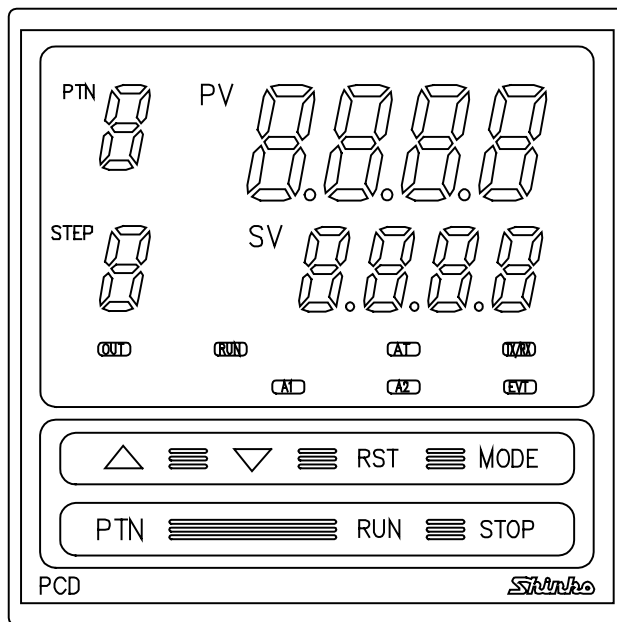


PROGRAMMABLE CONTROLLER

PCD-33A

INSTRUCTION MANUAL



Shinko

Preface


Thank you for purchasing our Programmable Controller PCD-33A. This manual contains instructions for the mounting, functions, operation and notes when operating the PCD-33A. To prevent accidents arising from the misuse of this controller, please ensure the operator receives this manual.

Notes

- This instrument should be used in accordance with the specifications described in the manual. If it is not used according to the specifications, it may malfunction or cause fire.
- Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- 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 our sales department.
- This instrument is designed to be installed within a control panel. If it is not, measures must be taken to ensure that the operator cannot touch power terminals or other high voltage sections.
- Any unauthorized transfer or copying of this document, in part or in whole, is prohibited.
- Shinko Technos CO., LTD. is not liable for any 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.



Warning

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



Safety precautions

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

Caution with respect to Export Trade Control Ordinance

To avoid this instrument from being used as a component in, or as being utilized in the manufacture of weapons of mass destruction (i.e. military applications, military equipment, etc.), please investigate the end users and the final use of this instrument.

In the case of resale, ensure that this instrument is not illegally exported.

1. Installation precautions

Caution

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

Ensure the mounting location corresponds to the following conditions:

- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gases
- Few mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of 0 to 50°C (32 to 122°F) 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 insulation sleeve in which the M3 screw fits 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)
- For a 24V AC/DC power source, do not confuse polarity when using direct current (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 instrument 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 the power to the PCD-33A OFF before cleaning.
- Use a soft, dry cloth when cleaning the instrument.
(Alcohol based substances may tarnish or deface the unit.)
- As the display section is vulnerable, do not strike or scratch it with a hard object or press hard on it.

--- CONTENTS ---

1. Models	
1.1 Models	5
1.2 Rated input	6
1.3 How to read the model label	6
2. Name and functions of the sections	
2.1 Name and displays	7
2.2 Keys	8
3. Mounting to the control panel	
3.1 Site selection	8
3.2 External dimensions and panel cutout	9
3.3 Mounting	9
4. Wiring	
4.1 Terminal arrangement	11
4.2 Wiring examples	12
5. Setup	
5.1 Setup	14
5.2 Basic operation for setup	15
5.3 Setting items in Auxiliary function setting mode 2	16
6. Operation	
6.1 Operation flowchart	22
6.2 Operation	
(1) Turn the power to the controller ON	24
(2) Program standby mode	24
(3) Program pattern number selection	24
(4) Pattern (Step SV/Time) setting mode	25
(5) Alarm/Time signal setting mode	27
(6) PID parameter setting mode	28
(7) Wait parameter setting mode	29
(8) Auxiliary function setting mode 1	31
(9) Auxiliary function setting mode 2	33
(10) Data clearing function	33
7. Running	
7.1 How to set the program	34
7.2 Performing program control	34
7.3 Stopping program control	39
7.4 Advance function	39
7.5 Switching to Fixed value control (Hold function)	40
7.6 Correcting PV (Sensor correction function)	41
7.7 PID auto-tuning	42
8. Control and Alarm action	
8.1 P, I, D, ARW action	45
(1) Proportional band (p)	45
(2) Integral time (I)	45
(3) Derivative time (D)	46
(4) ARW (Anti-reset windup)	46
8.2 Standard action	46
8.3 ON/OFF action	47
8.4 Pattern end output action	47
8.5 Alarm 1 (A1) and Alarm 2 (A2) action	48
9. Other functions	49
10. Specifications	
10.1 Standard specifications	51
10.2 Optional specifications	54
11. Troubleshooting	55
12. Character table	58
13. How to make the program pattern table	60

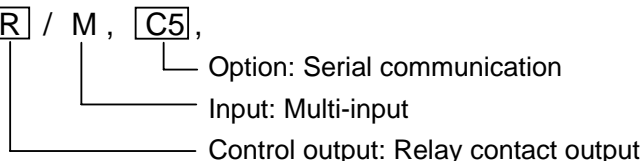
1. Models

1.1 Models

Fill in the squares with the alphanumeric character to represent the functions or type.

[Example]

PCD-33A - R / M , C5 ,



Standard model

P C D - 3 3 A - □ / 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)
Supply voltage				100 to 240V AC (standard)
	1			24V AC/DC 50/60Hz (*3)
Options			C5	Serial communication (based on EIA RS-485) (*4)
			SVTC	Set value digital transmission (*4)
			P24	Insulated power output (*5)
			TC	Electric 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 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 input

(Table 1.2-1)

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



Warning

Do not take the inner assembly out or touch the terminal with the power supply ON when confirming the model label.

Touching the terminal with the power switched ON may result in severe injury or death due to Electric Shock.

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

[Example]

PCD-33A-R/M

➔ Model: PCD-33A-R/M

C5

➔ Option: C5 (Serial communication)

MULTI-RANGE

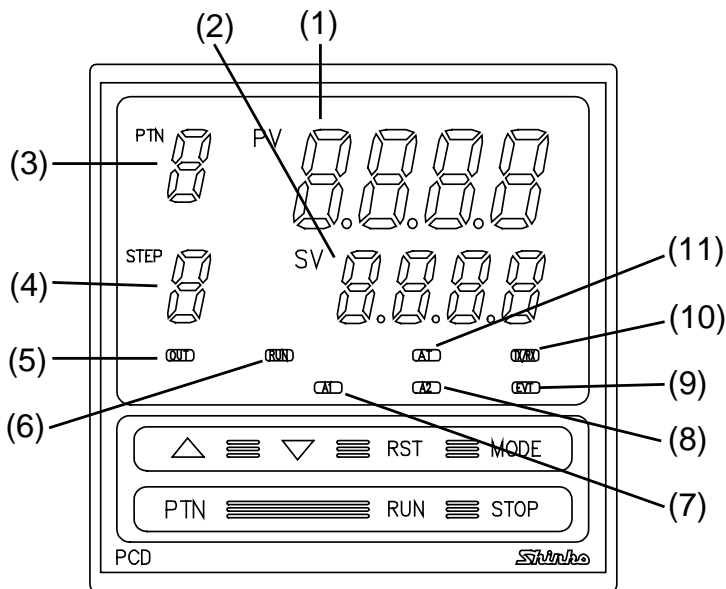
No. xxxxxx

➔ Serial number: Only indicated on the inner assembly.

(Fig. 1.3-1)

2 Name and functions of the sections

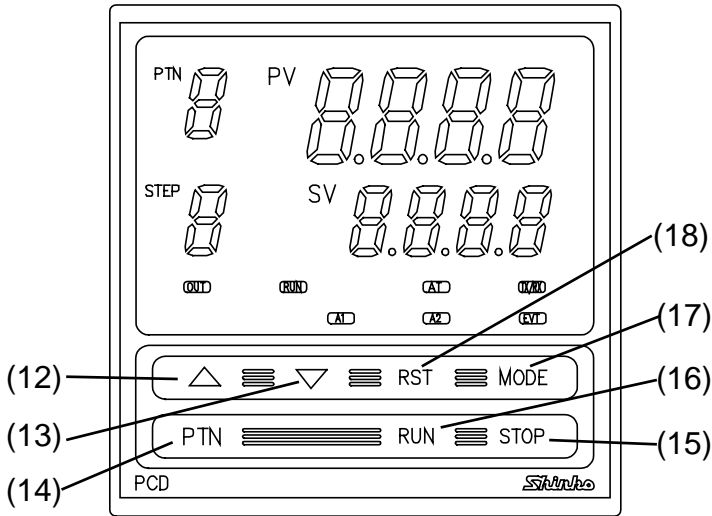
2.1 Name and Displays



(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 Set value (SV).
When the setting mode is indicated, the set 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 flashes.
- (5) **OUT indicator** (Green)
Lights when the control output is on.
(For the current output type, it flashes at a cycle of every 0.25 second corresponding to the output manipulated variable.)
- (6) **RUN indicator** (Red)
Lights while program control is performing.
Flashes 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)
Flashes while transmitting data in the Serial communication.
- (11) **AT indicator** (yellow)
Flashes 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 set values.
- (18) **RST (Reset key)** : Releases the setting mode, then reverts to the Program standby mode or Program control run mode.

3. Mounting to the control panel

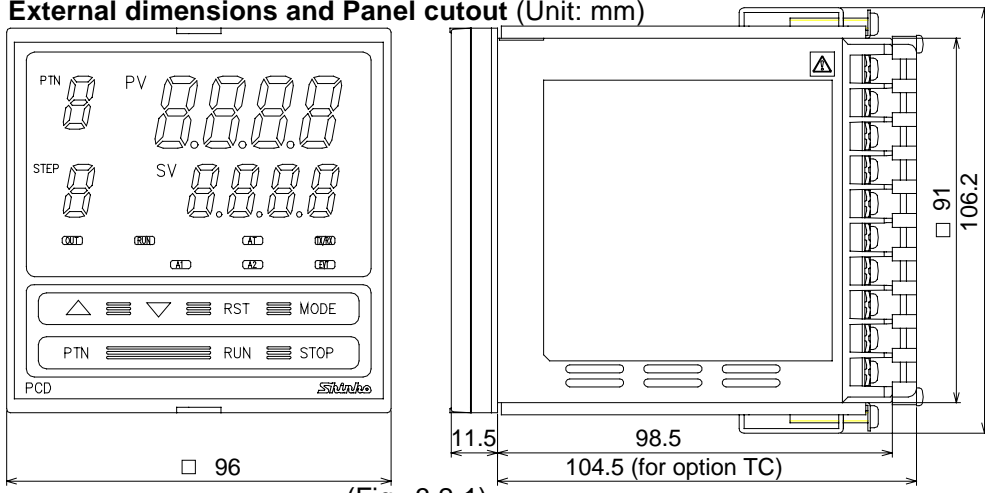
3.1 Site selection

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

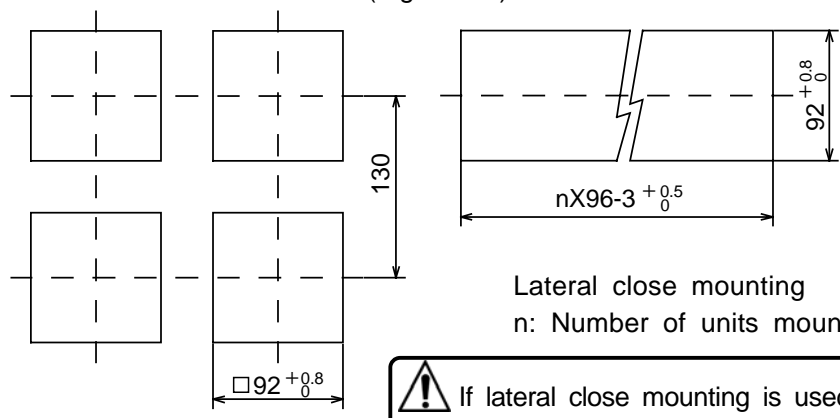
Ensure the mounting location corresponds to the following conditions:

- (1) A minimum of dust, and an absence of corrosive gases
- (2) No flammable, explosive gases
- (3) No mechanical vibrations or shocks
- (4) No exposure to direct sunlight, an ambient temperature of 0 to 50°C (32 to 122°F) 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 dimensions and Panel cutout (Unit: mm)



(Fig. 3.2-1)



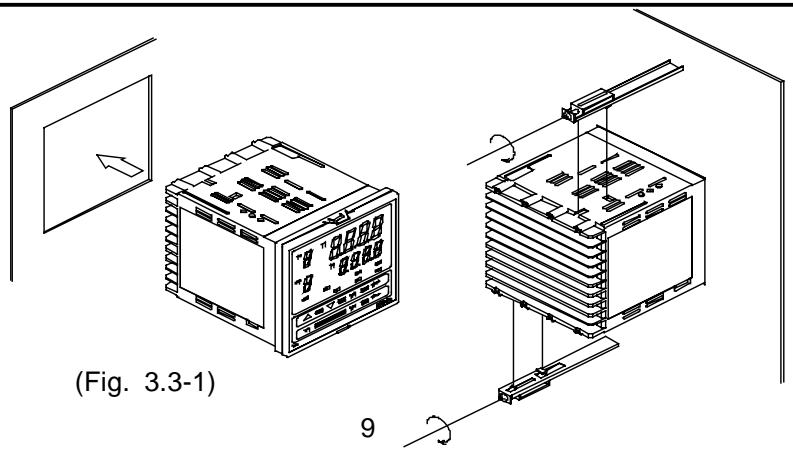
(Fig. 3.2-2)

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

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



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 leave wire chips in the instrument, because they could cause fire or malfunction.
- For the ground terminal of the PCD-33A, use 2mm² or more of thick wire. However, avoid grounding in conjunction with the power line.
- Use the solderless terminal with an insulation sleeve in which the M3 screw fits 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 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 250V AC, 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.

