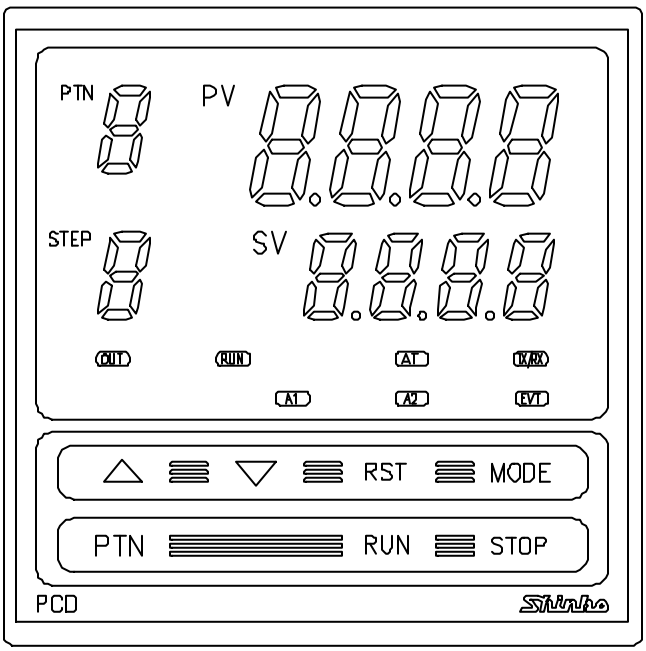
INSTRUCTION MANUAL

FOR

PROGRAMMABLE CONTROLLER

PCD-33A



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Preface

Thank you for the purchase of our Programmable Controller PCD-33A.
This manual contains instructions for the mounting, functions, operations and notes when operating the PCD-33A.
For confirmation of the model and specifications, please read this manual carefully before starting operation.

To prevent accidents arising from the misuse of this controller, please ensure the operator using it receives this manual.

Notes

- This instrument should be used according to the specifications described in the manual. If it is not used according to the specifications, it may malfunction or cause fire.
- Be sure to follow the warnings, cautions and notices. If not, it could cause serious injury or malfunction.
- Specifications of the PCD-33A and the contents of this instruction manual are subject to change without notice.
- Care has been taken to assure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform us through the shop where you purchased the unit.
- Any unauthorized transfer or copying of this document, in part or in whole, is prohibited.
- Shinko Technos CO., LTD. is not responsible for any damages or secondary damages incurred as a result of using this product, including any indirect damages.

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 be linked to serious results, so be sure to follow the directions for usage.

⚠ Warning

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

⚠ Caution

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

1. Installation precautions

⚠ Caution

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

Mount the controller in a place with:

- A minimum of dust, and an absense of corrosive gasses
- No flammable, explosive gasses
- Few mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of 0 to 50℃ (32 to 122℉) that does not change rapidly
- 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

Note: Although the case of this instrument is made of flame-resistant resin, do not install this instrument near flammable material.
Avoid setting this instrument directly on flammable material.

2. Wiring precautions

⚠ Caution

- Use the solderless terminal with an isolation sleeve that fits to the M3 screw when wiring the PCD-33A.
- 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 (M3).
- Tighten the terminal screw (M3) within the specified torque. If excessive force is applied to the screw when tightening, the screw (M3) or case may be damaged.
- 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, as the input circuit may be burnt out.
- This controller has no built-in power switch or fuse. It is necessary to install them near the controller.
  (Recommended fuse: Time-lag fuse, Rated voltage 250V AC, Rated current 2A)
- When using a 24V AC/DC for the power source, do not confuse the polarity when it is DC.

3.Running and maintenance precautions

⚠ Warning

- It is recommended to perform PID auto-tuning during trial run.
- Do not touch live terminals. This may cause electric shock or problems in operation.
- Turn the power supplied to the instrunment OFF before retightening the terminal. Working or touching the terminal with the power switched ON may result in severe injury or death due to Electric Shock.
- Be sure to turn OFF the power to the PCD-33A before cleaning.
- Wipe the instrument using a soft dry cloth.
  (If paint thinner is used for wiping, the instrument may be deformed or discolored.)
- The display part is vulnerable. Do not strike it with hard objects or press hard on it.

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1. Model names

1.1 Model names

Alphanumeric character to represent the functions or type is applied to the □.

[Example]

PCD-33A – R / M , C5 ,

- C5 — Option: Serial communication
- M — Input: Multi-input
- R — Control output: Relay contact output

Standard models

PCD – 33A – □ / M, □ □□□□						Series name: PCD-300
Control action	3					PID action
Alarm action		A				Alarm 1 (A1), Alarm 2 (A2) (*1)
Control output (OUT)			R			Relay contact
			S			Non-contact voltage
			A			DC current
Input				M		K, J, R, S, B, E, T, N, PL-Ⅱ, C (W/Re5-26), Pt100, JPt100, 4 to 20mA DC, 0 to 20mA DC, 0 to 1V DC, 0 to 5V DC, 1 to 5V DC 0 to 10V DC (*2)
					1	24V AC/DC 50/60Hz (*3)
Options					C5	Serial communication (based on EIA RS-485) (*4)
					SVTC	Setting value digital transmission (*4)
					P24	Isolated power output (*5)
					TC	Electrical shock protection terminal cover
					BK	Color, Black Front panel: Dark gray Case: Black

*1: 9 types of alarm action and no alarm action can be selected by the front keypad operation.

*2: One input type can be selected from 10 thermocouple types (K, J, R, S, B, E, T, N, PL-Ⅱ, C (W/Re5-26)), 2 RTD types (Pt100, JPt100), 2 DC current types (4 to 20mA DC, 0 to 20mA) and 4 DC voltage types (0 to 1V DC, 0 to 5V DC, 1 to 5V DC, 0 to 10V DC) by the front keypad operation.

*3: For the supply voltage, 100 to 240V AC is standard. “1” is entered for 24V AC/DC.

*4: If this option is applied, standard external operation is not available. C5 and SVTC cannot be applied together.

*5: If this option is applied, standard Alarm 2 (A2) is not available.

1.2 Rated scale

(Table 1.2-1)

Input type		Input range		Resolution
Thermo-couple	K	-200 to 1370 ℃	-320 to 2500 ℉	1℃(℉)
		-199.9 to 400.0 ℃	-199.9 to 750.0 ℉	0.1℃(℉)
	J	-200 to 1000 ℃	-320 to 1800 ℉	1℃(℉)
	R	0 to 1760 ℃	0 to 3200 ℉	1℃(℉)
	S	0 to 1760 ℃	0 to 3200 ℉	1℃(℉)
	B	0 to 1820 ℃	0 to 3300 ℉	1℃(℉)
	E	-200 to 800 ℃	-320 to 1500 ℉	1℃(℉)
	T	-199.9 to 400.0 ℃	-199.9 to 750.0 ℉	0.1℃(℉)
	N	-200 to 1300 ℃	-320 to 2300 ℉	1℃(℉)
	PL-Ⅱ	0 to 1390 ℃	0 to 2500 ℉	1℃(℉)
	C (W/Re5-26)	0 to 2315 ℃	0 to 4200 ℉	1℃(℉)
RTD	Pt100	-199.9 to 850.0 ℃	-199.9 to 999.9 ℉	0.1℃(℉)
		-200 to 850 ℃	-300 to 1500 ℉	1℃(℉)
	JPt100	-199.9 to 500.0 ℃	-199.9 to 900.0 ℉	0.1℃(℉)
		-200 to 500 ℃	-300 to 900 ℉	1℃(℉)
DC current DC voltage	4 to 20mA DC	-1999 to 9999 *1, *2		1
	0 to 20mA DC	-1999 to 9999 *1, *2		1
	0 to 1V DC	-1999 to 9999 *1		1
	0 to 10V DC	-1999 to 9999 *1		1
	1 to 5V DC	-1999 to 9999 *1		1
	0 to 5V DC	-1999 to 9999 *1		1

(*1) For DC current and voltage inputs, scaling and decimal point place change are possible.

(*2) For DC current input, 50Ω shunt resistor (sold separately) must be installed.

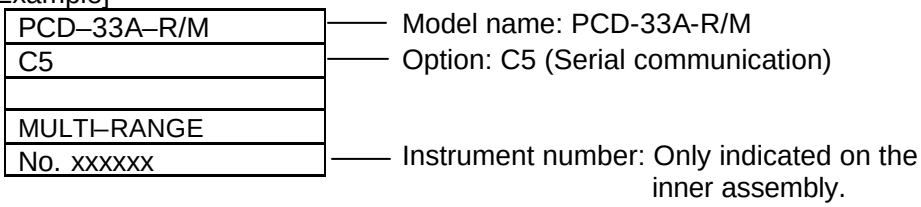
1.3 How to read the model nameplate

⚠ Warning

Do not take the inner assembly out or touch the terminal with the power supply on when confirming the model nameplate.
Touching the terminal with the power switched ON may result in severe injury or death due to Electric Shock.

Model nameplates are attached to the case and the left side of the inner assembly.

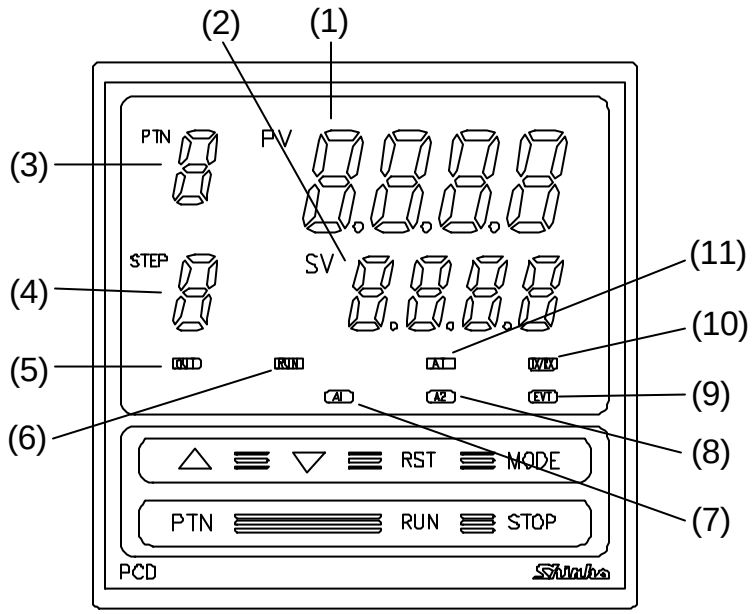
[Example]



(Fig. 1.3-1)

2 Name and functions of the sections

2.1 Name and Displays



(Fig. 2.1-1)

(1) **PV display** (Red)
Indicates the Process variable (PV).
When the setting mode is indicated, the setting item is indicated.

(2) **SV display** (Green)
Indicates the Setting value (SV).
When the setting mode is indicated, the setting value is indicated.

(3) **PTN display** (Green)
Indicates the Pattern number.

(4) **STEP display** (Green)
Indicates the step number.
While Wait function is working, the related step number blinks.

(5) **OUT indicator** (Green)
Lights when the control output is on.
(For the current output type, it blinks at a cycle of every 0.25 second corresponding to the output manipulated variable.)

(6) **RUN indicator** (Red)
Lights while program control is performing.
Blinks while program control is held.

(7) **A1 indicator** (Red)
Lights when Alarm 1 (A1) output is on.

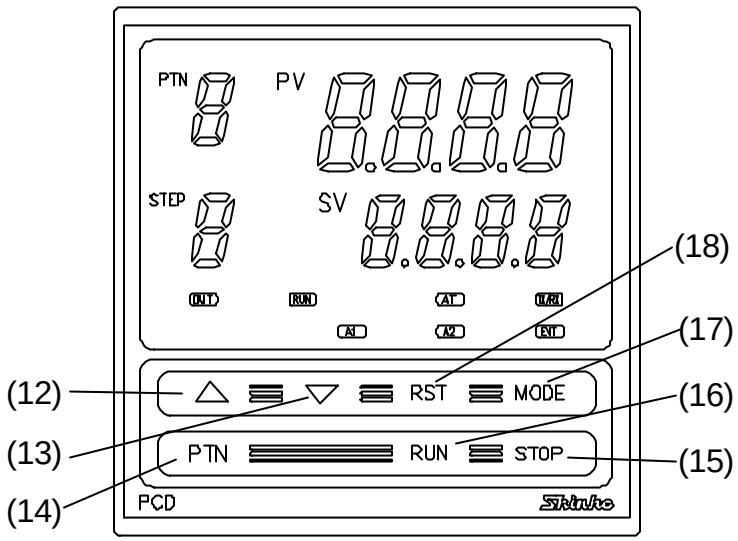
(8) **A2 indicator** (Red)
Lights when Alarm 2 (A2) output is on.

(9) **EVT indicator** (Red)
Lights when a selected output type from the Time signal output, Pattern end output and Run output is on.

(10) **TX/RX indicator** (yellow)
Blinks while transmitting data in the Serial communication.

(11) **AT indicator** (yellow)
Blinks while auto-tuning is being performed.

2.2 Keys



(Fig. 2.2-1)

(12) △ **(Increase key)** : Increases the numeric value on the SV display or switches to the next item.
(13) ▽ **(Decrease key)** : Decreases the numeric value on the SV display or switches to the next item.
(14) **PTN (Pattern key)** : Selects a program pattern number.
(15) **STOP (Stop key)** : Cancels the program control or the pattern end output.
(16) **RUN (Run key)** : Starts a program control, or advances to the next step after cancelling the current step (Advance function).
(17) **MODE (Mode key)** : Switches to the next setting mode, and registers the setting values.
(18) **RST (Reset key)** : Releases the setting mode, then reverts to the Program standby mode or Program control run mode.

3. Mounting to control panel

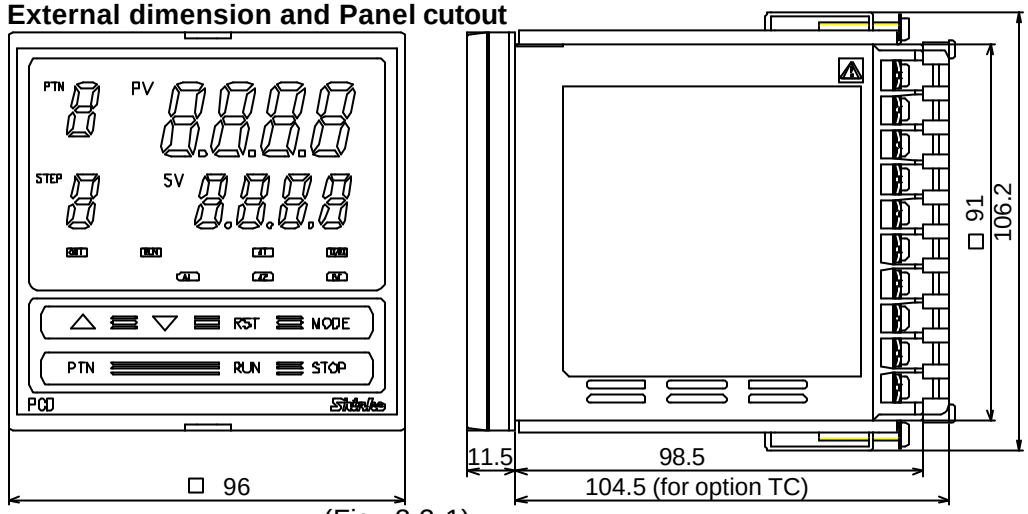
3.1 Site selection

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

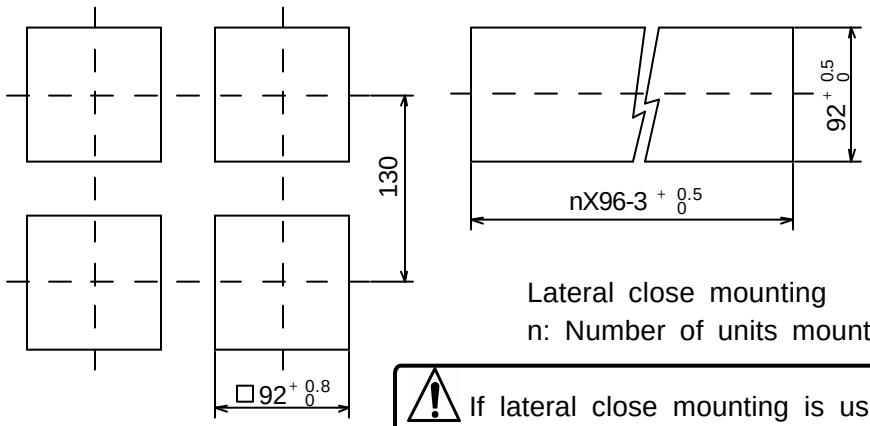
Mount the controller in a place with:

(1) A minimum of dust, and an absence of corrosive gases
(2) No flammable, explosive gasses
(3) No mechanical vibrations or shocks
(4) No exposure to direct sunlight, an ambient temperature of 0 to 50℃ (32 to 122℉) that does not change suddenly
(5) An ambient non-condensing humidity of 35 to 85%RH
(6) No large capacity electromagnetic switches or cables through which large current is flowing
(7) No water, oil or chemicals or where the vapors of these substances can come into direct contact with the controller

3.2 External dimension and Panel cutout



(Fig. 3.2-1)



Lateral close mounting
n: Number of units mounted

(Fig. 3.2-2)

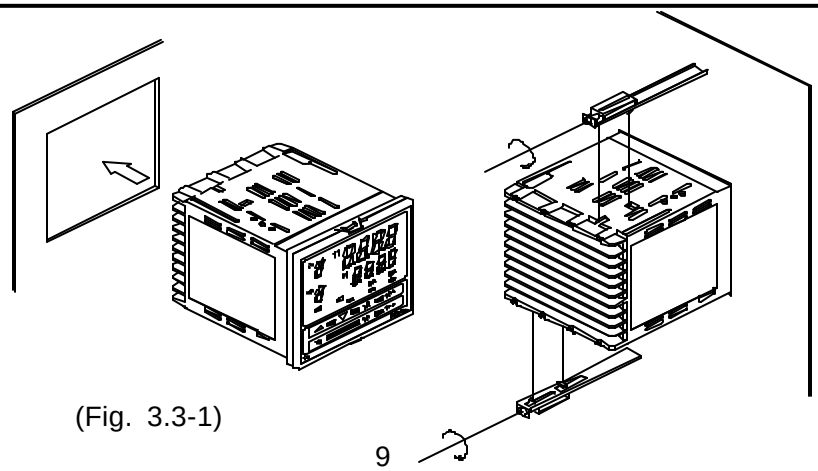
⚠ If lateral close mounting is used for the controller, IP66 specification will not be fulfilled.

3.3 Mounting

Mounting panel thickness is 1 to 15mm.
Insert the PCD-33A from the front of the control panel.
Slot the mounting bracket to the holes at the top and bottom of the case, and screw in place.

⚠ **Notice**

As the case is made of resin, do not use excessive force while screwing in the mounting bracket. The torque is approximately 0.12N•m.



