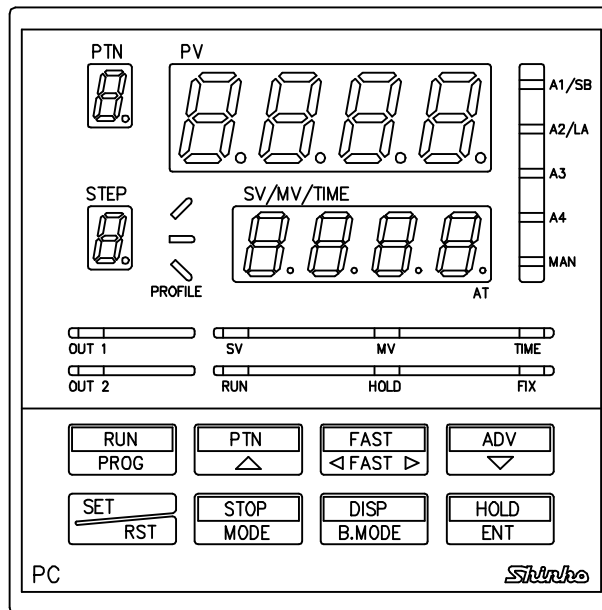


PROGRAMMABLE CONTROLLER

PC-900

INSTRUCTION MANUAL



Shinko

Preface

Thank you for purchasing our Programmable Controller PC-900.

This manual contains instructions for the mounting, functions, operations and notes when operating the PC-900.

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

Abbreviations

Symbol	Term
PV	Process variable
SV	Desired value
MV	Manipulated variable
OUT1	Control output 1
OUT2	Control output 2
AT	Auto-tuning
DC input	DC current input DC voltage input

Characters used in this manual

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

Notes

- This instrument should be used in accordance with the specifications described in the manual. If it is not used according to the specifications, it may malfunction or cause a fire.
- Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- Specifications, external appearance of the PC-900 and the contents of this instruction manual are subject to change without notice.
- Care has been taken to ensure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform our sales department.
- This instrument is designed to be installed 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 damage or secondary damage(s) incurred as a result of using this product, including any indirect damage.

Safety Precautions (Be sure to read these precautions before using our products.)

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

Depending on circumstances, procedures indicated by ⚠ Caution may 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 other qualified service personnel may handle the inner assembly.
- To prevent an electric shock, fire or damage to the instrument, parts replacement may only be undertaken by Shinko or other qualified service personnel.



Safety Precautions

- To ensure safe and correct use, thoroughly read and understand this manual before using this instrument.
- This instrument is intended to be used for industrial machinery, machine tools and measuring equipment. Verify correct usage after 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 protective equipment against excessive temperature rise, etc. must be installed, as malfunction of this product could result in serious damage to the system or injury to personnel. 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
- No 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, and no icing
- An ambient non-condensing humidity of 35 to 85%RH
- No large capacity electromagnetic switches or cables through which large current is flowing.
- No water, oil or chemicals or where the vapors of these substances can come into direct contact with the unit
- Take note that the ambient temperature of this unit – not the ambient temperature of the control panel – must not exceed 50°C (122°F) if mounted through the face of a control panel, otherwise the life of the electronic components (especially electrolytic capacitors) of the unit will be shortened.

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

2. Wiring precautions

Caution

- Do not leave bits of wire inside the instrument, because they could cause a fire or malfunction.
- Use a solderless terminal with an insulation sleeve in which an M3 screw fits when wiring the PC-900.
- The terminal block of this instrument is designed to be wired from the left side.
The lead wire must be inserted from the left side of the terminal, and fastened with the terminal screw.
- Tighten the terminal screw within the specified torque.
If excessive force is applied to the screw when tightening, the screw or case may be damaged.
- 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.
- This controller has no built-in power switch, circuit breaker or fuse. It is necessary to install a power switch, circuit breaker or fuse 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

Caution

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

Notice

- Setup of the Rotary switch and the DIP switch inside the controller is required before the power is turned on. Default values of the product are:
Sensor input: K, Control action: PID (with AT function), Heating control, Alarm (A1): Pattern end output, Alarm (A3): High limit alarm output, Alarm (A4): Low limit alarm output, Unit: °C. Refer to “3. Setup”.
- It is recommended that the auto-tuning be performed on the trial run.
- Install protective devices against environmental conditions which may cause damage to the instrument or the deterioration of its parts.
- In the case of the PC-955 model, set the Open and Closed output time according to the specification of the control valve.

-- CONTENTS --

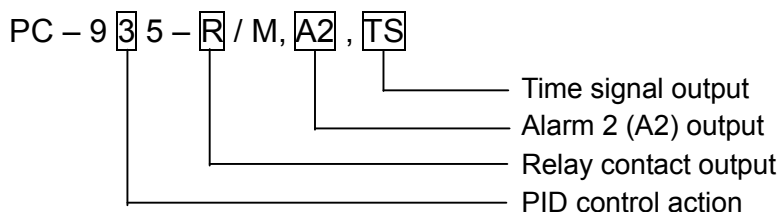
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1. Model

1.1 Explanation of the model

Alphanumeric characters to represent the function or type are entered for the .

[Example]



Standard model

PC-9 <input type="checkbox"/> 5 - <input type="checkbox"/> / M, <input type="checkbox"/>		Series name: PC-900 [96 x 96 x 100mm (W x H x D)]		
Control action	3		PID	
	5		ON/OFF servo output PID	
Alarm action	5		Alarm 3(A3): High limit, Alarm 4(A4): Low limit (*1)	
Control output 1 (OUT1)		R	Relay contact: 1a1b (PC-935) or 1a x 2 (PC-955) (*2)	
		S	Non-contact voltage (for SSR drive): 12 ⁺² ₀ V DC	
		A	DC current: 4 to 20mA DC	
Input		M	Multi-range (*3)	
Option		A2	Alarm 2 (A2) (including Pattern end output 2) (*4, *5)	
		LA	Loop break alarm (*5, *7)	
		DR	Control output 2 (OUT2) (Heating/Cooling control) (*4, *6)	Relay contact: 1a
		DS		Non-contact voltage (SSR drive): 12 ⁺² ₀ V DC
		DA		DC current: 4 to 20mA DC
		TA	Transmission output	DC current: 4 to 20mA DC
		TV		DC voltage: 0 to 1V DC
		C5	Serial communication	EIA RS-485
		C		EIA RS-232C
		SVTC	Set value digital transmission	
		TS	Time signal	
		BK	Color: Black	
		IP	Dust-proof/Drip-proof	
		TC	Terminal cover	
		User specified	Input range: Shipped as specified input range	
			Alarm type: Shipped as specified alarm type	
	OUT2 action mode: Shipped as specified OUT2 action mode			
	Transmission output: Shipped as specified output			

(See p.107 for detailed options.)

(*1) 12 types of alarm action, No alarm action and pattern end output are selectable by internal Rotary switch and DIP switch.

(*2) The relay contact output is available only for the PC-955 type.

(*3) 16 input types (Thermocouple, RTD, DC current and DC voltage) are selectable by internal Rotary switch and DIP switch.

(*4) This option is not available for the PC-955 type.

(*5) When A2 and LA option are added together, they utilize common output terminals.

(*6) When this option is added, A2 or LA cannot be added.

(*7) For the PC-955 type, the LA indicator lights in case of burnout, however, output does not occur.

1.2 How to read the model label

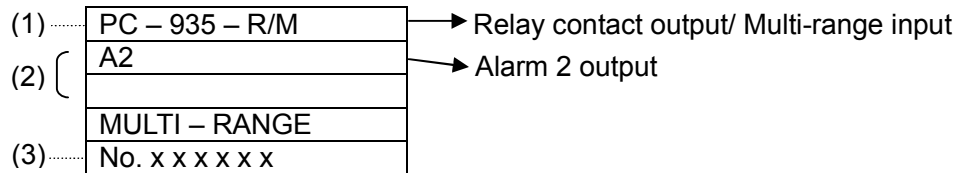


Warning

Turn the power supply to the instrument OFF before confirming the model labels.
Working on or touching the terminal with the power switched ON may result in severe injury or death due to electric shock.

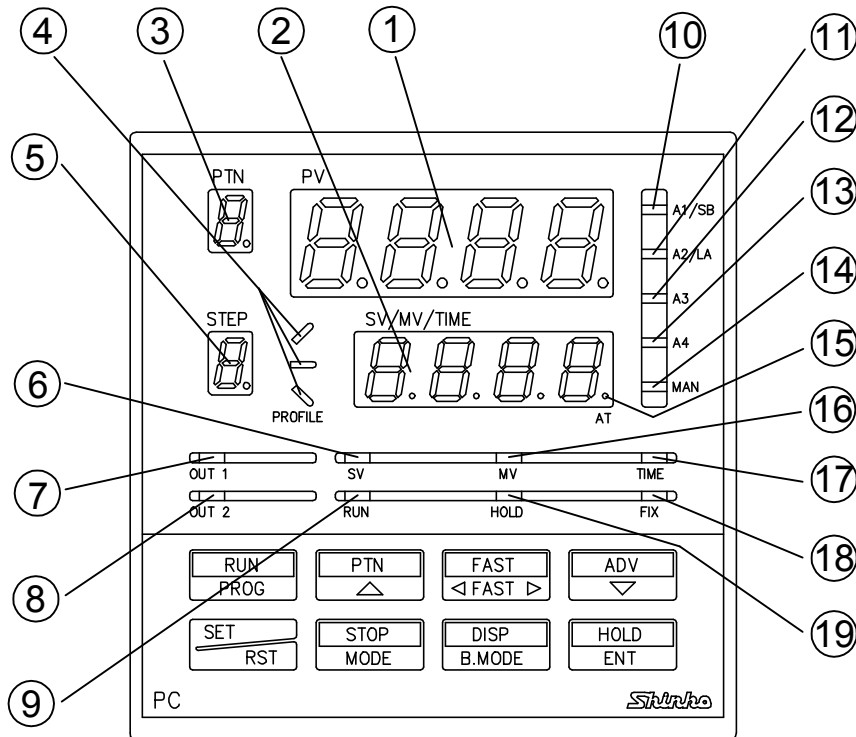
Model labels are attached to the case and the left side of the inner assembly.

Model label (Example)



- (1) Model
- (2) Option codes
- (3) Serial number

2. Name and functions



(Fig. 2-1)

① PV display

Indicates the PV (process variable) or setting characters in the setting mode with the red LED.

② SV/MV/TIME display

Indicates the SV (desired value), MV (manipulated variable), Time or each set value in the setting mode with the green LED. (The indication can be changed by the **DISP B.MODE** key.)

③ PTN (Pattern number) display

Indicates the Pattern number with the yellow LED.

④ Program monitor indicator

During program control, the green LED (/) lights when the PV is rising.
 During program control, the green LED (-) lights when the PV is constant.
 During program control, the green LED (\) lights when the PV is falling.

⑤ STEP (Step number) display

Indicates the Step number with the green LED.
 The Step number flashes during wait action.

⑥ SV indicator

The green LED lights while the SV (desired value) is indicated on the SV/MV/TIME display.

⑦ OUT1 indicator

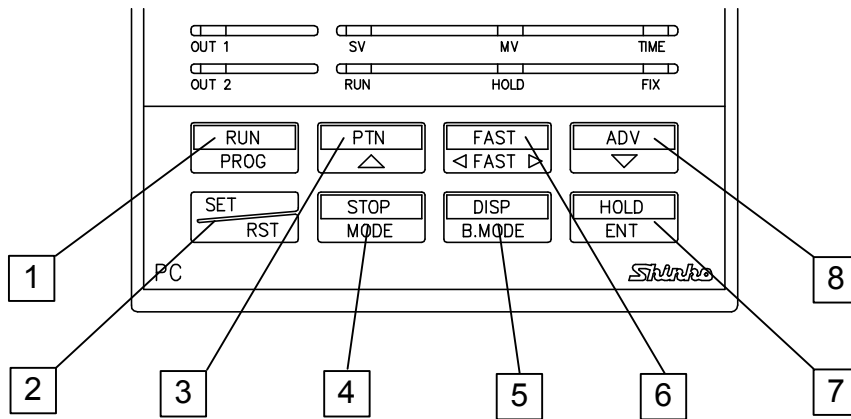
PC-935: Control output 1

The green LED lights when the Control output 1 (OUT1) is ON.
 (With DC current output type, it flashes corresponding to the MV (manipulated variable) at a cycle of every 125ms.)










PC-955: Control motor Open output

The green LED lights when the Control motor Open output (OUT1) is ON.
 (With DC current output type, it flashes corresponding to the MV (manipulated variable) at a cycle of every 125ms.)

- ⑧ **OUT2 indicator**
PC-935: Control output 2
 The yellow LED lights when the Control output 2 (OUT2) is ON.
 (With DC current output type, it flashes corresponding to the MV (manipulated variable) at a cycle of every 125ms.)
PC-955: Control motor Closed output
 The yellow LED lights when the Control motor Closed output (OUT2) is ON.
 (With DC current output type, it flashes corresponding to the MV (manipulated variable) at a cycle of every 125ms.)
- ⑨ **Run indicator (Program control RUN)**
 During program control, the red LED lights.
- ⑩ **A1/SB indicator: Alarm 1 output (including Pattern end 1 output)/Sensor burnout**
 The red LED lights when the Alarm 1 (A1) output or Pattern end 1 output is ON.
 The red LED lights when the Sensor is burnt out.
- ⑪ **A2/LA indicator: Alarm 2 output (including Pattern end 2 output)/ Loop break alarm output**
 The red LED lights when the Alarm 2 (A2) output or Pattern end 2 output is ON.
 The red LED lights when the Loop break alarm output is ON.
- ⑫ **A3 indicator: Alarm 3 output (including Pattern end 3 output)**
 The red LED lights when the Alarm 3 (A3) output or Pattern end 3 output is ON.
- ⑬ **A4 indicator: Alarm 4 output (including Pattern end 4 output)**
 The red LED lights when the Alarm 4 (A4) output or Pattern end 4 output is ON.
- ⑭ **MAN (Manual control) indicator**
 The red LED lights in Manual control.
- ⑮ **AT (Auto-tuning) indicator**
 The 1st decimal point (AT) from the right on the SV/MV/TIME display flashes during auto-tuning.
- ⑯ **MV indicator**
 The red LED lights while the MV (manipulated variable) of OUT1 is indicated on the SV/MV/TIME display.
 The red LED flashes while the MV (manipulated variable) of OUT2 is indicated on the SV/MV/TIME display.
- ⑰ **TIME indicator**
 The yellow LED lights while the time is indicated on the SV/MV/TIME display.
- ⑱ **FIX (Fixed value control) indicator**
 The red LED lights during Fixed value control.
- ⑲ **HOLD (Program control Hold) indicator**
 The red LED flashes when program control is being held.



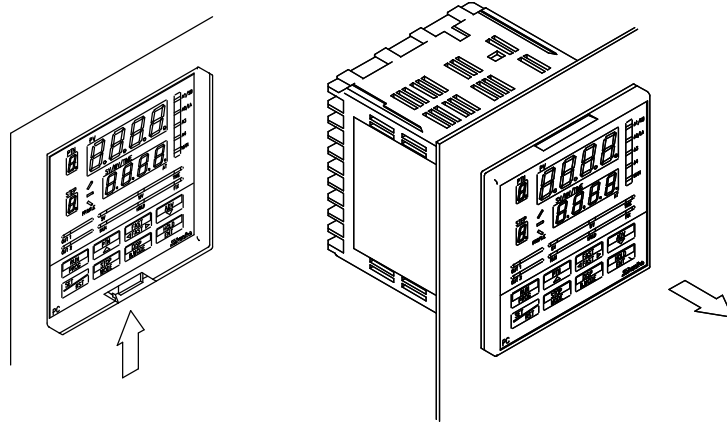
(Fig. 2-2)

- 1  **(Run/Program Key)**
 - **Run key:** Starts the Program run. Cancels the Hold function when holding.
 - **Program Key:** Changes the mode from Fixed value control to Program control. Clears the program in Pattern setting mode.
- 2  **(Set/Reset key)**
 - **Set key:** Proceeds to the Setting mode.
 - **Reset key:** Returns to the Run mode.
- 3  **(Pattern/Up key)**
 - **Pattern key:** Selects the Program pattern number.
 - **Up key:** Increases the value on the SV/MV/TIME display, or changes the selection item.
- 4  **(Stop/Mode key)**
 - **Stop key:** Stops the program control. Cancels the Pattern end output.
 - **Mode key:** Switches or selects the Setting mode, and registers the setting data as the  key does.
- 5  **(Display/Back mode key)**
 - **Display key:** Changes the indication on the SV/MV/TIME display.
 - **Back mode key:** Moves back to each setting mode.
- 6  **(Fast key)**
 - **Fast key:** During program control, makes step time progress 60 times faster than usual. Makes the numerical value change faster when setting.
- 7  **(Hold/Enter key)**
 - **Hold key:** During program control, it pauses time progression, and controls the process with the set value at that time.
 - **Enter key:** Registers the setting data, and proceeds to the next item.
- 8  **(Advance/Down key)**
 - **Advance key:** During program control, interrupts performing step, and proceeds to the next step.
 - **Down key:** Decreases the value on the SV/MV/TIME display, or changes the selection item.

3. Setup

3.1 Drawing out the internal assembly

Before the power supply to this instrument is turned on, take the internal assembly out from the case by pushing the hook (bottom of the instrument) in the direction indicated by the arrow and holding the latches.

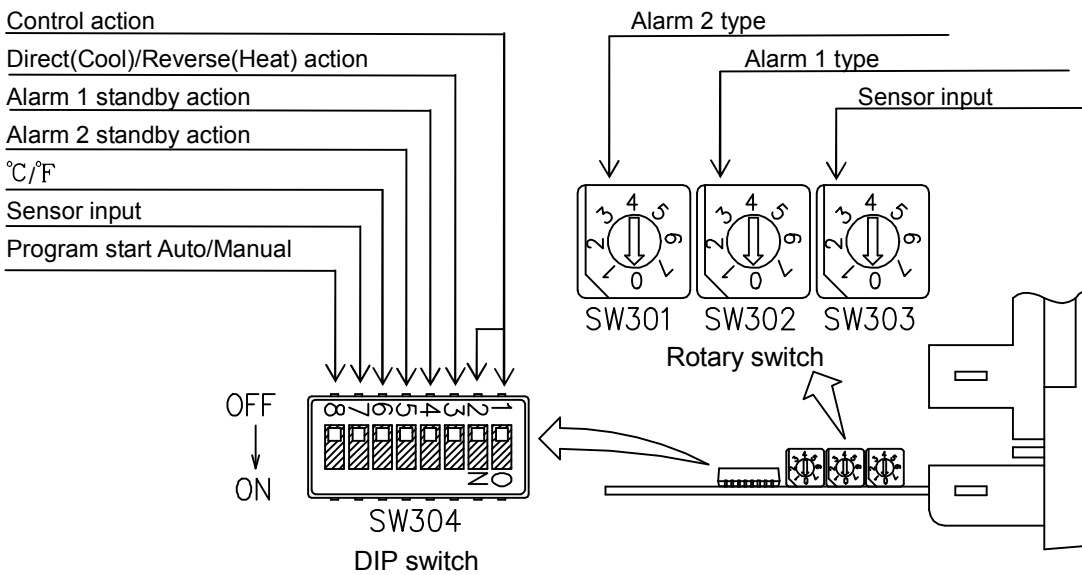


(Fig. 3.1-1)

3.2 Switch setting

Using a small flat blade screwdriver or tweezers, set the following by the Rotary switch and DIP switch:
 Sensor input, Alarm 1 (A1) type, Alarm 2 (A2) type, Control action, Direct (Cooling)/Reverse (Heating) action, Alarm 1 and 2 standby functions, Unit °C/°F and Program start Auto/Manual

Rotary switch SW301 is equipped only when A2 option is added.



(Fig. 3.2-1)

3.2.1 Multi function of the DIP switch

The following items can be set by the DIP switch (SW304).

Default value: All switches OFF.

(Table 3.2.1-1)


Item	DIP SW304 No.	Selection	DIP Switch Status
Control action	1	PID (with AT function)	OFF
		Fuzzy overshoot suppression PID	ON
Heating/Cooling action	3	Heating (reverse) action	OFF
		Cooling (direct) action	ON
Alarm 1 standby action	4	Without standby action	OFF
		Standby action	ON
Alarm 2 standby action *1	5	Without standby action	OFF
		Standby action	ON
°C/°F	6	°C	OFF
		°F	ON
Sensor input *2	7	K, J, R, B, N, PL-II, Pt100, JPt100 (with decimal point)	OFF
		S, E, T, C, 4 to 20mA, 0 to 20mA, 0 to 1V, Pt100 (no decimal point)	ON
Program start Auto/Manual	8	Manual start	OFF
		Automatic start	ON

• Be sure to turn the No. 2 DIP switch (SW304) always OFF.

*1: The A2 standby function works only when the A2 option is added.

*2: When selecting a sensor type, use this DIP switch (SW304) and the Rotary switch (SW303).

Program start for Program control
--

- **Manual start** : When the power to the PC-900 is turned on, the mode turns to the standby mode.
Press the  key to start the preset program.
- **Automatic start** : When the power to the PC-900 is turned on, the preset program automatically starts from Step 0 directly.

3.2.2 Sensor selection

Select the sensor type by the rotary switch (SW303) and the DIP switch (SW304, No. 7), and °C or °F by the DIP switch (SW304, No. 6).

Default value: K, -200 to 1370°C

Note: If the input type is changed, Scaling high/low limit and Transmission output high/low limit value (optional) will become the altered input range high/low limit value.

(Table 3.2.2-1)

Rotary SW303 No.	DIP SW304 No.7	Sensor type	Scale range	
			DIP SW 304 (No. 6 OFF)	DIP SW 304 (NO. 6 ON)
0	OFF	K	-200 to 1370°C	-320 to 2500°F
1	OFF	J	-200 to 1000°C	-320 to 1800°F
2	OFF	R	0 to 1760°C	0 to 3200°F
3	OFF	B	0 to 1820°C	0 to 3300°F
4	OFF	PL-II	0 to 1390°C	0 to 2500°F
5	OFF	N	0 to 1300°C	0 to 2300°F
6	OFF	Pt100	-199.9 to 850.0°C	-199.9 to 999.9°F
7	OFF	JPt100	-199.9 to 500.0°C	-199.9 to 900.0°F
0	ON	S	0 to 1760°C	0 to 3200°F
1	ON	E	0 to 1000°C	0 to 1800°F
2	ON	T	-199.9 to 400.0°C	-199.9 to 750.0°F
3	ON	C (W/Re5-26)	0 to 2315°C	0 to 4200°F
4	ON	4 to 20mA DC	-1999 to 9999	
5	ON	0 to 20mA DC	-1999 to 9999	
6	ON	0 to 1V DC	-1999 to 9999	
7	ON	Pt100	-200 to 850°C	-320 to 1560°F

3.2.3 Alarm 1 (A1), Alarm 2 (A2) type selection

Alarm 1 (A1), Alarm 2 (A2) type and pattern end output for program control can be set by the Rotary switches SW302 and SW301.

The Rotary switch SW301 is equipped only when A2 option is added.

Rotary switch SW302: Alarm 1 (A1) type, Pattern end 1 output.

Rotary switch SW301: Alarm 2 (A2) type, Pattern end 2 output.

Default value: Rotary switch SW302 (A1): Pattern end 1 output

Rotary switch SW301 (A2): No alarm action

Note: If an alarm type is changed, the alarm set value becomes 0 (0.0).

(Table 3.2.3-1)

Alarm 1 (A1) type	Rotary switch (SW302) No.	Alarm 2 (A2) type	Rotary switch (SW301) No.
No alarm action	0	No alarm action	0
High limit alarm	1	High limit alarm	1
Low limit alarm	2	Low limit alarm	2
High/Low limits alarm	3	High/Low limits alarm	3
High/Low limit range alarm	4	High/Low limit range alarm	4
Process high alarm	5	Process high alarm	5
Process low alarm	6	Process low alarm	6
Pattern end 1 output	7	Pattern end 2 output	7

3.3 Inserting the internal assembly

When the setup is completed, insert the internal assembly into the case.

Securely insert the assembly until it is locked by the hook at the bottom of the instrument.

(A clicking sound should be heard.)



Caution

Do not confuse the top and bottom of the internal assembly.

If the assembly is inserted into the case by force in the wrong direction, the PCB (printed circuit board) may be damaged.

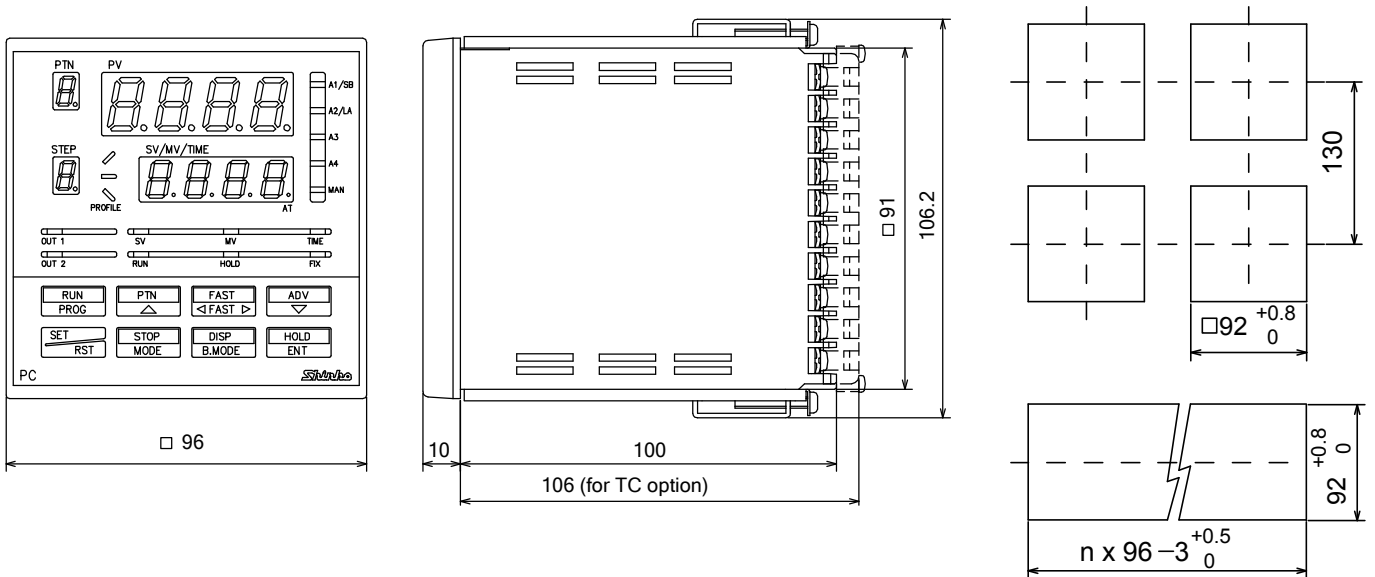
4. Mounting to the control panel

4.1 Site selection

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 rapidly, and no icing
- (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 unit
- (8) Take note that the ambient temperature of this unit – not the ambient temperature of the control panel – must not exceed 50°C (122°F) if mounted through the face of a control panel, otherwise the life of the electronic components (especially electrolytic capacitors) of the unit will be shortened.

4.2 External dimensions, Panel cutout (Scale: mm)



(Fig. 4.2-1)

Lateral close mounting
 n: Number of units mounted
 (Fig. 4.2-2)

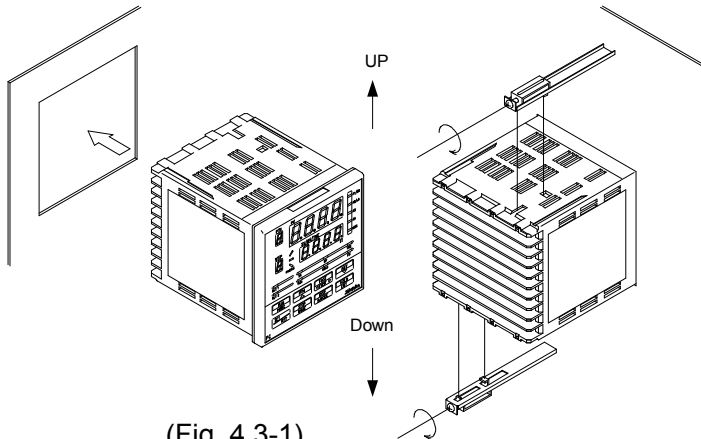
4.3 Mounting

Mountable panel thickness is 1 to 8mm.

Insert the PC-900 from the front of the panel. Attach mounting brackets by the holes top and bottom of the case, and secure the controller in place with the screws.

(As the case is made of resin, do not use excessive force while screwing in the mounting bracket, or the case could be damaged.)

The torque should be 0.12N•m.



(Fig. 4.3-1)

5. Wiring

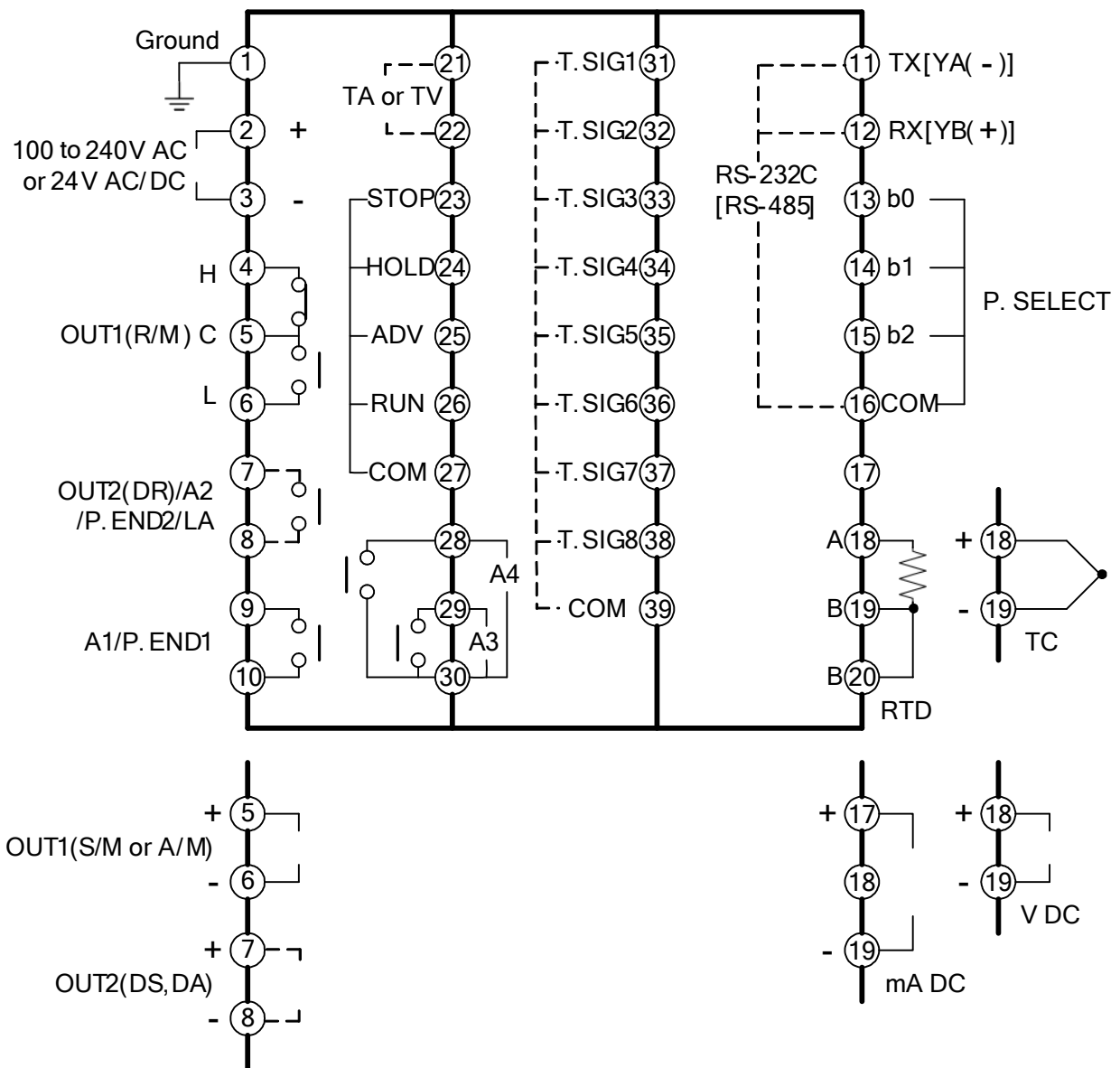
Warning

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

- The terminal block of this instrument is designed to be wired from the left side. A lead wire must be inserted from the left side of the terminal, and fastened by the terminal screw.
- Dotted lines show options, and no terminal is equipped unless specified.