● **External operation function**

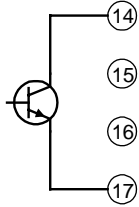
Program control run and Program control stop can be performed externally.

See (Fig. 4.1-3) and (Fig. 4.1-4).

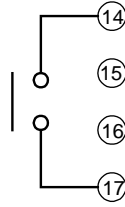
● **External operation input terminals**

External operation comprises 2 input types as follows.

Open collector input



Contact (pulse) input



(Fig. 4.1-3)

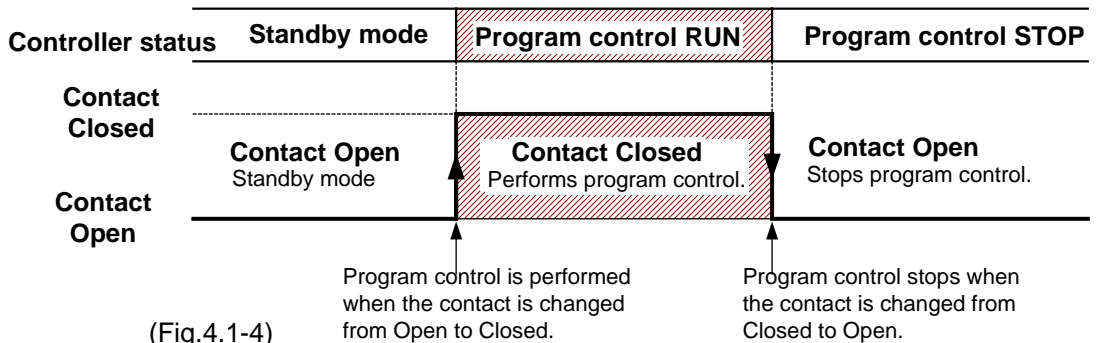
● **Program control run**

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

● **Program control stop**

Program control stops when terminals 14 and 17 are opened.

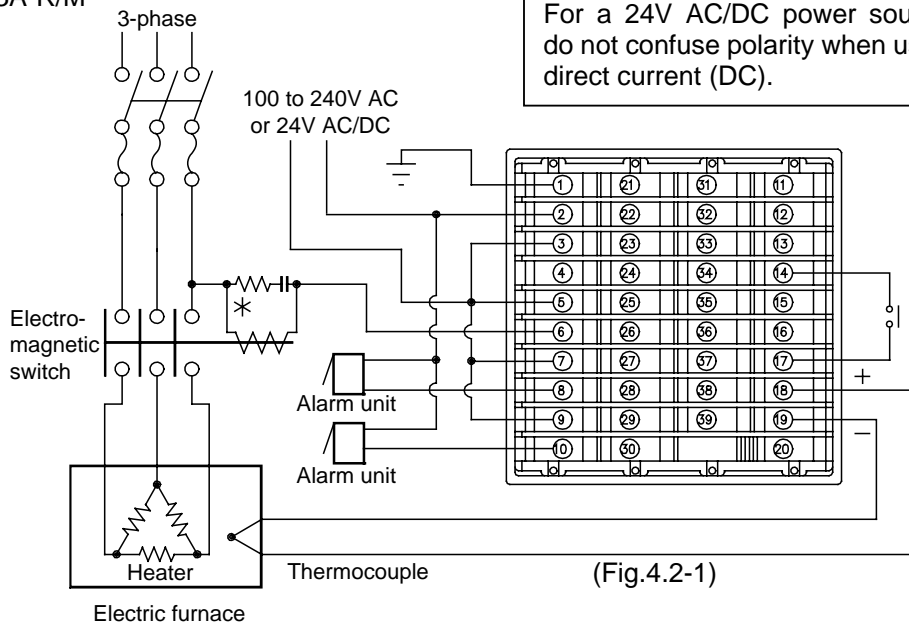
If pattern end output is turned ON after program control ends, pattern end output stops by opening terminals 14 and 17.



(Fig.4.1-4)

4.2 Wiring examples

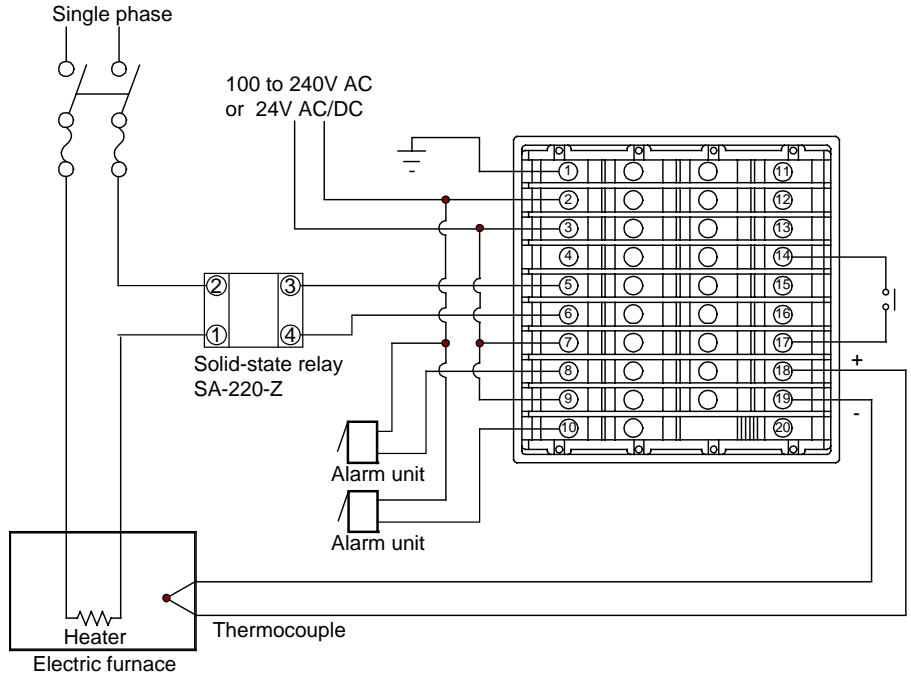
PCD-33A-R/M



(Fig.4.2-1)

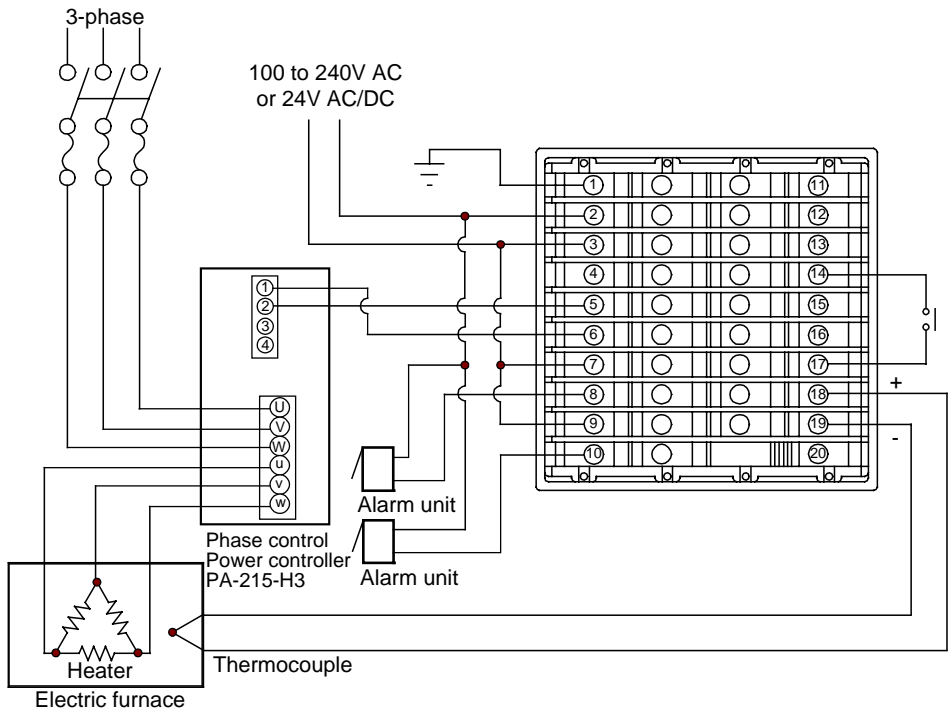
For the relay contact output type (PCD-33A-R/M), it is recommended that a surge absorber be installed between the electromagnetic switch coils to prevent the unit from harmful effects of unexpected level noise.

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 type, Alarm type, 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. Operation" (p.21)

Set up the controller after connecting terminals 2 and 3 for the power supply to this instrument, referring to "4. Wiring" (p.10).

Setup is conducted in Auxiliary function setup mode 2.

The setting items and default values 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)	4E77	Input type selection Selects a sensor type and unit °C/F.	Thermocouple K -200 to 1370°C
(2)	4FLH	Scaling high limit setting Sets the scaling high limit value.	9999
(3)	4FLL	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)	FILT	PV filter time constant setting Sets the PV filter time constant.	0.0 seconds
(6)	7.4□	Step time unit selection Selects the step time unit.	Hour:Minute
(7)	7.78	Step SV setting when control starts Sets step SV when program control starts.	0°C
(8)	7.7L	Program control start type selection Selects the program control start type.	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)	H44□	Control output ON/OFF action hysteresis setting Sets control output ON/OFF action hysteresis.	1.0°C
(12)	AL 1F	Alarm 1 (A1) type selection Selects Alarm 1 (A1) type.	No alarm action
(13)	AL 2F	Alarm 2 (A2) type selection Selects Alarm 2 (A2) type.	No alarm action
(14)	A 1L7	Alarm 1 (A1) Energized/Deenergized selection Selects Alarm 1 (A1) Energized/Deenergized.	Energized
(15)	A 2L7	Alarm 2 (A2) Energized/Deenergized selection Selects Alarm 2 (A2) Energized/Deenergized.	Energized
(16)	A 1H4	Alarm 1 (A1) hysteresis setting Sets Alarm 1 (A1) hysteresis.	1.0°C
(17)	A 2H4	Alarm 2 (A2) hysteresis setting Sets Alarm 2 (A2) hysteresis.	1.0°C
(18)	A 1d4	Alarm 1 (A1) action delayed timer setting Sets Alarm 1 (A1) action delayed timer.	0 seconds

(19)	<i>A2dy</i>	Alarm 2 (A2) action delayed timer setting Sets Alarm 2 (A2) action delayed timer.	0 seconds
(20)	<i>EE4L</i>	Event output function selection Selects an Event output type.	Time signal output
(21)	<i>PEF\bar{n}</i>	Pattern end output time setting Sets pattern end output time.	0sec(Continuous output)
(22)	<i>conf</i>	Direct/Reverse action selection Selects Direct (Cooling) or Reverse (Heating) action.	Reverse (Heating) action