(Fig. 3.3-1)

4. Wiring connection

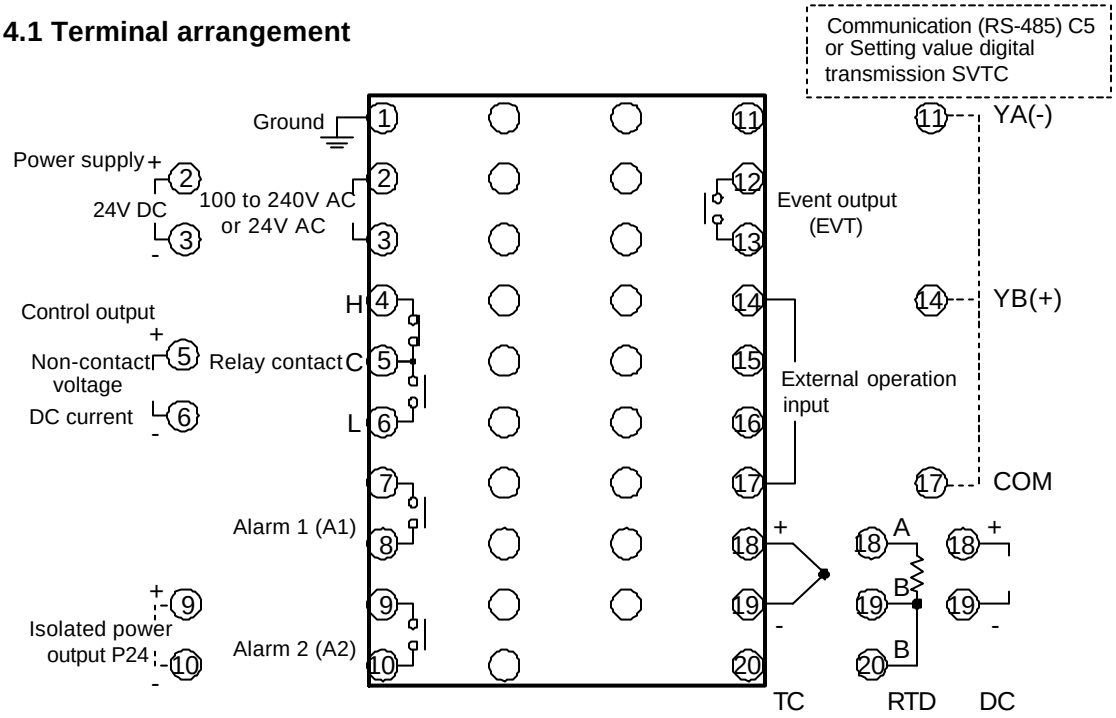
⚠ Warning

Turn the power supply to the instrument off before wiring or checking. Working or touching the terminal with the power switched on may result in severe injury or death due to Electric Shock.
Moreover, the instrument must be grounded before the power supply to the instrument is turned on.

⚠ Caution

- Do not drop wire chips into the instrument, because they could cause fire, malfunction or inconvenience.
- For the ground terminal of the PCD-33A, use 2mm^2 or greater of thick wire. However, avoid grounding in conjunction with the power line.
- Use the solderless terminal with an isolation sleeve that fits to the M3 screw when wiring the PCD-33A terminals.
- The terminal block of the PCD-33A 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 to the specified torque. If the screw is tightened too hard, the screw or case may be damaged.
- Use a thermocouple, compensating lead wire and 3-wire system RTD according to the input specification of this controller.
- In the case of 24V DC for power source, do not confuse the polarity.
- With the relay contact output type, externally use an auxiliary electromagnetic switch according to the capacity of the load to protect the built-in relay contact.
- When wiring, keep input wire (thermocouple, RTD, etc.) away from AC source and load wire to avoid external interference.
- This controller has neither a built-in power switch nor a fuse. Therefore, it is necessary to install them in the circuit near the external controller. (Recommended fuse: Time-lag fuse, rated voltage 250Vac, rated current 2A)
- Do not apply a commercial power source to the sensor connected to the input terminal nor allow the power source to come into contact with the sensor, as the input circuit may be burnt out.

4.1 Terminal arrangement



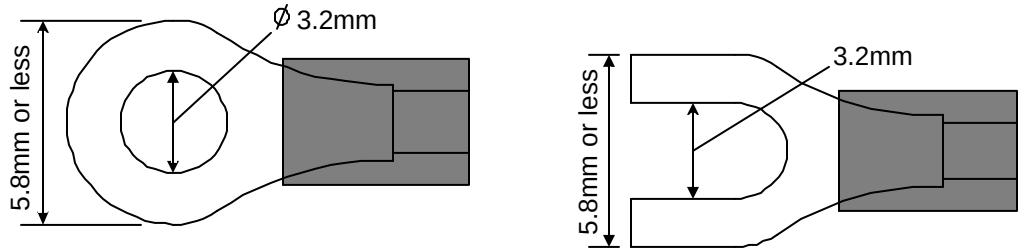
(Fig. 4.1-1)

- Dotted lines show options.
- When the option C5 or SVTC is applied, external operation cannot be performed. The options C5 and SVTC cannot be applied together.
  For details of options, see page 54.

● Solderless terminal

Use a solderless terminal with an isolation sleeve that fits to the M3 screw as shown below.

Solderless terminal	Manufacturer	Model name	Tightening torque
Y type	Nichifu Terminal Industries CO.,LTD.	1.25Y-3	0.6N•m Max. 1.0N•m
	Japan Solderless Terminal MFG CO.,LTD.	VD1.25-B3A	
Round type	Nichifu Terminal Industries CO.,LTD.	1.25-3	
	Japan Solderless Terminal MFG CO.,LTD.	V1.25-3	



(Fig. 4.1-2)

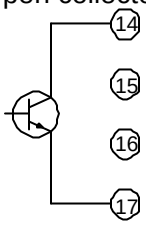
● **External operation function**

Program control run and Program control stop can be performed externally.
See (Fig. 4.1-3) and (Fig. 4.1-4).

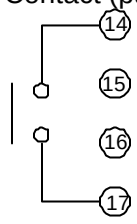
• **External operation input terminals**

External operation comprises of the following 2 types of input.

Open collector input



Contact (pulse) input



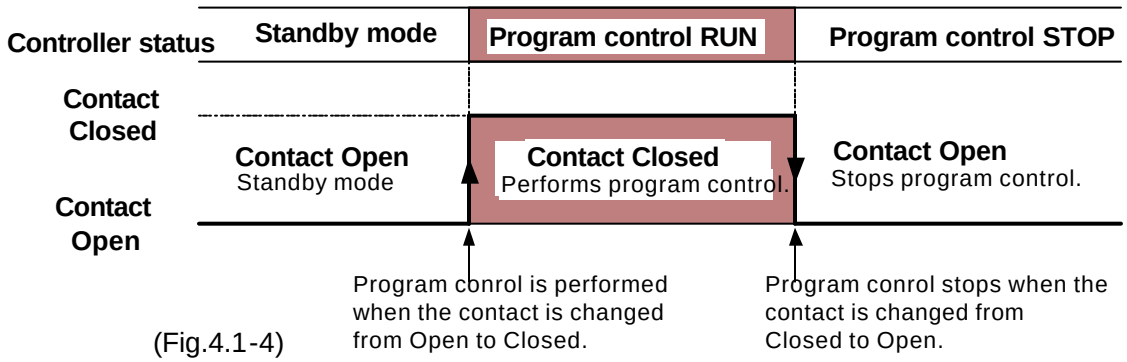
(Fig. 4.1-3)

• **Program control run**

Program control is performed when terminals 14 and 17 are closed.

• **Program control stop**

Program control stops when terminals 14 and 17 are opened.
If pattern end output is turned ON after program control ends, pattern end output stops by opening the terminals 14 and 17.

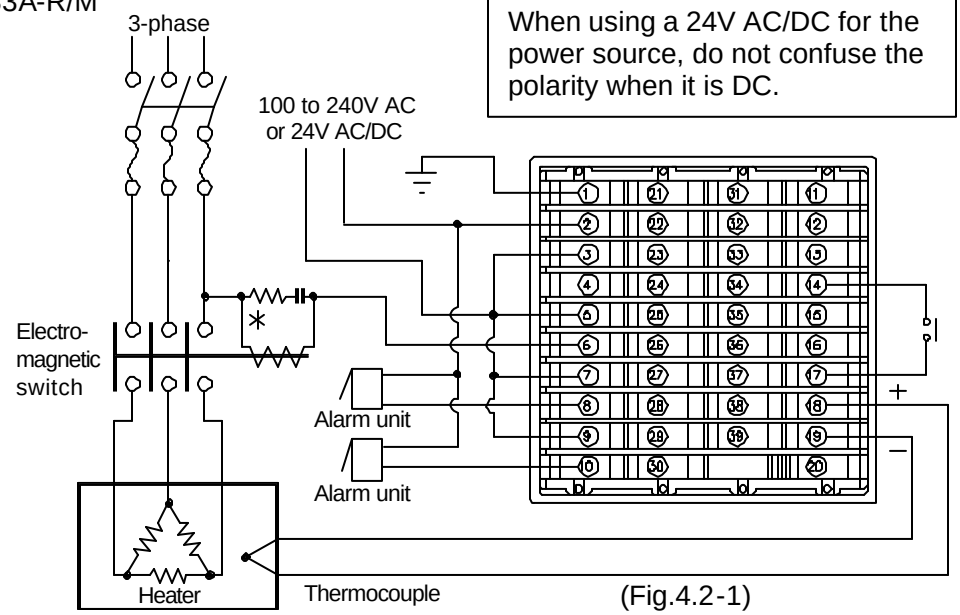


(Fig.4.1-4)

4.2 Wiring examples

PCD-33A-R/M

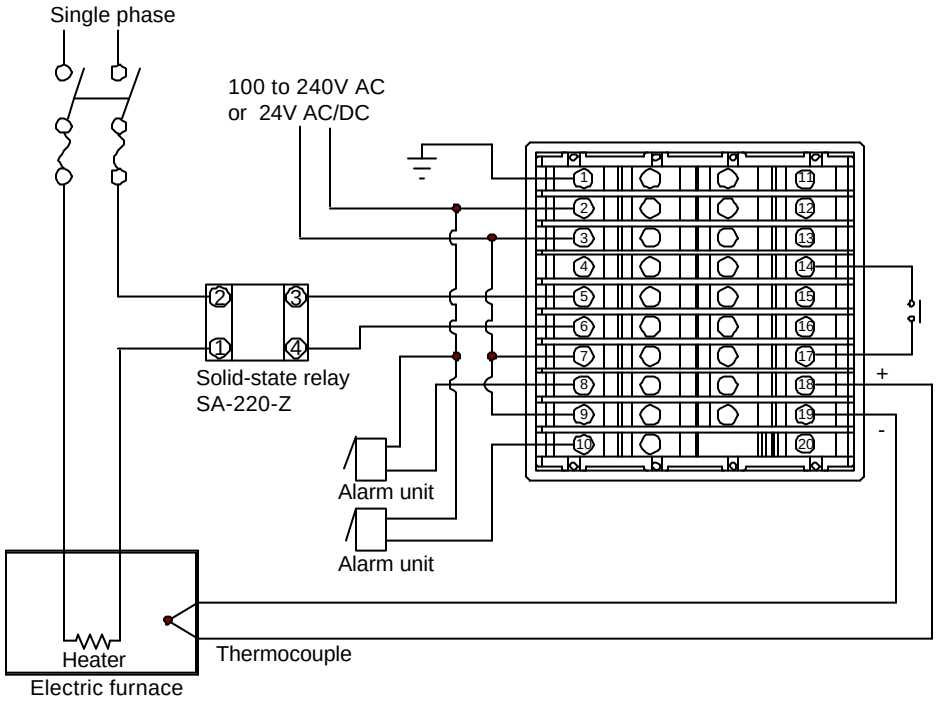
⚠ Caution
When using a 24V AC/DC for the power source, do not confuse the polarity when it is DC.



(Fig.4.2-1)

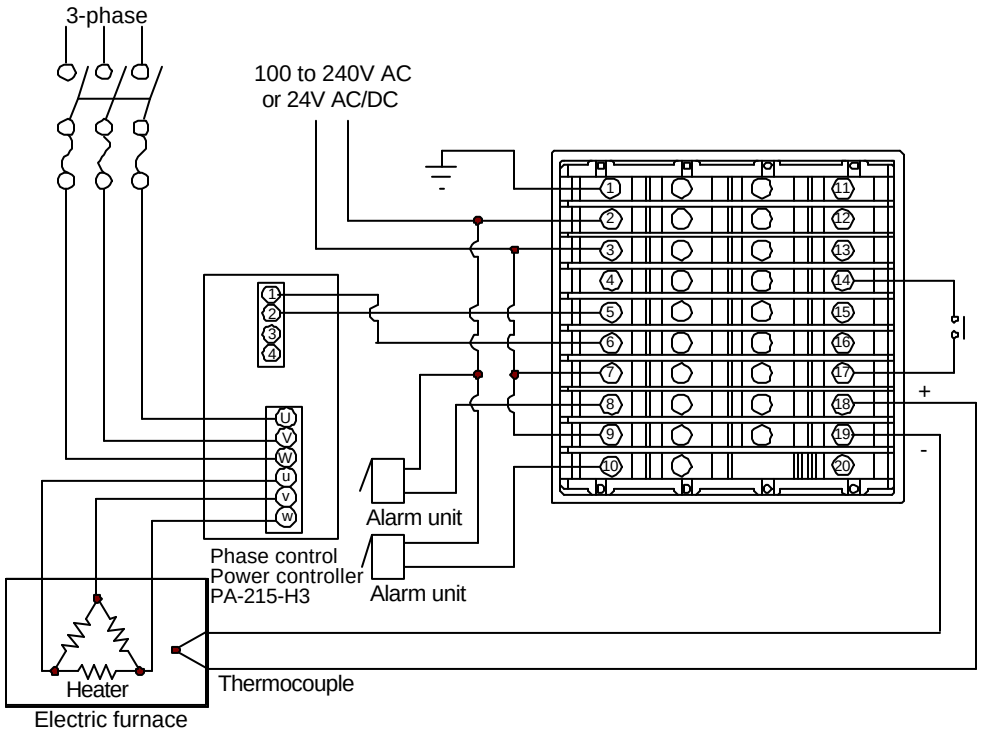
For the relay contact output type (PCD-33A-R/M), it is recommended that a surge absorber be installed between the electromagnetic switch coils to prevent the unit from harmful effects of unexpected level noise.

PCD-33A-S/M



(Fig.4.2-2)

PCD-33A-A/M



(Fig. 4.2-3)

5. Setup

5.1 Setup

Before using this controller, it is necessary to set up the Sensor type, Program control start form, Alarm action, Control action, etc. according to the users' conditions.
If the users' specification is the same as the default value of the PCD-33A, it is not necessary to set up the controller. Proceed to Chapter "6. Operations" (p.21)
Set up the controller after connecting terminals 2 and 3 for the power supply to this instrument, referring to "4. Wiring connection" (p.10).

Setup is conducted in Auxiliary function setup mode 2.
The setting item and default value in Auxiliary function setting mode 2 are shown below (Table 5.1-1).

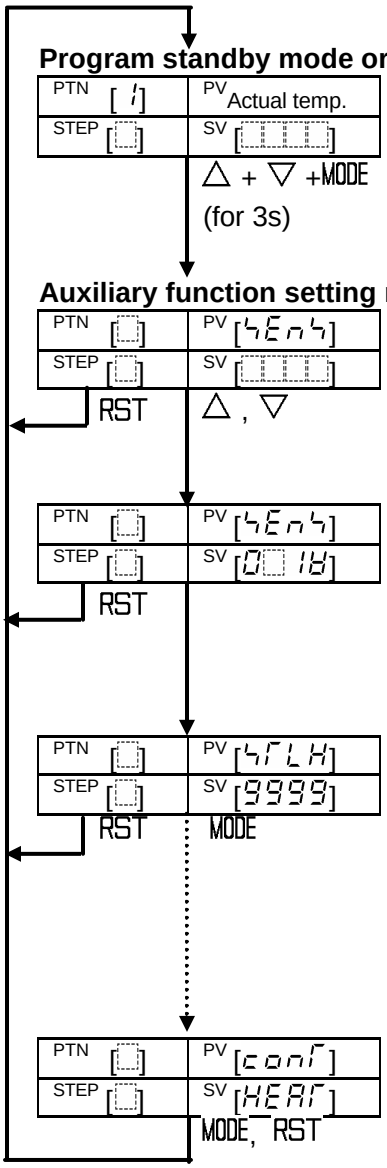
(Table 5.1-1)

	PV display	Setting/Selection item	Default value
(1)	sEnS	Input type selection Selects a sensor type and unit ℃/℉.	Thermocouple K -200 to 1370℃
(2)	sFLH	Scaling high limit setting Sets the scaling high limit value.	9999
(3)	sFLL	Scaling low limit setting Sets the scaling low limit value.	-1999
(4)	dP□□	Decimal point place selection Selects a decimal point place.	No decimal point
(5)	FILF	PV filter time constant setting Sets the PV filter time constant.	0.0 seconds
(6)	n_S□	Step time unit selection Selects the step time unit.	Hour:Minute
(7)	S_SV	Step SV setting when control starts Sets step SV when program control starts.	0℃
(8)	S_SL	Program control start form selection Selects the program control start form.	PV start
(9)	oLH□	Control output high limit setting Sets control output high limit.	100%
(10)	oLL□	Control output low limit setting Sets control output low limit.	0%
(11)	HYS□	Control output ON/OFF action Hysteresis setting Sets control output ON/OFF action hysteresis.	1.0℃
(12)	AL 1F	Alarm 1 (A1) action selection Selects Alarm 1 (A1) action type.	No alarm action
(13)	AL2F	Alarm 2 (A2) action selection Selects Alarm 2 (A2) action type.	No alarm action
(14)	A 1Ln	Alarm 1 (A1) Energized/Deenergized selection Selects Alarm 1 (A1) Energized/Deenergized.	Energized
(15)	A2Ln	Alarm 2 (A2) Energized/Deenergized selection Selects Alarm 2 (A2) Energized/Deenergized.	Energized
(16)	A 1HY	Alarm 1 (A1) hysteresis setting Sets Alarm 1 (A1) hysteresis.	1.0℃
(17)	A2HY	Alarm 2 (A2) hysteresis setting Sets Alarm 2 (A2) hysteresis.	1.0℃
(18)	A 1dY	Alarm 1 (A1) action delayed timer setting Sets Alarm 1 (A1) action delayed timer.	0 seconds

(19)	A2dY	Alarm 2 (A2) action delayed timer setting Sets Alarm 2 (A2) action delayed timer.	0 seconds
(20)	EVTL	Event output function selection Selects an Event output type.	Time signal output
(21)	PETn	Pattern end output time setting Sets pattern end output time.	0s (Continuous output)
(22)	cont	Direct/Reverse action selection Selects Direct (Cooling) or Reverse (Heating) action.	Reverse (Heating) action

5.2 Basic operation for setup

The following shows how to bring up Auxiliary function setting mode 2 and set it up.
To go to Auxiliary function setting mode 2, press the MODE key for 3 seconds while holding down the △ and ▽ keys in the program standby mode or in the program control run mode.
Set or select the values with the △ and ▽ key.
To register the values, use the MODE or RST key.



Input type selection
Select a sensor type to match with users' with the △ or ▽ key.
• Default: K (K, -200 to 1370℃)

DC voltage input 0 10 (0 to 1V DC) has been selected. in this example.
Press the MODE key. The input type will be registered and the Scaling high limit setting item will appear.
If any other input type except for DC input is selected, the Filter time constant setting item will appear.

Scaling high limit setting
Set a value with the △ or ▽ key and register it with the MODE key.

Set other items in the same way according to the users' conditions.

If the MODE key is pressed several times or if the RST key is pressed, the controller reverts to the program standby mode.

If the RST key is pressed, the controller reverts to the program standby mode from any mode.

