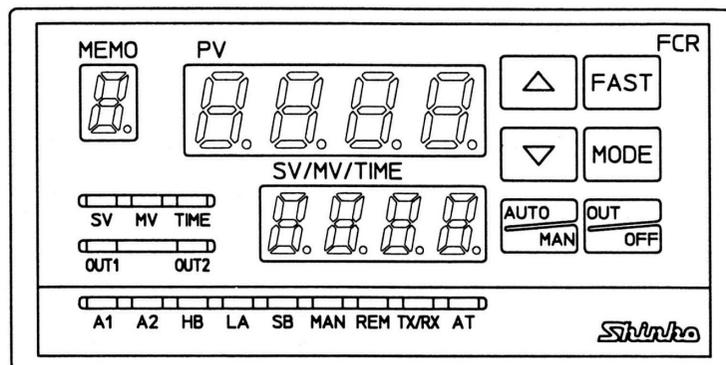# DIGITAL INDICATING CONTROLLER
FCR-23A
INSTRUCTION MANUAL

Shinko

Preface

Thank you for purchasing Digital Indicating Controller FCR-23A. This manual contains instructions for the mounting, functions, operations and notes when operating the FCR-23A. 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 a fire.
- Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- Specifications of the FCR-23A and the contents of this instruction manual are subject to change without notice.
- Care has been taken to ensure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform our sales department.
- This instrument is designed to be installed through the face of a control panel. If it is not, measures must be taken to ensure that the operator cannot touch power terminals or other high voltage sections.
- Any unauthorized transfer or copying of this document, in part or in whole, is prohibited.
- Shinko Technos CO., LTD. is not liable for any damage or secondary damage(s) incurred as a result of using this product, including any indirect damage.

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

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

Depending on circumstances, procedures indicated by ⚠ Caution may cause serious results, so be sure to follow the directions for usage.

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

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

⚠ **Warning**

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

⚠ **Safety Precautions**

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

Caution with respect to Export Trade Control Ordinance

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

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

1. Installation precautions

⚠ Caution

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

Ensure the mounting location corresponds to the following conditions:
- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gases
- No mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of 0 to 50℃ (32 to 122℉) that does not change rapidly, and no icing
- An ambient non-condensing humidity of 35 to 85%RH
- No large capacity electromagnetic switches or cables through which large current is flowing.
- No water, oil or chemicals or where the vapors of these substances can come into direct contact with the unit
- Take note that the ambient temperature of this unit must not exceed 50℃ (122℉) if mounted through the face of a control panel. Otherwise the life of electronic components (especially electrolytic capacitors) may be shortened.

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

2. Wiring precautions

⚠ Caution

- Use the solderless terminal with an insulation sleeve in which the M3 screw fits when wiring the FCR-23A.
- The terminal block of this instrument is designed to be wired from the upper side. The lead wire must be inserted from the upper side of the terminal, and fastened with the terminal screw.
- Tighten the terminal screw using the specified torque. If excessive force is applied to the screw when tightening, the 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. Operation and maintenance precautions

⚠ Caution

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

Abbreviations used in this manual

Symbol	Term
PV	Process variable
SV	Desired value
MV	Output manipulated variable
OUT1	Control output 1
OUT2	Control output 2
AT	Auto-tuning

Characters used in this manual

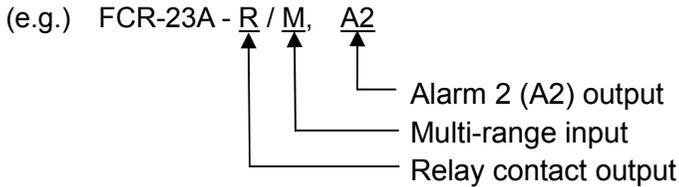| Indication	-1	0	1	2	3	4	5	6	7	8	9	C	F
Number, ℃/℉	-1	0	1	2	3	4	5	6	7	8	9	℃	℉
Indication	A	b	c	d	E	F	G	H	I	J	k	L	m
Alphabet	A	B	C	D	E	F	G	H	I	J	K	L	M
Indication	n	o	P	q	r	S	T	U	V	W	X	Y	Z
Alphabet	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

--- CONTENTS ---

1. Model

1.1 Model

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

(e.g.)   FCR-23A - <u>R</u> / <u>M</u>,   <u>A2</u>

         └─────── Alarm 2 (A2) output
        └─────── Multi-range input
       └─────── Relay contact output

Standard specifications

F C R – 2 3　A - □ / □　□				
Control action ┊ 3 ┊				PID control *1
Alarm 1 (A1)	A ┊			Alarm actions are selectable by keypad.*2
Control output (OUT1)		R ┊		Relay contact
		S ┊		Non-contact voltage (for SSR drive)
		A ┊		DC current
Input			M	Multi-range *3
Supply voltage				100 to 240V AC (standard)
			1	24V AC/DC *4

*1: Fuzzy self-tuning PID, PID, PD, ON/OFF action can be selected by internal DIP switch.
*2: 12 types of alarm plus 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).
*4: Supply voltage 100 to 240V AC is standard. When ordering 24V AC/DC, add "1" after the input code.

Optional specifications

Code	Name	
A2	Alarm 2 (A2) output (including Pattern end 2 output)	
DR	Relay contact	Heating/Cooling control output (OUT2)
DS	Non-contact voltage	
DA	DC current	
TA	DC current (4 to 20mA DC)	Transmission output
TV	DC voltage (0 to 1V DC)	
C5	RS-485	Serial communication
C	RS-232C	
SM	Set value memory number external selection	
EA	DC current (0 to 20mA DC, 4 to 20mA DC)	External setting
EV	DC voltage (0 to 1V DC, 1 to 5V DC)	
W	Single-phase	Heater burnout alarm output (including Sensor burnout alarm)
W3	Three-phase	
LA	Loop break alarm	
P24	Insulated power output	
BL	Screw type mounting bracket	
BK	Color: Black	
IP	Drip-proof/Dust-proof (IP54)	
TC	Terminal cover	

For more details about options, refer to section "11.2 Optional specifications".

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℃(℉)
JPt100	−199.9 to 500.0 ℃	−199.9 to 900.0 ℉	0.1℃(℉)
Pt100	−200 to 850 ℃	−320 to 1560 ℉	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.

Model label　　　　　　　(e.g.)

(1)	FCR-23A-R/M	Relay contact output
(2)	A2	Alarm 2 (A2) output
	W (20A)	Heater burnout alarm output (20A)
	Multi-range	
(3)	No.	

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

2. Name and functions of sections
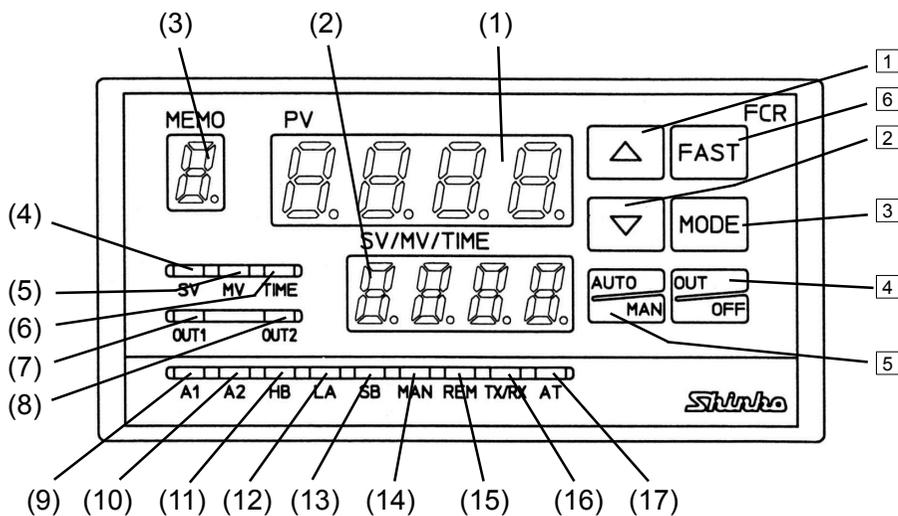
(Fig. 2-1)

(1) **PV display (Red)**

Indicates the PV or setting characters in the setting mode.

(2) **SV/MV/TIME display (Green)**

Indicates the SV, MV, TIME or set values in the setting mode.

(3) **MEMO display (Yellow)**

Indicates the Set value memory number.

(4) **SV indicator (Green)**

Lights when the SV is indicated on the SV/MV/TIME display.

(5) **MV indicator (Red)**

Lights when the MV is indicated on the SV/MV/TIME display.

(6) **Time indicator (Yellow)**

Lights when time is indicated on the SV/MV/TIME display.

(7) **OUT1 indicator (Green)**

Lights when OUT1 (control output) is on.

(For DC current output type, it flashes in 0.125 second cycles corresponding to the output MV.)

(8) **OUT2 indicator (Yellow) (Optional)**

Lights when OUT2 (DR/DS/DA option) is on.

(For DC current output type, it flashes in 0.125 second cycles corresponding to the output MV.)

(9) **A1 indicator (including Pattern end 1 output) (Red)**

Lights when Alarm 1 (A1) output or Pattern end 1 output is on.

(10) **A2 indicator (including Pattern end 2 output) (Red) (Optional)**

Lights when Alarm 2 (A2) output or Pattern end 2 output is on.

(11) **HB indicator (Red) (Optional)**

Lights when Heater burnout alarm output is on.

(12) **LA indicator (Red) (Optional)**
   Lights when Loop break alarm output is on.
(13) **SB indicator (Red)**
   Lights when sensor is burnt out.
(14) **MAN indicator (Red)**
   Lights during Manual control.
(15) **REM indicator (Red) (Optional)**
   Lights during Remote operation.
(16) **TX/RX indicator (Green) (Optional)**
   Lights during Serial communication (TX, transmitting).
(17) **AT indicator (Yellow)**
   Flashes during AT (auto-tuning).

1	▲ Increase key	: Increases the numeric value on the SV/MV/TIME display during setting mode.
2	▼ Decrease key	: Decreases the numeric value on the SV/MV/TIME display during setting mode.
3	MODE Mode key	: Selects 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. Starts/Stops the program control.
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.

• By pressing the OUT/OFF key for approx. 1 second from any mode, control output OFF
  function works.
  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. Control output OFF function
  keeps working.
  To cancel the function, press the OUT/OFF key again for approx. 1 second.

• To revert to the PV/SV display mode, press the MODE key for approx. 3sec during setting
  mode. The unit will revert to the PV/SV display mode from any mode.

3. Setup

3.1 Drawing the inner assembly out

Before the power supply to this instrument is turned ON, draw out the inner assembly from the case in the direction indicated by the arrow by pushing the latch (on the right side of the instrument) while holding the instrument by the right and left.