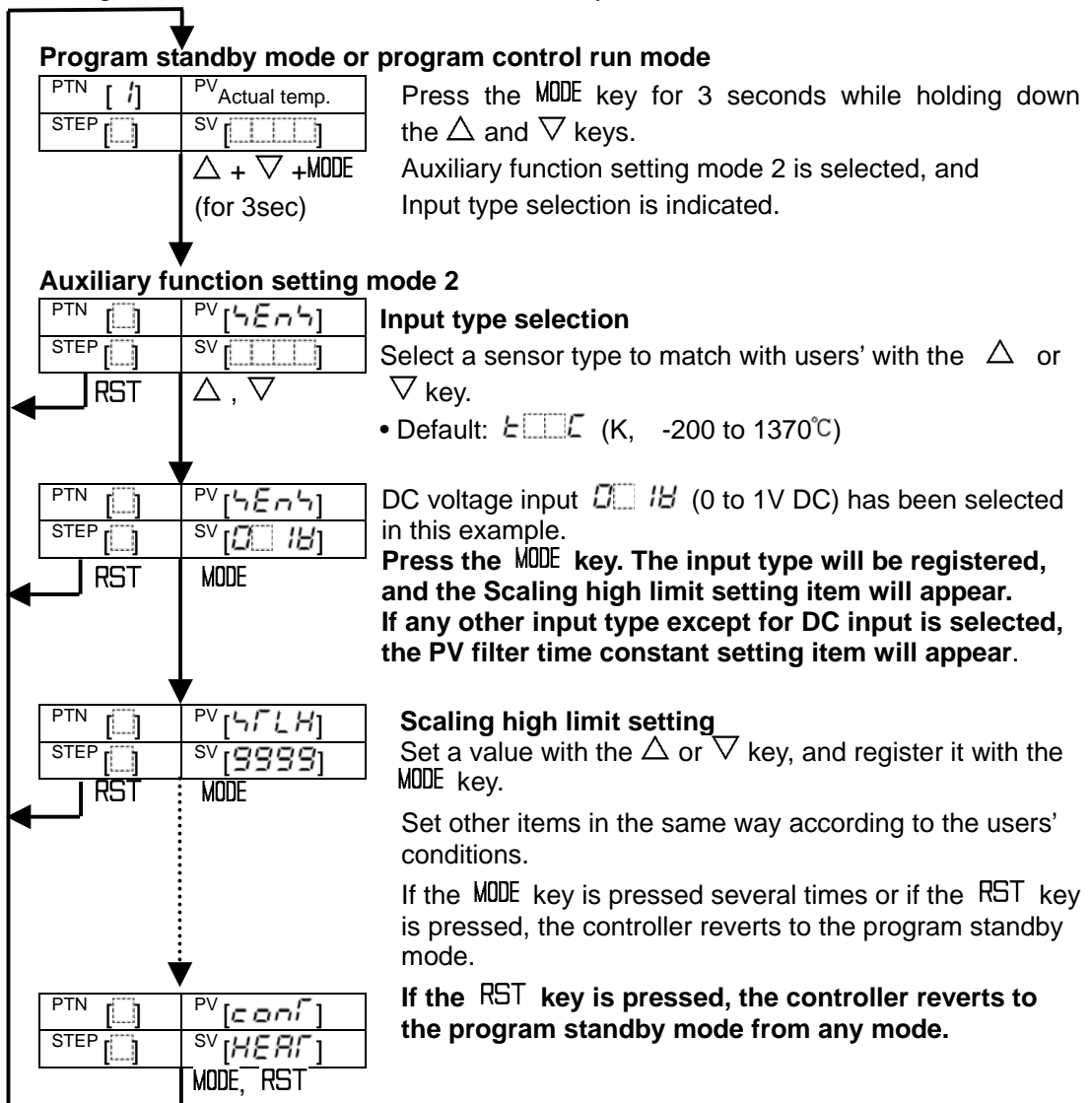
5.2 Basic operation for setup

The following shows how to enter and set up Auxiliary function setting mode 2.

To enter Auxiliary function setting mode 2, press the **MODE** key for 3 seconds while holding down the Δ and ∇ keys in the Program standby mode or in the Program control run mode.

Set or select the values with the Δ or ∇ key.

To register the values, use the **MODE** or **RST** key.



5.3 Setting items in Auxiliary function setting mode 2

(1) 4E74: 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: 4000 (K, -200 to 1370°C)

(Table 5.3-1)

Input types		Input range	Character	Input range	Character
Thermo-couple	K	-200 to 1370 °C	4000	-320 to 2500 °F	400F
		-199.9 to 400.0 °C	40.F	-199.9 to 750.0 °F	40.F
	J	-200 to 1000 °C	4000	-320 to 1800 °F	400F
	R	0 to 1760 °C	4000	0 to 3200 °F	400F
	S	0 to 1760 °C	4000	0 to 3200 °F	400F
	B	0 to 1820 °C	4000	0 to 3300 °F	400F
	E	-200 to 800 °C	4000	-320 to 1500 °F	400F
	T	-199.9 to 400.0 °C	40.F	-199.9 to 750.0 °F	40.F
	N	-200 to 1300 °C	4000	-320 to 2300 °F	400F
	PL-II	0 to 1390 °C	PL20	0 to 2500 °F	PL2F
C(W/Re5-26)	0 to 2315 °C	4000	0 to 4200 °F	400F	
RTD	Pt100	-199.9 to 850.0 °C	PT.F	-199.9 to 999.9 °F	PT.F
		-200 to 850 °C	PT00	-300 to 1500 °F	PT0F
	JPt100	-199.9 to 500.0 °C	JPT.F	-199.9 to 900.0 °F	JPT.F
		-200 to 500 °C	JPT0	-300 to 900 °F	JPT0F
DC current	4 to 20mA	-1999 to 9999	420A		
	0 to 20mA	-1999 to 9999	020A		
DC voltage	0 to 1V	-1999 to 9999	001V		
	0 to 5V	-1999 to 9999	005V		
	1 to 5V	-1999 to 9999	105V		
	0 to 10V	-1999 to 9999	010V		

(2) 4FLH Scaling high limit setting

Available only for DC current and voltage input

- Setting range: Scaling low limit value to input range high limit value
- Default value: 9999

(3) 4FLl Scaling low limit setting

Available only for DC current and voltage input

- Setting range: Input range low limit value to scaling high limit value
- Default value: -1999

(4) dP00 Decimal point place selection

For DC current and voltage input, the input indication can be freely set.

(e.g.) Default value: Scaling high limit value; 9999, Scaling low limit value; -1999

No decimal point

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 (000)".

- Selecting item: No decimal point
 1 digit after the decimal point
 2-digit after the decimal point
 3-digit after the decimal point
- Default value: (No decimal point)

(5) **FILF: 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 set 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) **7_4 Step time unit selection**

Selects the unit of program progressing time.

- Selecting item: Hour:Minute
 Minute:Second
- Default value: Hour:Minute

(7) **4_4B 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 type SV start or PV start.

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

(8) **4_4L Program control start type selection**

Selects a program control start type.

PV start: When the program control starts, the set value (SV) and time are advanced to the PV and the control starts. However, if the value set during “(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: PV start
 SV start
- Default value: PV start

(9) **0LH 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 higher than 100% is effective to DC current output type)

(10) **0LL 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) **H44 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°C (°F)
For DC input, 1 to 1000 (The placement of the decimal point follows the selection.)
- Default value: 1.0°C

(12) ***ALIF* Alarm 1 (A1) type selection**

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

- Selecting item: *----* No alarm action

H High limit alarm

L Low limit alarm

HL High and Low limits alarm

di d High and Low limit range alarm

PH Process High alarm

rPH Process Low alarm

H High limit alarm with standby

L Low limit alarm with standby

HL High and Low limits alarm with standby

- Default value: *----* No alarm action

(13) ***ALZF* Alarm 2 (A2) type selection**

Selects Alarm 2 (A2) type, referring to 8.5 Alarm 2 (A2) action (pages 48, 49).

The selecting item and default value are the same as those of Alarm 1 (A1) type selection.

Not available if P24 (option) is added.

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

Selects Alarm 1 (A1) Energized/Deenergized.

Not available if No alarm action is selected during Alarm 1 (A1) type selection

- Selecting item: *noñL* Energized

rEñL Deenergized

- Default value: *noñL* Energized

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

Selects Alarm 2 (A2) Energized/Deenergized.

Not available if No alarm action is selected during Alarm 2 (A2) type selection

Not available if P24 (option) is added.

The selecting item and default value are the same as those of Alarm 1 (A1) Energized/Deenergized selection.

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

Sets Alarm 1 (A1) hysteresis.

Not available if No alarm action is selected during Alarm 1 (A1) type selection

- Setting range: 0.1 to 100.0°C (°F)

For DC input, 1 to 1000 (The placement of the decimal point follows the selection.)

- Default value: 1.0°C

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

Sets Alarm 2 (A2) hysteresis.

Not available if No alarm action is selected during Alarm 2 (A2) type 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) ***ALdY* Alarm 1 (A1) action delayed timer setting**

Sets Alarm 1 (A1) action delayed timer.

Not available if No alarm action is selected during Alarm 1 (A1) type selection

- Setting range: 0 to 9999 seconds

- Default value: 0 seconds

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

Sets Alarm 2 (A2) action delayed timer.

Not available if No alarm action is selected during Alarm 2 (A2) type 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) **E44L 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.

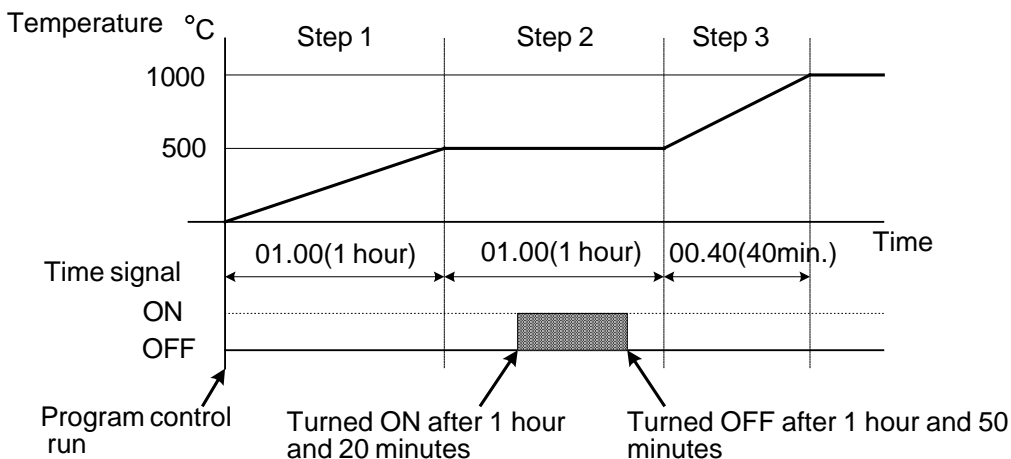
- Selecting item: *r4* Time signal output
PEnd Pattern end output
rUn Run output.
- Default value: *r4* Time signal output

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.

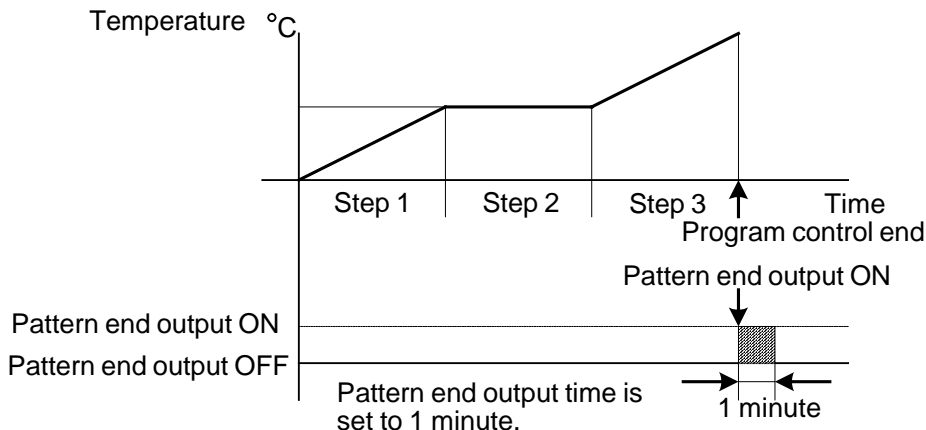
When Time signal output ON time has elapsed, Time signal output is turned OFF.



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)

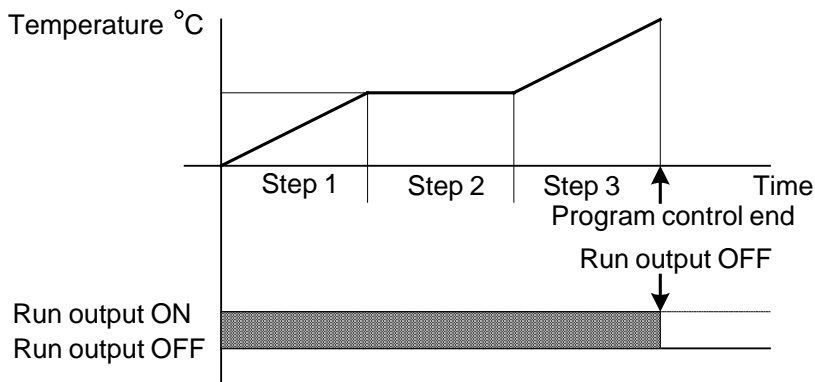
After the program control ends, pattern end output is turned ON for the time set during the Pattern end output time setting.



(Fig. 5.3-2)

[Run output] (Fig. 5.3-3)

This is outputted during the program control.



(Fig. 5.3-3)

(21) *PERn* **Pattern end output time setting**

Sets pattern end output time after pattern end output has been selected during Event output function selection.

