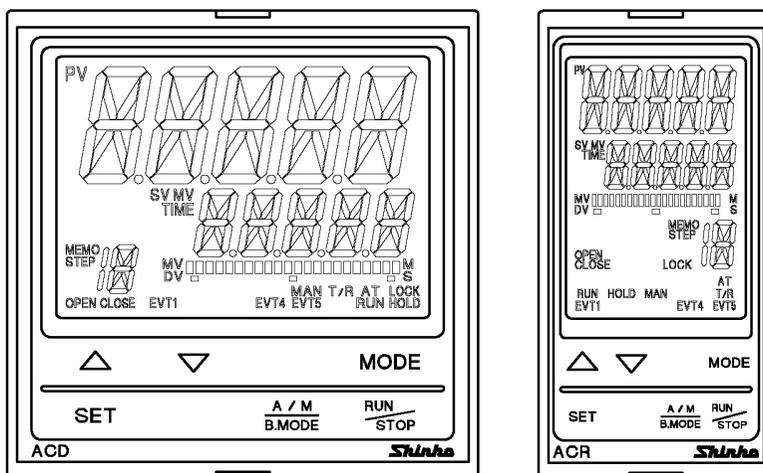# ON/OFF SERVO

DIGITAL INDICATING CONTROLLERS

ACD-15A, ACR-15A

INSTRUCTION MANUAL

Shinko

Preface

Thank you for the purchase of our ON/OFF SERVO Digital Indicating Controller ACD-15A or ACR-15A. This manual contains instructions for the mounting, functions, operations and notes when operating the ACD-15A or ACR-15A. To prevent accidents arising from the misuse of this controller, please ensure the operator receives this manual.

Notes
• This instrument should be used in accordance with the specifications described in the manual. If it is not used according to the specifications, it may malfunction or cause a fire.
• Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
• Specifications of the instrument and the contents of this instruction manual are subject to change without notice.
• Care has been taken to ensure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform our sales department.
• This instrument is designed to be installed through 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 result in serious consequences, 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 electrical shock or fire, only Shinko or other qualified service personnel may handle the inner assembly.
• To prevent an electrical 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 protective equipment against excessive temperature rise, etc. must be installed, as malfunction of this product could result in serious damage to the system or injury to personnel. Proper periodic maintenance is also 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, chemicals or the vapors of these substances can come into direct contact with the unit
• Take note that the ambient temperature of this unit – not the ambient temperature of the control panel – must not exceed 50℃ (122℉) if mounted through the face of a control panel. Otherwise the life of electronic components (especially electrolytic capacitors) may be shortened.

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

2. Wiring Precautions

⚠ Caution

• Do not leave wire remnants in the instrument, because they could cause a fire and/or malfunction.
• Use a solderless terminal with an insulation sleeve in which the M3 screw fits when wiring the instrument.
• 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 using the specified torque. If excessive force is applied to the screw when tightening, the terminal screw or case may be damaged.
• This instrument does not have a built-in power switch, circuit breaker and fuse.
  Be sure to install a power switch, circuit breaker and fuse near the controller.
  (Recommended fuse: Time-lag fuse, rated voltage 250 V AC, rated current 2 A)
• For a 24 V AC/DC power source, do not confuse polarity when using direct current (DC).
• 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.
• Use a thermocouple and compensating lead wire according to the sensor input specifications of this controller.
• Use the 3-wire RTD according to the sensor input specifications of this controller.
• For voltage input, (+) side input terminal number differs depending on its range as follows.
  (+) side input terminal number of 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC: 16
  (+) side input terminal number of 0 to 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 0 to 1 V DC: 18
• Externally use a relay according to the capacity of the load to protect the built-in relay contact.
• When wiring, keep input wires (thermocouple, RTD, etc.) away from AC sources or load wires.

3. Operation and Maintenance Precautions

⚠ Caution

- It is recommended that auto-tuning (AT) be performed during the trial run.
- Do not touch live terminals. This may cause electrical 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 electrical 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, be careful not to put pressure on, scratch or strike it with a hard object.