Latch

Draw out the FCR-23A toward you by pushing the latch

(Fig. 3.1-1)
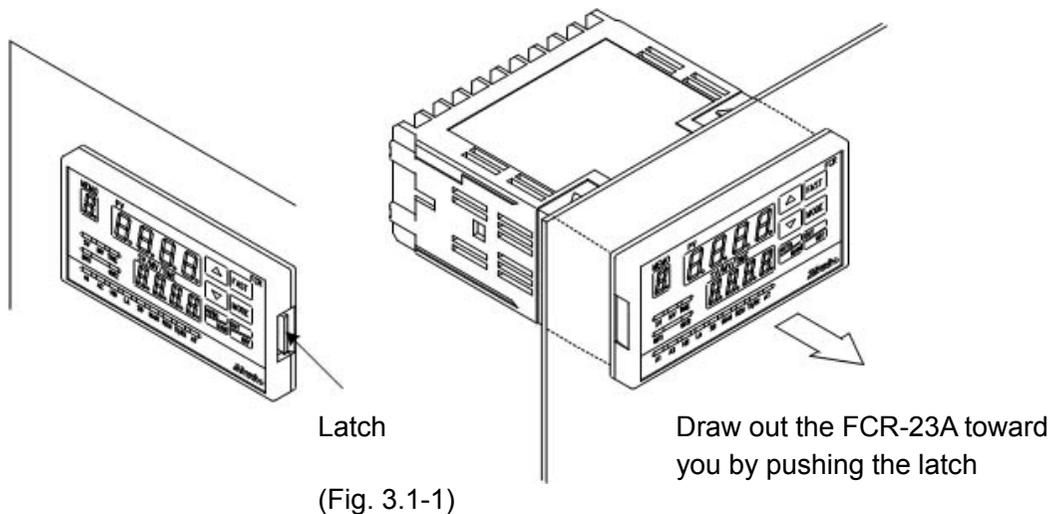
3.2 Switch setting (multi-function)

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

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

The Rotary switch (SW301) will be equipped only when A2 option is added. (Fig. 3.2-1)

Control action
Heating/Cooling action
Alarm 1 standby function
Alarm 2 standby function
℃/℉
Sensor input
Program start Auto/Manual

Alarm 2 type
Alarm 1 type
Sensor input

SW301   SW302   SW303
Rotary switch

OFF ↓ ON

SW304
DIP switch

(Fig. 3.2-1)

10
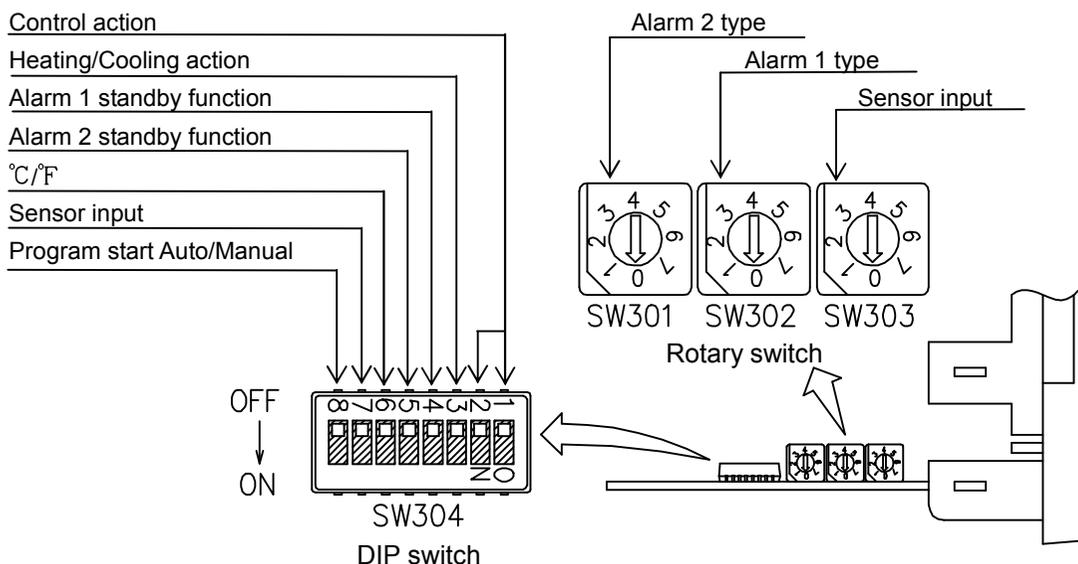
The following can be selected by the DIP switch (SW304).
Default value: All switches OFF.
(Table 3.2-1)

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 added.
(*2) Use the Rotary switch (SW303) and DIP switch (SW304) together for selecting the sensor input.

Program start: For program control.
    Manual start   : The preset program starts by pressing the [OUT/OFF] key.
    Automatic start : The preset program automatically starts from Step 1 after 2 seconds of warm-up status after power-on.

Select a sensor type with the Rotary switch (SW303).
Default value: K (-200 to 1370℃)
Note: If the input type is changed, Scaling high/low limit, External setting input high/low limit, transmission output high/low limit values (optional) will become the altered input range high/low limit value.

(Table 3.2-2)

Rotary SW303 No.	DIP SW304 No. 7	Sensor	Scale range (DIP SW304 No.6)	
			OFF	ON
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 added.

