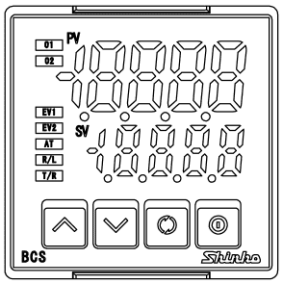
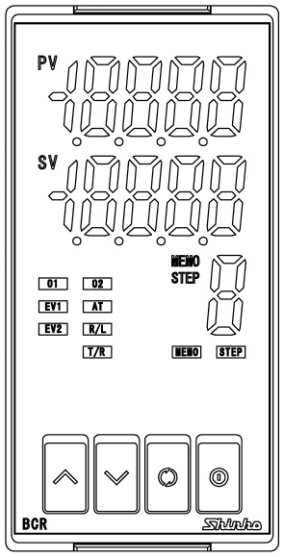
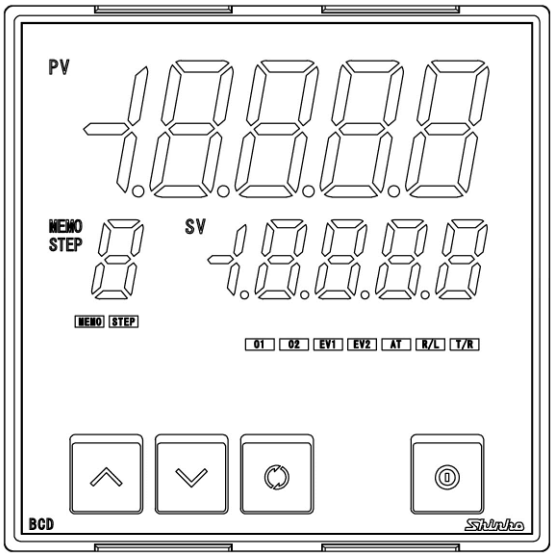
DIGITAL INDICATING CONTROLLER

BCx2

INSTRUCTION MANUAL







Shinko

Preface

Thank you for purchasing our digital indicating controller BCx2. This manual contains instructions for the mounting, functions, operations and notes when operating the BCx2. 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													
Number, ℃/℉	-1	0	1	2	3	4	5	6	7	8	9	℃	℉
Indication													
Alphabet	A	B	C	D	E	F	G	H	I	J	K	L	M
Indication													
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 sales department.
- 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.
- Shinko Technos 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 read these precautions before using our products.)**

The safety precautions are classified into categories: “Warning” and “Caution”. Depending on circumstances, procedures indicated by ⚠ Caution may cause serious results, so be sure to follow the directions for usage.

⚠ 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

- To prevent an electrical shock or fire, only Shinko or other qualified service personnel may handle the inner assembly.
- To prevent an electrical shock, fire or damage to the instrument, parts replacement may only be undertaken by Shinko or other qualified service personnel.

⚠ Safety Precautions

- To ensure safe and correct use, thoroughly read and understand this manual before using this instrument.
- This instrument is intended to be used for industrial machinery, machine tools and measuring equipment. Verify correct usage after purpose-of-use consultation with our agency or main office. (Never use this instrument for medical purposes with which human lives are involved.)
- External protection devices such as protective equipment against excessive temperature rise, etc. must be installed, as malfunction of this product could result in serious damage to the system or injury to personnel. Proper periodic maintenance is also required.
- This instrument must be used under the conditions and environment described in this manual. Shinko Technos Co., Ltd. does not accept liability for any injury, loss of life or damage occurring due to the instrument being used under conditions not otherwise stated in this manual.

Caution with respect to Export Trade Control Ordinance

To avoid this instrument from being used as a component in, or as being utilized in the manufacture of weapons of mass destruction (i.e. military applications, military equipment, etc.), please investigate the end users and the final use of this instrument. In the case of resale, ensure that this instrument is not illegally exported.

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℃ (14 to 131℉) 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℃ (131℉) if mounted through the face of a control panel, otherwise the life of electronic components (especially electrolytic capacitors) may be shortened.

Note • 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.
- Do not pull or bend the lead wire on the terminal side when wiring or after wiring, as it could cause malfunction.
- When using a terminal cover for the BCS2, 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 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
BCS2	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
BCR2, BCD2	㉑: (+) side of 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC ㉒: (+) 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 electrical 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 electrical 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.

Contents

1. Model

1.1 Model

B C□2 □ □ □- □ □							
Size	BCS2						48 x 48 x 68 mm (W x H x D) (Depth of control panel interior: 60)
	BCR2						48 x 96 x 68 mm (W x H x D) (Depth of control panel interior: 60)
	BCD2						96 x 96 x 68 mm (W x H x D) (Depth of control panel interior: 60)
Control output OUT1		R					Relay contact: 1a
		S					Non-contact voltage (for SSR drive) 12 V DC±15%
		A					Direct current: 4 to 20 mA DC
Power supply voltage			0				100 to 240 V AC (Standard)
			1				24 V AC/DC
Input				0			Multi-range (*1)
Option 1 (*2) (Choose only one option.)					0		No Option 1 needed.
					1		Event output EV2 (*3)
					2		Heating/Cooling control output OUT2, Non-contact voltage
					3		Heating/Cooling control output OUT2, Direct current
					4		Insulated power output

Option 2 (*2) (Choose only one option.)			
	0		No Option 2 needed.
	1	C5W (20A)	Event input (2 points) (*4) + Serial communication + Heater burnout alarm (20A) (*5)
	2	C5W (100A)	Event input (2 points) (*4) + Serial communication + Heater burnout alarm (100A) (*5)
	3	EIW (20A)	Event input (2 points) + Heater burnout alarm (20A) (*5)
	4	EIW (100A)	Event input (2 points) + Heater burnout alarm (100A) (*5)
	5	EIT	Event input (2 points) (*6)+ External setting input + Transmission output
	6	C5	Serial communication
	7	W (20A)	Heater burnout alarm (20 A) (*5)
	8	W (100A)	Heater burnout alarm (100 A) (*5)
	9	EI	Event input (2 points)

(*1) Thermocouple, RTD, Direct current and DC voltage can be selected by keypad.

(*2) Only one option can be selected from Option 1 and Option 2 respectively.

(*3) Event output EV1 is standard.

The following outputs can be selected in [Event output EV1/EV2 allocation] by keypad:

Alarm output (12 alarm types and No alarm action), Heater burnout alarm output, Loop break alarm output, Time signal output, Output during AT, Pattern end output, Output by communication command, Heating/Cooling control output OUT2 (for EV2 option only).

For Event output EV1/EV2, Heater burnout alarm output and Output by communication command are available when C5W, EIW, C5 or W option is ordered.

(*4) For the BCS2, Event input (2 points) is not available.

(*5) For Direct current output type, Heater burnout alarm does not work.

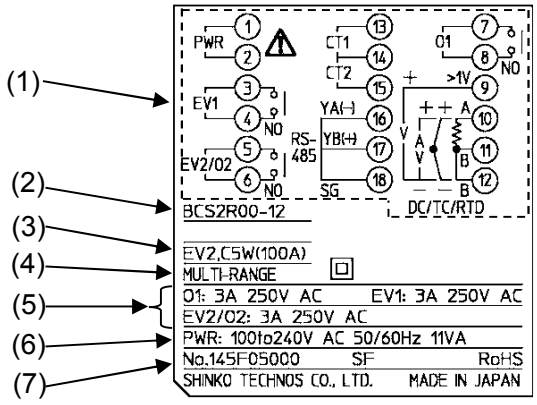
(*6) For the BCS2, 1 point of Event input is available.

1.2 How to Read the Model Label

The model label is attached to the right side of the case.

BCS2

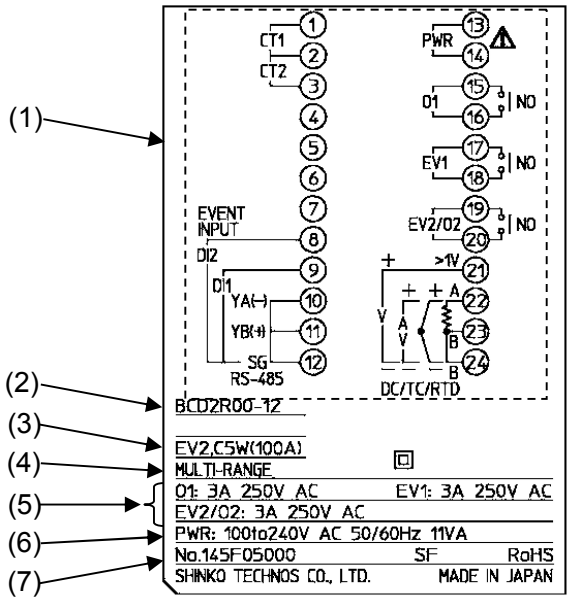
(e.g.) BCS2R00-12



(Fig. 1.2-1)

BCR2, BCD2

(e.g.) BCD2R00-12



(Fig. 1.2-2)

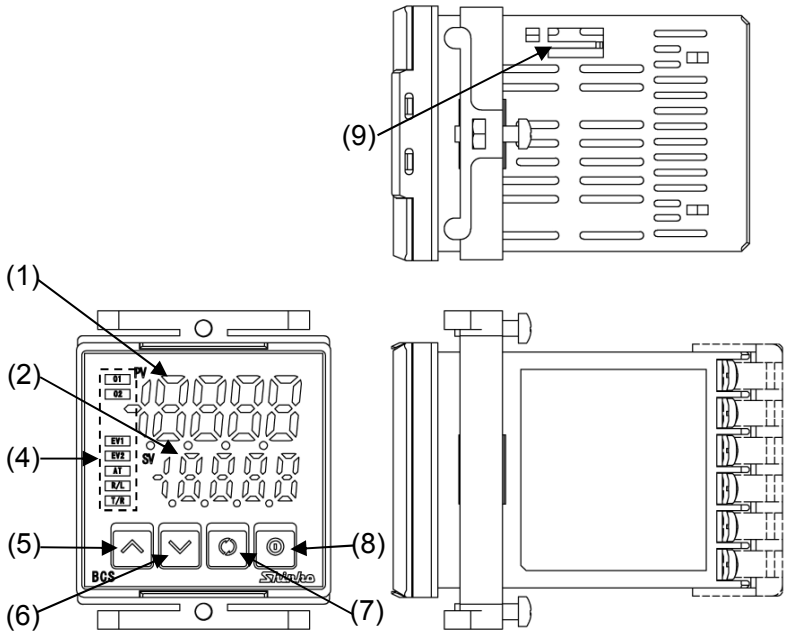
No.	Description	Example
(1)	Terminal arrangement	BCS2R00-12, BCD2R00-12 (*1)
(2)	Model	BCS2R00-12, BCD2R00-12
(3)	Option	EV2 (Event output EV2) C5W(100A) [Serial communication + Heater burnout alarm (100 A)] (*2)
(4)	Input	MULTI-RANGE (Multi-range input)
(5)	Control output, Event output	O1: 3 A 250 V AC (Control output OUT1) EV1: 3 A 250 V AC (Event output EV1) EV2: 3 A 250 V AC (Event output EV2)
(6)	Power supply voltage, Power consumption	100 to 240 V AC 50/60 Hz, 11 VA
(7)	Serial number	No. 145F05000

(*1) Terminal arrangement diagram differs depending on the model.

(*2) For Heater burnout alarm output (C5W, EIW, W options), CT rated current is entered in bracket ( ).

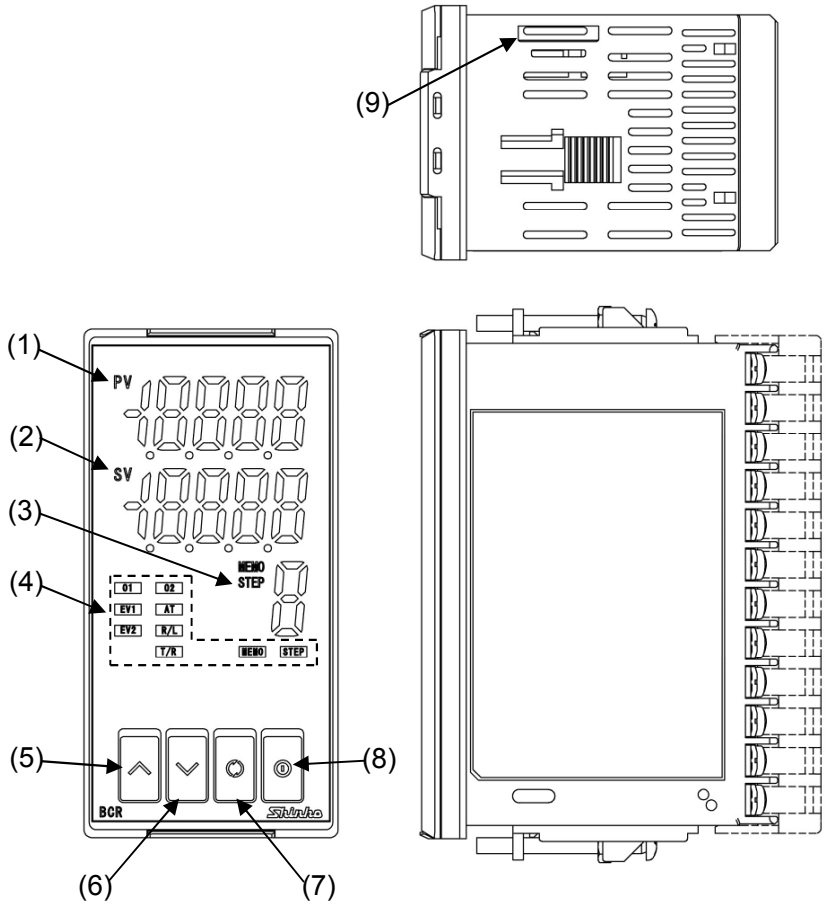
2. Names and Functions of Sections

BCS2



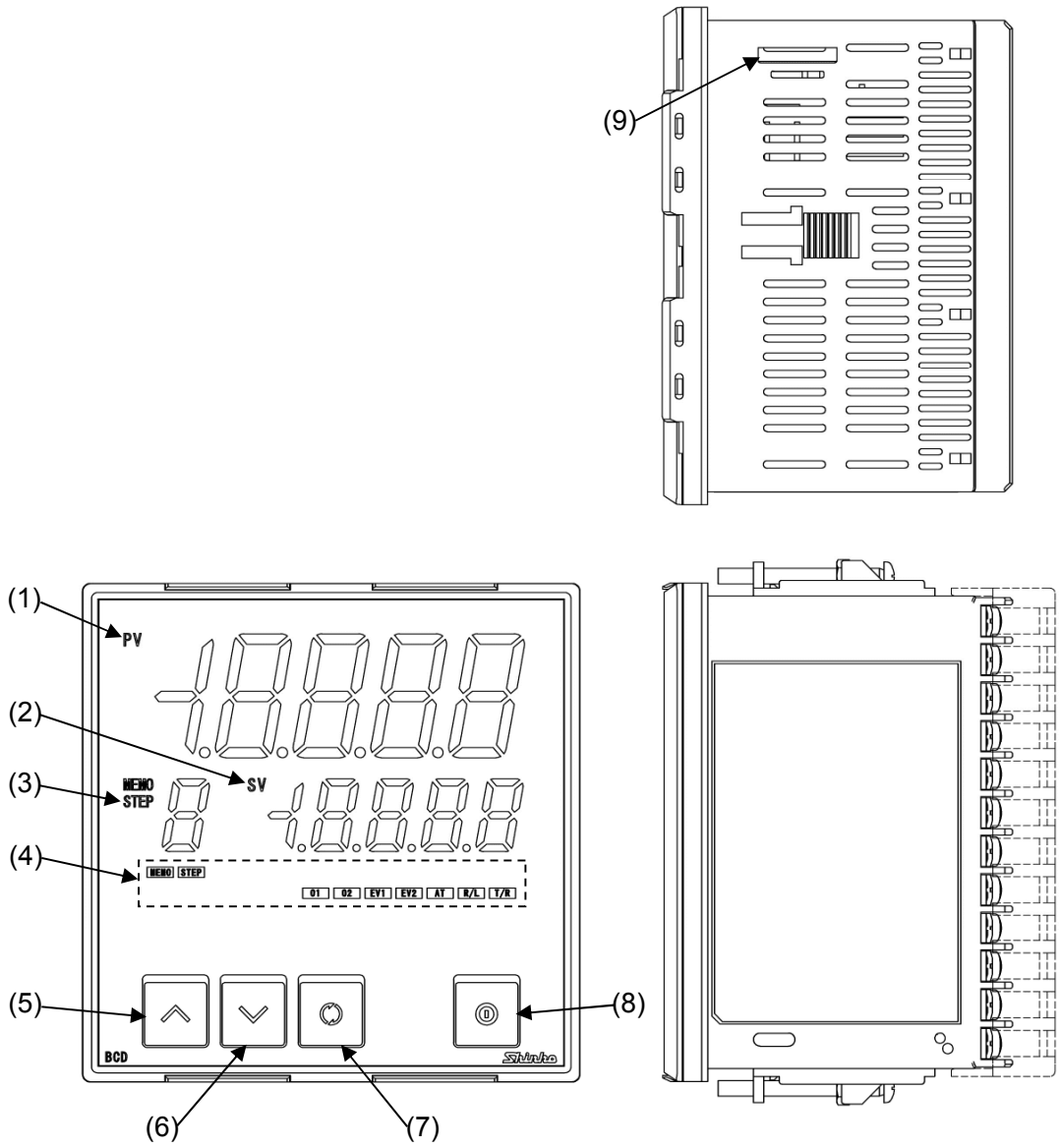
(Fig. 2-1)

BCR2



(Fig. 2-2)

BCD2



(Fig. 2-3)

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 as follows.
(3)	**MEMO/STEP Display**	Indicates Set value memory number (Fixed value control) or Step number (Program control). (For BCR2, BCD2)

Model	Indicated Contents
BCS2	Indicates MV, Remaining time (Program control), Step number (Program control) or Set value memory number (Fixed value control).
BCR2, BCD2	Indicates MV or Remaining time (Program control).

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 (EV2, DS options) is ON. For direct current output type (DA option), flashes corresponding to the MV in 125 ms cycles.
	EV1 (Red)	Lit when Event output 1 is ON.
	EV2 (Red)	Lit when Event output 2 (EV2 option) is ON. Unlit if □0 19 (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.
	R/L (Yellow)	Lit during Remote action, selected in [Remote/Local] (EIT option).
	T/R (Yellow)	Lit during Serial communication (C5W, C5 options) TX (transmitting) output.
	MEMO (Yellow)	Lit when Set value memory number (Fixed value control) is indicated. (For BCR2, BCD2)
	STEP (Green)	Lit when a step number (Program control) is indicated. (For BCR2, BCD2)

Key

No.	Name	Description
(5)	**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)
(6)	**DOWN key**	Decreases the numeric value.
(7)	**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.
(8)	**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/Stops the Program control.

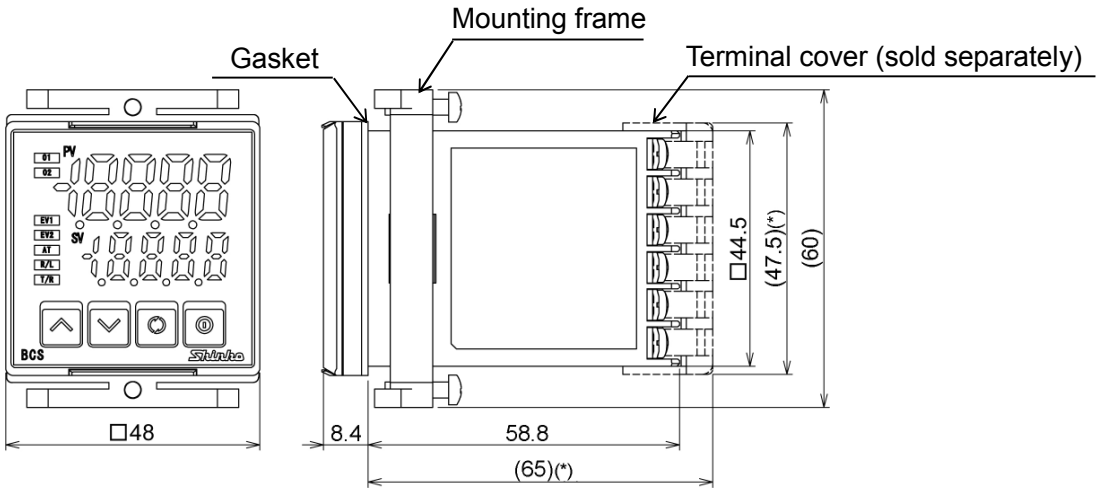
Console Connector

No.	Name	Description
(9)	**Console connector**	By connecting the tool cable (CMD-001, sold separately), the following operations can be conducted from an external computer using the Console software SWC-BCx01M. • Reading and setting of SV, PID and various set values • Reading of PV and action status • Function change

3. Mounting to the Control Panel

3.1 External Dimensions (Scale: mm)

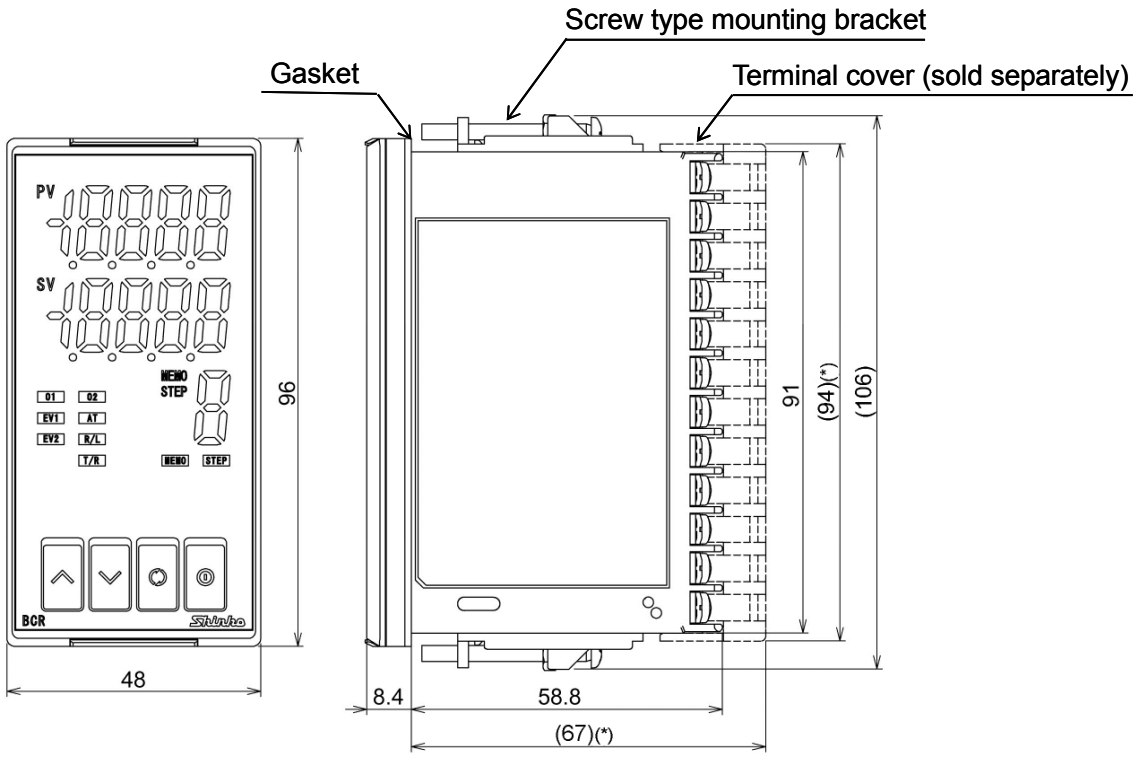
BCS2



(*) When the terminal cover is used.

(Fig. 3.1-1)

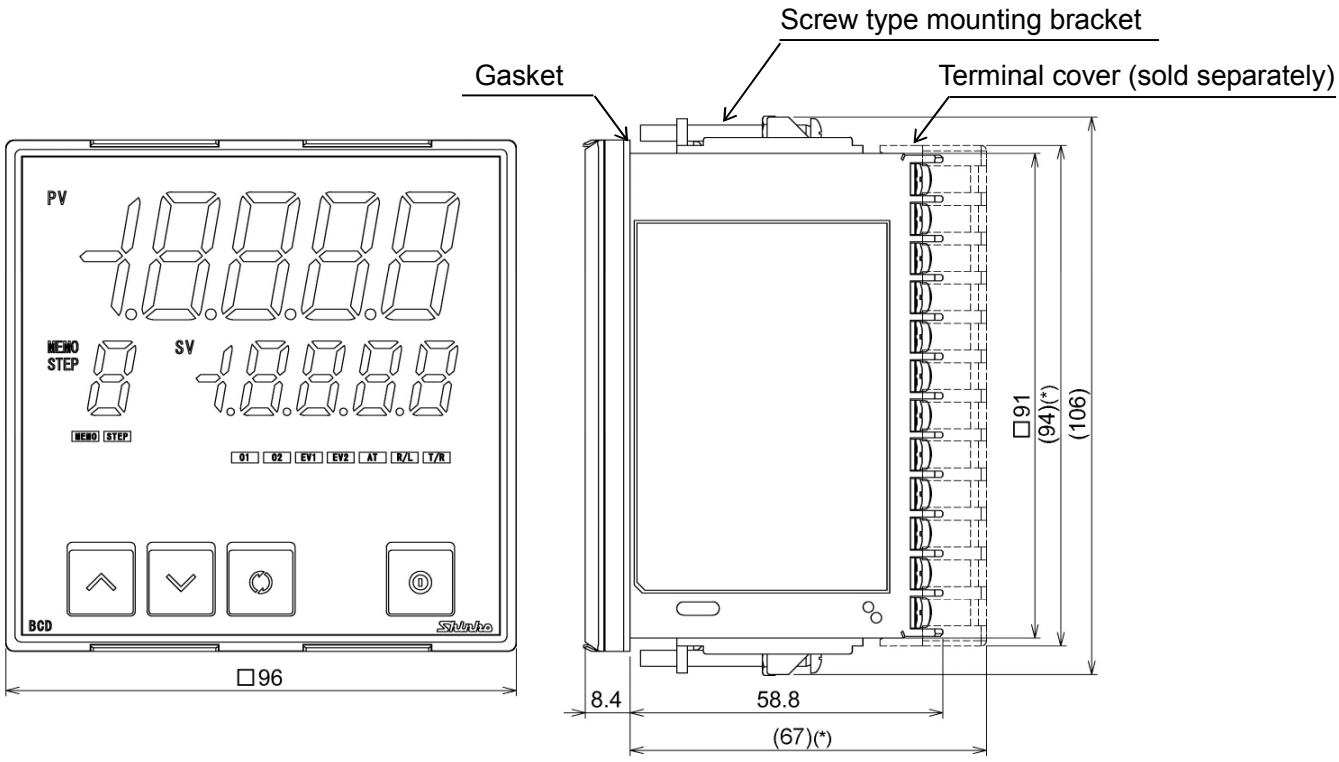
BCR2



(*) When the terminal cover is used.

(Fig. 3.1-2)

BCD2



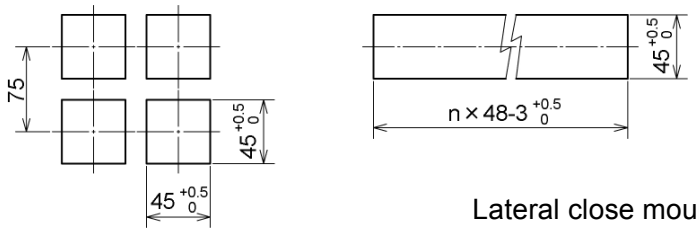
(*) When terminal covers are used.

(Fig. 3.1-3)

3.2 Panel Cutout (Scale: mm)

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

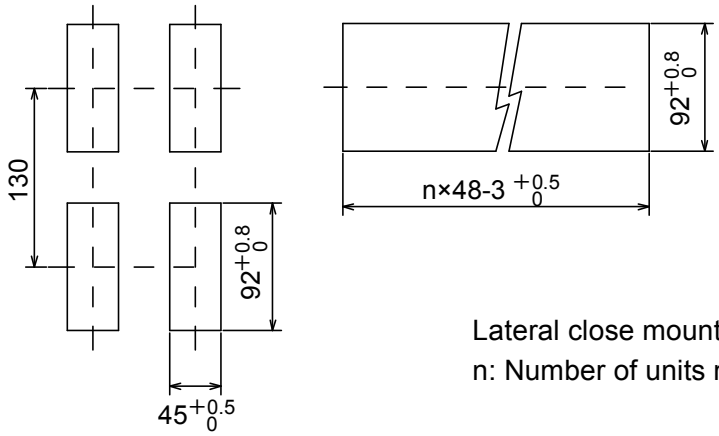
BCS2



Lateral close mounting
n: Number of units mounted

(Fig. 3.2-1)

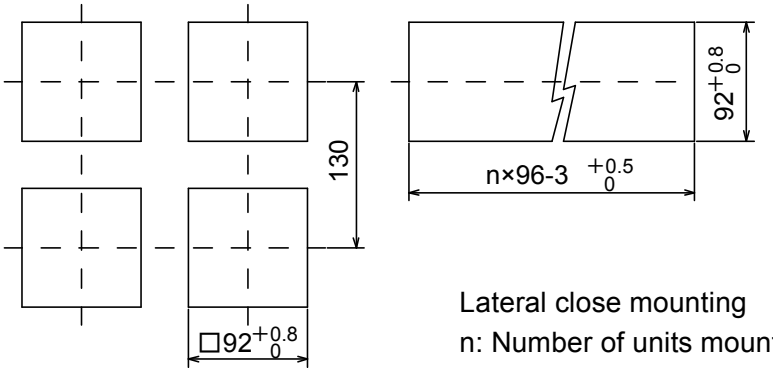
BCR2



Lateral close mounting
n: Number of units mounted

(Fig. 3.2-2)

BCD2

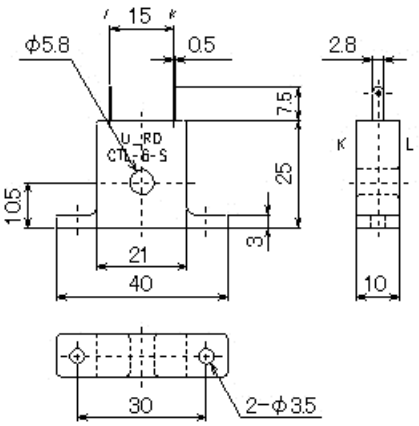


Lateral close mounting
n: Number of units mounted

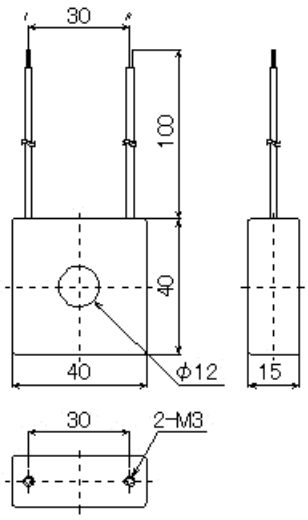
(Fig. 3.2-3)

3.3 CT (Current Transformer) External Dimensions (Scale: mm)

CTL-6S (for 20 A)



CTL-12-S36-10L1U (for 100 A)



(Fig. 3.3-1)

3.4 Mounting to, and Removal from, the Control Panel

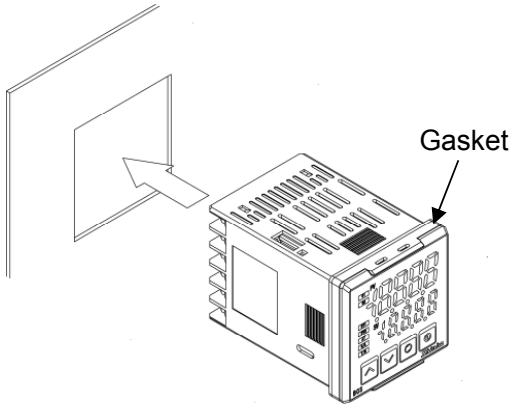
> **⚠ Caution**
>
> **As the mounting frame of the BCS2 is made of resin, do not use excessive force while tightening screws, or the mounting frame could be damaged.**
> **Tighten screws with one rotation upon the screw tips touching the panel.**
> **The torque is 0.05 to 0.06 N•m.**
> **For the BCR2, BCD2, the torque should be 0.1 N•m.**

3.4.1 How to Mount the Unit

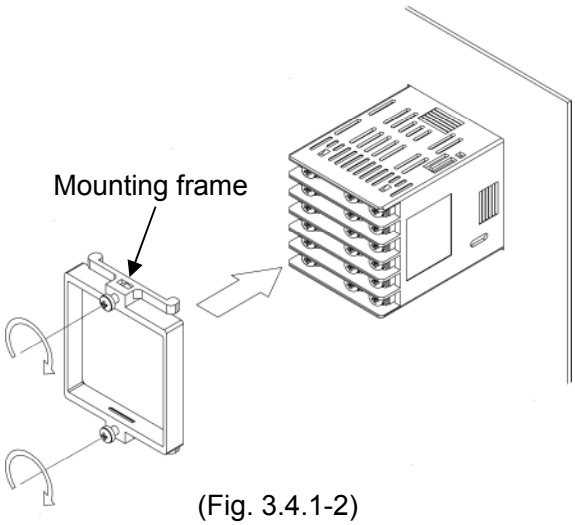
BCS2

Mount the controller vertically to the flat, rigid panel to ensure it adheres to the Drip-proof/Dust-proof specification (IP66).
If the lateral close mounting is used for the controller, IP66 specification (Drip-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. 3.4.1-1)
If the Drip-proof/Dust-proof specification (IP66) is not necessary, the gasket may be removed (please keep in mind the warranty is void if gasket is removed).
(2) Insert the mounting frame until it comes into contact with the panel, and fasten with screws.
Tighten screws with one rotation upon the screw tips touching the panel. (Fig. 3.4.1-2)
The torque is 0.05 to 0.06 N•m.



(Fig. 3.4.1-1)



(Fig. 3.4.1-2)

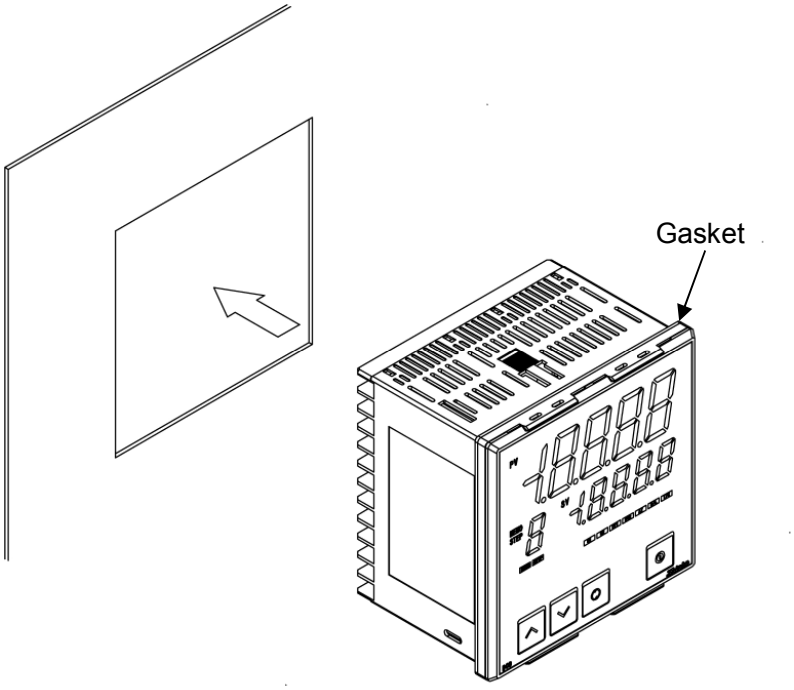
BCR2, BCD2

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

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

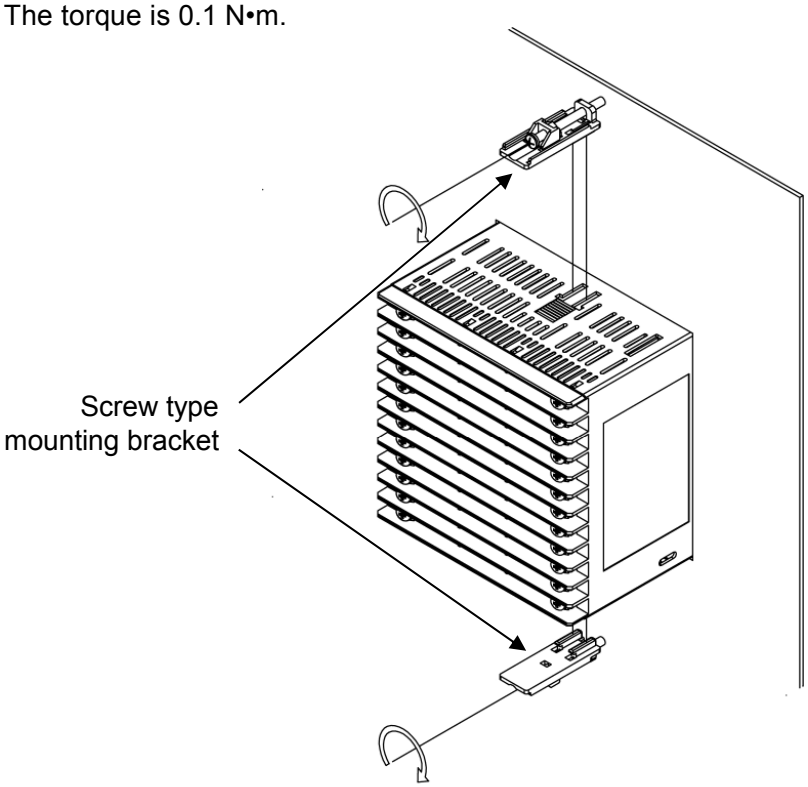
Mountable panel thickness: 1 to 7 mm

(1) Insert the controller from the front side of the control panel. (Fig. 3.4.1-3)
If the Drip-proof/Dust-proof specification (IP66) is not necessary, the gasket may be removed. (Please keep in mind the warranty is void if gasket is removed).