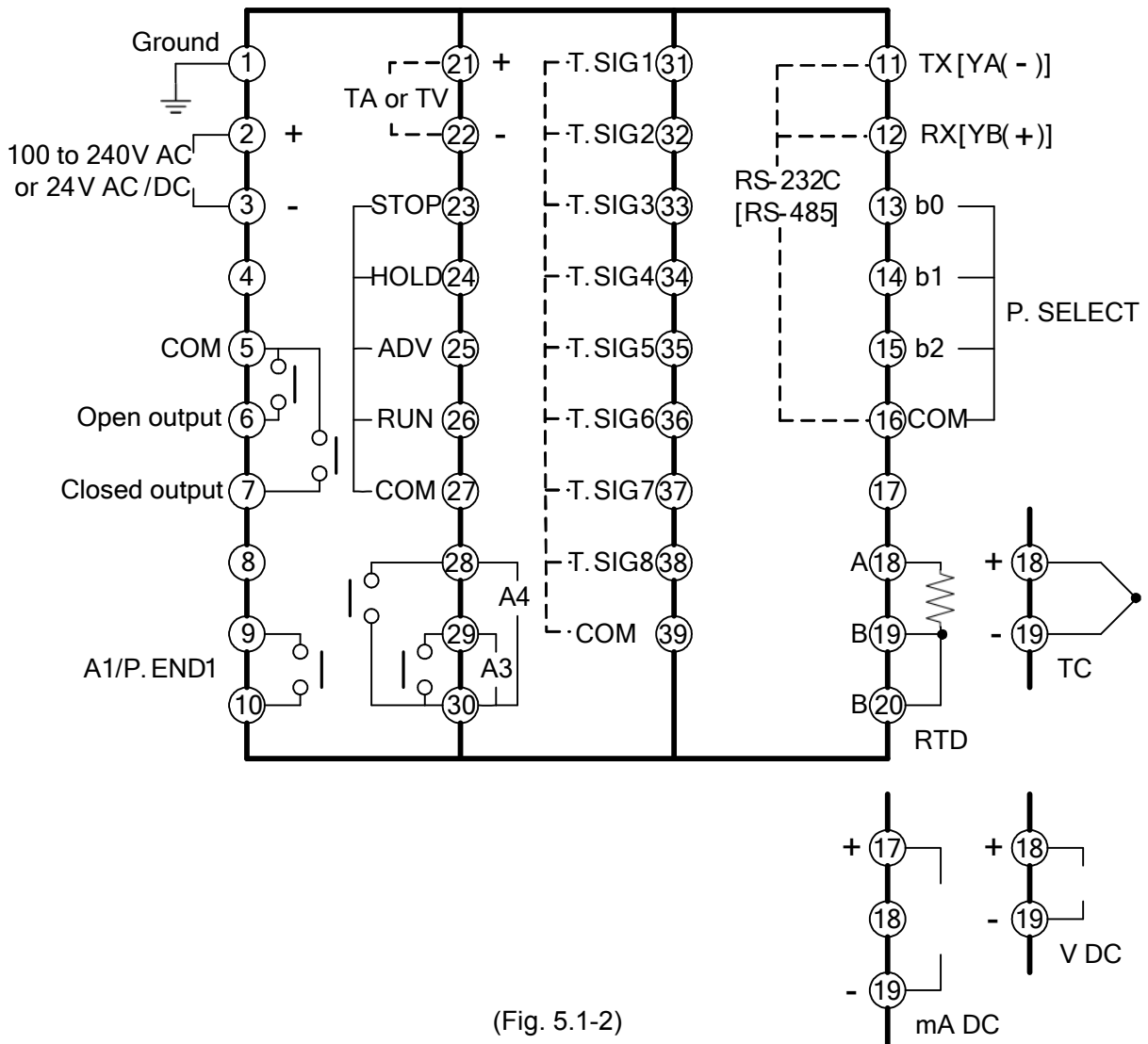
5.1 Terminal arrangement

[PC-935 type]



(Fig. 5.1-1)

[PC-955 type]

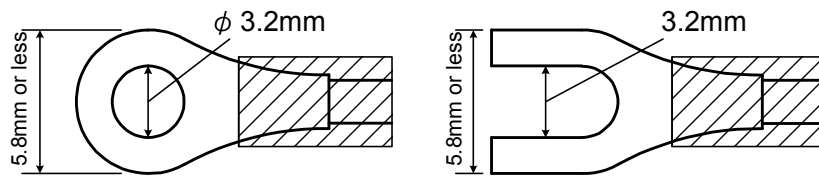


(Fig. 5.1-2)

- A1 to A4 : Alarm 1 output to Alarm 4 output
- OUT1, OUT2 : Control output 1, Control output 2 (Heating/Cooling control)
- DR, DS, DA : Heating/Cooling control output (Relay contact, Non-contact voltage, DC current)
- TA, TV : Transmission output
- LA : Loop break alarm output
- P. SELECT : Pattern No. external selection
- P. END : Pattern end output
- T.SIG : Time signal output
- STOP, HOLD, ADV, RUN, COM: External operation terminals

● **Recommended terminal**

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



(Fig. 5.1-3)

Solderless terminal	Manufacturer	Model	Tightening torque
Y-type	Nichifu Terminal Industries CO.,LTD.	TMEV1.25-Y3	0.63 N•m
	Japan Solderless Terminal MFG CO.,LTD.	VD1.25-B3A	
Ring-type	Nichifu Terminal Industries CO.,LTD.	TMEV1.25-3	
	Japan Solderless Terminal MFG CO.,LTD.	V1.25-3	

5.2 Wiring examples

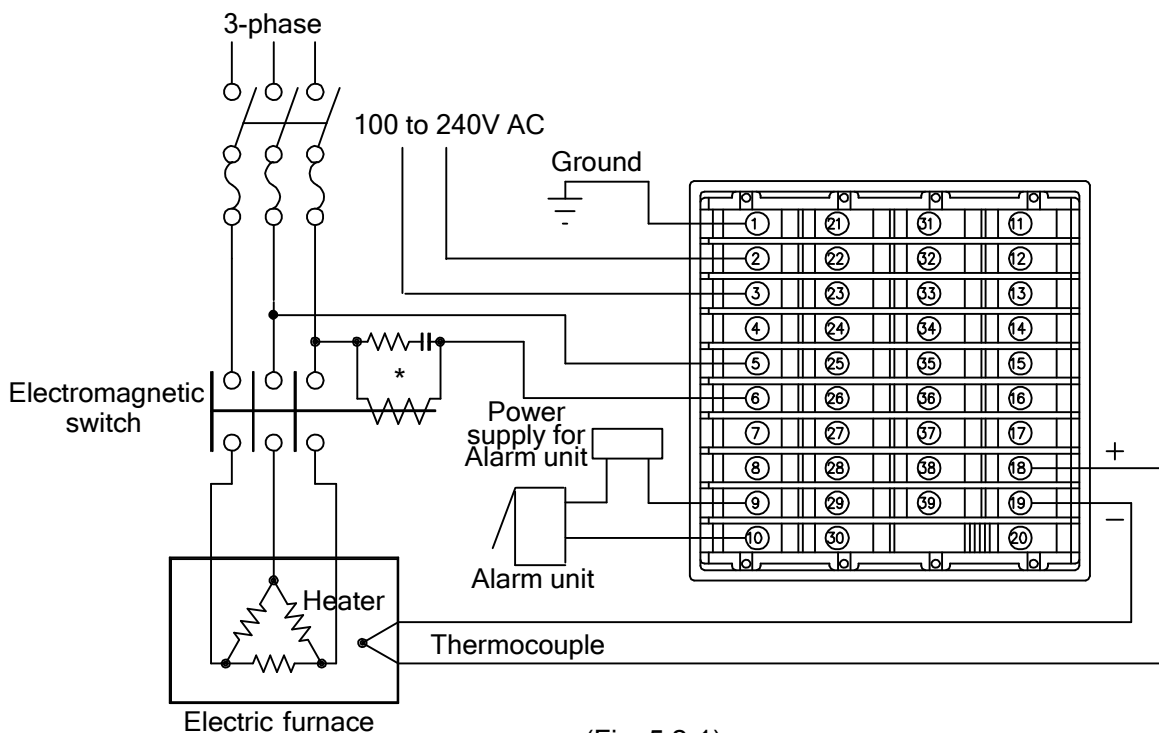
Notice

Select a 3A fuse from European qualified products, and mount it with the holder in the external circuit within 3m of distance from the controller.

Notice

- Use a thermocouple, compensating lead wire and RTD (3-wire system) according to the sensor input specifications of this controller.
- This controller does not have a built-in power switch, circuit breaker or fuse.
It is necessary to install a power switch, circuit breaker or fuse in a circuit near the controller.
(Recommended fuse: Time-lag fuse, rated voltage 250V AC, rated current 2A)
- In the case of 24V DC, do not confuse the polarity.
- With the relay contact output type, externally use a relay according to the capacity of the load to protect the built-in relay contact.
- For the PC-955 type, install an electromagnetic switch between the PC-955 and control motor.
- When wiring, keep input wires (Thermocouple, RTD, etc.) away from AC sources or load wires to avoid external interference.
- Use a thick wire (1.25 to 2.0mm²) for grounding.

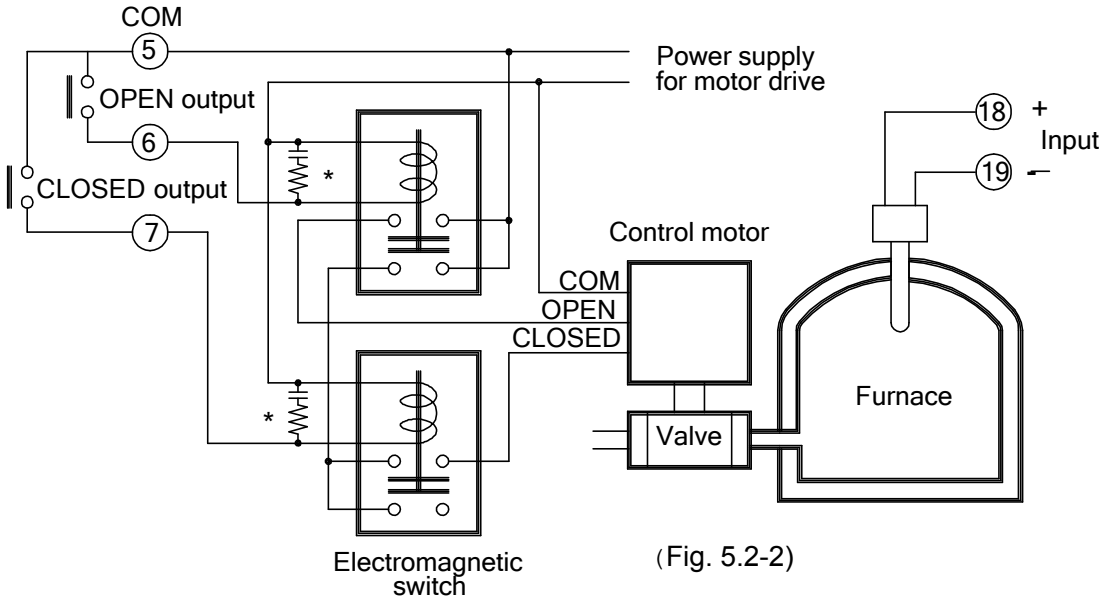
(Example) PC-935 type



(Fig. 5.2-1)

* To prevent the unit from harmful effects of unexpected high level noise, it is recommended that a surge absorber be installed between the electromagnetic switch coils.

(Example) PC-955 type

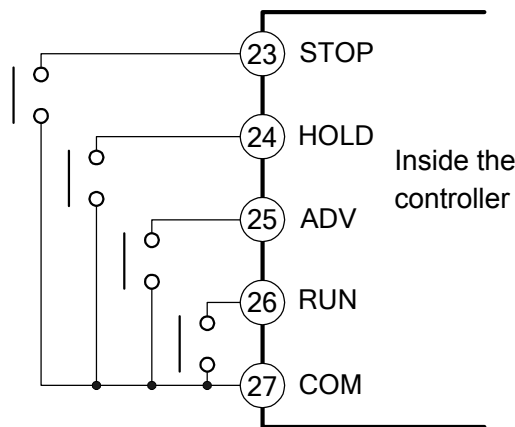
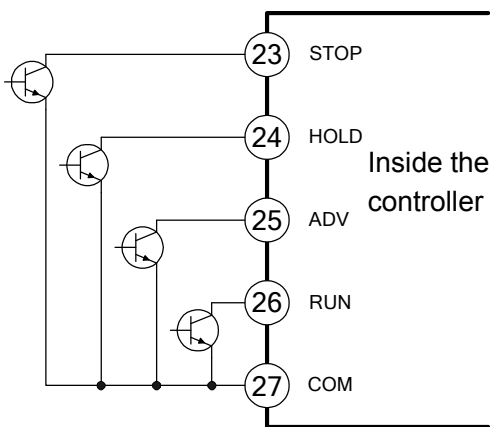


* To prevent the unit from harmful effects of unexpected high level noise, it is recommended that a surge absorber be installed between the electromagnetic switch coils.

• External operation input terminals

Open collector input

Contact (pulse) input

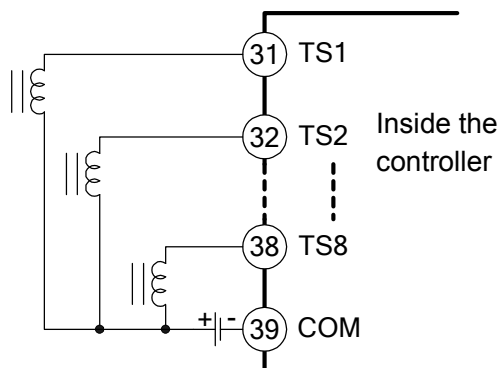
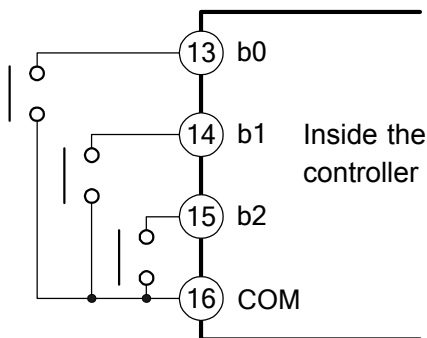


• Pattern number external selection

• Time signal output terminals (TS option)

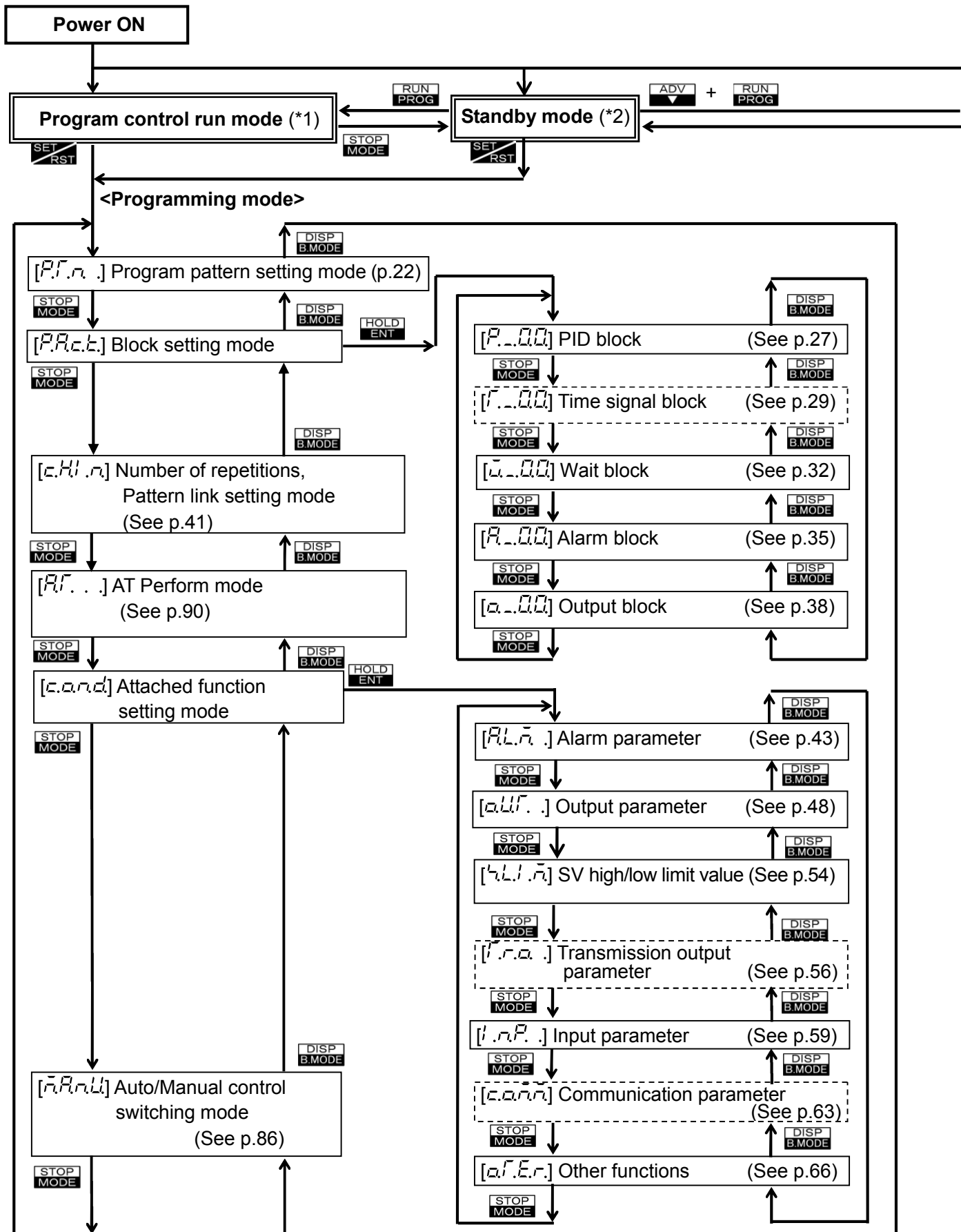
Open collector output: 8 circuits

Capacity: 24V DC Maximum 50mA

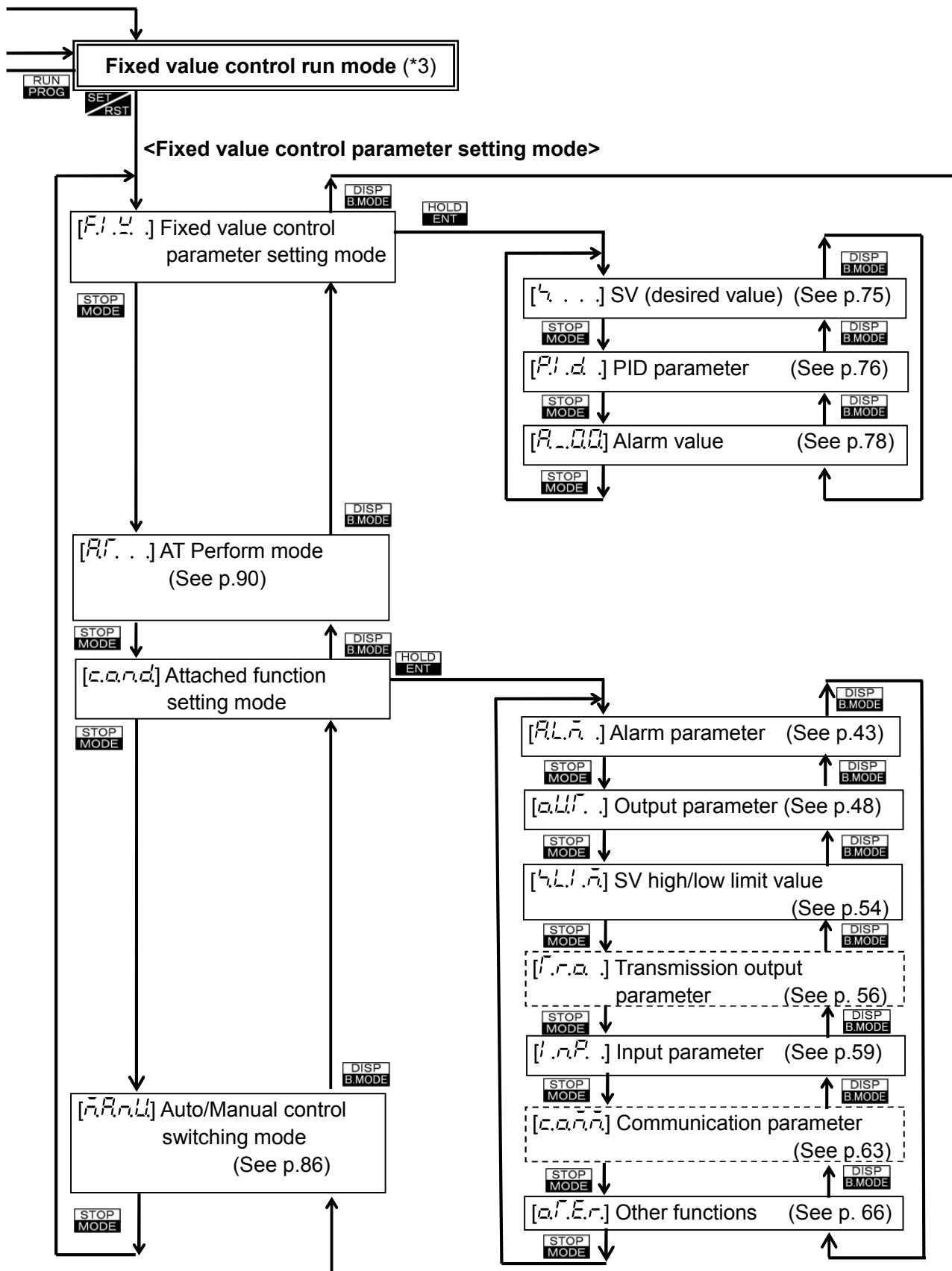


6. Operations

6.1 Operation flowchart



- If the **SET/RST** key is pressed in any mode, the mode returns to (*1), (*2) or (*3).
- Setting items with dotted lines are optional, and they appear only when the options are added.



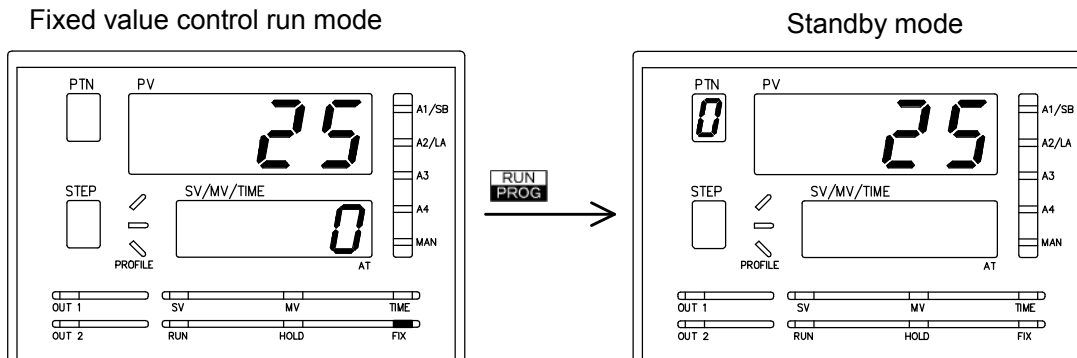
6.2 Key operation when setting

- Press the **PTN** or **ADV** key to change the set values or for selection.
When the **PTN** and **FAST** keys or the **ADV** and **FAST** keys are pressed simultaneously, the numeric value changes faster when setting.

- To register the set values or selection, use the **STOP MODE** or **HOLD ENT** key.
- To revert to the Program control run mode, Standby mode or Fixed value control run mode from any setting mode, press the **SET RST** key.

6.3 Program pattern setting

If the current mode is Fixed value control run mode, press the **RUN PROG** key to move to Standby mode.



The indicator (FIX) is lit.

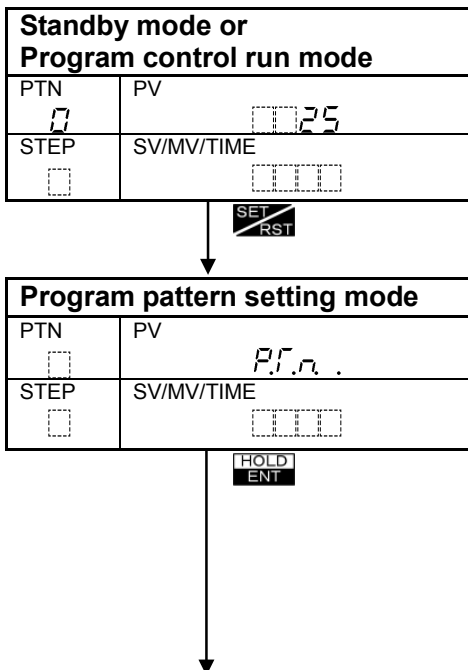
The indicator (FIX) is unlit.

(Indications of each display and indicator differ depending on the status of the instrument.)

(Fig. 6.3-1)

Program pattern setting

The setting procedures are shown below. Refer to p.122 (Program pattern graphing example).



Pattern number	
PTN 0	PV Pn0
STEP 0	SV/MV/TIME 000

- Selection: 0 to 9
- Default value: Pattern number 0.

HOLD
ENT

Step 0 SV	
PTN 0	PV TEMP
STEP 0	SV/MV/TIME 500

- Step SV is the value at the end of the step.
- Setting range: SV low limit to SV high limit value
- Default value: 0°C.

HOLD
ENT

Step 0 time	
PTN 0	PV TIME
STEP 0	SV/MV/TIME 0030

- Step time is the processing time of the step.
- Setting range: 00.00 to 99.59
(Hour:Minute, or Minute:Second)
The time unit can be changed during
Step time unit selection mode.
- Default value: 00.00 (Hour:Minute).

HOLD
ENT

Step 0 PID block number	
PTN 0	PV _PID
STEP 0	SV/MV/TIME 001

- Selects PID block number.
PID block number is the number which was set during PID
block data setting mode.
- Selection: 0 to 9
- Default value: PID block number 0.

HOLD
ENT

Step 0 Time signal 1 (TS1) block number	
PTN 0	PV _TS1
STEP 0	SV/MV/TIME 000

- Selects Time signal 1 (TS1) block number.
TS1 block number is the number which was set during TS
block data setting mode.
- Available only when Time signal output (TS option) is added.
Not available if Status output (RUN) is selected during [Time
signal output/Status output (RUN) selection for TS1].
- Selection: 0 to 15
- Default value: TS1 block number 0.

HOLD
ENT

Selection method, number and default values from [Time signal 2 (TS2) block number section] to [Time signal 8 (TS8) block number selection] are the same as those of the [Time signal 1 (TS1) block number section], however, the following are different.

- Time signal output/Status output (RUN) selection for TS1.
- Time signal output/Status output (HOLD) selection for TS2.
- Time signal output/Status output (WAIT) selection for TS3.
- Time signal output/Status output (FAST) selection for TS4.
- Time signal output/Status output (STOP) selection for TS5.

HOLD
ENT

Step 0 Wait block number	
PTN 0	PV _WAIT
STEP 0	SV/MV/TIME 0001

- Selects Wait block number.
Wait block number is the number which was set during Wait block data setting mode.
- Selection: 0 to 9
- Default value: Wait block number 0.

HOLD
ENT

Step 0 Alarm block number	
PTN 0	PV _ALN
STEP 0	SV/MV/TIME 0001

- Selects Alarm block number.
Alarm block number is the number which was set during Alarm block data setting mode.
- Selection: 0 to 9
- Default value: Alarm block number 0.

HOLD
ENT

Step 0 Output block number	
PTN 0	PV _OUT
STEP 0	SV/MV/TIME 0000

- Selects Output block number.
Output block number is the number which was set during Output block data setting mode.
- Selection: 0 to 9
- Default value: Output block number 0.

HOLD
ENT




Data setting for Step 0 is completed. The indication on the Step display will be changed to $\dot{1}$ (1), and the unit proceeds to **Step 1 SV setting**.



To set other required items from Step 1 to Step 9, repeat settings as **Step 0 (SV setting to Output block number selection)**

If the  key is pressed in the mode **Step 9 Output block number selection**, the unit returns to **Step 0 SV setting**.




When settings are completed, press the  key.
The unit returns to the **Standby** or **Program control run mode**.

6.4 How to clear set values

Data for and after any step number in the program pattern can be cleared, and all set values can be cleared as well.


If the data has been cleared once, the pattern data must be set again since the lost data cannot be restored.

- **How to clear the program pattern**

Press the  key for 3 seconds for any item in the program pattern setting mode, then the program pattern data for and after the step number being displayed on the Step number display will be cleared, and the data returns to default values.




<Example>

When clearing the program pattern for and after Step 3 in Pattern 0.

At any setting item in Step 3, if the  key is pressed for 3 seconds, the data from Step 3 to Step 9 in Pattern 0 will be cleared.

(Data from Step 0 to Step 2 in Pattern 0 and Data from Pattern 1 to Pattern 9 are not cleared.)

- **How to clear all set values**

In the standby mode, press the ,  and  keys at the same time for 3 seconds.

All set values except the proportional cycle of OUT1 and OUT2 return to default values, and the PV display indicates [ε L r □].

When the clearing is complete, [ε L r □] on the PV display disappears, and the unit returns to Standby.

6.5 Block data setting

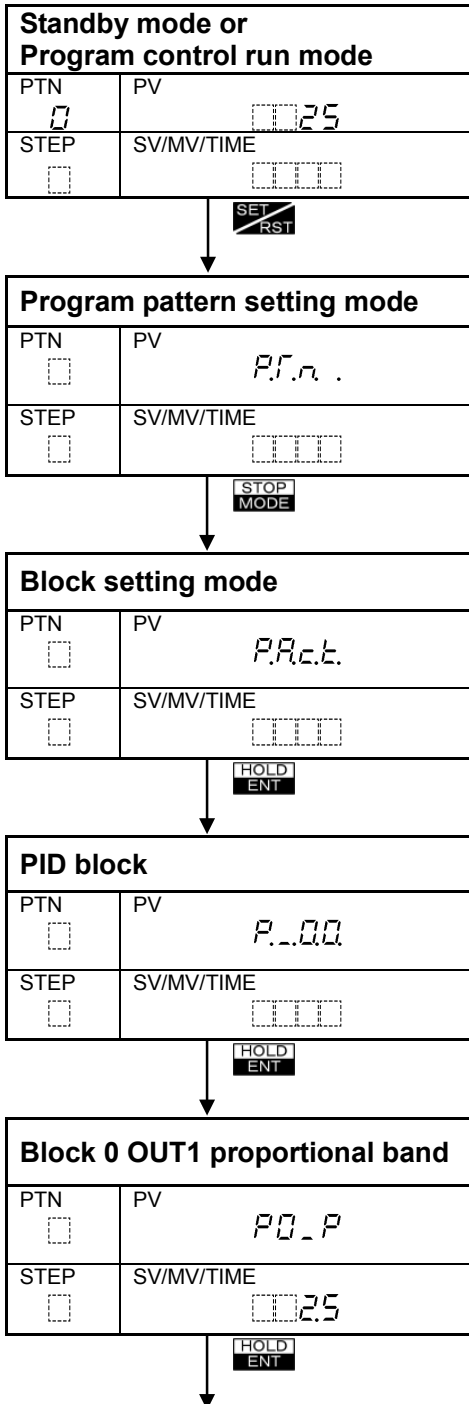
Block setting mode includes [PID block], [Time signal block], [Wait block], [Alarm block] and [Output block].