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

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 inner assembly into the case.
Firmly insert the assembly until it is locked by the latch on the right side of the instrument. (There will be a clicking sound.)

```
┌─────────────────────────────────────────────────────────────┐
│  ⚠ Caution                                                   │
│                                                               │
│  Do not confuse the top and bottom of the inner assembly.    │
│  If the assembly is inserted 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, and no icing
(5) An ambient non-condensing humidity of 35 to 85%RH
(6) No large capacity electromagnetic switches or cables through which large current flows
(7) No water, oil or chemicals or where the vapors of these substances can come into direct contact with the unit
(8) Take note that the ambient temperature of this unit must not exceed 50℃ (122℉) if mounted through the face of a control panel. Otherwise the life of electronic components (especially electrolytic capacitors) may be shortened.

4.2 External dimensions (Scale: mm)

When using one-touch type mounting bracket
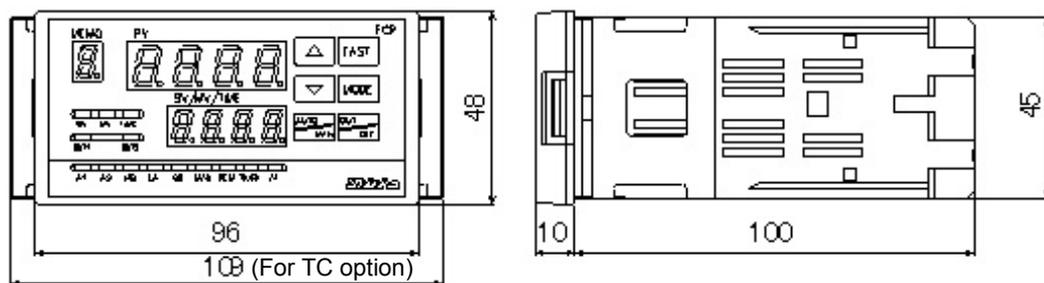
(Fig. 4.2-1)

When using Screw type mounting bracket (BL option)

(Fig. 4.2-2)

4.3 Panel cutout (Scale: mm)

$92^{+0.8}_{0}$

$45^{+0.5}_{0}$

130

$n \times 48-3^{+0.5}_{0}$

$92^{+0.8}_{0}$

Lengthwise close mounting
n: Number of units mounted

(Fig. 4.3-1)

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

CTL-6S (for 20A)   CTL-12-S36-10L1U (for 50A)

_l_ 15 _k_

$\emptyset$5.8

0.5

2.8

7.5

CTL-6-S

K   L

25

10.5

3

21

40

10

30

2-$\emptyset$3.5

_l_ 30 _k_

100

40

40

$\emptyset$12

15

30

2-M3

(Fig. 4.4-1)

14
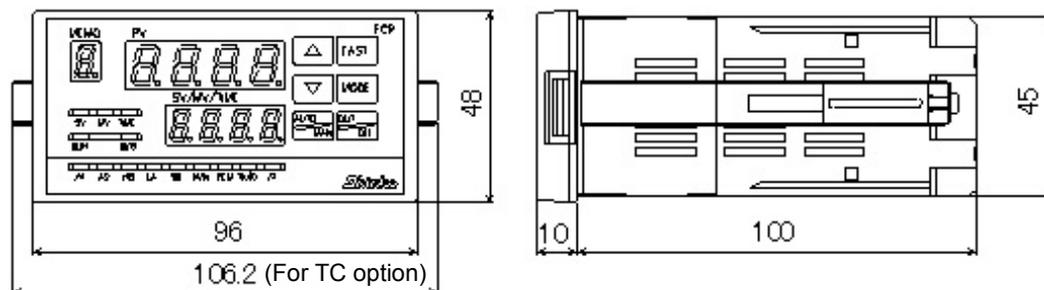
4.5 Mounting

• When using the One-touch type mounting bracket

Mounting panel thickness: 1 to 3mm.
Mount one-touch mounting brackets ①
to the instrument first, and then insert
the FCR-23A ② from the front of the
panel.

If a Soft front cover (FC-R) is used,
mounting panel thickness will be
1 to 2.5mm.
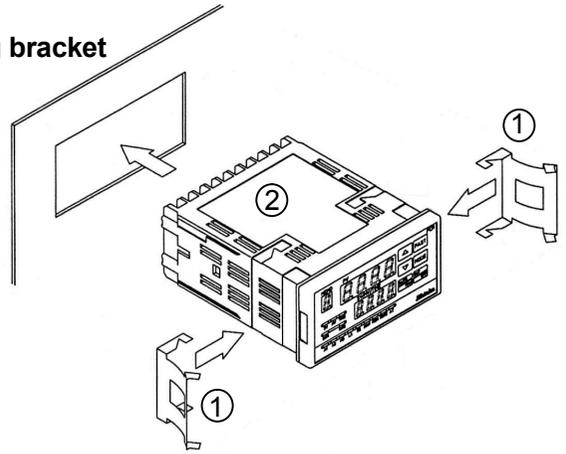
(Fig. 4.5-1)

• When using the Screw type mounting bracket (BL option)

Mounting panel thickness: 1 to 8mm.
Insert the FCR-23A from the front of the panel.
Attach the mounting brackets to the slots at the right and left of the case,
and secure the controller in place with the screws provided.
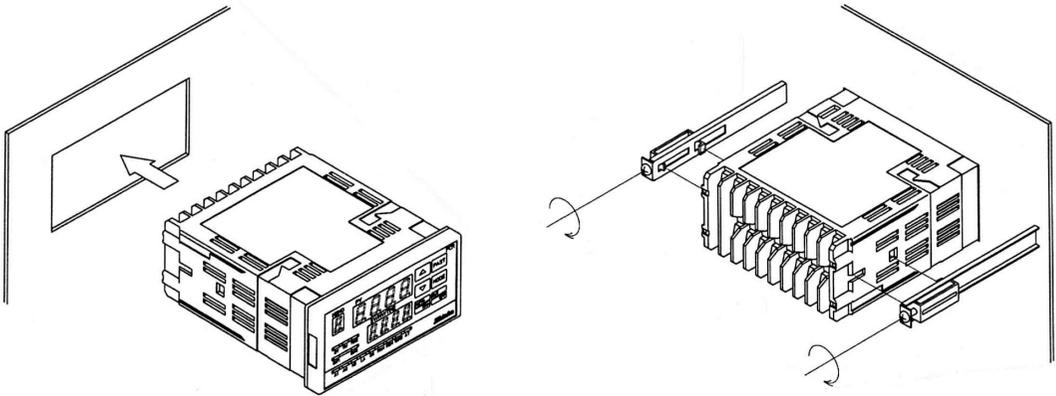
(Fig. 4.5-2)

⚠ Caution

**As the case is made of resin, do not use excessive force while screwing in
the mounting bracket, or the case or mounting brackets could be damaged.
The torque should be 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)
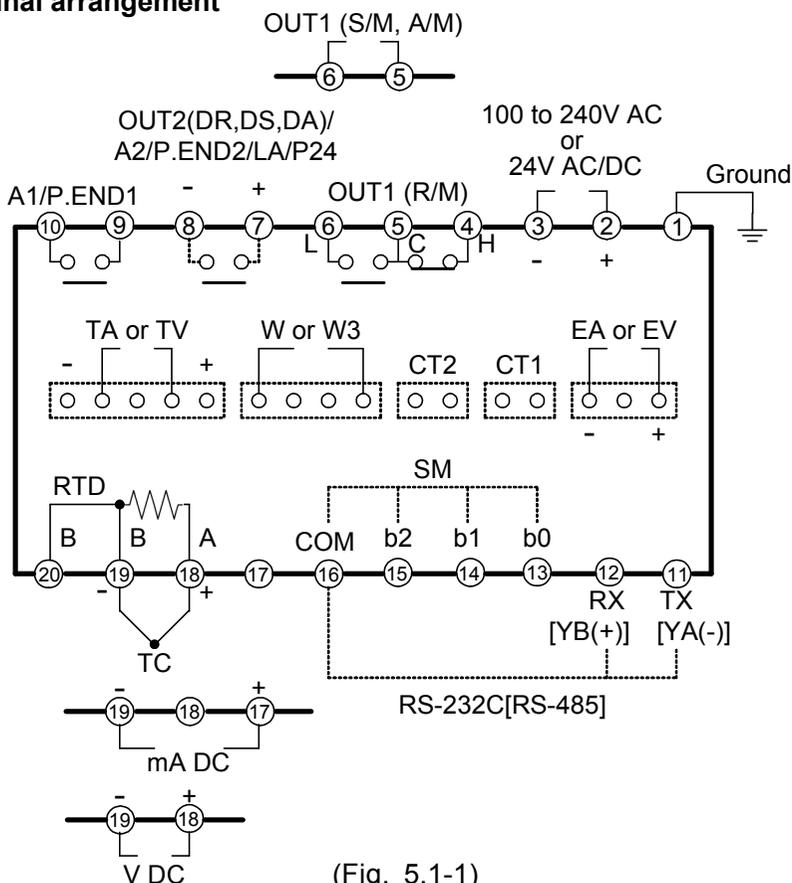
OUT1 : Control output 1	RS-232C(RS-485): Serial communication
OUT2 : Control output 2 (option)	(C, C5 option)
A1 : Alarm 1 output	TA, TV : Transmission output (option)
A2 : Alarm 2 output (option)	EA, EV : External setting (option)
LA : Loop break alarm output (option)	SM : Set value memory number
W, W3 : Heater burnout alarm output (option)	external selection (option)
P24 : Insulated power output (option)	P.END1, 2: Pattern end 1, Pattern end 2 (option)

The terminal block of this instrument is designed to be wired from the upper side.
The lead wire must be inserted from the upper side of the terminal, and fastened with the terminal screw.

Dotted lines show options, and no terminal is equipped unless specified.

If the A2 option and LA option are added together, they utilize 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 0.63N•m.

Solderless terminal	Manufacturer	Model	Tightening torque
Y type	Nichifu Terminal Industries CO.,LTD.	TMEV1.25Y-3	0.63N•m
	Japan Solderless Terminal MFG CO.,LTD.	VD1.25-B3A	
Round type	Nichifu Terminal Industries CO.,LTD.	TMEV1.25-3	
	Japan Solderless Terminal MFG CO.,LTD.	V1.25-3	
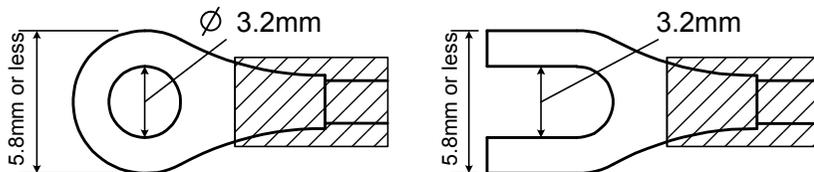
(Fig. 5.1-2)

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 does not have a built-in power switch, circuit breaker or fuse. Therefore, it is necessary to install them in a 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, externally use a relay according to the capacity of the load to protect the built-in relay contact.
> • When wiring, keep input wires (thermocouple, RTD, etc.) away from AC sources or load wires to avoid external interference.
> • Use a thick wire (1.25 to 2.0mm^2) for grounding.

Heater burnout alarm output

(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)

[Three-phase heater]

(Fig. 5.2-2)

(Fig. 5.2-3)

[FCR-23A-R/E]

3-phase

100 to 240V AC

Electro-
magnetic
switch

*

Power supply
for alarm unit

⑩ ⑨ ⑧ ⑦ ⑥ ⑤ ④ ③ ② ①

⑳ ⑲ ⑱ ⑰ ⑯ ⑮ ⑭ ⑬ ⑫ ⑪

Alarm unit

−   +

Heater   Thermocouple
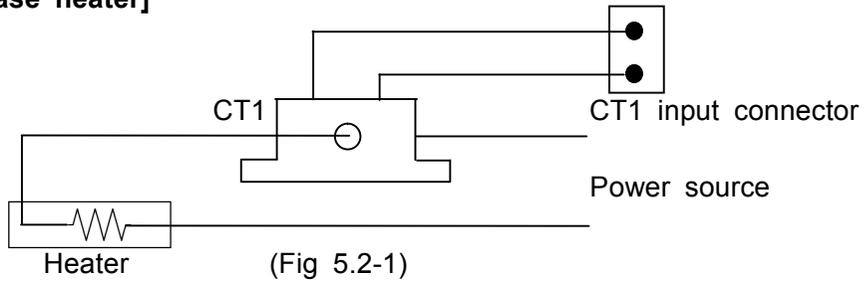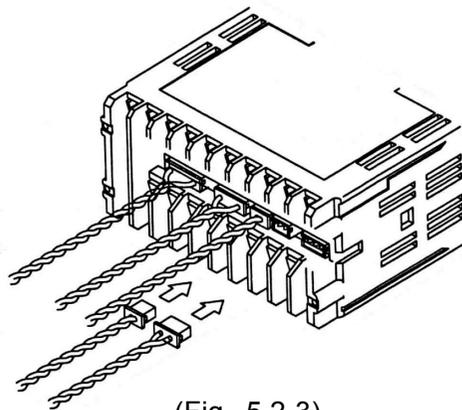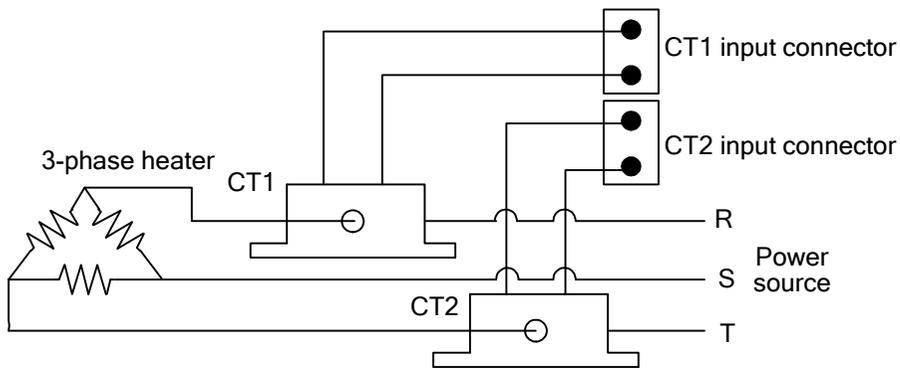
Electric furnace
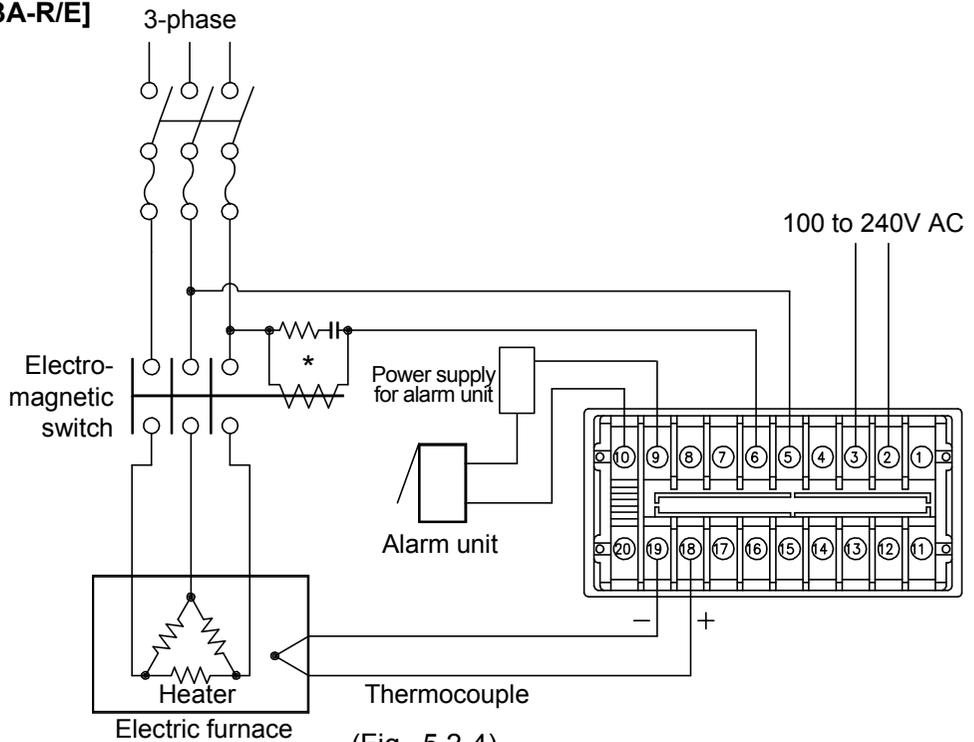
(Fig. 5.2-4)

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

[FCR-23A-S/E]

Single-phase

Alarm unit

SSR

24V

− +

CT

⑩ ⑨ ⑧ ⑦ ⑥ ⑤ ④ ③ ② ①

⑳ ⑲ ⑱ ⑰ ⑯ ⑮ ⑭ ⑬ ⑫ ⑪

Heater

Thermocouple

− +

Electric furnace
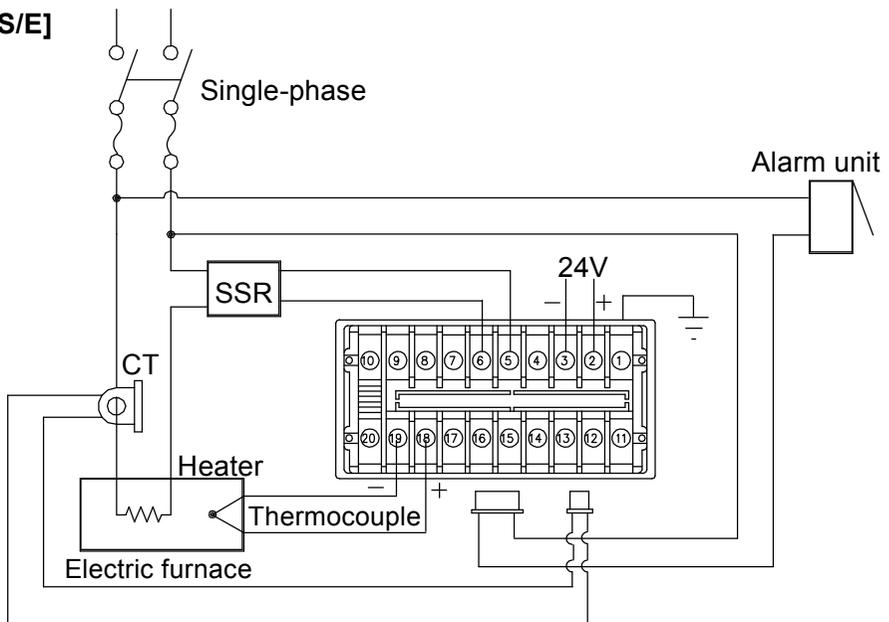
(Fig. 5.2-5)

• 4 units of the SA-300-Z or 5 units of the SA-400 series can be connected in
  parallel when Shinko SSR is used.
• AC or DC is available for supply voltage 24V, however, do not confuse polarity
  when using direct current (DC).

6. Settings

Turn the power supply to the instrument on.

The PV display indicates the sensor characters selected during Sensor input selection and temperature unit (℃/℉), and the SV/MV/TIME display indicates the input range high limit value or scaling high limit value for approx. 2 seconds after power-on. (Table 6-1)

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

After that, control starts indicating PV on the PV display and SV on the SV/MV/TIME display.

While the control output OFF function is working, PV display indicates an item previously selected during "Indication when control output OFF" mode.

(Table 6-1)

Input	℃		℉	
	PV display	SV/MV/TIME display	PV display	SV/MV/TIME 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	5☐☐C	1760	5☐☐F	3200
E	E☐☐C	1000	E☐☐F	1800
T	r☐☐C	400.0	r☐☐F	750.0
C (W/Re5-26)	c☐☐C	2315	c☐☐F	4200
Pt100	Pr☐C	850.0	Pr☐F	999.9
JPt100	JPrC	500.0	JPrF	900.0
Pt100	Pr☐C	☐850	Pr☐F	1560
4 to 20mA DC	42A☐	Scaling high limit value	42A☐	Scaling high limit value
0 to 20mA DC	02A☐		02A☐	
0 to 1V DC	01b☐		01b☐	

6.1 Operation flowchart

*1: Warm-up status lasts 2sec after power-on, then starts from previous controller status (last shutdown)
*2: Remaining step time is indicated only during program control.
*3: If AT is performed, the unit reverts to the PV/SV display mode. If AT is cancelled, the unit goes to the "OUT1 proportional band".
*4: If oFF is selected during "Program control" mode and MODE key is pressed, the unit reverts to the PV/SV display mode.

Power ON

*1

PV/SV display mode

OUT/OFF (1sec) → Control output OFF function (Fixed value control) *1

OUT/OFF → Standby mode (Program control)

OUT/OFF (1sec) → Manual control(Fixed value control)

AUTO/MAN → Output MV indication — MODE → Remaining step time indication *2

MODE (3sec)

[Main setting mode]	[Auxiliary function setting mode 1]	[Auxiliary function setting mode 2]		[Program mode]
MODE	▼+MODE(3sec)	▲+▼+MODE(3sec)		▲+▼(3sec)
SV [5]	Set value lock [Loc]	Scaling high limit [5FLH]	External setting input high limit [r5LH]	Program control [Proc] *4
	↓MODE	↓MODE	↓MODE	↓MODE
▲+MODE	SV high limit [5H]	Scaling low limit [5FLL]	External setting input low limit [r5LL]	Step 1 time [r_1]
	↓MODE	↓MODE	↓MODE	↓MODE
[Sub setting mode]	SV low limit [5L]	Decimal point place [dP]	Transmission output [Fro5]	Step 2 time [r_2]
	↓MODE	↓MODE	↓MODE	↓MODE
Set value memory number [mno]	Sensor correction [5o]	PV filter time constant [FILF]	Transmission output high limit [FrLH]	Step 3 time [r_3]
↓MODE	↓MODE	↓MODE	↓MODE	↓MODE
AT Perform/Cancel [AF]	Overlap/Dead band [db]	OUT1 high limit [oLH]	Transmission output low limit [FrLL]	Step 4 time [r_4]
*3 ↓MODE	↓MODE	↓MODE	↓MODE	↓MODE
OUT1 proportional band [P]	Remote/Local switching [rEmo]	OUT1 low limit [oLL]	Indication when control output OFF [P5o]	Step 5 time [r_5]
↓MODE	↓MODE	↓MODE	↓MODE	↓MODE
OUT2 proportional band [P_b]	Instrument number [cmno]	OUT1 ON/OFF action hysteresis [H95]	SV rise rate [rArU]	Step 6 time [r_6]
↓MODE	↓MODE	↓MODE	↓MODE	↓MODE
Integral time [I]	Communication speed [cm5P]	OUT2 action mode [cAcF]	SV fall rate [rArd]	Step 7 time [r_7]
↓MODE	↓MODE	↓MODE	↓MODE	↓MODE
Derivative time [d]	Communication protocol [cm5L]	OUT2 high limit [oLHb]	Output status when input abnormal[EoUF]	
↓MODE	↓MODE	↓MODE	↓MODE	
OUT1 proportional cycle [c]		OUT2 low limit [oLLb]		
↓MODE		↓MODE		
OUT2 proportional cycle [c_b]		OUT2 ON/OFF action hysteresis [H95b]		
↓MODE		↓MODE		
Manual reset [r5EF]		A1 Energized/ De-energized [A1Lm]		
↓MODE		↓MODE		
A1 value [A1]		A2 Energized/ De-energized [A2Lm]		
↓MODE		↓MODE		
A2 value [A2]		A1 hysteresis [A1HY]		
↓MODE		↓MODE		
Heater burnout alarm value [Hxx.x]		A2 hysteresis [A2HY]		
↓MODE		↓MODE		
Loop break alarm time [LP_F]		A1 action delay timer [A1dY]		
↓MODE		↓MODE		
Loop break alarm span [LP_H]		A2 action delay timer [A2dY]		
↓MODE		↓MODE		

↓MODE : This means that if the MODE key is pressed, the unit moves to the next setting item.

• 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(3sec) : Press the MODE key for approx. 3 seconds while holding down the ▼ key.
• ▲+▼+MODE(3sec) : Press the MODE key for approx. 3 seconds while holding down the ▲ and ▼ key.
• ▲+▼(3sec) : Press the ▼ key for approx. 3 seconds while holding down the ▲ key.

6.2 Main setting mode

If the MODE key is pressed in the PV/SV display mode, the unit moves to the Main setting mode.