Abbreviations used in this manual

Abbreviation	Term
PV	Process variable
SV	Desired value
MV	Manipulated variable
DV	Deviation
AT	Auto-tuning

Characters used in this manual:

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

CONTENTS

1. Model

1.1 Model

ACD-1 5 A - R / M □, □□□	ACD-15A (W96 x H96 x D100 mm)		
ACR-1 5 A - R / M □, □□□	ACR-15A (W48 x H96 x D100 mm)		
Control action	5		ON/OFF SERVO PID		
Event output EVT1	A		Selectable by front keypad (*1)		
Control output	R		Relay contact: 1a x 2 (Open/Closed)		
Input	M		Multi-range (*2)		
Power supply voltage			100 to 240 V AC (standard)		
		1	24 V AC/DC (*3)		
Options (Multiple options selectable)			EI	Event input	
			A5	Event output (EVT4, EVT5)	
			C	RS-232C	Serial communication
			C5	RS-485	
			EA1	4-20 mA DC	External setting input
			EA2	0-20 mA DC	
			EV1	0-1 V DC	
			EV2	1-5 V DC	
			TA1	4-20 mA DC	Transmission output
			TV1	0-1 V DC	

(*1) 13 types of alarm action (including No event) and Energized/De-energized, Timer output, Loop break alarm output, Time signal output, Output during AT or Pattern end output can be selected by front keypad.

(*2) An input type can be selected by front keypad from; Thermocouple, RTD, Direct current and DC voltage.

(*3) Power supply voltage 100 to 240 V AC is standard. When ordering 24 V AC/DC, enter "1" after the input code.

1.2 How to Read the Model Label

The model label is attached to the left side of the case.


```
ACD-15A-R/M

MULTI-RANGE
OUTPUT:3A 250V AC
100to240V AC 50/60Hz 16VA
AMB.TEMP. 0to50°C
SERIAL No.198F05000

SHINKO TECHNOS CO., LTD.
MADE IN JAPAN   RoHS SF
```
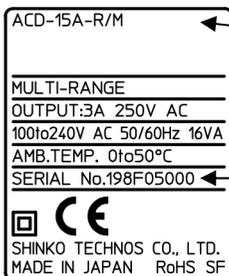
Model, Power supply voltage ("1" is entered for 24 V AC/DC), Option

Serial number

(e.g.) Relay contact output/Multi-range input

(Fig. 1.2-1)

2. Names and Functions
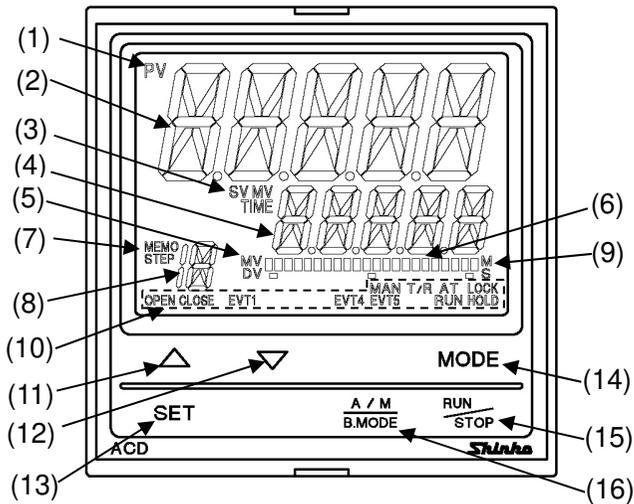
ACD-15A   **ACR-15A**
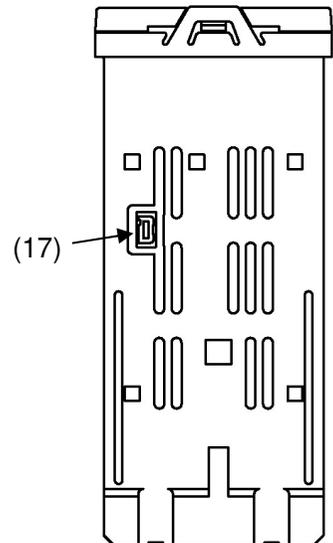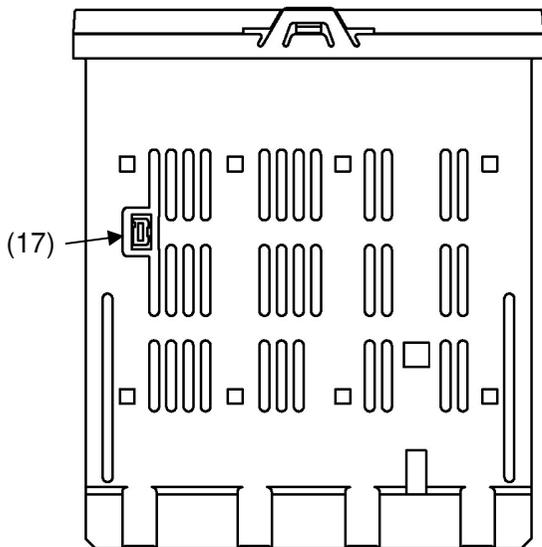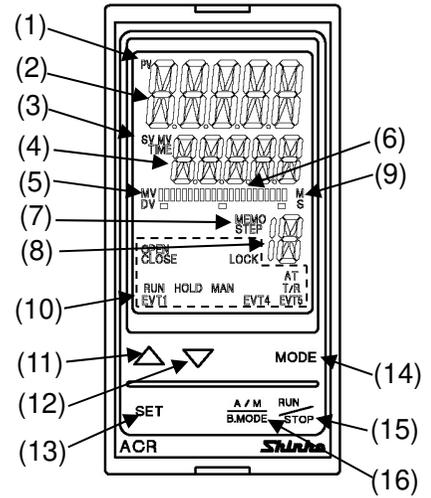
(Fig. 2-1)

Displays

(1) PV indicator

Lights when PV is indicated in PV/SV Display Mode.