When 0 seconds are set, the output remains ON 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 (Set 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 (Set 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. Operation

● Key operation for setup

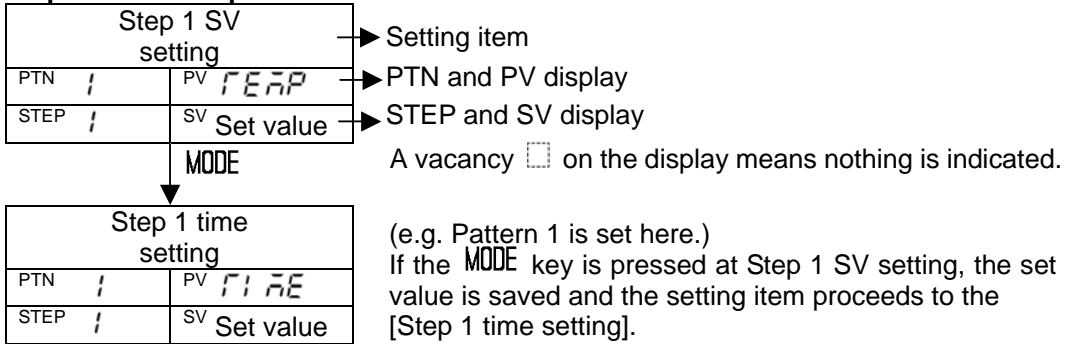
- PTN key : Selects a program pattern number.
- △, ▽ key : Increases or decreases the numeric value or switches the selecting item.
- MODE, RST key : Registers the set value (numeric value) or selected item.

By pressing the RST key, the controller reverts to the program standby mode or program control run mode. This key is very convenient as the user can revert to the Program standby mode or Program control run mode from any setting mode.

● Key operation on the Operation flowchart

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

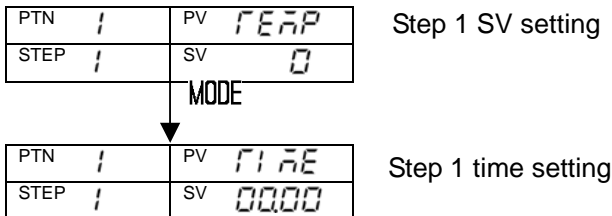
● Explanation of Operation flowchart



● Explanation of Operation

For the explanation of each setting item (pages 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.

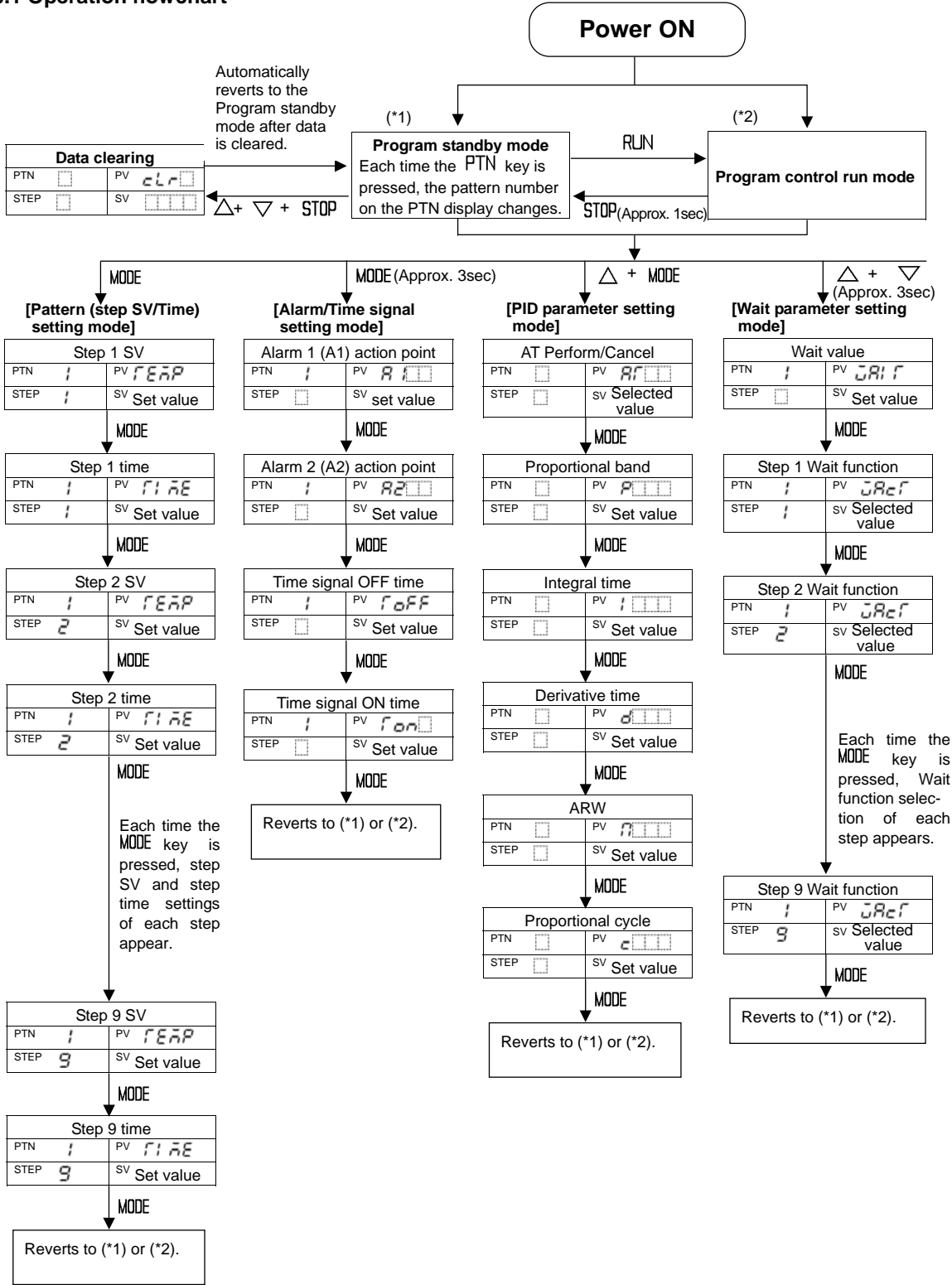
By pressing the MODE key, the set value is saved, and the setting item proceeds to the next one.



Characters

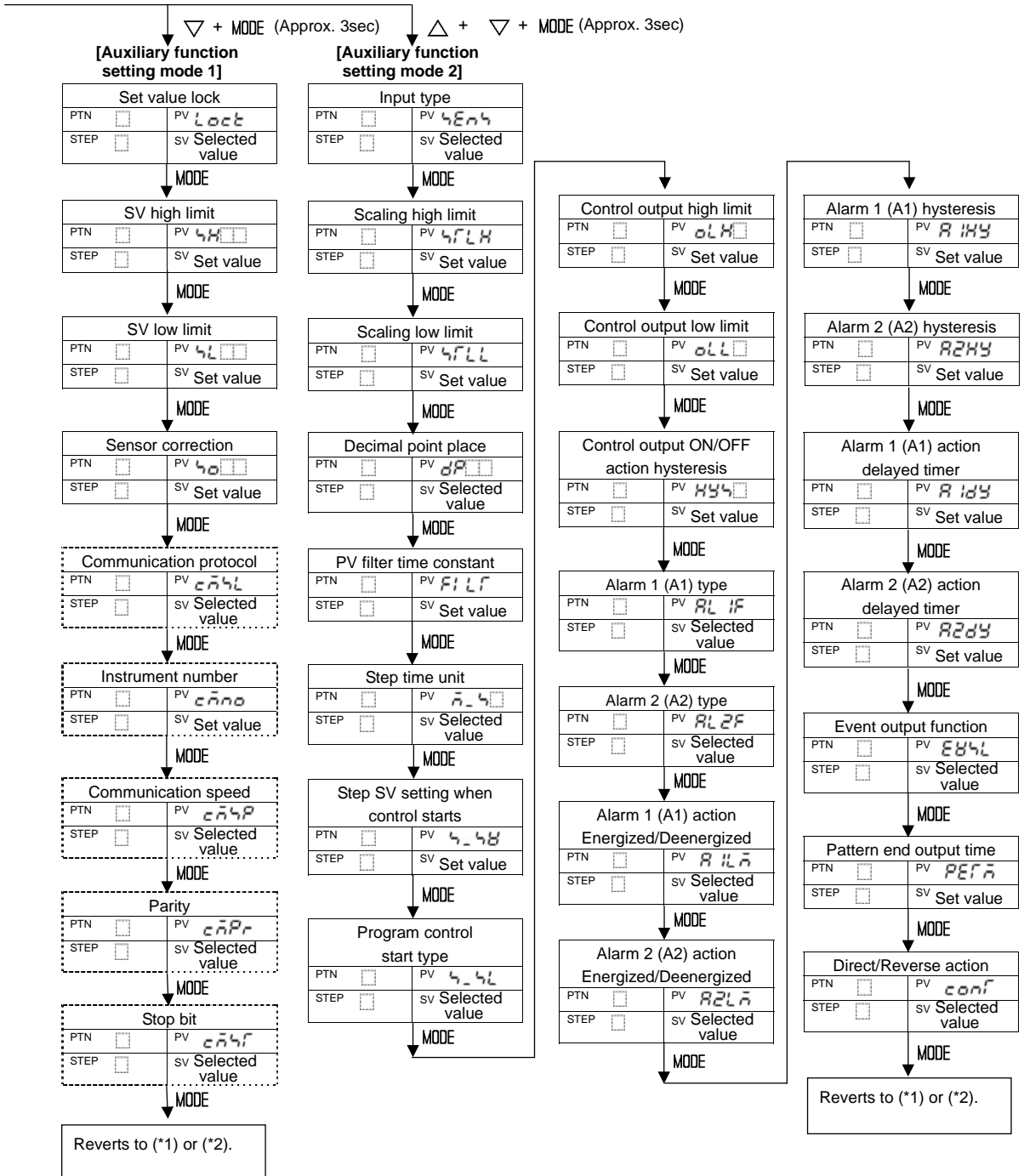
Indication	4	0	1	2	3	4	5	6	7	8	9		
Numeric value	-1	0	1	2	3	4	5	6	7	8	9		
Indication	A	b	c	d	E	F	G	H	I	J	t	L	ā
Alphabet	A	B	C	D	E	F	G	H	I	J	K	L	M
Indication	n	o	P	q	r	s	T	U	V	W	X	Y	Z
Alphabet	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

6.1 Operation flowchart



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

The setting items with dotted lines are optional and they appear only when the options are applied.



6.2 Operation

(1) Turn the power supply 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°C	ℓ□□□	-320 to 2500°F	ℓ□□□
K	-199.9 to 400.0°C	ℓ□.□	-199.9 to 750.0°F	ℓ□.□
J	-200 to 1000°C	ℓ□□□	-320 to 1800°F	ℓ□□□
R	0 to 1760°C	r□□□	0 to 3200°F	r□□□
S	0 to 1760°C	4□□□	0 to 3200°F	4□□□
B	0 to 1820°C	b□□□	0 to 3300°F	b□□□
E	-200 to 800°C	ℓ□□□	-320 to 1500°F	ℓ□□□
T	-199.9 to 400.0°C	r□.□	-199.9 to 750.0°F	r□.□
N	-200 to 1300°C	r□□□	-320 to 2300°F	r□□□
PL-II	0 to 1390°C	PL2□	0 to 2500°F	PL2□
C(W/Re5-26)	0 to 2315°C	ℓ□□□	0 to 4200°F	ℓ□□□
Pt100	-199.9 to 850.0°C	Pt□.□	-199.9 to 999.9°F	Pt□.□
JPt100	-199.9 to 500.0°C	JPt□.□	-199.9 to 900.0°F	JPt□.□
Pt100	-200 to 850°C	Pt□□	-300 to 1500°F	Pt□□
JPt100	-200 to 500°C	JPt□□	-300 to 900°F	JPt□□
4 to 20mA DC		-1999 to 9999		420A
0 to 20mA DC		-1999 to 9999		020A
0 to 1V DC		-1999 to 9999		0□.18
0 to 5V DC		-1999 to 9999		0□.58
1 to 5V DC		-1999 to 9999		□.58
0 to 10V DC		-1999 to 9999		0□.18

(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

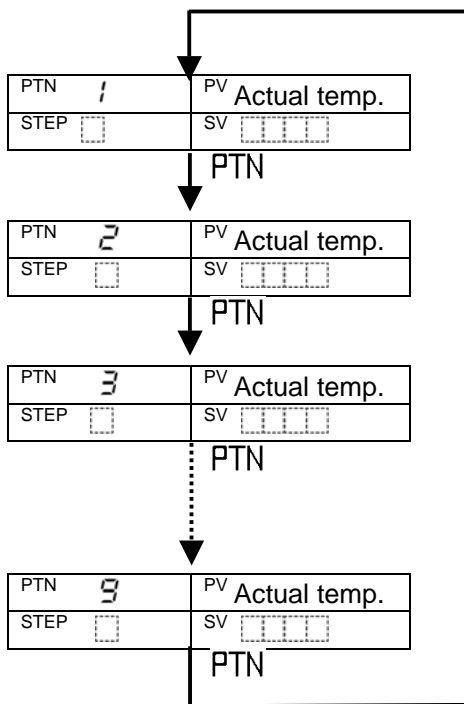
Select a program pattern number before initiating various program settings.

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.

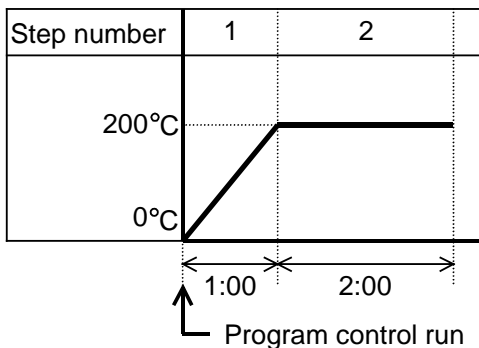
Program pattern 2 is selected.