The SV can be increased or decreased by pressing the ▲, ▼ and FAST key.

Pressing the MODE key registers the SV, and the unit will revert to the PV/SV display mode.

Character	Name, Function, Setting range	Default value
५▢▢▢	**SV** • Sets SV. • Setting range: SV low limit to SV high limit value	0℃

6.3 Sub setting mode

If the MODE key is pressed while holding down the ▲ key in the PV/SV display mode, the unit moves to the Sub setting mode.

The set value (numeric value) can be increased or decreased by pressing the ▲, ▼ and FAST key.

Pressing the MODE key registers the set value, and moves to the next setting item.

Character	Name, Function, Setting range	Default value
⊓⊓o▢	**Set value memory number** • Selects the memory number to be retrieved. • Selection range: 1 to 7	Memory number 1
RΓ▢	**AT Perform/Cancel** • Sets AT (Auto-tuning) Perform or Cancel. (If the MODE key is pressed after selecting AT Perform, the unit reverts to the PV/SV display mode.) • Not available if ON/OFF action or PD action is selected during Control action selection. • If the auto-tuning is cancelled during the process, P, I, D values revert to their previous value. • None of the settings can be performed during AT. • If the AT is not finished after 4 hours, it is cancelled automatically. • Selection item: [- - - -]: AT Cancel 　　　　　　　　[RΓ▢]: AT Perform	AT Cancel
P▢▢▢	**OUT1 proportional band** • Sets OUT1 proportional band. • Not available if ON/OFF action is selected during Control action selection • Setting range: 0.1 to 999.9%	2.5%
P-b▢	**OUT2 proportional band** • Sets OUT2 proportional band. • OUT2 becomes ON/OFF action when set to 0.0. • Not available if Heating/Cooling control (DR/DS/DA option) is not added, or if ON/OFF action is selected during Control action selection • Setting range: 0.0 to 10.0 times OUT1 proportional band	1.0 times (2.5%)
╎ ▢▢▢	**Integral time** • 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 • Setting range: 0 to 3600 seconds	200sec

Character	Name, Function, Setting range		Default value
d□□□	**Derivative time**		50sec

	• 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
	• Setting range: 0 to 3600 seconds		

c□□□	**OUT1 proportional cycle** • Sets OUT1 proportional cycle.	30sec (Relay contact output) 3sec (Non-contact voltage output	

	• Not available for DC current output type or if ON/OFF action is
	  selected during Control action selection
	• **For 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		

c_b□	**OUT2 proportional cycle** • Sets OUT2 proportional cycle.	30sec (Relay contact output) 3sec (Non-contact voltage output	

	• Not available for DC current output type
	  Not available if Heating/Cooling control (DR/DS/DA option) is not added,
	  or if ON/OFF action is selected during Control action selection
	• Setting range: 1 to 120 seconds		

r5Er	**Manual reset**		0.0℃

	• 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
	How to set manual reset:
	  When SV>PV, set the positive (+) value (SV–PV).
	  When SV<PV, set the negative (–) value (SV–PV).
	• Setting range: ±OUT1 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.)		

A1□□	**A1 value**		0℃

	• 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 the Rotary switch is set to No.0 or No.7 during A1 type
	  selection
	• Setting range: Refer to (Table 6.3-1).		

A2□□	**A2 value**		0℃

	• 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 if A2 output (A2 option) is not added or if the Rotary
	  switch is set to No.0 or No.7 during A2 type selection even if it is
	  added.
	• Setting range: Refer to (Table 6.3-1).		

Character	Name, Function, Setting range	Default value
Hxx.x (xx.x: Heater current value)	**HB (Heater burnout alarm) value**	0.0A

	• Sets the heater current value for Heater burnout alarm.
	  Setting the value to 0.0 disables the function.
	• Available only when Heater burnout alarm (W, W3 option) is added
	• It is recommended to set approx. 80% of the heater current value in
	  consideration of the voltage fluctuation.
	• Upon returning to set limits, the alarm will stop.
	• Setting range:
	  Rated current 20A: 0.0 to 20.0A
	  Rated current 50A: 0.0 to 50.0A	

LP_Γ	**LA (Loop break alarm) time**	0min
	• Sets the time to assess the Loop break alarm. • Available only when Loop break alarm (LA option) is added • Setting range: 0 to 200 minutes	
LP_H	**LA (Loop break alarm) span**	0℃

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

[A1, A2 setting range]
(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 low limit value is –199.9.
• For DC input, the negative low 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.

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

6.4 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 moves to the next setting item.

Character	Name, Function, Setting range	Default value
L o c ☐	**Set value lock**	Unlock

	• Locks the set values to prevent setting errors
	  The setting item to be locked differs depending on the selection.
	• When selecting Lock, 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 in consideration of the life of the non-volatile memory.
	• Selection item:
	  – – – – (Unlock): All set values can be changed.
	  L c /☐ (Lock 1): None of the set values can be changed.
	  L c 2☐ (Lock 2): Only SV (desired value) can be changed.
	  L c 3☐ (Lock 3): All set values can be changed temporarily. However, changed data reverts 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 for using with the Shinko programmable controllers (with the SVTC option).
	[About Lock 3]
	 When using the FCR-23A 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 values of the previous number are cancelled, and the previous values will return.
	 When using the FCR-23A 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 the previous values will return.
	  During program standby status, set value changes will be invalidated. (Operation starts with stored memory values.)	

5 H ☐☐	**SV high limit**	400℃
	• Sets SV high limit value. • Setting range: SV low limit to Input range high limit value DC input: SV low limit to Scaling high limit value (The placement of the decimal point follows the selection.)	
5 L ☐☐	**SV low limit**	0℃
	• Sets SV low limit value. • Setting range: Input range low limit value to SV high limit DC input: Scaling low limit to SV high limit value (The placement of the decimal point follows the selection.)	

Character	Name, Function, Setting range	Default value
5o⬚⬚	**Sensor correction** • Sets the sensor correction value. This corrects the input value from the sensor. When a sensor cannot be set at the exact location where control is desired, temperatures measured by the sensor may deviate from the temperature in the controlled location. When controlling with plural controllers, sometimes the measured temperatures (input value) do not concur due to differences in sensor accuracy or dispersion of load capacities. In such a case, the control can be set at the desired temperature by adjusting the input value of sensors. PV after sensor correction= Current PV+ (Sensor correction value) • Setting range: –100.0 to 100.0℃（℉） DC input: -1000 to 1000	0.0℃

db⬚⬚	**Overlap band/Dead band**
	
	 • 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
	 • Setting range: ±OUT1 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.)
		0.0% (℃ indication)

rEⁿⁱoⁱ	**Remote/Local switching** • Switches either Remote setting or Local setting of the SV (desired value). • Available only when External setting (EA/EV option) is added. • Selection item: LocL: Local setting. The SV can be set by the front keypad as usual. rEⁿⁱoⁱ: Remote setting. The SV can be set in analog by the remote operation externally.	Local
cⁿⁱno	**Instrument number** • 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 (C/C5 option) is added • Setting range: 0 to 95	0
cⁿⁱ5P	**Communication speed** • 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)	9600bps
cⁿⁱ5L	**Communication protocol** • Selects the communication protocol of this instrument. • Available only when the Serial communication (C/C5 option) is added • Selection item: noⁿⁱL (Shinko protocol) ⁿⁱodA (Modbus ASCII mode)	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.

Character	Name, Function, Setting range	Default value
५┌L H	**Scaling high limit**	1370℃
	• 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 to Input range high limit value	
५┌L L	**Scaling low limit**	-200℃
	• 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 to scaling high limit value	
dP☐☐	**Decimal point place**	No decimal point
	Selects the decimal point place.	
	• Not available if RTD or thermocouple is selected during Sensor input selection	
	• Selection item: ☐☐☐ . (No decimal point) ☐☐ . ☐ (1 digit after the decimal point) ☐ . ☐☐ (2 digits after the decimal point) . ☐☐☐ (3 digits after the decimal point)	
F I L ┌	**PV filter time constant**	0.0sec
	• 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	
o L H ☐	**OUT1 high limit**	100%
	• Sets the high limit value for OUT1.	
	• Not available if ON/OFF action is selected during Control action selection	
	• Setting range: OUT1 low limit value to 100% DC current output: OUT1 low limit value to 105%	
o L L ☐	**OUT1 low limit**	0%
	• Sets the low limit value for OUT1.	
	• Not available if ON/OFF action is selected during Control action selection	
	• Setting range: 0% to OUT1 high limit value DC current output: –5% to OUT1 high limit value	
H ५ ५ ☐	**OUT1 ON/OFF action hysteresis**	1.0℃
	• Sets ON/OFF action hysteresis for OUT1.	
	• Available only when ON/OFF action is selected during Control action selection	
	• Setting range: 0.1 to 100.0℃(℉), DC input: 1 to 1000 (The placement of the decimal point follows the selection.)	

Character	Name, Function, Setting range	Default value