5.3 Setting items in Auxiliary function setting mode 2

(1) **SEnS**: **Input type selection**

Selects a sensor type and temperature unit.
Set the same sensor type as the users'.
Selecting item: Refer to (Table 5.3-1) below.
Default value: tC (K, -200 to 1370℃)

(Table 5.3-1)

Input types		Scale range	Character	Scale range	Character
Thermo-couple	K	-200 to 1370 ℃	tC	-320 to 2500 ℉	tF
		-199.9 to 400.0 ℃	t .C	-199.9 to 750.0 ℉	t .F
	J	-200 to 1000 ℃	JC	-320 to 1800 ℉	JF
	R	0 to 1760 ℃	rC	0 to 3200 ℉	rF
	S	0 to 1760 ℃	SC	0 to 3200 ℉	SF
	B	0 to 1820 ℃	bC	0 to 3300 ℉	bF
	E	-200 to 800 ℃	EC	-320 to 1500 ℉	EF
	T	-199.9 to 400.0 ℃	r .C	-199.9 to 750.0 ℉	r .F
	N	-200 to 1300 ℃	nC	-320 to 2300 ℉	nF
	PL-Ⅱ	0 to 1390 ℃	PL2C	0 to 2500 ℉	PL2F
	C(W/Re5-26)	0 to 2315 ℃	cC	0 to 4200 ℉	cF
RTD	Pt100	-199.9 to 850.0 ℃	P .C	-199.9 to 999.9 ℉	P .F
		-200 to 850 ℃	PC	-300 to 1500 ℉	PF
	JPt100	-199.9 to 500.0 ℃	JP.C	-199.9 to 900.0 ℉	JP.F
		-200 to 500 ℃	JPC	-300 to 900 ℉	JPF
DC current DC voltage	4 to 20mA	-1999 to 9999			420A
	0 to 20mA	-1999 to 9999			020A
	0 to 1V	-1999 to 9999			0 1V
	0 to 5V	-1999 to 9999			0 5V
	1 to 5V	-1999 to 9999			1 5V
	0 to 10V	-1999 to 9999			0 10V

(2) **SCLH** **Scaling high limit setting**

(3) **SCLL** **Scaling low limit setting**

(4) **dP** **Decimal point place selection**

For DC current and voltage inputs, the input indication can be freely set.
Default value: Scaling high limit value; 9999, Scaling low limit value; -1999
No decimal point

For example, if DC voltage input 0 to 1V DC is set, 0V corresponds to -1999 and 1V corresponds to 9999. To indicate 0V as 0.0 and 1V as 100.0, Scaling high limit is 1000, Scaling low limit is 0, and select the decimal point place as "1 digit after the decimal point (0.0)".

• Setting range: Scaling high limit: Scaling low limit value to input range high limit value
Scaling low limit: Input range low limit value to scaling high limit value
Decimal point place selecting item: 0 No decimal point
0.0 1 digit after the decimal point
0.00 2-digit after the decimal point
0.000 3-digit after the decimal point

• Default value: Scaling high limit value; 9999
Scaling low limit value; -1999
Decimal point place selection: □□□0 (No decimal point)

(5) FILT: **PV filter time constant setting**

Sets the PV filter time constant.
This reduces input fluctuation caused by noise.
If the input changes in a step, set the time that reaches 63% of the step.
However, if setting value is set too large, it affects control result due to delay of response.

• Setting range: 0.0 to 10.0 seconds
• Default value: 0.0 seconds

(6) ñ_t□ **Step time unit selection**

Selects the unit of program progressing time.

• Selecting item: ñi n□ Hour:Minute
t_Ec□ Minute:Second
• Default value: ñi n□ Hour:Minute

(7) t_tU **Step SV setting when control starts**

Sets the step SV when program control starts.
Program control starts with the set value regardless of the program control start form SV start or PV start.

• Setting range: SV low limit to SV high limit
• Default value: 0℃

(8) t_tL **Program control start form selection**

Selects a program control start form.
PV start: When the program control starts, the setting value (SV) and time are advanced to the PV and the control starts. However, if the value set in "(7) Step SV setting when control starts" is larger than the PV, PV start is cancelled, and the control starts from the value which has been set during "(7) Step SV setting when control starts.
SV start: When the program control starts, the control starts from the value which has been set during "(7) Step SV setting when control starts".

• Setting range: PU□□: PV start
tU□□: SV start
• Default value: PV start

(9) oLH□ **Control output high limit setting**

Sets control output high limit value.
Not available for ON/OFF action

• Setting range: Control output low limit value to 105%
• Default value: 100% (Setting greater than 100% is effective to DC current output type)

(10) oLL□ **Control output low limit setting**

Sets control output low limit value.
Not available for ON/OFF action

• Setting range: -5% to control output high limit value
• Default value: 0% (Setting less than 0% is effective to DC current output type)

(11) HYS□ **Control output ON/OFF action hysteresis setting**

Sets control output ON/OFF action hysteresis.
Available only for ON/OFF action

• Setting range: 0.1 to 100.0℃ (℉)
For DC input, 1 to 1000 (The placement of the decimal point follows the selection.)
• Default value: 1.0℃

(12) AL 1F **Alarm 1 (A1) action selection**

Selects Alarm 1 (A1) action type, referring to 8.5 Alarm 1 (A1) action (pp.48, 49).

- Selecting item: ---- No alarm action
  - H□□□ High limit alarm
  - L□□□ Low limit alarm
  - HL□□ High and Low limits alarm
  - oI d□ High and Low limit range alarm
  - AH□□ Process High alarm
  - rAH□ Process Low alarm
  - H□□o High limit alarm with standby
  - L□□o Low limit alarm with standby
  - HL□o High and Low limits alarm with standby
- Default value: ---- No alarm action

(13) AL2F **Alarm 2 (A2) action selection**

Selects Alarm 2 (A2) action type, referring to 8.5 Alarm 2 (A2) action (pp.48, 49).
The selecting item and default value are the same as those of Alarm 1 (A1) action selection.
Not available if P24 (option) is added.

(14) A1Ln **Alarm 1 (A1) Energized/Deenergized selection**

Selects Alarm 1 (A1) Energized/Deenergized.
Not available if No alarm action is selected in Alarm 1 (A1) action selection

- Selecting item: nonL Energized
  - rEVH Deenergized
- Default value: nonL Energized

(15) A2Ln **Alarm 2 (A2) Energized/Deenergized selection**

Selects Alarm 2 (A2) Energized/Deenergized.
Not available if No alarm action is selected in Alarm 2 (A2) action selection
The selecting item and default value are the same as those of Alarm 1 (A1) Energized/Deenergized selection.

(16) A1HY **Alarm 1 (A1) hysteresis setting**

Sets Alarm 1 (A1) hysteresis.
Not available if No alarm action is selected in Alarm 1 (A1) action selection

- Setting range: 0.1 to 100.0℃ (℉)
  For DC input, 1 to 1000 (The placement of the decimal point follows the selection.)
- Default value: 1.0℃

(17) A2HY **Alarm 2 (A2) hysteresis setting**

Sets Alarm 2 (A2) hysteresis.
Not available if No alarm action is selected in Alarm 2 (A2) action selection
Not available if P24 (option) is added.
The setting range and default value are the same as those of Alarm 1 (A1) hysteresis setting.

(18) A1dY **Alarm 1 (A1) action delayed timer setting**

Sets Alarm 1 (A1) action delayed timer.
Not available if No alarm action is selected in Alarm 1 (A1) action selection

- Setting range: 0 to 9999 seconds
- Default value: 0 seconds

(19) A2dY **Alarm 2 (A2) action delayed timer setting**

Sets Alarm 2 (A2) action delayed timer.
Not available if No alarm action is selected in Alarm 2 (A2) action selection
Not available if P24 (option) is added.
The setting range and default value are the same as those of Alarm 1 (A1) action delayed timer setting.

(20) EVTL **Event output function selection**

Selects an Event output type from Time signal output, Pattern end output and Run output.

When Event output is turned ON, EVT indicator is turned on, and terminals 12 and 13 are used for the Event output.

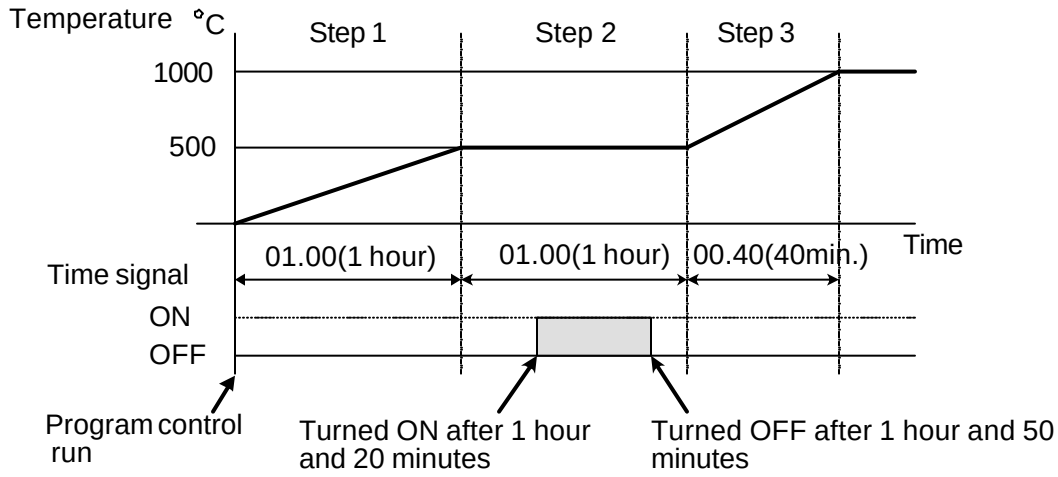
- Selecting item: TM□□ Time signal output
  P.End Pattern end output
  rUn□ Run output.
- Default value: TM□□ Time signal output

Event output

[Time signal output] (Fig. 5.3-1)

Sets the amount of time for Time signal output OFF time and ON time within 1 pattern time. Time signal output ON time follows Time signal output OFF time after the program control starts.

When Time signal output ON time has passed, Time signal output is turned OFF.

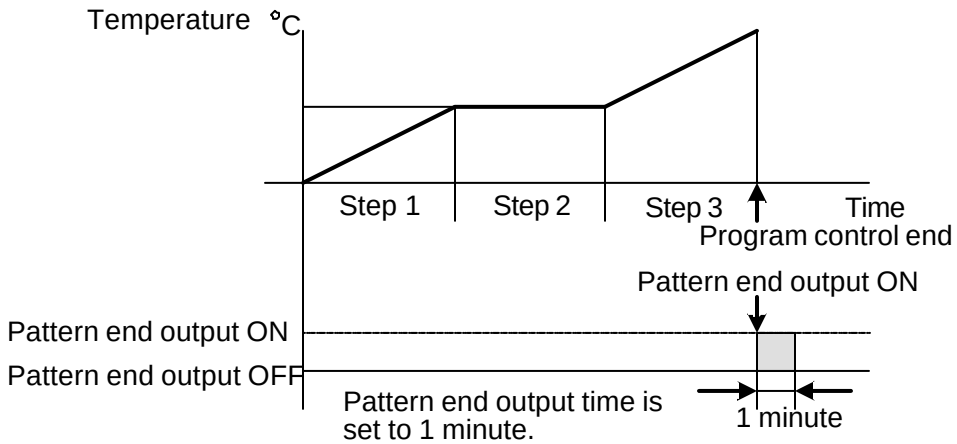


Setting: Time signal output OFF time: 1 hour 20 minutes
Time signal output ON time: 30 minutes

(Fig. 5.3-1)

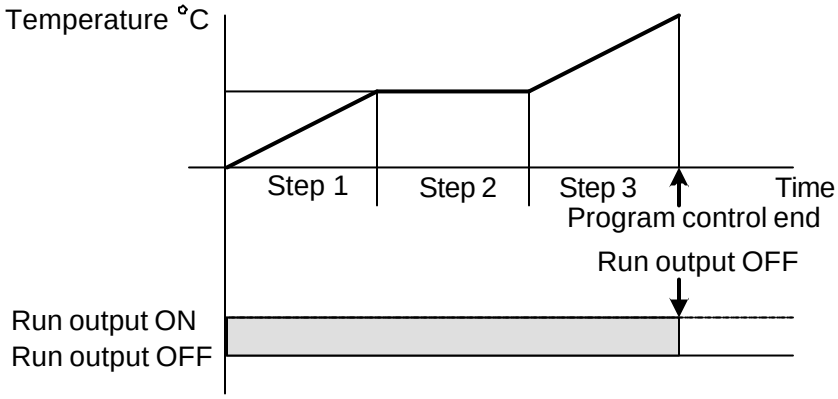
[Pattern end output] (Fig. 5.3-2)

After the program control ends, pattern end output is turned on for the time set at the Pattern end output time setting.



(Fig. 5.3-2)

[Run output] (Fig. 5.3-3)
This is outputted during the program control.



(Fig. 5.3-3)

(21) PEnd **Pattern end output time setting**
Sets pattern end output time after pattern end output has been selected during Event output function selection.
If 0 seconds are selected, the output keeps running until the STOP key is pressed.
Available only when pattern end output is selected during Event output function selection
- Setting range: 0 to 9999 seconds
- Default value: 0 seconds

(22) conF **Direct/Reverse action selection**
Selects the Direct (Cooling) or Reverse (Heating) action.

Direct action
When PV (process variable) is higher than SV (Setting value), the control output is turned ON. This is a direct action.
This is used for cooling control for devices such as refrigerators.

Reverse action
When PV (process variable) is lower than SV (Setting value), the control output is turned ON. This is a reverse action.
This is used for heating control for devices such as electric furnaces.
- Selecting item: HEAT Reverse (Heating) action
  cooL Direct (cooling) action
- Default value: HEAT Reverse (Heating) action

6. Operations

● Key operations for setup

PTN key : Selects a program pattern number.
△ , ▽ key : Increases or decreases the numeric number or switches the selecting item.
MODE, RST key : Registers the settig value (numeric value) or selected item.
By pressing the RST key, the controller reverts to the program standby mode or program control run mode. This key is very convenient to revert to the Program standby mode or Program control run mode from any setting mode.

● Key operations on the Operation flow chart

MODE : Press the MODE key.
MODE(3s) : Press the MODE key for 3 seconds.
△ +MODE : Press the MODE key while holding down the △ key.
△ + ▽ (3s) : Press the △ and ▽ keys for 3 seconds.
▽ +MODE (3s) : Press the MODE key for 3 seconds while holding down the ▽ key.
△ + ▽ +MODE (3s): Press the MODE key for 3 seconds while holding down the △ and ▽ keys.

● Explanation of Operation flow chart

Step 1 Step SV setting	
PTN 1	PV TEMP
STEP 1	SV Set value

Setting item
PTN and PV display
STEP and SV display

MODE

□ on the display means the vacancy which is not indicated.

Step 1 Step time setting	
PTN 1	PV TIME
STEP 1	SV Set value

(e.g. Pattern 1 is set here.)
If the MODE key is pressed at Step 1 Step SV setting, the set value is saved and the setting item proceeds to the next one [Step 1 Step time setting].

● Explanation of Operations

For the explanation of each setting item (pp. 24 to 33), current status of each display is indicated with diagrams on the left side and its item name and operation method are described on the right side.

By pressing the MODE key, the set value is saved and the setting item proceeds to the next one.

PTN 1	PV TEMP
STEP 1	SV 0

Step 1 step SV setting

MODE

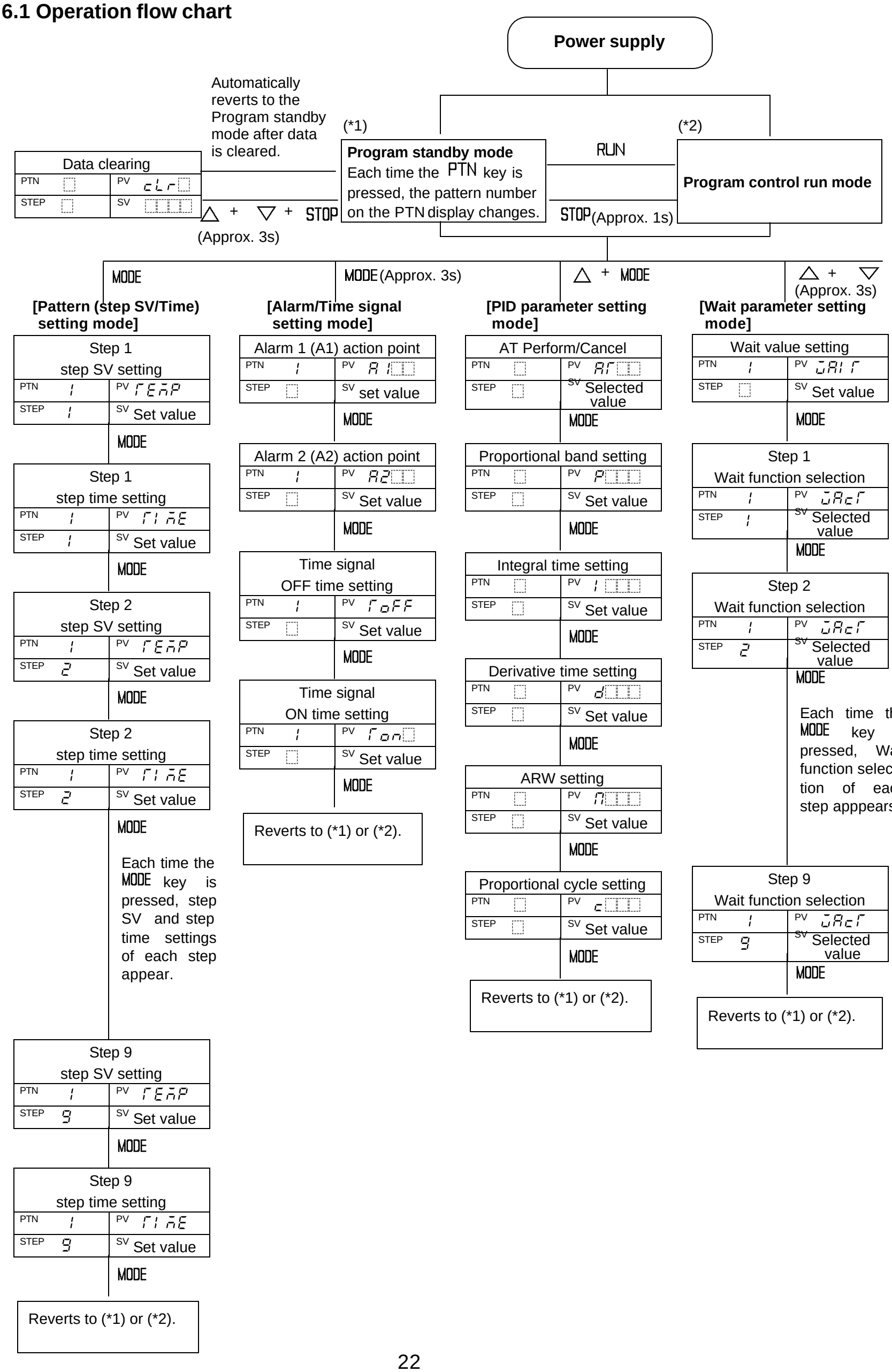
PTN 1	PV TIME
STEP 1	SV 00.00

Step 1 step time setting

Characters

Indication	-1	0	1	2	3	4	5	6	7	8	9		
Numeric 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

6.1 Operation flow chart



BY pressing the PTN key, the controller reverts to (*1) or (*2) from any mode.

▽ + MODE (Approx. 3s)

△ + ▽ + MODE (Approx. 3s)

[Auxiliary function setting mode 1]

[Auxiliary function setting mode 2]

Setting value lock selection
PTN | PV Lock
STEP | SV Selected value
MODE

SV (Setting value) high limit
PTN | PV SHL
STEP | SV Set value
MODE

SV (Setting value) low limit
PTN | PV SLL
STEP | SV Set value
MODE

Sensor correction setting
PTN | PV SoC
STEP | SV Set value
MODE

Communication protocol
PTN | PV cSL
STEP | SV Selected value
MODE

Instrument number setting
PTN | PV cno
STEP | SV Set value
MODE

Communication speed
PTN | PV cSP
STEP | SV Selected value
MODE

Parity selection
PTN | PV cPr
STEP | SV Selected value
MODE

Stop bit selection
PTN | PV cSt
STEP | SV Selected value
MODE

Reverts to (*1) or (*2).