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°C for 1 hour, and stays at 200°C for 2 hours. In this case, Step 1 SV is 200°C and Step 1 time is 1 hour.

(Fig.6.2-1)

[Program standby mode or program control run mode]

PTN	1	PV	Actual temp.
STEP	0	SV	0000

Press the **MODE** key.
Step 1 SV setting mode is indicated.

PTN	1	PV	TEMP
STEP	1	SV	0000

↓ Δ , ∇

Step 1 SV setting

Set the step SV to 200°C using Δ or ∇ key.

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

PTN	1	PV	TEMP
STEP	1	SV	200

Press the **MODE** key.
 Step 1 SV is registered, and
 Step 1 time setting mode is indicated.

MODE

PTN	1	PV	TIME
STEP	1	SV	0000

Step 1 time setting

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

Δ , ∇

PTN	1	PV	TIME
STEP	1	SV	0100

Press the **MODE** key.

Step 1 time is registered, and
 Step 2 SV setting mode is indicated.

MODE

PTN	1	PV	TEMP
STEP	2	SV	200

Step 2 SV setting

Set the step SV to 200°C using Δ or ∇ key.
 • Setting range: SV low limit to SV high limit
 • Default value: 0°C

Δ , ∇

PTN	1	PV	TEMP
STEP	2	SV	200

Press the **MODE** key.

Step 2 SV is registered, and
 Step 2 time setting mode is indicated.

MODE

PTN	1	PV	TIME
STEP	2	SV	0000

Step 2 time setting

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

Δ , ∇

PTN	1	PV	TIME
STEP	2	SV	0200

Press the **MODE** key.

Step 2 time is registered, and
 Step 3 SV setting mode is indicated.

MODE

PTN	1	PV	TEMP
STEP	3	SV	200

Step 3 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

RST

Program standby mode or program control run mode

PTN	1	PV	Actual temp.
STEP	0	SV	200

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 type except for No alarm action from Alarm 1 (A1) and Alarm 2 (A2) type 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]

PTN	1	PV	Actual temp.
STEP	□	SV	□□□□

MODE (for 3sec)

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]

PTN	1	PV	A1□□
STEP	□	SV	□□□□

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 during Alarm 1 (A1) type selection.

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

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

(Table 6.2-2)

Alarm type	Setting range
High limit alarm	-Input span to Input span°C (°F)
Low limit alarm	-Input span to Input span°C (°F)
High/Low limits alarm	0 to Input span°C (°F)
High/Low limit range alarm	0 to Input span°C (°F)
Process high alarm	Input range low limit to Input range high limit°C (°F)
Process low alarm	Input range low limit to Input range high limit°C (°F)
High limit alarm with standby	-Input span to Input span°C (°F)
Low limit alarm with standby	-Input span to Input span°C (°F)
H/L limits alarm w/standby	0 to Input span°C (°F)

- 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.

PTN	1	PV	A2□□
STEP	□	SV	□□□□

MODE

Pattern 1 Alarm 2 (A2) action point setting

Off when set to 0 or 0.0.

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

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

PTN	1	PV	Off
STEP	□	SV	0000

MODE

PTN	1	PV	On
STEP	□	SV	0000

MODE

[Program standby mode or program control run mode]

PTN	1	PV	Actual temp.
STEP	□	SV	□□□□

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 during 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 during Event output function selection.

- Setting range: 00:00 to 99.59
(Hour:Minute or Minute:Second)
- Default value: 00:00 (Hour:Minute)

(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]

PTN	1	PV	Actual temp.
STEP	□	SV	□□□□

Press the **MODE** key while holding down the **△** key.

PID parameter setting mode is selected, and PID auto-tuning Perform/Cancel is indicated.

△ + MODE

[PID parameter setting mode]

PTN	□	PV	AT
STEP	□	SV	----

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

MODE

PTN	□	PV	P
STEP	□	SV	10

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°C (0 to 2000°F)
For the input with a decimal point,
0.0 to 999.9°C (0 to 999.9°F)
For DC input, 0.0 to 100.0%
- Default value: 10°C

MODE

PTN	<input type="checkbox"/>	PV	1000
STEP	<input type="checkbox"/>	SV	200

MODE

PTN	<input type="checkbox"/>	PV	d000
STEP	<input type="checkbox"/>	SV	50

MODE

PTN	<input type="checkbox"/>	PV	n000
STEP	<input type="checkbox"/>	SV	50

MODE

PTN	<input type="checkbox"/>	PV	c000
STEP	<input type="checkbox"/>	SV	30

MODE

[Program standby mode or program control run mode]

PTN	/	PV	Actual temp.
STEP	<input type="checkbox"/>	SV	

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: 1 to 120 seconds
- Default value: 30s for relay contact output, 3s for non-contact voltage output type

(7) Wait parameter setting mode

This function prevents the step from proceeding to the next one until PV enters the range of $SV \pm \text{Wait value}$ 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]

PTN	1	PV	Actual temp.
STEP	0	SV	0000

△ + ▽ (3sec)

[Wait parameter setting mode]

PTN	1	PV	WAIT
STEP	0	SV	0000

MODE

PTN	1	PV	WAIT
STEP	1	SV	----

MODE

PTN	1	PV	WAIT
STEP	2	SV	----

MODE

PTN	1	PV	WAIT
STEP	9	SV	----

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 value setting

Sets Pattern 1 Wait value.

The step of which temperature is rising:
Step SV – Wait value

The step of which temperature is falling:
Step SV + Wait value

Off when set to 0 or 0.0

• Setting range: ±(0 to 100)°C (°F)

For the input with a decimal point:

±(0.0 to 100.0)°C (°F)

For DC input: ±(0 to 1000)(The placement

of the decimal point follows the selection)

• Default value: 0°C (°F)

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°C(°F) 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°C(°F) 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°C(°F) 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	/	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	/	PV	Actual temp.
STEP	□	SV	□□□□

Press the **MODE** key for 3 seconds while holding down the **▽** key.

Auxiliary function setting mode 1 is selected, and Set value lock selection item is indicated.

▽ + MODE (3sec)

[Auxiliary function setting mode 1]

PTN	□	PV	Lock
STEP	□	SV	----

Set value lock selection

Locks the set value to prevent erroneous settings.

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

Unlock : All set values can be changed.

Lock : None of the set values can be changed.

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

MODE

PTN	□	PV	4H□□
STEP	□	SV	1370

SV (Set 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°C

MODE

PTN	□	PV	4L□□
STEP	□	SV	-200

SV (Set 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°C

MODE

PTN	□	PV	40□□
STEP	□	SV	□□.□□

Sensor correction setting

Sets the value to correct PV.

PV=PV + Sensor correction value

• Setting range: -100.0°C to 100.0°C (°F)

For DC input, -1000 to 1000 (The placement of the decimal point place follows the selection.)

- Default value: 0.0°C

MODE

PTN	<input type="checkbox"/>	PV	cn4L
STEP	<input type="checkbox"/>	SV	nonL

MODE

PTN	<input type="checkbox"/>	PV	cnno
STEP	<input type="checkbox"/>	SV	0000

MODE

PTN	<input type="checkbox"/>	PV	cn4P
STEP	<input type="checkbox"/>	SV	0096

MODE

PTN	<input type="checkbox"/>	PV	cnPr
STEP	<input type="checkbox"/>	SV	EBEn

MODE

PTN	<input type="checkbox"/>	PV	cn4r
STEP	<input type="checkbox"/>	SV	0001

MODE

Communication protocol selection

Selects the communication protocol.
Available only when C5/SVTC (option) is applied.

- Selecting item:
 - nonL Shinko protocol
 - 4Bf Set value digital transmission (Shinko protocol)
 - 4Bfr Set value digital reception (Shinko protocol)
 - nodR Modbus protocol ASCII mode
 - nodr Modbus protocol RTU mode
- Default value: nonL Shinko protocol

Instrument number setting

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

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

Communication speed selection

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

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

Parity selection

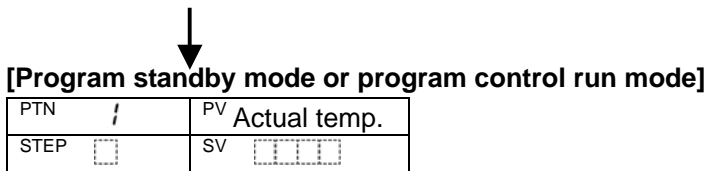
Selects the parity type from a choice of: No parity, Even and Odd parity in accordance with the host computer.
Available when C5/ SVTC (option) is applied, and when Modbus ASCII or RTU mode is selected.

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

Stop bit selection

Selects the stop bit in accordance with the host computer from 1 or 2.
Available when C5/SVTC (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)



(9) Auxiliary function setting mode 2

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

(10) Data clearing function

This function returns all set values to the default values (See pages 58, 59).
 This function can only be used during program standby mode.
 This function can not be used during program control run mode.

⚠ Caution

Be sure to write down all set values for all patterns before clearing data, using the photocopyable pages at the end of this manual.

Once data has been cleared, the set values have to be inputted again since the lost data can not be restored.

[Program standby mode]

PTN /	PV Actual temp.
STEP □	SV □□□□

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

△ + ▽ + STOP (3sec)

[Data clearing]

PTN □	PV CLR□
STEP □	SV □□□□

All set 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 /	PV Actual temp.
STEP □	SV □□□□

After data is cleared, the controller automatically 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 the control panel” (p.8) and “4. Wiring” (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. Operation” (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 Performing program control

Follow the procedures below in carrying out the program control.

(1) Select a program pattern number.

Select the 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	/	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) external operation input terminals 14 and 17.

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 type selected during the Program control start type 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].

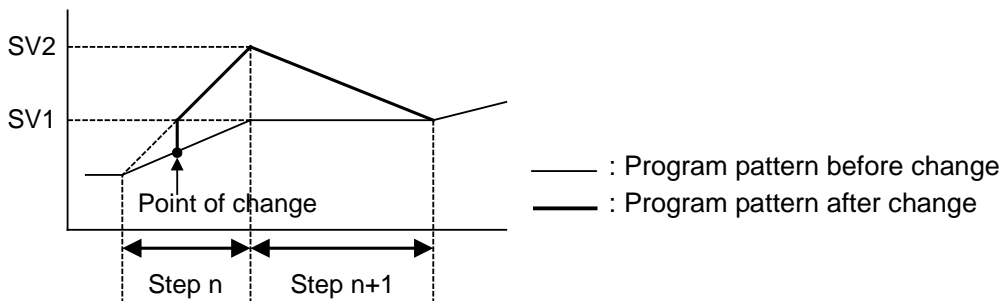
[Indication during program control run]

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

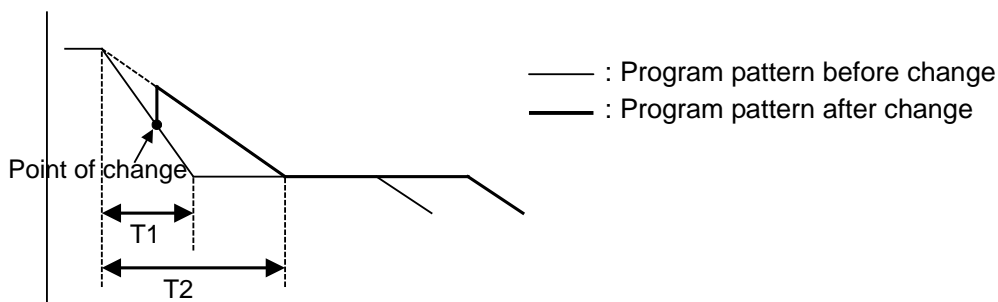
[Step SV or Step time change during running]

(1) When the temperature is 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 is restored]

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

[Indication during Wait action]

PTN	Actual temp.
STEP	Step SV

Flashes during WAIT action.

- PTN display : Selected program pattern number
- PV display : Current actual temperature
- STEP display : Flashes 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]

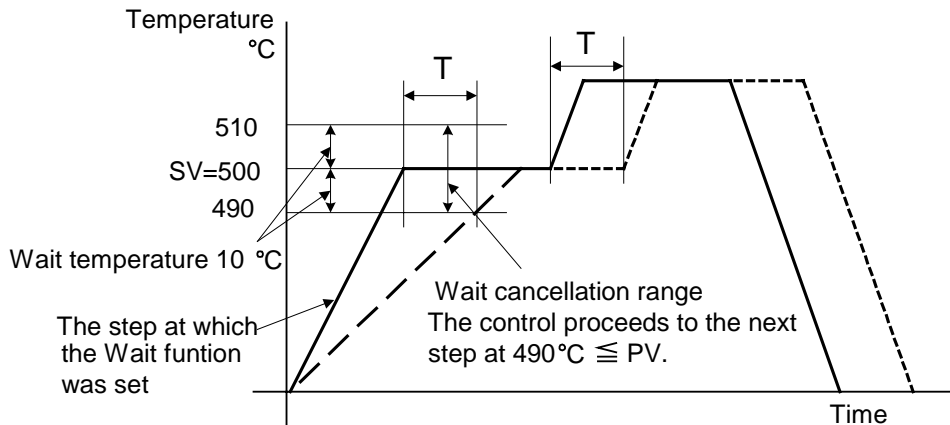
During the program control run, the program does not proceed to the next step until the deviation between PV and SV enters $SV \pm \text{Wait temperature}$ when the step ends.