$cAc\Gamma$	**OUT2 action mode**	Air cooling
	• Selects OUT2 cooling action from a choice of: Air cooling, oil cooling and water cooling. 　Available only when Heating/Cooling control (DR/DS/DA option) is added • Selection item: 　$AI\ r\square$ (Air cooling, Linear characteristic) 　$oi\ L\square$ (Oil cooling, 1.5th power of the linear characteristic) 　$\overline{\_}A\Gamma\square$ (Water cooling, 2nd power of the linear characteristic)	
$oLHb$	**OUT2 high limit**	100%
	• Sets the high limit value for OUT2. • Not available if Heating/Cooling control (DR/DS/DA option) is not added or if OUT2 is ON/OFF action • Setting range: OUT2 low limit value to 100% 　　　　　　DC current output: OUT2 low limit value to 105%	
$oLLb$	**OUT2 low limit**	0%
	• Sets the low limit value for OUT2. • Not available if Heating/Cooling control (DR/DS/DA option) is not added or if OUT2 is ON/OFF action • Setting range: 0% to OUT2 high limit value 　　　　　　DC current output: –5% to OUT2 high limit value	
$H\exists 5b$	**OUT2 ON/OFF action hysteresis**	1.0℃
	• Sets ON/OFF action hysteresis for OUT2. • Not available if Heating/Cooling control (DR/DS/DA option) is not added or if OUT2 is PID or PD action • Setting range: 0.1 to 100.0℃(℉), DC input: 1 to 1000 (The placement 　　　　　　of the decimal point follows the selection.)	
$A\ IL\bar{n}$	**A1 Energized/De-energized**	Energized
	• Selects Energized/De-energized status for Alarm 1. 　Not available if the Rotary switch (SW302) is set to No. 0 or No. 7 during A1 type selection. • Selection item: $\square n\sigma\bar{n}$: Energized 　　　　　　$\square r E\forall$: De-energized	
$A2L\bar{n}$	**A2 Energized/De-energized**	Energized
	• Selects Energized/De-energized status for Alarm 2. 　Not available if Alarm 2 (A2) option is not added, or if the Rotary switch (SW301) is set to No. 0 or No. 7 during A2 type selection. • Selection items are the same as those of A1 Energized/De-energized.	
$A\ IH\forall$	**A1 hysteresis**	1.0℃
	• Sets A1 hysteresis. • Not available if the Rotary switch (SW302) is set to No.0 or No.7 during A1 type selection. • Setting range: 0.1 to 100.0℃(℉), DC input: 1 to 1000 (The placement 　　　　　　of the decimal point follows the selection.)	
$A2H\forall$	**A2 hysteresis**	1.0℃
	• Sets A2 hysteresis. • Not available if A2 option is not added or if the Rotary switch (SW301) is set to No.0 or No.7 during A2 type selection. • Setting range: 0.1 to 100.0℃(℉), DC input: 1 to 1000 (The placement 　　　　　　of the decimal point follows the selection.)	

Character	Name, Function, Setting range	Default value
A 1dY	**A1 action delay timer**	0sec
	• Sets A1 action delay timer. When setting time has elapsed after the input entered the alarm output range, the alarm is activated. • Not available if the Rotary switch (SW302) is set to No.0 or No.7 during A1 type selection. • Setting range: 0 to 9999 seconds	
A2dY	**A2 action delay timer**	0sec
	• Sets A2 action delay timer. When setting time has elapsed after the input entered the alarm output range, the alarm is activated. • Not available if A2 option is not added or if the Rotary switch (SW301) is set to No.0 or No.7 during A2 type selection. • Setting range: 0 to 9999 seconds	
r 5LH	**External setting input high limit**	400℃
	• 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 (EA/EV option) is added • Setting range: External setting input low limit to Input range high limit value	
r 5LL	**External setting input low limit**	0℃
	• 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 to External setting input high limit value	
Tro5	**Transmission output**	PV transmission

	• Selects the Transmission output type.
	• Available only when Transmission output (TA/TV option) is added
	• Selection item:
	  PV□: PV (process variable) transmission
	  5V□: SV (desired value) transmission
	  ñV□: MV (manipulated variable) transmission	

TrLH	**Transmission output high limit**	400℃
	• Sets the Transmission output high limit value. (For the TA option, the value correponds to 20mA output.) • Available only when Transmission output (option) is added • Setting range: Transmission output low limit to Input range high limit value	
TrLL	**Transmission output low limit**	0℃
	• Sets the Transmission output low limit value. (For the TA option, the value corresponds to 4mA output.) • Available only when Transmission output (TA/TV option) is added • Setting range: Input range low limit to Transmission output high limit value	

Character	Name, Function, Setting range	Default value
P꒦ꮋ	**Indication when control output OFF**	oFF

	• Selects the indication when the control output is OFF.
	• Selection item:
	  oFF: OFF is indicated on the PV display.
	  ꓘoFF: No indication
	  Pꮋ: PV indication	

ꭇꓮꮁꓤ	**SV rise rate**	0℃/minute

	• Sets the SV rise rate (Rising value per minute).
	  Setting the value to 0 disables the function.
	• Setting range: 0 to 9999℃/min (℉/min) or
	            0.0 to 999.9℃/min (℉/min) (with a decimal point)
	            DC input: 0 to 9999 (The placement of the decimal
	                        point follows the selection.)	

ꭇꓮꮁd	**SV fall rate**	0℃/minute

	• Sets the SV fall rate (Falling value per minute).
	  Setting the value to 0 disables the function.
	• Setting range: 0 to 9999℃/min (℉/min) or
	            0.0 to 999.9℃/min (℉/min) (with a decimal point)
	            DC input: 0 to 9999 (The placement of the decimal
	                        point follows the selection.)	

Eoꓴꭇ	**Output status when input abnormal** • Selects control output status when	Outputs OFF (4mA) or OUT1 (OUT2) low limit value.

	DC input is in overscale or underscale.
	• Available only for DC current output type with DC input
	• Selection item:
	  ⁻oFF : Outputs OFF (4mA) or OUT1 (OUT2) low limit value.
	  on : Outputs a value between OFF (4mA) and ON (20mA) or
	        between OUT1 (OUT2) low limit value and OUT1 (OUT2)
	        high limit value, depending on a deviation.	

[Alarm action Energized/De-energized]

When [Alarm Energized] is selected, the alarm output (between terminals 7-8, or 9-10) is conductive (ON) while the alarm output indicator is lit.
The alarm output is not conductive (OFF) while the alarm output indicator is not lit.
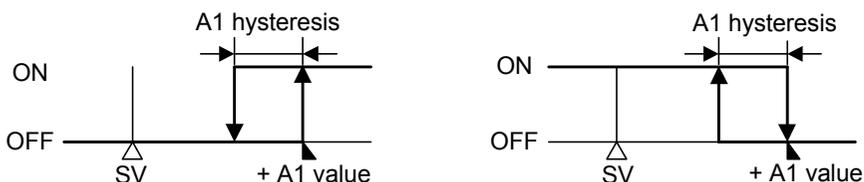
When [Alarm De-energized] is selected, the alarm output (between terminals 7-8, or 9-10) is not conductive (OFF) while the alarm output indicator is lit.
The alarm output is conductive (ON) while the alarm output indicator is not lit.

High limit alarm (when Energized is set)   High limit alarm (when De-energized is set)

(Fig. 6.5-1)

A1: Alarm 1.   For A2, read A2 for A1.

6.6 Program mode

In the PV/SV display mode, if the [▼] key is pressed for approx. 3 seconds while holding down the [▲] key, the unit will enter the Program mode.

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

- Each value of Set value memory numbers (1 to 7) set during the Fixed value control are assigned to the value for Steps 1 to 7 respectively.
  For example, values of Set value memory number 1 become Step 1 values,
  and values of Set value memory number 2 become Step 2 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 the unnecessary steps.

The following shows the program pattern example.

Step number (Set value memory number)	1	2	3	4	5	6	7
Step SV	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
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
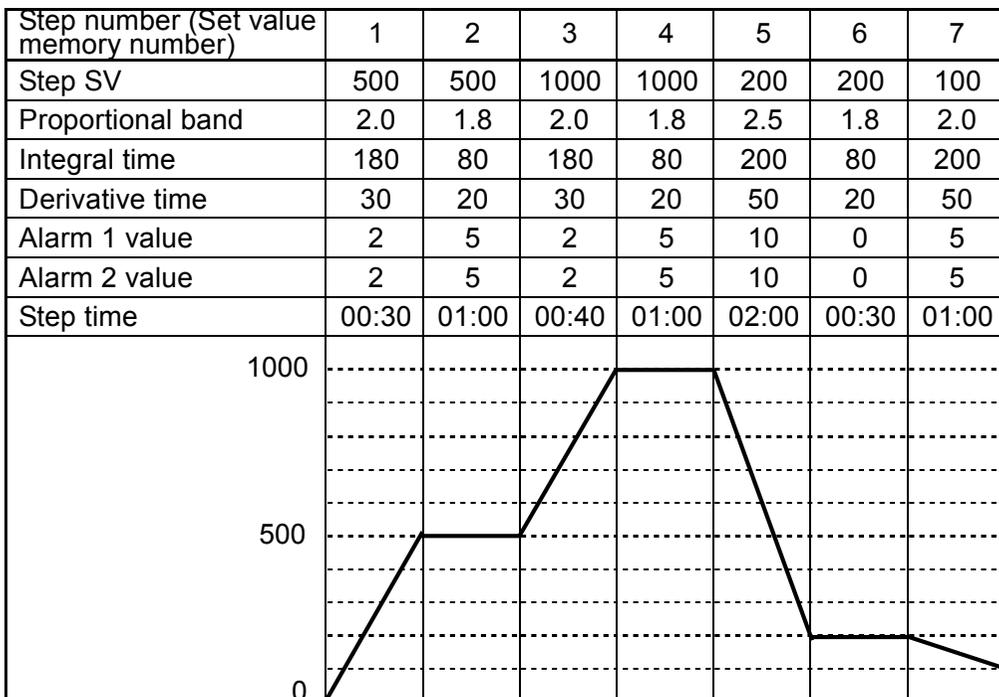
In the PV/SV display mode, if the [▼] key is pressed while holding down the [▲] key for approx. 3 seconds, the unit enters Program mode.

Character	Name, Function, Setting range	Default value
$Proc$	**Fixed value control/Program control switching**	Fixed value control
	• Either <u>Fixed</u> value control or Program control can be selected. • If the [MODE] key is pressed after selecting the fixed value control, the controller reverts to the PV/SV display mode. If the [MODE] key is pressed after selecting the program control, step time from Step 1 to Step 7 can be set. • Selection item: oFF : Fixed value control $Proc$: Program control	
r_1	**Step 1 time**	00.00

	• Sets Step 1 time. (Available only for program control)
	• <u>00</u>.<u>00</u>
	          └── Minute indication
	        └────── Hour indication
	   (e.g.) When setting 1 hour 58 minutes, set as [01.58].
	• Setting range: 00.00 to 99.59	

r_2	**Step 2 time**	00.00
	• Sets Step 2 time. (Available only for program control) • Setting range: 00.00 to 99.59	
r_3	**Step 3 time**	00.00
	• Sets Step 3 time. (Available only for program control) • Setting range: 00.00 to 99.59	
r_4	**Step 4 time**	00.00
	• Sets Step 4 time. (Available only for program control) • Setting range: 00.00 to 99.59	
r_5	**Step 5 time**	00.00
	• Sets Step 5 time. (Available only for program control) • Setting range: 00.00 to 99.59	
r_6	**Step 6 time**	00.00
	• Sets Step 6 time. (Available only for program control) • Setting range: 00.00 to 99.59	
r_7	**Step 7 time**	00.00
	• Sets Step 7 time. (Available only for program control) • Setting range: 00.00 to 99.59	

6.7 Control output OFF function

Control output OFF function
- 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.
- Pressing the $\boxed{\frac{OUT}{OFF}}$ key for approx. 1 second from any mode enables the control output OFF function. PV display indicates $oFF\square$, No indication or PV previously selected during "Indication when control output OFF" mode.
  To cancel the function, press the $\boxed{\frac{OUT}{OFF}}$ 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 $\boxed{\frac{OUT}{OFF}}$ key again for approx. 1 second.
- **During program control, the $\boxed{\frac{OUT}{OFF}}$ key becomes the Program Start/Stop key, and the control output OFF function is disabled.**

6.8 Auto/Manual control switching

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 switched from automatic to manual and vice versa.

