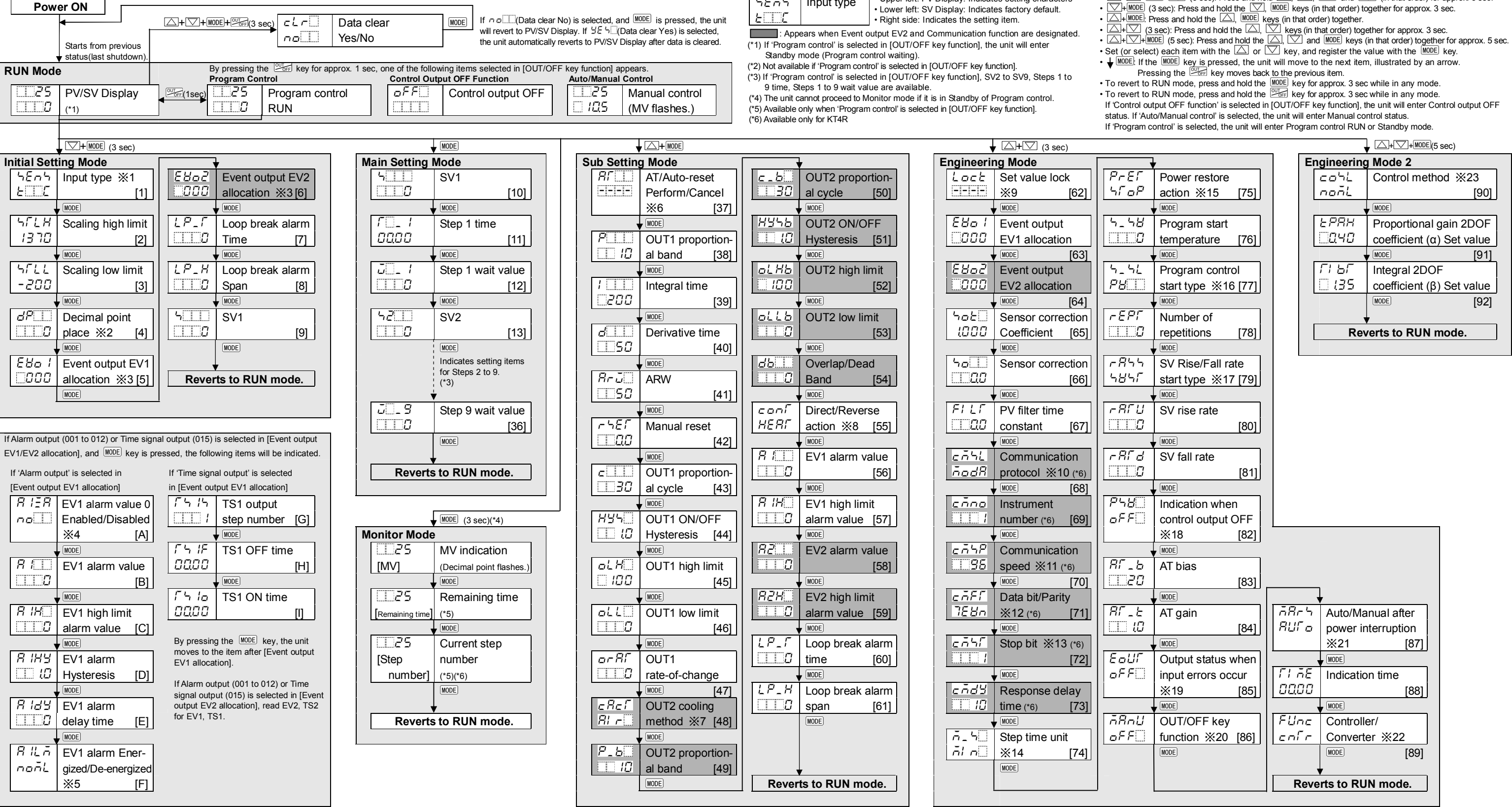
Characters, Factory Default	Setting Item, Setting Range	
<i>Fl AE</i> <i>0000</i>	Indication time Setting range: 00:00 to 60:00 (Minutes:Seconds) When set to 00:00, Displays remain ON.	
<i>FUnc</i> <i>cnfr</i>	Controller/Converter function	
	<i>cnfr</i>	Controller
	<i>cnbr</i>	Converter

13.8 Engineering Mode 2

The PV Display indicates setting characters, and the SV Display indicates factory default value.

