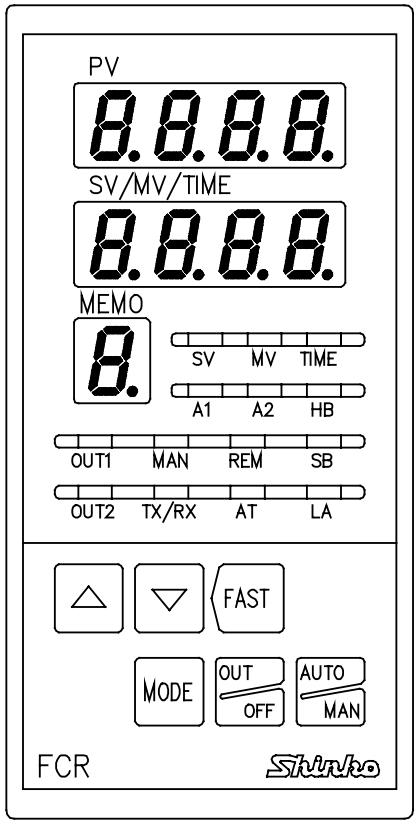
MICROCOMPUTER BASED

DIGITAL INDICATING CONTROLLER

FCR-13A

INSTRUCTION MANUAL



Shinko

Preface

Thank you for the purchase of our microcomputer based temperature indicating controller FCR-13A. This manual contains instructions for the mounting, functions, operations and notes when operating the FCR-13A. To prevent accidents arising from the misuse of this controller, please ensure the operator receives this manual.

Notes

- This instrument should be used in accordance with the specifications described in the manual. If it is not used according to the specifications, it may malfunction or cause fire.
- Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- Specifications, external appearance of the FCR-13A and the contents of this instruction manual are subject to change without notice.
- Care has been taken to assure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform our sales department.
- This instrument is designed to be installed within a control panel. If it is not, measures must be taken to ensure that the operator cannot touch power terminals or other high voltage sections.
- Any unauthorized transfer or copying of this document, in part or in whole, is prohibited.
- Shinko Technos CO., LTD. is not liable for any damages or secondary damages incurred as a result of using this product, including any indirect damages.

SAFETY PRECAUTIONS (Be sure to read these precautions before using our products.)

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

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

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

⚠ Warning

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

⚠ Safety Precautions

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

Caution with respect to Export Trade Control Ordinance

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

1. Installation precautions

⚠ Caution

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

Ensure the mounting location corresponds to the following conditions:

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

Note: Do not install this instrument near flammable material even though the case of this instrument is made of flame resisting resin.
Avoid setting this instrument directly on flammable material.

2. Wiring precautions

⚠ Caution

- **Use the solderless terminal with an insulation sleeve in which the M3 screw fits when wiring the FCR-13A.**
- **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 which is connected to the input terminal nor allow the power source to come into contact with the sensor, as the input circuit may be burnt out.**
- **This controller has no built-in power switch, circuit breaker or fuse. It is necessary to install them near the controller. (Recommended fuse: Time-lag fuse, rated voltage 250V AC, rated current 2A)**
- **For a 24V AC/DC power source, do not confuse polarity when using direct current (DC).**

3. Running and maintenance precautions

⚠ Caution

- **It is recommended that PID 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 instrunment 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 them**

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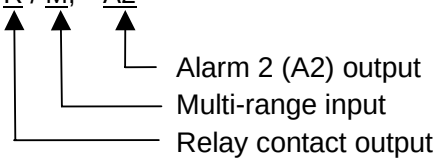
1. Model

1.1 Model

Control output (OUT1), input and option code, etc are entered where underlined.

(e.g.) F C R – 1 3 A - R / M, A2



Standard specifications

F C R – 1 3 A - □ / □				
Control action	3			PID control *1
Alarm 1 (A1)		A		Alarm action can be selected by keypad. *2
Control output (OUT1)			R	Relay contact
			S	Non-contact voltage (for SSR drive)
			A	DC current
Input				M	Multi-range *3

*1: Fuzzy self-tuning PID, PID, PD, ON/OFF action can be selected by internal DIP switch.

*2: 13 types of alarm action (including No alarm action) can be selected by internal DIP and Rotary switch.

*3: An input type can be selected by DIP and Rotary switch from a choice of: Thermocouple (10 types), RTD (3 types), DC current (2 types) and DC voltage (1 type).

Optional specifications

Code	Name	
A2	Alarm 2 (A2) output (Including Pattern end 2 output)	
DR	Heating/Cooling control output (OUT2)	Relay contact
DS		Non-contact voltage
DA		DC current
TA	Transmission output	DC current (4 to 20mA DC)
TV		DC voltage (0 to 1V DC)
C5	Serial communication	RS-485
C		RS-232C
SM	Set value memory external selection	
EA	External setting	DC current (0 to 20mA DC, 4 to 20mA DC)
EV		DC voltage (0 to 1V DC, 1 to 5V DC)
W	HB (Heater burnout alarm) output	Single phase
W3		Three phases
LA	Loop break alarm	
P24	Insulated power output	
BL	Screw type mounting bracket	
BK	Color: Black	
IP	Dust-proof•Drip-proof	
TC	Terminal cover	

For more details about options, refer to section “11.2 Optional specifications” (p.51).

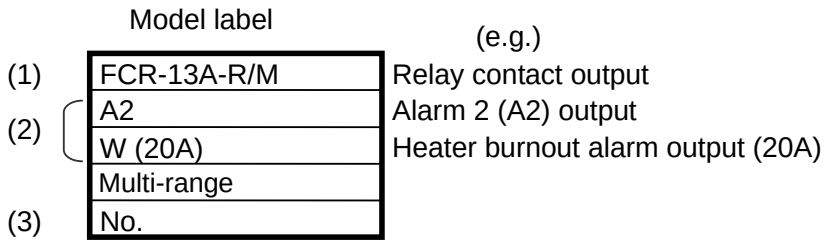
1.2 Rated input

Input type	Input range		Resolution
K	–200 to 1370 ℃	–320 to 2500 ℉	1℃(℉)
J	–200 to 1000 ℃	–320 to 1800 ℉	1℃(℉)
R	0 to 1760 ℃	0 to 3200 ℉	1℃(℉)
S	0 to 1760 ℃	0 to 3200 ℉	1℃(℉)
B	0 to 1820 ℃	0 to 3300 ℉	1℃(℉)
E	0 to 1000 ℃	0 to 1800 ℉	1℃(℉)
T	–199.9 to 400.0 ℃	–199.9 to 750.0 ℉	0.1℃(℉)
N	0 to 1300 ℃	0 to 2300 ℉	1℃(℉)
PL-Ⅱ	0 to 1390 ℃	0 to 2500 ℉	1℃(℉)
C(W/Re5-26)	0 to 2315 ℃	0 to 4200 ℉	1℃(℉)
Pt100	–199.9 to 850.0 ℃	–199.9 to 999.9 ℉	0.1℃(℉)
	–200 to 850 ℃	–320 to 1560 ℉	1℃(℉)
JPt100	–199.9 to 500.0 ℃	–199.9 to 900.0 ℉	0.1℃(℉)
4 to 20mA DC	–1999 to 9999 *		1
0 to 20mA DC	–1999 to 9999 *		1
0 to 1V DC	–1999 to 9999 *		1

*: For DC input, input range and decimal point place can be changed.

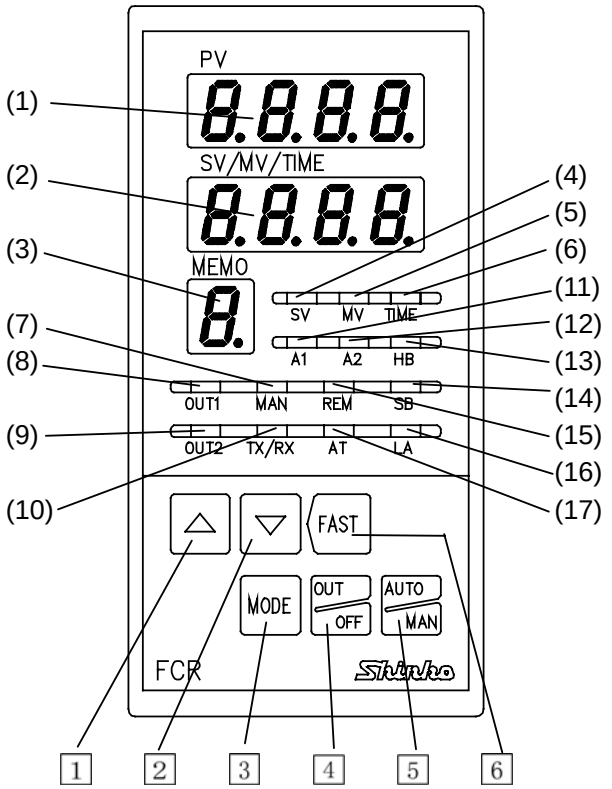
1.3 How to read the model label

Model labels are attached to the case and the inner assembly.



(1) Model
(2) Options
(3) Serial number

2. Name and functions of the sections



(Fig. 2-1)

(1) PV display
Indicates the Process variable (PV) with a red LED.

(2) SV/MV/TIME display
Indicates the Main set value (SV), Manipulated variable (MV) or Time (TIME) with a green LED.

(3) MEMO display
Indicates the Set value memory number with a yellow LED.

(4) SV indicator
A green LED lights when the Main set value (SV) is indicated on the SV/MV/TIME display.

(5) MV indicator
A red LED lights when the manipulated variable (MV) is indicated on the SV/MV/TIME display.

(6) Time indicator
A yellow LED lights when time (TIME) is indicated on the SV/MV/TIME display.

(7) Manual control indicator
A red LED lights during Manual control.

(8) OUT1 indicator
A green LED lights when OUT1 (control output) or Heating output is on.
(For DC current output type, it flashes in 0.125 second cycles corresponding to the output manipulated variable.)

(9) OUT2 indicator
The yellow LED lights when OUT2 (Cooling output) is on.
(For DC current output type, it flashes in 0.125 second cycles corresponding to the manipulated variable.)

(10) TX/RX indicator
A green LED lights during serial communication (TX, transmitting).

(11) A1 indicator (including Pattern end 1 output)
A red LED lights when the Alarm 1 (A1) output or Pattern end 1 output is on.

(12) A2 indicator (including Pattern end 2 output)
A red LED lights when the Alarm 2 (A2) output or Pattern end 2 output is on.

(13) HB indicator
A red LED lights when Heater burnout alarm output is on.

(14) SB indicator
A red LED lights when sensor is burnt out.

(15) REM indicator
A red LED lights during Remote operation.

(16) LA indicator
A red LED lights when Loop break alarm output is on.

(17) AT indicator
A yellow LED flashes during auto-tuning.

1 ▲ Increase key : Increases the numeric value.
2 ▼ Decrease key : Decreases the numeric value.
3 MODE Mode key : Switches a setting mode and registers set values. (To register each set value, press this key.)
4 OUT/OFF OUT/OFF key : Performs the control output ON or OFF.
5 AUTO/MAN Auto/Manual key : Switches either Automatic control or Manual control.
6 FAST Fast key : Makes the numerical value change faster by pressing the FAST key and the ▲ (or ▼) key simultaneously.

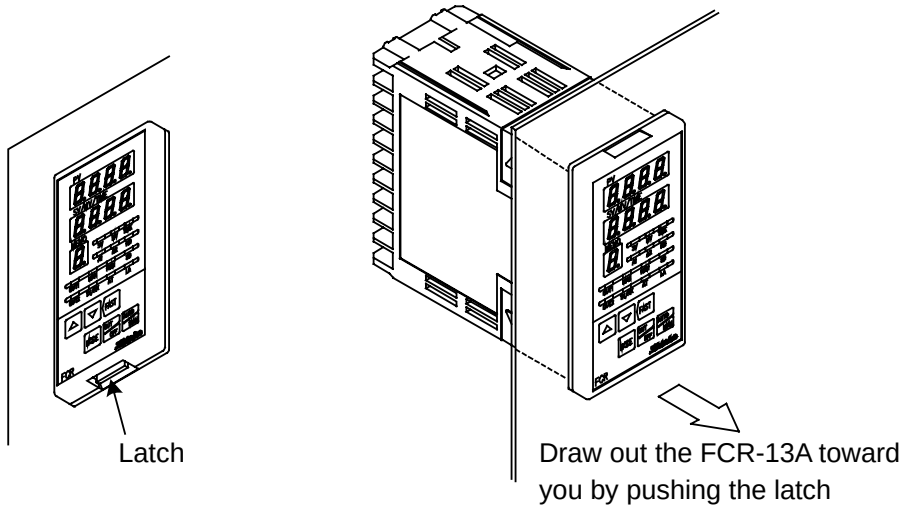
Notice

When setting the specifications and functions of this controller, connect terminals 2 and 3 for the power source first, then set them referring to “6. Operation” before performing “4. Mounting to the control panel” and “5. Wiring”.

3. Setup

3.1 Drawing out the internal assembly

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



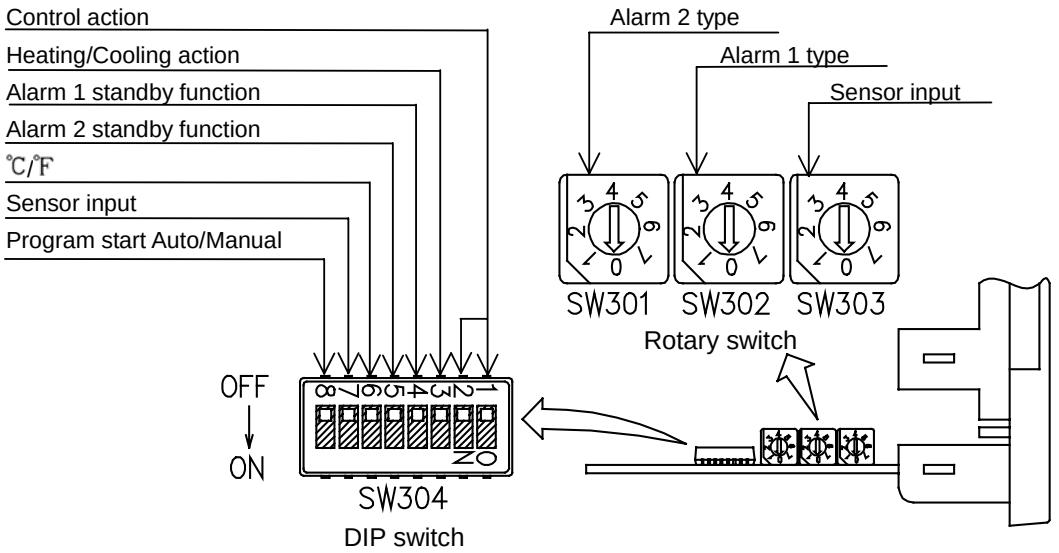
(Fig. 3.1-1)

3.2 Switch setting (multi-function)

Using a small flat blade screwdriver or tweezers, set the following with the DIP and Rotary switches as shown below and on pages 11 and 12.

Sensor input, Alarm 1 type, Alarm 2 type, Control action, Heating (reverse)/Cooling (direct) action, Alarm 1 and 2 standby function, Unit ℃/℉ and Program start Auto/Manual

If the A2 option is not applied, the rotary switch (SW301) will not be equipped.



(Fig. 3.2-1)

The following can be selected by the DIP switch (SW304).
Default value: All switches OFF [ ].
(Table 3.2-1)

Item	DIP SW 304 No.	Selection	Switch status	
Control action	1 and 2	Fuzzy self-tuning PID action	No.1: OFF	No.2: OFF
		PID action	No.1: ON	No.2: OFF
		PD action	No.1: OFF	No.2: ON
		ON/OFF action	No.1: ON	No.2: ON
Heating/Cooling action	3	Heating (reverse) action	No.3: OFF	
		Cooling (direct) action	No.3: ON	
Alarm 1 (A1) standby action	4	Without standby action	No.4: OFF	
		Standby action	No.4: ON	
Alarm 2 (A2) standby action (*1)	5	Without standby action	No.5: OFF	
		Standby action	No.5: ON	
℃/℉	6	℃	No.6: OFF	
		℉	No.6: ON	
Sensor input (*2)	7	K, J, R, B, N, PL-Ⅱ, Pt100, JPt100	No.7: OFF	
		S, E, T, C, 4 to 20mA, 0 to 20mA, 0 to 1V, Pt100	No.7: ON	
Program start Auto/Manual	8	Manual start	No.8: OFF	
		Automatic start	No.8: ON	

*1: The standby function will work only when the A2 option is applied.
*2: Use the rotary switch (SW303) and DIP switch (SW304) together for selecting the sensor input.

