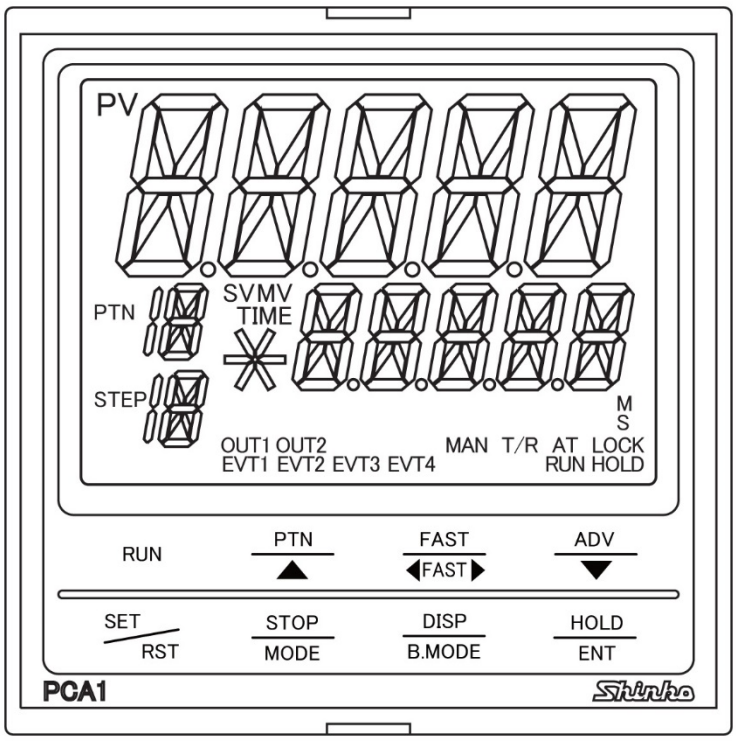
PROGRAMMABLE CONTROLLER

PCA1

INSTRUCTION MANUAL



Shinko

Preface

Thank you for purchasing our programmable controller PCA1. This manual contains instructions for the mounting, functions, operations and notes when operating the PCA1. 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
OUT1	Control output OUT1
OUT2	Control output OUT2
AT	Auto-tuning

Characters used in this manual (□: No character is indicated)

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

Notes

- This instrument should be used in accordance with the specifications described in the manual. If it is not used according to the specifications, it may malfunction or cause a fire.
- Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- The contents of this instruction manual are subject to change without notice.
- Care has been taken to ensure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform our sales department.
- This instrument is designed to be installed through the control panel. If it is not, 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 result in serious consequences, 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 0 to 50℃ (32 to 122℉) 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 50℃ (122℉) 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.
- This instrument does not have a built-in power switch, circuit breaker and fuse. It is necessary to install a-power switch, circuit breaker and fuse near the controller.
  (Recommended fuse: Time-lag fuse, rated voltage 250 V AC, rated current 2 A)
- For the grounding wire, use a thick wire (1.25 - 2.0 mm^2).
- 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 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 0 to 1 V DC.

Terminal Number	DC Voltage Input
⑯ and ⑲	0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
⑱ and ⑲	0 to 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 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 power sources or load wires.

3. Operation and Maintenance Precautions

⚠ Caution

- It is recommended that AT be performed on the trial run.
- When connecting USB communication cable (CMB-001) to the console connector, connect the cable after power is turned OFF.
- *Never* turn the power ON or OFF, while USB communication cable (CMB-001) is connected to the console connector.
- Do not touch live terminals. This may cause electrical shock or problems in operation.
- Turn the power supply to the instrument OFF before 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, be careful not to put pressure on, scratch or strike it with a hard object.

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1. Model

1.1 Model

PCA1 □ □ 0- □ □ □								
Control output OUT1	R						Relay contact output	
	S						Non-contact voltage output	
	A						Direct current output	
Power supply voltage		0					100 to 240 V AC	
		1					24 V AC/DC	
Input			0				Multi-range (*1)	
Option 1 (*2)				0				Option 1 not needed.
				1			C	Serial communication RS-232C
				2			C5	Serial communication RS-485
				3			TS	Time signal output
				4			C+TS	Serial communication RS-232C+Time signal output
				5			C5+TS	Serial communication RS-485+Time signal output
Option 2 (*2)					0			Option 2 not needed.
					1		TA	Transmission output (4 to 20 mA DC)
					2		TV	Transmission output (0 to 1 V DC)
Option 3 (*2)						0		Option 3 not needed.
						1	DR (*3)	Heating/Cooling control output OUT2 Relay contact output
						2	DS (*3)	Heating/Cooling control output OUT2 Non-contact voltage output
						3	DA (*3)	Heating/Cooling control output OUT2 Direct current output

Factory default values of Event output are shown below.

EV1 : Pattern end output

EV2 : No event

EV3 : Alarm output, High limit alarm

EV4 : Alarm output, Low limit alarm

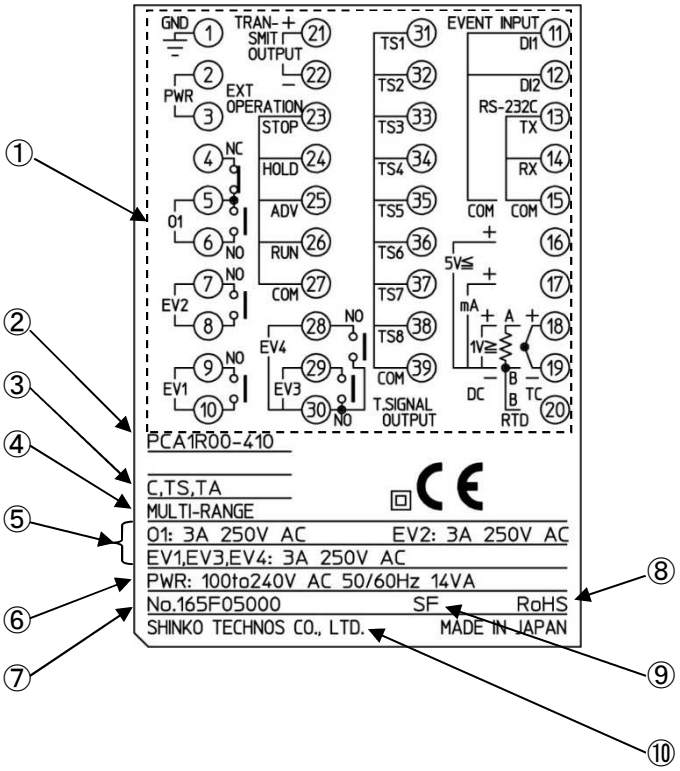
(*1) Thermocouple, RTD, Direct current or DC voltage can be selected by keypad.

(*2) Only one option can be selected from Option 1, Option 2 and Option 3 respectively.

(*3) If Heating/Cooling control (DR, DS or DA option) is ordered, Event output EV2 is not available.

1.2 How to Read the Model Label

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

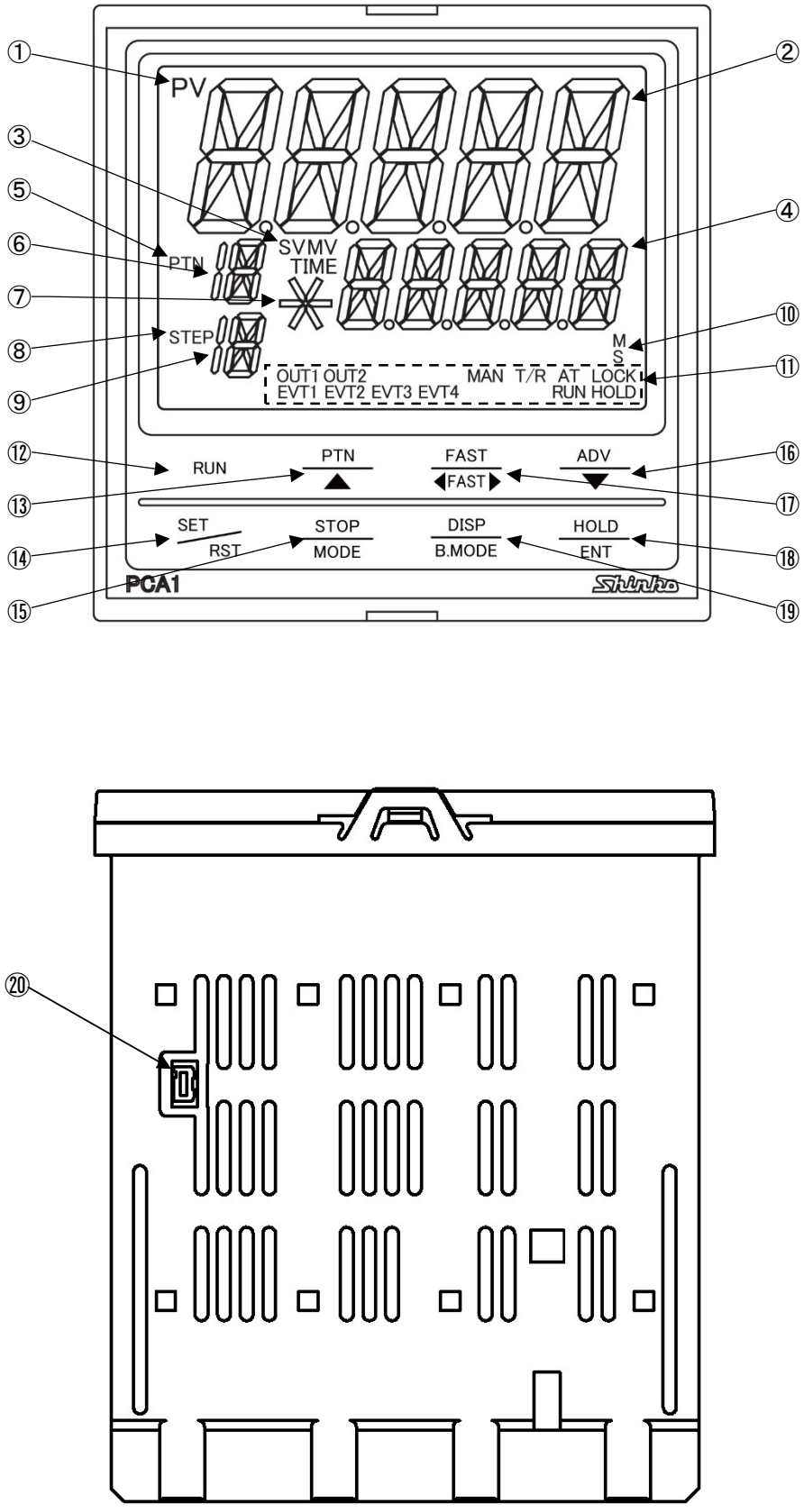


(Fig. 1.2-1)

No.	Description	Example
①	Terminal arrangement	Terminal arrangement of PCA1R00-410 (*)
②	Model	PCA1R00-410
③	Option	C+TS (Serial communication RS-232C+Time signal output) TA [Transmission output (4-20 mA DC)]
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) EV3: 3 A 250 V AC (Event output EV3) EV4: 3 A 250 V AC (Event output EV4)
⑥	Power supply, Power consumption	100 to 240 V AC 50/60 Hz, 14 VA
⑦	Serial number	No. 165F05000
⑧	RoHS directive	RoHS directive compliant
⑨	UL recognized factory ID	SF: Fukuoka factory
⑩	Manufacturer	SHINKO TECHNOS CO., LTD.

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

2. Name and Functions of Controller



(Fig. 2-1)

Action Indicators, Display

No.	Name	Description
①	PV indicator	Backlight: Red/Green/Orange Lit when PV is indicated in RUN mode.
②	PV Display	Backlight: Red/Green/Orange Indicates PV in RUN mode. Indicates setting characters in setting mode.
③	SV indicator	Backlight: Green Lit when SV is indicated on the SV/MV/TIME Display.
	MV indicator	Backlight: Green Lit when OUT1 MV is indicated on the SV/MV/TIME Display. Flashes when OUT2 MV is indicated on the SV/MV/TIME Display.
	TIME indicator	Backlight: Green Lit when TIME is indicated on the SV/MV/TIME Display.
④	SV/MV/TIME Display	Backlight: Green Indicates SV, MV or TIME in RUN mode. Indicates the set values in setting mode.
⑤	PTN indicator	Backlight: Orange Lit when the pattern number is indicated.
⑥	PTN Display	Backlight: Orange Indicates the pattern number. Flashes if 'Holding' is selected in [Step SV Hold function when program ends], when program control ends.
⑦	PROFILE indicator	Backlight: Green When program control is performing, the indicator lights up depending on the program setting as follows. : Lit when step SV is rising. : Lit when step SV is constant. : Lit when step SV is falling.
⑧	STEP indicator	Backlight: Orange Lit when the step number is indicated.
⑨	STEP Display	Backlight: Orange Indicates the step number. The step number flashes during Wait action. Indicates during Manual control.
⑩	Time unit indicator	Backlight: Green When the SV/MV/TIME Display indicates TIME, the following is shown depending on the selection in [Step time unit]. M: Lit when 'Hours:Minutes' is selected in [Step time unit]. S: Lit when 'Minutes:Seconds' is selected in [Step time unit].

Action Indicator (Backlight: Orange)

No.	Name	Description
⑪	OUT1	Lit when control output OUT1 is ON. For direct current output type, flashes corresponding to the MV in 125 ms cycles.
	OUT2	Lit when control output OUT2 (DR, DS or DA option) is ON. For direct current output type (DA option), flashes corresponding to the MV in 125 ms cycles.
	EVT1	Lit when Event output EV1 is ON.
	EVT2	Lit when Event output EV2 is ON.
	EVT3	Lit when Event output EV3 is ON.
	EVT4	Lit when Event output EV4 is ON.
	MAN	Lit when Manual control is performing.
	T/R	Lit during Serial communication (C or C5 option) TX (transmitting) output.
	AT	Flashes during AT (Auto-tuning). Lit in AT standby when 'Multi mode' is selected in [AT mode].
	LOCK	Lit when 'Lock' is selected in [Set value lock].
	RUN	Lit during program control RUN. Flashes during Fixed value control.
	HOLD	Flashes during program control HOLD.

Key

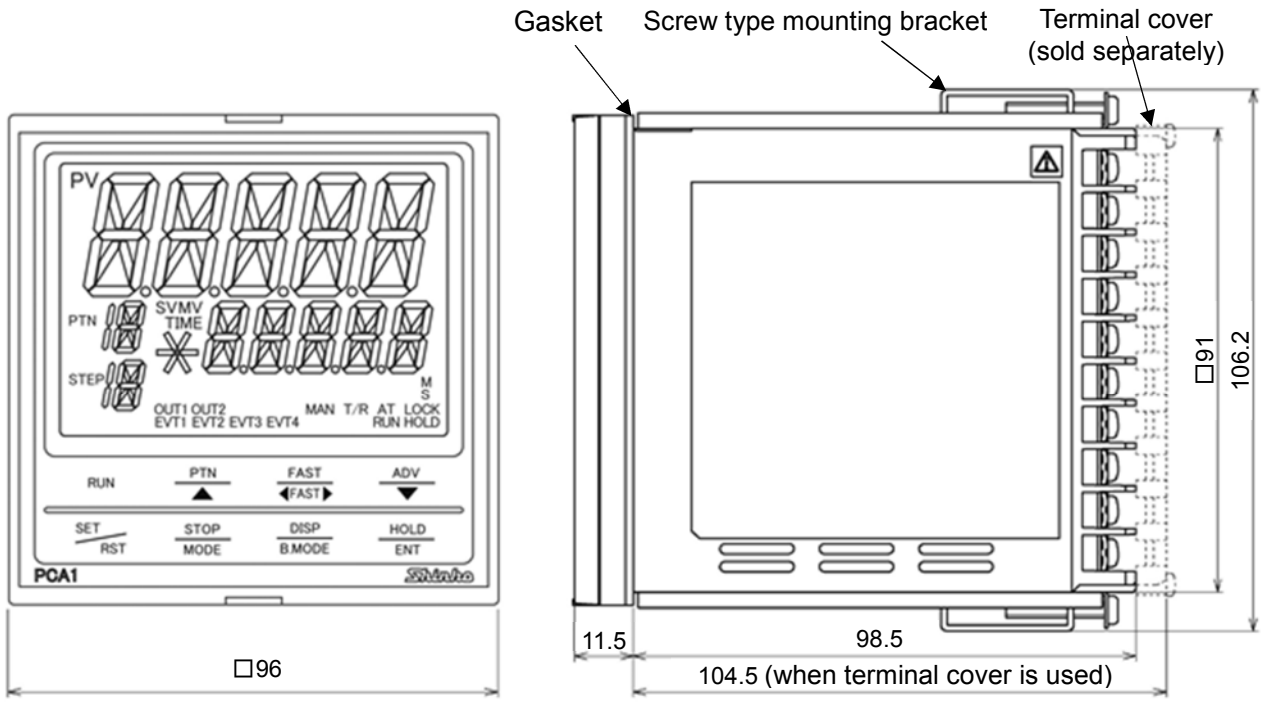
No.	Name	Description
⑫	**RUN key**	Performs program control. Cancels HOLD during Program control HOLD.
⑬	**PATTERN/UP key**	PATTERN key: Selects program pattern number to perform. UP key: Increases the numeric value of the set value in setting mode.
⑭	**SET/RESET key**	SET key: Moves to setting mode. RESET key: Moves to RUN mode.
⑮	**STOP/MODE key**	STOP key: Stops the program control, or cancels the pattern end output. MODE key: Switches or selects setting mode.
⑯	**ADVANCE/DOWN key**	ADVANCE key: During program control, interrupts performing step, and proceeds to the next step (ADVANCE function). DOWN key: Decreases the numeric value of the set value in setting mode.
⑰	**FAST key**	During program control, makes step time progress 60 times faster. In setting mode, makes the numeric value change faster.
⑱	**HOLD/ENTER key**	HOLD key: During program control, time progress pauses, and control continues with the SV at that time (HOLD function). ENTER key: Registers the setting data, and moves to the next setting item.
⑲	**DISPLAY/ BACK MODE key**	DISPLAY key: Switches the indication on the SV/MV/TIME Display. Indication will be maintained when power is OFF. BACK MODE key: Moves back to the previous mode.

Console Connector

No.	Name	Description
⑳	**Console connector**	By connecting the USB communication cable (CMB-001, sold separately), the following operations can be conducted from an external computer, using the Console software SWC-PCA01M. • Reading and setting of SV, PID and various set values • Reading of PV and action status • Function change

3. Mounting to the Control Panel

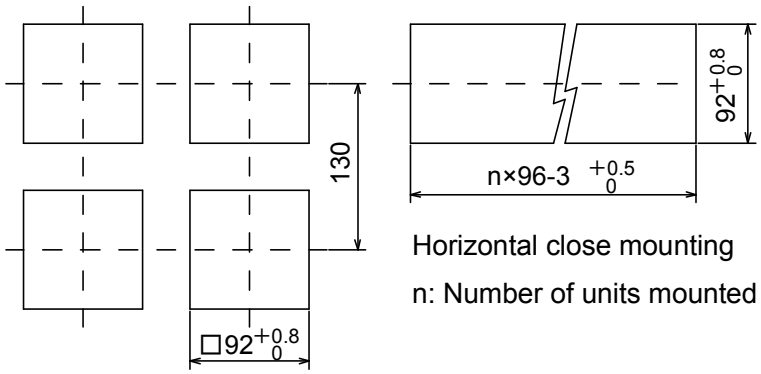
3.1 External Dimensions (Scale: mm)



(Fig. 3.1-1)

3.2 Panel Cutout (Scale: mm)

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



(Fig. 3.2-1)

3.3 Mounting to, and Removal from, the Control Panel

> **⚠ Caution**
>
> **As the case of the PCA1 is made of resin, do not use excessive force while tightening screws, or the mounting brackets or case could be damaged.**
> **0.12 N•m of torque is recommended.**

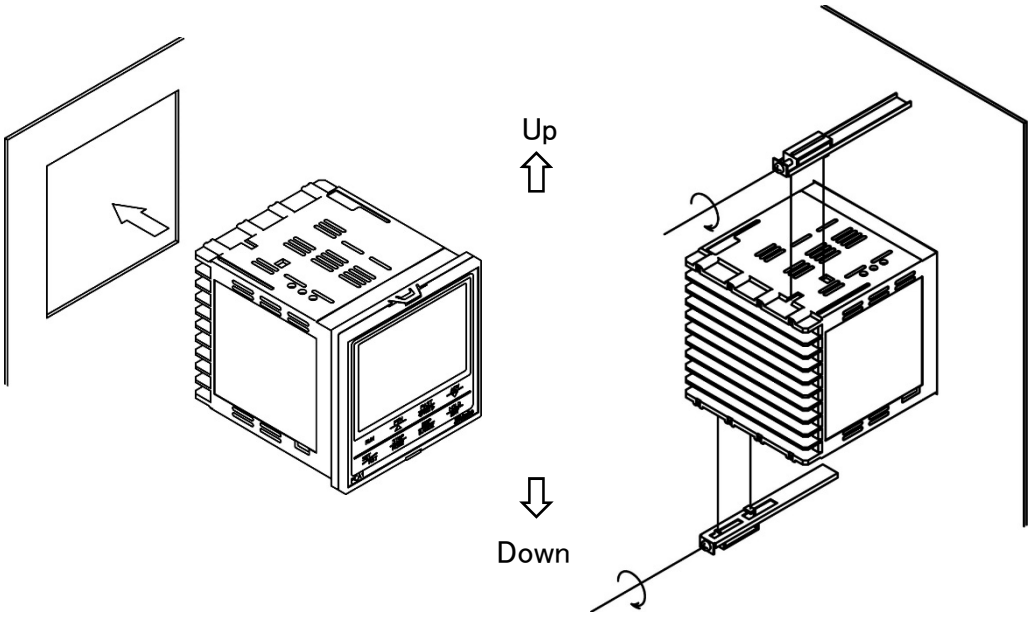
3.3.1 Mounting the Unit

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

CAUTION:
If the horizontal 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 8 mm

(1) Insert the controller from the front side of the control panel. (Fig. 3.3.1-1)
(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.
0.12 N•m of torque is recommended.



(Fig. 3.3.1-1)

3.3.2 Removing the Unit

(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.

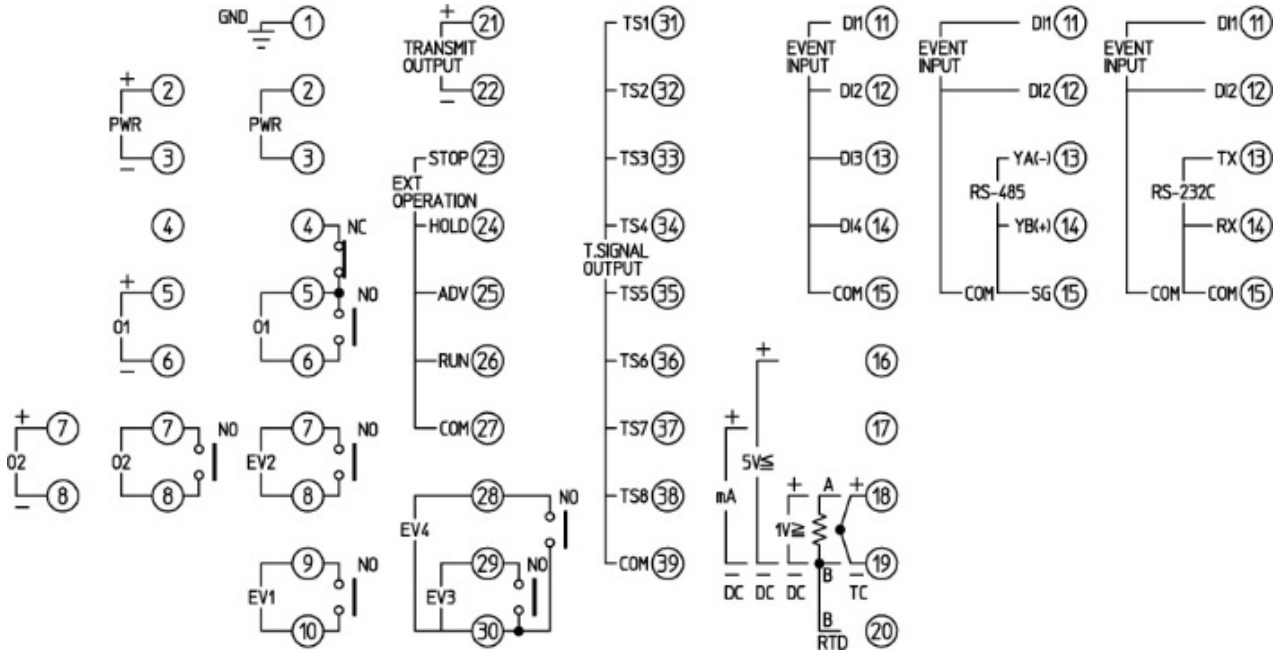
⚠ Caution

- 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.
- This instrument does not have a built-in power switch, circuit breaker and fuse. It is necessary to install a-power switch, circuit breaker and fuse near the controller.
  (Recommended fuse: Time-lag fuse, rated voltage 250 V AC, rated current 2 A)
- For the grounding wire, use a thick wire (1.25 – 2.0 mm^2).
- For a 24 V AC/DC power source, ensure polarity is correct 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 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC and 0 to 1 V DC.

Terminal Number	DC Voltage Input
⑯ and ⑲	0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
⑱ and ⑲	0 to 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 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 power sources or load wires.

4.1 Terminal Arrangement



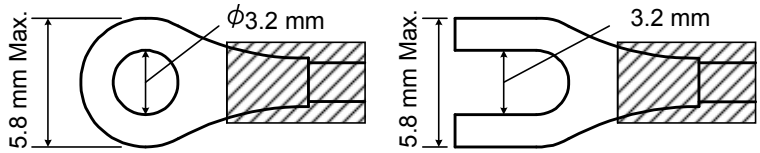
(Fig. 4.1-1)

Terminal Code	Description
GND	Grounding
PWR	Power supply 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).
O1	Control output OUT1
O2	Control output OUT2 (DR, DS or DA option)
EV1	Event output EV1
EV2	Event output EV2
EV3	Event output EV3
EV4	Event output EV4
EVENT INPUT	Event input
RS-485/RS-232C	Serial communication RS-485 (C5 option) or RS-232C (C option)
TC	Thermocouple input
RTD	RTD input
DC 1V≧	DC voltage input: 0 to 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 0 to 1 V DC
DC 5V≦	DC voltage input: 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
DC mA	Direct current input: 0 to 20 mA DC, 4 to 20 mA DC
TRANSMIT OUTPUT	Transmission output (TA or TV option)
EXT OPERATION	External operation input: STOP, HOLD, ADV, RUN
T.SIGNAL OUTPUT	Time signal output (TS option)

4.2 Lead Wire Solderless Terminal

Use a solderless terminal with an insulation sleeve in which an M3 screw fits as shown below.
0.63 N•m of torque is recommended.

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	



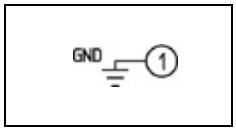
(Fig. 4.2-1)

4.3 Wiring

For the terminal arrangement, refer to Section “4.1 Terminal Arrangement” (p.15).

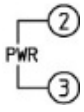
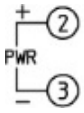
4.3.1 Grounding

For the grounding wire, use a thick wire (1.25 – 2.0 mm^2).



4.3.2 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).

AC	DC
	

4.3.3 Control Output OUT1 and OUT2

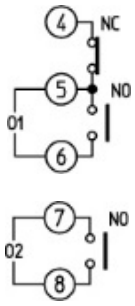
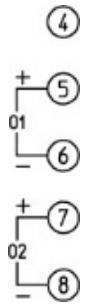
When Heating/Cooling control (DR, DS, DA option) is ordered, control output OUT2 is available.
Specifications of Control output OUT1 and OUT2 are shown below.

Control Output OUT1

Relay contact	1a 1b Control capacity: 3 A 250 V AC (resistive load), 1 A 250 V AC (inductive load cosϕ=0.4) Electrical life: 100,000 cycles
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. 600 Ω

Control Output OUT2

Relay contact (DR option)	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
Non-contact voltage (for SSR drive) (DS option)	12 V DC±15% Max. 40 mA (short circuit protected))
Direct current (DA option)	4 to 20 mA DC Load resistance: Max. 600 Ω

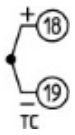
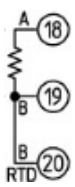
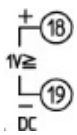
Relay contact	Non-contact voltage, Direct current
	

Number of Shinko SSR units when connected in parallel (for Non-contact voltage output):
- SA-400 series: 5 units
- SA-500 series: 2 units

4.3.4 Input

Input wirings are shown below.

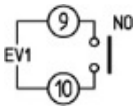
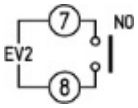
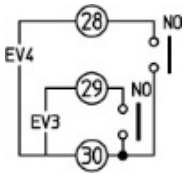
For DC voltage input, (+) side input terminal number of 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC differs from that of 0 to 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 0 to 1 V DC.

Thermocouple input	**RTD input**	**DC voltage input** 0 to 10 mV DC -10 to 10 mV DC 0 to 50 mV DC 0 to 100 mV DC 0 to 1 V DC	**DC voltage input** 0 to 5 V DC 1 to 5 V DC 0 to 10 V DC	**Direct current input**
				

4.3.5 Event Output EV1, EV2, EV3 and EV4

Specifications of Event output EV1, EV2, EV3 and EV4 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

Event output EV1	Event output EV2	Event output EV3 Event output EV4
		

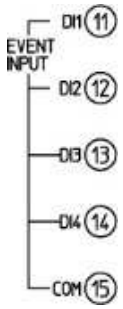
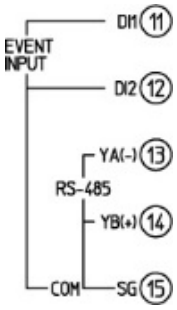
Event output EV3 and EV4 share one common terminal.

4.3.6 Event Input

Up to 4 points of Event input are available.
If Serial communication (C, C5 option) is ordered, up to 2 points of Event input are available.

Specifications of Event input are shown below.

Circuit current when closed	Approx. 16 mA

4 points of Event input	2 points of Event input
	

Level action is used to determine ON or OFF.
When power is turned ON, level action is engaged.

For 4 points of Event input, performing pattern numbers 0 to 15 can be switched by ON (Closed) or OFF (Open) status of DI1 to DI4.
For 2 points of Event input, performing pattern numbers 0 to 3 can be switched by ON (Closed) or OFF (Open) status of DI1 and DI2.

Pattern numbers (to perform) selected by Event input have priority over pattern numbers (to perform) selected by keypad operation.

• 4 points of Event input DI1 to DI4 [●: ON (Closed) status]

PTN Display	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DI1		●		●		●		●		●		●		●		●
DI2			●	●			●	●			●	●			●	●
DI3					●	●	●	●					●	●	●	●
DI4									●	●	●	●	●	●	●	●

• 2 points of Event input DI1 and DI2 [●: ON (Closed) status]

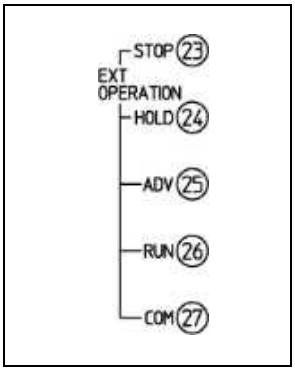
PTN Display	0	1	2	3
DI1		●		●
DI2			●	●

4.3.7 External Operation Input

4 points of External operation input are available.

Specifications of External operation input are shown below.

Circuit current when closed	Approx. 16 mA

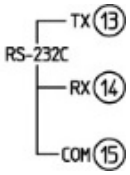


Signal edge action is used to determine ON or OFF.
Signal rising edge action from OFF (Open) to ON (Closed) of External operation input is engaged, and program control RUN, STOP, HOLD and ADVANCE are performed.
When power is turned ON, level action is engaged.

External Operation Input	External Operation Input Function
STOP	Stops the program control.
HOLD	During program control, current performing step progress pauses.
ADV	During program control, interrupts performing step, and proceeds to the beginning of the next step.
RUN	Performs program control.

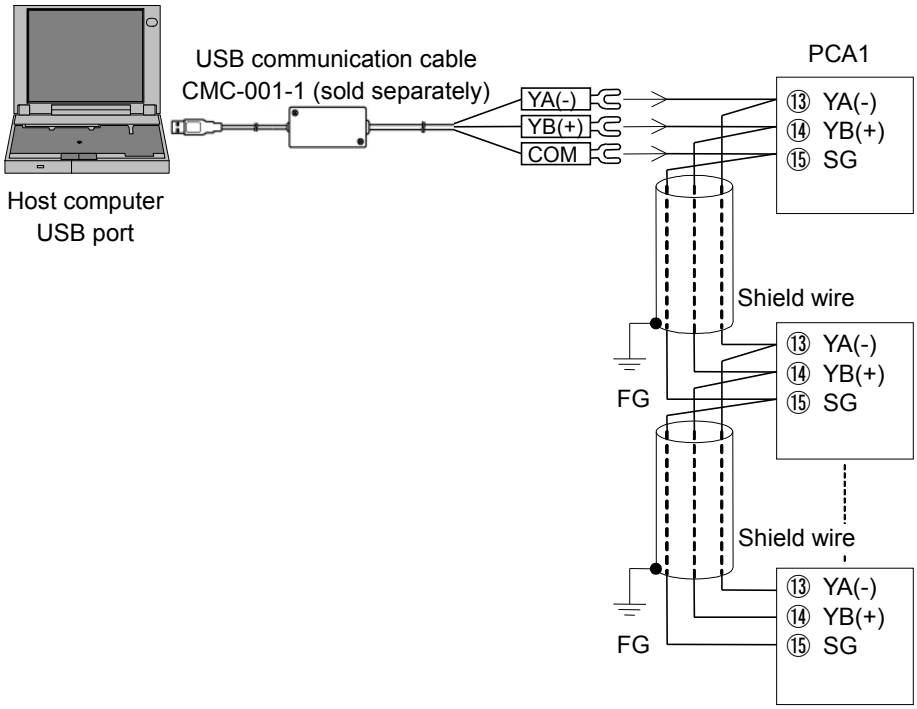
4.3.8 Serial Communication

When the C or C5 option is ordered, Serial communication is available.

C option	C5 option
	

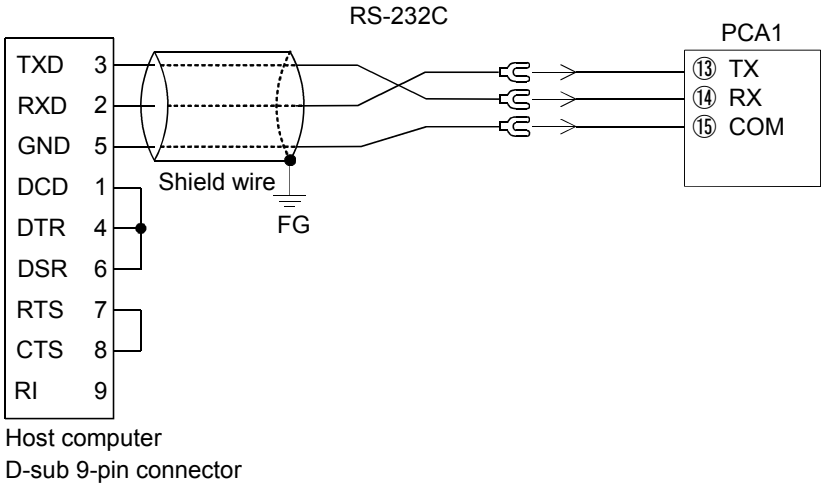
(1) Serial Communication

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



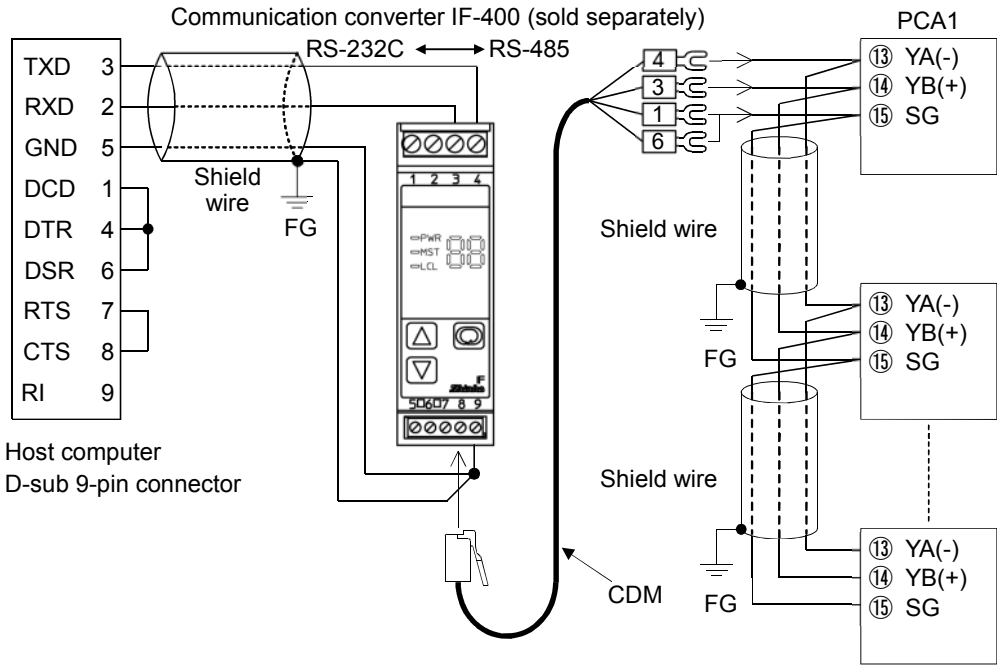
(Fig. 4.3.8-1)

When using RS-232C communication line



(Fig. 4.3.8-2)

When using communication converter IF-400 (sold separately)



(Fig. 4.3.8-3)

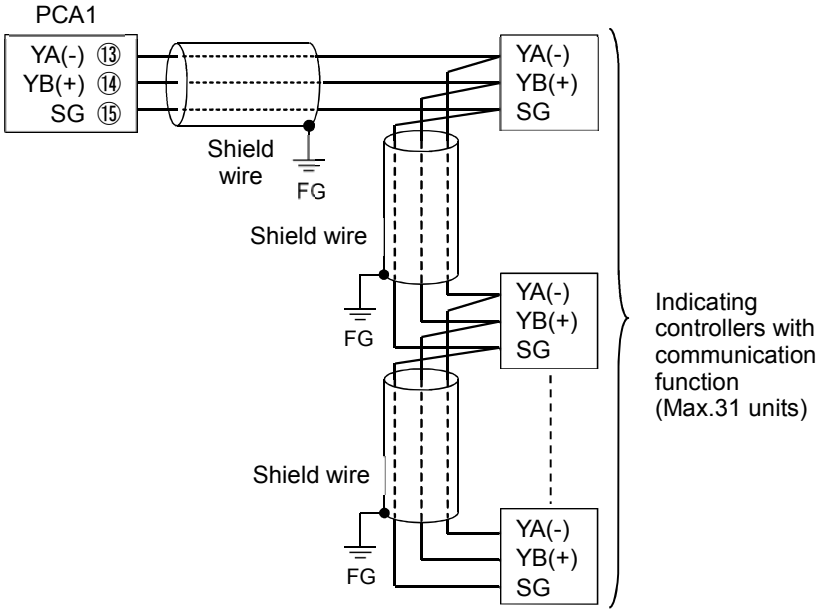
(2) Set Value (SV) Digital Transmission [SVTC]

If 'Set Value (SV) digital transmission' [SVTC] is selected in [Communication protocol], SV can be digitally transmitted to the Shinko indicating controllers with communication function (C5 option).
Update cycle: 250 ms

Connection

Connect YA (-) to YA (-), YB (+) to YB (+), SG to SG terminal (of PCA1 and indicating controllers with communication function) respectively.
A maximum of 31 units can be connected.

PCA1 and indicating controllers with communication function



(Fig. 4.3.8-4)

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.

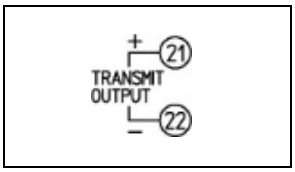
Recommended cable: OTSC-VB 2PX0.5SQ (made by Onamba Co., Ltd.) or equivalent (Use a twisted pair cable.)

4.3.9 Transmission Output

If the TA, TV option is ordered, Transmission output is available.

Specifications of Transmission output are shown below.

Resolution		12000
Output	**TA option**	4 to 20 mA DC Load resistance: Max. 500 Ω
	TV option	0 to 1 V DC Load resistance: Min. 100 kΩ
Output accuracy		Within ±0.3% of Transmission output span
Response time		400 ms + Input sampling period (0% ⟶ 90%)



Converting the value (PV, SV or MV transmission) to analog signal every 125 ms, outputs the value in current or voltage. (Factory default: PV transmission)

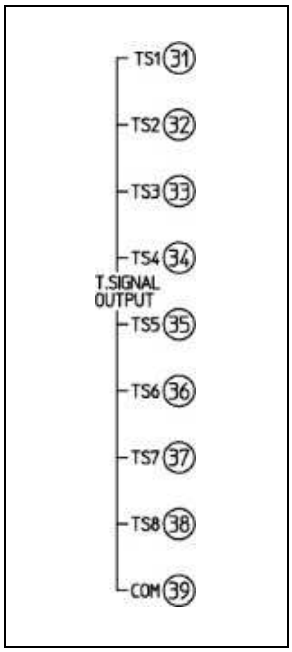
Outputs Transmission output low limit value if Transmission output high limit and low limit value are the same.

If SV or MV transmission is selected, 4 mA or 0 V will be output when program control stops (in Standby).

4.3.10 Time Signal Output

If the TS option is ordered, Time signal output is available.
Specifications of Time signal output are shown below.

Number of circuits	8
Open collector	Capacity: 24 V DC Max. 50 mA



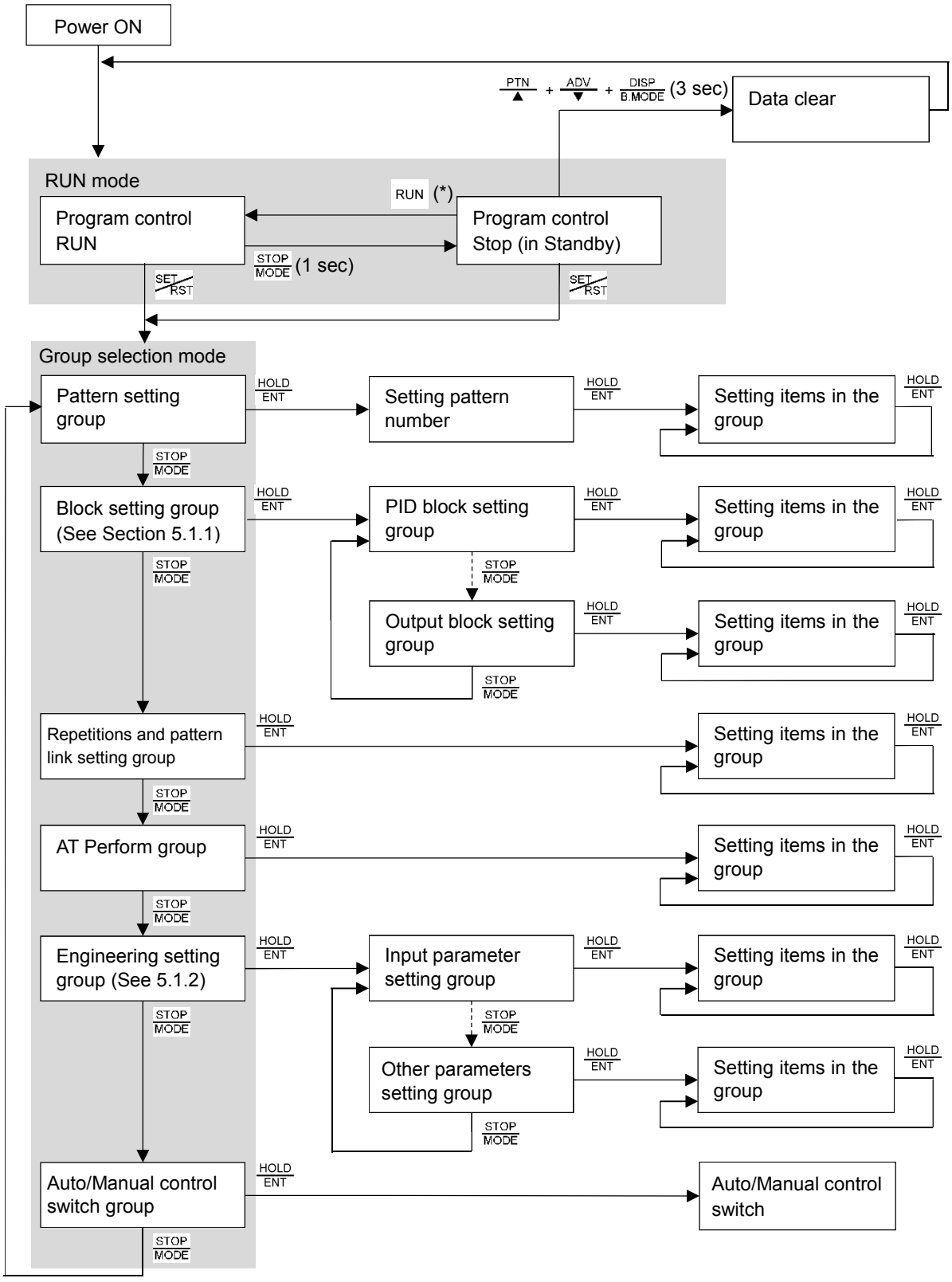
For the Time signal output, a maximum of 8 points (Time signal outputs TS1 to TS8) can be selected for each step.
Time signal outputs TS1 to TS5 can be used as Status output as follows.

Time signal output TS1 ⟶ Status (RUN) output
Time signal output TS2 ⟶ Status (HOLD) output
Time signal output TS3 ⟶ Status (WAIT) output
Time signal output TS4 ⟶ Status (FAST) output
Time signal output TS5 ⟶ Status (STOP) output

When program control is performing, outputs Time signal output TS1 to TS8 in accordance with the settings (Time signal output OFF time, Time signal output ON time) of selected time signal block.

5. Outline of Key Operation and Explanation of Groups

5.1 Outline of Key Operation



(*): Select a pattern number to perform with the PTN key, and perform program control with the RUN key.