Input type selection
PTN | PV SEnS
STEP | SV Selected value
MODE

Scaling high limit setting
PTN | PV SrLH
STEP | SV Set value
MODE

Scaling low limit setting
PTN | PV SrLL
STEP | SV Set value
MODE

Decimal point place
PTN | PV dP
STEP | SV Selected value
MODE

PV filter time constant
PTN | PV FILT
STEP | SV Set value
MODE

Step time unit selection
PTN | PV t_S
STEP | SV Selected value
MODE

Step SV setting when control starts
PTN | PV S_SU
STEP | SV Set value
MODE

Program control start form selection
PTN | PV S_SL
STEP | SV Selected value
MODE

Control output high limit
PTN | PV oLH
STEP | SV Set value
MODE

Control output low limit
PTN | PV oLL
STEP | SV Set value
MODE

Control output ON/OFF action hysteresis setting
PTN | PV HYS
STEP | SV Set value
MODE

Alarm 1(A1) action selection
PTN | PV AL 1F
STEP | SV Selected value
MODE

Alarm 2(A2) action selection
PTN | PV AL2F
STEP | SV Selected value
MODE

Alarm 1 (A1) action Energized/Deenergized
PTN | PV A1LA
STEP | SV Selected value
MODE

Alarm 2 (A2) action Energized/Deenergized
PTN | PV A2LA
STEP | SV Selected value
MODE

Alarm 1 (A1) hysteresis
PTN | PV A1HY
STEP | SV Set value
MODE

Alarm 2 (A2) hysteresis
PTN | PV A2HY
STEP | SV Set value
MODE

Alarm 1 (A1) action delayed timer setting
PTN | PV A1dY
STEP | SV Set value
MODE

Alarm 2 (A2) action delayed timer setting
PTN | PV A2dY
STEP | SV Set value
MODE

Event output function
PTN | PV EVSL
STEP | SV Selected value
MODE

Pattern end output time setting
PTN | PV PEtA
STEP | SV Set value
MODE

Direct/Reverse action
PTN | PV conF
STEP | SV Selected value
MODE

Reverts to (*1) or (*2).

6.2 Operations

(1) Turn the power to the controller ON.

The sensor input character and temperature unit are indicated on the PV display and the input range high limit value is indicated on the SV display for approx. 3 seconds after the power is turned on. See (Table 6.2-1).

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

After that, the controller switches to program standby mode.

(Table 6.2-1)

Input	Scale range	Character	Scale range	Character
K	-200 to 1370℃		-320 to 2500℉	
K	-199.9 to 400.0℃		-199.9 to 750.0℉	
J	-200 to 1000℃		-320 to 1800℉	
R	0 to 1760℃		0 to 3200℉	
S	0 to 1760℃		0 to 3200℉	
B	0 to 1820℃		0 to 3300℉	
E	-200 to 800℃		-320 to 1500℉	
T	-199.9 to 400.0℃		-199.9 to 750.0℉	
N	-200 to 1300℃		-320 to 2300℉	
PL-Ⅱ	0 to 1390℃		0 to 2500℉	
C(W/Re5-26)	0 to 2315℃		0 to 4200℉	
Pt100	-199.9 to 850.0℃		-199.9 to 999.9℉	
JPt100	-199.9 to 500.0℃		-199.9 to 900.0℉	
Pt100	-200 to 850℃		-300 to 1500℉	
JPt100	-200 to 500℃		-300 to 900℉	
4 to 20mA DC	-1999 to 9999			
0 to 20mA DC	-1999 to 9999			
0 to 1V DC	-1999 to 9999			
0 to 5V DC	-1999 to 9999			
1 to 5V DC	-1999 to 9999			
0 to 10V DC	-1999 to 9999			

(2) Program standby mode

This is a program standby mode. Therefore the control is not performed during this mode.

In this mode, the currently selected pattern number is indicated on the PTN display and actual temperature is indicated on the PV display.

(3) Program pattern number selection

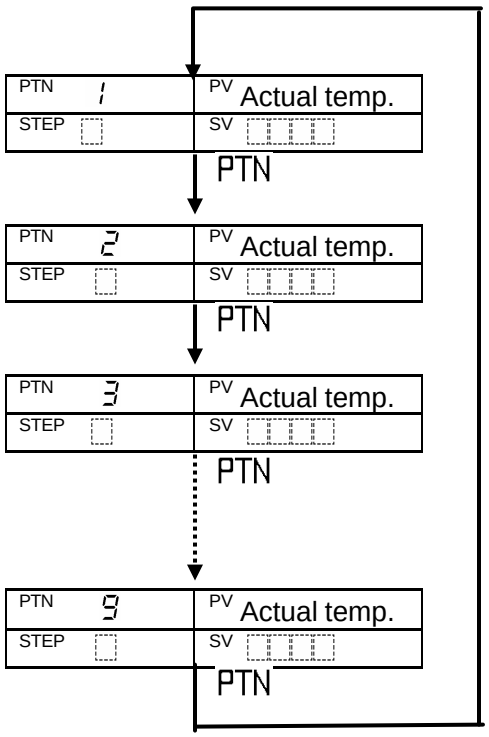
Select a program pattern number before initiating various program settings.

The program pattern number can only be selected during the program standby mode. It cannot be selected during program control run.

By pressing the PTN key, select a program pattern number (1 to 9).

Each time the PTN key is pressed, the program pattern number changes according to the following.

1 — 2 — 3 — 4 ……. 9 — 1



Program pattern 1 is selected.

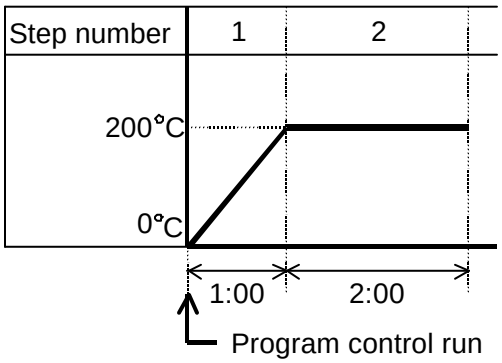
Program pattern 2 is selected.

Program pattern 3 is selected.

Program pattern 9 is selected.

(4) Pattern (step SV/Time) setting mode

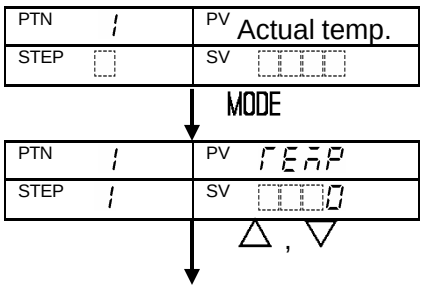
This mode is available for the currently selected program pattern number.
The following is an example of program pattern setting and its procedures.



This program pattern shows that the temperature rises to 200℃ for 1 hour and stays at 200℃ for 2 hours.
In this case, Step 1 step SV is 200℃ and Step 1 step time is 1 hour.

(Fig.6.2-1)

[Program standby mode or program control run mode]

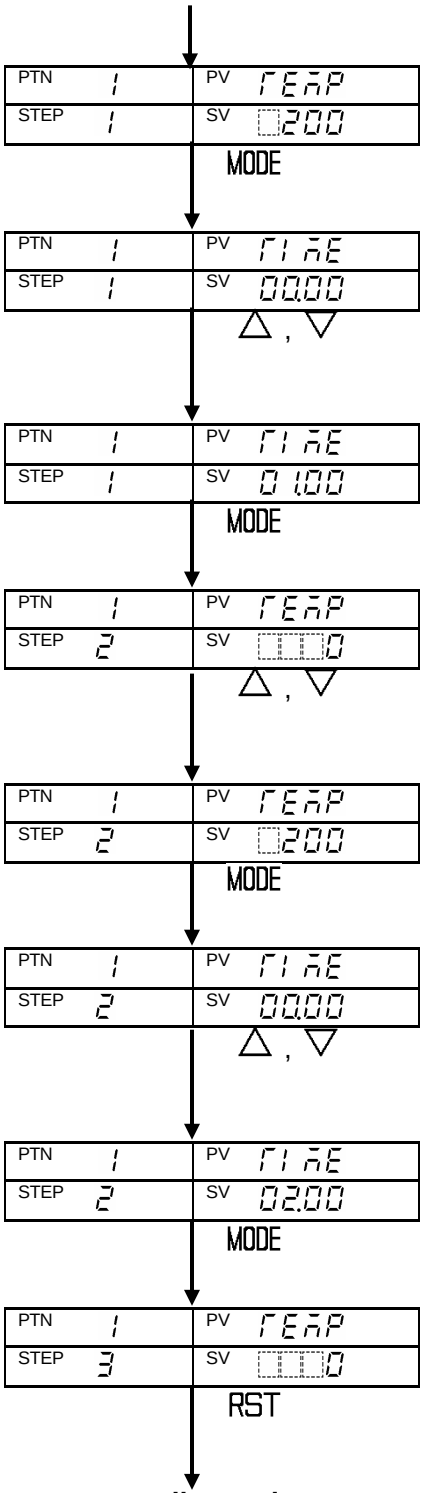


Press the MODE key.
Step 1 step SV setting mode is selected.

Step 1 step SV setting

Set the step SV to 200℃ using △ or ▽ key.

- Setting range: SV low limit to SV high limit
- Default value: 0℃



Press the MODE key.
Step 1 step SV is registered, and
Step 1 step time setting mode is selected.

Step 1 step time setting
Set the step time to (1:00) using △ or ▽ key.
• Setting range: - - - - to 00:00 to 99:59
(Hour:Minute or Minute:Second)
• Default value: 00:00 (Hour:Minute)

Press the MODE key.
Step 1 step time is registered, and
Step 2 step SV setting mode is selected.

Step 2 step SV setting
Set the step time to 200℃ using △ or ▽ key.
• Setting range: SV low limit to SV high limit
• Default value: 0℃

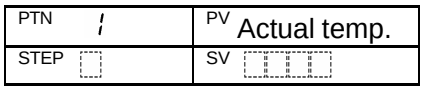
Press the MODE key.
Step 2 step SV is registered, and
Step 2 step time setting mode is selected.

Step 2 step time setting
Set the step time to (2:00) using △ or ▽ key.
• Setting range: - - - - to 00:00 to 99:59
(Hour:Minute or Minute:Second)
• Default value: 00:00 (Hour:Minute)

Press the MODE key.
Step 2 step time is registered, and
Step 3 step SV setting mode is selected.

Step 3 step SV setting
Step 3 and after can be set in the same way as the above.
Press RST key to return to program standby mode

Program standby mode or program control run mode



The program pattern setting (example) has been completed.

(5) Alarm/Time signal setting mode

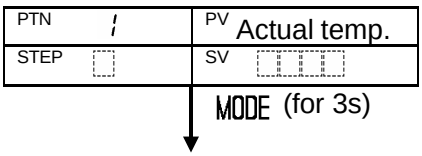
Alarm/Time signal setting mode is available for the currently selected program pattern number.

During program control run, settings are available only for the running pattern.

Note: To go to the Alarm/Time signal setting mode, select an alarm action type except for No alarm action from Alarm 1 (A1) and Alarm 2 (A2) action selection in "5. Setup", or select Time signal output from Event output function selection.

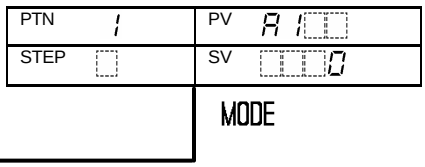
If either of the above is not selected, the controller cannot proceed to the Alarm/Time signal setting mode.

[Program standby mode or program control run mode]



Press the MODE key for 3 seconds.
Alarm/Time signal setting mode is selected, and Pattern 1 Alarm 1 (A1) action point setting item is indicated.

[Alarm/Time signal setting mode]



Pattern 1 Alarm 1 (A1) action point setting

Off when set to 0 or 0.0.

Not available if No alarm action is selected from Alarm 1 (A1) action selection.

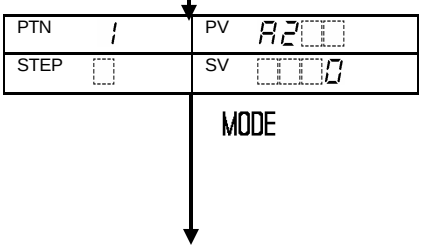
- Setting range: Refer to (Table 6.2-2) below.
- Default value: 0℃

● **Alarm 1 (A1), Alarm 2 (A2) setting range**

(Table 6.2-2)

Alarm type	Setting range
High limit alarm	-Input span to Input span℃ (℉)
Low limit alarm	-Input span to Input span℃ (℉)
High/Low limits alarm	0 to Input span℃ (℉)
High/Low limit range alarm	0 to Input span℃ (℉)
Process high alarm	Input range minimum to Input range maximum℃ (℉)
Process low alarm	Input range minimum to Input range maximum℃ (℉)
High limit alarm with standby	-Input span to Input span℃ (℉)
Low limit alarm with standby	-Input span to Input span℃ (℉)
H/L limits alarm w/standby	0 to Input span℃ (℉)

- For the input with a decimal point, the negative minimum value is -199.9 and the positive maximum value is 999.9.
- For DC input, the input span is the same as the scaling span, and input range low (or high) limit value is the same as the scaling low (or high) limit value.

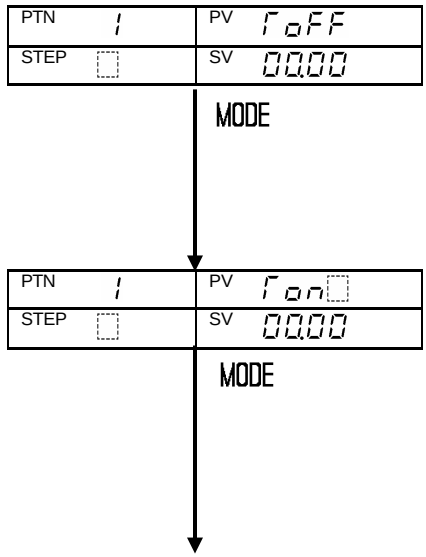


Pattern 1 Alarm 2 (A2) action point setting

Off when set to 0 or 0.0.

Not available if No alarm action is selected from Alarm 2 (A2) action selection, or when P24 (option) is applied.

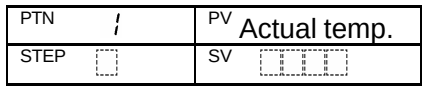
- Setting range: Refer to (Table 6.2-2) (p.27)
- Default value: 0℃



Pattern 1 Time signal output OFF time setting
Sets Time signal output OFF time after the program control run.
Available only when Time signal output is selected from Event output function selection.
• Setting range: 00:00 to 99.59
(Hour:Minute or Minute:Second)
• Default value: 00:00 (Hour:Minute)

Pattern 1 Time signal output ON time setting
Sets Time signal output ON time after the Time signal output OFF time.
Available only when Time signal output is selected from Event output function selection.
• Setting range: 00:00 to 99.59
(Hour:Minute or Minute:Second)
• Default value: 00:00 (Hour:Minute)

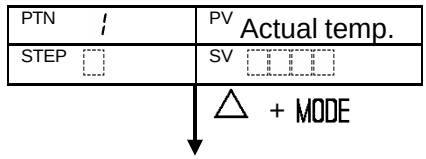
[Program standby mode or program control run mode]



(6) PID parameter setting mode

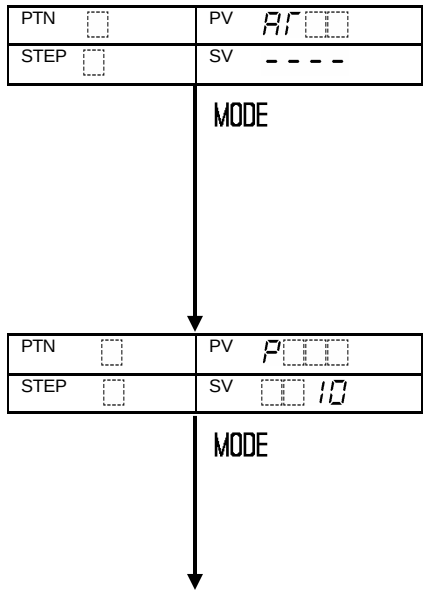
Sets parameters and items necessary for the control such as PID auto-tuning Perform/ Cancel, P, I, D and Proportional cycle, etc.
The settings in this mode are applied to all program pattern numbers.

[Program standby mode or program control run mode]



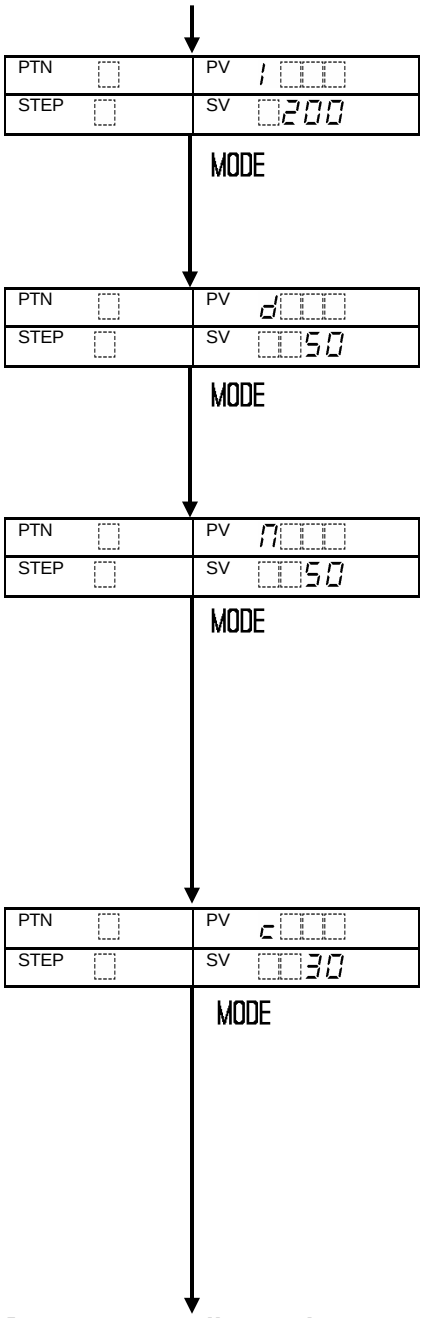
Press the MODE key while holding down the △ key.
PID parameter setting mode is selected, and PID auto-tuning Perform/Cancel is indicated.

[PID parameter setting mode]



PID auto-tuning Perform/Cancel selection
PID auto-tuning Perform or Cancel can be selected.
Available only during program control run and during PID action
Not available for program standby mode
• Setting range: ---- PID AT Cancel
AT PID AT Perform
• Default value: ---- PID AT Cancel

Proportional band setting
Sets the proportional band for the control output.
ON/OFF action when set to 0 or 0.0.
• Setting range: 0 to 1000℃ (0 to 2000℉)
For the input with a decimal point,
0.0 to 999.9℃ (0 to 999.9℉)
For DC input, 0.0 to 100.0%
• Default value: 10℃



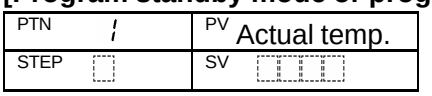
Integral time setting
Sets the integral time.
Off when set to 0
Not available for ON/OFF action
• Setting range: 0 to 1000 seconds
• Default value: 200 seconds

Derivative time setting
Sets the derivative time.
Off when set to 0
Not available for ON/OFF action
• Setting range: 0 to 300 seconds
• Default value: 50 seconds

ARW(Anti-reset windup) setting
Sets the ARW.
Available only for PID action
This prevents overshoot caused by the integral action.
ARW is automatically set by performing auto-tuning. When setting manually, set ARW to the closest MV (manipulated variable) when the control is stabilized.
• Setting range: 0 to 100%
• Default value: 50%

Proportional cycle setting
Sets the proportional cycle.
Not available for ON/OFF action and for DC current output type
With the relay contact output type, if the proportional cycle time is decreased, the frequency of relay action increases and the life of the relay contact is shortened.
• Setting range: 0 to 120 seconds
• Default value: 30s for relay contact output, 3s for non-contact voltage output type

[Program standby mode or program control run mode]



(7) Wait parameter setting mode

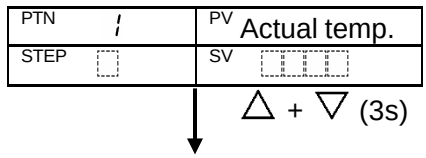
This function prevents the step from proceeding to the next one until PV enters the range of SV±Wait value regardless of the step time.

Wait function Used/Not used can be set to each step.

Wait parameter setting mode is available for the currently selected program pattern number.