(2) PV Display

Indicates the PV or setting characters in the setting mode.

(3) SV/MV/TIME indicator

SV: Lights when SV is indicated in PV/SV Display Mode.

MV: Lights when MV is indicated in PV/SV Display Mode.

TIME: Lights when remaining step time (program control) is indicated in PV/SV
        Display Mode.

(4) SV/MV/TIME Display

Indicates the SV, MV, remaining step time (program control) or set values in each
setting mode.

8

(5) MV/DV indicator

MV: Lights when MV or degree of valve opening is indicated on the bar graph.

DV: Lights when DV is indicated on the bar graph.

(6) MV/DV/Valve Bar Graph Display

MV, DV or degree of valve opening is indicated on the bar graph.

(7) MEMO/STEP indicator

MEMO : Lights when a Set value memory number is indicated.

STEP: Lights when a step number is indicated during program control.

Flashes during Wait action.

(8) MEMO/STEP Display

Indicates the Set value memory number or step number (program control).

(9) M/S indicator

M: Lights when step time unit "Hours:Minutes" is selected in the program control.

S: Lights when step time unit "Minutes:Seconds" is selected in the program control.

(10) Action indicators

OPEN: Lights when OPEN output is ON.

CLOSED: Lights when CLOSED output is ON.

EVT1: Lights when EVT1 (Event 1) is ON.

EVT4: Lights when EVT4 (Event 4) is ON.

EVT5: Lights when EVT5 (Event 5) is ON.

MAN: Lights during manual control.

T/R: Lights during Serial communication (C, C5 option) [TX (transmitting) output].

AT: Flashes while AT (auto-tuning) or auto-reset is performing.

LOCK: Lights when Set value Lock 1, Lock 2, Lock 3 or Lock 4 is selected.

RUN: Lights while program control is running.

HOLD: Flashes while program control is on hold (suspended).

Key operations

(11) △ **UP key**: Increases the numeric value.

If this key is pressed for 1 second during program operation (RUN), the unit proceeds to the next step. (This is the Advance function.)

(12) ▽ **DOWN key**: Decreases the numeric value.

(13) SET key

Switches setting groups.

Switches step numbers in the Program group.

Switches Set value memory numbers in the 'SV, Event group'.

Switches block numbers in the PID group.

(14) MODE key

Selects the setting mode, and registers the set value.

(15) RUN/STOP key

For Fixed value control, PV/SV Display Mode or standby mode can be
switched by pressing this key for 1 second.
In the standby mode, pressing this key turns all outputs OFF as when the
power supply is turned off.

In the program mode, control RUNS/STOPS.
In the standby mode, pressing this key RUNS program control.
Program control STOPS by pressing this key for 1 second during program
operation (RUN).

(16) A/M, B.MODE key

Switches Auto/Manual control.
If this key is pressed during the setting mode, the unit reverts to the previous
group or mode.

Case

(17) Console connector

By connecting to the USB communication cable (CMB-001, sold separately),
the following operations can be conducted from an external computer using
the Console software SWS-AC001M.
• Reading and setting of SV, PID and various set values
• Reading of PV and action status
• Function change

3. Mounting to the Control Panel

3.1 External Dimensions (Scale: mm)

ACD-15A

Gasket A

Screw type mounting bracket

Terminal cover (Sold separately)

□96

11.5   98.5

□91   106.2

104.5 (When terminal cover is used)

(Fig. 3.1-1)

ACR-15A

Gasket A

Screw type mounting bracket

Terminal cover (Sold separately)

