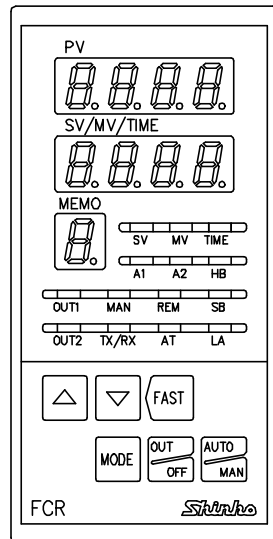# DIGITAL INDICATING CONTROLLER
FCR-13A
INSTRUCTION MANUAL

Shinko

Preface

Thank you for purchasing our Digital indicating controller FCR-13A.

This manual contains instructions for the mounting, functions, operations and notes when operating the FCR-13A.

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

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 (option)
AT	Auto-tuning
DC input	Direct current input
	DC voltage input

Characters Used in This Manual

Indication	ᴴ	ᴏ	₁	₂	₃	₄	₅	₆	₇	₈	₉	ᴄ	ᶠ
Number, ℃/℉	-1	0	1	2	3	4	5	6	7	8	9	℃	℉
Indication	ᴴ	ᵇ	ᶜ	ᵈ	ᴱ	ᶠ	ᴳ	ᴴ	ᵢ	ᴶ	ᵗ	ᴸ	ᴾ
Alphabet	A	B	C	D	E	F	G	H	I	J	K	L	M
Indication	ⁿ	ᵒ	ᴾ	ᑫ	ᵣ	ᔕ	ᴦ	ᵤ	ᵇ	ᵤ	ᵧ	ᵧ	ᵌ
Alphabet	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Notes

- This instrument should be used in accordance with the specifications described in the manual. If it is not used according to the specifications, it may malfunction or cause a fire.
- Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- Specifications of the FCR-13A and the contents of this instruction manual are subject to change without notice.
- Care has been taken to assure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform our sales department.
- This instrument is designed to be installed through 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 the 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 purpose-of-use consultation with our agency or main office. (Never use this instrument for medical purposes with which human lives are involved.)
- External protection devices such as protection equipment against excessive temperature rise, etc. must be installed, as malfunction of this product could result in serious damage to the system or injury to personnel. Also proper periodic maintenance is required.
- This instrument must be used under the conditions and environment described in this manual. Shinko Technos Co., Ltd. does not accept liability for any injury, loss of life or damage occurring due to the instrument being used under conditions not otherwise stated in this manual.

Caution with respect to Export Trade Control Ordinance

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

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

1. Installation Precautions

⚠ Caution

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

Ensure the mounting location corresponds to the following conditions:
• A minimum of dust, and an absence of corrosive gases
• No flammable, explosive gases
• No mechanical vibrations or shocks
• No exposure to direct sunlight, an ambient temperature of 0 to 50℃ (32 to 122℉) that does not change rapidly, 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 ambient temperature of this unit - not the ambient temperature of the control panel - must not exceed 50℃ (122℉) if mounted through the control panel. Otherwise the life of electronic components (especially electrolytic capacitor) 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

• Do not leave bits of wire in the instrument, because they could cause a fire or malfunction.
• Use the solderless terminal with an insulation sleeve in which an M3 screw fits when wiring the FCR-13A.
• The terminal block of this instrument is designed to be wired from the left side. The lead wire must be inserted from the left side of the terminal, and fastened with the terminal screw.
• Tighten the terminal screw within the specified torque. If excessive force is applied to the screw when tightening, the screw or case may be damaged.
• Do not apply a commercial power source to the sensor 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 (auto-tuning) be performed on the trial run.
• Do not touch live terminals. This may cause electric shock or problems in operation.
• Turn the power supply to the instrument OFF when retightening the terminal and cleaning. Working on 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 put pressure on it.

--- CONTENTS ---

1. Model

1.1 Model

Alphanumeric characters to represent the control output (OUT1), input or options are entered where underlined.

[Example]

FCR - 13A - R / M, A2

- Alarm 2 (A2) output
- Multi-range input
- Relay contact output
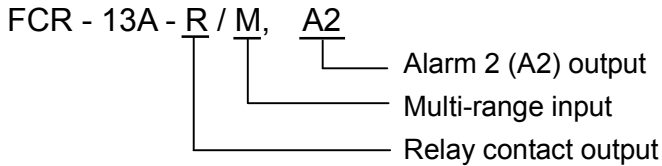
Standard specifications

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

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

*2: 12 types of alarm plus No alarm action can be selected by internal DIP and Rotary switches.

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

Optional specifications

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

(For options in detail, see Section "11.2 Optional Specifications".)

⚠ **Warning**

Do not take the inner assembly out nor touch the terminal with the power supply ON.
Touching the terminal with the power switched ON may result in severe injury or death due to electric shock.

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

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

1.3 How to Read the Model Label

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

Model label

FCR-13A-R/M ← Model
← Option

MULTI-RANGE ← Input
OUTPUT:3A 250V AC ← Output
100to240V AC 50/60Hz 15VA ← Power supply, power consumption
AMB.TEMP. 0to50°C ← Ambient temperature
SERIAL No.123F05000 ← Serial number

回 C€ cᴿᵁus
SHINKO TECHNOS CO., LTD.
MADE IN JAPAN
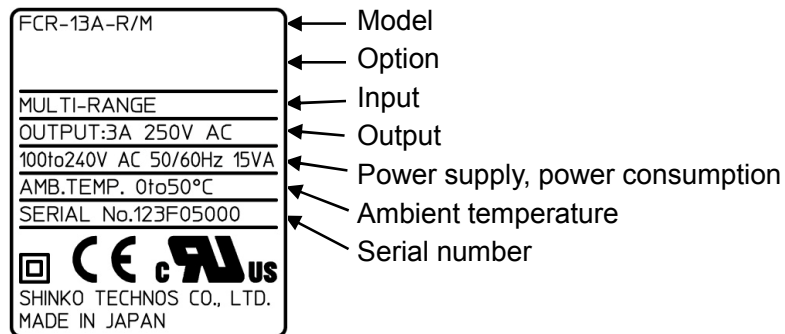
2 Name and Functions of Sections
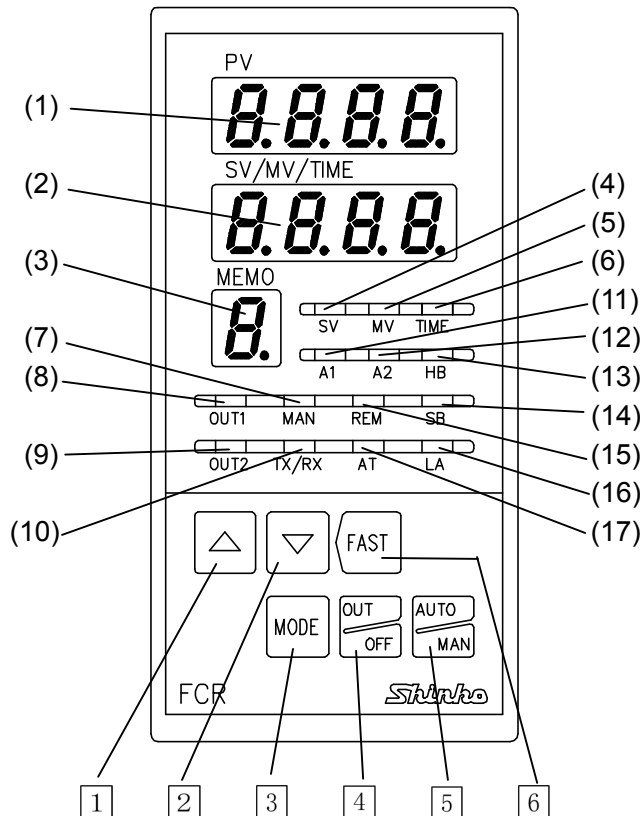
(Fig. 2-1)

(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 each setting mode.

(3) MEMO display (Yellow)
Indicates the Set value memory number.

(4) SV indicator (Green)
Lights while the SV is indicated on the SV/MV/TIME display.

(5) MV indicator (Red)
Lights while the MV is indicated on the SV/MV/TIME display.

(6) TIME indicator (Yellow)
Lights while the Time is indicated on the SV/MV/TIME display.

(7) MAN indicator (Red)
Lights during Manual control.

(8) OUT1 indicator (Green)
Lights when OUT1 (control output 1) is on.
(For Direct current output type, flashes corresponding to the MV in 125ms cycles.)

(9) OUT2 indicator (Yellow)

Lights when OUT2 (control output 2) is on.

(For Direct current output type, flashes corresponding to the MV in 125ms cycles.)

(10) TX/RX indicator (Green)

Lights during Serial communication [TX (transmitting) output].

(11) A1 indicator (including Pattern end 1 output) (Red)

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

(12) A2 indicator (including Pattern end 2 output) (Red) (Option)

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

(13) HB indicator (Red)

Lights when the Heater burnout alarm output is on.

(14) SB indicator (Red)

Lights when Sensor is burnt out.

(15) REM indicator (Red)

Lights during Remote operation.

(16) LA indicator (Red)

Lights when the Loop break alarm output is on.

(17) AT indicator (Yellow)

Flashes during AT (auto-tuning).

Keys

1	▲ Increase key:	Increases the numeric value on the SV/MV/TIME display in the setting mode.
2	▼ Decrease key:	Decreases the numeric value on the SV/MV/TIME display in the setting mode.
3	MODE Mode key:	Switches a setting mode and registers set values. [To register each set (or selected) value, press this key.]
4	OUT/OFF OUT/OFF key:	Performs the control output ON or OFF (Fixed value control). Starts/Stops the program control (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 with the ▲ or ▼ key simultaneously.

3. Setup

3.1 Drawing the Internal Assembly Out

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

Latch

(Fig. 3.1-1)

Draw out the FCR-13A toward you by pushing the latch.
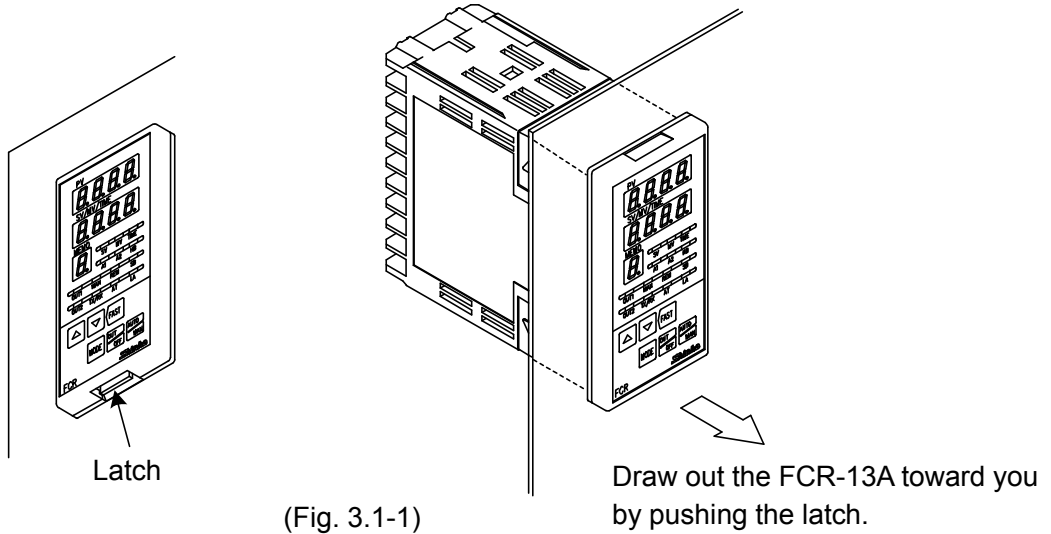
3.2 Switch Setting (Multi-function)

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

Sensor input, Alarm 1 (A1) type, Alarm 2 (A2) type, Control action, Heating (reverse)/Cooling (direct) action, Alarm 1 (A1) and Alarm 2 (A2) standby actions, ℃/℉, Program start Auto/Manual

Rotary switch (SW301) will be equipped only when A2 option is ordered.

(Fig. 3.2-1)

12
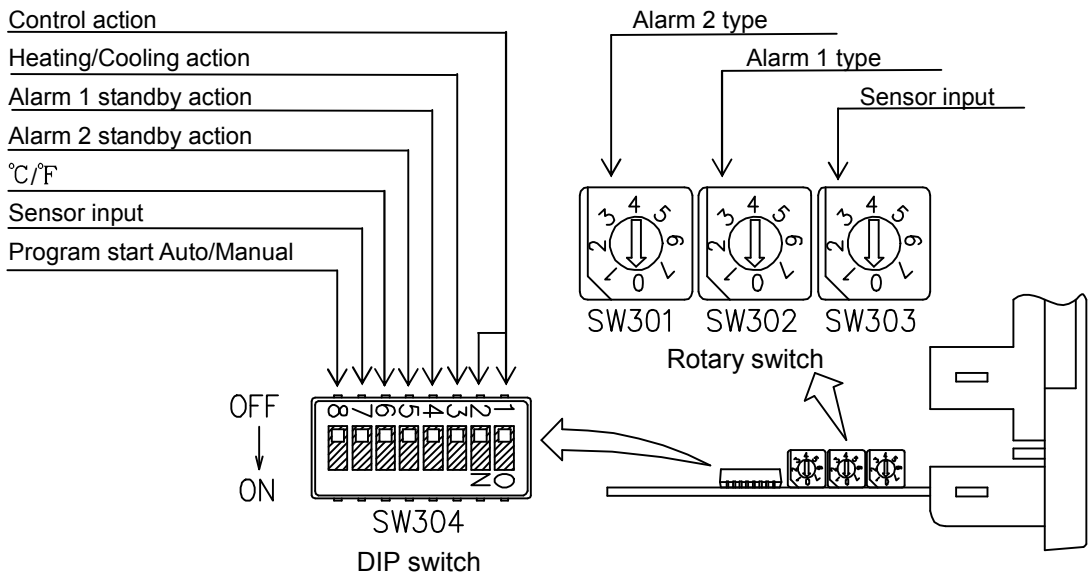
The following items can be selected by the DIP switch (SW304).
Default value: All switches OFF.