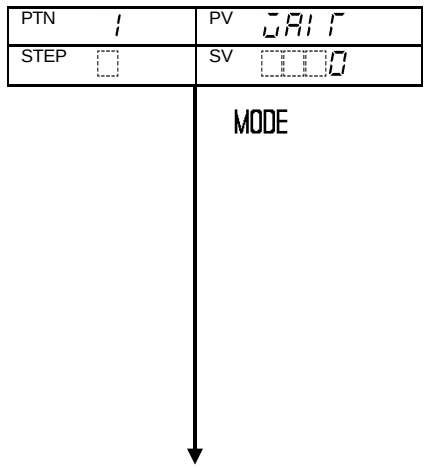
During the program control run, settings are available only for the running pattern.

[Program standby mode or program control run mode]



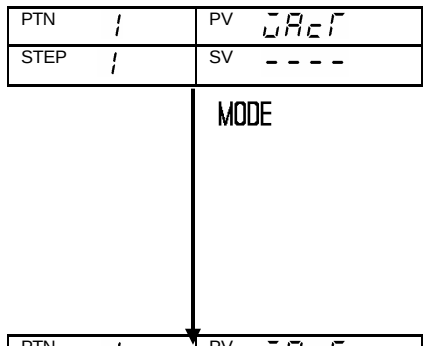
Press the ▽ key for 3 seconds while holding down the △ key.
Wait parameter setting mode is selected, and Wait value setting item is indicated.

[Wait parameter setting mode]



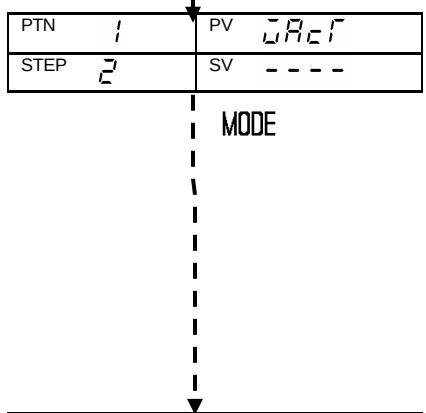
Wait value setting

Sets Pattern 1 Wait value.
The step whose temperature is rising:
Step SV – Wait value
The step whose temperature is falling:
Step SV + Wait value
Off when set to 0 or 0.0
• Setting range: 0 to 100℃ (℉)
For the input with a decimal point:
0.0 to 100.0℃ (℉)
For DC input: 0 to 1000 (The placement of the decimal point follows the selection)
• Default value: 0℃ (℉)



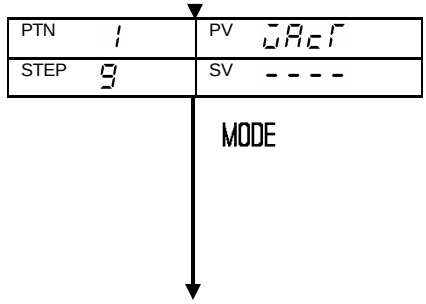
Step 1 Wait function selection

Selects Step 1 Wait function Used or Not used.
Not available if Wait value is set to 0 or 0.0℃(℉) during Wait value setting.
• Selecting item:
----: Wait function Not used
USE: Wait function Used
• Default value:
----: Wait function Not used



Step 2 Wait function selection

Selects Step 2 Wait function Used or Not used.
Not available if Wait value is set to 0 or 0.0℃(℉) during Wait value setting.
• Selecting item:
----: Wait function Not used
USE: Wait function Used
• Default value:
----: Wait function Not used



Step 9 Wait function selection

Selects Step 9 Wait function Used or Not used.
Not available if Wait value is set to 0 or 0.0℃(℉) during Wait value setting.
• Selecting item:
----: Wait function Not used
USE: Wait function Used
• Default value:
----: WAIT function Not used

[Program standby mode or program control run mode]

PTN 1	PV Actual temp.
STEP	SV

(8) Auxiliary function setting mode 1

The settings in Auxiliary function setting mode 1 are applied to all program pattern numbers.

[Program standby mode or program control run mode]

PTN 1	PV Actual temp.
STEP	SV

▽ + MODE (3s)

Press the MODE key for 3 seconds while holding down the ▽ key.
Auxiliary function setting mode 1 is selected, and Setting value lock selection item is indicated.

[Auxiliary function setting mode 1]

PTN	PV Lock
STEP	SV ----

Setting value lock selection

Locks the setting value to prevent erroneous settings.

Before designating the lock function, set each setting item in advance.

Unlock : All setting values can be changed.

Lock : None of the setting values can be changed.

- Selecting item: ---- (Unlock)
  Lock (Lock)
- Default value : ---- (Unlock)

PTN	PV SH
STEP	SV 1370

MODE

SV (Setting value) high limit setting

Sets the step SV high limit.

- Setting range:
  SV low limit to input range high limit value
  For DC input, SV low limit to scaling high limit value
- Default value: 1370℃

PTN	PV SL
STEP	SV -200

MODE

SV (Setting value) low limit setting

Sets the step SV low limit.

- Setting range:
  Input range low limit value to SV high limit
  For DC input, scaling low limit value to SV high limit
- Default value: -200℃

PTN	PV So
STEP	SV 0.0

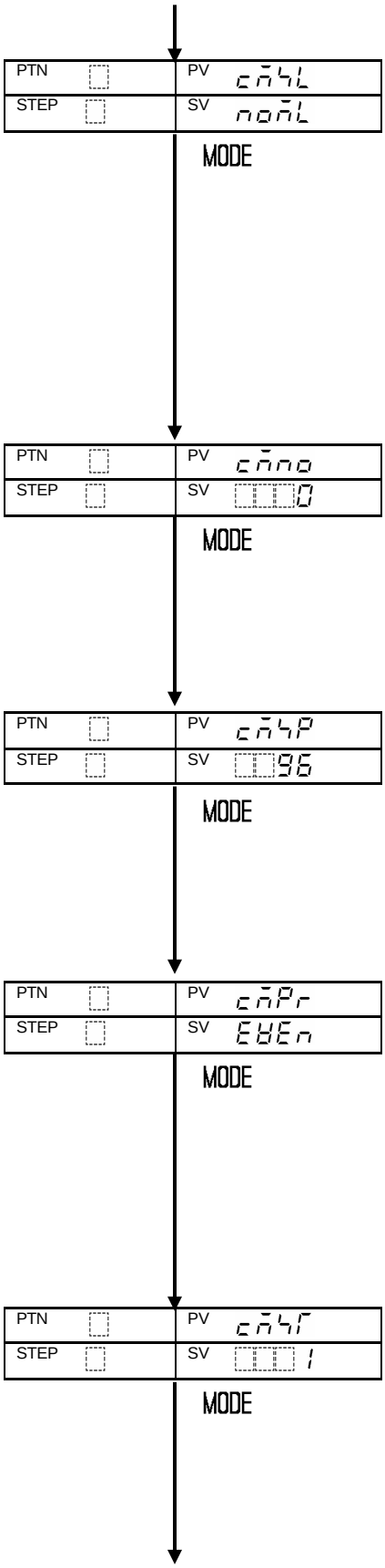
MODE

Sensor correction setting

Sets the value to correct PV.

PV=PV + Sensor correction value

- Setting range: -100.0℃ to 100.0℃ (℉)
  For DC input, -1000 to 1000 (The placement of the decimal point place follows the selection.
- Default value: 0.0℃



Communication protocol selection

Selects the communication protocol and form.
Available only when C5 (option) is applied.

- Selecting item:
  - nonL Shinko protocol
  - xbr Setting value digital transmission (Shinko protocol)
  - xbrr Setting value digital reception (Shinko protocol)
  - nodA Modbus protocol ASCII mode
  - nodr Modbus protocol RTU mode
- Default value: nonL Shinko protocol

Instrument number setting

Selects the instrument number.
Set the PCD-33A to the instrument number individually when communicating by connecting plural PCD-33As.
Available only when C5 (option) is applied.

- Setting range: 0 to 95
- Default value: 0

Communication speed selection

Selects the communication speed.
Available only when C5 (option) is applied.

- Selecting item:
  - 24 2400bps
  - 48 4800bps
  - 96 9600bps
  - 192 19200bps
- Default value: 96 9600bps

Parity selection

Selects the parity type from a choice of: No parity, Even and Odd parity in accordance with the host computer.
Available when C5 (option) is applied, and when Modbus ASCII or RTU mode is selected.

- Selecting item:
  - nonE No parity
  - EVEn Even parity
  - odd Odd parity
- Default value: EVEn Even parity

Stop bit selection

Selects the stop bit in accordance with the host computer from 1 or 2.
Available when C5 (option) is applied, and when Modbus ASCII or RTU mode is selected.

- Selecting item:
  - 1 (stop bit 1)
  - 2 (stop bit 2)
- Default value: 1 (stop bit 1)

[Program standby mode or program control run mode]

PTN 1	PV Actual temp.
STEP	SV

(9) Auxiliary function setting mode 2

The settings in Auxiliary function setting mode 2 has already been completed in Chapter “5. Setup” (p.14).

(10) Data clearing function

This function returns all setting values to the default value.
This function can only be carried out during program standby mode.
During program control run mode, this is not available.

Caution

Be sure to note down of all setting values for all patterns before clearing data, using the photocopiable pages at the end of this manual.
If data has been cleared once, the setting values have to be inputted again since the lost data can not be restored.

[Program standby mode]

PTN 1	PV Actual temp.
STEP	SV

Press the MODE key while for 3 seconds holding down the △ and ▽ keys.

△ + ▽ + STOP (3s)

[Data clearing]

PTN	PV clr
STEP	SV

All setting values are cleared and they return to their default values.
During data clearing, the PV display indicates clr and other displays are turned off.

[Program standby mode]

PTN 1	PV Actual temp.
STEP	SV

After data is cleared, the controller reverts to the program standby mode.

7. Running

[Before running]

Before running the controller, check the mounting and wiring carefully, referring to "3. Mounting to control panel" (p.8) and "4. Wiring connection" (p.10) .

Check that settings are applicable for the users' conditions, referring to "5. Setup" (p.14).

7.1 How to set the program.

Set the following items, referring to "6. Operations" (p.21)

(1) Program pattern number (p.24)

(2) Pattern (Step SV/Time) setting mode (p.25)

Set the following items if necessary.

(3) Alarm/Time signal setting mode (p.27)

(4) PID parameter setting mode (p.28)

(5) Wait parameter setting mode (p.29)

(6) Auxiliary function setting mode 1 (p.31)

(7) Auxiliary function setting mode 2 (Refer to "5. Setup") (p.14)

7.2 How to perform the program control.

Follow the procedures below in carrying out the program control.

(1) Select a program pattern number.

Select a desired program pattern number to perform program control by pressing the PTN key in the program standby mode.

Each time the PTN key is pressed, the program pattern number is switched.

[Indication when Program pattern 1 is selected]

PTN 1	PV Actual temp.
STEP	SV

PTN display : Selected program pattern number

PV display : Current actual temperature

STEP display: Unlit

SV display : Unlit

All indicators : Unlit

(2) Perform the program control.

Press the RUN key.

The program control of the selected program pattern number will be started.

The program control can also be started by connecting (Contact closed) input terminals 14 and 17 instead of pressing the RUN key.

The program control cannot be performed if pattern end output is turned on. Press the STOP key to turn the pattern end output off, then press the RUN key.

[Control action when the program control starts]

Program control starts with the form selected from the Program control start form selection.

PV start: When the program control starts, SV and step time are advanced to the PV, then the program control is performed.
However, if the value set during the [Step SV setting when control starts] and the step SV are equal, or if the value set during the [Step SV setting when control starts] is higher than PV, PV start is cancelled, and SV start is adopted.
When Wait function is set, the function has priority.

SV start: When the program control starts, the program control starts from the value which has been set during the [Step SV setting when control starts].

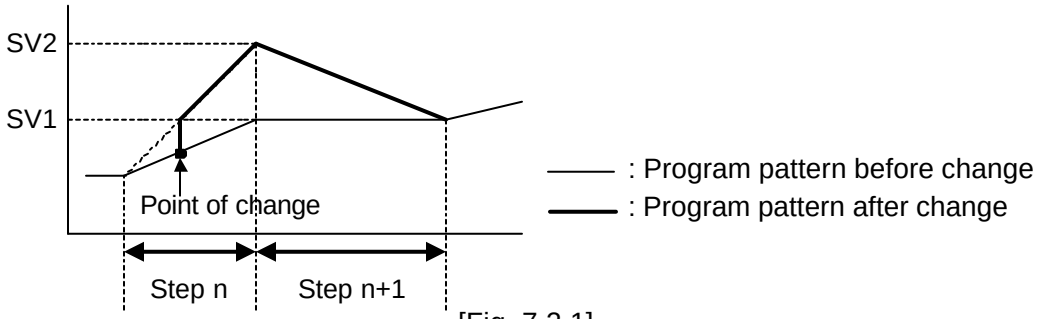
[Indication during program control run]

PTN /	PV Actual temp.
STEP /	SV Step SV

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Step number of the program control which is running
SV display : Current step temperature
RUN indicator : Lit during program control run
Other indicators: Lit or unlit according to the controller status

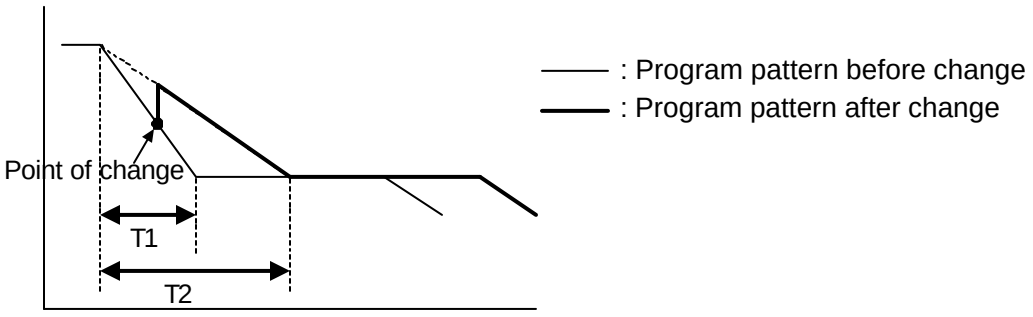
[Step SV or Step time change during running]

(1) When the temperature changed from SV1 to SV2



[Fig. 7.2-1]

(2) When the time is changed from T1 to T2



[Fig. 7.2-2]

[Action after power failure is restored]

(1) If the power failure occurs during program control run, the control resumes from the point at which power failure occurred.
(2) If the power failure occurs during program standby mode, the control resumes from the program standby mode.

[Indication during Wait action]

PTN	PV Actual temp.
STEP	SV Step SV

Blinks during WAIT action.

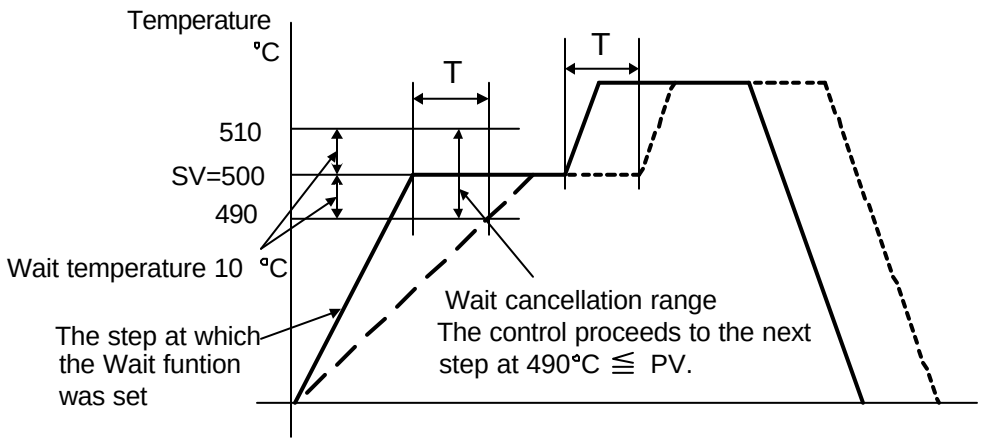
PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Blinks during Wait action.
SV display : Current step temperature
RUN indicator : Lit during program control
Other indicators: Lit or unlit according to the controller status

[Wait function]

During the program control run, the program does not proceed to the next step until the deviation between PV and SV enters SV±Wait temperature when the step ends.
While the Wait function is working, the numeric value on the Step display blinks.

The Wait function is cancelled on the condition that:
(SV – Wait temperature)≦ PV ≦(SV + Wait temperature)

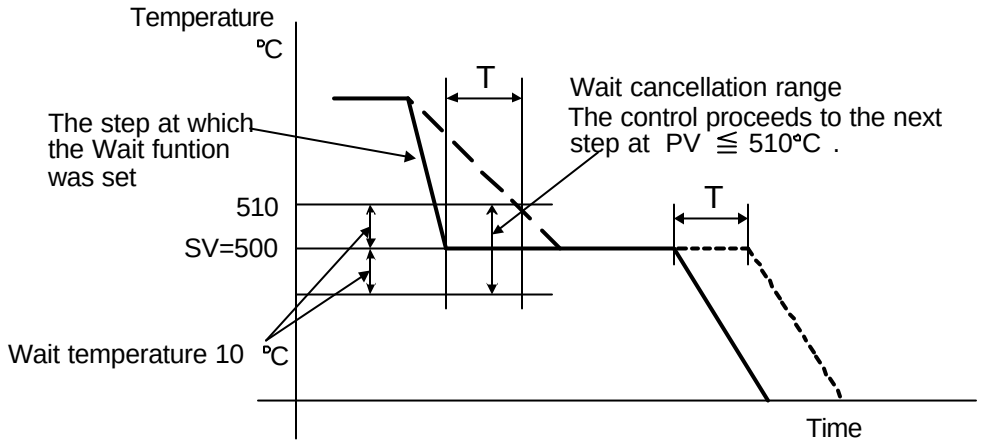
When the program pattern is rising [The Wait function is cancelled at (SV – Wait temperature) ≦ PV]



[Fig. 7.2-3]

——— : Program pattern
— — - : PV
– – – – – : Program pattern which is delayed as much as T time due to Wait function
T : Wait time

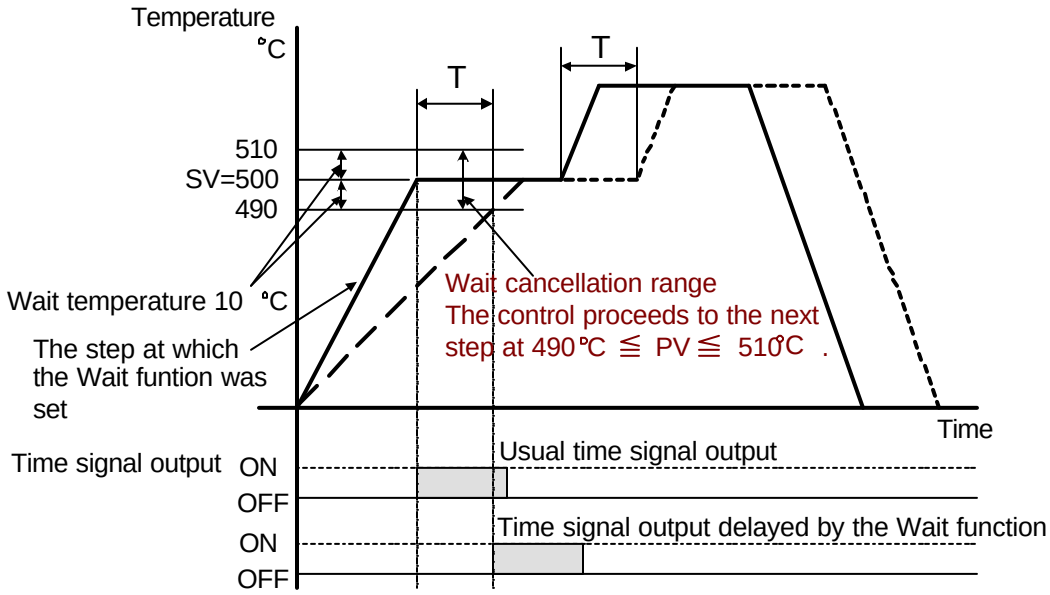
When the program pattern is falling [The Wait function is cancelled at PV ≦(SV + Wait temperature)]



——— : Program pattern [Fig. 7.2-4]
— — - : PV
– – – – – – : Program pattern which is delayed as much as T time due to Wait function
T : Wait time

[Time signal action during WAIT action]

During Wait action, time signal time measurement as well as step time pauses.
After Wait function is cancelled, time signal time measurement resumes.