While the Wait function is working, the numeric value on the Step display flashes.

The Wait function is cancelled on the condition that:

$$(SV - \text{Wait temperature}) \leq PV \leq (SV + \text{Wait temperature})$$

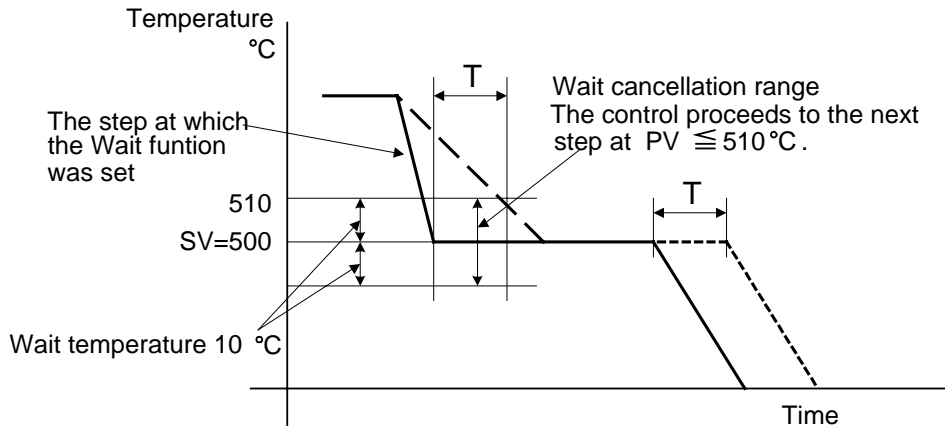
When the program pattern is rising [The Wait function is cancelled at $(SV - \text{Wait temperature}) \leq PV$]



(Fig. 7.2-3)

- : Program pattern
- - - - : PV
- - - - - : Program pattern which is delayed by T due to the Wait function
- T : Wait time

When the program pattern is falling [The Wait function is cancelled at $PV \leq (SV + \text{Wait temperature})$]

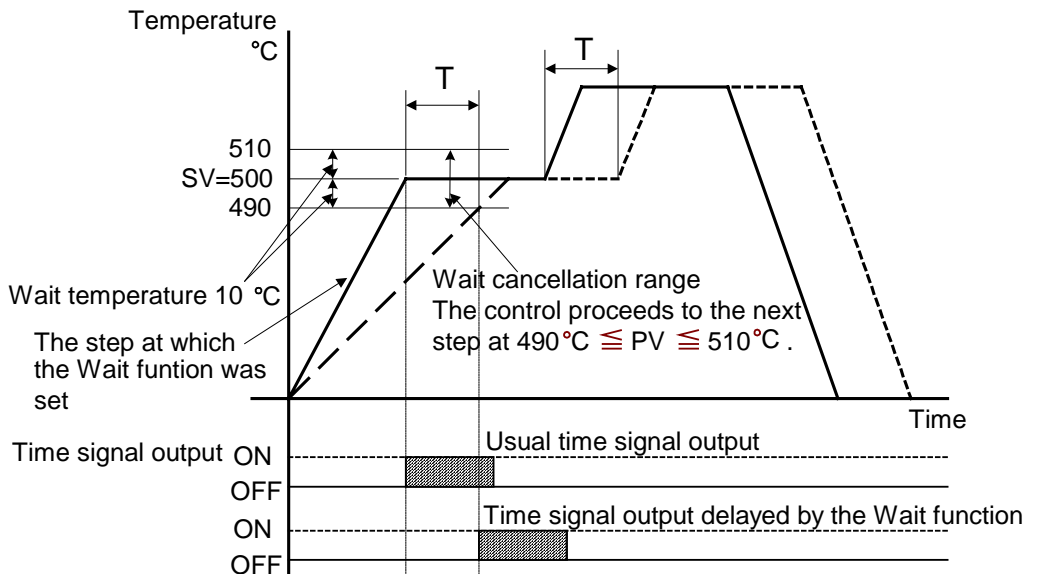


- : Program pattern
- - - - : PV
- : Program pattern which is delayed by T due to the Wait function
- T : Wait time

(Fig. 7.2-4)

[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
- - - - : PV
- : Program pattern which is delayed by T due to the Wait function
- T : Wait time

(Fig. 7.2-5)

[Indication during Time signal action]

If Time signal output is selected during 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 elapsed, EVT indicator is turned off.

The following shows the indication during time signal action.

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

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 during the Event output function selection, Event output is turned on for the time which has been set during the Pattern end output time setting.

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

If Pattern end output time is set to 0, the output remains ON.

By pressing the **STOP** key for 1 second or more, 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	/	PV	Actual temp.
STEP	□	SV	<i>P.End</i>

Flashes while Pattern end output is ON.

PTN display : Selected program pattern number

PV display : Current actual temperature

STEP display : Unlit

SV display : *P.End* flashes 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 during 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 more, Event output is turned off.

The following shows the indication during Run output.

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
 EVT indicator : Lit while Run output is ON
 Other indicators: Lit or unlit according to the controller status

7.3 Stopping program control

Pressing the **STOP** key for 1 second or more stops the program control. The program control also stops by disconnecting (Contact open) external operation input terminals 14 and 17.

[Indication after program control stops]

PTN	/	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 more. This function is also available during Wait action or during Fixed value control action.

[Indication when Advance function is used at Step 1]

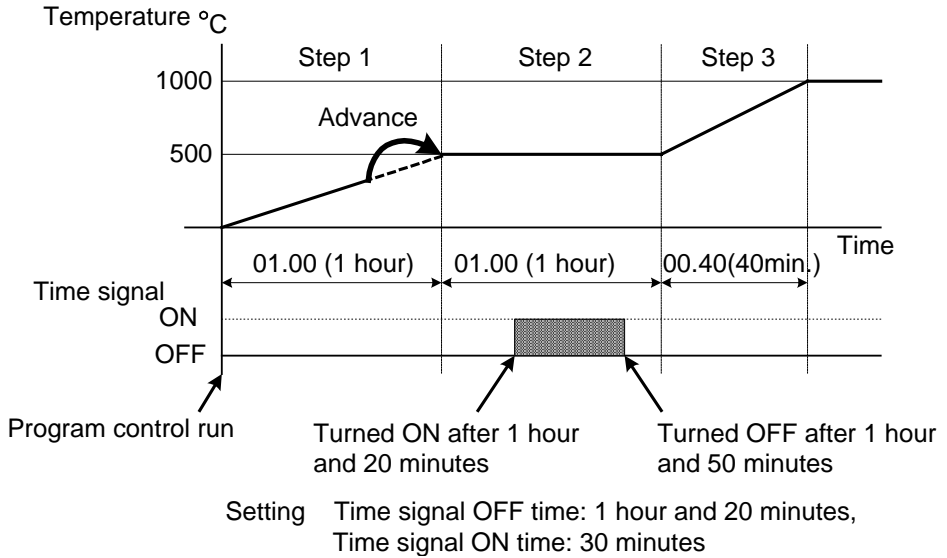
PTN	/	PV	Actual temp.
STEP	2	SV	Step SV

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 when Advance function is used during step 1, time signal output is turned on 20 minutes after the step 1 is advanced to step 2.



(Fig. 7.4-1)

7.5 Switching 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

Press the **MODE** key 4 times.
Step 2 time setting item is indicated.

MODE (4 times)

[Step 2 time setting]

PTN	1	PV	FLRE
STEP	2	SV	Step time

Keep pressing the ∇ key.
Step time switches from [0000] to [----], which is the Hold function character.

∇ (Keep pressing)

PTN	1	PV	FLRE
STEP	2	SV	----

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

RST

Performs fixed value control.

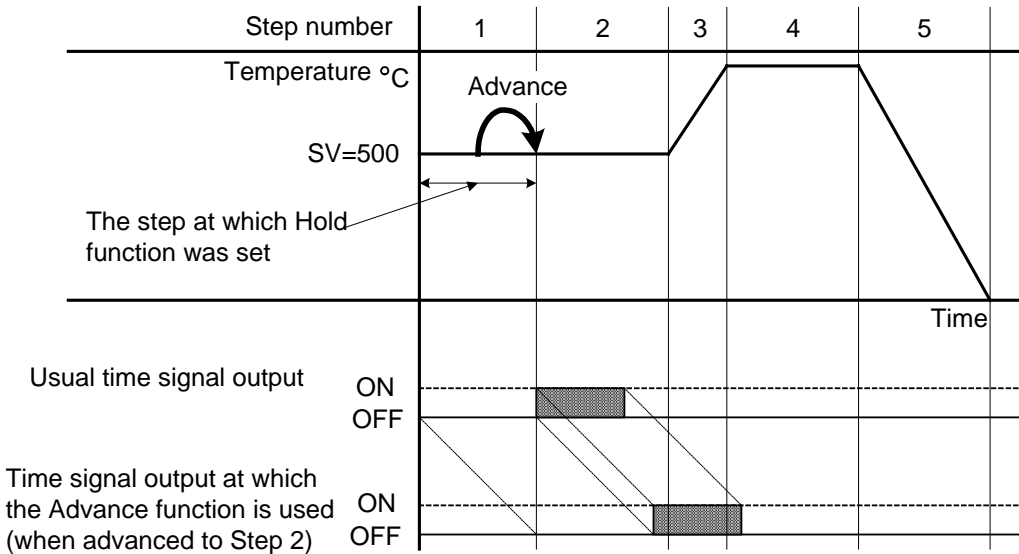
[Indication when switched to fixed value control at Step 2]

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 temperature
RUN indicator : Flashes 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 is restored]

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

7.6 Correcting 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 set value.

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

$$PV = \text{Current actual temperature} + \text{Sensor correction value}$$

[How to set sensor correction value]

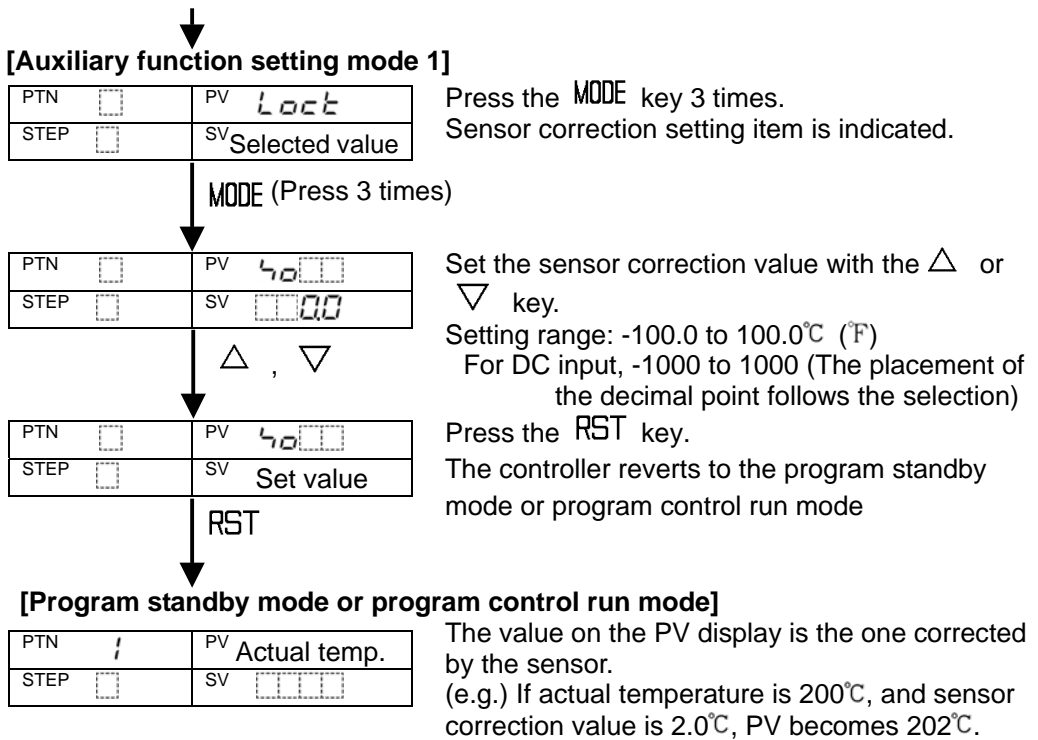
[Program standby mode or program control run mode]

PTN	!	PV	Actual temp.
STEP	□	SV	□□□□

↓ ∇ + MODE (for 3sec)

Press the MODE key for 3 seconds while holding down the ∇ key.

Auxiliary function setting mode 1 is selected, and Set value lock selection is indicated.