(Fig. 3.4.1-3)

(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 0.1 N•m.

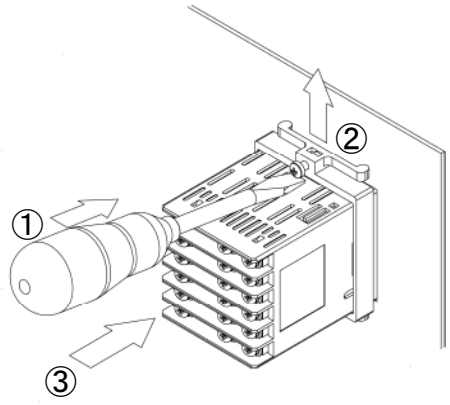


(Fig. 3.4.1-4)

3.4.2 How to Remove the Mounting Frame and Unit

BCS2 (Fig. 3.4.2-1)

(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. 3.4.2-1)

BCR2, BCD2

(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 electrical shock.

⚠ 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.
- Do not pull or bend the lead wire on the terminal side when wiring or after wiring, as it could cause malfunction.
- When using a terminal cover for the BCS2, 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 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.

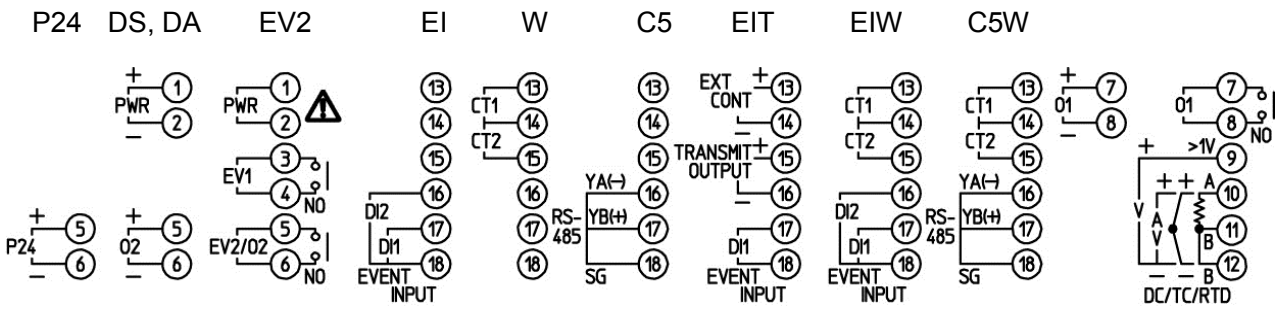
Model	Terminal Number
BCS2	⑨: (+) side of 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC ⑩: (+) side of 0 to 1 V DC
BCR2, BCD2	㉑: (+) side of 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC ㉒: (+) side of 0 to 1 V DC

- 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.

4.1 Terminal Arrangement

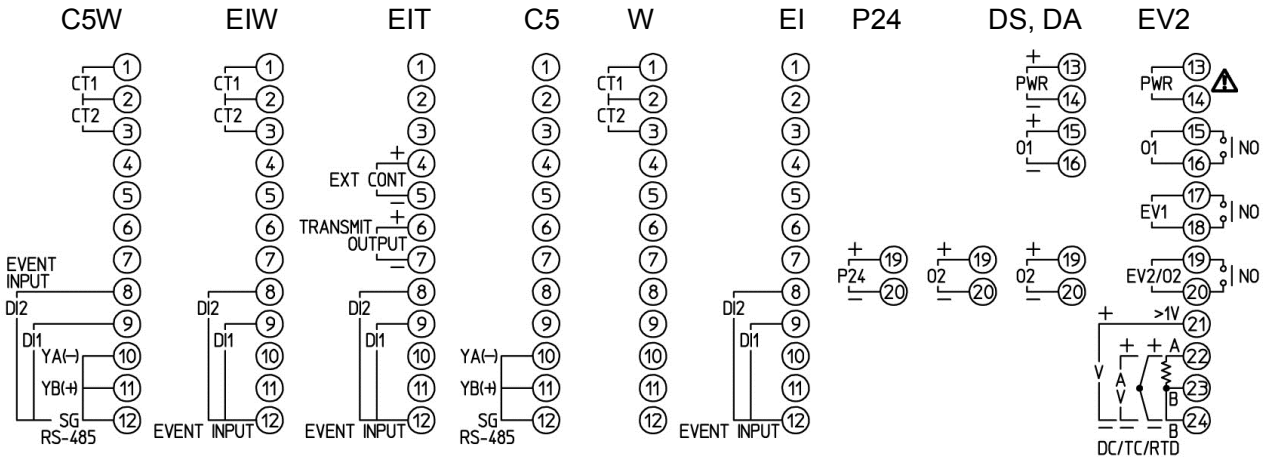
Terminal arrangement of the BCS2, BCR2, BCD2 differs depending on the options as follows.

BCS2



(Fig. 4.1-1)

BCR2, BCD2



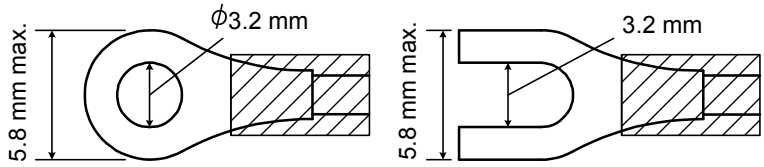
(Fig. 4.1-2)

<table>
<tr><th>Terminal</th><th>Description</th></tr>
<tr><td>PWR
(Power supply)</td><td>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).</td></tr>
<tr><td>EV1</td><td>Event output EV1</td></tr>
<tr><td>EV2</td><td>Event output EV2 (EV2 option)</td></tr>
<tr><td>O2</td><td>Control output OUT2 (EV2, DS, DA options)</td></tr>
<tr><td>P24</td><td>24 V DC insulated power output (P24 option)</td></tr>
<tr><td>O1</td><td>Control output OUT1</td></tr>
<tr><td>RTD</td><td>RTD input</td></tr>
<tr><td>TC</td><td>Thermocouple input</td></tr>
<tr><td>DC</td><td>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.
<table>
<tr><th>Model</th><th>Terminal Number</th></tr>
<tr><td>BCS2</td><td>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</td></tr>
<tr><td>BCR2, BCD2</td><td>㉑: + side of 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
㉒: + side of 0 to 1 V DC</td></tr>
</table></td></tr>
<tr><td>CT1</td><td>CT input 1 (C5W, EIW, W options)</td></tr>
<tr><td>CT2</td><td>CT input 2 (C5W, EIW, W options)</td></tr>
<tr><td>RS-485</td><td>Serial communication RS-485 (C5W, C5 options)</td></tr>
<tr><td>EVENT INPUT</td><td>Event input DI1 (BCS2: EIW, EIT, EI options,
BCR2/BCD2: C5W, EIW, EIT, EI options)
Event input DI2 (BCS2: EIW, EI options,
BCR2/BCD2: C5W, EIW, EIT, EI options)</td></tr>
<tr><td>EXT CONT</td><td>External setting input (EIT option)</td></tr>
<tr><td>TRANSMIT OUTPUT</td><td>Transmission output (EIT option)</td></tr>
</table>

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	

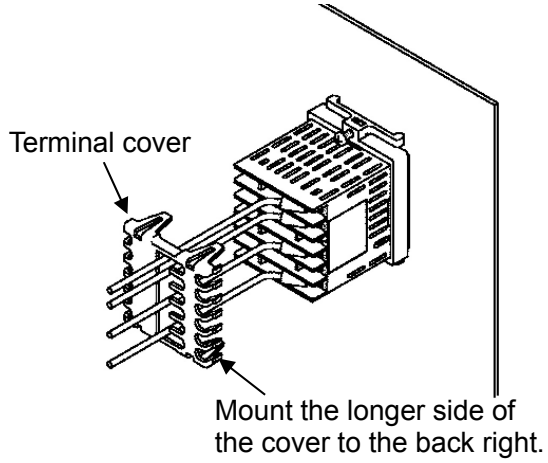


(Fig. 4.2-1)

4.3 Terminal Cover

BCS2

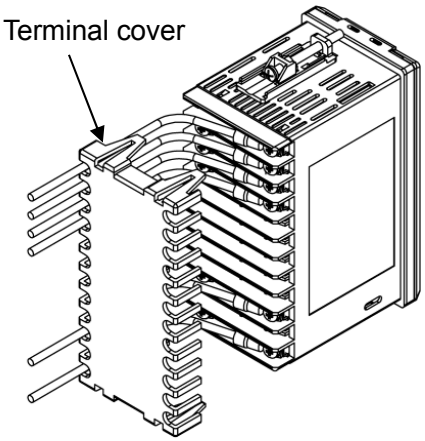
When using a terminal cover (sold separately), make sure the longer side is on the back right side of the case. Pass the wires from terminals 7 to 12 into the holes of the terminal cover.



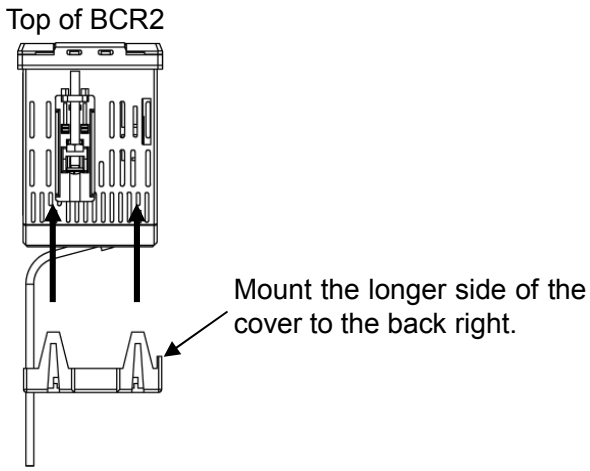
(Fig. 4.3-1)

BCR2

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.



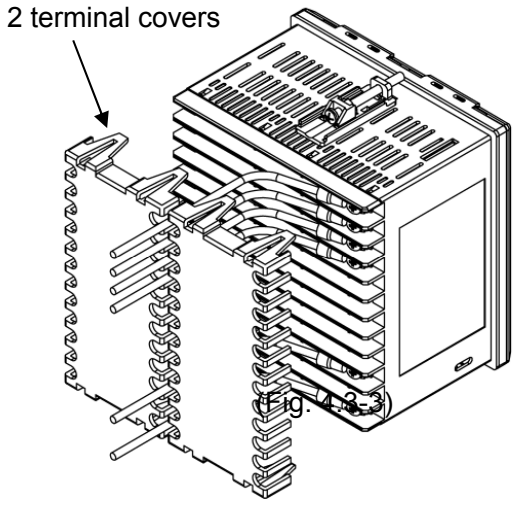
(Fig. 4.3-2)



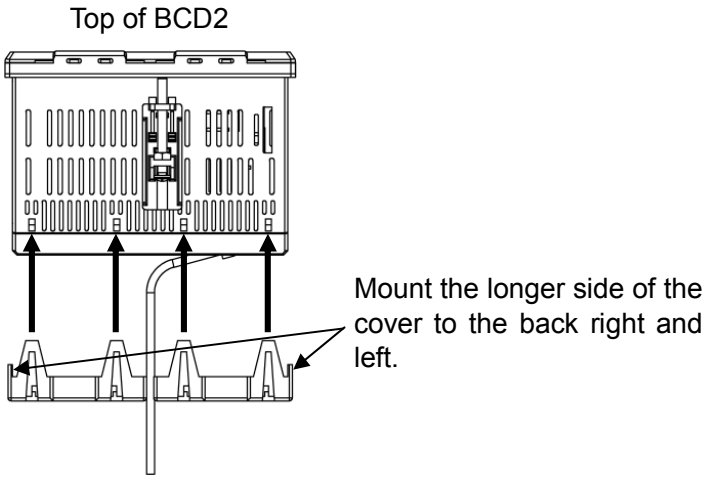
(Fig. 4.3-3)

BCD2

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)

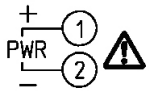
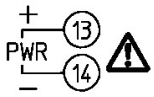
4.4 Wiring

For the terminal arrangement, refer to Section '4.1 Terminal Arrangement' (p.20).

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).

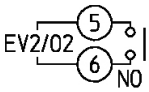
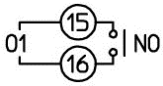
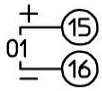
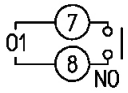
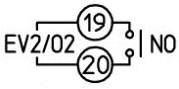
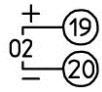
BCS2	BCR2, BCD2
	

4.4.2 Control Output OUT1, OUT2

When EV2, DS or DA option is ordered, control output OUT2 is available.

Specifications of Control output OUT1, OUT2 are shown below.

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

BCS2		BCR2, BCD2	
Relay contact	**Non-contact voltage, Direct current**	**Relay contact**	**Non-contact voltage, Direct current**
			
			

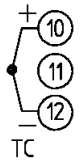
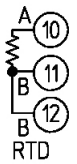
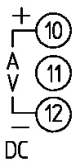
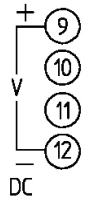
Number of Shinko SSR units when connected in parallel (for Non-contact voltage output):

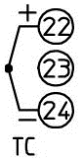
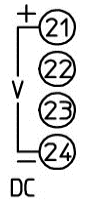
- SA-400 series: 5 units
- SA-500 series: 2 units

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.

BCS2			
Thermocouple	**RTD**	**Direct current, DC voltage (0 to 1 V)**	**DC voltage (0 to 5 V, 1 to 5 V, 0 to 10 V)**
			

BCR2, BCD2			
Thermocouple	**RTD**	**Direct current, DC voltage (0 to 1 V)**	**DC voltage (0 to 5 V, 1 to 5 V, 0 to 10 V)**
			

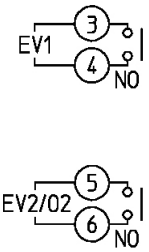
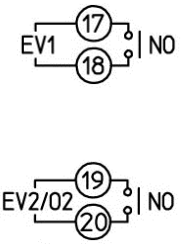
4.4.4 Event Output 1, Event Output 2

Event output EV1 is a standard feature.

If EV2 option is ordered, Event output EV2 is available.

Specifications of Event output 1 and Event output 2 are shown below.

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

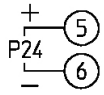
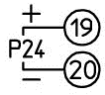
BCS2	BCR2, BCD2
	

4.4.5 Insulated Power Output

If P24 option is ordered, the Insulated power output is available.

Specifications of Insulated power output are shown below.

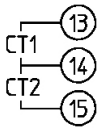
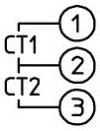
Output voltage	24±3 V DC (at load current 30 mA DC)
Ripple voltage	Within 200 mV DC (at load current 30 mA DC)
Max load current	30 mA DC

BCS2	BCR2, BCD2
	

4.4.6 CT Input

CT input is available when Heater burnout alarm (C5W, EIW, W options) is ordered.

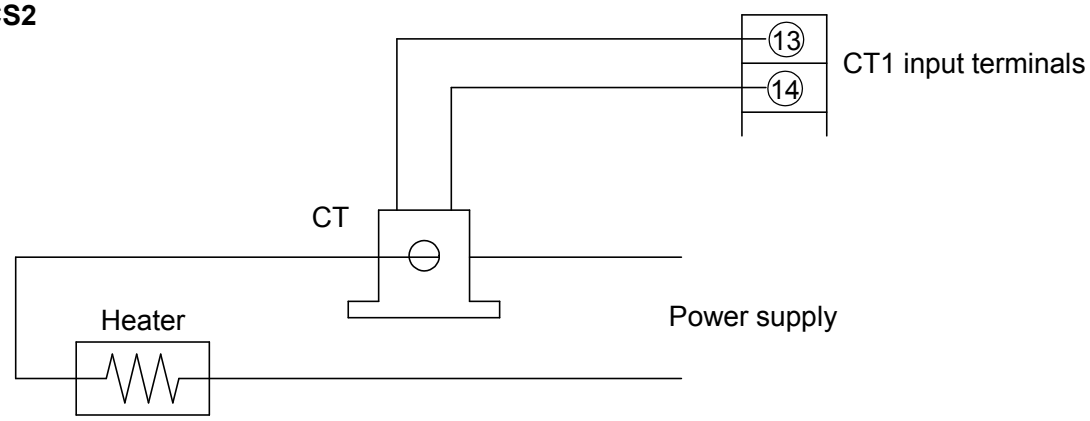
Cannot be used for detecting heater current under phase control.

BCS2	BCR2, BCD2
	

Use the CT (current transformer) provided, and pass one lead wire of the heater circuit into the hole of the CT. (Fig. 4.4.6-1)

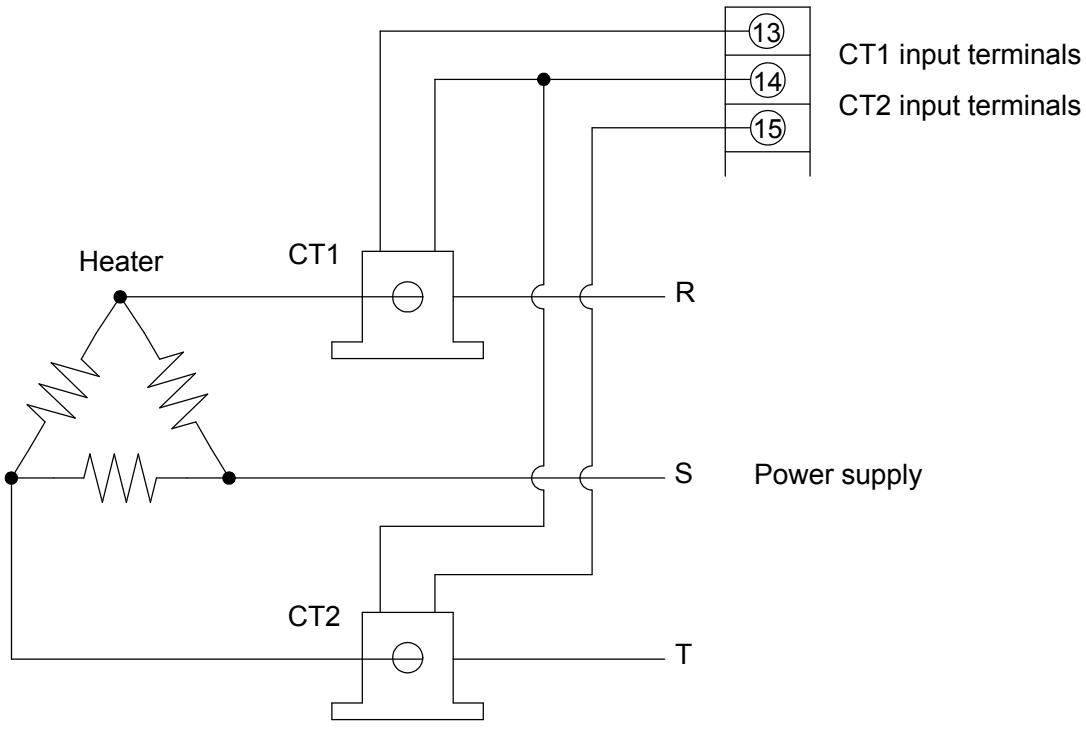
When wiring, keep the CT wire away from AC sources or load wires to avoid the external interference.

BCS2

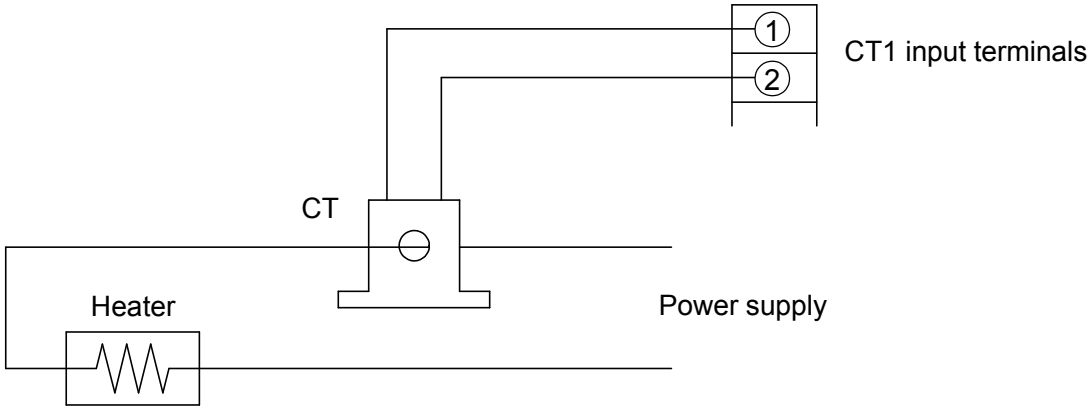


(Fig. 4.4.6-1)

If using 3-phase, pass any 2 lead wires of R, S, T into the CT, and connect them to CT1 (⑬-⑭) and CT2 (⑭-⑮) terminals. (Fig. 4.4.6-2)

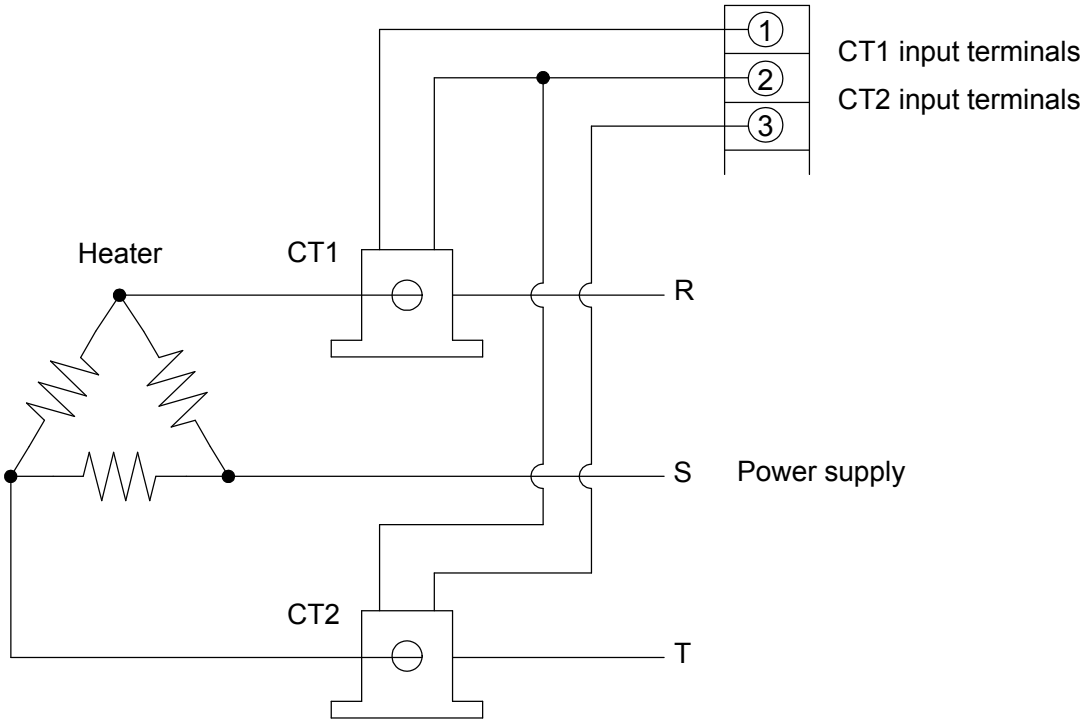


(Fig. 4.4.6-2)



(Fig. 4.4.6-3)

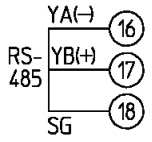
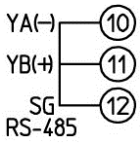
If using 3-phase, pass any 2 lead wires of R, S, T into the CT, and connect them to CT1 (①-②) and CT2 (②-③) terminals. (Fig. 4.4.6-4)



(Fig. 4.4.6-4)

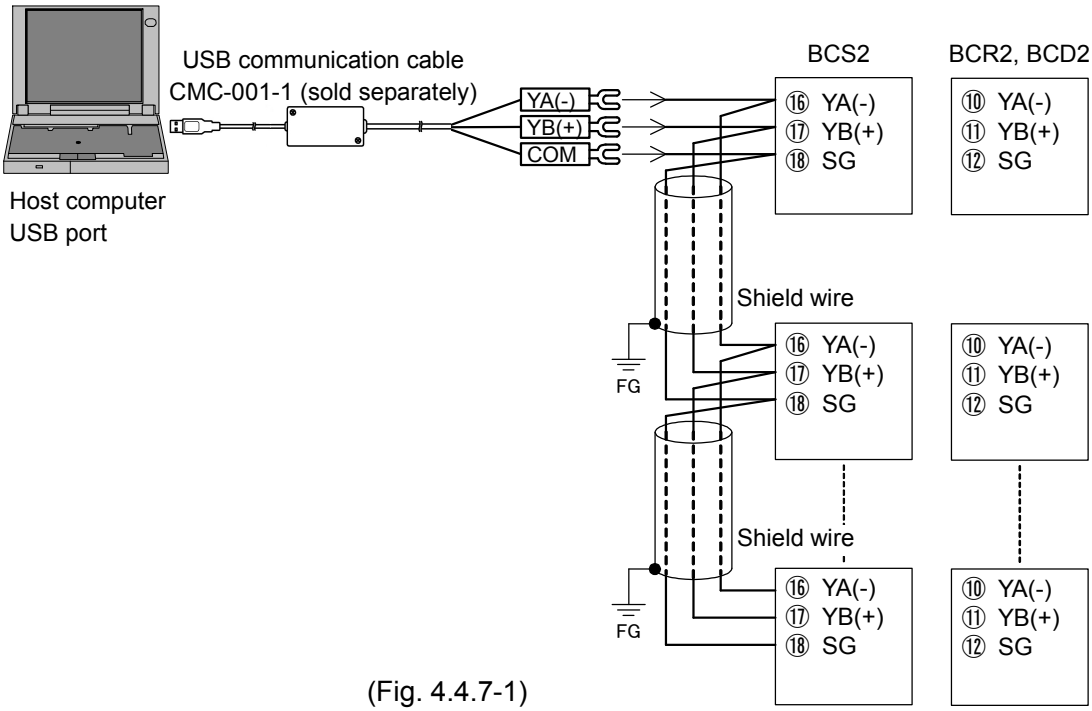
4.4.7 Serial Communication

If the C5W or C5 option is ordered, Serial communication is available.

BCS2	BCR2, BCD2
	

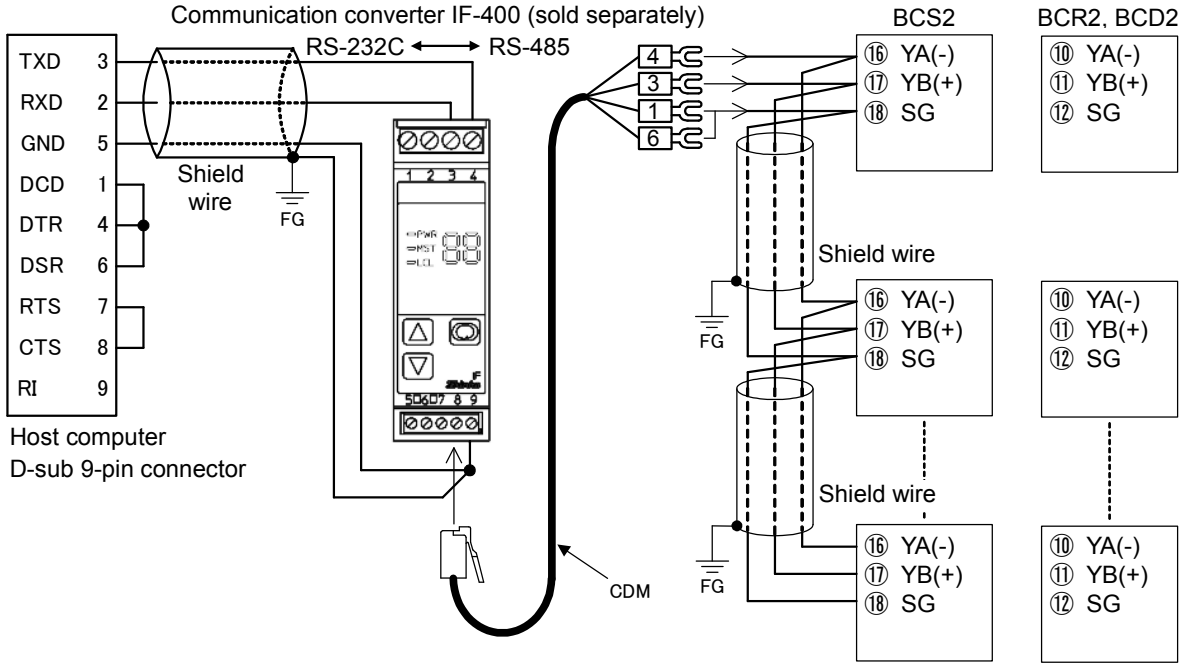
(1) Serial Communication

• When using USB communication cable CMC-001-1 (sold separately)



(Fig. 4.4.7-1)

• When using communication converter IF-400 (sold separately)



(Fig. 4.4.7-2)

(2) Set value digital transmission

By connecting to Shinko programmable controllers [PC-900 or PCD-33A with the SVTC (Set value digital transmission) option], digital SV via the SVTC command can be received from programmable controllers.

Wiring

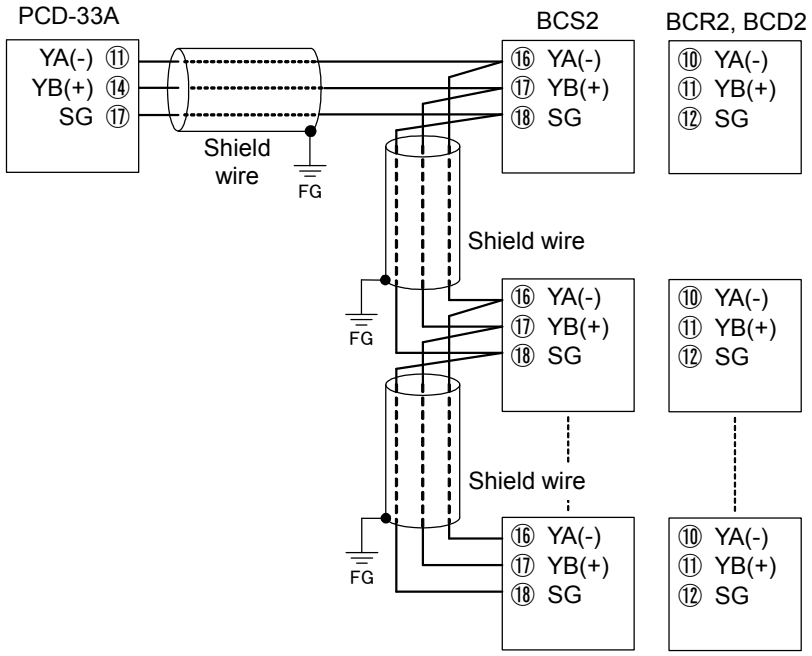
For the PC-900, connect YA (-) to YA (-), YB (+) to YB (+), COM (PC-900) to SG (BCx2) terminal respectively.

For the PCD-33A, connect YA (-) to YA (-), YB (+) to YB (+), SG to SG terminal respectively.

Up to 31 units of the BCS2 or BCR2 or BCD2 can be connected.

The following shows a connection example of PCD-33A and BCS2, BCR2, BCD2. (Fig. 4.4.7-3)

Wiring example of PCD-33A and BCx2



(Fig. 4.4.7-3)

Shield wire

Connect only one end of the shield to the FG terminal to avoid a ground loop. If both ends of the shield wire are connected to the FG terminal, the circuit will be closed, resulting in a ground loop. This may cause noise. Be sure to ground the FG terminal.

Recommended cable: OTSC-VB 2PX0.5SQ (made by Onamba Co., Ltd.) or equivalent (Use a twisted pair cable.)

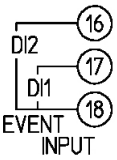
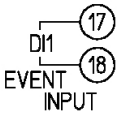
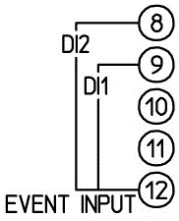
4.4.8 Event Input

Event Input DI1 is available for the BCS2 with Event input (EIW, EIT, EI options).
Event Input DI1 is available for the BCR2, BCD2 with Serial communication (C5W option) or Event input (EIW, EIT, EI options).

Event Input DI2 is available for the BCS2 with Event input (EIW, EI options).
Event Input DI2 is available for the BCR2, BCD2 with Serial communication (C5W option) or Event input (EIW, EIT, EI options).

Specifications of Event input are shown below.

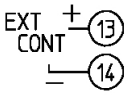
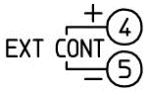
Circuit current when closed	Approx. 16 mA

BCS2		BCR2, BCD2
EIW (20A), EIW (100A), EI	**EIT**	**EIW (20A), EIW (100A), EIT, EI**
		

4.4.9 External Setting Input

If the EIT option is ordered, External setting input is available.
Specifications of External setting input are shown below.

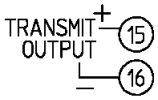
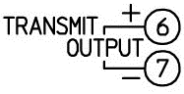
Setting signal	Direct current 4 to 20 mA DC
Allowable input	50 mA DC max.
Input impedance	50 Ω max.
Input sampling period	125 ms

BCS2	BCR2, BCD2
	

4.4.10 Transmission Output

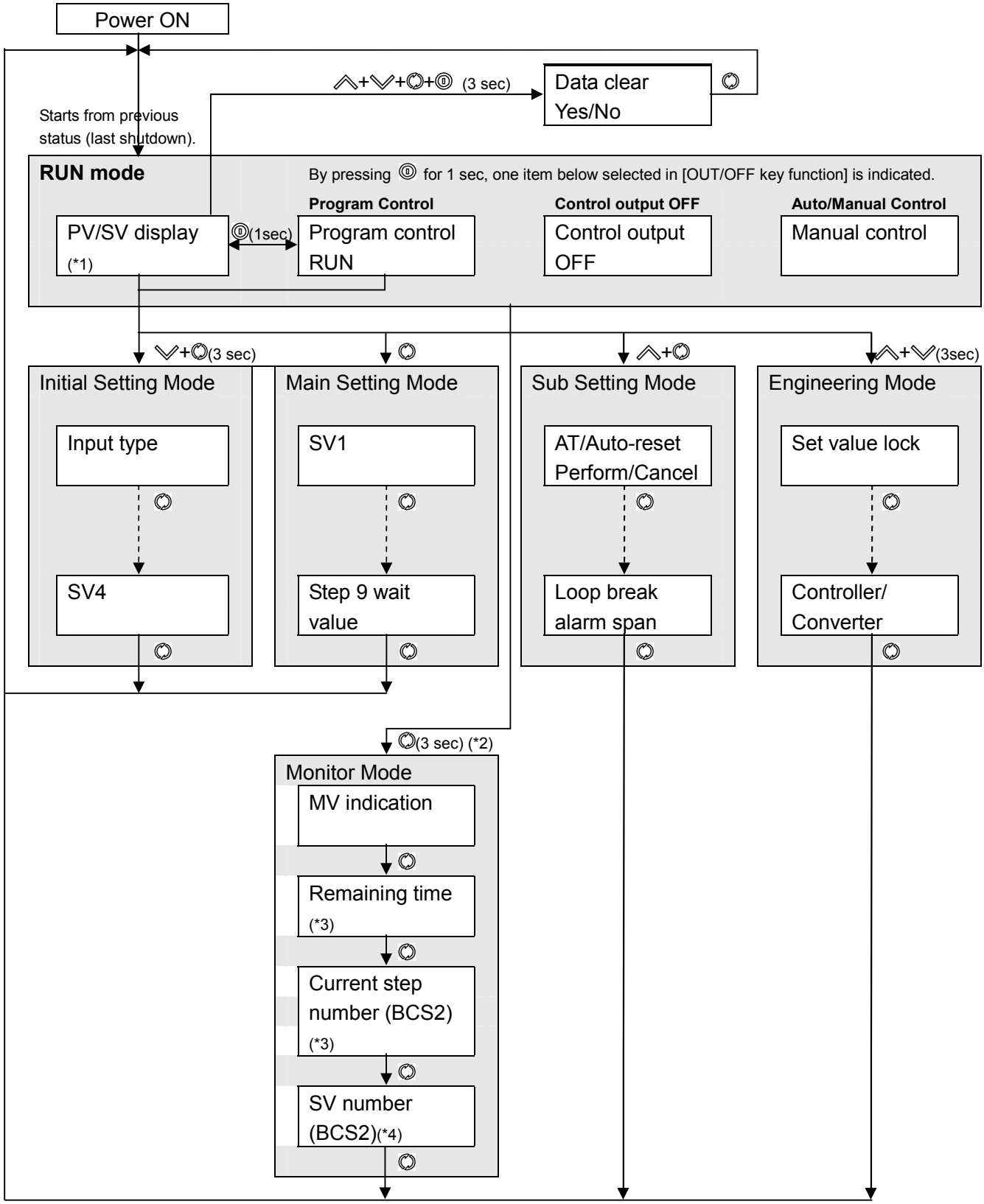
If the EIT option is ordered, Transmission output is available.
Specifications of Transmission output are shown below.

Resolution	12000
Output	4 to 20 mA DC Load resistance: Max 550 Ω
Output accuracy	Within ±0.3% of Transmission output span

BCS2	BCR2, BCD2
	

5. Outline of Key Operation and Each Mode

5.1 Key Operation



(*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].