48

96

11.5   98.5

91   106.2

104.5 (When terminal cover is used)
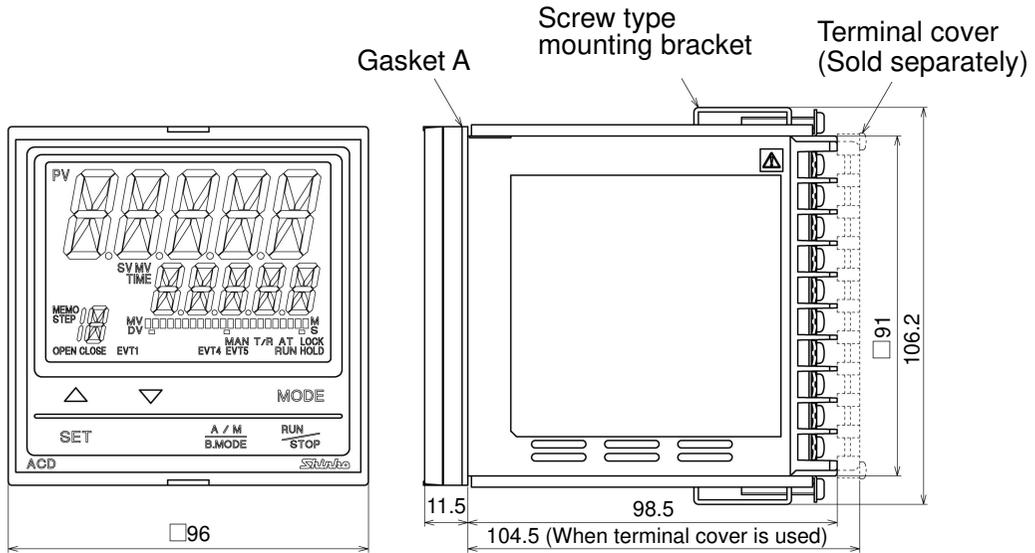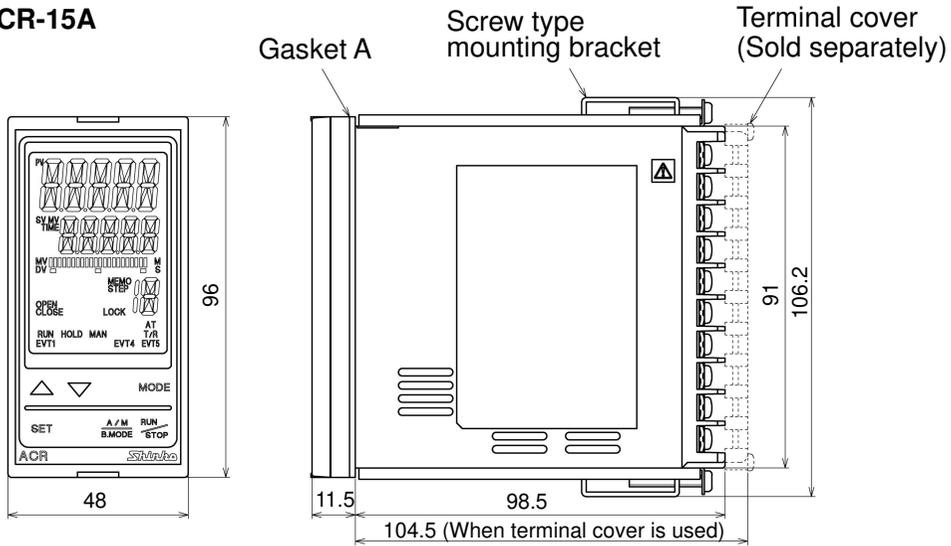
(Fig. 3.1-2)

3.2 Panel Cutout (Scale: mm)

> ⚠ **Caution**
>
> If horizontal close mounting is used for the controller, IP66 specification (Drip-proof/ Dust-proof) may be compromised, and all warranties will be invalidated.

ACD-15A

$n \times 96\text{-}3^{+0.5}_{0}$

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

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

130

Horizontal close mounting
n: Number of mounted units

(Fig. 3.2-1)

ACR-15A

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

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

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

130

Horizontal close mounting
n: Number of mounted units
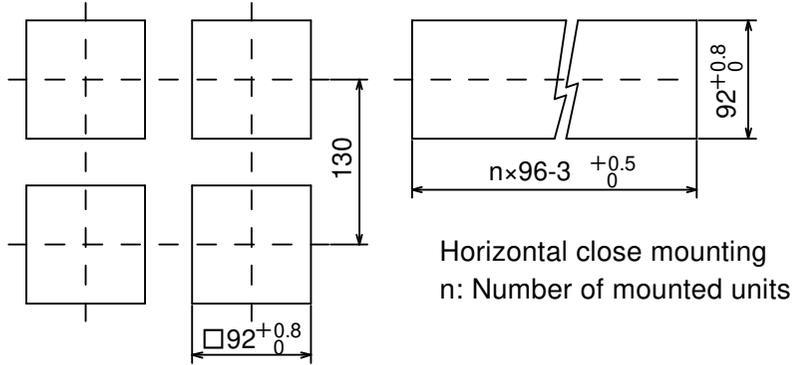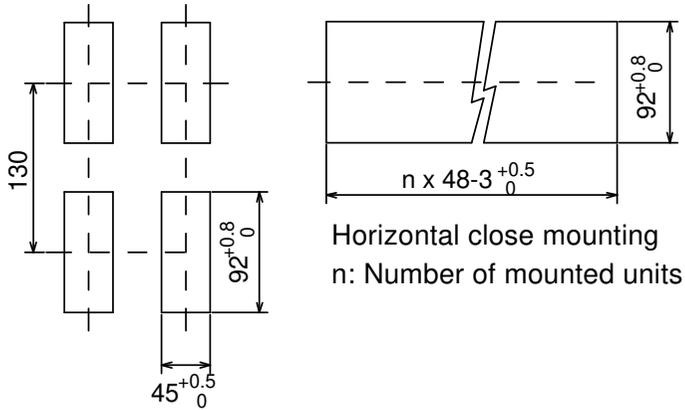
(Fig. 3.2-2)