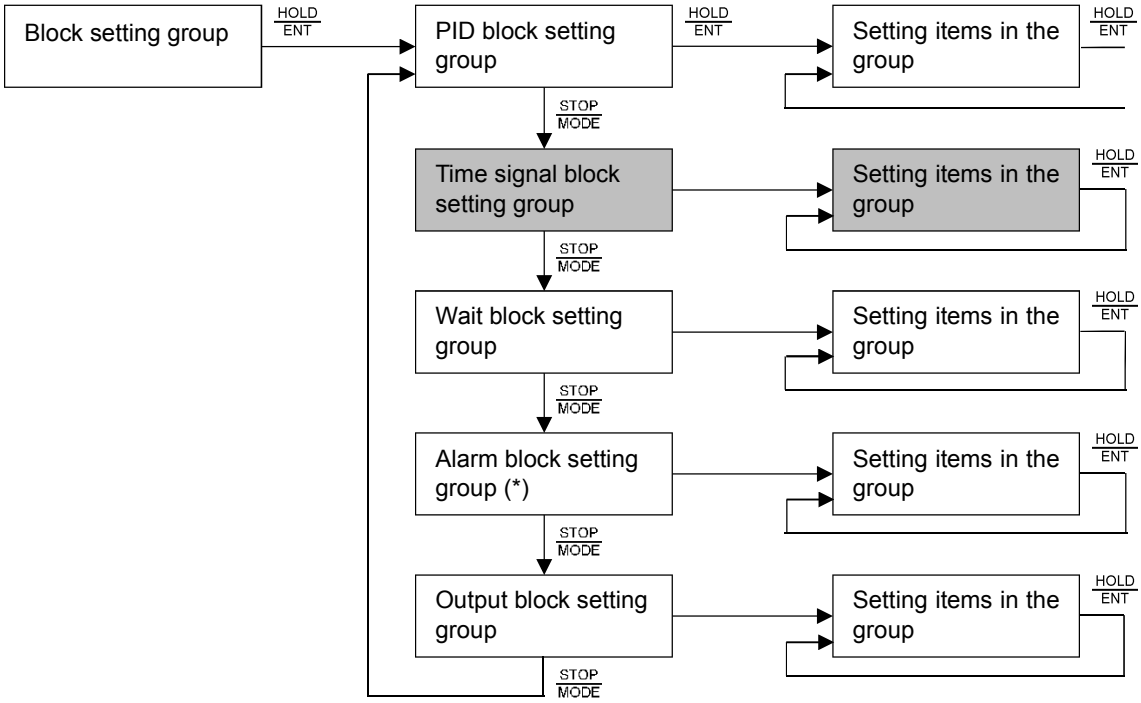
Explanation of Mode

Mode	Description	
RUN mode	The unit enters the RUN mode when power is turned ON. Resumes from Program control Stop (in Standby) or Program control RUN, depending on the status of power OFF. Indication differs depending on the status below.	
	Program control Stop (in Standby)	PV, SV and PTN indicators light up. The PV Display indicates PV, and the PTN Display indicates the pattern number. Other indicators and Displays are unlit.
	Program control RUN	PV, SV, PTN, STEP, PROFILE, Time unit and Action indicators are lit. The PV Display indicates PV. The SV/MV/TIME Display indicates SV, MV or TIME. The PTN Display indicates the pattern number. The STEP Display indicates the step number.
Group selection mode	Selects a group from the following: Pattern setting group, Block setting group, Repetitions and Pattern link setting group, AT perform group, Engineering setting group, Auto/Manual control switch group	

Key Operation

Key Operation	Description
↓ , →	If any key is pressed, the unit moves to the next item, illustrated by an arrow.
STOP/MODE	Press the STOP/MODE key until the desired setting item appears.
SET/RST	Returns to RUN mode from any mode.
DISP/B.MODE	Moves back to the previous mode (opposite to when the STOP/MODE or HOLD/ENT key is pressed).
STOP/MODE + DISP/B.MODE	When the STOP/MODE and DISP/B.MODE key are pressed at the same time, the mode returns to the previous setting group as follows. Block setting group ← STOP/MODE + DISP/B.MODE ← Alarm block setting group ← STOP/MODE + DISP/B.MODE ← EV4 alarm value
PTN/▲ + ADV/▼	**Return to Previous Function** If PTN/▲ and ADV/▼ keys are pressed at the same time during program control RUN, interrupts performing step, and the unit moves back to the previous step, and performs control. However, if the elapsed time of the current step is less than 1 minute, the program control goes back to the beginning of the previous step. If the elapsed time in the current step is longer than 1 minute, the program control goes back to the beginning of the current step. The Return to Previous Function is disabled at Step 0 of started pattern, but moves back to the beginning of Step 0.
RUN	**Program clearing function** When program control is stopped (in Standby), and if the RUN key is pressed for approximately 3 seconds at any item in pattern setting group, data (for current step on the STEP Display and all the following steps) will return to the default value.
PTN/▲ + ADV/▼ + DISP/B.MODE (3 sec)	**Data clearing function** When program control is stopped (in Standby), and if the PTN/▲, ADV/▼ and DISP/B.MODE keys are pressed simultaneously for 3 seconds, the PV Display indicates CLR, and all program data – except Input type, OUT1 proportional cycle, OUT2 proportional cycle – will return to the default value. It takes approx. 30 seconds for data clear.

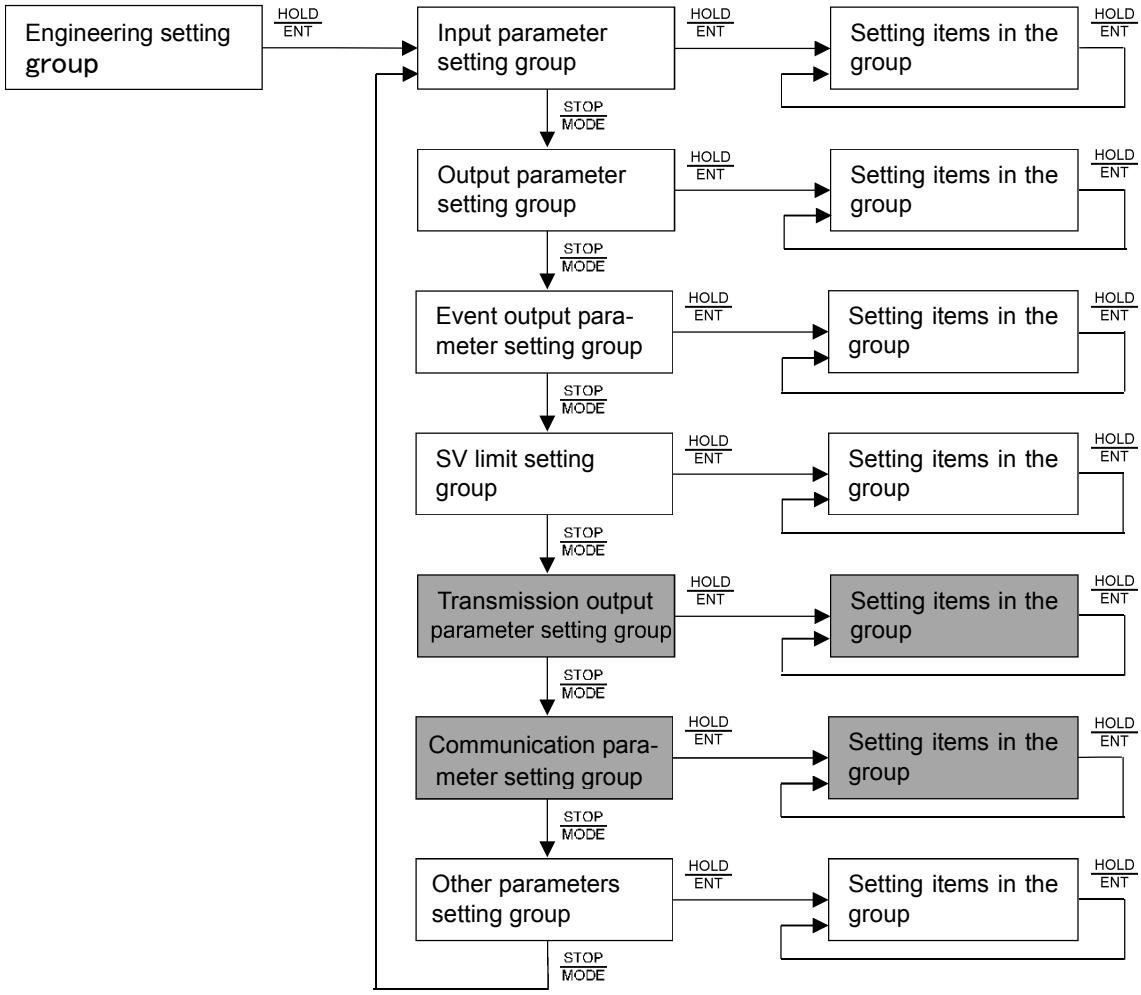
5.1.1 Block Setting Group



(*) Appears when an Alarm type is selected in [Event output EVT□ allocation].

: Appears only when the option is ordered.

5.1.2 Engineering Setting Group



: Appears only when the option is ordered.

5.2 Explanation of Groups

Press the SET/RST key in RUN mode. The unit moves to Pattern setting group in Group selection mode.
Select a group with the STOP/MODE key, and press the HOLD/ENT key. Setting items in the group can be set.

If the HOLD/ENT key is pressed in the Block setting group, the unit enters setting groups such as PID block, Alarm block.
Select a group with the STOP/MODE key, and press the HOLD/ENT key. Setting items in the group can be set.

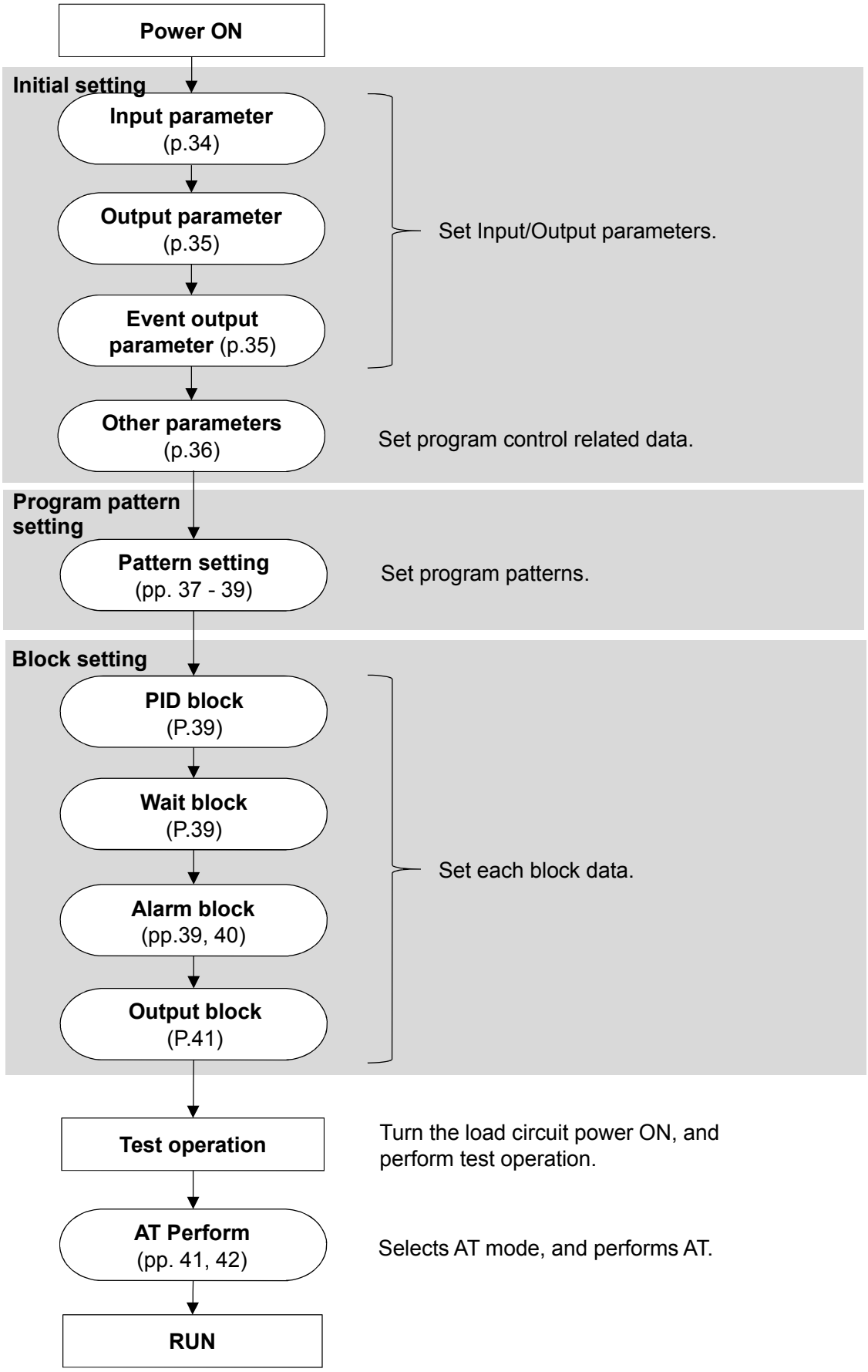
If the HOLD/ENT key is pressed in the Engineering setting group, the unit enters setting groups such as Input parameter, Output parameter.
Select a group with the STOP/MODE key, and press the HOLD/ENT key. Setting items in the group can be set.

Group	PV Display	Contents
Pattern setting group	G_PTN	Selects the following items: Setting pattern number, Step SV, Step time, PID block number, Alarm block number, etc.
Block setting group	G_bLK	Selects the following setting groups: PID block, Time signal block, Wait block, Alarm block, Output block
PID block setting group	b_PId	Sets the following items of blocks 0 to 9: OUT1 proportional band, Integral time, Derivative time, ARW, OUT2 proportional band (when DR, DS or DA option is ordered)
Time signal block setting group (when the TS option is ordered)	b_T□	Sets the following items of blocks 0 to 15: Time signal output OFF time, Time signal output ON time
Wait block setting group	b_WAIT	Sets Wait value of blocks 0 to 9.
Alarm block setting group	b_ALM	Sets the following alarm values of blocks 0 to 9: EV1 alarm value, EV2 alarm value, EV3 alarm value, EV4 alarm value (Appears when an Alarm type is selected in [Event output EV□ allocation].)
Output block setting group	b_oUT	Sets items of blocks 0 to 9: OUT1 high limit, OUT1 low limit, OUT2 high limit (when DR, DS or DA option is ordered), OUT2 low limit (when DR, DS or DA option is ordered), OUT1 rate-of-change
Repetitions and Pattern link setting group	G_cHN	Sets the number of repetitions and pattern links.
AT Perform group	G_AT□	Sets the following items: AT mode, AT Perform/Cancel, AT bias.

Group	PV Display	Contents
Engineering setting group	G_ENG	Selects the following setting groups: Input parameter, Output parameter, Event output parameter, SV limit, Transmission output parameter, Communication parameter, Other parameters
Input parameter setting group	E_INP	Sets the following items: Input type, Scaling high limit, Scaling low limit, Decimal point place, Sensor correction, PV filter time constant
Output parameter setting group	E_oUT	Sets the following items: OUT1 proportional cycle, OUT1 ON/OFF hysteresis, OUT2 proportional cycle (when DR, DS or DA option is ordered), OUT2 cooling method (when DR, DS or DA option is ordered), Direct/Reverse action, etc.
Event output parameter setting group	E_EVo	Sets the following items: Event output EV1 allocation, Event output EV2 allocation, Event output EV3 allocation, Event output EV4 allocation
SV limit setting group	E_LIM	Sets the following items: SV high limit, SV low limit.
Transmission output parameter setting group (When TA or TV option is ordered)	E_TRA	Sets the following items: Transmission output type, Transmission output high limit, Transmission output low limit
Communication parameter setting group (When C or C5 option is ordered)	E_coM	Sets the following items: Communication protocol, Instrument number, Communication speed, Response delay time, etc.
Other parameters setting group	E_oTH	Sets the following items: Set value lock, Program start Auto/Manual, Program control start type, Power restore action, etc.
Auto/Manual control switch group	G_MAN	Sets the following item: Auto/Manual control switch.

6. Basic Operating Procedure after Power ON and Setting Examples

6.1 Basic Operating Procedure after Power ON



6.2 Initial Setting, Program Pattern Setting and Block Setting

• Example of Initial Setting

Setting Group	Setting Item	Setting Example
Input parameter setting group	Input type	K, -200 to 1370℃
	Scaling high limit	1200℃
	Scaling low limit	0℃
Output parameter setting group	OUT1 proportional cycle	15 sec
	Direct/Reverse action	Reverse action
Event output parameter setting group	Event output EV2 allocation	Process high alarm
	EV2 alarm Energized/ De-energized	Energized
Other parameters setting group	Program start Auto/Manual	Manual start
	Program control start type	PV start
	Power restore action	Continues after power is restored
	Step time unit	Hours:Minutes
	Step time indication	Remaining time
	Step SV indication	SV corresponding to the step time progress
	Step SV Hold function when program ends	Not holding

• Example of Program Pattern Setting

Pattern 1					
Step number	0	1	2	3	4
Step SV	500	500	1000	1000	0
Step time	0:30	1:00	0:40	1:00	2:00
PID block number	1	1	2	2	1
Wait block number	1	0	1	0	0
Alarm block number	1	2	1	2	1
Output block number	0	1	0	1	0

(Fig. 6.2-1)

Explanation of the Program Pattern

Step 0: After program control starts, control is performed so that SV gradually rises from 0℃ to 500℃ for 30 minutes.

Step 1: Control is performed to keep the SV at 500℃ for 1 hour.

Step 2: Control is performed so that SV gradually rises from 500℃ to 1000℃ for 40 minutes.

Step 3: Control is performed to keep the SV at 1000℃ for 1 hour.

Step 4: Control is performed so that SV gradually falls from 1000℃ to 0℃ for 2 hours.

• Example of Block Setting

How to set each block setting group

If program pattern is not set for a step, its block number becomes 0 (zero). We highly recommend that you leave the factory default values of Block 0 in each block setting group as they are, and set the values from Block 1.

Setting Group	Setting Item	Setting Example
PID block setting group (*1)	Block 0 OUT1 proportional band	10℃
	Block 0 integral time	200 sec
	Block 0 derivative time	50 sec
	Block 0 ARW	50%
	Block 1 OUT1 proportional band	10℃
	Block 1 integral time	200 sec
	Block 1 derivative time	50 sec
	Block 1 ARW	50%
	Block 2 OUT1 proportional band	10℃
	Block 2 integral time	200 sec
	Block 2 derivative time	50 sec
	Block 2 ARW	50%
Wait block setting group	Block 0 Wait value	0℃ (*3)
	Block 1 Wait value	10℃
Alarm block setting group (*2)	Block 0 EV2 alarm value	0℃ (*4)
	Block 0 EV3 alarm value	0℃ (*4)
	Block 0 EV4 alarm value	0℃ (*4)
	Block 1 EV2 alarm value	600℃
	Block 1 EV3 alarm value	5℃
	Block 1 EV4 alarm value	5℃
	Block 2 EV2 alarm value	1100℃
	Block 2 EV3 alarm value	10℃
	Block 2 EV4 alarm value	10℃
Output block setting group	Block 0 OUT1 high limit	100% (*5)
	Block 0 OUT1 low limit	0% (*5)
	Block 1 OUT1 high limit	80%
	Block 1 OUT1 low limit	0%

(*1) As PID constant are obtained by performing AT, values in the PID block setting group are factory default value.

(*2) As EV1 is used as Pattern end output, 'EV1 alarm value' setting item does not appear.

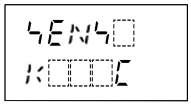
(*3) As 'Block 0 Wait value' is used as Wait Disabled, the Wait value is factory default value.

(*4) As Block 0 EV2, EV3 and EV4 alarm values are used as No alarm action, their values are factory default value.

(*5) As Block 0 OUT1 high limit and low limit are used as MV setting range for manual control, their values are factory default value.

Operation method will be described based on the Initial setting, Program pattern setting and Block setting examples.

Indication of Setting Details

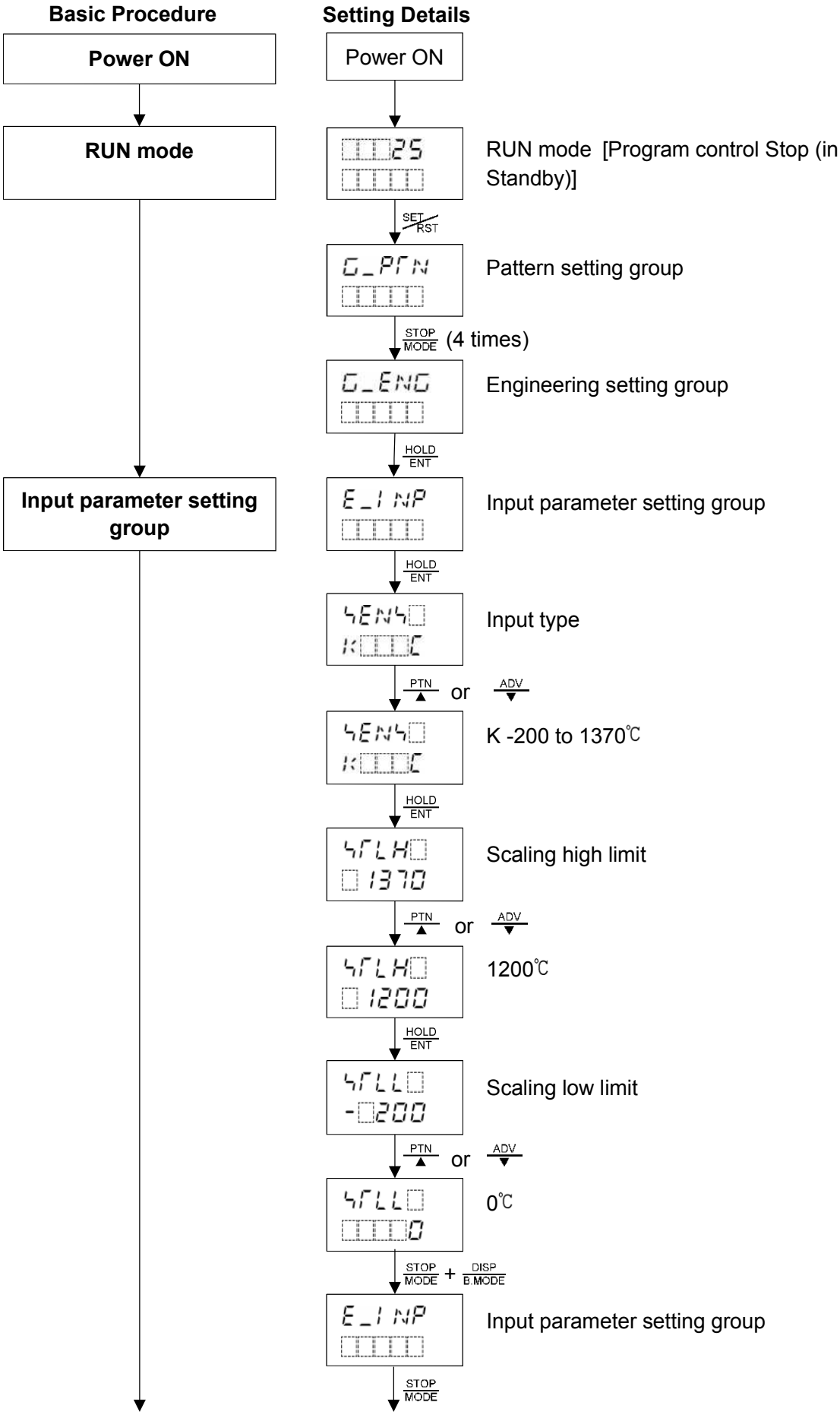


Input type

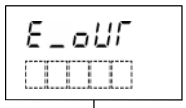
- Upper left: PV Display: Indicates setting characters.
- Lower left: SV/MV/TIME Display: Indicates setting values or selections.
- Right side: Indicates the setting item.

Key Operation for Setting

- To increase or decrease the set value (numeric value), use the PTN ▲ or ADV ▼ key.
  If the PTN ▲ or ADV ▼ key is pressed with the FAST ◀FAST▶ key simultaneously, makes the numeric value change faster.
  To switch the selection items, use the PTN ▲ or ADV ▼ key.
- To register the setting data, use the HOLD ENT or STOP MODE key.
- STOP MODE + DISP B.MODE means pressing the STOP MODE and DISP B.MODE keys at the same time.
- To return to RUN mode from any setting group, press the SET RST key.
  The unit can return to RUN mode from any setting item.

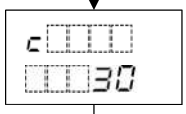

Basic Procedure
Setting Details
Power ON
RUN mode
Input parameter setting group
Power ON
25
RUN mode [Program control Stop (in Standby)]
SET/RST
G_PTN
Pattern setting group
STOP/MODE (4 times)
G_ENG
Engineering setting group
HOLD/ENT
E_INP
Input parameter setting group
HOLD/ENT
SENS
K
Input type
PTN or ADV
SENS
K
K -200 to 1370℃
HOLD/ENT
SCLH
1370
Scaling high limit
PTN or ADV
SCLH
1200
1200℃
HOLD/ENT
SCLL
-200
Scaling low limit
PTN or ADV
SCLL
0
0℃
STOP/MODE + DISP/B.MODE
E_INP
Input parameter setting group
STOP/MODE

Output parameter setting group



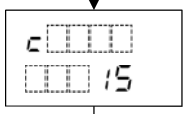
Output parameter setting group

HOLD ENT



OUT1 proportional cycle

PTN or ADV



15 sec

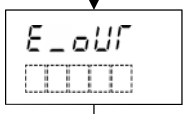
HOLD ENT (Multiple times)

Direct/Reverse action

PTN or ADV

Reverse action

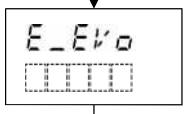
STOP MODE + DISP B.MODE



Output parameter setting group

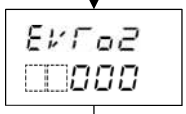
STOP MODE

Event output parameter setting group



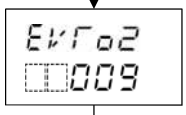
Event output parameter setting group

HOLD ENT (Twice)



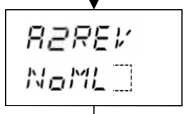
Event output EV2 allocation

PTN or ADV



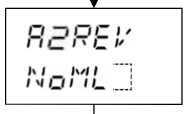
Process high alarm

HOLD ENT (3 times)



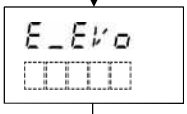
EV2 alarm Energized/De-energized

PTN or ADV



Energized

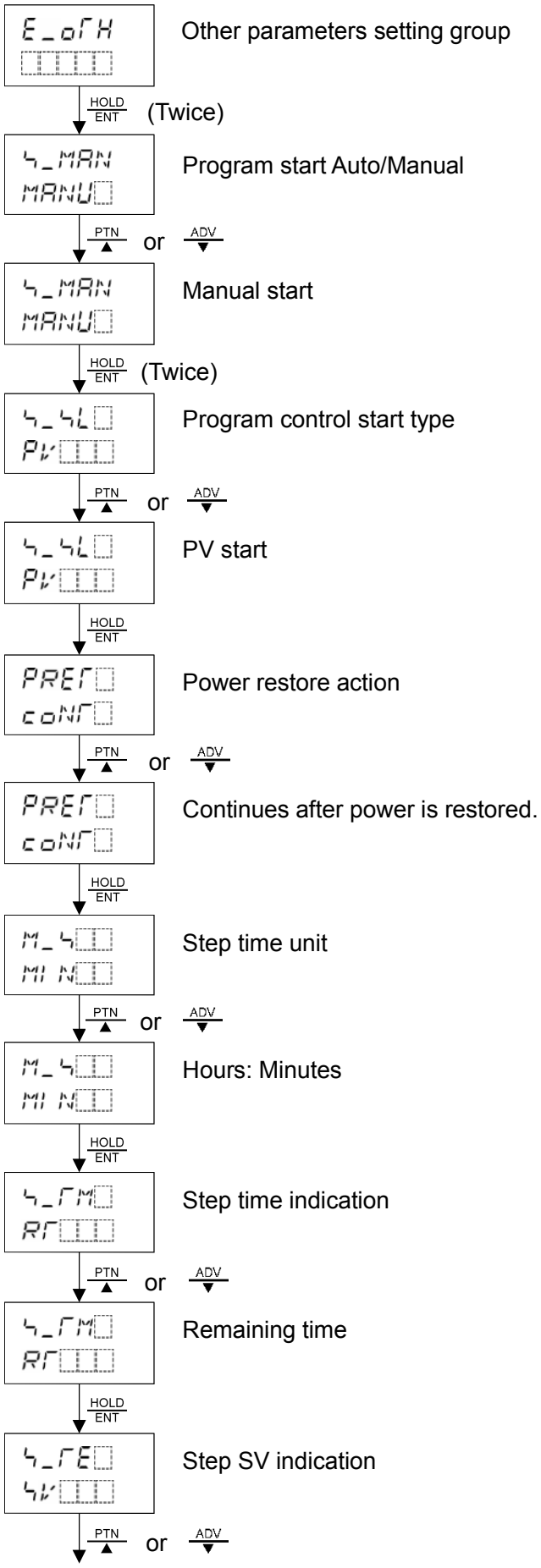
STOP MODE + DISP B.MODE

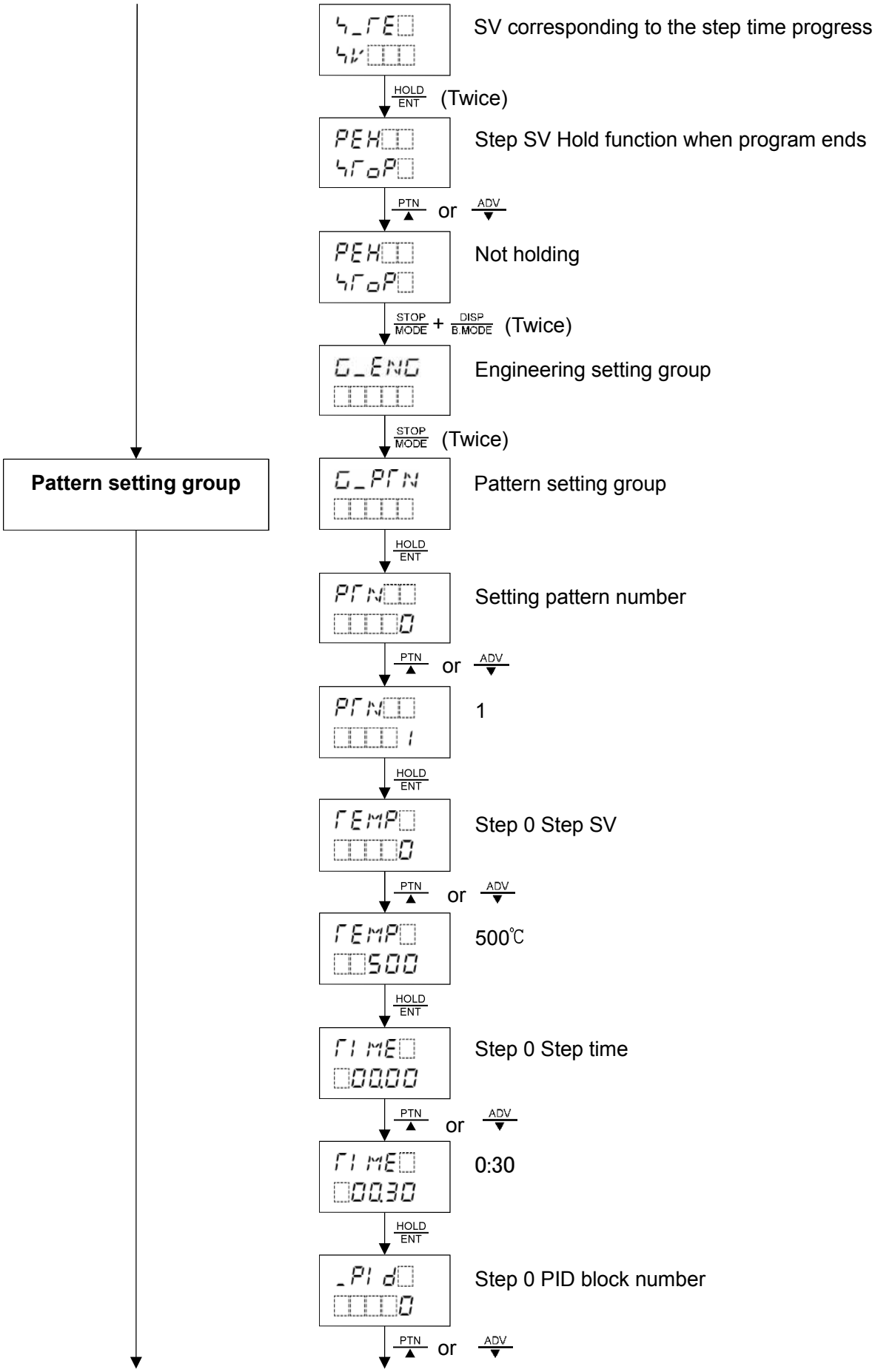


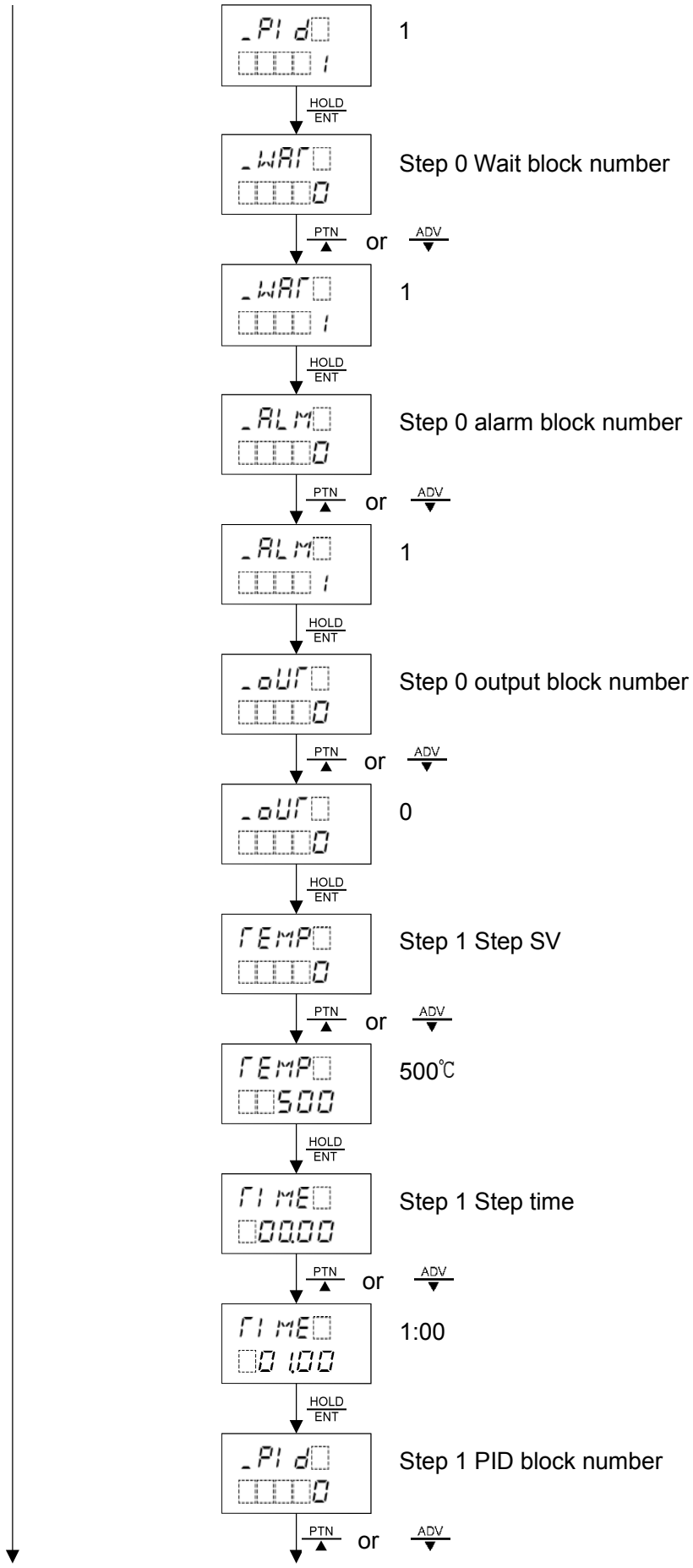
Event output parameter setting group

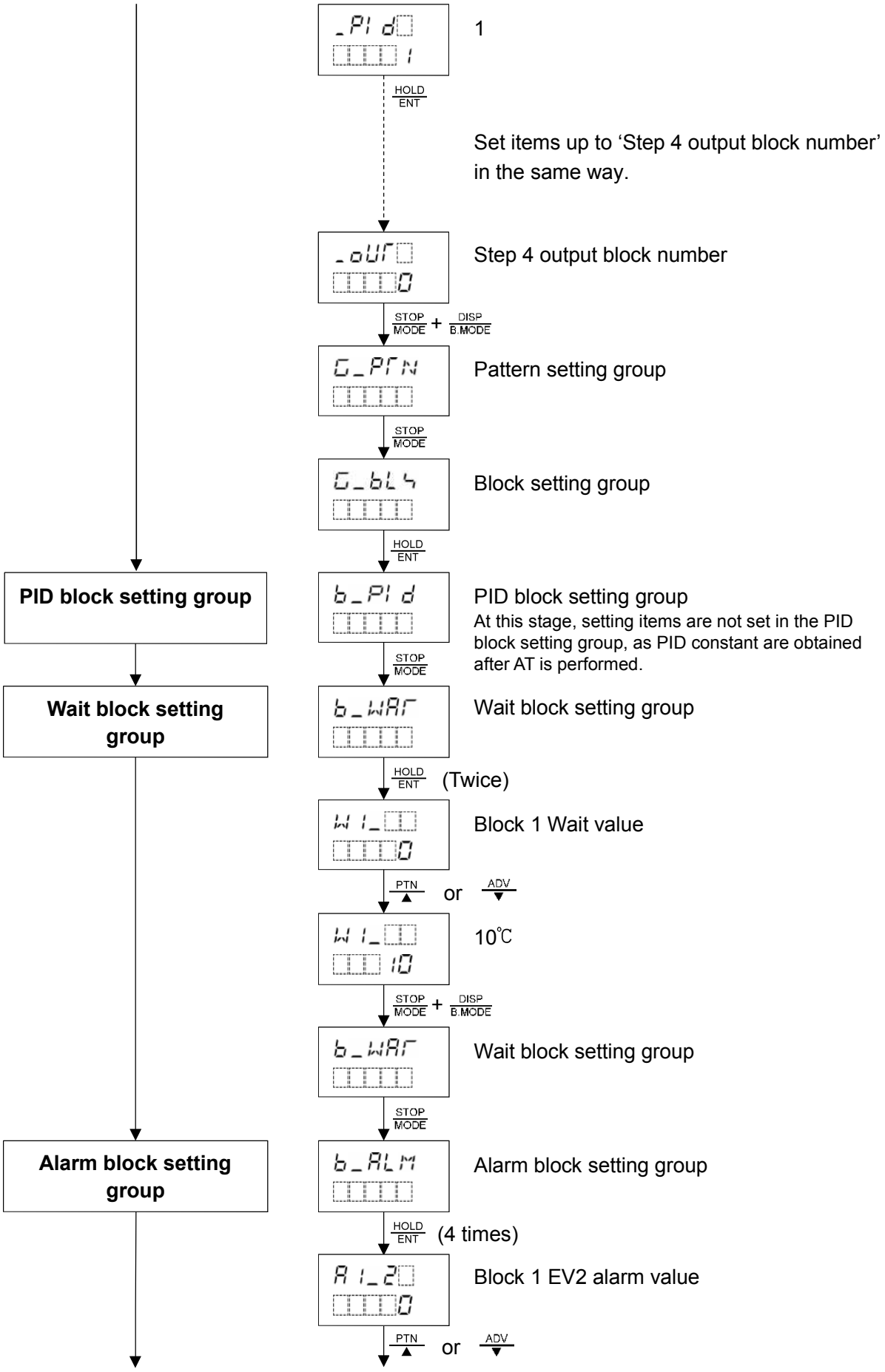
STOP MODE (Multiple times)

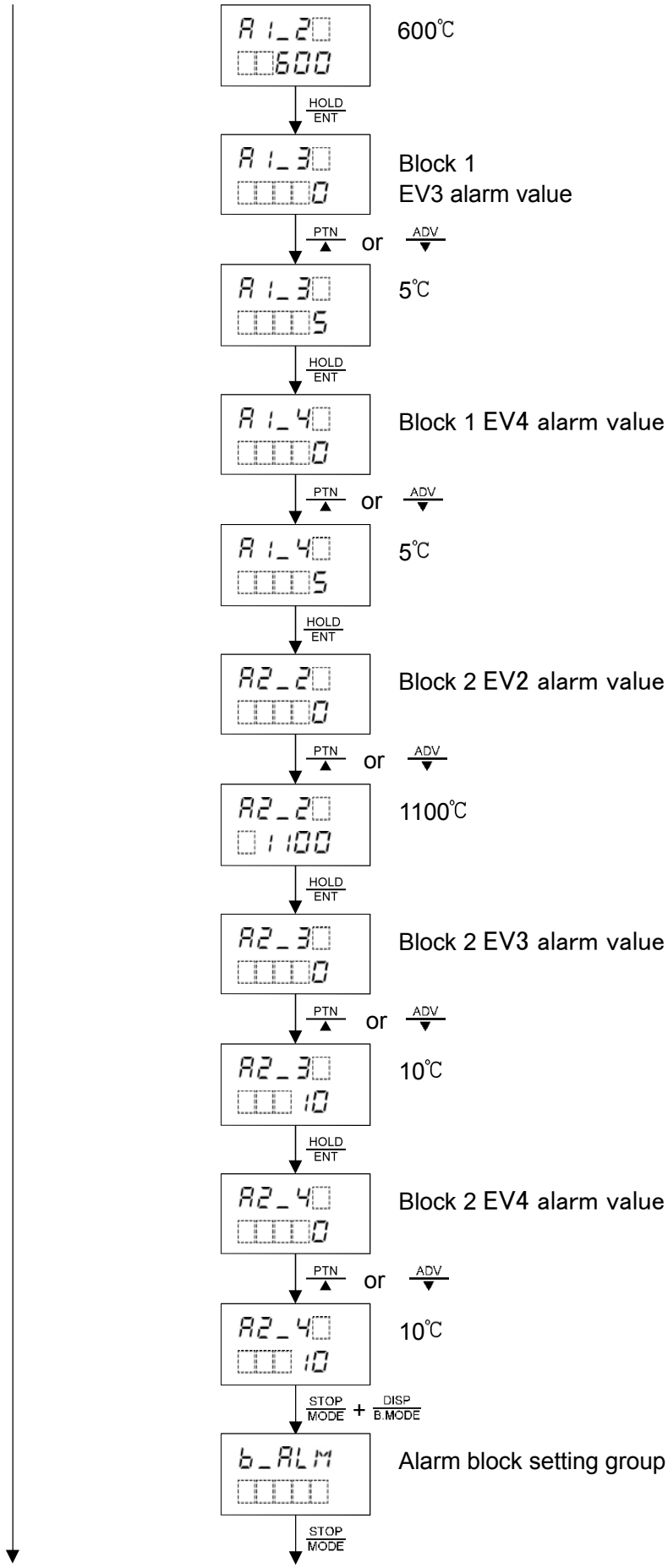
Other parameters setting group

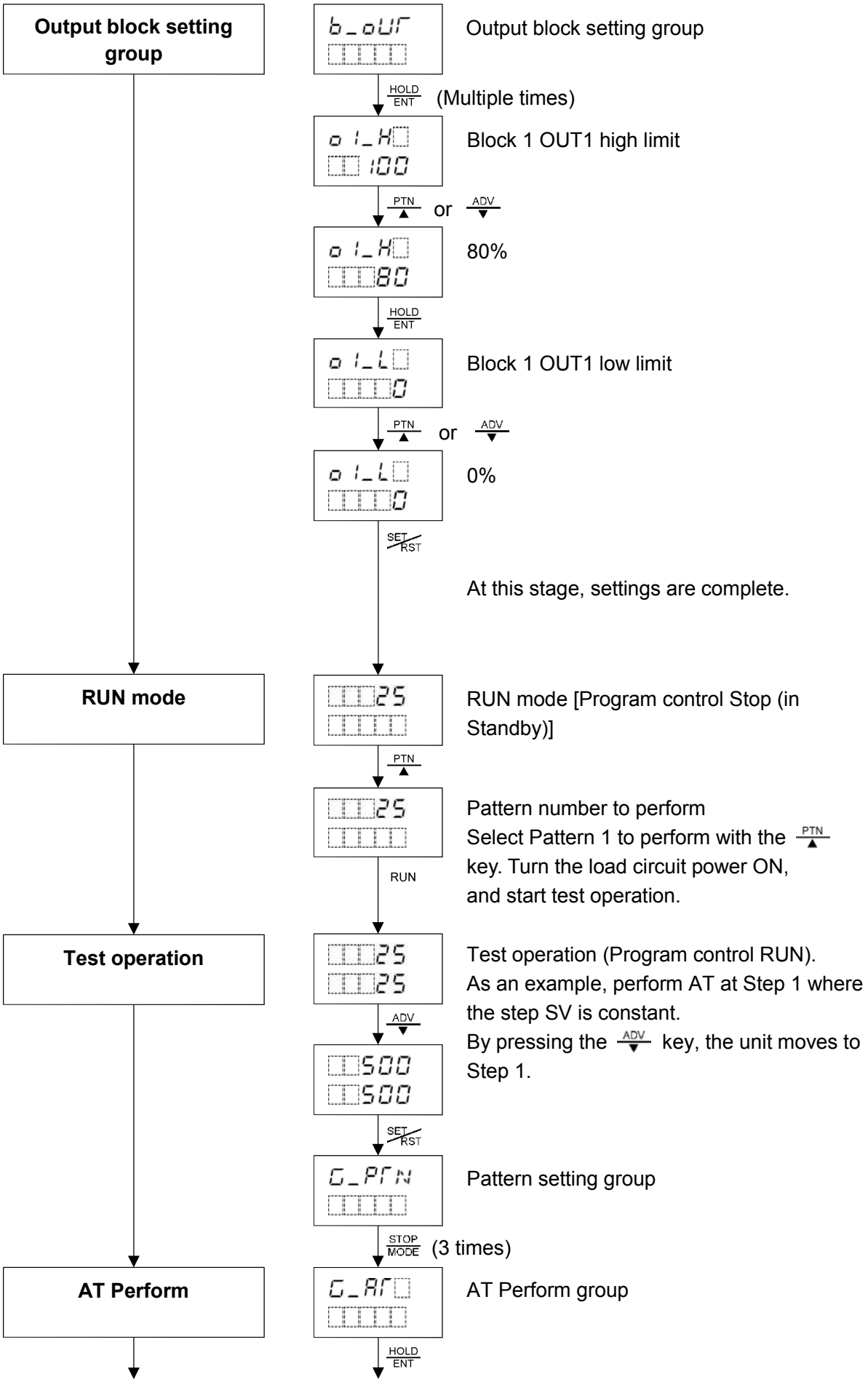


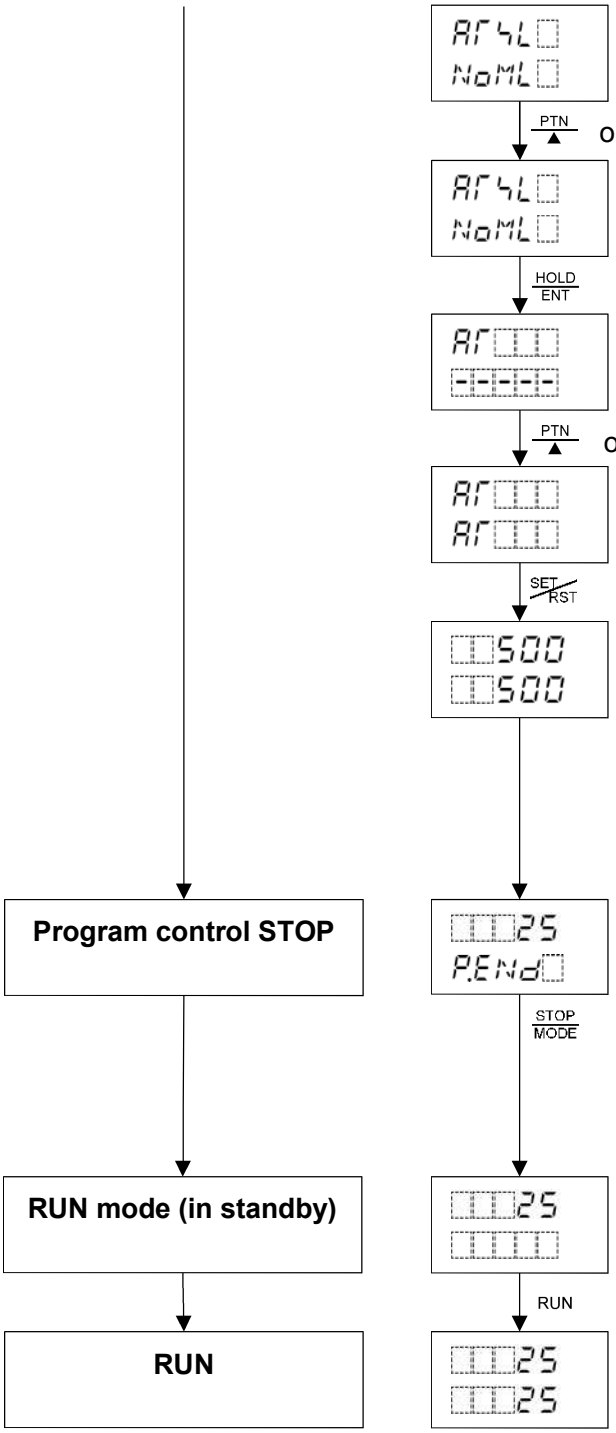

Pattern setting group
SV corresponding to the step time progress
HOLD ENT (Twice)
Step SV Hold function when program ends
PTN or ADV
Not holding
STOP MODE + DISP B.MODE (Twice)
Engineering setting group
STOP MODE (Twice)
Pattern setting group
HOLD ENT
Setting pattern number
PTN or ADV
1
HOLD ENT
Step 0 Step SV
PTN or ADV
500℃
HOLD ENT
Step 0 Step time
PTN or ADV
0:30
HOLD ENT
Step 0 PID block number
PTN or ADV