(*4) Not available if 'Program control' is selected in [OUT/OFF key function].

- ∧+∨+◎+ⓓ (3 sec): Press and hold the ∧, ∨, ◎, ⓓ 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.
- 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

<table>
<tr><th>Mode</th><th colspan="2">Description</th></tr>
<tr><td>RUN mode</td><td colspan="2">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.</td></tr>
<tr><td></td><td>OUT/OFF Key Function</td><td>Description</td></tr>
<tr><td></td><td>Control output OFF function</td><td>Turns the control output ON or OFF.</td></tr>
<tr><td></td><td>Auto/Manual control</td><td>Switches the Auto/Manual control.</td></tr>
<tr><td></td><td>Program control</td><td>Starts/Stops the Program control.</td></tr>
<tr><td>Monitor mode</td><td colspan="2">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.</td></tr>
<tr><td></td><td>Model</td><td>Indicated Contents</td></tr>
<tr><td></td><td>BCS2</td><td>Indicates MV, Remaining time (Program control), Step number (Program control) or Set value memory number (Fixed value control).</td></tr>
<tr><td></td><td>BCR2, BCD2</td><td>Indicates MV or Remaining time (Program control).</td></tr>
<tr><td>Initial setting mode</td><td colspan="2">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 (EV2 option) allocation, Event input DI1/DI2 allocation (*), SV1, etc.</td></tr>
<tr><td>Main setting mode</td><td colspan="2">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.
If ‘Set value memory number’ is selected in [Event input DI1/DI2 allocation] (*), SV1 to SV4 can be set.</td></tr>
<tr><td>Sub setting mode</td><td colspan="2">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 (EV2 option), etc.</td></tr>
<tr><td>Engineering mode</td><td colspan="2">By pressing the ∧ and ∨ keys (in that order) together for approx. 3 sec in RUN mode, the unit enters Engineering mode.
The following items can be set.
Set value lock, Event input DI1/DI2 allocation (*), Event output EV1/EV2 (EV2 option) allocation, Sensor correction, PV filter time constant, Program control, OUT/OFF key function, Controller/Converter, etc.</td></tr>
</table>

(*) Event input DI1 allocation: BCS2 with EIW, EIT, EI options, BCR2/BCD2 with C5W, EIW, EIT, EI options)
Event input DI2 allocation: BCS2 with EIW, EI options, BCR2/BCD2 with C5W, EIW, EIT, EI options)

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 procedure below.

(1) Turn the power supply to the unit ON

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 on the PV Display and SV on 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	℃		℉	
	PV Display	SV Display	PV Display	SV Display
K	t□□C	1370	t□□F	2498
	t□ .C	400.0	t□ .F	752.0
J	J□□C	1000	J□□F	1832
R	r□□C	1760	r□□F	3200
S	S□□C	1760	S□□F	3200
B	b□□C	1820	b□□F	3308
E	E□□C	□800	E□□F	1472
T	t□ .C	400.0	t□ .F	752.0
N	n□□C	1300	n□□F	2372
PL-Ⅱ	PL2C	1390	PL2F	2534
C(W/Re5-26)	c□□C	2315	c□□F	4199
Pt100	Pt .C	850.0	Pt .F	1562.0
JPt100	JPt.C	500.0	JPt.F	932.0
Pt100	Pt□C	□850	Pt□F	1562
JPt100	JPtC	□500	JPtF	□932
4 to 20 mA DC	420A	Scaling high limit value		
0 to 20 mA DC	020A			
0 to 1 V DC	0□ 1V			
0 to 5 V DC	0□5V			
1 to 5 V DC	1□5V			
0 to 10 V DC	0 10V			

When power is turned ON, and any errors are found, the following error codes are indicated on the PV Display.
To cancel the error code, press the ◎ 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 Setting’ (p.37) to ‘8. Operation and Settings of Standard Functions’ (p.96):
Enter each value: Input type, Control action (PID control, ON/OFF control, etc), 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 on the PV Display.

Error Code	Error Contents
Er05	PV has exceeded Input range high limit value (scaling high limit value for DC voltage, current inputs).
Er06	PV has dropped below Input range low limit value (scaling low limit value for DC voltage, current inputs).
Er07	Input burnout, or PV has exceeded the Indication range and Control range.
Er 10	Hardware malfunction

Indication Range and Control Range

Input Type	Indication Range and Control Range
Thermocouple	[Input range low limit – 50℃ (100℉)] to [Input range high limit + 50℃ (100℉)]
RTD	[Input range low limit – Input span x 1%] to [Input range high limit + 50℃ (100℉)]
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 [Er05] are indicated on 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 [Er06] are indicated on the PV Display alternately.

For manual control, the preset MV is output.

Burnout

If PV has exceeded Indication range and Control range, [----] and [Er07] are alternately indicated on the PV Display.
If PV has dropped below Indication range and Control range, [----] and [Er07] are alternately indicated on the PV Display.

If thermocouple or RTD input is burnt out, or if DC voltage (0 to 1 V DC) input is disconnected, [----] and [Er07] are alternately indicated on 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 [Er07] 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/OUT2 low limit value for Direct current output).
For manual control, the preset MV is output.
If Alarm, Heater burnout 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 and voltage inputs, 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 [Er07] alternately.	ON (20mA) or OUT1 high limit value (*)	OFF (4mA) or OUT1 low limit value	OFF or OUT2 low limit value	ON or OUT2 high limit value (*)
oFF		OFF (4mA) or OUT1 low limit value			OFF or OUT2 low limit value
on	Indicates [----] and [Er07] alternately.	OFF (4mA) or OUT1 low limit value	ON (20mA) or OUT1 high limit value (*)	ON or OUT2 high limit value (*)	OFF or OUT2 low limit value
oFF			OFF (4mA) or OUT1 low limit value	OFF or OUT2 low limit value	

(*) Outputs a value between OFF (4mA) and ON (20mA) or between OUT1 (or OUT2) low limit value and OUT1 (or OUT2) high limit value, depending on deviation.

6. Initial Setting

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.53).

(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 (EV2 option)	No event
EV2 alarm value 0 Enabled/Disabled (EV2 option)	Disabled
EV2 alarm value (EV2 option)	0℃
EV2 high limit alarm value (EV2 option)	0℃
EV2 alarm hysteresis (EV2 option)	1.0℃
EV2 alarm delay time (EV2 option)	0 sec
EV2 alarm Energized/De-energized (EV2 option)	Energized
Heater burnout alarm 1 value (C5W, EIW, W options)	0.0 A
Heater burnout alarm 2 value (C5W, EIW, W options)	0.0 A
Loop break alarm time	0 minutes
Loop break alarm span	0℃
Event input DI1 allocation (BCS2: EIW, EIT, EI options, BCR2/BCD2: C5W, EIW, EIT, EI options)	No event
Event input DI2 allocation (BCS2: EIW, EI options, BCR2/BCD2: C5W, EIW, EIT, EI options)	No event
External setting input high limit (EIT option)	1370℃
External setting input low limit (EIT option)	-200℃
Transmission output type (EIT option)	PV transmission
Transmission output high limit (EIT option)	1370℃
Transmission output low limit (EIT option)	-200℃
SV1	0℃
SV2 (BCS2: EIW, EIT, EI options, BCR2/BCD2: C5W, EIW, EIT, EI options)	0℃
SV3 (BCS2: EIW, EI option, BCR2/BCD2: C5W, EIW, EIT, EI options)	0℃
SV4 (BCS2: EIW, EI option, BCR2/BCD2: C5W, EIW, EIT, EI options)	0℃

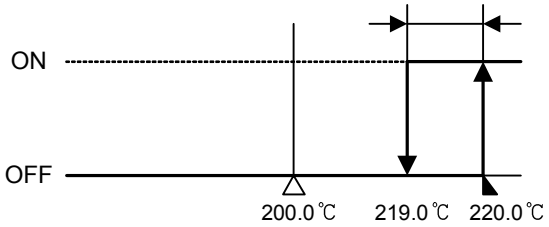
6.1 Example of Initial Setting

(e.g.) BCS2R00-00

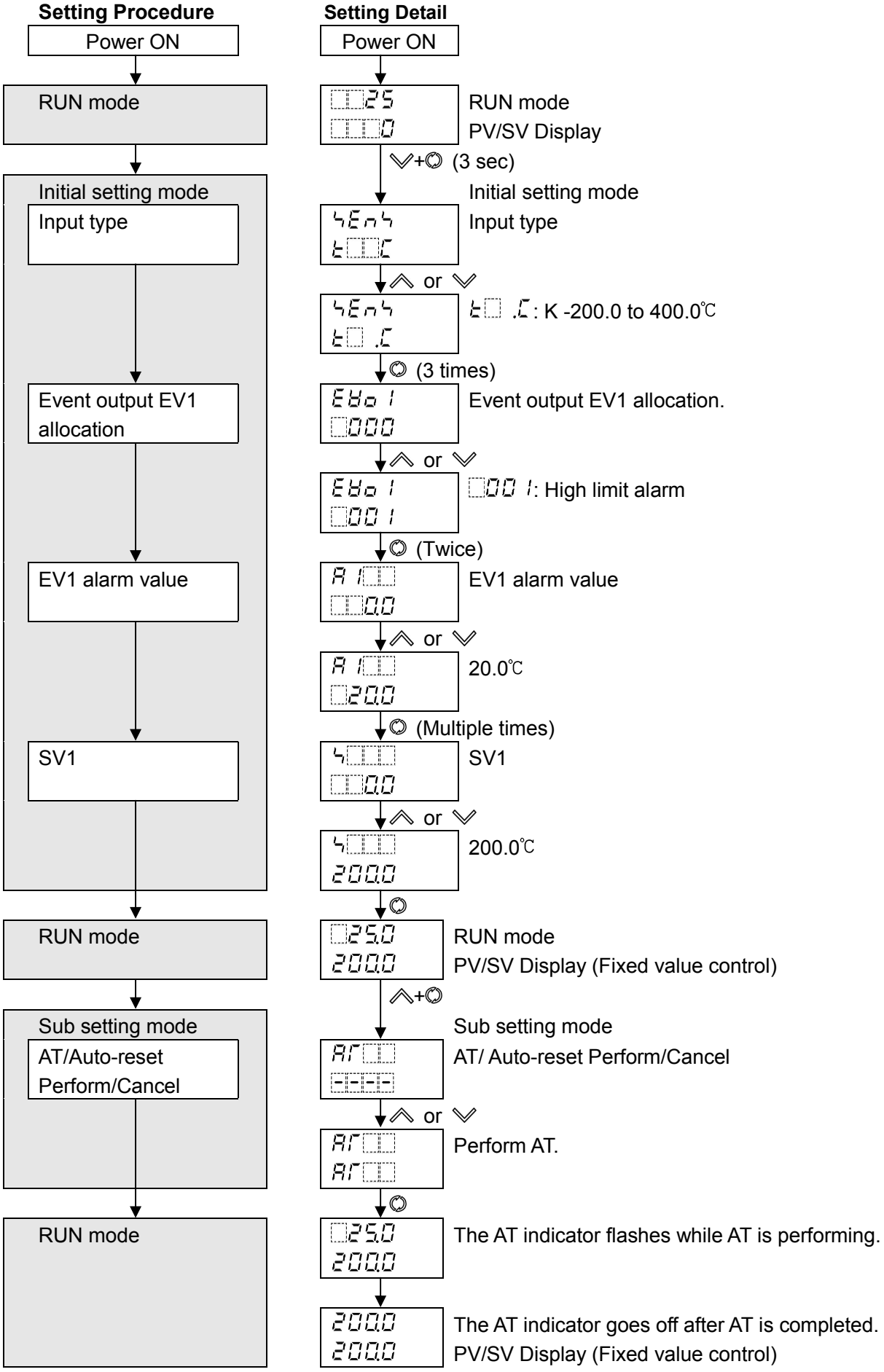
Initial Setting Items	Example
Input type	K -200.0 to 400.0℃
Event output EV1 allocation	High limit alarm
EV1 alarm value	20.0℃ (Deviation setting from SV)
SV	200.0℃ (Fixed value control)

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

Alarm action



(Fig. 6.1-1)

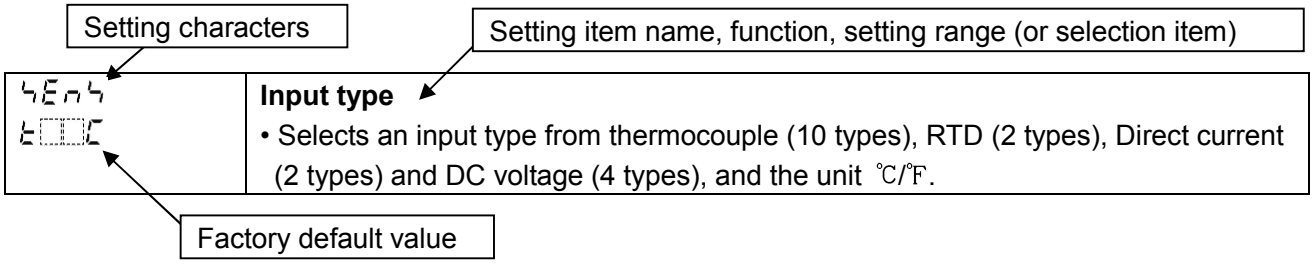

Setting Procedure
Setting Detail
Power ON
Power ON
RUN mode
RUN mode
PV/SV Display
(3 sec)
Initial setting mode
Initial setting mode
Input type
Input type
or
: K -200.0 to 400.0℃
(3 times)
Event output EV1 allocation
Event output EV1 allocation.
or
: High limit alarm
(Twice)
EV1 alarm value
EV1 alarm value
or
20.0℃
(Multiple times)
SV1
SV1
or
200.0℃
RUN mode
RUN mode
PV/SV Display (Fixed value control)
Sub setting mode
Sub setting mode
AT/Auto-reset Perform/Cancel
AT/ Auto-reset Perform/Cancel
or
Perform AT.
RUN mode
The AT indicator flashes while AT is performing.
The AT indicator goes off after AT is completed.
PV/SV Display (Fixed value control)

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).



5En5 tC	**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 ℃/℉.

Characters, Factory Default	Setting Item, Function, Setting Range			
5En5 tC	**Input type** • Selects an input type from thermocouple (10 types), RTD (2 types), Direct current (2 types) and DC voltage (4 type), and the unit ℃/℉. • 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.96). • Selection item:			
	tC	K -200 to 1370℃	tF	K -328 to 2498℉
	t .C	K -200.0 to 400.0℃	t .F	K -328.0 to 752.0℉
	JC	J -200 to 1000℃	JF	J -328 to 1832℉
	rC	R 0 to 1760℃	rF	R 32 to 3200℉
	5C	S 0 to 1760℃	5F	S 32 to 3200℉
	bC	B 0 to 1820℃	bF	B 32 to 3308℉
	EC	E -200 to 800℃	EF	E -328 to 1472℉
	r .C	T -200.0 to 400.0℃	r .F	T -328.0 to 752.0℉
	nC	N -200 to 1300℃	nF	N -328 to 2372℉
	PL2C	PL-Ⅱ 0 to 1390℃	PL2F	PL-Ⅱ 32 to 2534℉
	cC	C(W/Re5-26) 0 to 2315℃	cF	C(W/Re5-26) 32 to 4199℉
	Pr .C	Pt100 -200.0 to 850.0℃	Pr .F	Pt100 -328.0 to1562.0℉
	JPr.C	JPt100 -200.0 to 500.0℃	JPr.F	JPt100 -328.0 to 932.0℉
	PrC	Pt100 -200 to 850℃	PrF	Pt100 -328 to 1562℉
	JPrC	JPt100 -200 to 500℃	JPrF	JPt100 -328 to 932℉
	420A	4 to 20 mA DC -2000 to 10000		
	020A	0 to 20 mA DC -2000 to 10000		
	0 1V	0 to 1 V DC -2000 to 10000		
	0 5V	0 to 5 V DC -2000 to 10000		
	1 5V	1 to 5 V DC -2000 to 10000		
	0 10V	0 to 10 V DC -2000 to 10000		
5rLH 1370	**Scaling high limit** • 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)			

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

Characters, Factory Default	Setting Item, Function, Setting Range		
SCLL -200	**Scaling low limit** • 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)		
dP□□ □□□0	**Decimal point place** • Selects decimal point place. • Selection item:		
	□□□0	No decimal point	
	□□0.0	1 digit after decimal point	
	□0.00	2 digits after decimal point	
	0.000	3 digits after decimal point	
	Available only for DC voltage and current inputs		
Evo1 □000	**Event output EV1 allocation** • 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.96). • 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	
	□013	Heater burnout alarm output	
	□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 ◎ 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

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

Characters, Factory Default	Setting Item, Function, Setting Range	
A1EA no	**EV1 alarm value 0 Enabled/Disabled** • When EV1 alarm value is 0 (zero), alarm action can be Enabled or Disabled. • Selection item:	
	no: Disabled	
	YES: Enabled	
	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 EV1 allocation].	
A1□□ □□□0	**EV1 alarm value** • Sets EV1 alarm value. EV1 alarm value matches EV1 low limit alarm value in the following cases: 004 (Alarm output, High/Low limits independent alarm), 006 (Alarm output, High/Low limit range independent alarm), or 012 (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 ℃ (℉) (*1) (*2)
	Low limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits independent alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range independent alarm	0 to Input span ℃ (℉) (*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 ℃ (℉) (*1) (*2)
	Low limit with standby alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby independent alarm	0 to Input span ℃ (℉) (*1) (*2)
	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 EV1 allocation].	
A1H□ □□□0	**EV1 high limit alarm value** • Sets EV1 high limit alarm value. This value is available only for the following cases. 004 (Alarm output, High/Low limits independent alarm), 006 (Alarm output, High/Low limit range independent alarm), or 012 (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
A1HY □□ 1.0	**EV1 alarm hysteresis** • Sets EV1 alarm hysteresis. • Setting range: 0.1 to 1000.0℃ (℉), DC voltage, current inputs: 1 to 10000 (*1) 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 EV1 allocation].
A1dY □□□0	**EV1 alarm delay time** • 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 □001 (Alarm output, High limit alarm) to □012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation].
A1LA noAL	**EV1 alarm Energized/De-energized** • Selects Energized/De-energized status for EV1 alarm. (Refer to 'EV1/EV2 Energized/De-energized' on p.50.) • Selection item: noAL: Energized rEbY: De-energized 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 EV1 allocation].
TS1S □□□1	**TS1 output step number** • 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.52.) • Setting range: 1 to 9 Available only when □015 (Time signal output) is selected in [Event output EV1 allocation].
TS1F 00.00	**TS1 OFF time** • Sets Time signal output TS1 OFF time. (Refer to 'Time Signal Output' on p.52.) • Setting range: 00:00 to 99:59 (*4) Available only when □015 (Time signal output) is selected in [Event output EV1 allocation].
TS1o 00.00	**TS1 ON time** • Sets Time signal output TS1 ON time. (Refer to 'Time Signal Output' on p.52.) • Setting range: 00:00 to 99:59 (*4) Available only when □015 (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		
EVo2 □000	**Event output EV2 allocation** • 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.96). • 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	
	□013	Heater burnout alarm output	
	□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 ⓪ 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 (EV2 option) is ordered.		
A2EA no□□	**EV2 alarm value 0 Enabled/Disabled** • When EV2 alarm value is 0 (zero), alarm action can be Enabled or Disabled. • Selection item:		
	no□□	Disabled	
	YES□	Enabled	
	Available only when Event output EV2 (EV2 option) is ordered. 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	
A2□ □□□0	**EV2 alarm value** • Sets EV2 alarm value. EV2 alarm value matches EV2 low limit alarm value in the following cases: □004 (Alarm output, High/Low limits independent alarm), □006 (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]. • Setting range:	
	High limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	Low limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits independent alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range independent alarm	0 to Input span ℃ (℉) (*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 ℃ (℉) (*1) (*2)
	Low limit with standby alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby independent alarm	0 to Input span ℃ (℉) (*1) (*2)
	Available only when Event output EV2 (EV2 option) is ordered. 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].	
A2H□ □□□0	**EV2 high limit alarm value** • Sets EV2 high limit alarm value. This value is available only for the following cases: □004 (Alarm output, High/Low limits independent alarm), □006 (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]. • Setting range: Same as those of EV2 alarm value Available only when Event output EV2 (EV2 option) is ordered.	
A2HY □□ 1.0	**EV2 alarm hysteresis** • Sets EV2 alarm hysteresis. • Setting range: 0.1 to 1000.0℃ (℉), DC voltage, current inputs: 1 to 10000 (*1) Available only when Event output EV2 (EV2 option) is ordered. 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].	
A2dY □□□0	**EV2 alarm delay time** • Sets EV2 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 only when Event output EV2 (EV2 option) is ordered. 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].	

(*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
A2LA noAL	**EV2 alarm Energized/De-energized** • Selects Energized/De-energized status for EV2 alarm. (Refer to 'EV1/EV2 Energized/De-energized' on p.50.) • Selection item: noAL: Energized rEV: De-energized Available only when Event output EV2 (EV2 option) is ordered. 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].
TS2 □□1	**TS2 output step number** • 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.52.) • Setting range: 1 to 9 Available only when □015 (Time signal output) is selected in [Event output EV2 allocation].
TS2F 00.00	**TS2 OFF time** • Sets Time signal output TS2 OFF time. (Refer to 'Time Signal Output' on p.52.) • Setting range: 00:00 to 99:59 (*4) Available only when □015 (Time signal output) is selected in [Event output EV2 allocation].
TS2o 00.00	**TS2 ON time** • Sets Time signal output TS2 ON time. (Refer to 'Time Signal Output' on p.52.) • Setting range: 00:00 to 99:59 (*4) Available only when □015 (Time signal output) is selected in [Event output EV2 allocation].
H1□ □□0.0 H1 and CT1 current value are alternately indicated on the PV Display.	**Heater burnout alarm 1 value** • Sets the heater current value for Heater burnout alarm 1. Characters H1 and CT1 current value are alternately indicated on the PV Display. When OUT1 is ON, the CT1 current value is updated. When OUT1 is OFF, the unit memorizes the previous value when OUT1 was ON. Upon returning to set limits, the alarm will stop. • Setting range: 20 A: 0.0 to 20.0 A 100 A: 0.0 to 100.0 A Setting to 0.0 disables the alarm. Not available for the Direct current output type. Available when Heater burnout alarm (C5W, EIW, W options) is ordered.

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

<table>
<tr><th>Characters,
Factory Default</th><th>Setting Item, Function, Setting Range</th></tr>
<tr><td>H2□□
□□0.0

H2 and CT2 current value are alternately indicated on the PV Display.</td><td>Heater burnout alarm 2 value
• Sets the heater current value for Heater burnout alarm 2.
Available only when using 3-phase.
Characters H2 and CT2 current value are alternately indicated on the PV Display.
When OUT1 is ON, the CT2 current value is updated.
When OUT1 is OFF, the unit memorizes the previous value when OUT1 was ON.
Upon returning to set limits, the alarm will stop.
• Setting range:
20 A: 0.0 to 20.0 A
100 A: 0.0 to 100.0 A
Setting to 0.0 disables the alarm.
Not available for the Direct current output type.
Available only when Heater burnout alarm (C5W, EIW, W options) is ordered.</td></tr>
<tr><td>LP_T
□□□0</td><td>Loop break alarm time
• Sets the time to assess the Loop break alarm.
Refer to ‘Loop Break Alarm’ on p.50.
• Setting range: 0 to 200 minutes
Setting to 0 (zero) disables the alarm.</td></tr>
<tr><td>LP_H
□□□0</td><td>Loop break alarm span
• Sets the temperature to assess the Loop break alarm.
Refer to ’Loop Break Alarm’ on p.50.
• Setting range: 0 to 150℃ (℉), or 0.0 to 150.0℃ (℉)
DC voltage, current inputs: 0 to 1500 (*1)
Setting to 0 (zero) disables the alarm.</td></tr>
<tr><td>EVI 1
□000</td><td>Event input DI1 allocation
• Selects Event input DI1 from Event Input Allocation Table.
(Refer to ’Event Input’ on p.51.)
• Selection item:
Event Input Allocation Table
<table>
<tr><th></th><th>Event input function</th><th>Input ON (Closed)</th><th>Input OFF (Open)</th><th>Remarks</th></tr>
<tr><td>□000</td><td>No event</td><td></td><td></td><td></td></tr>
<tr><td>□001</td><td>Set value memory</td><td></td><td></td><td></td></tr>
<tr><td>□002</td><td>Control ON/OFF</td><td>Control OFF</td><td>Control ON</td><td>Control output OFF function</td></tr>
<tr><td>□003</td><td>Direct/Reverse action</td><td>Direct action</td><td>Reverse action</td><td>Always effective</td></tr>
<tr><td>□004</td><td>Preset output 1 ON/OFF</td><td>Preset output</td><td>Usual control</td><td>If sensor is burnt out, the unit maintains control with the preset MV.</td></tr>
<tr><td>□005</td><td>Preset output 2 ON/OFF</td><td>Preset output</td><td>Usual control</td><td>The unit maintains control with the preset MV.</td></tr>
<tr><td>□006</td><td>Auto/Manual control</td><td>Manual control</td><td>Automatic control</td><td>Effective when Auto/Manual control is selected in [OUT/ OFF key function].</td></tr>
</table></td></tr>
</table>

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

Characters, Factory Default	Setting Item, Function, Setting Range				
EVI 1 □000		**Event input function**	**Input ON (Closed)**	**Input OFF (Open)**	**Remarks**
	□007	Remote/Local	Remote	Local	Effective when External setting input (EIT option) is ordered.
	□008	Program control RUN/STOP	RUN	STOP	Level action when power is turned on
	□009	Program control Holding/Not holding	Holding	Not holding	Level action when power is turned on
	□010	Program control Advance function	Advance function	Usual control	
	□011	Integral action Holding	Integral action Holding	Usual integral action	Control continues with the integral value being held.
	For BCS2, available only when Event input (EIW, EIT, EI options) is ordered. For BCR2/BCD2, available when Serial communication (C5W option) or Event input (EIW, EIT, EI options) is ordered.				
EVI 2 □000	**Event input DI2 allocation** • Selects Event input DI2 from Event Input Allocation Table. (Refer to 'Event Input' on p.51) • Selection item: Same as those of Event input DI1 allocation For BCS2, available only when Event input (EIW, EI option) is ordered. For BCR2/BCD2, available when Serial communication (C5W option) or Event input (EIW, EIT, EI options) is ordered.				
rTLH 1370	**External setting input high limit** • Sets External setting input high limit value. This value corresponds to 20 mA in Direct current input. • Setting range: External setting input low limit to Input range high limit (*1) Available only when External setting input (EIT option) is ordered.				
rTLL -200	**External setting input low limit** • Sets External setting input low limit value. This value corresponds to 4 mA in Direct current input. • Setting range: Input range low limit to External setting input high limit (*1) Available only when External setting input (EIT option) is ordered.				
Tro5 PV□□	**Transmission output type** • Selects transmission output type. • When changing transmission output type, refer to Section "8.10 Items to be Initialized by Changing Settings" (p.96). • Selection item:				
	PV□□	PV transmission			
	5V□□	SV transmission			
	MV□□	MV transmission			
	dV□□	DV transmission			
	Available only when Transmission output (EIT option) is ordered.				

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

Characters, Factory Default	Setting Item, Function, Setting Range	
r-LH 1370	**Transmission output high limit** • Sets the Transmission output high limit value. This value correponds to 20 mA in DC current output. • Setting range:	
	PV, SV transmission	Transmission output low limit to Input range high limit value DC voltage, current inputs: -2000 to 10000
	MV transmission	Transmission output low limit to 105.0%
	DV transmission	Transmission output low limit to Scaling span (*1)
	Available only when Transmission output (EIT option) is ordered.	
r-LL -200	**Transmission output low limit** • Sets the Transmission output low limit value. This value correponds to 4 mA in DC current output. • Selection item:	
	PV, SV transmission	Input range low limit to Transmission output high limit value DC voltage, current inputs: -2000 to 10000
	MV transmission	-5.0% to Transmission output high limit value
	DV transmission	-Scaling span to Transmission output high limit value (*1)
	Available only when Transmission output (EIT option) is ordered.	
S□□□ □□□0	**SV1** • 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].	
S2□□ □□□0	**SV2** • Sets SV2. • Setting range: Scaling low limit to Scaling high limit (*1) Available for the following cases: • When Control output OFF function or Auto/Manual control is selected in [OUT/OFF key function]. • For BCS2, Event input (EIW, EIT, EI options) is ordered. • For BCR2/BCD2, Serial communication (C5W option) or Event input (EIW, EIT, EI options) is ordered. • When □001 (Set value memory) is selected in [Event input DI1/DI2 allocation].	
S3□□ □□□0	**SV3** • Sets SV3. • Setting range: Scaling low limit to Scaling high limit (*1) Available for the following cases: • When Control output OFF function or Auto/Manual control is selected in [OUT/OFF key function]. • For BCS2, Event input (EIW, EI options) is ordered. • For BCR2/BCD2, Serial communication (C5W option) or Event input (EIW, EIT, EI options) is ordered. • When □001 (Set value memory) is selected in [Event input DI1/DI2 allocation].	
S4□□ □□□0	**SV4** • Sets SV4. • Setting range: Scaling low limit to Scaling high limit (*1) Available for the following cases: • When Control output OFF function or Auto/Manual control is selected in [OUT/OFF key function]. • For BCS2, Event input (EIW, EI options) is ordered • For BCR2/BCD2, Serial communication (C5W option) or Event input (EIW, EIT, EI options) is ordered. • When □001 (Set value memory) is selected in [Event input DI1/DI2 allocation].	

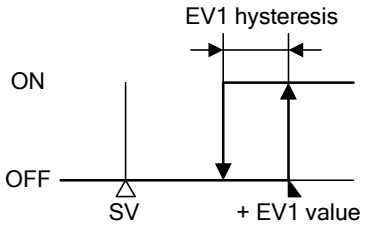
(*1) The placement of the decimal point follows the selection.

[EV1/EV2 Energized/De-energized]

When nonL (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.

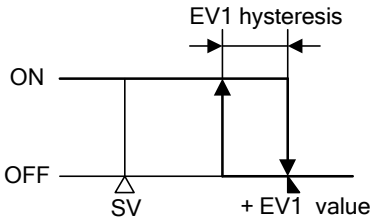
When rEVr (De-energized) is selected, Event output 1 or 2 is not conductive (OFF) while the EV1/EV2 indicator is lit.
Event output 1 or 2 is conductive (ON) while the EV1/EV2 indicator is not lit.

High limit alarm (when Energized is set)



(Fig. 6.2-1)

High limit alarm (when De-energized is set)



(Fig. 6.2-2)

EV1 value and EV1 hysteresis represent EV1 alarm value and EV1 alarm hysteresis respectively.
For EV2, read “EV2” for “EV1”.

[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 (C5W, C5 options) is ordered, status can be read by reading Status flag 1.

[Event Input]

• If □001 (Set value memory) is selected, the set value memory number will be as follows.

When only Event input DI1 is selected.

Set value memory number	SV1	SV2
DI1	Open	Closed

When only Event input DI2 is selected.

Set value memory number	SV1	SV2
DI2	Open	Closed

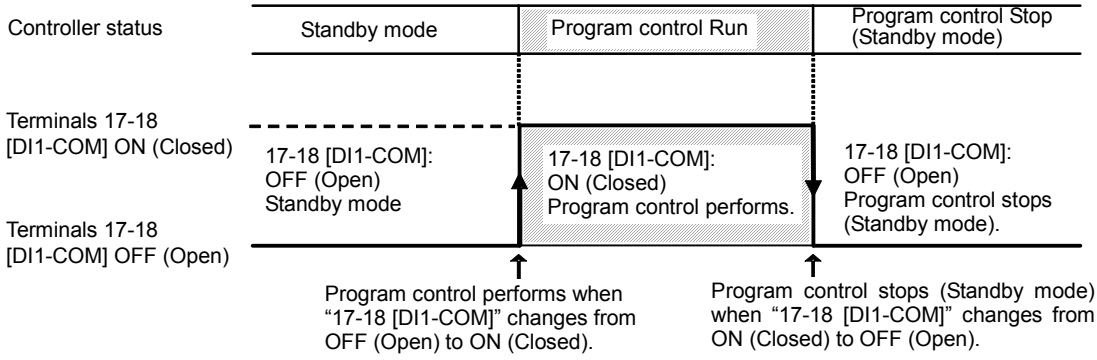
When both Event inputs DI1, DI2 are selected.

Set value memory number	SV1	SV2	SV3	SV4
DI1	Open	Closed	Open	Closed
DI2	Open	Open	Closed	Closed

• Preset value of □004 (Preset output 1 ON/OFF) and □005 (Preset output 2 ON/OFF) can be set in [OUT1, OUT2 MV preset value] in Engineering mode (p.77).

• If □005 (Preset output 2 ON/OFF) is selected in [Event input DI1 allocation], and □006 (Auto/Manual control) is selected in Event input DI2 allocation, and if DI1-COM and DI2-COM terminals are turned ON (Closed) simultaneously, then Preset output 2 will be given priority, and control starts with the MV set in [OUT1/OUT2 MV preset value (p.77)] in Engineering mode. In this case, control will be switched to manual control, and MV cannot be changed via keypad.

• Signal edge action from OFF to ON / ON to OFF is engaged.
If □008 (Program control RUN/STOP) is selected in [Event input DI1 allocation], the following action will be performed.
However, only when power is turned ON, Level action is engaged - which follows the input status [ON (Closed) or OFF (Open)] of Event input DI1.



(Fig. 6.2-3)

• OR calculation [if any one is ON (closed), the function activates] begins if the same functions except □001 (Set value memory) have been selected in [Event input DI1/DI2 allocation].
If any terminals DI1-COM or DI2-COM is ON (closed), the function activates.

• If any function except □010 (Program control Advance function) is selected in [Event input DI1/DI2 allocation], Level action is engaged when power is turned ON - which follows the input status [ON (Closed) or OFF (Open)] of Event input DI1/DI2.

[Time Signal Output]

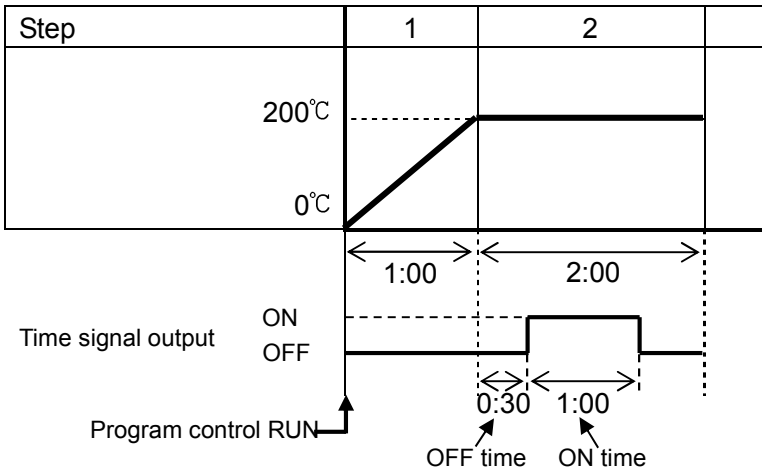
Time signal output activates during Time signal output ON time within the step (number).
Time signal output ON time follows Time signal output OFF time after the program control starts.

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

Step	1	2
Step SV	200℃	200℃
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.

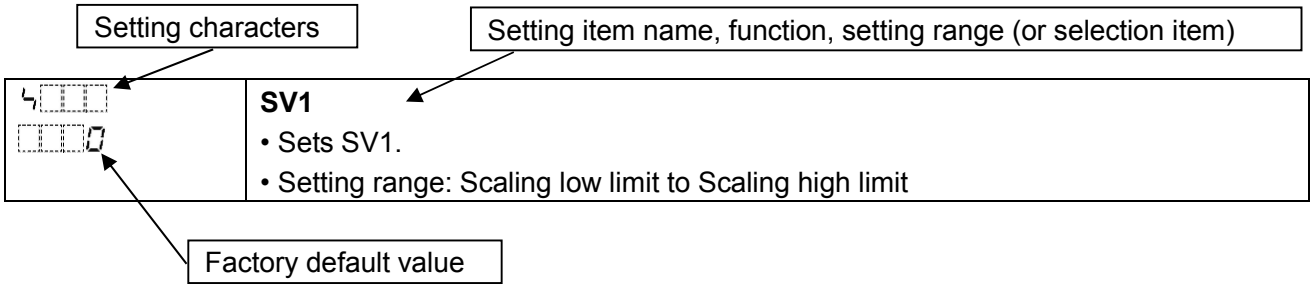
7. Settings

In this section, Main setting, Sub setting and Engineering modes will be explained.

7.1 Main Setting Mode

To enter Main setting mode, press the ◎ key 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).