Program start: This item is available for the program control.
Manual start : The set program starts by pressing the OUT/OFF key.
Automatic start : The set program automatically starts from Step 1 after 2 seconds of warm-up status after power-on.

Select a sensor type with a rotary switch (SW303).
Default value: K (-200 to 1370℃)
(Table 3.2-2)

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

The alarm type and the pattern end output can be selected by the rotary switch A1 (SW302) and A2 (SW301).
The rotary switch A2 (SW301) is equipped only when the A2 option is applied.

Rotary switch A1 (SW302): Alarm 1 (A1) type and Pattern end 1 output.
Rotary switch A2 (SW301): Alarm 2 (A2) type and Pattern end 2 output.

Default value: No alarm action.
(Table 3.2-3)

Alarm 1 type	A1 Rotary SW302 No.	Alarm 2 type	A2 Rotary 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 inner assembly

If setup is completed, insert the internal assembly into the case.
Firmly insert the assembly until it is locked by the latch at the bottom of the instrument.
(There will be a clicking sound.)

> **⚠ Caution**
>
> Do not confuse the top and bottom of the internal assembly.
> If inserting the assembly into the case in the wrong direction, the PCB may be damaged.

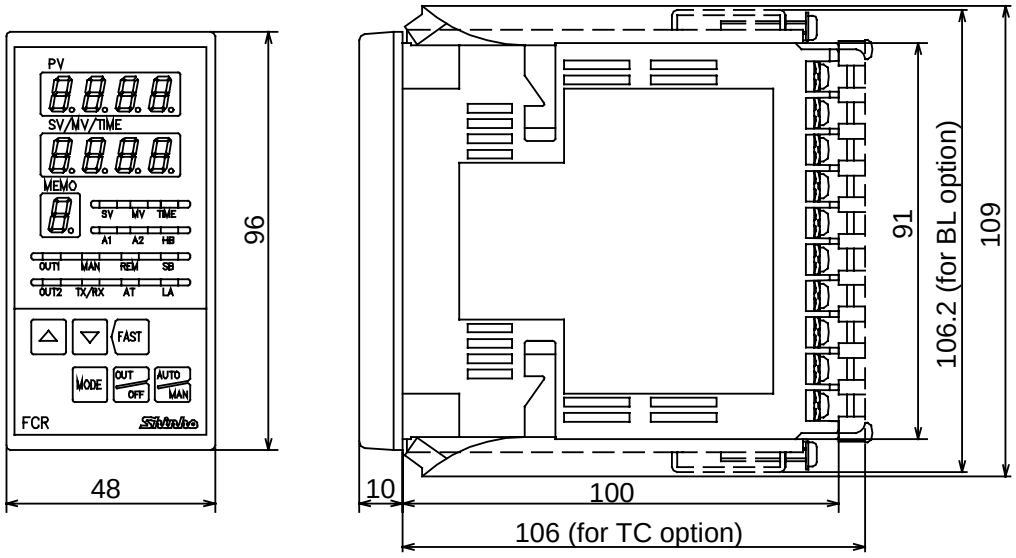
4. Mounting to the control panel

4.1 Site selection

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

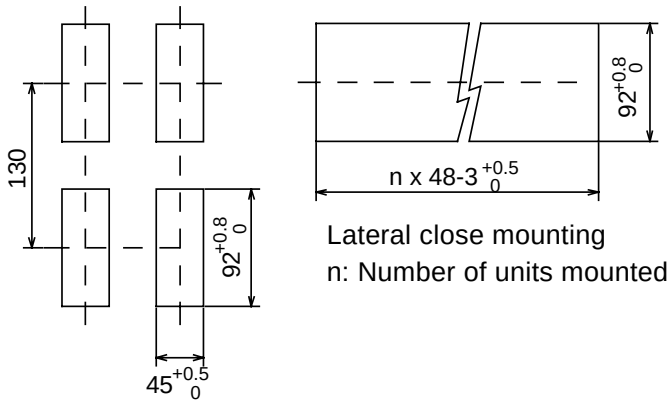
(1) A minimum of dust, and an absence of corrosive gases
(2) No flammable, explosive gases
(3) No mechanical vibrations or shocks
(4) No exposure to direct sunlight, an ambient temperature of 0 to 50℃ (32 to 122℉) that does not change rapidly
(5) An ambient non-condensing humidity of 35 to 85%RH
(6)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

4.2 External dimensions (Unit: mm)



(Fig. 4.2-1)

4.3 Panel cutout (Unit: mm)

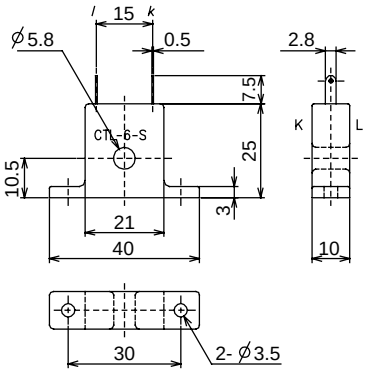


Lateral close mounting
n: Number of units mounted

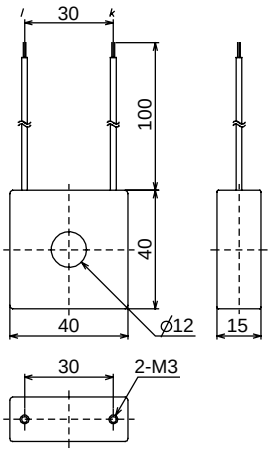
(Fig. 4.3-1)

4.4 CT (Current transformer) external dimensions (Unit: mm)

CTL-6S (for 5A, 10A, 20A)



CTL-12-S36-10L1 (for 50A)

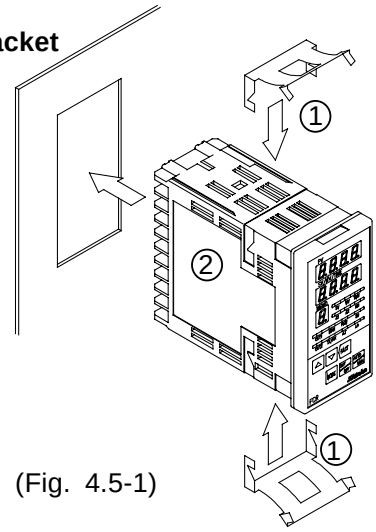


(Fig. 4.4-1)

4.5 Mounting

- **When using the One-touch type mounting bracket**

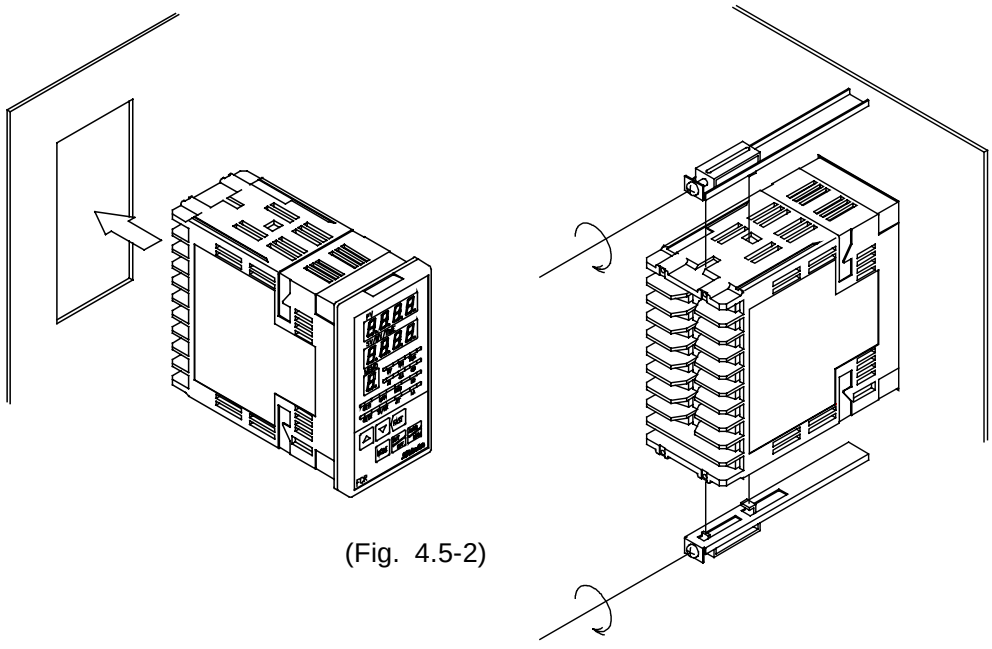
  Mounting panel thickness is within 1 to 3mm.
  Mount one-touch mounting bracket① to the instrument first, and then insert the FCR-13A② from the front of the panel.
  If Soft front cover (FC-R) is used, mounting panel thickness will be within 1 to 2.5mm.



(Fig. 4.5-1)

- **When using the Screw type mounting bracket (BL option)**

  Mounting panel thickness is within 1 to 15mm.
  Insert the FCR-13A from the front of the panel.
  Slot the mounting bracket to the holes at the top and bottom of the case, and screw in place.



(Fig. 4.5-2)

⚠ Warning

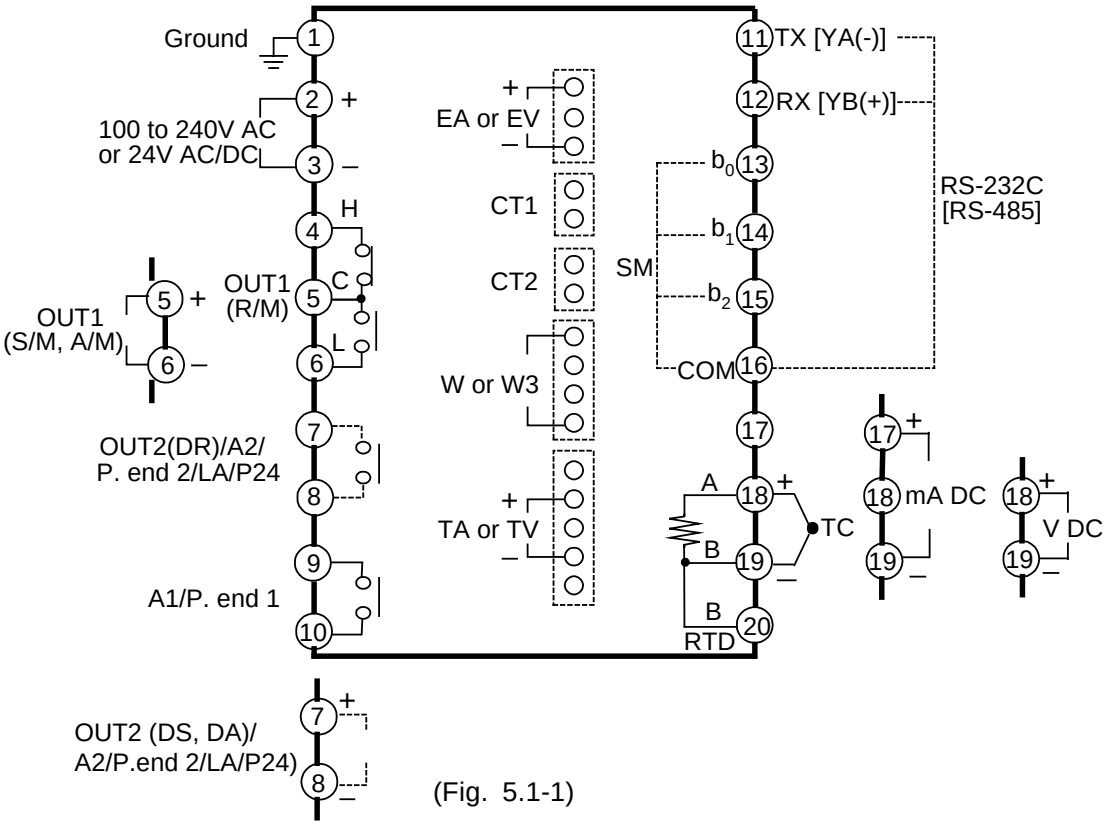
As the case is made of resin, do not use excessive force while screwing in the mounting bracket, or the case could be damaged.
The torque is approximately 0.12N•m.

5. Wiring

⚠ Warning

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

5.1 Terminal arrangement



(Fig. 5.1-1)

OUT1 : Control output 1 (Heating output)
OUT2 : Control output 1 (Cooling output)
A1 : Alarm 1 output
A2 : Alarm 2 output
LA : Loop break alarm output
W, W3: Heater burnout alarm output
P24 : Insulated power output

RS-232C(RS-485): Serial communication
TA, TV : Transmission output
EA, EV : External setting
SM : Set value memory number external selection
P. end : Pattern end output

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.

Dotted lines are optional, and no terminal is equipped unless specified.

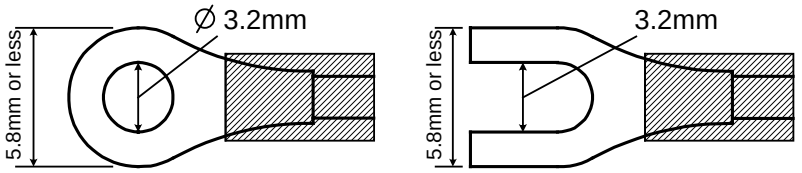
If the A2 and LA (option) are applied together, they use common output terminals.

Lead wire solderless terminal

Use a solderless terminal with an insulation sleeve in which an M3 screw fits as shown below.

The torque should be 0.6N･m to 1.0N･m.

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



(Fig. 5.1-2)

5.2 Wiring example

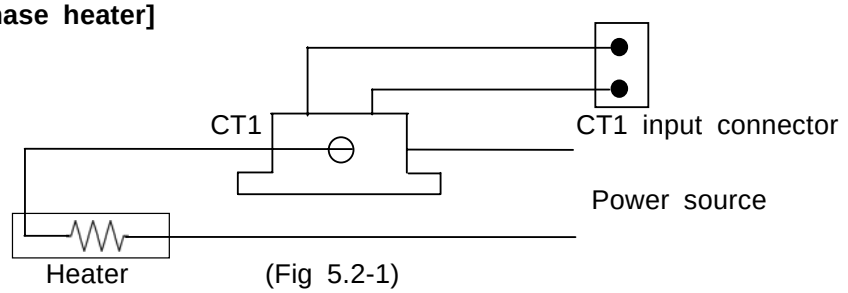
⚠ Caution

- Use a thermocouple and compensating lead wire according to the sensor input specifications of this controller.
- Use a 3-wire RTD system according to the sensor input specifications of this controller.
- This controller has no built-in power switch or fuse. It is necessary to install them in the circuit near the external controller.
  (Recommended fuse: Time-lag fuse, rated voltage 250V AC, rated current 2A)
- For a 24V AC/DC power source, do not confuse polarity when using direct current (DC).
- When using a relay contact output type, use a relay according to the capacity of the load to protect the built-in relay contact.
- When wiring, keep input wires (thermocouple, RTD, etc.) away from AC sources or load wires to avoid external interference.
- Use a thick wire (1.25 to 2.0mm^2) for grounding.

Heater burnout alarm

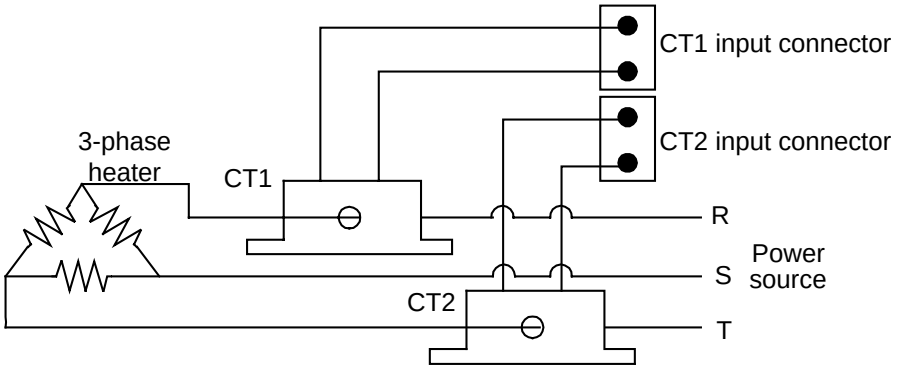
(1) This alarm is not usable for detecting current under phase control.
(2) Use the current transformer (CT) provided, and pass one lead wire of heater circuit into the hole of the CT.
(3) When wiring, keep CT wire away from AC sources and load wires to avoid the external interference.