Each time the $\boxed{\frac{AUTO}{MAN}}$ key is pressed, the control changes from Automatic to Manual and vice versa.
- Setting range: OUT1 low limit to OUT1 high limit value
  OUT2 low limit to OUT1 high limit value (When Heating/ Cooling control option is added)

6.9 Output MV, Remaining step time indication

Output MV (manipulated variable) indication
In the PV/SV display mode, press the $\boxed{MODE}$ key for approx. 3 seconds.
Keep pressing the $\boxed{MODE}$ key until the output MV appears, though the main setting mode appears temporarily during the process. The MV indicator lights, the MV is indicated on the SV/MV/TIME display, and The 2nd decimal point from the right on the SV/MV/TIME display flashes.
For the fixed value control, when the $\boxed{MODE}$ key is pressed again, the unit reverts to the PV/SV display mode.

Remaining step time indication
In the program control, if the $\boxed{MODE}$ key is pressed while an output MV is indicated, the unit moves to the Remaining step time indication mode.
The Time indicator lights, and the SV/MV/TIME display indicates remaining step time.
If the $\boxed{MODE}$ key is pressed again, the unit reverts to the PV/SV display mode.

7. Set value memory function (SM option)

If the Set value memory number external selection (SM option) is added, 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 are included: 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

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-23A can be connected in parallel.

Terminal connection for Set value memory number (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.

- The Set value memory number cannot be changed during setting mode or AT.

Operation procedures

(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, the number of which is indicated on the MEMO display.

- When any number is retrieved by connecting terminals, the selected number is indicated, and the control is performed using the data (set values) of the indicated file number.

- To change set values, repeat the operation procedures above.

8. Operation

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-23A as a standard controller

(1) Turn the power supply to the FCR-23A ON.

For approx. 2sec after the power is switched ON, the sensor characters and temperature unit (℃/℉) selected during Sensor input selection are indicated on the PV display, and the input range high limit value or Scaling high limit value is indicated on the SV/MV/TIME display. See (Table 8.1-1).

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

After that, control starts indicating PV on the PV display and SV on the SV/MV/TIME display.

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

(Table 8.1-1)

Input	℃		℉	
	PV display	SV/MV/TIME display	PV display	SV/MV/TIME 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	5☐☐C	1760	5☐☐F	3200
E	E☐☐C	1000	E☐☐F	1800
T	r☐☐C	400.0	r☐☐F	750.0
C (W/Re5-26)	c☐☐C	2315	c☐☐F	4200
Pt100	Pr☐C	850.0	Pr☐F	999.9
JPt100	JPrC	500.0	JPrF	900.0
Pt100	Pr☐C	☐850	Pr☐F	1560
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.

Refer to Section "6. Settings".

When controlling by Fuzzy self-tuning PID action, select "Perform" during the "AT Perform/Cancel" 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 SV (desired value).

8.2 When using the FCR-23A as a Simplified program controller

(1) Turn the power supply to the FCR-23A ON.

For approx. 2sec after power-ON, the sensor type and temperature unit (℃/℉) selected during Sensor input selection are indicated on the PV display, and the input range high limit value or Scaling high limit value is indicated on the SV/MV/TIME display. See (Table 8.1-1).

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

After that, the unit moves to Standby mode.

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

(2) Input each set value and step time.

Refer to Section "6. Settings".

The PV display indicates actual temperature and the unit enters Standby mode.

(3) Turn the load circuit power ON.

(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 power-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 power-on, and then it will switch to Standby mode. 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) change is not effective.

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 longer.

To switch the indication of Output MV and Remaining step 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 remaining step time will be indicated.

Instrument status after power is restored

After restoration following a power failure during program control, the FCR-23A resumes program performance from where it stopped.

The PV display flashes until the power failure step finishes.

9. Action explanation

9.1 OUT1 action

	Heating (reverse) action			Cooling (direct) action		
Control action	ON ——— Proportional band ——— OFF ———△——— SV			Proportional band ——— ON ———△——— OFF SV		
R/□	H④ C⑤ L⑥	H④ C⑤ L⑥	H④ C⑤ L⑥	H④ C⑤ L⑥	H④ C⑤ L⑥	H④ C⑤ L⑥
	Cycle action is performed according to deviation.			Cycle action is performed according to deviation.		
S/□	+⑤ 12V DC -⑥	+⑤ 12/0V DC −⑥	+⑤ 0V DC −⑥	+⑤ 0V DC −⑥	+⑤ 0/12V DC −⑥	+⑤ 12V DC −⑥
	Cycle action is performed according to deviation.			Cycle action is performed according to deviation.		
A/□	+⑤ 20mA DC −⑥	+⑤ 20 to 4mA DC −⑥	+⑤ 4mA DC −⑥	+⑤ 4mA DC −⑥	+⑤ 4 to 20mA DC −⑥	+⑤ 20mA DC −⑥
	Changes continuously according to deviation.			Changes continuously according to deviation.		
Indicator (OUT1) Green	██████ ▨▨▨▨ ☐☐☐☐ Lit Unlit			☐☐☐☐ ▨▨▨▨ ██████ Unlit Lit		

▨▨▨▨ : Acts ON (lit) or OFF (unlit).

9.2 Heater burnout alarm action (option)

Heater burnout alarm action	ON ——— OFF ······· Heater burnout alarm value ←——— Small Load current Large ———→
Heater burnout alarm output	(relay contacts)
Indicator (HB) Red	██████ ☐☐☐☐ Lit Unlit

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9.3 OUT1 ON/OFF action

	Heating (reverse) action		Cooling (direct) action	
Control action	ON ——————— Hysteresis ——— OFF ————————— SV		ON ——— Hysteresis ——————— OFF ————————— SV	
R/□	H④ C⑤ L⑥	H④ C⑤ L⑥	H④ C⑤ L⑥	H④ C⑤ L⑥
S/□	+⑤ 12V DC −⑥	+⑤ 0V DC −⑥	+⑤ 0V DC −⑥	+⑤ 12V DC −⑥
A/□	+⑤ 20mA DC −⑥	+⑤ 4mA DC −⑥	+⑤ 4mA DC −⑥	+⑤ 20mA DC −⑥
Indicator (OUT1) Green	Lit ▨▨▨ Unlit		Unlit ▨▨▨ Lit	

▨▨▨ : Acts ON (lit) or OFF (unlit).

9.4 Pattern end action

Pattern end action	ON ——————— OFF ———————— Time ——→ Program control end Pattern end output is released by pressing the [OUT/OFF] key.
Pattern end output	⑨ ⑩ ⑨ ⑩ ⑨ ⑩
Indicator (A1) Red	Unlit Lit Unlit

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

Terminals 7 and 8 are used for Pattern end 2 output.
The A2 indicator lights when Pattern end 2 output is ON.

9.5 Heating/Cooling control action (DR/DS/DA Option)

Control action	Heating P-band (Cooling P-band) ON — Heating action — OFF ··· SV ··· (Cooling action) — ON / OFF		
R/ □	H④ C⑤ L⑥	H④ C⑤ L⑥	H④ C⑤ L⑥
		Cycle action is performed according to deviation.	
DR	⑦ ⑧	⑦ ⑧	⑦ ⑧
		Cycle action is performed according to deviation.	
S/ □	+⑤ 12V DC −⑥	+⑤ 12/0V DC −⑥	+⑤ 0V DC −⑥
		Cycle action is performed according to deviation.	
DS		+⑦ 0V DC −⑧	+⑦ 0/12V DC −⑧	+⑦ 12V DC −⑧
		Cycle action is performed according to deviation.	
A/ □	+⑤ 20mA DC −⑥	+⑤ 20 to 4mA DC −⑥	+⑤ 4mA DC −⑥
		Changes continuously according to deviation.	
DA		+⑦ 4mA DC −⑧	+⑦ 4 to 20mA DC −⑧	+⑦ 20mA DC −⑧
		Changes continuously according to deviation.	
Indicator (OUT1) Green	Lit ▓▓▓ ░░░ □□□ Unlit		
Indicator (OUT2) Yellow	Unlit □□□ ░░░ ▓▓▓ Lit		

▨▨▨ : Acts ON (lit) or OFF (unlit).

——— : Represents Heating control action.

– – – – : Represents Cooling control action.

When setting Dead band

Control action					
	ON ———— Heating action OFF - - - -	Heating P-band	Dead band	(Cooling P-band)	ON - - - - (Cooling action) OFF ———— △ SV

R/□	H④ C⑤ L⑥	H④ C⑤ L⑥ Cycle action is performed according to deviation.	H④ C⑤ L⑥		
DR			⑦ ⑧	⑦ ⑧ Cycle action is performed according to deviation.	⑦ ⑧
S/□	+ ⑤ 12V DC – ⑥	+ ⑤ 12/0V DC – ⑥ Cycle action is performed according to deviation.	+ ⑤ 0V DC – ⑥		
DS			+ ⑦ 0V DC – ⑧	+ ⑦ 0/12V DC – ⑧ Cycle action is performed according to deviation.	+ ⑦ 12V DC – ⑧
A/□	+ ⑤ 20mA DC – ⑥	+ ⑤ 20 to 4mA DC – ⑥ Changes continuously according to deviation.	+ ⑤ 4mA DC – ⑥		
DA			+ ⑦ 4mA DC – ⑧	+ ⑦ 4 to 20mA DC – ⑧ Changes continuously according to deviation.	+ ⑦ 20mA DC – ⑧
Indicator (OUT1) Green	Lit				Unlit
Indicator (OUT2) Yellow	Unlit				Lit

⬚⬚⬚ : Acts ON (lit) or OFF (unlit).

———— : Represents Heating control action.

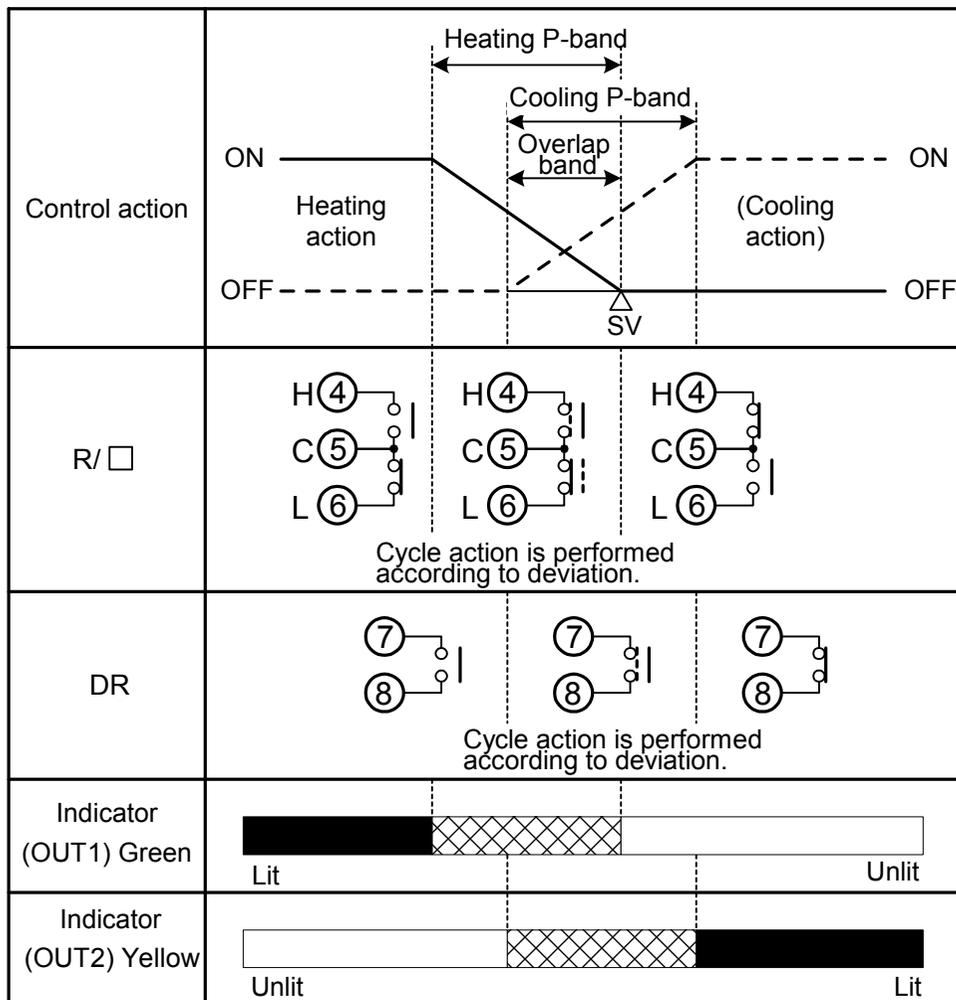- - - - : Represents Cooling control action.

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When setting Overlap band with Relay contact output.

Control action	Heating P-band Cooling P-band Overlap band ON ─────── Heating action ─── ON (Cooling action) OFF ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ OFF △ SV
R/ □	H④ H④ H④ C⑤ C⑤ C⑤ L⑥ L⑥ L⑥ Cycle action is performed according to deviation.
DR	⑦ ⑦ ⑦ ⑧ ⑧ ⑧ Cycle action is performed according to deviation.
Indicator (OUT1) Green	Lit ▨▨▨▨ Unlit
Indicator (OUT2) Yellow	Unlit ▨▨▨▨ Lit

▨▨▨▨ : Acts ON (lit) or OFF (unlit).

───── : Represents Heating control action.

─ ─ ─ ─ : Represents Cooling control action.

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

	High limit alarm	Low limit alarm
Alarm action	A1 hysteresis — ON / OFF — −A1 value, SV, +A1 value	A1 hysteresis — ON / OFF — −A1 value, SV, +A1 value
Alarm output	+ side / − side	+ side / − side

	High/Low limits alarm	High/Low limit range alarm
Alarm action	A1 hysteresis — ON / OFF — A1 value, SV, A1 value	A1 hysteresis — ON / OFF — A1 value, SV, A1 value
Alarm output		

	Process high alarm	Process low alarm
Alarm action	A1 hysteresis — ON / OFF — A1 value	A1 hysteresis — ON / OFF — A1 value
Alarm output		