Characters, Factory Default	Setting Item, Function, Setting Range
SV1 0	**SV1** • 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)
r0_1 00.00	**Step 1 time** • Sets Step 1 time. • Setting range: -:--, or 00:00 to 99:59 If -:-- is set, Step 1 time will be held, and Fixed value control will be performed using Step 1 SV. Available only when Program control is selected in [OUT/OFF key function].
J0_1 0	**Step 1 wait value** • Sets Step 1 wait value. • Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1) Setting the value to 0 disables this Wait function. 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
SV2 0	**SV2** • Sets SV2. • Corresponds to [SV2] in Initial setting mode. If Program control is selected in [OUT/OFF key function], this will become Step 2 SV. • Setting range: Scaling low limit to Scaling high limit (*1) Available for the following cases: • When Program control is selected in [OUT/OFF key function] • For BCS2, Event input (EIW, EIT, EI options) is ordered • For BCR2/BCD2, Serial communication (C5W option) or Event input (EIW, EIT, EI options) is ordered. • When 001 (Set value memory) is selected in [Event input DI1/DI2 allocation].
r_2 00.00	**Step 2 time** • Sets Step 2 time. • Setting range: ----, or 00:00 to 99:59 If ---- is set, Step 2 time will be held, and Fixed value control will be performed using Step 2 SV. Available only when Program control is selected in [OUT/OFF key function].
J_2 0	**Step 2 wait value** • Sets Step 2 wait value. • Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1) Setting the value to 0 disables Wait function. Available only when Program control is selected in [OUT/OFF key function].
SV3 0	**SV3** • Sets SV3. • Corresponds to [SV3] in Initial setting mode. If Program control is selected in [OUT/OFF key function], this will become Step 3 SV. • Setting range: Scaling low limit to Scaling high limit (*1) Available for the following cases: • When Program control is selected in [OUT/OFF key function] • For BCS2, Event input (EIW, EI options) is ordered • For BCR2/BCD2, Serial communication (C5W option) or Event input (EIW, EIT, EI options) is ordered. • When 001 (Set value memory) is selected in [Event input DI1/DI2 allocation].
r_3 00.00	**Step 3 time** • Sets Step 3 time. • Setting range: ----, or 00:00 to 99:59 If ---- is set, Step 3 time will be held, and Fixed value control will be performed using Step 3 SV. Available only when Program control is selected in [OUT/OFF key function].
J_3 0	**Step 3 wait value** • Sets Step 3 wait value. • Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1) Setting the value to 0 disables Wait function. 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
SV4 0	**SV4** • Sets SV4. • Corresponds to [SV4] in Initial setting mode. If Program control is selected in [OUT/OFF key function], this will become Step 4 SV. • Setting range: Scaling low limit to Scaling high limit (*1) Available for the following cases: • When Program control is selected in [OUT/OFF key function] • For BCS2, Event input (EIW, EI options) is ordered • For BCR2/BCD2, Serial communication (C5W option) or Event input (EIW, EIT, EI options) is ordered. • When 001 (Set value memory) is selected in [Event input DI1/DI2 allocation].
T_4 00.00	**Step 4 time** • Sets Step 4 time. • Setting range: --:--, or 00:00 to 99:59 If --:-- is set, Step 4 time will be held, and Fixed value control will be performed using Step 4 SV. Available only when Program control is selected in [OUT/OFF key function].
J_4 0	**Step 4 wait value** • Sets Step 4 wait value. • Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1) Setting the value to 0 disables Wait function. Available only when Program control is selected in [OUT/OFF key function].
SV5 0	**Step 5 SV** • Sets Step 5 SV. • Setting range: Scaling low limit to Scaling high limit (*1) Available only when Program control is selected in [OUT/OFF key function].
T_5 00.00	**Step 5 time** • Sets Step 5 time. • Setting range: --:--, or 00:00 to 99:59 If --:-- is set, Step 5 time will be held, and Fixed value control will be performed using Step 5 SV. Available only when Program control is selected in [OUT/OFF key function].
J_5 0	**Step 5 wait value** • Sets Step 5 wait value. • Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1) Setting the value to 0 disables Wait function. 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
56□□ □□□0	**Step 6 SV** • Sets Step 6 SV. • Setting range: Scaling low limit to Scaling high limit (*1) Available only when Program control is selected in [OUT/OFF key function].
r□_6 00.00	**Step 6 time** • Sets Step 6 time. • Setting range: -:--, or 00:00 to 99:59 If -:-- is set, Step 6 time will be held, and Fixed value control will be performed using Step 6 SV. Available only when Program control is selected in [OUT/OFF key function].
J□_6 □□□0	**Step 6 wait value** • Sets Step 6 wait value. • Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1) Setting the value to 0 disables Wait function. Available only when Program control is selected in [OUT/OFF key function].
57□□ □□□0	**Step 7 SV** • Sets Step 7 SV. • Setting range: Scaling low limit to Scaling high limit (*1) Available only when Program control is selected in [OUT/OFF key function].
r□_7 00.00	**Step 7 time** • Sets Step 7 time. • Setting range: -:--, or 00:00 to 99:59 If -:-- is set, Step 7 time will be held, and Fixed value control will be performed using Step 7 SV. Available only when Program control is selected in [OUT/OFF key function].
J□_7 □□□0	**Step 7 wait value** • Sets Step 7 wait value. • Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1) Setting the value to 0 disables Wait function. Available only when Program control is selected in [OUT/OFF key function].

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

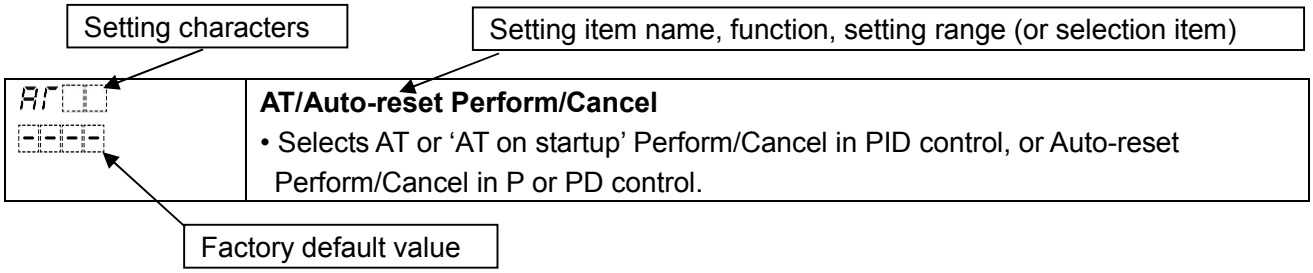
Characters, Factory Default	Setting Item, Function, Setting Range
SP 8 0	**Step 8 SV** • Sets Step 8 SV. • Setting range: Scaling low limit to Scaling high limit (*1) Available only when Program control is selected in [OUT/OFF key function].
r_8 00.00	**Step 8 time** • Sets Step 8 time. • Setting range: ----, or 00:00 to 99:59 If ---- is set, Step 8 time will be held, and Fixed value control will be performed using Step 8 SV. Available only when Program control is selected in [OUT/OFF key function].
J_8 0	**Step 8 wait value** • Sets Step 8 wait value. • Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1) Setting the value to 0 disables Wait function. Available only when Program control is selected in [OUT/OFF key function].
SP 9 0	**Step 9 SV** • Sets Step 9 SV. • Setting range: Scaling low limit to Scaling high limit (*1) Available only when Program control is selected in [OUT/OFF key function].
r_9 00.00	**Step 9 time** • Sets Step 9 time. • Setting range: ----, or 00:00 to 99:59 If ---- is set, Step 9 time will be held, and Fixed value control will be performed using Step 9 SV. Available only when Program control is selected in [OUT/OFF key function].
J_9 0	**Step 9 wait value** • Sets Step 9 wait value. • Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1) Setting the value to 0 disables Wait function. Available only when Program control is selected in [OUT/OFF key function].

(*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.

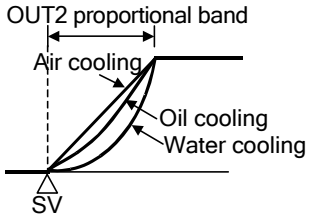
Explanation of setting items:
• Upper left: PV Display: Indicates setting characters.
• Lower left: SV Display: Indicates factory default value.
• Right side: Indicates the setting item, explanation of its function and setting range (or selection item).



Characters, Factory Default	Setting Item, Function, Setting Range	
AT -I-I-I-	**AT/Auto-reset Perform/Cancel** • 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. 82), and '8.6 Performing Auto-reset' (p. 85). • Selection item:	
	-I-I-I-	AT/AT on startup/Auto-reset Cancel
	AT	AT Perform
	AT_4	'AT on startup' Perform
	rSET	Auto-reset Perform
	Not available for ON/OFF control or PI control.	
P 10	**OUT1 proportional band** • Sets OUT1 proportional band. • Setting range: 0 to Input span ℃ (℉) DC voltage, current inputs: 0.0 to 1000.0% OUT1 becomes ON/OFF control when set to 0 or 0.0.	
I 200	**Integral time** • 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.	
d 50	**Derivative time** • 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
Ar-J 50	**ARW** • Sets ARW (anti-reset windup). • Setting range: 0 to 100% Available only for PID control.
r-hEr 0	**Manual reset** • Sets the reset value manually. • Setting range: ±Proportional band value If a value larger than 100.0% is set in [OUT1 proportional band], the setting range will be ±100.0. Available for P and PD controls.
c 30 Factory default: Relay contact output: 30 sec. Non-contact voltage output: 3 sec.	**OUT1 proportional cycle** • Sets proportional cycle for OUT1. 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. • Setting range: 0.5, or 1 to 120 seconds Not available for Direct current output type, or if OUT1 is in ON/OFF control.
HY- 1.0	**OUT1 ON/OFF hysteresis** • Sets ON/OFF hysteresis for OUT1. • Setting range: 0.1 to 1000.0℃ (℉), DC voltage, current inputs: 1 to 10000 (*1) Available only when OUT1 is in ON/OFF control.
oLH 100	**OUT1 high limit** • Sets OUT1 high limit value. • Setting range: OUT1 low limit value to 100% (Direct current output type: OUT1 low limit value to 105%) Not available if OUT1 is in ON/OFF control.
oLL 0	**OUT1 low limit** • Sets OUT1 low limit value. • Setting range: 0% to OUT1 high limit value (Direct current output type: -5% to OUT1 high limit value) Not available if OUT1 is in ON/OFF control.
or-Rr 0	**OUT1 rate-of-change** • Sets changing value of OUT1 MV for 1 second. See 'OUT1 rate-of-change' on p. 63. • Setting range: 0 to 100 %/second Setting the value to 0 disables this function. Not available if OUT1 is in ON/OFF control.

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

Characters, Factory Default	Setting Item, Function, Setting Range
cAcT AIr□	**OUT2 cooling method** • Selects OUT2 cooling method from air, oil or water cooling.  (Fig. 7.2-1) • Selection item:
	AIr□ — Air cooling (linear characteristics) oIL□ — Oil cooling (1.5th power of the linear characteristics) JAT□ — Water cooling (2nd power of the linear characteristics)
	Available when Event output EV2 (EV2 option) or Heating/Cooling control (DS, DA options) is ordered. Not available if OUT2 is in ON/OFF control.
P_b□ □□10	**OUT2 proportional band** • Sets the proportional band for OUT2. • Setting range: 0 to Input span ℃ (℉) DC voltage, current inputs: 0.0 to 1000.0% 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. Available when Event output EV2 (EV2 option) or Heating/Cooling control (DS, DA options) is ordered.
c_b□ □□30 Factory default: EV2(*2): 30 sec. DS: 3 sec.	**OUT2 proportional cycle** • Sets proportional cycle for OUT2. 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. • Setting range: 0.5, or 1 to 120 seconds Available when Event output EV2 (EV2 option) or Heating/Cooling control (DS, DA options) is ordered. Not available for Direct current output type, or if OUT2 is in ON/OFF control.
HYSb □□1.0	**OUT2 ON/OFF hysteresis** • Sets ON/OFF hysteresis for OUT2. • Setting range: 0.1 to 1000.0℃ (℉), DC voltage, current inputs: 1 to 10000 (*1) Available when Event output EV2 (EV2 option) or Heating/Cooling control (DS, DA options) is ordered.
oLHb □100	**OUT2 high limit** • Sets OUT2 high limit value. • Setting range: OUT2 low limit value to 100% (Direct current output type: OUT2 low limit value to 105%) Available when Event output EV2 (EV2 option) or Heating/Cooling control (DS, DA options) is ordered.

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

(*2) When □019 (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation]}.

Characters, Factory Default	Setting Item, Function, Setting Range
oLLb □□□0	**OUT2 low limit** • Sets OUT2 low limit value. • Setting range: 0% to OUT2 high limit value (Direct current output type: -5% to OUT2 high limit value) Available when Event output EV2 (EV2 option) or Heating/Cooling control (DS, DA options) is ordered.
db□□ □□□0	**Overlap/Dead band** • Sets the overlap band or dead band for OUT1 and OUT2. + Set value: Dead band – Set value: Overlap band • Setting range: -200.0 to 200.0℃ (℉), DC voltage, current inputs: -2000 to 2000 (*1) Available when Event output EV2 (EV2 option) or Heating/Cooling control (DS, DA options) is ordered.
conF HEAT	**Direct/Reverse action** • Selects either Reverse (Heating) or Direct (Cooling) control action. HEAT: Reverse (Heating) action cooL: Direct (Cooling) action
A 1□□ □□□0	**EV1 alarm value** • 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: □004 (Alarm output, High/Low limits independent alarm), □006 (Alarm output, High/Low limit range independent alarm), or □012 (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 ℃ (℉) (*1) (*2)
Low limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
High/Low limits alarm	0 to Input span ℃ (℉) (*1) (*2)
High/Low limits independent alarm	0 to Input span ℃ (℉) (*1) (*2)
High/Low limit range alarm	0 to Input span ℃ (℉) (*1) (*2)
High/Low limit range independent alarm	0 to Input span ℃ (℉) (*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 ℃ (℉) (*1) (*2)
Low limit with standby alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
High/Low limits with standby alarm	0 to Input span ℃ (℉) (*1) (*2)
High/Low limits with standby independent alarm	0 to Input span ℃ (℉) (*1) (*2)

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 EV1 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.

Characters, Factory Default	Setting Item, Function, Setting Range
A1H□ □□□0	**EV1 high limit alarm value** • Sets EV1 high limit alarm value. This value is available only for the following cases: □004 (Alarm output, High/Low limits independent alarm), □006 (Alarm output, High/Low limit range independent alarm), or □012 (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
A2□□ □□□0	**EV2 alarm value** • 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), □006 (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]. • Setting range: Same as those of EV1 alarm value Available only when □001 (Alarm output, High limit alarm) to □012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV2 allocation].
A2H□ □□□0	**EV2 high limit alarm value** • Sets EV2 high limit alarm value. This value is available only for the following cases: □004 (Alarm output, High/Low limits independent alarm), □006 (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. • Setting range: Same as those of EV1 alarm value
H1□□ □□0.0 H1 and CT1 current value are alternately indicated on the PV Display.	**Heater burnout alarm 1 value** • Sets the heater current value for Heater burnout alarm 1. Corresponds to [Heater burnout alarm 1 value] in Initial setting mode. Characters H1 and CT1 current value are indicated alternately on the PV Display. When OUT1 is ON, the CT1 current value is updated. When OUT1 is OFF, the unit memorizes the previous value when OUT1 was ON. Upon returning to set limits, the alarm will stop. • Setting range: 20.0 A: 0.0 to 20.0 A 100.0 A: 0.0 to 100.0 A Setting to 0.0 disables the alarm. Not available for direct current output type. Available only when Heater burnout alarm (C5W, EIW, W options) is ordered.

Characters, Factory Default	Setting Item, Function, Setting Range
H2□ □0.0 H2 and CT2 current value are alternately indicated on the PV Display.	**Heater burnout alarm 2 value** • Sets the heater current value for Heater burnout alarm 2. Available only when using 3-phase. Corresponds to [Heater burnout alarm 2 value] in Initial setting mode. Characters H2 and CT2 current value are indicated alternately on the PV Display. When OUT1 is ON, the CT2 current value is updated. When OUT1 is OFF, the unit memorizes the previous value when OUT1 was ON. Upon returning to set limits, the alarm will stop. • Setting range: 20.0 A: 0.0 to 20.0 A 100.0 A: 0.0 to 100.0 A Setting to 0.0 disables the alarm. Not available for direct current output type. Available only when Heater burnout alarm (C5W, EIW, W options) is ordered.
LP_T □□0	**Loop break alarm time** • Sets the time to assess the Loop break alarm. Corresponds to [Loop break alarm time] in Initial setting mode. Refer to 'Loop Break Alarm' on p.50. • Setting range: 0 to 200 minutes Setting to 0 (zero) disables the alarm.
LP_H □□0	**Loop break alarm span** • Sets the temperature to assess the Loop break alarm. Corresponds to [Loop Break alarm span] in Initial setting mode. Refer to 'Loop Break Alarm' on p.50. • Setting range: 0 to 150℃ (℉), 0.0 to 150.0℃ (℉) DC voltage, current inputs: 0 to 1500 (*1) Setting to 0 (zero) disables the alarm.

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

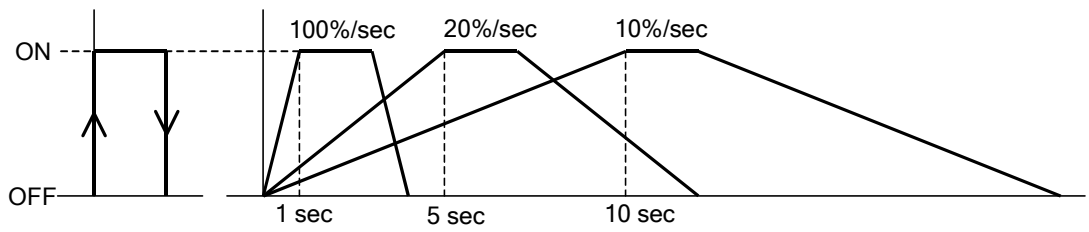
[OUT1 rate-of-change]

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℃) which are easily burnt out from turning on electricity rapidly.

● **Usual output** ● **Output when Output rate-of-change is set**



(Fig. 7.2-2) (Fig. 7.2-3)

7.3 Engineering Mode

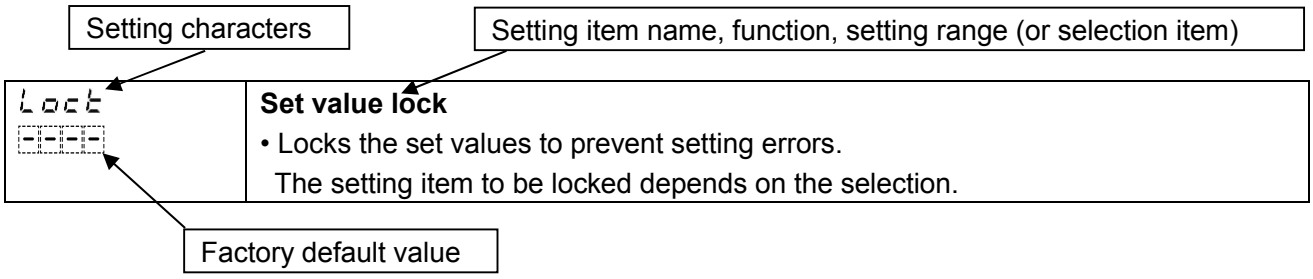
To enter Engineering mode, press and hold the ∧ and ∨ keys (in that order) together for 3 seconds in RUN mode.

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).



Characters, Factory Default	Setting Item, Function, Setting Range			
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.	All set values can be changed.
	Loc 1	Lock 1	None of the set values can be changed.	
	Loc2	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.	
	Loc3	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.
	Loc4	Lock 4	None of the set values can be changed.	
	Loc5	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
EVI 1 □000	**Event input DI1 allocation** • Selects Event input DI1 from the Event Input Allocation Table. Corresponds to [Event input DI1 allocation] in Initial setting mode. • Selection item: **Event Input Allocation Table**

	Event input function	Input ON (Closed)	Input OFF (Open)	Remarks
□000	No event			
□001	Set value memory			
□002	Control ON/OFF	Control OFF	Control ON	Control output OFF function
□003	Direct/Reverse action	Direct action	Reverse action	Always effective
□004	Preset output 1 ON/OFF	Preset output	Usual control	If sensor is burnt out, the unit maintains control with the preset MV.
□005	Preset output 2 ON/OFF	Preset output	Usual control	The unit maintains control with the preset MV.
□006	Auto/Manual control	Manual control	Automatic control	Effective when Auto/Manual control is selected in [OUT/ OFF key function].
□007	Remote/Local	Remote	Local	Effective when External setting input (EIT option) is ordered.
□008	Program control RUN/STOP	RUN	STOP	Level action when power is turned on
□009	Program control Holding/Not holding	Holding	Not holding	Level action when power is turned on
□010	Program control Advance function	Advance function	Usual control	
□011	Integral action holding	Integral action holding	Usual integral action	Control continues with the integral value being held.

For BCS2, available only when Event input (EIW, EIT, EI options) is ordered.
For BCR2/BCD2, available when Serial communication (C5W option) or Event input (EIW, EIT, EI options) is ordered.

EVI 2 □000	**Event input DI2 allocation** • Selects Event input DI2 from the Event Input Allocation Table. Corresponds to [Event input DI2 allocation] in Initial setting mode. • Selection item: Same as Event input DI1 allocation For BCS2, available only when Event input (EIW, EI options) is ordered. For BCR2/BCD2, available when Serial communication (C5W option) or Event input (EIW, EIT, EI options) is ordered.

<table>
<tr><th>Characters,
Factory Default</th><th colspan="3">Setting Item, Function, Setting Range</th></tr>
<tr><td>Evo 1
□000</td><td colspan="3">Event output EV1 allocation
• 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.96).
• Selection item:
Event Output Allocation Table
<table>
<tr><td>□000</td><td>No event</td><td></td></tr>
<tr><td>□001</td><td>Alarm output, High limit alarm</td><td></td></tr>
<tr><td>□002</td><td>Alarm output, Low limit alarm</td><td></td></tr>
<tr><td>□003</td><td>Alarm output, High/Low limits alarm</td><td></td></tr>
<tr><td>□004</td><td>Alarm output, High/Low limits independent alarm</td><td></td></tr>
<tr><td>□005</td><td>Alarm output, High/Low limit range alarm</td><td></td></tr>
<tr><td>□006</td><td>Alarm output, High/Low limit range independent alarm</td><td></td></tr>
<tr><td>□007</td><td>Alarm output, Process high alarm</td><td></td></tr>
<tr><td>□008</td><td>Alarm output, Process low alarm</td><td></td></tr>
<tr><td>□009</td><td>Alarm output, High limit with standby</td><td></td></tr>
<tr><td>□010</td><td>Alarm output, Low limit with standby</td><td></td></tr>
<tr><td>□011</td><td>Alarm output, High/Low limits with standby alarm</td><td></td></tr>
<tr><td>□012</td><td>Alarm output, High/Low limits with standby independent alarm</td><td></td></tr>
<tr><td>□013</td><td>Heater burnout alarm output</td><td></td></tr>
<tr><td>□014</td><td>Loop break alarm output</td><td></td></tr>
<tr><td>□015</td><td>Time signal output</td><td>Turns OFF or ON during Program control, by setting OFF and ON times within the step set in [Step number].</td></tr>
<tr><td>□016</td><td>Output during AT</td><td>Turns ON during AT.</td></tr>
<tr><td>□017</td><td>Pattern end output</td><td>Turns ON when Program control ends, and remains ON until turned OFF by pressing the ⓪ key.</td></tr>
<tr><td>□018</td><td>Output by communication command</td><td>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</td></tr>
</table></td></tr>
<tr><td>AlEA
no□□</td><td colspan="3">EV1 alarm value 0 Enabled/Disabled
• 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:
<table>
<tr><td>no□□</td><td>Disabled</td></tr>
<tr><td>YES□</td><td>Enabled</td></tr>
</table>
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 EV1 allocation].</td></tr>
</table>

Characters, Factory Default	Setting Item, Function, Setting Range	
A 1□ □□□0	**EV1 alarm value** • 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: □004 (Alarm output, High/Low limits independent alarm), □006 (Alarm output, High/Low limit range independent alarm), or □012 (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 ℃ (℉) (*1) (*2)
	Low limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits independent alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range independent alarm	0 to Input span ℃ (℉) (*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 ℃ (℉) (*1) (*2)
	Low limit with standby alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby independent alarm	0 to Input span ℃ (℉) (*1) (*2)
	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 EV1 allocation].	
A 1H□ □□□0	**EV1 high limit alarm value** • Sets EV1 high limit alarm value. This value is available only for the following cases: □004 (Alarm output, High/Low limits independent alarm), □006 (Alarm output, High/Low limit range independent alarm), □012 (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	
A 1HY □□ 1.0	**EV1 alarm hysteresis** • Sets EV1 alarm hysteresis. Corresponds to [EV1 alarm hysteresis] in Initial setting mode. • Setting range: 0.1 to 1000.0℃ (℉), DC voltage, current inputs: 1 to 10000 (*1) 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 EV1 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.

Characters, Factory Default	Setting Item, Function, Setting Range
A1dY □□□0	**EV1 alarm delay time** • 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 □001 (Alarm output, High limit alarm) to □012 (Alarm output, High/Low limits with standby independent alarm) is selected in [Event output EV1 allocation].
A1LA noAL	**EV1 alarm Energized/De-energized** • 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.50.) • Selection item: noAL: Energized rEVS: De-energized 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 EV1 allocation].
TS1S □□□1	**TS1 output step number** • 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 □015 (Time signal output) is selected in [Event output EV1 allocation].
TS1F 00.00	**TS1 OFF time** • 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 □015 (Time signal output) is selected in [Event output EV1 allocation].
TS1o 00.00	**TS1 ON time** • 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 □015 (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		
Eво2 □000	**Event output EV2 allocation** • 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.96). • 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	
	□013	Heater burnout alarm output	
	□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 ◎ 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 (EV2 option) is ordered.		

Characters, Factory Default	Setting Item, Function, Setting Range	
A2EA no□□	**EV2 alarm value 0 Enabled/Disabled** • 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
	YES□	Enabled
	Available only when Event output EV2 (EV2 option) is ordered. 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].	
A2□□ □□□0	**EV2 alarm value** • 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), □006 (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]. • Setting range:	
	High limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	Low limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits independent alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range independent alarm	0 to Input span ℃ (℉) (*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 ℃ (℉) (*1) (*2)
	Low limit with standby alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby independent alarm	0 to Input span ℃ (℉) (*1) (*2)
	Available only when Event output EV2 (EV2 option) is ordered. 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].	
A2H□ □□□0	**EV2 high limit alarm value** • Sets EV2 high limit alarm value. This value is available only for the following cases: □004 (Alarm output, High/Low limits independent alarm), □006 (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. • Setting range: Same as those of EV2 alarm value Available only when Event output EV2 (EV2 option) is ordered.	

(*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
A2HY □□ 1.0	**EV2 alarm hysteresis** • Sets EV2 alarm hysteresis. Corresponds to [EV2 alarm hysteresis] in Initial setting mode. • Setting range: 0.1 to 1000.0℃ (℉), DC voltage, current inputs: 1 to 10000 (*1) Available only when Event output EV2 (EV2 option) is ordered. 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].
A2dY □□□0	**EV2 alarm delay time** • 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 (EV2 option) is ordered. 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].
A2LA noAL	**EV2 alarm Energized/De-energized** • 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.50). • Selection item: noAL — Energized rEVS — De-energized Available only when Event output EV2 (EV2 option) is ordered. 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].
TS2N □□□1	**TS2 output step number** • 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 □015 (Time signal output) is selected in [Event output EV2 allocation].
TS2F 00.00	**TS2 OFF time** • 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 □015 (Time signal output) is selected in [Event output EV2 allocation].
TS2o 00.00	**TS2 ON time** • 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 □015 (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
SoC 1.000	**Sensor correction coefficient** • Sets sensor correction coefficient. Sets slope of input value from a sensor. PV after sensor correction= Current PV x (Sensor correction coefficient) + (Sensor correction value) Refer to Section '9.1 Input Value Correction' (p. 97). • Setting range: -10.000 to 10.000
So 0.0	**Sensor correction** • 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. PV after sensor correction= Current PV x (Sensor correction coefficient) + (Sensor correction value) Refer to Section '9.1 Input Value Correction' (p.97). • Setting range: -1000.0 to 1000.0℃ (℉) DC voltage, current inputs: -10000 to 10000 (*1)
FILT 0.0	**PV filter time constant** • 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
cMdL noML	**Communication protocol** • Selects communication protocol. • Selection item: noML: Shinko protocol ModA: Modbus ASCII Modr: Modbus RTU Available only when Serial communication (C5W, C5 options) is ordered.
cMno 0	**Instrument number** • 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 Available only when Serial communication (C5W, C5 options) is ordered.

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

Characters, Factory Default	Setting Item, Function, Setting Range	
cMSP □□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 (C5W, C5 options) is ordered.	
cMFT 7EVn	**Data bit/Parity** • Selects data bit and parity. • Selection item:	
	8non	8 bits/No parity
	7non	7 bits/No parity
	8EVn	8 bits/Even
	7EVn	7 bits/Even
	8odd	8 bits/Odd
	7odd	7 bits/Odd
	Available only when Serial communication (C5W, C5 options) is ordered.	
cMST □□□1	**Stop bit** • Selects the stop bit. • Selection item:	
	□□□1	1 bit
	□□□2	2 bits
	Available only when Serial communication (C5W, C5 options) is ordered.	
cMdY □□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 (C5W, C5 options) is ordered.	
SV_b □□□0	**SVTC bias** • Control desired value (SV) adds SVTC bias value to the value received by the SVTC command. • Setting range: ±20% of the input span DC voltage, current inputs: ±20% of the scaling span (*1) Available when Shinko protocol is selected in [Communication protocol]. Available when Serial communication (C5W, C5 options) is ordered.	
rEMT LocL	**Remote/Local** • Selects Remote (Remote operation) or Local (keypad operation) setting of the SV. • Selection item:	
	LocL	Local
	rEMT	Remote
	Available only when External setting input (EIT option) is ordered.	

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

Characters, Factory Default	Setting Item, Function, Setting Range
rTLH 1370	**External setting input high limit** • Sets External setting input high limit value. (This value corresponds to 20 mA in Direct current input.) • Setting range: External setting input low limit to Input range high limit Available only when External setting input (EIT option) is ordered.
rTLL -200	**External setting input low limit** • Sets External setting input low limit value. (This value corresponds to 4 mA in Direct current input.) • Setting range: Input range low limit to External setting input high limit Available only when External setting input (EIT option) is ordered.
rT_b □□0	**Remote bias** • During remote action, SV includes the remote bias value. • Setting range: ±20% of the input span DC voltage, current inputs: ±20% of the scaling span (*1) Available only when External setting input (EIT option) is ordered.
Tro4 PV□□	**Transmission output type** • Selects the transmission output type. • When changing transmission output type, refer to Section “8.10 Items to be Initialized by Changing Settings” (p.96). • Selection item: PV□□ PV transmission SV□□ SV transmission AV□□ MV transmission dV□□ DV transmission Available only when Transmission output (EIT option) is ordered.
TrLH 1370	**Transmission output high limit** • Sets the Transmission output high limit value. (This value correponds to 20 mA in Direct current output.) • Setting range: PV, SV transmission: Transmission output low limit to Input range high limit value MV transmission: Transmission output low limit to 105.0% DV transmission: Transmission output low limit to Scaling span (*1) Available only when Transmission output (EIT option) is ordered.
TrLL -200	**Transmission output low limit** • Sets the Transmission output low limit value. (This value correponds to 4 mA in Direct current output.) • Setting range: PV, SV transmission: Input range low limit to Transmission output high limit value MV transmission: -5.0% to Transmission output high limit value DV transmission: -Scaling span to Transmission output high limit value (*1) Available only when Transmission output (EIT option) is ordered.
A_4□ Hr n□	**Step time unit** • Selects the Step time unit for the Program control. • Selection item: Hr n□ Hours:Minutes 4Ec□ 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	
P-ET STOP	**Power restore action** • Selects the program status if a power failure occurs mid-program and it is restored. • Selection item:	
	STOP	Stops after power is restored.
	CONT	Continues (resumes) after power is restored.
	HOLD	Suspends (on hold) after power is restored.
	Available only when Program control is selected in [OUT/OFF key function].	
S_SV □□□0	**Program start temperature** • 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].	
S_SL PV□□	**Program control start type** • Selects the Program control start type. • Selection item:	
	PV□□	PV start
	PVR□	PVR start
	SV□□	SV start
	Available only when Program control is selected in [OUT/OFF key function].	
REPT □□□0	**Number of repetitions** • 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].	
RSS SVST	**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. • When power is turned ON, PV start is adopted for SV Rise/Fall rate action, regardless of the selected type. • Selection item:	
	SVST	SV start
	PVST	PV start
RATU □□□0	**SV rise rate** • Sets SV rise rate (rising value for 1 minute). When the SV is adjusted, it approaches the new SV by the preset rate-of-change (℃/min, ℉/min). When the power is turned on, the control starts from the PV, and approaches the SV by the rate-of-change (℃/min, ℉/min). • Setting range: 0 to 10000 ℃/min (℉/min) Thermocouple, RTD inputs with a decimal point: 0.0 to 1000.0 ℃/min (℉/min) DC voltage, current inputs: 0 to 10000/min Setting to 0 or 0.0 disables this function.	

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

Characters, Factory Default	Setting Item, Function, Setting Range	
rRTd □□□0	**SV fall rate** • 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 (℃/min, ℉/min). When the power is turned on, the control starts from the PV and approaches the SV by the rate-of-change (℃/min, ℉/min). • Setting range: 0 to 10000 ℃/min (℉/min) Thermocouple, RTD inputs with a decimal point: 0.0 to 1000.0 ℃/min (℉/min) DC voltage, current inputs: 0 to 10000/min Setting to 0 or 0.0 disables this function.	
PYB□ oFF□	**Indication when control output OFF** • Selects the indication when control output is OFF. • Selection item:	
	oFF□	OFF indication
	RoFF	No indication
	PV□□	PV indication
	PVAL	PV indication + Any Alarm active
AT_b □□20	**AT bias** • 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.82). • Setting range: 0 to 50℃ (0 to 100℉) or 0.0 to 50.0℃ (0.0 to 100.0℉) Available only for PID control. Not available for DC voltage, current inputs	
AT_t □□ 10	**AT gain** • Sets proportional band ratio calculated by performing AT or 'AT on startup'. • Setting range: 0.1 to 10.0 times	
EoUT oFF□	**Output status when input errors occur** • Selects the output status when input errors occur. • Selection item:	
	oFF□	Output OFF
	on□□	Output ON
	Available for Direct current and voltage inputs, and Direct current output.	
mAnU oFF□	**OUT/OFF key function** • Selects OUT/OFF key function. • Selection item:	
	oFF□	Control output OFF function
	mAnU	Auto/Manual control
	ProG	Program control
mArk AUTo	**Auto/Manual after power interruption** • When the power to the controller is turned ON, selects whether the unit starts using Automatic control or Manual control. • Selection item:	
	AUTo	Automatic control
	mAnU	Manual control
	Available only when Auto/Manual control is selected in [OUT/OFF key function].	

Characters, Factory Default	Setting Item, Function, Setting Range
tIME 00:00	**Indication time** • Sets time from no operation status until Displays are switched off. Displays relight by pressing any key while Displays are unlit. 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.
PWR 1 □0.0	**OUT1 MV preset value** • If 'Preset output 1 ON/OFF' or 'Preset output 2 ON/OFF' is selected in [Event input allocation], OUT1 MV can be set. **Preset output 1 ON/OFF**: If sensor is burnt out during Event Input ON, control is performed with the preset MV. **Preset output 2 ON/OFF**: When Event input is ON, control is performed with the preset MV. • Setting range: 0.0 to 100.0% (Direct current output: -5.0 to 105.0%) For BCS2, available only when Event input (EIW, EIT, EI options) is ordered. For BCR2/BCD2, available when Serial communication (C5W option) or Event input (EIW, EIT, EI options) is ordered.
PWR2 □0.0	**OUT2 MV preset value** • If 'Preset output 1 ON/OFF' or 'Preset output 2 ON/OFF' is selected in [Event input allocation], OUT2 MV can be set. **Preset output 1 ON/OFF**: If sensor is burnt out during Event Input ON, control is performed with the preset MV. **Preset output 2 ON/OFF**: When Event input is ON, control is performed with the preset MV. • Setting range: 0.0 to 100.0% (Direct current output: -5.0 to 105.0%) Available for the following cases: • For BCS2, Event output EV2 (EV2 option), Heating/Cooling control (DS, DA) or Event input (EIW, EIT, EI options) is ordered. • For BCR2/BCD2, Event output EV2 (EV2 option), Heating/Cooling control (DS, DA), Serial communication (C5W option) or Event input (EIW, EIT, EI options) is ordered. • When □019 (Heating/Cooling control relay contact output) is selected in [Event output EV2 allocation].
FUnc cnTr	**Controller/Converter function** • Selects either controller or converter function. • Selection item: cnTr: Controller cnVT: Converter Available only when OUT1 is Direct current output.

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:

tC	K -200 to 1370 ℃	tF	K -328 to 2498 ℉
t .C	K -200.0 to 400.0 ℃	t .F	K -328.0 to 752.0 ℉
JC	J -200 to 1000 ℃	JF	J -328 to 1832 ℉
rC	R 0 to 1760 ℃	rF	R 32 to 3200 ℉
SC	S 0 to 1760 ℃	SF	S 32 to 3200 ℉
bC	B 0 to 1820 ℃	bF	B 32 to 3308 ℉
EC	E -200 to 800 ℃	EF	E -328 to 1472 ℉
T .C	T -200.0 to 400.0 ℃	T .F	T -328.0 to 752.0 ℉
nC	N -200 to 1300 ℃	nF	N -328 to 2372 ℉
PL2C	PL-Ⅱ 0 to 1390 ℃	PL2F	PL-Ⅱ 32 to 2534 ℉
cC	C(W/Re5-26) 0 to 2315 ℃	cF	C(W/Re5-26) 32 to 4199 ℉
Pt .C	Pt100 -200.0 to 850.0 ℃	Pt .F	Pt100 -328.0 to 1562.0 ℉
JPt.C	JPt100 -200.0 to 500.0 ℃	JPt.F	JPt100 -328.0 to 932.0 ℉
PtC	Pt100 -200 to 850 ℃	PtF	Pt100 -328 to 1562 ℉
JPtC	JPt100 -200 to 500 ℃	JPtF	JPt100 -328 to 932 ℉
420A	4 to 20 mA DC -2000 to 10000		
020A	0 to 20 mA DC -2000 to 10000		
01 1V	0 to 1 V DC -2000 to 10000		
05V	0 to 5 V DC -2000 to 10000		
15V	1 to 5 V DC -2000 to 10000		
0 10V	0 to 10 V DC -2000 to 10000		

Factory default value is K -200 to 1370℃.