[Single phase heater]

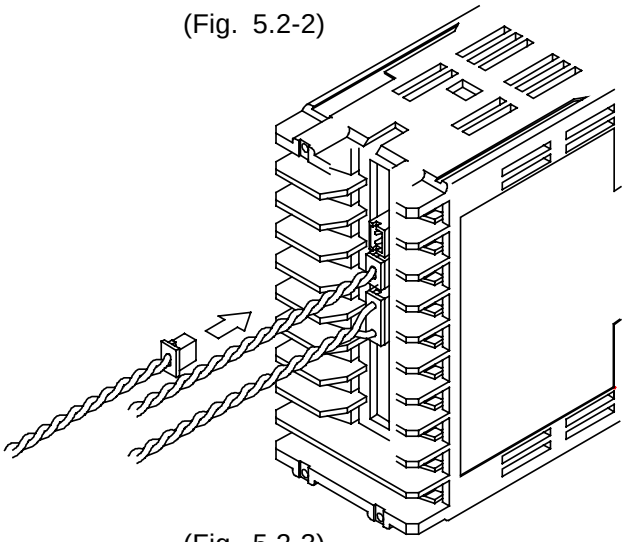


(Fig 5.2-1)

[3-phase heater]

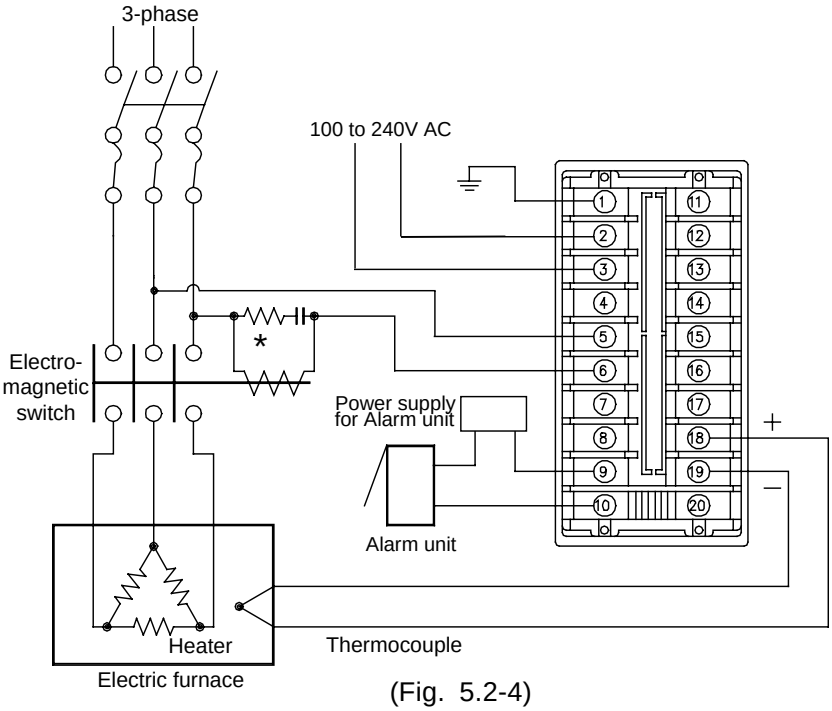


(Fig. 5.2-2)



(Fig. 5.2-3)

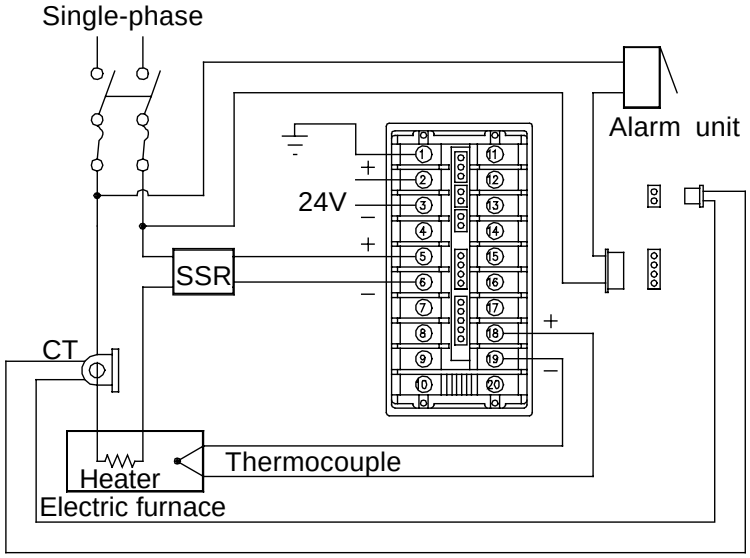
[FCR-13A-R/E]



(Fig. 5.2-4)

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

[FCR-13A-S/E]



(Fig. 5.2-5)

AC or DC is available for supply voltage 24V, however, do not confuse polarity when using direct current (DC).

6. Operation

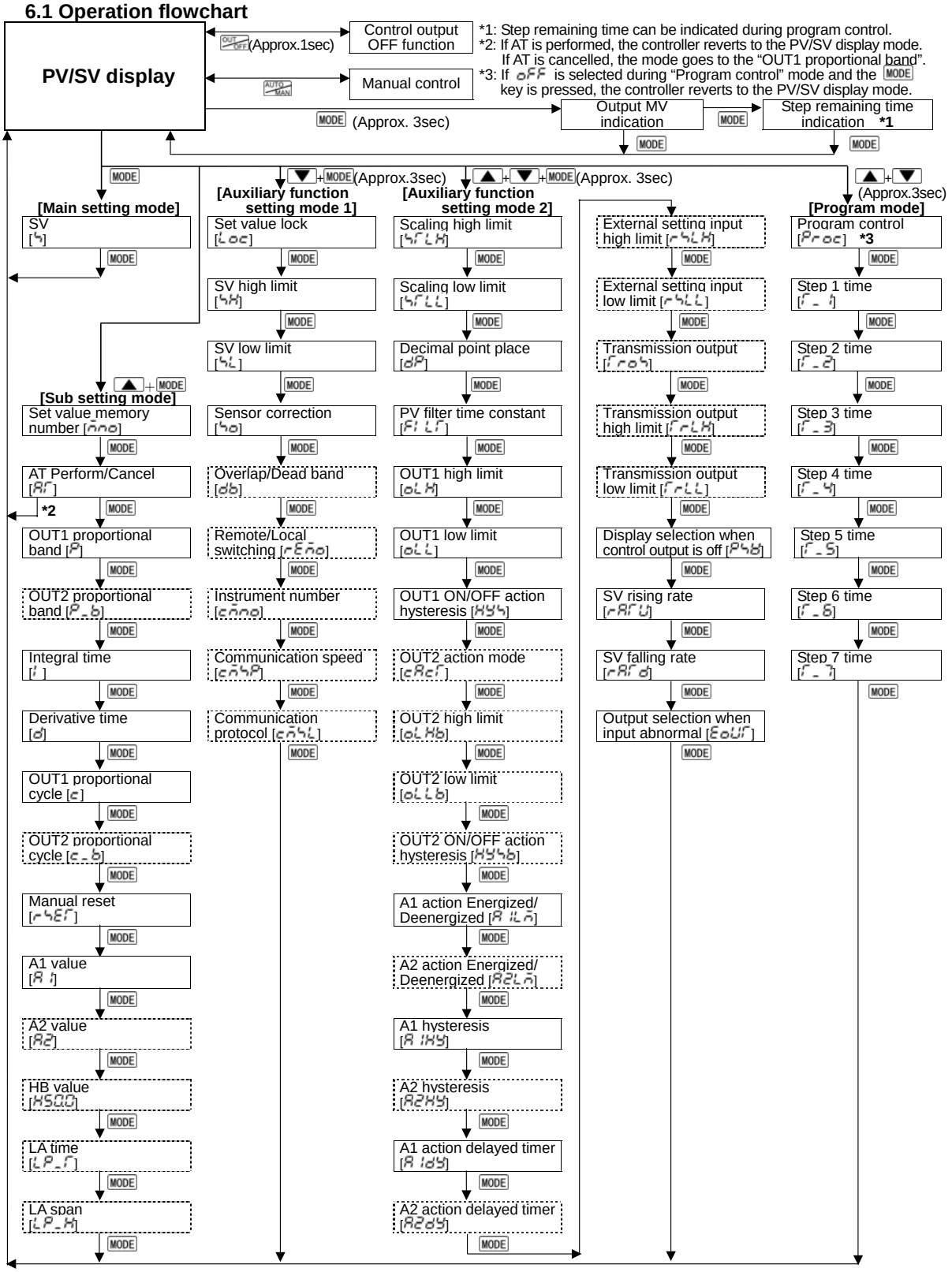
The PV display indicates the sensor character selected during Sensor input selection and temperature unit, and the SV/MV/TIME display indicates the rated maximum value for approx. 2 seconds after the power is turned on. See (Table 6-1).

During this time, all outputs and LED indicators are in OFF status.
After that, control starts indicating the actual temperature on the PV display and SV on the SV/MV/TIME display.
While the control output OFF function is working, PV display indicates oFF, No indication or PV previously selected during “Display selection when control output is off” mode.

(Table 6-1)

Input	℃		℉	
	PV display	SV display	PV display	SV display
K	tC	1370	tF	2500
J	JC	1000	JF	1800
R	rC	1760	rF	3200
B	bC	1820	bF	3300
PL-Ⅱ	PL2C	1390	PL2F	2500
N	nC	1300	nF	2300
S	SC	1760	SF	3200
E	EC	1000	EF	1800
T	T.C	400.0	T.F	750.0
C (W/Re5-26)	cC	2315	cF	4200
Pt100	Pr.C	850.0	Pr.F	999.9
	PrC	850	PrF	1560
JPt100	JPr.C	500.0	JPr.F	900.0
4 to 20mA DC	42A	Scaling high limit value	42A	Scaling high limit value
0 to 20mA DC	02A		02A	
0 to 1V DC	01V		01V	

6.1 Operation flowchart



*1: Step remaining time can be indicated during program control.
*2: If AT is performed, the controller reverts to the PV/SV display mode. If AT is cancelled, the mode goes to the "OUT1 proportional band".
*3: If oFF is selected during "Program control" mode and the MODE key is pressed, the controller reverts to the PV/SV display mode.

- Setting items with dotted lines are optional and they appear only when the options are added.
- ▲ + MODE : Press the MODE key while holding down the ▲ key.
- ▼ + MODE (approx. 3sec): Press the MODE key for approx. 3 seconds while holding down the ▼ key.
- ▲ + ▼ + MODE (approx. 3sec): Press the MODE key for approx. 3 seconds while holding down the ▲ and ▼ key.
- ▲ + ▼ (approx. 3sec): Press the ▼ key for approx. 3 seconds while holding down the ▲ key.

6.2 Main setting mode

If the MODE key is pressed, the main setting mode is selected.
The ▲, ▼ and FAST key increase or decrease the set value (numeric value).
Pressing the MODE key registers the set value, and the controller will revert to the PV/SV display mode.

SV [SV]
- Sets SV.
- Setting range: SV low limit to SV high limit
- Default: 0℃

6.3 Sub setting mode

By pressing the MODE key while holding down the ▲ key, the Sub setting mode can be selected.
The ▲, ▼ and FAST key increase or decrease the set value (numeric value).
Pressing the MODE key registers the set value and switches to the next setting item.

Set value memory number selection [mnu]
- Selects the memory numbers to be brought up.
- Selection item: 1 to 7
- Default: 1

AT Perform/Cancel [AT]
- Sets AT (Auto-tuning) Perform or Cancel.
  If AT Perform is selected and the MODE key is pressed, the controller reverts to the PV/SV display mode.
- Not available if ON/OFF action or PD action is selected during Control action selection (p.11).
- Default: AT Cancel

[Auto-tuning]
- If auto-tuning is performed, AT indicator flashes, and the controller reverts to the PV/SV display mode.
- After auto-tuning ends, AT indicator is turned off and P, I, D values are automatically set.
- During auto-tuning, none of the settings can be performed.
- If the auto-tuning is cancelled during the process, P, I, D values revert to their previous value.
- If the OUT/OFF key is pressed during auto-tuning, control output OFF function is activated, and if the OUT/OFF key is pressed again, PID auto-tuning is cancelled.
- If AT has not finished 4 hours after it started, it automatically finishes.

OUT1 proportional band setting [P]
- Sets OUT1 proportional band.
- Not available if ON/OFF action is selected during Control action selection (p.11)
- Setting range: 0.1 to 999.9%
- Default: 2.5%

OUT2 proportional band setting [P_b]
- Sets OUT2 proportional band.
  OUT2 becomes ON/OFF action when set to 0.0
- Not available if Heating/Cooling control (option) is not applied or when ON/OFF action is selected during Control action selection (p.11)
- Setting range: 0.0 to 10.0 times (multiplying factor to OUT1 proportional band)
- Default: 1.0 times

Integral time setting [I]
- Sets the integral time.
  Setting the value to 0 disables the function (PD action).
- Not available if ON/OFF action or PD action is selected during Control action selection (p.11)
- Setting range: 0 to 3600 seconds
- Default: 200 seconds

Derivative time setting [d]
- Sets the derivative time.
  Setting the value to 0 disables the function. (PI action)
- Not available if ON/OFF action is selected during Control action selection (p.11)
- Setting range: 0 to 3600 seconds
- Default: 50 seconds

OUT1 proportional cycle setting [c]
- Sets OUT1 proportional cycle.
- Not available for DC current output type or if ON/OFF action is selected during Control action selection (p.11)
- **For the relay contact output type, if the proportional cycle time is decreased, the frequency of the relay action increases and the life of the relay contact is shortened.**
- Setting range: 1 to 120 seconds
- Default: 30 seconds for Relay contact output type,
  3 seconds for Non-contact voltage output type

OUT2 proportional cycle setting [c_b]
- Sets OUT2 proportional cycle.
- Not available for DC current output type
  Not available if Heating/Cooling control (option) is not added, or if ON/OFF action is selected during Control action selection (p.11)
- Setting range: 1 to 120 seconds
- Default: 30 seconds for Relay contact output type,
  3 seconds for Non-contact voltage output type

Manual reset setting [rSET]
- Sets the reset value to correct the offset (deviation between SV and PV in equilibrium status)
- Available only when PD action is selected during Control action selection (p.11)
- Setting range: ±Proportional band converted value
- Default: 0.0℃

How to set manual reset:
When SV>PV, set the positive (+) value (SV–PV).
When SV<PV, set the negative (–) value (SV–PV).

A1 value setting [A 1]
- Sets the action point of A1 output.
  Setting the value to 0 or 0.0 disables the function.
  (Excluding process high alarm and process low alarm)
  Not available if rotary switch is set to No.0 or No.7 during A1 type selection (p.12)
- Setting range: Refer to (Table 6.3-1) (p.24).
- Default: 0℃

A2 value setting [A2]
- Sets the action point of A2 output.
  Setting the value to 0 or 0.0 disables the function.
  (Excluding process high alarm and process low alarm)
- Not available when A2 output (option) is not added or if rotary switch is set to No.0 or No.7 during A2 type selection (p.12) even if it is added
- Setting range and default value are the same as those of A1 value setting.