_PId
1
HOLD ENT
_WAIT
Step 0 Wait block number
PTN or ADV
_WAIT
1
HOLD ENT
_ALM
Step 0 alarm block number
PTN or ADV
_ALM
1
HOLD ENT
_OUT
Step 0 output block number
PTN or ADV
_OUT
0
HOLD ENT
TEMP
Step 1 Step SV
PTN or ADV
TEMP
500℃
HOLD ENT
TIME
Step 1 Step time
PTN or ADV
TIME
1:00
HOLD ENT
_PId
Step 1 PID block number
PTN or ADV


_PId
1
HOLD ENT
Set items up to 'Step 4 output block number' in the same way.
_oUT
Step 4 output block number
STOP MODE + DISP B.MODE
G_PTN
Pattern setting group
STOP MODE
G_bLK
Block setting group
HOLD ENT
PID block setting group
b_PId
PID block setting group
At this stage, setting items are not set in the PID block setting group, as PID constant are obtained after AT is performed.
STOP MODE
Wait block setting group
b_WAT
Wait block setting group
HOLD ENT (Twice)
W1_
Block 1 Wait value
PTN or ADV
10℃
STOP MODE + DISP B.MODE
b_WAT
Wait block setting group
STOP MODE
Alarm block setting group
b_ALM
Alarm block setting group
HOLD ENT (4 times)
A1_2
Block 1 EV2 alarm value
PTN or ADV


A1_2
600
600℃
HOLD ENT
A1_3
0
Block 1
EV3 alarm value
PTN or ADV
A1_3
5
5℃
HOLD ENT
A1_4
0
Block 1 EV4 alarm value
PTN or ADV
A1_4
5
5℃
HOLD ENT
A2_2
0
Block 2 EV2 alarm value
PTN or ADV
A2_2
1100
1100℃
HOLD ENT
A2_3
0
Block 2 EV3 alarm value
PTN or ADV
A2_3
10
10℃
HOLD ENT
A2_4
0
Block 2 EV4 alarm value
PTN or ADV
A2_4
10
10℃
STOP MODE + DISP B.MODE
b_ALM
Alarm block setting group
STOP MODE


Output block setting group
b_oUT
Output block setting group
HOLD ENT
(Multiple times)
o1_H
100
Block 1 OUT1 high limit
PTN
or
ADV
o1_H
80
80%
HOLD ENT
o1_L
0
Block 1 OUT1 low limit
PTN
or
ADV
o1_L
0
0%
SET RST
At this stage, settings are complete.
RUN mode
25
RUN mode [Program control Stop (in Standby)]
PTN
25
Pattern number to perform
Select Pattern 1 to perform with the PTN key. Turn the load circuit power ON, and start test operation.
RUN
Test operation
25
25
Test operation (Program control RUN).
As an example, perform AT at Step 1 where the step SV is constant.
ADV
500
500
By pressing the ADV key, the unit moves to Step 1.
SET RST
G_PTN
Pattern setting group
STOP MODE
(3 times)
AT Perform
G_AT
AT Perform group
HOLD ENT


AT mode
PTN
or
ADV
Normal mode
HOLD
ENT
AT Perform/Cancel
PTN
or
ADV
AT Perform
SET
RST
RUN mode
The AT indicator flashes while AT is performing.
The AT indicator goes off after AT finishes.
Perform AT at Steps 2 or 3 for which PID block number 2 is selected in the same way.
Program control STOP
Program control complete
After program control is finished, pattern end output is turned ON, flashing P.END.
STOP
MODE
If the STOP MODE key is pressed for 1 sec, pattern end output goes off, and the unit returns to Standby status.
RUN mode (in standby)
RUN mode [Program control Stop (in Standby)]
RUN
RUN
Program control starts (Program control RUN).

7. Setting Items

⚠ Caution

- **When connecting USB communication cable (CMB-001) to the console connector, connect the cable after power is turned OFF.**
- ***Never* turn the power ON or OFF, while USB communication cable (CMB-001) is connected to the console connector.**

The following groups will be described:

Pattern setting group, Block setting group, Repetitions and Pattern link setting group, AT perform group, Engineering setting group, Auto/Manual control switch group

How to register the Setting Data

- To increase or decrease the set value (numeric value), use the PTN ▲ or ADV ▼ key.
  If the PTN ▲ or ADV ▼ key is pressed with the FAST ◀FAST▶ key simultaneously, makes the numeric value change faster.
  To switch the selection items, use the PTN ▲ or ADV ▼ key.
- To register the setting data, use the HOLD ENT or STOP MODE key.

7.1 Pattern Setting Group

In the Pattern setting group, the following setting items can be set:
Setting pattern number, Step SV, Step time, PID block number, Alarm block number, etc.

• To enter Pattern Setting Group

Press the SET RST key in RUN mode. The PV Display indicates G_PTN, and the unit enters Pattern setting group in Group selection mode.

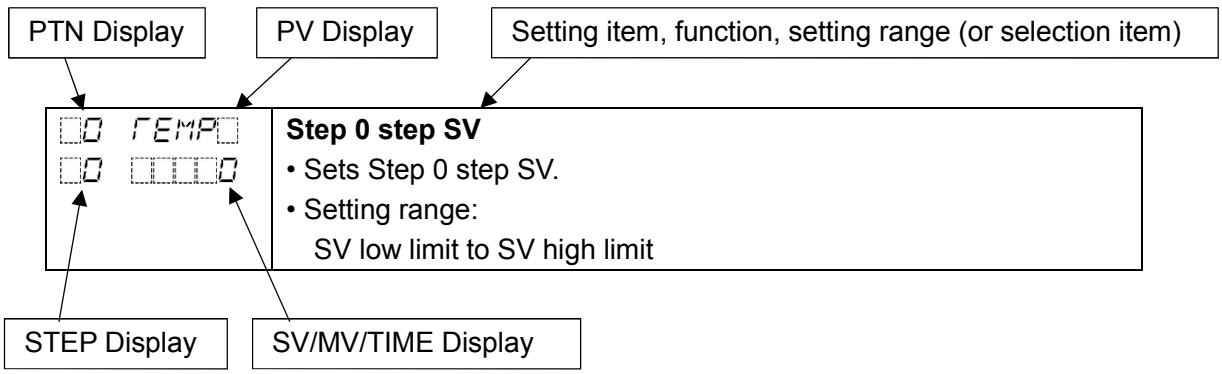
Press the HOLD ENT key in the Pattern setting group. The PV Display indicates PTN□□, and the unit enters 'Setting pattern number'.

• Explanation of Setting Item

Upper left: PTN Display, PV Display
The PTN Display indicates the setting pattern number, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display
The STEP Display indicates the setting step number, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item, explanation of its function, and setting range (or selection item).



Setting items in the Pattern setting group are shown below.

Character, Factory Default	Setting Item, Function, Setting Range
PTN 0	**Setting pattern number** • Selects the setting pattern number. • Selection item: 0 to 15
0 TEMP 0 0	**Step 0 step SV** • Sets Step 0 step SV. Step SV is the value at the end of the step. • Setting range: SV low limit to SV high limit
0 TIME 0 00.00	**Step 0 step time** • Sets Step 0 step time. Step time is the processing time of the step. • Setting range: ----, 0:00 to 99:59 Time unit follows the selection in [Step time unit]. If the ADV key is pressed at 0:00, ---- will be set. When ---- is set, Fixed value control will be performed using step SV at Step 0.
0 _PID 0 0	**Step 0 PID block number** • Selects PID block number used for Step 0. • Selection item: 0 to 9
0 _TS1 0 0	**Step 0 Time signal 1 block number** • Selects Time signal 1 block number used for Step 0. Selects any one number from a maximum of 16 Time signal blocks. The same number can be selected as many times as desired. • Selection item: 0 to 15 Available when Time signal output (TS option) is ordered, and when Time signal output TS1 is selected in [Time signal output TS1/Status (RUN) output].
0 _TS2 0 0	**Step 0 Time signal 2 block number** • Selects Time signal 2 block number used for Step 0. Selects any one number from a maximum of 16 Time signal blocks. The same number can be selected as many times as desired. • Selection item: 0 to 15 Available when Time signal output (TS option) is ordered, and when Time signal output TS2 is selected in [Time signal output TS2/Status (HOLD) output].
0 _TS3 0 0	**Step 0 Time signal 3 block number** • Selects Time signal 3 block number used for Step 0. Selects any one number from a maximum of 16 Time signal blocks. The same number can be selected as many times as desired. • Selection item: 0 to 15 Available when Time signal output (TS option) is ordered, and when Time signal output TS3 is selected in [Time signal output TS3/Status (WAIT) output].

Character, Factory Default	Setting Item, Function, Setting Range
0 _T54 0 0	**Step 0 Time signal 4 block number** • Selects Time signal 4 block number used for Step 0. Selects any one number from a maximum of 16 Time signal blocks. The same number can be selected as many times as desired. • Selection item: 0 to 15 Available when Time signal output (TS option) is ordered, and when Time signal output TS4 is selected in [Time signal output TS4/Status (FAST) output].
0 _T55 0 0	**Step 0 Time signal 5 block number** • Selects Time signal 5 block number used for Step 0. Selects any one number from a maximum of 16 Time signal blocks. The same number can be selected as many times as desired. • Selection item: 0 to 15 Available when Time signal output (TS option) is ordered, and when Time signal output TS5 is selected in [Time signal output TS5/Status (STOP) output].
0 _T56 0 0	**Step 0 Time signal 6 block number** • Selects Time signal 6 block number used for Step 0. Selects any one number from a maximum of 16 Time signal blocks. The same number can be selected as many times as desired. • Selection item: 0 to 15 Available when Time signal output (TS option) is ordered.
0 _T57 0 0	**Step 0 Time signal 7 block number** • Selects Time signal 7 block number used for Step 0. Selects any one number from a maximum of 16 Time signal blocks. The same number can be selected as many times as desired. • Selection item: 0 to 15 Available when Time signal output (TS option) is ordered.
0 _T58 0 0	**Step 0 Time signal 8 block number** • Selects Time signal 8 block number used for Step 0. Selects any one number from a maximum of 16 Time signal blocks. The same number can be selected as many times as desired. • Selection item: 0 to 15 Available when Time signal output (TS option) is ordered.
0 _WAT 0 0	**Step 0 Wait block number** • Selects a Wait block number used for Step 0. • Selection item: 0 to 9
0 _ALM 0 0	**Step 0 Alarm block number** • Selects an Alarm block number used for Step 0. • Selection item: 0 to 9

Character, Factory Default	Setting Item, Function, Setting Range
0 _oUT 0 0	**Step 0 Output block number** • Selects an Output block number used for Step 0. • Selection item: 0 to 9
0 TEMP 1 0	**Step 1 step SV** • Sets Step 1 step SV. • Setting range: SV low limit to SV high limit
	Repeat the above settings up to ‘Step 15 Output block number’, in the same way if necessary.
0 _oUT 15 0	**Step 15 Output block number** • Selects an Output block number used for Step 15. • Selection item: 0 to 9

At this stage, settings of Pattern setting group are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to Group selection mode.
By pressing the SET/RST key, the unit returns to RUN mode.

7.2 Block Setting Group

In the Block setting group, the following block setting groups are included:

PID block setting group, Time signal block setting group, Wait block setting group, Alarm block setting group, Output block setting group

About settings in each block setting group

If program pattern is not set for a step, its block number becomes 0 (zero). We highly recommend that you leave the factory default values of Block 0 in each block setting group as they are, and set the values from Block 1.

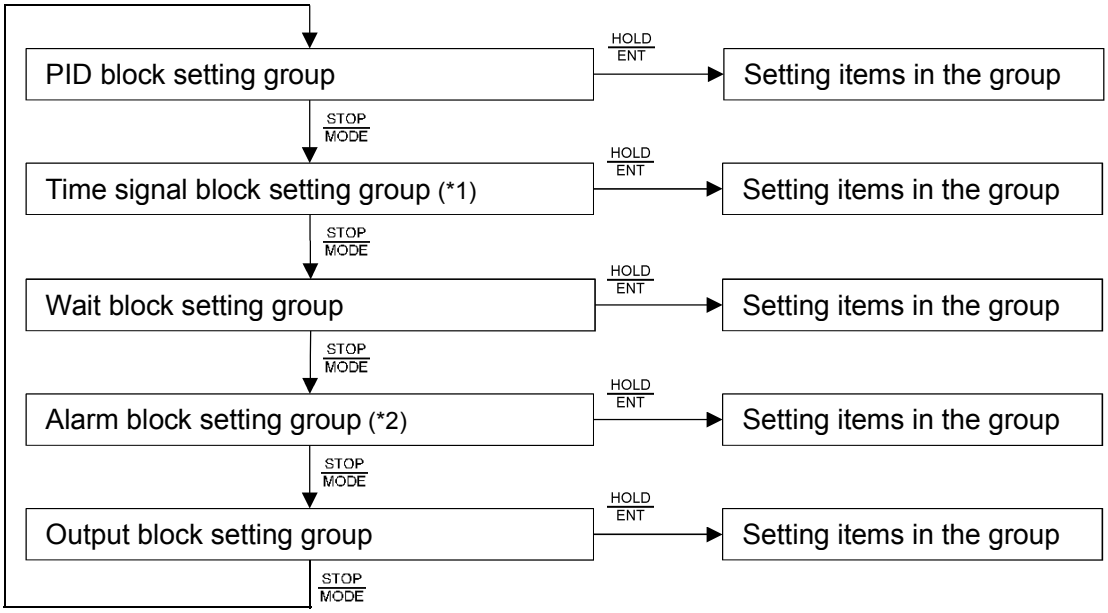
• To enter the Block setting group

Press the SET/RST in RUN mode, and press STOP/MODE key (in that order). The PV Display indicates G_bLK, and the unit enters the Block setting group in Group selection mode.

Press the HOLD/ENT in the Block setting group. The PV Display indicates b_PI d, and the unit enters PID block setting group.

Every time the STOP/MODE key is pressed, the block setting groups are switched as shown below.

By pressing the HOLD/ENT key at each block setting group, the unit moves to the setting items in the group.



(*1) Available when Time signal output (TS option) is ordered.

(*2) Available when 001 to 012 (Alarm output) is selected in [Event output EV□ allocation].

• Explanation of Setting Item

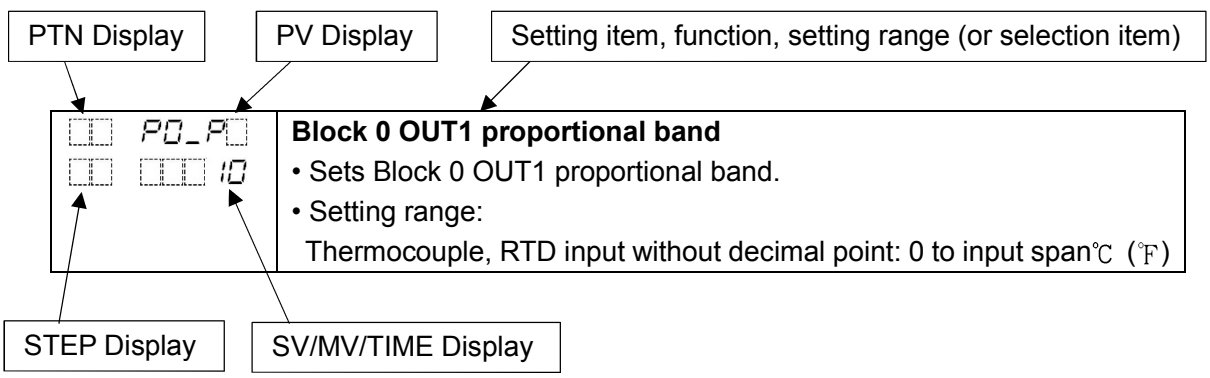
Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item, explanation of its function, and setting range (or selection item).



7.2.1 PID Block Setting Group

In PID block setting group, the following can be set for blocks 0 to 9:
OUT1 proportional band, Integral time, Derivative time, ARW and OUT2 proportional band (DR, DS or DA option)

Refer to recommended usage of block numbers as follows:
Block 0: For Fixed value control
Block 1: For low temperature program control
Block 2: For medium temperature program control
Block 3: For high temperature program control

Setting items in the PID block setting group are shown below.

Character, Factory Default	Setting Item, Function, Setting Range
P0_P 10	**Block 0 OUT1 proportional band** • Sets Block 0 OUT1 proportional band. When set to 0 or 0.0, OUT1 becomes ON/OFF control. • Setting range: Thermocouple, RTD input without decimal point: 0 to input span℃ (℉) Thermocouple, RTD input with decimal point: 0.0 to input span℃ (℉) DC voltage, current input: 0.0 to 1000.0%
P0_I 200	**Block 0 integral time** • Sets Block 0 integral time. Setting the value to 0 disables the function. • Setting range: 0 to 3600 sec
P0_d 50	**Block 0 derivative time** • Sets Block 0 derivative time. Setting the value to 0 disables the function. • Setting range: 0 to 1800 sec
P0_r 50	**Block 0 ARW** • Sets Block 0 ARW. • Setting range: 0 to 100%
P0Pb 1.0	**Block 0 OUT2 proportional band** • Sets Block 0 OUT2 proportional band. OUT2 proportional band: Multiplied value of OUT1 proportional band OUT2 proportional band is calculated as follows. OUT2 proportional band = OUT1 proportional band x Multiplication factor When set to 0.0, OUT2 becomes ON/OFF control. When OUT1 proportional band is set to 0 or 0.0, OUT2 becomes ON/OFF control. • Setting range: 0.0 to 10.0 times Block 0 OUT1 proportional band Available when Heating/Cooling control (DR, DS or DA option) is ordered.

Character, Factory Default	Setting Item, Function, Setting Range
P1_P 10	**Block 1 OUT1 proportional band** • Sets Block 1 OUT1 proportional band. When set to 0 or 0.0, OUT1 becomes ON/OFF control. • Setting range: Thermocouple, RTD input without decimal point: 0 to input span℃ (℉) Thermocouple, RTD input with decimal point: 0.0 to input span℃ (℉) DC voltage, current input: 0.0 to 1000.0%
	Repeat the above settings up to 'Block 9 OUT2 proportional band', in the same way if necessary.
P9Pb 10	**Block 9 OUT2 proportional band** • Sets Block 9 OUT2 proportional band. OUT2 proportional band: Multiplied value of OUT1 proportional band OUT2 proportional band is calculated as follows. OUT2 proportional band = OUT1 proportional band x Multiplication factor When set to 0.0, OUT2 becomes ON/OFF control. When OUT1 proportional band is set to 0 or 0.0, OUT2 becomes ON/OFF control. • Setting range: 0.0 to 10.0 times Block 9 OUT1 proportional band Available when Heating/Cooling control (DR, DS or DA option) is ordered.

At this stage, settings of PID block setting group are complete.
If the $\frac{\text{STOP}}{\text{MODE}}$ and $\frac{\text{DISP}}{\text{B.MODE}}$ keys are pressed at the same time, the unit returns to the Block setting group.
By pressing the $\frac{\text{SET}}{\text{RST}}$ key, the unit returns to RUN mode.

7.2.2 Time Signal Block Setting Group

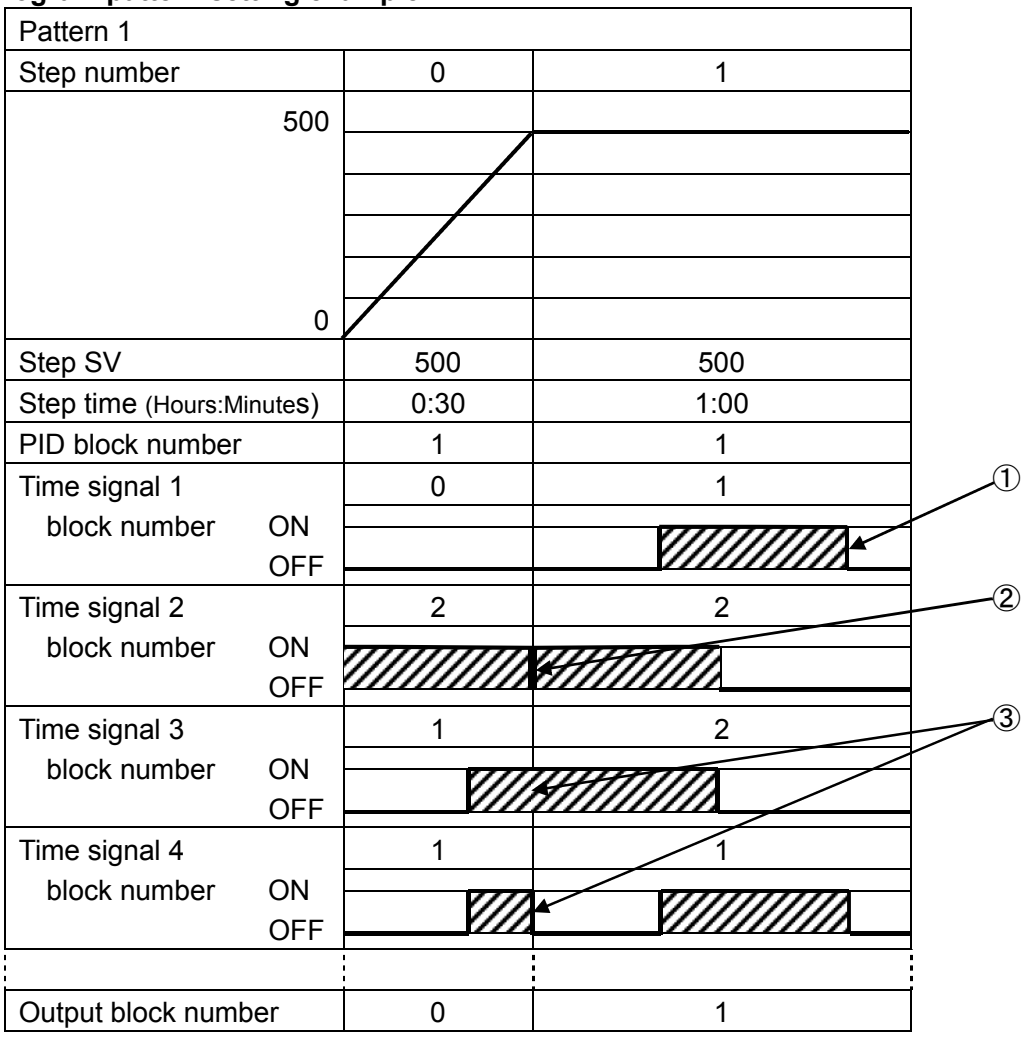
In Time signal block setting group, the following can be set for blocks 0 to 15:
Time signal output OFF time, Time signal output ON time

• Time signal output function

Time signal output OFF time and Time signal output ON time are set within each step time, and outputs them during Program control RUN.
A maximum of 8 points of Time signal output can be set for each step.
To use the Time signal output function, set the Time signal block number (for which Time signal output OFF time and Time signal output ON time have been set) for each step.
Up to 16 Time signal blocks can be set.

• Program pattern setting example

Pattern 1			
Step number		0	1
500 0			
Step SV		500	500
Step time (Hours:Minutes)		0:30	1:00
PID block number		1	1
Time signal 1 block number	ON	0	1
	OFF		
Time signal 2 block number	ON	2	2
	OFF		
Time signal 3 block number	ON	1	2
	OFF		
Time signal 4 block number	ON	1	1
	OFF		
Output block number		0	1



• Time signal block setting example

Time signal block number	Output OFF time (Hours:Minutes)	Output ON time (Hours:Minutes)
0	0:00	0:00
1	0:20	0:30
2	0:00	0:30

① Time signal output operates in a sequence of Time signal output OFF time and then Time signal output ON time.
The Time signal output automatically turns OFF when Time signal output ON time expires within a step.

② If ON time is the same value as the step time, the Time signal output will turn OFF for a brief moment while Step numbers change.
Therefore, set the Time signal output ON time longer than the step time so that Time signal output may turn ON even when steps changes.

③ When ON time is not the same value as the step time, from the point where steps move to the next step, the Time signal output operates following the Time signal output OFF or ON time of the next step, regardless of the Time signal output settings of the previous step.

Setting items in the Time signal block setting group are shown below.
Available when Time signal output (TS option) is ordered.

Character, Factory Default	Setting Item, Function, Setting Range
00_F 00.00	**Block 0 Time signal output OFF time** • Sets Block 0 Time signal output OFF time. • Setting range: 00:00 to 99:59 Time unit follows the selection in [Step time unit].
00_N 00.00	**Block 0 Time signal output ON time** • Sets Block 0 Time signal output ON time. • Setting range: 00:00 to 99:59 Time unit follows the selection in [Step time unit].
01_F 00.00	**Block 1 Time signal output OFF time** • Sets Block 1 Time signal output OFF time. • Setting range: 00:00 to 99:59 Time unit follows the selection in [Step time unit].
	Repeat the above settings up to 'Block 15 Time signal output ON time', in the same way if necessary.
15_N 00.00	**Block 15 Time signal output ON time** • Sets Block 15 Time signal output ON time. • Setting range: 00:00 to 99:59 Time unit follows the selection in [Step time unit].

At this stage, settings of Time signal block setting group are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to the Block setting group.
By pressing the SET/RST key, the unit returns to RUN mode.

7.2.3 Wait Block Setting Group

In Wait block setting group, Wait value can be set for blocks 0 to 9.

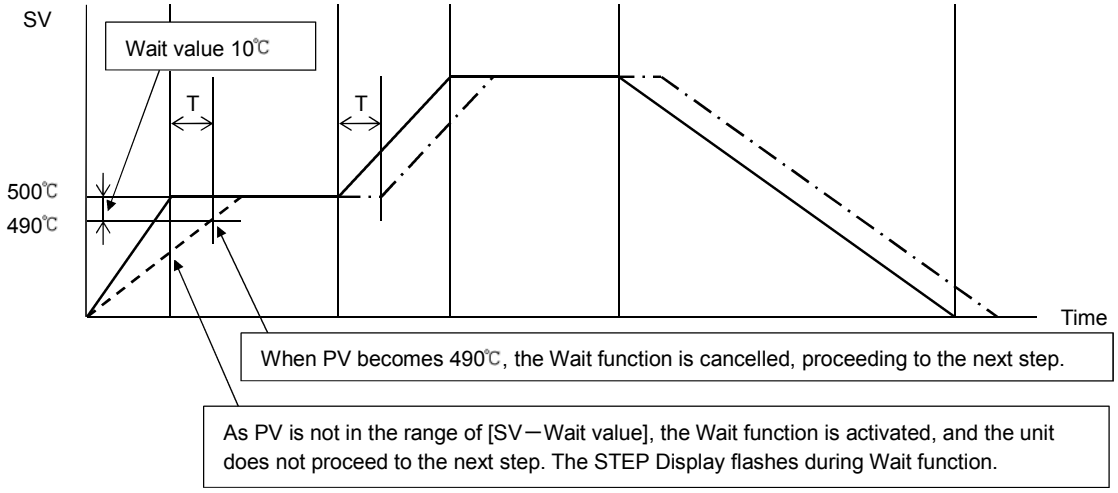
• **Wait function**

During Program control RUN, 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.

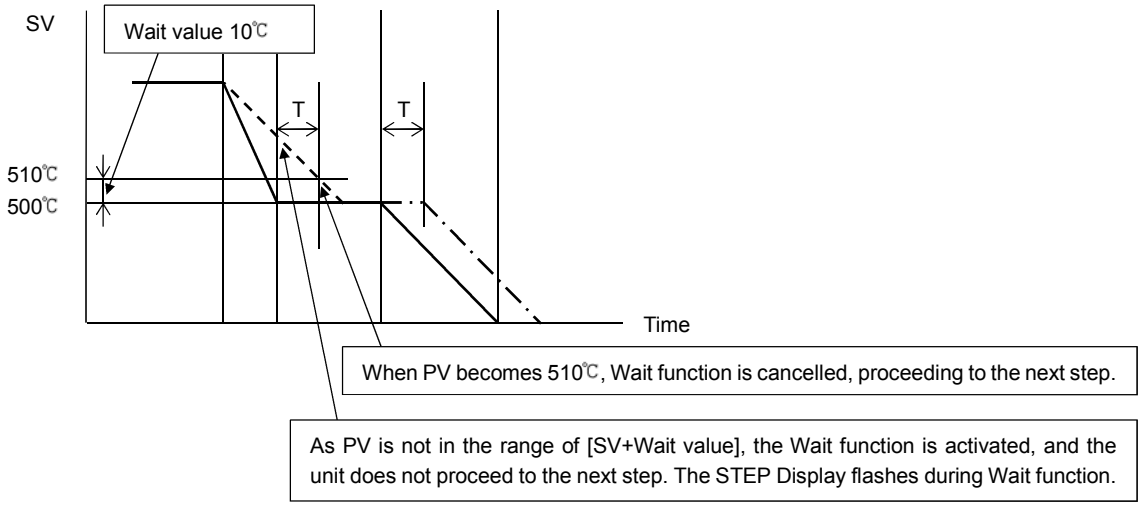
When the Wait function is activated, the STEP Display flashes.

• **Explanation of Wait function**

• **Program pattern rising step**



• **Program pattern falling step**



——— Program pattern

- - - - - - PV

—·—·— Program pattern which is delayed by T due to Wait function

• **How to cancel the Wait function**

Press the ADV/▼ or STOP/MODE key to cancel the Wait function.

Use [ADV] input or [STOP] input of External operation to cancel the Wait function as well.

Setting items in the Wait block setting group are shown below.

Character, Factory Default	Setting Item, Function, Setting Range
W0_ 0	**Block 0 Wait value** • Sets Block 0 Wait value. When set to 0 or 0.0, the Wait function is disabled. • Setting range: Thermocouple, RTD input without decimal point: 0 to 100℃ (℉) Thermocouple, RTD input with decimal point: 0.0 to 100.0℃ (℉) DC voltage, current input: 0 to 1000 (The placement of the decimal point follows the selection.)
W1_ 0	**Block 1 Wait value** • Sets Block 1 Wait value. When set to 0 or 0.0, the Wait function is disabled. • Setting range: Thermocouple, RTD input without decimal point: 0 to 100℃ (℉) Thermocouple, RTD input with decimal point: 0.0 to 100.0℃ (℉) DC voltage, current input: 0 to 1000 (The placement of the decimal point follows the selection.)
	Repeat the above settings up to 'Block 9 Wait value', in the same way if necessary.
W9_ 0	**Block 9 Wait value** • Sets Block 9 Wait value. When set to 0 or 0.0, the Wait function will be disabled. • Setting range: Thermocouple, RTD input without decimal point: 0 to 100℃(℉) Thermocouple, RTD input with decimal point: 0.0 to 100.0℃(℉) DC voltage, current input: 0 to 1000 (The placement of the decimal point follows the selection.)

At this stage, settings of Wait block setting group are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to the Block setting group.
By pressing the SET/RST key, the unit returns to RUN mode.

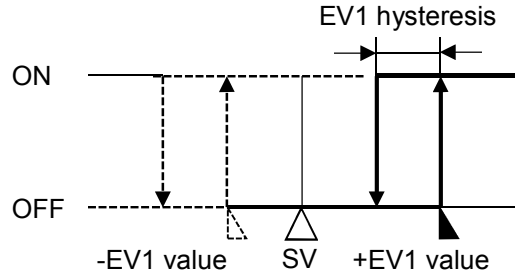
7.2.4 Alarm Block Setting Group

In Alarm block setting group, the following can be set for blocks 0 to 9:
EV1 alarm value, EV2 alarm value, EV3 alarm value, EV4 alarm value

• Alarm output

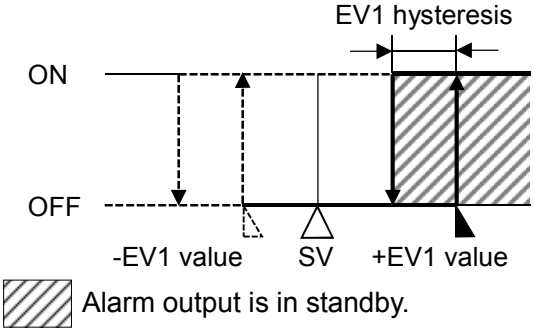
EV1 alarm output actions are shown below.
The same applies to EV2 alarm output, EV3 alarm output and EV4 alarm output.

• High limit alarm



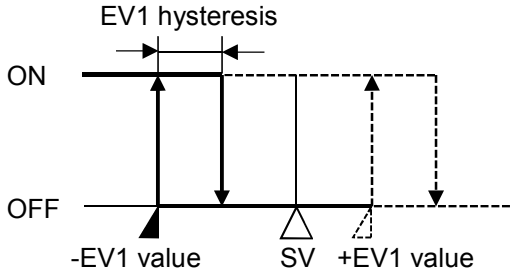
(Fig. 7.2.4-1)

• High limit alarm with standby



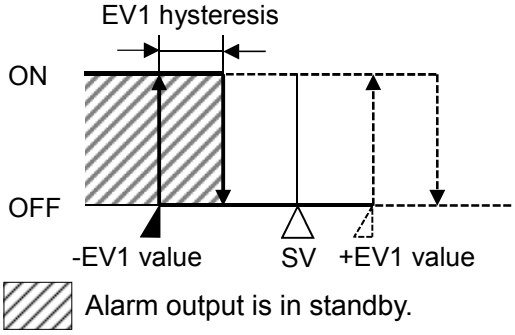
(Fig. 7.2.4-2)

• Low limit alarm



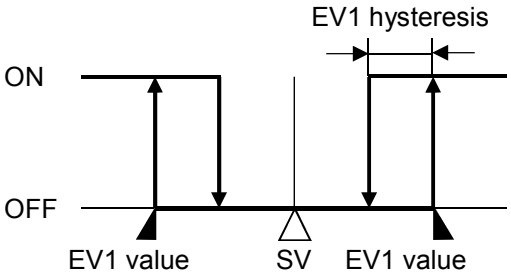
(Fig. 7.2.4-3)

• Low limit alarm with standby



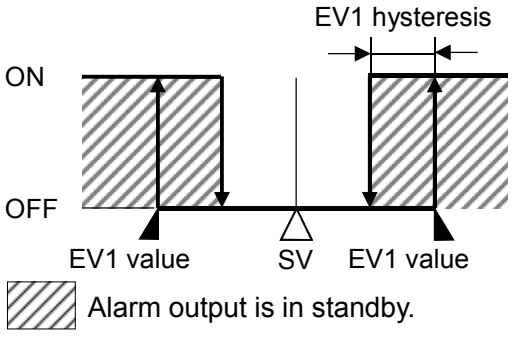
(Fig. 7.2.4-4)

• High/Low limits alarm



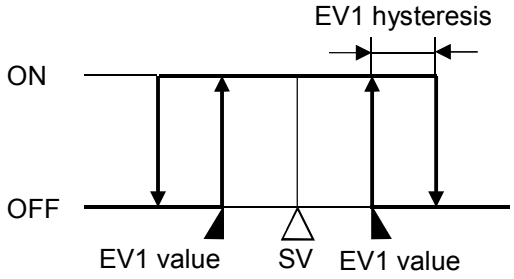
(Fig. 7.2.4-5)

• High/Low limits with standby alarm



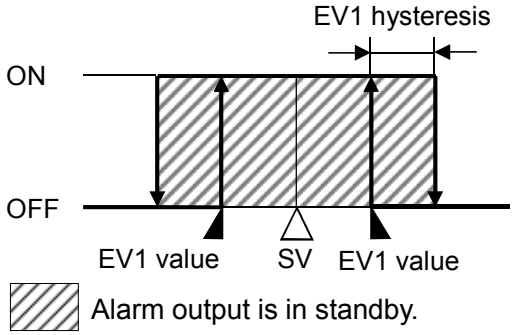
(Fig. 7.2.4-6)

• High/Low limit range alarm



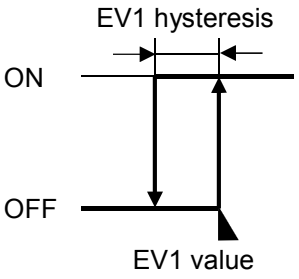
(Fig. 7.2.4-7)

• High/Low limit range with standby alarm



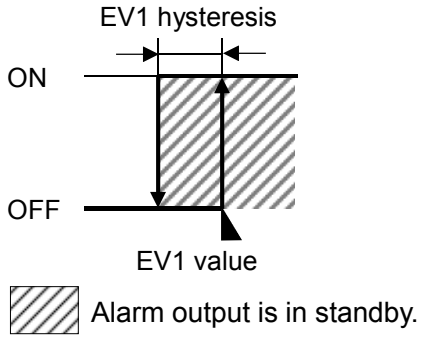
(Fig. 7.2.4-8)

• Process high alarm



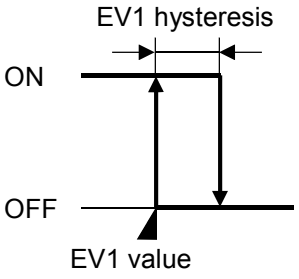
(Fig. 7.2.4-9)

• Process high with standby alarm



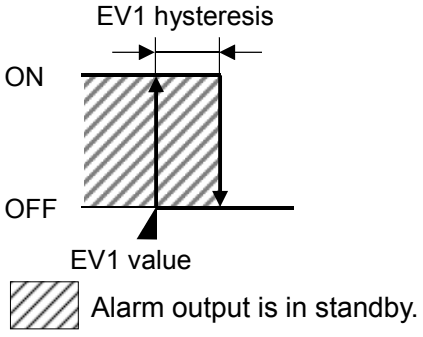
(Fig. 7.2.4-10)

• Process low alarm



(Fig. 7.2.4-11)

• Process low with standby alarm



(Fig. 7.2.4-12)

For the alarm types (High limit alarm, High/Low limits alarm, Process high alarm), alarm output is activated when the indication is overscale, and the standby function is released for the alarms with standby function.
For the alarm types (Low limit alarm, High/Low limits alarm, Process low alarm), alarm output is activated when the indication is underscale, and the standby function is released for the alarms with standby function.

When the alarm action De-energized is selected, the output ON/OFF status acts conversely to the alarm action described above. (The Event indicators act the same as the action Energized.)

	Energized	De-energized
Event indicators	Light	Light
Event output	ON	OFF

Setting items in the Alarm block setting group are shown below.
When 001 to 012 (Alarm output) is selected in [Event output EV□ allocation], the following will appear.

<table>
<tr><th>Character,
Factory Default</th><th>Setting Item, Function, Setting Range</th></tr>
<tr><td>A0_1
0</td><td>Block 0 EV1 alarm value
• Sets Block 0 EV1 alarm value.
• Setting range:
<table>
<tr><th>Type</th><th>Setting Range</th></tr>
<tr><td>No alarm action</td><td></td></tr>
<tr><td>High limit alarm</td><td>– (Input span) to Input span (*1)
(Alarm action is disabled when set to 0 or 0.0.)</td></tr>
<tr><td>High limit
with standby alarm</td><td>– (Input span) to Input span (*1)
(Alarm action is disabled when set to 0 or 0.0.)</td></tr>
<tr><td>Low limit alarm</td><td>– (Input span) to Input span (*1)
(Alarm action is disabled when set to 0 or 0.0.)</td></tr>
<tr><td>Low limit
with standby alarm</td><td>– (Input span) to Input span (*1)
(Alarm action is disabled when set to 0 or 0.0.)</td></tr>
<tr><td>High/Low limits
alarm</td><td>0 to Input span (*1)
(Alarm action is disabled when set to 0 or 0.0.)</td></tr>
<tr><td>High/Low limits
with standby alarm</td><td>0 to Input span (*1)
(Alarm action is disabled when set to 0 or 0.0.)</td></tr>
<tr><td>High/Low limit
range alarm</td><td>0 to Input span (*1)
(Alarm action is disabled when set to 0 or 0.0.)</td></tr>
<tr><td>High/Low limit
range with standby</td><td>0 to Input span (*1)
(Alarm action is disabled when set to 0 or 0.0.)</td></tr>
<tr><td>Process high alarm</td><td>Input range low limit to Input range high limit (*2)</td></tr>
<tr><td>Process high
with standby alarm</td><td>Input range low limit to Input range high limit (*2)</td></tr>
<tr><td>Process low alarm</td><td>Input range low limit to Input range high limit (*2)</td></tr>
<tr><td>Process low
with standby alarm</td><td>Input range low limit to Input range high limit (*2)</td></tr>
</table>
(*1) For DC voltage, current input, the input span is the same as the scaling span.
(*2) For DC voltage, current input, input range low (or high) limit value is the same as scaling low (or high) limit value.
Available when 001 to 012 (Alarm output) is selected in [Event output EV1 allocation],</td></tr>
<tr><td>A0_2
0</td><td>Block 0 EV2 alarm value
• Sets Block 0 EV2 alarm value.
• Setting range:
Same as that of Block 0 EV1 alarm value.
Available when 001 to 012 (Alarm output) is selected in [Event output EV2 allocation].</td></tr>
<tr><td>A0_3
0</td><td>Block 0 EV3 alarm value
• Sets Block 0 EV3 alarm value.
• Setting range:
Same as that of Block 0 EV1 alarm value.
Available when 001 to 012 (Alarm output) is selected in [Event output EV3 allocation].</td></tr>
</table>

Character, Factory Default	Setting Item, Function, Setting Range
A0_4 0	**Block 0 EV4 alarm value** • Sets Block 0 EV4 alarm value. • Setting range: Same as that of Block 0 EV1 alarm value. Available when 001 to 012 (Alarm output) is selected in [Event output EV4 allocation].
A1_1 0	**Block 1 EV1 alarm value** • Sets Block 1 EV1 alarm value. • Setting range: Same as that of Block 0 EV1 alarm value. Available when 001 to 012 (Alarm output) is selected in [Event output EV1 allocation].
	Repeat the above settings up to 'Block 9 EV4 alarm value', in the same way if necessary.
A9_4 0	**Block 9 EV4 alarm value** • Sets Block 9 EV4 alarm value. • Setting range: Same as that of Block 0 EV1 alarm value. Available when 001 to 012 (Alarm output) is selected in [Event output EV4 allocation].

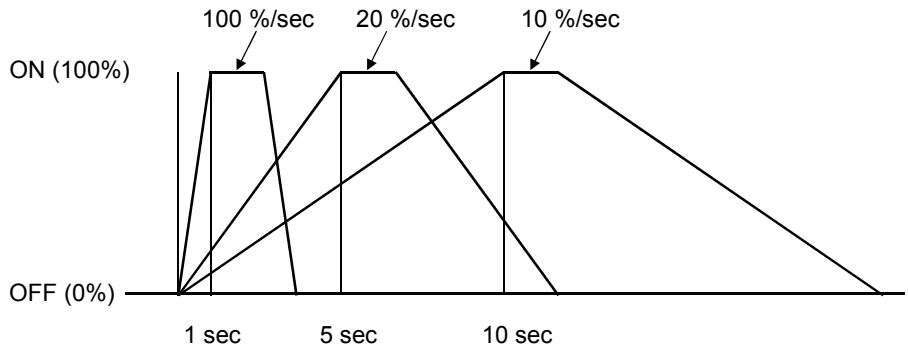
At this stage, settings of Alarm block setting group are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to the Block setting group.
By pressing the SET/RST key, the unit returns to RUN mode.