To set each block, make sure that the mode is Standby mode or Program control run mode.

If the current mode is in the Fixed value control run mode, press the **RUN** **PROG** key to go to the Standby mode. Refer to (Fig. 6.3-1).

6.5.1 PID block data setting

The setting procedures are shown below. Refer to p.122 (Program pattern graphing example).



- Sets OUT1 proportional band for Block 0. ON/OFF control when set to 0.0
- Setting range: 0.0 to 999.9% (For PC-935)
0.1 to 999.9% (For PC-955)
- Default value: 2.5%

Block 0 Integral time	
PTN <input type="checkbox"/>	PV P0_I
STEP <input type="checkbox"/>	SV/MV/TIME 200

- Sets the Integral time for Block 0. Setting the value to 0 disables the function.
- Setting range: 0 to 3600 sec. (For PC-935)
1 to 3600 sec. (For PC-955)
- Default value: 200 sec.

Block 0 Derivative time	
PTN <input type="checkbox"/>	PV P0_d
STEP <input type="checkbox"/>	SV/MV/TIME 50

- Sets the Derivative time for Block 0. Setting the value to 0 disables the function.
- Setting range: 0 to 1800 sec.
- Default value: 50 sec.

Block 0 ARW	
PTN <input type="checkbox"/>	PV P0_n
STEP <input type="checkbox"/>	SV/MV/TIME 50

- Sets the ARW (Anti-reset windup) value for Block 0. Setting the value to 0 disables the function.
- Setting range: 0 to 100 %
- Default value: 50 %

Block 0 OUT2 proportional band	
PTN <input type="checkbox"/>	PV P0Pb
STEP <input type="checkbox"/>	SV/MV/TIME 10

- Sets the OUT2 proportional band for Block 0. Multiplying factor setting to OUT1 proportional band. The equation is as follows.
ON/OFF control when OUT1 or OUT2 proportional band is set to 0.0.
- Available only when the Heating/Cooling control (DR, DS or DA option) is added.
- Not available for the PC-955 type.
- Setting range: 0.0 to 10.0 (Multiplying factor)
- Default value: 1.0

<Equation>

$$\text{OUT2 proportional band} = \text{OUT1 proportional band} \times \text{Multiplying factor}$$

PID block data setting for Block 0 is completed. The indication on the PV display will be changed to [P1 - P], and the unit proceeds to **Block 1 OUT1 proportional band setting**.

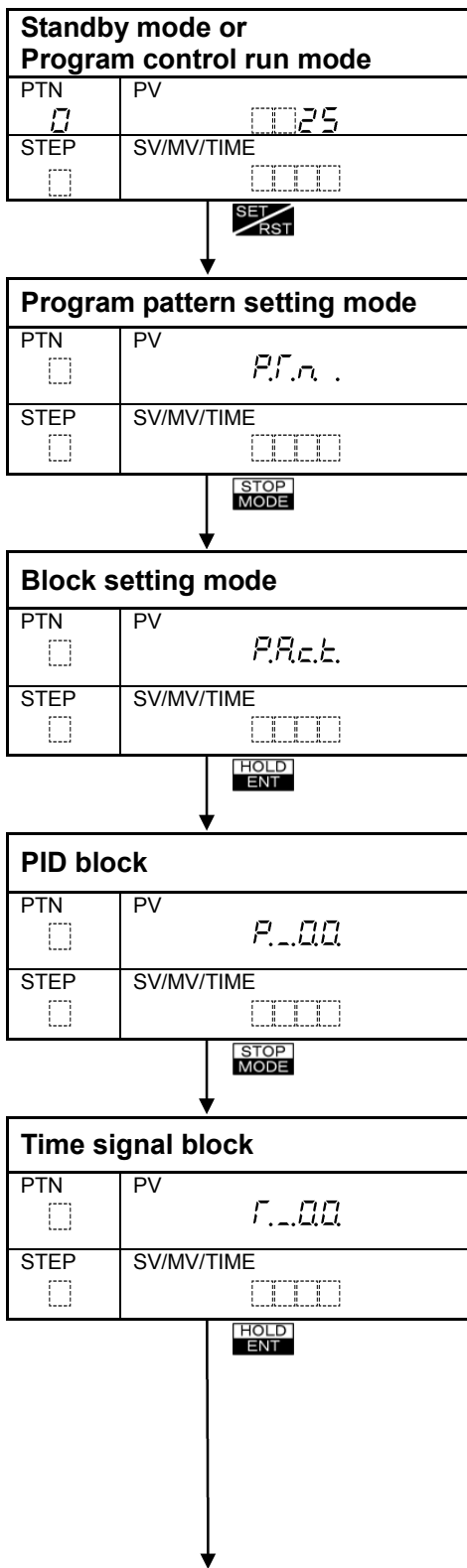
To set other required items from Block 1 to Block 9, repeat settings as **Block 0 (OUT1 proportional band setting to OUT2 proportional band setting)**.
If the **HOLD ENT** key is pressed in the mode **Block 9 OUT2 proportional band setting**, the unit returns to **Block 0 OUT1 proportional band setting**.

When settings are completed, press the **SET RST** key.
The unit returns to the **Standby** or **Program control run mode**.

6.5.2 Time signal block data setting

If the Time signal output (TS option) is added, Time signal block [r...00] will be indicated on the PV display.

The setting procedures are shown below. Refer to p.122 (Program pattern graphing example).



Block 0 Time signal output OFF time	
PTN <input type="checkbox"/>	PV 00.F
STEP <input type="checkbox"/>	SV/MV/TIME 0000

- Sets the Time signal output OFF time for Block 0.
- Setting range: 00.00 to 99.59
(Hour:Minute or Minute:Second)
Time unit can be changed during Step time unit selection mode.
- Default value: 00.00 (Hour:Minute)

HOLD
ENT

Block 0 Time signal output ON time	
PTN <input type="checkbox"/>	PV 00.n
STEP <input type="checkbox"/>	SV/MV/TIME 0000

- Sets the Time signal output ON time for Block 0.
- Setting range: 00.00 to 99.59
(Hour:Minute or Minute:Second)
Time unit can be changed during Step time unit selection mode.
- Default value: 00.00 (Hour:Minute)

HOLD
ENT

Block 0 Time signal block data setting is completed. The indication on the PV display will be changed to [0 F], and the unit proceeds to **Block 1 Time signal output OFF time setting**.

To set other required items, repeat settings as **Block 0 (Time signal output OFF time setting to Time signal output ON time setting)**.

If the **HOLD** key is pressed in the mode **Block 15 Time signal output ON time setting**, the unit returns to **Block 0 Time signal output OFF time setting**.

When the setting is completed, press the **SET** key.
The unit returns to the **Standby** or **Program control run mode**.

[Time signal function]

During program control, this provides Time signal outputs for each step within step time by setting the output OFF time and ON time.

- A maximum of 8 Time signal outputs (OFF time and ON time) can be set for each step number.
- By combining Output OFF time and Output ON time in one block, up to 16 blocks can be set.

(1) Time signal output operates in a sequence of Output OFF time and then Output ON time.

The signal automatically turns OFF when ON time expires within a step.

(2) If ON time is set to the same value as the Step time, the Time signal output will turn OFF for a brief moment while Step numbers change.

Therefore, set the Time signal ON time longer than the step time so that Time signal output may turn ON even when steps changes.

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

Program pattern example

Program pattern (Pattern No.0)		
Step No.	0	1
500		
0		
Step SV	500	500
Step time (Hour:Minute)	0:30	1:00
PID block number	1	1
Time signal 1 block No.	0	1
ON		
OFF		
Time signal 2 block No.	2	2
ON		
OFF		
Time signal 3 block No.	1	2
ON		
OFF		
Time signal 4 block No.	1	1
ON		
OFF		
Output block number	0	1

(1) Time signal output turns OFF after Time signal output ON time has passed.

(2) If ON time is set to the same value as Step time, the Time signal output will turn OFF for a brief moment while Step numbers change.

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

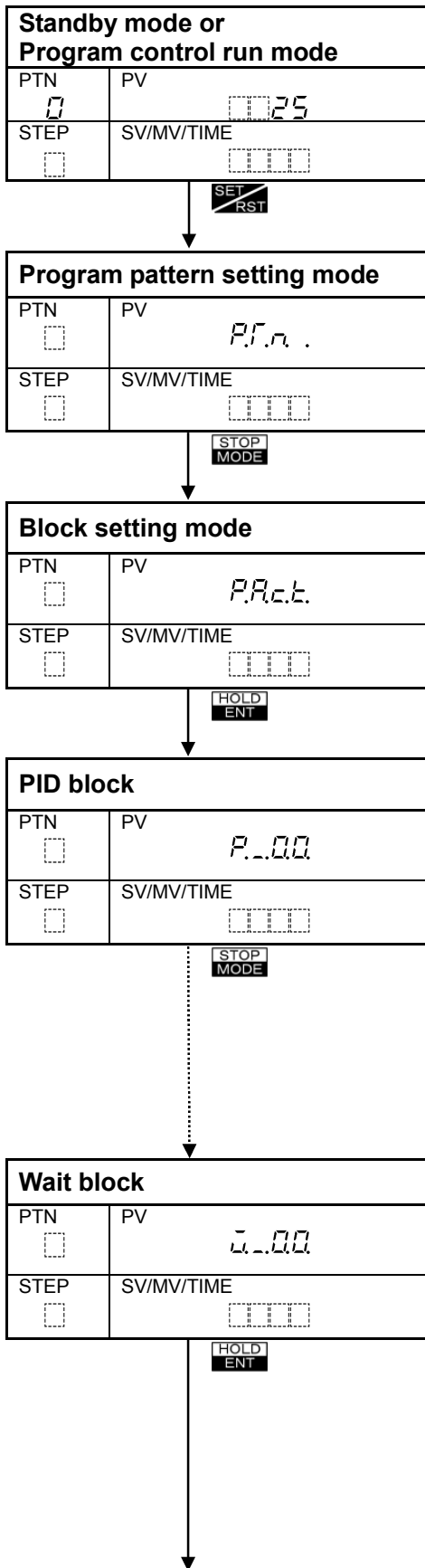
(Fig. 6.5.2-1)

Time signal block setting example

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

6.5.3 Wait block data setting

The setting procedures are shown below. Refer to p.122 (Program pattern graphing example).



Press the **STOP/MODE** key until the Wait block mode[0..00] is indicated on the PV display.
 If [0..00] is passed by mistake, use the **DISP/B.MODE** key.

Block 0 Wait value	
PTN □	PV 20.0
STEP □	SV/MV/TIME 000

HOLD
ENT

- Sets the Wait value for Block 0.
Wait action will be disabled if the wait value is set to 0 or 0.0.
- Setting range: 0 to 100°C(°F)
Thermocouple T or RTD with a decimal point:
0.0 to 100.0°C(°F)
DC input: 0 to 1000 (The placement of the decimal point follows the selection.)
- Default value: 0°C

Wait value setting for Block 0 is completed. The indication on the PV display will be changed to [□ / □], and the unit proceeds to **Block 1 Wait value setting**.

To set other required items from Block 1 to Block 9, repeat as **Block 0 Wait value setting**.

If the **HOLD ENT** key is pressed in the mode **Block 9 Wait value setting**, the unit returns to **Block 0 Wait value setting**.

When the setting is completed, press the **SET RST** key.
The unit returns to the **Standby** or **Program control run mode**.

Wait function

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

The step time progress is suspended at that time.

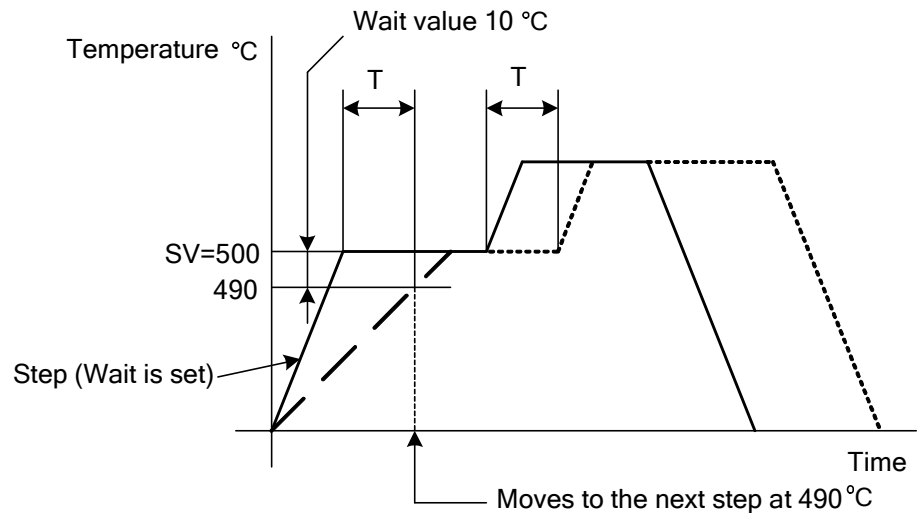
The step number flashes during the Wait action.

The Wait function works on the condition that:

$$SV - \text{Wait value} \leq PV \leq SV + \text{Wait value}$$

- In the case the program pattern is rising:

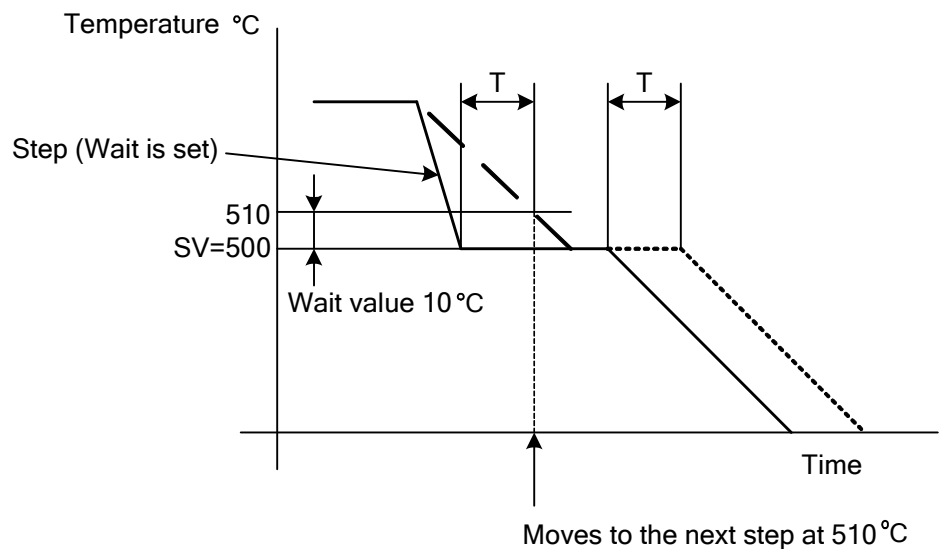
$$SV - \text{Wait value} \leq PV$$



(Fig. 6.5.3-1)

- In the case the program pattern is falling:

$$PV \leq SV + \text{Wait value}$$



(Fig. 6.5.3-2)

———— Program pattern

- - - - - PV (process variable)

..... Program pattern which is delayed by T due to the wait function

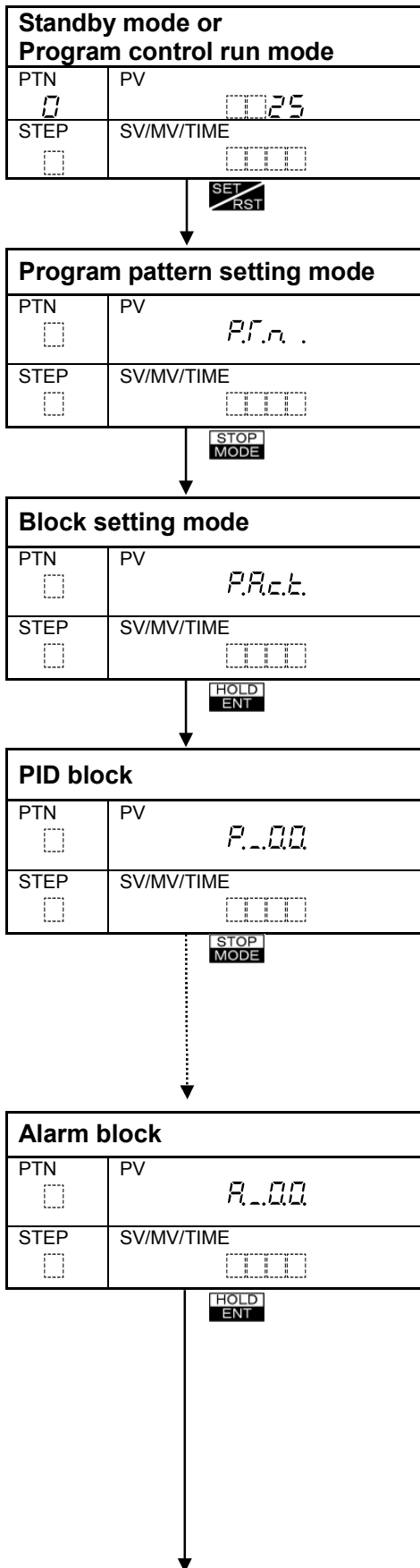
Wait function cancellation

To cancel the Wait function, press the **ADV** or **STOP MODE** key.

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

6.5.4 Alarm block data setting

The setting procedures are shown below. Refer to p.122 (Program pattern graphing example).



Press the **STOP**/**MODE** key until the Alarm block mode [A..00] is indicated on the PV display.
 If [A..00] is passed by mistake, use the **DISP**/**B.MODE** key.

Block 0 Alarm 1 (A1) value	
PTN <input type="checkbox"/>	PV RD_1
STEP <input type="checkbox"/>	SV/MV/TIME 0000

HOLD
ENT

Block 0 Alarm 2 (A2) value	
PTN <input type="checkbox"/>	PV RD_2
STEP <input type="checkbox"/>	SV/MV/TIME 0000

HOLD
ENT

Block 0 Alarm 3 (A3) value	
PTN <input type="checkbox"/>	PV RD_3
STEP <input type="checkbox"/>	SV/MV/TIME 0000

HOLD
ENT

Block 0 Alarm 4 (A4) value	
PTN <input type="checkbox"/>	PV RD_4
STEP <input type="checkbox"/>	SV/MV/TIME 0000

HOLD
ENT

- Sets Alarm 1 (A1) value for Block 0.
- Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm)
- Not available because Pattern end 1 output has been selected as a default value of Alarm 1 (A1).
Not available if No alarm action is selected by Rotary switch (SW302).
- When using Alarm 1 (A1) as an alarm action, select Alarm 1 type by Rotary switch SW302 (A1).
- Setting range: See (Table 6.5.4-1).

- Sets Alarm 2 (A2) value for Block 0.
- Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm)
- Not available for the following cases.
 - (1) A2 option is not added.
 - (2) No alarm action or Pattern end 2 output is selected by Rotary switch (SW301).
 - (3) PC-955 type.
- Setting range: See (Table 6.5.4-1).
- Default value: 0°C

- Sets Alarm 3 (A3) value for Block 0.
- Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm)
- Not available if No alarm action or Pattern end 3 output is selected by key operation during Alarm 3 (A3) type selection mode.
- Setting range: See (Table 6.5.4-1).
- Default value: 0°C

- Sets Alarm 4 (A4) value for Block 0.
- Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm)
- Not available if No alarm action or Pattern end 4 output is selected by key operation during Alarm 4 (A4) type selection mode.
- Setting range: See (Table 6.5.4-1).
- Default value: 0°C

Alarm block data setting for Block 0 is completed. The indication on the PV display will be changed to [A1], and the unit proceeds to **Block 1 Alarm 1 (A1) value setting**.

To set other required blocks, repeat settings as **Block 0 [Alarm 1 (A1) value setting to Alarm 4 (A4) value setting]**.

If the **HOLD/ENT** key is pressed in the mode **Block 9 Alarm 4 (A4) value setting**, the unit returns to **Block 0 Alarm 1 (A1) value setting**.

When the setting is completed, press the **SET/RST** key.
The unit returns to the **Standby** or **Program control run mode**.

● **Alarm 1 to Alarm 4 setting range (The same range is applicable to the alarm standby function.)**

(Table 6.5.4-1)

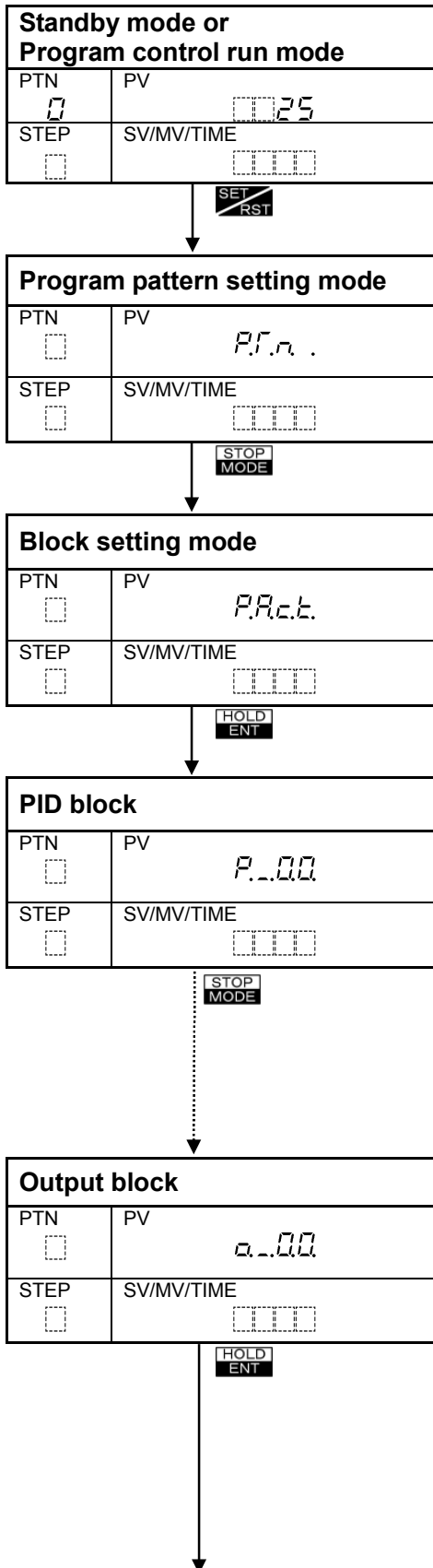
Alarm type	Setting range	Setting range (with decimal point)
High limit alarm (*)	-Input span to Input span	-199.9 to Input span
Low limit alarm (*)	-Input span to Input span	-199.9 to Input span
High/Low limits alarm (*)	0 to Input span	0.0 to Input span
High/Low limit range alarm (*)	0 to Input span	0.0 to Input span
Process high alarm	Input range low limit value to Input range high limit value	-199.9 to Input range high limit value
Process low alarm	Input range low limit value to Input range high limit value	-199.9 to Input range high limit value

(*): Deviation setting

- For DC input, input span is the same as the scaling span.
The negative low limit value is -199.9. (The placement of the decimal point follows the selection.)
- When the input type is RTD with a decimal point or thermocouple T, the negative low limit value is -199.9. (The placement of the decimal point follows the selection.)

6.5.5 Output block data setting

The setting procedures are shown below. Refer to p.122 (Program pattern graphing example).



Press the **STOP/MODE** key several times until the Output block mode [a..00] is indicated on the PV display. If [a..00] is passed by mistake, use the **DISP/B.MODE** key.

Block 0 OUT1 high limit value	
PTN <input type="checkbox"/>	PV 00.H
STEP <input type="checkbox"/>	SV/MV/TIME 100

HOLD
ENT

Block 0 OUT1 low limit value	
PTN <input type="checkbox"/>	PV 00.L
STEP <input type="checkbox"/>	SV/MV/TIME 000

HOLD
ENT

Block 0 OUT2 high limit value	
PTN <input type="checkbox"/>	PV 00.Hb
STEP <input type="checkbox"/>	SV/MV/TIME 100

HOLD
ENT

Block 0 OUT2 low limit value	
PTN <input type="checkbox"/>	PV 00.Lb
STEP <input type="checkbox"/>	SV/MV/TIME 000

HOLD
ENT

- Sets OUT1 high limit value for Block 0.
- Setting range: OUT1 low limit value to 100%
DC current output: OUT1 low limit value to 105%
- Default value: 100%.

- Sets OUT1 low limit value for Block 0.
- Setting range: 0% to OUT1 high limit value
DC current output: -5% to OUT1 high limit value
- Default value: 0%.

- Sets OUT2 high limit value for Block 0.
- Available only when the Heating/Cooling control output (OUT2) (DR, DS, DA option) is added.
- Not available for the PC-955 type.
- Setting range: OUT2 low limit value to 100%
DC current output (DA option): OUT2 low limit value to 105%
- Default value: 100%.

- Sets the OUT2 low limit for Block 0.
- Available only when the Heating/Cooling control output (OUT2) (DR, DS, DA option) is added.
- Not available for the PC-955 type.
- Setting range: 0% to OUT2 high limit value
DC current output (DA option): -5% to OUT2 high limit value
- Default value: 0%.

↓

Block 0 OUT1 rate-of-change	
PTN □	PV 00cL
STEP □	SV/MV/TIME 0000

- Sets the OUT1 rate-of-change for Block 0. Setting the value to 0%/sec disables the function.
- Setting range: 0 to 100%/sec
- Default value: 0%/sec

HOLD
ENT

↓

Output block data setting for Block 0 is completed. The indication on the PV display will be changed to [□ L_H], and the unit proceeds to **Block 1 OUT1 high limit setting**.

↓

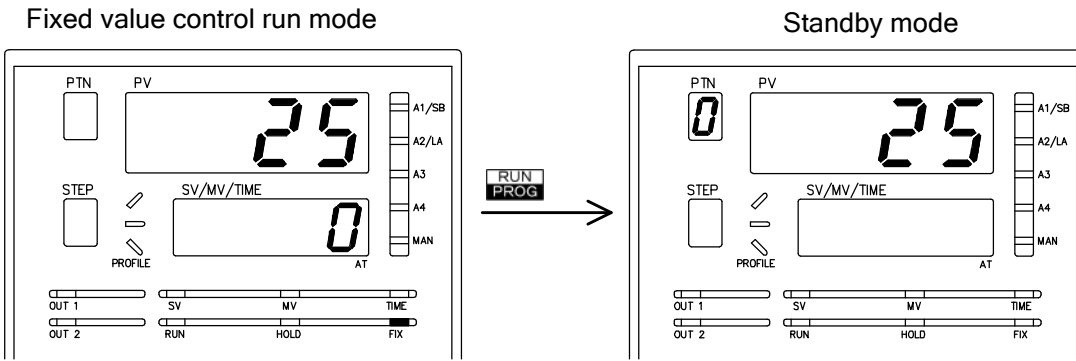
To set other required items, repeat settings as **Block 0 (OUT1 high limit setting to OUT1 rate-of-change setting)**.
 If the **HOLD ENT** key is pressed in the mode **Block 9 OUT1 rate-of-change setting**, the unit returns to **Block 0 OUT1 high limit setting**.

↓

When the setting is completed, press the **SET Rst** key.
 The unit returns to the **Standby** or **Program control run mode**.

6.6 Number of Repetitions of the Pattern, Pattern link setting

If the current mode is Fixed value control run mode, press the **RUN PROG** key to move to Standby mode.



The indicator (FIX) is lit.

The indicator (FIX) is unlit.

(Indications of each display and indicators differ depending on the status of the instrument.)

(Fig. 6.6-1)

Number of repetitions of pattern, pattern link setting

The setting procedures are shown below. Refer to p.122 (Program pattern graphing example).

Standby mode or Program control run mode	
PTN	PV
0	25
STEP	SV/MV/TIME
0	0.00

SET RST

Program pattern setting mode	
PTN	PV
0	P.P.N.
STEP	SV/MV/TIME
0	0.00

STOP MODE

Number of repetitions and Pattern link setting mode	
PTN	PV
0	c.H.I.
STEP	SV/MV/TIME
0	0.00

HOLD ENT

Press the **STOP MODE** key until [c.H.I.] is indicated on PV display.
If [c.H.I.] is passed by mistake, use the **DISP B.MODE** key.

Pattern 0 Number of repetitions	
PTN 0	PV rEPt
STEP □	SV/MV/TIME 000

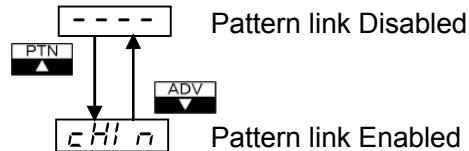
- Sets the Number of repetitions for Pattern 0.
- Setting range: 0 to 9999 times
- Default value: 0 times

HOLD
ENT

Pattern link between Pattern 0 and Pattern 1	
PTN 0	PV cHl n
STEP □	SV/MV/TIME - - - -

- Selects whether to link the program between Pattern 0 and Pattern 1.
- Only pattern numbers in numerical order can be linked. (e.g.)
Pattern 0 and 3: Link impossible
Pattern 0 and 1, 1 and 2: Link possible
- The SV/MV/TIME display will show the below.

HOLD
ENT



Setting for Pattern 0 is completed. The indication on the PTN display will change to “l”, and the unit proceeds to **Pattern 1 Number of Repetitions setting**.

To set the required items from Pattern 1 to Pattern 9, repeat settings as **Pattern 0 (Number of Repetitions setting to Pattern link between Pattern 0 and Pattern 1)**.
If the **HOLD ENT** key is pressed in the mode **Pattern link between Pattern 9 and Pattern 0**, then the unit returns to **Pattern 0 Number of Repetitions setting**.

When the setting is completed, press the **SET RST** key.
The unit returns to the **Standby or Program control run mode**.

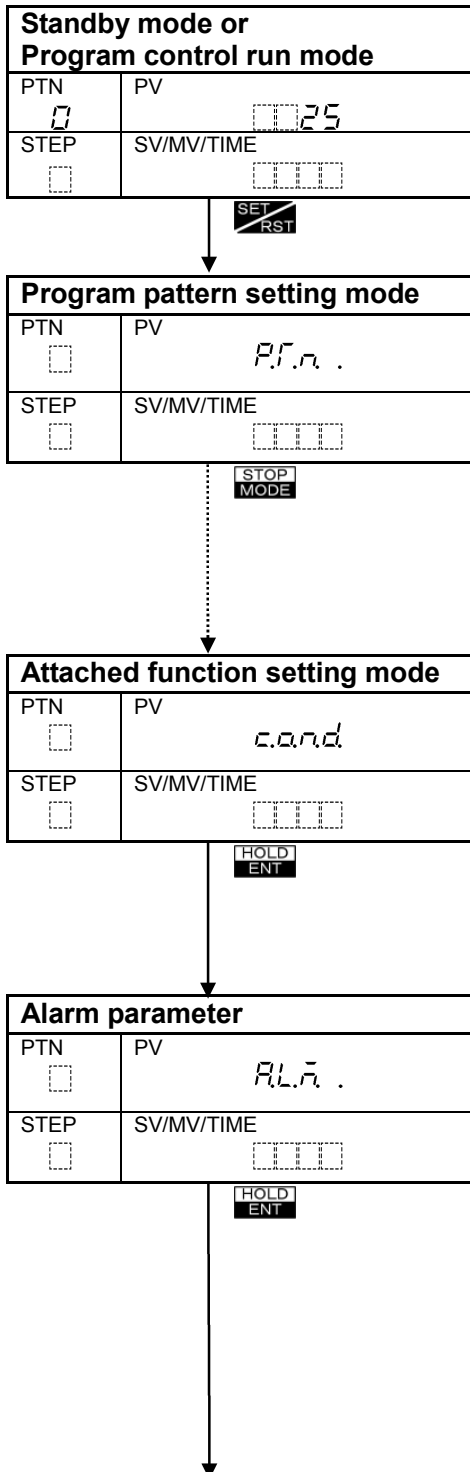
6.7 Attached function setting

Set each parameter for Alarm, Output, SV high/low limit, Transmission output, Input, Communication and Other functions as required.