	High limit alarm with standby	Low limit alarm with standby
Alarm action	A1 hysteresis — ON / OFF — −A1 value, SV, +A1 value	A1 hysteresis — ON / OFF — −A1 value, SV, +A1 value
Alarm output	+ side / − side	+ side / − side

	High/Low limits alarm with standby	High/Low limit range alarm with standby
Alarm action	ON ··· A1 hysteresis, OFF, A1 value, SV, A1 value	ON ··· A1 hysteresis, OFF, A1 value, SV, A1 value
Alarm output		
	Process high alarm with standby	Process low alarm with standby
Alarm action	ON ··· A1 hysteresis, OFF, A1 value	ON ··· A1 hysteresis, OFF, A1 value
Alarm output		

For "A2", read "A2" for "A1".

■ : 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.

Terminals 7 and 8 are used for A2 output.

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 PID

Fuzzy self-tuning PID 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 production process change due to various external factors (types and rates of production).

> If Lock 1 or Lock 2 is selected, Fuzzy self-tuning or AT does not work.
> In the control system in which load fluctuation periodically occurs, the Fuzzy self-tuning PID may malfunction. In such cases, use controllers with the AT mode.

(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 the process, the controller checks the convergence 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, AT starts automatically.
When the AT "Perform" is selected by the keypad, AT initiates. When the control is stabilized, the AT is released, and the controller returns to self-tuning status.

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 SV (desired value) and the PV (process variable).
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 SV (desired value) and a constant temperature is maintained, the most suitable value is selected by gradually narrowing the proportional band while observing the control results.

(2) Integral time (I)

Integral action is used to eliminate offset. When the integral time is shortened, the returning speed to the setting point is 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 AT of this controller

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

Sometimes the AT process will not fluctuate if AT is performed at or near room temperature. Therefore AT might not finish normally.

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

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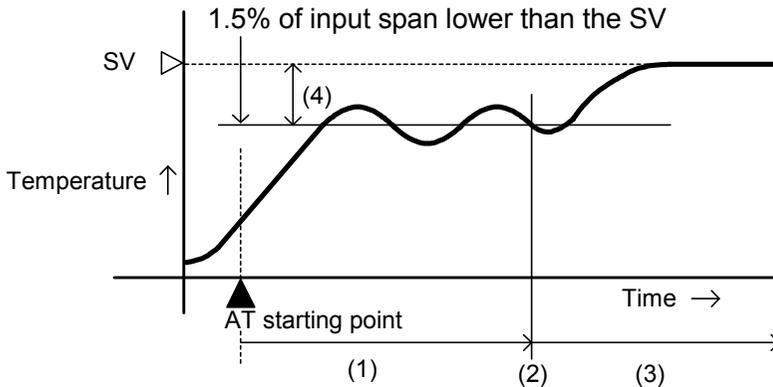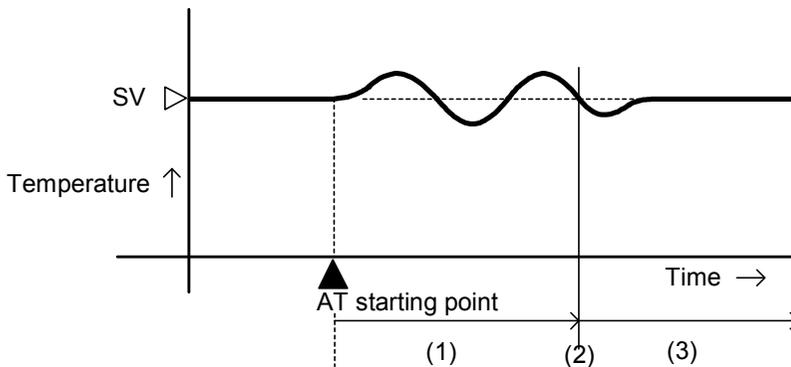
1.5% of input span lower than the SV

(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by AT.
(4) 1.5% of input span

(Fig. 10.3-1)

(B) In the case of a stable control or when PV is within SV±1.5% of input span.

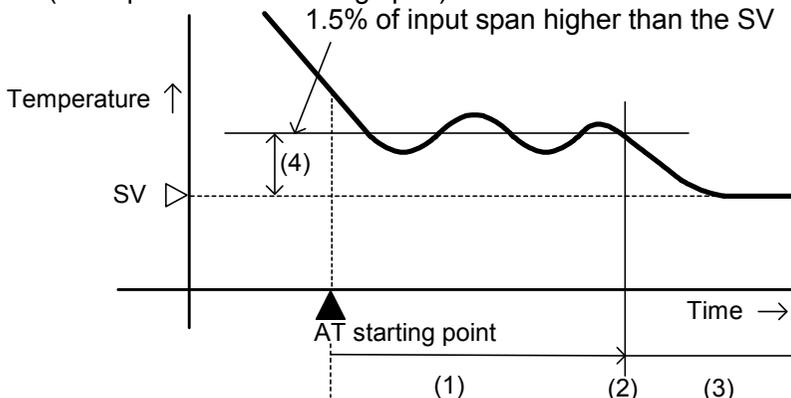The AT process will fluctuate around the SV. [DC input: ±(1.5% of scaling span)]

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

(Fig. 10.3-2)

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

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

1.5% of input span higher than the SV

(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by AT.
(4) 1.5% of input span

(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, 10(H) x 5.5(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 span ±1 digit

                     However,

                     K, J, T input, range less than 0℃ (32℉):

                        Within ±0.4% of input span ±1 digit

                        (Cold junction temperature compensation accuracy: ±1℃

                        at 0 to 50℃)

                     R, S input, the range 0 to 200℃ (0 to 400℉):

                        Within ±4℃ (8℉)

                     B input, the range 0 to 300℃ (0 to 600℉):

                        Accuracy is not guaranteed.

      RTD   : Within ±0.2% of input span ±1 digit

      DC current   : Within ±0.2% of input span ±1 digit

      DC voltage   : Within ±0.2% of input span ±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℃(℉)
JPt100	−199.9 to 500.0 ℃	−199.9 to 900.0 ℉	0.1℃(℉)
Pt100	−200 to 850 ℃	−320 to 1560 ℉	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 (EA, EV option) or

                                Heater burnout alarm (W, W3 option) is added]

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 $\cos\phi$=0.4)
	Electric life: 100,000 cycles
Non-contact voltage	: For SSR drive
	12^{+2}_{0}V DC maximum 40mA DC(short circuit protected)
	4 units of the SA-300-Z or 5 units of the SA-400 series can
	be connected in parallel when Shinko SSR is used.
Current	: 4 to 20mA DC (insulated)
	Load resistance, maximum 550Ω

Alarm 1 (A1) output

[When the alarm action Energized is selected during A1 action Energized/
De-energized selection]
The alarm action point is set by ±deviation from SV (except Process 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 De-energized is selected]
The output acts conversely.

Setting accuracy	: Within ±0.2% of input span ±1 digit
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 $\cos\phi$ =0.4)
	Electric life: 100,000 cycles

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

OUT1 proportional band (P) : Automatic
Integral time (I)   : Automatic
Derivative time (D)   : Automatic
Anti-reset windup (ARW)   : Automatic
OUT1 proportional cycle   : 1 to 120sec
OUT1 high limit, OUT1 low limit: 0 to 100% (For DC current output, –5 to 105%)

• PID action (with AT function)

OUT1 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
OUT1 proportional cycle   : 1 to 120sec
OUT1 high limit, OUT1 low limit: 0 to 100% (For DC current output, –5 to 105%)

• PD action

OUT1 proportional band (P) : 0.1 to 999.9%
Derivative time (D)   : 0 to 3600sec (Off when set to 0)
OUT1 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.)
OUT1 high limit, OUT1 low limit: 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
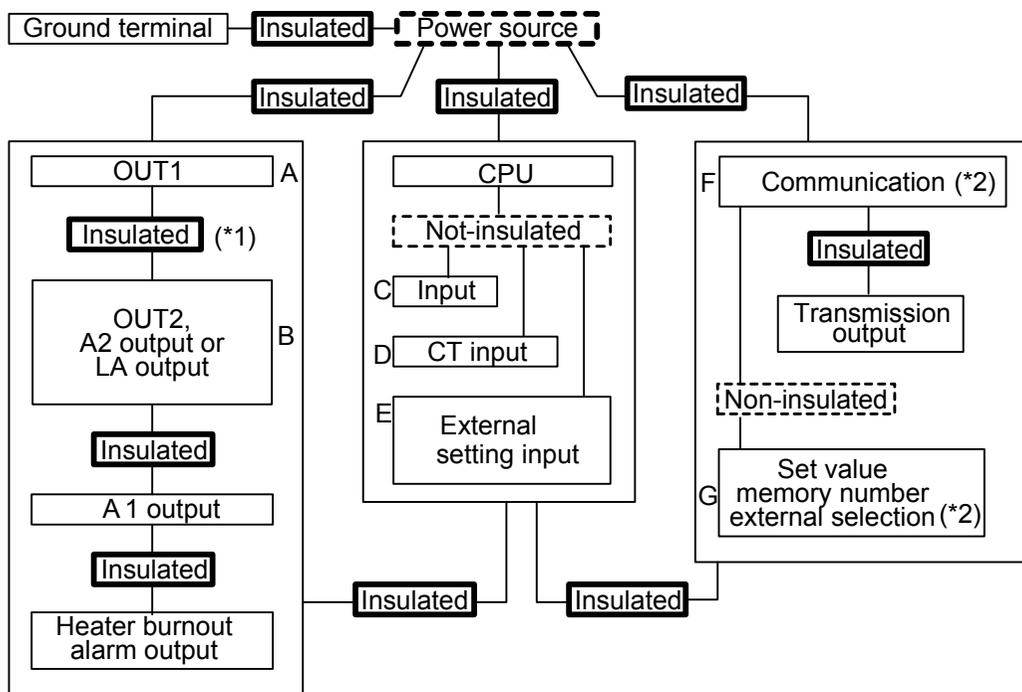   point follows the selection.)

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 (non-condensing)
Power consumption   : Approx. 15VA

Circuit insulation configuration

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

(*2) When OUT1 is DC current output type or Non-contact voltage output type (for SSR drive), A-F and A-G are not insulated.
When OUT2 is DC current output type or Non-contact voltage output type (for 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 for (*1), (*2) and between C-D-E and F-G in the diagram 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 : 96 x 48 x 100mm (W x H x D)

Material   : Case: Flame-resistant resin

Color   : Case: Light gray

Attached functions : **[Control output OFF], [Set value lock], [SV limit], [Sensor correction], [Multi-range input], [Multi-function], [Simplified program control], [Power failure countermeasure], [Self diagnosis], [Automatic cold junction temperature compensation], [Burnout], [SV ramp]**

[Input abnormality]

Output status when input abnormal(*1)	Contents and Indication	Output status			
		OUT1		OUT2	
		Direct action	Reverse action	Direct action	Reverse action
⌐⌐▯	**Overscale** Measured value has exceeded Indication range high limit value. "‾‾‾‾" flashes.	ON (20mA) or OUT1 high limit value **(*2)**	OFF (4mA) or OUT1 low limit value	OFF or OUT2 low limit value	ON or OUT2 high limit value **(*2)**
⌐FF▯		OFF (4mA) or OUT1 low limit value			OFF or OUT2 low limit value
⌐⌐▯	**Underscale** Measured value has dropped below Indication range low limit value. "₋₋₋₋" flashes.	OFF (4mA) or OUT1 low limit value	ON (20mA) or OUT1 high limit value**(*2)**	ON or OUT2 high limit value**(*2)**	OFF or OUT2 low limit value
⌐FF▯			OFF (4mA) or OUT1 low limit value	OFF or OUT2 low limit value	

(*1) This is only available for DC input and when OUT1 is DC current output type.
If OUT1 is not DC current output, the output status will be the same one as when ⌐FF▯ is selected during "Output status when input abnormal".
For manual control, the preset manipulated variable (MV) is outputted.

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

Thermocouple, RTD input:

Input	Input range	Indication range	Control range
T	−199.9 to 400.0℃	−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 with all outputs OFF.

[Automatic cold junction temperature compensation] (Thermocouple input type)
 This detects the temperature at the connecting terminal between the thermocouple
 and the instrument, and always maintains it at the same status as if the reference
 junction was 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/MV/TIME display.

[SV ramp function]
 When the SV (desired value) is adjusted, it approaches the new SV by the preset
 rate-of-change.
 When the power is turned on, the control starts from the PV (process variable) and
 approaches the SV by the rate-of-change.
 For the program control, this function will not work.

Accessories:
 One-touch type mounting brackets: 1 set
 Instruction manual   : 1 copy
 Unit label   : 1
 Current transformer   : 1 piece
      (CTL-6S): When the W (20A) option is added.
      (CTL-12-S36-10L1U): When the W (50A) option is added.
 Current transformer   : 2 pieces
      (CTL-6S): When the W3 (20A) option is added.
      (CTL-12-S36-10L1U): When the W3 (50A) option is added.
 Wire harness   : 3m (When the TA/TV option is added.)
 Wire harness   : 3m (When the EA/EV option is added.)
 Screw type mounting brackets : 1 set (When the BL option is added.)
 Terminal cover   : 1 piece (When the TC option is added.)

11.2 Optional specifications

Alarm 2 (Option code: A2)

 [When the alarm action Energized is selected during A2 action Energized/
 De-energized selection]
  The alarm action point is set by the ±deviation from the SV (except Process
  alarm), and when the input goes outside the range, the output turns ON or OFF (in
  the case of High/Low limit range alarm)
 [When the alarm action De-energized is selected]