7.2.5 Output Block Setting Group

In Output block setting group, the following can be set for blocks 0 to 9:
OUT1 high limit, OUT1 low limit, OUT2 high limit (DR, DS or DA option), OUT2 low limit (DR, DS or DA option), OUT1 rate-of-change

Setting items in the Output block setting group are shown below.

Character, Factory Default	Setting Item, Function, Setting Range
o0_H 100	**Block 0 OUT1 high limit** • Sets Block 0 OUT1 high limit. • Setting range: OUT1 low limit to 100% (For direct current output: OUT1 low limit to 105%)
o0_L 0	**Block 0 OUT1 low limit** • Sets Block 0 OUT1 low limit. • Setting range: 0% to OUT1 high limit (For direct current output: -5% to OUT1 high limit)
o0Hb 100	**Block 0 OUT2 high limit** • Sets Block 0 OUT2 high limit. • Setting range: OUT2 low limit to 100% (For direct current output: OUT2 low limit to 105%) Available when Heating/Cooling control (DR, DS or DA option) is ordered.
o0Lb 0	**Block 0 OUT2 low limit** • Sets Block 0 OUT2 low limit. • Setting range: 0% to OUT2 high limit. (For direct current output: -5% to OUT2 high limit) Available when Heating/Cooling control (DR, DS or DA option) is ordered.
o0cL 0	**Block 0 OUT1 rate-of-change** • Sets Block 0 OUT1 rate-of-change (changing value of OUT1 MV for 1 second) Setting the value to 0 disables this function. **[OUT1 rate-of-change]** For Heating control, if PV is lower than SV, OUT1 MV changes as shown in (Fig. 7.2.5-1). If OUT1 rate-of-change is set, OUT1 MV can be changed by the rate-of-change (Fig. 7.2.5-2). This control is suitable for high temperature heaters (for which slow temperature rise is required, and used at approx. 1500 to 1800℃) which are easily burnt out from turning on electricity rapidly. (Fig. 7.2.5-1)

	 (Fig. 7.2.5-2) • Setting range: 0 to 100 %/Second
o1_H 100	**Block 1 OUT1 high limit** • Sets Block 1 OUT1 high limit. • Setting range: OUT1 low limit to 100% (For direct current output: OUT1 low limit to 105%)
	Repeat the above settings up to 'Block 9 OUT1 rate-of-change', in the same way if necessary.
o9cL 0	**Block 9 OUT1 rate-of-change** • Sets Block 9 OUT1 rate-of-change (changing value of OUT1 MV for 1 second). Setting the value to 0 disables this function. • Setting range: 0 to 100 %/second

At this stage, settings of Output block setting group are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to the Block setting group.
By pressing the SET/RST key, the unit returns to RUN mode.

7.3 Repetitions and Pattern Link Setting Group

In Repetitions and pattern link setting group, the following can be set:

Number of repetitions, Pattern link

Pattern numbers 0 to 15 can be linked to the next pattern. Only pattern numbers in numerical order can be linked. For Pattern 15, Pattern 0 can be linked.

Randomly selected pattern numbers (Pattern 0 and Pattern 3) cannot be linked.

Number of repetitions for Pattern numbers 0 to 15: 0 to 9999 times.

For repetitions of linked pattern, the whole linked pattern will be repeated as many times as set in “starting pattern number”.

(e.g.) If patterns 1 and 2 are linked, and if the number of repetitions of pattern 1 is set to 2 times, the whole linked pattern (Patterns 1 and 2) will be repeated twice.

• To enter Repetitions and Pattern link setting group

Press the SET/RST key once in RUN mode, and press the STOP/MODE key twice. The PV Display indicates G_cHN, and the unit enters the Repetitions and Pattern link setting group.

Press the HOLD/ENT key in the Repetitions and Pattern link setting group. The PV Display indicates REPT□, and the unit enters ‘Repetitions for pattern 0’.

• Explanation of Setting Item

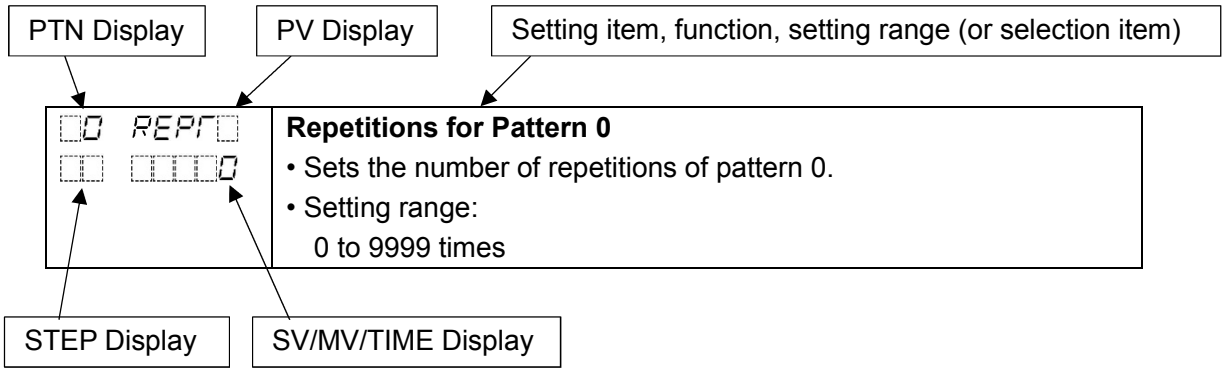
Upper left: PTN Display, PV Display

The PTN Display indicates the setting pattern number, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item, explanation of its function, and setting range.



Setting items in the Repetitions and Pattern link setting group are shown below.

Character, Factory Default	Setting Item, Function, Setting Range
0 REPT 0	**Repetitions for pattern 0** • Sets the number of repetitions of pattern 0. • Setting range: 0 to 9999 times
0 cHI N - - - - -	**Pattern link between pattern 0 and pattern 1** • Selects Pattern link Enabled/Disabled for pattern 0 and pattern 1. • Selection item: - - - - - : Pattern link Disabled cHI N : Pattern link Enabled

Character, Factory Default	Setting Item, Function, Setting Range
1 REPT 0	**Repetitions for Pattern 1** • Sets the number of repetitions of Pattern 1. • Setting range: 0 to 9999 times
	Repeat the above settings up to ‘Pattern link between pattern 15 and pattern 0’, in the same way if necessary.
15 cHI N ----	**Pattern link between pattern 15 and pattern 0** • Selects Pattern link Enabled/Disabled for pattern 15 and pattern 0. • Selection item: ---- : Pattern link Disabled cHI N : Pattern link Enabled

At this stage, settings of “Repetitions and pattern link setting group” are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to Group selection mode.
By pressing the SET/RST key, the unit returns to RUN mode.

7.4 AT Perform Group

In AT Perform group, the following can be set:

AT mode, AT Perform/Cancel, AT bias

• To enter AT Perform group

Press the SET/RST key once in RUN mode, and press the STOP/MODE key 3 times. The PV Display indicates G_AT□, and the unit enters the AT Perform group.

Press the HOLD/ENT in the AT Perform group. The PV Display indicates ATMD□, and the unit enters 'AT mode'.

• Explanation of Setting Item

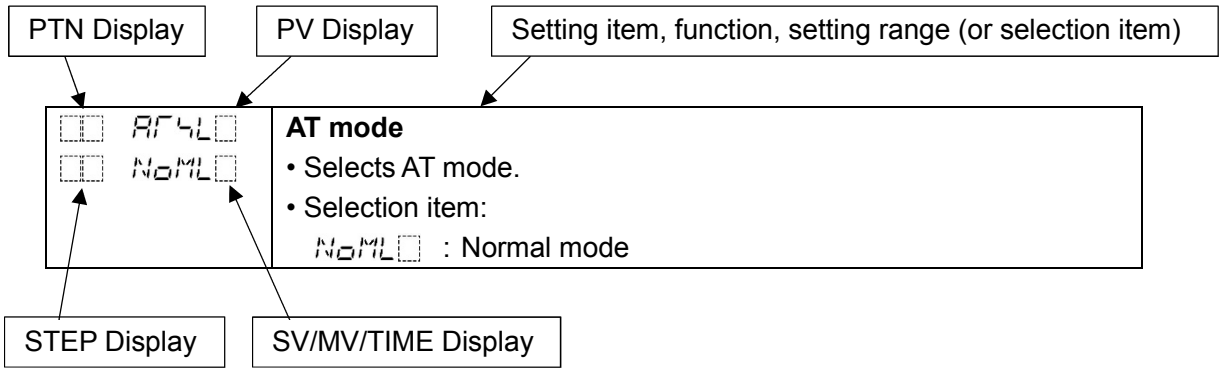
Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item, explanation of its function, and setting range.



Setting items in the AT Perform group are shown below.

Character, Factory Default	Setting Item, Function, Setting Range
□□ ATMD□ □□ NoML□	**AT mode** • Selects AT mode. Multi mode is enabled only during program control. • Selection item: NoML□ : Normal mode When AT Perform is selected in [AT Perform/Cancel], AT starts immediately. MULT□ : Multi mode AT is automatically performed at the point where 90% of progressed step time has elapsed. If there are the same PID block numbers in one pattern, the AT is performed only for the first step.
□□ AT□□□ □□ -----□	**AT Perform/Cancel** • Selects AT Perform/Cancel. AT continues to perform when input errors (overscale, underscale) occur. AT will be forced to stop if it has not been completed within 4 hours. • Selection item: -----□ : AT Cancel AT□□□ : AT Perform

Character, Factory Default	Setting Item, Function, Setting Range
AT_b 20	**AT bias** • Sets bias value for the AT. (See p.117) AT point is automatically determined by the deviation between PV and SV. AT bias setting is available for Fixed value control. • Setting range: Thermocouple, RTD input without decimal point: 0 to 50℃ (0 to 100℉) Thermocouple, RTD input with decimal point: 0.0 to 50.0℃ (0.0 to 100.0℉)

At this stage, settings of AT Perform group are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to Group selection mode.
By pressing the SET/RST key, the unit returns to RUN mode.

7.5 Engineering Setting Group

In Engineering setting group, the following setting groups are included:

Input parameter setting group, Output parameter setting group, Event output parameter setting group, SV limit setting group, Transmission output parameter setting group, Communication parameter setting group, Other parameters setting group

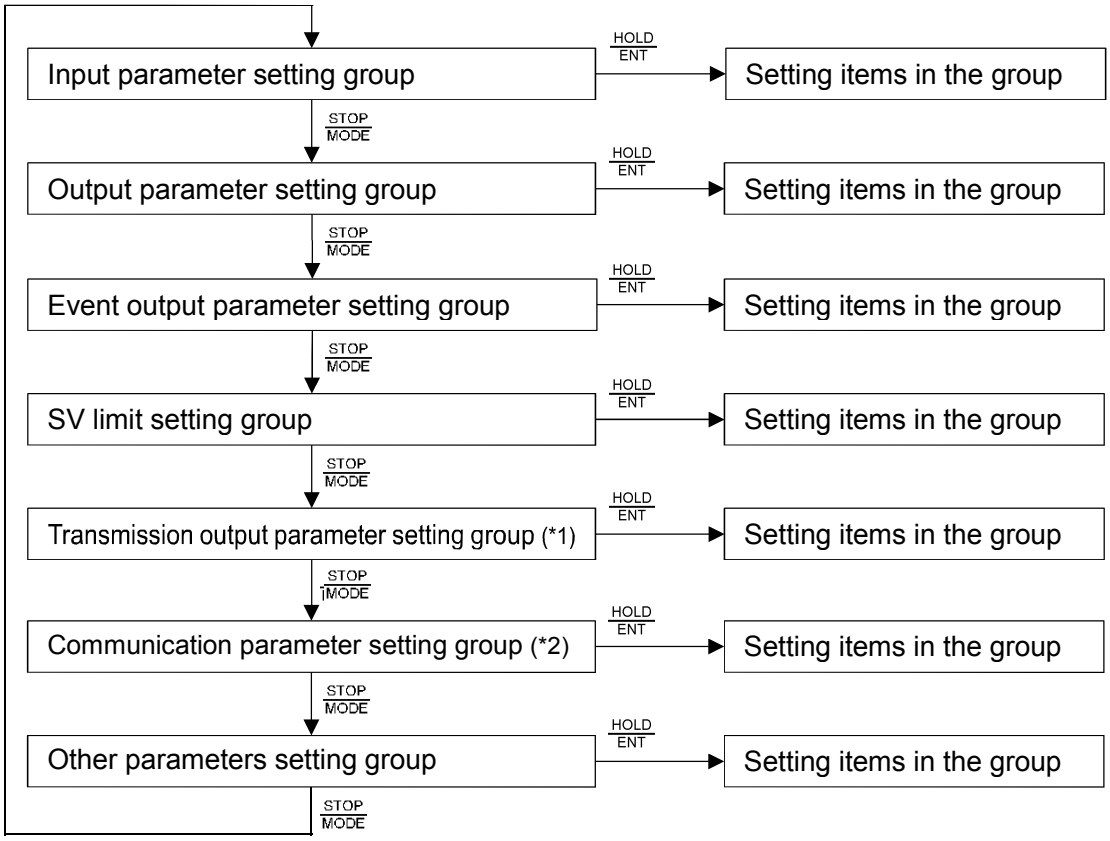
• To Enter the Engineering Setting Group

Press the SET/RST key once in RUN mode, and press the STOP/MODE key 4 times. The PV Display indicates G_ENG, and the unit enters the Engineering setting group.

Press the HOLD/ENT key in the Engineering setting group. The PV Display indicates E_INP, and the unit enters Input parameter setting group in the Engineering setting group.

Each time the STOP/MODE key is pressed, the Engineering setting group is switched as follows.

By pressing the HOLD/ENT key at each setting group, the unit moves to its setting items in the group.



(*1) Available when Transmission output (TA or TV option) is ordered.

(*2) Available when Serial communication (C or C5 option) is ordered.

• **Explanation of Setting Item**

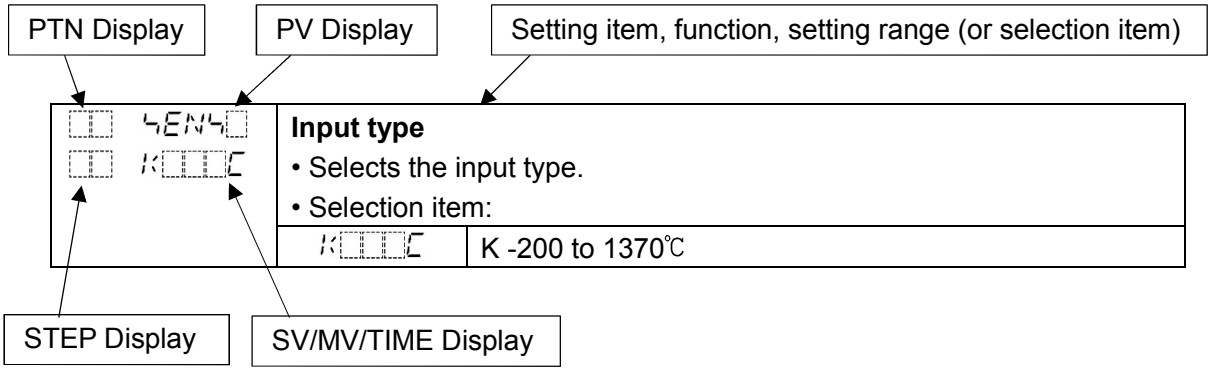
Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item, explanation of its function, and setting range.



7.5.1 Input Parameter Setting Group

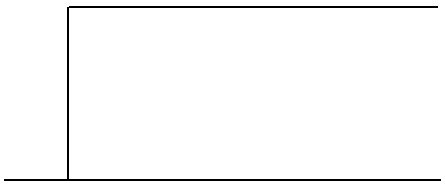
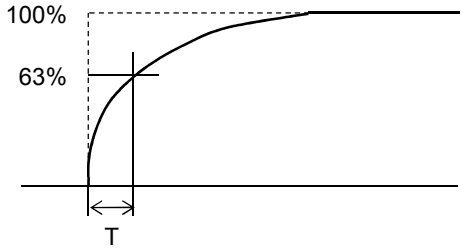
In Input parameter setting group, the following can be set:

Input type, Scaling high limit, Scaling low limit, Sensor correction, PV filter time constant, etc.

Setting items in the Input parameter setting group are shown below.

Character, Factory Default	Setting Item, Function, Setting Range
SEN K	**Input type** • Selects an input type. If input type is changed, the following items revert to the factory default value: Scaling high limit, Scaling low limit, Sensor correction, SV high limit, SV low limit, Transmission output high limit (except MV transmission), Transmission output low limit (except MV transmission), Step SV when program control starts, PV color range, Loop break alarm time, Loop break alarm span, AT bias • Selection item: K : K -200 to 1370℃ K .C : K -200.0 to 400.0℃ J : J -200 to 1000℃ R : R 0 to 1760℃ S : S 0 to 1760℃ B : B 0 to 1820℃ E : E -200 to 800℃ T .C : T -200.0 to 400.0℃ N : N -200 to 1300℃ PL2 : PL-Ⅱ 0 to 1390℃ 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 : Pt100 -200 to 850℃ JPt : JPt100 -200 to 500℃ Pt 1.C : Pt100 -100.0 to 100.0℃ Pt5 .C : Pt100 -100.0 to 500.0℃ K : K -328 to 2498℉ K .F : K -328.0 to 752.0℉ J : J -328 to 1832℉ R : R 32 to 3200℉ S : S 32 to 3200℉ B : B 32 to 3308℉ E : E -328 to 1472℉ T .F : T -328.0 to 752.0℉ N : N -328 to 2372℉ PL2 : PL-Ⅱ 32 to 2534℉ C : C(W/Re5-26) 32 to 4199℉ Pt .F : Pt100 -328.0 to 1562.0℉ JPt .F : JPt100 -328.0 to 932.0℉ Pt : Pt100 -328 to 1562℉ JPt : JPt100 -328 to 932℉

Character, Factory Default	Setting Item, Function, Setting Range
	Pt2.F : Pt100 -148.0 to 212.0℉ Pt9.F : Pt100 -148.0 to 932.0℉ 4-20mA : 4 to 20 mA DC -2000 to 10000 0-20mA : 0 to 20 mA DC -2000 to 10000 □10mV : 0 to 10 mV DC -2000 to 10000 -10mV : -10 to 10 mV DC -2000 to 10000 □50mV : 0 to 50 mV DC -2000 to 10000 100mV : 0 to 100 mV DC -2000 to 10000 0□1□V : 0 to 1 V DC -2000 to 10000 0□5□V : 0 to 5 V DC -2000 to 10000 1□5□V : 1 to 5 V DC -2000 to 10000 0 10□V : 0 to 10 V DC -2000 to 10000
SCLH □1370	**Scaling high limit** • Sets scaling high limit value. • Setting range: Scaling low limit value to Input range high limit value
SCLL -□200	**Scaling low limit** • Sets scaling low limit value. • Setting range: Input range low limit value to Scaling high limit value
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 0.0000 : 4 digits after decimal point Available for DC voltage and current inputs.
So□□□ □□□0.0	**Sensor correction** • Sets sensor correction value. **[Sensor correction function]** 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 multiple indicating 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. However, it is effective within the input rated range regardless of the sensor correction value. PV after sensor correction= Current PV + (Sensor correction value) • Setting range: Thermocouple, RTD input: -200.0 to 200.0℃ (℉) DC voltage, current input: -2000 to 2000 (The placement of the decimal point follows the selection.)

Character, Factory Default	Setting Item, Function, Setting Range
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. **[PV filter time constant]** This is a filter function on the software, which has the same effect as a CR filter. By calculating first-order lag of PV, this suppresses input fluctuation caused by noise. When the input value changes as shown in (Fig. 7.5.1-1), this function makes the input change slowly, as shown in (Fig. 7.5.1-2). T (PV filter time constant) is the time when input change reaches 63% of the desired PV.  (Fig. 7.5.1-1)  (Fig. 7.5.1-2) • Setting range: 0.0 to 100.0 seconds

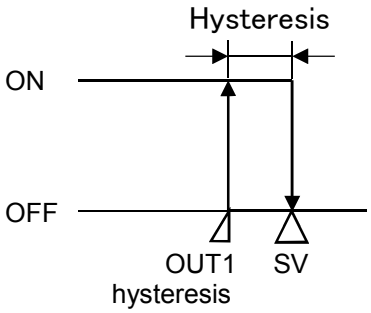
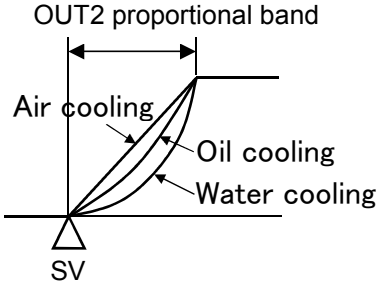
At this stage, settings of Input parameter setting group are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to the Engineering setting group.
By pressing the SET/RST key, the unit returns to RUN mode.

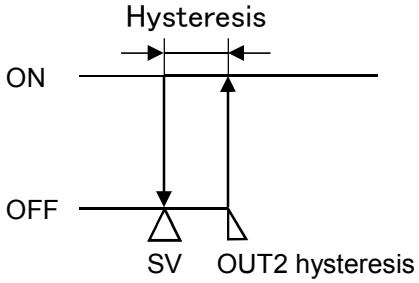
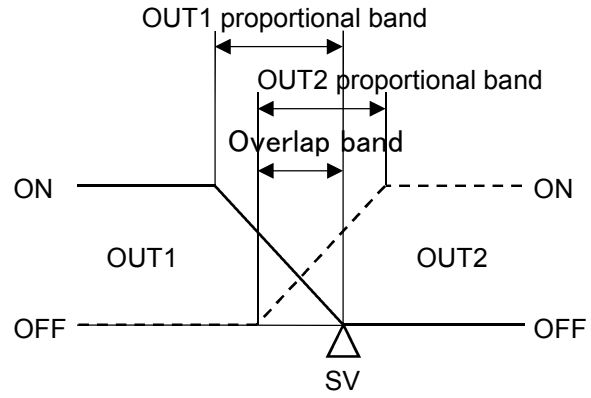
7.5.2 Output Parameter Setting Group

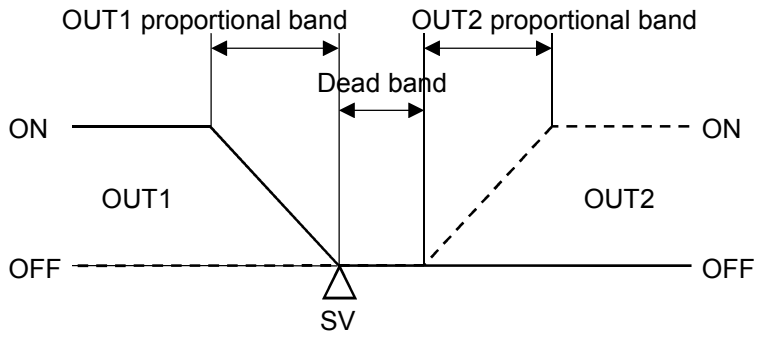
In Output parameter setting group, the following can be set:

OUT1 proportional cycle, OUT1 ON/OFF hysteresis, OUT2 proportional cycle (DR, DS or DA option), OUT2 cooling method (DR, DS or DA option), Direct/Reverse action, etc.

Setting items in the Output parameter setting group are shown below.

Character, Factory Default	Setting Item, Function, Setting Range
c 30 • Relay contact output: 30 sec • Non-contact voltage output: 3 sec	**OUT1 proportional cycle** • Sets OUT1 proportional cycle. • Setting range: 1 to 120 sec Available when control output OUT1 is Relay contact output or Non-contact voltage output.
HYS 10	**OUT1 ON/OFF hysteresis** • Sets OUT1 ON/OFF hysteresis.  (Fig. 7.5.2-1) • Setting range: Thermocouple, RTD input: 0.1 to 1000.0℃ (℉) DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.)
c_b 30 • DR: 30 sec • DS: 3 sec	**OUT2 proportional cycle** • Sets OUT2 proportional cycle. • Setting range: 1 to 120 sec Available when Heating/Cooling control (DR or DS option) is ordered.
cRcF AIR	**OUT2 cooling method** • Selects OUT2 cooling method.  (Fig. 7.5.2-2)

Character, Factory Default	Setting Item, Function, Setting Range
	• Selection item: AI R□ : Air cooling (Linear characteristics) oI L□ : Oil cooling (1.5th power of the linear characteristics) WAT□ : Water cooling (2nd power of the linear characteristics) Available when Heating/Cooling control (DR, DS or DA option) is ordered.
□□ HYS□ □□ □□□ 1.0	**OUT2 ON/OFF hysteresis** • Sets OUT2 ON/OFF hysteresis.  (Fig. 7.5.2-3) • Setting range: Thermocouple, RTD input: 0.1 to 1000.0℃ (℉) DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.) Available when Heating/Cooling control (DR, DS or DA option) is ordered.
□□ db□□ □□ □□□0.0	**Overlap/Dead band** • Sets the overlap band or dead band for OUT1 and OUT2. + Set value: Dead band – Set value: Overlap band **[Overlap band]**  (Fig. 7.5.2-4)

Character, Factory Default	Setting Item, Function, Setting Range
	[Dead band]  (Fig. 7.5.2-5) • Setting range: Thermocouple, RTD input: -200.0 to 200.0℃ (℉) DC voltage, current input: -2000 to 2000 (The placement of the decimal point follows the selection.) Available when Heating/Cooling control (DR, DS or DA option) is ordered.
□□ coNT□ □□ HEAT□	**Direct/Reverse action** • Selects either Reverse (Heating) or Direct (Cooling) control action. • Selection item: HEAT□ : Reverse action cooL□ : Direct action

At this stage, settings of Output parameter setting group are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to the Engineering setting group.
By pressing the SET/RST key, the unit returns to RUN mode.

7.5.3 Event Output Parameter Setting Group

In Event output parameter setting group, the following can be set:

Event output EV1 allocation, Event output EV2 allocation,
Event output EV3 allocation, Event output EV4 allocation

In Event output (EV1 to EV4) allocation, the following can be selected:

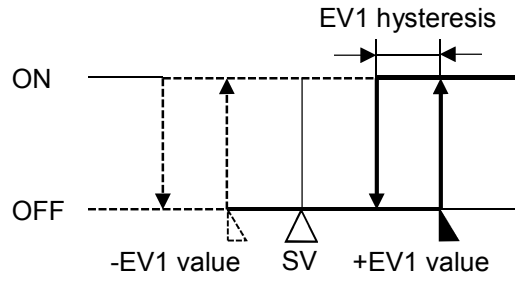
Alarm output, Pattern end output, Loop break alarm, Output during AT

Factory default values for EV1, EV2, EV and EV4:

EV1: Pattern end output
EV2: No event
EV3: Alarm output, High limit alarm
EV4: Alarm output, Low limit alarm

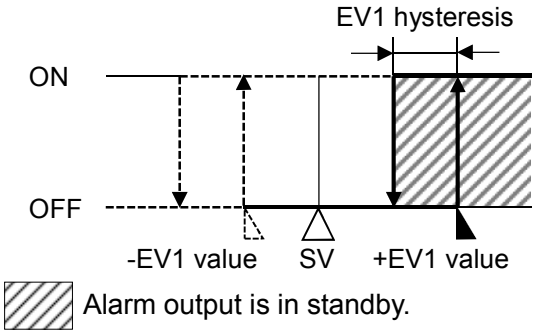
Alarm output actions are shown below.

• High limit alarm



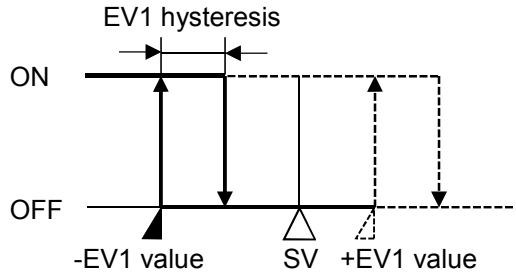
(Fig. 7.5.3-1)

• High limit with standby alarm



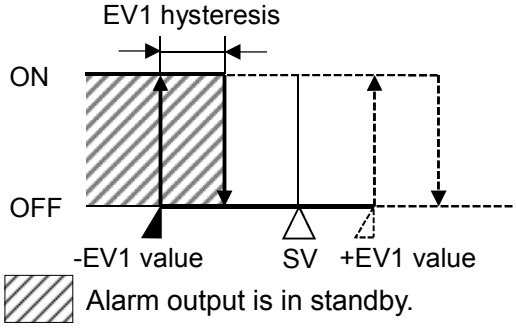
(Fig. 7.5.3-2)

• Low limit alarm



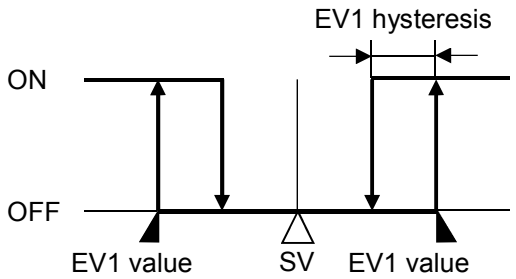
(Fig. 7.5.3-3)

• Low limit with standby alarm



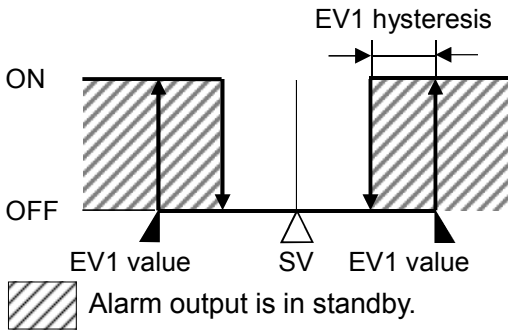
(Fig. 7.5.3-4)

• High/Low limits alarm



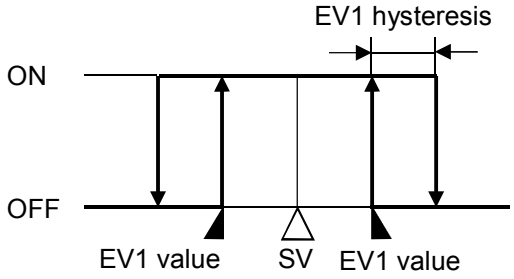
(Fig. 7.5.3-5)

• High/Low limits with standby alarm



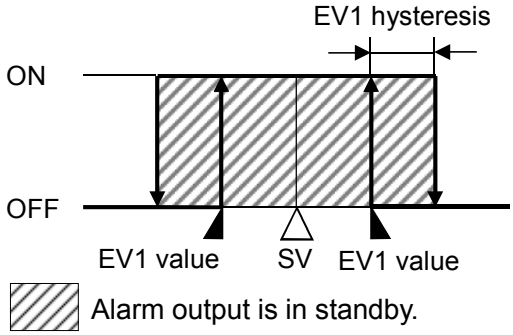
(Fig. 7.5.3-6)

• High/Low limit range alarm



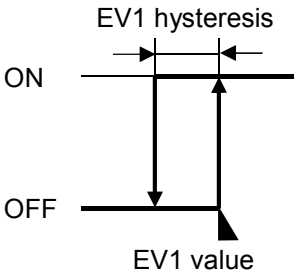
(Fig. 7.5.3-7)

• High/Low limit range with standby alarm



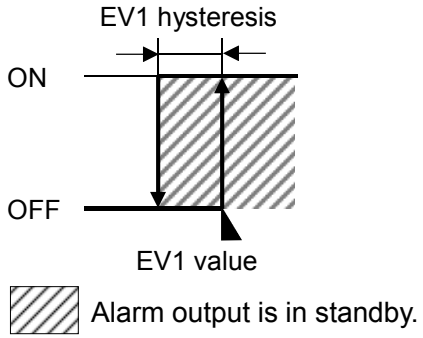
(Fig. 7.5.3-8)

• Process high alarm



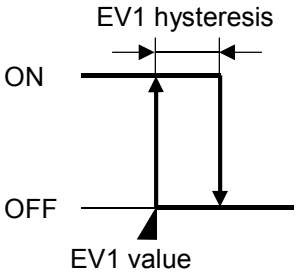
(Fig. 7.5.3-9)

• Process high with standby alarm



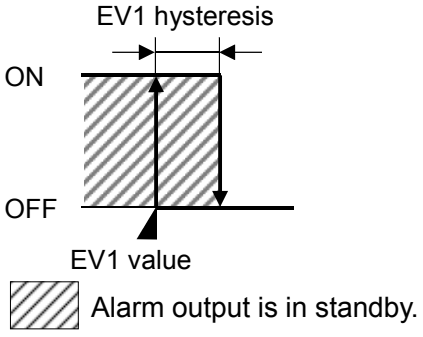
(Fig. 7.5.3-10)

• Process low alarm



(Fig. 7.5.3-11)

• Process low with standby alarm



(Fig. 7.5.3-12)

For the alarm types (High limit alarm, High/Low limits alarm, Process high alarm), alarm output is activated when the indication is overscale, and the standby function is released for the alarms with standby function.

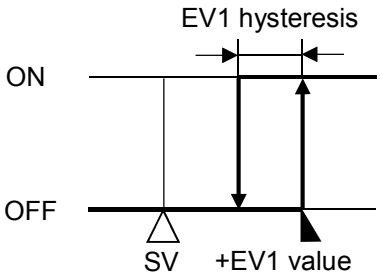
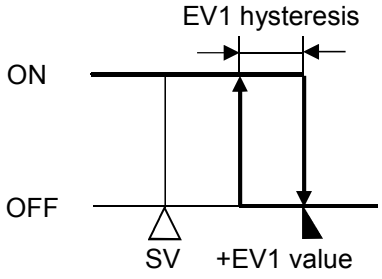
For the alarm types (Low limit alarm, High/Low limits alarm, Process low alarm), alarm output is activated when the indication is underscale, and the standby function is released for the alarms with standby function.

When the alarm action De-energized is selected, the output ON/OFF status acts conversely to the alarm action described above. (The Event indicators act the same as the action Energized.)

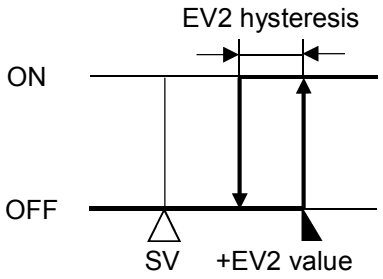
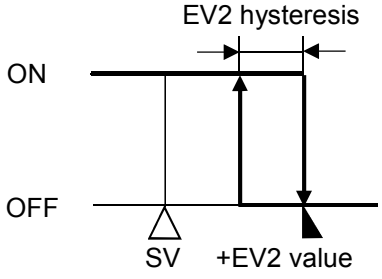
	Energized	De-energized
Event indicators	Light	Light
Event output	ON	OFF

Setting items in the Event output parameter setting group are shown below.

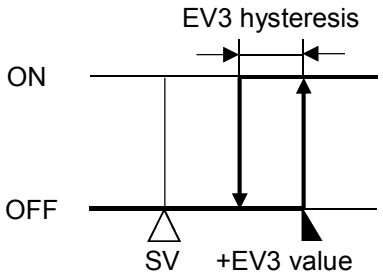
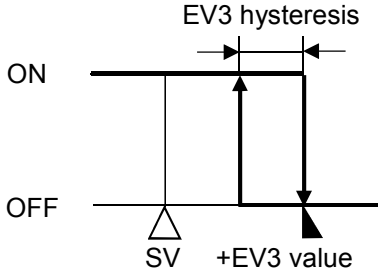
<table>
<tr><th>Character,
Factory Default</th><th>Setting Item, Function, Setting Range</th></tr>
<tr><td>EVT01
□□013</td><td>
Event output EV1 allocation
• Selects Event output EV1 from the Event Output Allocation Table below.
For Alarm output, the alarm value is set by ±deviation from the SV (excluding Process alarm), and if the input goes outside the range, the Alarm output is turned ON (turned OFF for High/Low limit range alarm).
When De-energized action is selected, the output is activated conversely.
Pattern end output turns ON after program control ends.
Loop break alarm output turns ON after detecting actuator trouble (heater burnout, heater adhesion) or sensor burnout.
'Output during AT' turns ON during AT.
• Selection item:
[Event Output Allocation Table]
<table>
<tr><th>Selection</th><th>Event output</th><th>Remarks</th></tr>
<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, High limit with standby alarm</td><td></td></tr>
<tr><td>□□003</td><td>Alarm output, Low limit alarm</td><td></td></tr>
<tr><td>□□004</td><td>Alarm output, Low limit with standby alarm</td><td></td></tr>
<tr><td>□□005</td><td>Alarm output, High/Low limits alarm</td><td></td></tr>
<tr><td>□□006</td><td>Alarm output, High/Low limits with standby alarm</td><td></td></tr>
<tr><td>□□007</td><td>Alarm output, High/Low limit range alarm</td><td></td></tr>
<tr><td>□□008</td><td>Alarm output, High/Low limit range with standby alarm</td><td></td></tr>
<tr><td>□□009</td><td>Alarm output, Process high alarm</td><td></td></tr>
<tr><td>□□010</td><td>Alarm output, Process high with standby alarm</td><td></td></tr>
<tr><td>□□011</td><td>Alarm output, Process low alarm</td><td></td></tr>
<tr><td>□□012</td><td>Alarm output, Process low with standby alarm</td><td></td></tr>
<tr><td>□□013</td><td>Pattern end output</td><td></td></tr>
<tr><td>□□014</td><td>Loop break alarm output</td><td></td></tr>
<tr><td>□□015</td><td>Output during AT</td><td>Turns ON during AT.</td></tr>
</table>
When 001 to 012 (Alarm output) is selected, one alarm can be set to one event output.
When 013 to 015 is selected, each output is common to multiple event outputs.
</td></tr>
<tr><td>A1HY4
□□□10</td><td>
EV1 alarm hysteresis
• Sets EV1 alarm hysteresis.
• Setting range:
Thermocouple, RTD input: 0.1 to 1000.0℃ (℉)
DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.)
Available when 001 to 012 (Alarm output) is selected in [Event output EV1 allocation].
</td></tr>
<tr><td>A1DLY
□□□□0</td><td>
EV1 alarm delay time
• Sets EV1 alarm action delay time.
When setting time has elapsed after PV enters the alarm output range, the alarm is activated.
• Setting range:
0 to 10000 seconds
Available when 001 to 012 (Alarm output) is selected in [Event output EV1 allocation].
</td></tr>
</table>

Character, Factory Default	Setting Item, Function, Setting Range
A1REV NoML	**EV1 alarm Energized/De-energized** • Selects Energized/De-energized status for EV1 alarm. When Energized is selected, Event output EV1 is conductive (ON) while the EV1 indicator is lit. Event output EV1 is not conductive (OFF) while the EV1 indicator is not lit. When De-energized is selected, Event output EV1 is not conductive (OFF) while the EV1 indicator is lit. Event output EV1 is conductive (ON) while the EV1 indicator is not lit. **High limit alarm (Energized)**  (Fig. 7.5.3-13) **High limit alarm (De-energized)**  (Fig. 7.5.3-14) • Selection item: NoML : Energized REV4 : De-energized Available when 001 to 012 (Alarm output) is selected in [Event output EV1 allocation].
LP_T 0000	**Loop break alarm time** • Sets the time to assess the Loop break alarm. **[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 OUT1 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 OUT1 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 OUT1 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 OUT1 low limit value), the alarm will be activated. • Setting range: 0 to 200 minutes [Setting to 0 (zero) disables the Loop break alarm.] Available when 014 (Loop break alarm output) is selected in [Event output EV1 allocation].

<table>
<tr><th>Character,
Factory Default</th><th>Setting Item, Function, Setting Range</th></tr>
<tr><td>LP_H
0</td><td>Loop break alarm span
• Sets the temperature to assess the Loop break alarm.
• Setting range:
Thermocouple, RTD input without decimal point: 0 to 150℃ (℉)
Thermocouple, RTD input with decimal point: 0.0 to 150.0℃ (℉)
DC voltage, current input: 1 to 1500 (The placement of the decimal point follows the selection.)
Available when 014 (Loop break alarm output) is selected in [Event output EV1 allocation].</td></tr>
<tr><td>EVT02
000</td><td>Event output EV2 allocation
• Selects Event output EV2 from the Event Output Allocation Table below.
For Alarm output, the alarm value is set by ±deviation from the SV (excluding Process alarm), and if the input goes outside the range, the Alarm output is turned ON (turned OFF for High/Low limit range alarm).
When De-energized action is selected, the output is activated conversely.
Pattern end output turns ON after program control ends.
Loop break alarm output turns ON after detecting actuator trouble (heater burnout, heater adhesion) or sensor burnout.
'Output during AT' turns ON during AT.
• Selection item:
[Event Output Allocation Table]
<table>
<tr><th>Selection</th><th>Event output</th><th>Remarks</th></tr>
<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, High limit with standby alarm</td><td></td></tr>
<tr><td>003</td><td>Alarm output, Low limit alarm</td><td></td></tr>
<tr><td>004</td><td>Alarm output, Low limit with standby alarm</td><td></td></tr>
<tr><td>005</td><td>Alarm output, High/Low limits alarm</td><td></td></tr>
<tr><td>006</td><td>Alarm output, High/Low limits with standby alarm</td><td></td></tr>
<tr><td>007</td><td>Alarm output, High/Low limit range alarm</td><td></td></tr>
<tr><td>008</td><td>Alarm output, High/Low limit range with standby alarm</td><td></td></tr>
<tr><td>009</td><td>Alarm output, Process high alarm</td><td></td></tr>
<tr><td>010</td><td>Alarm output, Process high with standby alarm</td><td></td></tr>
<tr><td>011</td><td>Alarm output, Process low alarm</td><td></td></tr>
<tr><td>012</td><td>Alarm output, Process low with standby alarm</td><td></td></tr>
<tr><td>013</td><td>Pattern end output</td><td></td></tr>
<tr><td>014</td><td>Loop break alarm output</td><td></td></tr>
<tr><td>015</td><td>Output during AT</td><td>Turns ON during AT.</td></tr>
</table>
When 001 to 012 (Alarm output) is selected, one alarm can be set to one event output.
When 013 to 015 is selected, each output is common to multiple event outputs.</td></tr>
<tr><td>A2HY
1.0</td><td>EV2 alarm hysteresis
• Sets EV2 alarm hysteresis.
• Setting range:
Thermocouple, RTD input: 0.1 to 1000.0℃ (℉)
DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.)
Available when 001 to 012 (Alarm output) is selected in [Event output EV2 allocation].</td></tr>
</table>

Character, Factory Default	Setting Item, Function, Setting Range
A2dLY 0	**EV2 alarm delay time** • Sets EV2 alarm action delay time. When setting time has elapsed after PV enters the alarm output range, the alarm is activated. • Setting range: 0 to 10000 seconds Available when 001 to 012 (Alarm output) is selected in [Event output EV2 allocation].
A2REV NoML	**EV2 alarm Energized/De-energized** • Selects Energized/De-energized status for EV2 alarm. When Energized is selected, Event output EV2 is conductive (ON) while the EV2 indicator is lit. Event output EV2 is not conductive (OFF) while the EV2 indicator is not lit. When De-energized is selected, Event output EV2 is not conductive (OFF) while the EV2 indicator is lit. Event output EV2 is conductive (ON) while the EV2 indicator is not lit. **High limit alarm (Energized)**  (Fig. 7.5.3-15) **High limit alarm (De-energized)**  (Fig. 7.5.3-16) • Selection item: NoML : Energized REV4 : De-energized Available when 001 to 012 (Alarm output) is selected in [Event output EV2 allocation].
LP_T 0	**Loop break alarm time** • Sets the time to assess the Loop break alarm. **[About 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 OUT1 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 OUT1 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 OUT1 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 OUT1 low limit value), the alarm will be activated. • Setting range: 0 to 200 minutes [Setting to 0 (zero) disables the Loop break alarm.] Available when 014 (Loop break alarm output) is selected in [Event output EV2 allocation].

<table>
<tr><th>Character,
Factory Default</th><th>Setting Item, Function, Setting Range</th></tr>
<tr><td>LP_H
0</td><td>Loop break alarm span
• Sets the temperature to assess the Loop break alarm.
• Setting range:
Thermocouple, RTD input without decimal point: 0 to 150℃ (℉)
Thermocouple, RTD input with decimal point: 0.0 to 150.0℃ (℉)
DC voltage, current input: 1 to 1500 (The placement of the decimal point follows the selection.)
Available when 014 (Loop break alarm output) is selected in [Event output EV2 allocation].</td></tr>
<tr><td>EVT03
001</td><td>Event output EV3 allocation
• Selects Event output EV3 from the Event Output Allocation Table below.
For Alarm output, the alarm value is set by ± deviation from the SV (excluding Process alarm), and if the input goes outside the range, the Alarm output is turned ON (turned OFF for High/Low limit range alarm).
When De-energized action is selected, the output is activated conversely.
Pattern end output turns ON after program control ends.
Loop break alarm output turns ON after detecting actuator trouble (heater burnout, heater adhesion) or sensor burnout.
'Output during AT' turns ON during AT.
• Selection item:
[Event Output Allocation Table]
<table>
<tr><th>Selection</th><th>Event output</th><th>Remarks</th></tr>
<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, High limit with standby alarm</td><td></td></tr>
<tr><td>003</td><td>Alarm output, Low limit alarm</td><td></td></tr>
<tr><td>004</td><td>Alarm output, Low limit with standby alarm</td><td></td></tr>
<tr><td>005</td><td>Alarm output, High/Low limits alarm</td><td></td></tr>
<tr><td>006</td><td>Alarm output, High/Low limits with standby alarm</td><td></td></tr>
<tr><td>007</td><td>Alarm output, High/Low limit range alarm</td><td></td></tr>
<tr><td>008</td><td>Alarm output, High/Low limit range with standby alarm</td><td></td></tr>
<tr><td>009</td><td>Alarm output, Process high alarm</td><td></td></tr>
<tr><td>010</td><td>Alarm output, Process high with standby alarm</td><td></td></tr>
<tr><td>011</td><td>Alarm output, Process low alarm</td><td></td></tr>
<tr><td>012</td><td>Alarm output, Process low with standby alarm</td><td></td></tr>
<tr><td>013</td><td>Pattern end output</td><td></td></tr>
<tr><td>014</td><td>Loop break alarm output</td><td></td></tr>
<tr><td>015</td><td>Output during AT</td><td>Turns ON during AT.</td></tr>
</table>
When 001 to 012 (Alarm output) is selected, one alarm can be set to one event output.
When 013 to 015 is selected, each output is common to multiple event outputs.</td></tr>
<tr><td>A3HY
10</td><td>EV3 alarm hysteresis
• Sets EV3 alarm hysteresis.
• Setting range:
Thermocouple, RTD input: 0.1 to 1000.0℃ (℉)
DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.)
Available when 001 to 012 (Alarm output) is selected in [Event output EV3 allocation].</td></tr>
</table>

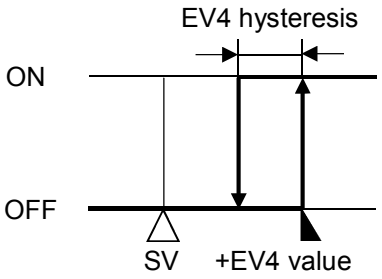
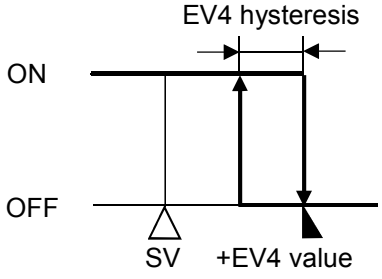
Character, Factory Default	Setting Item, Function, Setting Range
A3dLY 0	**EV3 alarm delay time** • Sets EV3 alarm action delay time. When setting time has elapsed after PV enters the alarm output range, the alarm is activated. • Setting range: 0 to 10000 seconds Available when 001 to 012 (Alarm output) is selected in [Event output EV3 allocation]
A3REV NoML	**EV3 alarm Energized/De-energized** • Selects Energized/De-energized status for EV3 alarm. When Energized is selected, Event output EV3 is conductive (ON) while the EV3 indicator is lit. Event output EV3 is not conductive (OFF) while the EV3 indicator is not lit. When De-energized is selected, Event output EV3 is not conductive (OFF) while the EV3 indicator is lit. Event output EV3 is conductive (ON) while the EV3 indicator is not lit. **High limit alarm (Energized)**  (Fig. 7.5.3-17) **High limit alarm (De-energized)**  (Fig. 7.5.3-18) • Selection item: NoML : Energized REV4 : De-energized Available when 001 to 012 (Alarm output) is selected in [Event output EV3 allocation].
LP_T 0	**Loop break alarm time** • Sets the time to assess the Loop break alarm. **[About 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 OUT1 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 OUT1 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 OUT1 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 OUT1 low limit value), the alarm will be activated. • Setting range: 0 to 200 minutes [Setting to 0 (zero) disables the Loop break alarm.] Available when 014 (Loop break alarm output) is selected in [Event output EV3 allocation].