6.7.1 Alarm parameter setting

The alarm parameter setting items of **Program control run mode** are the same as those of **Fixed value control run mode**.

This section describes how to set the alarm parameters in the **Program control run mode**.



- For Fixed value control parameter setting mode, the characters [F.L.V.] are indicated on the PV display.

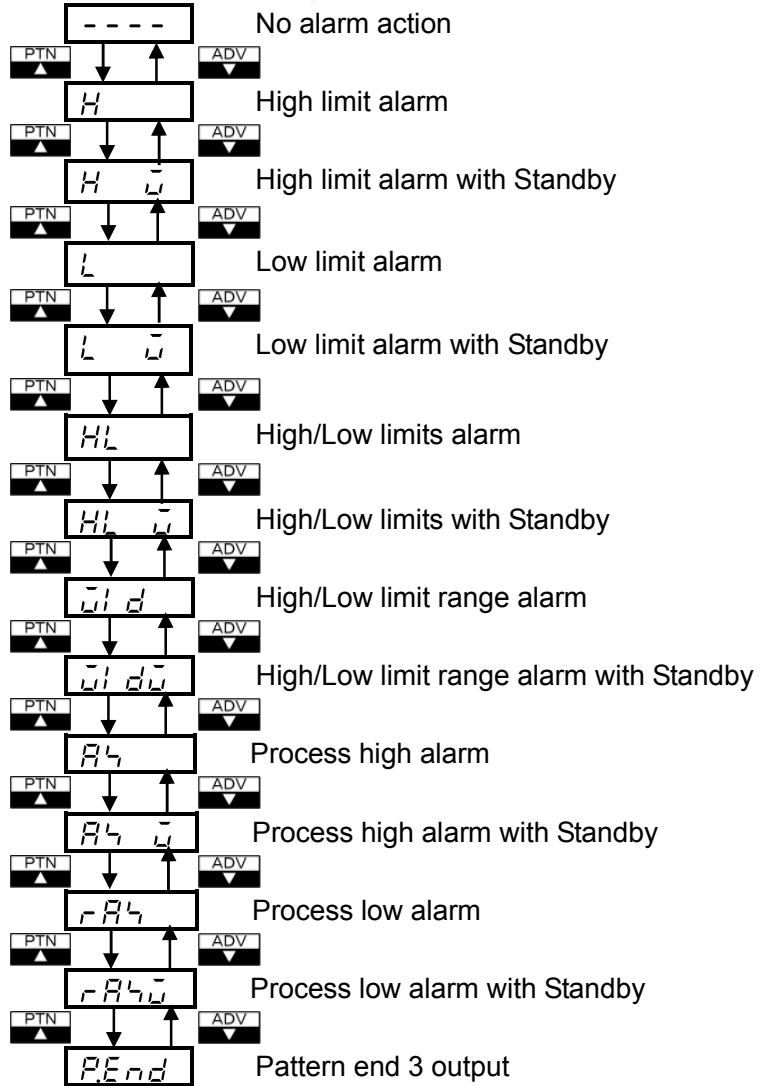
Press the **STOP/MODE** key several times until Attached function setting mode [c.a.n.d.] is indicated on the PV display. If [c.a.n.d.] is passed by mistake, press the **DISP/B.MODE** key.

Alarm 3 (A3) type	
PTN □	PV AL3F
STEP □	SV/MV/TIME H000

- Selects Alarm 3 (A3) type.
- If an alarm type is changed, Alarm 3 (A3) value becomes 0 (0.0).
- Selecting item: See the diagram below.
- Default value: High limit alarm.

HOLD
ENT

The SV/MV/TIME display will show the below.



Alarm 4 (A4) type	
PTN <input type="checkbox"/>	PV AL4F
STEP <input type="checkbox"/>	SV/MV/TIME LO

HOLD
ENT

Alarm 1 (A1) hysteresis	
PTN <input type="checkbox"/>	PV A1H4
STEP <input type="checkbox"/>	SV/MV/TIME 10

HOLD
ENT

Alarm 2 (A2) hysteresis	
PTN <input type="checkbox"/>	PV A2H4
STEP <input type="checkbox"/>	SV/MV/TIME 10

HOLD
ENT

Alarm 3 (A3) hysteresis	
PTN <input type="checkbox"/>	PV A3H4
STEP <input type="checkbox"/>	SV/MV/TIME 10

HOLD
ENT

Alarm 4 (A4) hysteresis	
PTN <input type="checkbox"/>	PV A4H4
STEP <input type="checkbox"/>	SV/MV/TIME 10

HOLD
ENT

- Selects Alarm 4 (A4) type.
- If an alarm type is changed, Alarm 4 (A4) value becomes 0 (0.0).
- Selecting item: The same as Alarm 3 (A3) type selection.
- Default value: Low limit alarm.

- Sets Alarm 1 (A1) hysteresis.
- Not available if Pattern end 1 output is selected, or if No alarm action is selected by the Rotary switch SW302.
- Setting range: 0.1 to 100.0°C(°F)
- Default value: 1.0°C.

- Sets Alarm 2 (A2) hysteresis.
- Not available for the following cases
 - (1) A2 option is not added.
 - (2) No alarm action or Pattern end 2 output is selected by the Rotary switch SW301.
 - (3) PC-955 type.
- Setting range: 0.1 to 100.0°C(°F)
- Default value: 1.0°C

- Sets Alarm 3 (A3) hysteresis.
- Not available if No alarm action or Pattern end 3 output is selected by keypad during Alarm 3 (A3) type selection
- Setting range: 0.1 to 100.0°C(°F)
- Default value: 1.0°C

- Sets Alarm 4 (A4) hysteresis.
- Not available if No alarm action or Pattern end 4 output is selected by keypad during Alarm 4 (A4) type selection.
- Setting range: 0.1 to 100.0°C(°F)
- Default value: 1.0°C

↓

Alarm 1 (A1) delay timer	
PTN <input type="checkbox"/>	PV A1d4
STEP <input type="checkbox"/>	SV/MV/TIME 0000

HOLD
ENT

↓

Alarm 2 (A2) delay timer	
PTN <input type="checkbox"/>	PV A2d4
STEP <input type="checkbox"/>	SV/MV/TIME 0000

HOLD
ENT

↓

Alarm 3 (A3) delay timer	
PTN <input type="checkbox"/>	PV A3d4
STEP <input type="checkbox"/>	SV/MV/TIME 0000

HOLD
ENT

↓

Alarm 4 (A4) delay timer	
PTN <input type="checkbox"/>	PV A4d4
STEP <input type="checkbox"/>	SV/MV/TIME 0000

HOLD
ENT

↓

- Sets Alarm 1 (A1) delay timer.
Alarm output turns ON when the setting time has passed after the PV enters the Alarm output range.
 - Not available if Pattern end 1 output is selected (default value), or if No alarm action is selected by the Rotary switch SW302.
 - Setting range: 0 to 9999 seconds
 - Default value: 0 seconds
-
- Sets Alarm 2 (A2) delay timer.
Alarm output turns ON when the setting time has passed after the PV enters the Alarm output range.
 - Not available for the following cases.
 - (1) A2 option is not added.
 - (2) No alarm action or Pattern end 2 output is selected by the Rotary switch SW301.
 - (3) PC-955 type.
 - Setting range: 0 to 9999 seconds
 - Default value: 0 seconds
-
- Sets Alarm 3 (A3) delay timer.
Alarm output turns ON when the setting time has passed after the PV enters the Alarm output range.
 - Not available if No alarm action or Pattern end 3 output is selected by keypad during Alarm 3 (A3) type selection mode.
 - Setting range: 0 to 9999 seconds
 - Default value: 0 seconds
-
- Sets Alarm 4 (A4) delay timer.
Alarm output turns ON when the setting time has passed after the PV enters the Alarm output range.
 - Not available if No alarm action or Pattern end 4 output is selected by keypad during Alarm 4 (A4) type selection mode.
 - Setting range: 0 to 9999 seconds
 - Default value: 0 seconds

Loop break alarm time	
PTN □	PV LP_F
STEP □	SV/MV/TIME 0000

- Sets the assessment time for the Loop break alarm.
- Available when the Loop break alarm option is added.
- Setting range: 0 to 200 minutes
- Default value: 0 minutes

HOLD
ENT

Loop break alarm span	
PTN □	PV LP_H
STEP □	SV/MV/TIME 0000

- Sets the assessment span for the Loop break alarm.
- Available when the Loop break alarm option is added.
- Setting range: 0 to 100°C (°F)
For thermocouple T, or RTD 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

HOLD
ENT

Setting for Alarm parameter is completed. If the **HOLD ENT** key is pressed in the mode **Loop break alarm span setting**, the unit proceeds to **Alarm 3 (A3) type selection**.

When the setting is completed, press the **SET RST** key.
The unit returns to the **Standby** or **Program control run mode**.

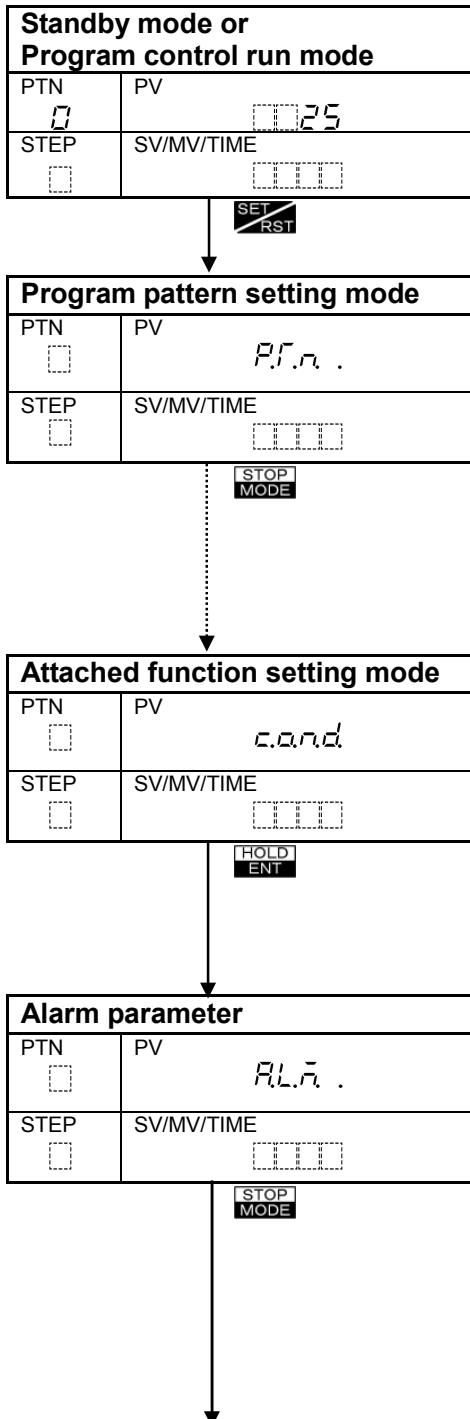
● Loop break alarm

- The alarm will be activated when the PV does not **rise** as much as the span or more within the time it takes to assess the loop break alarm after the MV has reached 100% or the output high limit value.
- The alarm will also be activated when the PV does not **fall** as much as the span or more within the time it takes to assess the loop break alarm after the MV has reached 0% or the output low limit value.
- When the control action is Direct (Cooling), read “**fall**” for “**rise**” and vice versa.

6.7.2 Output parameter setting

Setting items in the **Program control run mode** are almost the same as those of **Fixed value control run mode**. However, setting items such as [OUT1 high limit value], [OUT1 low limit value], [OUT1 rate-of-change], [OUT2 high limit value] and [OUT2 low limit value] in Fixed value control are not indicated in the Program control run mode.

This section describes how to set the output parameters in the **Program control run mode**.



- For Fixed value control parameter setting mode, [*F.V.*] is indicated on the PV display.

Press the **STOP/MODE** key several times until Attached function setting mode [*c.a.n.d.*] is indicated on the PV display. If [*c.a.n.d.*] is passed by mistake, press the **DISP/BMODE** key.

Output parameter	
PTN <input type="checkbox"/>	PV OUT.
STEP <input type="checkbox"/>	SV/MV/TIME 000

HOLD
ENT

OUT1 proportional cycle	
PTN <input type="checkbox"/>	PV 000
STEP <input type="checkbox"/>	SV/MV/TIME 0030

HOLD
ENT

OUT1 high limit value	
PTN <input type="checkbox"/>	PV 0LH0
STEP <input type="checkbox"/>	SV/MV/TIME 0100

HOLD
ENT

OUT1 low limit value	
PTN <input type="checkbox"/>	PV 0LL0
STEP <input type="checkbox"/>	SV/MV/TIME 0000

HOLD
ENT

- Sets OUT1 proportional cycle.
- For the PC-955, OUT1 proportional cycle is the MV computation cycle. Control is performed by computing the MV periodically (with programmable period).
- Not available for the DC current output.
- Setting range: 1 to 120 seconds
- Default value:
 - Relay contact output type: 30sec
 - Non-contact voltage output type: 3sec

- Sets OUT1 high limit value.
- Available only for Fixed value control parameter setting mode.
- Setting range: OUT1 low limit value to 100%
 - DC current output: OUT1 low limit value to 105%
- Default value: 100%.

- Sets OUT1 low limit value.
- Available only for Fixed value control parameter setting mode.
- Setting range: 0% to OUT1 high limit value
 - DC current output: -5% to OUT1 high limit value
- Default value: 0%.

OUT1 ON/OFF hysteresis	
PTN □	PV H44□
STEP □	SV/MV/TIME □□ 10

- Sets OUT1 ON/OFF hysteresis.
- Not available for the PC-955 type.
- Setting range: 0.1 to 100.0°C(°F)
- Default value: 1.0°C

HOLD
ENT

OUT1 rate-of-change	
PTN □	PV o r Rf
STEP □	SV/MV/TIME □□□□

- Sets OUT1 rate-of-change.
- Available only for Fixed value control parameter setting mode.
- Setting range: 0 to 100%/sec
- Default value: 0%/sec

HOLD
ENT

OUT2 proportional cycle	
PTN □	PV c - b□
STEP □	SV/MV/TIME □□ 30

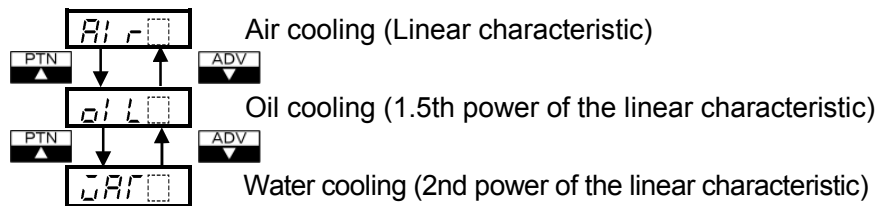
- Sets OUT2 proportional cycle.
- Available only when the DR or DS option is added.
- Not available for the PC-955 type and the DC current output.
- Setting range: 1 to 120 seconds
- Default value:
 - Relay contact output type: 30sec
 - Non-contact voltage output type: 3sec

HOLD
ENT

OUT2 action mode	
PTN □	PV c R c f
STEP □	SV/MV/TIME R f r □

- Selects a cooling action for OUT2.
- Available only when the DR, DS or DA option is added.
- Not available for the PC-955 type.
- Selecting item: The SV/MV/TIME display will show the below.
- Default value: Air cooling

HOLD
ENT



OUT2 high limit value	
PTN <input type="checkbox"/>	PV dLHb
STEP <input type="checkbox"/>	SV/MV/TIME 0100

HOLD
ENT

OUT2 low limit value	
PTN <input type="checkbox"/>	PV dLLb
STEP <input type="checkbox"/>	SV/MV/TIME 0000

HOLD
ENT

OUT2 ON/OFF hysteresis	
PTN <input type="checkbox"/>	PV H44b
STEP <input type="checkbox"/>	SV/MV/TIME 0010

HOLD
ENT

Overlap band/Dead band	
PTN <input type="checkbox"/>	PV db00
STEP <input type="checkbox"/>	SV/MV/TIME 0000

HOLD
ENT

- Sets OUT2 high limit value.
- Available only when the DR, DS or DA option is added.
- Available only for Fixed value control parameter setting mode.
- Not available for the PC-955 type.
- Setting range: OUT2 low limit value to 100%
DC current output: OUT2 low limit value to 105%
- Default value: 100%

- Sets OUT2 low limit value.
- Available only when the DR, DS or DA option is added.
- Available only for Fixed value control parameter setting mode.
- Not available for the PC-955 type.
- Setting range: 0% to OUT2 high limit value
DC current output: -5% to OUT2 high limit value
- Default value: 0%

- Sets OUT2 ON/OFF hysteresis.
- Available only when the DR, DS or DA option is added.
- Not available for the PC-955 type.
- Setting range: 0.1 to 100.0°C (°F)
- Default value: 1.0°C

- Sets the Overlap band/Dead band of OUT1 and OUT2.
Dead band: + setting, Overlap band: - setting
- Available only when the DR, DS or DA option is added.
- Not available for the PC-955 type.
- Setting range: ±OUT1 proportional band converted value
- Default value: 0.0°C

How to calculate ±Proportional band converted value:

[Calculation example] Sensor input: Thermocouple K, -200 to 1370°C
Proportional band: 10.0%

Calculating equation: $P_c = \pm(S_r \times P_b)$

P_c : Proportional band converted value (±157)

Where S_r : Sensor span (1570)

P_b : Proportional band (0.1)

According to the calculation above mentioned, the Overlap band/Dead band setting range is ±157.0°C.

↓

Open/Closed output dead band	
PTN <input type="checkbox"/>	PV <i>P_db</i>
STEP <input type="checkbox"/>	SV/MV/TIME <i>030</i>

- Sets the dead band value for Open output and Closed output.
- Available only for the PC-955 type.
- Setting range: 0.1 to 100.0% (OUT1 proportional band converted value)
- Default value: 3.0%

HOLD
ENT

↓

Open output time	
PTN <input type="checkbox"/>	PV <i>P_oT0</i>
STEP <input type="checkbox"/>	SV/MV/TIME <i>0360</i>

- Sets the time from valve Fully Closed to valve Fully Open.
- Available only for the PC-955 type.
- Setting range: 0.1 to 999.9 seconds
- Default value: 30.0 seconds

HOLD
ENT

↓

Closed output time	
PTN <input type="checkbox"/>	PV <i>P_cT0</i>
STEP <input type="checkbox"/>	SV/MV/TIME <i>0360</i>

- Sets the time from valve Fully Open to valve Fully Closed.
- Available only for the PC-955 type.
- Setting range: 0.1 to 999.9 seconds
- Default value: 30.0 seconds

HOLD
ENT

↓

The unit returns to **OUT1** proportional cycle setting.

↓

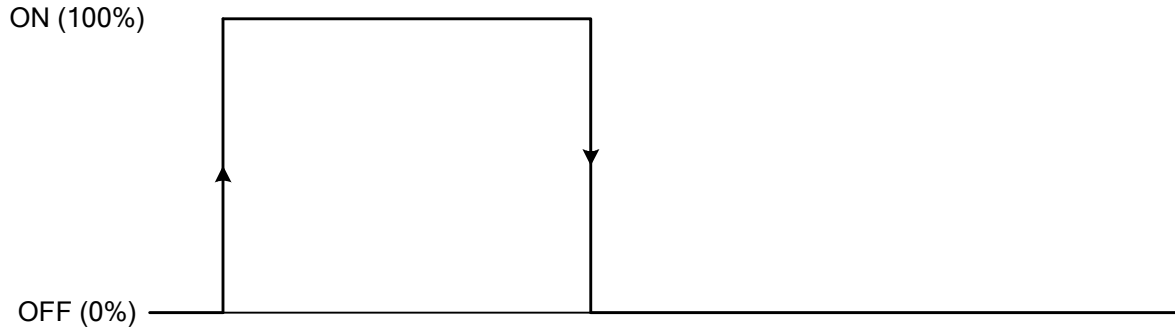
When the setting is completed, press the  key.
The unit returns to the **Standby** or **Program control run mode**.

● **OUT1 rate-of-change**

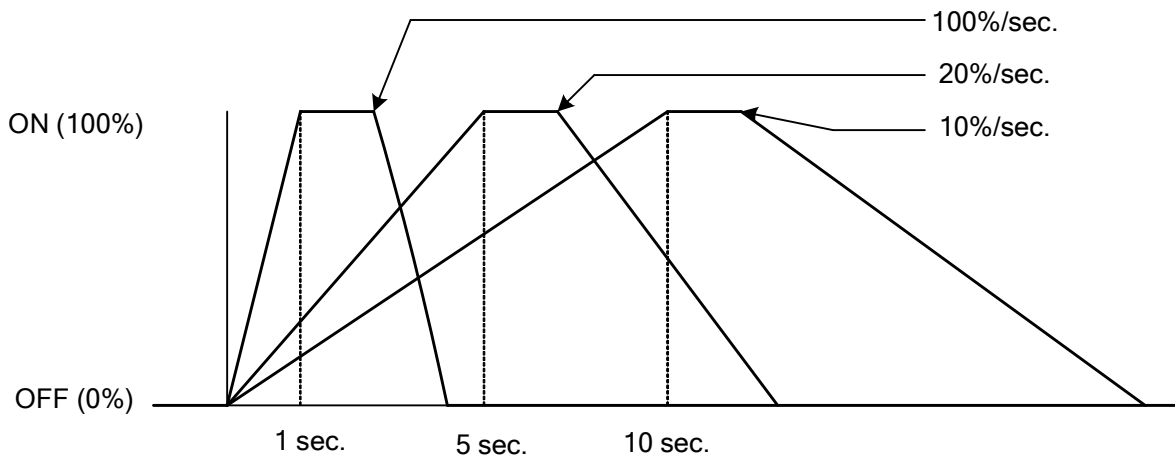
In the case of heating control, when the PV (process variable) is lower than the SV (desired value), the OUT1 MV (manipulated variable) generally changes from OFF to ON as shown in (Fig. 6.7.2-1).

However, if OUT1 rate-of-change is set, the rate-of-change of OUT1 MV can be changed as shown in (Fig. 6.7.2-2).

For example, this function can be used for a high temperature heater (used at approximate 1500 to 1800°C) which has to be heated gradually, as the heater is easily burnt out if the power is supplied rapidly.



(Fig. 6.7.2-1)



(Fig. 6.7.2-2)

● **Automatic measurement of Open output time and Closed output time**

Press the **PTN** and **ADV** keys simultaneously after checking that the valve position is Fully Closed or Fully Open.

The mode switches to automatic measurement of Open output time or Closed output time, and counting starts from 0.0 seconds. (Control motor open output or closed output is turned ON, and the motor will move to open or closed direction.)

When the valve reaches Fully Open or Fully Closed, press the **FAST** key. Counting stops, and Open output or Closed output time will be automatically registered. (Control motor open or closed output is turned OFF.)

6.7.3 SV high/low limit value setting

Setting items in the **Fixed value control run mode** are the same as those of **Program control run mode**.

This section describes how to set the SV high/low limit value in the **Program control run mode**.

Standby mode or Program control run mode	
PTN	PV
0	025
STEP	SV/MV/TIME
□	□□□

SET
RST

Program pattern setting mode	
PTN	PV
□	P.P.N.
STEP	SV/MV/TIME
□	□□□

STOP
MODE

Attached function setting mode	
PTN	PV
□	c.a.n.d.
STEP	SV/MV/TIME
□	□□□

HOLD
ENT

Alarm parameter	
PTN	PV
□	AL.N.
STEP	SV/MV/TIME
□	□□□

STOP
MODE

- For Fixed value control parameter setting mode, [P.P.N.] is indicated on the PV display.

Press the **STOP MODE** key several times until Attached function setting mode [c.a.n.d.] is indicated on the PV display. If [c.a.n.d.] is passed by mistake, press the **DISP B.MODE** key.

Press the **STOP MODE** key until SV high/low limit value mode [AL.N.] is indicated on the PV display. If [AL.N.] is passed by mistake, use the **DISP B.MODE** key.

SV high/low limit value	
PTN <input type="checkbox"/>	PV 42.5
STEP <input type="checkbox"/>	SV/MV/TIME 000

HOLD
ENT

SV high limit value	
PTN <input type="checkbox"/>	PV 42.0
STEP <input type="checkbox"/>	SV/MV/TIME 1370

HOLD
ENT

SV low limit value	
PTN <input type="checkbox"/>	PV 42.0
STEP <input type="checkbox"/>	SV/MV/TIME -200

HOLD
ENT

The unit returns to **SV high limit setting**.

When the required settings are completed, press the  key.
The unit returns to the **Standby** or **Program control run mode**.

- Sets the SV high limit value.
- Setting range: SV low limit to Input range high limit value
DC input: SV low limit to Scaling high limit value
(The placement of the decimal point follows the selection.)
- Default value: 1370°C
- Sets the SV low limit value.
- Setting range: Input range low limit to SV high limit value
DC input: Scaling low limit to SV high limit value
(The placement of the decimal point follows the selection.)
- Default value: -200°C

6.7.4 Transmission output parameter setting

Setting items in the **Program control run mode** are the same as those of **Fixed value control run mode**.

If the Transmission output (TA, TV option) is added, [*f.r.d.*] will be indicated.

This section describes how to set the Transmission output parameter in the **Program control run mode**.

Standby mode or Program control run mode	
PTN	PV
<input type="checkbox"/>	025
STEP	SV/MV/TIME
<input type="checkbox"/>	000

SET
RST

Program pattern setting mode	
PTN	PV
<input type="checkbox"/>	<i>P.F.n.</i>
STEP	SV/MV/TIME
<input type="checkbox"/>	000

STOP
MODE

Attached function setting mode	
PTN	PV
<input type="checkbox"/>	<i>c.a.n.d.</i>
STEP	SV/MV/TIME
<input type="checkbox"/>	000

HOLD
ENT

Alarm parameter	
PTN	PV
<input type="checkbox"/>	<i>ALn.</i>
STEP	SV/MV/TIME
<input type="checkbox"/>	000

STOP
MODE

- For Fixed value control parameter setting mode, [*F.V.*] is indicated on the PV display.

Press the **STOP MODE** key several times until the Attached function setting mode [*c.a.n.d.*] is indicated on the PV display. If [*c.a.n.d.*] is passed by mistake, press the **DISP B.MODE** key.

Press the **STOP MODE** key until Transmission output parameter mode [*f.r.d.*] is indicated on the PV display. If [*f.r.d.*] is passed by mistake, use the **DISP B.MODE** key.

Transmission output parameter	
PTN <input type="checkbox"/>	PV r.r.a.
STEP <input type="checkbox"/>	SV/MV/TIME 000

HOLD
ENT

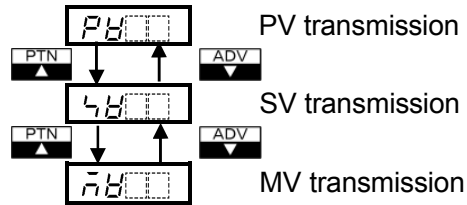
Transmission output type	
PTN <input type="checkbox"/>	PV r.r.a.
STEP <input type="checkbox"/>	SV/MV/TIME PV00

HOLD
ENT

Transmission output high limit value	
PTN <input type="checkbox"/>	PV r.r.LH
STEP <input type="checkbox"/>	SV/MV/TIME 1370

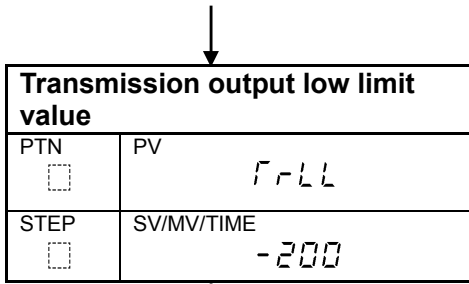
HOLD
ENT

- Selects a Transmission output type.
- Available when the Transmission output (TA, TV option) is added.
- Selecting item: The SV/MV/TIME display will show the below.



- Default value: PV transmission

- Sets the Transmission output high limit value. The high limit value corresponds to 20mA (TA option) or 1V (TV option).
- Available when the Transmission output (TA, TV option) is added.
- Setting range: Transmission output low limit value to Input range high limit value. For DC input, the placement of the decimal point follows the selection.
- Default value: 1370°C



- Sets the Transmission output low limit value. The low limit value corresponds to 4mA (TA option) or 0V (TV option).
- Available when the Transmission output (TA, TV option) is added.
- Setting range: Input range low limit value to Transmission output high limit value
For DC input, the placement of the decimal point follows the selection.
- Default value: -200°C

Transmission output parameter setting is completed.
The unit returns to **Transmission output high limit setting**.

When the desired settings are completed, press the  key.
The unit returns to the **Standby** or **Program control run mode**.

- When the Transmission output type is changed during Transmission output type selection mode, the Transmission output high limit and low limit value are changed as follows.

(Table 6.7.4-1)

Transmission output type	Transmission output high limit value	Transmission output low limit value
PV transmission	Input range high limit value*	Input range low limit value*
SV transmission		
MV transmission	100.0	0.0

* For Thermocouple K input, High limit value: 1370°C, Low limit value: -200°C.

- During Standby mode, the Transmission output values are shown below.

(Table 6.7.4-2)

Transmission output type	Transmission output value
PV transmission	Outputs PV corresponding to the Transmission output high or low limit value.
SV transmission	TA option: 4mA, TV option: 0V
MV transmission	TA option: 4mA, TV option: 0V

6.7.5 Input parameter setting

Setting items in the **Program control run mode** are the same as those of **Fixed value control run mode**.

This section describes how to set the input parameter in the **Program control run mode**.

Standby mode or Program control run mode	
PTN 0	PV 025
STEP □	SV/MV/TIME □□□

SET
RST

Program pattern setting mode	
PTN □	PV P.P.N.
STEP □	SV/MV/TIME □□□

STOP
MODE

Attached function setting mode	
PTN □	PV c.a.n.d.
STEP □	SV/MV/TIME □□□

HOLD
ENT

Alarm parameter	
PTN □	PV AL.A.
STEP □	SV/MV/TIME □□□

STOP
MODE

- For Fixed value control parameter setting mode, [F.V.] is indicated on the PV display.

Press the **STOP MODE** key several times until Attached function setting mode [c.a.n.d.] is indicated on the PV display. If [c.a.n.d.] is passed by mistake, press the **DISP B.MODE** key.

Press the **STOP MODE** key several times until Input parameter mode [I.N.P.] is indicated on the PV display. If [I.N.P.] is passed by mistake, use the **DISP B.MODE** key.