(Example) Selecting K -200.0 to 400.0℃

Power ON

↓

25
0 — RUN mode, PV/SV Display

↓ ∨+◎ (3 sec)

InS
tC — Initial setting mode, Input type

↓ ∧ or ∨

InS
t .C — t .C : K -200.0 to 400.0℃

↓ ◎ (Multiple times) or ◎ (3 sec)

25
0 — RUN mode, PV/SV Display

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.

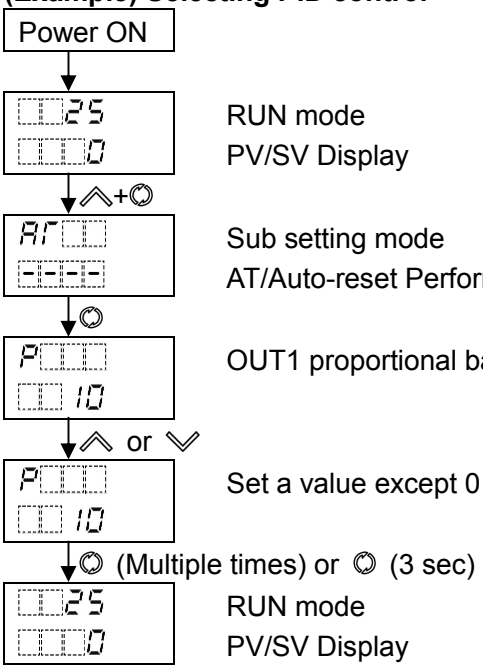
PID control

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.

- 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).

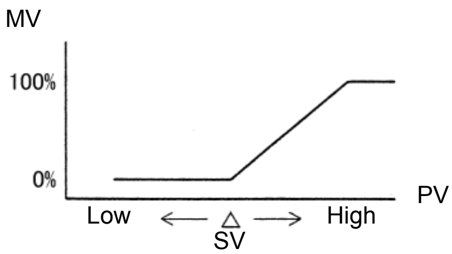
8.3 Selecting Direct/Reverse Action

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

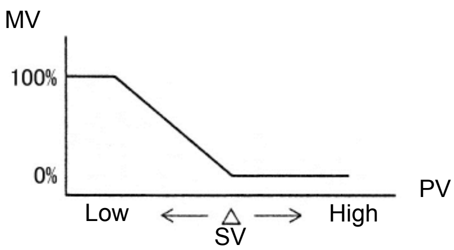
In Direct action, MV is increased when PV is higher than SV (positive deviation).
Refrigerators, etc. perform Direct action.



(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

Power ON

↓

25 / 0 — RUN mode, PV/SV Display

↓ ⩓+◎

Ar / ---- — Sub setting mode, AT/Auto-reset Perform/Cancel

↓ ◎ (Multiple times)

conT / HEAT — Direct/Reverse action.

↓ ⩓ or ⩔

conT / HEAT — Select HEAT (Reverse action).

↓ ◎ (Multiple times) or ◎ (3 sec)

25 / 0 — RUN mode, PV/SV Display

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.

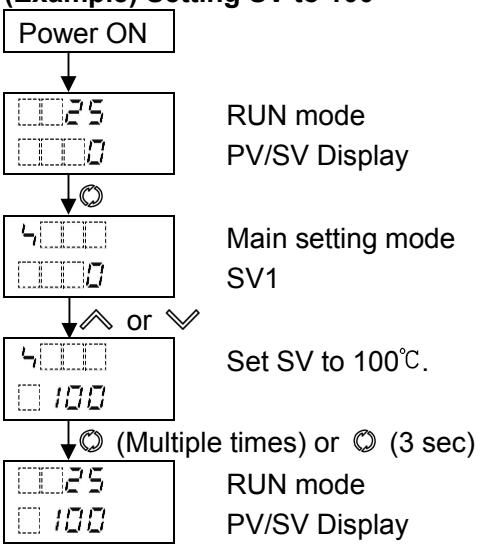
There are 2 ways to set the SV.

- 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℃



Now, settings are complete.

⚠ 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

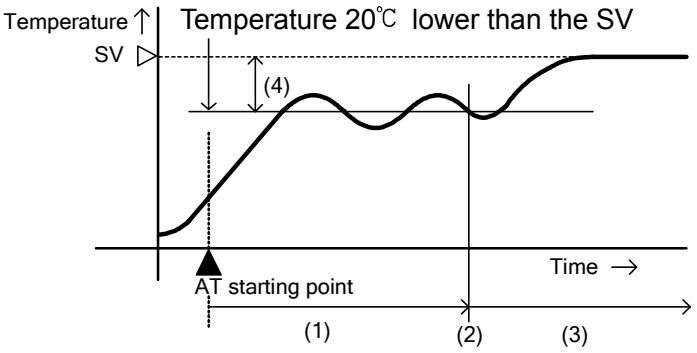
In order to set each value of P, I, D and ARW automatically, the AT process should be made to fluctuate to obtain an optimal value.

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℃, the AT process will fluctuate at the temperature 20℃ lower than the SV.

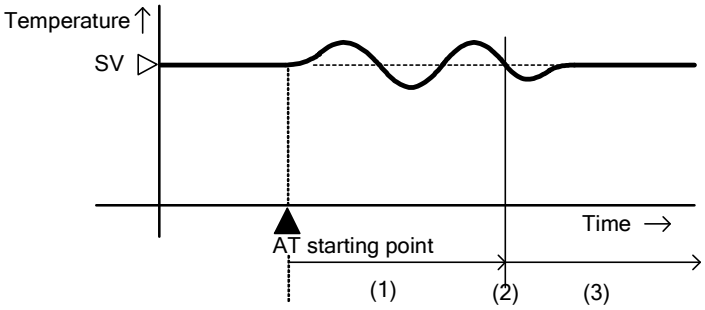


(1) Calculating PID constants
(2) PID constants calculated
(3) Controlled by the PID constants set by AT.
(4) AT bias value (Factory default: 20℃)

(Fig. 8.5-1)

[B] When the control is stable

The AT process will fluctuate around the SV.

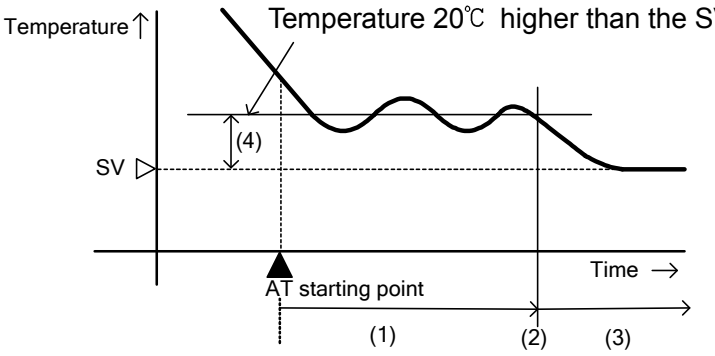


(1) Calculating PID constants
(2) PID constants calculated
(3) Controlled by the PID constants set by AT.

(Fig. 8.5-2)

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

When AT bias is set to 20℃, the AT process will fluctuate at the temperature 20℃ 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℃)

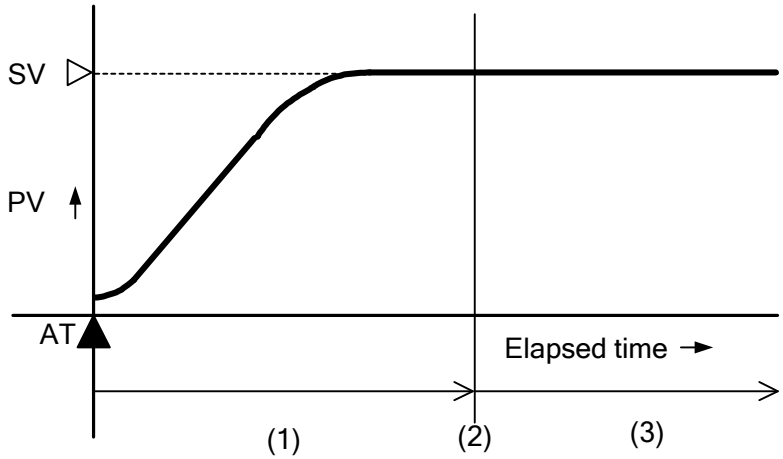
(Fig. 8.5-3)

(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 on 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.

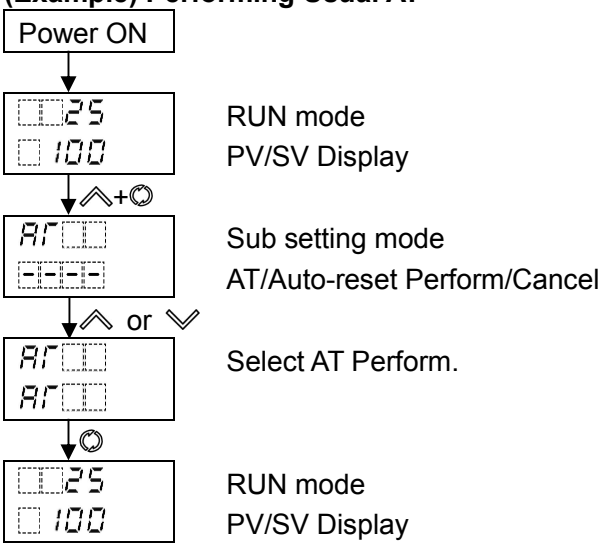
Error Code	Error Contents
E-20	PV slope and delay time cannot be measured normally for P, I, D calculation.

To cancel the error code, press the ◎ 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 not within 2℃ or is not 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 on the PV Display, and AT will automatically stop.

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

To cancel the error code, press the ◎ key.
The error code will be cancelled in the following cases.

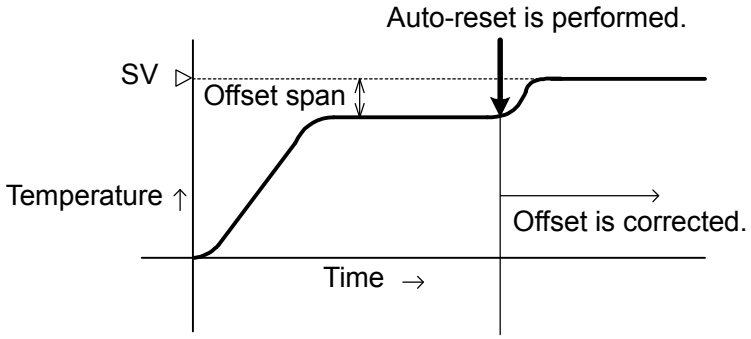
- When Control output OFF function is enabled
- When Program control is stopped and the unit reverts to the Standby (Program control waiting) mode.
- When 'Control output OFF function' or 'Auto/Manual control' is selected in [OUT/OFF key function].
- When 'AT/AT on startup/Auto-reset Cancel' is selected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

8.6 Performing Auto-reset

⚠ Notice

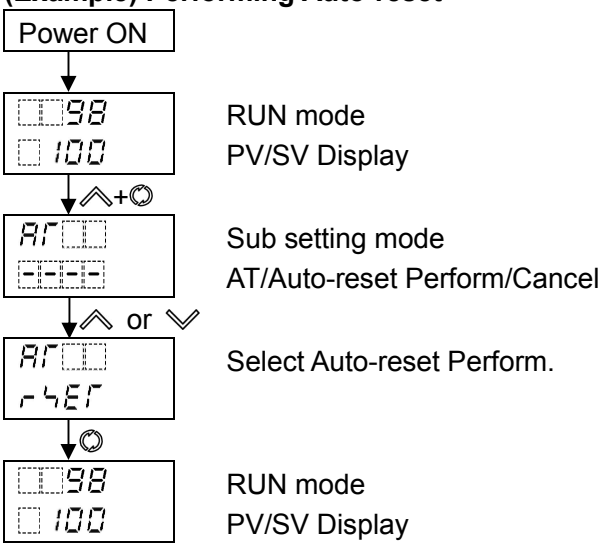
- Auto-reset is cancelled in approximately 4 minutes. It cannot be cancelled while performing this function.
- If input is burnt out, Auto-reset will be forced to stop.

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



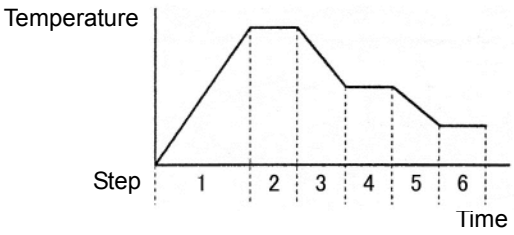
Now, selection is complete.

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 to 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.

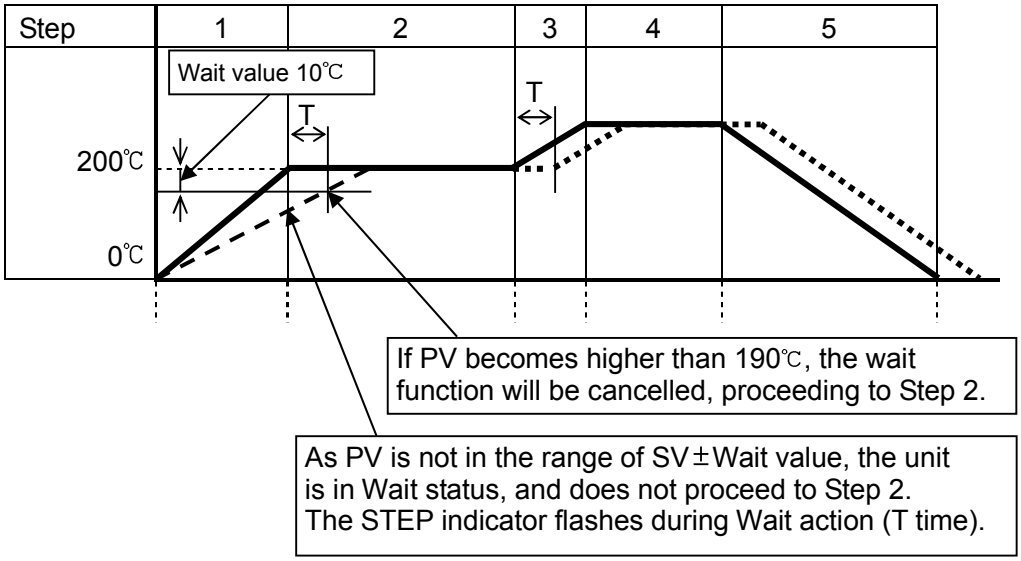
Number of patterns and steps: 1 pattern; 9 steps

[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±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- Wait value
- When program pattern is falling: PV is lower than SV+ 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 in [Event input DI1/DI2 allocation].

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.

Select this function in [Event input DI1/DI2 allocation].

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.End.

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'.

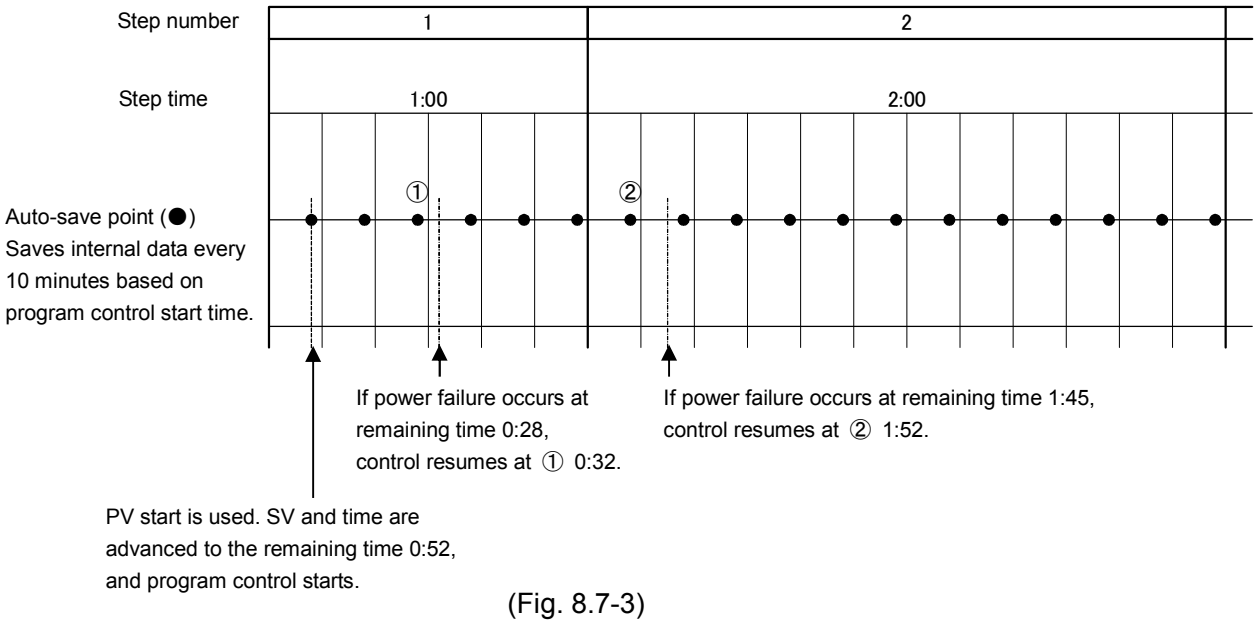
Power Restore Action	Description
Stops after power is restored.	Stops Program control, and returns to Standby (Program control waiting) mode.
Continues after power is restored. (*)	Continues (resumes) Program control.
Suspends after power is restored. (*)	Suspends (on hold) current program, and performs 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

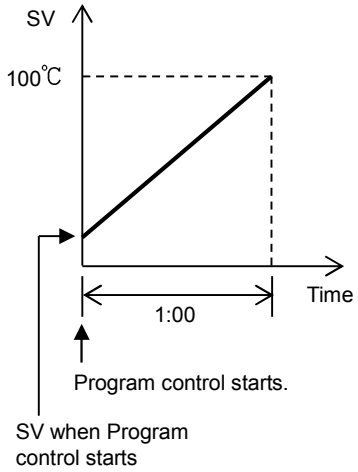
When Program control starts, it starts from the value set in [Program start temperature].
Factory default value is 0℃.

Program control start type

One type can be selected: PV start, PVR start, SV start.
Factory default value is PV start.

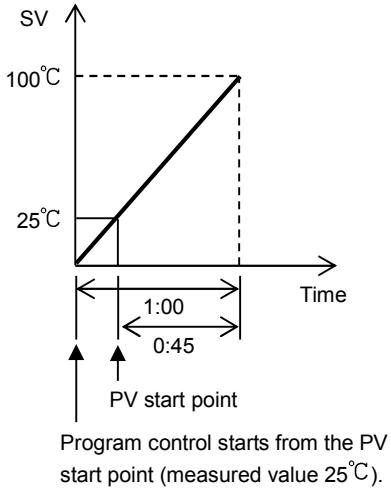
Program control start type	Description
PV start	When Program control starts, the SV and step time are advanced to the PV, then Program control starts. However, if [Program start temperature] at the time of Program control start is higher than the PV (when PV start is initiated), then Program control 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).

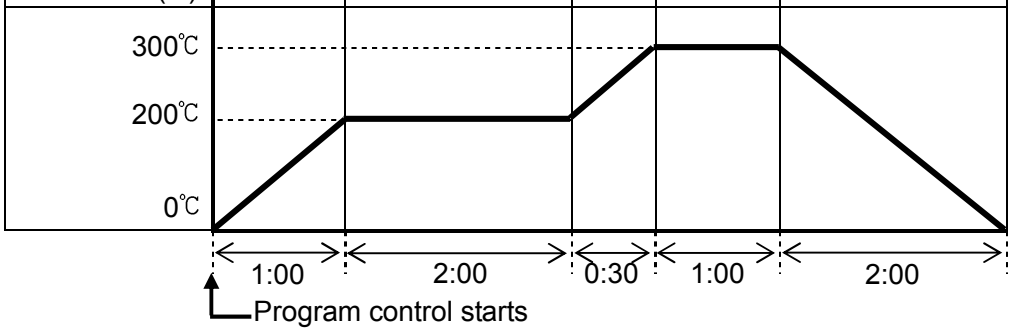
Select ‘Program control’ in [OUT/OFF key function] in Engineering mode.
Factory default value is Control output OFF function.

Set the following items in Engineering mode:
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

Step	1	2	3	4	5
SV (℃)	200	200	300	300	0
Time	1:00	2:00	0:30	1:00	2:00
Wait value (℃)	10	0	10	0	0



(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℃ for 1 hour.
When step ends, Wait function works so that control cannot proceed to the next step until PV reaches 190℃ when step ends.

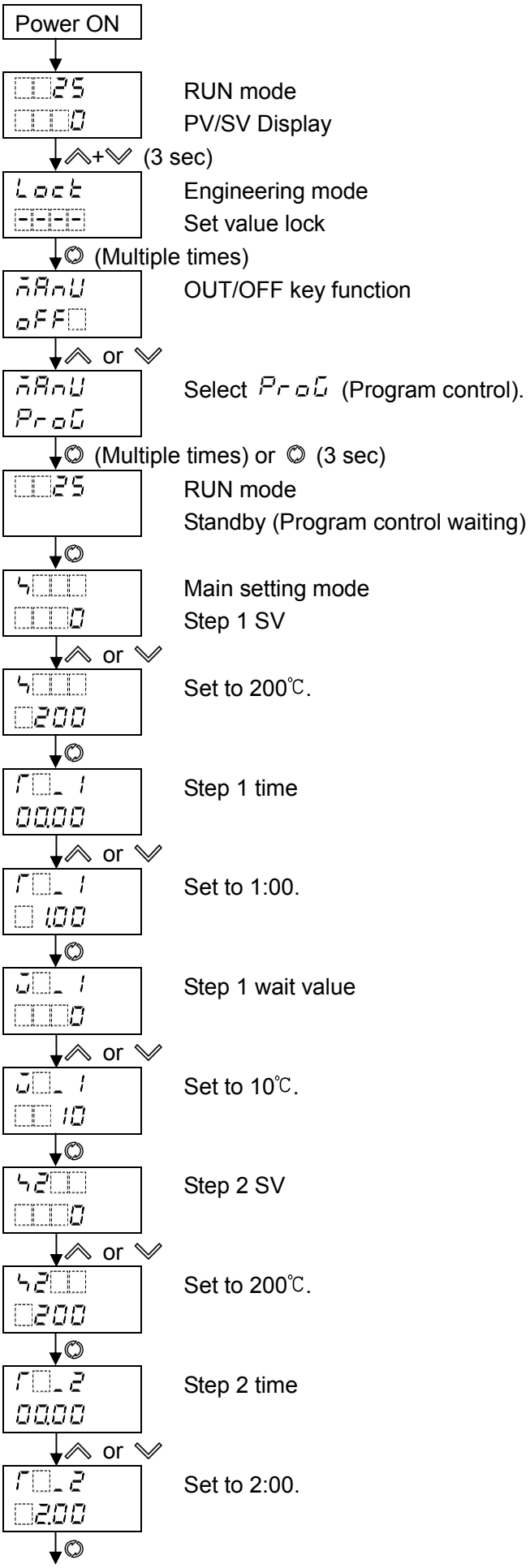
Step 2: Fixed value control is performed to keep SV at 200℃ for 2 hours.

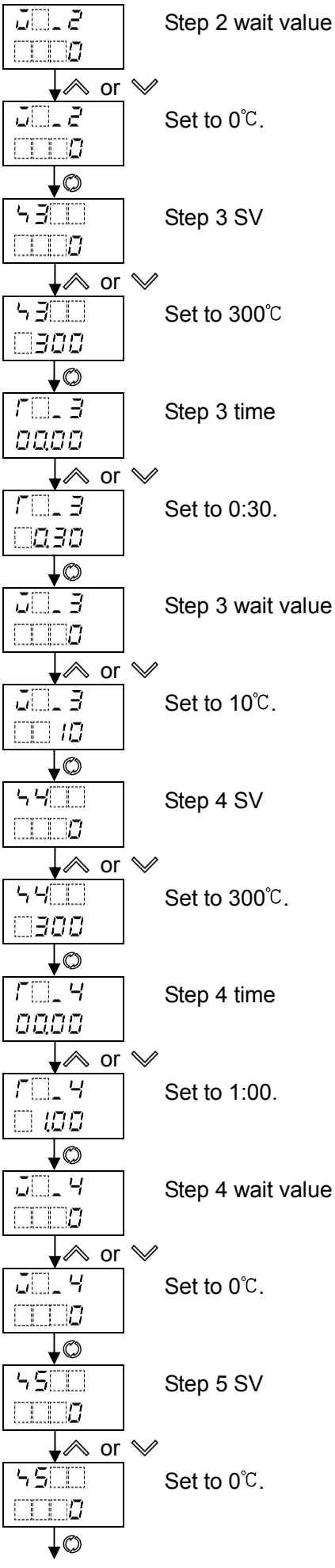
Step 3: Control is performed so that the SV gradually rises to 300℃ for 30 minutes.
When step is finished, Wait function works so that control cannot proceed to the next step until PV reaches 290℃.

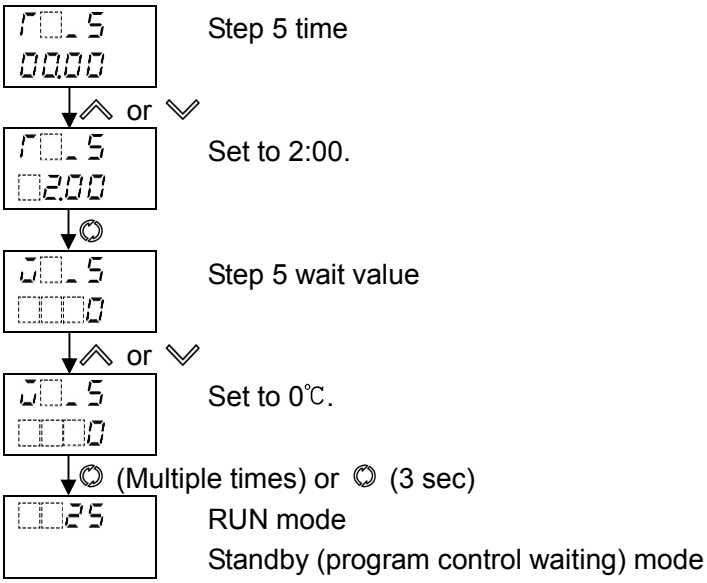
Step 4: Fixed value control is performed to keep SV at 300℃ for 1 hour.

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

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




Step 2 wait value
or
Set to 0℃.
Step 3 SV
or
Set to 300℃
Step 3 time
or
Set to 0:30.
Step 3 wait value
or
Set to 10℃.
Step 4 SV
or
Set to 300℃.
Step 4 time
or
Set to 1:00.
Step 4 wait value
or
Set to 0℃.
Step 5 SV
or
Set to 0℃.



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.

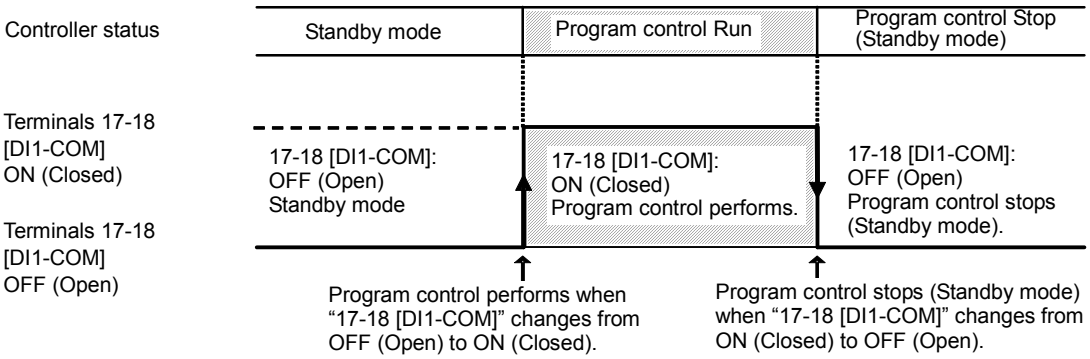
Program control will stop, and the unit will revert to Standby (Program control waiting) mode.

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.

If '008 (Program control RUN/STOP)' is selected in [Event input DI1 allocation], Program control RUN/STOP can be switched by terminals 17-18 [DI1-COM]:
Signal edge action from OFF to ON / ON to OFF is engaged.
However, for the action when power is turned ON, Level action [ON (Closed) or OFF (Open)] is engaged.



(Fig. 8.7-7)

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.

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

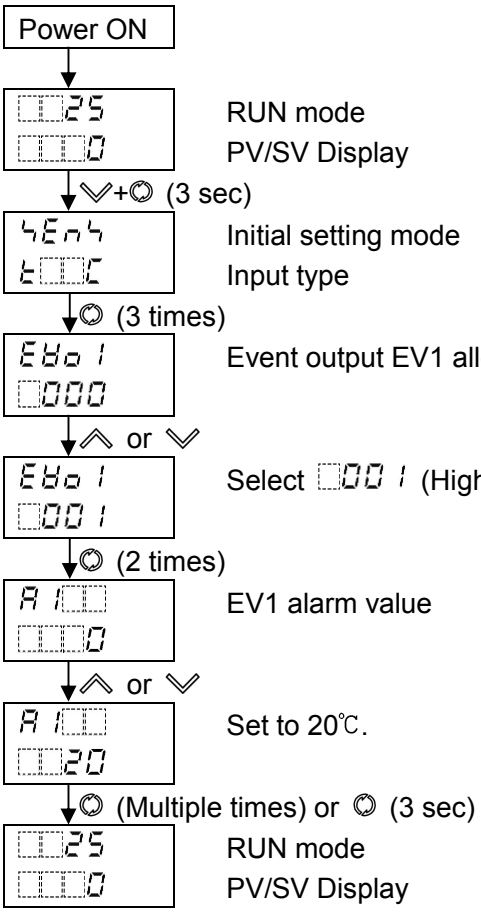
Therefore, if one [Event output EV1 allocation] is changed, the other [Event output EV1 allocation] will also be changed.

Factory default value is No event.

Selection item:

□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	
□013	Heater burnout alarm output	
□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 ⓪ 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

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



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.

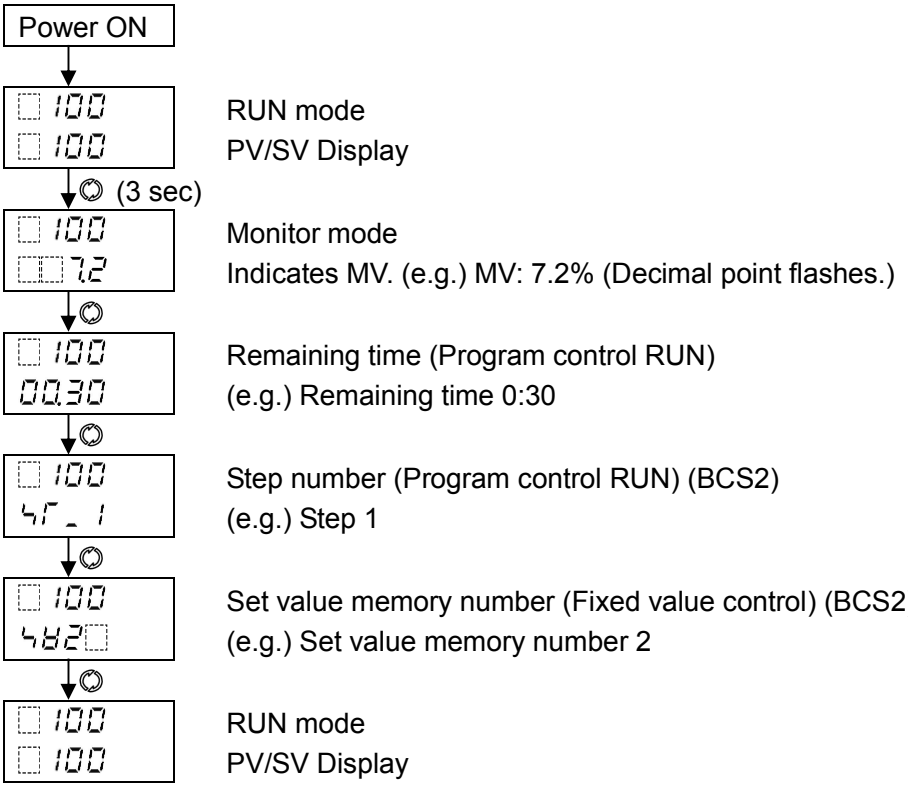
To indicate MV, press and hold the ◎ key for approx. 3 seconds on the PV/SV Display.
The unit enters Monitor mode, and indicates MV.
While MV is indicating, the decimal point flashes.
While in Standby (Program control waiting) mode of Program control, the unit cannot move to Monitor mode.

In Monitor mode, the following contents are switched every time the ◎ key is pressed.

Model	Indicated Contents	
BCS2	Fixed value control	Indicates MV, Set value memory number (in that order).
	Program control	Indicates MV, Remaining time, Step number (in that order).
BCR2, BCD2	Fixed value control	Indicates only MV. (*)
	Program control	Indicates MV, Remaining time (in that order). (*)

(*) For the BCR2, BCD2, Set value memory number (Fixed value control) and step number (Program control) are indicated on the MEMO/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.

●: Initialized

X: 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	●	X	X	X
Steps 1 to 9 wait value	●	X	X	X
AT bias	●	X	X	X
OUT1 proportional band	●	X	X	X
Manual reset	●	X	X	X
SV rise rate	●	X	X	X
SV fall rate	●	X	X	X
Scaling high limit	●	X	X	X
Scaling low limit	●	X	X	X
Program start temperature	●	X	X	X
EV1 alarm value	●	●	X	X
EV1 high limit alarm value	●	●	X	X
Loop break alarm time	●	X	X	X
Loop break alarm span	●	X	X	X
SVTC bias	●	X	X	X
Remote bias	●	X	X	X
EV2 alarm value	●	X	●	X
EV2 high limit alarm value	●	X	●	X
Transmission output high limit (Except MV transmission)	●	X	X	●
Transmission output low limit (Except MV transmission)	●	X	X	●
OUT2 proportional band	●	X	X	X
EV1 alarm value 0 Enabled/Disabled	X	●	X	X
EV1 alarm hysteresis	X	●	X	X
EV1 alarm delay time	X	●	X	X
EV1 alarm Energized/De-energized	X	●	X	X
EV2 alarm value 0 Enabled/Disabled	X	X	●	X
EV2 alarm hysteresis	X	X	●	X
EV2 alarm delay time	X	X	●	X
EV2 alarm Energized/De-energized	X	X	●	X
Sensor correction coefficient	●	X	X	X
Sensor correction value	●	X	X	X
External setting input high limit	●	X	X	X
External setting input low limit	●	X	X	X

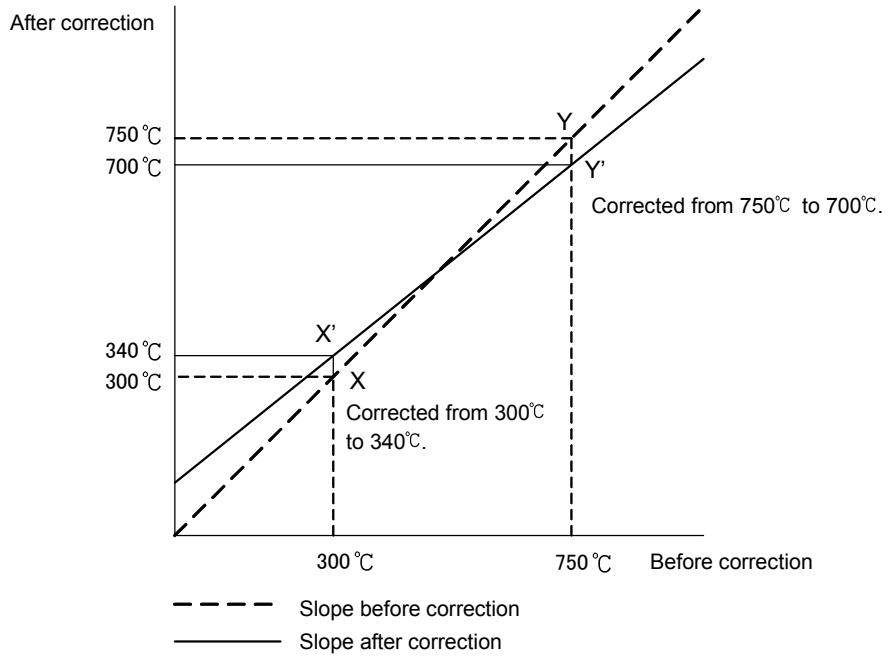
9. Attached Function

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)

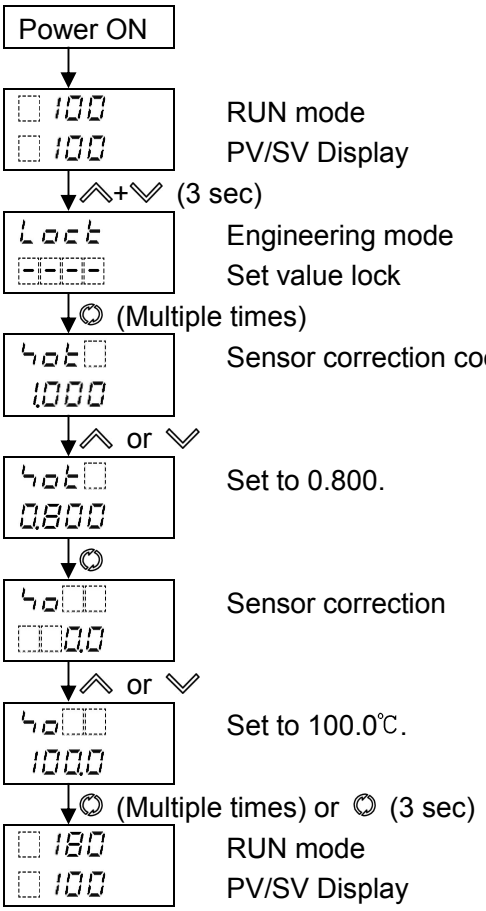
The following shows an example of input value correction using 'Sensor correction coefficient' and 'Sensor correction value'.