——— : Program pattern [Fig. 7.2-5]
— — - : PV
– – – – – – : Program pattern which is delayed as much as T time due to Wait function
T : Wait time

[Indication during Time signal action]

If Time signal output is selected in the [Event output function selection], Event output is turned on during time signal output ON time.

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

If Time signal output ON time has passed, EVT indicator is turned off.

The following shows the indication during time signal action.

PTN 1	PV Actual temp.
STEP 1	SV Step SV

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Step number of the program control which is running.
SV display : Current step temperature
RUN indicator : Lit during program control run
EVT indicator : Lit during Time signal output ON
Other indicators: Lit or unlit according to the controller status

[Indication during Pattern end output]

If Pattern end output is selected in the Event output function selection, Event output is turned on for the time which has been set at the Pattern end output time setting.

If Pattern end output time has passed, Event output is turned off.

If Pattern end output time is set to 0, the output continues to work.

By pressing the STOP key for 1 second or greater, the pattern end output is turned off, and the controller reverts to the program standby mode.

The following shows the indication during pattern end output.

PTN 1	PV Actual temp.
STEP	SV P.End

Blinks while Pattern end output is ON.

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Unlit
SV display : P.End blinks while pattern end output is on.
RUN indicator : Unlit
EVT indicator : Lit while pattern end output is ON
Other indicators: Unlit

[Indication during Run output]

If Run output is selected in the Event output function selection, Event output is turned on during program control run.

When the program control ends or when making program control stop by pressing the STOP key for 1 second or greater, Event output is turned off.

The following shows the indication during Run output.

PTN 1	PV Actual temp.
STEP 1	SV Step SV

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Step number of the program control which is running
SV display : Current step temperature
RUN indicator : Lit
EVT indicator : Lit while Run output is ON
Other indicators: Lit or unlit according to the controller status

7.3 How to stop the program control

Pressing the STOP key for 1 second or greater stops the program control.
The program control also stops by disconnecting (Contact open) input terminals 14 and 17 instead of pressing the STOP key.

[Indication after program control stops]

PTN 1	PV Actual temp.
STEP	SV

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Unlit
SV display : Unlit
All indicators : Unlit

7.4 Advance function (Advances to the next step during program control run)

To cancel the current step and advance to the next step during the program control, press the RUN key for 1 second or greater. This function is also available during Wait action or during Fixed value control action.

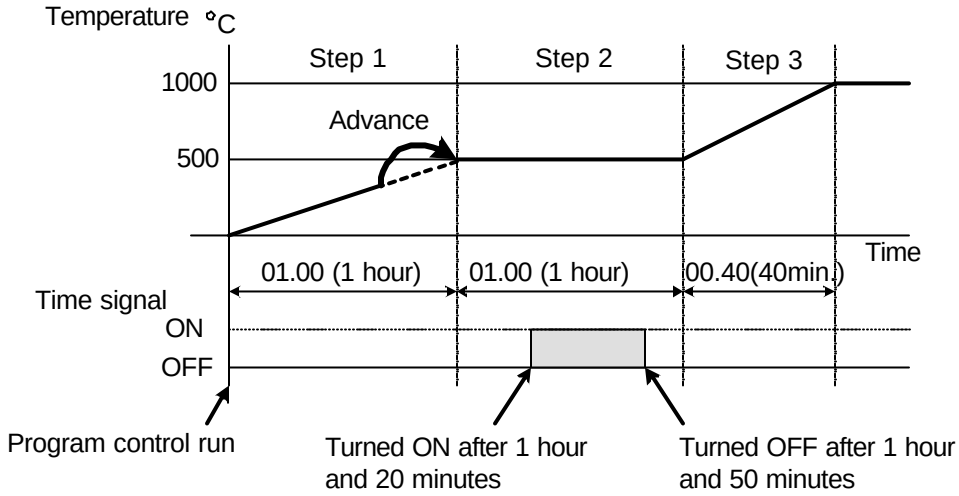
[Indication when Advance function is used at Step 1]

PTN 1	PV Actual temp.
STEP 2	SV Step SV

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Step 2 after the Advance function is used.
SV display : Current step temperature
RUN indicator : Lit during program control run
Other indicators: Lit or unlit according to the controller status

[Time signal action after Advance function is used]

If Advance function is used, only the step time advances. Time signal output timing does not change.
The following example shows that if Advance function is used during step 1, time signal output is turned on 20 minutes after the step 1 is advanced to step 2.



Setting Time signal OFF time: 1 hour and 20 minutes,
Time signal ON time: 30 minutes

(Fig. 7.4-1)

7.5 How to switch to Fixed value control (Hold function)

Fixed value control (identical to control of the indicating controller) at the step temperature can be carried out when the step time is held.

[How to switch to Fixed value control at Step 2]

[During Program control run]

PTN 1	PV Actual temp.
STEP 2	SV Step SV

MODE (4 times)

Press the MODE key 4 times.
Step 2 step time setting item is selected.

[Step 2 step time setting]

PTN 1	PV TIME
STEP 2	SV Step time

▽ (Keep pressing)

Keep pressing the ▽ key.
Step time switches from [00.00] to [----], which is the Hold function character.

PTN 1	PV TIME
STEP 2	SV ----

RST

Performs fixed value control.

Press the RST key.
Fixed value control can be performed at the step temperature as a main setting value.

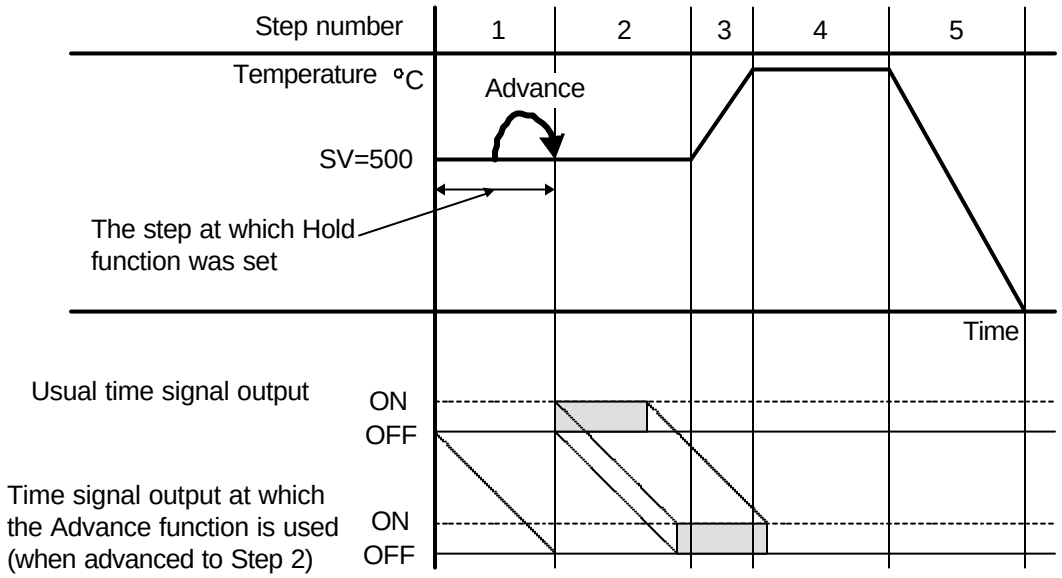
[Indication when switched to fixed value control at Step 2]

PTN 1	PV Actual temp.
STEP 2	SV Step SV

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Step 2 after switched to the Fixed value control
SV display : Step 2 step temperature
RUN indicator : Blinks during fixed value control
Other indicators: Lit or unlit according to the controller status

[Time signal action during fixed value control]

During the fixed value control, step time of the step at which the Hold function was set is regarded as (00:00). Time signal time measurement is carried out ignoring this step.



(Fig. 7.5-1)

[Action after the power failure is restored]

If power failure occurs during fixed value control, fixed value control resumes after the power failure is restored.

7.6 How to correct PV (Sensor correction function)

[Sensor correction function]

This corrects the input value from the sensor. When a sensor cannot be set at a location where control is desired, the sensor measuring temperature may deviate from the temperature in the controlled location.

When controlling with multiple controllers, the accuracy of the sensors or dispersion of load capacity has influence on the control.

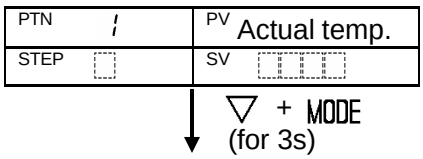
Therefore, sometimes the measured temperature (input value) does not concur with the same setting value.

In such a case the control can be set at the desired temperature by correcting the input value of the sensors.

PV = Current actual temperature + Sensor correction value

[How to set sensor correction value]

[Program standby mode or program control run mode]



Press the MODE key for 3 seconds while holding down the ▽ key.
Auxiliary function setting mode 1 is selected and Setting value lock selection is selected.

[Auxiliary function setting mode 1]

PTN	PV Lock
STEP	SV Selected value

Press the MODE key 3 times.
Sensor correction setting item is selected.

MODE (Press 3 times)

PTN	PV Lo
STEP	SV 0.0

△ , ▽

Set the sensor correction value with △ or ▽ key.
Setting range: -100.0 to 100.0℃ (℉)
For DC input, -1000 to 1000 (The placement of the decimal point follows the selection)

PTN	PV Lo
STEP	SV Set value

RST

Press the RST key.
The controller reverts to the program standby mode or program control run mode

[Program standby mode or program control run mode]

PTN 1	PV Actual temp.
STEP	SV

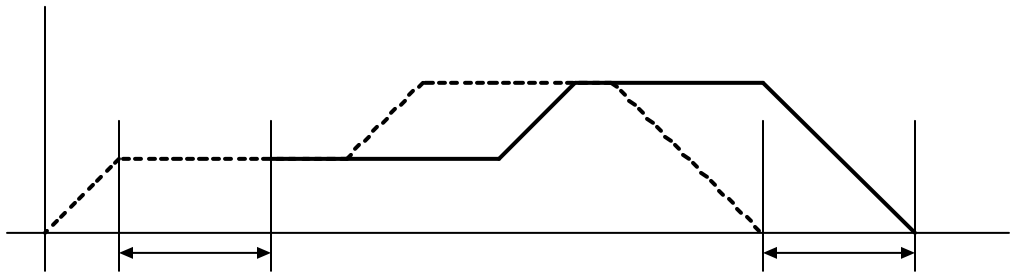
The value on the PV display is the one corrected by the sensor.
(e.g.) If actual temperature is 200℃, and sensor correction value is 2.0℃, PV becomes 202℃.

7.7 PID auto-tuning.

In order to decide each value of P, I, D and ARW automatically, this system makes the controlled object's temperature fluctuate.

Notice

- Perform the PID auto-tuning during the trial run.
- During the PID auto-tuning, none of the setting items can be set.
- If PID auto-tuning is performed, PID auto-tuning starts at the same time as performance, and step time and time signal time do not progress until the auto-tuning ends. After the PID auto-tuning ends, the remaining step time is performed.
- If power failure occurs during the PID auto-tuning, the tuning stops.



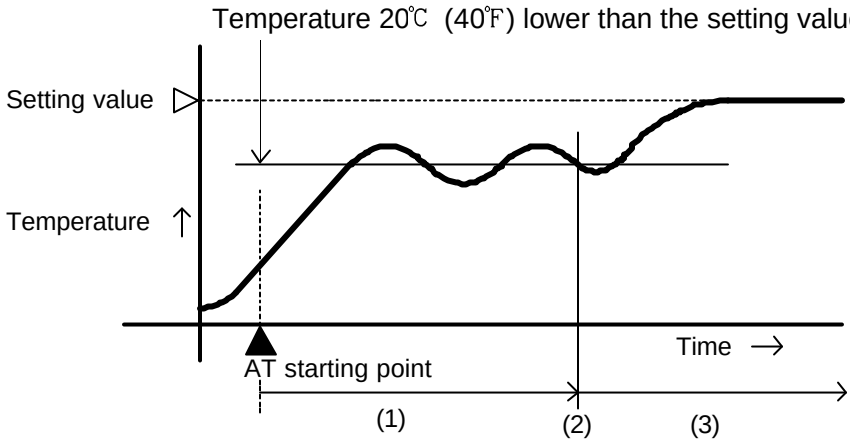
--------- : Pattern before the PID auto-tuning is performed
——— : Pattern after the PID auto-tuning is performed

(Fig. 7.7-1)

[PID auto-tuning performing conditions]

(1) When processing temperature is lower than [setting value –20℃ (40℉)]

Fluctuation is applied at the temperature 20℃ (40℉) lower than the setting value.

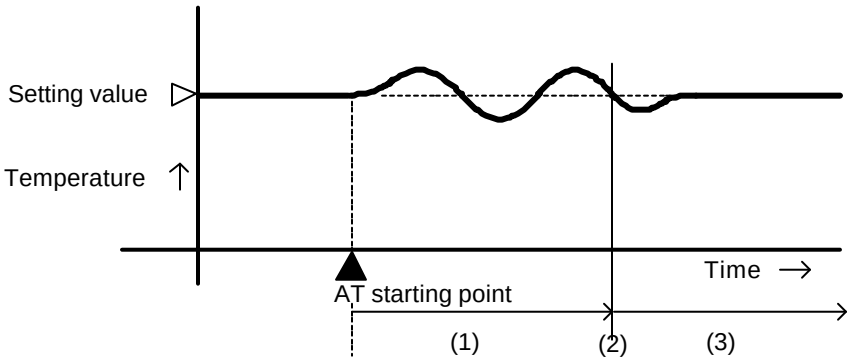


(1) PID calculation
(2) PID values decided
(3) Controlling action is performed with the values set by PID auto-tuning.

(Fig. 7.7-2)

(2) When the control is stable or when processing temperature is within [setting value±20℃ (40℉)]

Fluctuation is applied at the setting value.

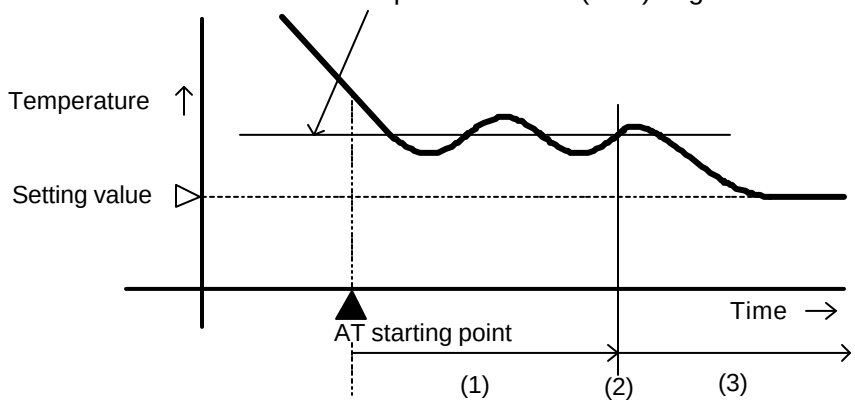


(1) PID calculation
(2) PID values decided
(3) Controlling action is performed with the values set by PID auto-tuning.

(Fig. 7.7-3)

(3) When the processing temperature is higher than [setting value+20℃ (40℉)]

Fluctuation is applied at the temperature 20℃ (40℉) higher than the setting value.



(1) PID calculation
(2) PID values decided
(3) Controlling action is performed with the value set by PID auto-tuning.

(Fig. 7.7-4)

[If P, I, D, ARW values cannot be changed]

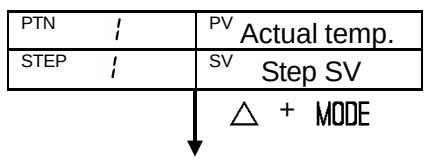
- If PID auto-tuning does not finish in 4 hours after it starts, PID auto-tuning is cancelled automatically, and P, I, D, ARW values return to the value set before the auto-tuning was performed. In this case, set P, I, D, ARW values manually.
- If PID auto-tuning is cancelled during the process, P, I, D, ARW values return to the value set before the auto-tuning was performed.

[How to perform PID auto-tuning]

PID auto-tuning can be performed only during program control run mode.

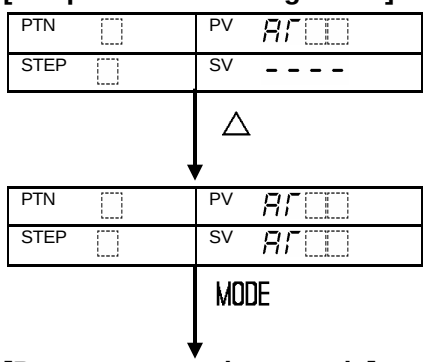
PID auto-tuning cannot be performed during the program standby mode or during any other control actions except for PID action.

[Program control run mode]



Press the MODE key while holding down the △ key.
PID parameter setting mode is selected and Auto-tuning Perform/Cancel item is selected.

[PID parameter setting mode]



AT Perform/Cancel selection
Press the △ key.

Press the MODE key.
The controller reverts to the Program control run mode, and PID auto-tuning is performed.

[Program control run mode]

PTN 1	PV Actual temp.
STEP 1	SV Step SV

[Indication during auto-tuning Perform]

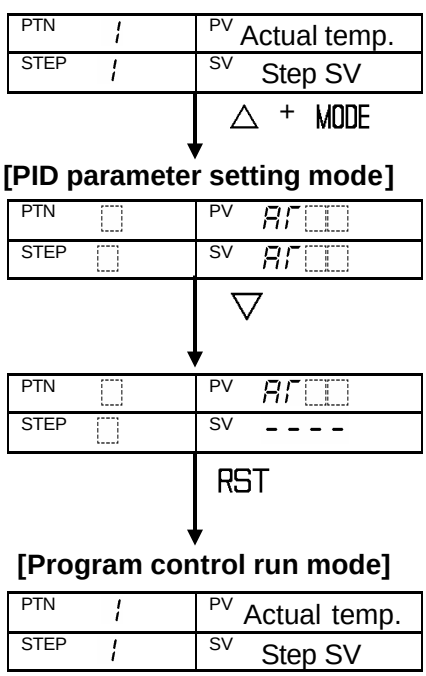
PTN 1	PV Actual temp.
STEP 1	SV Step SV

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Current step number
SV display : Current step temperature
RUN indicator : Lit during program control run
AT indicator : Blinks during auto-tuning Perform
Other indicators: Lit or unlit according to the controller status

[How to cancel PID auto-tuning]

Available only during PID auto-tuning Perform

[PID auto-tuning Perform]



Press the MODE key while holding down the △ key. .
PID parameter setting mode is selected and AT Perform/Cancel item is indicated.

AT Perform/Cancel selection
Press the ▽ key.

Press the RST key.
PID auto-tuning is cancelled and the controller reverts to the program control run mode.

8. Control and Alarm action

8.1 P, I, D, ARW action

(1) Proportional band (P)

Proportional action is the action which the control output varies in proportion to the deviation between the setting value and the processing temperature.

If the proportional band is narrowed, even if the output changes by a slight variation of the processing temperature, better control results can be obtained as the offset decreases.

However, if the proportional band is narrowed too much, even slight disturbances may cause variation in the processing temperature, control action changes to ON/OFF action and the so called hunting phenomenon occurs.

Therefore, when the processing temperature comes to the balanced position near the setting value and a constant temperature is maintained, the most suitable value is selected by gradually narrowing the proportional band while observing the control results.