Character, Factory Default	Setting Item, Function, Setting Range
LP_H 0	**Loop break alarm span** • Sets the temperature to assess the Loop break alarm. • Setting range: Thermocouple, RTD input without decimal point: 0 to 150℃ (℉) Thermocouple, RTD input with decimal point: 0.0 to 150.0℃ (℉) DC voltage, current input: 1 to 1500 (The placement of the decimal point follows the selection.) Available when 014 (Loop break alarm output) is selected in [Event output EV3 allocation].
EVT04 003	**Event output EV4 allocation** • Selects Event output EV4 from the Event Output Allocation Table below. For Alarm output, the alarm value is set by ±deviation from the SV (excluding Process alarm), and if the input goes outside the range, the Alarm output is turned ON (turned OFF for High/Low limit range alarm). When De-energized action is selected, the output is activated conversely. Pattern end output turns ON after program control ends. Loop break alarm output turns ON after detecting actuator trouble (heater burnout, heater adhesion) or sensor burnout. 'Output during AT' turns ON during AT. • Selection item: **[Event Output Allocation Table]**

Selection	Event output	Remarks
000	No event	
001	Alarm output, High limit alarm	
002	Alarm output, High limit with standby alarm	
003	Alarm output, Low limit alarm	
004	Alarm output, Low limit with standby alarm	
005	Alarm output, High/Low limits alarm	
006	Alarm output, High/Low limits with standby alarm	
007	Alarm output, High/Low limit range alarm	
008	Alarm output, High/Low limit range with standby alarm	
009	Alarm output, Process high alarm	
010	Alarm output, Process high with standby alarm	
011	Alarm output, Process low alarm	
012	Alarm output, Process low with standby alarm	
013	Pattern end output	
014	Loop break alarm output	
015	Output during AT	Turns ON during AT.

When 001 to 012 (Alarm output) is selected, one alarm can be set to one event output.
When 013 to 015 is selected, each output is common to multiple event outputs.

A4HY4 10	**EV4 alarm hysteresis** • Sets EV4 alarm hysteresis. • Setting range: Thermocouple, RTD input: 0.1 to 1000.0℃ (℉) DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.) Available when 001 to 012 (Alarm output) is selected in [Event output EV4 allocation].

Character, Factory Default	Setting Item, Function, Setting Range
A4dLY 0	**EV4 alarm delay time** • Sets EV4 alarm action delay time. When setting time has elapsed after PV enters the alarm output range, the alarm is activated. • Setting range: 0 to 10000 seconds Available when 001 to 012 (Alarm output) is selected in [Event output EV4 allocation].
A4REV NoML	**EV4 alarm Energized/De-energized** • Selects Energized/De-energized status for EV4 alarm. When Energized is selected, Event output EV4 is conductive (ON) while the EV4 indicator is lit. Event output EV4 is not conductive (OFF) while the EV4 indicator is not lit. When De-energized is selected, Event output EV4 is not conductive (OFF) while the EV4 indicator is lit. Event output EV4 is conductive (ON) while the EV4 indicator is not lit. **High limit alarm (Energized)**  (Fig. 7.5.3-19) **High limit alarm (De-energized)**  (Fig. 7.5.3-20) • Selection item: NoML : Energized REV4 : De-energized Available when 001 to 012 (Alarm output) is selected in [Event output EV4 allocation].
LP_T 0	**Loop break alarm time** • Sets the time to assess the Loop break alarm. **[About 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 OUT1 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 OUT1 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 OUT1 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 OUT1 low limit value), the alarm will be activated. • Setting range: 0 to 200 minutes [Setting to 0 (zero) disables the Loop break alarm.] Available when 014 (Loop break alarm output) is selected in [Event output EV4 allocation].

Character, Factory Default	Setting Item, Function, Setting Range
LP_H 0	**Loop break alarm span** • Sets the temperature to assess the Loop break alarm. • Setting range: Thermocouple, RTD input without decimal point: 0 to 150℃ (℉) Thermocouple, RTD input with decimal point: 0.0 to 150.0℃ (℉) DC voltage, current input: 1 to 1500 (The placement of the decimal point follows the selection.) Available when 014 (Loop break alarm output) is selected in [Event output EV4 allocation].

At this stage, settings of Event output parameter setting group are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to the Engineering setting group.
By pressing the SET/RST key, the unit returns to RUN mode.

7.5.4 SV Limit Setting Group

In SV limit setting group, the following can be set:

SV high limit, SV low limit

Setting items in the SV limit setting group are shown below.

Character, Factory Default	Setting Item, Function, Setting Range
SH 1370	**SV high limit** • Sets SV high limit value. • Setting range: SV low limit to Scaling high limit
SL -200	**SV low limit** • Sets SV low limit value. • Setting range: Scaling low limit to SV high limit

At this stage, settings of SV limit setting group are complete.

If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to the Engineering setting group.

By pressing the SET/RST key, the unit returns to RUN mode.

7.5.5 Transmission Output Parameter Setting Group

In Transmission output parameter setting group, the following can be set:

Transmission output type, Transmission output high limit, Transmission output low limit,

Setting items in the Transmission output parameter setting group are shown below.
Available when Transmission output (TA or TV option) are ordered.

Character, Factory Default	Setting Item, Function, Setting Range
TRo4 PV	**Transmission output type** • Selects transmission output type. Converting the value (PV, SV or MV transmission) to analog signal every 125 ms, outputs the value in current or voltage. • Selection item: PV : PV transmission SV : SV transmission MV : MV transmission
TRLH 1370	**Transmission output high limit** • Sets the Transmission output high limit value. This value correponds to 20 mA DC output or 1 V DC output. If Transmission output high limit and low limit are set to the same value, Transmission output low limit will be output. If SV or MV transmission is selected, 4 mA DC or 0 V DC will be output when program control stops (in Standby). • Setting range: When PV or SV transmission is selected: Transmission output low limit to Input range high limit When MV transmission is selected: Transmission output low limit to 105.0%
TRLL -200	**Transmission output low limit** • Sets the Transmission output low limit value. This value correponds to 4 mA DC output or 0 V DC output. If Transmission output high limit and low limit are set to the same value, Transmission output low limit will be output. If SV or MV transmission is selected, 4 mA DC or 0 V DC will be output when program control stops (in Standby). • Setting range: When PV or SV transmission is selected: Input range low limit to Transmission output high limit When MV transmission is selected: -5.0% to Transmission output high limit

At this stage, settings of Transmission output parameter setting group are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to the Engineering setting group.
By pressing the SET/RST key, the unit returns to RUN mode.

7.5.6 Communication Parameter Setting Group

In Communication parameter setting group, the following can be set:
Communication protocol, Instrument number, Communication speed, Response delay time, etc.

Setting items in the Communication parameter setting group are shown below.
Available when Serial communication (C or C5 option) are ordered.

Character, Factory Default	Setting Item, Function, Setting Range
cMHL NoML	**Communication protocol** • Selects communication protocol. • Selection item: NoML : Shinko protocol ModA : Modbus ASCII ModR : Modbus RTU HVT : Set value (SV) digital transmission
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
cMHP 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
cMFT 7EVN	**Data bit/Parity** • Selects data bit and parity, in accordance with the data bit and parity of the host computer. • 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
cMHT 1	**Stop bit** • Selects the stop bit, in accordance with the stop bit of the host computer. • Selection item: 1 : 1 bit 2 : 2 bits

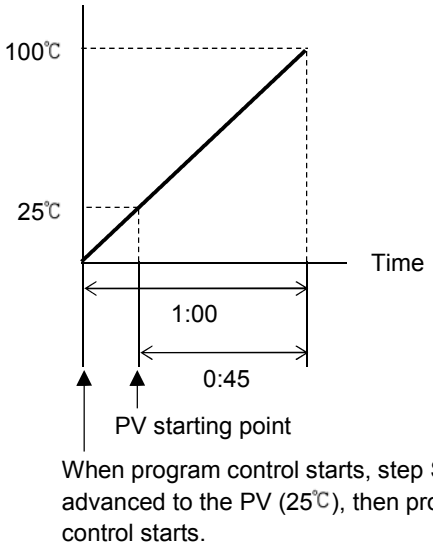
Character, Factory Default	Setting Item, Function, Setting Range
cMdy 10	**Response delay time** • Response from the controller can be delayed after receiving command from the host computer. If Response delay time is changed via software communication, the changed delay time will be reflected from that response data. • Setting range: 0 to 1000 ms

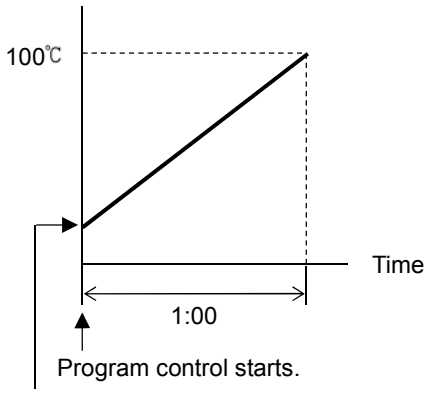
At this stage, settings of Communication parameter setting group are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to the Engineering setting group.
By pressing the SET/RST key, the unit returns to RUN mode.

7.5.7 Other Parameters Setting Group

In Other parameters setting group, the following can be set:
Set value lock, Program start Auto/Manual, Program control start type, Power restore action, etc.

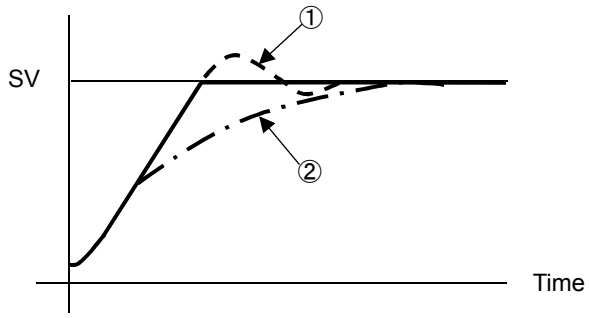
Setting items in the Other parameters setting group are shown below.

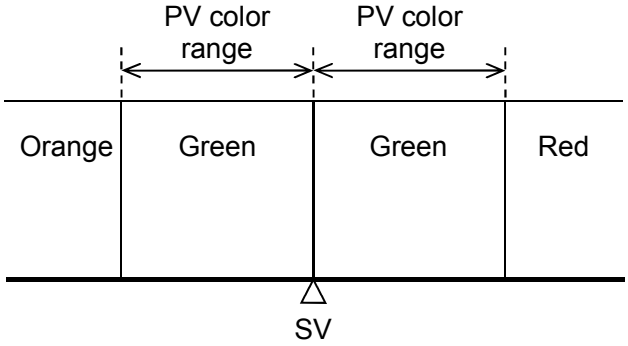
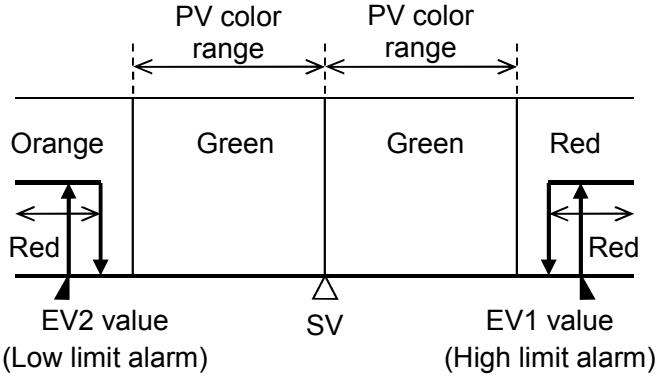
Character, Factory Default	Setting Item, Function, Setting Range
LocK -----	**Set value lock** • Selects either Unlock or Lock. • Selection item: ----- : Unlock LocK : Lock (None of the set values – except Set value lock – can be changed.)
5_MAN MANU	**Program start Auto/Manual** • Selects Program start Auto/Manual when power is turned ON. • Selection item: MANU : Manual start If the RUN key is pressed when power is turned on, and when in Program control Stop (in Standby), the selected pattern number program will be performed from Step 0. AUTo : Automatic start When power is turned on, the selected pattern number program will be automatically performed from Step 0.
5_5V 0	**Step SV when program control starts** • Sets SV when program control starts. • Setting range: SV low limit to SV high limit
5_5L PV	**Program control start type** • Selects program control start type. **PV start, PVR start**  When program control starts, step SV is advanced to the PV (25℃), then program control starts. (Fig. 7.5.7-1)

Character, Factory Default	Setting Item, Function, Setting Range
	SV start  Program control starts from the step SV which has been set in [Step SV when program control starts]. (Fig. 7.5.7-2) • Selection item: PV□□ : PV start Only when program control starts, the step SV is advanced to the PV, then program control starts. PVR□ : PVR start When program control starts and in pattern repeating, the step SV is advanced to the PV, then program control starts. SV□□ : SV start Program control starts from the step SV which has been set in [Step SV when program control starts].
□□ PREr□ □□ conT□	**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. Stops program control, and returns to Standby status. conT□ : Continues after power is restored. Continues (Resumes) previous program control after power is restored. HoLd□ : Suspends after power is restored. Suspends (on hold) current program control, and performs control using the step SV from the point of suspension. Pressing the RUN key cancels suspension, and Program control resumes.

Character, Factory Default	Setting Item, Function, Setting Range
M_t MIN	**Step time unit** • Selects the Step time unit. • Selection item: MIN : Hours:Minutes tSec : Minutes:Seconds
t_TM RT	**Step time indication** • During program control, selects step time indication type when the SV/MV/TIME Display is switched to TIME indication. • Selection item: RT : Remaining time Indicates remaining step time. TM : Step time Indicates step time which has been set.
t_TE tW	**Step SV indication** • During program control, selects step SV indication type when the SV/MV/TIME Display is switched to SV indication. • Selection item: tW : SV corresponding to the step time progress. Updates step SV corresponding to the step time progress. TtW : Step SV Indicates the step SV which has been set during program pattern setting.
PETM 0	**Pattern end output time** • Sets Pattern end output time after program control is finished. If Pattern end output is selected in [Event output EV□ allocation], pattern end output is turned ON after program control is finished, and the SV/MV/TIME Display flashes P.End□. Setting the time to 0 (zero) seconds causes continuous output, until the STOP/MODE key is pressed for 1 second, or until the power is turned OFF. By pressing the STOP/MODE key for 1 second, Pattern end output is turned OFF, and the unit returns to Program control Stop (in Standby). When set to 1 to 10000 seconds: Pattern end output is automatically turned OFF after Pattern end output time has elapsed, and the unit returns to Program control Stop (in Standby). • Setting range: 0 to 10000 seconds

Character, Factory Default	Setting Item, Function, Setting Range
PEH nrmP	**Step SV Hold function when program ends** • When program control ends, selects either 'Holding' or 'Not holding' of the Step SV Hold function. If 'Holding' is selected, the PTN Display flashes when program control ends, and control performs using the step SV of the last step. By pressing the STOP/MODE key for 1 second, the Step SV Hold function is cancelled, and the unit returns to Program control Stop (in Standby). • **How to set program pattern when 'Holding' is selected**: Set the last step values (of the program pattern in the Pattern setting group – except step time), to all steps which have not been set yet. Set the step time to 0:00. • Selection item: nrmP : Not Holding (of Step SV Hold function) Hold : Holding (of Step SV Hold function)
rt1 rt	**Time signal output TS1 / Status (RUN) output** • Selects either Time signal output or Status (RUN) output for Time signal output TS1. • Selection item: rt : Time signal output TS1 RUN : Status (RUN) output Available when Time signal output (TS option) is ordered.
rt2 rt	**Time signal output TS2 / Status (HOLD) output** • Selects either Time signal output or Status (HOLD) output for Time signal output TS2. • Selection item: rt : Time signal output TS2 Hold : Status (HOLD) output Available when Time signal output (TS option) is ordered.
rt3 rt	**Time signal output TS3 / Status (WAIT) output** • Selects either Time signal output or Status (WAIT) output for Time signal output TS3. • Selection item: rt : Time signal output TS3 WAIt : Status (WAIT) output Available when Time signal output (TS option) is ordered.
rt4 rt	**Time signal output TS4 / Status (FAST) output** • Selects either Time signal output or Status (FAST) output for Time signal output TS4. • Selection item: rt : Time signal output TS4 FASt : Status (FAST) output Available when Time signal output (TS option) is ordered.

Character, Factory Default	Setting Item, Function, Setting Range
r5S5 r5	**Time signal output TS5 / Status (STOP) output** • Selects either Time signal output or Status (STOP) output for Time signal output TS5. • Selection item: r5 : Time signal output TS5 5toP : Status (STOP) output Available when Time signal output (TS option) is ordered.
oSFN oFF	**Overshoot suppression Enabled/Disabled** • Selects overshoot suppression Enabled/Disabled. • Selection item: oFF : Disabled oN : Enabled
oSF 10.0	**Overshoot suppression factor** • Sets overshoot suppression factor. **[Overshoot suppression factor]** When overshoot or undershoot occurs at the step change point during program control, if overshoot suppression factor is set, overshoot or undershoot can be suppressed at the step change point. If overshoot occurs as ①, makes the overshoot suppression factor larger. When it takes time until control is stabilized as ②, makes the factor smaller.  (Fig. 7.5.7-3) • Setting range: 0.1 to 10.0 Available when Enabled is selected in [Overshoot suppression Enabled/Disabled].
EoUT oFF	**Output status when input errors occur** • Selects output status when input errors (overshoot or undershoot) occur. • Selection item: oFF : Output OFF oN : Output ON Available only for controllers using direct current and voltage inputs, and direct current output.
bKLT ALL	**Backlight selection** • Selects the display to backlight. • Selection item: ALL : All are backlit. PV : PV Display is backlit.

Character, Factory Default	Setting Item, Function, Setting Range
coLR RED	**PV color** • Selects PV Display color. • Selection item: GRN : Green RED : Red oRG : Orange ALGR : When any alarm (EV1 to EV4) is ON: Green ⟶ Red When alarm is OFF: Green When any alarm (EV1 to EV4) is ON: The PV color turns from green to red continuously according to the alarm. ALoR : When any alarm (EV1 to EV4) is ON: Orange ⟶ Red When alarm is OFF: Orange When any alarm (EV1 to EV4) is ON: The PV color turns from orange to red continuously according to the alarm. PVGR : PV color changes continuously. PV color changes continuously according to the PV color range. PV is lower than [SV – PV color range]: Orange PV is within [SV±PV color range]: Green PV is higher than [SV+PV color range]: Red  (Fig. 7.5.7-4) APGR : PV color changes continuously + Any alarm (EV1 to EV4) is ON: Red PV color changes continuously according to the PV color range. In addition, when any alarm (EV1 to EV4) is ON: PV color turns red. PV is lower than [SV – PV color range]: Orange PV is within [SV±PV color range]: Green PV is higher than [SV+PV color range]: Red Any alarm (EV1 to EV4) is ON: Red  (Fig. 7.5.7-5)

Character, Factory Default	Setting Item, Function, Setting Range
cLRG 5.0	**PV color range** • Sets PV color range depending on the user setting. • Setting range: Thermocouple, RTD input: 0.1 to 200.0℃ (℉) DC voltage, current input: 1 to 2000 (The placement of the decimal point follows the selection.) Available when PVCR (PV color changes continuously) or APCR[PV color changes continuously + Any alarm (EV1 to EV4) is ON: Red] is selected in [PV color].
dPTM 0	**Backlight time** • Sets time to backlight. Sets backlight time from no operation status until backlight is switched off. When set to 0, the backlight remains ON. Backlight relights by pressing any key while backlight is OFF. • Setting range: 0 to 99 minutes

At this stage, settings of Other parameters setting group are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to the Engineering setting group.
By pressing the SET/RST key, the unit returns to RUN mode.

7.6 Auto/Manual Control Switch Group

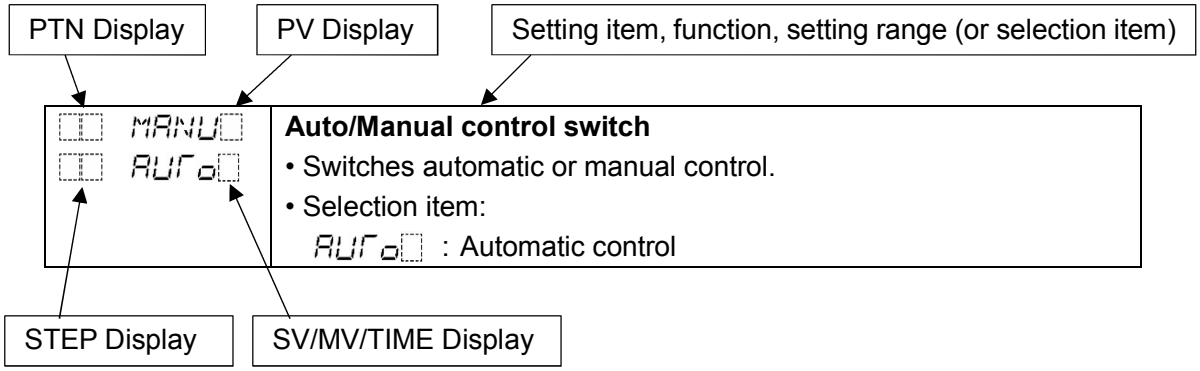
In Auto/Manual control switch group, Auto/Manual control can be switched.

• To Enter the Auto/Manual control switch group

Press the SET/RST key once in RUN mode, and press the STOP/MODE key 5 times. The PV Display indicates G_MAN, and the unit enters the Auto/Manual control switch group in Group selection mode.
Press the HOLD/ENT key in the Auto/Manual control switch group. The PV Display indicates MANU, and the unit enters 'Auto/Manual control switch'.

• Explanation of Setting Item

Upper left: PTN Display, PV Display
The PTN Display is unlit, and the PV Display indicates setting characters.
Lower left: STEP Display, SV/MV/TIME Display
The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.
Right side: Indicates the setting item, explanation of its function, and setting range.



Setting item in Auto/Manual control switch group is shown below.

Character, Factory Default	Setting Item, Function, Setting Range
MANU AUTo	**Auto/Manual control switch** • Switches automatic or manual control. If control action is switched from automatic to manual and vice versa, balanceless-bumpless function works to prevent a sudden change in MV. When control action is switched to manual control, the MAN and MV indicators light up, the STEP Display indicates M, and the SV/MV/TIME Display indicates the manual MV. Manual MV can be set with the PTN/▲ or ADV/▼ key. If control action is switched to automatic control, the SV/MV/TIME Display shows SV. • Selection item: AUTo : Auto (Automatic control) MANU : Manual (Manual control)

At this stage, settings of Auto/Manual control switch group are complete.
If the STOP/MODE and DISP/B.MODE keys are pressed at the same time, the unit returns to Group selection mode.
By pressing the SET/RST key, the unit returns to RUN mode.

7.7 Clearing the Setting Data

There are 2 methods in data clearing.

• Program Clearing:

Program pattern data of the selected step and all the following steps within the program pattern will be removed.

• Data Clearing:

All setting data – except Input type, OUT1 proportional cycle, OUT2 proportional cycle – will be cleared. Once data is mistakenly cleared, data should be entered again. Cleared data cannot be restored.

Clearing methods are shown below.

• Program Clearing

When program control is stopped (in Standby), and if the RUN key is pressed for 3 seconds at any items in Pattern setting group, program pattern data (for current step on the STEP Display and all the following steps) will return to the default value.

(e.g.)

To clear the program pattern data of Pattern 1 Step 3 and all the following steps:

Keep pressing the RUN key for approx. 3 seconds at any setting items of Pattern 1 Step 3.

All data of Pattern 1 Steps 3 to 15 will be cleared.

All data of Pattern 1 Steps 0 to 2 will not be cleared.

All data of Pattern 0 and Patterns 2 to 15 will not be cleared either.

• Data Clearing

When program control is stopped (in Standby), and if the PTN ▲, ADV ▼ and DISP B.MODE keys are pressed for approx. 3 seconds, the PV Display indicates cLR□, and all setting values – except Input type, OUT1 proportional cycle, OUT2 proportional cycle – will return to the default value. It takes approximately 30 seconds for data clear.

After data clearing is compete, cLR□ on the PV Display will disappear, and the unit will return to Program control Stop (in Standby).

8. Operation

8.1 Performing Program Control

8.1.1 Performing Program Control

(1) Before turning the power ON

Check Sections “3. Mounting to the Control Panel (pp.12, 13)” and “4. Wiring (p.14 to 23)” before turning the power ON.

(2) After turning the power ON

Set necessary items after turning the power ON.
Refer to Sections “5. Outline of Key Operation and Explanation of Groups (pp.24 to 29)”, “6. Basic Operating Procedure after Power ON and Setting Examples (pp.30 to 42)” and “7. Setting Items (pp.43 to 95)”.

(3) Selecting a pattern number to perform

There are 2 methods for selecting a pattern number to perform:
Using the PTN key, or using Event input
Selection with Event input has priority over selection with the PTN key.

• Using the PTN key

Select a pattern from 0 – 15 in Program control Stop (in Standby) with the PTN key.

• Using Event input

Select a pattern from 0 – 15, depending on Closed (ON) or Open (OFF) status of any terminal (Event input DI1 to DI4) and the COM terminal.

If Serial communication (C or C5 option) is ordered, only Event input DI1 and DI2 can be used. Select a pattern from 0 – 3 by means of Closed (ON) or Open (OFF) status of any terminal (Event input DI1 or DI2) and the COM terminal.
To select a pattern from 4 – 15, press the PTN key.

Level action is used to determine ON or OFF.
When power is turned ON, level action is engaged.

Event Input DI1 to DI4:

Select a performing pattern by closing any one terminal (DI1 to DI4) and the COM terminal.
●: Close any one terminal (DI1 – DI4) and the COM terminal.
(e.g.) To select pattern 7 to perform, close ⑪ & ⑮, close ⑫ & ⑮, and close ⑬ & ⑮.

(Table 8.1.1-1)

Pattern No. / Terminal No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
⑪ DI1		●		●		●		●		●		●		●		●
⑫ DI2			●	●			●	●			●	●			●	●
⑬ DI3					●	●	●	●					●	●	●	●
⑭ DI4									●	●	●	●	●	●	●	●

Event Input DI1 and DI2:

Select a performing pattern by closing any one terminal (DI1 or DI2) and the COM terminal.

●: Close DI1 or DI2 terminal and the COM terminal.

(e.g.) To select pattern 3 to perform, close ⑪ & ⑮, and close ⑫ & ⑮.

(Table 8.1.1-2)

Pattern No. / Terminal No.	0	1	2	3
⑪ DI1		●		●
⑫ DI2			●	●

(4) Perform Program Control

Automatic or manual start can be selected to perform program control.

Factory default value: Manual start

Manual start: When power is turned ON, and when in Program control Stop (in Standby) status, the program pattern selected at (3) performs from Step 0, by pressing the RUN key.

Automatic start: When power is turned ON, the program pattern selected at (3) automatically performs from Step 0.

For Manual start, there are 2 ways to start program control:

Using the RUN key, or using External operation input.

• Using the RUN key

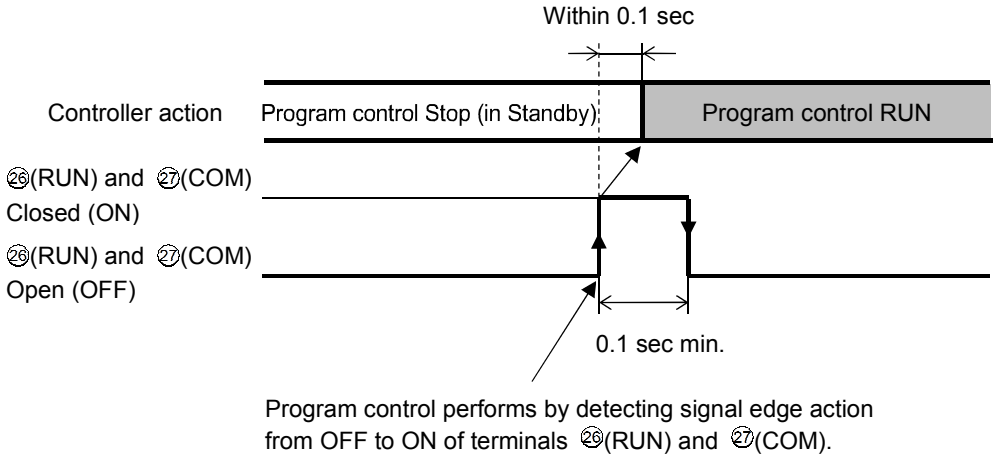
Press the RUN key in Program control Stop (in Standby).

Program control starts.

• Using External operation input

Close terminals ㉖(RUN) and ㉗(COM) of External operation input.

Program control starts.



(Fig. 8.1.1-1)

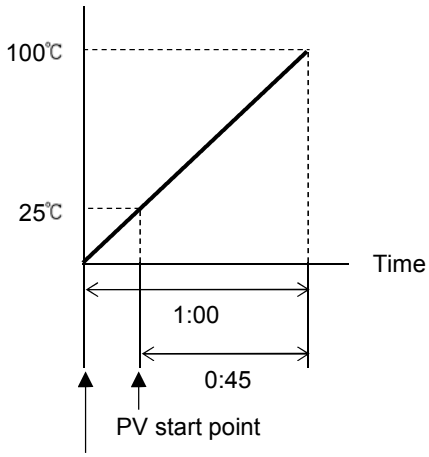
[Program control start type]

Program control start type can be selected in [Program control start type].

PV start:

Only when program control starts, step SV and step time are advanced to the PV, then program control starts.

However, if step SV 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 [Step SV when program control starts].



When program control starts,
step SV is advanced to PV (25℃).

(Fig. 8.1.1-2)

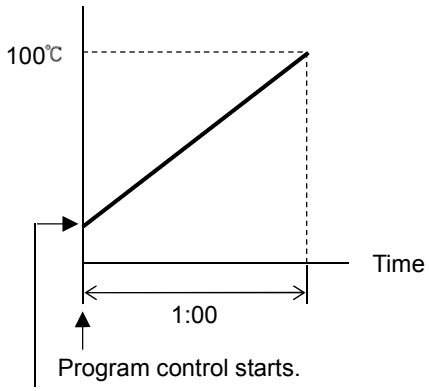
PVR start:

When program control starts and in pattern repeating, the step SV and step time are advanced to the PV, then the program control starts.

Action is the same as that of PV start. Refer to (Fig. 8.1.1-2).

SV start:

Program control starts from the SV set in [Step SV when program control starts].



Program control starts from the SV set in
[Step SV when program control starts].

(Fig. 8.1.1-3)

[Power Restore Action]

If power fails during program control, the controller can be operated depending on the selection in [Power restore action].

Progressing time error when power is restored: 1 minute

- Stops after power is restored:
  After power is restored, stops program control, and returns to Standby mode.

- Continues after power is restored:
  After power is restored, continues (Resumes) program control.

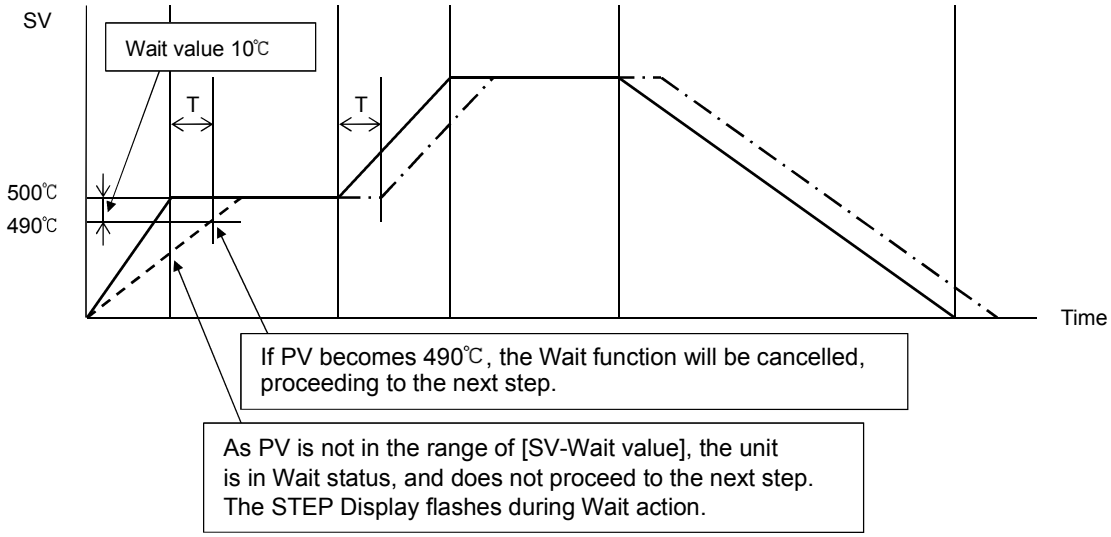
- Suspends after power is restored:
  After power is restored, suspends (on hold) current program, and performs Fixed value control using the step SV from the point of suspension.
  Pressing the RUN key cancels suspension, and program control resumes.

[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 STEP Display flashes while the Wait function is working.

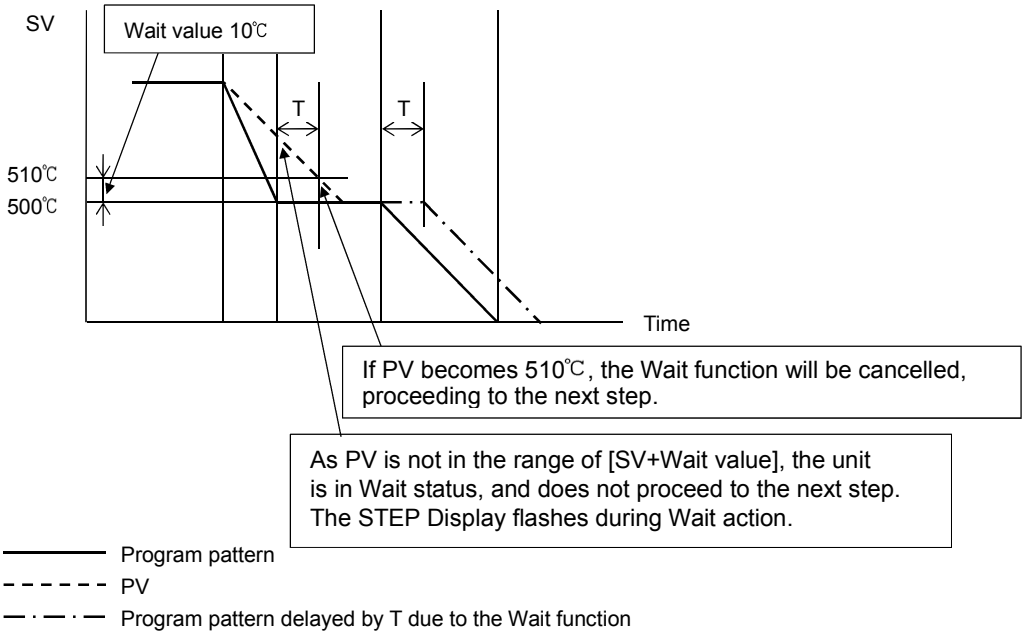
Explanation of Wait function

• When program pattern is rising:



(Fig. 8.1.1-4)

• When program pattern is falling:



(Fig. 8.1.1-5)

• How to cancel the Wait function

Cancel the Wait function by pressing the ADV/▼ or STOP/MODE key.

The Wait function can also be cancelled by [ADV] input or [STOP] input of External operation.

8.1.2 Stopping Program Control

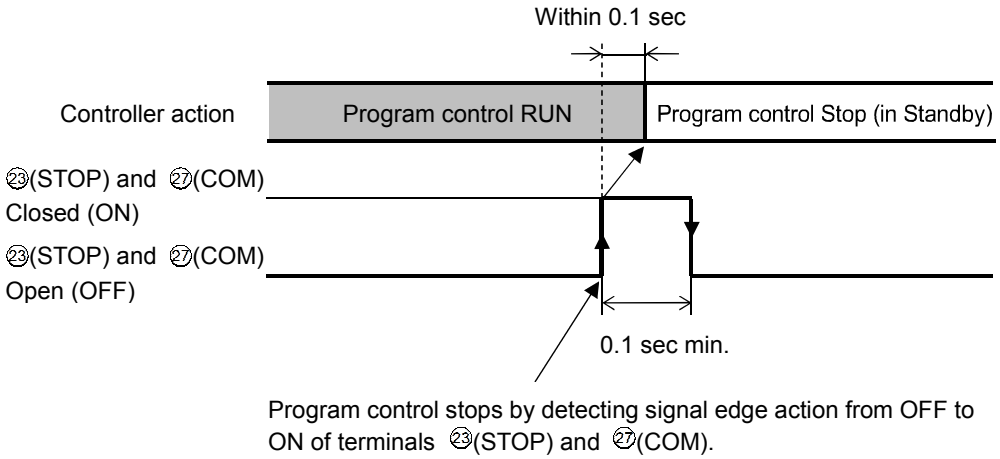
To stop program control, press the STOP/MODE key, or use External operation input.

• Using the STOP/MODE key

Press the STOP/MODE key for approximately 1 second during program control.
Program control will stop.

• Using External operation input

Close terminals ㉓(STOP) and ㉗(COM) of External operation input.
Program control will stop.



(Fig. 8.1.2-1)

8.1.3 Suspending Program Control (Hold Function)

During program control, progress of current step can be suspended (paused).
Pressing the RUN key cancels suspension, and program control resumes.
During manual control, suspension cannot be cancelled.

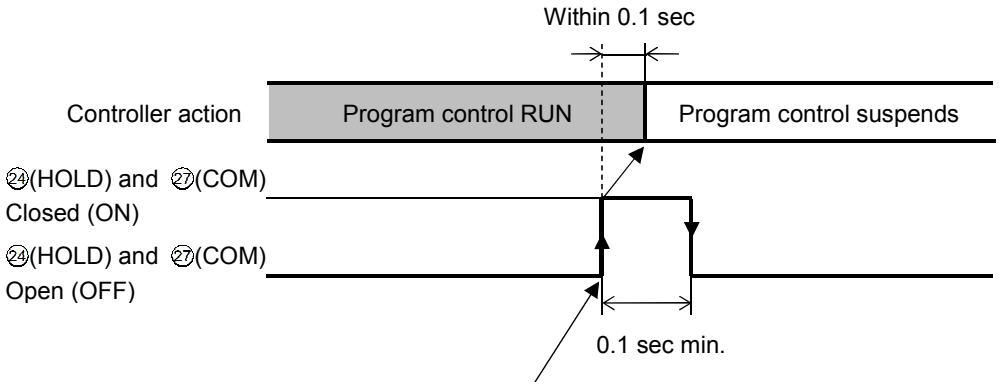
To suspend program control, there are 2 methods:
Using the HOLD/ENT key, or using External operation input

• Using the HOLD/ENT key

Pressing the HOLD/ENT key during program control.
Progress of current step is suspended, and then Fixed value control is performed using the SV from the point of suspension.
The HOLD indicator flashes.

• Using External operation input

Close terminals ㉔(HOLD) and ㉗(COM) of External operation input.
Progress of current step is suspended, and then Fixed value control is performed using the SV at the point of suspension.
The HOLD indicator flashes.



(Fig. 8.1.3-1)

8.1.4 Advancing Program Step (Advance Function)

Interrupts current step while program control is running, and proceeds to the beginning of the next step.
While the Wait function is working, the Wait function is cancelled, and proceeds to the beginning of the next step.

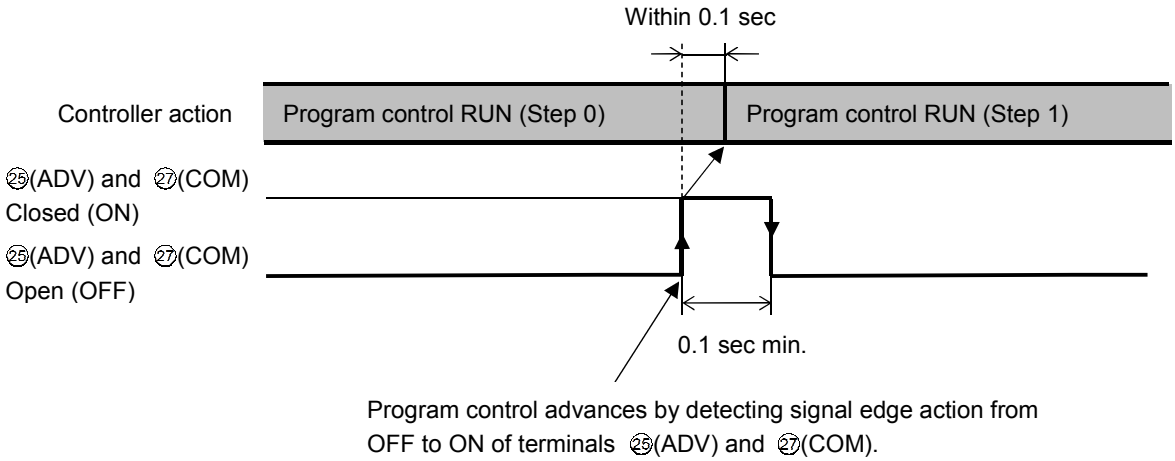
To advance program step, there are 2 methods:
Using the ADV key, or using External operation input

• Using the ADV key

Press the ADV key during program control.
Current step is stopped, and the unit proceeds to the beginning of the next step.
Each time the ADV key is pressed, the unit proceeds to the next step.

• Using External operation input

Close terminals ㉕(ADV) and ㉗(COM) of External operation input.
Current step is stopped, and the unit proceeds to the beginning of the next step.
Each time terminals㉕(ADV) and ㉗(COM) are open and closed, the unit proceeds to the next step.



(Fig. 8.1.4-1)

8.1.5 Returning to Previous Program Step (Return to Previous Function)

Stops the current step in program control, and returns to the previous step.

If the elapsed time of the current step is less than 1 minute, the program control returns to the beginning of the previous step.

If the elapsed time of the current step is longer than 1 minute, the program control returns to the beginning of the current step.

When this function is executed at Step 0 of starting pattern, this function is disabled, but returns to the beginning of Step 0.

To return to the previous step, press PTN ▲ and ADV ▼ keys (in that order) together.

Current step stops, and the unit returns to the previous step or the beginning of the current step.

8.1.6 Speeding up Program Step Time (Step Time Speed-up Function)

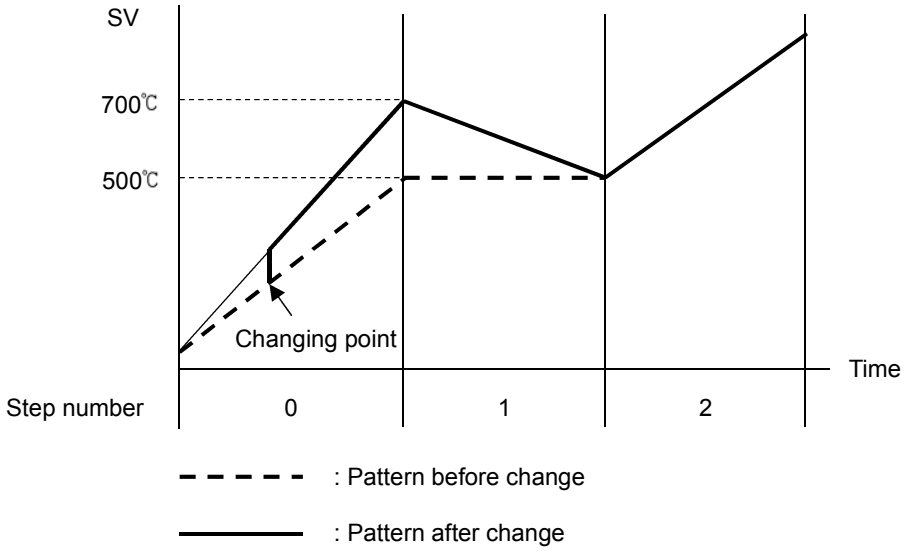
To make program step time progress faster, press the FAST key.
Pressing the FAST key makes the step time progress 60 times faster.

If the Wait function is set, this function will be disabled as the Wait function has priority.