(Table 3.2-1)

Item	DIP SW304 No.	Selection	Switch status	
Control action	1 and 2	Fuzzy self-tuning PID control	No.1: OFF	No.2: OFF
		PID control	No.1: ON	No.2: OFF
		PD control	No.1: OFF	No.2: ON
		ON/OFF control	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 (*3)	8	Manual start	No.8: OFF	
		Automatic start	No.8: ON	

(*1) The standby function will work only when the A2 option is ordered.
(*2) Use the Rotary switch (SW303) and DIP switch (SW304) together for making a
      selection.
(*3) **Program start Auto/Manual: 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 using the Rotary switch (SW303) and DIP switch (SW304).

Default value: K -200 to 1370℃

Note: If the input type is changed, Scaling high/low limit, External setting input high/low limit and 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 type	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 for program control can be selected by the Rotary switches (SW302) and (SW301).

Rotary switch (SW301) will be equipped only when A2 option is ordered.

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

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

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

Default value: No alarm action

(Table 3.2-3)

Alarm 1 (A1) type	Rotary SW302 No.	Alarm 2 (A2) type	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 Internal Assembly

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

⚠ Caution

Do not confuse the top and bottom of the internal assembly.
If inserting the assembly into the case by force in the wrong direction, the PCB may be damaged.

---

4. Mounting to the Control Panel

4.1 Site Selection

Ensure the mounting location corresponds to the following conditions
(IEC61010-1): Overvoltage category Ⅱ, Pollution degree 2
(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 ambient temperature of this unit - not the ambient temperature of the control panel - must not exceed 50℃ (122℉) if mounted through the control panel. Otherwise the life of electronic components (especially electrolytic capacitor) may be shortened.

4.2 External Dimensions (Scale: mm)

(Fig. 4.2-1)

15

4.3 Panel Cutout (Scale: mm)

Lateral close mounting
n: Number of units mounted
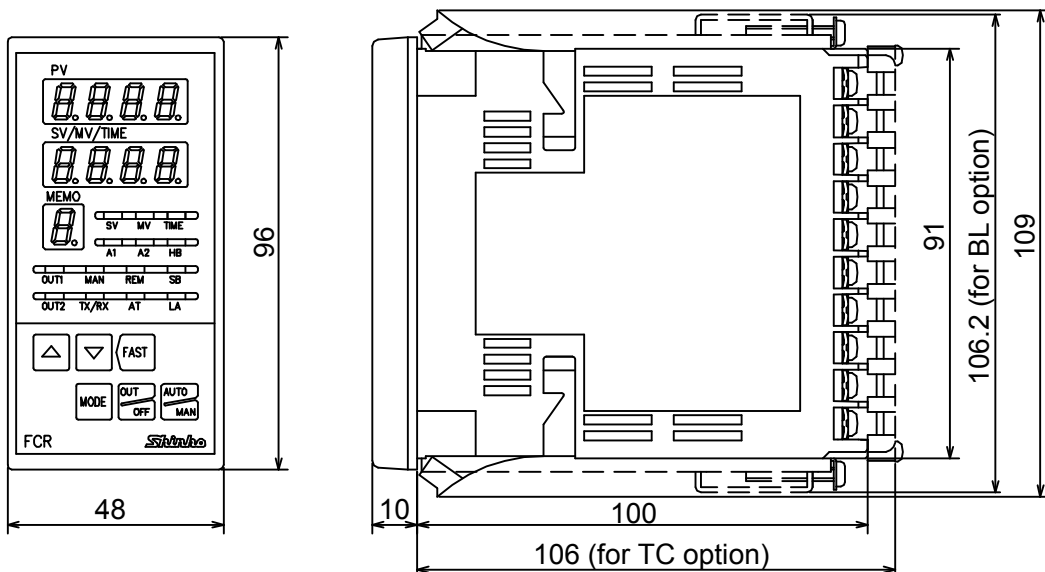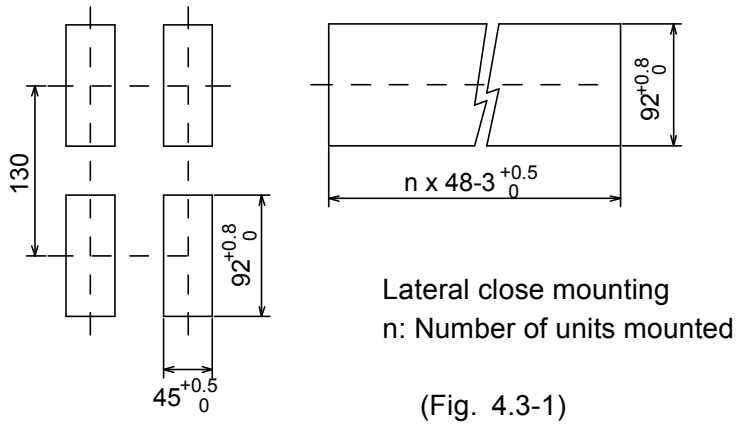
(Fig. 4.3-1)

4.4 Current Transformer (CT) Dimensions (Scale: mm)

CTL-6S (for 20A)   CTL-12-S36-10L1U (for 50A)
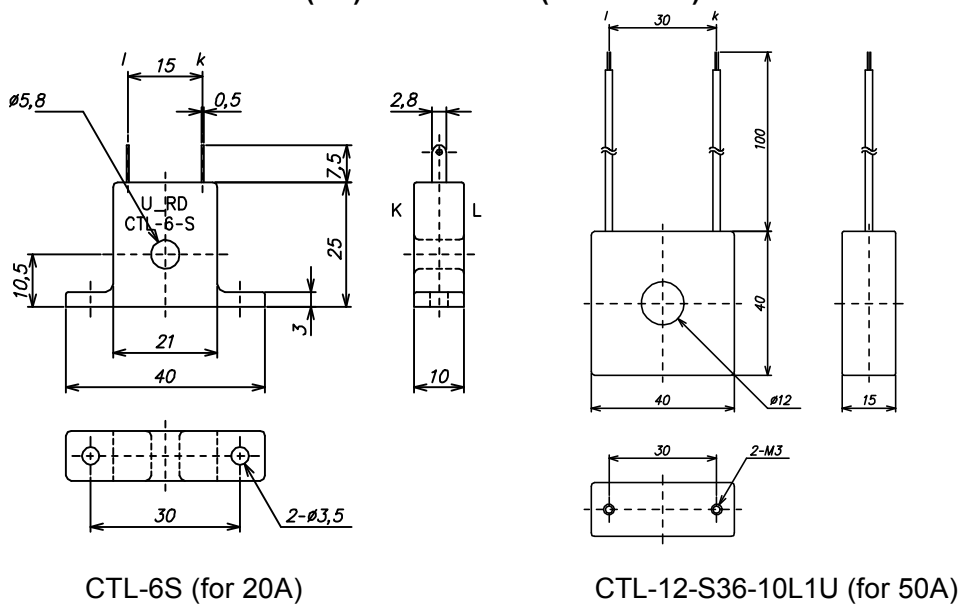
(Fig. 4.4-1)

4.5 Mounting

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

• When using the One-touch type mounting bracket

Mountable panel thickness: 1 to 3mm.

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

Mount one-touch mounting bracket ① to the
instrument first, and then insert the FCR-13A
② from the front of the panel.
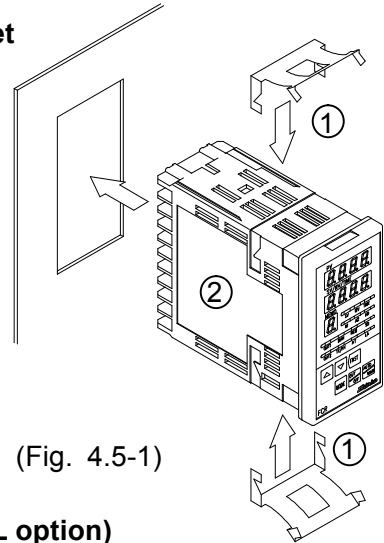
(Fig. 4.5-1)

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

Mountable panel thickness: 1 to 8mm.

If Soft front cover (FC-R-S) is used, mounting panel thickness will be 1 to 7.5mm.

Insert the FCR-13A from the front of the panel.

Attach the mounting brackets to the slots at the top and bottom of the case,

and secure the controller in place with the screws provided.
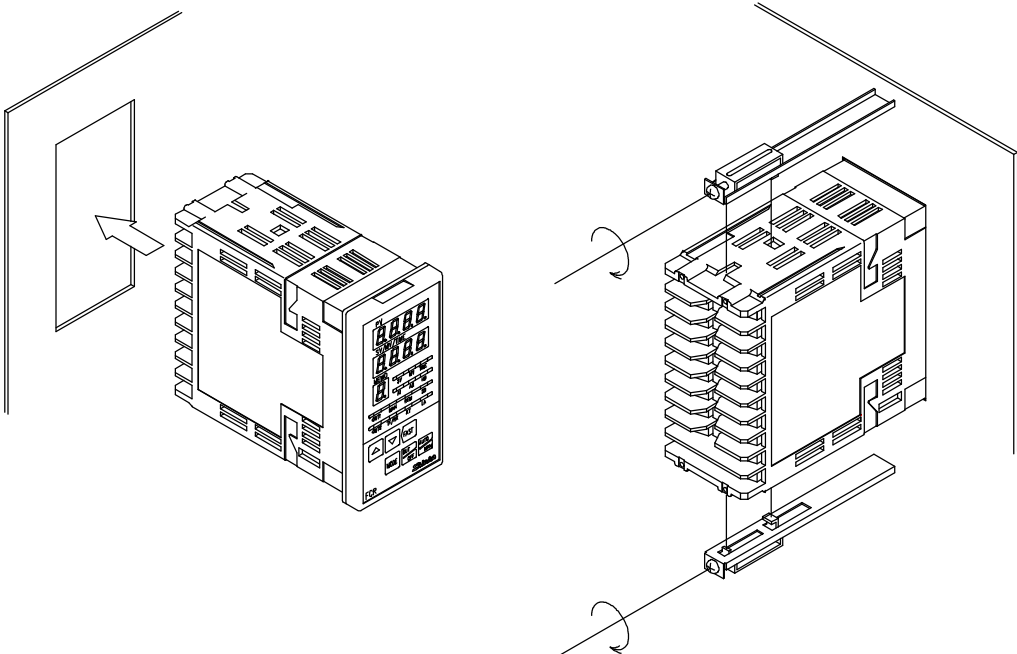
(Fig. 4.5-2)

5. Wiring

⚠ Warning

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

⚠ Caution

- Do not leave wire remnants in the instrument, as they could cause a fire or a malfunction.
- Use a solderless terminal with an insulation sleeve in which the M3 screw fits when wiring the controller.
- The terminal block of this instrument is designed to be wired from the left side.
  The lead wire must be inserted from the left side of the terminal, and fastened by the terminal screw.
- Tighten the terminal screw using the specified torque. If excessive force is applied to the screw when tightening, the terminal screw 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.
- This controller does not have a built-in power switch, circuit breaker or fuse.
  Therefore, it is necessary to install them in a circuit externally, 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).
- Use a thermocouple and compensating lead wire according to the sensor input specifications of this controller.
- Use a 3-wire RTD according to the sensor input specifications of this controller.
- When using a relay contact output type, use a relay according to the capacity of the load to protect the built-in relay contact.
- When wiring, keep input wires (thermocouple, RTD, etc.) away from AC sources or load wires.
- Use a thick wire (1.25 to 2.0mm^2) for grounding.