(Fig.9.1-1)

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

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



Now, settings are complete.

9.2 Set Value Lock

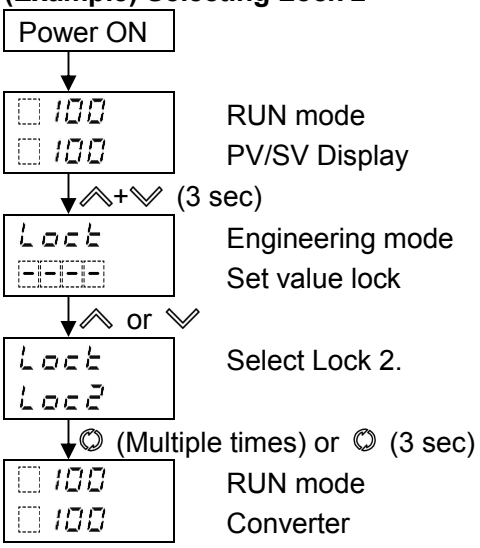
Locks the set values to prevent setting errors.

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

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



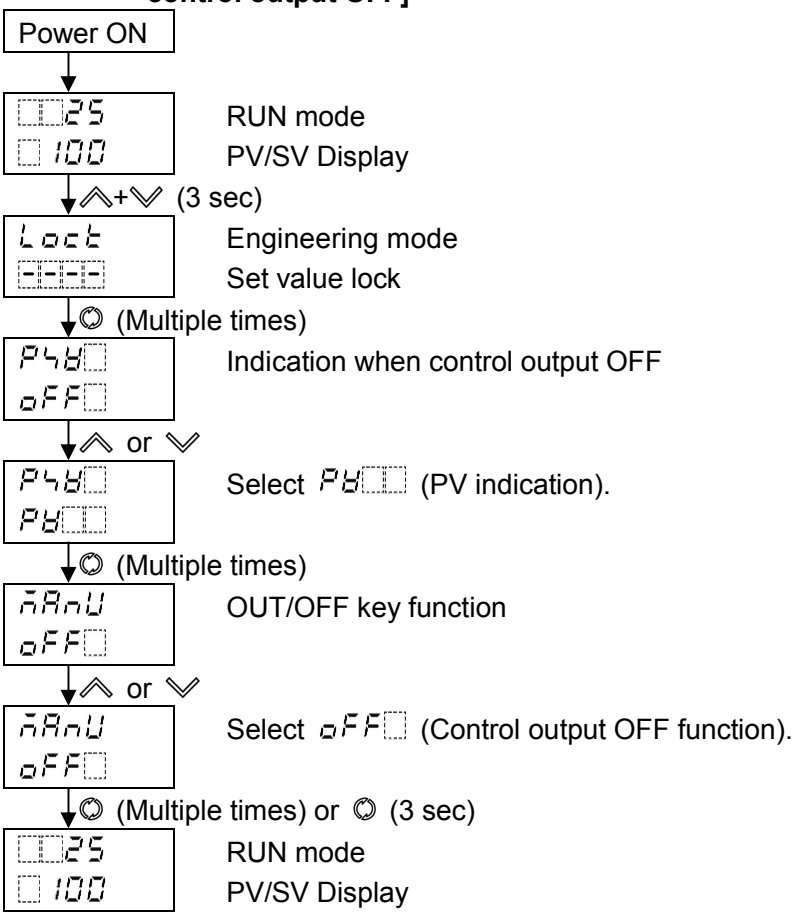
Now, selection is complete.

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.

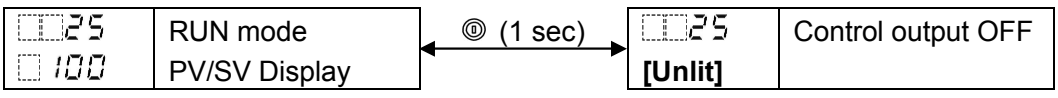
Select 'Control output OFF function' in [OUT/OFF key function] in Engineering mode.
Factory default value is Control output OFF function.

(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 on the PV/SV Display. PV is indicated on 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.



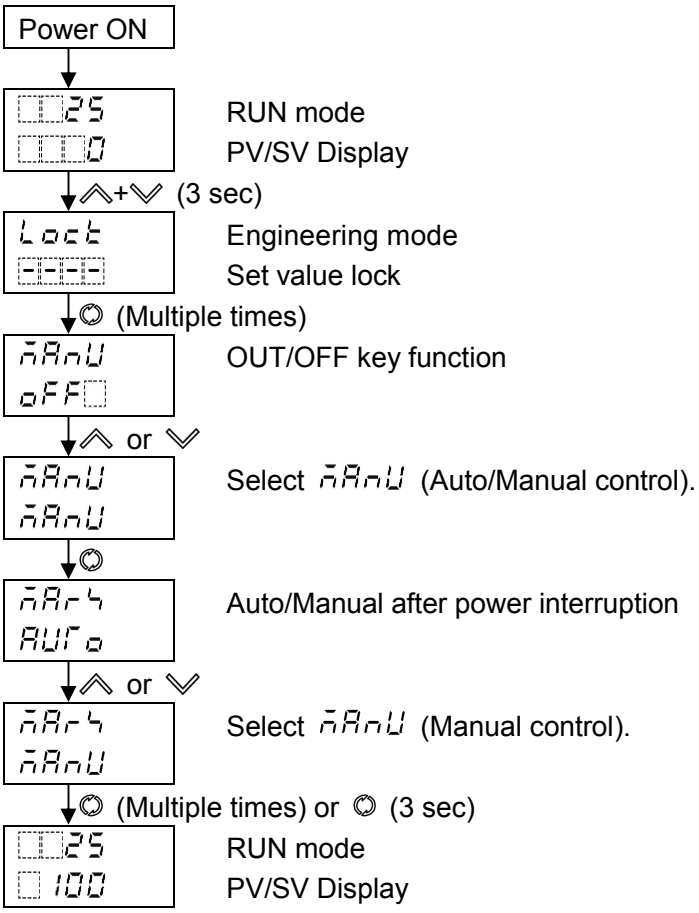
9.4 Switching Auto/Manual Control (Auto/Manual Control Function)

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.
Factory default value is Control output OFF function.

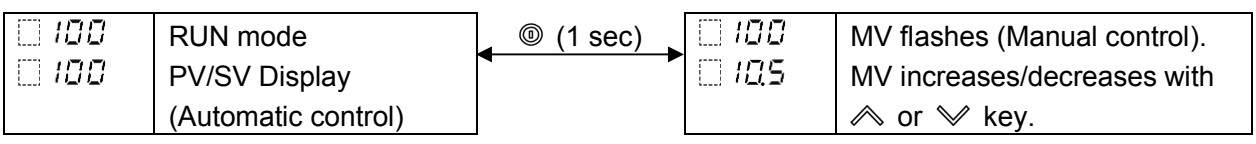
Select 'Automatic control' or 'Manual control' in [Auto/Manual after power interruption] in Engineering mode.
Factory default value is Automatic control.

(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 on the SV Display.
The MV on 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]).
However, if 006 (Auto/Manual control) is selected in [Event input DI1/DI2 allocation], then Event input status has priority.
By pressing the key again for approx. 1 second, the unit reverts to automatic control.



9.5 Using as a Converter

⚠ Caution

• Input/Output response time of this instrument is approx. 1 second.
When using as a converter, the converter input will be 1 sec slower due to the response time.
(In such cases please use a converter with input time slower than the response time above.)

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.
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 turns blank.

When this instrument is switched from converter to controller, the PV Display indicates `Init` for 1 second, and factory default values are set.

(Table 9.5-1)

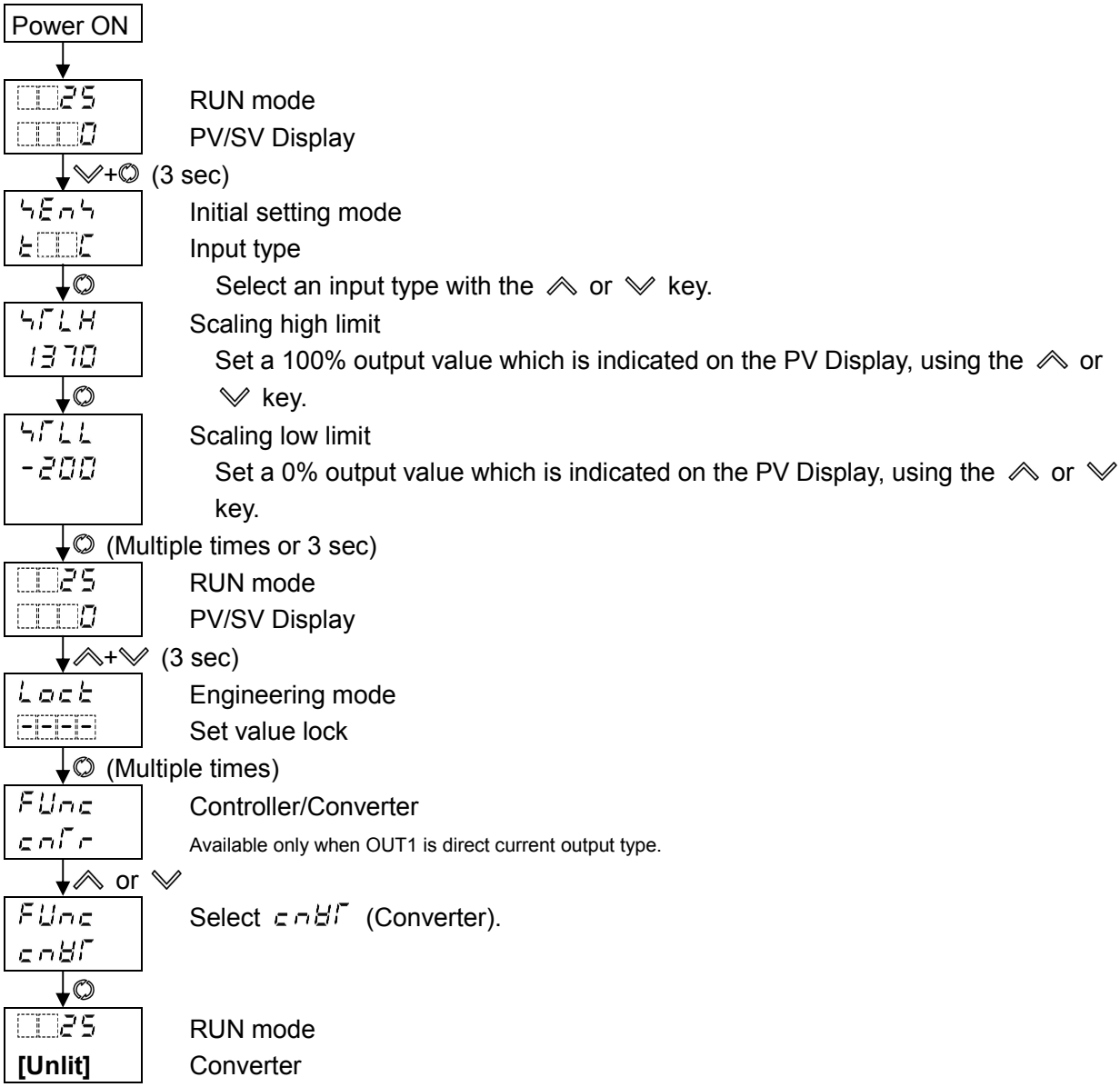
Setting Item	Set Value (or Selection)
SV1 (*1)	Scaling low limit value
SV2 (*1) (BCS2: EIW, EIT, EI options, BCR2/BCD2: C5W, EIW, EIT, EI options)	Scaling low limit value
SV3 (*1) (BCS2: EIW, EI options, BCR2/BCD2: C5W, EIW, EIT, EI options)	Scaling low limit value
SV4 (*1) (BCS2: EIW, EI options, BCR2/BCD2: C5W, EIW, EIT, EI options)	Scaling low limit value
AT/Auto-reset Perform/Cancel (*2)	AT/AT on startup/Auto-reset Cancel
OUT1 proportional band (*1)	Input span
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)	Input span
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 input DI1 allocation (BCS2: EIW, EIT, EI options, BCR2/BCD2: C5W, EIW, EIT, EI options)	No event
Event input DI2 allocation (BCS2: EIW, EI options, BCR2/BCD2: C5W, EIW, EIT, EI options)	No event

Setting Item	Set Value (or Selection)
Event output EV1 allocation	No event
Event output EV2 allocation (EV2 option)	No event
Remote/Local (EIT option)	Local
Transmission output type (EIT option)	PV transmission
Transmission output high limit (EIT option)	Input range high limit
Transmission output low limit (EIT option)	Input range low limit
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).

9.5.1 Selecting Converter Function



Now, selection is complete.

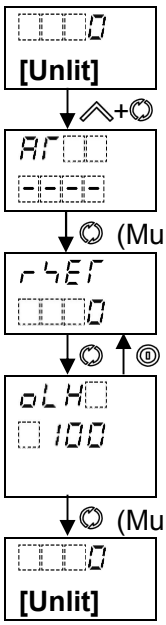
9.5.2 Converter Output Fine Adjustment (4 to 20 mA DC)

4 to 20 mA DC will be output corresponding to the input from Scaling low limit to Scaling high limit.
Fine adjustment range: 1/Scaling span

Fine Adjustment Method for Converter Output

Be sure to perform Zero side first in fine adjustment of converter output.
Perform Zero side adjustment in [Manual reset].
Perform Span side adjustment in [OUT1 proportional band].

(1) Adjust Zero side.



RUN mode (Converter)
Enter a value so that the scaling low limit value is indicated on the PV Display.

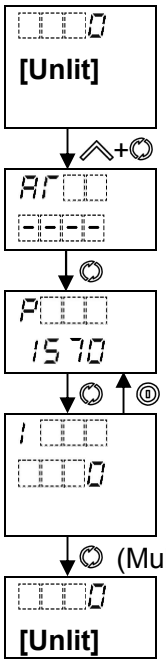
Sub setting mode
Select 'AT/Auto-reset Perform/Cancel'.

Manual reset
Adjust a value with the ∧ or ∨ key so that the output value becomes 4 mA DC. The ∧ decreases the output, and the ∨ increases the output.

OUT1 high limit
If the output value is not 4 mA DC, return to [Manual reset] with the ◎ key, and adjust again.

RUN mode (Converter)

(2) Adjust Span side.



RUN mode (Converter)
Enter a value so that the scaling high limit value is indicated on the PV Display.

Sub setting mode
Select 'AT/Auto-reset Perform/Cancel'.

OUT1 proportional band
Adjust the value with ∧ or ∨ key so that the output value becomes 20 mA DC. The ∧ decreases the output, and the ∨ increases the output.

Integral time
If the output value is not 20 mA DC, return to [OUT1 proportional band] with the ◎ key, and adjust again.

RUN mode (Converter)

(3) Repeat (1) and (2) until the correct value is output.

9.5.3 Converter Setting Example

When the input is any other value except 4 to 20 mA DC

Input and output conditions:

Input: 6 to 14 mA DC (Indication: 30.0 to 130.0),

Output: 4 to 20 mA DC

Setting method

(1) Calculating Scaling high and low limit values of 4 to 20 mA DC

Indication value per mA DC: (130.0 – 30.0) ÷ (14 – 6) = 100 ÷ 8 = 12.5

Scaling high limit value: 130.0 + (20 – 14) x 12.5 = 205.0

Scaling low limit value 30.0 – (6 – 4) x 12.5 = 5.0

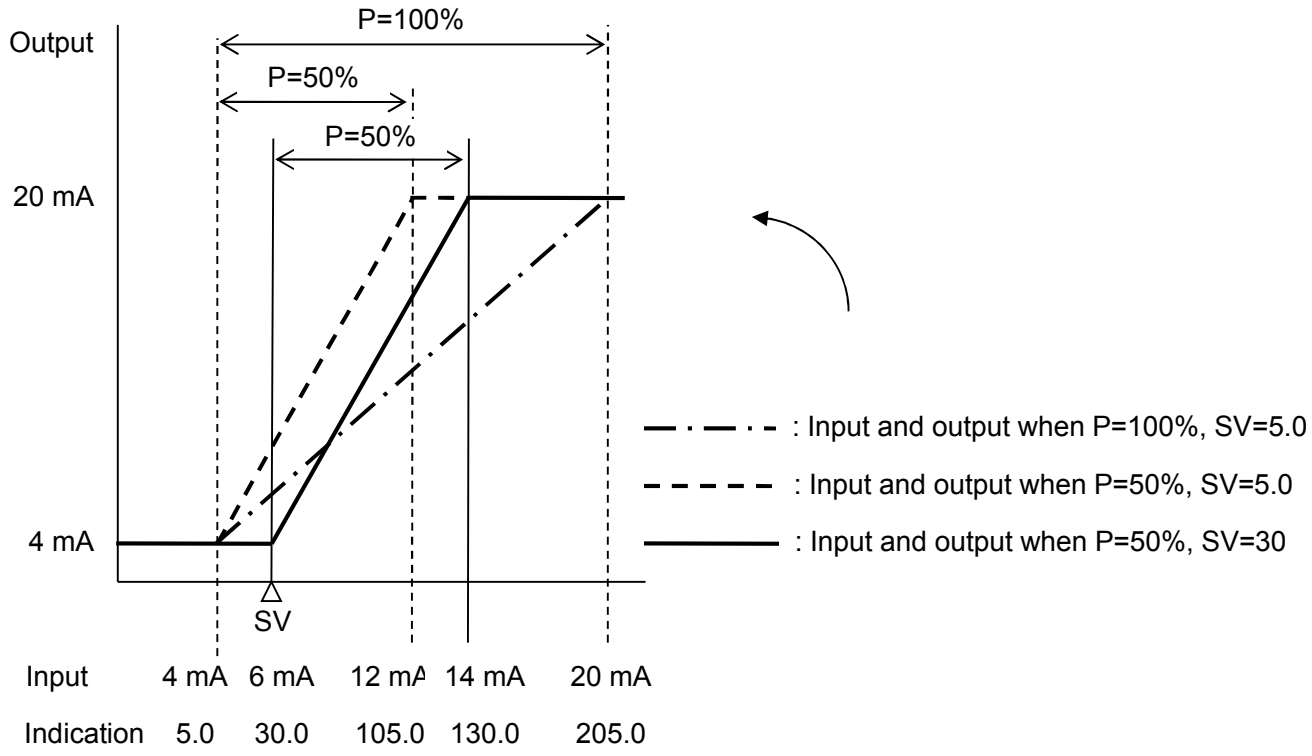
(2) Calculating OUT1 Proportional band of 6 to 14 mA DC (Slope setting)

OUT1 Proportional band (P) = {(14 – 6) ÷ (20 – 4)} x 100 = 0.5 x 100 = 50 (%)

(3) Calculating SV (desired value) so that 4 mA DC output can be obtained from 6 mA DC input (Parallel shift setting)

SV = {(6 – 4) x 12.5} + 5.0 (Scaling low limit) = 30.0

Input, Output and Indication



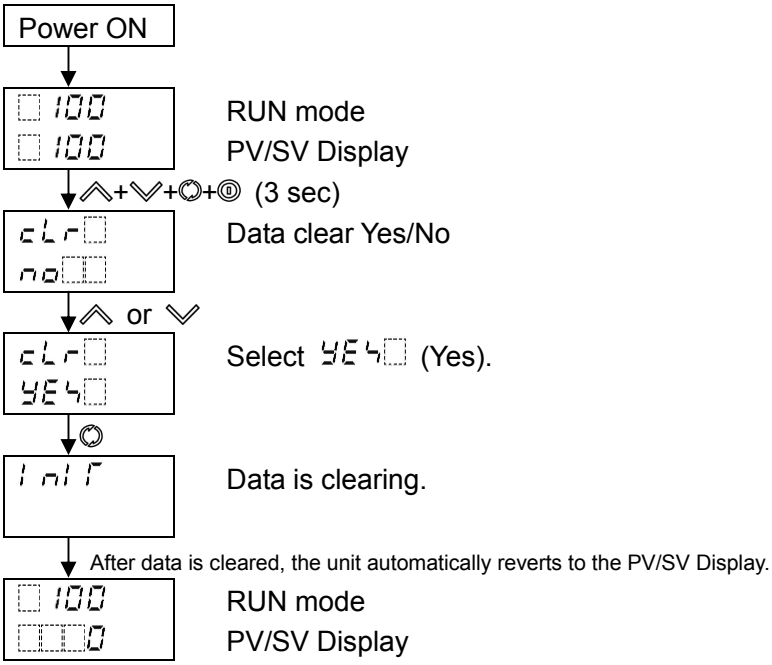
(Fig. 9.5.3-1)

9.6 Clearing Data

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

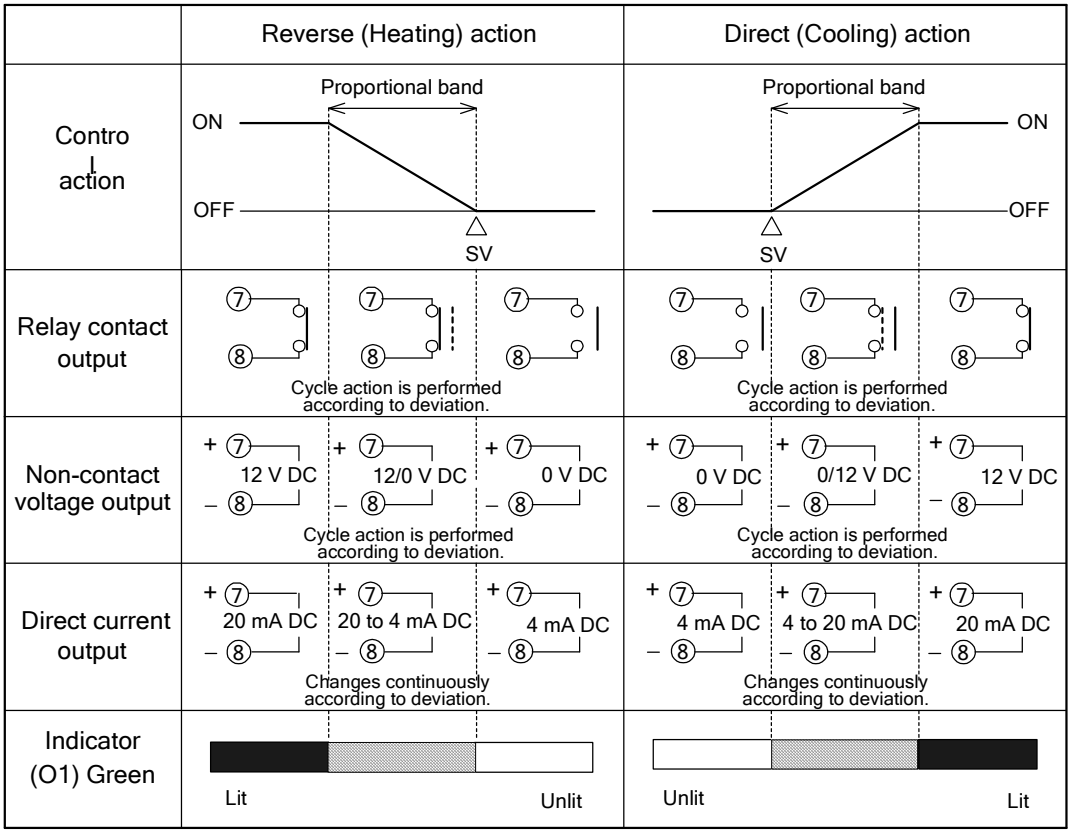
To clear data, press and hold ∧, ∨, ◎, ⓓ (in that order) together for approx. 3 seconds on the PV/SV Display.
The unit enters [Data clear Yes/No] mode.
Select 'Yes', and press the ◎ key. Data will be cleared.
While data is clearing, `Init` is indicated on the PV Display.

Executing data clear



10. Action Explanation

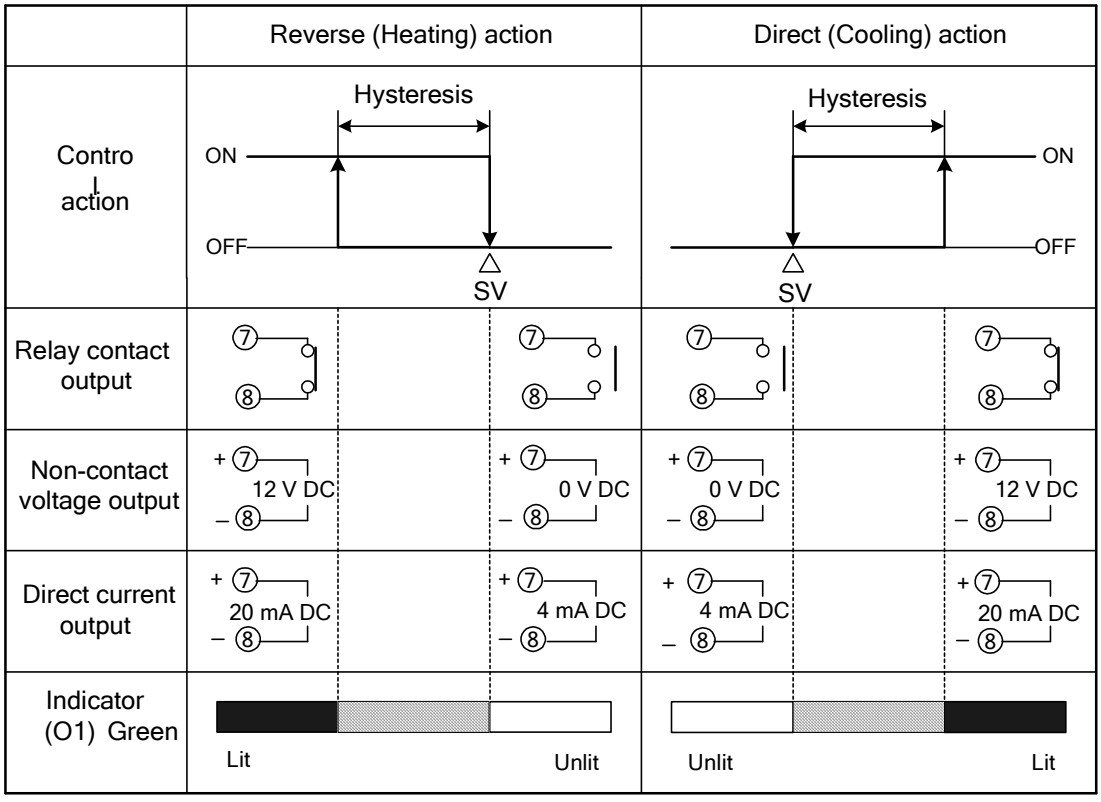
10.1 OUT1 Action



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

OUT1 terminal numbers of the BCR2, BCD2: 15, 16

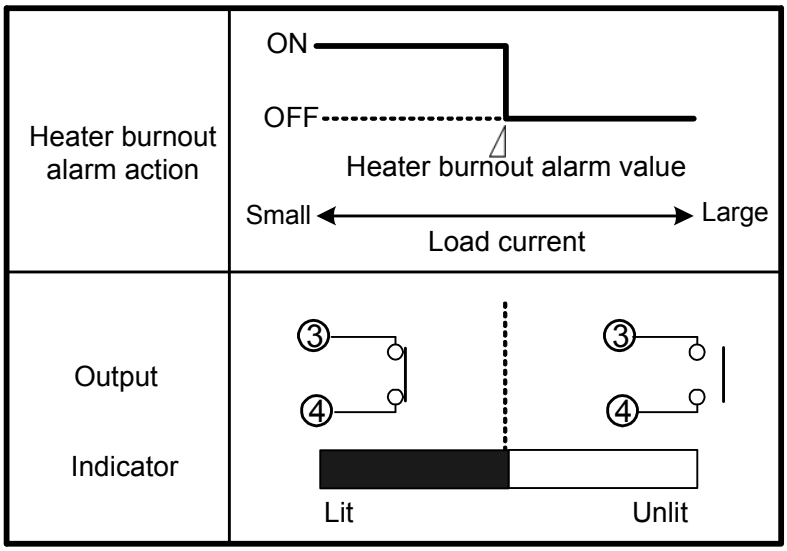
10.2 OUT1 ON/OFF Control Action



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

OUT1 terminal numbers of the BCR2, BCD2: 15, 16

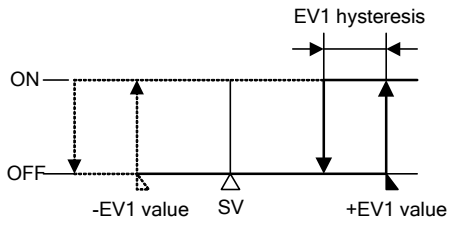
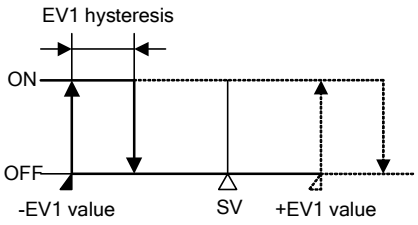
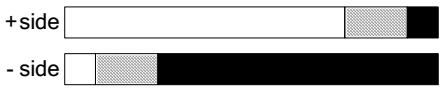
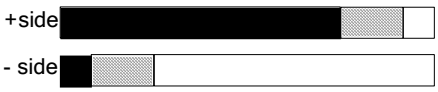
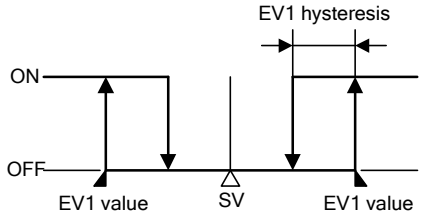
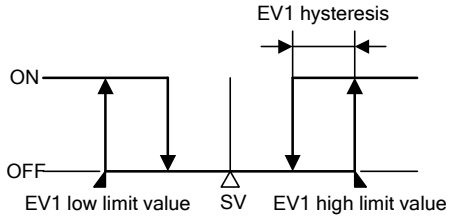
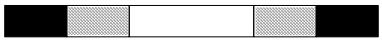
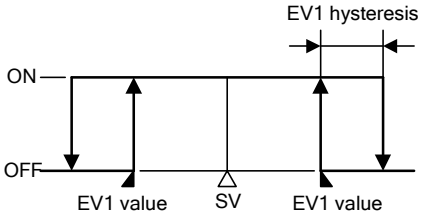
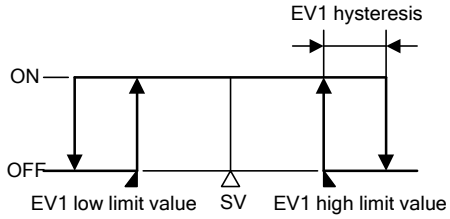
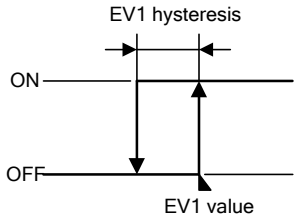
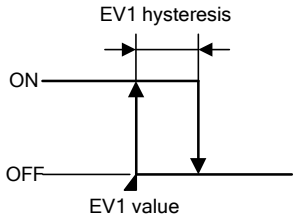
10.3 Heater Burnout Alarm Action

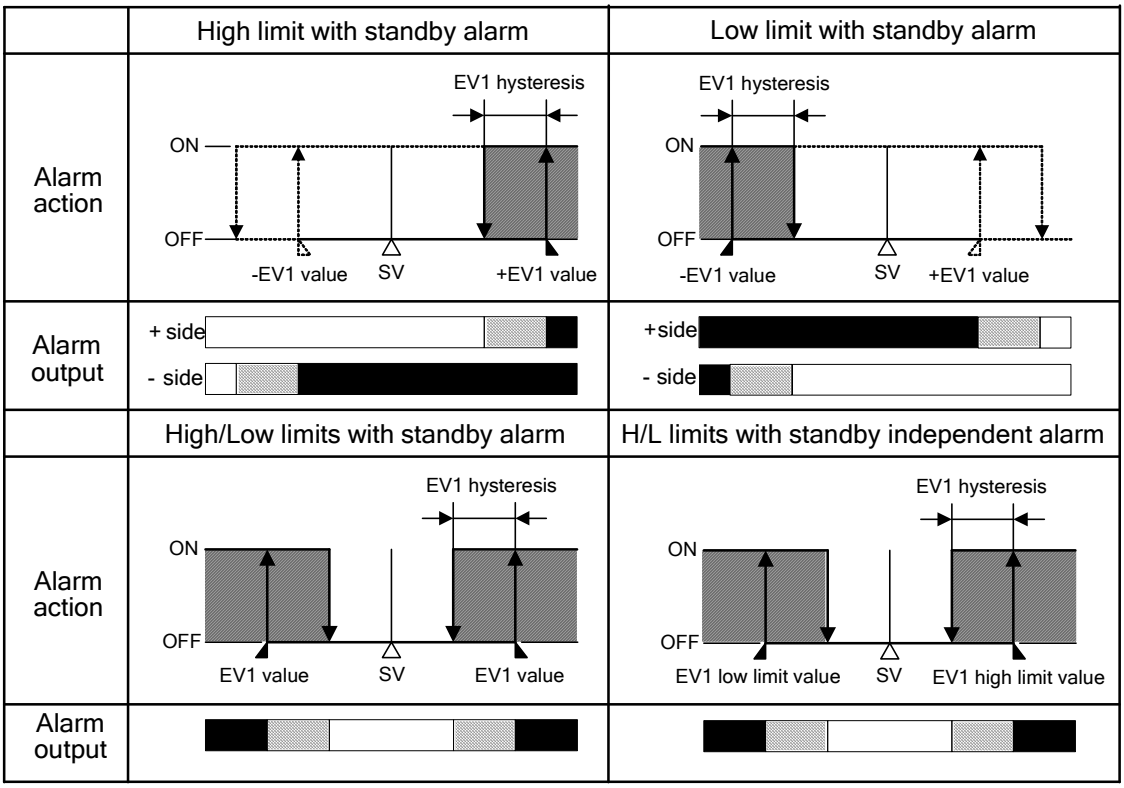


BCS2: Event output 1 terminal numbers: 3, 4 Event output 2 terminal numbers: 5, 6

BCR2, BCD2: Event output 1 terminal numbers: 17, 18 Event output 2 terminal numbers: 19, 20

10.4 Alarm Action

	High limit alarm	Low limit alarm
Alarm action		
Alarm output		
	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		



: Event output 1 terminals 3 and 4: ON (closed).

: Event output 1 terminals 3 and 4: ON (closed) or OFF (open).

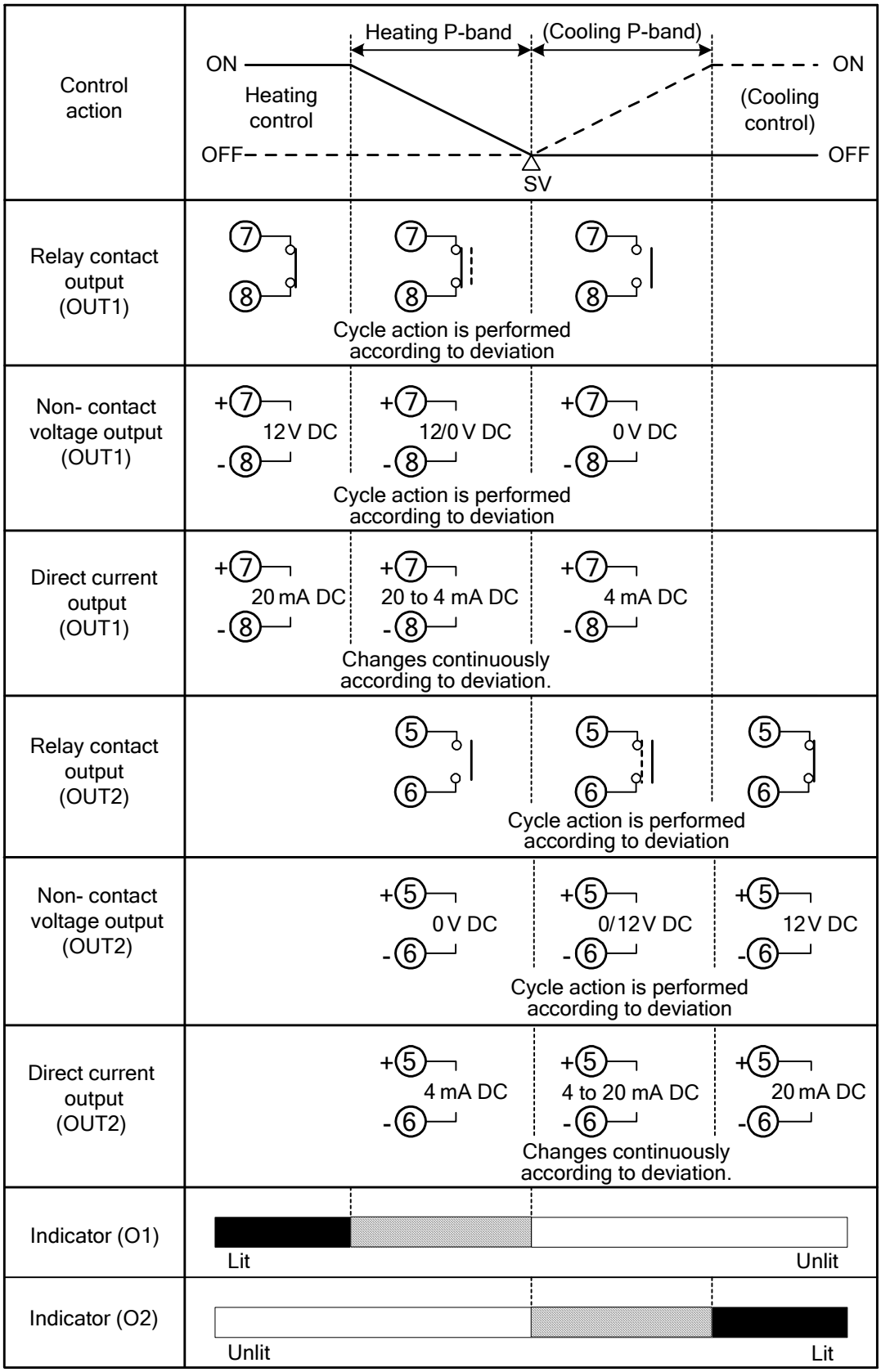
: Event output 1 terminals 3 and 4: OFF (open).