Input parameter	
PTN <input type="checkbox"/>	PV 1.nP.
STEP <input type="checkbox"/>	SV/MV/TIME 000

HOLD
ENT

Scaling high limit value	
PTN <input type="checkbox"/>	PV 4FLH
STEP <input type="checkbox"/>	SV/MV/TIME 1370

HOLD
ENT

Scaling low limit value	
PTN <input type="checkbox"/>	PV 4FLl
STEP <input type="checkbox"/>	SV/MV/TIME -200

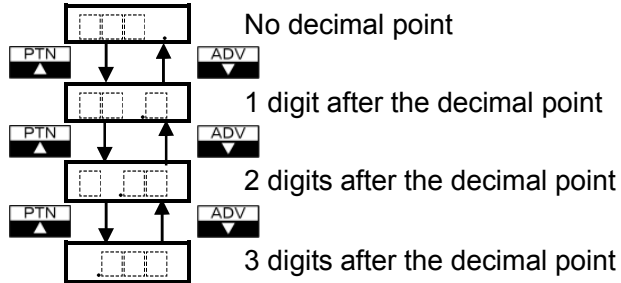
HOLD
ENT

- Sets the Scaling high limit value.
- Setting range: Scaling low limit value to Input range high limit value
DC input: The placement of the decimal point follows the selection.
- Default value: 1370°C

- Sets the Scaling low limit value.
- Setting range: Input range low limit value to Scaling high limit value
DC input: The placement of the decimal point follows the selection.
- Default value: -200°C

Decimal point place	
PTN	PV
<input type="checkbox"/>	2P00
STEP	SV/MV/TIME
<input type="checkbox"/>	00.

- Selects the Decimal point place.
- Available only when DC (voltage/current) input is set during Sensor type selection.
- Selecting item: The SV/MV/TIME display will show the below.



- Default value: No decimal point.


Sensor correction	
PTN	PV
<input type="checkbox"/>	4000
STEP	SV/MV/TIME
<input type="checkbox"/>	0000

- Sets the sensor correction value.
- Setting range: -100.0 to 100.0°C(°F)
DC input: -1000 to 1000 (The placement of the decimal point follows the selection.)
- Default value: 0.0°C(°F)

PV filter time constant	
PTN	PV
<input type="checkbox"/>	FILT
STEP	SV/MV/TIME
<input type="checkbox"/>	0000

- Sets the PV filter time constant.
- Setting range: 0.0 to 10.0 seconds
- Default value: 0.0 seconds

Input parameter settings are completed.
The unit returns to **Scaling high limit setting**.

When the setting is completed, press the  key.
The unit returns to **Standby** or **Program control run mode**.

● **Sensor correction function**

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

When controlling with plural controllers, sometimes the measured temperatures (input value) do not concur due to differences in sensor accuracy or dispersion of load capacities.

In such a case, the control can be set at the desired temperature by adjusting the input value of sensors.
 $PV \text{ after sensor correction} = \text{Current PV} + (\text{Sensor correction value})$

● **PV filter time constant**

This is a filter function on the software, which has the same effect as a CR filter.

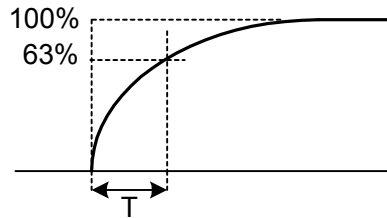
By calculating first-order lag of PV, this suppresses input fluctuation caused by noise.

When the input value changes as shown in (Fig. 6.7.5-1), this function makes the input change slowly, as shown in (Fig. 6.7.5-2).

T (PV filter time constant) is the time when input change reaches 63% of the desired PV.



(Fig. 6.7.5-1)



(Fig. 6.7.5-2)

6.7.6 Communication parameter setting

Setting items in the **Program control run mode** are the same as those of **Fixed value control run mode**.

If the Serial communication [C, C5] option is added, communication parameter [C.A.N.] is indicated.

This section describes how to set the communication parameter in the **Program control run mode**.

Standby mode or Program control run mode	
PTN 0	PV 025
STEP 0	SV/MV/TIME 000

SET
RST

Program pattern setting mode	
PTN 0	PV P.F.n.
STEP 0	SV/MV/TIME 000

STOP
MODE

Attached function setting mode	
PTN 0	PV c.a.n.d
STEP 0	SV/MV/TIME 000

HOLD
ENT

Alarm parameter	
PTN 0	PV AL.n.
STEP 0	SV/MV/TIME 000

STOP
MODE

- For Fixed value control parameter setting mode, [F].n.] is indicated on the PV display.

Press the **STOP MODE** key several times until Attached function setting mode [c.a.n.d] is indicated on the PV display. If [c.a.n.d] is passed by mistake, press the **DISP B.MODE** key.

Press the **STOP MODE** key several times until Communication parameter mode [C.A.N.] is indicated on the PV display. If [C.A.N.] is passed by mistake, use the **DISP B.MODE** key.

Communication parameter	
PTN <input type="checkbox"/>	PV c.0.0.0
STEP <input type="checkbox"/>	SV/MV/TIME 000

HOLD
ENT

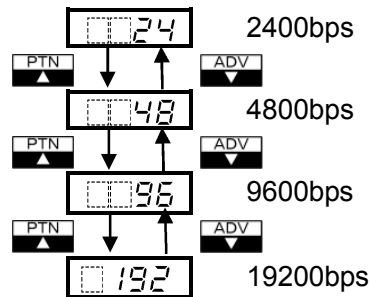
Communication speed	
PTN <input type="checkbox"/>	PV c.0.4P
STEP <input type="checkbox"/>	SV/MV/TIME 0096

HOLD
ENT

Instrument number	
PTN <input type="checkbox"/>	PV c.0.0.0
STEP <input type="checkbox"/>	SV/MV/TIME 000

HOLD
ENT

- Selects the communication speed equal to that of the Host computer.
- Available only when C or C5 option is added.
- Selecting item: The SV/MV/TIME display will show the below.

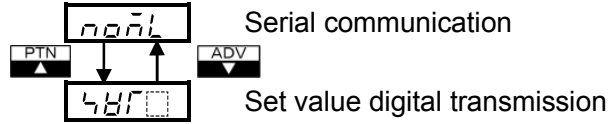


- Default value: 9600bps

- Sets the individual instrument number to the PC-900 when communicating by connecting plural PC-900 units. When connecting plural PC-900 units, the instrument number must not be duplicated.
- Available only when C or C5 option is added.
- Setting range: 0 to 95
- Default value: 0

Communication mode	
PTN □	PV cñ4□
STEP □	SV/MV/TIME noñL


- Selects either Serial communication or Set value digital transmission.
- Available only when C or C5 option is added.
- Selecting item: The SV/MV/TIME display will show the below.



- Default value: Serial communication.

HOLD
ENT

Communication parameter setting is completed.
The unit returns to **Communication speed selection**.

When the setting is completed, press the  key.
The unit returns to the **Standby** or **Program control run mode**.

6.7.7 Other functions setting

Fixed value control run mode includes only two items [Set value lock] and [Output status when input abnormal].

This section describes how to set Other functions in the Program control run mode.

Standby mode or Program control run mode	
PTN 0	PV 025
STEP □	SV/MV/TIME □□□

SET
RST

Program pattern setting mode	
PTN □	PV P.F.r.
STEP □	SV/MV/TIME □□□

STOP
MODE

Attached function setting mode	
PTN □	PV c.a.n.d.
STEP □	SV/MV/TIME □□□

HOLD
ENT

Alarm parameter	
PTN □	PV ALr.
STEP □	SV/MV/TIME □□□

STOP
MODE

- For Fixed value control parameter setting mode, [P.F.r.] is indicated on the PV display.

Press the **STOP MODE** key several times until Attached function setting mode [c.a.n.d.] is indicated on the PV display. If [c.a.n.d.] is passed by mistake, press the **DISP B.MODE** key.

Press the **STOP MODE** key several times until Other functions setting mode [ALr.] is indicated on the PV display. If [ALr.] is passed by mistake, use the **DISP B.MODE** key.

Other functions	
PTN <input type="checkbox"/>	PV a.r.E.r.
STEP <input type="checkbox"/>	SV/MV/TIME 0000

HOLD
ENT

Set value lock	
PTN <input type="checkbox"/>	PV Lock
STEP <input type="checkbox"/>	SV/MV/TIME ----

HOLD
ENT

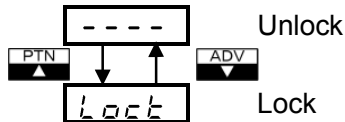
Step SV when program control starts	
PTN <input type="checkbox"/>	PV 4.48
STEP <input type="checkbox"/>	SV/MV/TIME 0000

HOLD
ENT

Program control start type	
PTN <input type="checkbox"/>	PV 4.4L
STEP <input type="checkbox"/>	SV/MV/TIME P800

HOLD
ENT

- Selects either Unlock or Lock of set values.
- Selecting item: The SV/MV/TIME display will show the below.



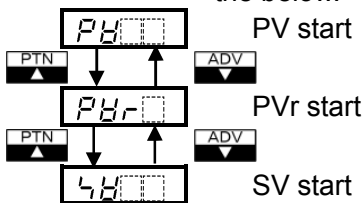
Unlock: All setting items can be changed.

Lock: None of the setting items can be changed.

- Default value: Unlock

- Sets the Step SV when program control starts. Program control starts from the Step SV regardless of Program control start type.
- Setting range: SV low limit to SV high limit
For DC input, the placement of the decimal point follows the selection.
- Default value: 0°C

- Selects the program control start type.
- Selecting item: The SV/MV/TIME display will show the below.



- Default value: PV start

- PV start:
When the Program control starts, the SV (desired value) and step time are advanced to the PV (process variable), then the Program control starts.
- PVr start:
Basically this is the same as PV start. However, even in pattern repeating, the SV and step time are advanced to the PV, then the Program control starts.
- SV start:
When the Program control starts, the Program control starts from the SV which has been set during "Step SV when program control starts" mode.

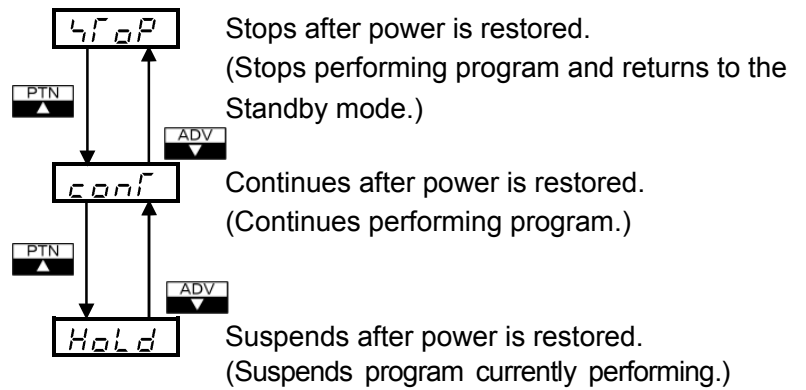
Status after power is restored	
PTN <input type="checkbox"/>	PV P-r-Er
STEP <input type="checkbox"/>	SV/MV/TIME 4r0P

HOLD
ENT

Step time unit	
PTN <input type="checkbox"/>	PV h_4
STEP <input type="checkbox"/>	SV/MV/TIME h1 m

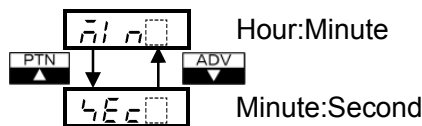
HOLD
ENT

- Selects a status after the power is restored.
- Selecting item: The SV/MV/TIME will show the below.



- Default value: Continues after power is restored.

- Selects the Step time unit for the program control.
- Selecting item: The following are indicated on the SV/MV/TIME display



- Default value: Hour.Minute

Step time indication type	
PTN	PV 4.75
STEP	SV/MV/TIME 7.75

HOLD
ENT

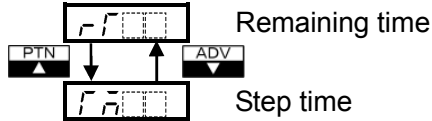
Step SV indication type	
PTN	PV 4.7E
STEP	SV/MV/TIME 4.8

HOLD
ENT

Pattern end output time	
PTN	PV PEF.7
STEP	SV/MV/TIME 0.00

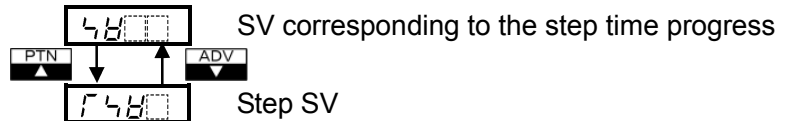
HOLD
ENT

- Selects the Step time indication type when the SV/MV/TIME display is changed to TIME display during program control. Select either Remaining time or Step time.
- Selecting item: The SV/MV/TIME display will show the below.



- Default value: Remaining time

- Selects the Step SV indication type when the SV/MV/TIME display is changed to SV display during program control. Selects either SV corresponding to the step time progress or Step SV.
- Selecting item: The SV/MV/TIME display will show the below.



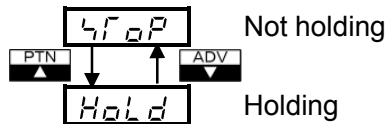
- Default value: SV corresponding to the step time progress

- Sets the seconds desired for pattern end output time. Setting the time to 0 causes continuous output until the STOP MODE key is pressed for 1 second or until the power supply to the PC-900 is turned OFF.
- This function operates only when the Pattern end output is selected for A1, A2, A3 or A4.
- Setting range: 0 to 9999sec.
- Default value: 0sec. (continuous output)

Step SV Hold function at program end	
PTN <input type="checkbox"/>	PV PEH
STEP <input type="checkbox"/>	SV/MV/TIME 470P

HOLD
ENT

- Selects either Not holding or Holding of step SV.
If Holding is selected, Step 9 SV is held when program control ends, and then the Fixed value control is performed at the held step SV.
- The PTN display flashes while the Holding function is working.
- To cancel Holding, press the **STOP MODE** key for 1 second or turn the power supply to the PC-900 OFF
- Selecting item: The SV/MV/TIME display will show the below.

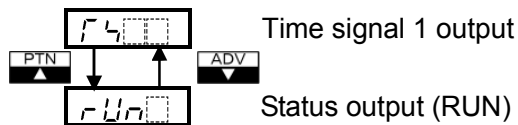


- Default value: Not holding
- Not holding:
When the program is finished, and if the Pattern end output is selected, [P.End] on the SV/MV/TIME display flashes, and Pattern end output is turned ON. If it is not selected, the SV/MV/TIME display indicates nothing.
- Holding:
When the program is finished, the Fixed value control is performed at Step 9 SV.
If no value is registered for Step 9 SV, the Fixed value control is performed at the default value 0°C.

Time signal output/Status output (RUN) for TS1	
PTN <input type="checkbox"/>	PV 7414
STEP <input type="checkbox"/>	SV/MV/TIME 7400

HOLD
ENT

- Selects either Time signal output or Status output (RUN) when Time signal 1 output (TS1) is used.
- Available only when the Time signal output option is added.
- Status output (RUN) is ON during Program control.
- Selecting item: The SV/MV/TIME display will show the below.



- Default value: Time signal output [TS]

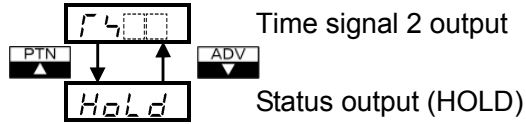
Time signal output/Status output (HOLD) for TS2	
PTN <input type="checkbox"/>	PV r424
STEP <input type="checkbox"/>	SV/MV/TIME r4:00

HOLD
ENT

Time signal output/Status output (WAIT) for TS3	
PTN <input type="checkbox"/>	PV r434
STEP <input type="checkbox"/>	SV/MV/TIME r4:00

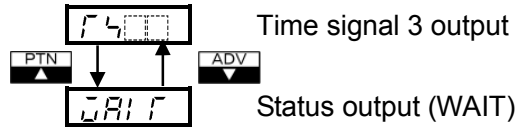
HOLD
ENT

- Selects either Time signal output or Status output (HOLD) when Time signal 2 output (TS2) is used.
- Available only when the Time signal output option is added.
- Status output (HOLD) turns ON when Program control is suspended.
- Selecting item: The SV/MV/TIME display will show the below.



- Default value: Time signal output [TS]

- Selects either Time signal output or Status output (WAIT) when Time signal 3 output (TS3) is used.
- Available only when the Time signal output option is added.
- Status output (WAIT) turns ON during Program control WAIT action.
- Selecting item: The SV/MV/TIME display will show the below.



- Default value: Time signal output [TS]

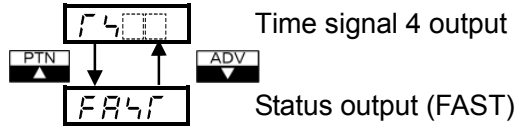
Time signal output/Status output (FAST) for TS4	
PTN <input type="checkbox"/>	PV r444
STEP <input type="checkbox"/>	SV/MV/TIME r400

HOLD
ENT

Time signal output/Status output (STOP) for TS5	
PTN <input type="checkbox"/>	PV r454
STEP <input type="checkbox"/>	SV/MV/TIME r400

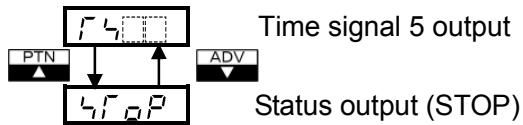
HOLD
ENT

- Selects either Time signal output or Status output (FAST) when Time signal 4 output (TS4) is used.
- Available only when the Time signal output option is added.
- Status output (FAST) turns ON while pressing the **FAST** key to increase the step time speed.
- Selecting item: The SV/MV/TIME display will show the below.



- Default value: Time signal output [TS]

- Selects either Time signal output or Status output (STOP) when Time signal 5 output (TS5) is used.
- Available only when the Time signal output option is added.
- Status output (STOP) turns ON when the controller is in Standby mode or when Program control ends.
- Selecting item: The SV/MV/TIME display will show the below.



- Default value: Time signal output [TS]

Overshoot suppression factor	
PTN □	PV 0.4F□
STEP □	SV/MV/TIME □□ 1.0

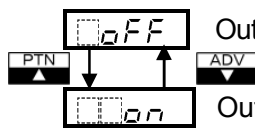
HOLD
ENT

Output status when input abnormal	
PTN □	PV EoUF
STEP □	SV/MV/TIME □□ OFF

HOLD
ENT

- Sets a factor to suppress overshoot.
- Setting the integral time to 0 disables this function.
- Available only when the DIP switch (SW304) No.1 is set to ON side (to Control action Fuzzy overshoot suppression PID).
- Setting range: 0.0 to 10.0
- Default value: 1.0

- Selects OUT1 or OUT2 status when the DC current or voltage input is overscale or underscale.
- Available only for DC current and voltage input
- Not available for the PC-955 type.
- Setting item: The SV/MV/TIME display will show the below.




Outputs OFF(4mA) or OUT1(OUT2) low limit value.

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

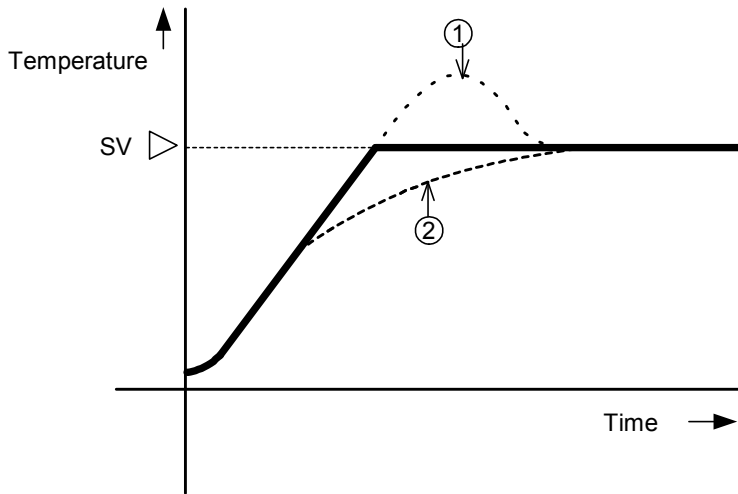
- Default value: Outputs OFF(4mA) or OUT1(OUT2) low limit value

Setting is completed.
The unit returns to **Set value lock selection**.

When the required settings are completed, press the  key.
The unit returns to the **Standby** or **Program control run mode**.

● **Overshoot suppression factor selection**

When AT is performed with the optimal P, I, D and ARW values after AT multi mode was selected, and if the overshoot or undershoot occurs at the step change point, set the overshoot suppression factor to suppress the overshoot or undershoot.

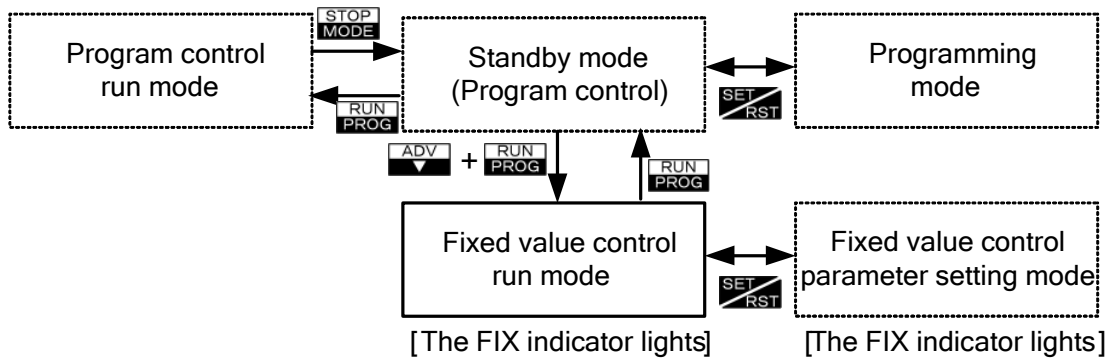


When overshoot occurs as shown ①, make the factor larger.

When it takes too much time until stabilization as shown ②, make the factor smaller.

(Fig. 6.7.7-1)

6.8 Fixed value control parameter setting



6.8.1 SV setting

Fixed value control run mode	
PTN □	PV 0025
STEP □	SV/MV/TIME 0000



Fixed value control parameter setting mode	
PTN □	PV F.V.
STEP □	SV/MV/TIME 0000



SV (desired value)	
PTN □	PV 4...
STEP □	SV/MV/TIME 0000

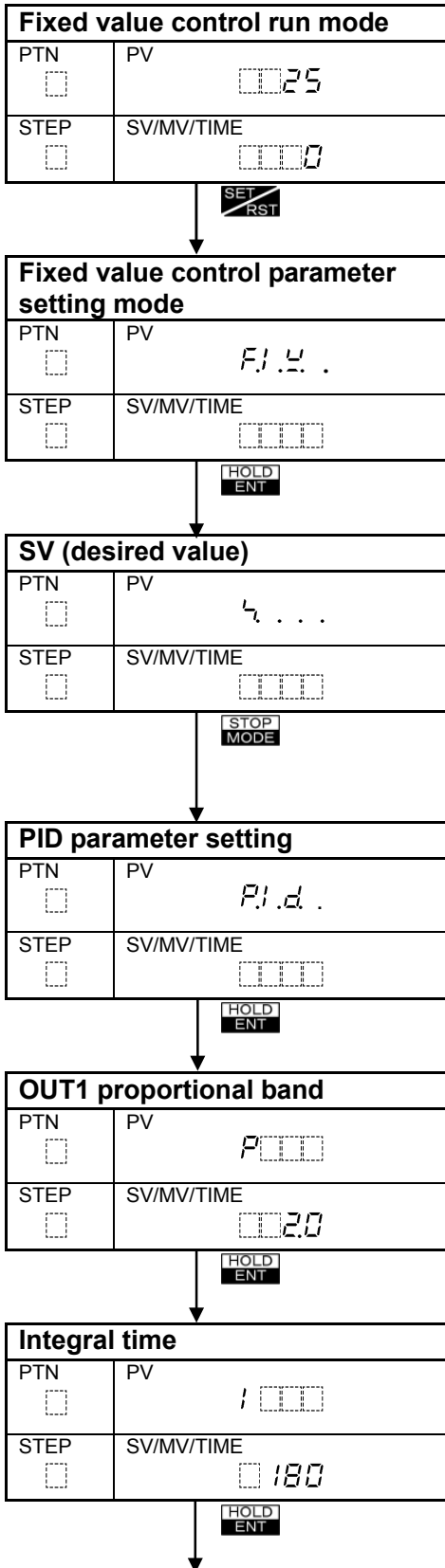


SV setting	
PTN □	PV 400
STEP □	SV/MV/TIME 0000

- Sets the SV (desired value).
- Setting range: SV low limit to SV high limit value
- Default value: 0°C

When the setting is completed, press the key.
The unit returns to **Fixed value control run mode**.

6.8.2 PID parameter setting



- Sets the proportional band for OUT1.
ON/OFF action when set to 0.0 (PC-935)
- Setting range: 0.0 to 999.9% (PC-935)
0.1 to 999.9% (PC-955)
- Default value: 2.5%

- Sets the integral time.
Setting the value to 0 disables the function.
- Setting range: 0 to 3600 seconds (PC-935)
1 to 3600 seconds (PC-955)
- Default value: 200 seconds

Derivative time	
PTN □	PV d000
STEP □	SV/MV/TIME 0030

- Sets the Derivative time.
Setting the value to 0 disables the function.
- Setting range: 0 to 1800 seconds
- Default value: 50 seconds

HOLD
ENT

ARW	
PTN □	PV 700
STEP □	SV/MV/TIME 0050

- Sets the ARW (Anti-reset windup).
- Setting range: 0 to 100%
- Default value: 50%

HOLD
ENT

OUT2 proportional band	
PTN □	PV Pb00
STEP □	SV/MV/TIME 0010


- Sets the OUT2 proportional band.
Multiplying factor setting to OUT1 proportional band.
Refer to the equation below.
ON/OFF action when OUT1 proportional band is set to 0.0%,
or when OUT2 proportional band is set 0.0
- Available only when Heating/Cooling control (DR, DS, DA option)
is added.
- Not available for the PC-955 type.
- Setting range: 0.0 to 10.0 (Multiplying factor)
- Default value: 1.0

HOLD
ENT

<Equation>

OUT2 proportional band= OUT1 proportional band x Multiplying factor

PID parameter setting is completed.
The unit returns to **OUT1 proportional band setting**.

PID parameter setting is completed. Press the  key,
then the unit returns to **Fixed value control run mode**.

6.8.3 Alarm value setting

Fixed value control run mode	
PTN <input type="checkbox"/>	PV 0025
STEP <input type="checkbox"/>	SV/MV/TIME 000

SET
RST

Fixed value control parameter setting mode	
PTN <input type="checkbox"/>	PV F.L.
STEP <input type="checkbox"/>	SV/MV/TIME 000

HOLD
ENT

SV (desired value)	
PTN <input type="checkbox"/>	PV 4...
STEP <input type="checkbox"/>	SV/MV/TIME 000

STOP
MODE

Press the **STOP MODE** key twice until Alarm value setting mode [A . . .] is indicated on the PV display.

Alarm value	
PTN <input type="checkbox"/>	PV A...
STEP <input type="checkbox"/>	SV/MV/TIME 000

HOLD
ENT

Alarm 1 (A1) value	
PTN <input type="checkbox"/>	PV A 00
STEP <input type="checkbox"/>	SV/MV/TIME 000

HOLD
ENT

- Sets Alarm 1 (A1) value.
- Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).
- Not available if Pattern end 1 output (default value) is selected, or if No alarm action is selected by the rotary switch (SW302).
- Setting range: See (Table 6.8.3-1).

↓

Alarm 2 (A2) value	
PTN <input type="checkbox"/>	PV A2.00
STEP <input type="checkbox"/>	SV/MV/TIME 1370

HOLD
ENT

↓

Alarm 3 (A3) value	
PTN <input type="checkbox"/>	PV A3.00
STEP <input type="checkbox"/>	SV/MV/TIME 0010

HOLD
ENT

↓

Alarm 4 (A4) value	
PTN <input type="checkbox"/>	PV A4.00
STEP <input type="checkbox"/>	SV/MV/TIME 0010

HOLD
ENT

↓

Alarm value setting is completed. Press the  key. The unit returns to Fixed value control run mode .

- Sets Alarm 2 (A2) value.
- Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).
- Not available for the following cases.
 - (1) A2 option is not added.
 - (2) No alarm action or Pattern end 2 output is selected by the Rotary switch (SW301).
 - (3) PC-955 type.
- Setting range: See (Table 6.8.3-1).
- Default value: 0°C.

- Sets Alarm 3 (A3) value.
- Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).
- Not available if No alarm action or Pattern end 3 output is selected by keypad during Alarm 3 (A3) type selection mode.
- Setting range: See (Table 6.8.3-1).
- Default value: 0°C

- Sets Alarm 4 (A4) value.
- Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).
- Not available if No alarm action or Pattern end 4 output is selected by keypad during Alarm 4 (A4) type selection mode.
- Setting range: See (Table 6.8.3-1).
- Default value: 0°C

● **Alarm 1 to Alarm 4 setting range (The same range is applicable to the Standby function)**
(Table 6.8.3-1)

Alarm type	Setting range	Setting range (with a decimal point)
High limit alarm (*)	-Input span to Input span	-199.9 to Input span
Low limit alarm (*)	-Input span to Input span	-199.9 to Input span
High/Low limits alarm (*)	0 to Input span	0.0 to Input span
High/Low limit range alarm (*)	0 to Input span	0.0 to Input span
Process high alarm	Input range low limit value to Input range high limit value	-199.9 to Input range high limit value
Process low alarm	Input range low limit value to Input range high limit value	-199.9 to Input range high limit value

(*): Deviation setting

For DC input, the input span is the same as the scaling span.

6.8.4 Attached function setting mode

This includes the following parameters and setting items.

Setting method and items are the same as each parameter of Program control run mode.

[Alarm parameters]

- Alarm 3 (A3) type
- Alarm 4 (A4) type
- Alarm 1 (A1) hysteresis
- Alarm 2 (A2) hysteresis *1
- Alarm 3 (A3) hysteresis
- Alarm 4 (A4) hysteresis
- Alarm 1 (A1) delay timer
- Alarm 2 (A2) delay timer *1
- Alarm 3 (A3) delay timer
- Alarm 4 (A4) delay timer
- Loop break alarm time *2
- Loop break alarm span *2

*1: Available when A2 option is added.

*2: Available when LA option is added.

[Output parameters]

- OUT1 proportional cycle
- OUT1 high limit value
- OUT1 low limit value
- OUT1 ON/OFF hysteresis
- OUT1 rate-of-change
- OUT2 proportional cycle *3
- OUT2 action mode*3
- OUT2 high limit value *3
- OUT2 low limit value *3
- OUT2 ON/OFF hysteresis *3
- Overlap band/Dead band *3
- Open/Closed output dead band *4
- Open output time *4
- Closed output time *4

*3: Available when the [DR, DS, DA] option is added.

*4: Available only for the PC-955 type.

[SV high/low limit value]

- SV high limit value
- SV low limit value

[Transmission output parameters]

- Transmission output type *5
 - Transmission output high limit *5
 - Transmission output low limit *5
- *5: Available when the [TA or TV] option is added

[Input parameters]

- Scaling high limit value
- Scaling low limit value
- Decimal point place
- Sensor correction
- PV filter time constant

[Communication parameters]

- Communication speed *6
 - Instrument number *6
 - Communication mode *6
- *6: Available when the [C or C5] option is added.

[Other functions]

- Set value lock
- Output status when input abnormal

7 Running


7.1 Program setting


Before starting the Program control, check the following.

[Before the power is turned on]


- Mounting to the control panel
- Wiring
- Setup

[After the power is turned on]

When the current mode is Fixed value control (The FIX indicator lights), press the  key to switch to the Standby mode.