● **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	Torque
Y type	Nichifu Terminal Industries CO.,LTD.	TMEV1.25Y-3	0.63N•m
	Japan Solderless Terminal MFG CO.,LTD.	VD1.25-B3A	
Ring type	Nichifu Terminal Industries CO.,LTD.	TMEV1.25-3	
	Japan Solderless Terminal MFG CO.,LTD.	V1.25-3	
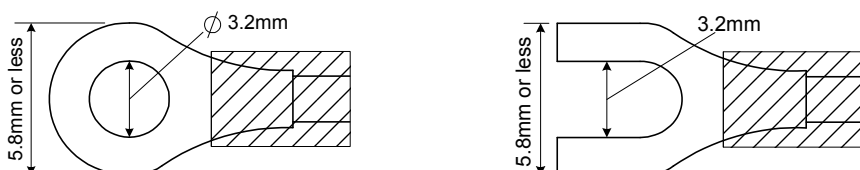
(Fig. 5-1)

5.1 Terminal Arrangement
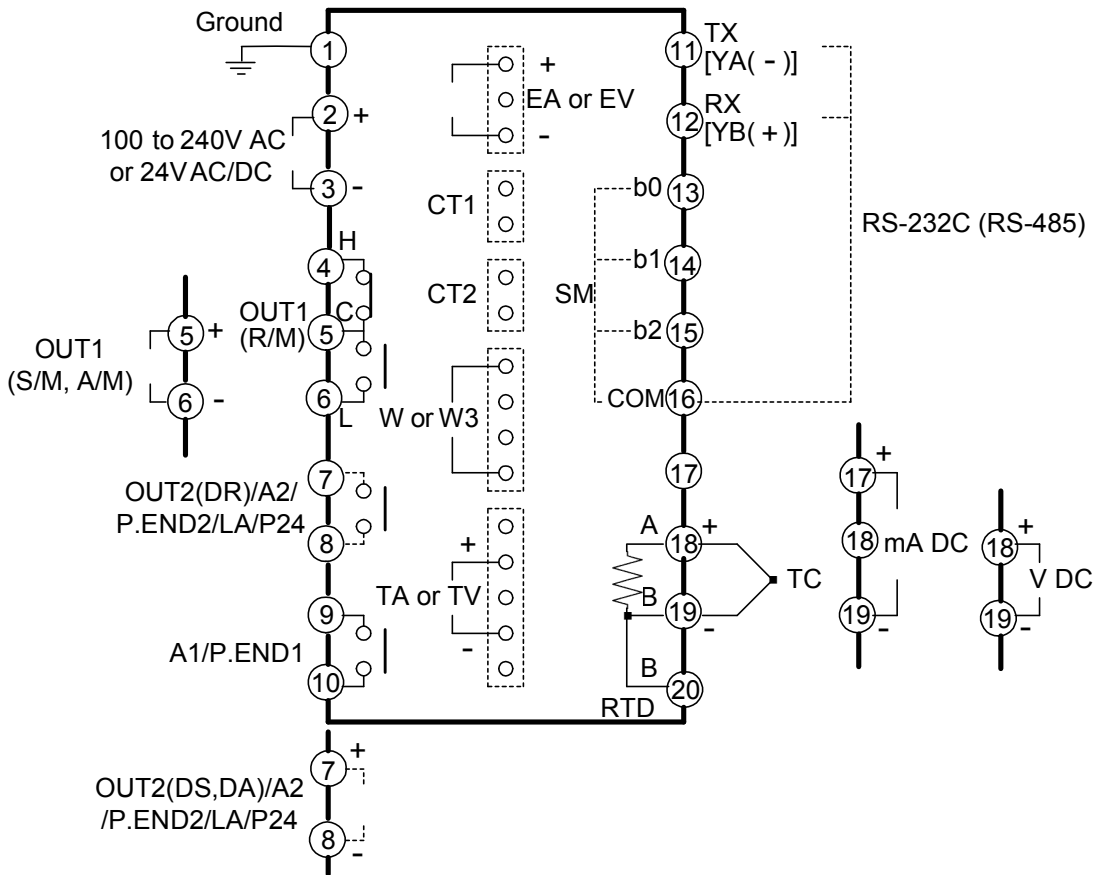
(Fig. 5.1-1)

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

If Alarm 2 (A2 option/Pattern end 2) and Loop break alarm (LA option) are ordered together, they will utilize common output terminals.

OUT1:   Control output 1
OUT2:   Control output 2
A1:   Alarm 1 output
A2:   Alarm 2 output
P.END1:   Pattern end 1 output
P.END2:   Pattern end 2 output
LA: Loop break alarm output
P24:   Insulated power output
RS-232C (RS-485): Serial communication
SM: Set value memory number external selection
TC: Thermocouple input
RTD: RTD input
DC: DC voltage, current input
EA or EV: External setting input
CT1, CT2: CT1 input (W, W3 option), CT2 input (W3 option)
W or W3:   Heater burnout alarm output
TA or TV: Transmission output

5.2 Wiring Examples
[FCR-13A-R/M]
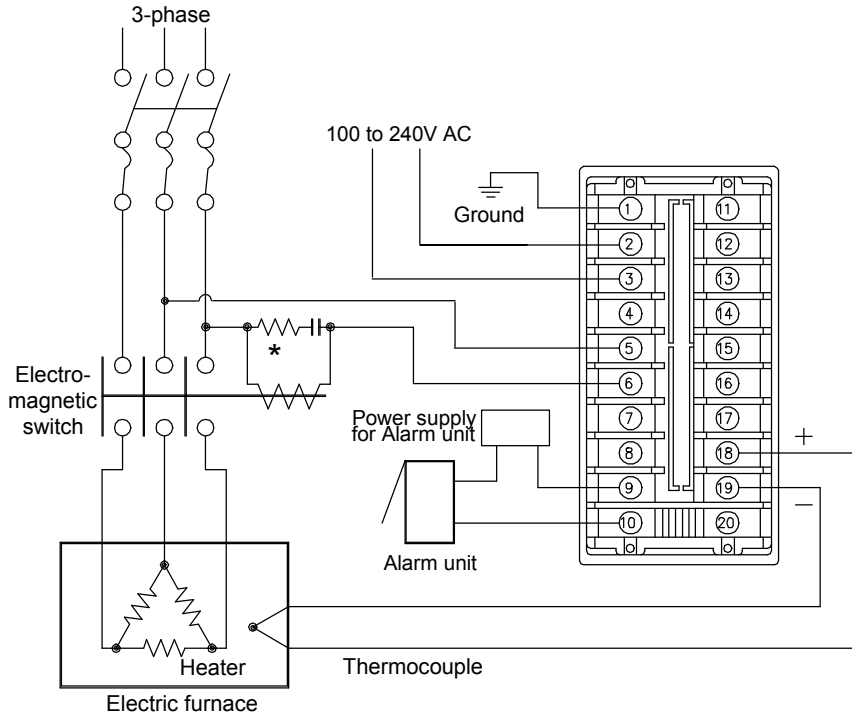
* To prevent the unit from harmful effects of unexpected level noise, it is recommended that a surge absorber be installed between the electromagnetic switch coils.

(Fig. 5.2-1)

[FCR-13A-S/M, W   Power supply: 24V DC]
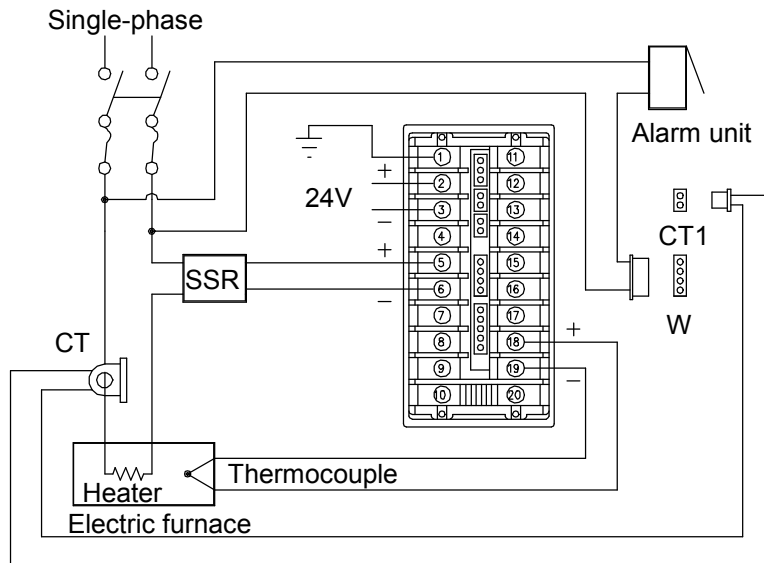
• The connectable SSRs in parallel are 2 units if the Shinko SSRs (SA-500 series) are used.
• For a 24V AC/DC power source, do not confuse polarity when using direct current (DC).

(Fig. 5.2-2)

5.2.1 Current Transformer 1 (CT1), 2 (CT2) Input Wiring (W/W3 Option)
[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. 5.2-3)
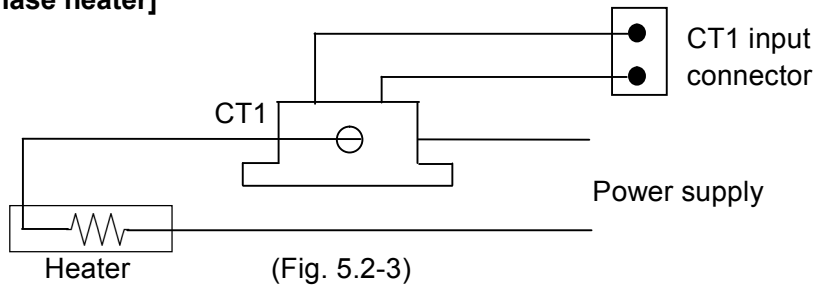
[Three-phase heater]

(Fig. 5.2-4)
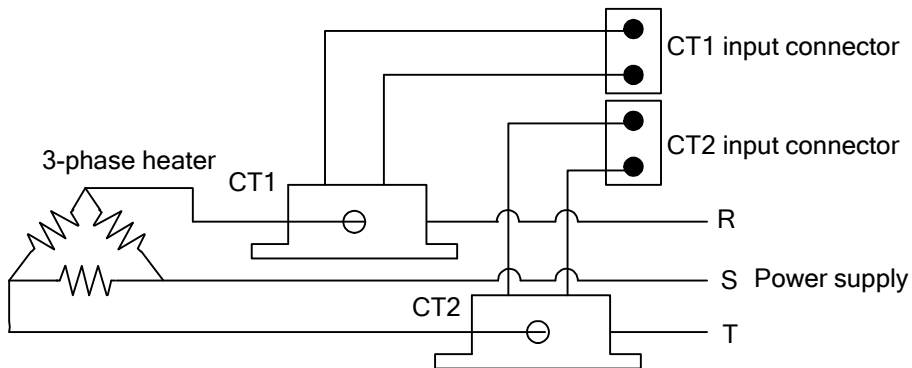
[Mounting the wire harness]

(Fig. 5.2-5)
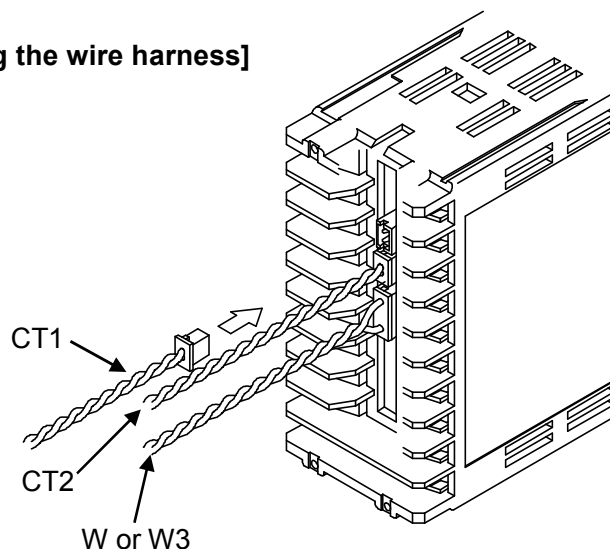
6. Settings

6.1 Operation Flowchart

Power ON

(*1)   (*1)

Control output OFF function (Fixed value control)

$\boxed{\text{OUT}\atop\text{OFF}}$ (approx. 1sec)

PV/SV display mode

Manual control (Fixed value control)

$\boxed{\text{AUTO}\atop\text{MAN}}$ $\boxed{\text{OUT}\atop\text{OFF}}$

(*1)

Standby mode (Program control)

$\boxed{\text{OUT}\atop\text{OFF}}$ (approx. 1sec)

MV indication		Remaining step time indication (*2)

MODE (approx. 3sec)   MODE   MODE   MODE

MODE   ▲ + MODE   ▼ + MODE (appprox. 3sec)

[Main setting mode]	[Sub setting mode]	[Auxiliary function setting mode 1]
[႟] SV	[m̄no] Set value memory number	[Loc] Set value lock
MODE	MODE	MODE
	[Ar] AT Perform/Cancel (*3)	[SH] SV high limit
	MODE	MODE
	[P] OUT1 proportional band	[SL] SV low limit
	MODE	MODE
	[P_b] OUT2 proportional band	[So] Sensor correction
	MODE	MODE
	[I] Integral time	[db] Overlap/Dead band
	MODE	MODE
	[d] Derivative time	[rEmo] Remote/Local
	MODE	MODE
	[c] OUT1 proportional cycle	[cmno] Instrument number
	MODE	MODE
	[c_b] OUT2 proportional cycle	[cm̄SP] Communication speed
	MODE	MODE
	[rSET] Manual reset	[cm̄SL] Communication protocol
	MODE	MODE
	[A1] Alarm 1 (A1) value	
	MODE	
	[A2] Alarm 2 (A2) value	
	MODE	
	[Hxx.x] Heater burnout alarm value	
	MODE	
	[LP_T] Loop break alarm time	
	MODE	
	[LP_H] Loop break alarm span	
	MODE	

: Setting items with dotted lines are optional, and they appear only when the options are ordered.

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

▲ + MODE : Press the MODE key while holding down the ▲ key.

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

▲ + ▼ + MODE (approx.3sec): Press the MODE for approx.3 sec while holding down the ▲, ▼.

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

If the MODE is pressed for 3 sec, the unit reverts to the PV/SV display mode from any mode.

(*1): Warm-up status lasts 2 sec 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 proceeds to the [OUT1 proportional band].

(*4): Select ᴏFF in this mode and press the MODE. The unit reverts to the PV/SV display mode.