(2) Integral time (I)

Integral action is used to eliminate offset. When the integral time is shortened, the returning speed to the setting point is accelerated. However, the cycle of oscillation is also accelerated and the control becomes unstable.

(3) Derivative time (D)

Derivative action is used to restore the change in the processing temperature according to the rate of change. It reduces the amplitude of overshoot and undershoot width.

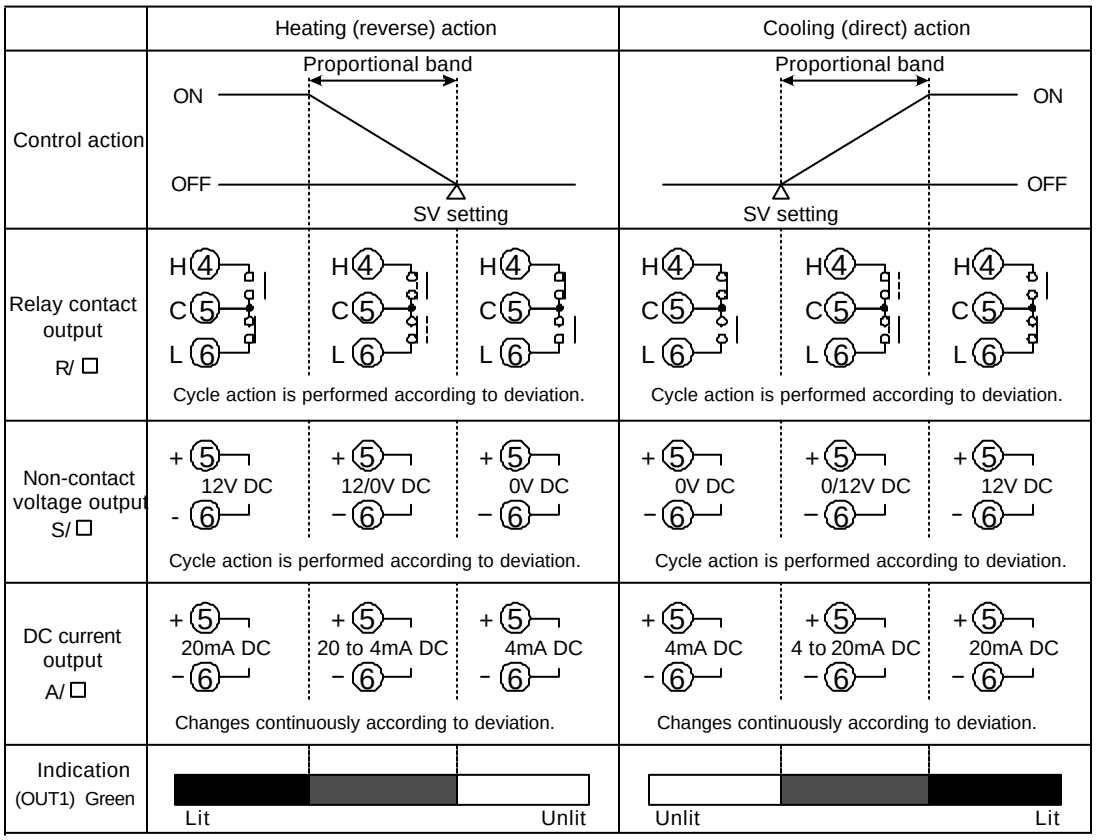
If the derivative time is shortened, restoring value becomes small, and if the derivative time is made longer, an excessive returning phenomenon may occur and the control system may be oscillated.

(4) Anti-reset windup (ARW)

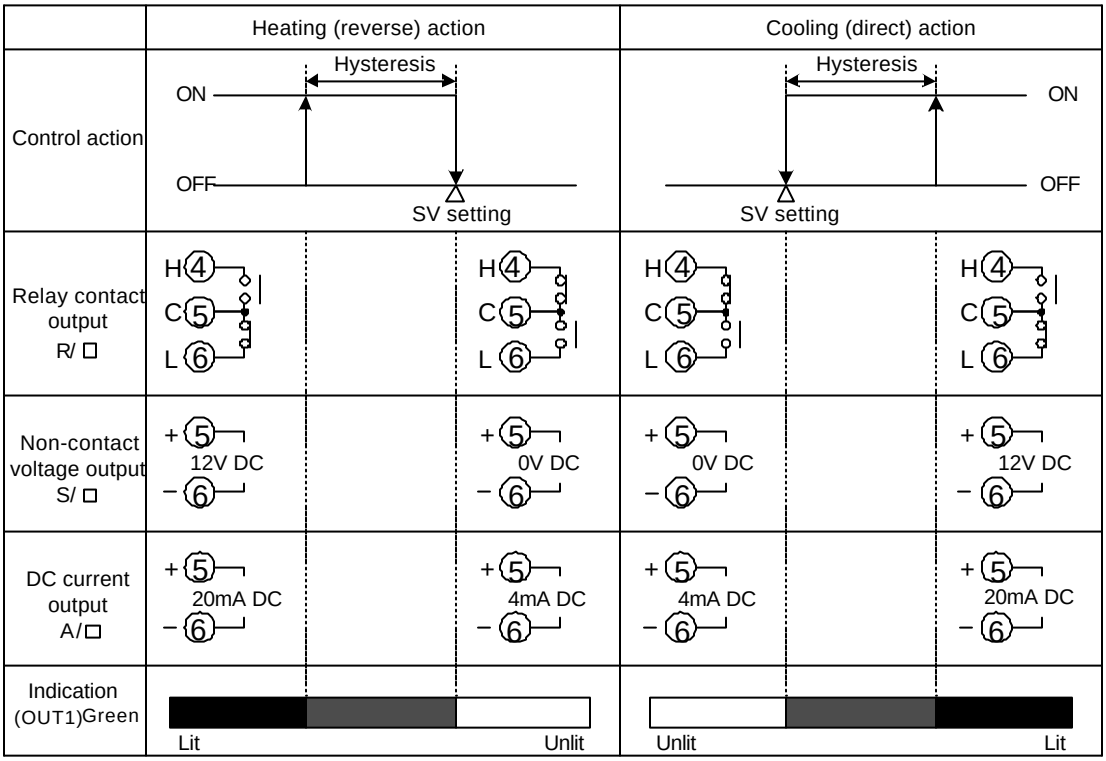
ARW (Anti-reset windup) prevents overshoot caused by the integral action. The smaller the ARW value, the less the overshoot caused by the integral action in the transition status, however it takes time until stabilization.

When setting ARW manually, set it to the closest MV (manipulated variable) when the control is stabilized.

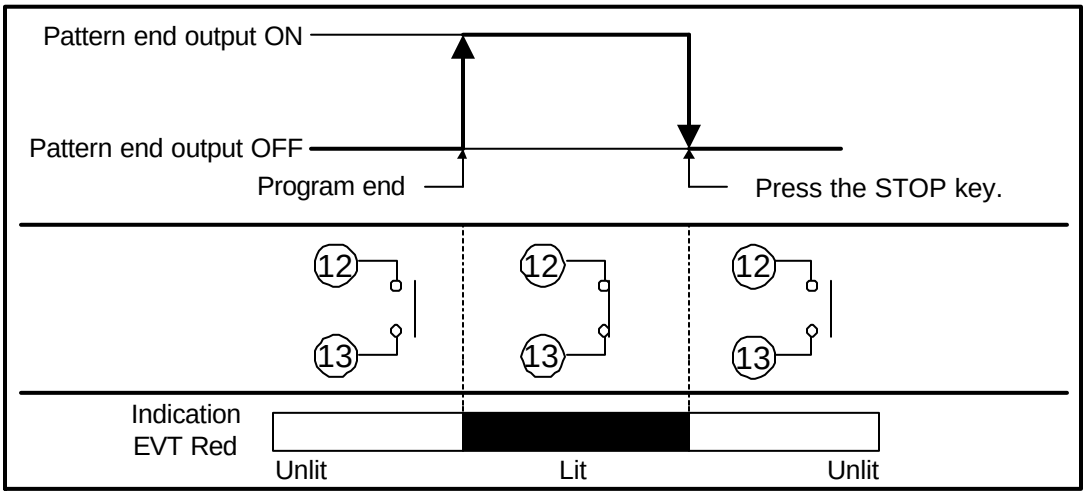
8.2 Standard action



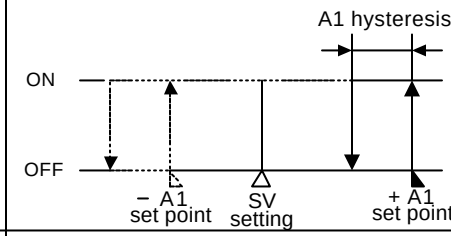
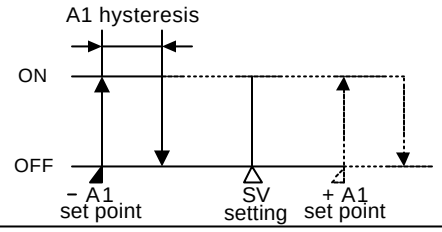
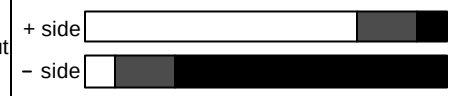
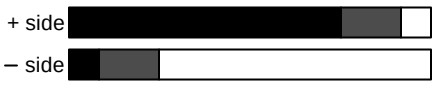
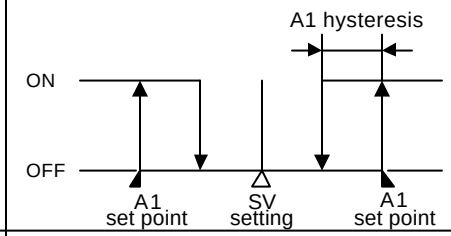
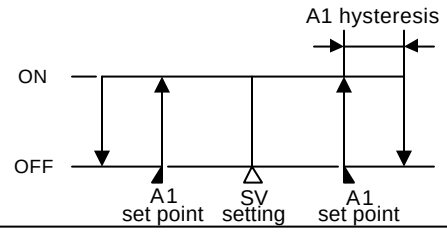
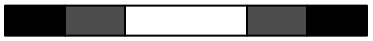
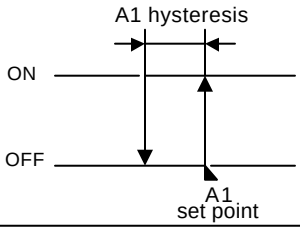
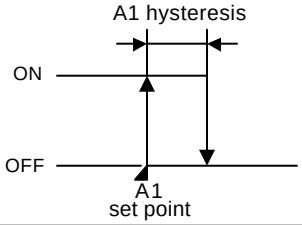
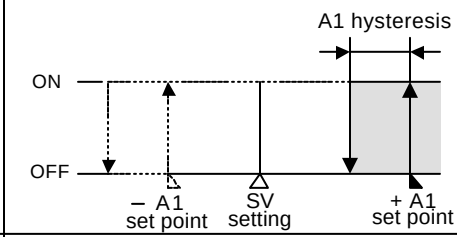
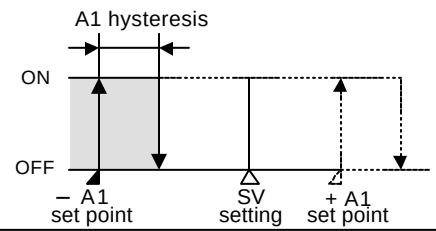
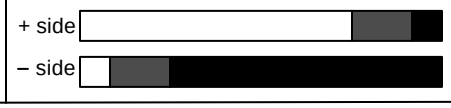
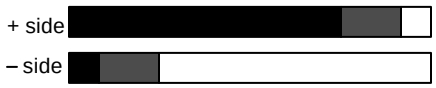
8.3 ON/OFF action

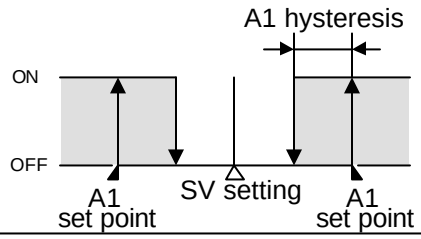
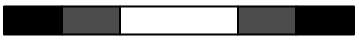


8.4 Pattern end output action



8.5 Alarm 1 (A1), Alarm 2 (A2) action

	High limit alarm	Low limit alarm
Alarm action		
Alarm output		
	High/Low limits alarm	High/Low limit range alarm
Alarm action		
Alarm output		
	Process high alarm	Process low alarm
Alarm action		
Alarm output		
	High limit alarm with standby	Low limit alarm with standby
Alarm action		
Alarm output		

	High/Low limits alarm with standby
Alarm action	
Alarm output	

: A1 output terminals 7 and 8 are connected (ON).

: A1 output terminals 7 and 8 are connected (ON) or disconnected (OFF).

: A1 output terminals 7 and 8 are disconnected (OFF).

: Standby functions.

Alarm indicator and Alarm output

For A2 output, use terminals 12 and 13.
A1 and A2 indicators light when their terminals are connected, and go out when their terminals are disconnected respectively.

When Alarm 1 (A1) Deenergized or Alarm 2 (A2) Deenergized is selected, the alarm output ON/OFF status acts reversely. In this case, A1 and A2 indicators light when their terminals are disconnected, and go out when their terminals are connected respectively.

Alarm action in overscale and underscale

During overscale, High limit alarm, High/Low limits alarm and Process high alarm are activated.
During underscale, Low limit alarm, High/Low limits alarm and Process low alarm are activated.
For the alarm with standby function, the standby function is released.

9. Other functions

Power failure countermeasure

The setting data is backed up in the non-volatile IC memory.
If power failure occurs during the program control run, and if the power failure is restored, the program control resumes from the point at which power failure occurred.
If power failure occurs during the fixed value control, and if the power failure is restored, the fixed value control resumes.

Self-diagnosis

The CPU is monitored by a watchdog timer, and when any abnormal status is found on the CPU, the indicator is switched to warm-up status.

Automatic cold junction temperature compensation (Only thermocouple input type)

This detects the temperature at the connecting terminal between the thermocouple and the instrument, and always keeps it set to the same status as when the reference junction is located at 0℃ (32℉).

Burnout

When the thermocouple or RTD input is burnt out, PV display blinks "‾ ‾ ‾ ‾".

When DC input is burnt out:

For 4 to 20mA DC and 1 to 5V DC input, PV display blinks "_ _ _ _".

For 0 to 1V DC input, PV display blinks "‾ ‾ ‾ ‾".

For 0 to 20mA DC, 0 to 5V DC and 0 to 10V DC input, the PV display indicates the corresponding value with which 0mA or 0V is inputted.

Input burnout

Indication	Contents	Control output
Blinks [‾ ‾ ‾ ‾]	Overscale If the input value exceeds the indication range high limit value.	Relay contact: OFF Non-contact voltage: 0V Current output: 4mA or Control output low limit value
Blinks [_ _ _ _]	Underscale If the input value goes under the indication range low limit value.	Relay contact: OFF Non-contact voltage: 0V Current output: 4mA or Control output low limit value

Thermocouple input

Input	Input range	Indication range	Control range
K, T	-199.9 to 400.0℃	-199.9 to 450.0℃	-205.0 to 450.0℃
	-199.9 to 750.0℉	-199.9 to 850.0℉	-209.0 to 850.0℉

Indication range and Control range of thermocouple inputs other than the above:
Input range low limit value –50℃ (100℉) to Input range high limit value +50℃ (100℉)

RTD input

Input	Input range	Indication range	Control range
Pt100	-199.9 to 850.0℃	-199.9 to 900.0℃	-210.0 to 900.0℃
	-200 to 850℃	-210 to 900℃	-210 to 900℃
	-199.9 to 999.9℉	-199.9 to 999.9℉	-211.0 to 1099.9℉
	-300 to 1500℉	-318 to 1600℉	-318 to 1600℉
JPt100	-199.9 to 500.0℃	-199.9 to 550.0℃	-206.0 to 550.0℃
	-200 to 500℃	-206 to 550℃	-206 to 550℃
	-199.9 to 900.0℉	-199.9 to 999.9℉	-211.0 to 999.9℉
	-300 to 900℉	-312 to 1000℉	-312 to 1000℉

DC input

Indication range: [Scaling low limit value – Scaling span x 1%] to [Scaling high limit value +Scaling span x 10%]
(If the input value goes outside the range –1999 to 9999, the PV display blinks "‾ ‾ ‾ ‾" or "_ _ _ _")

Control range: [Scaling low limit value – Scaling span x 1%] to [Scaling high limit value +Scaling span x 10%]

10. Specifications

10.1 Standard specifications

Model : Programmable controller
Name : PCD-33A
Mounting method : Flush
Setting : Input system using membrane sheet key
Display
PV display : Red LED display 4 digits, character size, 18(H) x 8(W)mm
SV display : Green LED display 4 digits, character size, 12.6(H) x6(W)mm
PTN display : Green LED display 1 digit, size, 12.6(H) x 6(W) mm
STEP display : Green LED display 1 digit, size, 12.6(H) x 6(W) mm
Input
Thermocouple : K, J, R, S, B, E, T, N, PL-Ⅱ, C
External resistance, 100Ω or less (for B input, 40Ω or less)
RTD : Pt100, JPt100, 3-wire system
Allowable input lead wire resistance, 10Ω or less per wire
DC current : 0 to 20mA DC, 4 to 20mA DC
Input impedance 50Ω
Allowable input current 50mA DC or less
[50Ω shunt resistor (sold separately) must be installed between input terminals.]
DC voltage : 0 to 1V DC
Input impedance (1MΩ or greater)
Allowable input voltage (5V DC or less)
Allowable signal source resistance (2kΩ or less)
: 0 to 5V DC, 1 to 5V DC, 0 to 10V DC
Input impedance (100kΩ or greater)
Allowable input voltage (15V DC or less)
Allowable signal source resistance (100Ω or less)
Input sampling period : 0.25 seconds
Accuracy (Indication and setting)
Thermocouple : Within ±0.2% of each input span ±1digit or within ±2℃ (4℉), whichever is greater
However, for R or S input, the range 0 to 200℃ (0 to 400℉), within ±6℃ (12℉)
When B input, the range 0 to 300℃ (0 to 600℉), accuracy is not guaranteed.
RTD : Within ±0.1% of each input span ±1digit or within ±1℃ (2℉), whichever is greater
DC current, voltage : Within ±0.2% of each input span ±1digit
Time indication accuracy: Within ±0.5% of the setting time
Program performance
Number of patterns: 9
Number of steps : 9 steps/1 pattern
Program time range: 0 to 99 hours 59 min./1 step, or 0 to 99 min. 59sec./1 step
For each step, - - - - (Program control Hold) can be set.
Fixed value control at the step temperature can be performed since Hold function works.
Time setting accuracy: Within ±0.5% of the setting time

Setting resolution

Temperature: Refer to Section "1.2 Rated scale" (p. 6).

Time : 1 minute or 1 second

Status after power failure is restored:

The control resumes from the point at which power failure occurred. (Progressing time error after power failure is restored: Maximum 1 minute or 1 second.)

Controlling action

- PID action (with auto-tuning function)
- PI action (When derivative time is set to 0)
- PD action (When integral time is set to 0)
- P action (When both integral and derivative time are set to 0)
- ON/OFF action (When proportional band is set to 0 or 0.0)

Proportional band (P) : TC, RTD input without a decimal point, 0 to 1000℃ (2000℉) [Default value: 10℃]
TC, RTD input with a decimal point, 0.0 to 999.9℃ (999.9℉)
DC input, 0.0 to 100.0%

Integral time (I) : 0 to 1000 sec. (off when set to 0) [Default value: 200s]

Derivative time (D) : 0 to 300 sec. (off when set to 0)) [Default value: 50s]

Proportional cycle : 1 to 120 sec. [Default value: 30s for –R/M, 3s for –S/M, not available for –A/M]

Anti-reset windup (ARW) : 0 to 100% [Default value: 50%]

ON/OFF action hysteresis : 0.1 to 100.0℃ (℉) [Default value: 1.0℃]

Output high limit, low limit: 0 to 100% (for DC current output, -5 to 105%) [Default: Output high limit; 100%, Output low limit; 0%]

Control output (OUT)

Relay contact : 1a1b
Control capacity, 250V AC 3A (resistive load)
250V AC 1A (inductive load cosø=0.4)
Electric life: 100,000 times

Non-contact voltage : For SSR drive
12^{+2}_{0}V DC maximum 40mA DC (short circuit protected)

Current : 4 to 20mA DC
Load resistance, maximum 550Ω

Alarm 1 (A1) and Alarm 2 (A2) output

The alarm action point is set by ±deviation to the setting value (except Process value alarm). When the input goes outside the range, the output is turned ON or OFF (for High/Low limit range alarm).