Press the  key in the Standby mode. The unit will proceed to the Programming mode.

From there, set the required items.

(When the current mode is Program control run mode, press the  key. The unit will proceed to the Programming mode.)

- (1) Program pattern setting
- (2) Block data setting
- (3) Number of repetitions of pattern, Pattern link setting
- (4) Attached function setting

For the PC-955 type, set the Open/Closed output time setting in accordance with the specifications of the control valve motor.

- (5) Auto/Manual control switching
- (6) Pattern number selection

[Pattern number selection by External operation]

Pattern numbers from 1 to 7 can be selected by external terminal connection.

The Pattern number selected by Pattern number External operation has priority over the number selected by keypad on the front panel.

Even when “Pattern link Enabled” is selected, the Pattern number selected by Pattern number External operation has priority.

(e.g.)

When pattern numbers 0 through 3 are linked, and if Pattern No.2 is selected by Pattern number External operation, Pattern No. 2 currently linked will be selected.)

Select a Pattern number by connecting terminals 13, 14 and/or 15 (marked ○) and 16 (COM).

(Table 7.1-1)

Terminal number	Pattern number							
	0	1	2	3	4	5	6	7
(13) b0		○		○		○		○
(14) b1			○	○			○	○
(15) b2					○	○	○	○

(e.g.)

To select Pattern number 7, connect (ON) terminals 13-16, 14-16, and 15-16.

To cancel the number, disconnect (OFF) terminals 13-16, 14-16, and 15-16.

7.2 Program control run

[Program Automatic/Manual start]

- Automatic start: Turn the power supply to the PC-900 on, then the program automatically starts from Step 0 after warm-up status.
To set the automatic start, set the DIP switch (SW304) No. 8 ON before turning the power supply to the PC-900 ON.
- Manual start : After the power is turned on and warm-up is completed, the program starts from Step 0 by pressing the **RUN PROG** key in the Standby mode.
For Fixed value control run mode, press the **RUN PROG** key to return to the Standby. Press the **RUN PROG** key in the Standby mode.
The program will start from step 0.
To set the manual start, switch the DIP switch (SW304) No. 8 OFF before turning the power supply to the PC-900 ON.

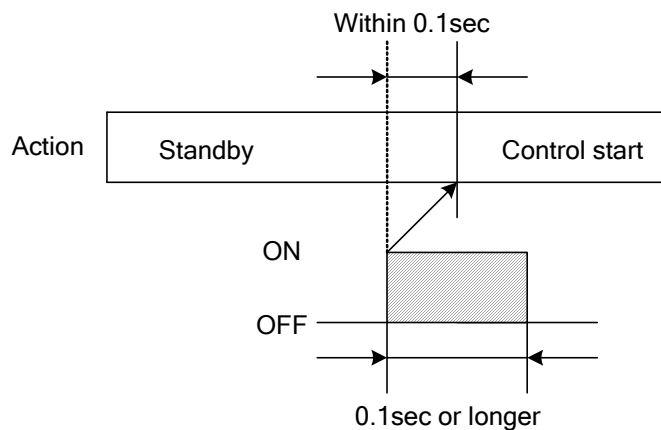
[SV start, PV start and PVr start when program control starts]

- SV start : The program control starts from the SV which has been set during [Step SV when program control starts] mode.
- PV start : The SV and step time are advanced to the PV, then the program control starts.
- PVr start : This is the same as the PV start. However, even when repeating the pattern, the control also starts by PV start.

[Program control run by External operation]

Program control (RUN input) starts when terminals 26 – 27 are closed using a relay contact or open collector output.

- RUN input: Program control starts when changed from OFF to ON.



(Fig. 7.2-1)

The following external settings operate in the same way as RUN input.

(STOP input, HOLD input, ADV input)

STOP: Terminals 23 – 27

HOLD: Terminals 24 – 27



ADV : Terminals 25 – 27

[Program control suspension (HOLD)]



Press the **HOLD ENT** key to suspend the time progress temporarily, then the Fixed value control can be performed at the SV for that time. The HOLD indicator (Red) flashes while time is being held.

To resume the program control, press the **RUN PROG** key.


[Step progress (ADV)]

Each time the  key is pressed, the step progresses to the next.
Even if the Wait function is working, if the  key is pressed, the step progresses to the next.

[Step Regress]

Each time the  key is pressed while the  key is being pressed, the running step ends its process, and goes back to the previous step, and performs the control.


[To make Step time progress faster (FAST)]

While the  key is held down, the time progress becomes 60 times faster than usual.
If the Wait action is set, the Wait function has priority over this function.

[To stop Program control in process (STOP)]

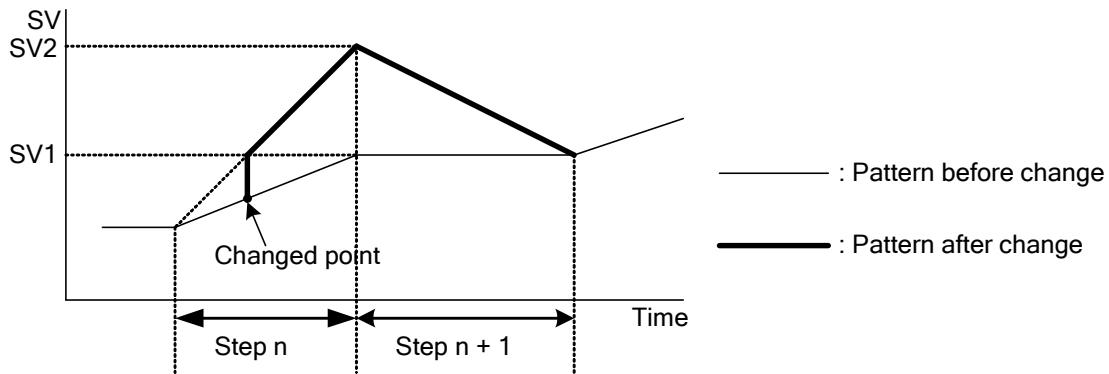
Press the  key, and the Program control will stop in process.

[Program control end (P. END)]

When the Program control is finished, the mode turns to the Standby, the A1/SB indicator lights and [P. END] flashes on the SV/MV/TIME display (The Pattern end output is turned ON.).
If the  key is pressed for 1 second or longer, the Pattern end output is turned OFF.

When step SV or step time is changed, the control is changed as follows.

[When the step SV is changed from SV1 to SV2.]



(Fig. 7.2-2)

[When the step time is changed from T1 to T2.]

SV
Time
T1
T2
Changed point
: Pattern before change
: Pattern after change

(Fig. 7.2-3)

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7.3 Fixed value control run


Before starting the Fixed value control, check the following.

[Before the power is turned on]

- (1) Mounting to the control panel
- (2) Wiring
- (3) Setup

[After the power is turned on]

When the current mode is Program control run mode (PTN display lights), press the  key to enter Standby mode, then press the  key and  keys to enter Fixed value control run mode.


Then press the  key to proceed to Fixed value control parameter setting mode (The PV display indicates [F.V. .L. .]), and set the following when necessary.

- (1) Fixed value control parameter setting
- (2) Attached function setting
- (3) Auto/Manual control switching

When the setting is completed, press the  key. The control action starts so as to maintain the control target at the SV (desired value).

[Key operations during Fixed value control]

 key: Changes the SV indication to MV indication and vice versa on the SV/MV/TIME display.

 key: Finishes the Fixed value control, and the mode switches to Program control Standby.

7.4 Manual control Perform

Sets output MV (manipulated variable) manually.

Auto/Manual control switching

The switching method is common to [Fixed value control run mode] and [Program control run mode].
The Program control is used for switching Auto/Manual control in this section.

Standby mode or Program control run mode	
PTN	PV
0	0025
STEP	SV/MV/TIME
0	000

SET
RST

Program pattern setting mode	
PTN	PV
0	P.F.n.
STEP	SV/MV/TIME
0	000

STOP
MODE

Auto/Manual control switching mode	
PTN	PV
0	MANU
STEP	SV/MV/TIME
0	000

HOLD
ENT

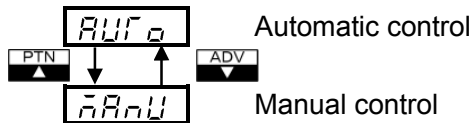
Auto/Manual control switching	
PTN	PV
0	MANU
STEP	SV/MV/TIME
0	MANU

When completed, press the SET/RST key.

- For Fixed value control parameter setting mode, [F.n.] is indicated on the PV display.

Press the STOP MODE key until Auto/Manual control switching mode [MANU] is indicated on the PV display.
If [MANU] is passed by mistake, press the DISP B.MODE key.

- Selects control mode either Automatic or Manual.
- Setting item: The SV/MV/TIME display will show the below.



- Default value: Automatic control

[Key operation in Manual control]

During Manual control, use the ,  or  keys to increase or decrease the output MV (manipulated variable).

Setting range: [Fixed value control OUT1 low limit] to [Fixed value control OUT1 high limit value]
Maximum range, 0.0 to 100.0% (R/M, S/M),
-5.0 to 105.0% (A/M)

[Manual control when the Heating/Cooling control output (DR, DS, DA option) is added]

Setting range: –[Fixed value control OUT2 high limit] to [Fixed value control OUT1 high limit]
Maximum range, -100.0 to 100.0% (R/M, S/M),
-105.0 to 105.0% (A/M)

[Manual control of the PC-955 type]

Control output MV → 0.0% (Fully closed)

Control output MV → 100.0% (Fully open)

When control output MV is 0.1% to 99.9%, Open output ON time and Closed output ON time are determined by the control output MV and set values (Open/Closed output dead band, MV computation cycle, Open output time, Closed output time, etc.).

Thus the valve flow rate is adjusted.

[With Manual control, refer to the following parameters for Fixed value control.]


- OUT1 high limit value
- OUT1 low limit value
- OUT1 rate-of-change
- OUT2 high limit value (when DR, DS or DA option is added to the PC-935)
- OUT2 low limit value (when DR, DS or DA option is added to the PC-935)
- Open output time (only for PC-955)
- Closed output time (only for PC-955)

[Balance/bumpless function]

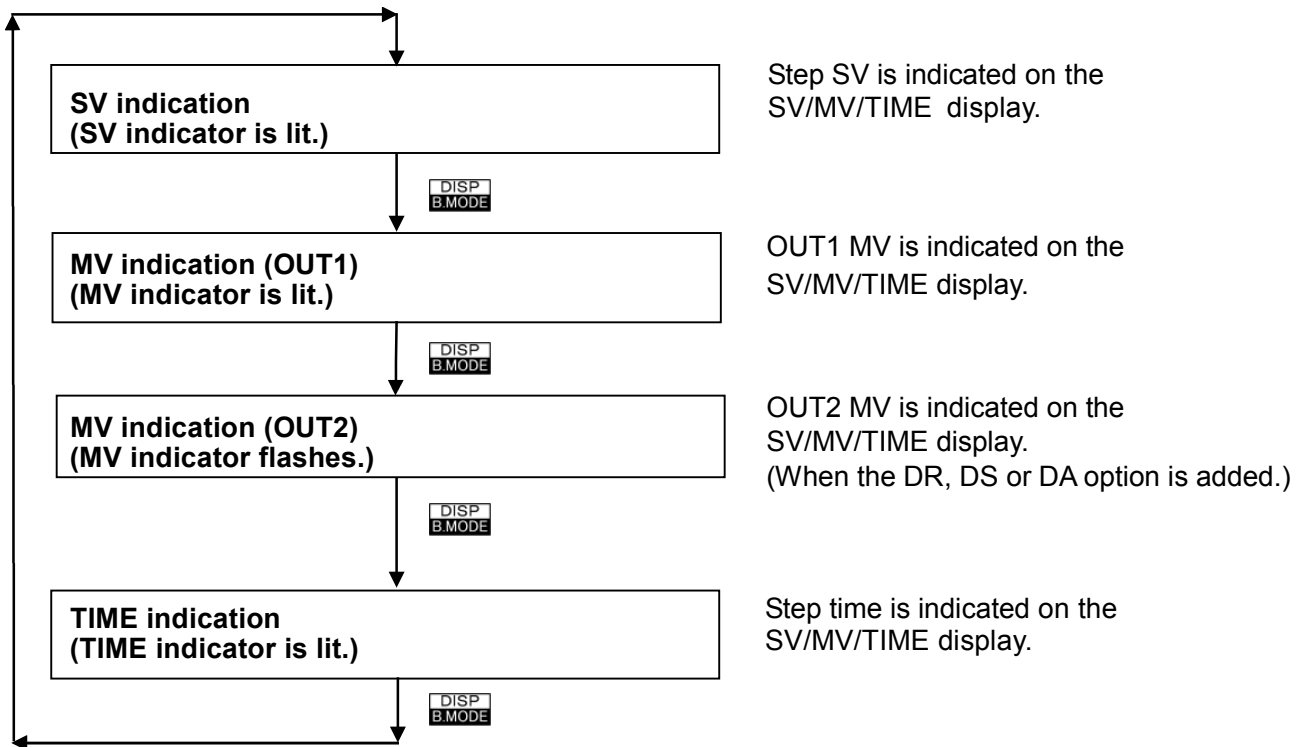
This prevents sudden changes in output MV (manipulated variable) when the control mode is switched from automatic to manual and vice versa.

- When the mode is changed from automatic to manual, the output MV before the change becomes the default value for manual control.
- When the mode is changed from manual to automatic, the output MV before the change becomes the default value for automatic control.

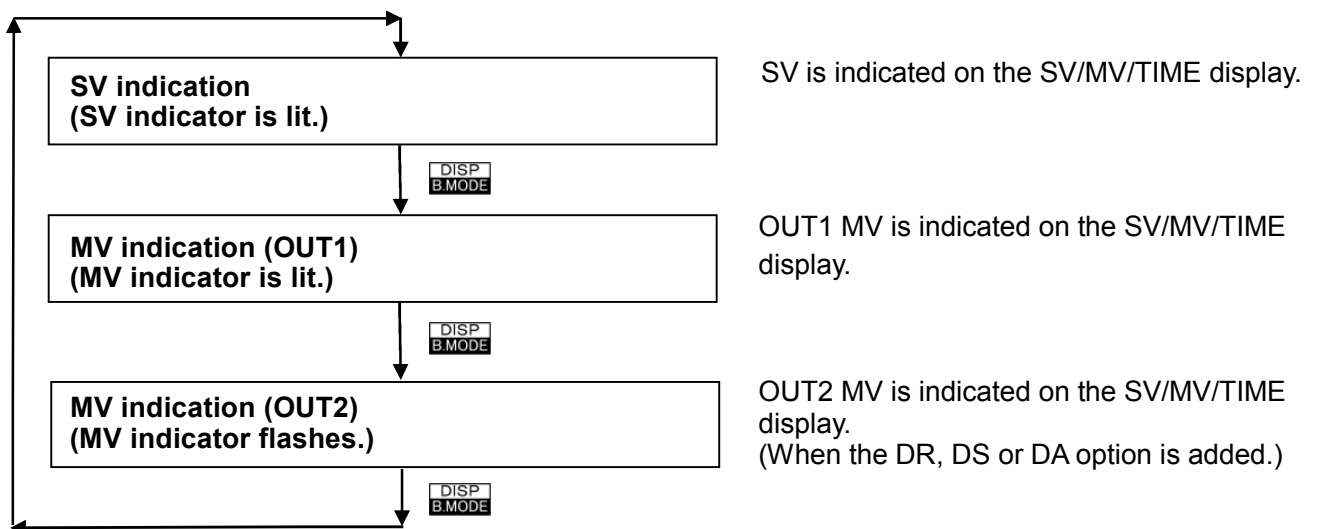
7.5 SV/MV/TIME display indication change

Each time the  key is pressed, the indication on the SV/MV/TIME display changes as follows.

• Program control



• Fixed value control



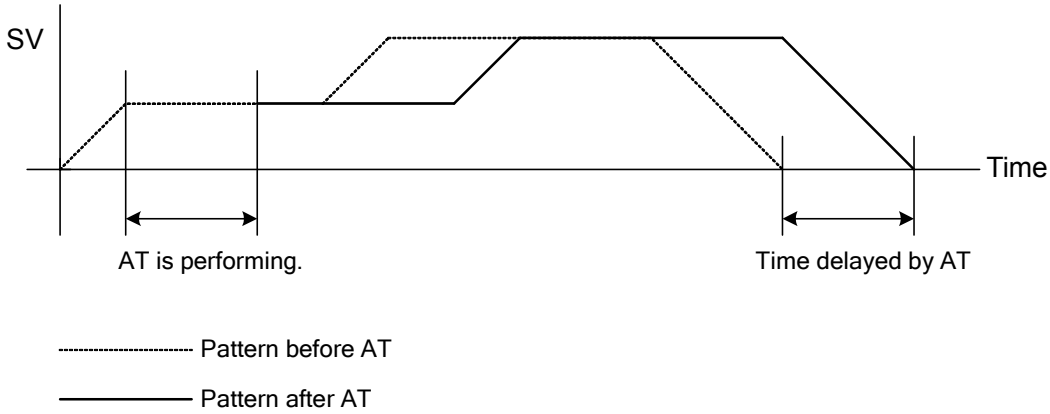
7.6 Notes when performing AT

- If [L O C L] is selected during Set value lock selection mode, AT cannot be performed.
- During AT, none of the parameters can be set.

[In Program control run mode]

When AT is performed, the tuning starts at the same time as performance, and the step time does not progress until AT is completed.

The remaining time is performed after AT is terminated.

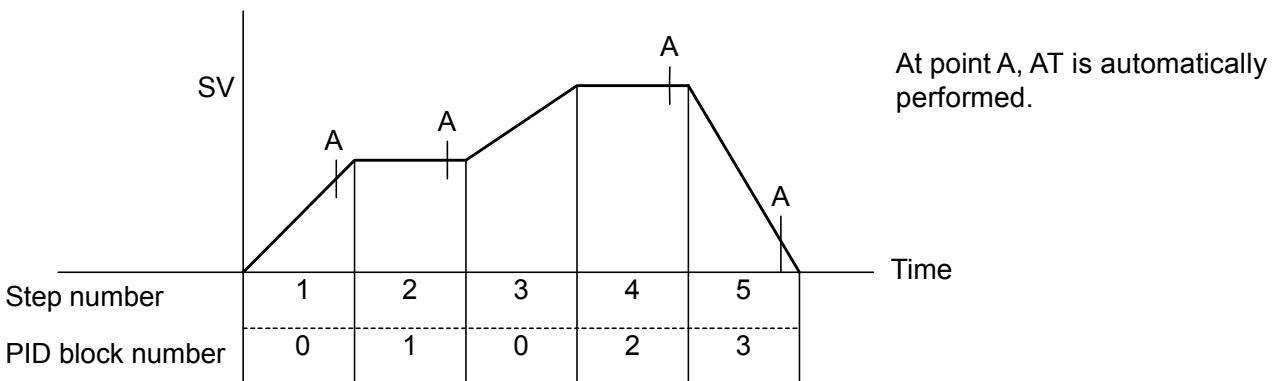


(Fig 7.6-1)

If Multi mode is selected during AT mode selection, AT is automatically performed at point A where 90% of progressed time for each step has elapsed.

If there are the same PID blocks in one pattern (e.g. step 1 and 3), the tuning is performed only for the first step (e.g. step 1), and other steps (e.g. step 3) are ignored.

After the AT is terminated for each step, the values such as OUT1 proportional band, Integral time, Derivative time, ARW and OUT2 proportional band are automatically set to the PID block number selected at each step.



(Fig. 7.6-2)

When Multi mode auto-tuning is selected, the AT indicator lights.

However, during AT after the time reaches point A, the AT indicator flashes.

7.7 AT Perform/Cancel

This section describes how to set AT (auto-tuning) in the **Program control run mode**.

Standby mode or Program control run mode	
PTN	PV
0	025
STEP	SV/MV/TIME
0	000

SET
RST

Program pattern setting mode	
PTN	PV
0	AT..
STEP	SV/MV/TIME
0	000

STOP
MODE

AT Perform mode	
PTN	PV
0	AT...
STEP	SV/MV/TIME
0	000

HOLD
ENT

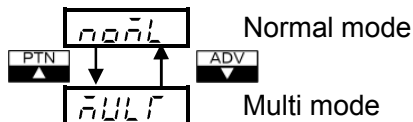
AT mode	
PTN	PV
0	AT40
STEP	SV/MV/TIME
0	noñL

HOLD
ENT

- For Fixed value control parameter setting mode, [F.V.] is indicated on the PV display.

Press the **STOP MODE** key until AT Perform mode [AT...] is indicated on the PV display.
If [AT...] is passed by mistake, press the **DISP B.MODE** key.

- Selects AT Normal or Multi mode.
- Selecting item: The SV/MV/TIME display will show the below.



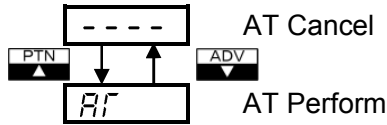
- Default value: Normal mode

- Normal mode: AT starts and performs immediately.
- Multi mode : AT is automatically started when 90% of the progressed time of each step has passed.
However, if there are the same PID blocks in one pattern, the tuning is performed only for the first step.
Multi mode is not available for the Fixed value control.

AT Perform/Cancel	
PTN	PV AT
STEP	SV/MV/TIME -----

HOLD
ENT

- Selects AT Perform or Cancel.
- Selecting item: The SV/MV/TIME display will show the below.



- Default value: AT Cancel

- AT Perform or Cancel can be set when controlling by Program or Fixed value. During AT, the 1st decimal point from the right (AT) on the SV/MV/TIME display flashes.
- During AT, none of the parameters can be set. To change the set values during AT, cancel AT.
- When Normal mode is selected during AT mode selection, perform AT at each step.
- If AT is cancelled during performance, the values such as OUT1 proportional band, Integral time, Derivative time, ARW and OUT2 proportional band will return to the values before AT was performed. Auto-tuning will be forced to stop if it has not been completed within 4 hours. The abovementioned values return to the values before AT was performed.
- When the AT is finished, the decimal point (AT, the 1st from the right) on the SV/MV/TIME display goes off, and values such as OUT1 proportional band, Integral time, Derivative time, ARW and OUT2 proportional band are automatically set.
- Refer to Section “8.3 AT” for AT action.

When completed, Press the  key.

8. Explanation of Control action and Alarm action

8.1 Fuzzy overshoot suppression PID action

Constantly monitors the rate-of-change of the control output MV and the rate-of-change of the deviation between SV and PV from the start of program control, and suppresses the control output MV in advance of the step change, thus preventing overshoot.

- Fuzzy overshoot suppression function is disabled when the integral time (I) is set to 0 sec.
- If Wait or Hold function works, Fuzzy overshoot suppression function will be cancelled.

8.2 PID and ARW

Proportional band (P)

Proportional action is the action by which the control output varies in proportion to the deviation between the SV (desired value) and the PV (process variable).

If the proportional band is narrowed, even if the output changes by a slight variation of the PV, 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 PV, control action changes to ON/OFF action and the so-called hunting phenomenon occurs.

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

Integral time (I)

Integral action is used to eliminate offset. When 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.

Derivative time (D)

Derivative action is used to restore the change in the PV (processing variable) according to the rate-of-change of the deviation between SV and PV. It reduces the amplitude of overshoot and undershoot width.

If the derivative time is shortened, the restoring value becomes small, and if the derivative time is extended, an excessive returning phenomenon may occur and the control system may oscillate.

Anti-reset windup (ARW)

ARW prevents overshoot (undershoot) caused by the integral action.

For Fixed value control, the smaller the ARW value, the fewer cases of overshoot (undershoot) caused by the integral action at the point where the PV reaches the SV. However, it takes time for stabilization.

For Program control, ARW is used with the overshoot suppression coefficient, and suppresses the overshoot (or undershoot) at the point where the gradient of each step is changed.

(When the Wait value is set, overshoot suppression coefficient does not work.)

ARW can be set automatically by performing AT. When setting ARW manually, set it to the duty factor when the control is stabilized.

● **How to obtain the duty factor for ARW manually**
Relay contact output, Non-contact voltage output:

$$\text{Duty factor (\%)} = \frac{\text{ON action time}}{\text{Proportional cycle}} \times 100$$

DC current output:

$$\text{Duty factor (\%)} = \frac{\text{Output current value (mA)} - 4}{16} \times 100$$

- Set to 50% (default value) for the trial run, if duty factor is unknown.

8.3 AT (auto-tuning)



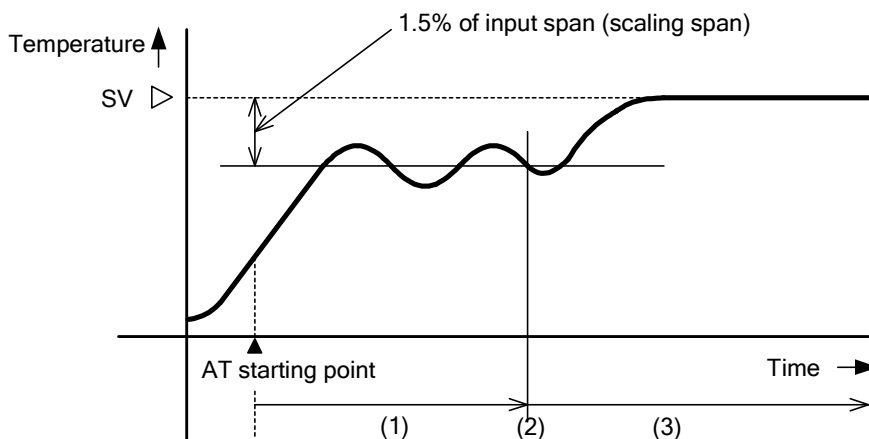
Caution

- Perform AT (auto-tuning) during the trial run.
- Sometimes the AT process will not fluctuate if AT is performed at or near room temperature. Therefore AT might not finish normally.

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

[In the case of a large difference between the SV (desired value) and PV (process variable) as the temperature is rising]

The AT process will fluctuate at a temperature 1.5% of input span (scaling span) lower than the SV.

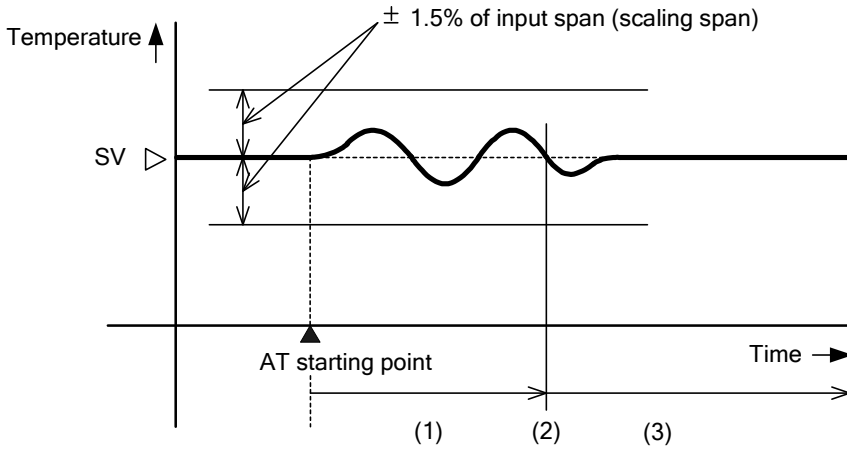


- (1) Calculating PID constant
- (2) PID constant calculated
- (3) Controlled by the PID constant set by AT

(Fig. 8.3-1)

[In the case of a stable control or when control temperature is within $\pm 1.5\%$ of input span (scaling span)]

The AT process will fluctuate around the SV.

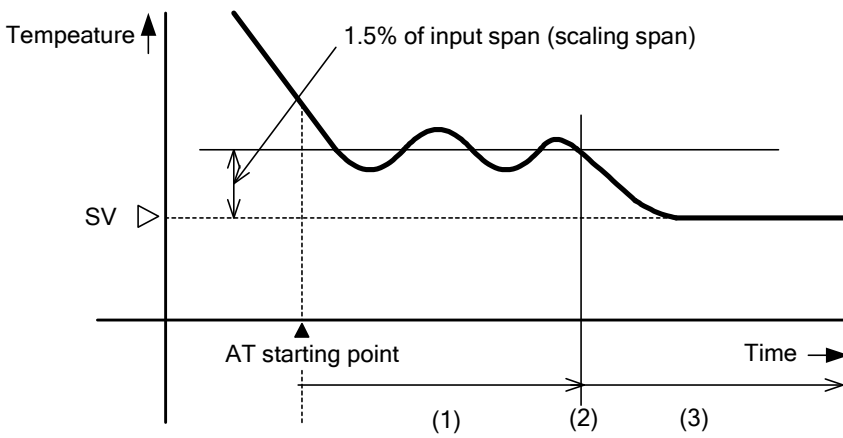


- (1) Calculating PID constant
- (2) PID constant calculated
- (3) Controlled by the PID constant set by AT

(Fig. 8.3-2)

[When control temperature is 1.5% of input span (scaling span) or more higher than the SV]

The AT process will fluctuate at a temperature 1.5% of input span (scaling span) higher than the SV.



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

(Fig. 8.3-3)

8.4 Standard control action

Action	Heating (reverse) action			Cooling (direct) action		
Control action						
PC-935						
Relay contact output						
Non- contact voltage output						
DC current output						
Indicator [OUT1] Green						
PC-955						
Open output terminals ⑤-⑥						
Closed output terminals ⑤-⑦						
Indicator [OUT1] Green						
Indicator [OUT2] Yellow						

: Turns ON or OFF.

(*1) Cycle action is performed according to deviation.

(*2) Changes continuously according to deviation.

8.5 ON/OFF control action

Action	Heating (reverse) action			Cooling (direct) action		
Control action						
PC-935						
Relay contact output						
Non-contact voltage output						
DC current output						
Indicator [OUT1] Green						
PC-955						
Open output terminals ⑤—⑥						
Closed output terminals ⑤—⑦						
Indicator [OUT1] Green						
Indicator [OUT2] Yellow						

: Turns ON or OFF.

8.6 Heating/Cooling control action (DR, DS, DA option) (only for PC-935 type)

Control action			
OUT1: Solid line —————			
Relay contact output			
Non-contact voltage output			
DC current output			
Indicator [OUT1] Green			
OUT2: Dotted line			
Relay contact output			
Non-contact voltage output			
DC current output			
Indicator [OUT2] Yellow			

: Turns ON or OFF.

(*1) Cycle action is performed according to deviation.

(*2) Changes continuously according to deviation.