▲ + ▼ + MODE (Appprox. 3sec)   ▲ + ▼ (Appprox. 3sec)

[Auxiliary function setting mode2]   **[Program mode]**

[ᶎᴦLH] Scaling high limit	[A1dy] A1 action delay time	[Proc] Program control
↓ MODE	↓ MODE	↓ MODE (*4)
[ᶎᴦLL] Scaling low limit	[A2dy] A2 action delay time	[ᴦ_1] Step 1 time
↓ MODE	↓ MODE	↓ MODE
[dP] Decimal point place	[ᴦ ᶎLH] External setting input high limit	[ᴦ_2] Step 2 time
↓ MODE	↓ MODE	↓ MODE
[FILI] PV filter time constant	[ᴦ ᶎLL] External setting input low limit	[ᴦ_3] Step 3 time
↓ MODE	↓ MODE	↓ MODE
[ᴏLH] OUT1 high limit	[Iᴦoᶎ] Transmission output	[ᴦ_4] Step 4 time
↓ MODE	↓ MODE	↓ MODE
[ᴏLL] OUT1 low limit	[IᴦLH] Transmission output high limit	[ᴦ_5] Step 5 time
↓ MODE	↓ MODE	↓ MODE
[HYᶎ] OUT1 ON/OFF hysteresis	[IᴦLL] Transmission output low limit	[ᴦ_6] Step 6 time
↓ MODE	↓ MODE	↓ MODE
[cAcI] OUT2 action mode	[PᶎU] Indication when control output OFF	[ᴦ_7] Step 7 time
↓ MODE	↓ MODE	MODE
[ᴏLHb] OUT2 high limit	[ᴦAᴦU] SV rise rate	
↓ MODE	↓ MODE	
[ᴏLLb] OUT2 low limit	[ᴦAᴦd] SV fall rate	
↓ MODE	↓ MODE	
[HYᶎb] OUT2 ON/OFF hysteresis	[EoUI] Output status when input error	
↓ MODE	↓ MODE	
[A1Lᴨ] A1 Energized/De-energized		
↓ MODE		
[A2Lᴨ] A2 Energized/De-energized		
↓ MODE		
[A1HY] A1 hysteresis		
↓ MODE		
[A2HY] A2 hysteresis		
MODE		

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6.2 Settings

The PV display indicates the sensor characters selected in [Sensor input], and the SV/MV/TIME display indicates input range high limit (or Scaling high limit value for DC voltage, current inputs) for approx. 2 seconds (warm-up status) after power-on.
See (Table 6.2-1).
During this time, all outputs and LED indicators are in OFF status.
Control will then start, indicating PV on the PV display and SV on the SV/MV/TIME display.
While control output OFF function is working, the PV display indicates the item selected in [Indication when control output OFF].

(Table 6.2-1)

Input	℃		℉	
	PV display	SV/MV/TIME display	PV display	SV/MV/TIME display
K	ヒ□□℃	1370	ヒ□□℉	2500
J	J□□℃	1000	J□□℉	1800
R	r□□℃	1760	r□□℉	3200
B	b□□℃	1820	b□□℉	3300
PL-Ⅱ	PL2℃	1390	PL2℉	2500
N	n□□℃	1300	n□□℉	2300
S	5□□℃	1760	5□□℉	3200
E	E□□℃	1000	E□□℉	1800
T	┌□□℃	400.0	┌□□℉	750.0
C(W/Re5-26)	c□□℃	2315	c□□℉	4200
Pt100	Pr□℃	850.0	Pr□℉	999.9
JPt100	JPr℃	500.0	JPr℉	900.0
Pt100	Pr□℃	□850	Pr□℉	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□	

Notes before key operation

• Pressing the ⌷OUT/OFF key for approx. 1 second from any mode enables the control output OFF function.
  Once the control output OFF function is enabled, the function cannot be released even if the power to the instrument is turned OFF and ON again. To cancel the function, press the ⌷OUT/OFF key again for approx. 1 second.
  In the program control, the ⌷OUT/OFF key works as program Start/Stop key.
  The control output OFF function does not work.

• If the MODE is pressed for 3 sec, the unit will revert to the PV/SV display mode from any mode.

6.2.1 Main Setting Mode

In the PV/SV display mode, if the $\boxed{\text{MODE}}$ key is pressed, the unit proceeds to the Main setting mode.

The SV can be increased or decreased using the $\boxed{\blacktriangle}$, $\boxed{\blacktriangledown}$ and $\langle\text{FAST}\rangle$ keys.

If the $\boxed{\text{MODE}}$ key is pressed, the SV will be registered, and the controller will revert to the PV/SV display mode.

Character	Name, Function, Setting range	Default value
5⬚⬚⬚	**SV** • Sets SV (desired value). • Setting range: SV low limit to SV high limit	0℃

6.2.2 Sub Setting Mode

In the PV/SV display mode, if the $\boxed{\text{MODE}}$ key is pressed while holding down the $\boxed{\blacktriangle}$ key, the unit moves to the Sub setting mode.

The set value can be increased or decreased using the $\boxed{\blacktriangle}$, $\boxed{\blacktriangledown}$ and $\langle\text{FAST}\rangle$ keys.

Pressing the $\boxed{\text{MODE}}$ key registers the set value, and proceeds to the next setting item.

Pressing the $\boxed{\text{MODE}}$ key at the last setting item registers the set value, and the unit reverts to the PV/SV display mode.

Character	Name, Function, Setting range	Default value
m̄no⬚	**Set value memory number** • Selects the number (file) to be set or to be retrieved. • Selection range: 1 to 7	1

At⬚⬚	**AT Perform/Cancel**
	 • Sets AT (Auto-tuning) Perform or Cancel.
	  If the $\boxed{\text{MODE}}$ key is pressed after selecting AT Perform, the unit reverts to the PV/SV display mode.
	 • Not available if ON/OFF or PD control is selected in [Control action].
	 • During AT, none of the settings can be performed.
	 • If the AT is cancelled during the process, P, I, D values revert to the values before AT was performed.
	 • Selection item:
	  - - - -: AT Cancel
	  At⬚⬚: AT Perform
		AT Cancel

P⬚⬚⬚	**OUT1 proportional band** • Sets OUT1 proportional band. OUT1 proportional band depends on the scaling span. (e.g.) When OUT1 proportional band: 2.5%, -200 to 1370℃: OUT1 proportional band converted value: (1370-(-200))x2.5/100=39.25℃ When scaling high limit value: 100℃, scaling low limit value: 0℃ OUT1 proportional band converted value: (100-0)x2.5/100=2.5℃ • Not available if ON/OFF control is selected in [Control action]. • Setting range: 0.1 to 999.9%	2.5%
P.b⬚	**OUT2 proportional band** • Sets OUT2 proportional band. • OUT2 becomes ON/OFF control when set to 0.0. • Not available if Heating/Cooling control (DR, DS, DA option) is not ordered, or if ON/OFF control is selected in [Control action]. • Setting range: 0.0 to 10.0 times (multiplied value of OUT1 proportional band)	1.0 times (2.5%)

Character	Name, Function, Setting range		Default value
$I\ \square\square\square$	**Integral time**		200 sec
	• Sets the integral time. Setting the value to 0 disables the function (PD control). • Not available if ON/OFF control or PD control is selected in [Control action]. • Setting range: 0 to 3600 seconds		
$d\square\square\square$	**Derivative time**		50 sec
	• Sets the derivative time. Setting the value to 0 disables the function (PI control). • Not available if ON/OFF control is selected in [Control action]. • Setting range: 0 to 3600 seconds		
$c\square\square\square$	**OUT1 proportional cycle** • Sets OUT1 proportional cycle.	Relay contact output: 30 sec Non-contact voltage output: 3 sec	
	• Not available for Direct current output type or if ON/OFF control is selected in [Control action]. • **For the relay contact output type, if the proportional cycle time is decreased, the frequency of the relay action increases, and the life of the relay contact is shortened.** • Setting range: 1 to 120 seconds		
$c\_b\square$	**OUT2 proportional cycle** • Sets OUT2 proportional cycle.	Relay contact output: 30 sec Non-contact voltage output: 3 sec	
	• Not available for Direct current output type. Not available if Heating/Cooling control (DR, DS, DA option) is not ordered, or if ON/OFF control is selected in [Control action]. • **For the relay contact output type, if the proportional cycle time is decreased, the frequency of the relay action increases, and the life of the relay contact is shortened.** • Setting range: 1 to 120 seconds		
$r\,5E\Gamma$	**Manual reset**		0.0℃

	• Sets the reset value to correct the offset (deviation between SV and PV in equilibrium status).
	• Available only when PD control is selected in [Control action].
	• Setting range: ±Proportional band converted value
	  Thermocouple, RTD inputs: -199.9 to 999.9℃
	  DC voltage input: -1999 to 9999 (The placement of the decimal point
	  follows the selection.)
	How to set manual reset:
	  When SV>PV, set the positive (+) value (SV–PV).
	  When SV<PV, set the negative (–) value (SV–PV).		

$A\ I\square\square$	**A1 value**		0℃
	• Sets the action point of Alarm 1 (A1) output. • **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** • Not available if the Rotary switch is set to No.0 or No.7 • Setting range: Refer to (Table 6.2.2-1).		
$A2\square\square$	**A2 value**		0℃
	• Sets the action point of Alarm 2 (A2) output. • **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** • Not available if A2 output (option) is not ordered, or if Rotary switch is set to No.0 or No.7 in [A2 type] even if it is ordered. • Setting range: Refer to (Table 6.2.2-1).		

Character	Name, Function, Setting range	Default value

Hxx.x (xx.x: Heater current value)	**Heater burnout alarm value**
	• 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 ordered.
	• It is recommended to set approx. 80% of the heater current value (set value) considering the voltage fluctuation.
	• Upon returning to set limits, the alarm will stop.
	• Setting range:
	  Rated current 20A: 0.0 to 20.0A (Indication: 0.0 to 50.0)
	  Rated current 50A: 0.0 to 50.0A
		0.0A

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

LP_H	**Loop break alarm span**
	• Sets the span to assess the Loop break alarm.
	• Available only when Loop break alarm (LA option) is ordered
	• Setting range:
	  Thermocouple, RTD without decimal point: 0 to 150℃
	  Thermocouple, RTD with decimal point: 0.0 to 150.0℃
	  DC input: 0 to 1500 (The placement of the decimal point follows the selection.)
		0℃

[A1, A2 setting range]
Alarms with the standby function have the same setting range.

(Table 6.2.2-1)

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]
 Detects the breaking status on the loop such as heater burnout, sensor burnout or actuator trouble.
 When the control action is Heating (Reverse) control:
• The alarm will be activated when the PV does not **rise** as much as the alarm span or more within the loop break alarm time after the MV has reached 100% or the output high limit value.
• The alarm will also be activated when the PV does not **fall** as much value as the span or more within the loop break alarm time 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.

6.2.3 Auxiliary Function Setting Mode 1

In the PV/SV display mode, if the [MODE] key is pressed for approx. 3 seconds while holding down the [▼] key, the unit proceeds to Auxiliary function setting mode 1.
The set value can be increased or decreased by pressing the [▲], [▼] and [FAST] keys.

Pressing the [MODE] key registers the set value and proceeds to the next setting item.
If the [MODE] key is pressed at the last setting item, the set value will be registered and the unit will revert to the PV/SV display mode.

Character	Name, Function, Setting range	Default value
$Loc\square$	**Set value lock**	Unlock
	• Locks the set value to prevent setting errors. The setting item to be locked differs depending on the selection. • When selecting Lock, set the necessary items in the status Unlock, then select Lock 1, Lock 2 or Lock 3. • **Fuzzy self-tuning or AT will not function if [$Lc\ 1\square$] or [$Lc2\square$] is selected**. • Be sure to select Lock 3 when changing the set value frequently via communication function considering the life of non-volatile memory. • Selection item: $----$ (Unlock): All set values can be changed. $Lc\ 1\square$ (Lock 1): None of set values can be changed. $Lc2\square$ (Lock 2): Only SV can be changed. $Lc3\square$ (Lock 3): All set values can be changed temporarily. However, changed values revert to their previous value after power-off because they are not saved in the non-volatile memory. Since this function has no relation to the memory life, it is well suited when using with Shinko programmable controllers (with SVTC option). **[About Lock 3]** **When using the FCR -13A as a Fixed value controller** The data in the selected Set value memory number can be temporarily changed. However, if the memory number is changed, the data in the previous memory number is cancelled, and returns to the previous values. **When using the FCR -13A as a Programmable controller** The data in the currently performing step number can be temporarily changed. However, if the step number is changed, the data is cancelled, and returns to the previous values. During program standby status, the data changes will be invalidated.	

Character	Name, Function, Setting range	Default value
５Ｈ☐☐	**SV high limit**	400℃
	• Sets SV high limit value within the Scaling low limit value/Scaling high limit value range. • Setting range: SV low limit to Scaling high limit value 　　　　　(For DC input, the placement of the decimal point follows 　　　　　　the selection.)	
５Ｌ☐☐	**SV low limit**	0℃
	• Sets SV low limit value within the Scaling low limit value/Scaling high limit value range. • Setting range: Scaling low limit value to SV high limit 　　　　　(For DC input, the placement of the decimal point follows 　　　　　　the selection.)	
５ｏ☐☐	**Sensor correction**	0.0℃
	• Sets the sensor correction value. • Setting range: –100.0 to 100.0℃（℉） **[Sensor correction function]** This corrects the input value from the sensor. When a sensor cannot be set at the exact location where control is desired, temperatures measured by the sensor may deviate from the temperature in the controlled location. When controlling with plural controllers, sometimes the measured temperatures (input value) do not concur due to differences in sensor accuracy or dispersion of load capacities. In such a case, the control can be set at the desired temperature by adjusting the input value of sensors. However, it is effective within the input rated range regardless of the sensor correction value. PV after sensor correction= Current PV+ (Sensor correction value)	
ｄｂ☐☐	**Overlap/Dead band**	0.0℃
	• Sets the Overlap or Dead band for OUT1 and OUT2. • + Set value: Dead band 　– Set value: Overlap band • Not available if Heating/Cooling control (DR, DS, DA option) is not ordered, or if ON/OFF control is selected in [Control action]. • Setting range: ±OUT1 proportional band converted value 　　　　　Thermocouple, RTD : -199.9 to 999.9 ℃（℉） 　　　　　DC voltage, current : -1999 to 9999 (The placement of 　　　　　　the decimal point follows the selection.)	
ｒĒ̄ｏ	**Remote/Local setting**	Local setting
	• SV can be set with either Remote or Local method. • Available only when External setting input (EA, EV option) is ordered. • Selection item: ＬｏｃＬ: Local setting. The SV can be set by the front keypad. ｒĒ̄ｏ: Remote setting. The SV can be set by external remote operation.	