: 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, read “EV2” for “EV1”.
- 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.
- BCR2, BCD2: Event output 1 terminal numbers: 17, 18
  Event output 2 terminal numbers: 19, 20

10.5 OUT2 (Heating/Cooling Control) Action

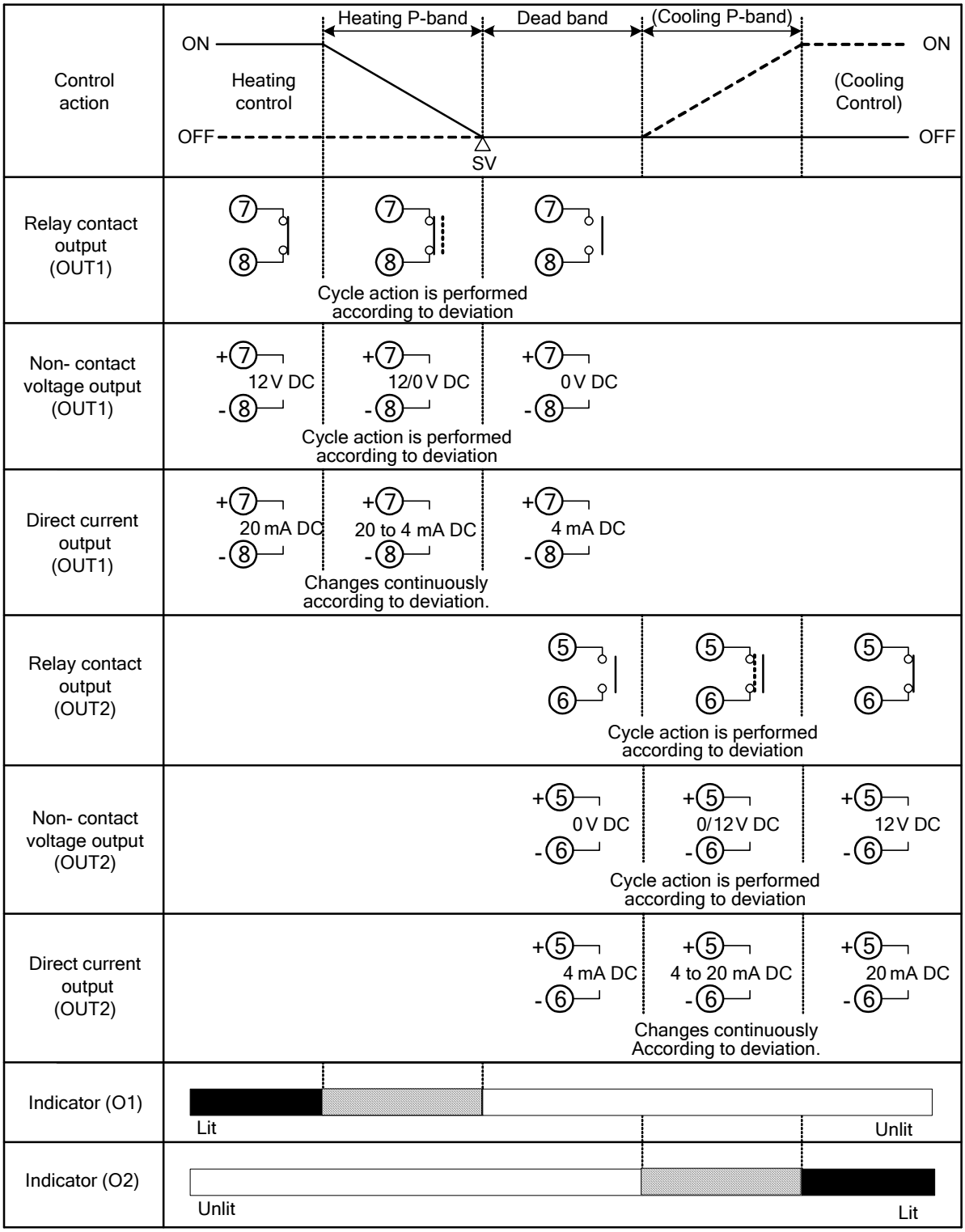


: Turns ON (lit) or OFF (unlit).

——— : Represents Heating control action.

- - - - : Represents Cooling control action.

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

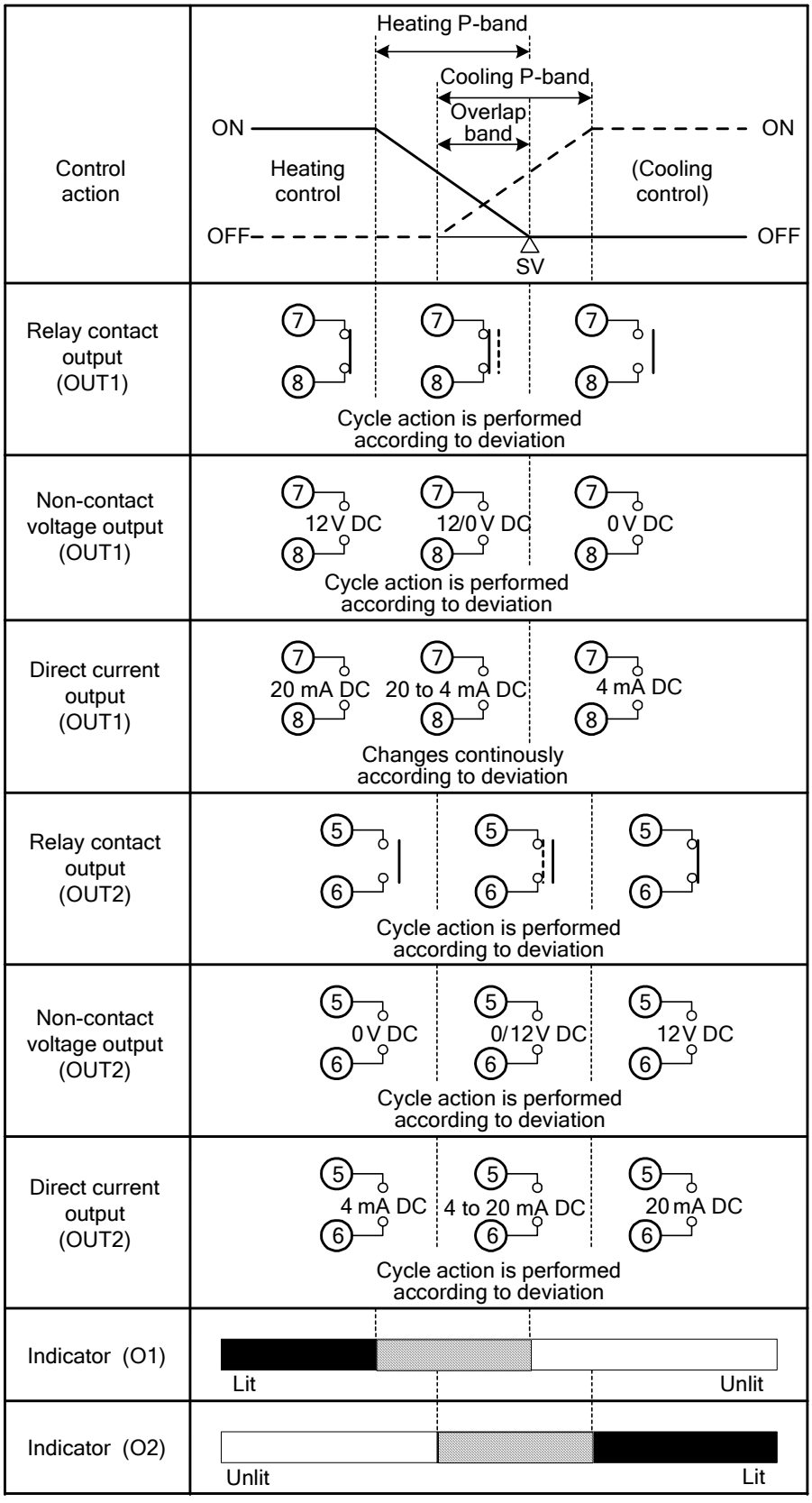


: Turns ON (lit) or OFF (unlit).

——— : Represents Heating control action.

- - - - : Represents Cooling control action.

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



: Alternates between ON (lit) and 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 ℃	-328 to 2498 ℉	1 ℃(℉)
			-200.0 to 400.0 ℃	-328.0 to 752.0 ℉	0.1 ℃(℉)
		J	-200 to 1000 ℃	-328 to 1832 ℉	1 ℃(℉)
		R	0 to 1760 ℃	32 to 3200 ℉	1 ℃(℉)
		S	0 to 1760 ℃	32 to 3200 ℉	1 ℃(℉)
		B	0 to 1820 ℃	32 to 3308 ℉	1 ℃(℉)
		E	-200 to 800 ℃	-328 to 1472 ℉	1 ℃(℉)
		T	-200.0 to 400.0 ℃	-328.0 to 752.0 ℉	0.1 ℃(℉)
		N	-200 to 1300 ℃	-328 to 2372 ℉	1 ℃(℉)
		PL-Ⅱ	0 to 1390 ℃	32 to 2534 ℉	1 ℃(℉)
		C(W/Re5-26)	0 to 2315 ℃	32 to 4199 ℉	1 ℃(℉)
		Pt100	-200.0 to 850.0 ℃	-328.0 to 1562.0 ℉	0.1 ℃(℉)
			-200 to 850 ℃	-328 to 1562 ℉	1 ℃(℉)
		JPt100	-200.0 to 500.0 ℃	-328.0 to 932.0 ℉	0.1 ℃(℉)
			-200 to 500 ℃	-328 to 932 ℉	1 ℃(℉)
		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	BC□2□00-□□	100 to 240 V AC 50/60 Hz			
	BC□2□10-□□	24 V AC/DC 50/60 Hz			
Allowable voltage fluctuation	BC□2□00-□□	85 to 264 V AC			
	BC□2□10-□□	20 to 28 V AC/DC			

General Structure

External dimensions	BCS2	48 x 48 x 68 mm (W x H x D) (Depth of control panel interior: 60 mm)	
	BCR2	48 x 96 x 68 mm (W x H x D) (Depth of control panel interior: 60 mm)	
	BCD2	96 x 96 x 68 mm (W x H x D) (Depth of control panel interior: 60 mm)	
Mounting		Flush	
Case		Flame-resistant resin, Black	
Front panel		Membrane sheet	
Drip-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	
		BCS2	Character size: 12.4 x 5.8 mm (H x W)
		BCR2	Character size: 14 x 5.8 mm (H x W)
		BCD2	Character size: 24 x 11 mm (H x W)
	SV Display	Indicates SV. 7-segment Green LED display	
		BCS2	Character size: 8.8 x 3.9 mm (H x W)
		BCR2	Character size: 14 x 5.8 mm (H x W)
		BCD2	Character size: 14 x 7 mm (H x W)
	MEMO/STEP Display (BCR2, BCD2)	Indicates Set value memory number (Fixed value control) or Step number (Program control). 7-segment Green LED display	
		BCR2	Character size: 14 x 5.8 mm (H x W)
		BCD2	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 (EV2, DS, DA options) is ON. For direct current output type (DA option), flashes corresponding to the MV in 125 ms cycles.
		EV1 (Red)	Lit when Event output 1 is ON.
		EV2 (Red)	Lit when Event output 2 (EV2 option) is ON. Unlit if □0 19 (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.
		R/L (Yellow)	Lit during Remote action from Remote/Local switching (EIT option).
		T/R (Yellow)	Lit during Serial communication (C5W, C5 options) TX (transmitting) output.
		MEMO (Yellow)	Lit when Set value memory number (Fixed value control) is indicated. (BCR2, BCD2)
		STEP (Green)	Lit when a step number (Program control) is indicated. (BCR2, BCD2)

Terminal arrangement	Refer to 'Terminal arrangement'. (p.20)
Console connector	By connecting to the tool cable (CMD-001, sold separately), the following operations can be conducted from an external computer using the Console software SWC-BCx01M. • Reading and setting of SV, PID and various set values • Reading of PV and action status • Function change

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

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

Control Performance

Control action		• 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	±Proportional band value
	OUT1 ON/OFF hysteresis	Thermocouple, RTD inputs: 0.1 to 1000.0℃ (℉) 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 cosϕ=0.4) Electrical life: 100,000 cycles Minimum applicable load: 10 mA 5 V DC
	Non-contact voltage (For SSR drive)	12 V DC±15% Max 40 mA (short circuit protected)
	Direct current	4 to 20 mA DC Resolution: 12000 Load resistance: Max 550 Ω

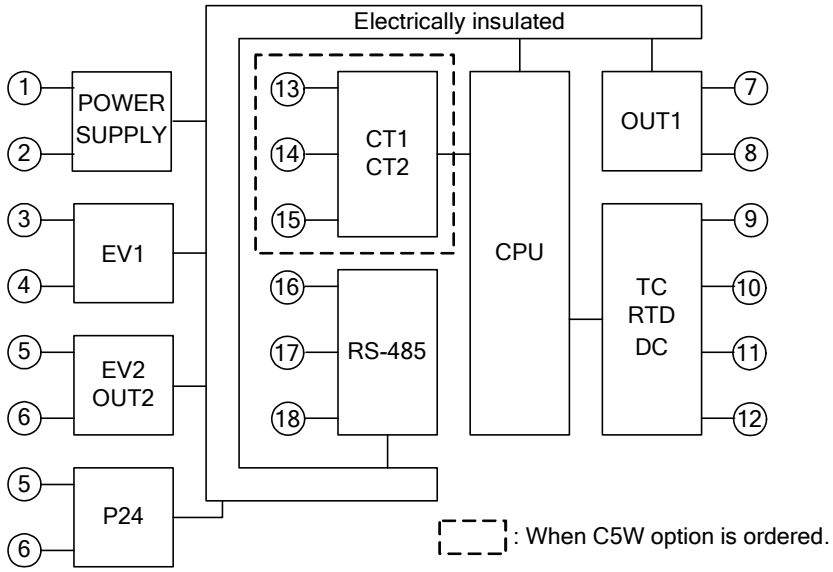
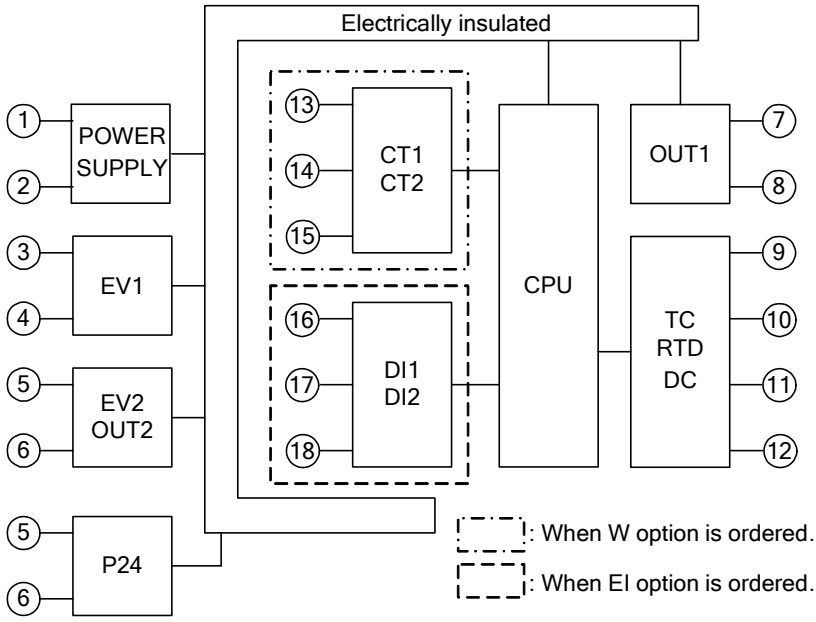
Standard Function

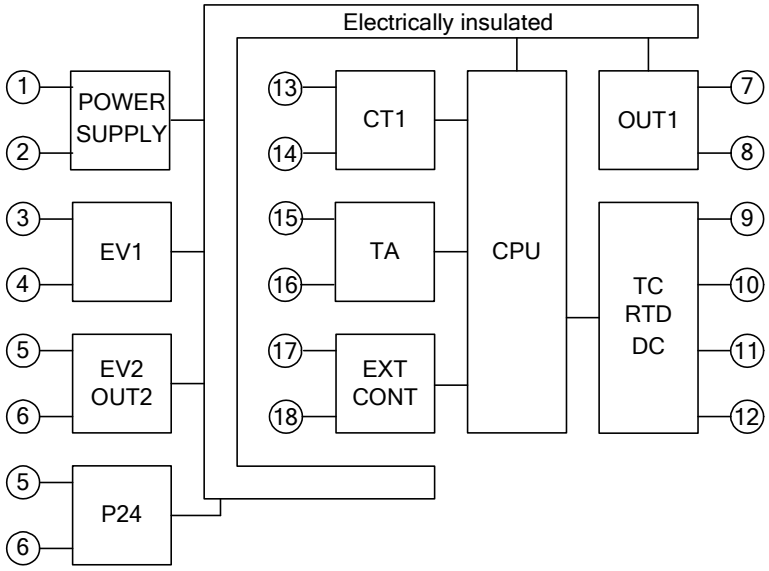
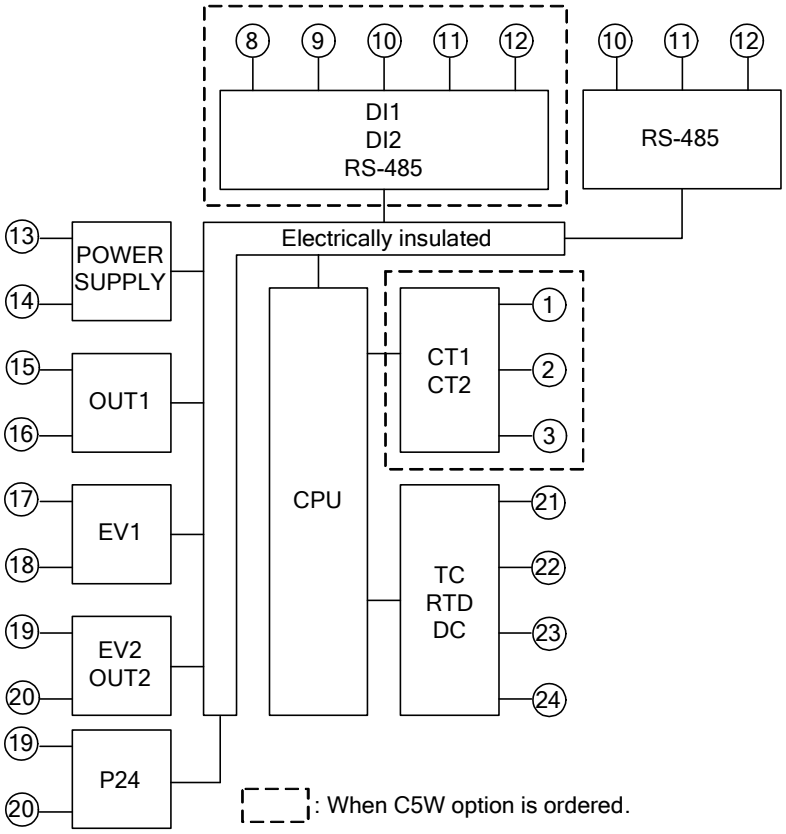
EV1 output		The output is turned ON or OFF depending on the conditions selected in [Event output EV1 allocation]. Relay contact 1a Control capacity: 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load cosϕ=0.4) Electrical life: 100,000 cycles Minimum applicable load: 10 mA 5 V DC
Alarm action		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 ±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℃ (℉) 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].

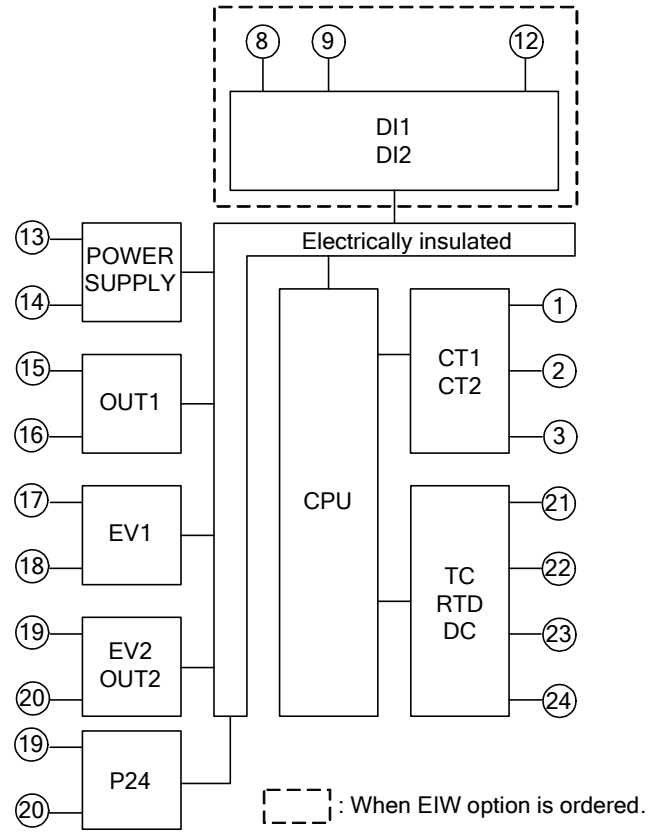
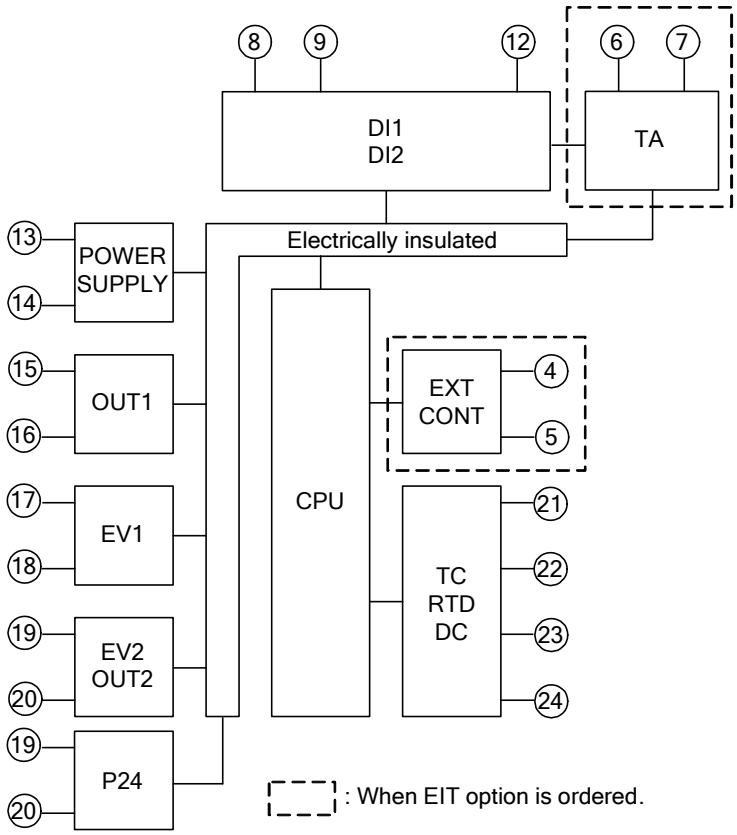
Simplified converter function	If 'Converter' is selected in [Controller/Converter], this instrument can be used as a converter, by setting the following items.	
	Setting Item	**Values or Selection**
	SV1	Scaling low limit value
	SV2 (BCS2: EIW, EIT, EI options, BCR2/BCD2: C5W, EIW, EIT, EI options)	Scaling low limit value
	SV3 (EIW option) (BCS2: EIW, EI options, BCR2/BCD2: C5W, EIW, EIT, EI options)	Scaling low limit value
	SV4 (EIW option) (BCS2: EIW, EI options, BCR2/BCD2: C5W, EIW, EIT, EI options)	Scaling low limit value
	AT/Auto-reset Perform/Cancel	AT/AT on startup/Auto-reset Cancel
	OUT1 proportional band	Input span
	Integral time	0
	Derivative time	0
	Reset	0 (Reset value, calculated by Auto-reset function)
	OUT2 proportional band	Input span
	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
	Direct/Reverse control	Direct control
	OUT/OFF key function	Control output OFF function
	Event input DI1 allocation (BCS2: EIW, EIT, EI options, BCR2/BCD2: C5W, EIW, EIT, EI options)	000: No event
	Event input DI2 allocation (BCS2: EIW, EI option, BCR2/BCD2: C5W, EIW, EIT, EI options)	000: No event
	Event output EV1 allocation	000: No event
	Event output EV2 allocation (EV2 option)	000: No event
	Remote/Local (EIT option)	Local
	Transmission output type (EIT option)	PV transmission
	Transmission output high limit (EIT option)	Input range high limit

	Transmission output low limit (EIT option)	Input range low limit
	SV rise rate	0
	SV fall rate	0
	OUT1 high limit	100
	OUT1 low limit	0
	OUT1 rate-of-change	0
	4 to 20 mA DC Load resistance: Max 550 Ω	

Insulation, Dielectric Strength

Circuit insulation configuration	**BCS2** When the C5W or C5 option is ordered.  When the EIW, EI or W option is ordered. 

Circuit insulation configuration	When the EIT option is ordered.  When OUT1 is a non-contact voltage output or direct current output, and when OUT2 is a non-contact voltage output or direct current output, OUT1 is not electrically insulated from OUT2. Insulation resistance: 10 MΩ min., at 500 V DC **BCR2, BCD2** When the C5W or C5 option is ordered. 

Circuit insulation configuration	When the EIW or W option is ordered.  When the EIT or EI option is ordered.  When OUT1 is a non-contact voltage output or direct current output, and when OUT2 is a non-contact voltage output or direct current output, OUT1 is not electrically insulated from OUT2. Insulation resistance: 10 MΩ min., 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 Between output terminal (P24) and power terminal: 500 V AC for 1 minute

Power consumption		100 to 240 V AC	Approx. 8 VA max. (When the maximum number of options are added: Approx. 11 VA max.)
		24 V AC	Approx. 5 VA max. (When the maximum number of options are added: Approx. 8 VA max.)
		24 V DC	Approx. 5 W max. (When the maximum number of options are added: Approx. 8 W max.)
Rush current		100 to 240 V AC	Max. 14 to 34 A
		24 V AC	Max. 34 A
		24 V DC	Max. 34 A
Ambient temperature		-10 to 55℃ (Non-condensing, No icing)	
Ambient humidity		35 to 85%RH (Non-condensing)	
Weight	BCS2	Approx. 110 g	
	BCR2	Approx. 160 g	
	BCD2	Approx. 220 g	
Accessories included		Mounting frame: 1 piece (BCS2) Screw type mounting bracket: 1 set (BCR2, BCD2) Instruction manual (excerpt): 1 copy	
Accessories sold separately		Terminal cover CT (Current transformer): CTL-6S (For Heater burnout alarm 20 A) CTL-12-S36-10L1U (For Heater burnout alarm 100 A) Tool cable CMD-001	
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.
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 SV 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℃ (32℉).
Indication range, Control range	Thermocouple	[Input range low limit value - 50℃ (100℉)] to [Input range high limit value + 50℃ (100℉)]
	RTD	[Input range low limit value – (Input span x 1%)] to [Input range high limit value + 50℃ (100℉)]
	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 [Er05] are alternately indicated on 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 [Er06] are alternately indicated on the PV Display. For Manual control, the preset MV is output.

Burnout

If PV has exceeded Indication range, Control range, the PV Display indicates [‾‾‾‾] and [Er07] alternately.

If PV has dropped below Indication range, Control range, the PV Display indicates [____] and [Er07] alternately.

If thermocouple, RTD or DC voltage (0 to 1 V DC) input is burnt out or disconnected, the PV Display indicates [‾‾‾‾] and [Er07] alternately.

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 [Er07] 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/OUT2 low limit value for Direct current output type).
For Manual control, the preset MV is output.

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

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

[Output status when input errors occur] can be used only for controllers using Direct current and voltage inputs, and Direct current output.
For manual control, the preset MV is output.

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 [Er07] alternately.	ON (20mA) or OUT1 high limit value (*)	OFF (4mA) or OUT1 low limit value	OFF or OUT2 low limit value	ON or OUT2 high limit value (*)
oFF		OFF (4mA) or OUT1 low limit value			OFF or OUT2 low limit value
on	Indicates [____] and [Er07] alternately.	OFF (4mA) or OUT1 low limit value	ON (20mA) or OUT1 high limit value (*)	ON or OUT2 high limit value (*)	OFF or OUT2 low limit value
oFF			OFF (4mA) or OUT1 low limit value	OFF or OUT2 low limit value	

(*) Outputs a value between OFF (4mA) and ON (20mA) or between OUT1 (or OUT2) low limit value and OUT1 (or OUT2) high limit value, depending on deviation.

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.
Console communication	By connecting to the tool cable (CMD-001, sold separately) to the console connector, the following operations can be conducted from an external computer, using the Console software SWC-BCx01M. Console communication and Serial communication (C5W option) cannot be used together. (1) Reading and setting of SV, PID and various set values (2) Reading of PV and action status (3) Function change Communication line: TTL level

11.2 Optional Specifications

Event input BCS2: EIW, EIT, EI options BCR2/BCD2: C5W, EIW, EIT, EI options	2 points of Event input (BCS2: 1 point for EIT option) can be applied. Any Event selected in [Event input DI1/DI2 allocation] will be performed depending on the DI1/DI2 input ON (Closed) or OFF (Open) status. Circuit current when Closed: Approx. 16 mA
Event output (EV2 option)	Output will be turned ON or OFF depending on the Event conditions selected in [Event output EV2 allocation]. Relay contact, 1a Control capacity: 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load, cosϕ=0.4) Electric life: 100,000 cycles Minimum applicable load: 10 mA 5 V DC
Heater burnout alarm (C5W, EIW, W options)	Monitors heater current with CT (current transformer), and detects burnout. EV1/EV2 output, for which Heater burnout alarm is selected in [Event output EV1/EV2 allocation], will be turned ON or OFF. This alarm is also activated when the input is burnt out. Rated current: 20 A, 100 A (Must be specified when ordering.) Single-phase: Detects burnout with CT1 input. 3-phase: Detects burnout with CT1 and CT2 inputs. Setting accuracy: Within ±5% of the rated value
Heating/Cooling control (DS, DA, EV2 options)	Performs Heating/Cooling control. (Specifications of Heating side are the same as those of OUT1.) OUT2 proportional band: 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% OUT2 integral time: Same as OUT1 integral time OUT2 derivative time: Same as OUT1 derivative time OUT2 proportional cycle: 0.5, or 1 or 120 seconds Overlap/Dead band setting range: Thermocouple, RTD inputs: -200.0 to 200.0℃ (℉) DC voltage, current inputs: -2000 to 2000 (The placement of the decimal point follows the selection.) OUT2 ON/OFF hysteresis: Thermocouple, RTD inputs: 0.1 to 1000.0℃ (℉) DC voltage, current inputs: 1 to 10000 (The placement of the decimal point follows the selection.) OUT2 high limit: 0 to 100% (Direct current: -5 to 105%) OUT2 low limit: 0 to 100% (Direct current: -5 to 105%) OUT2 cooling method: 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. Cooling output (OUT2): Relay contact 1a (EV2) Control capacity: 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load, cosϕ=0.4) Electric life: 100,000 cycles Non-contact voltage (for SSR drive) (DS): 12 V DC±15%, Max. 40 mA (short circuit protected) Direct current (DA): 4 to 20 mA DC Resolution: 12000 Load resistance: Max. 550 Ω

<table>
<tr><td>Serial communication
(C5W, C5 options)</td><td>The following operations can be carried out from an external computer.
Serial communication and Console communication cannot be used together.
(1) Reading and setting of the SV, PID values and various set values
(2) Reading of the PV and action status
(3) Function change
Cable length: Max 1.2 km, Cable resistance: Within 50 Ω (Terminators are not necessary, but if used, use 120 Ω or more on both sides.)
Communication line: EIA RS-485
Communication method: Half-duplex communication
Synchronization method: Start-stop synchronization
Communication speed: 9600/19200/38400 bps (Selectable by keypad)
Data bit/Parity: 7 bits, 8 bits/Even, Odd, No parity (Selectable by keypad)
Stop bit: 1 bit, 2 bits (Selectable by keypad)
Communication protocol: Shinko protocol/Modbus ASCII/Modbus RTU (Selectable by keypad)
Data format:
<table>
<tr><th>Communication protocol</th><th>Shinko protocol</th><th>Modbus ASCII</th><th>Modbus RTU</th></tr>
<tr><td>Start bit</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Data bit</td><td>7</td><td>7 or 8</td><td>8</td></tr>
<tr><td>Parity</td><td>Yes (Even)</td><td>Yes (Even, Odd), No parity</td><td>Yes (Even, Odd), No parity</td></tr>
<tr><td>Stop bit</td><td>1</td><td>1 or 2</td><td>1 or 2</td></tr>
</table>
Number of connectable units: Maximum 31 units to 1 host computer
Communication error detection: Parity, checksum (Shinko protocol), LRC (Modbus ASCII), CRC-16 (Modbus RTU)
Digital external setting:
Receives digital SV from Shinko programmable controllers (PC-900, PCD-33A with SVTC option).</td></tr>
<tr><td>External setting input
(EIT option)</td><td>SV adds external analog signal to remote bias value.
Not available for Program control.
Setting signal: 4 to 20 mA DC
Allowable input: 50 mA DC max.
Input impedance: 50 Ω max.
Input sampling period: 125 ms</td></tr>
<tr><td>Transmission output
(EIT option)</td><td>Converting the value (PV, SV, MV or DV transmission) to analog signal every 125 ms, outputs the value in current or voltage.
Outputs Transmission output low limit value if Transmission output high limit and low limit value are the same.
Resolution: 12000
Output: 4 to 20 mA DC (Load resistance: Maximum 550 Ω)
Output accuracy: Within ±0.3% of Transmission output span</td></tr>
<tr><td>Insulated power output
(P24 option)</td><td>Output voltage: 24±3 V DC (when load current is 30 mA DC)
Ripple voltage: Within 200 mV DC (when load current is 30 mA DC)
Max. load current: 30 mA DC</td></tr>
</table>

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
[Er01] is indicated on the PV Display.	Internal non-volatile IC memory is defective.	Cancel the error code by pressing the ◎ key, and perform data clearing. (p.106) If the problem is not still solved, contact our agency or us.
[Er02] is indicated on the PV Display.	Data writing (in non-volatile IC memory) error when power failure occurs.	Cancel the error code by pressing the ◎ key, and perform data clearing. (p.106)
PV and [Er05] are alternately indicated on 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 [Er06] are alternately indicated on 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 [Er07] are alternately indicated on 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)	Replace each sensor. **How to check whether the sensor is burnt out** **[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. **[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℃ (32℉) is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out. **[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.
	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 [Er 07] are alternately indicated on 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 thermo-couple or compensating lead wire is correct. Check whether codes (A, B, B) of RTD agree with the instrument terminals.	Wire them correctly.
[Er 10] is indicated on the PV Display.	Hardware malfunction	Contact our agency or us.
[oFF], nothing or PV is indicated on 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 (℃ or ℉) is correct.	Select the sensor input and temperature unit (℃ or ℉) 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.	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). **How to check whether the input signal wire is disconnected** **[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. **[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.
	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.
[Er20] is indicated on 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 on the PV Display.