3.3 Mounting to, and Removal from, the Control Panel (Common to ACD-15A, ACR-15A)

⚠ Caution

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

How to mount the unit

Mount the controller vertically to the flat, rigid panel to ensure it adheres to the Drip-proof/Dust-proof specification (IP66).

Mountable panel thickness: 1 to 8 mm

(1) Insert the controller from the front side of the panel.

(2) Attach the mounting brackets by the holes at the top and bottom of the case, and secure the controller in place with the screws.

How to remove the unit

(1) Turn the power to the unit OFF, and disconnect all wires before removing the unit.

(2) Loosen the screws of the mounting brackets, and remove the mounting brackets.

(3) Pull the unit out from the front of the panel.

UP

(Fig.3.3-1)

13
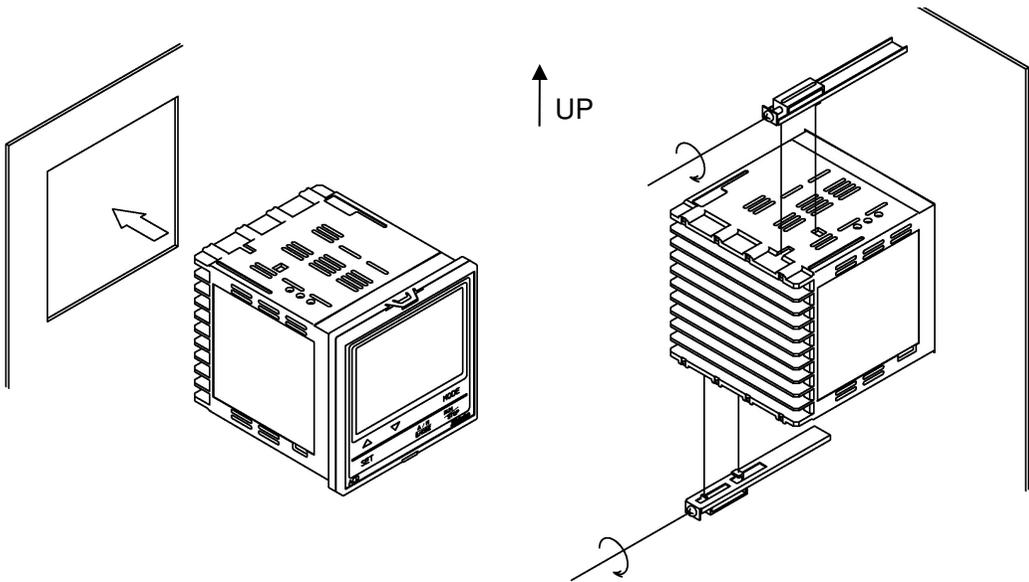
4. Wiring

⚠ 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 electrical shock.

4.1 Terminal Arrangement

ACD-15A

(Fig. 4.1-1)

ACR-15A

(Fig. 4.1-2)

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GND	Ground
POWER SUPPLY	Power supply voltage 100-240 V AC or 24 V AC/DC
	For a 24 V AC/DC power source, do not confuse polarity when using direct current (DC).
OPEN	Open output
CLOSED	Closed output
EVT1	EVT1 output
EVENT INPUT	Event input (EI option)
RS-485/RS-232C	Serial communication RS-485(C5 option) or RS-232C(C option)
TC	Thermocouple input
RTD	RTD input
DC	DC voltage, current inputs
	(+) side input terminal number of 0 to 5 V DC, 1 to 5V DC, 0 to 10 V DC: 16
	(+) side input terminal number of 0 to 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 0 to 1 V DC: 18
TRANSMIT OUTPUT	Transmission output (T□□ option)
EXT CONT	External setting input (E□□ option)
F.B.P	Feedback potentiometer input
EVT4	EVT4 output (A5 option)
EVT5	EVT5 output (A5 option)

4.2 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 0.63 N·m.