Character	Name, Function, Setting range	Default value
c ̄ ̄no	**Instrument number**	0
	• Sets the instrument number of this unit. (The instrument numbers should be set one by one when multiple instruments are connected in series in Serial communication, otherwise communication is impossible.) • Available only when the Serial communication (C, C5 option) is ordered • Setting range: 0 to 95	
c ̄ ̄4P	**Communication speed**	9600bps
	• 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 (C, C5 option) is ordered • Selection item: □□24: 2400bps 　　　　　　　□□48: 4800bps 　　　　　　　□□96: 9600bps 　　　　　　　□ 192: 19200bps	
c ̄ ̄4L	**Communication protocol** • Selects the communication protocol of this instrument.	Shinko protocol
	• Available only when the Serial communication (C, C5 option) is ordered • Selection item: no ̄ ̄L: Shinko protocol 　　　　　　 ̄odA: Modbus ASCII mode	

6.2.4 Auxiliary Function Setting Mode 2

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

The set value can be increased or decreased using the ▲, ▼ and FAST keys. Pressing the MODE key registers the set value, and proceeds to the next setting item. If the MODE key is pressed at the last setting item, the set value is registered and the unit reverts to the PV/SV display mode.

Character	Name, Function, Setting range	Default value
4ΓLH	**Scaling high limit value**	1370℃
	• Sets scaling high limit value. If scaling high limit value is changed, SV high limit automatically changes to the scaling high limit value. • Setting range: Scaling low limit to Input range high limit value	
4ΓLL	**Scaling low limit value**	−200℃
	• Sets scaling low limit value. If scaling low limit value is changed, SV low limit automatically changes to the scaling low limit value. • Setting range: Input range low limit to scaling high limit value	

Character	Name, Function, Setting range	Default value
$dP\Box\Box$	**Decimal point place** • Selects the decimal point place.	No decimal point
	• Not available if RTD or thermocouple is selected in [Sensor input]. • Selection item: $\Box\Box\Box$.: No decimal point $\quad\quad\quad\quad\quad\quad\quad$ $\Box\Box\ .\Box$: 1 digit after the decimal point $\quad\quad\quad\quad\quad\quad\quad$ $\Box\ .\Box\Box$: 2 digits after the decimal point $\quad\quad\quad\quad\quad\quad\quad$ $.\Box\Box\Box$: 3 digits after the decimal point	
$FILT$	**PV filter time constant**	0.0 sec
	• Sets PV filter time constant. However, if the set value is set too large, it affects control result due to the delay of response. • Setting range: 0.0 to 10.0 sec	
$oLH\Box$	**OUT1 high limit value**	100%
	• Sets the high limit value for OUT1. • Not available if ON/OFF control is selected in [Control action] • Setting range: OUT1 low limit value to 100% $\quad\quad\quad\quad\quad\quad$ (Direct current output: OUT1 low limit value to 105%)	
$oLL\Box$	**OUT1 low limit value**	0%
	• Sets low limit value for OUT1. • Not available if ON/OFF control is selected in [Control action] • Setting range: 0% to OUT1 high limit value $\quad\quad\quad\quad\quad\quad$ (Direct current output: −5% to OUT1 high limit value)	
$HYS\Box$	**OUT1 ON/OFF hysteresis**	1.0℃
	• Sets ON/OFF hysteresis for OUT1. • Available only when ON/OFF control is selected in [Control action] • Setting range: 0.1 to 100.0℃ (℉)	
$cAcT$	**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 ordered • Selection item: $\quad$ $AIr\Box$: Air cooling (linear characteristic) $\quad$ $oIL\Box$: Oil cooling (1.5th power of the linear characteristic) $\quad$ $\_AT\Box$: Water cooling (2nd power of the linear characteristic)	
$oLHb$	**OUT2 high limit value**	100%
	• Sets the high limit value for OUT2. • Not available if Heating/Cooling control (DR, DS, DA option) is not ordered, or if OUT2 is ON/OFF control action • Setting range: OUT2 low limit value to 100% $\quad\quad\quad\quad\quad\quad$ (Direct current output: OUT2 low limit value to 105%)	
$oLLb$	**OUT2 low limit value**	0%
	• Sets the low limit value for OUT2. • Not available if Heating/Cooling control (DR, DS, DA option) is not ordered, or if OUT2 is ON/OFF control action • Setting range: 0% to OUT2 high limit value $\quad\quad\quad\quad\quad\quad$ (Direct current output: −5% to OUT2 high limit value)	

Character	Name, Function, Setting range	Default value
HY5b	**OUT2 ON/OFF hysteresis**	1.0℃
	• Sets ON/OFF hysteresis for OUT2. • Not available if Heating/Cooling control (DR, DS, DA option) is not ordered, or if OUT2 is PID or PD control action. • Setting range: 0.1 to 100.0℃(℉)	
A1Lñ	**A1 action Energized/De-energized**	Energized
	• Selects A1 action Energized/De-energized. • Not available if Rotary switch is set to No.0 or No.7 in [A1 type]. • Selection item: ☐noñ: Energized,　　☐rEʋ: De-energized	
A2Lñ	**A2 action Energized/De-energized**	Energized
	• Selects A2 action Energized/De-energized. • Not available if A2 option is not ordered, or if Rotary switch is set to No.0 or No.7 in [A2 type]. • Selection item: ☐noñ: Energized,　　☐rEʋ: De-energized	
A1HY	**A1 hysteresis**	1.0℃
	• Sets A1 hysteresis. • Not available if Rotary switch is set to No.0 or No.7 in [A1 type]. • Setting range: Thermocouple, RTD input: 0.1 to 100.0℃ (℉) 　　　　　　DC input: 1 to 1000 (The placement of the decimal point follows the selection.)	
A2HY	**A2 hysteresis**	1.0℃
	• Sets A2 hysteresis. • Not available if A2 option is not ordered. Not available if Rotary switch is set to No.0 or No.7 in [A2 type]. • Setting range: Thermocouple, RTD input: 0.1 to 100.0℃ (℉) 　　　　　　DC input: 1 to 1000 (The placement of the decimal point follows the selection.)	
A1dY	**A1 action delay time**	0 sec
	• Sets A1 action delay time. When setting time has elapsed after the input enters the alarm output range, the alarm is activated. • Not available if the Rotary switch is set to No.0 or No.7 in [A1 type]. • Setting range: 0 to 9999 seconds	
A2dY	**A2 action delay time**	0 sec
	• Sets A2 action delay time. When setting time has elapsed after the input enters the alarm output range, the alarm is activated. • Not available if A2 option is not ordered, or if the Rotary switch is set to No.0 or No.7 in [A2 type] even if A2 option is ordered. • Setting range: 0 to 9999 seconds	

Character	Name, Function, Setting range	Default value
⌐5LH	**External setting input high limit**	400℃
	• Sets External setting input high limit value.	
	For EA option (4 to 20mA), the value corresponds to 20mA input.	
	• Available only when External setting (EA, EV option) is ordered.	
	• Setting range: External setting input low limit value to	
	Input range high limit value	
⌐5LL	**External setting input low limit**	0℃
	• Sets External setting input low limit value.	
	For EA option (4 to 20mA), the value corresponds to 4mA input.	
	• Available only when External setting (EA, EV option) is ordered.	
	• Setting range: Input range low limit value to	
	External setting input high limit value	
⌐⌐o5	**Transmission output** • Selects a Transmission output type.	PV transmission
	• Available only when Transmission output (TA, TV option) is ordered	
	• Selection item: PU☐: PV transmission	
	5U☐: SV transmission	
	nU☐: MV transmission	
⌐⌐LH	**Transmission output high limit**	400℃
	• Sets the Transmission output high limit value.	
	For TA option, the value correponds to 20mA output.	
	• Available only when Transmission output (TA, TV option) is ordered	
	• Setting range: Transmission output low limit value to Input range high	
	limit value	
⌐⌐LL	**Transmission output low limit**	0℃
	• Sets the Transmission output low limit value.	
	For TA option, the value correponds to 4mA output.	
	• Available only when Transmission output (TA, TV option) is ordered	
	• Setting range: Input range low limit value to Transmission output high	
	limit value	
P5U☐	**Indication when control output OFF**	OFF is indicated on the PV display.
	• Selects the indication when the control output is off.	
	• Selection item:	
	oFF☐ : OFF is indicated on the PV display.	
	AoFF : No indication	
	PU☐ : Only PV is indicated.	
⌐ALU	**SV rise rate**	0℃/minute
	• Sets the SV rise rate (Rising value per minute).	
	Setting the value to 0 or 0.0 disables the function.	
	• Setting range: 0 to 9999℃/min.	
	With a decimal point: 0.0 to 999.9℃/min.	
	DC input: 0 to 9999 (The placement of the decimal	
	point follows the selection.)	

Character	Name, Function, Setting range	Default value
⌐ＡＦ⌐	**SV fall rate** • Sets the SV fall rate (Falling value per minute). Setting the value to 0 or 0.0 disables the function. • Setting range: 0 to 9999℃/min. 　　　　　　With a decimal point: 0.0 to 999.9℃/min. 　　　　　　DC input: 0 to 9999 (The placement of the decimal point 　　　　　　　　　　　　follows the selection.)	0℃/minute
ＥｏＵＦ	**Output status when input error** • Selects control output (OUT1/OUT2) status when DC input is in overscale or underscale. • Available only for Direct 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.	Outputs OFF(4mA) or OUT1(OUT2) low limit value.

Alarm 1 (A1), 2 (A2) Energized/De-energized function
[If the alarm action Energized is selected]
 When the alarm output indicator is lit, the alarm output (terminals 7-8, 9-10) is conducted (ON). When the alarm output indicator is unlit, the alarm output is not conducted (OFF).

[If the alarm action De-energized is selected]
 When the alarm output indicator is lit, the alarm output (terminals 7-8, 9-10) is not conducted (OFF). When the alarm output indicator is unlit, the alarm output is conducted (ON).

High limit alarm (when Energized is set)　High limit alarm (when De-energized is set)
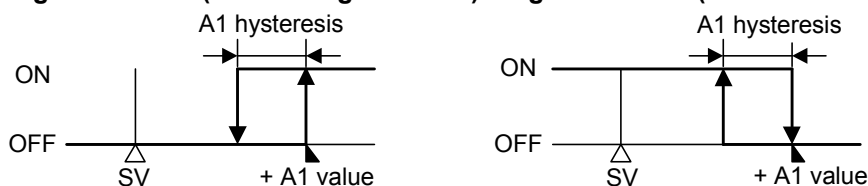
A1: Alarm 1.
For Alarm 2(A2),
read "A2" for "A1".

(Fig. 6.2.4-1)

6.2.5 Program Mode
 In PV/SV display mode, if the ▼ key is pressed for approximately 3 seconds while holding down the ▲ key, the units moves to the Program mode.
 The ▲ , ▼ and FAST keys increase or decrease the set values (numeric value).
 Pressing the MODE key registers the set value, and proceeds to the next setting item.
 If the MODE key is pressed at the last setting item, the set value is registered and the unit reverts to the PV/SV display mode.

• Data in Set value memory numbers (1 to 7, set with Fixed value control method) is assigned to Steps 1 to 7 respectively.
 For example, data in Set value memory number 1 becomes Step 1 data, and data in Set value memory number 2 becomes Step 2 data, and so on.
• 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.

• The following shows the program pattern example.
  Set the step time to 00.00 for the unnecessary steps.

[Program Example]

Step number (Set value memory number)	1	2	3	4	5	6	7
Step SV	500	500	1000	1000	200	200	100
OUT1 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
OUT1 proportional cycle	30	30	30	30	30	30	30
A1 value	2	5	2	5	10	0	5
A2 value	2	5	2	5	10	0	5
Step time	00:30	01:00	00:40	01:00	02:00	00:30	01:00

Character	Name, Function, Setting range	Default value
Proc	**Fixed value control/Program control switching** • Fixed value control or program control can be selected.	Fixed value control
	• If the [MODE] key is pressed after selecting the fixed value control, the controller will revert 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** • Sets Step 1 time. (Available only for program control) (e.g.) When setting 1 hour 58 minutes, set as [*0 158*]. • Setting range: 00.00 to 99.59	00.00
r_2	**Step 2 time** • Sets Step 2 time. (Available only for program control) • Setting range: 00.00 to 99.59	00.00
r_3	**Step 3 time** • Sets Step 3 time. (Available only for program control) • Setting range: 00.00 to 99.59	00.00
r_4	**Step 4 time** • Sets Step 4 time. (Available only for program control) • Setting range: 00.00 to 99.59	00.00
r_5	**Step 5 time** • Sets Step 5 time. (Available only for program control) • Setting range: 00.00 to 99.59	00.00

$\digamma \llcorner \boxminus \Box$	**Step 6 time**	00.00
	• Sets Step 6 time. (Available only for program control) • Setting range: 00.00 to 99.59	
$\digamma \llcorner \daleth \Box$	**Step 7 time**	00.00
	• Sets Step 7 time. (Available only for program control) • Setting range: 00.00 to 99.59	

6.2.6 Auto/Manual Control Switching

MV can be changed manually.

As a proportional action, the MV is automatically outputted in proportion to the deviation. This is called an automoatic control.