When setting Dead band

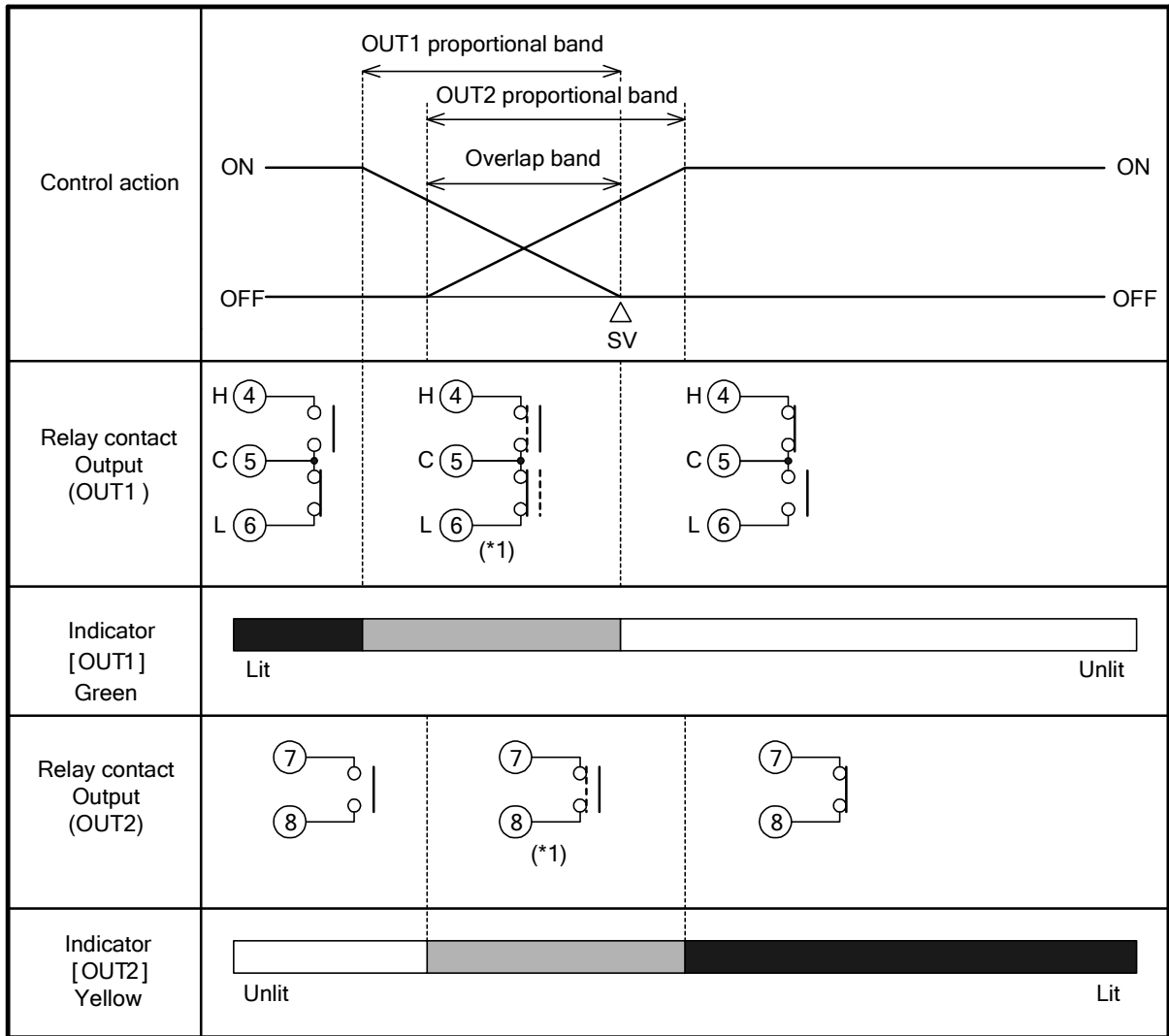
Action	Control output (OUT1)			Control output (OUT2)		
Control action						
Relay contact output		 (*1)			 (*1)	
Non-cotact voltage output		 (*1)			 (*1)	
Current output		 (*2)			 (*2)	
Indicator [OUT1] Green						
Indicator [OUT2] Yellow						

: Turns ON or OFF.

(*1) Cycle action is performed according to deviation.

(*2) Changes continuously according to deviation.

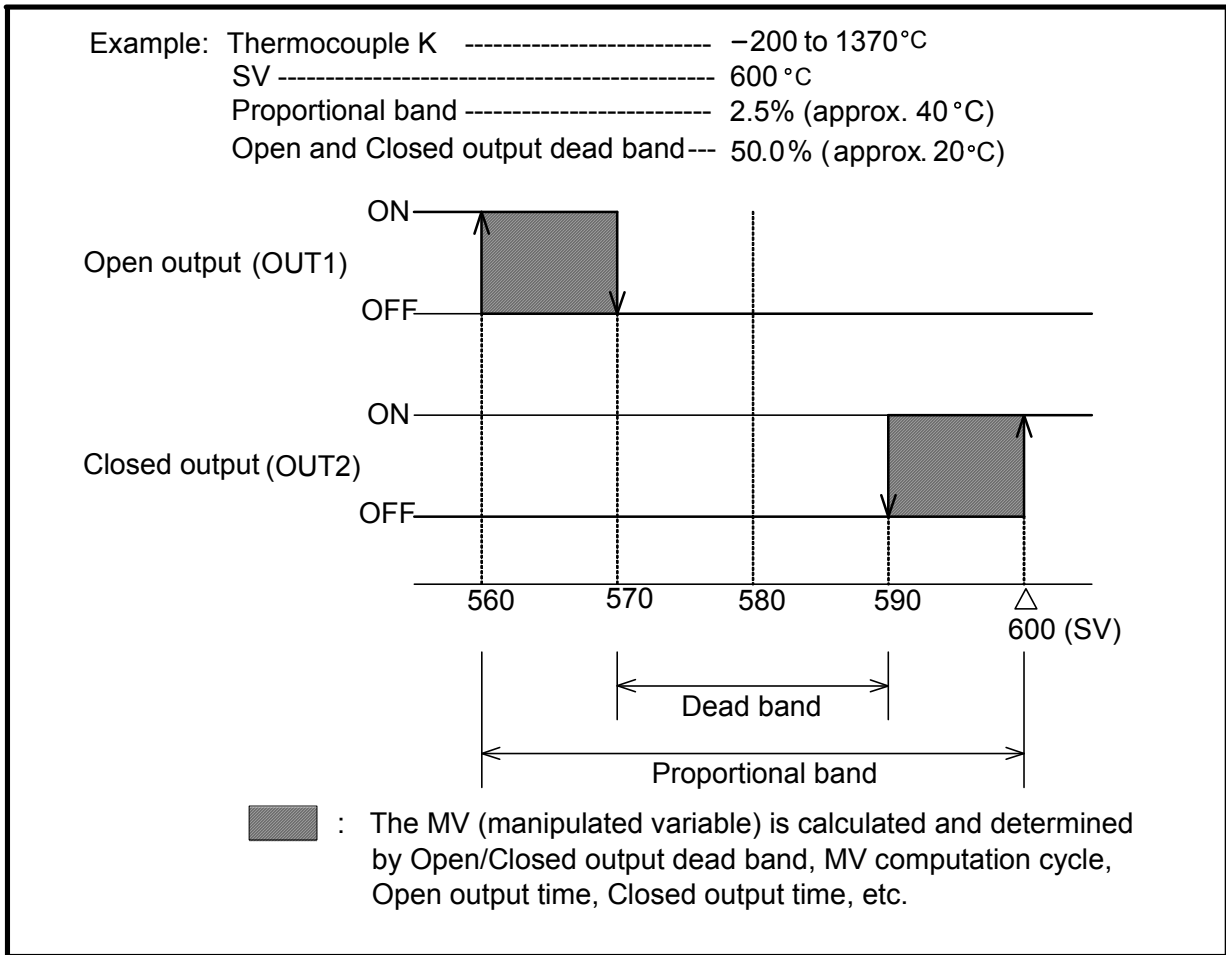
When setting the Overlap band with Relay contact output



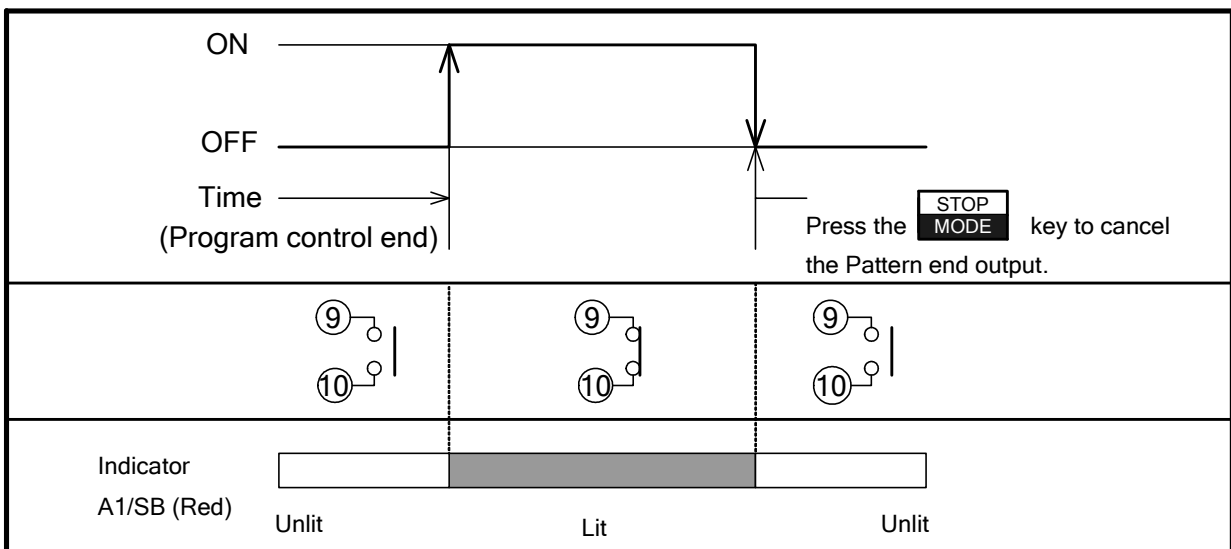
: Turns ON or OFF.

(*1) Cycle action is performed according to deviation.

8.7 When setting Open/Closed output dead band (only for PC-955)



8.8 Pattern end action



Pattern end output is turned ON when the Program control is finished.

Pattern end output is not cancelled until the **STOP MODE** key is pressed.

8.9 Alarm 1 (A1) to Alarm 4 (A4) actions

	High limit alarm	Low limit alarm
Alarm action		
Output		
Indicator		
	High limit alarm with standby	Low limit alarm with standby
Alarm action		
Output		
Indicator		
	High/Low limits alarm	High/Low limit range alarm
Alarm action		
Output		
Indicator		

- Standby function works at .
- ▲ and ▼ show the action point of the alarm output.
- Output terminals for Alarm 2 (A2): 7-8 (only for PC-935)
Output terminals for Alarm 3 (A3): 29-30
Output terminals for Alarm 4 (A4): 28-30

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

- Standby function works at .
- ▲ and ▼ show the action point of the alarm output.
- Output terminals for Alarm 2 (A2): 7-8 (only for PC-935)
Output terminals for Alarm 3 (A3): 29-30
Output terminals for Alarm 4 (A4): 28-30

9. Other functions

(1) Burnout

When the thermocouple or RTD input is burnt out, control output (OUT1, OUT2) is turned OFF (for DC current output type, OUT1 or OUT2 low limit value), and the PV display flashes "----".

For manual control, the preset manipulated variable (MV) is outputted.

When DC input is disconnected, the PV display flashes "----" for 4 to 20mA DC input, and "----" for 0 to 1V DC input. For 0 to 20mA DC input, the PV display indicates the value corresponding with 0mA.

(2) Input abnormality indication

Output status when input abnormal *1	Contents and Indication	Output status			
		OUT1		OUT2	
		Direct(Cooling) action	Reverse(Heating) action	Direct(Cooling) action	Reverse(Heating) action
<input type="checkbox"/> ON	Overscale Measured value has exceeded	ON (20mA) or OUT1 high limit value *2	OFF(4mA) or OUT1 low limit value	OFF(4mA) or OUT2 low limit value	ON(20mA) or OUT2 high limit value *2
<input type="checkbox"/> OFF	Indication range high limit value. "----" flashes.	OFF (4mA) or OUT1 low limit value			OFF(4mA) or OUT2 low limit value
<input type="checkbox"/> ON	Underscale Measured value has dropped below	OFF (4mA) or OUT1 low limit value	ON (20mA) or OUT1 high limit value *2	ON (20mA) or OUT2 high limit value *2	OFF(4mA) or OUT2 low limit value
<input type="checkbox"/> OFF	Indication range low limit value. "----" flashes.		OFF(4mA) or OUT1 low limit value	OFF(4mA) or OUT2 low limit value	

*1 This is available only for DC voltage and current input.

For PC-955 type, the output status will be the same one as when OFF is selected during "Output status when input abnormal".

For manual control, the preset manipulated variable (MV) is outputted.

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

Thermocouple, RTD input:

Input	Input range	Indication range	Control range
T	-199.9 to 400.0°C	-199.9 to 405.0°C	-205.0 to 405.0°C
	-199.9 to 750.0°F	-199.9 to 759.0°F	-209.0 to 759.0°F
Pt100	-199.9 to 850.0°C	-199.9 to 860.0°C	-210.0 to 860.0°C
	-200 to 850°C	-210 to 860°C	-210 to 860°C
	-199.9 to 999.9°F	-199.9 to 999.9°F	-211.0 to 1010.9°F
	-320 to 1560°F	-338 to 1578°F	-338 to 1578°F
JPt100	-199.9 to 500.0°C	-199.9 to 506.0°C	-206.0 to 506.0°C
	-199.9 to 900.0°F	-199.9 to 910.9°F	-211.0 to 910.9°F

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

Input range low limit value – (Input span x 1%) to Input range high limit value + (Input span x 1%)

• DC input

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

However, if the input value drops below -1999, the PV display flashes "----".

If the input value exceeds 9999, the PV display flashes "----".

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

(3) Self-diagnosis

The CPU is monitored by a watchdog timer, and if an abnormal status is found on the CPU, the controller is switched to warm-up status.

(4) Automatic cold junction temperature compensation (Thermocouple input type)

This detects the temperature at the connecting terminal between the thermocouple and the instrument, and always maintains it at the same status as if the reference junction location temperature was at 0°C (32°F).

(5) Warm-up indication

For approximately 3sec after power-on, the input type and the temperature unit are indicated on the PV display, and the input range high limit value (for DC input, scaling high limit value) is indicated on the SV/MV/TIME display.

10. Specifications

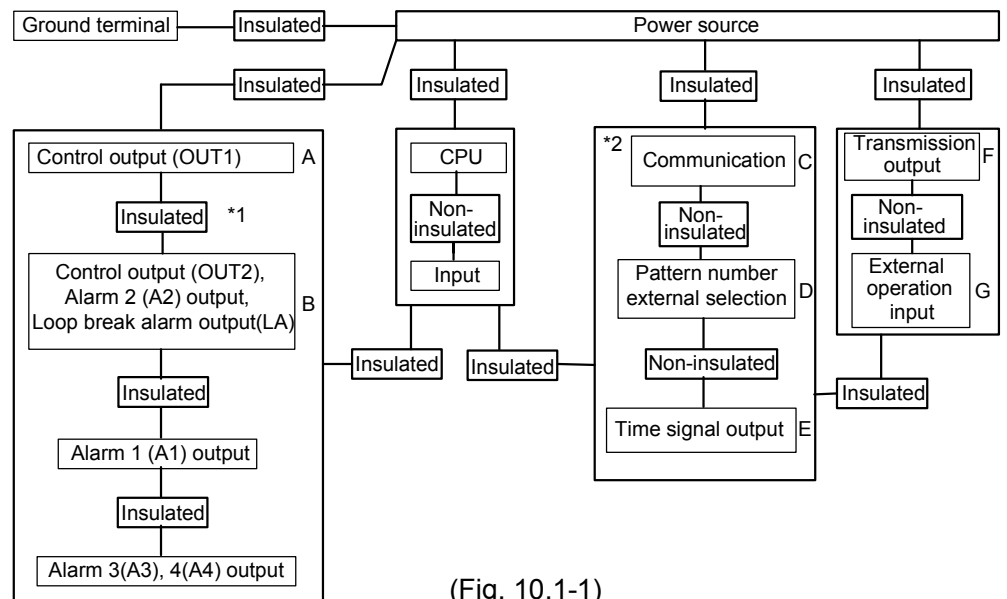
10.1 Standard specifications

Name	Programmable Controller : PC-935 ON/OFF SERVO Programmable Controller: PC-955									
Mounting	Flush									
Setting	Input system using membrane sheet key									
Display	<table border="1"> <tr> <td>PV display</td> <td>Red LED 4 digits, Character size 14.3x8mm (HxW)</td> </tr> <tr> <td>SV/MV/TIME display</td> <td>Green LED 4 digits, Character size 10x5.5m (HxW)</td> </tr> <tr> <td>Pattern No. display</td> <td>Yellow LED 1 digit, Character size 8x4mm (HxW)</td> </tr> <tr> <td>Step No. display</td> <td>Green LED 1 digit, Character size 8x4mm (HxW)</td> </tr> </table>		PV display	Red LED 4 digits, Character size 14.3x8mm (HxW)	SV/MV/TIME display	Green LED 4 digits, Character size 10x5.5m (HxW)	Pattern No. display	Yellow LED 1 digit, Character size 8x4mm (HxW)	Step No. display	Green LED 1 digit, Character size 8x4mm (HxW)
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Input	<table border="1"> <tr> <td>Thermocouple</td> <td>K, J, R, S, B, E, T, C(W/Re5-26), N, PL-Ⅱ External resistance 100Ω or less For input burnout, Overscale</td> </tr> <tr> <td>RTD</td> <td>Pt100, JPt100 3-wire system Allowable input lead wire resistance: 10Ω or less per wire For input burnout, Overscale</td> </tr> <tr> <td>DC current</td> <td>0 to 20mA DC, 4 to 20mA DC Input impedance: 50Ω For input disconnection: 0 to 20mA DC: The same as 0mA DC 4 to 20mA DC: Underscale</td> </tr> <tr> <td>DC voltage</td> <td>0 to 1V DC Input impedance: 1MΩ or more Allowable input voltage 5V DC or less Allowable signal source resistance, 2kΩ or less For input disconnection, Overscale</td> </tr> </table>		Thermocouple	K, J, R, S, B, E, T, C(W/Re5-26), N, PL-Ⅱ External resistance 100Ω or less For input burnout, Overscale	RTD	Pt100, JPt100 3-wire system Allowable input lead wire resistance: 10Ω or less per wire For input burnout, Overscale	DC current	0 to 20mA DC, 4 to 20mA DC Input impedance: 50Ω For input disconnection: 0 to 20mA DC: The same as 0mA DC 4 to 20mA DC: Underscale	DC voltage	0 to 1V DC Input impedance: 1MΩ or more Allowable input voltage 5V DC or less Allowable signal source resistance, 2kΩ or less For input disconnection, Overscale
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DC voltage	0 to 1V DC Input impedance: 1MΩ or more Allowable input voltage 5V DC or less Allowable signal source resistance, 2kΩ or less For input disconnection, Overscale									
Input sampling period	125ms									
Accuracy (indication, setting)	Within ±0.2% of each input span ±1digit, however, K, J, T input, less than 0°C (32°F): Within ±0.4% of each input span ±1digit R, S input, range 0 to 200°C (0 to 400°F): Within ±4°C (8°F). B input, range 0 to 300°C (0 to 600°F): Accuracy is not guaranteed. (Cold junction temperature compensation accuracy, ±1°C, at 0 to 50°C)									
Time indication accuracy	Within ±0.1% of setting time									
Control output (OUT1)	<table border="1"> <tr> <td>Relay contact</td> <td>1a1b (PC-955 type: 1a x 2) Control capacity: 3A 250V AC (resistive load) 1A 250V AC (inductive load $\cos\phi=0.4$)</td> </tr> <tr> <td>Non-contact voltage (for SSR drive)</td> <td>12⁺²₀ V DC Max 40mA DC (short circuit protected)</td> </tr> <tr> <td>DC current</td> <td>4 to 20mA DC(Isolated type) Load resistance: Max 550Ω</td> </tr> </table>		Relay contact	1a1b (PC-955 type: 1a x 2) Control capacity: 3A 250V AC (resistive load) 1A 250V AC (inductive load $\cos\phi=0.4$)	Non-contact voltage (for SSR drive)	12 ⁺² ₀ V DC Max 40mA DC (short circuit protected)	DC current	4 to 20mA DC(Isolated type) Load resistance: Max 550Ω		
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Alarm 1 (A1) Alarm 3 (A3) Alarm 4 (A4)	<p>The alarm action point is set by the \pm deviation from the SV (except Process alarm).</p> <p>When the input goes outside the range, the output turns ON or OFF (in the case of High/Low limit range alarm).</p> <p>Alarm type can be selected by internal switch or by keypad.</p> <ul style="list-style-type: none"> • No alarm action • High limit alarm (Deviation setting) : \pm Input span* (Off when set to 0) • Low limit alarm (Deviation setting) : \pm Input span* (Off when set to 0) • High/Low limits alarm (Deviation setting) : 0 to input span* (Off when set to 0) • High/Low limit range alarm (Deviation setting): 0 to input span* (Off when set to 0) • Process high alarm : Input range low limit to input range high limit • Process low alarm : Input range low limit to input range high limit <p>* For DC input, input span is the same as scaling span.</p> <table border="1" data-bbox="467 593 1481 958"> <tr> <td>Standby function</td> <td>Selectable</td> </tr> <tr> <td>Setting accuracy</td> <td>Within $\pm 0.2\%$ of each input span ± 1 digit</td> </tr> <tr> <td>Action</td> <td>ON/OFF action</td> </tr> <tr> <td>Hysteresis</td> <td>Thermocouple, RTD input: 0.1 to 100.0°C (°F) DC input: 1 to 1000 (The placement of the decimal point follows the selection.)</td> </tr> <tr> <td>Output</td> <td>Relay contact, 1a (A3, A4: 1a x 2) Control capacity: 3A 250V AC (resistive load) 1A 250V AC (inductive load $\cos\phi=0.4$) (However, A3 and A4 common terminal: Max 3A)</td> </tr> </table>	Standby function	Selectable	Setting accuracy	Within $\pm 0.2\%$ of each input span ± 1 digit	Action	ON/OFF action	Hysteresis	Thermocouple, RTD input: 0.1 to 100.0°C (°F) DC input: 1 to 1000 (The placement of the decimal point follows the selection.)	Output	Relay contact, 1a (A3, A4: 1a x 2) Control capacity: 3A 250V AC (resistive load) 1A 250V AC (inductive load $\cos\phi=0.4$) (However, A3 and A4 common terminal: Max 3A)								
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Controlling action	<p>Selectable with the DIP switch.</p> <ul style="list-style-type: none"> • Fuzzy overshoot suppression PID (with AT) • PID (with AT) <table border="1" data-bbox="467 1086 1481 1523"> <tr> <td>OUT1 proportional band (P)</td> <td>0.0 to 999.9% (ON/OFF control when set to 0.0)</td> </tr> <tr> <td>Integral time (I)</td> <td>0 to 3600 sec</td> </tr> <tr> <td>Derivative time (D)</td> <td>0 to 1800 sec</td> </tr> <tr> <td>Proportional cycle</td> <td>1 to 120 sec (Not available for DC current output type)</td> </tr> <tr> <td>ARW</td> <td>0 to 100%</td> </tr> <tr> <td>OUT1 high limit, low limit</td> <td>0 to 100% (DC current output type: -5 to 105%)</td> </tr> <tr> <td>Open output time</td> <td>0.1 to 999.9 sec (For PC-955 type)</td> </tr> <tr> <td>Closed output time</td> <td>0.1 to 999.9 sec (For PC-955 type)</td> </tr> <tr> <td>Hysteresis</td> <td>Thermocouple, RTD input: 0.1 to 100.0°C (°F) DC input: 1 to 1000 (The placement of the decimal point follows the selection.)</td> </tr> </table>	OUT1 proportional band (P)	0.0 to 999.9% (ON/OFF control when set to 0.0)	Integral time (I)	0 to 3600 sec	Derivative time (D)	0 to 1800 sec	Proportional cycle	1 to 120 sec (Not available for DC current output type)	ARW	0 to 100%	OUT1 high limit, low limit	0 to 100% (DC current output type: -5 to 105%)	Open output time	0.1 to 999.9 sec (For PC-955 type)	Closed output time	0.1 to 999.9 sec (For PC-955 type)	Hysteresis	Thermocouple, RTD input: 0.1 to 100.0°C (°F) DC input: 1 to 1000 (The placement of the decimal point follows the selection.)
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Hysteresis	Thermocouple, RTD input: 0.1 to 100.0°C (°F) DC input: 1 to 1000 (The placement of the decimal point follows the selection.)																		
Supply voltage	100 to 240V AC 50/60Hz 24V AC/DC 50/60Hz																		
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. 15VA																		

Circuit insulation configuration

[PC-935]



(Fig. 10.1-1)

- *1: When both OUT1 and OUT2 are DC current output or Non-contact voltage output, A is not insulated from B.
- *2: When OUT1 is DC current output or Non-contact voltage output, A-C, A-D, and A-E are not insulated from each other. When OUT2 is DC current output or Non-contact voltage output, B-C, B-D, and B-E are not insulated from each other.

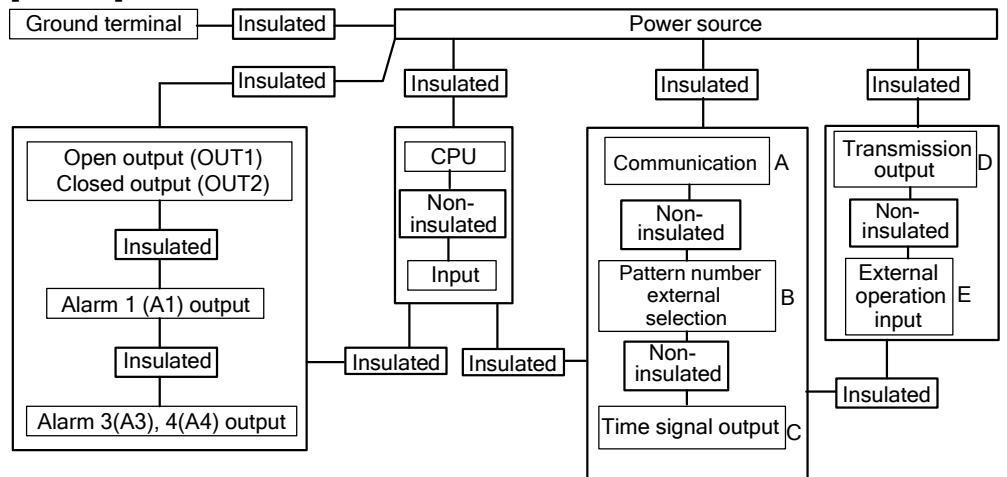
Insulation resistance

10MΩ or more, at 500V DC

An insulation test between the following **must not** be carried out because they are not insulated from each other.

*1 (A-B), *2 (A-C, A-D, A-E, B-C, B-D, B-E, C-D-E, F-G) in (Fig. 10.1-1)

[PC-955]



(Fig. 10.1-2)

Insulation resistance

10MΩ or more, at 500V DC

A-B-C and D-E in (Fig. 10.1-2): An insulation test **must not** be carried out because they are not insulated from each other.

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 power terminal and ground terminal: 1.5kV AC for 1 minute Between output terminal and power terminal : 1.5kV AC for 1 minute Between output terminal and ground terminal: 1.5kV AC for 1 minute
Weight	Approx. 500g
External dimensions	96 x 96 x 100mm(W x H x D)
Material	Base and Case: Flame-resistant resin
Color	Base and Case: Light gray
Attached functions	Set value lock, SV high/low limit, Sensor correction, Multi-range, Multi function, Alarm action delay timer, Warm-up display, Wait, Hold, Step progress, Step regress, Pattern Repeat/Link, Time faster progress, Data clearing, Pattern number external selection, External operation, Power failure countermeasure, Fixed value control, Self-diagnosis, Automatic cold junction temperature compensation, Sensor burnout function (overscale, underscale) and PV start.
Accessories	Mounting brackets : 1 set Instruction manual : 1 copy Unit label : 1 Terminal cover : 2 pieces (When TC option is added.) Gasket : 1 piece (When IP option is added.) Auxiliary frame : 1 piece (When IP option is added.)

10.2 Optional specifications

Alarm 2 output [A2 option] (only for PC-935 type)

The alarm action point is set by the \pm deviation from the SV (except Process alarm).

When the input goes outside the range, the output turns ON or OFF (in the case of High/Low limit range alarm).

Alarm type can be selected by internal switches.

When Alarm 2 (A2 option) and Loop break alarm (LA option) are added together, they utilize common output terminals.

If Alarm 2 (A2 option) is added, the Heating/Cooling control output (DR, DS, DA option) cannot be added.

- No alarm action
- High limit alarm (Deviation setting) : \pm Input span* (Off when set to 0)
- Low limit alarm (Deviation setting) : \pm Input span* (Off when set to 0)
- High/Low limits alarm (Deviation setting) : 0 to input span* (Off when set to 0)
- High/Low limit range alarm (Deviation setting): 0 to input span* (Off when set to 0)
- Process high alarm : Input range low limit to input range high limit
- Process low alarm : Input range low limit to input range high limit

* For DC input, input span is the same as the scaling span.

Standby function	Selectable
Setting accuracy	Within $\pm 0.2\%$ of each input span ± 1 digit
Action	ON/OFF action
Hysteresis	Thermocouple, RTD input: 0.1 to 100.0°C (°F) DC 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 $\cos\phi=0.4$)

Loop break alarm output [LA option]

Detects heater burnout, sensor burnout or actuator trouble.

When Loop break alarm (LA option) and Alarm 2 (A2 option) are added together, they utilize common output terminals.

If Loop break alarm (LA option) is added, Heating/Cooling control output (DR, DS, DA option) cannot be added.

For the PC-955 type, relay contact output is not available. (However, the LA indicator lights.)

Loop break alarm time	0 to 200 minutes
Loop break alarm span	Thermocouple (except T), RTD input: 0 to 100°C(°F) With a decimal point: 0.0 to 100.0°C(°F) DC 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 $\cos\phi=0.4$)

Heating/Cooling control output (OUT2) [DR, DS, DA option] (only for PC-935 type)

If Heating/Cooling control output is added, Alarm 2 (A2) or Loop break alarm (LA) cannot be added together.

Heating side: The same as OUT1

Cooling side: PID control

OUT2 proportional band(P)	0.0 to 10.0 times OUT1 proportional band (ON/OFF control when set to 0.0)
Integral time (I)	OUT1 integral time
Derivative time (D)	OUT1 derivative time
OUT2 proportional cycle	1 to 120 sec (Not available for the DC current output type)
Overlap band/Dead band	± Converted value of OUT1 proportional band Thermocouple, RTD input: -199.9 to 999.9°C(°F), DC input: -1999 to 9999 (The placement of the decimal point follows the selection.)
ON/OFF hysteresis	Thermocouple, RTD input: 0.1 to 100.0°C(°F), DC input: 1 to 1000 (The placement of the decimal point follows the selection.)
OUT2 high, low limit value	0 to 100% (DC current output type: -5 to 105%)
OUT2 action mode	Air cooling (Linear characteristic) Oil cooling (1.5th power of the linear characteristic) Water cooling (2nd power of the linear characteristic)
Control output (OUT2)	Relay contact [DR] : 1a, 3A 250V AC (resistive load) 1A 250V AC (inductive load $\cos\phi=0.4$) Non-contact voltage (for SSR drive) [DS]: 12 ⁺² ₀ V DC Max 40mA (short circuit protected) DC current [DA] : 4 to 20mA DC (Isolated type) Load resistance: Max 550Ω

Transmission output [TA, TV option]

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

Transmittable parameter: PV, SV, MV (Selectable by keypad)

Resolution	1/10000
Output signal	DC current (TA): 4 to 20mA DC (load resistance, Maximum 500Ω) DC voltage (TV): 0 to 1V DC (load resistance, Minimum 100kΩ)
Output accuracy	Within ±0.3% of Transmission output span

Serial communication [C, C5 option]

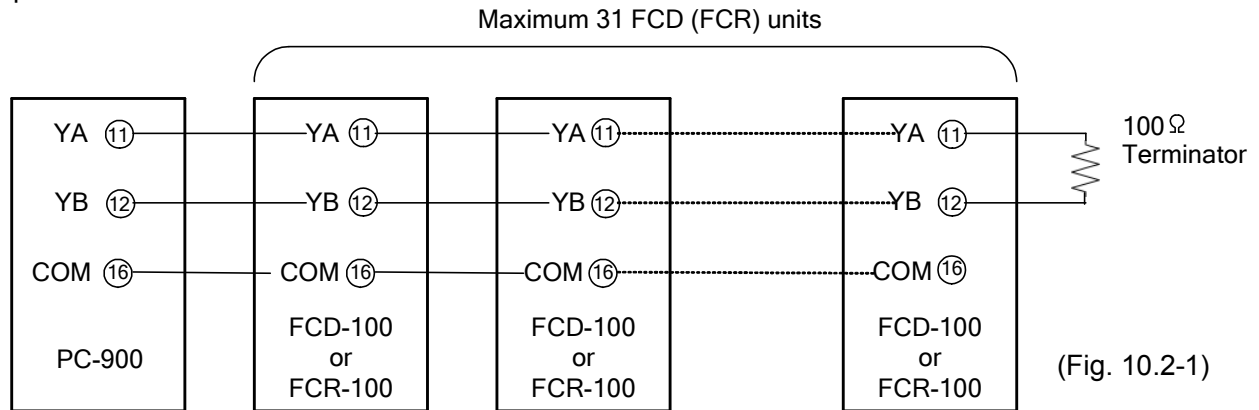
The following operations can be executed from an external computer.