8.1.7 Changing Program Step SV and Step Time

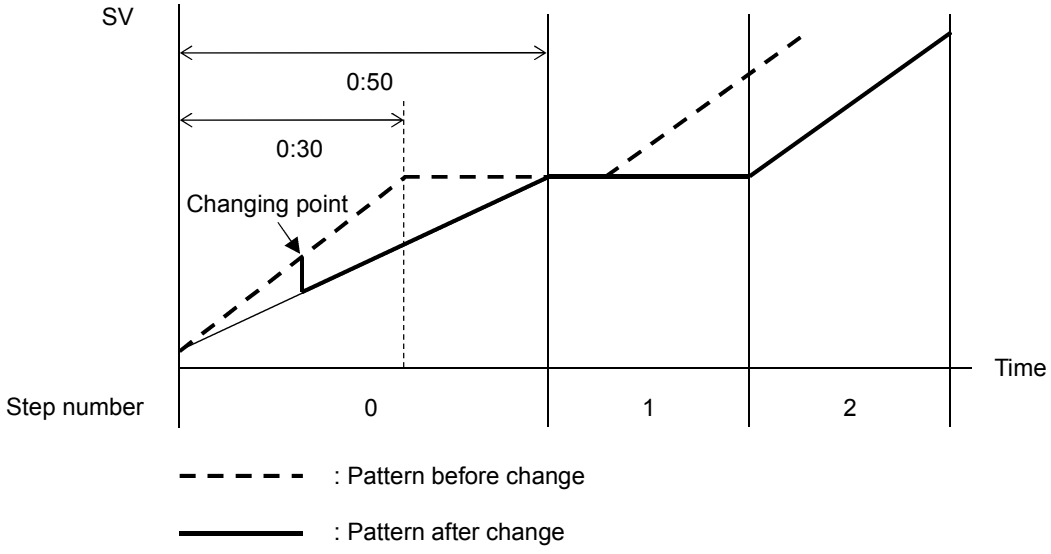
When step SV and step time are changed during program control, they will change as follows.

• When changing step SV from 500 to 700℃



(Fig. 8.1.7-1)

• When changing step time from 0:30 to 0:50



(Fig. 8.1.7-2)

8.1.8 Ending Program (Pattern End Function)

If Pattern end output is selected in [Event output EV□ allocation], Pattern end output is turned ON after program control is finished, and the SV/MV/TIME Display flashes P.END□.

By pressing the STOP/MODE key for approximately 1 second, Pattern end output is turned OFF, and the unit returns to Program control Stop (in Standby).

If Pattern end output time is set, Pattern end output is automatically turned OFF after Pattern end output time has expired. And the unit returns to Program control Stop (in Standby).

[Step SV Hold function when program ends]

If 'Holding' is selected in [Step SV Hold function when program ends], the PTN Display flashes when program control ends, and control performs using the step SV of the last step.

By pressing the STOP/MODE key for approximately 1 second, this function will be cancelled, and the unit returns to Program control Stop (in Standby).

If 'Holding' is selected in [Step SV Hold function when program ends] when program control ends, the PTN Display flashes, and control is performed using the step SV of the last step.

If 'Not Holding' is selected in [Step SV Hold function when program ends] while Step SV Hold function is working, the program will be forced to stop.
If Pattern end output is selected in [Event output EV□ allocation], Pattern end output is turned ON after program control is finished, and the SV/MV/TIME Display flashes P.END□.

8.2 Performing Fixed Value Control

8.2.1 Performing Fixed Value Control

Fixed value control (control action that indicating controllers are performing) is performed using the set step SV.

To perform Fixed value control, set the step time (of the desired step SV) to -:--:--.

(e.g.) Set the step SV (of Pattern 0, Step 0) to 500℃, and set the step time to -:--:--.

Press the RUN key. Fixed value control is performed at 500℃.

(1) Before turning the power ON

Check Sections “3. Mounting to the Control Panel (pp.12, 13)” and “4. Wiring (pp.14 to 23)” before turning the power ON.

(2) After turning the power ON

Set necessary items after turning the power ON.

Refer to Sections “5. Outline of Key Operation and Explanation of Groups (pp.24 to 29)”, “6. Basic Operating Procedure after Power ON and Setting Examples (pp. 30 to 42)” and “7. Setting Items (pp.43 to 95)”.

To perform Fixed value control. set the step SV and step time for the desired pattern.

To set the step time, press the ADV ▼ key at 0:00. -:--:-- will be selected.

Select the PID block number, Alarm block number and Output block number.

During Fixed value control, Time signal block number and Wait block number are disabled.

(3) Selecting a pattern number to perform

There are 2 methods for selecting a pattern number to perform:

Using the PTN ▲ key, or using Event input

Selection with Event input has priority over selection with the PTN ▲ key.

• Using the PTN ▲ key

Select a pattern from 0 – 15 for which step time is set to -:--:-- at (2) in Program control Stop (in Standby), using the PTN ▲ key.

• Using Event input

Select a pattern from 0 – 15 for which step time is set to -:--:-- at (2), depending on Closed (ON) or Open (OFF) status of any terminal (DI1 to DI4) and the COM terminal.

If Serial communication (C or C5 option) is ordered, only Event input DI1 and DI2 can be used.

Select a pattern from 0 – 3 for which step time is set to -:--:-- at (2), by means of Closed (ON) or Open (OFF) status of DI1 or DI2 terminal and the COM terminal.

To select a pattern from 4 – 15, press the PTN ▲ key.

Level action is used to determine ON or OFF.

When power is turned ON, level action is engaged.

Event Input DI1 to DI4:

Select a pattern for which step time is set to -:--:-- at (2), by closing any one terminal (DI1 – DI4) and the COM terminal.

●: Close any one terminal (from DI1 – DI4) and the COM terminal.

(e.g.) To select Pattern 7 to perform, close ⑪ & ⑮, close ⑫ & ⑮, and close ⑬ & ⑮ respectively.

(Table 8.2.1-1)

Pattern No. / Terminal No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
⑪ DI1		●		●		●		●		●		●		●		●
⑫ DI2			●	●			●	●			●	●			●	●
⑬ DI3					●	●	●	●					●	●	●	●
⑭ DI4									●	●	●	●	●	●	●	●

Event Input DI1 and DI2:

Select a pattern for which step time is set to -:-:-:-:- at (2), by closing DI1 or DI2 terminal and the COM terminal.

●: Close DI1 or DI2 terminal and the COM terminal.

(e.g.) To select Pattern 3 to perform, close ⑪ & ⑮, and close ⑫ & ⑮ respectively.

(Table 8.2.1-2)

Pattern No. / Terminal No.	0	1	2	3
⑪ DI1		●		●
⑫ DI2			●	●

(4) Execute Fixed Value Control

There are 2 ways to execute Fixed value control:

Using the RUN key, or using External operation input

• Using the RUN key.

Press the RUN key in Program control Stop (in Standby).

The step, for which step time is set to -:-:-:-:- at (2), is held, and

Fixed value control is performed using step SV.

The RUN indicator flashes during Fixed value control.

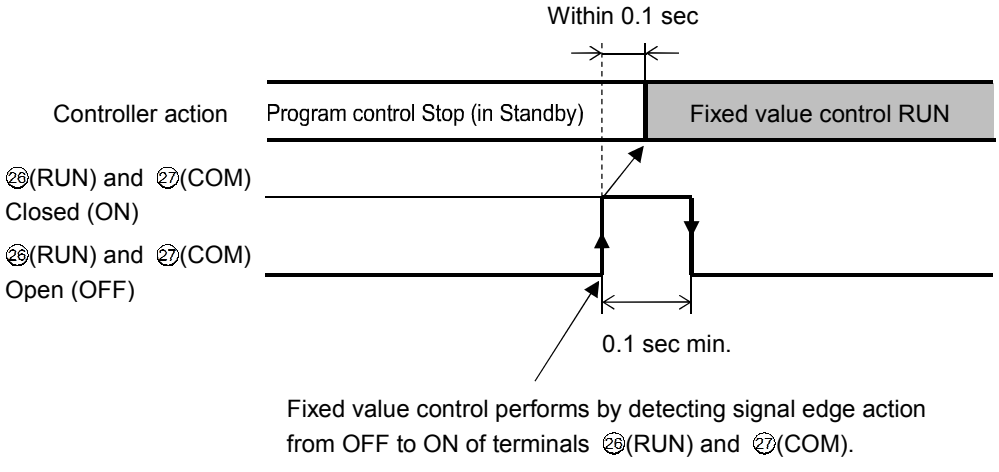
• Using External operation input

Close terminals ㉖(RUN) and ㉗(COM) of External operation input.

The step, for which step time is set to -:-:-:-:- at (2), is held, and

Fixed value control is performed using step SV.

The RUN indicator flashes during Fixed value control.



(Fig. 8.2.1-1)

8.2.2 Finishing Fixed Value Control

There are 2 ways to finish Fixed value control:

Using the STOP/MODE key, or using External operation input

• Using the STOP/MODE key

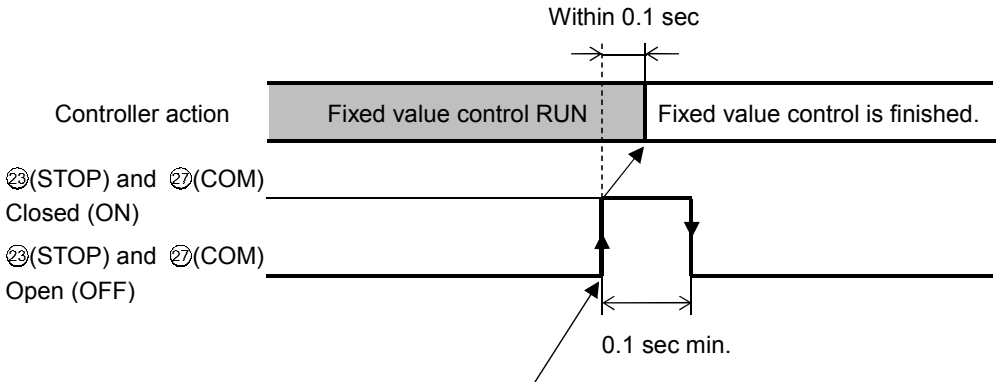
Press the STOP/MODE key for approximately 1 second during Fixed value control.

Fixed value control will stop, and the unit will revert to Program control Stop (in Standby).

• Using External operation input

Close terminals ㉓(STOP) and ㉗(COM) of External operation input.

Fixed value control will stop, and the unit will revert to Program control Stop (in Standby).



(Fig. 8.2.2-1)

8.3 Switching Auto/Manual Control

Auto/Manual control can be selected in [Auto/Manual control switch] in the Auto/Manual control switch group.

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

- When control action is switched from automatic to manual, the MV before switching will become the default value for the manual control.
- When control action is switched from manual to automatic, the MV before switching will be the default value for the automatic control.

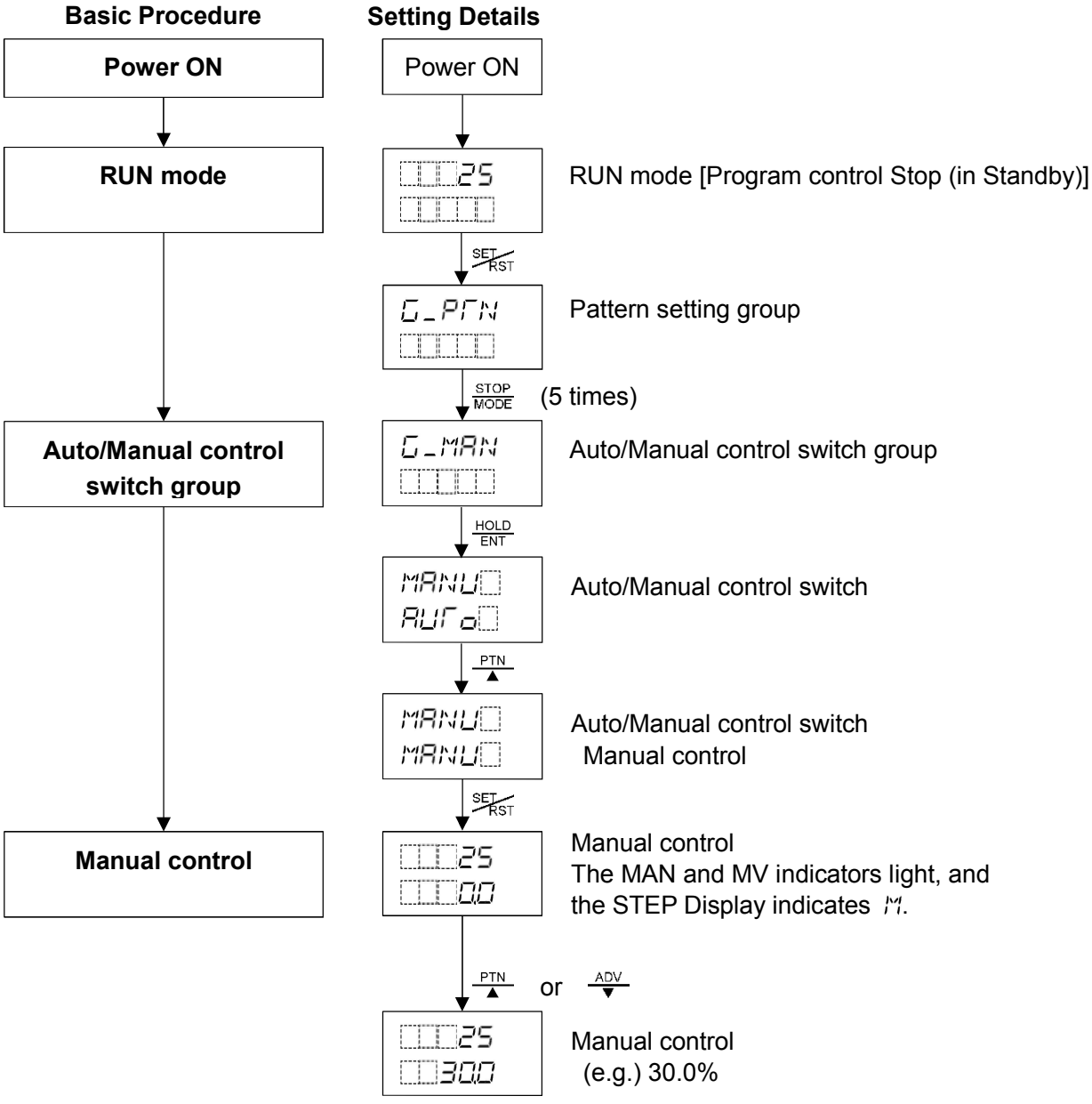
8.3.1 Switching to Manual Control

To switch to Manual control, select "MANU (Manual)" in [Auto/Manual control switch], and press the SET/RST key.

When control action is switched to manual, the MAN and MV indicators light up, the STEP Display indicates M, and the SV/MV/TIME Display indicates the MV.

To increase or decrease the MV, use the PTN or ADV key.
Pressing the PTN or ADV key and FAST keys at the same time, makes MV change faster.
MV setting range: [Output block 0 OUT1 low limit] to [Output block 0 OUT1 high limit]
When Heating/Cooling control (DR, DS or DA option) is ordered:
[–(Output block 0 OUT2 high limit)] to [Output block 0 OUT1 high limit]

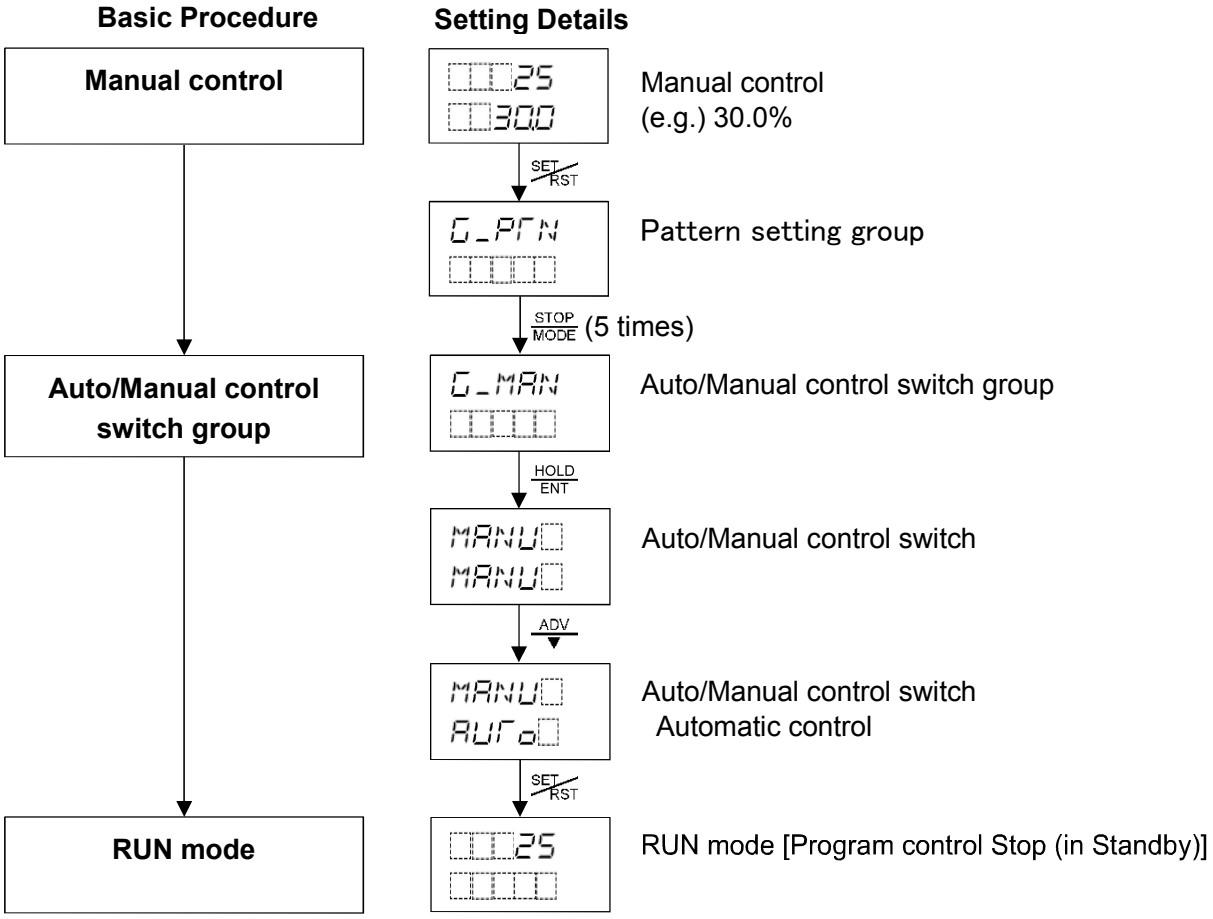
Performs Manual control using the increased/decreased MV.



8.3.2 Switching to Automatic Control

To switch to Automatic control, select "AUTo (Automatic)" in [Auto/Manual control switch], and press the SET/RST key.

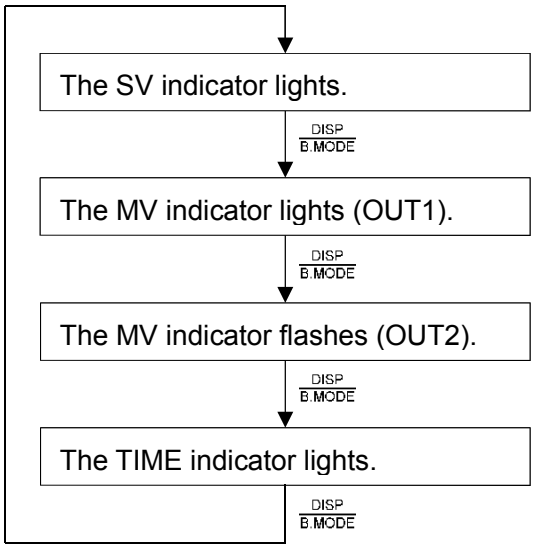
When control action is switched to automatic, the SV/MV/TIME Display shows SV.



8.4 Switching the SV/MV/TIME Display

To switch the SV/MV/TIME Display, use the DISP/B.MODE key.
Each time the DISP/B.MODE key is pressed, the display and indicators change as follows.

[Program control]



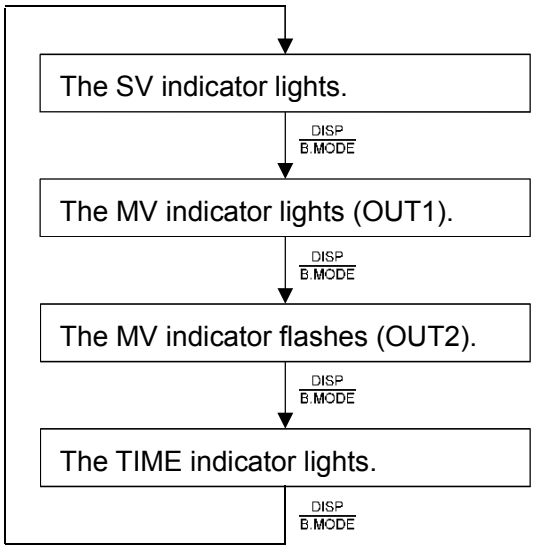
The SV/MV/TIME Display indicates step SV.

The SV/MV/TIME Display indicates OUT1 MV.

The SV/MV/TIME Display indicates OUT2 MV.
When Heating/Cooling control (DR, DS or DA option) is ordered.

The SV/MV/TIME Display indicates step time.

[Fixed value control]



The SV/MV/TIME Display indicates SV.

The SV/MV/TIME Display indicates OUT1 MV.

The SV/MV/TIME Display indicates OUT2 MV.
When Heating/Cooling control (DR, DS or DA option) is ordered.

The SV/MV/TIME Display indicates -----.

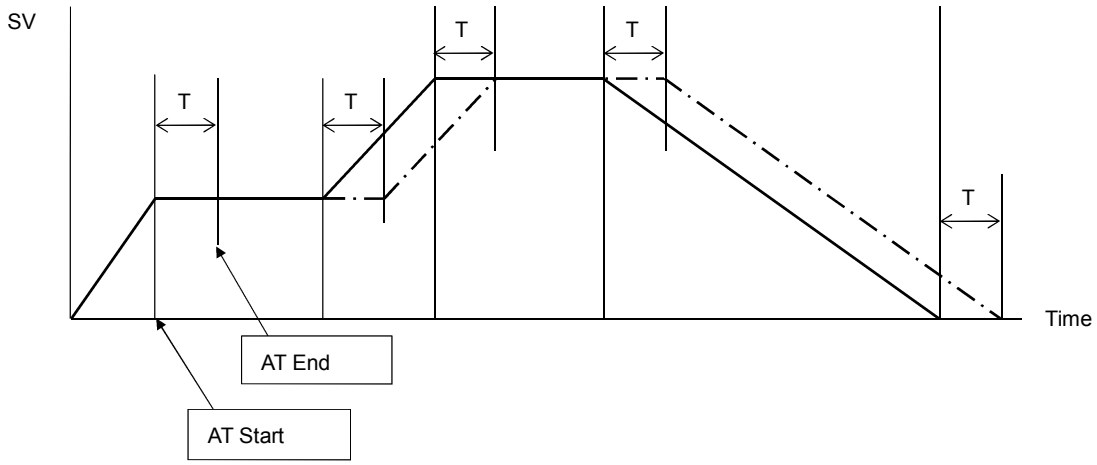
8.5 Performing AT

8.5.1 Notice when Performing AT

- Perform the AT during the trial run.
- AT will be disabled if Lock (Lock) is selected in [Set value lock].
- During AT, none of the setting items – except [AT Perform/Cancel] – can be set.
- If AT is cancelled during the process, OUT1 proportional band, Integral time, Derivative time, ARW and OUT2 proportional band will revert to the values before AT was performed.
  AT will be forced to stop if it has not been completed within 4 hours.
  OUT1 proportional band, Integral time, Derivative time, ARW and OUT2 proportional band will revert to the values before AT was performed.

[Notice when performing AT during Program control RUN]

- If AT is performed, AT starts from the AT starting point, and step time does not progress until AT finishes. After AT finishes, remaining step will be performed.



T : Time delay due to AT

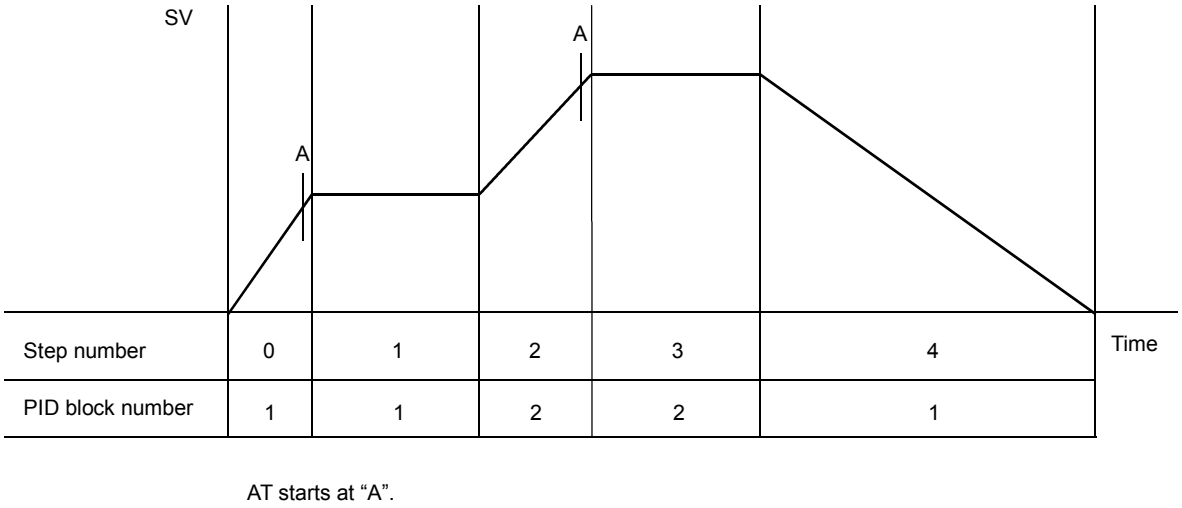
——— : Program pattern before AT is performed.

—·—·- : Program pattern after AT is performed.

(Fig. 8.5.1-1)

• When NoML (Normal mode) is selected in [AT mode], manually perform AT for every step which has different PID block number.

• When MULT (Multi mode) is selected in [AT mode], AT is automatically performed at A (a point where 90% of step progress time has elapsed at each step).
However, when there are same PID block numbers within 1 pattern as shown in (Fig. 8.5.1-2):
PID block 1 is used for steps 0, 1 and 4.
PID block 2 is used for steps 2 and 3.
AT will be performed at steps 0 and 2.
AT will not be performed at steps 1, 3 and 4.



(Fig. 8.5.1-2)

When AT is performed in Multi mode, the AT indicator lights in AT standby, and flashes while AT is performing. After AT finishes at each step, the following values are automatically set for the PID block selected for each step:
OUT1 proportional band, Integral time, Derivative time, ARW, OUT2 proportional band

During Fixed value control, multi mode is disabled.

8.5.2 AT Action

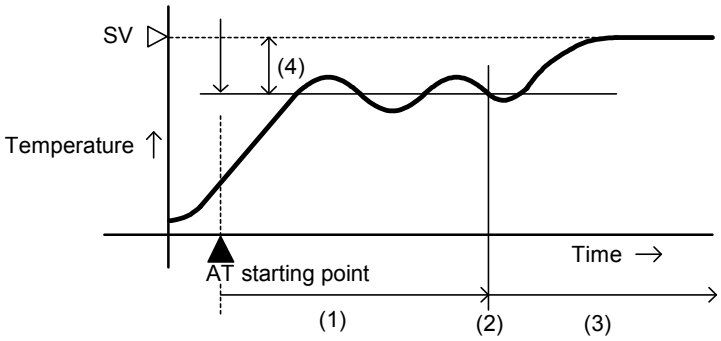
In order to set each value of P, I, D and ARW automatically, the AT process should be made to fluctuate to obtain an optimal value.

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

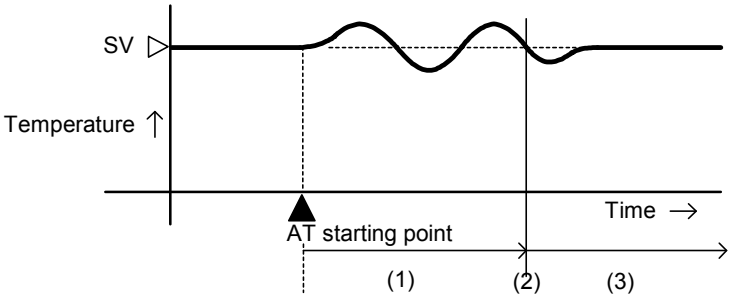


(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by AT.
(4) AT bias value (Factory default: 20℃)

(Fig. 8.5.2-1)

[B] When the control is stable

The AT process will fluctuate around the SV.

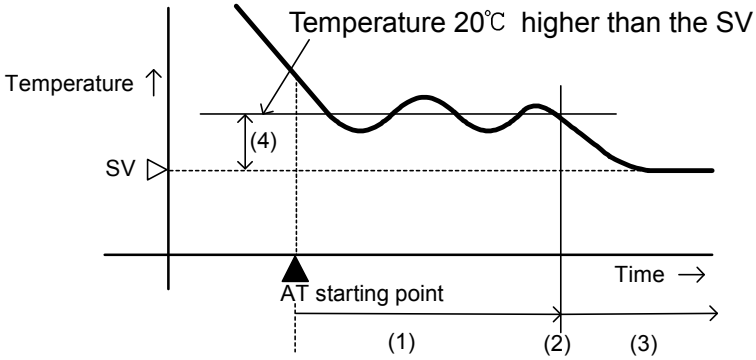


(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by AT.

(Fig. 8.5.2-2)

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

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

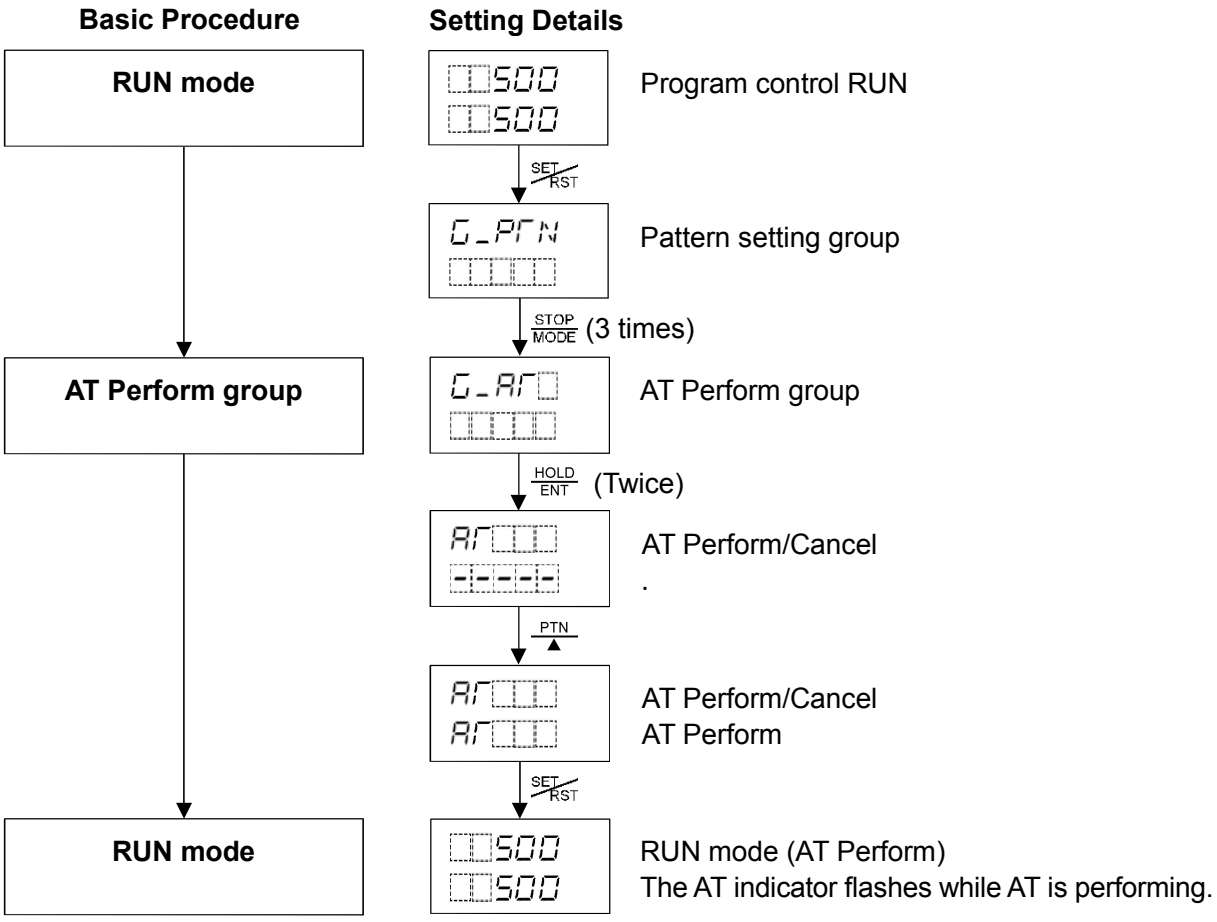


(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by AT.
(4) AT bias value (Factory default: 20℃)

(Fig. 8.5.2-3)

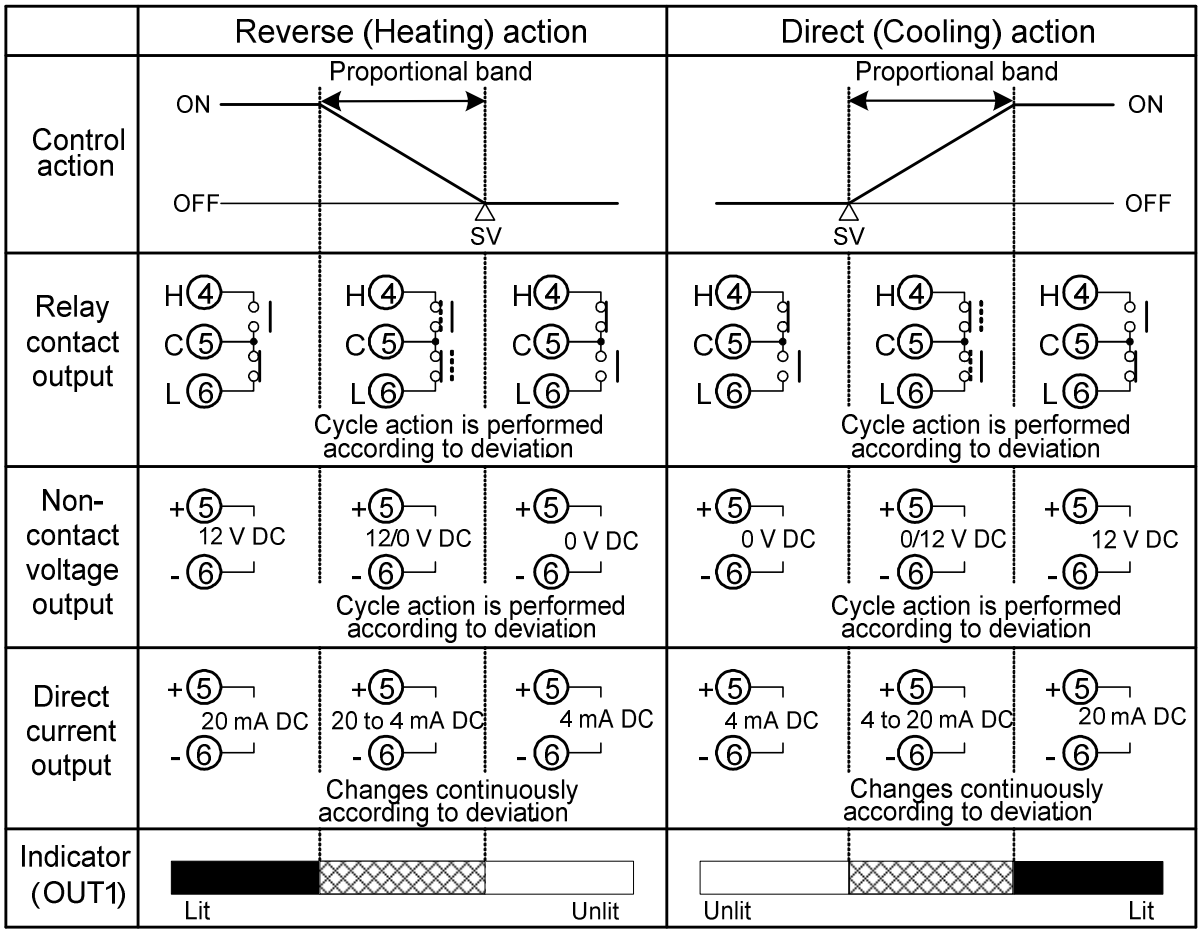
8.5.3 Performing AT

To perform AT, select AT□□ (AT Perform) in [AT Perform/Cancel] in the AT Perform group. And press the SET/RST key.



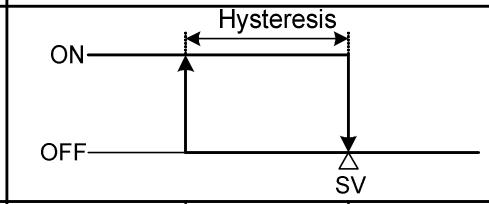
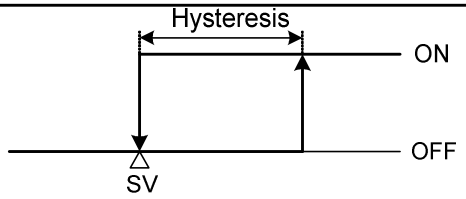
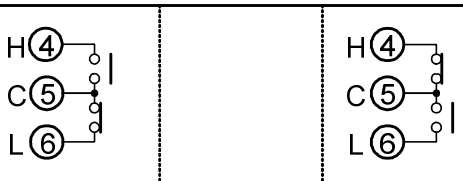
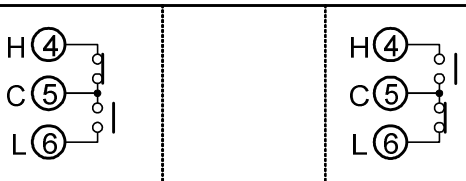
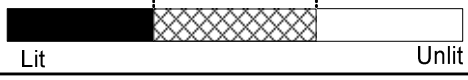
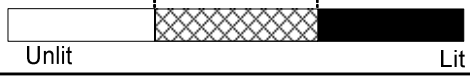
9. Action Explanation

9.1 OUT1 Action



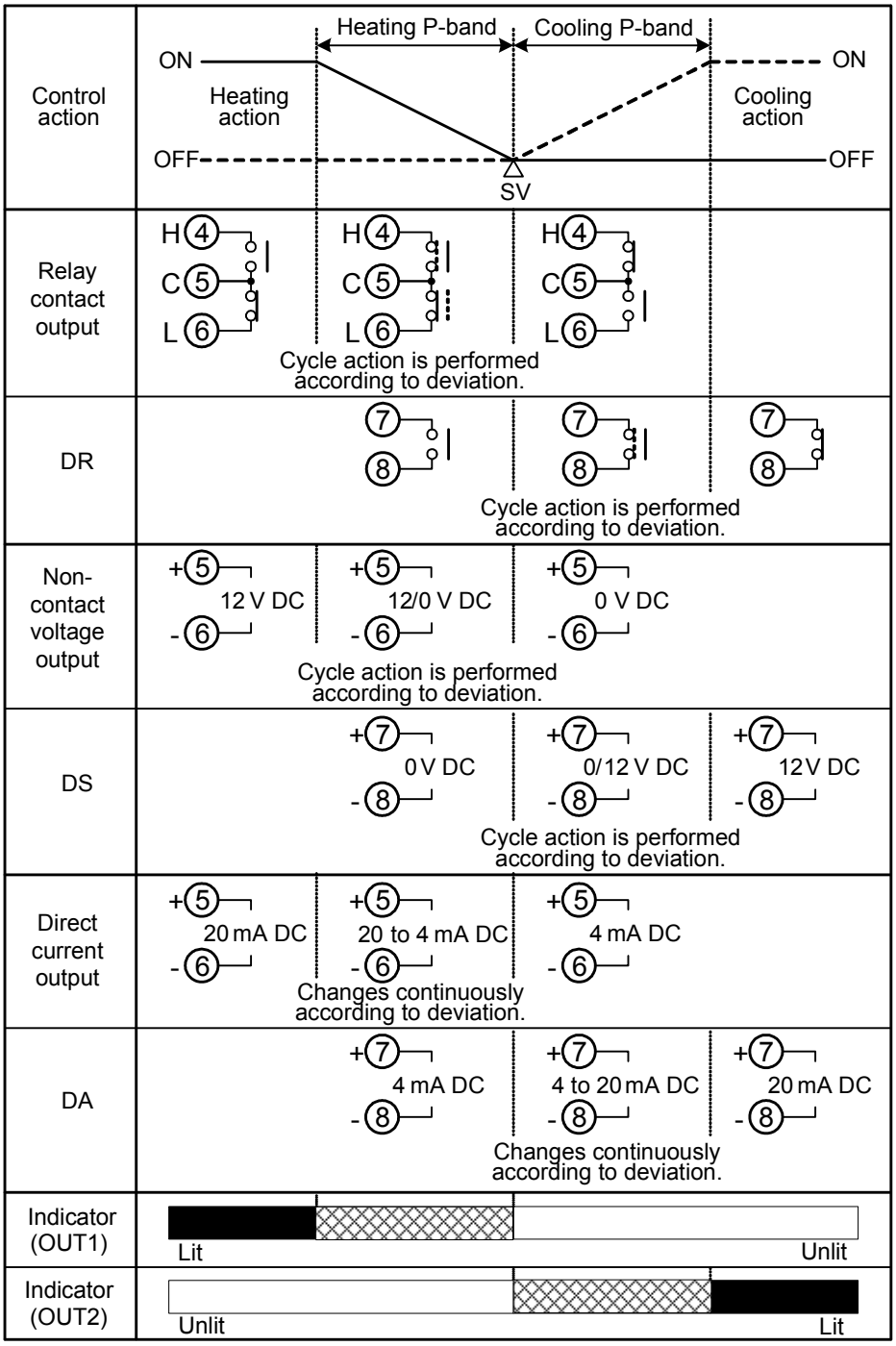
: Turns ON (lit) or OFF (unlit).

9.2 OUT1 ON/OFF Control Action

	Reverse (Heating) action	Direct (Cooling) action
Control action		
Relay contact output		
Non-contact voltage output		
Direct current output		
Indicator (OUT1)		

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

9.3 OUT2 (Heating/Cooling Control) Action

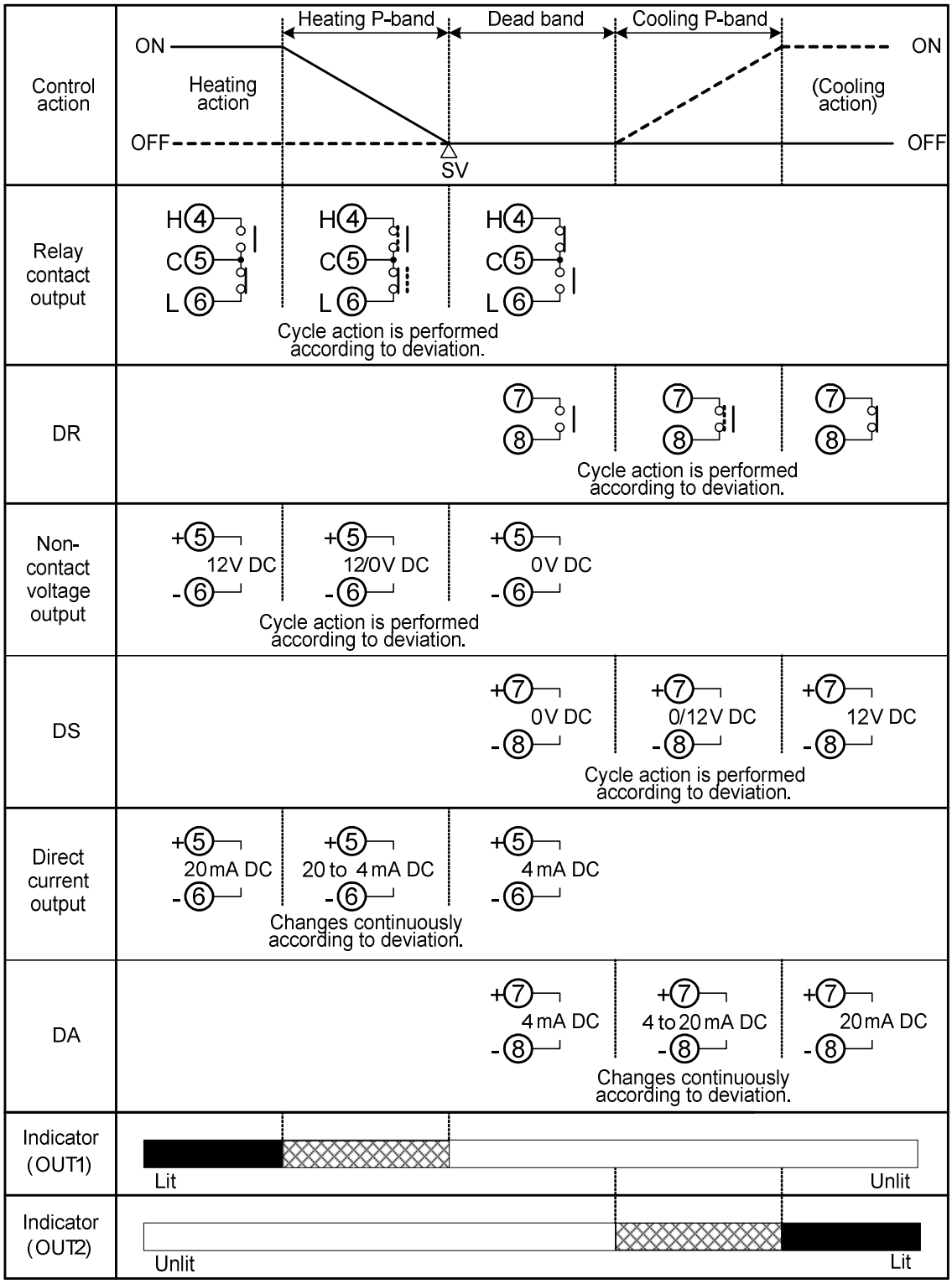


: Turns ON (lit) or OFF (unlit).

——— : Represents Heating control action.

- - - - - : Represents Cooling control action.