HB (Heater burnout alarm) value setting [H50.0]
- Sets the heater current value for Heater burnout alarm.
  Setting the value to 0.0 disables the function.
- Available only when Heater burnout alarm (option) is added
- When OUT1 is OFF, heater current value shows the same value as when OUT1 was on.
- It is recommended to set approx. 80% of the heater current value considering the voltage fluctuation.
- Self-holding is not available for the alarm output.
- Setting range:
  Rating 20A: 0.0 to 20.0A
  Rating 50A: 0.0 to 50.0A
- Default: 0.0A

LA (Loop break alarm) time setting [LP_T]
- Sets the time to assess the Loop break alarm.
- Available only when Loop break alarm (option) is added
- Setting range: 0 to 200 minutes
- Default: 0 minutes

LA (Loop break alarm) span setting [LP_H]
- Sets the span to assess the Loop break alarm.
- Available only when Loop break alarm (option) is added
- Setting range: 0 to 150℃ (℉)
  However, with a decimal point: 0.0 to 150.0℃ (℉)
  For DC input, 0 to 1500 (The placement of the decimal point follows the selection.)
- Default: 0℃

[A1, A2 setting]
(Table 6.3-1)

Alarm type	Setting range
High limit alarm	–Input span to Input span ℃(℉) *1
Low limit alarm	–Input span to Input span ℃(℉) *1
High/Low limits alarm	0 to Input span ℃(℉) *1
High/Low limit range alarm	0 to Input span ℃(℉) *1
Process high alarm	Input range low limit to Input range high limit*2
Process low alarm	Input range low limit to Input range high limit*2

- For RTD input, the negative lower limit value is –199.9.
- For DC input, the negative lower limit value is –1999.
  (The placement of the decimal point follows the selection.)

*1: For DC input, the Input span is the same as the scaling span.
*2: For DC input, Input range low (or high) limit value is the same as the scaling low (or high) limit value.

6.4 Auxiliary function setting mode 1

By pressing the MODE key while holding down the ▼ key for approx. 3 seconds, Auxiliary function setting mode 1 can be selected.
The ▲, ▼ and FAST key increase or decrease the set value (numeric value).
Pressing the MODE key registers the set value and switches to the next setting item.

Set value lock selection [LOC]
- Mode to lock the set values to prevent setting errors
  The setting item to be locked depends on the selection.
- When designating Lock mode, set the necessary items in the Unlock status, then select Lock 1, Lock 2 or Lock 3.
- Be sure to select Lock 3 when changing the set value frequently via communication function considering the life of the non-volatile memory.
- Selection item:
  ---- (Unlock): All set values can be changed.
  Lc 1 (Lock 1): None of set values can be changed.
  Lc2 (Lock 2): Only main set value (SV) can be changed.
  Lc3 (Lock 3): All set values can be changed temporarily. However, changed data revert to their previous value after the power is turned off because they are not saved in the non-volatile memory.
  Since this function has no relation to the memory life, it is well suited when using with the Shinko programmable controllers with the SVTC option.
- Default: Unlock

[About Lock 3]

When using the FCR-13A as a Fixed value controller

The set values of the current memory number can be changed temporarily, however, if the memory number is changed, the changed set values of the previous memory number are cancelled and returns to the previous values.

When using the FCR-13A as a Program controller

The set values of the currently performing step number can be changed temporarily, however, if the step number is changed, the changed set values are cancelled and returns to the previous values.
Set value change during running standby status is not effective.
The running starts at the values memorized.

SV high limit setting [SVH]
- Sets SV high limit within a range of Scaling low limit value to Scaling high limit value.
- Setting range: SV low limit to Scaling high limit value
  (For DC input, the placement of the decimal point follows the selection.)
- Default: 400℃

SV low limit setting [SVL]
- Sets SV low limit within a range of Scaling low limit value to Scaling high limit value.
- Setting range: Scaling low limit value to SV high limit
  (For DC input, the placement of the decimal point follows the selection.)
- Default: 0℃

Sensor correction setting [So]
- Sets the sensor correction value.
- Setting range: –100.0 to 100.0℃ (℉)
- Default: 0.0℃

Overlap band/Dead band setting [db]
- Sets the Overlap band and Dead band for OUT1 and OUT2.
- \+ set value: Dead band
  – set value: Overlap band
- Not available if Heating/Cooling control (option) is not added, or if ON/OFF action is selected during Control action selection (p.11)
- Setting range: ±Heating proportional band converted value
- Default: 0.0℃

Remote/Local switching [rEmo]
- Switches either Remote setting or Local setting of the SV (main set value).
- Available only when External setting (option) is added.
- Selection item:
  LocA: Local setting. The SV can be set by the front keypad as usual.
  rEmo: Remote setting. The SV can be set in analog by the remote operation externally.
- Default: Local setting

Instrument number setting [cmno]
- Sets the instrument number of this unit. (The instrument number should be set individually when communicating by connecting plural instruments in serial communication, otherwise communication is impossible.)
- Available only when the Serial communication (option) is applied
- Setting range: 0 to 95
- Default: 0

Communication speed selection [cmSP]
- Selects the communication speed of this instrument. (The communication speed of this instrument must be equal to that of host computer, otherwise communication is impossible.)
- Available only when the Serial communication (option) is applied
- Selection item: 24(2400bps), 48(4800bps), 96(9600bps), 192(19200bps)
- Default: 9600bps

Communication protocol selection [cmSL]
- Selects the communication protocol of this instrument.
- Available only when the Serial communication (option) is applied
- Selection item: nomL (Shinko protocol)
  modA (Modbus ASCII mode)
- Default: Shinko protocol

6.5 Auxiliary function setting mode 2

In the PV/SV display mode, if the MODE key is pressed while holding down the ▲ and ▼ keys for approx. 3 seconds, Auxiliary function setting mode 2 can be selected.

The ▲, ▼ and FAST key increase or decrease the set value (numeric value). Pressing the MODE key registers the set value and switches to the next setting item.

Scaling high limit setting [SCLH] • Sets scaling high limit value. If scaling high limit value is changed, SV high limit value will be changed to the scaling high limit value as well. • Setting range: Scaling low limit value to Input range high limit value • Default: 1370℃
Scaling low limit setting [SCLL] • Sets scaling low limit value. If scaling low limit value is changed, SV low limit value will be changed to the scaling low limit value as well. • Setting range: Input range low limit value to scaling high limit value • Default: –200℃
Decimal point place selection [dP] • Selects the decimal point place. • Not available if RTD or thermocouple is selected during Sensor input selection (pages 11, 12) • Selection item: 0 (No decimal point) 0.0 (1 digit after the decimal point) 0.00 (2 digits after the decimal point) 0.000 (3 digits after the decimal point) • Default: No decimal point
PV filter time constant setting [FILT] • Sets PV filter time constant. However, if the value is set too large, it affects control result due to the delay of response. • Setting range: 0.0 to 10.0 seconds • Default: 0.0 seconds
OUT1 high limit setting [oLH] • Sets the high limit value for OUT1. • Not available if ON/OFF action is selected during Control action selection (p.11) • Setting range: OUT1 low limit value to 105% • Default: 100%
OUT1 low limit setting [oLL] • Sets low limit value for OUT1. • Not available if ON/OFF action is selected during Control action selection (p.11) • Setting range: –5% to OUT1 high limit value • Default: 0%
OUT1 ON/OFF action hysteresis setting [HYS] • Sets ON/OFF action hysteresis for OUT1. • Available only when ON/OFF action is selected during Control action selection (p.11) • Setting range: 0.1 to 100.0℃(℉) • Default: 1.0℃

OUT2 action mode selection [cAcr]
- Selects OUT2 cooling action from a choice of: Air cooling, oil cooling and water cooling.
  Available only when Heating/Cooling control (option) is added
- Selection item: Air (Air cooling, linear characteristic)
  oil (Oil cooling, 1.5th power of the linear characteristic)
  WAtr (Water cooling, 2nd power of the linear characteristic)
- Default: Air cooling

OUT2 high limit setting [oLHb]
- Sets the high limit value for OUT2.
- Not available if Heating/Cooling control (option) is not added or if OUT2 is ON/OFF action
- Setting range: OUT2 low limit value to 105%
- Default: 100%

OUT2 low limit setting [oLLb]
- Sets the low limit value for OUT2.
- Not available if Heating/Cooling control (option) is not added or if OUT2 is ON/OFF action
- Setting range: –5% to OUT2 high limit value
- Default: 0%

OUT2 ON/OFF action hysteresis setting [HYSb]
- Sets ON/OFF action hysteresis for OUT2.
- Not available if Heating/Cooling control (option) is not added or if OUT2 is PID, PD action
- Setting range: 0.1 to 100.0℃(℉)
- Default: 1.0℃

A1 action Energized/Deenergized selection [A1LN]
- Selects A1 action Energized/Deenergized.
- Not available if the rotary switch is set to No.0 or No.7 during A1 type selection (p.12).
- Selection item: nonL (Energized)
  rEVS (Deenergized)
- Default: Energized

A2 action Energized/Deenergized selection [A2LN]
- Selects Energized or Deenergized for A2 action.
- Not available if A2 (option) is not added or if the rotary switch is set to No.0 or No.7 during A2 type selection (p.12).
- Selection item and default value are the same as those of A1 action Energized/ Deenergized selection.

A1 hysteresis setting [A1HY]
- Sets A1 hysteresis.
- Not available if the rotary switch is set to No.0 or No.7 during A1 type selection (p.12).
- Setting range: 0.1 to 100.0℃(℉)
  For DC input, 1 to 1000 (The placement of the decimal point follows the selection.)
- Default: 1.0℃

A2 hysteresis setting [A2HY]
- Sets A2 hysteresis.
- Not available if A2 (option) is not added or if the rotary switch is set to No.0 or No.7 during A2 type selection (p.12).
- Setting range and default value are the same as those of A1 hysteresis setting.

A1 action delayed timer setting [A 1dY]
- Sets the action delayed timer for A1.
  Alarm will not activate before the delayed time has passed, even if input has entered the alarm output range.
- Not available if the rotary switch is set to No.0 or No.7 during A1 type selection (p.12).
- Setting range: 0 to 9999 seconds
- Default: 0 seconds

A2 action delayed timer setting [A2dY]
- Sets the action delayed timer for A2.
  When setting time has elapsed after the input entered the alarm output range, the alarm is activated.
- Not available if A2 (option) is not applied or if the rotary switch is set to No.0 or No.7 during A2 type selection (p.12).
- Setting range and default value are the same as those of A1 action delayed timer setting.

External setting input high limit setting [rSLH]
- Sets the high limit value for External setting input [For EA option (4 to 20mA), the value corresponds to 20mA input.]
- Available only when External setting (option) is added
  Setting range: External setting input low limit value to Input range high limit value
- Default: 400℃

External setting input low limit setting [rSLL]
- Sets the low limit value for External setting input [For EA option (4 to 20mA), the value corresponds to 4mA input]
- Available only when External setting (option) is added
- Setting range: Input range low limit value to External setting input high limit value
- Default: 0℃

Transmission output selection [rtoS]
- Selects a Transmission output type.
- Available only when Transmission output (option) is added
- Selection item:
  PV: PV (Process variable) transmission
  SV: SV (Main set value) transmission
  MV: MV (Manipulated variable) transmission
- Default: PV transmission

Transmission output high limit selection [rtLH]
- Sets the Transmission output high limit value.
  (For TA option, the value correponds to 20mA output.)
- Available only when Transmission output (option) is added
- Setting range: Transmission output low limit value to Input range high limit value
- Default: 400℃

Transmission output low limit selection [rtLL]
- Sets the Transmission output low limit value. (For TA option, the value correponds to 4mA output.)
- Available only when Transmission output (option) is added
- Setting range: Input range low limit value to Transmission output high limit value
- Default: 0℃

Display selection when control output is off [PHd]
- Selects the display when the control output is off.
- Selection item:
  oFF : OFF is indicated on the PV display.
  AoFF : No indication
  Pd : Only PV is indicated.
- Default : oFF

SV rising rate setting [rAtU]
- Sets the SV rising rate (Rising value per minute).
  Setting the value to 0 disables the function.
- Setting range: 0 to 9999℃/min. or 0.0 to 999.9℃/min. (with a decimal point)
  For DC input, 0 to 9999 (The placement of the decimal point follows the selection.)
- Default: 0℃/minute

SV falling rate setting [rAtd]
- Sets the SV falling rate (Falling value per minute).
  Setting the value to 0 disables the function.
- Setting range: 0 to 9999℃/min. or 0.0 to 999.9℃/min. (with a decimal point)
  For DC input, 0 to 9999 (The placement of the decimal point follows the selection.)
- Default: 0℃/minute

Output status selection when input abnormal [EoUt]
- Selects control output status when DC input is in overscale or underscale.
- Available only for DC current output type with DC input
- Selection item: -oFF (Control output OFF), on (Control output ON)
- Default: -oFF (Control output OFF)

[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, the sensor measured temperature 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. However, it is effective within the input rated range regardless of the sensor correction value.

[Loop break alarm]

The alarm will be activated when the process variable (PV) does not **rise** as much as the span or more within the time it takes to assess the loop break alarm after the manipulated variable has reached 100% or the output high limit value.

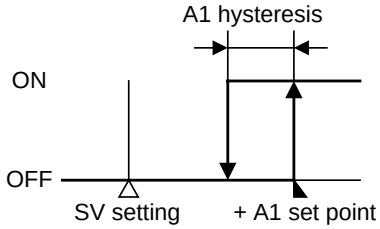
The alarm will also be activated when the process variable (PV) does not **fall** as much as the span or more within the time it takes to assess loop break alarm after the manipulated variable has reached 0% or the output low limit value.

When the control action is Direct (Cooling), read "**fall**" for "**rise**" and vice versa.

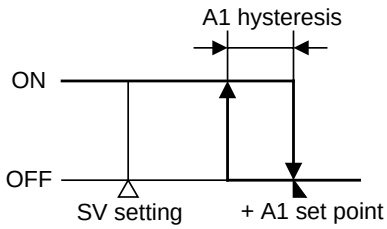
[Energized/Deenergized]

When alarm action Energized is selected, the alarm output (between terminals 7-8, or 9-10) is conducted (ON) while the alarm output indicator is lit.
The alarm output is not conducted (OFF) while the alarm output indicator is not lit.
See (Fig. 6.5-1).

When alarm action Deenergized is selected, the alarm output (between terminals 7-8, or 9-10) is not conducted (OFF) while the alarm output indicator is lit.
The alarm output is conducted (ON) while the alarm output indicator is not lit.
See (Fig. 6.5-2).



High limit alarm (when Energized is set)
(Fig. 6.5-1)



High limit alarm (when Deenergized is set)
(Fig. 6.5-2)

6.6 Control output OFF function

Control output OFF function [oFF]

- A function to pause the control action or turn the control output of the unused instrument of the plural units OFF even if the power to the instrument is supplied. [oFF] is indicated on the PV display while the function is working.
- Pressing the OUT/OFF key for approx. 1 second from any mode enables the control output OFF function. PV display indicates oFF, No indication or PV previously selected during “Display selection when control output is off” mode.
  To cancel the function, press the OUT/OFF key again for approx. 1 second.
- Once the control output OFF function is enabled, the function cannot be released even if the power to the instrument is turned OFF and ON again.
  To cancel the function, press the OUT/OFF key again for approx. 1 second.
- During program control, the OUT/OFF key becomes the Program Start/Stop key, and the control output OFF function is disabled.

6.7 Auto/Manual control

Output manipulated variable (MV) can be changed manually.
With the proportional action, the MV is automatically outputted in proportion to the deviation. This is an automoatic control.

As compared with the above, in the manual control, the value set by front keypad can be outputted regardless of the deviation.
The balance/bumpless function is provided to prevent rapid output change when the control mode is changed from automatic to manual and vice versa.

Each time the OUT/OFF key is pressed, the control changes from Automatic to Manual and vice versa.

- Setting range: OUT1 low limit value to OUT1 high limit value
  OUT2 low limit value to OUT2 high limit value [When Heating/Cooling control (option) is applied]

6.8 Output MV and Step remaining time indication

Output MV (manipulated variable) indication

In the PV/SV display mode, press the MODE key for approx. 3 seconds.
Keep pressing the MODE key until the output manipulated variable appears, though the main setting mode appears temporarily during the process.
For the fixed value control, when the MODE key is pressed again, the mode reverts to the PV/SV display.