- Reading and setting of the SV, PID and various set values.
- Reading of the PV and action status.
- Function change

Communication line	EIA RS-485 [C5] EIA RS-232C [C]
Number of units connected	RS-232C: 1 unit (Unable to connect in parallel) RS-485: Max 31 units of PC-900
Communication method	Half-duplex communication
Synchronization method	Start-stop synchronization
Communication speed	2400/4800/9600/19200bps (Selectable by keypad)
Data format	Start bit : 1 Data bit : 7 Parity : Even parity Stop bit : 1

Set value digital transmission [SVTC option]

The SV (desired value) can be transmitted digitally to Shinko controllers FCD or FCR to which the C5 option is added.



Time signal output [TS option]

Time signal block number (Block number to which signal OFF time and ON time are set) can be set for each step.

A maximum of 8 channels per step can be outputted.

The time signal output is changeable to status output as shown below.

- Time signal output TS1 ➔ RUN
- Time signal output TS2 ➔ HOLD
- Time signal output TS3 ➔ WAIT
- Time signal output TS4 ➔ FAST
- Time signal output TS5 ➔ STOP

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

Color black [BK option]

Front panel : Dark gray
Case : Black

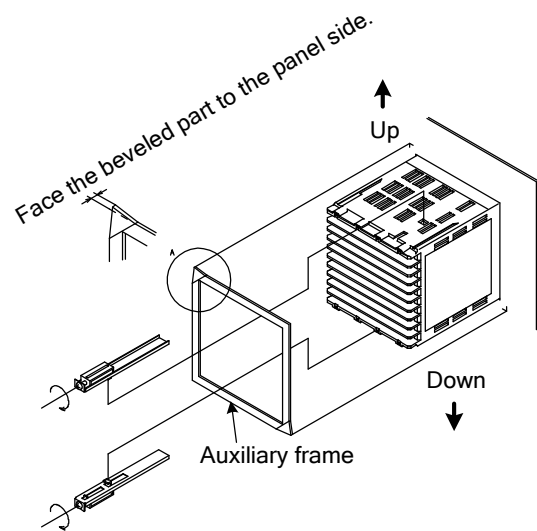
Terminal cover [TC option]

Electrical shock protection terminal cover

Drip-proof/Dust-proof [IP option]

Drip-proof and Dust-proof specification (IP54)

- Effective only for panel surface, case is excluded. Please use the front cover (soft type, sold separately) for comprehensive Drip-proof/Dust-proof protection.
- To protect the controller from water leaks between the control panel and controller, be sure to take note of the following.
 - (1) The panel cutout dimensions should be correct and have no burr(s).
 - (2) The control panel surface for mounting should be vertical.



User specified

- Input range : Shipped with specified input range
- Alarm type : Shipped with specified alarm type (A1, A2, A3, A4)
- OUT2 action mode : Shipped with specified OUT2 action mode (When DR, DS, DA option is added)
- Transmission output : Shipped with specified output (When TA, TV option is added)

11. Troubleshooting

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



Warning

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

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

Moreover, the instrument must be grounded before the power supply to the instrument is turned on.

[Indication]

Problem: The PV display flashes [- - - -].

Presumed cause	Solution
<ul style="list-style-type: none"> • Thermocouple or RTD is burnt out 	<ul style="list-style-type: none"> • Replace the Thermocouple or RTD. [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 A-B on the instrument, and terminals B-B are shorted, and if a value around 0°C(32°F) is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out.
<ul style="list-style-type: none"> • Lead wire of the thermocouple or RTD is not securely connected to the instrument terminals. 	<ul style="list-style-type: none"> • Ensure that the lead wire is securely connected to the instrument terminals.



Problem: The PV display flashes [- - -].

Presumed cause	Solution
<ul style="list-style-type: none"> • Codes (A, B, B) of RTD do not agree with the instrument terminal. • Polarity of thermocouple or compensation lead wire is reversed. 	<ul style="list-style-type: none"> • Ensure that they are wired correctly. • Ensure that they are wired correctly.

Problem: Indication on the PV display is irregular or unstable.

Presumed cause	Solution
<ul style="list-style-type: none"> • Designation of the sensor input is improper. • The temperature unit (°C or °F) is mistaken. • Sensor correcting value is unsuitable. • Specification of Thermocouple or RTD does not accord with that of the instrument. • AC leaks into the thermocouple or RTD circuit. • There may be equipment that interferes with or makes noise near the controller. 	<ul style="list-style-type: none"> • Set the Sensor input properly by the Rotary switch and DIP switch. • Set it to a suitable unit using the DIP switch. • Set it to a suitable value. • Use a sensor in accordance with the specification of the instrument. • Use an ungrounded type sensor. • Keep equipment that interferes with or makes noise away from the controller.

[Key operation]

Problem: SV, PID values, Proportional cycle and Alarm 1 to Alarm 4, etc. cannot be set.
 (Values cannot be changed by the  or  key.)

Presumed cause	Solution
<ul style="list-style-type: none"> • Set value lock is selected. • During AT (auto-tuning). 	<ul style="list-style-type: none"> • Release the lock selection. • Cancel AT if necessary.

Problem: Even if the  or  key is pressed, the setting indication does not change within the input range.

Presumed cause	Solution
<ul style="list-style-type: none"> • SV high limit or low limit value may be set at the point where the value does not change. 	<ul style="list-style-type: none"> • Set them to suitable values.




Problem: Program does not start even if the  key is pressed in the Program mode.

Presumed cause	Solution
<ul style="list-style-type: none"> • External operation STOP function is working. 	<ul style="list-style-type: none"> • Disconnect terminals 23 and 27.

Problem: Program ends immediately.

Presumed cause	Solution
<ul style="list-style-type: none"> • Step time is not set. 	<ul style="list-style-type: none"> • Set the step time.

Problem: Step does not proceed.

Presumed cause	Solution
<ul style="list-style-type: none"> • Status: HOLD mode. • WAIT action is working. 	<ul style="list-style-type: none"> • Press the  key to resume the program control. • Press the  or  key to cancel Wait function.

[Control]

Problem: PV (process variable) does not rise.

Presumed cause	Solution
<ul style="list-style-type: none">• Thermocouple or RTD is burnt out• Thermocouple or RTD is not securely mounted (inserted) to the control target.	<ul style="list-style-type: none">• Replace the thermocouple or RTD.• Securely mount (insert) the Thermocouple or RTD to the control target.

Problem: PV (process variable) rises too much.

Presumed cause	Solution
<ul style="list-style-type: none">• Specification of the Thermocouple or RTD does not accord with that of the instrument.	<ul style="list-style-type: none">• Use a sensor in accordance with the specification of the instrument.

Problem: Fixed value control cannot be performed.

Presumed cause	Solution
<ul style="list-style-type: none">• Program mode has been selected.	<ul style="list-style-type: none">• Change the mode to Fixed value control.

Problem: Output remains in an ON status.

Presumed cause	Solution
<ul style="list-style-type: none">• For the Fixed value control, OUT1 low limit value or OUT2 low limit value is set to 100% or higher in the Output parameter setting mode.	<ul style="list-style-type: none">• Set it to a suitable value.
<ul style="list-style-type: none">• For the Program control, OUT1 low limit value or OUT2 low limit value is set to 100% or higher in the Output block data setting mode.	<ul style="list-style-type: none">• Set it to a suitable value.

Problem: Output remains in an OFF status.

Presumed cause	Solution
<ul style="list-style-type: none">• For the Fixed value control, OUT1 high limit value or OUT2 high limit value is set to 0% or less in the Output parameter setting mode.	<ul style="list-style-type: none">• Set it to a suitable value.
<ul style="list-style-type: none">• For the Program control, OUT1 high limit value or OUT2 high limit value is set to 0% or less in the Output block data setting mode.	<ul style="list-style-type: none">• Set it to a suitable value.

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

12. Default values

[Program control]

● Pattern setting mode [*P.P.n.*]

PV display	Setting item	Default value (SV/MV/TIME display)	Data
<i>P.P.n</i>	Pattern number	0	
<i>T.E.n.P</i>	Step SV (temperature)	0°C	
<i>T.I.n.E</i>	Step time	00.00 min.	
<i>.P.I.d</i>	PID block number	0	
<i>.T.S.1</i>	Time signal 1 block number	0	
<i>.T.S.2</i>	Time signal 2 block number	0	
<i>.T.S.3</i>	Time signal 3 block number	0	
<i>.T.S.4</i>	Time signal 4 block number	0	
<i>.T.S.5</i>	Time signal 5 block number	0	
<i>.T.S.6</i>	Time signal 6 block number	0	
<i>.T.S.7</i>	Time signal 7 block number	0	
<i>.T.S.8</i>	Time signal 8 block number	0	
<i>.W.A.I</i>	Wait block number	0	
<i>.A.L.n</i>	Alarm block number	0	
<i>.O.U.T</i>	Output block number	0	

● Block setting mode [*P.P.c.t.*]

PID block [*P..00*] (PID block number 0)

<i>P.O.P</i>	OUT1 proportional band	2.5%	
<i>P.O.I</i>	Integral time	200 sec.	
<i>P.O.d</i>	Derivative time	50 sec.	
<i>P.O.n</i>	ARW (Anti-reset windup)	50%	
<i>P.O.P.b</i>	OUT2 proportional band	1.0 times	

Time signal block [*T..00*] (Time signal block number 0)

<i>00.F</i>	Time signal output OFF time	00.00 min.	
<i>00.n</i>	Time signal output ON time	00.00 min.	

Wait block [*W..00*] (Wait block number 0)

<i>W.0</i>	Wait value	0°C	
------------	------------	-----	--

Alarm block [*A..00*] (Alarm block number 0)

<i>A0.1</i>	Alarm 1 (A1) value	Unavailable because default value is Pattern end 1 output	
<i>A0.2</i>	Alarm 2 (A2) value	0°C	
<i>A0.3</i>	Alarm 3 (A3) value	0°C	
<i>A0.4</i>	Alarm 4 (A4) value	0°C	

Output block [*O..00*] (Output block number 0)

<i>o0.H</i>	OUT1 high limit value	100%	
<i>o0.L</i>	OUT1 low limit value	0%	
<i>o0.H.b</i>	OUT2 high limit value	100%	
<i>o0.L.b</i>	OUT2 low limit value	0%	
<i>o0.c.L</i>	OUT1 rate-of-change	0%	

● Number of repetitions, Pattern link setting mode [*c.HI.n*]

PV display	Setting item	Default value (SV/MV/TIME display)	Data
<i>rEPF</i>	Number of repetitions (Pattern No. 0)	0	
<i>cHI n</i>	Pattern link (Pattern No.0 and No.1)	- - - - : Pattern link Disabled	

● AT Perform mode [*AT. . .*]

<i>AT4</i>	AT mode	<i>noNL</i> : Normal mode	
<i>AT</i>	AT Perform/Cancel	- - - - : Cancel	

● Attached function setting mode [*c.o.n.d.*]

Alarm parameter setting mode [*AL.n .*]

<i>AL3F</i>	Alarm 3 (A3) type	<i>Hi</i> : High limit alarm	
<i>AL4F</i>	Alarm 4 (A4) type	<i>Lo</i> : Low limit alarm	
<i>A1HY</i>	Alarm 1 (A1) hysteresis	1.0°C	
<i>A2HY</i>	Alarm 2 (A2) hysteresis	1.0°C	
<i>A3HY</i>	Alarm 3 (A3) hysteresis	1.0°C	
<i>A4HY</i>	Alarm 4 (A4) hysteresis	1.0°C	
<i>A1dY</i>	Alarm 1 (A1) delay timer	0 sec.	
<i>A2dY</i>	Alarm 2 (A2) delay timer	0 sec.	
<i>A3dY</i>	Alarm 3 (A3) delay timer	0 sec.	
<i>A4dY</i>	Alarm 4 (A4) delay timer	0 sec.	
<i>LP_F</i>	Loop break alarm time	0 min.	
<i>LP_H</i>	Loop break alarm span	0°C	

Output parameter setting mode [*OUT. . .*]

<i>c00</i>	OUT1 proportional cycle	R/M: 30 sec., S/M: 3 sec.	
<i>HY4</i>	OUT1 ON/OFF hysteresis	1.0°C	
<i>c_b</i>	OUT2 proportional cycle	DR: 30 sec., DS: 3 sec.	
<i>cAct</i>	OUT2 action mode	<i>AI r</i> : Air cooling	
<i>HY4b</i>	OUT2 ON/OFF hysteresis	1.0°C	
<i>db</i>	Overlap band/Dead band	0.0°C	
<i>P_db</i>	Open/Closed output dead band	3.0%	
<i>P_oT</i>	Open output time	30.0 sec.	
<i>P_cT</i>	Closed output time	30.0 sec.	

SV high/low limit value setting mode [*HLI.n*]

<i>4H</i>	SV high limit value	1370°C	
<i>4L</i>	SV low limit value	-200°C	

Transmission output parameter setting mode [*Tr.o .*]

<i>Tr_oY</i>	Transmission output type	<i>PV</i> : PV(process variable)	
<i>Tr_LH</i>	Transmission output high limit value	1370°C	
<i>Tr_LL</i>	Transmission output low limit value	-200°C	

Input parameter setting mode [*IP. . .*]

<i>4FLH</i>	Scaling high limit value	1370	
<i>4FLl</i>	Scaling low limit value	-200	
<i>dP</i>	Decimal point place	<i>00</i> : No decimal point	
<i>4o</i>	Sensor correction	0.0°C	
<i>FlLT</i>	PV filter time constant	0.0 sec.	

Communication parameter setting mode [c.o.n.]

PV display	Setting item	Default value (SV/MV/TIME display)	Data
c n 4 P	Communication speed	96: 9600bps	
c n n n	Instrument number	0	
c n 4	Communication mode	n o n L: Serial communication	

Other functions setting mode [a.f.e.r.]

L o c k	Set value lock	- - - -: Unlock	
4 _ 4 B	Step SV when program control starts	0.0°C	
4 _ 4 L	Program control start type	P B : PV start	
P r E L	Status after power is restored	c o n : Continuation	
n _ 4	Step time unit	n / n : Minute	
4 _ r n	Step time indication type	r : Remaining time	
4 _ r E	Step SV indication type	4 B : SV corresponding to the step time progress	
P E r n	Pattern end output time	0 sec.	
P E H	Step SV Hold function at program end	4 r o P: Not holding	
r 4 1 4	Time signal output/Status output (RUN) selection for TS1	r 4 : Time signal output	
r 4 2 4	Time signal output/Status output (HOLD) selection for TS2	r 4 : Time signal output	
r 4 3 4	Time signal output/Status output (WAIT) selection for TS3	r 4 : Time signal output	
r 4 4 4	Time signal output/Status output (FAST) selection for TS4	r 4 : Time signal output	
r 4 5 4	Time signal output/Status output (STOP) selection for TS5	r 4 : Time signal output	
o 4 F	Overshoot suppression factor	1.0	
E o U T	Output status when input abnormal	o F F : Outputs OFF (4mA) or OUT1 (OUT2) low limit value.	

● **Automatic/Manual control switching mode [n.R.n.U.]**

n R n U	Automatic/Manual control switching	A U T o: Automatic	
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[Fixed value control]

- Fixed value control parameter setting mode [F.V.]

SV (desired value) setting mode [S.V.]

PV display	Setting item	Default value (SV/MV/TIME display)	Data
SV	SV (desired value)	0°C	

PID parameter setting mode [P.I.D.]

P	OUT1 proportional band	2.5%	
I	Integral time	200 sec.	
D	Derivative time	50 sec.	
ARW	ARW (Anti-reset windup)	50%	
Pb	OUT2 proportional band	1.0 times	

Alarm value setting mode [A.L.]

A1	Alarm 1 (A1) value	Unavailable because default value is Pattern end 1 output	
A2	Alarm 2 (A2) value	0°C	
A3	Alarm 3 (A3) value	0°C	
A4	Alarm 4 (A4) value	0°C	

- Auto-tuning Perform mode [A.T.]

AT	AT mode	normal: Normal mode	
AT	AT Perform/Cancel	----: Cancel	

- Attached function setting mode [c.f.]

Alarm parameter setting mode [A.L.]

AL3F	Alarm 3 (A3) type	H: High limit alarm	
AL4F	Alarm 4 (A4) type	L: Low limit alarm	
A1H4	Alarm 1 (A1) hysteresis	1.0°C	
A2H4	Alarm 2 (A2) hysteresis	1.0°C	
A3H4	Alarm 3 (A3) hysteresis	1.0°C	
A4H4	Alarm 4 (A4) hysteresis	1.0°C	
A1d4	Alarm 1 (A1) delay timer	0 sec.	
A2d4	Alarm 2 (A2) delay timer	0 sec.	
A3d4	Alarm 3 (A3) delay timer	0 sec.	
A4d4	Alarm 4 (A4) delay timer	0 sec.	
LP_r	Loop break alarm time	0 min.	
LP_H	Loop break alarm span	0°C	

Output parameter setting mode [O.V.]

c	OUT1 proportional cycle	R/M: 30 sec., S/M: 3 sec.	
oLH	OUT1 high limit value	100%	
oLL	OUT1 low limit value	0%	
H44	OUT1 ON/OFF hysteresis	1.0°C	
oRd	OUT1 rate-of-change	0%	
c_b	OUT2 proportional cycle	DR: 30 sec., DS: 3 sec.	
cAc	OUT2 action mode	Air cooling	
oLHb	OUT2 high limit value	100%	
oLLb	OUT2 low limit value	0%	
H44b	OUT2 ON/OFF hysteresis	1.0°C	
db	Overlap band/Dead band	0.0°C	
P_db	Open/Closed output dead band	3.0%	
PoT	Open output time	30.0 sec.	
PcT	Closed output time	30.0 sec.	

SV high/low limit setting mode [4.L.L.]

PV display	Setting item	Default value (SV/MV/TIME display)	Data
4H□□	SV high limit value	1370°C	
4L□□	SV low limit value	-200°C	

Transmission output parameter setting mode [7.r.a.]

7r□□	Transmission output type	PV□□: PV	
7rLH	Transmission output high limit value	1370°C	
7rLL	Transmission output low limit value	-200°C	

Input parameter setting mode [1.n.P.]

4FLH	Scaling high limit value	1370	
4FLL	Scaling low limit value	-200	
dP□□	Decimal point place	□□ . : No decimal point	
4□□□	Sensor correction	0.0°C	
F1L□	PV filter time constant	0.0 sec.	

Communication parameter setting mode [c.a.n.]

c□□P	Communication speed	□□96: 9600bps	
c□□□	Instrument number	0	
c□□□	Communication mode	□□□□: Serial communication	

Other functions setting mode [a.f.E.r.]

Lo□□	Set value lock	----: Unlock	
EO□□	Output status when input abnormal	□□FF: Outputs OFF (4mA) or OUT1 (OUT2) low limit value.	

● **Automatic/Manual control switching mode [r.R.n.]**

rR□□	Automatic/Manual control switching	R□□□: Automatic	
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[Auto/Manual control switching mode]

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Index 2 (Fixed value control)

[Fixed value control parameter setting mode]

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[Auto-tuning Perform mode]

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[Attached function setting mode]

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[Auto/Manual control switching mode]

Auto/Manual control switching	86
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Program pattern graphing

Make a Program pattern and Data table before setting the Program.

Copy the Program pattern table (p.126) and graph the pattern by following procedures.

- Write down the SV on Y axis including the highest and lowest temperature.
- From Step 0, write down the step SV, step time and block number data such as PID, Time signal 1 to 8, Wait, Alarm and Output in sequence.
(Write down the block number for each step even if the same number is used.)
- 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:Minute or Minute:Second).

Vertical (Y) axis : SV (°C or °F)

Horizontal (X) axis : Step time (Hour:Minute or Minute:Second)

- Step SV is considered to be the value at the end of the step.
- Step time is considered to be the step process time.

The relation between the step SV and Step time can be explained as follows. (Refer to p.122)

Step 0: The control is performed so that the temperature reaches 500°C in 30 minutes (0:30). (*1)

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

- (*1) If the SV start is selected during the Program control start type selection, the control starts from SV.
If the PV or PVr start is selected during the Program control start type selection, the SV is advanced to the PV and the control starts.

<PID block>

Consists of OUT1 proportional band (P), Integral time (I), Derivative time (D) and OUT2 proportional band (P) (*3) (10 block numbers from 0 to 9 can be set).

<Time signal block>

Consists of Time signal output OFF time and Time signal output ON time.

16 types of Time signal block (Block numbers from 0 to 15) can be set to Time signal 1 to 8 (TS1 to TS8) respectively (*2).

(*2): Time signal 1 to 5 (TS1 to TS5) can be set only when Time signal output is selected during Time signal output/Status output section (when TS option is applied) (pages 70 to 72).

<Wait block>

Wait block for block number 0 to 9 can be set.

<Alarm block>

Consists of Alarm 1 value, Alarm 2 value (only when A2 option is added), Alarm 3 value and Alarm 4 value.

Alarm block for block number 0 to 9 can be set.

<Output block>

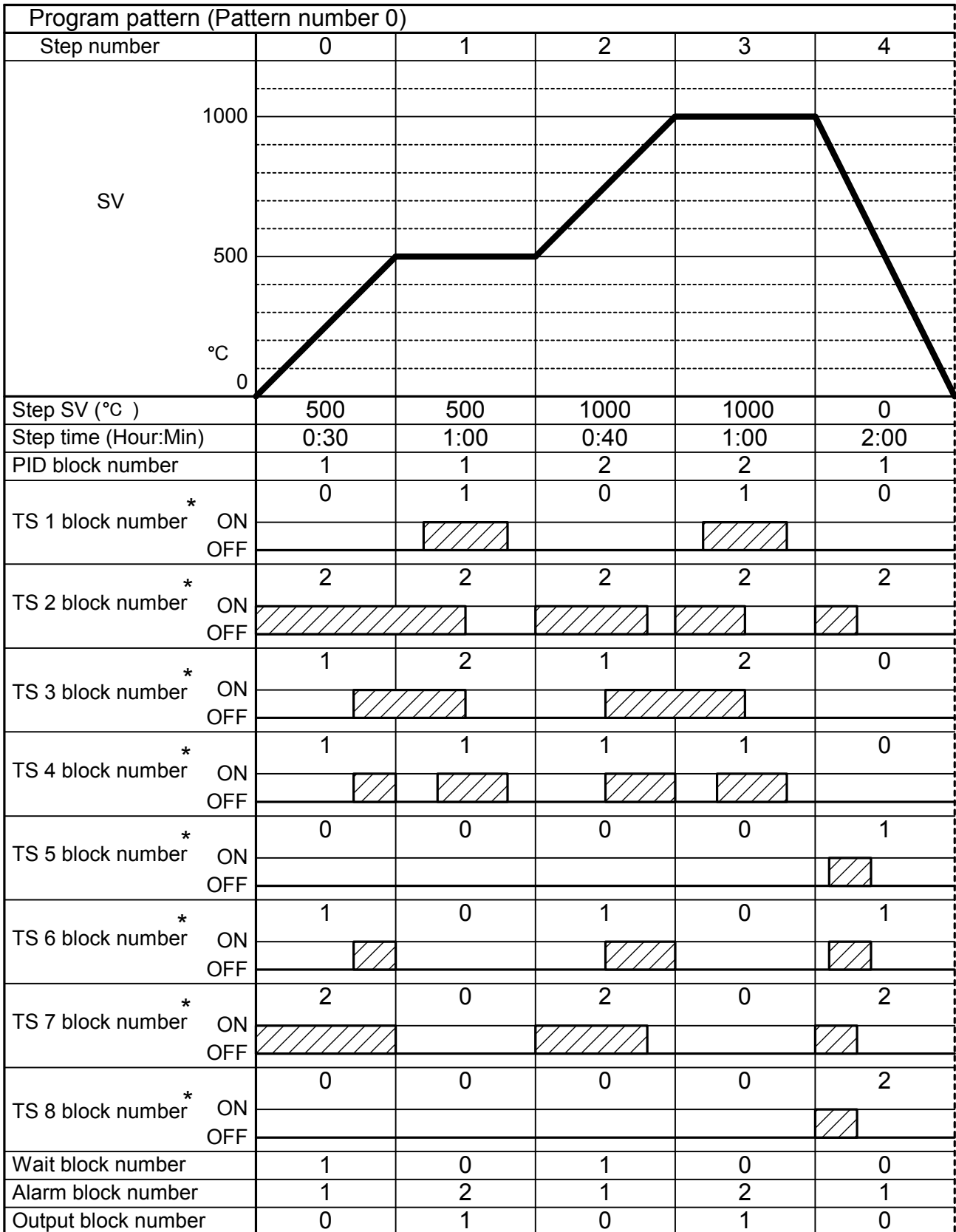
Consists of OUT1 high limit, OUT1 low limit, OUT2 high limit (*3), OUT2 low limit (*3) and OUT1 rate-of-change.

10 types of Output block (Block number from 0 to 9) can be set.

Output block for block number 0 to 9 can be set.

(*3): Only when the DR, DS or DA option is added.

● Program pattern graphing example



Even though the step intervals are shown to be equal length on the sheet, the actual length will depend on the step time.

* These items are indicated when TS option is added.

● **Data table making**

Copy the Data table (Pages 123 to 127) and make your own table by following procedures.

- Write down block data such as PID, Time signal 1 to 8 (TS option), Wait, Alarm and Output for block numbers as required.
- Write down other setting items as required.

● **Data table example**

[PID block]

No.	OUT1 proportional band	Integral time	Derivative time	(ARW)	OUT2 proportional band
0	2.5%	200sec.	50sec.	50%	2.5%
1	2.0%	180sec.	30sec.	40%	2.0%
2	1.8%	80sec.	20sec.	60%	1.8%

[Time signal block (TS option)]

No.	Output OFF time (Hour:Minute)	Output ON time (Hour:Minute)
0	0:00	0:00
1	0:20	0:30
2	0:00	0:30

[Wait block]

No.	Wait value
0	0 (OFF)
1	10°C
2	5°C

[Alarm block]

No.	Alarm 1 (A1) value (Pattern end output)	Alarm 2 (A2) value (Process alarm)	Alarm 3 (A3) value (High limit alarm)	Alarm 4 (A4) value (Low limit alarm)
0		1370°C	0 (OFF)	0 (OFF)
1		1370°C	10°C	10°C
2		1370°C	5°C	5°C

[Output block]

No.	OUT1 high limit	OUT1 low limit	OUT2 high limit	OUT2 low limit	OUT1 rate-of-change
0	100%	0%	100%	0%	0%/sec
1	100%	10%	100%	10%	10%/sec
2	80%	0%	80%	0%	0%/sec

- Proportional cycle : 15 seconds
- Number of repetitions : 1
- Pattern link : Pattern link Disabled
- Communication speed : 9600bps
- Communication instrument number: 1
- Overshoot suppression factor : 1.0

[Fixed value control parameter]

- SV (desired value) [SV]: 1000°C
- OUT1 proportional band [P]: 2.0%
- Integral time [I]: 180 seconds
- Derivative time [D]: 30 seconds
- ARW [ARW]: 50%
- OUT2 proportional band [Pb]: 2.0% (When multiplying factor is 1.0)
- Alarm 1 (A1) value [A1]: Pattern end output
- Alarm 2 (A2) value [A2]: 1370°C (Process alarm)
- Alarm 3 (A3) value [A3]: 10°C (High limit alarm)
- Alarm 4 (A4) value [A4]: 10°C (Low limit alarm)

● Data and Program pattern table

[PID block]

No.	OUT1 proportional band	Integral time	Derivative time	ARW	OUT2 proportional band
0	%	sec.	sec.	%	%
1	%	sec.	sec.	%	%
2	%	sec.	sec.	%	%
3	%	sec.	sec.	%	%
4	%	sec.	sec.	%	%
5	%	sec.	sec.	%	%
6	%	sec.	sec.	%	%
7	%	sec.	sec.	%	%
8	%	sec.	sec.	%	%
9	%	sec.	sec.	%	%

[Time signal block (TS option)]

No.	Output OFF time (:)	Output ON time (:)
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

[Wait block]

No.	Wait value
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

[Alarm block]

No.	Alarm 1 (A1) value ()	Alarm 2 (A2) value ()	Alarm 3 (A3) value ()	Alarm 4 (A4) value ()
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				

[Output block]

No.	OUT1 high limit	OUT1 low limit	OUT2 high limit	OUT2 low limit	OUT1 rate-of-change
0	%	%	%	%	%/sec.
1	%	%	%	%	%/sec.
2	%	%	%	%	%/sec.
3	%	%	%	%	%/sec.
4	%	%	%	%	%/sec.
5	%	%	%	%	%/sec.
6	%	%	%	%	%/sec.
7	%	%	%	%	%/sec.
8	%	%	%	%	%/sec.
9	%	%	%	%	%/sec.

- Proportional cycle : sec.
- Number of repetitions :
- Pattern link :
- Communication speed : bps
- Communication instrument number :
- Overshoot suppression factor :

[Fixed value control parameter]

- SV (Desired value) [SV]:
- OUT1 proportional band [Pb1]: %
- Integral time [I]: sec.
- Derivative time [d]: sec.
- ARW [ARW]: %
- OUT2 proportional band [Pb2]: %
- Alarm (A1) value [A1]:
- Alarm (A2) value [A2]:
- Alarm (A3) value [A3]:
- Alarm (A4) value [A4]:

Program pattern (Pattern number)					
Step number	0	1	2	3	4
SV (Desired value)					
Step SV (°C)					
Step time (:)					
PID block number					
TS 1 block number ON OFF					
TS 2 block number ON OFF					
TS 3 block number ON OFF					
TS 4 block number ON OFF					
TS 5 block number ON OFF					
TS 6 block number ON OFF					
TS 7 block number ON OFF					
TS 8 block number ON OFF					
Wait block number					
Alarm block number					
Output block number					

Program pattern (Pattern number)					Step number
5	6	7	8	9	
					SV (Desired value)
					Step SV (°C)
					Step time (:)
					PID block number
					ON TS 1 block number
					OFF
					ON TS 2 block number
					OFF
					ON TS 3 block number
					OFF
					ON TS 4 block number
					OFF
					ON TS 5 block number
					OFF
					ON TS 6 block number
					OFF
					ON TS 7 block number
					OFF
					ON TS 8 block number
					OFF
					Wait block number
					Alarm block number
					Output block number

**** Inquiries ****

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

(Example)

- Model ----- PC-935-R/M
- Input type ----- K
- Option ----- A2, TS
- Serial number ----- No. xxxxxxx

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

**SHINKO TECHNOS CO., LTD.
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