In comparison with the above, in the manual control, the value set by front keypad can be outputted regardless of the deviation.

If control action is switched from automatic to manual and vice versa, balanceless-bumpless function works to prevent sudden change of MV.

Each time the AUTO/MAN key is pressed, the control switches from Automatic to Manual and vice versa.

• Setting range: OUT1 low limit value to OUT1 high limit value

When Heating/Cooling control (DR, DS, DA option) is ordered: OUT2 low limit value to OUT1 high limit value

6.2.7 Control Output OFF Function

Control output OFF function [$\sigma \digamma \digamma \Box$]

• The control action and output of an instrument (or any instruments in series) can be turned off without turning off the power supplies using this function.

• Pressing the OUT/OFF key for approx. 1 second from any mode enables the control output OFF function. The PV display indicates the setting item selected in [Indication when control output OFF].
To cancel the function, press the OUT/OFF key again for approx. 1 second.

• Once the control output OFF function is enabled, the function cannot be released even if the power to the instrument is turned OFF and ON again.
To cancel the function, press the OUT/OFF key again for approx. 1 second.

• During program control, the OUT/OFF key becomes the Program Start/Stop key, and the control output OFF function is disabled.

6.2.8 MV, Remaining Step Time Indication

MV indication

In the PV/SV display mode, press the MODE key for approx. 3 seconds.
Keep pressing the MODE key until the MV appears, though the SV setting mode appears during the process.
The MV indicator lights. The SV/MV/TIME display indicates the output MV. The 2nd decimal point from the right on the SV/MV/TIME display flashes.
For the fixed value control, when the MODE key is pressed again, the unit reverts to the PV/SV display mode.

Remaining step time indication

For the program control, if the MODE key is pressed while in MV indication, remaining step time will be indicated on the SV/MV/TIME display. The TIME indicator lights. By pressing the MODE key again, the unit reverts to the PV/SV display mode.

7. Set Value Memory Function (SM Option)

If the SM option (Set value memory number external selection) is ordered, a maximum of 7 files (12 pieces of data per file) of data can be memorized.
Control can be performed by selecting the desired file.

One file comprises 12 kinds of data:
SV, OUT1 proportional band, Integral time, Derivative time, OUT2 proportional band, A1 value, A2 value, Overlap/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 terminals 13 to 16 as shown below (Table 7-1).
Up to 50 units of the FCR -13A can be connected in parallel.

Terminal connection for Set value memory number selection (Table 7-1)

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

- If the Set value memory number is selected externally, the number cannot be selected by front keypad.

- To select 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 for Set value memory function

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

Registering Data

- Data is registered in the file number indicated by the MEMO display.

- When any number is retrieved by connecting terminals, the selected number is indicated, and the control is performed using 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-13A as a Temperature Controller

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

For approx. 2 seconds after power-on, the sensor characters and the temperature unit selected in [Sensor input] will be indicated on the PV display, and input range high limit value (or Scaling high limit value for DC input) will be 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 in [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□□℃	1370	ᵗ□□℉	2500
J	J□□℃	1000	J□□℉	1800
R	r□□℃	1760	r□□℉	3200
B	b□□℃	1820	b□□℉	3300
PL-Ⅱ	PL2℃	1390	PL2℉	2500
N	n□□℃	1300	n□□℉	2300
S	ᵴ□□℃	1760	ᵴ□□℉	3200
E	E□□℃	1000	E□□℉	1800
T	ᵣ□□℃	400.0	ᵣ□□℉	750.0
C(W/Re5-26)	c□□℃	2315	c□□℉	4200
Pt100	Pᵣ□℃	850.0	Pᵣ□℉	999.9
JPt100	JPᵣ℃	500.0	JPᵣ℉	900.0
Pt100	Pᵣ□℃	□850	Pᵣ□℉	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□	

(2) Input each set value.

Refer to Section "6. Settings".

When controlling by Fuzzy self-tuning PID, select "Perform" in [AT Perform/Cancel (p.25)] mode to start control in optimal conditions.

(3) Turn the load circuit power ON.

Control action starts so as to keep the control target at the SV.

8.2 When Using the FCR-13A as a Simplified Programmable Controller

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

For approx. 2 seconds after power-on, the sensor type and the temperature unit selected in [Sensor input] are indicated on the PV display, and input range high limit value (or scaling high limit value for DC input) 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 PV display indicates the PV, and the unit enters standby mode.

(2) Input each set value and step time

Refer to Section "6. Settings".

(3) Turn the load circuit power ON.

(4) Program control start

If "Automatic start" is selected in [Program start Auto/Manual], the unit will switch to warm-up status for approx. 2 seconds after power-on. Program control automatically starts from Step 1.

If "Manual start" is selected in [Program start Auto/Manual], the unit will switch to warm-up status for approx. 2 seconds after power-on. The unit proceeds to the standby status. In this status, if the $\boxed{\text{OUT}_\text{OFF}}$ key is pressed, the program control starts from Step 1.

For the program control start, SV start (0℃) is used.

During program control (RUN), 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 $\boxed{\text{FAST}}$ key is pressed.

To terminate the program control during the process

The program control will be terminated if the $\boxed{\text{OUT}_\text{OFF}}$ key is pressed for approx. 1 sec or longer.

To switch the indication of MV and Remaining step time

In the PV/SV display, if the $\boxed{\text{MODE}}$ key is pressed for approximately 3 seconds, the MV is indicated. If the $\boxed{\text{MODE}}$ key is pressed again, the remaining step time will be indicated.

Instrument status when power is restored

After restoration following a power failure during program control, the FCR-13A resumes program performance from where it stopped.

(The PV display flashes until the step at which the power failure occurred is finished.)

9 Action Explanations

9.1 OUT1 Standard Control 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 Cycle action is performed according to deviation.	H④ C⑤ L⑥ H④ C⑤ L⑥ H④ C⑤ L⑥ 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.	+⑤ 0V DC −⑥ +⑤ 0/12V DC −⑥ +⑤ 12V DC −⑥ 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.	+⑤ 4mA DC −⑥ +⑤ 4 to 20mA DC −⑥ +⑤ 20mA DC −⑥ Changes continuously according to deviation.
Indicator (OUT1) Green	▉▉ (Lit) ▨▨ ☐☐ (Unlit)	☐☐ (Unlit) ▨▨ ▉▉ (Lit)

▨ : Turns ON (lit) or OFF (unlit).

9.2 Heater Burnout Alarm Action (Optional)

Heater burnout alarm action	ON ——— OFF ···⟍___ Heater burnout alarm value ⟵ Small Load current Large ⟶
Heater burnout alarm output	(contact diagrams)
Indicator (HB) Red	▉▉ (Lit) ☐☐ (Unlit)

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9.3 OUT1 ON/OFF Control Action

	Heating (reverse) action		Cooling (direct) action	
Control action	ON ——┐ Hysteresis ┌── ← → OFF————————▽———— SV		Hysteresis ← → ON ←——— ▽ 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	

▒▒▒ : Turns ON (lit) or OFF (unlit).

9.4 Pattern End Action

Pattern end action	ON ————————┐ OFF—————┐ ╳ Time ——→ │ Pattern end output is released by pressing Program control end 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 is completed,

and it can be released when the [OUT/OFF] key is pressed.

Use terminals 7 and 8 for Pattern end 2 output.

The A2 indicator lights when Pattern end 2 output is ON.

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9.5 Heating/Cooling Control Action (DR, DS, DA Option)

9.5.1 Heating/Cooling Control Action

Control action		OUT1 P-band	(OUT2 P-band)	
Control action	ON —— Heating action		△ SV	———— ON (Cooling action)
Control action	OFF – – – – –			– – – – OFF
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

▓▓▓ : Turns ON (lit) or OFF (unlit).

——— : Represents Heating control action.

– – – – : Represents Cooling control action.

9.5.2 When Setting Dead Band

Control action						
	OUT1 P-band / Dead band / (OUT2 P-band). ON — Heating action — OFF, SV; (Cooling action) ON---- OFF					
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	

▨ : Turns ON (lit) or OFF (unlit).

——— : Represents Heating control action.

− − − − : Represents Cooling control action.

9.5.3 When Setting Overlap Band with Relay Contact Output.
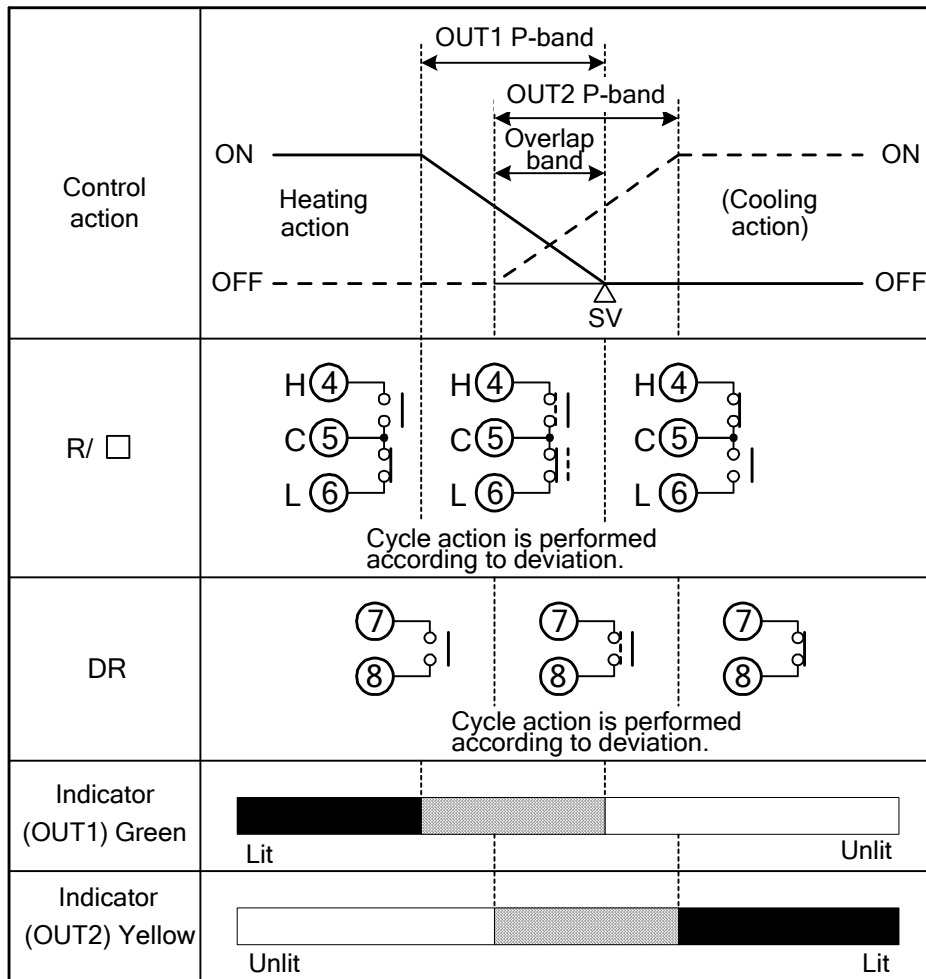
Control action	OUT1 P-band OUT2 P-band Overlap band ON ——————— ON Heating action (Cooling action) OFF – – – – – – – – OFF △ SV
R/ □	H④ C⑤ L⑥ H④ C⑤ L⑥ H④ C⑤ L⑥ Cycle action is performed according to deviation.
DR	⑦ ⑧ ⑦ ⑧ ⑦ ⑧ Cycle action is performed according to deviation.
Indicator (OUT1) Green	Lit Unlit
Indicator (OUT2) Yellow	Unlit Lit

▨ : Turns ON (lit) or OFF (unlit).

——— : Represents Heating control action.

– – – – : Represents Cooling control action.

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

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

■ : A1 output terminals 9 and 10 are closed.

▨ : A1 output terminals 9 and 10 are closed or opened.

☐ : A1 output terminals 9 and 10 are opened.

▥ : Standby functions.

A2 output terminals: 7 and 8

A1 and A2 indicators light when their output terminals are closed,
and go off when their output terminals are opened.

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

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10 Control Actions

10.1 Fuzzy Self-tuning

Fuzzy self-tuning is a function that performs fine adjustment of PID values automatically. Stable control can be carried out even if the conditions of the production process are changed due to various external factors (types and rates of production).

(1) When using the controller for the first time, perform the AT (auto-tuning) or set the proper PID values by keypad operation.
(2) When control initiates, the controller performs this function by the previously adjusted PID values.
(3) When 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.

The instrument is constantly in self-tuning status, and when deviation occurs, the tuning starts.
• If the convergence is performed smoothly, the PID values are not changed.
• If the convergent speed is slow, the controller corrects the PID values to accelerate the convergence.
• When overshoot is generated during the convergence, the controller changes the PID values to correct this.
• When hunting occurs, the controller checks its waveform and performs a fine adjustment of PID values.

Even in Fuzzy self-tuning status, when very large hunting occurs and the control is not stabilized, AT automatically starts.
When the AT "Perform" is selected by the keypad, AT initiates, and when the control is stabilized, the AT is released and the controller returns to self-tuning status.

> When lock mode [L c 1] or [L c 2] is selected, Fuzzy self-tuning or AT does not work.
>
> For a control system in which load fluctuation periodically occurs, the Fuzzy self-tuning PID control may malfunction. In such a case, use the controller with the PID control.

10.2 PID

(1) Proportional band (P)

Proportional action is the action which the control output varies in proportion to the deviation between the SV (desired value) and the processing temperature (PV).
If the proportional band is narrowed, even if 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 control action and the so-called hunting phenomenon occurs. Therefore, when the processing temperature comes to the balanced position near the SV and a constant temperature is maintained, the most suitable value is selected by gradually narrowing the proportional band while observing the control results.