7.7 PID auto-tuning

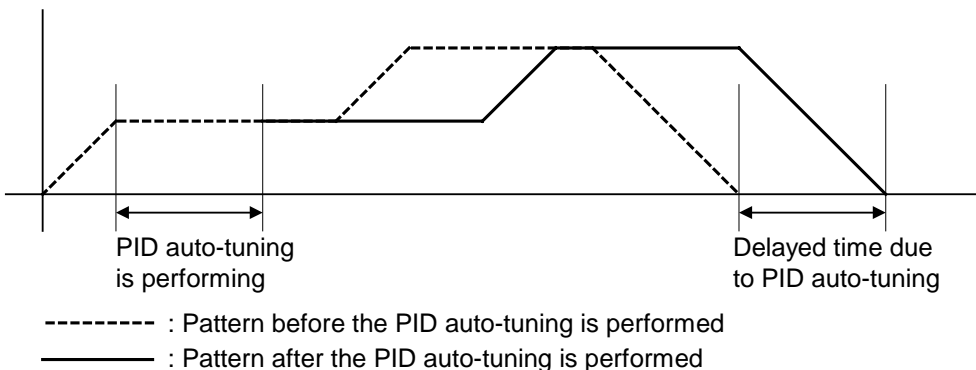
In order to set each value of P, I, D and ARW automatically, the auto-tuning process should be made to fluctuate.

For DC input, the AT process will fluctuate around the SV (set value) for conditions of [A], [B] and [C] on page 43.



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.

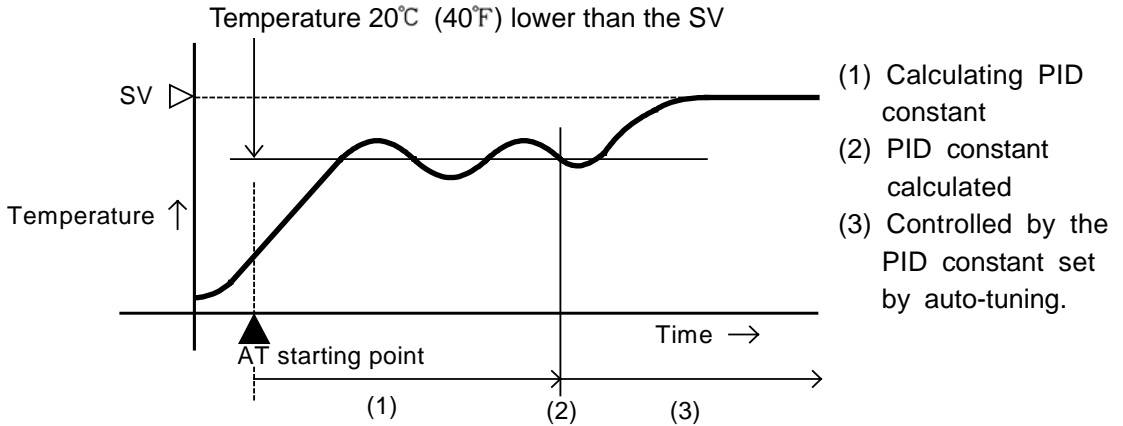


(Fig. 7.7-1)

[PID auto-tuning performing conditions]

(A) When processing temperature is lower than [SV -20°C (40°F)]

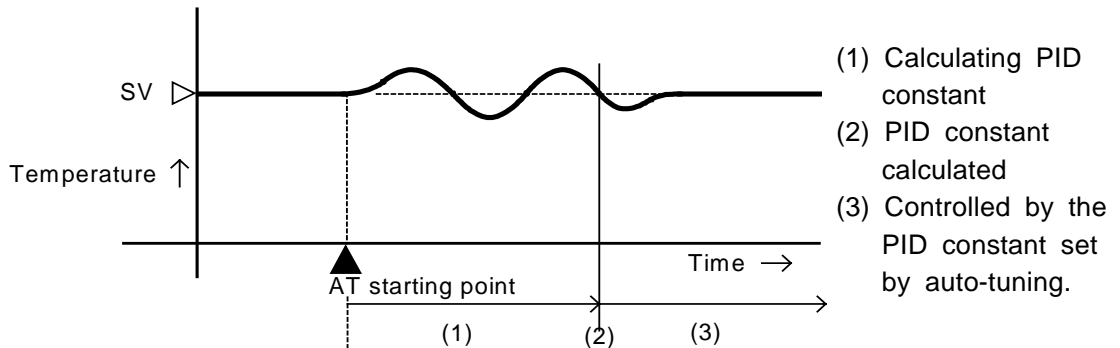
The AT process will fluctuate at the temperature 20°C (40°F) lower than the SV.



(Fig. 7.7-2)

(B) When the control is stable or when processing temperature is within [SV±20°C (40°F)]

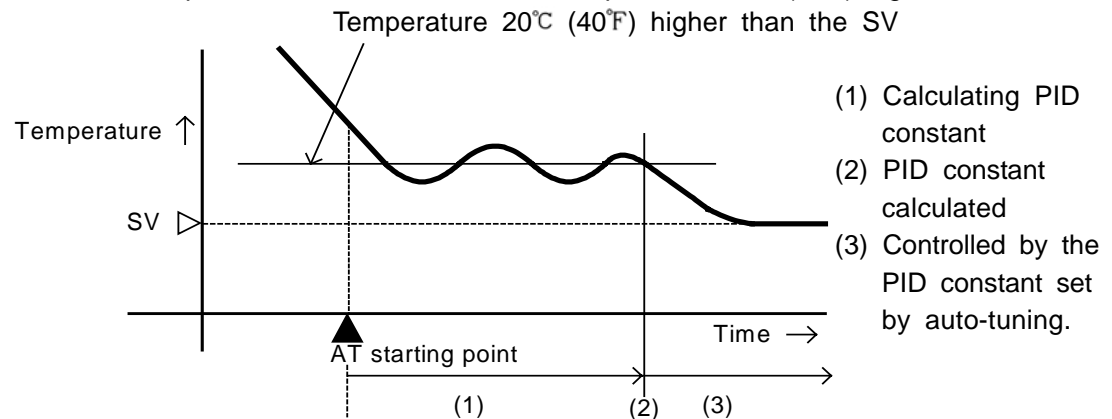
The AT process will fluctuate around the SV.



(Fig. 7.7-3)

(C) When the processing temperature is higher than [SV+20°C (40°F)]

The AT process will fluctuate at the temperature 20°C (40°F) higher than the SV.



(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, it will be 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.

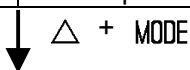
[How to perform PID auto-tuning]

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]

PTN	/	PV	Actual temp.
STEP	/	SV	Step SV

Press the **MODE** key while pressing the Δ key. The PID parameter setting mode is selected, and Auto-tuning Perform/Cancel item is indicated.



[PID parameter setting mode]

PTN	<input type="checkbox"/>	PV	AT <input type="checkbox"/>
STEP	<input type="checkbox"/>	SV	----

AT Perform/Cancel selection

Press the Δ key.



PTN	<input type="checkbox"/>	PV	AT <input type="checkbox"/>
STEP	<input type="checkbox"/>	SV	AT <input type="checkbox"/>

Press the **MODE** key.

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



[Program control run mode]

PTN	/	PV	Actual temp.
STEP	/	SV	Step SV

[Indication during auto-tuning Perform]

PTN	/	PV	Actual temp.
STEP	/	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 : Flashes 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]

PTN	/	PV	Actual temp.
STEP	/	SV	Step SV

△ + MODE

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

[PID parameter setting mode]

PTN	□	PV	AT□□
STEP	□	SV	AT□□

▽

AT Perform/Cancel selection

Press the **▽** key.

PTN	□	PV	AT□□
STEP	□	SV	---

RST

Press the **RST** key.

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

[Program control run mode]

PTN	/	PV	Actual temp.
STEP	/	SV	Step SV

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 set 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 set 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, the restoring value becomes smaller, and if the derivative time is extended longer, an excessive returning phenomenon may occur and the control system may oscillate.

(4) ARW (Anti-reset windup)

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 stabilization will take some time.

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

8.2 Standard action

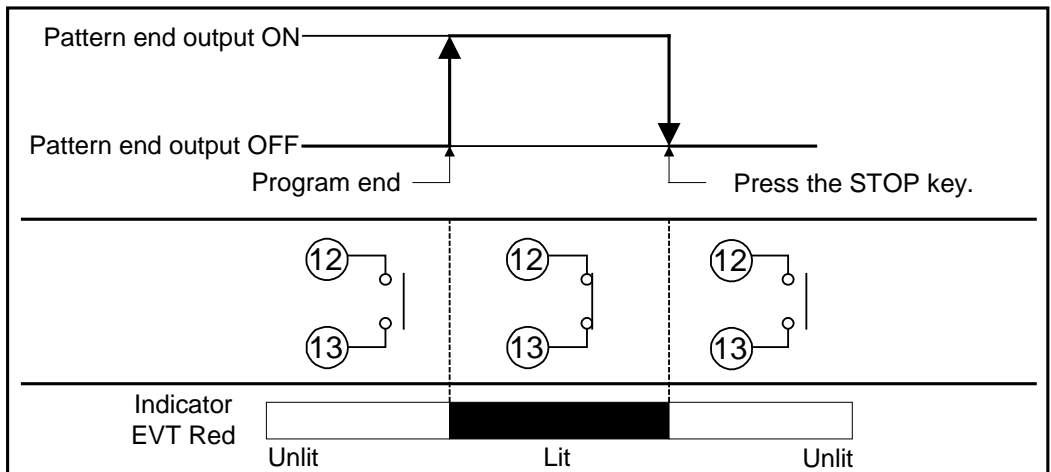
	Heating (reverse) action			Cooling (direct) action		
Control action						
Relay contact output R/□						
Non-contact voltage output S/□						
DC current output A/□						
Indicator (OUT1) Green						

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

8.3 ON/OFF action

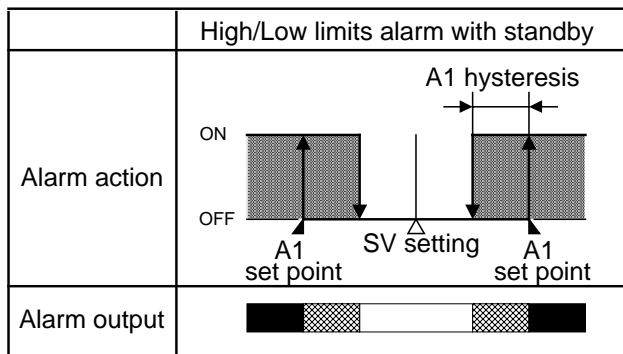
	Heating (reverse) action		Cooling (direct) action	
Control action				
Relay contact output R/□				
Non-contact voltage output S/□				
DC current output A/□				
Indicator (OUT1) Green				


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		



 : 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 off when their terminals are disconnected.

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

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 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 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 controller 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 maintains the same status as when the reference junction is located at 0°C (32°F).

Burnout

When the **thermocouple or RTD input** is burnt out, PV display flashes “- - - -” (For DC current output, control output low limit value) with control output being turned off.

When **DC input** is burnt out:

For 4 to 20mA DC and 1 to 5V DC input, PV display flashes “- - - -”.

For 0 to 1V DC input, PV display flashes “- - - -”.

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

Input burnout

Indication	Contents	Control output
[- - - -] flashes.	Overscale Measured value has exceeded indication range high limit value.	Relay contact: OFF Non-contact voltage: 0V DC current output: 4mA or Control output low limit value
[- - - -] flashes.	Underscale Measured value has dropped below indication range low limit value.	Relay contact: OFF Non-contact voltage: 0V DC 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°C	-199.9 to 450.0°C	-205.0 to 450.0°C
	-199.9 to 750.0°F	-199.9 to 850.0°F	-209.0 to 850.0°F

Indication range and Control range of thermocouple inputs other than the above:

Input range low limit value -50°C (100°F) to Input range high limit value +50°C (100°F)

RTD input

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

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 flashes “- - - -” 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	:	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) x 6(W)mm
	PTN display	: Green LED display 1 digit, character size, 12.6(H) x 6(W) mm
	STEP display	: Green LED display 1 digit, character size, 12.6(H) x 6(W) mm

Input

Thermocouple	:	K, J, R, S, B, E, T, N, PL-II, C External resistance, 100 Ω or less (for B input, 40 Ω or less)
RTD	:	Pt100, JPt100, 3-wire system Allowable input lead wire resistance, 10 Ω or less per wire
DC current	:	0 to 20mA DC, 4 to 20mA DC Input impedance 50 Ω Allowable input current 50mA DC or less [50 Ω shunt resistor (sold separately) must be installed between input terminals.]
DC voltage	:	0 to 1V DC Input impedance (1M Ω or more) Allowable input voltage (5V DC or less) Allowable signal source resistance (2k Ω or less) 0 to 5V DC, 1 to 5V DC, 0 to 10V DC Input impedance (100k Ω or more) Allowable input voltage (15V DC or less) Allowable signal source resistance (100 Ω or less)

Input sampling period : 0.25 seconds

Accuracy (Indication and setting)

Thermocouple	:	Within $\pm 0.2\%$ of each input span ± 1 digit, or within $\pm 2^\circ\text{C}$ (4°F), whichever is greater R, S input, the range 0 to 200 $^\circ\text{C}$ (0 to 400 $^\circ\text{F}$): Within $\pm 6^\circ\text{C}$ (12°F) B input, the range 0 to 300 $^\circ\text{C}$ (0 to 600 $^\circ\text{F}$): Accuracy is not guaranteed. K, J, E, T, N input, less than 0 $^\circ\text{C}$ (32°F): Within $\pm 0.4\%$ of each input span ± 1 digit
RTD	:	Within $\pm 0.1\%$ of each input span ± 1 digit, or within $\pm 1^\circ\text{C}$ (2°F), whichever is greater
DC current, voltage	:	Within $\pm 0.2\%$ of each input span ± 1 digit

Time indication accuracy: Within $\pm 0.5\%$ 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 $\pm 0.5\%$ of the setting time

Setting resolution

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

Time : 1 minute or 1 second

Status after power is restored: The control resumes from the point at which power failure occurred.