Step remaining time indication

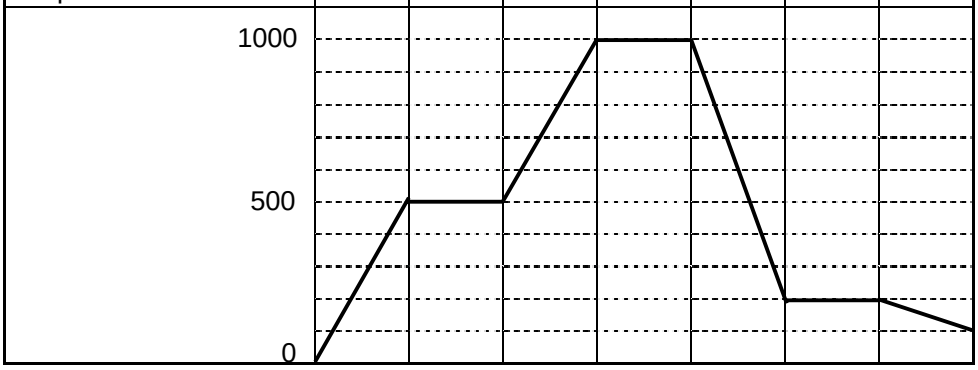
In the program control, if the MODE key is pressed while an output manipulated variable(MV) is indicated, the mode changes to the Step remaining time indication mode.
If the MODE key is pressed again, the mode reverts to the PV/SV display mode.

6.9 Program mode

In the PV/SV display mode, if the ▼ key is pressed for approx. 3 seconds while holding down the ▲ key, the Program mode can be selected.
The ▲, ▼ and FAST keys increase or decrease the set values (numeric value).
Pressing the MODE key registers the set value and switches to the next setting item.

- Set values of Set value memory number 1 to 7 set during the Fixed value control are assigned to set value for Step 1 to 7 respectively.
  For example, set values of Set value memory number 1 become Step 1 set values, and set values of Set value memory number 2 become Step 2 set values.
- If the Pattern end output is selected and the program control is performed, the Pattern end output is turned on when the program is completed.
- If the OUT/OFF key is pressed while the Pattern end output is on, the Pattern end output is turned off. If the OUT/OFF key is pressed again, the program will be performed.
- Set the step time to 00.00 for unnecessary step numbers.

Step number (Set value memory number)	1	2	3	4	5	6	7
Main set value	500	500	1000	1000	200	200	100
Proportional band	2.0	1.8	2.0	1.8	2.5	1.8	2.0
Integral time	180	80	180	80	200	80	200
Derivative time	30	20	30	20	50	20	50
Proportional cycle	30	30	30	30	30	30	30
Alarm 1 value	2	5	2	5	10	0	5
Alarm 2 value	2	5	2	5	10	0	5
Step time	00:30	01:00	00:40	01:00	02:00	00:30	01:00



In the PV/SV display mode, if the ▼ key is pressed while holding down the ▲ key for approx. 3 seconds, the Program mode can be selected.

Program control [Proc]
- Either fixed value control or program control can be selected.
- If the MODE key is pressed in the fixed value control, the controller reverts to the PV/SV display mode.
  If the controller is not set to program control mode, Step time setting (from Step 1 time) is impossible.
- Selection item: oFF (Fixed value control)
  Proc (Program control)
- Default: oFF (Fixed value control)

If program control is selected during [Program control] mode and the MODE key is pressed, Step 1 to Step 7 time can be set.

Step 1 to Step 7 time setting are indicated only during program control.

Step 1 time setting [r - 1]
- Sets Step 1 time. (Available only for program control)
- 00.00
  - Minute indication
  - Hour indication

  (e.g.) When setting 1 hour 58 minutes, set as [1.58].
- Setting range: 00.00 to 99.59
- Default: 00.00

Step 2 time setting [r - 2]
- Sets Step 2 time. (Available only for program control)
- Setting range and default value are the same as those of Step 1 time setting.

Step 3 time setting [r - 3]
- Sets Step 3 time. (Available only for program control)
- Setting range and default value are the same as those of Step 1 time setting.

Step 4 time setting [r - 4]
- Sets Step 4 time. (Available only for program control)
- Setting range and default value are the same as those of Step 1 time setting.

Step 5 time setting [r - 5]
- Sets Step 5 time. (Available only for program control)
- Setting range and default value are the same as those of Step 1 time setting.

Step 6 time setting [r - 6]
- Sets Step 6 time. (Available only for program control)
- Setting range and default value are the same as those of Step 1 time setting.

Step 7 time setting [r - 7]
- Sets Step 7 time. (Available only for program control)
- Setting range and default value are the same as those of Step 1 time setting.

7. Set value memory function (SM option)

If the Set value memory number external selection (SM option) is applied, a maximum of 7 files with 12 pieces of data can be memorized.
Control can be performed with the desired file.
In one file, 12 kinds of set value (SV, PID values, OUT2 proportional band, A1 value, A2 value, Overlap band/Dead band, OUT1 high limit value, OUT1 low limit value, OUT2 high limit value, OUT2 low limit value) can be memorized.
To select the set value memory number (file number), connect the terminals between 13 to 16 as shown below (Table 7-1).
Up to approx. 50 units of FCR-13A can be connected in parallel.

Terminal connection for Set value memory number selection

(Table 7-1)

Set value memory No. / Connecting terminal	1	2	3	4	5	6	7
13 - 16 (b0-COM)	–	O	–	O	–	O	–
14 - 16 (b1-COM)	O	–	–	O	O	–	–
15 - 16 (b2-COM)	O	O	O	–	–	–	–

–: Closed O: Open

- If the Set value memory number is selected externally, the number cannot be selected by front keypad.
- When selecting the memory number by front keypad, all terminals (b0, b1, b2 and COM) should be open.
- Set value memory number cannot be changed during setting mode or PID auto-tuning.

Operation procedure for Set value memory function

(1) In the PV/SV display mode, select a set value memory number by connecting terminals.
(2) In the setting mode, set each value: SV, PID values, OUT2 proportional band, A1 value, A2 value, Overlap band/Dead band, OUT1 high limit value, OUT1 low limit value, OUT2 high limit value, OUT2 low limit value.
(3) After setting, press the MODE key to revert to the PV/SV display mode.

Registration

- Each set value is registered in the file of which number is indicated on the MEMO display.
- When any number is brought up by connecting terminals, the selected number is indicated, and the control is performed using the indicated file number data (set values).
- To change the set values, repeat the operation procedure above.

8. Running

After the controller is mounted to the control panel and wiring is completed, operate the unit following the procedures below.

8.1 When using the FCR-13A as a Temperature controller

(1) Turn the power supply to the FCR-13A ON.

For approx. 2sec after the power is switched ON, the sensor character and temperature unit selected during Sensor input selection (pages 11, 12) are indicated on the PV display, and the rated maximum value is indicated on the SV display. See (Table 8-1).

However, if any other value is set during Scaling high limit setting, the value is indicated on the SV display.

(During this time, all outputs and LED indicators are in OFF status.)

After that, control starts indicating input value on the PV display and SV on the SV display.

When the Control output OFF function is working, the item selected during "Display selection when control output is off" mode is indicated on the PV display.

(Table 8.1-1)

Input	℃		℉	
	PV display	SV display	PV display	SV display
K	t C	1370	t F	2500
J	J C	1000	J F	1800
R	r C	1760	r F	3200
B	b C	1820	b F	3300
PL-Ⅱ	PL2C	1390	PL2F	2500
N	n C	1300	n F	2300
S	S C	1760	S F	3200
E	E C	1000	E F	1800
T	T .C	400.0	T .F	750.0
C (W/Re5-26)	c C	2315	c F	4200
Pt100	Pt .C	850.0	Pt .F	999.9
	Pt C	850	Pt F	1560
JPt100	JPt.C	500.0	JPt.F	900.0
4 to 20mA DC	42A	Scaling high limit value	42A	Scaling high limit value
0 to 20mA DC	02A		02A	
0 to 1V DC	0 1V		0 1V	

(2) Input each set value, referring to Chapter "6. Operations".

When controlling by Fuzzy self-tuning PID action, select "Perform" during the "Auto-tuning Perform/Cancel selection" mode to start the control in optimal conditions.

(3) Turn the load circuit power ON.

Control action starts so as to keep the control target at the main set value (SV).

8.2 When using the FCR-13A as a Simplified program controller

(1) Turn the power supply to the FCR-13A ON.

For approx. 2sec after the power is turned ON, the sensor type and temperature unit selected during Sensor input selection are indicated on the PV display, and the rated maximum value is indicated on the SV display. See (Table 8-1).
(However, if any other value is set during Scaling high limit setting, the value is indicated on the SV display.)
During this time, all outputs and LED indicators are in OFF status.
After that, control starts indicating input value on the PV display and SV on the SV display.

When the Control output OFF function is working, the item selected during "Display selection when control output is off" mode is indicated on the PV display.

(2) Input each set value and step time, referring to Chapter "6. Operations".
The PV display will indicate the actual temperature in Run standby status.

(3) Turn the load circuit power ON.
Control action starts so as to keep the control target at the main set value (SV).

(4) Program control start

If Automatic start is selected during [Program start Auto/Manual selection], the controller will switch to warm-up status for approx. 2 seconds after the power is turned on, and then the program control automatically starts from Step 1.

If Manual start is selected during [Program start Auto/Manual selection], the controller will switch to warm-up status for approx. 2 seconds after the power is turned on, and then it switches to Run standby status. In this status, if the OUT/OFF key is pressed, the program control starts from Step 1.
During program control, the Step number (Set value memory number) cannot be changed.

To make the step time progress faster

The step time progress becomes 60 times faster than usual when the FAST key is pressed.

To end the program control during the process

To end the program control, press the OUT/OFF key for approx. 1 second or more.

To switch the indication of Output MV and Step remaining time

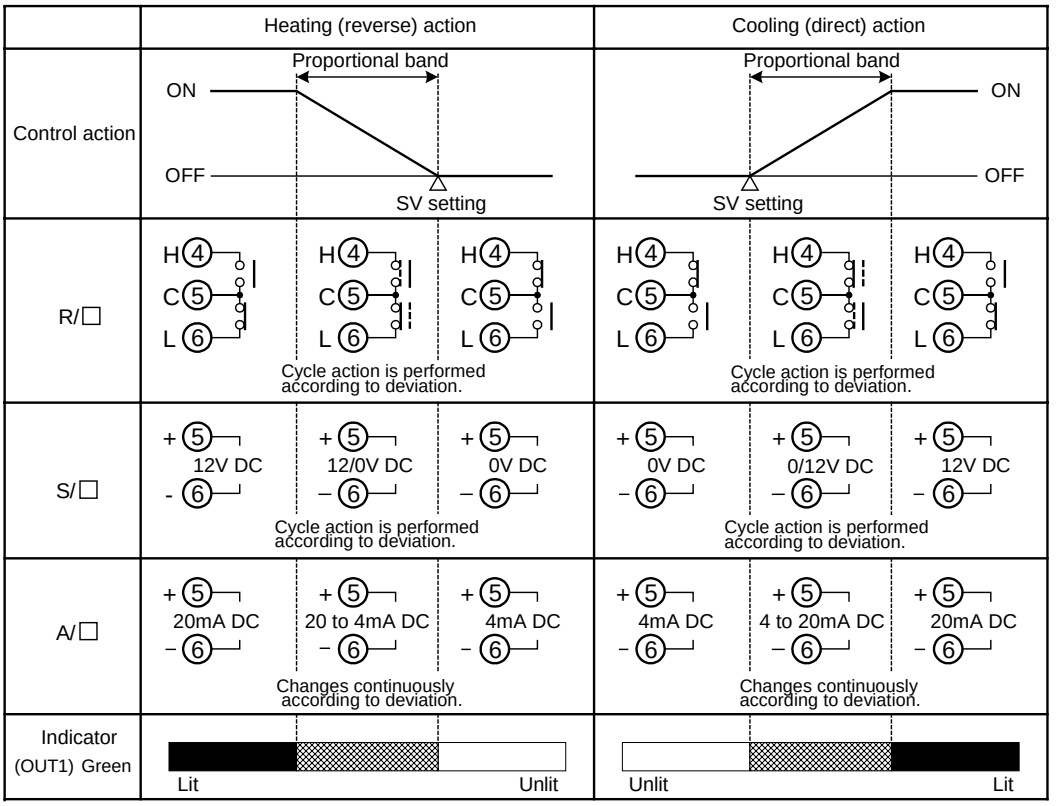
In the PV/SV display, if the MODE key is pressed for approximately 3 seconds, the Output MV is indicated. If the MODE key is pressed again, the Step remaining time is indicated .

Instrument status after power is restored

After restoration following a power failure during program control, the FCR-13A resumes program performance from where it stopped.
The PV display flashes until the step at which the power failure occurred is finished.

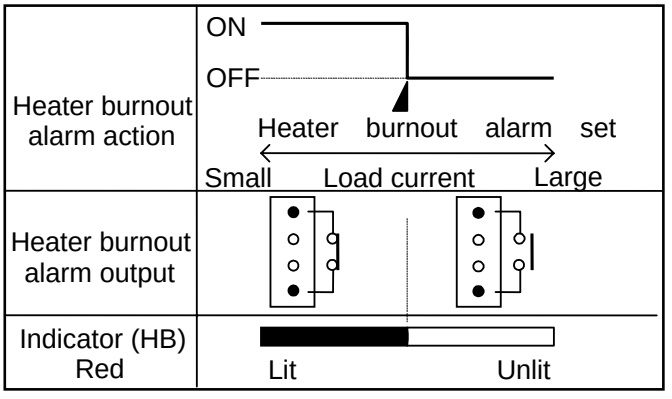
9. Action explanation

9.1 OUT1 action

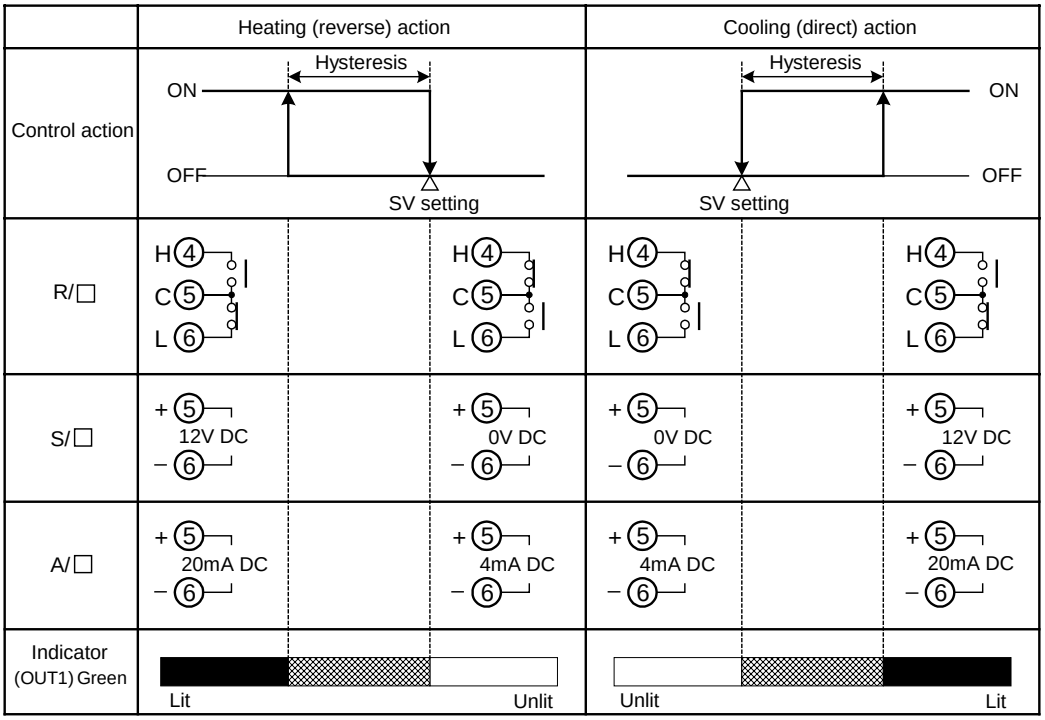


: Acts ON (lit) or OFF (unlit).