Solderless Terminal	Manufacturer	Model	Tightening Torque
Y-type	Nichifu Terminal Industries CO.,LTD.	TMEV1.25Y-3	0.63 N•m
	Japan Solderless Terminal MFG CO.,LTD.	VD1.25-B3A	
Ring-type	Nichifu Terminal Industries CO.,LTD.	TMEV1.25-3	
	Japan Solderless Terminal MFG CO.,LTD.	V1.25-3	
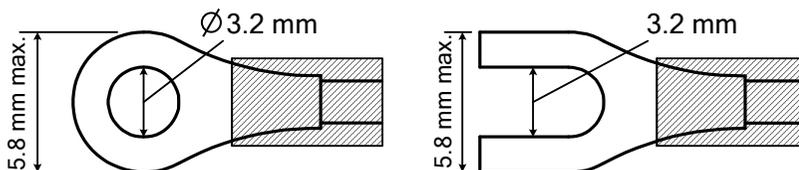
(Fig. 4.2-1)

4.3 Wiring Example
ACD-15A-R/M

Single phase 200 V
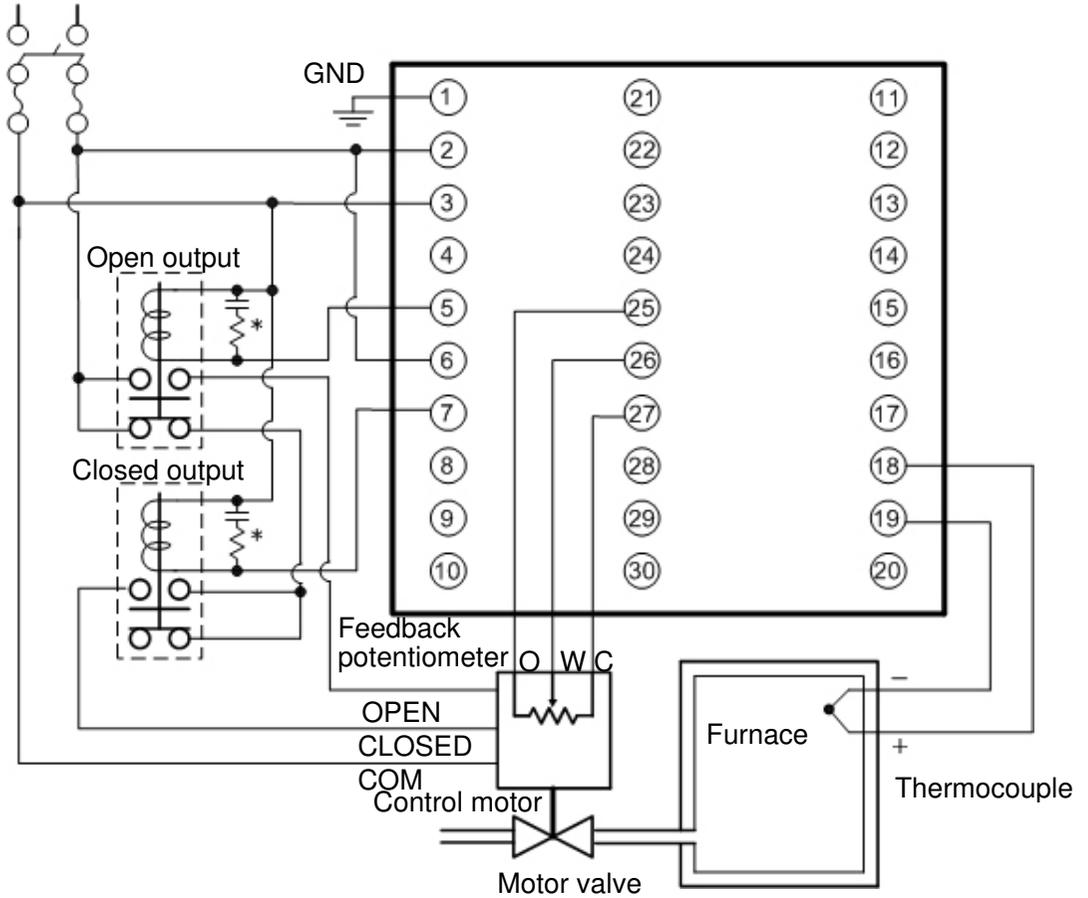
* To prevent the unit from harmful effects of unexpected high level noise, it is recommended that a surge absorber be installed between the electromagnetic switch coils.