  The output acts conversely.

 One alarm can be selected by Rotary switch and DIP switch:
  High limit alarm, Low limit alarm, High/Low limits alarm, High/Low limit range
  alarm, Process high alarm and Process low alarm, the standby function which is
  applied to them respectively, as well as No alarm and Pattern end output.

 • When Alarm 2 (A2) and Loop break alarm (LA option) are added together, they utilize
   common output terminals.
 • If Alarm 2 (A2 option) is added, Heating/Cooling control output (DR/DS/DA option) or
   Insulated power output (P24 option) cannot be added 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 $\cos\phi$=0.4)

                  Electric life: 100,000 cycles

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

If this option is added, Alarm 2 (A2 option), Loop break alarm (LA option) or Insulated power output (P24 option) cannot be added 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 OUT1 integral time

OUT2 derivative time   : The same as OUT1 derivative time

OUT2 proportional cycle: 1 to 120sec

Overlap/Dead band   : $\pm$OUT1 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 $\cos\phi$=0.4)

                 Electric life: 100,000 cycles

           [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 (Isolated type)

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

One 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 $\pm$0.3% of Transmission output span

Serial communication (Option code: C, C5)

The following operations can be executed from an 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) Function change
      Communication interface : EIA RS-485 (C5)
                               : EIA RS-232C (C)
      Communication method : Half-duplex communication
      Synchronization method : Start-stop synchronization
      Communication speed   : 2400, 4800, 9600, 19200bps (selectable by keypad)
                               (Default: 9600bps)
      Data format   Start bit : 1
                         Data bit : 7
                         Parity   : Even parity
                         Stop bit : 1
      Communication protocol : Shinko protocol, Modbus ASCII mode
                               (Selectable by keypad) (Default: Shinko protocol)
      Digital external setting:
          Receives digital set value from Shinko programmable controllers such as
          PCD-33A or PC-900 series (with SVTC option).
          (Be sure to select Lock 3 during the Set value lock selection for the FCR.)
          (When Modbus protocol ASCII mode is selected, digital external setting is
          not available.)

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

Selects the set value memory number from 7 files (mentioned below is 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 numbers : 1 to 7 (7 files)
   Data   : 12 pieces

External setting (Option code: EA, EV)

The SV can be set using an external analog signal.
   Setting signal: DC current (EA): 0 to 20mA DC, 4 to 20mA DC
                   Allowable input current: 100mA DC or less
                   Input impedance: 50Ω (non-isolated 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 (non-isolated from input)

   Setting signal sampling period: 0.5 seconds
       (If EA or EV option is added, 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 0.0 to 50.0.)
                     50A: 0.0 to 50.0A
                    (Setting the value to 0.0 disables the function.)

Setting accuracy : Within $\pm5\%$ of the heater rated current

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, $\cos\phi$=0.4)
                   Electric life: 100,000 cycles

Loop break alarm (Option code: LA)

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

When this option and Alarm 2 output (A2 option) are added together, they utilize common output terminals.

If Loop break alarm output (LA option) is added, Heating/Cooling control output (DR/DS/DA option) or Insulated power output (P24 option) cannot be added 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,
               Control capacity: 3A   250V AC (resistive load)
                             1A   250V AC (inductive load, $\cos\phi$=0.4)
               Electrical life: 100,000 cycles

Insulated power output (Option code: P24)

Can be used as a small capacity power source for various sensors and converters.
If this option is added, Alarm 2 output (A2 option), Heating/Cooling control output (DR/DA/DS option) or Loop break alarm (LA option) cannot be added together.
Output voltage: 24$\pm$3V DC (when load current is 30mA.)
Ripple voltage: Within 200mV DC (when load current is 30mA.)
Maximum load current: 30mA DC

Screw type mounting bracket (Option code: BL)

Mounting panel thickness: 1 to 8mm

Color Black (Option code: BK)

Front panel: Dark gray
Case   : Black

Dust-proof/Drip-proof (Option code: IP)

Drip-proof and Dust-proof specification (IP54)

Effective for only front panel, case section is excluded.

To protect the controller from water leaks 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 Drip-proof and Dust-proof protection.

Terminal cover (Option code: TC)

Electrical shock protection terminal cover

User specified

Input, Scale range   : Shipped as specified input and scale range.

Alarm type   : Shipped as specified alarm type (A1, A2).

Control action   : Shipped as specified control action (e.g. PD action).

OUT2 action mode : Shipped as specified cooling action (e.g. Water cooling)
       (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 External setting input.
       (When the External setting option is added)

Transmission output scaling: Shipped as specified scaling range.

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 [ᴏFF□], no indication or only PV.	• Control output OFF function is working. Press the [OUT/OFF] key for approx. 1 second to release the function.

[‾ ‾ ‾ ‾] 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 match with the controller terminals.

The indication of PV display is abnormal or unstable.	• Sensor input selection is incorrect.
	  Set the Sensor input properly with the Rotary switch (SW303) and the DIP switch (SW304).
	• Set the temperature unit (℃ or ℉) properly.
	  Set the unit properly with the DIP switch (SW304).
	• Sensor correction value is unsuitable.
	  Set it to a suitable value.
	• Specification of the Thermocouple or RTD is incorrect.
	• AC may be leaking into the 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.
Settings (SV, PID values, proportional cycle, A1, A2, 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. • AT is performing. Cancel AT.
The setting indication does not change within the input 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.
Program control does not start even if the OUT/OFF key is pressed in the Program mode.	• Step time has not been set. Set the step time.

\<Control\>

Problem	Presumed cause and solution
PV (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, the sensor may be burnt out. • Check whether the lead wire of thermocouple or RTD is securely connected to the instrument terminal.
Control does not start. (The PV display is Indicated)	• 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 for approx. 3sec while holding down the ▲ key.
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.
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.

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

13. Character table

<Main setting mode>

Character	Setting item	Default value	Data
`५⬚⬚⬚`	SV	0℃	

<Sub setting mode>

Character	Setting item	Default value	Data
`m̄no̲`	Set value memory number	1	
`AՐ⬚⬚`	AT 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	
`r५EՐ`	Manual reset	0.0℃	
`A I⬚⬚`	Alarm 1 value	0℃	
`A2⬚⬚`	Alarm 2 value	0℃	
`H`xx.x (xx.x: Heater current value)	HB (Heater burnout alarm)	0.0A	
`LP_Γ`	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)	
`५H⬚⬚`	SV high limit	400℃	
`५L⬚⬚`	SV low limit	0℃	
`५o⬚⬚`	Sensor correction	0.0℃	
`db⬚⬚`	Overlap band/Dead band	0.0℃	
`rEm̄o`	Remote/Local switching	`LocA`: Local	
`cm̄no`	Instrument number	0	
`cm̄५P`	Communication speed	9600bps	
`cm̄५L`	Communication protocol	Shinko protocol	

<Auxiliary function setting mode 2>

Character	Setting item	Default value	Data
५гLH	Scaling high limit	1370℃	
५гLL	Scaling low limit	-200℃	
dP☐	Decimal point place	No decimal point	
FILг	PV filter time constant	0.0sec	
oLH☐	OUT1 high limit	100%	
oLL☐	OUT1 low limit	0%	
HY५☐	OUT1 ON/OFF action hysteresis	1.0℃	
cAcг	OUT2 action mode selection	Air cooling	
oLHb	OUT2 high limit	100%	
oLLb	OUT2 low limit	0%	
HY५b	OUT2 ON/OFF action hysteresis	1.0℃	
A1Lг	Alarm 1 action Energized/De-energized	Energized	
A2Lг	Alarm 2 action Energized/De-energized	Energized	
A1HY	Alarm 1 hysteresis	1.0℃	
A2HY	Alarm 2 hysteresis	1.0℃	
A1dY	Alarm 1 delay timer	0sec	
A2dY	Alarm 2 delay timer	0sec	
г५LH	External setting input high limit	400℃	
г५LL	External setting input low limit	0℃	
Ггo५	Transmission output selection	PV transmission	
ГгLH	Transmission output high limit	400℃	
ГгLL	Transmission output low limit	0℃	
P५४☐	Indication when control output OFF	oFF☐	
гAгu	SV rise rate	0℃/minute	
гAгd	SV fall rate	0℃/minute	
EoUг	Output status when input abnormal	-oFF	

<Program mode>

Character	Setting item	Default value	Data
Proc	Fixed value control/Program control	Fixed value control	
г_1☐	Step 1 time	00.00	
г_2☐	Step 2 time	00.00	
г_3☐	Step 3 time	00.00	
г_4☐	Step 4 time	00.00	
г_5☐	Step 5 time	00.00	
г_6☐	Step 6 time	00.00	
г_7☐	Step 7 time	00.00	

***** Inquiry *****

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

                                        [Example]
        • Model   -------------------------- FCR-23A-R/M
        • Input type   --------------------- 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.