9.2 Heater burnout alarm action (option)

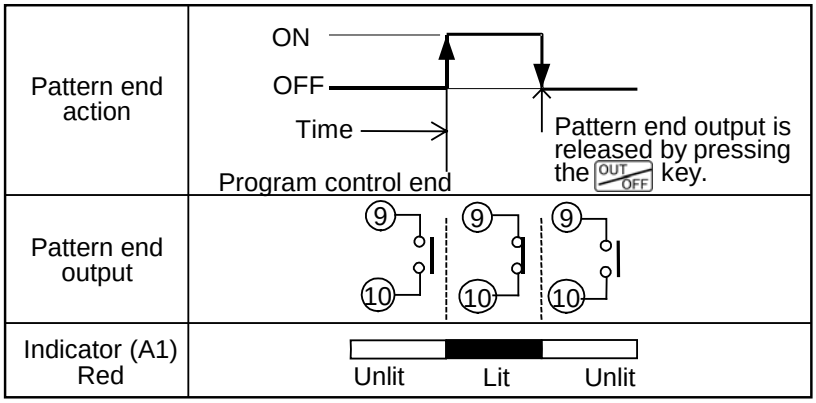


9.3 OUT1 ON/OFF action



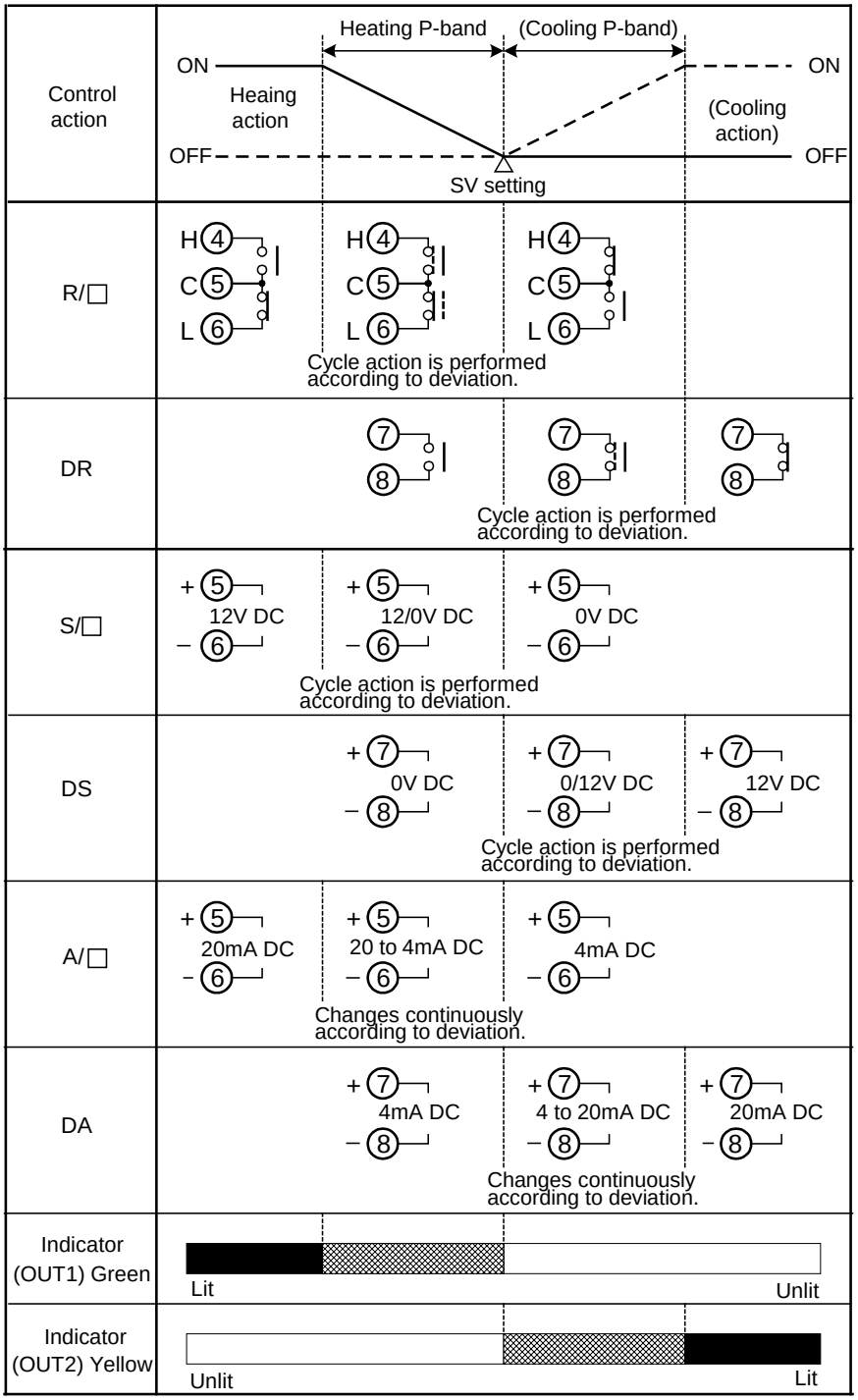
: Acts ON (lit) or OFF (unlit).

9.4 Pattern end action



Pattern end output is turned ON when the program control ends, and it is not released until the OUT/OFF key is pressed.

9.5 OUT2 (Heating/Cooling control) action (Option)

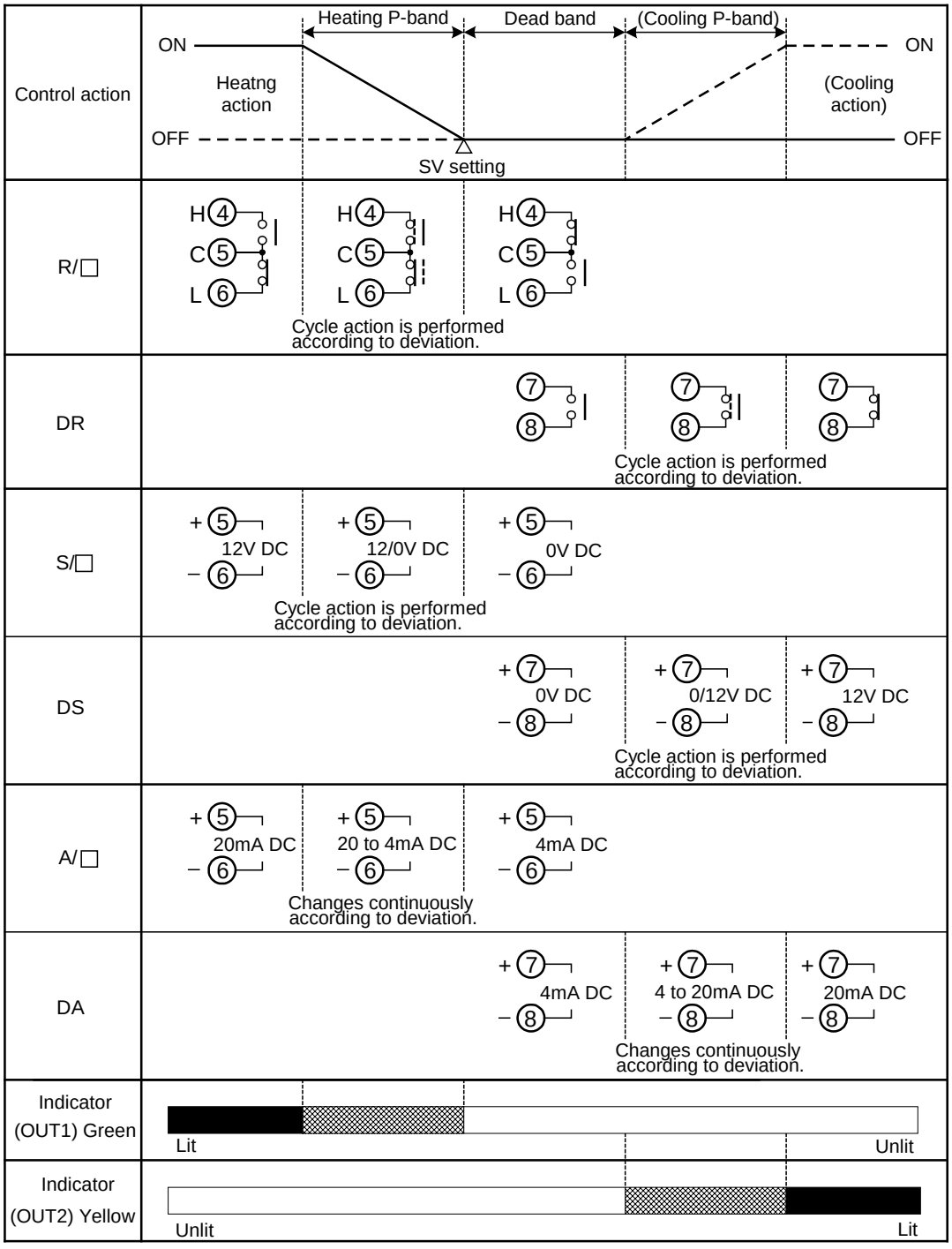


: Acts ON (lit) or OFF (unlit).

——— : Represents Heating control action.

– – – – : Represents Cooling control action.

When setting Dead band

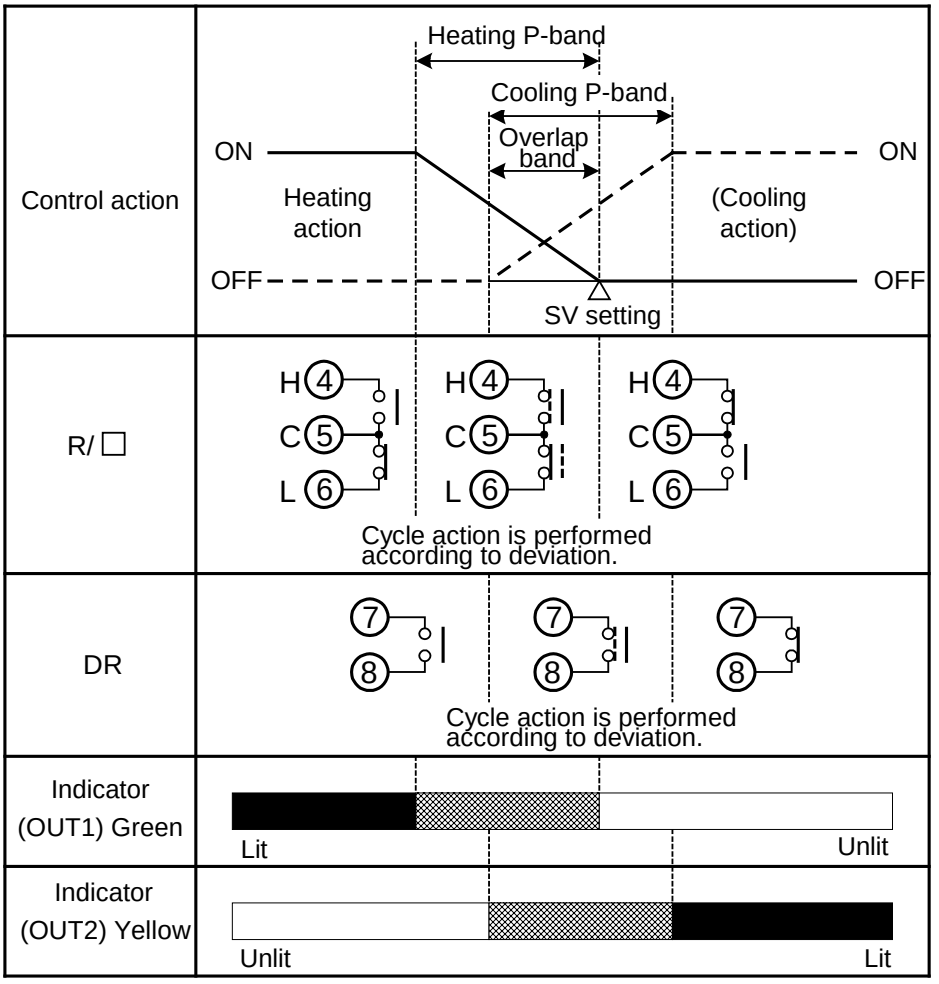


: Acts ON (lit) or OFF (unlit).

——— : Represents Heating control action.

– – – – : Represents Cooling control action.

When setting Overlap band with Relay contact output.

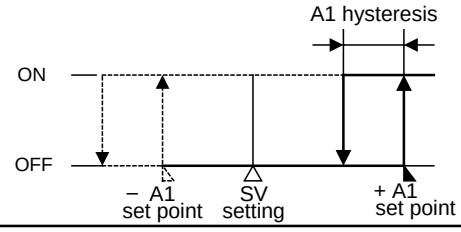
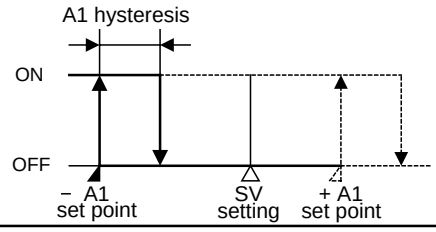


: Acts ON (lit) or OFF (unlit).

——— : Represents Heating control action.

– – – – : Represents Cooling control action.

9.6 Alarm 1 (A1) and Alarm 2 (A2) action

<table>
<tr><td></td><td>High limit alarm</td><td>Low limit alarm</td></tr>
<tr><td>Alarm action</td><td> 
</td><td> 
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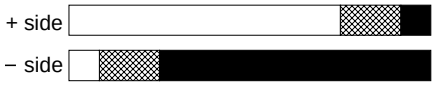
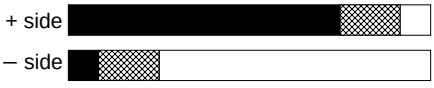
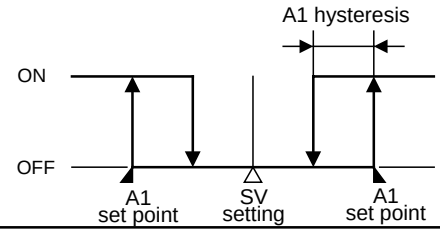
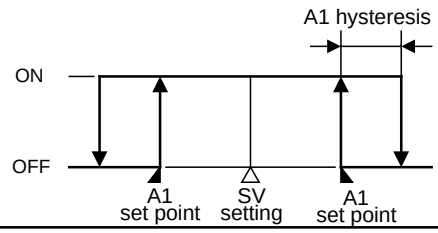
<tr><td>Alarm output</td><td> 
</td><td> 
</td></tr>
<tr><td></td><td>High/Low limits alarm</td><td>High/Low limit range alarm</td></tr>
<tr><td>Alarm action</td><td> 
</td><td> 
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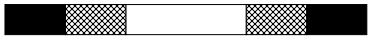
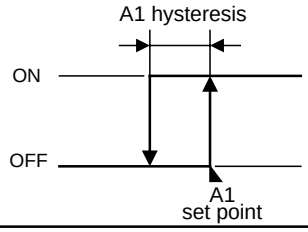
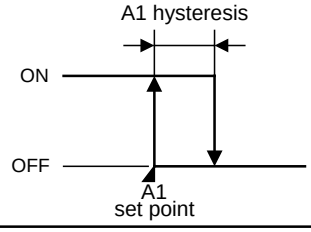
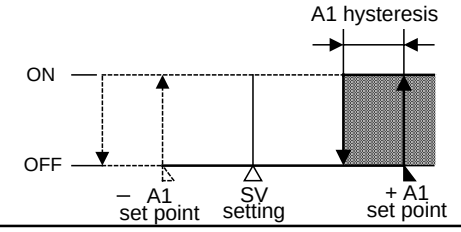
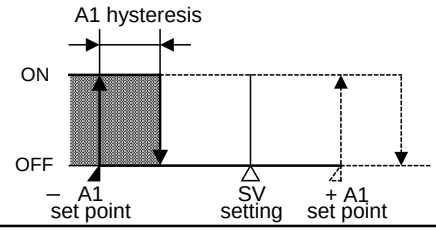
<tr><td>Alarm output</td><td>  </td><td>  </td></tr>
<tr><td></td><td>Process high alarm</td><td>Process low alarm</td></tr>
<tr><td>Alarm action</td><td> 
</td><td> 
</td></tr>
<tr><td>Alarm output</td><td>  </td><td>  </td></tr>
<tr><td></td><td>High limit alarm with standby</td><td>Low limit alarm with standby</td></tr>
<tr><td>Alarm action</td><td> 
</td><td> 
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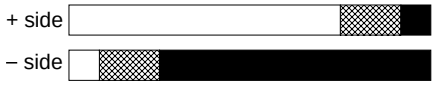
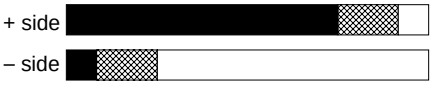
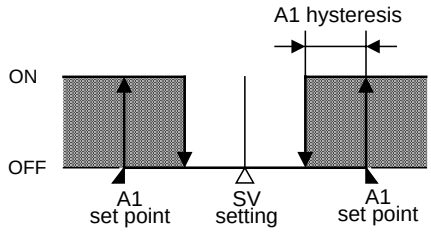
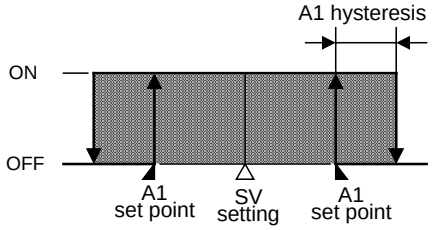
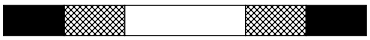
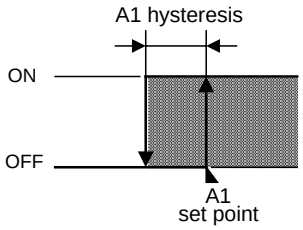
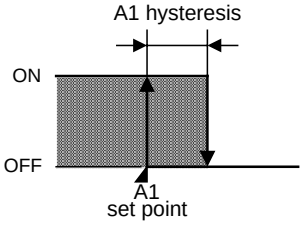
<tr><td>Alarm output</td><td> 
</td><td> 
</td></tr>
</table>

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

: A1 output terminals 9 and 10 are connected.