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

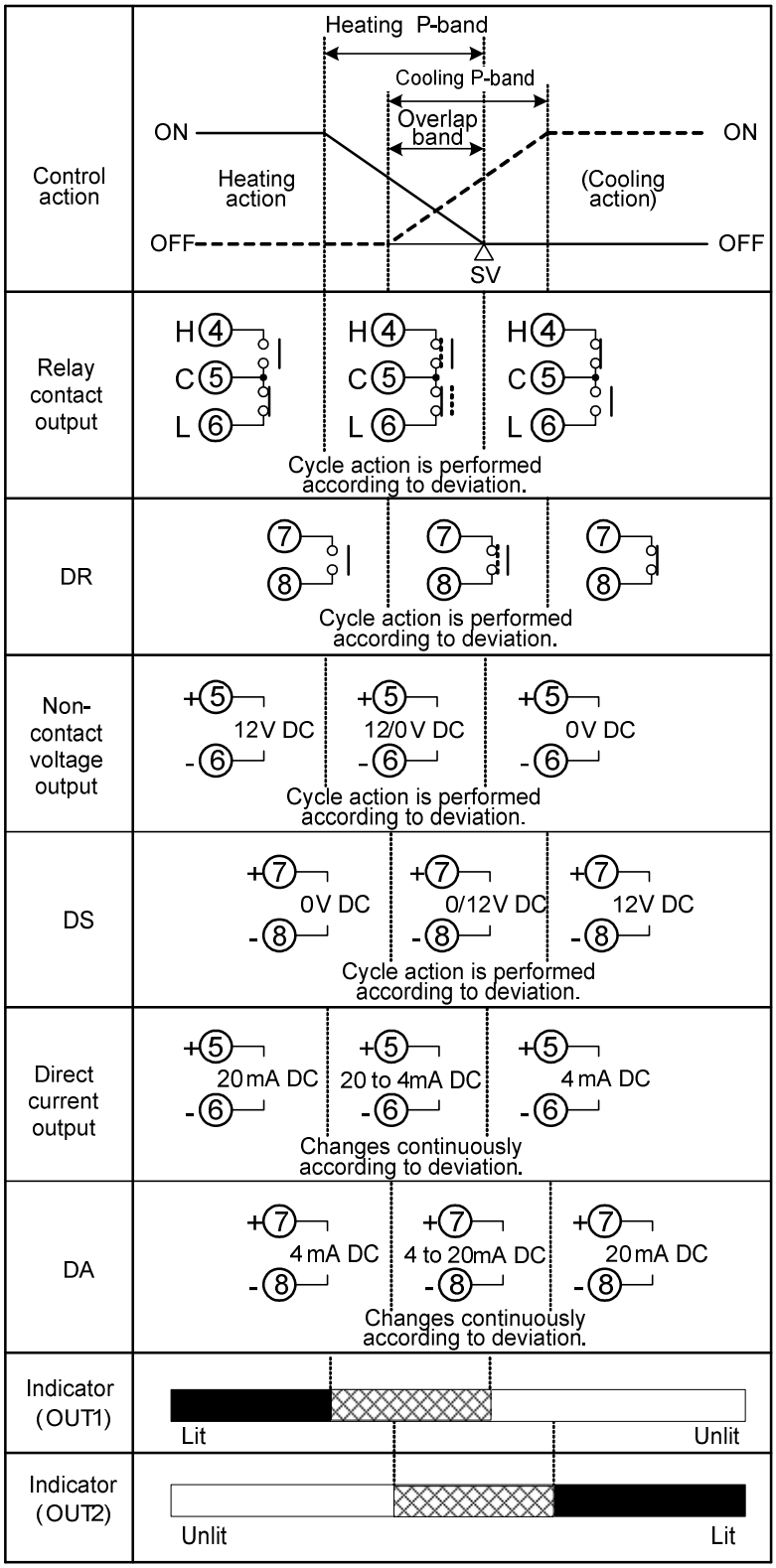


: Turns ON (lit) or OFF (unlit).

——— : Represents Heating control action.

- - - - : Represents Cooling control action.

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



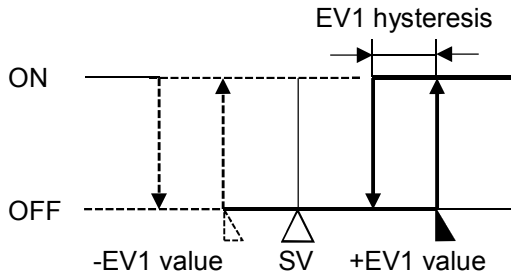
: Turns ON (lit) or OFF (unlit).

——— : Represents Heating control action.

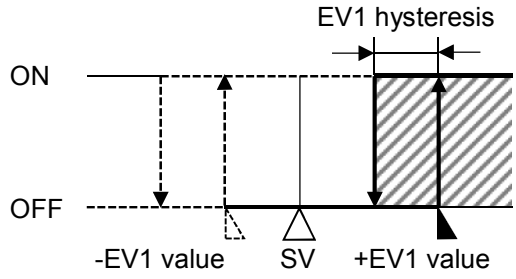
- - - - : Represents Cooling control action.

9.6 Alarm Action

• High limit alarm

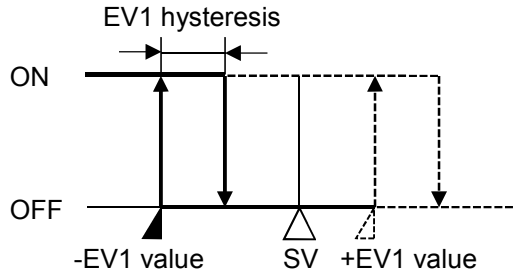


• High limit with standby alarm

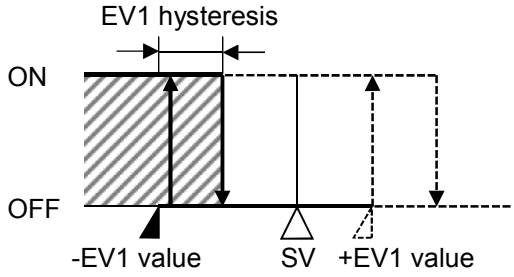


Alarm output is in standby.

• Low limit alarm

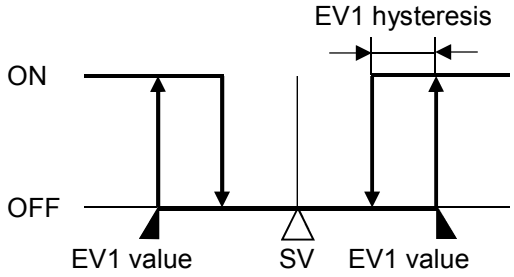


• Low limit with standby alarm

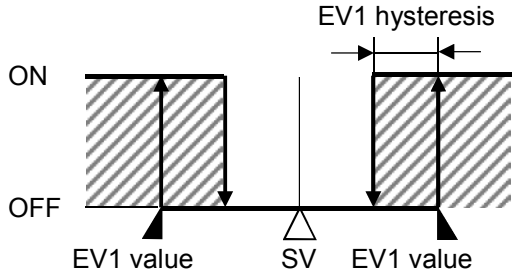


Alarm output is in standby.

• High/Low limits alarm

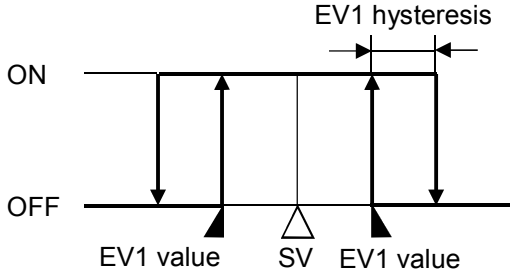


• High/Low limits with standby alarm

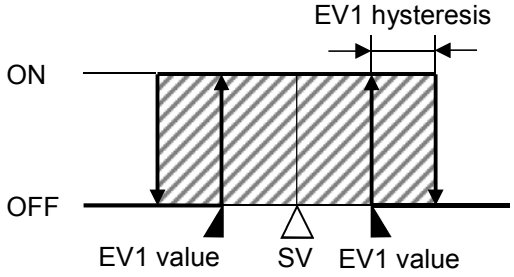


Alarm output is in standby.

• High/Low limit range alarm

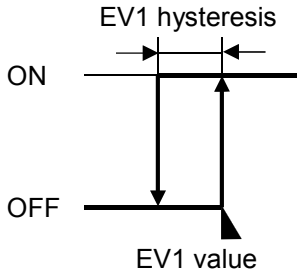


• High/Low limit range with standby alarm

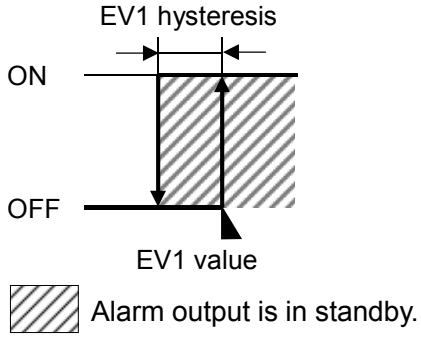


Alarm output is in standby.

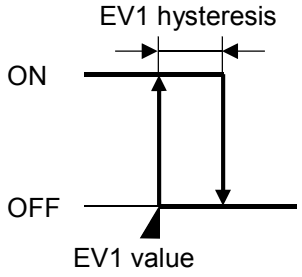
• Process high alarm



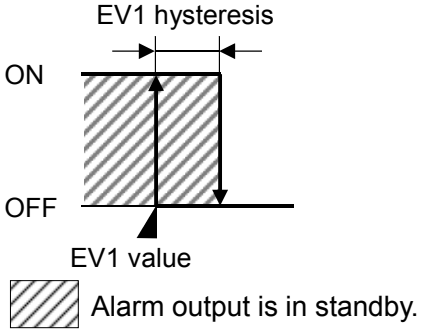
• Process high with standby alarm



• Process low alarm



• Process low with standby alarm



EV1 value and EV1 hysteresis represent EV1 alarm value and EV1 alarm hysteresis respectively.
The same applies to EV2, EV3 and EV4.

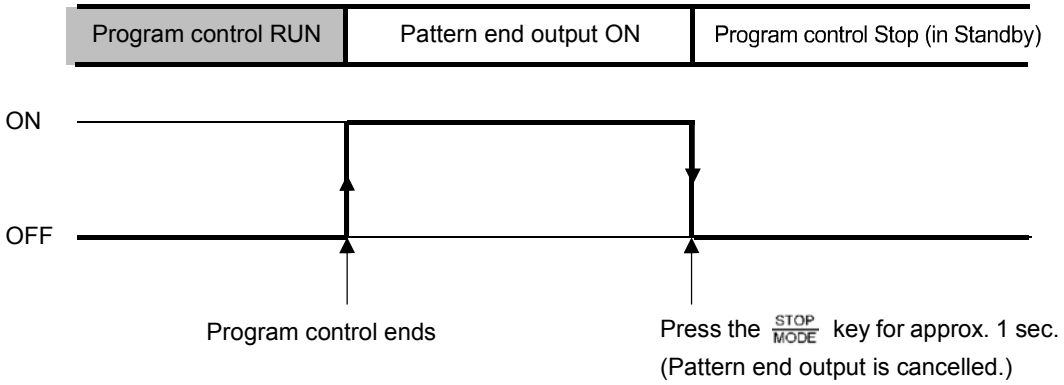
EVT1 indicator: Lit when EV1 terminals ⑨ and ⑩ are ON, and unlit when they are OFF.
EVT2 indicator: Lit when EV2 terminals ⑦ and ⑧ are ON, and unlit when they are OFF.
EVT3 indicator: Lit when EV3 terminals ㉙ and ㉚ are ON, and unlit when they are OFF.
EVT4 indicator: Lit when EV4 terminals ㉘ and ㉚ are ON, and unlit when they are OFF.

For the alarm types (High limit alarm, High/Low limits alarm, Process high alarm), alarm output is activated when the indication is overscale, and the standby function is released for the alarms with standby function.
For the alarm types (Low limit alarm, High/Low limits alarm, Process low alarm), alarm output is activated when the indication is underscale, and the standby function is released for the alarms with standby function.

When the alarm action De-energized is selected, the output ON/OFF status acts conversely to the alarm action described above.
(The Event indicators acts the same as the action Energized.)

	Energized	De-energized
Event indicators	Light	Light
Event output	ON	OFF

9.7 Pattern End Output



If Pattern end output is selected in [Event output EV□ allocation], the Pattern end output turns ON after program control ends. The SV/MV/TIME Display flashes P.END□.

By pressing the STOP/MODE key for approximately 1 second, the Pattern end output is turned OFF, and the unit reverts to Program control Stop (in Standby).
If Pattern end output time is set, the Pattern end output automatically turns OFF after Pattern end output time has expired, and the unit reverts to Program control Stop (in Standby).

10. Specifications

10.1 Standard Specifications

Rating

	Input	Scale Range		Resolution
Rated scale	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℃ (℉)
		-100.0 to 100.0℃	-148.0 to 212.0℉	0.1℃ (℉)
		-100.0 to 500.0℃	-148.0 to 932.0℉	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 10 mV	-2000 to 10000 (*)		1
	-10 to 10 mV	-2000 to 10000 (*)		1
	0 to 50 mV	-2000 to 10000 (*)		1
	0 to 100 mV	-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.			

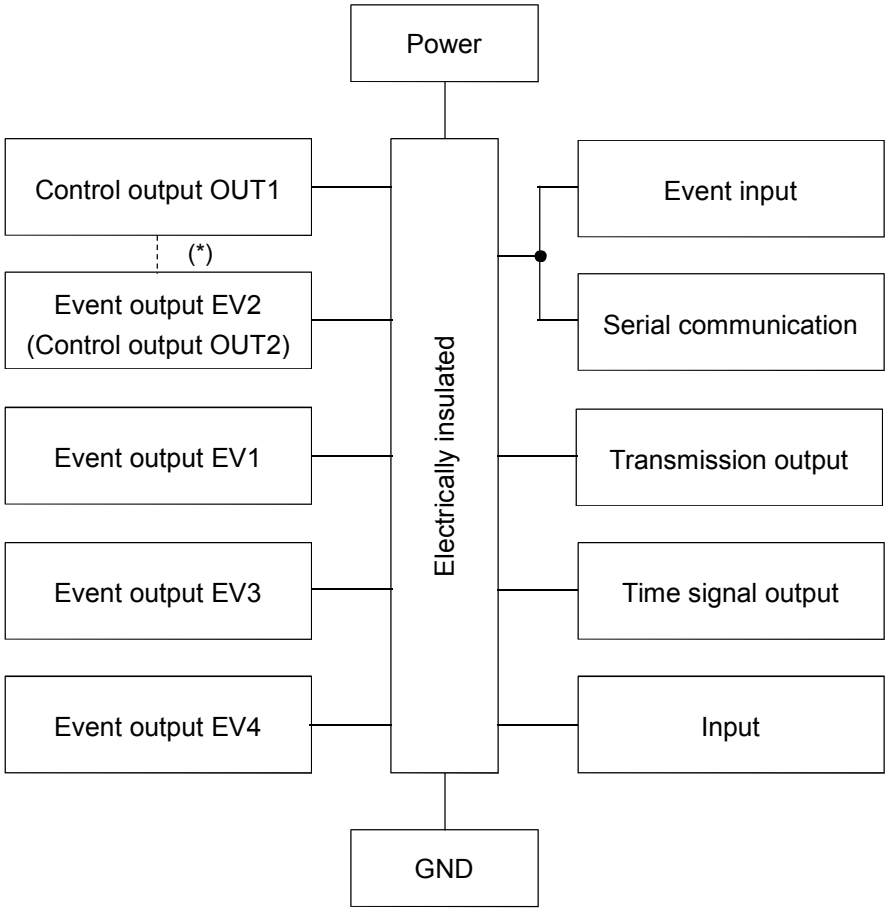
Input

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 However, Pt100, -100.0 to 100.0℃: 5 Ω max.
	Direct current	0 to 20 mA DC, 4 to 20 mA DC Input impedance: 50 Ω Allowable input current: 100 mA max.
	DC voltage	0 to 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 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 1 V DC) 200 Ω max. (0 to 100 mV DC, 0 to 50 mV DC) 40 Ω max. (-10 to 10 mV DC) 20 Ω max. (0 to 10 mV DC) 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.
Event input	Input points	Max. 4 points (When C or C5 option is ordered: 2 points)
	Circuit current when closed	Approx. 16 mA
External operation input	Input points	4 points (STOP, HOLD, ADV, RUN)
	Circuit current when closed	Approx. 16 mA
	Action	Signal edge action When power is turned ON, level action is engaged.

Output

Control output OUT1	Relay contact 1a 1b	Control capacity: 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load cosϕ=0.4) Electrical life: 100,000 cycles
	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. 600 Ω
Event output EV1	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
Event output EV2	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
Event output EV3, EV4	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 Event output EV3 and EV4 share one common terminal.
Time signal output (TS option)	Number of circuits	8
	Open collector	Capacity: 24 V DC Max. 50 mA
Control output OUT2 (D□ option)	Relay contact 1a 1b (DR option)	Control capacity: 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load cosϕ=0.4) Electrical life: 100,000 cycles
	Non-contact voltage (For SSR drive) (DS option)	12 V DC ± 15% Max. 40 mA (short circuit protected)
	Direct current (DA option)	4 to 20 mA DC (Resolution: 12000) Load resistance: Max. 600 Ω
Transmission output (T□ option)	Resolution	12000
	Output	TA: 4 to 20 mA DC (Load resistance: Max. 500 Ω) TV: 0 to 1 V DC (Load resistance: Min.100 KΩ)
	Output accuracy	Within ±0.3% of Transmission output span
	Response time	400 ms + Input sampling period (0%→90%)

Power supply

Power supply voltage	Model	PCA1□00-□□□	PCA1□10-□□□
	Power supply	100 to 240 V AC, 50/60 Hz	24 V AC/DC, 50/60 Hz
	Allowable voltage fluctuation	85 to 264 V AC	20 to 28 V AC/DC
Power consumption	Approx.14 VA		
Circuit insulation configuration	 (Fig. 10.1-1) (*) When both OUT1 and OUT2 are a non-contact voltage output or direct current output type, OUT1 is not electrically insulated from OUT2. Insulation resistance: 10 MΩ min. at 500 V DC		
Dielectric strength	Between Power terminal – Ground (GND) 1.5 kV AC for 1 minute Between Input terminal – Ground (GND) 1.5 kV AC for 1 minute Between Input terminal – Power terminal 1.5 kV AC for 1 minute		

Recommended Environment

Ambient temperature	0 to 50℃
Ambient humidity	35 to 85 %RH (Non-condensing)
Environmental specification	RoHS directive compliant

Performance

Basic accuracy	Thermocouple	Within ±0.2% of each input span±1 digit However, R, S input, 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 input, 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
Cold junction compensation accuracy		Within ±1℃ at 0 to 50℃
Effect of ambient temperature		Within 50 ppm/℃ of each input span
Input sampling period		125 ms
Time indication accuracy		±0.1% of setting time
Setting accuracy		Based on Basic accuracy and Cold junction compensation accuracy.
Time setting accuracy		±0.1% of setting time
Setting resolution	Temperature	Thermocouple, RTD input without decimal point: 1℃ (℉) Thermocouple, RTD input with decimal point: 0.1℃ (℉) DC voltage, current input: 1
	Time	1 minute or 1 second

General Structure

Weight		Approx. 460 g
External dimensions		96 x 96 x 98.5 mm (W x H x D)
Mounting		Flush (Applicable panel thickness: 1 to 8 mm)
Case		Flame-resistant resin, Color: Black
Front panel		Membrane sheet
Drip-proof/Dust-proof		IP66 for front panel only
Display	PV Display	Indicates PV in RUN mode. Indicates setting characters in setting mode. 11-segments LCD display 5-digits Backlight Red/Green/Orange Character size: 24.0 x 11.0 mm (H x W)
	SV/MV/TIME Display	Indicates SV, MV or TIME in RUN mode. Retains display indication when power is OFF. Indicates the set values in setting mode. 11-segments LCD display 5-digits Backlight: Green Character size: 14.0 x 7.0 mm (H x W)
	PTN Display	Indicates the pattern number. Flashes if 'Holding' is selected in [Step SV Hold function when program ends], when program control ends. 11-segments LCD display 2-digits Backlight: Orange Character size: 10.0 x 5.0 mm (H x W)
	STEP Display	Indicates the step number. Flashes during Wait action. Indicates M during Manual control. 11-segments LCD display 2-digits Backlight: Orange Character size: 10.0 x 5.0 mm (H x W)

Indicator	PV indicator	Lit when PV is indicated in RUN mode. Backlight: Red/Green/Orange	
	SV indicator	Lit when SV is indicated on the SV/MV/TIME Display. Retains display indication when power is OFF. Backlight: Green	
	MV indicator	Lit when OUT1 MV is indicated on the SV/MV/TIME Display. Flashes when OUT2 MV is indicated on the SV/MV/TIME Display. Retains display indication when power is OFF. Backlight: Green	
	TIME indicator	Lit when TIME is indicated on the SV/MV/TIME Display. Retains display indication when power is OFF. Backlight: Green	
	PTN indicator	Lit when the pattern number is indicated. Backlight: Orange	
	STEP indicator	Lit when the step number is indicated. Backlight: Orange	
	PROFILE indicator	During program control, the indicator lights up depending on the program setting as follows. : Lit when step SV is rising. : Lit when step SV is constant. : Lit when step SV is falling. Unlit when Fixed value control is performing. Backlight: Green	
	Time unit indicator	When the SV/MV/TIME Display indicates TIME, the following is shown depending on the selection in [Step time unit]. M: Lit when 'Hours:Minutes' is selected in [Step time unit]. S: Lit when 'Minutes:Seconds' is selected in [Step time unit]. Backlight: Green	
	Action indicator	Backlight: Orange	
		OUT1	Lit when control output OUT1 is ON. For direct current output type, flashes corresponding to the MV in 125 ms cycles.
		OUT2	Lit when control output OUT2 (DR, DS or DA option) is ON. For direct current output type (DA option), flashes corresponding to the MV in 125 ms cycles.
		EVT1	Lit when Event output EV1 is ON.
		EVT2	Lit when Event output EV2 is ON.
		EVT3	Lit when Event output EV3 is ON.
		EVT4	Lit when Event output EV4 is ON.
		MAN	Lit when Manual control is performing.
		T/R	Lit during Serial communication (C or C5 option) TX (transmitting) output.
		AT	Flashes during AT. Lit in AT standby when 'Multi mode' is selected in [AT mode].
		LOCK	Lit when 'Lock' is selected in [Set value lock].
		RUN	Lit during Program control RUN. Flashes during Fixed value control.
		HOLD	Flashes during Program control HOLD.

Setting Structure

Function key	RUN	RUN key	Performs program control. Cancels HOLD during Program control HOLD.
	PTN ▲	PATTERN key	Selects program pattern number.
		UP key	Increases the numeric value in setting mode.
	FAST ◀FAST▶	FAST key	During program control, makes step time progress 60 times faster. In setting mode, makes the numeric value change faster.
	ADV ▼	ADVANCE key	During program control, interrupts performing step, and proceeds to the next step (Advance function).
		DOWN key	Decreases the numeric value in setting mode.
	SET RST	SET key	Moves to setting mode.
		RESET key	Moves to RUN mode.
	STOP MODE	STOP key	Stops the program control, or cancels the pattern end output.
		MODE key	Switches or selects setting mode.
	DISP B.MODE	DISPLAY key	Switches the indication on the SV/MV/TIME Display.
		BACK MODE key	Moves back to the previous mode.
	HOLD ENT	HOLD key	During program control, time progress pauses, and control continues using the SV at that time (HOLD function).
		ENTER key	Registers the setting data, and moves to the next setting item.

Program Performance

Number of patterns	16 (Linkable)
Number of steps	256 (16 steps/pattern)
Number of repetitions	0 to 9999 times (Repetitions disabled when set to 0)
Program time range	0 to 99 hours 59 minutes/step, or 0 to 99 minutes 59 seconds/step (When -----is set: Fixed value control is performed using step SV.)
Wait value	Thermocouple, RTD input without decimal point: ±(0 to 100) ℃(℉) Thermocouple, RTD input with decimal point: ±(0.0 to 100.0) ℃(℉) DC voltage, current input: ±(0 to 1000)(The placement of the decimal point follows the selection.) (The Wait function is disabled when set to 0 or 0.0.)

Control Performance

Control action		• PID control action (with AT function) • ON/OFF control action (When proportional band is set to 0 or 0.0.)
	OUT1 proportional band (P)	0 to Input span℃ (℉) DC voltage, current input: 0.0 to 1000.0% (ON/OFF control action when set to 0 or 0.0.)
	Integral time (I)	0 to 3600 sec (Setting the value to 0 disables the function.)
	Derivative time (D)	0 to 1800 sec (Setting the value to 0 disables the function.)
	OUT1 proportional cycle	1 to 120 sec
	ARW	0 to 100%
	OUT1 ON/OFF hysteresis	0.1 to 1000.0℃ (℉) DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.)
	OUT1 high limit, low limit	0 to 100% (Direct current output: -5 to 105%)

Standard Function

Wait function	During program control, 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 STEP Display flashes while the Wait function is working.
Hold function	During program control, progress of current step can be suspended. Pressing the RUN key cancels suspension, and program control resumes. During manual control, suspension cannot be cancelled.
Advance function	Interrupts current step during program control, and proceeds to the beginning of the next step.
Return to previous function	Stops current perfroming step, and returns to the previous program step. If the elapsed time of the current step is less than 1 minute, the program control returns to the beginning of the previous step. If the elapsed time of the current step is longer than 1 minute, the program control returns to the beginning of the current step. This function is disabled at Step 0 of started pattern, but returns to the beginning of Step 0.
Repetitions and pattern link function	Patterns 0 to 15 can be linked to the next pattern. Only pattern numbers in numerical order can be linked. For Pattern 15, Pattern 0 can be linked. Number of repetitions for Patterns 0 to 15: 0 to 9999 times. For repetitions of linked pattern, the whole linked pattern will be repeated as many times as set in “starting pattern number”.
Step time speed-up function	During program control, makes step time progress 60 times faster while the FAST key is pressed. If the Wait function is set, the Wait function has priority.
Program clearing	When program control is stopped (in Standby), and if the RUN key is pressed for 3 seconds at any items in Pattern setting group, program pattern data (for current step on the STEP Display and all the following steps) will return to the factory default value.
Power restore action	If power fails during program control, the controller can be operated depending on the selection in [Power restore action]. Stops after power is restored: Stops program control, and returns to Standby mode. Continues after power is restored: Continues (Resumes) previous program control after power is restored. Suspends after power is restored: Suspends (on hold) current program control, and performs control using the step SV from the point of suspension. Pressing the RUN key cancels suspension, and program control resumes. Progressing time error when power is restored: 1 minute
Pattern end function	If Pattern end output is selected in [Event output EV□ allocation], Pattern end output is turned ON after program control is finished, and the SV/MV/TIME Display flashes P.End□. By pressing the STOP key for approximately 1 second, Pattern end output is turned OFF, and the unit returns to Program control Stop (in Standby). If Pattern end output time is set, Pattern end output is automatically turned OFF after Pattern end output time has expired. The unit returns to Program control Stop (in Standby).

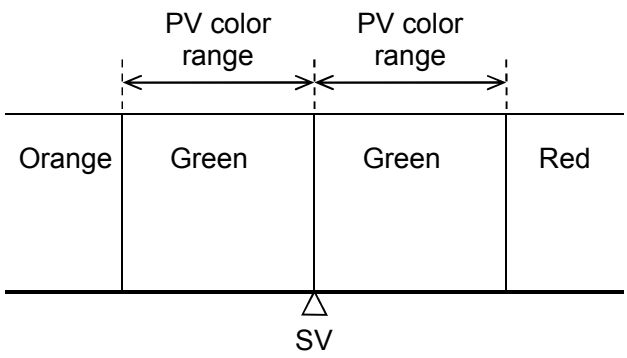
Event output EV1	Output turns ON or OFF, depending on Event condition which is selected in [Event output EV1 allocation].
Event output EV2	Output turns ON or OFF, depending on Event condition which is selected in [Event output EV2 allocation]. Disabled if the D□ option is ordered.
Event outputs EV3, EV4	Output turns ON or OFF, depending on Event condition which is selected in [Event output EV3 allocation] or [Event output EV4 allocation]. Event output EV3 and EV4 share one common terminal.
Alarm action	High limit alarm, High limit with standby alarm, Low limit alarm, Low limit with standby alarm, High/Low limits alarm, High/Low limits with standby alarm, High/Low limit range alarm, High/Low limit range with standby alarm, Process high alarm, Process high with standby alarm, Process low alarm, Process low with standby Alarm Energized/De-energized action are applied to the above alarms, totaling 24 alarm types. No alarm action can also be selected.
Set value	Factory default value: 0
Action	ON/OFF action
Alarm hysteresis	0.1 to 1000.0℃ (℉) DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.)
Output	EV□ output for which Alarm output (001 to 012) is selected in [Event output EV□ allocation].
Loop break alarm	When Loop break alarm is selected in [Event output EV□ allocation], detects actuator trouble (heater burnout, heater adhesion) or sensor burnout.
Loop break alarm time	0 to 200 minutes
Loop break alarm span	Thermocouple, RTD input without decimal point: 0 to 150℃ (℉) Thermocouple, RTD input with decimal point: 0.0 to 150.0℃ (℉) DC voltage, current input: 0 to 1500 (The placement of the decimal point follows the selection.)
Output	EV□ output for which Loop break alarm output (014) is selected in [Event output EV□ allocation].
Event input	Select a pattern from 0 – 15 depending on ON (Closed) or OFF (Open) status of any terminal (DI1 to DI4) and the COM terminal. If Serial communication (C or C5 option) is ordered, only Event input DI1 and DI2 can be used, and a pattern from 0 – 3 can be selected to perform. Pattern number selected by Event input has priority over Pattern number selected by the PTN ▲ key. Level action is used to determine ON or OFF. When power is turned ON, level action is engaged.
External operation input	By detecting signal edge action from OFF (Open) to ON (Closed), program control can be performed, stopped, held or advanced. During Manual control, External operation input will be disabled. Signal edge action is used to determine OFF or ON. When power is turned ON, level action is engaged.
Data clear function	When program control is stopped (in Standby), and if the PTN ▲, ADV ▼ and DISP B.MODE keys are pressed for approx. 3 seconds, the PV Display indicates cLR□, and all setting values – except Input type, OUT1 proportional cycle, OUT2 proportional cycle – will return to the default value. It takes approximately 30 seconds for data clear.

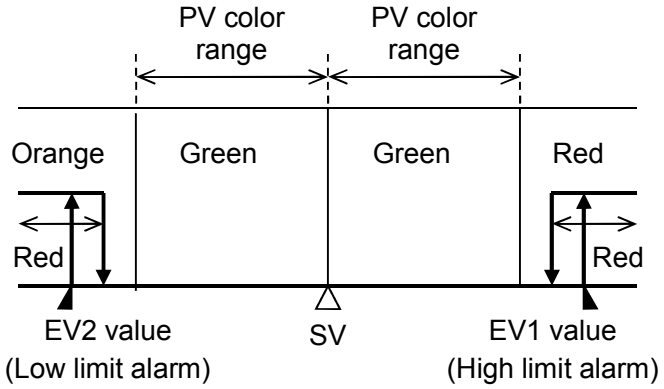
Attached Function

Sensor correction	Shifts the PV when the temperature at the controlling location does not match with the temperature at the sensor location. (Effective within the input rating range regardless of the sensor correction value.) Correction range: Thermocouple, RTD input: -200.0 to 200.0℃ (℉) DC voltage, current input: -2000 to 2000 (The placement of the decimal point follows the selection.)
Set value lock	Locks all set values – except Set value lock – to prevent setting errors.
Auto/Manual control switch	Auto/Manual control can be selected in [Auto/Manual control switch] in Auto/Manual control switch group. If control action is switched from automatic to manual and vice versa, balanceless-bumpless function works to prevent a sudden change in MV. When switched to manual control, the MAN and MV indicators light up, the STEP Display indicates M, and the SV/MV/TIME Display indicates the MV. To set the MV, use the PTN ▲ or ADV ▼ key. When switched to automatic control, the SV/MV/TIME Display shows SV. When power is turned ON, automatic control is performed. MV setting range: [Output block 0 OUT1 low limit] to [Output block 0 OUT1 high limit] If D□ option is ordered, the setting range is: – [Output block 0 OUT2 high limit] to [Output block 0 OUT1 high limit]
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℉).
Burnout (Overscale)	If thermocouple or RTD input is burnt out, the PV display flashes ----, and OUT1, OUT2 is turned OFF (OUT1 low limit value for direct current output). For Manual control, the preset MV is output.

Input error	Contents, Indication	Output Status			
		OUT1		OUT2	
		Direct (Cooling) action	Reverse (Heating) action	Direct (Cooling) action	Reverse (Heating) action
	Overscale If PV exceeded indication range high limit: ---- flashes.	OFF (4 mA) or OUT1 low limit value	OFF (4 mA) or OUT1 low limit value	OFF or OUT2 low limit value	OFF or OUT2 low limit value
	Underscale If PV has dropped below indication range low limit: .... flashes.	OFF (4 mA) or OUT1 low limit value	OFF (4 mA) or OUT1 low limit value	OFF or OUT2 low limit value	OFF or OUT2 low limit value
	For Manual control, the preset MV is output. DC input disconnection: If DC voltage or current input is disconnected, the following is indicated depending on the input. 4 to 20 mA DC, 1 to 5 V DC input: The PV display flashes .... 0 to 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 0 to 1 V DC input: The PV display flashes ----. 0 to 20 mA, 0 to 5 V DC, 0 to 10 V DC input: The PV Display indicates the value corresponding with 0 mA DC or 0 V DC input.				

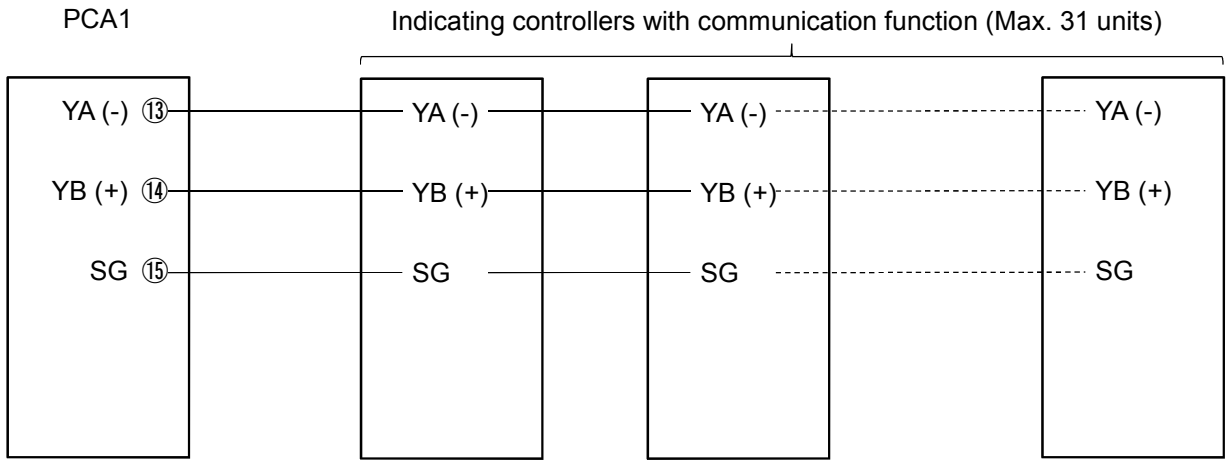
Indication range, Control range	Thermocouple input: [Input range low limit value – 50℃ (100℉)] to [Input range high limit value + 50℃ (100℉)] RTD input: [Input range low limit value – Input span x 1%] to [Input range high limit value + 50℃ (100℉)] DC voltage, current input: [Scaling low limit value – Scaling span x 1%] to [Scaling high limit value + Scaling span x 10%]
Warm-up indication	After the power supply to the instrument is turned on, the PV Display indicates the input type, and the SV Display indicates input range high limit value (for thermocouple, RTD input) or scaling high limit value (for direct current and voltage input) for approximately 3 seconds.
Console communication	By connecting the USB communication cable (CMB-001, sold separately) to the console connector (*), the following operations can be conducted from an external computer, using the Console software SWC- PCA01M. Console communication and Serial communication (C or C5 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 interface: C-MOS level (*) Connect the USB communication cable (CMB-001) after power is turned OFF. *Never* turn the power ON or OFF after connection.
PV color range	The PV Display color can be selected from 7 types as follows.

Setting	Function	PV color
GRN□	Green	Constantly Green
REd□	Red	Constantly Red
oRG□	Orange	Constantly Orange
ALGR□	When any alarm (EV1 to EV4) is ON: Green ⟶ Red	When alarm is OFF: Green When any alarm (EV1 to EV4) is ON: The PV color turns from green to red continuously according to the alarm.
ALoR□	When any alarm (EV1 to EV4) is ON: Orange ⟶ Red	When alarm is OFF: Orange When any alarm (EV1 to EV4) is ON: The PV color turns from orange to red continuously according to the alarm.
PVGR□	PV color changes continuously.	PV color changes continuously according to the PV color range. PV is lower than [SV – PV color range]: Orange PV is within [SV±PV color range]: Green PV is higher than [SV+PV color range]: Red  (Fig. 10.1-2)

Setting	Function	PV color
APCR□	PV color changes continuously + Any alarm (EV1 to EV4) is ON: Red	PV color changes continuously according to the PV color range. In addition, when any alarm (EV1 to EV4) is ON: PV color turns red. PV color changes continuously according to the PV color range. PV is lower than [SV – PV color range]: Orange PV is within [SV±PV color range]: Green PV is higher than [SV+PV color range]: Red Any alarm (EV1 to EV4) is ON: Red  (Fig. 10.1-3)

10.2 Optional Specifications

Serial communication (C or C5 option)		The following operations can be carried out from an external computer. (1) Reading and setting of the step SV, step time, PID and various set values (2) Reading of the PV and action status (3) Function change
Communication line		EIA RS-232C (C option) EIA RS-485 (C5 option)
Communication method		Half-duplex communication
Communication speed		9600, 19200, 38400 bps (Selectable by keypad)
Synchronization method		Start-stop synchronization
Communication protocol		Shinko protocol/Modbus ASCII/Modbus RTU (Selectable by keypad) Communication converter IF-400 is available for Shinko protocol and Modbus protocol.
Data bit/Parity		Data bit: 7 or 8 Parity: Even, Odd, No parity (Selectable by keypad)
Stop bit		1 or 2 (Selectable by keypad)
Data format	**Communication protocol**	**Shinko protocol** / **Modbus ASCII** / **Modbus RTU**
	Start bit	1 / 1 / 1
	Data bit	7 / 7 or 8 Selectable / 8
	Parity	Even / Even (No parity, Odd) Selectable / No parity (Even, Odd) Selectable
	Stop bit	1 / 1 or 2 Selectable / 1 or 2 Selectable
SV digital transmission		If 'SV digital transmission' is selected in [Communication protocol] in Serial communication, SV can be digitally transmitted to Shinko indicating controllers (with Serial communication C5 option). Update cycle: 250 ms



(Fig. 10.2-1)

Time signal output (TS option)		Time signal output OFF time and Time signal output ON time are set within each step time, and outputs them during Program control RUN. To use the Time signal output function, set the Time signal block number (for which Time signal output OFF time and Time signal output ON time have been set) for each step. Select any one number from a maximum of 16 Time signal blocks. The same number can be selected as many times as desired. A maximum of 8 points of Time signal output can be used for one step. Time signal output can be used as a status output. Time signal output TS1 → Status (RUN) output Time signal output TS2 → Status (HOLD) output Time signal output TS3 → Status (WAIT) output Time signal output TS4 → Status (FAST) output Time signal output TS5 → Status (STOP) output
Transmission output (TA, TV option)		Converting the value (PV, SV or MV transmission) to analog signal every 125 ms, outputs the value in current or voltage. If Transmission output high limit and low limit value are the same, Transmission output low limit value will be output. If SV or MV transmission is selected, 4 mA or 0 V will be output when program control stops (in Standby).
Heating/Cooling control output (DR, DS or DA option)		Performs Heating/Cooling control. If the D□ option is ordered, Event output EV2 will be disabled.
	OUT2 proportional band	0.0 to 10.0 times OUT1 proportional band (ON/OFF control when set to 0.0)
	Integral time(I)	0 to 3600 sec (Setting to 0 disables the function.) (Same value as that of OUT1)
	Derivative time (D)	0 to 1800 sec (Setting to 0 disables the function.) (Same value as that of OUT1)
	OUT2 proportional cycle	1 to 120 seconds
	Overlap/Dead band	Thermocouple, RTD input: -200.0 to 200.0℃ (℉) DC voltage, current input: -2000 to 2000 (The placement of the decimal point follows the selection.)
	OUT2 ON/OFF hysteresis	Thermocouple, RTD input: 0.1 to 1000.0℃ (℉) DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.)
	OUT2 high limit, OUT2 low limit	0 to 100% (DA: -5 to 105%)
	OUT2 cooling method	(1) Air cooling: Linear characteristics (2) Oil cooling: 1.5th power of the linear characteristics (3) Water cooling: 2nd power of the linear characteristics

11. Troubleshooting

⚠ 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.
The instrument *must* be grounded before turning the power ON.

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

11.1 Indication

Problem	Possible Cause	Solution
The PV Display indicates ERR 1.	Internal non-volatile IC memory is defective.	If the problem is not still solved after the power is turned OFF and ON again, contact our agency or us.
The PV Display flashes ☐☐☐☐.	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 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 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 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 0 to 1 V DC)]** If the input terminals of the instrument are shorted, and a value corresponding to 0 mV or 0 V 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 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 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
The PV Display flashes ⬚⬚⬚⬚	PV has dropped below the Indication range and Control range.	Check the input signal source and wiring of input terminals.
	Check whether input signal wire for DC voltage (1 to 5 V DC) or direct current (4 to 20 mA DC) is disconnected.	**How to check whether the input signal wire is disconnected** **[DC voltage (1 to 5 V DC)]** If the input to the input terminals of the instrument is 1 V DC and if a scaling low limit value is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected. **[Direct current (4 to 20 mA DC)]** If the input to the input terminals of the instrument is 4 mA DC and if a scaling low limit value is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected.
	Check whether input signal wire for DC voltage (1 to 5 V DC) or current (4 to 20 mA DC) is securely connected to the instrument input terminals.	Connect the input signal wire to the terminals of this instrument securely.
	Check if polarity of thermocouple or compensating lead wire is correct. Check whether codes (A, B, B) of RTD agree with the instrument terminals.	Wire them correctly.
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.

Problem	Possible Cause	Solution
The indication of PV Display is irregular or unstable.	Check whether sensor input or temperature unit (℃ or ℉) is correct.	Select the input type and temperature unit (℃ or ℉) correctly.
	Sensor correction value is unsuitable.	Set them to suitable values.
	Check whether the sensor specifications are 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.

11.2 Key Operation

Problem	Possible Cause	Solution
None of the set values (Step SV, step time, OUT1 proportional band, EV□ alarm value, etc.) can be set.	'Lock' is selected in [Set value lock].	Select 'Unlock' in [Set value lock].
	AT is performing.	Cancel the AT.
The setting indication does not change in the input range, and new values are unable to be set.	SV high or low limit value may be set at the point where the value does not change.	Set them to a suitable value.
A performing pattern number cannot be selected by the PTN/▲ key.	A pattern number might be selected by means of Event input. The pattern number selected via Event input has priority over a pattern number selected by the PTN/▲ key.	Open the COM terminal and any one terminal of Event input (DI1 to DI4).

11.3 Control

Problem	Possible Cause	Solution
Even though program control is executed, the control is advanced and the program is finished soon.	The step time of the performing pattern number is set to 0.00.	Set the step time to a suitable value.
Step does not progress.	Program control is suspended (Hold function). While program control is suspended, the HOLD indicator flashes.	Press the RUN key. Suspension of control will be cancelled, and program control will resume.
	The Wait function is working. If the Wait function is working, the STEP Display flashes.	Cancel the Wait function by pressing the ADV ▼ or STOP MODE key. The Wait function will be cancelled, and program control will continue.
PV does not rise or fall.	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 OUT1 or OUT2 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 OUT1 or OUT2 remains in an OFF status.	OUT1 or OUT2 high limit value is set to 0% or less.	Set it to a suitable value.
The step SV Hold function does not work.	'Not holding' is selected in [Step SV Hold function when program ends].	Select 'Holding' in [Step SV Hold function when program ends].
The step SV Hold function does not work even if 'Holding' is selected in [Step SV Hold function when program ends].	There are steps which have not been set within the program pattern.	Set the last step values (of the program pattern in the Pattern setting group – except step time), to all steps which have not been set yet. Set the step time to 0:00.

12. Character Table

12.1 Group Selection

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display and the SV/MV/TIME Display are unlit.

Right side: Indicates the group name.

Character, Factory Default	Group Name
G_PTN	**Pattern setting group**
G_bLK	**Block setting group**
G_cHN	**Repetitions and pattern link setting group**
G_AT	**AT Perfrom group**
G_ENG	**Engineering setting group**
G_MAN	**Auto/Manual control switch group**

12.2 Pattern Setting Group

Upper left: PTN Display, PV Display

The PTN Display indicates the pattern number to set, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display indicates the step number to set, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range (or selection item).

Character, Factory Default	Setting Item, Setting Range	Data
PTN 0	**Setting pattern number** 0 to 15	
0 TEMP 0 0	**Step 0 step SV** SV low limit to SV high limit	
0 TIME 0 00.00	**Step 0 step time** ----, 0:00 to 99:59 Time unit follows the selection in [Step time unit]. If the ADV key is pressed at 0:00, ---- is set. When ---- is set, Fixed value control is performed using step SV at Step 0.	
0 PID 0 0	**Step 0 PID block number** 0 to 9	
0 TS1 0 0	**Step 0 Time signal 1 block number** 0 to 15 Available when Time signal output (TS option) is ordered, and when Time signal output TS1 is selected in [Time signal output TS1/Status (RUN) output].	
0 TS2 0 0	**Step 0 Time signal 2 block number** 0 to 15 Available when Time signal output (TS option) is ordered, and when Time signal output TS2 is selected in [Time signal output TS2/Status (HOLD) output].	
0 TS3 0 0	**Step 0 Time signal 3 block number** 0 to 15 Available when Time signal output (TS option) is ordered, and when Time signal output TS3 is selected in [Time signal output TS3/Status (WAIT) output].	
0 TS4 0 0	**Step 0 Time signal 4 block number** 0 to 15 Available when Time signal output (TS option) is ordered, and when Time signal output TS4 is selected in [Time signal output TS4/Status (FAST) output].	
0 TS5 0 0	**Step 0 Time signal 5 block number** 0 to 15 Available when Time signal output (TS option) is ordered, and when Time signal output TS5 is selected in [Time signal output TS5/Status (STOP) output].	
0 TS6 0 0	**Step 0 Time signal 6 block number** 0 to 15 Available when Time signal output (TS option) is ordered.	
0 TS7 0 0	**Step 0 Time signal 7 block number** 0 to 15 Available when Time signal output (TS option) is ordered.	
0 TS8 0 0	**Step 0 Time signal 8 block number** 0 to 15 Available when Time signal output (TS option) is ordered.	
0 WAIT 0 0	**Step 0 Wait block number** 0 to 9	

Character, Factory Default	Setting Item, Setting Range	Data
0 _ALM 0 0	**Step 0 Alarm block number** 0 to 9	
0 _oUT 0 0	**Step 0 Output block number** 0 to 9	
0 TEMP 1 0	**Step 1 step SV** SV low limit to SV high limit	
	Repeat the above settings up to ‘Step 15 Output block number’, in the same way if necessary.	
0 _oUT 15 0	**Step 15 Output block number** 0 to 9	

12.3 Block Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display and the SV/MV/TIME Display are unlit.

Right side: Indicates the group name.