Error Code	Error Contents
Er01	Internal non-volatile IC memory is defective.
Er02	Data writing (in non-volatile IC memory) error when power failure occurs.
Er05	PV has exceeded Input range high limit value (Scaling high limit value for DC voltage, current inputs).
Er06	PV has dropped below Input range low limit value (Scaling low limit value for DC voltage, current inputs).
Er07	Input burnout or disconnection. Input value is outside of the Indication range and control range.
Er 10	Hardware malfunction
Er20	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 0.0	Control output OFF
25 10.5	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) (BCS2) St_1 to St_9
25 [Memory number]	SV number indicated (BCS2) SV 1 to SV4

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			
SEnS tC	**Input type**			
	tC	K -200 to 1370 ℃	tF	K -328 to 2498 ℉
	tC.C	K -200.0 to 400.0 ℃	tC.F	K -328.0 to 752.0 ℉
	JC	J -200 to 1000 ℃	JF	J -328 to 1832 ℉
	rC	R 0 to 1760 ℃	rF	R 32 to 3200 ℉
	SC	S 0 to 1760 ℃	SF	S 32 to 3200 ℉
	bC	B 0 to 1820 ℃	bF	B 32 to 3308 ℉
	EC	E -200 to 800 ℃	EF	E -328 to 1472 ℉
	tC.C	T -200.0 to 400.0 ℃	tC.F	T -328.0 to 752.0 ℉
	nC	N -200 to 1300 ℃	nF	N -328 to 2372 ℉
	PL2C	PL-Ⅱ 0 to 1390 ℃	PL2F	PL-Ⅱ 32 to 2534 ℉
	cC	C(W/Re5-26) 0 to 2315 ℃	cF	C(W/Re5-26) 32 to 4199 ℉
	Pt.C	Pt100 -200.0 to 850.0 ℃	Pt.F	Pt100 -328.0 to 1562.0 ℉
	JPt.C	JPt100 -200.0 to 500.0 ℃	JPt.F	JPt100 -328.0 to 932.0 ℉
	PtC	Pt100 -200 to 850 ℃	PtF	Pt100 -328 to 1562 ℉
	JPtC	JPt100 -200 to 500 ℃	JPtF	JPt100 -328 to 932 ℉
	420A	4 to 20 mA DC -2000 to 10000		
	020A	0 to 20 mA DC -2000 to 10000		
	01.1V	0 to 1 V DC -2000 to 10000		
	05V	0 to 5 V DC -2000 to 10000		
	15V	1 to 5 V DC -2000 to 10000		
	0.10V	0 to 10 V DC -2000 to 10000		
SCLH 1370	**Scaling high limit** Setting range: Scaling low limit value to input range high limit value DC voltage, current inputs: -2000 to 10000 (*1)			
SCLL -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	**Decimal point place**			
	□□□0	No decimal point		
	□□0.0	1 digit after decimal point		
	□0.00	2 digits after decimal point		
	0.000	3 digits after decimal point		

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

Characters, Factory Default	Setting Item, Setting Range		
EVo 1 □000	**Event output EV1 allocation** **[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	
	□013	Heater burnout alarm output	
	□014	Loop break alarm output	
	□015	Time signal output	
	□016	Output during AT	
	□017	Pattern end output	
	□018	Output by communication command	
A1EA no□□	**EV1 alarm value 0 Enabled/Disabled**		
	no□□	Disabled	
	YES□	Enabled	
A1□□ □□□0	**EV1 alarm value**		
	High limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)	
	Low limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)	
	High/Low limits alarm	0 to Input span ℃ (℉) (*1) (*2)	
	High/Low limits independent alarm	0 to Input span ℃ (℉) (*1) (*2)	
	High/Low limit range alarm	0 to Input span ℃ (℉) (*1) (*2)	
	High/Low limit range independent alarm	0 to Input span ℃ (℉) (*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 ℃ (℉) (*1) (*2)	
	Low limit with standby alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)	
	High/Low limits with standby alarm	0 to Input span ℃ (℉) (*1) (*2)	
	High/Low limits with standby independent alarm	0 to Input span ℃ (℉) (*1) (*2)	
A1H□ □□□0	**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		
A1HY □□ 1.0	**EV1 alarm hysteresis** Setting range: 0.1 to 1000.0℃(℉), DC voltage, current inputs: 1 to 10000 (*1)		
A1dY □□□0	**EV1 alarm delay time** Setting range: 0 to 10000 seconds		
A1LA noAL	**EV1 alarm Energized/De-energized**		
	noAL	Energized	
	rEVS	De-energized	
TS1S □□□ 1	**TS1 output step number** Setting range: 1 to 9		
TS1F 00.00	**TS1 OFF time** Setting range: 00:00 to 99:59 (*4)		
TS1o 00.00	**TS1 ON time** Setting range: 00:00 to 99:59 (*4)		
EVo2 □000	**Event output EV2 allocation** **[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	
	□013	Heater burnout alarm output	
	□014	Loop break alarm output	
	□015	Time signal output	
	□016	Output during AT	
	□017	Pattern end output	
	□018	Output by communication command	
	□019	Heating/Cooling control relay contact output	
A2EA no□□	**EV2 alarm value 0 Enabled/Disabled**		
	no□□	Disabled	
	YES□	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	
A2□ □□□0	**EV2 alarm value**	
	High limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	Low limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits independent alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range independent alarm	0 to Input span ℃ (℉) (*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 ℃ (℉) (*1) (*2)
	Low limit with standby alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby independent alarm	0 to Input span ℃ (℉) (*1) (*2)
A2H□ □□□0	**EV2 high limit alarm value** Setting range: Same as those of EV2 alarm value	
A2HY □□ 1.0	**EV2 alarm hysteresis** Setting range: 0.1 to 1000.0℃ (℉), DC voltage, current inputs: 1 to 10000 (*1)	
A2dY □□□0	**EV2 alarm delay time** Setting range: 0 to 10000 seconds	
A2LA noAL	**EV2 alarm Energized/De-energized**	
	noAL	Energized
	rEVS	De-energized
rS2S □□□ 1	**TS2 output step number** Setting range: 1 to 9	
rS2F 00.00	**TS2 OFF time** Setting range: 00:00 to 99:59 (*4)	
rS2o 00.00	**TS2 ON time** Setting range: 00:00 to 99:59 (*4)	
H 1□ □□0.0 H 1 and CT1 current value are alternately indicated on the PV Display.	**Heater burnout alarm 1 value** Setting range: 20 A: 0.0 to 20.0 A 100 A: 0.0 to 100.0 A	
H2□ □□0.0 H2 and CT2 current value are alternately indicated on the PV Display.	**Heater burnout alarm 2 value** Setting range: 20 A: 0.0 to 20.0 A 100 A: 0.0 to 100.0 A	

(*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].

<table>
<tr><th>Characters,
Factory Default</th><th colspan="5">Setting Item, Setting Range</th></tr>
<tr><td>LP_T
□□□0</td><td colspan="5">Loop break alarm time
Setting range: 0 to 200 minutes</td></tr>
<tr><td>LP_H
□□□0</td><td colspan="5">Loop break alarm span
Setting range: 0 to 150℃ (℉), or 0.0 to 150.0℃ (℉)
DC voltage, current inputs: 0 to 1500 (*1)</td></tr>
<tr><td>EVI 1
□000</td><td colspan="5">Event input DI1 allocation
[Event Input Allocation Table]
<table>
<tr><th></th><th>Event input function</th><th>Input ON (Closed)</th><th>Input OFF (Open)</th><th></th></tr>
<tr><td>□000</td><td>No event</td><td></td><td></td><td></td></tr>
<tr><td>□001</td><td>Set value memory</td><td></td><td></td><td></td></tr>
<tr><td>□002</td><td>Control ON/OFF</td><td>Control OFF</td><td>Control ON</td><td></td></tr>
<tr><td>□003</td><td>Direct/Reverse action</td><td>Direct action</td><td>Reverse action</td><td></td></tr>
<tr><td>□004</td><td>Preset output 1 ON/OFF</td><td>Preset output</td><td>Usual control</td><td></td></tr>
<tr><td>□005</td><td>Preset output 2 ON/OFF</td><td>Preset output</td><td>Usual control</td><td></td></tr>
<tr><td>□006</td><td>Auto/Manual control</td><td>Manual control</td><td>Automatic control</td><td></td></tr>
<tr><td>□007</td><td>Remote/Local</td><td>Remote</td><td>Local</td><td></td></tr>
<tr><td>□008</td><td>Program control RUN/STOP</td><td>RUN</td><td>STOP</td><td></td></tr>
<tr><td>□009</td><td>Program control Holding/Not holding</td><td>Holding</td><td>Not holding</td><td></td></tr>
<tr><td>□010</td><td>Program control Advance function</td><td>Advance function</td><td>Usual control</td><td></td></tr>
<tr><td>□011</td><td>Integral action Holding</td><td>Integral action Holding</td><td>Usual integral action</td><td></td></tr>
</table></td></tr>
<tr><td>EVI 2
□000</td><td colspan="5">Event input DI2 allocation
Selection item: Same as those of Event input DI1 allocation</td></tr>
<tr><td>rTLH
1370</td><td colspan="5">External setting input high limit
Setting range: External setting input low limit to Input range high limit (*1)</td></tr>
<tr><td>rTLL
-200</td><td colspan="5">External setting input low limit
Setting range: Input range low limit to External setting input high limit (*1)</td></tr>
<tr><td>Trns
PV□□</td><td colspan="5">Transmission output type
<table>
<tr><td>PV□□</td><td>PV transmission</td></tr>
<tr><td>SV□□</td><td>SV transmission</td></tr>
<tr><td>MV□□</td><td>MV transmission</td></tr>
<tr><td>dV□□</td><td>DV transmission</td></tr>
</table></td></tr>
</table>

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

Characters, Factory Default	Setting Item, Setting Range	
r-LH 1370	**Transmission output high limit**	
	PV, SV transmission	Transmission output low limit to Input range high limit DC voltage, current inputs: -2000 to 10000
	MV transmission	Transmission output low limit to 105.0%
	DV transmission	Transmission output low limit to Scaling span (*1)
r-LL -200	**Transmission output low limit**	
	PV, SV transmission	Input range low limit to Transmission output high limit DC voltage, current inputs: -2000 to 10000
	MV transmission	-5.0% to Transmission output high limit value
	DV transmission	-Scaling span to Transmission output high limit value (*1)
S□□□ □□□0	**SV1** Setting range: Scaling low limit to Scaling high limit (*1)	
S2□□ □□□0	**SV2** Setting range: Scaling low limit to Scaling high limit (*1)	
S3□□ □□□0	**SV3** Setting range: Scaling low limit to Scaling high limit (*1)	
S4□□ □□□0	**SV4** Setting range: Scaling low limit to Scaling high limit (*1)	

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

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
SV1 0	**SV1** Setting range: Scaling low limit to Scaling high limit (*1)
r1-1 00.00	**Step 1 time** Setting range: -:--, or 00:00 to 99:59
J1-1 0	**Step 1 wait value** Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1)
SV2 0	**SV2** Setting range: Scaling low limit to Scaling high limit (*1)
r1-2 00.00	**Step 2 time** Setting range: -:--, or 00:00 to 99:59
J1-2 0	**Step 2 wait value** Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1)
SV3 0	**SV3** Setting range: Scaling low limit to Scaling high limit (*1)
r1-3 00.00	**Step 3 time** Setting range: -:--, or 00:00 to 99:59
J1-3 0	**Step 3 wait value** Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1)
SV4 0	**SV4** Setting range: Scaling low limit to Scaling high limit (*1)
r1-4 00.00	**Step 4 time** Setting range: -:--, or 00:00 to 99:59
J1-4 0	**Step 4 wait value** Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1)
SV5 0	**Step 5 SV** Setting range: Scaling low limit to Scaling high limit (*1)
r1-5 00.00	**Step 5 time** Setting range: -:--, or 00:00 to 99:59
J1-5 0	**Step 5 wait value** Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1)
SV6 0	**Step 6 SV** Setting range: Scaling low limit to Scaling high limit (*1)
r1-6 00.00	**Step 6 time** Setting range: -:--, or 00:00 to 99:59
J1-6 0	**Step 6 wait value** Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1)

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

Characters, Factory Default	Setting Item, Setting Range
S7□□ □□□0	**Step 7 SV** Setting range: Scaling low limit to Scaling high limit (*1)
T□_7 00.00	**Step 7 time** Setting range: -:--, or 00:00 to 99:59
J□_7 □□□0	**Step 7 wait value** Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1)
S8□□ □□□0	**Step 8 SV** Setting range: Scaling low limit to Scaling high limit (*1)
T□_8 00.00	**Step 8 time** Setting range: -:--, or 00:00 to 99:59
J□_8 □□□0	**Step 8 wait value** Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 20% of scaling span (*1)
S9□□ □□□0	**Step 9 SV** Setting range: Scaling low limit to Scaling high limit (*1)
T□_9 00.00	**Step 9 time** Setting range: -:--, or 00:00 to 99:59
J□_9 □□□0	**Step 9 wait value** Setting range: 0 to 20% of the input span DC voltage, current inputs: 0 to 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_S	AT on startup Perform
	rSET	Auto-reset Perform
P 10	**OUT1 proportional band** Setting range: 0 to Input span℃ (℉) 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	
ArW 50	**ARW** Setting range: 0 to 100%	
rSET 0	**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	
HYS 1.0	**OUT1 ON/OFF hysteresis** Setting range: 0.1 to 1000.0℃ (℉) 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)	
orAT 0	**OUT1 rate-of-change** Setting range: 0 to 100 %/second	
cACT AIR	**OUT2 cooling method**	
	AIR	Air cooling (linear characteristics)
	oIL	Oil cooling (1.5th power of the linear characteristics)
	WAT	Water cooling (2nd power of the linear characteristics)
P_b 10	**OUT2 proportional band** Setting range: 0 to Input span ℃ (℉) 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	
HYSb 1.0	**OUT2 ON/OFF hysteresis** Setting range: 0.1 to 1000.0℃ (℉), 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% (Direct current output type: OUT2 low limit value to 105%)	
oLLb 0	**OUT2 low limit** Setting range: 0% to OUT2 high limit value (Direct current output type: -5% to OUT2 high limit value)	
db 0	**Overlap/Dead band** Setting range: -200.0 to 200.0℃ (℉), DC voltage, current inputs: -2000 to 2000 (*1)	
conF HEAT	**Direct/Reverse action**	
	HEAT	Reverse (Heating) action
	cooL	Direct (Cooling) action
A1 0	**EV1 alarm value**	
	High limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	Low limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits independent	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range independent alarm	0 to Input span ℃ (℉) (*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 ℃ (℉) (*1) (*2)
	Low limit with standby alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby independent alarm	0 to Input span ℃ (℉) (*1) (*2)
A1H 0	**EV1 high limit alarm value** Setting range: Same as those of EV1 alarm value	
A2 0	**EV2 alarm value** Setting range: Same as those of EV1 alarm value	
A2H 0	**EV2 high limit alarm value** Setting range: Same as those of EV1 alarm value	
H1 0.0 H1 and CT1 current value are alternately indicated on the PV Display.	**Heater burnout alarm 1 value** Setting range: 20.0 A: 0.0 to 20.0 A 100.0 A: 0.0 to 100.0 A	
H2 0.0 H2 and CT2 current value are alternately indicated on the PV Display.	**Heater burnout alarm 2 value** Setting range: 20.0 A: 0.0 to 20.0 A 100.0 A: 0.0 to 100.0 A	
LP_T 0	**Loop break alarm time** Setting range: 0 to 200 minutes	
LP_H 0	**Loop break alarm span** Setting range: 0 to 150℃ (℉), 0.0 to 150.0℃ (℉) 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

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

<table>
<tr><th>Characters, Factory Default</th><th colspan="4">Setting Item, Setting Range</th></tr>
<tr><td>Lock
----</td><td colspan="4">Set value lock
<table>
<tr><th colspan="2"></th><th>Change via Keypad</th><th>Change via Software Communication</th></tr>
<tr><td>----</td><td>Unlock</td><td>All set values can be changed.</td><td rowspan="3">All set values can be changed.</td></tr>
<tr><td>Loc 1</td><td>Lock 1</td><td>None of the set values can be changed.</td></tr>
<tr><td>Loc2</td><td>Lock 2</td><td>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.</td></tr>
<tr><td>Loc3</td><td>Lock 3</td><td>All set values can be changed.</td><td rowspan="3">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.</td></tr>
<tr><td>Loc4</td><td>Lock 4</td><td>None of the set values can be changed.</td></tr>
<tr><td>Loc5</td><td>Lock 5</td><td>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.</td></tr>
</table></td></tr>
<tr><td>EVI 1
□000</td><td colspan="4">Event input DI1 allocation
[Event Input Allocation Table]
<table>
<tr><th></th><th>Event input function</th><th>Input ON (Closed)</th><th>Input OFF (Open)</th><th></th></tr>
<tr><td>□000</td><td>No event</td><td></td><td></td><td></td></tr>
<tr><td>□001</td><td>Set value memory</td><td></td><td></td><td></td></tr>
<tr><td>□002</td><td>Control ON/OFF</td><td>Control OFF</td><td>Control ON</td><td></td></tr>
<tr><td>□003</td><td>Direct/Reverse action</td><td>Direct action</td><td>Reverse action</td><td></td></tr>
<tr><td>□004</td><td>Preset output 1 ON/OFF</td><td>Preset output</td><td>Usual control</td><td></td></tr>
<tr><td>□005</td><td>Preset output 2 ON/OFF</td><td>Preset output</td><td>Usual control</td><td></td></tr>
<tr><td>□006</td><td>Auto/Manual control</td><td>Manual control</td><td>Automatic control</td><td></td></tr>
<tr><td>□007</td><td>Remote/Local</td><td>Remote</td><td>Local</td><td></td></tr>
<tr><td>□008</td><td>Program control RUN/STOP</td><td>RUN</td><td>STOP</td><td></td></tr>
<tr><td>□009</td><td>Program control Holding/Not holding</td><td>Holding</td><td>Not holding</td><td></td></tr>
<tr><td>□010</td><td>Program control Advance function</td><td>Advance function</td><td>Usual control</td><td></td></tr>
<tr><td>□011</td><td>Integral action holding</td><td>Integral action holding</td><td>Usual integral action</td><td></td></tr>
</table></td></tr>
</table>

Characters, Factory Default	Setting Item, Setting Range		
EVI 2 □000	**Event input DI2 allocation** Selection item: Same as Event input DI1 allocation		
EVo 1 □000	**Event output EV1 allocation** **[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	
	□013	Heater burnout alarm output	
	□014	Loop break alarm output	
	□015	Time signal output	
	□016	Output during AT	
	□017	Pattern end output	
	□018	Output by communication command	
A1EA no□□	**EV1 alarm value 0 Enabled/Disabled**		
	no□□	Disabled	
	YES□	Enabled	
A1□□ □□□0	**EV1 alarm value**		
	High limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)	
	Low limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)	
	High/Low limits alarm	0 to Input span ℃ (℉) (*1) (*2)	
	High/Low limits independent alarm	0 to Input span ℃ (℉) (*1) (*2)	
	High/Low limit range alarm	0 to Input span ℃ (℉) (*1) (*2)	
	High/Low limit range independent alarm	0 to Input span ℃ (℉) (*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 ℃ (℉) (*1) (*2)	
	Low limit with standby alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)	
	High/Low limits with standby alarm	0 to Input span ℃ (℉) (*1) (*2)	
	High/Low limits with standby independent alarm	0 to Input span ℃ (℉) (*1) (*2)	
A1H□ □□□0	**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		
A1HY □□ 1.0	**EV1 alarm hysteresis** Setting range: 0.1 to 1000.0℃ (℉), DC voltage, current inputs: 1 to 10000 (*1)		
A1dY □□□0	**EV1 alarm delay time** Setting range: 0 to 10000 seconds		
A1LA noAL	**EV1 alarm Energized/De-energized**		
	noAL	Energized	
	rEVS	De-energized	
TS1S □□□ 1	**TS1 output step number** Setting range: 1 to 9		
TS1F 00.00	**TS1 OFF time** Setting range: 00:00 to 99:59 (*4)		
TS1o 00.00	**TS1 ON time** Setting range: 00:00 to 99:59 (*4)		
EVo2 □000	**Event output EV2 allocation** **[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	
	□013	Heater burnout alarm output	
	□014	Loop break alarm output	
	□015	Time signal output	
	□016	Output during AT	
	□017	Pattern end output	
	□018	Output by communication command	
	□019	Heating/Cooling control relay contact output	
A2EA no□□	**EV2 alarm value 0 Enabled/Disabled**		
	no□□	Disabled	
	YES□	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	
A2□□ □□□0	**EV2 alarm value**	
	High limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	Low limit alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits independent alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limit range independent alarm	0 to Input span ℃ (℉) (*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 ℃ (℉) (*1) (*2)
	Low limit with standby alarm	-(Input span) to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby alarm	0 to Input span ℃ (℉) (*1) (*2)
	High/Low limits with standby independent alarm	0 to Input span ℃ (℉) (*1) (*2)
A2H□ □□□0	**EV2 high limit alarm value** Setting range: Same as those of EV2 alarm value	
A2HY □□ 1.0	**EV2 alarm hysteresis** Setting range: 0.1 to 1000.0℃ (℉), DC voltage, current inputs: 1 to 10000 (*1)	
A2dY □□□0	**EV2 alarm delay time** Setting range: 0 to 10000 seconds	
A2LA noAL	**EV2 alarm Energized/De-energized**	
	noAL	Energized
	rEVS	De-energized
TS2S □□□ 1	**TS2 output step number** Setting range: 1 to 9	
TS2F 00.00	**TS2 OFF time** Setting range: 00:00 to 99:59 (*4)	
TS2o 00.00	**TS2 ON time** Setting range: 00:00 to 99:59 (*4)	
SotC 1.000	**Sensor correction coefficient** Setting range: -10.000 to 10.000	
So□□ □□0.0	**Sensor correction** Setting range: -1000.0 to 1000.0℃ (℉) DC voltage, current inputs: -10000 to 10000 (*1)	
FILT □□0.0	**PV filter time constant** Setting range: 0.0 to 10.0 seconds	
CAUL noAL	**Communication protocol**	
	noAL	Shinko protocol
	AodA	Modbus ASCII
	Aodr	Modbus RTU
CAno □□□0	**Instrument number** Setting range: 0 to 95	

(*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	
cmsP □□96	**Communication speed**	
	□□96	9600 bps
	□192	19200 bps
	□384	38400 bps
cmFr 7Evn	**Data bit/Parity**	
	8non	8 bits/No parity
	7non	7 bits/No parity
	8Evn	8 bits/Even
	7Evn	7 bits/Even
	8odd	8 bits/Odd
	7odd	7 bits/Odd
cmsr □□□1	**Stop bit**	
	□□□1	1 bit
	□□□2	2 bits
cmdy □□10	**Response delay time** Setting range: 0 to 1000 ms	
svb_b □□□0	**SVTC bias** Setting range: ±20% of the input span DC voltage, current inputs: ±20% of the scaling span (*1)	
rEmr Locl	**Remote/Local**	
	Locl	Local
	rEmr	Remote
rrlH 1370	**External setting input high limit** Setting range: External setting input low limit to Input range high limit	
rrll -200	**External setting input low limit** Setting range: Input range low limit to External setting input high limit	
rr_b □□□0	**Remote bias** Setting range: ±20% of the input span DC voltage, current inputs: ±20% of the scaling span (*1)	
trsb PV□□	**Transmission output type**	
	PV□□	PV transmission
	sv□□	SV transmission
	mv□□	MV transmission
	dv□□	DV transmission
trlH 1370	**Transmission output high limit**	
	PV, SV transmission	Transmission output low limit to Input range high limit value
	MV transmission	Transmission output low limit to 105.0%
	DV transmission	Transmission output low limit to Scaling span (*1)
trll -200	**Transmission output low limit**	
	PV, SV transmission	Input range low limit to Transmission output high limit value
	MV transmission	-5.0% to Transmission output high limit value
	DV transmission	-Scaling span to Transmission output high limit value (*1)

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

Characters, Factory Default	Setting Item, Setting Range	
M_S□ MIN□	**Step time unit**	
	MIN□	Hours:Minutes
	SEC□	Minutes:Seconds
PrET STOP	**Power restore action**	
	STOP	Stops after power is restored
	CONT	Continues (resumes) after power is restored.
	HOLD	Suspends (on hold) after power is restored.
S_SV □□□0	**Program start temperature** Setting range: Scaling low limit value to Scaling high limit value (*1)	
S_SL PV□□	**Program control start type**	
	PV□□	PV start
	PVr□	PVR start
	SV□□	SV start
rEPT □□□0	**Number of repetitions** Setting range: 0 to 10000 times	
rASS SVST	**SV Rise/Fall rate start type**	
	SVST	SV start
	PVST	PV start
rATU □□□0	**SV rise rate** Setting range: 0 to10000 ℃/min (℉/min) Thermocouple, RTD inputs with a decimal point: 0.0 to 1000.0 ℃/min (℉/min) DC voltage, current inputs: 0 to 10000/min	
rATd □□□0	**SV fall rate** Setting range: 0 to10000℃/min (℉/min) Thermocouple, RTD inputs with a decimal point: 0.0 to 1000.0 ℃/min (℉/min) DC voltage, current inputs: 0 to 10000/min	
PSV□ OFF□	**Indication when control output OFF**	
	OFF□	OFF indication
	NOFF	No indication
	PV□□	PV indication
	PVAL	PV indication + Any Alarm active
AT_b □□20	**AT bias** Setting range: 0 to 50℃ (0 to 100℉), or 0.0 to 50.0℃ (0.0 to 100.0℉)	
AT_t □□1.0	**AT gain** Setting range: 0.1 to 10.0 times	
EoUT OFF□	**Output status when input errors occur**	
	OFF□	Output OFF
	ON□□	Output ON
MANU OFF□	**OUT/OFF key function**	
	OFF□	Control output OFF function
	MANU	Auto/Manual control
	PROG	Program control
MArS AUTO	**Auto/Manual after power interruption**	
	AUTO	Automatic control
	MANU	Manual control

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

Characters, Factory Default	Setting Item, Setting Range	
TIME 00:00	**Indication time** Setting range: 00:00 to 60:00 (Minutes:Seconds) When set to 00:00, Displays remain ON.	
PWR 1 □□0.0	**OUT1 MV preset value** Setting range: 0.0 to 100.0% (Direct current output: -5.0 to 105.0%)	
PWR2 □□0.0	**OUT2 MV preset value** Setting range: 0.0 to 100.0% (Direct current output: -5.0 to 105.0%)	
FUnc cntr	**Controller/Converter function**	
	cntr	Controller
	cnVT	Converter

14. Key Operation Flowchart

Power ON

Starts from previous status(last shutdown).

△+▽+◎+◉(3 sec): Data clear (clr / no) — Data clear Yes/No ◎

If Data clear no (No) is selected, and ◎ is pressed, the unit will revert to PV/SV Display. If Data clear YES (Yes) is selected, the unit automatically reverts to PV/SV Display after data is cleared.

● About Setting Item

SEnS / K□□C	Input type

- Upper left: PV Display: Indicates setting characters.
- Lower left: SV Display: Indicates factory default.
- Right side: Indicates the setting item.

(Shaded box): This setting item is optional, and appears only when the option is ordered.

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

(*2) Not available if 'Program control' is selected in [OUT/OFF key function].

(*3) If the option is ordered, and if 'Set value memory' is selected in [Event input DI1/DI2 allocation], setting items SV2 to SV4 are available. If 'Program control' is selected in [OUT/OFF key function], SV2 to SV9, Steps 1 to 9 time, Steps 1 to 9 wait value are available.

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

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

● Key Operation

- △+▽+◎+◉ (3 sec): Press and hold △, ▽, ◎, ◉ (in that order) 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.
- Set (or select) each item with the △ or ▽ key, and register the value with the ◎ key.
- ↓◎: If the ◎ key is pressed, the unit proceeds to the next item, illustrated by an arrow. Pressing ◉ 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, the unit will enter Manual control status. If 'Program control' is selected, the unit will enter Program control RUN or Standby mode.

RUN Mode

25 / 0	PV/SV Display (*1)

◉(1 sec) ↔

By pressing the ◉ key for approx. 1 sec, one of the following items selected in [OUT/OFF key function] is indicated.

Program Control		Control Output OFF Function		Auto/Manual Control	
25 / 0	Program control RUN	oFF	Control output OFF	25 / 10.5	Manual control (MV flashes.)

Initial Setting Mode (▽+◎(3 sec))

Display	Default	Item
SEnS	K□□C	Input type
SCLH	1370	Scaling high limit
SCLL	-200	Scaling low limit
dP	0	Decimal point place
EVo1	000	Event output EV1 allocation
EVo2	000	Event output EV2 allocation
H1	0.0	Heater burnout alarm 1 value
H2	0.0	Heater burnout alarm 2 value
LP_T	0	Loop break alarm time
LP_H	0	Loop break alarm span
EVI1	000	Event input DI1 allocation
EVI2	000	Event input DI2 allocation
rTLH	1370	External setting input high limit
rTLL	-200	External setting input low limit
Tro5	PV	Transmission output type
TrLH	1370	Transmission output high limit
TrLL	-200	Transmission output low limit
S1	0	SV1 (*2)
S2	0	SV2 (*2)
S3	0	SV3 (*2)
S4	0	SV4 (*2)

Reverts to RUN mode.

If Alarm output (001 to 012) or Time signal output (015) is selected in [Event output EV1/EV2 allocation], and the ◎ key is pressed, the following items will be indicated.

If 'Alarm output' is selected in [Event output EV1 allocation]:

Display	Default	Item
A1EA	no	EV1 alarm value 0 Enabled/Disabled
A1	0	EV1 alarm value
A1H	0	EV1 high limit alarm value
A1HY	1.0	EV1 alarm hysteresis
A1dY	0	EV1 alarm delay time
A1LA	noML	EV1 alarm Energized/De-energized

If 'Time signal output' is selected in [Event output EV1 allocation]:

Display	Default	Item
TS1S	1	TS1 output step number
TS1F	00.00	TS1 OFF time
TS1o	00.00	TS1 ON time

By pressing the ◎ key, the unit moves to the item after [Event output EV1 allocation].

If Alarm output (001 to 012) or Time signal output (015) is selected in [Event output EV2 allocation], read EV2, TS2 for EV1, TS1.

Main Setting Mode (◎)

Display	Default	Item
S1	0	SV1
T_1	00.00	Step 1 time
W_1	0	Step 1 wait value
S2	0	SV2

Indicates setting items for Steps 2 to 9. (*3)

Display	Default	Item
W_9	0	Step 9 wait value

Reverts to RUN mode.

Monitor Mode (◎ (3 sec) (*4))

Display	Item
25 [MV]	MV indication (Decimal point flashes.)
25 [Remaining time]	Remaining time (*5)
25 [Step number]	Current step number (BCS2) (*5)
25 [Memory number]	SV number (BCS2) (*2)

Reverts to RUN mode.

Sub Setting Mode (△+◎)

Display	Default	Item
AT	----	AT/Auto-reset Perform/Cancel
P	10	OUT1 proportional band
I	200	Integral time
d	50	Derivative time
ArW	50	ARW
rSET	0	Manual reset
c	30	OUT1 proportional cycle
HYS	1.0	OUT1 ON/OFF hysteresis
oLH	100	OUT1 high limit
oLL	0	OUT1 low limit
orAT	0	OUT1 rate-of-change
cACT	Air	OUT2 cooling method
P_b	1.0	OUT2 proportional band
c_b	30	OUT2 proportional cycle
HYSb	1.0	OUT2 ON/OFF hysteresis
oLHb	100	OUT2 high limit
oLLb	0	OUT2 low limit
db	0	Overlap/Dead band
conT	HEAT	Direct/Reverse action
A1	0	EV1 alarm value
A1H	0	EV1 high limit alarm value
A2	0	EV2 alarm value
A2H	0	EV2 high limit alarm value
H1	0.0	Heater burnout alarm 1 value
H2	0.0	Heater burnout alarm 2 value
LP_T	0	Loop break alarm time
LP_H	0	Loop break alarm span

Reverts to RUN mode.

Engineering Mode (△+▽(3 sec))

Display	Default	Item
LocK	----	Set value lock
EVI1	000	Event input DI1 allocation
EVI2	000	Event input DI2 allocation
EVo1	000	Event output EV1 allocation
EVo2	000	Event output EV2 allocation
SoT	1.000	Sensor correction coefficient
So	0.0	Sensor correction
FILT	0.0	PV filter time constant
cMSL	noML	Communication protocol
cMno	0	Instrument number
cMSP	96	Communication speed
cMFT	7EVn	Data bit/Parity
cMST	1	Stop bit
cMdY	10	Response delay time
SV_b	0	SVTC bias
rEMT	LocL	Remote/Local
rTLH	1370	External setting input high limit
rTLL	-200	External setting input low limit
rT_b	0	Remote bias
Tro5	PV	Transmission output type
TrLH	1370	Transmission output high limit
TrLL	-200	Transmission output low limit
M_SU	MIn	Step time unit
PrET	SToP	Power restore action
S_SV	0	Program start temperature
S_SL	PV	Program control start type
rEPT	0	Number of repetitions
rASS	SVST	SV Rise/Fall rate start type
rATU	0	SV rise rate
rATd	0	SV fall rate
PSVo	oFF	Indication when control output OFF
AT_b	20	AT bias
AT_T	1.0	AT gain
EoUT	oFF	Output status when input errors occur
MAnU	oFF	OUT/OFF key function
MArS	AUTo	Auto/Manual after power interruption
TIME	00.00	Indication time
PST1	0.0	OUT1 MV preset value
PST2	0.0	OUT2 MV preset value
FUnc	cnTr	Controller/Converter

Reverts to RUN mode.

Reference tables

Input type				
K□□C	K	-200	to 1370	℃
K□.C	K	-200.0	to 400.0	℃
J□□C	J	-200	to 1000	℃
r□□C	R	0	to 1760	℃
S□□C	S	0	to 1760	℃
b□□C	B	0	to 1820	℃
E□□C	E	-200	to 800	℃
T□.C	T	-200.0	to 400.0	℃
n□□C	N	-200	to 1300	℃
PL2C	PL-Ⅱ	0	to 1390	℃
c□□C	C(W/Re5-26)	0	to 2315	℃
PT.C	Pt100	-200.0	to 850.0	℃
JPT.C	JPt100	-200.0	to 500.0	℃
PT□C	Pt100	-200	to 850	℃
JPTC	JPt100	-200	to 500	℃
K□□F	K	-328	to 2498	℉
K□.F	K	-328.0	to 752.0	℉
J□□F	J	-328	to 1832	℉
r□□F	R	32	to 3200	℉
S□□F	S	32	to 3200	℉
b□□F	B	32	to 3308	℉
E□□F	E	-328	to 1472	℉
T□.F	T	-328.0	to 752.0	℉
n□□F	N	-328	to 2372	℉
PL2F	PL-Ⅱ	32	to 2534	℉
c□□F	C(W/Re5-26)	32	to 4199	℉
PT.F	Pt100	-328.0	to 1562.0	℉
JPT.F	JPt100	-328.0	to 932.0	℉
PT□F	Pt100	-328	to 1562	℉
JPTF	JPt100	-328	to 932	℉
420A	4 to 20 mA	-2000	to 10000	
020A	0 to 20 mA	-2000	to 10000	
0□1V	0 to 1 V	-2000	to 10000	
0□5V	0 to 5 V	-2000	to 10000	
1□5V	1 to 5 V	-2000	to 10000	
010V	0 to 10 V	-2000	to 10000	

Decimal point place	
0	No decimal point
0.0	1 digit after decimal point
0.00	2 digits after decimal point
0.000	3 digits after decimal point

Event output EV1/EV2 allocation	
000	No event
001	High limit alarm
002	Low limit alarm
003	H/L limits alarm
004	H/L limits independent
005	H/L limit range alarm
006	H/L limit range independent
007	Process high alarm
008	Process low alarm
009	High limit with standby
010	Low limit with standby
011	H/L limits with standby
012	H/L limits standby independent
013	Heater burnout alarm output
014	Loop break alarm output
015	Time signal output
016	Output during AT
017	Pattern end output
018	Output by communication command
019	Heating/Cooling control relay contact output (for EV2 only)

EV1/EV2 alarm value 0 Disabled/Enabled	
no	Disabled
YES	Enabled

EV1/EV2 alarm Energized/De-energized	
noML	Energized
rEVS	De-energized

Event input DI1/DI2 allocation	
000	No event
001	Set value memory
002	Control ON/OFF
003	Direct/Reverse action
004	Preset output 1 ON/OFF
005	Preset output 2 ON/OFF
006	Auto/Manual control
007	Remote/Local
008	Program control Run/Stop
009	Program control Holding/Not holding
010	Program control Advance function
011	Integral action Holding

Transmission output	
PV	PV transmission
SV	SV transmission
MV	MV transmission
dV	DV transmission

AT/Auto-reset Perform/Cancel	
----	AT/Auto-reset Cancel
AT	AT Perform
AT_S	AT on startup Perform
rSET	Auto-reset Perform

OUT2 cooling method	
Air	Air cooling
oIL	Oil cooling
WAT	Water cooling

Direct/Reverse action	
HEAT	Reverse action
cooL	Direct action

Set value lock	
----	Unlock
Loc1	Lock 1
Loc2	Lock 2
Loc3	Lock 3
Loc4	Lock 4
Loc5	Lock 5

Communication protocol	
noML	Shinko protocol
ModA	Modbus ASCII
Modr	Modbus RTU

Communication speed	
96	9600 bps
192	19200 bps
384	38400 bps

Data bit/Parity	
8non	8 bits/No parity
7non	7 bits/No parity
8EVn	8 bits/Even
7EVn	7 bits/Even
8odd	8 bits/Odd
7odd	7 bits/Odd

Stop bit	
1	1 bit
2	2 bits

Remote/Local	
LocL	Local
rEMT	Remote

Step time unit	
MIn	Hours:Minutes
SEc	Minutes:Seconds

Power restore action	
SToP	Stop
conT	Continue (resume)
HoLd	Suspend (on hold)

Program control start type	
PV	PV start
PVr	PVR start
SV	SV start

SV Rise/Fall rate start type	
SVST	SV start
PVST	PV start

Indication when control output OFF	
oFF	OFF indication
AoFF	No indication
PV	PV indication
PVAL	PV + Any Alarm active

Output status when input errors occur	
oFF	Output OFF
on	Output ON

OUT/OFF key function	
oFF	Control output OFF
MAnU	Auto/Manual control
ProG	Program control

Auto/Manual after power interruption	
AUTo	Automatic control
MAnU	Manual control

Controller/Converter function	
cnTr	Controller
cnVT	Converter

***** Inquiries *****

For any inquiries about this unit, please contact our agency or the vendor where you purchased the unit after checking the following.

[Example]

- Model ---------- BCS2R00-12
- Option ---------- EV2, C5W (100A)
- Serial number ---------- No. 145F05000

In addition to the above, please let us know the details of the malfunction, or discrepancy, and the operating conditions.

SHINKO TECHNOS CO., LTD.
OVERSEAS DIVISION

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