: A1 output terminals 9 and 10 are connected or disconnected.

: A1 output terminals 9 and 10 are disconnected.

: Standby functions.

For A2 output, use terminals 7 and 8.
A1 and A2 indicators light when their output terminals are connected, and go off when their output terminals are disconnected.

10. Control actions

10.1 Fuzzy self-tuning

Fuzzy self-tuning is a function to perform a fine adjustment of PID values automatically. The stable control can be carried out even if the conditions of the process are changed due to things like change in types and rates of production.

(1) When the control initiates, the unit performs this function by the PID values previously adjusted.

(2) When the control result is disordered by disturbance or a change in process, the controller checks the converging status, and performs a fine adjustment of PID values if necessary.

(a) If the convergence is performed smoothly, the PID values are not changed.

(b) If the convergent speed is slow, the controller corrects the PID values to accelerate the convergence.

(c) When overshoot is generated during the convergence, the controller changes the PID values to correct this.

(d) When hunting occurs, the controller checks its waveform and performs a fine adjustment of PID values.

The instrument is always in self-tuning status, and when deviation occurs, the tuning starts. Even in Fuzzy self-tuning status, when very large hunting occurs and the control is not stabilized, auto-tuning starts automatically.

When the auto-tuning “Perform” is selected by the keypad, auto-tuning initiates.

When the control is stabilized, the auto-tuning is released and the controller returns to self-tuning status.

If Lock 1 [LC 1] or Lock 2 [LC2] is selected, Fuzzy self-tuning or PID Auto-tuning cannot work.

With the control system in which load fluctuation periodically occurs, the Fuzzy self-tuning may malfunction.
In such a case, use the controller with the PID auto-tuning mode.

10.2 PID

(1) Proportional band (P)

Proportional action is the action during which the control output varies in proportion to the deviation between the main set value (SV) and the processing temperature.
If the proportional band is narrowed, the output changes by a slight variation of the processing temperature, and better control results can be obtained as the offset decreases.
However, if the proportional band is narrowed too much, even slight disturbances may cause variation in the processing temperature, and control action changes to ON/OFF action and the so-called hunting phenomenon occurs.
Therefore, when the processing temperature comes to the balanced position near the main set value (SV) and a constant temperature is maintained, the most suitable value is selected by gradually narrowing the proportional band while observing the control results.

(2) Integral time (I)

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

(3) Derivative time (D)

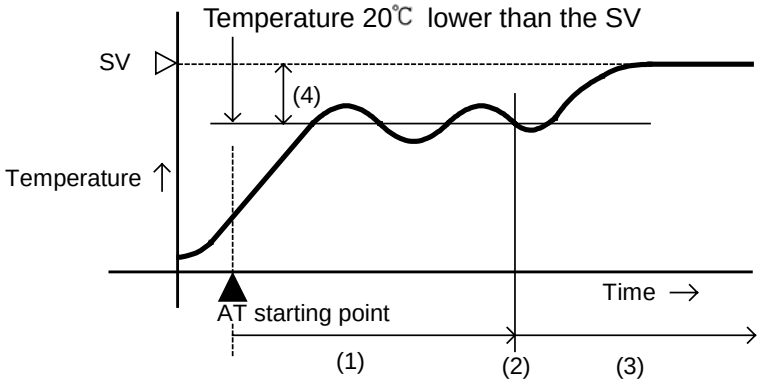
Derivative action is used to restore the change in the processing temperature according to the rate of change. It reduces the amplitude of overshoot and undershoot width. If the derivative time is shortened, the restoring value becomes small, and if the derivative time is extended, an excessive returning phenomenon may occur and the control system may oscillate.

10.3 PID auto-tuning of this controller

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

(A) In the case of a large difference between the SV and processing temperature as the temperature is rising.

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

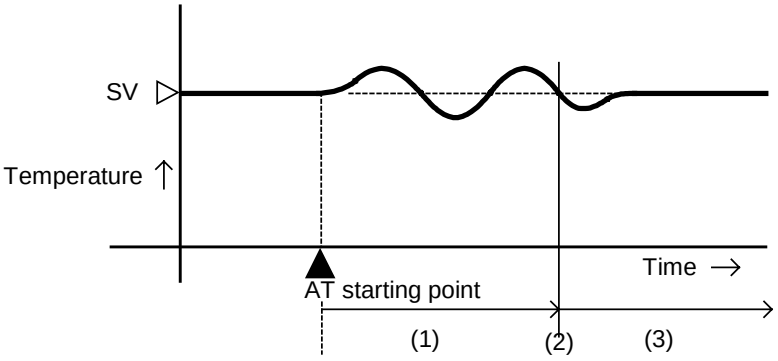


(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by auto-tuning.
(4) AT bias value

(Fig. 10.3-1)

(B) In the case of a stable control

The AT process will fluctuate around the SV.

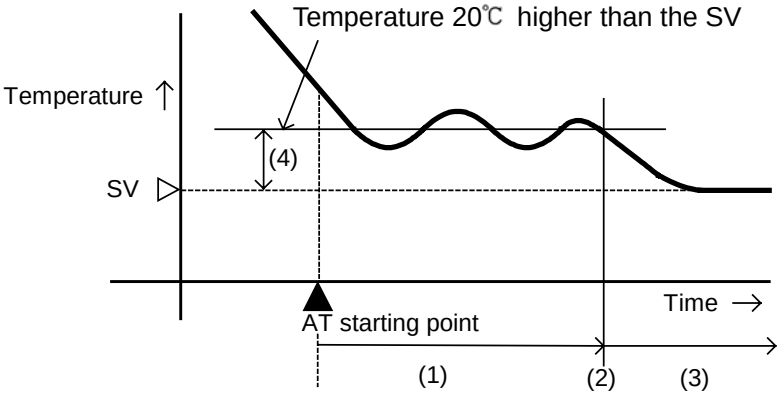


(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by auto-tuning.

(Fig. 10.3-2)

(C) In the case of a large difference between the SV and processing temperature as the temperature is falling

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



(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by auto-tuning.
(4) AT bias value

(Fig. 10.3-3)

11. Specifications

11.1 Standard specifications

Mounting : Flush

Setting : Membrane sheet key

Display

PV display : Red LED display 4 digits, character size, 8(H) x 4(W)mm

SV/MV/TIME display: Green LED display 4 digits, character size, 8(H) x 4(W)mm

MEMO display : Yellow LED display 1 digit, character size, 8(H) x 4(W)mm

Accuracy (setting, indication)

Thermocouple : Within ±0.2% of input range full scale ±1 digit
However,
For K, J, T input, range less than 0℃ (32℉):
Within ±0.4% of input range full scale ±1 digit
For R, S input, the range 0 to 200℃ (0 to 400℉):
Within ±4℃ (8℉)
For B input, the range 0 to 300℃ (0 to 600℉):
Accuracy is not guaranteed.

RTD : Within ±0.2% of input range full scale ±1 digit

DC current : Within ±0.2% of input range full scale ±1 digit

DC voltage : Within ±0.2% of input range full scale ±1 digit

Rated input

Input type	Input range		Resolution
K	–200 to 1370 ℃	–320 to 2500 ℉	1℃(℉)
J	–200 to 1000 ℃	–320 to 1800 ℉	1℃(℉)
R	0 to 1760 ℃	0 to 3200 ℉	1℃(℉)
S	0 to 1760 ℃	0 to 3200 ℉	1℃(℉)
B	0 to 1820 ℃	0 to 3300 ℉	1℃(℉)
E	0 to 1000 ℃	0 to 1800 ℉	1℃(℉)
T	–199.9 to 400.0 ℃	–199.9 to 750.0 ℉	0.1℃(℉)
N	0 to 1300 ℃	0 to 2300 ℉	1℃(℉)
PL-Ⅱ	0 to 1390 ℃	0 to 2500 ℉	1℃(℉)
C(W/Re5-26)	0 to 2315 ℃	0 to 4200 ℉	1℃(℉)
Pt100	–199.9 to 850.0 ℃	–199.9 to 999.9 ℉	0.1℃(℉)
	–200 to 850 ℃	–320 to 1560 ℉	1℃(℉)
JPt100	–199.9 to 500.0 ℃	–199.9 to 900.0 ℉	0.1℃(℉)
4 to 20mA DC	–1999 to 9999 *		1
0 to 20mA DC	–1999 to 9999 *		1
0 to 1V DC	–1999 to 9999 *		1

*: For DC input, input range and decimal point place are changeable.

Input sampling period : 0.125 seconds
[0.5 seconds when External setting (option) or Heater burnout alarm (option) is applied]

Input

Thermocouple : K, J, R, S, B, E, T, N, PL-Ⅱ, C (W/Re5-26)
External resistance, 100Ω or less
In case of input burnout, Overscale

RTD : Pt100, JPt100, 3-wire system
Allowable input lead wire resistance,
10Ω or less per wire
In case of input burnout, Overscale

DC current : 0 to 20mA DC, 4 to 20mA DC
Input impedance, 50Ω
Allowable input current, 100mA DC or less
In case of input disconnection, 0 to 20mA: The same as 0mA
4 to 20mA: Underscale

DC voltage : 0 to 1V DC
Input impedance, 1MΩ or more
Allowable input voltage, 5V or less
Allowable signal source resistance, 2kΩ or less
In case of input disconnection, Overscale

Control output (OUT1)

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

Non-contact voltage : For SSR drive
12^{+2}_{0}V DC maximum 40mA DC(short circuit protected)
If Shinko SSR (SA-200 series) is used, 4 units can be connected in parallel.

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

Alarm 1 (A1) output

[When the alarm action Energized is selected during A1 action Energized/ Deenergized selection]
The alarm action point is set by ±deviation from SV (except Process value alarm), and when the input exceeds the range, the output turns ON or OFF (in the case of High/Low limit range alarm)
[When the alarm action Deenergized is selected]
The output acts conversely.

Setting accuracy : The same as the Indication accuracy

Action : ON/OFF action

Hysteresis : Thermocouple, RTD input: 0.1 to 100.0℃ (℉)
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 cosø =0.4)
Electric life: 100,000 times

Control action

The fuzzy self-tuning PID, PID, PD or ON/OFF action can be selected by the DIP switch.

• Fuzzy self-tuning PID action

Proportional band (P)	: Automatic
Integral time (I)	: Automatic
Derivative time (D)	: Automatic
Anti-reset windup (ARW)	: Automatic
Proportional cycle	: 1 to 120sec
Output limiter	: 0 to 100% (For DC current output, –5 to 105%)

• PID action (with auto-tuning function)

Proportional band (P)	: 0.1 to 999.9%
Integral time (I)	: 0 to 3600sec (Off when set to 0)
Derivative time (D)	: 0 to 3600sec (Off when set to 0)
Anti-reset windup (ARW)	: Automatic
Proportional cycle	: 1 to 120sec
Output limiter	: 0 to 100% (For DC current output, –5 to 105%)

• PD action

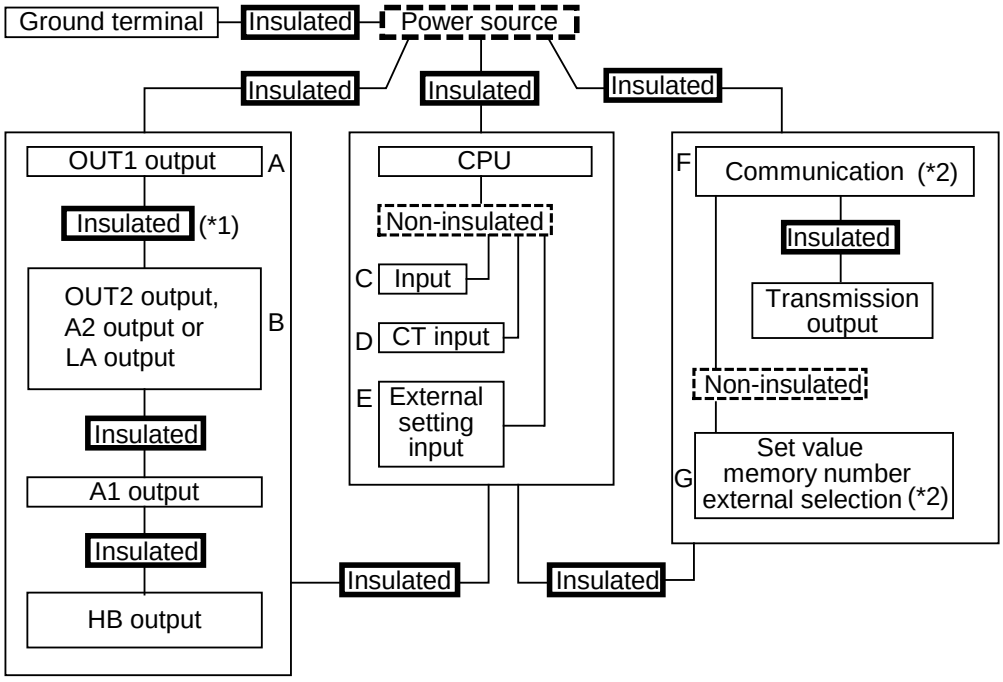
Proportional band (P)	: 0.1 to 999.9%
Derivative time (D)	: 0 to 3600sec (Off when set to 0)
Proportional cycle	: 1 to 120sec
Reset	: ±Proportional band converted value Thermocouple, RTD input: –199.9 to 999.9℃(℉) DC input: –1999 to 9999 (The placement of the decimal point follows the selection.)
Output limiter	: 0 to 100% (for DC current output, –5 to 105%)

• ON/OFF action

Hysteresis	: Thermocouple, RTD input: 0.1 to 100.0℃ (℉) 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℃ (32 to 122℉)
Ambient humidity	: 35 to 85%RH (no condensation)
Power consumption	: Approx. 15VA

Circuit insulation configuration



(*1) When both OUT1 and OUT2 are DC current output type or Non-contact voltage output type (the SSR drive), A is not insulated from B.

(*2) When OUT1 is DC current output type or Non-contact voltage output type (the SSR drive), A-F and A-G are not insulated.
When OUT2 is DC current output type or Non-contact voltage output type (the SSR drive), B-F and B-G are not insulated.