Character, Factory Default	Group Name
b_PId	**PID block setting group**
b_rS	**Time signal block setting group (When the TS option is ordered)**
b_WAIt	**Wait block setting group**
b_ALM	**Alarm block setting group**
b_oUt	**Output block setting group**

12.4 PID Block Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range	Data
P0_P 10	**Block 0 OUT1 proportional band** Thermocouple, RTD input without decimal point: 0 to input span℃ (℉) Thermocouple, RTD input with decimal point: 0.0 to input span℃ (℉) DC voltage, current input: 0.0 to 1000.0%	
P0_I 200	**Block 0 integral time** 0 to 3600 sec	
P0_d 50	**Block 0 integral time** 0 to 1800 sec	
P0_n 50	**Block 0 ARW** 0 to 100%	
P0Pb 1.0	**Block 0 OUT2 proportional band** 0.0 to 10.0 times Block 0 OUT1 proportional band Available when Heating/Cooling control (DR, DS or DA option) is ordered.	
P1_P 10	**Block 1 OUT1 proportional band** Thermocouple, RTD input without decimal point: 0 to input span℃ (℉) Thermocouple, RTD input with decimal point: 0.0 to input span℃ (℉) DC voltage, current input: 0.0 to 1000.0%	
	Repeat the above settings up to 'Block 9 OUT2 proportional band', in the same way if necessary.	
P9Pb 1.0	**Block 9 OUT2 proportional band** 0.0 to 10.0 times Block 9 OUT1 proportional band Available when Heating/Cooling control (DR, DS or DA option) is ordered.	

12.5 Time Signal Block Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range	Data
00_F 00.00	**Block 0 Time signal output OFF time** 00:00 to 99:59 Time unit follows the selection in [Step time unit].	
00_N 00.00	**Block 0 Time signal output ON time** 00:00 to 99:59 Time unit follows the selection in [Step time unit].	
01_F 00.00	**Block 1 Time signal output OFF time** 00:00 to 99:59 Time unit follows the selection in [Step time unit].	
	Repeat the above settings up to 'Block 15 Time signal output ON time', in the same way if necessary.	
15_N 00.00	**Block 15 Time signal output ON time** 00:00 to 99:59 Time unit follows the selection in [Step time unit].	

12.6 Wait Block Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range	Data
W0_ 0	**Block 0 Wait value** Thermocouple, RTD input without decimal point: 0 to 100℃ (℉) Thermocouple, RTD input with decimal point: 0.0 to 100.0℃ (℉) DC voltage, current input: 0 to 1000 (The placement of the decimal point follows the selection.)	
W1_ 0	**Block 1 Wait value** Thermocouple, RTD input without decimal point: 0 to 100℃ (℉) Thermocouple, RTD input with decimal point: 0.0 to 100.0℃ (℉) DC voltage, current input: 0 to 1000 (The placement of the decimal point follows the selection.)	
	Repeat the above settings up to 'Block 9 Wait value', in the same way if necessary.	
W9_ 0	**Block 9 Wait value** Thermocouple, RTD input without decimal point: 0 to 100℃ (℉) Thermocouple, RTD input with decimal point: 0.0 to 100.0℃ (℉) DC voltage, current input: 0 to 1000 (The placement of the decimal point follows the selection.)	

12.7 Alarlm Block Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range		Data
AO_1 0	**Block 0 EV1 alarm value**		
	Type	**Setting Range**	
	No alarm action		
	High limit alarm	– (Input span) to Input span (*1) (Alarm action will be disabled when set to 0 or 0.0.)	
	High limit with standby alarm	– (Input span) to Input span (*1) (Alarm action will be disabled when set to 0 or 0.0.)	
	Low limit alarm	– (Input span) to Input span (*1) (Alarm action will be disabled when set to 0 or 0.0.)	
	Low limit with standby alarm	– (Input span) to Input span (*1) (Alarm action will be disabled when set to 0 or 0.0.)	
	High/Low limits alarm	0 to Input span (*1) (Alarm action will be disabled when set to 0 or 0.0.)	
	High/Low limits with standby alarm	0 to Input span (*1) (Alarm action will be disabled when set to 0 or 0.0.)	
	High/Low limit range alarm	0 to Input span (*1) (Alarm action will be disabled when set to 0 or 0.0.)	
	High/Low limit range with standby alarm	0 to Input span (*1) (Alarm action will be disabled when set to 0 or 0.0.)	
	Process high alarm	Input range low limit to Input range high limit (*2)	
	Process high with standby alarm	Input range low limit to Input range high limit (*2)	
	Process low alarm	Input range low limit to Input range high limit (*2)	
	Process low with standby alarm	Input range low limit to Input range high limit (*2)	
	(*1) For DC voltage, current input, the input span is the same as the scaling span. (*2) For DC voltage, current input, input range low (or high) limit value is the same as scaling low (or high) limit value.		
	Available when 001 to 012 (Alarm output) is selected in [Event output EV1 allocation].		
AO_2 0	**Block 0 EV2 alarm value** Same as that of Block 0 EV1 alarm value. Available when 001 to 012 (Alarm output) is selected in [Event output EV2 allocation].		
AO_3 0	**Block 0 EV3 alarm value** Same as that of Block 0 EV1 alarm value. Available when 001 to 012 (Alarm output) is selected in [Event output EV3 allocation].		
AO_4 0	**Block 0 EV4 alarm value** Same as that of Block 0 EV1 alarm value. Available when 001 to 012 (Alarm output) is selected in [Event output EV4 allocation].		

Character, Factory Default	Setting Item, Setting Range	Data
A1_1 0	**Block 1 EV1 alarm value** Same as that of Block 0 EV1 alarm value. Available when 001 to 012 (Alarm output) is selected in [Event output EV1 allocation].	
	Repeat the above settings up to 'Block 9 EV4 alarm value', in the same way if necessary.	
A9_4 0	**Block 9 EV4 alarm value** Same as that of Block 0 EV1 alarm value. Available when 001 to 012 (Alarm output) is selected in [Event output EV4 allocation].	

12.8 Output Block Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range	Data
oO_H 100	**Block 0 OUT1 high limit** OUT1 low limit to 100% (For direct current output: OUT1 low limit to 105%)	
oO_L 0	**Block 0 OUT1 low limit** 0% to OUT1 high limit (For direct current output: -5% to OUT1 high limit)	
oOHb 100	**Block 0 OUT2 high limit** OUT2 low limit to 100% (For direct current output: OUT2 low limit to 105%) Available when Heating/Cooling control (DR, DS or DA option) is ordered.	
oOLb 0	**Block 0 OUT2 low limit** 0% to OUT2 high limit. (For direct current output: -5% to OUT2 high limit) Available when Heating/Cooling control (DR, DS or DA option) is ordered.	
oOcL 0	**Block 0 OUT1 rate-of-change** 0 to 100 %/second	
o1_H 100	**Block 1 OUT1 high limit** OUT1 low limit to 100% (For direct current output: OUT1 low limit to 105%)	
	Repeat the above settings up to ‘Block 9 OUT1 rate-of-change’, in the same way if necessary.	
o9cL 0	**Block 9 OUT1 rate-of-change** 0 to 100 %/second	

12.9 Repetitions and Pattern Link Setting Group

Upper left: PTN Display, PV Display

The PTN Display indicates the setting pattern number, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range	Data
0 REPT 0 0000	**Repetitions for Pattern 0** 0 to 9999 times	
0 CHIN 0 ------	**Pattern link between pattern 0 and pattern 1** ------ : Pattern link Disabled CHIN : Pattern link Enabled	
1 REPT 0 0000	**Repetitions for Pattern 1** 0 to 9999 times	
	Repeat the above settings up to ‘Pattern link between pattern 15 and pattern 0’, in the same way if necessary.	
15 CHIN 0 ------	**Pattern link between pattern 15 and pattern 0** ------ : Pattern link Disabled CHIN : Pattern link Enabled	

12.10 AT Perform Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range	Data
AT4L NoML	**AT mode** NoML : Normal mode When AT Perform is selected in [AT Perform/Cancel], AT starts immediately. MULT : Multi mode AT is automatically performed at the point where 90% of progressed step time has elapsed. If there are the same PID block numbers in one pattern, the AT is performed only for the first step.	
AT -----	**AT Perform/Cancel** ----- : AT Cancel AT : AT Perform	
AT_b 20	**AT bias** Thermocouple, RTD input without decimal point: 0 to 50℃ (0 to 100℉) Thermocouple, RTD input with decimal point: 0.0 to 50.0℃ (0.0 to 100.0℉)	

12.11 Engineering Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display and the SV/MV/TIME Display are unlit.

Right side: Indicates the group name.

Character, Factory Default	Group Name
E_INP	**Input parameter setting group**
E_oUT	**Output parameter setting group**
E_EVo	**Event output parameter setting group**
E_LIM	**SV limit setting group**
E_TRA	**Transmission output parameter setting group**
E_coM	**Communication parameter setting group**
E_oTH	**Other parameters setting group**

12.12 Input Parameter Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range	Data
SEN5 K℃	**Input type** K℃ : K -200 to 1370℃ K .℃ : K -200.0 to 400.0℃ J℃ : J -200 to 1000℃ R℃ : R 0 to 1760℃ S℃ : S 0 to 1760℃ b℃ : B 0 to 1820℃ E℃ : E -200 to 800℃ T .℃ : T -200.0 to 400.0℃ N℃ : N -200 to 1300℃ PL2℃ : PL-Ⅱ 0 to 1390℃ C℃ : C(W/Re5-26) 0 to 2315℃ Pt .℃ : Pt100 -200.0 to 850.0℃ JPt .℃ : JPt100 -200.0 to 500.0℃ Pt℃ : Pt100 -200 to 850℃ JPt℃ : JPt100 -200 to 500℃ Pt1.℃ : Pt100 -100.0 to 100.0℃ Pt5.℃ : Pt100 -100.0 to 500.0℃ K℉ : K -328 to 2498℉ K .℉ : K -328.0 to 752.0℉ J℉ : J -328 to 1832℉ R℉ : R 32 to 3200℉ S℉ : S 32 to 3200℉ b℉ : B 32 to 3308℉ E℉ : E -328 to 1472℉ T .℉ : T -328.0 to 752.0℉ N℉ : N -328 to 2372℉ PL2℉ : PL-Ⅱ 32 to 2534℉ C℉ : C(W/Re5-26) 32 to 4199℉ Pt .℉ : Pt100 -328.0 to 1562.0℉ JPt .℉ : JPt100 -328.0 to 932.0℉ Pt℉ : Pt100 -328 to 1562℉ JPt℉ : JPt100 -328 to 932℉ Pt2.℉ : Pt100 -148.0 to 212.0℉ Pt9.℉ : Pt100 -148.0 to 932.0℉ 420MA : 4 to 20 mA DC -2000 to 10000 020MA : 0 to 20 mA DC -2000 to 10000 10MV : 0 to 10 mV DC -2000 to 10000 -10MV : -10 to 10 mV DC -2000 to 10000 50MV : 0 to 50 mV DC -2000 to 10000 100MV : 0 to 100 mV DC -2000 to 10000	

Character, Factory Default	Setting Item, Setting Range	Data
	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	
SCLH 1370	**Scaling high limit** Scaling low limit value to Input range high limit value	
SCLL -200	**Scaling low limit** Input range low limit value to Scaling high limit value	
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 0.0000 : 4 digits after decimal point Available for DC voltage and current inputs.	
So 0.0	**Sensor correction** Thermocouple, RTD input: -200.0 to 200.0℃ (℉) DC voltage, current input: -2000 to 2000 (The placement of the decimal point follows the selection.)	
FILT 0.0	**PV filter time constant** 0.0 to 100.0 sec	

12.13 Output Parameter Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range	Data
c 30 • Relay contact output: 30 sec • Non-contact voltage output: 3 sec	**OUT1 proportional cycle** 1 to 120 sec Available when control output OUT1 is Relay contact output or Non-contact voltage output.	
HYS 1.0	**OUT1 ON/OFF hysteresis** Thermocouple, RTD input: 0.1 to 1000.0℃ (℉) DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.)	
c_b 30 • DR: 30 sec • DS: 3 sec	**OUT2 proportional cycle** 1 to 120 sec Available when Heating/Cooling control (DR or DS option) is ordered.	
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) Available when Heating/Cooling control (DR, DS or DA option) is ordered.	
HYSb 1.0	**OUT2 ON/OFF hysteresis** Thermocouple, RTD input: 0.1 to 1000.0℃ (℉) DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.) Available when Heating/Cooling control (DR, DS or DA option) is ordered.	
db 0.0	**Overlap/Dead band** Thermocouple, RTD input: -200.0 to 200.0℃ (℉) DC voltage, current input: -2000 to 2000 (The placement of the decimal point follows the selection.) Available when Heating/Cooling control (DR, DS or DA option) is ordered.	
conT HEAT	**Direct/Reverse action** HEAT : Reverse action cool : Direct action	

12.14 Event Output Parameter Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

<table>
<tr><th>Character,
Factory Default</th><th colspan="3">Setting Item, Setting Range</th><th>Data</th></tr>
<tr><td>EVT01
□□013</td><td colspan="3">Event output EV1 allocation
[Event Output Allocation Table]
<table>
<tr><th>Selection</th><th>Event output</th><th>Remarks</th></tr>
<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, High limit with standby alarm</td><td></td></tr>
<tr><td>□□003</td><td>Alarm output, Low limit alarm</td><td></td></tr>
<tr><td>□□004</td><td>Alarm output, Low limit with standby alarm</td><td></td></tr>
<tr><td>□□005</td><td>Alarm output, High/Low limits alarm</td><td></td></tr>
<tr><td>□□006</td><td>Alarm output, High/Low limits with standby alarm</td><td></td></tr>
<tr><td>□□007</td><td>Alarm output, High/Low limit range alarm</td><td></td></tr>
<tr><td>□□008</td><td>Alarm output, High/Low limit range with standby alarm</td><td></td></tr>
<tr><td>□□009</td><td>Alarm output, Process high alarm</td><td></td></tr>
<tr><td>□□010</td><td>Alarm output, Process high with standby alarm</td><td></td></tr>
<tr><td>□□011</td><td>Alarm output, Process low alarm</td><td></td></tr>
<tr><td>□□012</td><td>Alarm output, Process low with standby alarm</td><td></td></tr>
<tr><td>□□013</td><td>Pattern end output</td><td></td></tr>
<tr><td>□□014</td><td>Loop break alarm output</td><td></td></tr>
<tr><td>□□015</td><td>Output during AT</td><td>Turns ON during AT.</td></tr>
</table>
When 001 to 012 (Alarm output) is selected, one alarm can be set to one event output. When 013 to 015 is selected, each output is common to multiple event outputs.</td><td></td></tr>
<tr><td>A1HY
□□□10</td><td colspan="3">EV1 alarm hysteresis
Thermocouple, RTD input: 0.1 to 1000.0℃ (℉)
DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.)
Available when 001 to 012 (Alarm output) is selected in [Event output EV1 allocation].</td><td></td></tr>
<tr><td>A1DLY
□□□□0</td><td colspan="3">EV1 alarm delay time
0 to 10000 sec
Available when 001 to 012 (Alarm output) is selected in [Event output EV1 allocation].</td><td></td></tr>
<tr><td>A1REV
NoML□</td><td colspan="3">EV1 alarm Energized/De-energized
NoML□ : Energized
REV4□ : De-energized
Available when 001 to 012 (Alarm output) is selected in [Event output EV1 allocation].</td><td></td></tr>
</table>

<table>
<tr><th>Character,
Factory Default</th><th>Setting Item, Setting Range</th><th>Data</th></tr>
<tr><td>LP_T
0</td><td>Loop break alarm time
0 to 200 minutes [Setting to 0 (zero) disables the Loop break alarm.]
Available when 014 (Loop break alarm output) is selected in [Event output EV1 allocation].</td><td></td></tr>
<tr><td>LP_H
0</td><td>Loop break alarm span
Thermocouple, RTD input without decimal point: 0 to 150℃ (℉)
Thermocouple, RTD input with decimal point: 0.0 to 150.0℃ (℉)
DC voltage, current input: 1 to 1500 (The placement of the decimal point follows the selection.)
Available when 014 (Loop break alarm output) is selected in [Event output EV1 allocation].</td><td></td></tr>
<tr><td>EVT02
000</td><td>Event output EV2 allocation
[Event Output Allocation Table]
<table>
<tr><th>Selection</th><th>Event Output</th><th>Remarks</th></tr>
<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, High limit with standby alarm</td><td></td></tr>
<tr><td>003</td><td>Alarm output, Low limit alarm</td><td></td></tr>
<tr><td>004</td><td>Alarm output, Low limit with standby alarm</td><td></td></tr>
<tr><td>005</td><td>Alarm output, High/Low limits alarm</td><td></td></tr>
<tr><td>006</td><td>Alarm output, High/Low limits with standby alarm</td><td></td></tr>
<tr><td>007</td><td>Alarm output, High/Low limit range alarm</td><td></td></tr>
<tr><td>008</td><td>Alarm output, High/Low limit range with standby alarm</td><td></td></tr>
<tr><td>009</td><td>Alarm output, Process high alarm</td><td></td></tr>
<tr><td>010</td><td>Alarm output, Process high with standby alarm</td><td></td></tr>
<tr><td>011</td><td>Alarm output, Process low alarm</td><td></td></tr>
<tr><td>012</td><td>Alarm output, Process low with standby alarm</td><td></td></tr>
<tr><td>013</td><td>Pattern end output</td><td></td></tr>
<tr><td>014</td><td>Loop break alarm output</td><td></td></tr>
<tr><td>015</td><td>Output during AT</td><td>Turns ON during AT.</td></tr>
</table>
When 001 to 012 (Alarm output) is selected, one alarm can be set to one event output. When 013 to 015 is selected, each output is common to multiple event outputs.</td><td></td></tr>
<tr><td>A2HY
10</td><td>EV2 alarm hysteresis
Thermocouple, RTD input: 0.1 to 1000.0℃ (℉)
DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.)
Available when 001 to 012 (Alarm output) is selected in [Event output EV2 allocation].</td><td></td></tr>
<tr><td>A2dLY
0</td><td>EV2 alarm delay time
0 to 10000 seconds
Available when 001 to 012 (Alarm output) is selected in [Event output EV2 allocation].</td><td></td></tr>
</table>

<table>
<tr><th>Character,
Factory Default</th><th>Setting Item, Setting Range</th><th>Data</th></tr>
<tr><td>A2REV
NoML</td><td>EV2 alarm Energized/De-energized
NoML : Energized
REV : De-energized
Available when 001 to 012 (Alarm output) is selected in [Event output EV2 allocation].</td><td></td></tr>
<tr><td>LP_T
0</td><td>Loop break alarm time
0 to 200 minutes [Setting to 0 (zero) disables the Loop break alarm.]
Available when 014 (Loop break alarm output) is selected in [Event output EV2 allocation].</td><td></td></tr>
<tr><td>LP_H
0</td><td>Loop break alarm span
Thermocouple, RTD input without decimal point: 0 to 150℃ (℉)
Thermocouple, RTD input with decimal point: 0.0 to 150.0℃ (℉)
DC voltage, current input: 1 to 1500 (The placement of the decimal point follows the selection.)
Available when 014 (Loop break alarm output) is selected in [Event output EV2 allocation].</td><td></td></tr>
<tr><td>EVT03
001</td><td>Event output EV3 allocation
[Event Output Allocation Table]
<table>
<tr><th>Selection</th><th>Event output</th><th>Remarks</th></tr>
<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, High limit with standby alarm</td><td></td></tr>
<tr><td>003</td><td>Alarm output, Low limit alarm</td><td></td></tr>
<tr><td>004</td><td>Alarm output, Low limit with standby alarm</td><td></td></tr>
<tr><td>005</td><td>Alarm output, High/Low limits alarm</td><td></td></tr>
<tr><td>006</td><td>Alarm output, High/Low limits with standby alarm</td><td></td></tr>
<tr><td>007</td><td>Alarm output, High/Low limit range alarm</td><td></td></tr>
<tr><td>008</td><td>Alarm output, High/Low limit range with standby alarm</td><td></td></tr>
<tr><td>009</td><td>Alarm output, Process high alarm</td><td></td></tr>
<tr><td>010</td><td>Alarm output, Process high with standby alarm</td><td></td></tr>
<tr><td>011</td><td>Alarm output, Process low alarm</td><td></td></tr>
<tr><td>012</td><td>Alarm output, Process low with standby alarm</td><td></td></tr>
<tr><td>013</td><td>Pattern end output</td><td></td></tr>
<tr><td>014</td><td>Loop break alarm output</td><td></td></tr>
<tr><td>015</td><td>Output during AT</td><td>Turns ON during AT.</td></tr>
</table>
When 001 to 012 (Alarm output) is selected, one alarm can be set to one event output.
When 013 to 015 is selected, each output is common to multiple event outputs.</td><td></td></tr>
<tr><td>A3HY
10</td><td>EV3 alarm hysteresis
Thermocouple, RTD input: 0.1 to 1000.0℃ (℉)
DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.)
Available when 001 to 012 (Alarm output) is selected in [Event output EV3 allocation].</td><td></td></tr>
</table>

<table>
<tr><th>Character,
Factory Default</th><th>Setting Item, Setting Range</th><th>Data</th></tr>
<tr><td>A3dLY
0</td><td>EV3 alarm delay time
0 to 10000 sec
Available when 001 to 012 (Alarm output) is selected in [Event output EV3 allocation]</td><td></td></tr>
<tr><td>A3REV
NoML</td><td>EV3 alarm Energized/De-energized
NoML : Energized
REV : De-energized
Available when 001 to 012 (Alarm output) is selected in [Event output EV3 allocation].</td><td></td></tr>
<tr><td>LP_T
0</td><td>Loop break alarm time
0 to 200 minutes [Setting to 0 (zero) disables the Loop break alarm.]
Available when 014 (Loop break alarm output) is selected in [Event output EV3 allocation].</td><td></td></tr>
<tr><td>LP_H
0</td><td>Loop break alarm span
Thermocouple, RTD input without decimal point: 0 to 150℃ (℉)
Thermocouple, RTD input with decimal point: 0.0 to 150.0℃ (℉)
DC voltage, current input: 1 to 1500 (The placement of the decimal point follows the selection.)
Available when 014 (Loop break alarm output) is selected in [Event output EV3 allocation].</td><td></td></tr>
<tr><td>EVT04
003</td><td>Event output EV4 allocation
[Event Output Allocation Table]
<table>
<tr><th>Selection</th><th>Event output</th><th>Remarks</th></tr>
<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, High limit with standby alarm</td><td></td></tr>
<tr><td>003</td><td>Alarm output, Low limit alarm</td><td></td></tr>
<tr><td>004</td><td>Alarm output, Low limit with standby alarm</td><td></td></tr>
<tr><td>005</td><td>Alarm output, High/Low limits alarm</td><td></td></tr>
<tr><td>006</td><td>Alarm output, High/Low limits with standby alarm</td><td></td></tr>
<tr><td>007</td><td>Alarm output, High/Low limit range alarm</td><td></td></tr>
<tr><td>008</td><td>Alarm output, High/Low limit range with standby alarm</td><td></td></tr>
<tr><td>009</td><td>Alarm output, Process high alarm</td><td></td></tr>
<tr><td>010</td><td>Alarm output, Process high with standby alarm</td><td></td></tr>
<tr><td>011</td><td>Alarm output, Process low alarm</td><td></td></tr>
<tr><td>012</td><td>Alarm output, Process low with standby alarm</td><td></td></tr>
<tr><td>013</td><td>Pattern end output</td><td></td></tr>
<tr><td>014</td><td>Loop break alarm output</td><td></td></tr>
<tr><td>015</td><td>Output during AT</td><td>Turns ON during AT.</td></tr>
<tr><td colspan="3">When 001 to 012 (Alarm output) is selected, one alarm can be set to one event output.
When 013 to 015 is selected, each output is common to multiple event outputs.</td></tr>
</table></td><td></td></tr>
</table>

Character, Factory Default	Setting Item, Setting Range	Data
A4HY5 10	**EV4 alarm hysteresis** Thermocouple, RTD input: 0.1 to 1000.0℃ (℉) DC voltage, current input: 1 to 10000 (The placement of the decimal point follows the selection.) Available when 001 to 012 (Alarm output) is selected in [Event output EV4 allocation].	
A4dLY 0	**EV4 alarm delay time** 0 to 10000 seconds Available when 001 to 012 (Alarm output) is selected in [Event output EV4 allocation].	
A4REV NoML	**EV4 alarm Energized/De-energized** NoML : Energized REV4 : De-energized Available when 001 to 012 (Alarm output) is selected in [Event output EV4 allocation].	
LP_T 0	**Loop break alarm time** 0 to 200 minutes [Setting to 0 (zero) disables the Loop break alarm.] Available when 014 (Loop break alarm output) is selected in [Event output EV4 allocation].	
LP_H 0	**Loop break alarm span** Thermocouple, RTD input without decimal point: 0 to 150℃ (℉) Thermocouple, RTD input with decimal point: 0.0 to 150.0℃ (℉) DC voltage, current input: 1 to 1500 (The placement of the decimal point follows the selection.) Available when 014 (Loop break alarm output) is selected in [Event output EV4 allocation].	

12.15 SV Limit Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range	Data
SH 1370	**SV high limit** SV low limit to Scaling high limit	
SL -200	**SV low limit** Scaling low limit to SV high limit	

12.16 Transmission Output Parameter Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range	Data
□□ rRo4□ □□ PV□□□	**Transmission output type** PV□□□ : PV transmission SV□□□ : SV transmission MV□□□ : MV transmission	
□□ rRLH□ □□ □1370	**Transmission output high limit** When PV or SV transmission is selected: Transmission output low limit to Input range high limit When MV transmission is selected in [Transmission output type]: Transmission output low limit to 105.0%	
□□ rRLL□ □□ -□200	**Transmission output low limit** When PV or SV transmission is selected: Input range low limit to Transmission output high limit When MV transmission is selected in [Transmission output type]: -5.0% to Transmission output high limit	

12.17 Communication Parameter Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range	Data
cMPL NoML	**Communication protocol** NoML : Shinko protocol ModA : Modbus ASCII ModR : Modbus RTU SVT : Set value (SV) digital transmission	
cMNo 0	**Instrument number** 0 to 95	
cMSP 96	**Communication speed** 96 : 9600 bps 192 : 19200 bps 384 : 38400 bps	
cMFT 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	
cMST 1	**Stop bit** 1 : 1 bit 2 : 2 bits	
cMdY 10	**Response delay time** 0 to 1000 ms	

12.18 Other Parameters Setting Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range	Data
LocK -----	**Set value lock** ----- : Unlock LocK : Lock (None of the set values – except Set value lock – can be changed.)	
S_MAN MANU	**Program start Auto/Manual** MANU : Manual start If the RUN key is pressed when power is turned on, and when in Program control Stop (in Standby), the selected pattern number program will be performed from Step 0. AUTo : Automatic start When power is turned on, the selected pattern number program will be automatically performed from Step 0.	
S_SV 0	**Step SV when program control starts** SV low limit to SV high limit	
S_SL PV	**Program control start type** PV : PV start Only when program control starts, the step SV is advanced to the PV, then program control starts. PVR : PVR start When program control starts and in pattern repeating, the step SV is advanced to the PV, then program control starts. SV : SV start Program control starts from the step SV which has been set in [Step SV when program control starts].	
PREF CONT	**Power restore action** StoP : Stops after power is restored. Stops current program control, and returns to Standby. CONT : Continues after power is restored. Continues (Resumes) previous program control after power is restored. HoLd : Suspends after power is restored. Suspends (on hold) current program control, and performs control using the step SV from the point of suspension. Pressing the RUN key cancels suspension, and program control resumes.	

Character, Factory Default	Setting Item, Setting Range	Data
M_SU MIN	**Step time unit** MIN : Hours:Minutes SEC : Minutes:Seconds	
S_TM RT	**Step time indication** RT : Remaining time Indicates remaining step time. TM : Step time Indicates step time which has been set.	
S_TE SV	**Step SV indication** SV : SV corresponding to the step time progress. Updates step SV corresponding to the step time progress. TSV : Step SV Indicates the step SV which has been set during program pattern setting.	
PETM 0	**Pattern end output time** 0 to 10000 seconds	
PEH STOP	**Step SV Hold function when program ends** STOP : Not Holding (of Step SV Hold function) HOLD : Holding (of Step SV Hold function)	
TS 1S TS	**Time signal output TS1 / Status (RUN) output** TS : Time signal output TS1 RUN : Status (RUN) output Available when Time signal output (TS option) is ordered.	
TS2S TS	**Time signal output TS2 / Status (HOLD) output** TS : Time signal output TS2 HOLD : Status (HOLD) output Available when Time signal output (TS option) is ordered.	
TS3S TS	**Time signal output TS3 / Status (WAIT) output** TS : Time signal output TS3 WAIT : Status (WAIT) output Available when Time signal output (TS option) is ordered.	
TS4S TS	**Time signal output TS4 / Status (FAST) output** TS : Time signal output TS4 FAST : Status (FAST) output Available when Time signal output (TS option) is ordered.	
TS5S TS	**Time signal output TS5 / Status (STOP) output** TS : Time signal output TS5 STOP : Status (STOP) output Available when Time signal output (TS option) is ordered.	
OSFN OFF	**Overshoot suppression Enabled/Disabled** OFF : Disabled ON : Enabled	
OSF 10	**Overshoot suppression factor** 0.1 to 10.0 Available when 'Enabled' is selected in [Overshoot suppression Enabled/Disabled].	

Character, Factory Default	Setting Item, Setting Range	Data
EoUT oFF	**Output status when input errors occur** oFF : Output OFF oN : Output ON Available only for controllers using direct current and voltage inputs, and direct current output.	
bKLT ALL	**Backlight selection** ALL : All are backlit. PV : PV Display is backlit.	
coLR REd	**PV color** GRN : Green REd : Red oRG : Orange ALGR : When any alarm (EV1 to EV4) is ON: Green ⟶ Red When alarm is OFF: Green When any alarm (EV1 to EV4) is ON: The PV color turns from green to red continuously according to the alarm. ALoR : When any alarm (EV1 to EV4) is ON: Orange ⟶ Red When alarm is OFF: Orange When any alarm (EV1 to EV4) is ON: The PV color turns from orange to red continuously according to the alarm. PVGR : PV color changes continuously. PV color changes continuously according to the PV color range. PV is lower than [SV – PV color range]: Orange PV is within [SV±PV color range]: Green PV is higher than [SV + PV color range]: Red APGR : PV color changes continuously + Any alarm (EV1 to EV4) is ON: Red PV color changes continuously according to the PV color range. In addition, when any alarm (EV1 to EV4) is ON: PV color turns red. PV is lower than [SV – PV color range]: Orange PV is within [SV±PV color range]: Green PV is higher than [SV + PV color range]: Red Any alarm (EV1 to EV4) is ON: Red	
cLRG 5.0	**PV color range** Thermocouple, RTD input: 0.1 to 200.0℃ (℉) DC voltage, current input: 1 to 2000 (The placement of the decimal point follows the selection.) Available when PVGR (PV color changes continuously) or APGR [PV color changes continuously + Any alarm (EV1 to EV4) is ON: Red] is selected in [PV color].	
dPTM 0	**Backlight time** 0 to 99 minutes	

12.19 Auto/Manual Control Switch Group

Upper left: PTN Display, PV Display

The PTN Display is unlit, and the PV Display indicates setting characters.

Lower left: STEP Display, SV/MV/TIME Display

The STEP Display is unlit, and the SV/MV/TIME Display indicates factory default value.

Right side: Indicates the setting item and setting range.

Character, Factory Default	Setting Item, Setting Range	Data
MANU AUTo	**Auto/Manual control switch** AUTo : Auto (Automatic control) MANU : Manual (Manual control)	

13. Making Program Pattern Table and Data Table

Before setting program, make a program pattern table and data table.

13.1 Making Program Pattern Table

Please make a copy of the program pattern table (p.177), and follow the procedure below.

(1) Write a block number (Step SV, Step time, PID, Time signal 1 to 8, Wait, Alarm, Output) for each step from Step 0 in numerical order.
(Even if the same block number is used, write for every step.)

(2) Draw a line graph of step SV.

Explanation of Program Pattern Table

Program pattern table consists of Y axis which represents the step SV (℃, ℉), and X axis which represents the step time (Hours:Minutes, Minutes:Seconds).
Step SV is considered to be the SV at the end of the step.
Step time is considered to be the step process time.

• The relation between the step SV and Step time can be explained as follows.

Step 0: The control is performed so that the temperature reaches from 0 to 500℃ for 30 minutes.
Depending on the selection in [Program control start type], control is performed as follows.
- When SV start is selected: Performs control from the step SV set in [Step SV when program control starts] so that the temperature reaches 500℃.
- When PV start or PVR start is selected: Step SV and time are advanced to PV, and control starts so that the temperature reaches 500℃.

Step 1: The control is performed so that SV is maintained at 500℃ for 1 hour.
Step 2: The control is performed so that SV rises from 500℃ to 1000℃ for 40 minutes.
Step 3: The control is performed so that SV is maintained at 1000℃ for 1 hour.
Step 4: The control is performed so that SV drops from 1000℃ to 0℃ for 2 hours.

• PID block includes: OUT1 proportional band, Integral time, Derivative time, ARW, OUT2 proportional band
10 types of PID block (0 – 9) can be set.

• Time signal 1 to 8 (TS1 – TS8) includes: Time signal output OFF time and Time signal output ON time.
16 types of Time signal block (0 – 15) can be set for Time signal 1 to 8 (TS1 – TS8) respectively.
For Time signal 1 to 5 (TS1 – TS5), the Time signal output can be used only when Time signal output is selected in [Time signal output/Status output].

• Wait block includes Wait values.
10 types of Wait block (0 – 9) can be set.

• Alarm block includes: EV1 alarm value, EV2 alarm value, EV3 alarm value, EV4 alarm value
10 types of Alarm block (0 – 9) can be set.

• Output block includes: OUT1 high limit, OUT1 low limit, OUT2 high limit, OUT2 low limit, OUT1 rate-of-change.
10 types of Output block (0 – 9) can be set.

Program Pattern Table Example

Pattern 1					
Step number	0	1	2	3	4
	1000 500 0				
Step SV	500	500	1000	1000	0
Step time	0:30	1:00	0:40	1:00	2:00
PID block number	1	1	2	2	1
Time signal 1 block number	0	1	0	1	0
ON OFF					
Time signal 2 block number	2	2	2	2	2
ON OFF					
Time signal 3 block number	1	2	1	2	0
ON OFF					
Time signal 4 block number	1	1	1	1	0
ON OFF					
Time signal 5 block number	0	0	0	0	1
ON OFF					
Time signal 6 block number	1	0	1	0	1
ON OFF					
Time signal 7 block number	2	0	2	0	2
ON OFF					
Time signal 8 block number	0	0	0	0	2
ON OFF					
Wait block number	1	0	1	0	0
Alarm block number	1	2	1	2	1
Output block number	0	1	0	1	0

(Fig. 13.1-1)

13.2 Making Data Table

Please make a copy of Data Table (p.178), and follow the procedure below.

(1) Write data for blocks in each group, by referring to the Block numbers in the Program pattern table.

(2) For other setting items, write the data in the table if required.

About settings in each block setting group

If program pattern is not set for a step, its block number becomes 0 (zero). We highly recommend that you leave the factory default values of Block 0 in each block setting group as they are, and set the values from Block 1.

Data Table Example

• PID block setting group (*1)

Block number	OUT1 P-band	Integral time	Derivative time	ARW	OUT2 P-band
0	10℃	200 sec	50 sec	50%	1.0 times
1	10℃	200 sec	50 sec	50%	1.0 times
2	10℃	200 sec	50 sec	50%	1.0 times

• Time signal block setting group (TS option)

Block number	Time signal output OFF time (Hours:Minutes)	Time signal output ON time (Hours:Minutes)
0	0:00	0:00
1	0:20	0:30
2	0:00	0:30

• Wait block setting group

Block number	Wait value
0	0℃ (*2)
1	10℃
2	5℃

• Alarm block setting group (*3)

Block number	EV1 alarm value (Pattern end output)	EV2 alarm value (Process high alarm)	EV3 alarm value (High limit alarm)	EV4 alarm value (Low limit alarm)
0		0℃ (*4)	0℃ (*4)	0℃ (*4)
1		600℃	5℃	5℃
2		1100℃	10℃	10℃

• Output block setting group

Block number	OUT1 high limit	OUT1 low limit	OUT2 high limit	OUT2 low limit	OUT1 rate-of change
0	100% (*5)	0% (*5)	100%	0%	0 %/sec
1	80%	0%	80%	0%	10 %/sec
2	100%	10%	100%	10%	0 %/sec

(*1) As PID constant are obtained by performing AT, values in the PID block setting group are factory default value.

(*2) As 'Block 0 Wait value' is used as Wait Disabled, the Wait value is factory default value.

(*3) As EV1 is used as Pattern end output, 'EV1 alarm value' setting item does not appear.

(*4) As Block 0 EV2, EV3, EV4 alarm values are used as No alarm action, their values are factory default value.

(*5) As Block 0 OUT1 high limit and low limit are used as MV setting range for manual control, their values are factory default value.

• **Other setting data**

Setting Item	Data
OUT1 proportional cycle	15 sec
OUT2 proportional cycle	15 sec
Number of repetitions	1
Pattern link	Disabled
Communication protocol	Shinko protocol
Instrument number	1
Communication speed	38400 bps
Data bit/Parity	7 bits/Even
Stop bit	1 bit
Response delay time	10 ms
Overshoot suppression factor	1.0

Program Pattern Table

Please make a copy of this table for use.

Pattern number																
Step number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1000																
500																
0																
Step SV																
Step time																
PID block number																
Time signal 1 block number																
ON																
OFF																
Time signal 2 block number																
ON																
OFF																
Time signal 3 block number																
ON																
OFF																
Time signal 4 block number																
ON																
OFF																
Time signal 5 block number																
ON																
OFF																
Time signal 6 block number																
ON																
OFF																
Time signal 7 block number																
ON																
OFF																
Time signal 8 block number																
ON																
OFF																
Wait block number																
Alarm block number																
Output block number																

Data Table

Please make a copy of this table for use.

• PID block setting group

Block number	OUT1 P-band	Integral time	Derivative time	ARW	OUT2 P-band
0		sec	sec	%	
1		sec	sec	%	
2		sec	sec	%	
3		sec	sec	%	
4		sec	sec	%	
5		sec	sec	%	
6		sec	sec	%	
7		sec	sec	%	
8		sec	sec	%	
9		sec	sec	%	

• Time signal block setting group (TS option)

Block number	Time signal output OFF time (:)	Time signal output ON time (:)
0	:	:
1	:	:
2	:	:
3	:	:
4	:	:
5	:	:
6	:	:
7	:	:
8	:	:
9	:	:
10	:	:
11	:	:
12	:	:
13	:	:
14	:	:
15	:	:

• Wait block setting group

Block number	Wait value
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

• Alarm block setting group

Block number	EV1 alarm value ( )	EV2 alarm value ( )	EV3 alarm value ( )	EV4 alarm value ( )
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				

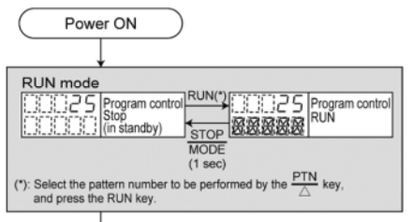
• Output block setting group

Block number	OUT1 high limit	OUT1 low limit	OUT2 high limit	OUT2 low limit	OUT1 rate-of change
0	%	%	%	%	%/sec
1	%	%	%	%	%/sec
2	%	%	%	%	%/sec
3	%	%	%	%	%/sec
4	%	%	%	%	%/sec
5	%	%	%	%	%/sec
6	%	%	%	%	%/sec
7	%	%	%	%	%/sec
8	%	%	%	%	%/sec
9	%	%	%	%	%/sec

• Other setting data

Setting item	Data
OUT1 proportional cycle	sec
OUT2 proportional cycle	sec
Number of repetitions	times
Pattern link	
Communication protocol	
Instrument number	
Communication speed	bps
Data bit/Parity	
Stop bit	
Response delay time	ms
Overshoot suppression factor	

PCA1 Key Operation Flowchart



●Setting Items

Setting pattern number

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

: This setting item is optional, and appears only when the option is ordered.

●Key Operation

- SET RST : Returns to RUN mode from any mode.
- DISP B.MODE : Progresses back through setting items (opposite to when the STOP MODE key or HOLD ENT key is pressed).
- STOP MODE + DISP B.MODE : When the STOP MODE and DISP B.MODE key are pressed simultaneously, the mode returns to the previous setting group as follows.

- RUN (3 sec) : Program clearing
  When program control is stopped (in standby), and if the RUN key is pressed for 3 seconds at any items in Pattern setting group, data (for current step on the STEP Display and all the following steps) will return to the default value.
- PTN + ADV + DISP B.MODE (3 sec) : Data clearing
  When program control is stopped (in standby), and if the PTN, ADV and DISP B.MODE keys are pressed simultaneously for 3 seconds, the PV Display indicates CLR, and all program and setting data – except Input type, OUT1 proportional cycle, OUT2 proportional cycle – will return to the default value. It takes approximately 30 seconds for data clear.

●Selection Items

Pattern link		PT100 -200 to 850 °C	10MV	0 to 10mV -2000 to 10000	001	High limit alarm	NoML Shinko protocol	AUTO Automatic start	STOP Not holding	**Backlight selection**	
-----	Pattern link Disabled	JPT100 -200 to 500 °C	-10MV	-10 to 10mV -2000 to 10000	002	High limit with standby	ModA Modbus ASCII mode	**Program control start type**	HOLD Holding	ALL	All are backlit
CHIN	Pattern link Enabled	PT100 -100.0 to 100.0 °C	50MV	0 to 50mV -2000 to 10000	003	Low limit alarm	ModR Modbus RTU mode	PV	PV start	**Time signal output TS1/Status (RUN)**	PV	PV Display is backlit
AT mode		PT100 -100.0 to 500.0°C	100MV	0 to 100mV -2000 to 10000	004	Low limit with standby	SVT SV digital transmission	PVR	PVR start	TS1	Time signal output TS1	**PV color**	
NoML	Normal mode	K -328 to 2498 °F	0 1V	0 to 1V -2000 to 10000	005	H/L limits alarm	**Communication speed**	SV	SV start	RUN	Status output (RUN)	GRN	Green
MULT	Multi mode	K -328.0 to 752.0 °F	0 5V	0 to 5V -2000 to 10000	006	H/L limits with standby	96 9600 bps	**Power restore action**		**Time signal output TS2/Status (HOLD)**		RED	Red
AT Perform/Cancel		J -328 to 1832 °F	1 5V	1 to 5V -2000 to 10000	007	H/L limit range alarm	192 19200 bps	STOP	Stops after power is restored	TS2	Time signal output TS2	ORG	Orange
-----	AT Cancel	R 32 to 3200 °F	0 10V	0 to 10V -2000 to 10000	008	H/L limit range with standby	384 38400 bps	CONT	Continues after power is restored	HOLD	Status output (HOLD)	ALGR	Alarm (EV1-EV4) ON: Green→Red
AT	AT Perform	S 32 to 3200 °F	**Decimal point place**		009	Process high alarm	**Data bit/Parity**	HOLD	Suspends after power is restored	**Time signal output TS3/Status (WAIT)**		ALOR	Alarm (EV1-EV4) ON: Orange→Red
Input type		B 32 to 3308 °F	0	No decimal point	010	Process high with standby	8NON 8 bits/ No parity	**Step time unit**		TS3	Time signal output TS3	PVGR	PV color changes continuously
K	K -200 to 1370 °C	E -328 to 1472 °F	0.0	1 digit after decimal point	011	Process low alarm	7NON 7 bits/ No parity	MIN	Hours:Minutes	WAIT	Status output (WAIT)	APGR	PV color changes continuously + Alarm (EV1-EV4) ON: Red
K	K -200.0 to 400.0 °C	T -328.0 to 752.0 °F	0.00	2 digits after decimal point	012	Process low with standby	8EVN 8 bits/ Even	SEC	Minutes:Seconds	**Time signal output TS4/Status (FAST)**			
J	J -200 to 1000 °C	N -328 to 2372 °F	0.000	3 digits after decimal point	013	Pattern end output	7EVN 7 bits/ Even	**Step time indication**		TS4	Time signal output TS4		
R	R 0 to 1760 °C	PL-II 32 to 2534 °F	0.0000	4 digits after decimal point	014	Loop break alarm output	8odd 8 bits/ Odd	RT	Remaining time	FAST	Status output (FAST)		
S	S 0 to 1760 °C	C(W/Re5-26) 32 to 4199 °F	**OUT2 cooling method**		015	Output during AT	7odd 7 bits/ Odd	TM	Step time	**Time signal output TS5/Status (STOP)**			
B	B 0 to 1820 °C	PT100 -328.0 to 1562.0 °F	AIR	Air cooling	**EV□ Alarm Energized/De-energized**		**Stop bit**	**Step SV indication**		TS5	Time signal output TS5		
E	E -200 to 800 °C	JPT100 -328.0 to 932.0 °F	OIL	Oil cooling	NoML	Energized	1 1 bit	SV	SV corresponding to the step time progress	STOP	Status output (STOP)		
T	T -200.0 to 400.0 °C	PT100 -328 to 1562 °F	WAT	Water cooling	REVS	De-energized	2 2 bits	PTN	Step SV	**Overshoot suppression Enabled/Disabled**			
N	N -200 to 1300 °C	JPT100 -328 to 932 °F	**Direct/Reverse action**		**Transmission output type**		**Set value lock**	**Step SV Hold function when program ends**		OFF	Disabled	**Auto/Manual control switch**	
PL2	PL-II 0 to 1390 °C	PT100 -148.0 to 212.0 °F	HEAT	Reverse action	PV	PV transmission	----- Unlock			ON	Enabled	AUTO	Automatic control
C	C(W/Re5-26) 0 to 2315 °C	PT100 -148.0 to 932.0 °F	COOL	Direct action	SV	SV transmission	LOCK Lock			**Output status when input errors occur**		MANU	Manual control
PT	PT100 -200.0 to 850.0 °C	420MA 4 to 20mA -2000 to 10000	**Event output EV□ allocation**		MV	MV transmission	**Program start Auto/Manual**			OFF	Output OFF		
JPT	JPT100 -200.0 to 500.0 °C	020MA 0 to 20mA -2000 to 10000	000	No event	**Communication protocol**		MANU Manual start			ON	Output ON		

***** 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 ---------- PCA1R00-410
- Option ---------- C, TS, TA
- Serial number ---------- No. 165F05000

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

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