Alarm Energized (When Alarm output is turned ON, Alarm indicator lights, and when Alarm output is turned OFF, the alarm indicator goes out) or Deenergized (When Alarm output is turned ON, Alarm indicator goes out, and when Alarm output is turned OFF, the alarm indicator lights) can be selected by keypad operation.

Setting accuracy : The same as the indication accuracy

Action : ON/OFF action

Hysteresis : 0.1 to 100.0℃ (℉) [Default value: 1.0℃]
For DC current, voltage input, 1 to 1000 (The placement of the decimal point follows the selection)

Output : Relay contact 1a
Control capacity, 250V AC 3A (resistive load)
250V AC 1A (inductive load cosø=0.4)
Electric life: 100,000 times

Alarm output action : One alarm can be selected with the front keypad from 10 types of alarm; High limit alarm, Low limit alarm, High/Low limits alarm, High/Low limit range alarm, Process high alarm and Process low alarm, High limit alarm with the standby function, Low limit alarm with the standby function, High/Low limits alarm with the standby function and No alarm action.
[Default value: No alarm action for Alarm 1(A1) and Alarm 2 (A2).]

Event output

One of the outputs can be selected by the front keypad from a choice of:
Time signal output, Pattern end output and RUN output.
[Default value: Time signal output]

Output : Relay contact 1a
Control capacity, 250V AC 3A (resistive load)
250V AC 1A (inductive load cosø =0.4)
Electric life: 100,000 times

Time signal output:

Sets the amount of time for time signal output ON time and time signal output OFF time within one pattern time. Time signal output is turned on during time signal output ON time. Time signal output ON time follows time signal output OFF time.
Setting range: OFF time, 00.00 to 99.59 (Hour:Minute or Minute:Second)
ON time, 00.00 to 99.59 (Hour:Minute or Minute:Second)
The time unit can be selected from the Step time unit selection.
[Default value: 00.00 (Hour:Minute)]

Pattern end output:

After program control is complete, pattern end output is turned on during pattern end output setting time.
When set to 0, the output continues to work. The output is turned off by pressing the STOP key for 1 second or greater.
Pattern end output time setting range: 0 to 9999 sec. [Default value: 0s]

Run (program control run) output:

The program control run output is turned on during program control run.

Supply voltage : 100 to 240V AC 50/60Hz, or 24V AC/DC 50/60Hz
For the supply voltage, 100 to 240V AC is standard.
For 24V AC/DC, “1” is entered after the model name PCD-33A-x/M.

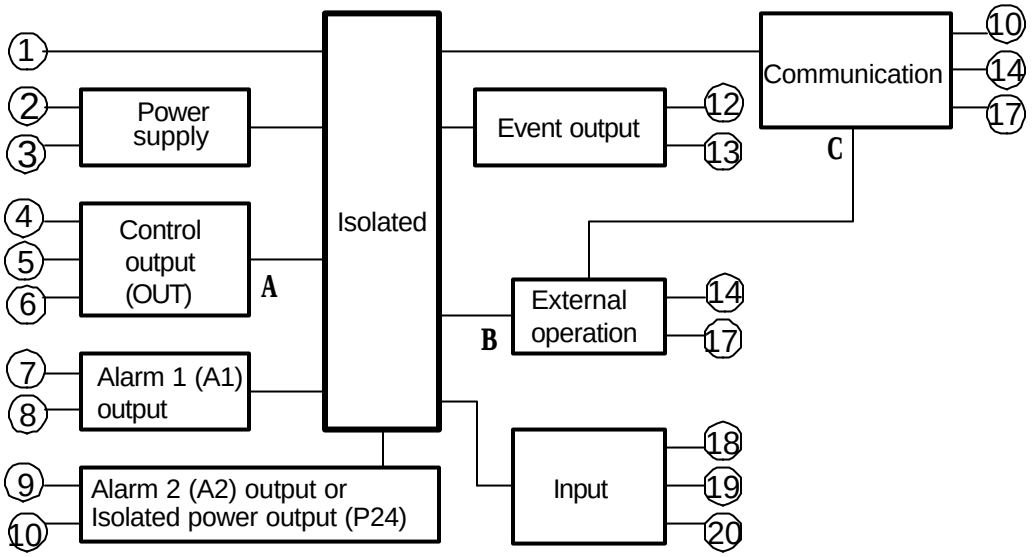
Allowable voltage fluctuation:
100 to 240V AC: 85 to 264V AC
24V AC/DC : 20 to 28V AC/DC

Ambient temperature : 0 to 50℃ (32 to 122℉)

Ambient humidity : 35 to 85%RH (non-condensing)

Power consumption: Approx. 8VA

Circuit isolation configuration



When the control output is non-contact voltage output type or DC current output type, between A to B and A to C are not isolated.

Isolation resistance

10MΩ or greater at 500V DC for other combinations except those mentioned above

Dielectric strength

Between input terminal and ground terminal, 1.5kV AC for 1 minute
Between input terminal and power terminal, 1.5kV AC for 1 minute
Between output terminal and ground terminal, 1.5kV AC for 1 minute
Between output terminal and power terminal, 1.5kV AC for 1 minute
Between power terminal and ground terminal, 1.5kV AC for 1 minute

Weight : Approx. 370g
External dimension: 96 x 96 x 100mm (W x H x D)
Material : Case, Flame resistant resin
Color : Case, Light gray
Attached functions: Setting value lock function, Sensor correction function, Power failure countermeasure, Self-diagnosis, Automatic cold junction temperature compensation, Burnout function (overscale), Input burnout, Warm-up indication
Accessories : Mounting bracket 1 set
Instruction manual 1 copy
Terminal cover 2 pieces (When the option TC is applied.)

10.2 Optional specifications

Serial communication (Option code: C5)

External operation function cannot be used if option [C5] is applied.

The following operations can be executed from the external computer.
(1) Reading and setting of Step SV, Step time, PID values and various setting values.
(2) Reading of the input value and the action status.
(3) Change of the functions.

Communication line : Based on EIA RS-485
Communication method : Half-duplex communication start-stop synchronous
Communication protocol: Shinko, Setting value digital transmission (Shinko protocol), Setting value digital reception (Shinko protocol), Modbus ASCII, Modbus RTU
[Default value: Shinko protocol]
Communication speed : 2400, 4800, 9600, 19200bps, [Default value: 9600bps]
Selectable by keypad operation
Parity : Even, Odd and No parity
Selectable by keypad operation [Default value: Even]
Stop bit : 1, 2 (Selectable by keypad operation) [Default value: 1]
Data format : Data bit is automatically changed by selecting a communication protocol.

Protocol	Shinko	Modbus ASCII	Modbus RTU
Start bit	1	1	1
Data bit	7	7	8
Parity	Even	Selected value (Even)	Selected value (No)
Stop bit	1	Selected value (1)	Selected value (1)

Value in the bracket ( ): Basic setting value

Setting value digital transmission (Option code: SVTC)

If option SVTC is added, external operation function is not available.
If Setting value digital transmission is selected from Communication protocol selection, step SV of the PCD-33A can be transmitted digitally to a maximum of 31 units of Shinko controllers with communication function (option C5).
If Setting value digital reception is selected from Communication protocol selection, step SV can be received from Shinko PC-935/PCD-13A/PCD-33A with Setting value digital transmission (option SVTC).

Isolated power output (Option code: P24)

When option P24 is added, Alarm 2 (A2) is not available.
Output voltage: 24±3V DC (When load current is 30mA DC)
Ripple voltage: Within 200mV DC (When load current is 30mA DC)
Max. load current: 30mA DC

Color black (Option code: BK)

Front panel: Dark gray
Case : Black

Terminal cover (Option code: TC)

Electrical shock protection terminal cover

11. Troubleshooting

If any malfunctions occur, refer to the following items after checking the power and the wiring.

⚠ Warning

Turn the power supply to the instrument off before checking the wiring. Working or touching the terminal with the power switched on may result in severe injury or death due to Electric Shock.

<Indication>

Problem	Presumed cause and solution
The PV display is blinking [ ].	• Thermocouple or RTD is burnt out. [Thermocouple] If the input terminal of the instrument is shorted, and if nearby room temperature is indicated, the instrument is probably normal and the sensor may be burnt out. [RTD] If approx. 100Ω of resistance is connected to the input terminals between A-B of the instrument and between B-B is shorted, and if nearby 0℃ (32℉) is indicated, the instrument is probably normal and the sensor may be burnt out. • Lead wire of thermocouple or RTD is not securely mounted to the instrument terminals.
The PV display is blinking [----].	• Polarity of thermocouple or compensating lead wire is reversed. • Codes (A, B, B) of RTD do not agree with the instrument terminals.
If indication of PV display is abnormal or unstable.	• Designation of the sensor input is improper. • Temperature unit (℃ or ℉) is mistaken. Set the sensor type which is the same as users' and the temperature unit from the Input type selection [InP]. (p.16) • Sensor correction value is unsuitable. Set the value properly from the Sensor correction setting [Sn□] in Auxiliary function setting mode 1. (pp.31, 41, 42) • AC may be leaking into thermocouple or the RTD circuit. • There may be equipment nearby producing an inductive fault or noise near the controller.
PV display indicates [Err 1].	• Internal memory is defective. Make inquiries to Shinko Technos or our dealers.

<Keypad operation>

Problem	Presumed cause and solution
It is impossible to select program pattern number.	• The program control is running. Change the mode. The program pattern number can be selected in the program standby mode.
If settings or selections are impossible.	• Setting value lock [Lock] is designated from the Setting value lock selection in Auxiliary function setting mode 1. Release the lock designation and set to [----]. (p.31) • PID auto-tuning is performing. Cancel the tuning if necessary. (p.28)

If the setting indication does not change in the rated scale range even if the △, ▽ keys are pressed, and settings are impossible.	• SV high limit or low limit in Auxiliary function setting mode 1 may be set at the point the value does not change. Set it (5H□□, or 5L□□) again while in Auxiliary function setting mode 1. (p.31)

<Control>

Problem	Presumed cause and solution
If process variable (temperature) does not rise.	• Thermocouple or RTD is burnt out. • Lead wire of thermocouple or RTD is not securely connected to the instrument terminals. • Direct (Cooling) action [cool] has been selected in the Direct/Reverse action selection [cont]. Select Reverse (Heating) [HEAT] action. (p.20)
If the control output (OUT) remains ON status.	• Control output low limit setting value is set to 100% or greater in Auxiliary function setting mode 2. (p.17) • The proportional band is set to extremely small value. Set the value appropriately. (p.28)
If the control output (OUT) remains OFF status.	• Main output high limit setting value is set to 0% or less in Auxiliary function setting mode 2. (p.17) • The proportional band is set an extremely high value. Set the value appropriately. (p.28)
Step numbers progress fast and program control stops soon after it is started.	• The program has not been set. Set the program from the Pattern (Step SV/Time) setting mode. (pp.25, 26) • The default value is PV start. If the PV is higher than the Step SV, the program advances and it ends soon. (p.17)
The step does not proceed	• Wait function is working. Release the wait function. • The fixed value control is performing due to Hold function. Press the RUN key for more than 1 second to release the Hold function. (p.39)

If any unexplained malfunctions occur other than the above mentioned, make inquiries at our agency or the shop where you purchased the unit.

12. Character table

Photocopiable material

<Setting value/Time setting mode>

Step No.	PV display	Setting item	Default value	Data
1	1SEtP	Step 1 Step SV	0℃	
1	1t tME	Step 1 Step time	00.00 (H:M)	
2	2SEtP	Step 2 Step SV	0℃	
2	2t tME	Step 2 Step time	00.00 (H:M)	
3	3SEtP	Step 3 Step SV	0℃	
3	3t tME	Step 3 Step time	00.00 (H:M)	
4	4SEtP	Step 4 Step SV	0℃	
4	4t tME	Step 4 Step time	00.00 (H:M)	
5	5SEtP	Step 5 Step SV	0℃	
5	5t tME	Step 5 Step time	00.00 (H:M)	
6	6SEtP	Step 6 Step SV	0℃	
6	6t tME	Step 6 Step time	00.00 (H:M)	
7	7SEtP	Step 7 Step SV	0℃	
7	7t tME	Step 7 Step time	00.00 (H:M)	
8	8SEtP	Step 8 Step SV	0℃	
8	8t tME	Step 8 Step time	00.00 (H:M)	
9	9SEtP	Step 9 Step SV	0℃	
9	9t tME	Step 9 Step time	00.00 (H:M)	

<Alarm/Time signal setting mode>

Step No.	PV display	Setting item	Default value	Data
	A1□□	Alarm 1 (A1) action point	0℃	
	A2□□	Alarm 2 (A2) action point	0℃	
	toFF	Time signal OFF time	00.00 (H:M)	
	ton□	Time signal ON time	00.00 (H:M)	

< PID parameter setting mode>

Step No.	PV display	Setting item	Default value	Data
	AT□□	PID Auto-tuning Perform/Cancel	Cancel	
	P□□□	Proportional band	10℃	
	I □□□	Integral time	200sec.	
	d□□□	Derivative time	50sec.	
	n□□□	Anti-reset windup	50%	
	c□□□	Proportional cycle	R/□ (30s), S/□ (3s)	

<Wait parameter setting mode>

Step No.	PV display	Setting item	Default value	Data
	WAIT	Wait value	0℃ (No Wait action)	
1	W1cT	Step 1 Wait function Used/Not used	Not used	
2	W2cT	Step 2 Wait function Used/Not used	Not used	
3	W3cT	Step 3 Wait function Used/Not used	Not used	
4	W4cT	Step 4 Wait function Used/Not used	Not used	

5	JAcT	Step 5 Wait function Used/Not used	Not used	
6	JAcT	Step 6 Wait function Used/Not used	Not used	
7	JAcT	Step 7 Wait function Used/Not used	Not used	
8	JAcT	Step 8 Wait function Used/Not used	Not used	
9	JAcT	Step 9 Wait function Used/Not used	Not used	

<Auxiliary function setting mode 1>

Step No.	PV display	Setting item	Default value	Data
	Lock	Setting value lock	Unlock	
	SH□□	SV (Setting value) high limit	1370℃	
	SL□□	SV (Setting value) low limit	-200℃	
	So□□	Sensor correction setting	0.0℃	
	cmSL	Communication protocol	Shinko protocol	
	cmno	Instrument number	0	
	cmSP	Communication speed	9600bps	
	cmPr	Parity	Even	
	cmST	Stop bit	1	

<Auxiliary function setting mode 2>

Step No.	PV display	Setting item	Default value	Data
	SEnS	Input type selection	K: -200 to 1370℃	
	SrLH	Scaling high limit value	9999	
	SrLL	Scaling low limit value	-1999	
	dP□□	Decimal point place	No decimal point	
	FILT	PV filter time constant	0.0 seconds	
	m_S□	Step time unit selection	Hour/Minute	
	S_SB	Step SV setting when control starts	0℃	
	S_SL	Program control start form	PV start	
	oLH□	Control output high limit	100%	
	oLL□	Control output low limit	0%	
	HYS□	Control output ON/OFF action hysteresis	1.0℃	
	AL 1F	Alarm 1 (A1) action	No alarm	
	AL2F	Alarm 2 (A2) action	No alarm	
	A1Lm	Alarm 1 (A1) Energized/Deenergized	Energized	
	A2Lm	Alarm 2 (A2) Energized/Deenergized	Energized	
	A1HY	Alarm 1 (A1) hysteresis	1.0℃	
	A2HY	Alarm 2 (A2) hysteresis	1.0℃	
	A1dY	Alarm 1 (A1) action delayed timer	0 sec.	
	A2dY	Alarm 2 (A2) action delayed timer	0 sec.	
	EVSL	Event output function	Time signal output	
	PETm	Pattern end output time	0s (continuous output)	
	conT	Direct (Cooling)/ Reverse (Heating) action	Reverse (Heating) action	

13. How to make the program pattern table

Before setting the program, make a program pattern and data table.
Copy the program pattern table and follow the procedure mentioned below.

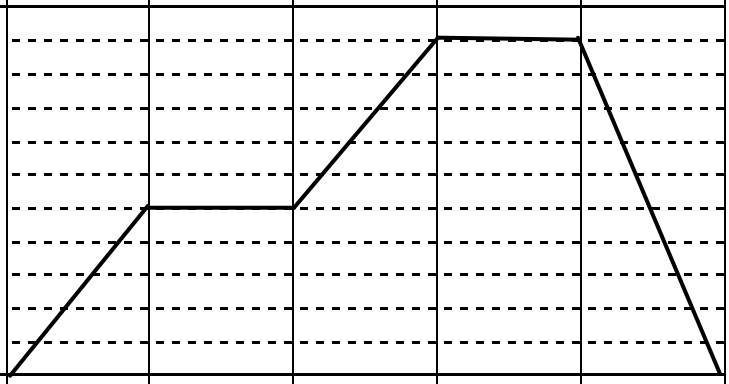
(1) Write down the program pattern number.
(2) From Step 1, write down step SV and time of each step in sequence.
(3) Write down Alarm 1 (A1) and Alarm 2 (A2) action points and Time signal output time.
(4) Write down the P, I, D, ARW and proportional cycle values.
(5) Write down the Wait value and Wait function Used/Not used of each step.
(6) Draw a line graph of the step SV.

Explanation of the program pattern table

Program pattern table consists of Y axis which represents the step SV (℃ or ℉) and X axis which represents the step time (Hour:Min or Min:Sec).
In this context, Step SV is considered to be the value at the end of the step, and step time is considered to be the step processing time.
The relation between the step SV and step time can be explained as follows.

Step 1: The control is performed so that the temperature reaches 500℃ in 30 minutes (0:30). (*1)
Step 2: The control is performed at 500℃ for 1 hour (1:00).
(*1) When the control starts, SV differs depending on the program control start form. If the SV start is selected in the Program control start form selection, the control starts from SV. If the PV start is selected in the Program control start form selection, the SV is advanced to the PV and the control starts.

Program pattern table example

Program pattern (Pattern 1)					
Step number	1	2	3	4	5
Setting value (SV) 1000 / 500 / 0					
Step temperature (℃)	500	500	1000	1000	0
Step time (Hour:Min)	0:30	1:00	0:40	1:00	2:00
Wait function Used/Not used	Used	Used	Used	Used	Not used
Wait value setting	1℃				
P (Proportional band)	10℃				
I (Integral time)	200 sec.				
D (Derivative time)	50 sec.				
Anti-reset windup	50%				
C (Proportional cycle)	30 sec.				
Time signal output ON / OFF					

Program pattern (Pattern number)				
Step number	1	2	3	4
Setting value (SV)				
Step temperature (°C)				
Step time (Hour:Minute)				
Wait function Used/Not used				
Wait value setting				
P (Proportional band)				
I (Integral time)				
D (derivative time)				
Anti-reset windup				
Proportional cycle				
Time signal output ON				
OFF				

5	6	7	8	9

Revisions

The manual number is noted at the lower right of the back cover.

Print date	Manual number	Revision
Jan. 2003	PCD31E1	First edition

***** Inquiry *****

For any inquiries about this unit, please contact the shop where you purchased the unit after checking the following.

	[Example]
• Model ----------	PCD-33A-R/M
• Option ----------	C5
• Instrument number ----------	No. xxxxxx

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

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25 Whitefriars Drive
Toronto, Ontario, Canada M3A 2L2
TEL: 416 444-0817
FAX: 416 444-2361
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