(Fig. 4.3-1)

5. Outline of Key Operation and Setting Groups

There are 2 setting methods for this controller; Simplified setting (traditional setting method), Group selection. For each setting method, refer to page 18 and those which follow it.
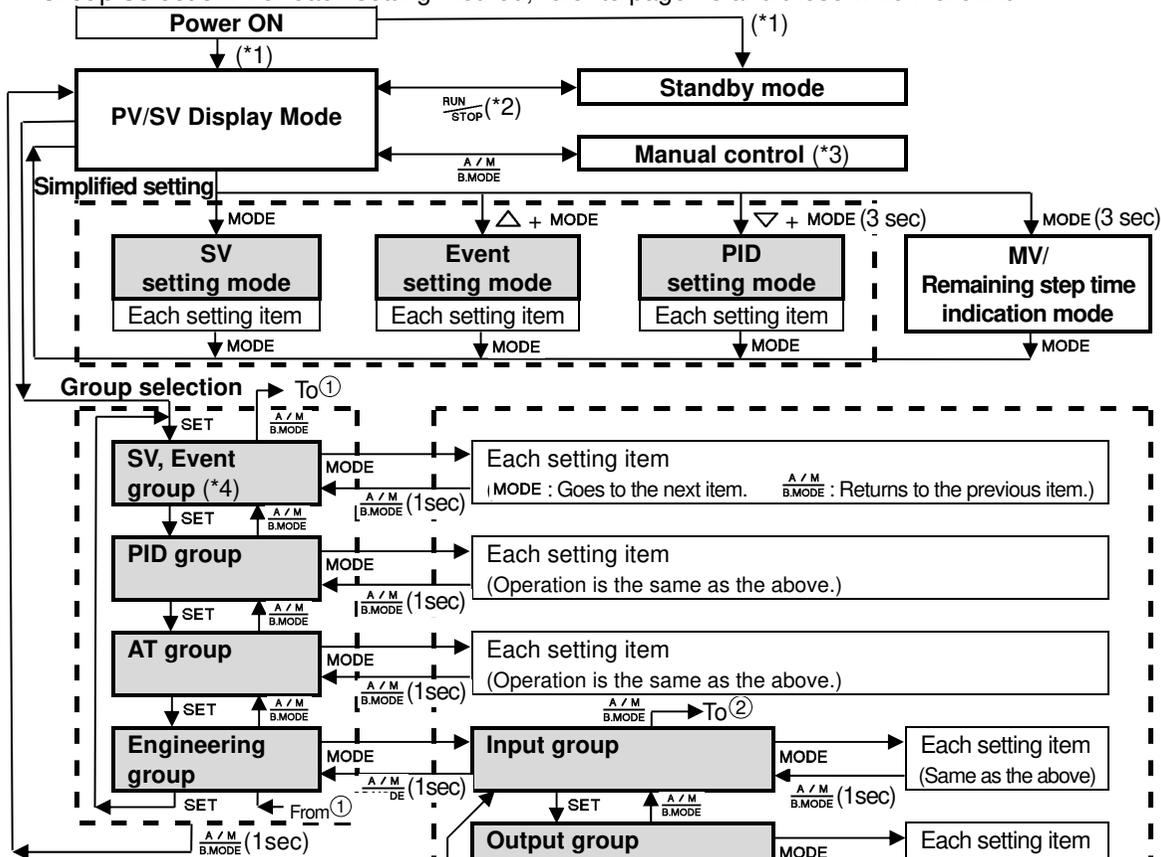
- If the Mode key is pressed for 3 seconds at any setting mode, the unit reverts to PV/SV Display Mode.
- **(*1)** The unit starts from the power-off status.
- **(*2)** For fixed value control, if this key is pressed for 1 second, PV/SV Display Mode and standby mode can be switched. For program control, this key runs/stops the control.
- **(*3)** If power is turned off during manual control, the unit starts from PV/SV Display Mode. Settings with Group selection method is possible during the manual control. After settings, are complete, the unit starts from the manual control.
- **(*4)** During program control, this will be Program Pattern group.
- **(*5)** If option is not added, relevant setting groups will not be displayed.

6. Operation Flowchart

Simplified setting and group selection are explained separately.
All setting items are used for the purpose of explanation, however some items will not be indicated depending on the specification.

6.1 Simplified Setting (SV, Event and PID setting modes: Effective for Fixed value control)

```
┌─────────────────┐                                    (*1)
│    Power ON      │────────────────────────────┐
└─────────────────┘                             │
         │ (*1)                                 ▼
         ▼                          ┌─────────────────────────┐
┌─────────────────┐    RUN/STOP(*2) │      Standby mode        │
│ PV/SV Display    │◄──────────────►└─────────────────────────┘
│ Mode             │                             │
│      25          │      A/M        ┌─────────────────────────┐
│       0          │◄──────────────►│   Manual control (*3)    │
└─────────────────┘    B.MODE       └─────────────────────────┘
```