(Progressing time error after power is restored: Max. 1 minute)

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°C (2000°F) (Default value: 10°C)
TC, RTD input with a decimal point:
0.0 to 999.9°C (999.9°F)
DC input: 0.0 to 100.0%
 - Integral time (I) : 0 to 1000 sec (off when set to 0) (Default value: 200sec)
 - Derivative time (D) : 0 to 300 sec (off when set to 0) (Default value: 50sec)
 - Proportional cycle : 1 to 120 sec (Default value: 30sec for -R/M,
3sec 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°C (°F) (Default value: 1.0°C)
 - 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, 3A 250V AC (resistive load)
1A 250V AC (inductive load $\cos\phi=0.4$)
Electric life: 100,000 times
- Non-contact voltage : For SSR drive
12⁻²₀V 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 \pm deviation from the SV (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 off) or Deenergized (When Alarm output is turned ON, Alarm indicator goes off, 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°C (°F) (Default value: 1.0°C)
For DC current, voltage input: 1 to 1000 (The placement of the decimal point follows the selection)
- Output : Relay contact 1a
Control capacity, 3A 250V AC (resistive load)
1A 250V AC (inductive load $\cos\phi=0.4$)
Electric life: 100,000 times

Alarm output action: One alarm can be selected by 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 (program control run) output. (Default value: Time signal output)

Output : Relay contact 1a

Control capacity, 3A 250V AC (resistive load)

1A 250V AC (inductive load $\cos\phi = 0.4$)

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 remains ON. The output is turned off by pressing the STOP key for 1 second or more.

Pattern end output time setting range: 0 to 9999 sec. (Default value: 0sec)

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

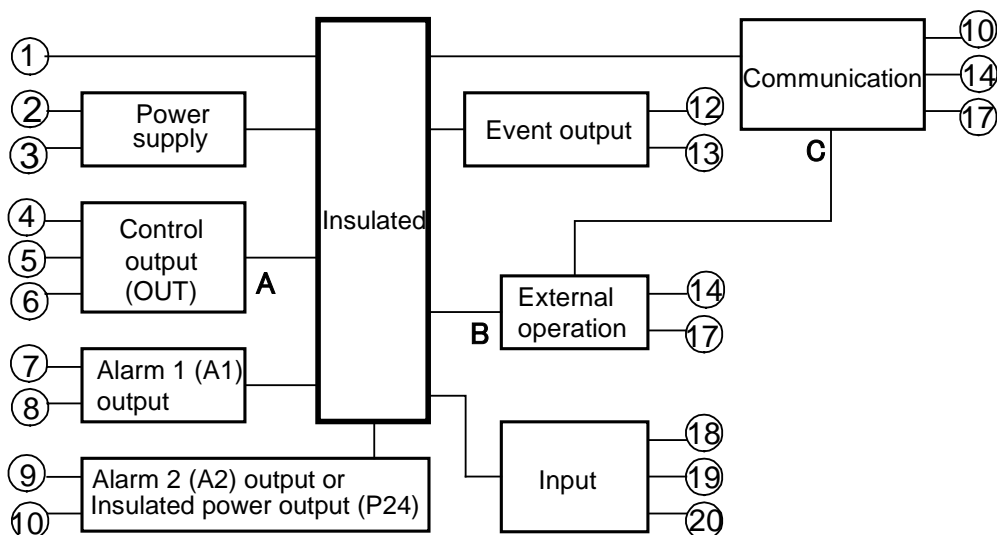
24V AC/DC : 20 to 28V AC/DC

Ambient temperature: 0 to 50°C (32 to 122°F)

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

Power consumption: Approx. 8VA

Circuit insulation configuration



**When the control output is non-contact voltage or DC current,
A is not insulated from B, and A is not insulated from C.**

Insulation resistance

10M Ω or more, 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 dimensions : 96 x 96 x 100mm (W x H x D)

Material : Case, Flame resistant resin

Color : Case, Light gray

Attached functions : Set 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 TC option is applied.)

10.2 Optional specifications

Serial communication (Option code: C5)

External operation function cannot be used if C5 option 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 set values.
- (2) Reading of the input value and the action status.
- (3) Function change.

Communication line : EIA RS-485
 Communication method : Half-duplex communication start-stop synchronous
 Communication protocol: Shinko protocol, Set value digital transmission (Shinko protocol), Set 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 set value

Set value digital transmission (Option code: SVTC)

If SVTC option is added, external operation function cannot be used.

If Set value digital transmission is selected during 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 (C5 option).

If Set value digital reception is selected during Communication protocol selection, step SV can be received from Shinko PC-935/PCD-33A with Set value digital transmission (SVTC option).

Insulated power output (Option code: P24)

When P24 option is added, Alarm 2 (A2) cannot be used.

Output voltage: $24 \pm 3V$ 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
[- - - -] is flashing on the PV display.	<ul style="list-style-type: none"> • Thermocouple or RTD is burnt out. [Thermocouple] If the input terminal of the instrument is shorted, and if a value around room temperature is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out. [RTD] If approx. 100Ω of resistance is connected to the input terminals between A-B of the instrument and between B-B is shorted, and if approximate 0°C (32°F) is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out. • Check whether the input terminals of thermocouple, RTD are securely mounted to the instrument input terminals.
[- - - -] is flashing on the PV display.	<ul style="list-style-type: none"> • Check if polarity of thermocouple or compensating lead wire is correct. • Check whether codes (A, B, B) of RTD agree with the instrument terminals.
The indication of PV display is abnormal or unstable.	<ul style="list-style-type: none"> • Check whether sensor input or temperature unit (°C or °F) is correct. Set the sensor type which is the same as users' and the temperature unit during the Input type selection [4 5 6 7]. (p.16) • Sensor correcting value is unsuitable. Set it to a suitable value during the Sensor correction setting [4 0 0 0] in Auxiliary function setting mode 1. (p.31, 41, 42) • AC leaks into thermocouple or RTD circuit. • There may be equipment that interferes with or makes noise near the controller. Keep equipment that interferes with or makes noise away from the controller.
[E r r !] is indicated on the PV display.	<ul style="list-style-type: none"> • Internal memory is defective. Contact our agency or us.

<Keypad operation>

Problem	Presumed cause and solution
It is impossible to select program pattern number.	<ul style="list-style-type: none"> • The program control is running. Change the mode. The program pattern number can only be selected during the program standby mode.
Settings or selections are impossible.	<ul style="list-style-type: none"> • Set value lock [L o c k] is designated during the Set 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)

<p>The setting indication does not change in the input range even if the Δ, ∇ keys are pressed, and new values are unable to be set.</p>	<ul style="list-style-type: none"> SV high limit or low limit in Auxiliary function setting mode 1 may be set at the point where the value does not change. Set it to a suitable value ($\text{H}\square\square$, or $\text{L}\square\square$) while in Auxiliary function setting mode 1. (p.31)
--	--

<Control>

Problem	Presumed cause and solution
<p>If process variable (temperature) does not rise.</p>	<ul style="list-style-type: none"> 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 during the Direct/Reverse action selection [CONF]. Select Reverse (Heating) [HEAT] action. (p.20)
<p>If the control output (OUT) remains ON status.</p>	<ul style="list-style-type: none"> Control output low limit value is set to 100% or higher in Auxiliary function setting mode 2. (p.17) The proportional band is set at extremely small value. Set it to a suitable value. (p.28)
<p>If the control output (OUT) remains OFF status.</p>	<ul style="list-style-type: none"> Control output high limit value is set to 0% or less in Auxiliary function setting mode 2. (p.17) The proportional band is set at extremely high value. Set it to a suitable value. (p.28)
<p>Step numbers progress fast and program control stops soon after it is started.</p>	<ul style="list-style-type: none"> The program has not been set. Set the program from the Pattern (Step SV/Time) setting mode. (pages 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)
<p>The step does not proceed.</p>	<ul style="list-style-type: none"> 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

<Set value/Time setting mode>

Step No.	PV display	Setting item	Default value	Data
1	TE \bar{A} P	Step 1 SV	0°C	
1	TI \bar{A} E	Step 1 time	00.00 (H:M)	
2	TE \bar{A} P	Step 2 SV	0°C	
2	TI \bar{A} E	Step 2 time	00.00 (H:M)	
3	TE \bar{A} P	Step 3 SV	0°C	
3	TI \bar{A} E	Step 3 time	00.00 (H:M)	
4	TE \bar{A} P	Step 4 SV	0°C	
4	TI \bar{A} E	Step 4 time	00.00 (H:M)	
5	TE \bar{A} P	Step 5 SV	0°C	
5	TI \bar{A} E	Step 5 time	00.00 (H:M)	
6	TE \bar{A} P	Step 6 SV	0°C	
6	TI \bar{A} E	Step 6 time	00.00 (H:M)	
7	TE \bar{A} P	Step 7 SV	0°C	
7	TI \bar{A} E	Step 7 time	00.00 (H:M)	
8	TE \bar{A} P	Step 8 SV	0°C	
8	TI \bar{A} E	Step 8 time	00.00 (H:M)	
9	TE \bar{A} P	Step 9 SV	0°C	
9	TI \bar{A} E	Step 9 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°C	
	A2□□	Alarm 2 (A2) action point	0°C	
	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°C	
	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
	WA \bar{I}	Wait value	0°C (No Wait action)	
1	WA \bar{C}	Step 1 Wait function Used/Not used	Not used	
2	WA \bar{C}	Step 2 Wait function Used/Not used	Not used	
3	WA \bar{C}	Step 3 Wait function Used/Not used	Not used	
4	WA \bar{C}	Step 4 Wait function Used/Not used	Not used	

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

<Auxiliary function setting mode 1>

Step No.	PV display	Setting item	Default value	Data
	Loct	Set value lock	Unlock	
	4H□□	SV high limit	1370°C	
	4L□□	SV low limit	-200°C	
	4o□□	Sensor correction	0.0°C	
	cñ4L	Communication protocol	Shinko protocol	
	cñno	Instrument number	0	
	cñ4P	Communication speed	9600bps	
	cñPr	Parity	Even	
	cñ4r	Stop bit	1	

<Auxiliary function setting mode 2>

Step No.	PV display	Setting item	Default value	Data
	4En4	Input type	K: -200 to 1370°C	
	4FLH	Scaling high limit value	9999	
	4FLl	Scaling low limit value	-1999	
	dP□□	Decimal point place	No decimal point	
	FILr	PV filter time constant	0.0 seconds	
	ñ_4□	Step time unit	Hour/Minute	
	4_4B	Step SV setting when control starts	0°C	
	4_4L	Program control start type	PV start	
	oLH□	Control output high limit	100%	
	oLL□	Control output low limit	0%	
	H44□	Control output ON/OFF action hysteresis	1.0°C	
	AL1F	Alarm 1 (A1) type	No alarm	
	AL2F	Alarm 2 (A2) type	No alarm	
	A1Lñ	Alarm 1 (A1) Energized/Deenergized	Energized	
	A2Lñ	Alarm 2 (A2) Energized/Deenergized	Energized	
	A1H4	Alarm 1 (A1) hysteresis	1.0°C	
	A2H4	Alarm 2 (A2) hysteresis	1.0°C	
	A1d4	Alarm 1 (A1) action delayed timer	0sec	
	A2d4	Alarm 2 (A2) action delayed timer	0sec	
	E44L	Event output function	Time signal output	
	PErñ	Pattern end output time	0sec(continuous output)	
	cOnr	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 (°C or °F) 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°C in 30 minutes (0:30). (*1)

Step 2: The control is performed at 500°C for 1 hour (1:00).

(*1) When the control starts, SV differs depending on the program control start type.

If the SV start is selected during the Program control start type selection, the control starts from SV. If the PV start is selected during the Program control start type 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	
SV (Set value)						
	Step temperature (°C)	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	1°C				
P (Proportional band)	10°C					
I (Integral time)	200 sec.					
D (Derivative time)	50 sec.					
Anti-reset windup	50%					
C (Proportional cycle)	30 sec.					
Time signal output	ON					
	OFF					

This page is deliberately left blank.

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

***** 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
- Serial number ----- No. xxxxxx

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

SHINKO TECHNOS CO., LTD.
OVERSEAS DIVISION

Reg. Office : 2-5-1, Senbahigashi, Minoo, Osaka, Japan

URL : <http://www.shinko-technos.co.jp>

Tel : 81-72-727-6100

E-mail : overseas@shinko-technos.co.jp

Fax: 81-72-727-7006