Characters, Factory Default	Setting Item, Setting Range	
cōL nōL	Control method	
	nōL	PID control
	2bōF	2DOF PID control
tPRH □004	Proportional gain 2DOF coefficient (α) 0.00 to 1.00	
I1 bF □135	Integral 2DOF coefficient (β) 0.00 to 10.00	

14. Key Operation Flowchart



Input type ※1	r F R 32 to 3200 F	Decimal point place ※2	0 12 H/L limits standby independent	R F 4 AT on startup Perform	modr MODBUS RTU	Step time unit ※14	R o F F No indication
E K -200 to 1370 °C	4 S 32 to 3200 F	0 10 No decimal point	0 14 Loop break alarm output	r 4 E F Auto-reset Perform	e ndr MODBUS ASCII	n i n Hours:Minutes	P b PV indication
E K -200.0 to 400.0 °C	6 B 32 to 3308 F	1 00 1 digit after decimal point	0 15 Time signal output	OUT2 cooling method ※7	(KT command allocation)	4 E c Minutes:Seconds	P b a L PV + Any Alarm active
E J -200 to 1000 °C	6 E -328 to 1472 F	0 00 2 digits after decimal point	0 16 Output during AT	R i r Air cooling	modr MODBUS RTU	Power restore action ※15	Output status when input errors occur ※19
r R 0 to 1760 °C	r F T -328.0 to 752.0 F	0 00 3 digits after decimal point	0 17 Pattern end output	o i L Oil cooling	(KT command allocation)	4 f o P Stop	o F F Output OFF
4 S 0 to 1760 °C	r N -328 to 2372 F	Event output EV1/EV2 allocation ※3	0 18 Output by communication command	W a r Water cooling	Communication speed ※11	c o n Continue (resume)	o n Output ON
b B 0 to 1820 °C	P L 2 F PL-II 32 to 2534 F	0 00 2 Disabled/Enabled ※4	0 19 Heating/Cooling control relay contact output (for EV2 only)	D i r e c t / R e v e r s e a c t i o n ※8	9600 bps	H o l d Suspend (on hold)	OUT/OFF key function ※20
E E -200 to 800 °C	c C(W/Re5-26) 32 to 4199 F	0 00 1 High limit alarm	EV1/EV2 alarm value 0	H E A R Reverse action	1920 bps	P r o C Program control start type ※16	o F F Control output OFF
r T -200.0 to 400.0 °C	P t 100 -328.0 to 1562.0 F	0 00 2 Low limit alarm	Disabled/Enabled ※4	c o o L Direct action	3840 bps	P b PV start	n a u Auto/Manual control
n N -200 to 1300 °C	J P t 100 -328.0 to 932.0 F	0 00 3 H/L limits alarm	no Disabled	S e t v a l u e l o c k ※9	Data bit/Parity ※12	P r o C Program control	P r o C Program control
P L 2 C PL-II 0 to 1390 °C	P t 100 -328 to 1562 F	0 00 4 H/L limits independent	4 E 4 Enabled	U n l o c k	8 bits/No parity	4 b SV start	A u t o M a n u a l A f t e r p o w e r i n t e r r u p t i o n ※21
c C(W/Re5-26) 0 to 2315 °C	J P t 100 -328 to 932 F	0 00 5 H/L limit range alarm	EV1/EV2 alarm	L o c 1 Lock 1	7 bits/No parity	S V R i s e / F a l l r a t e s t a r t t y p e ※17	n a u M a n u a l c o n t r o l
P t 100 -200.0 to 850.0 °C	4 20 mA -2000 to 10000	0 00 6 H/L limit range independent	Enabled/De-energized ※5	L o c 2 Lock 2	8 bits/Even	7 b i t s / E v e n	C o n t r o l l e r / C o n v e r t e r f u n c t i o n ※22
J P t 100 -200.0 to 500.0 °C	0 20 mA -2000 to 10000	0 00 7 Process high alarm	no Energized	L o c 3 Lock 3	7 b i t s / E v e n	4 b SV start	c n r C o n t r o l l e r
P t 100 -200 to 850 °C	0 1 V -2000 to 10000	0 00 8 Process low alarm	r 4 De-energized	L o c 4 Lock 4	8 b i t s / O d d	P b PV start	c n r C o n v e r t e r
J P t 100 -200 to 500 °C	0 5 V -2000 to 10000	0 00 9 High limit with standby	AT/Auto-reset Perform/Cancel ※6	L o c 5 Lock 5	7 b i t s / O d d	I n d i c a t i o n w h e n c o n t r o l o u t p u t O F F ※18	n o n U s u a l P I D
E K -328 to 2498 °C	1 to 5 V -2000 to 10000	0 10 Low limit with standby	AT/Auto-reset Cancel	C o m m u n i c a t i o n p r o t o c o l ※10	S t o p b i t ※13	o F F O F F i n d i c a t i o n	2 b o F 2 D O F P I D
E F K -328.0 to 752.0 °C	0 10 V -2000 to 10000	0 11 H/L limits with standby	R F AT Perform	n e u M E W T O C O L	1 b i t		
J K -328 to 1832 °C				modr MODBUS ASCII	2 b i t s		

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