(2) Integral time (I)

Integral action is used to eliminate offset. When the integral time is shortened, the returning speed to the setting point is accelerated. However, the cycle of oscillation is also accelerated and 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 and D automatically, the AT process has been made to fluctuate in order to achieve an optimal value.

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

(A) If there is a large difference between the SV and PV 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)
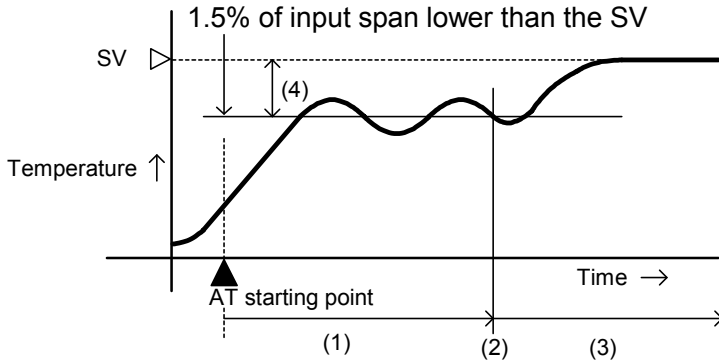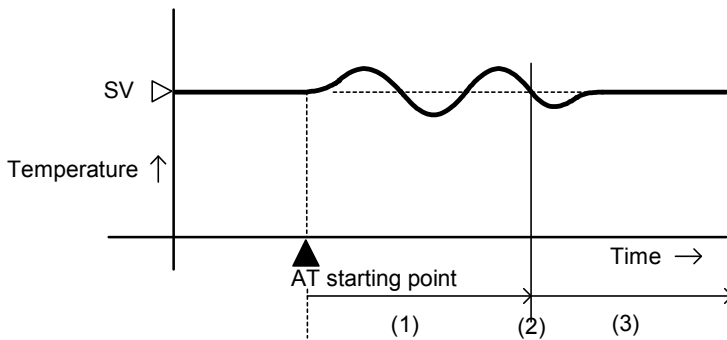

(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by AT.
(4) 1.5% of input span

(Fig. 10.3-1)

(B) When the control is stable 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) When the PV is 1.5% of input span higher than the SV

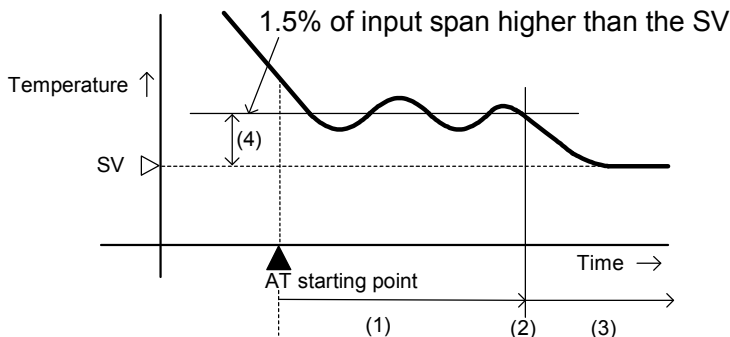The AT process will fluctuate at the temperature 1.5% of input span higher than the SV. (DC input: 1.5% of scaling span)

(1) 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

Mountable panel thickness: 1 to 3mm [If Soft front cover (FC-R-S) is used, 1 to 2.5mm]

Setting: Input system using membrane sheet key

Display:

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

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

 MEMO display (Set value memory number):

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

Accuracy (Indication, setting)

 Thermocouple: Within ±0.2% of each input span±1 digit

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

         Within ±0.4% of each input span±1 digit

        R, S inputs, range 0 to 200℃(0 to 400℉): Within ±4℃(8℉)

        B input, range 0 to 300℃ (0 to 600℉): Accuracy is not guaranteed.

        Cold junction temperature compensation accuracy:

         ±1℃ (at 0 to 50℃)

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

 Direct current: Within ±0.2% of each input span±1 digit

 DC voltage: Within ±0.2% of each input span±1 digit

Input sampling period: 125ms

        (When EA, EV or W, W3 option is ordered: 500ms)

Input

 Thermocouple: K, J, R, S, B, E, T, N, PL-Ⅱ, C (W/Re5-26)

        External resistance, 100Ω or less

        When input is burnt out, Overscale

 RTD: Pt100, JPt100, 3-wire system

        Allowable input lead wire resistance: 10Ω or less per wire

        When input is burnt out, Overscale

 Direct current: 0 to 20mA DC, 4 to 20mA DC

        Input impedance, 50Ω

        Allowable input current, 100mA or less

        When input is disconnected:

         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

        When input is disconnected, Overscale

OUT1 (Control output 1)

 Relay contact: 1a1b

        Control capacity:

         3A 250V AC (resistive load)

         1A 250V AC (inductive load cosϕ=0.4)

        Electrical life: 100,000 cycles

 Non-contact voltage: For SSR drive

        12^{+2}_{0}V DC maximum 40mA DC (short circuit protected)

 Direct current: 4 to 20mA DC (Isolated type)

        Load resistance, maximum 550Ω

Alarm 1 output

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

[When A1 action Energized is selected]

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

[When A1 action De-energized is selected]

The output acts conversely.

An alarm can be selected by Rotary switch and DIP switch from 13 types of alarm (including No alarm) plus Pattern end output: 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 Pattern end output. [See Section 9.6 Alarm 1 (A1), Alarm 2 (A2) Action.]

Setting accuracy: Within ±0.2% of each input span±1 digit
Action: ON/OFF action
Hysteresis: Thermocouple, RTD inputs: 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)
                  Electrical life: 100,000 cycles

Pattern end output (A1 output)

If the Pattern end output [Rotary switch A1 (SW302) No.7] is selected, and the program control is performed, the Pattern end output is turned ON when the program is completed. The Pattern end output can be turned OFF by pressing the [OUT/OFF] key. (See Section 9.4 Pattern End Action.)

Controlling action

The fuzzy self-tuning PID, PID, PD or ON/OFF control is selectable by DIP switch.

Fuzzy self-tuning PID control
   OUT1 proportional band (P): Automatic
   Integral time (I):   Automatic
   Derivative time (D):   Automatic
   Anti-reset windup (ARW):   Automatic
   OUT1 proportional cycle: 1 to 120 sec
   OUT1 high/low limit: 0 to 100% (Direct current output: –5 to 105%)

PID control (with AT function)
   OUT1 proportional band (P): 0.1 to 999.9%
   Integral time (I):   0 to 3600 sec (off when set to 0)
   Derivative time (D):   0 to 3600 sec (off when set to 0)
   Anti-reset windup (ARW):   Automatic
   OUT1 proportional cycle: 1 to 120 sec
   OUT1 high/low limit: 0 to 100% (Direct current output, –5 to 105%)

PD control
   OUT1 proportional band (P): 0.1 to 999.9%
   Derivative time (D):   0 to 3600 sec (off when set to 0)
   OUT1 proportional cycle: 1 to 120 sec
   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/low limit: 0 to 100% (Direct current output: –5 to 105%)

ON/OFF control
 OUT1 ON/OFF hysteresis: Thermocouple, RTD input: 0.1 to 100.0℃ (℉)
                          DC input: 1 to 1000 (The placement of the decimal
                                    point follows the selection.)

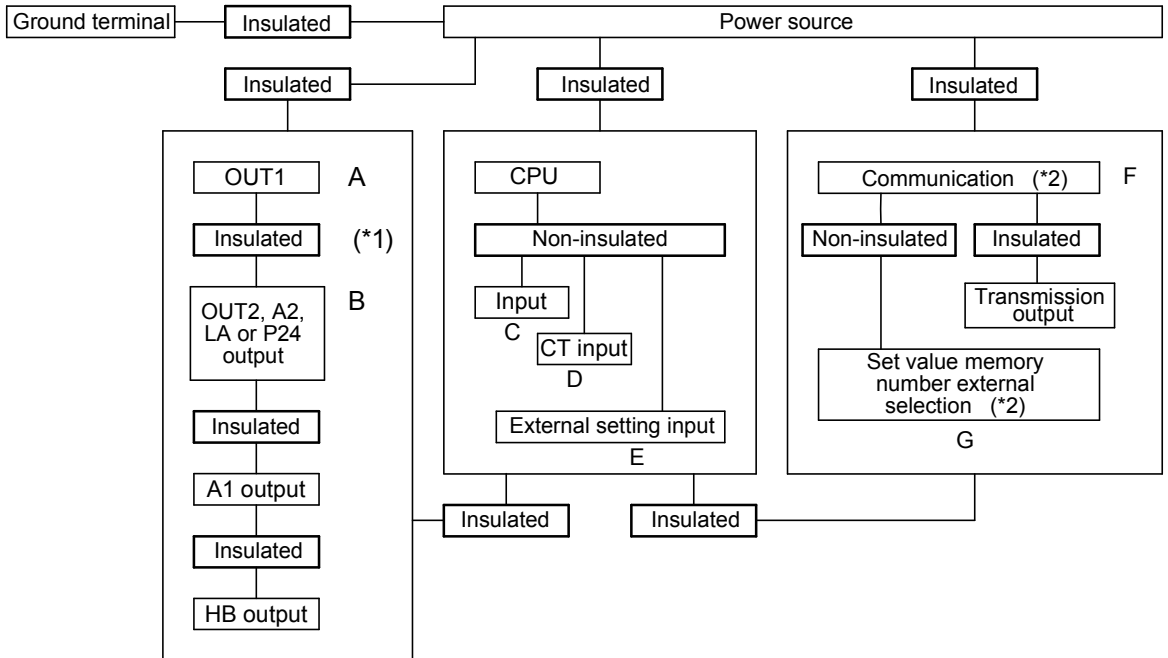**Supply voltage:**   100 to 240V AC, 50/60Hz,   24V AC/DC, 50/60Hz
Allowable voltage fluctuation: 100 to 240V AC: 85 to 264V AC
                                   24V AC/DC: 20 to 28V AC/DC
Ambient temperature: 0 to 50℃ (32 to 122℉)
Ambient humidity: 35 to 85%RH (non-condensing)
Power consumption: Approx. 15VA
Circuit insulation configuration:

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

(*2) When OUT1 is Direct current output type or Non-contact voltage output type,
     A is not electrically insulated from F, and A is not electrically insulated from G.
     When OUT2 is Direct current output type or Non-contact voltage output type,
     B is not electrically insulated from F, and B is not electrically insulated from G.

Insulation resistance
 10MΩ or more, at 500V DC
 Insulation test **must not** be carried out between A-B in the case of (*1) above,
 and between A-F, A-G, B-F, B-G, C-D-E and F-G in the case of (*2) above
 because they are not insulated from each other.

Dielectric strength
 Between input terminal and ground terminal: 1.5kV AC for 1 minute
 Between input terminal and power terminal: 1.5kV AC for 1 minute
 Between output terminal and ground terminal: 1.5kV AC for 1 minute
 Between output terminal and power terminal: 1.5kV AC for 1 minute
 Between power terminal and ground terminal: 1.5kV AC for 1 minute

Weight: Approx. 320g
External dimensions: 48 x 96 x 100mm (W x H x D)
Material: Case, Front panel: Flame-resistant resin
Color: Case, Front panel: Light gray

Attached functions: [Control output OFF function], [Set value lock], [SV high/low limit]
[Sensor correction], [Multi-range], [Multi-function], [Simplified programmable controller]

[Burnout]

When the thermocouple or RTD input is burnt out, OUT1 and OUT2 are turned off (for Direct current output type, OUT1, OUT2 low limit value), and the PV display flashes "‾ ‾ ‾ ‾".

For manual control, the preset MV is outputted.

When DC input is disconnected, the PV display flashes "˷ ˷ ˷ ˷" for 4 to 20mA DC input, and "‾ ‾ ‾ ‾" for 0 to 1V DC input.

For 0 to 20mA DC, the PV display indicates the value corresponding with 0mA input.

[Input error indication]

Output status when input error **(*1)**	Contents and indication	Output status			
		OUT1		OUT2	
		Direct action	Reverse action	Direct action	Reverse action
☐on	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 (4mA) or OUT2 low limit value	ON (20mA) or OUT2 high limit value **(*2)**
-oFF		OFF (4mA) or OUT1 low limit value			OFF (4mA) or OUT2 low limit value
☐on	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 (20mA) or OUT2 high limit value**(*2)**	OFF (4mA) or OUT2 low limit value
-oFF			OFF (4mA) or OUT1 low limit value	OFF (4mA) or OUT2 low limit value	

(*1) This is available only for DC input.
For manual control, the preset 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.

TC, RTD inputs

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℉
	−320 to 1560℉	−338 to 1578℉	−338 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, if the input value is out of the range –1999 to 9999, the PV display flashes "‾ ‾ ‾ ‾" or "˷ ˷ ˷ ˷".

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

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

[Automatic cold junction temperature compensation] (Thermocouple input type)
   This detects the temperature at the connecting terminal between thermocouple and the instrument, and always maintains it at the same status as if the reference junction temperature was at 0℃ (32℉).

[Warm-up indication]
   For approximately 2 seconds after power-on, the input type and the temperature unit are indicated on the PV display, and the input range high limit value (for DC input, scaling high limit value) is indicated on the SV/MV/TIME display.