Insulation resistance

10MΩ or more, at 500V DC

Insulation test **must not** be carried out between A-B in the diagram (*1) above and between A-F, B-F, A-G, B-G, C-D-E and F-G in the diagram (*2) above 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 ground terminal, 1.5kV AC for 1 minute
Between output terminal and power terminal, 1.5kV AC for 1 minute

Weight : Approx. 320g
External dimensions : 48 x 96 x 100mm (W x H x D)
Material : Case, Flame-resistant resin
Color : Case, Light gray
Attached functions : **[Control output OFF function], [Set value lock], [Set value limit], [Sensor correction], [Multi-range], [Multi-function], [Simplified program controller function]**

[Input abnormality]

Indication	Contents	OUT1	OUT2
"----" flashes.	Overscale Measured value has exceeded Indication range high limit value.	OFF (4mA) or OUT1 low limit value	OFF(4mA) or OUT2 low limit value *
"____" flashes.	Underscale Measured value has dropped below Indication range low limit value.	OFF (4mA) or OUT1 low limit value *	OFF (4mA) or OUT2 low limit value

***** 20mA or high limit value when on is selected during "Output status selection when input abnormal" mode

Thermocouple and RTD input

Input	Input range	Indication range	Control range
T	–199.9 to 400.0℃	–199.9 to 405.0℃	–205.0 to 405.0℃
	–199.9 to 750.0℉	–199.9 to 759.0℉	–209.0 to 759.0℉
Pt100	–199.9 to 850.0℃	–199.9 to 860.0℃	–210.0 to 860.0℃
	–200 to 850℃	–210 to 860℃	–210 to 860℃
	–199.9 to 999.9℉	–199.9 to 999.9℉	–211.0 to 1010.9℉
	–300 to 1560℉	–318 to 1578℉	–318 to 1578℉
JPt100	–199.9 to 500.0℃	–199.9 to 506.0℃	–206.0 to 506.0℃
	–199.9 to 900.0℉	–199.9 to 910.9℉	–211.0 to 910.9℉

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, "----" or "____" flashes when a range of –1999 to 9999 is exceeded.

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

DC input disconnection

When DC input is disconnected, 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 input.

[Self-diagnosis]

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

[Automatic cold junction temperature compensation] (Thermocouple input type)

This detects the temperature at the connecting terminal between thermocouple and the instrument, and always maintains it at the same status as when the reference junction is located at 0℃ [32℉].

[Power failure countermeasure]

The setting data is backed up in non-volatile IC memory.

[Warm-up indication]

For approx. 2 seconds after the power supply to the instrument is turned on, the input type and 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 display.

[Set value ramp function]

When adjusting the main set value (SV), it approaches the new SV by the set rate of change.

When the power is turned on, the control starts from the PV (process variable) and approaches the main set value (SV) by the rate of change.

Accessories: One-touch type mounting bracket 1 set

Instruction manual	1 copy
Unit name label	1 sheet
Current transformer	1 piece
(CTL-6-S)	[When the W (20A) option is applied.]
(CTL-12-S36-10L1)	[When the W (50A) option is applied.]
Current transformer	2 pieces
(CTL-6-S)	[When the W3 (20A) option is applied.]
(CTL-12-S36-10L1)	[When the W3 (50A) option is applied.]
Wire harness	3m [When the TA or TV option is applied.]
Wire harness	3m [When the EA or EV option is applied.]
Screw type mounting bracket	1 set [When the BL option is applied.]
Terminal cover	1 piece [When the TC option is applied.]

11.2 Optional specifications

Alarm 2 (option code: A2)

[When the alarm action Energized is selected during A2 action Energized/ Deenergized selection]

The alarm action point is set by ±deviation from SV (except Process value alarm), and when the input exceeds the range, the output turns ON or OFF (in the case of High/Low limit range alarm)

[When the alarm action Deenergized is selected]

The output acts conversely.

- When Alarm 2 (A2) and Loop break alarm output (LA option) are applied together, they use common output terminals.
- If Alarm 2 (A2) is applied, Heating/Cooling control output (option) or Insulated power output (option) cannot be applied together.

Setting accuracy : The same as the Indication accuracy

Action : ON/OFF action

Hysteresis: Thermocouple, RTD input: 0.1 to 100.0℃ (℉)

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 cosø=0.4)
Electric life: 100,000 times

Heating/Cooling control (option code: DR, DS, DA)

When Heating/Cooling control (option) is applied, A2 (option), LA (option), or Insulated power output (option) cannot be applied together.

OUT2 proportional band: 0.0 to 10.0 times OUT1 proportional band
(ON/OFF action when setting the value to 0.0.)

OUT2 integral time : The same as that of OUT1

OUT2 derivative time : The same as that of OUT1

OUT2 proportional cycle: 1 to 120sec

Overlap/Dead band : ±Heating proportional band converted value
Thermocouple, RTD input: –199.9 to 999.9℃ (℉)
DC input: –1999 to 9999 (The placement of the decimal point follows the selection.)

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

[DS] Non-contact voltage (for SSR drive)
12^{+2}_{0}V DC, Maximum 40mA DC (short circuit protected)

[DA] DC current
4 to 20mA DC
Load resistance: Maximum 550Ω

OUT2 action mode selection: Selectable by keypad
Air cooling (Linear characteristic),
Oil cooling (1.5th power of the linear characteristic),
Water cooling (2nd power of the linear characteristic).

Transmission output (option code: TA, TV)

Converting the value (PV transmission, SV transmission or MV transmission) to analog signal every 0.125 seconds, outputs the value in current or voltage.

Transmission output (PV, SV, MV) can be selected by keypad.

Resolution 1/10000

Current (TA) 4 to 20mA DC (load resistance, maximum 500Ω)

Voltage (TV) 0 to 1V DC (load resistance, minimum 100kΩ)

Output accuracy Within ±0.3% of full scale

Serial communication (option code: C, C5)

The following operations can be executed from the external computer.

(1) Reading and setting of the SV, PID values and various set values
(2) Reading of the PV and the action status
(3) Change of the functions

Communication line	EIA RS-485 (C5) EIA RS-232C (C)
Communication method	Half-duplex communication start-stop synchronous
Communication speed	2400, 4800, 9600 and 19200bps (selectable by keypad)
Data format	Start bit : 1 Data bit : 7 Parity : Even parity Stop bit : 1
Communication protocol	Shinko protocol or Modbus ASCII mode (Selectable by keypad)

Digital external setting

Receives digital set value from Shinko programmable controllers such as PCD-33A (with SVTC option) or PC-900 series (with SVTC option).
(Be sure to select Lock 3 during the Set value lock selection.)
(When Modbus protocol ASCII mode is selected, digital external setting is not available.)
Shinko communication converter IF-300-C5 is not available for the Modbus protocol.

Set value memory number external selection (option code: SM)

Selects the set value memory number from 7 files (data mentioned below as one file) by connecting terminals externally.
(SV, PID values, OUT2 proportional band, A1 value, A2 value, Overlap band/Dead band, OUT1 high limit value, OUT1 low limit value, OUT2 high limit value, OUT2 low limit value)

Memory number: 1 to 7 (7 files)
Data : 12

External setting (option code: EA, EV)

External analog signal can be set as a main set value.

Setting signal: DC current (EA)
0 to 20mA DC, 4 to 20mA DC
Allowable input current: 100mA DC or less
Input impedance, 50Ω (Not insulated from input)

DC voltage (EV)
0 to 1V DC, 1 to 5V DC
Allowable input voltage: 0 to 1V DC: 5V DC or less
1 to 5V DC: 10V DC or less
Input impedance, 100kΩ (Not insulated from input)

Setting signal sampling period: 0.5 seconds
(If EA or EV is applied, the input sampling period will also change to 0.5 seconds.)

Heater burnout alarm (option code: W, W3) (Including sensor burnout alarm)

Monitors the heater current with CT (current transformer), and detects the burnout.

• If Heater burnout alarm is applied, the input sampling period will be 0.5 seconds.

• **This option cannot be applied to the DC current output type**.

Rating : 20A [Option W (20A), W3 (20A)] or
50A [Option W (50A), W3 (50A)] Must be specified.

Setting range : 20A: 0.0 to 20.0A (however, the indication is 0 to 50.0.)
50A: 0.0 to 50.0A
(Setting the value to 0.0 disables the function.)

Setting accuracy: Within ±5% of the heater rated current

Action point : Set value

Action : ON/OFF action

Output : Relay contact 1a(Upon returning to set limits, the alarm will stop.)
Control capacity, 3A 250V AC (resistive load)
1A 250V AC (inductive load, cosø=0.4)
Electric life: 100,000 times

Loop break alarm (option code: LA)

Detects the breaking status on the loop such as heater burnout, sensor or actuator trouble.

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

If Loop break alarm output (LA) is applied, Heating/Cooling control output (option) or Insulated power output (option) cannot be applied together.

Setting range: Loop break alarm time, 0 to 200 minutes
Loop break alarm span, 0 to 150℃(℉), 0.0 to 150.0℃(℉),
For DC input, 0 to 1500 (The placement of the decimal point follows the selection)

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

Insulated power output (option code: P24)

Can be used as a small capacity power source for various sensors and converters.

If Insulated power output (P24) is applied, A2 output (option), Heating/Cooling control output (option) or LA (option) cannot be applied together.

Output voltage: 24±3V DC (when load current is 30mA.)

Ripple voltage: Within 200mV (when load current is 30mA.)

Maximum load current: 30mA

Screw type mounting bracket (option code: BL)

Mounting panel thickness: 1 to 15mm

Color Black (option code: BK)

Front panel frame and case: Black

Dust-proof•Drip-proof (option code: IP)

Dust-proof and Drip-proof specification (IP54)
Effective for the face only, case is excluded.
To protect the controller from water leak between control panel and controller, take note of the following items.
(1) The panel cutout dimensions should be proper and have no burrs.
(2) The control panel surface to be mounted should be vertical.
Please use the front cover (soft type, sold separately) for comprehensive Dust-proof and Drip-proof protection.

Terminal cover (option code: TC)

Electrical shock protection terminal cover

Users' specifications

Input, Scale range	: Shipped as specified input and scale range.
Alarm action	: Shipped as specified alarm action (A1, A2).
Control action	: Shipped as specified control action.
Cooling action mode	: Shipped as specified action mode. (When the Heating/Cooling control output option is added)
Transmission output	: Shipped as specified transmission output. (When the Transmission output option is added)
External setting	: Shipped as specified input. (When the External setting option is added)

12. Troubleshooting

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

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

<Indication>

Problem	Presumed cause and solution
If the PV display is indicating [oFF]	• Control output OFF function is working. Press the OUT/OFF key for approx. 1 second to release the function. (p.31)
[- - - -] is flashing on the PV display.	• Thermocouple or RTD is burnt out. [In the case of Thermocouple] If the input terminals of the instrument are shorted, and a value around room temperature is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out. [In the case of RTD] If approx. 100Ω of resistance is connected to the input terminals between A-B of the instrument and between B-B is shorted, and if a value around 0℃ (32℉) is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out. • Check whether the lead wire of thermocouple or RTD is securely connected to the instrument terminal.
[- - - -] is flashing on the PV display.	• Check whether the polarity of thermocouple or compensating lead wire is correct. • Check whether codes (A, B, B) of the RTD agree with the controller terminals.
The indication of PV display is abnormal or unstable.	• Sensor input selection is improper. Set the Sensor input properly with the Rotary switch (SW303) and the DIP switch (SW304). (Pages 11, 12) • Set the temperature unit (℃ or ℉) properly. Set the unit properly with the DIP switch. (p.11) • Sensor correction value is unsuitable. Set it to a suitable value. (p.26) • Specification of the Thermocouple or RTD is improper. • AC may be leaking into thermocouple or the RTD circuit. • There may be equipment which interferes with or makes noise near the controller. Keep equipment which interferes with or makes noise away from the controller.

<Key operation>

Problem	Presumed cause and solution
The setting mode cannot be selected.	• Manual control is selected. Change the mode to Automatic control. (p.31)
Settings (SV, P, I, D values, proportional cycle, alarm, etc.) are impossible. The value does not change by the ▲, ▼ keys.	• Set value lock (Lock 1 or Lock 2) is selected. Release the lock selection. (p.25) • During PID auto-tuning. Cancel auto-tuning. (p.22)
The setting indication does not change within the rated scale range even if the ▲ or ▼ key is pressed, and new values are unable to be set.	• SV high limit or SV low limit may be set at the point where the value does not change. Set it to a suitable value again while in Auxiliary function setting mode 1.
If control does not start even if the OUT/OFF key is pressed in the Program mode.	• Step time is not set. Set the step time. (p.33)

<Control>

Problem	Presumed cause and solution
If process variable (temperature) does not rise.	• Thermocouple or RTD is burnt out. [In the case of Thermocouple] If the input terminals of the instrument are connected, and a value around room temperature is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out. [In the case of RTD] If approx. 100Ω of resistance is connected to the input terminals between A-B of the instrument and between B-B is shorted, and if a value around 0℃ (32℉) is indicated, the instrument is likely to be operating normally, however, sensor may be burnt out. • Check whether the lead wire of thermocouple or RTD is securely connected to the instrument terminal.
Control is not performing. (Indicates only PV display)	• Program mode is selected. To perform Program control, press the OUT/OFF key. • To perform Fixed value control, select the Fixed value control mode by pressing the ▼ key while holding down the ▲ key for approx. 3sec.
Control output (OUT1 or OUT2) remains in an ON status.	• OUT1 low limit value or OUT2 low limit value is set to 100% or higher. Set it to a suitable value while in Auxiliary function setting mode 2. (Pages 27, 28)
Control output (OUT1 or OUT2) remains in an OFF status.	• OUT1 high limit value or OUT2 high limit value is set to 0% or less. Set it to a suitable value while in Auxiliary function setting mode 2. (Pages 27, 28)

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

13. Character table

<Main setting mode>

Character	Setting item	Default value	Data
SV	SV	0℃	

<Sub setting mode>

Character	Setting item	Default value	Data
Ano	Set value memory number	1	
AT	Auto-tuning Perform/Cancel	- - - - (Cancel)	
P	OUT1 proportional band	2.5%	
P_b	OUT2 proportional band	1.0 times	
I	Integral time	200sec	
d	Derivative time	50sec	
c	OUT1 proportional cycle	R/M: 30sec S/M: 3sec	
c_b	OUT2 proportional cycle	R/M: 30sec S/M: 3sec	
rSET	Manual reset	0.0℃	
A1	Alarm 1 value	0℃	
A2	Alarm 2 value	0℃	
HS0.0	HB (Heater burnout alarm)	0.0A	
LP_T	LA (Loop break alarm) time	0 minutes	
LP_H	LA (Loop break alarm) span	0℃	

<Auxiliary function setting mode 1>

Character	Setting item	Default value	Data
Loc	Set value lock	- - - - (Unlock)	
SH	SV high limit	400℃	
SL	SV low limit	0℃	
So	Sensor correction	0.0℃	
db	Overlap band/Dead band	0.0℃	
rEno	Remote/Local switching	LocA: Local	
cno	Instrument number	0	
cSP	Communication speed	9600bps	
cSL	Communication protocol	noSL: Shinko protocol	

<Auxiliary function setting mode 2>

Character	Setting item	Default value	Data
SCLH	Scaling high limit	1370℃	
SCLL	Scaling low limit	-200℃	
dP	Decimal point place	No decimal point	
FILC	PV filter time constant	0.0 seconds	
oLH	OUT1 high limit	100%	
oLL	OUT1 low limit	0%	
HYS	OUT1 ON/OFF action hysteresis	1.0℃	
cAcC	OUT2 action mode selection	Air cooling	
oLHb	OUT2 high limit	100%	
oLLb	OUT2 low limit	0%	
HYSb	OUT2 ON/OFF action hysteresis	1.0℃	
A1LA	Alarm 1 action Energized/Deenergized	Energized	
A2LA	Alarm 2 action Energized/Deenergized	Energized	
A1HY	Alarm 1 hysteresis	1.0℃	
A2HY	Alarm 2 hysteresis	1.0℃	
A1dY	Alarm 1 delayed timer	0 seconds	
A2dY	Alarm 2 delayed timer	0 seconds	
rSLH	External setting input high limit	400℃	
rSLL	External setting input low limit	0℃	
Tro5	Transmission output selection	PV transmission	
TrLH	Transmission output high limit	400℃	
TrLL	Transmission output low limit	0℃	
PSU	Display selection when control output is off	oFF	
rAtU	SV rising rate	0℃/minute	
rAtd	SV falling rate	0℃/minute	
EoUT	Output status selection when input abnormal	-oFF: Turns the control output off.	

<Program mode>

Character	Setting item	Default value	Data
Proc	Program control	Fixed value control	
t_1	Step 1 time	00.00	
t_2	Step 2 time	00.00	
t_3	Step 3 time	00.00	
t_4	Step 4 time	00.00	
t_5	Step 5 time	00.00	
t_6	Step 6 time	00.00	
t_7	Step 7 time	00.00	

***** Inquiry *****

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

	[Example]
• Model ----------	FCR-13A-R/M
• Type of input ----------	K
• Option ----------	A2, C5, W(20A)
• Serial number ----------	No. xxxxxx

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

SHINKO TECHNOS CO.,LTD.
OVERSEAS DIVISION

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