[SV ramp function]
   When the SV is adjusted, it approaches the new SV by the preset rate-of-change (Rising/Falling value per minute).
   When the power is turned on, the control starts from the PV 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 label
   Current transformer (CT):   1 piece
        (CTL-6S) (When W (20A) option is ordered.)
        (CTL-12-S36-10L1U) (When W (50A) option is ordered.)
   Current transformer (CT):   2 pieces
        (CTL-6S) (When W3 (20A) option is ordered.)
        (CTL-12-S36-10L1U) (When W3 (50A) option is ordered.)
   Wire harness: 3m (When the W/W3, TA/TV or EA/EV option is
                                             ordered.)
   Screw type mounting brackets: 1 set (When the BL option is ordered.)
   Gasket: 1 piece (When the IP option is ordered.)
   Terminal cover: 1 piece (When the TC option is ordered.)

11.2 Optional Specifications

Alarm 2 (Option code: A2)

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

[When A2 action Energized is selected]

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

[When A2 action De-energized is selected]

The output acts conversely.

One alarm can be selected by Rotary switch and DIP switch from 13 types of alarm (including No alarm) and Pattern end output: 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 Pattern end output.

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

• If Alarm 2 (A2 option) is ordered, Heating/Cooling control (DR, DS, DA option) or Insulated power output (P24 option) cannot be ordered.

Setting accuracy: Within ±0.2% of each input span±1 digit
Action: ON/OFF action
Hysteresis: Thermocouple, RTD inputs: 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)
Electrical life: 100,000 cycles

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

If this option is ordered, Alarm 2 (A2 option), Loop break alarm (LA option) or Insulated power output (P24 option) cannot be ordered.

OUT2 proportional band: 0.0 to 10.0 times OUT1 proportional band
(ON/OFF control 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 120 sec
Overlap/Dead band: ±OUT1 proportional band converted value
Thermocouple, RTD inputs: –199.9 to 999.9℃ (℉)
DC input: –1999 to 9999 (The placement of the decimal point follows the selection.)
OUT2 ON/OFF hysteresis:
Thermocouple, RTD inputs: 0.1 to 100.0℃ (℉)
DC input: 1 to 1000 (The placement of the decimal point follows the selection.)
Output [DR] Relay contact, 1a
Control capacity: 3A 250V AC (resistive load)
1A 250V AC (inductive load $\cos\phi$=0.4)
Electrical life: 100,000 cycles
[DS] Non-contact voltage (for SSR drive)
12^{+2}_{0} V DC Maximum 40mA DC (short circuit protected)
[DA] Direct current: 4 to 20mA DC (Isolated type)
Load resistance: Maximum 550Ω
OUT2 high/low limit: 0 to 100% (Direct current output: -5 to 105%)
OUT2 action mode: Selectable by keypad
Air cooling (Linear characteristic), Oil cooling (1.5th power of the linear characteristic), Water cooling (2nd power of the linear characteristic).

Transmission output (Option code: TA, TV)

Converting the value (PV transmission, SV transmission, MV transmission) to analog signal every 125ms, 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 ±0.3% of Transmission output span

Serial communication (Option code: C5, C)

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 action status.
(3) Function change

Communication line: EIA RS-485 (C5 option)
                           EIA RS-232C (C option)
Communication method: Half-duplex communication
Synchronization method: Start-stop synchronization
Communication speed: 2400, 4800, 9600, 19200bps (Selectable by keypad)
Data format   Start bit: 1
               Data bit: 7
               Parity: Even parity
               Stop bit: 1
Communication protocol: Shinko protocol, Modbus ASCII (Selectable by keypad)
                           (When Modbus protocol is selected, the Digital external
                           setting can not be used.)
Digital external setting: Receives digital set value from Shinko Programmable
                           controller PC-900, PCD-33A (with SVTC option).

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

Selects the Set value memory number from 7 files (the below-mentioned data as one file) by external terminals:

  SV, OUT1 proportional band, Integral time, Derivative time, OUT2 proportional band, A1 value, A2 value, Overlap/Dead band, OUT1 high limit value, OUT1 low limit value, OUT2 high limit value, OUT2 low limit value

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

External setting input (Option code: EA, EV)

SV can be set by External analog signal.

  Setting signal : Direct 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
                    Input impedance, 100kΩ (non-isolated from input)
  Setting signal sampling period: 500ms
      (If this External setting input is ordered, the input sampling period also changes
      to 500ms.)

Heater burnout alarm (Option code: W, W3)

Watches the heater current with CT (current transformer), and detects the burnout.
 • For the direct current output type, this option cannot be ordered.
 • If this option is ordered, the input sampling period also changes to 500ms.
 Rated current: 20A [W (20A), W3 (20A) option] or
                 50A [W (50A), W3 (50A) option]   Must be specified

Setting range: 20A: 0.0 to 20.0A (Indication: 0.0 to 50.0),   50A: 0.0 to 50.0A
The alarm will be disabled when set to 0.0.
Setting accuracy: Within ±5% of heater rated current
Action: ON/OFF action
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

Loop break alarm (Option code: LA)

Detects the breaking status on the loop such as heater burnout, sensor burnout or actuator trouble.
• When this option and Alarm 2 (A2) option are ordered together, they utilize common output terminals.
• If this option is ordered, Heating/Cooling control (DR, DS, DA option) or Insulated power output (P24 option) cannot be ordered.
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 each sensor and converter.
If this option is ordered, Alarm 2 (A2 option), Heating/Cooling control (DR, DS, DA option) or Loop break alarm (LA option) cannot be ordered.

Output voltage: 24±3V DC (when the load current is 30mA.)
Ripple voltage: Within 200mV DC (when the load current is 30mA DC.)
Max load current: 30mA DC

Screw-type mounting brackets (Option code: BL)

Mountable panel thickness: 1 to 8mm (When soft front cover FC-R-S is used: 1 to 7.5mm)

Color black (Option code: BK)

Front panel: Dark gray,   Case: Black

Drip-proof/Dust-proof (IP54) (Option code: IP)

Effective only for front panel surface, case section is excluded.
Mount the controller vertically to the flat, rigid panel to ensure it adheres to the Drip-proof/Dust-proof specification.
The front cover (soft type, FC-R-S, sold separately) is recommended for comprehensive Drip-proof/Dust-proof protection.

Terminal cover (Option code: TC)

Electrical shock protection terminal cover

User specified

Input, Scale range: Shipped as specified range.
Alarm type: Shipped as specified alarm type [A1, A2 (A2 is optional)].
Control action: Shipped as specified control action.
OUT2 action mode: Shipped as specified cooling action mode (DR, DS, DA option).
Transmission output: Shipped as specified output (TA, TV option).
External setting input: Shipped as specified input (EA, EV option).
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 on or touching the terminal with the power switched on may result in severe injury or death due to electric shock.


\<Indication\>

Problem	Possible Cause and Solution
The PV display is indicating [ᴏFF], no indication or only PV.	• Control output OFF function is working. To release the function, press the [OUT/OFF] key for approx. 1 sec.

The PV display is flashing [‾ ‾ ‾ ‾].	• Thermocouple or RTD is burnt out.
	  Change each sensor.
	  [Thermocouple]
	    If the input terminals of the instrument are shorted, and if a value around room temperature is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out.
	  [RTD]
	    If approximate 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 mounted to the instrument input terminals.

The PV display is flashing [ˍ ˍ ˍ ˍ].	• Check if polarity of thermocouple or compensating lead wire is correct. • Check whether codes (A, B, B) of RTD agree with the instrument terminals.

The indication of the PV display is irregular or unstable.	• Suitable sensor input has not been selected.
	  Set the sensor input properly using the Rotary switch (SW303) and DIP switch (SW304).
	• Temperature unit (℃ or ℉) is not correct.
	  Set it to a suitable unit with the DIP switch (SW304).
	• Sensor correction value is not suitable.
	  Set it to a suitable value.
	• Specification of thermocouple or RTD is improper.
	• AC leaks into the thermocouple or RTD circuit.
	  Use an ungrounded type sensor.
	• There may be equipment that interferes with, or makes noise near the controller.
	  Keep equipment that interferes with or makes noise away from the controller.

<Key operation>

Problem	Possible Cause and Solution
The setting mode cannot be selected.	• Manual control is selected. Change the mode to Automatic control.
• Unable to set the SV, P, I, D, OUT1 proportional cycle, alarm value, etc.	• Set value lock (Lock 1 or Lock 2) is selected. Release the lock selection.
• The values do not change by the ▲, ▼ keys.	• AT (Auto-tuning) is performing. Cancel AT.
The setting indication does not change within the input range even if the ▲, ▼ keys are pressed, and new values are unable to be set.	• SV high limit or SV low limit in Auxiliary function setting mode 1 may be set at the point where the value does not change. Set it to a suitable value 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	Possible Cause and Solution
PV does not rise.	• Thermocouple or RTD is burnt out. Replace the sensor. • Check whether the sensor or control output terminals are securely mounted to the instrument terminals. • Check whether the wiring of sensor or control output terminals is correct.

Control is not performing.
(Only PV display is indicated)
	• Control output OFF function is working.
	  Press the OUT/OFF key to cancel Control output OFF function.
	• Program mode is selected.
	  To start Program control, press the OUT/OFF key.
	  To perform Fixed value control, press the ▼ key for approx. 3 sec while holding down the ▲ key.

OUT1 or OUT2 remains in an ON status.	• OUT1 low limit value or OUT2 low limit value is set to 100% or higher in Auxiliary function setting mode 2. Set it to a suitable value.
OUT1 or OUT2 remains in an OFF status.	• OUT1 high limit value or OUT2 high limit value is set to 0% or less in Auxiliary function setting mode 2. Set it to a suitable value.

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

13 Character Table

\<Main setting mode\>

Character	Item	Default	Data
`५⬚⬚⬚`	SV	0℃	

\<Sub setting mode\>

Character	Item	Default	Data
`ñño⬚`	Set value memory number	1	
`AT⬚⬚`	AT Perform/Cancel	Cancel	
`P⬚⬚⬚`	OUT1 proportional band	2.5%	
`P_b⬚`	OUT2 proportional band	1.0 times	
`I⬚⬚⬚`	Integral time	200 sec	
`d⬚⬚⬚`	Derivative time	50 sec	
`c⬚⬚⬚`	OUT1 proportional cycle	R/M: 30 sec S/M: 3 sec	
`c_b⬚`	OUT2 proportional cycle	DR: 30 sec DS: 3 sec	
`r५ET`	Manual reset	0.0℃	
`A1⬚⬚`	Alarm 1 value	0℃	
`A2⬚⬚`	Alarm 2 value	0℃	
`Hxx.x` **xx.x**: Heater current value	Heater burnout alarm value	0.0A	
`LP_T`	Loop break alarm time	0 minutes	
`LP_H`	Loop break alarm span	0℃	

\<Auxiliary function setting mode 1\>

Character	Item	Default	Data
`Loc⬚`	Set value lock	Unlock	
`५H⬚⬚`	SV high limit	400℃	
`५L⬚⬚`	SV low limit	0℃	
`५o⬚⬚`	Sensor correction	0.0℃	
`db⬚⬚`	Overlap/Dead band	0.0℃	
`rEño`	Remote/Local setting	Local	
`cñño`	Instrument number	0	
`cñ५P`	Communication speed	9600bps	
`cñ५L`	Communication protocol	Shinko protocol	

\<Auxiliary function setting mode 2\>

Character	Item	Default	Data
`५rLH`	Scaling high limit value	1370℃	
`५rLL`	Scaling low limit value	-200℃	
`dP⬚⬚`	Decimal point place	No decimal point	
`FILT`	PV filter time constant	0.0 sec	
`oLH⬚`	OUT1 high limit value	100%	
`oLL⬚`	OUT1 low limit value	0%	
`HY५⬚`	OUT1 ON/OFF hysteresis	1.0℃	
`cAcT`	OUT2 action mode	Air cooling	
`oLHb`	OUT2 high limit value	100%	
`oLLb`	OUT2 low limit value	0%	
`HY५b`	OUT2 ON/OFF hysteresis	1.0℃	
`A1Lñ`	Alarm 1 action Energized/De-energized	Energized	
`A2Lñ`	Alarm 2 action Energized/De-energized	Energized	

⧄⧄⧄	Alarm 1 hysteresis	1.0℃	
⧄⧄⧄	Alarm 2 hysteresis	1.0℃	
⧄⧄⧄	Alarm 1 delay time	0 sec	
⧄⧄⧄	Alarm 2 delay time	0 sec	
⧄⧄⧄	External setting input high limit	400℃	
⧄⧄⧄	External setting input low limit	0℃	
⧄⧄⧄	Transmission output	PV transmission	
⧄⧄⧄	Transmission output high limit	400℃	
⧄⧄⧄	Transmission output low limit	0℃	
⧄⧄⧄	Indication when control output OFF	OFF on the PV display	
⧄⧄⧄	SV rise rate	0℃/minute	
⧄⧄⧄	SV fall rate	0℃/minute	
⧄⧄⧄	Output status when input error	Outputs OFF(4mA) or OUT1(OUT2) low limit value.	

<Program mode>

Character	Item	Default	Data
⧄⧄⧄	Fixed value control/Program control	Fixed value control	
⧄⧄⧄	Step 1 time	00.00	
⧄⧄⧄	Step 2 time	00.00	
⧄⧄⧄	Step 3 time	00.00	
⧄⧄⧄	Step 4 time	00.00	
⧄⧄⧄	Step 5 time	00.00	
⧄⧄⧄	Step 6 time	00.00	
⧄⧄⧄	Step 7 time	00.00	

***** Inquiries *****

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

[Example]
- Model ---------------------------- FCR -13A-R/M
- Input type ---------------------- K
- Option --------------------------- A2, TV, C5, W (20A)
- Serial number ----------------- No. 123F05000

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

SHINKO TECHNOS CO., LTD.
OVERSEAS DIVISION

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