↓ MODE	△ + MODE	▽ + MODE (3 sec)	MODE (3 sec)
SV setting mode (*4)	**Event setting mode (*4)**	**PID setting mode (*5)**	**MV/ Remaining step time indication mode**
`5` SV1 `0`	`A1` EVT1 alarm value `0`	`P` Proportional band `10`	`25` MV indication `1000`
	↓ MODE	↓ MODE	↓ MODE
↑ MODE	`A1H` EVT1 high limit alarm value `0`	`I` Integral time `200`	`25` Remaining step time indication `00.15` (program control)
	↓ MODE	↓ MODE	MODE
	`A4` EVT4 alarm value `0`	`d` Derivative time `50`	
	↓ MODE	↓ MODE	
	`A4H` EVT4 high limit alarm value `0`	`ARW` ARW `50`	
	↓ MODE	↓ MODE	
	`A5` EVT5 alarm value `0`	`R5Er` Manual reset `00`	
	↓ MODE	↓ MODE	
	`A5H` EVT5 high limit alarm value `0`	`oRAr` MV rate-of-change `0`	
	MODE	MODE	

(*1) The unit starts from the power-off status.

(*2) For fixed value control, if this key is pressed for 1 sec, the PV/SV Display Mode and standby mode can be switched.

(*3) If power is turned OFF during manual control, the unit starts from PV/SV Display Mode.

(*4) If 'Set value memory' is selected in [Event input allocation], only the setting items of the Set value memory number (selected by terminal connection) can be set. To select other memory numbers, connect relevant terminals again.

(*5) If PID zone function "Used" is selected, the settable PID zone parameters depend on the SV.

[Key operation]

- ↓ MODE : This means that if the MODE key is pressed, the unit proceeds to the next setting mode.
- △ + MODE : Press the △ key and MODE key (in that order) together.
- ▽ + MODE : Press the ▽ key and MODE key (in that order) together.
- MODE (3 sec) : Press the MODE key for 3 seconds.

[Setting item]

• The PV Display indicates setting characters, and the SV/MV/TIME Display indicates the factory default.

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

6.2 Group Selection (for Fixed Value Control)

Power ON

(*1)

(*1)

PV/SV Display Mode

$\overset{RUN}{\underset{STOP}{}}$(*2)

Standby mode

$\dfrac{A/M}{B.MODE}$

Manual control (*3)

$\dfrac{A/M}{B.MODE}$ (1 sec)

SET

SET · SET · SET · SET

| `G_S` | **SV, Event group** | `G_PId` | **PID group** | `G_AT` | **AT group** | `G_ENG` | **Engineering group** |

① ①

$\dfrac{A/M}{B.MODE}$ MODE · $\dfrac{A/M}{B.MODE}$ MODE · $\dfrac{A/M}{B.MODE}$ MODE · $\dfrac{A/M}{B.MODE}$ MODE

$\dfrac{A/M}{B.MODE}$ (1 sec) · $\dfrac{A/M}{B.MODE}$ (1 sec) · $\dfrac{A/M}{B.MODE}$ (1 sec)

②

SET

| `S` | SV1 | `ZV` | PID zone value 1 | `AT` | AT/Auto-reset | `E_INP` | **Input group** |

③ ④

| `A1` | EVT1 alarm value 1 | `P` | Proportional band 1 | `AT_b` | AT bias |

$\dfrac{A/M}{B.MODE}$ (1sec)

| `A1H` | EVT1 high limit alarm value 1 | `I` | Integral time 1 | `SENS` | Input type |

| `A4` | EVT4 alarm value 1 | `d` | Derivative time 1 | `SCLH` | Scaling high limit |

| `A4H` | EVT4 high limit alarm value 1 | `ARW` | ARW 1 | `SCLL` | Scaling low limit |

| `A5` | EVT5 alarm value 1 | `RSET` | Manual reset 1 | `dP` | Decimal point place |

| `A5H` | EVT5 high limit alarm value 1 | `oRAT` | MV rate-of-change 1 | `FILT` | PV filter time constant |

| | | | | `So` | Sensor correction |

If 'Set value memory' is selected in [Event input allocation], settings for the selected memory numbers are possible.
If 'Set value memory' is selected for EVI1 and EVI2, the Set value memory numbers will be 1 to 4.
(See '9.7 Set Value Memory Function' on p.72.)

Block 1 consists of the above items. Repeat the above settings up to Block 5.

| `oRAT` | MV rate-of-change 5 |

(*1) The unit starts from the power-off status.

(*2) For Fixed value control, if this key is pressed for 1 second, PV/SV Display Mode and standby mode can be switched.

(*3) If power is turned off during manual control, the unit starts from PV/SV Display Mode.
Settings using the Group selection method are possible. After settings are complete, the unit starts from the manual control.

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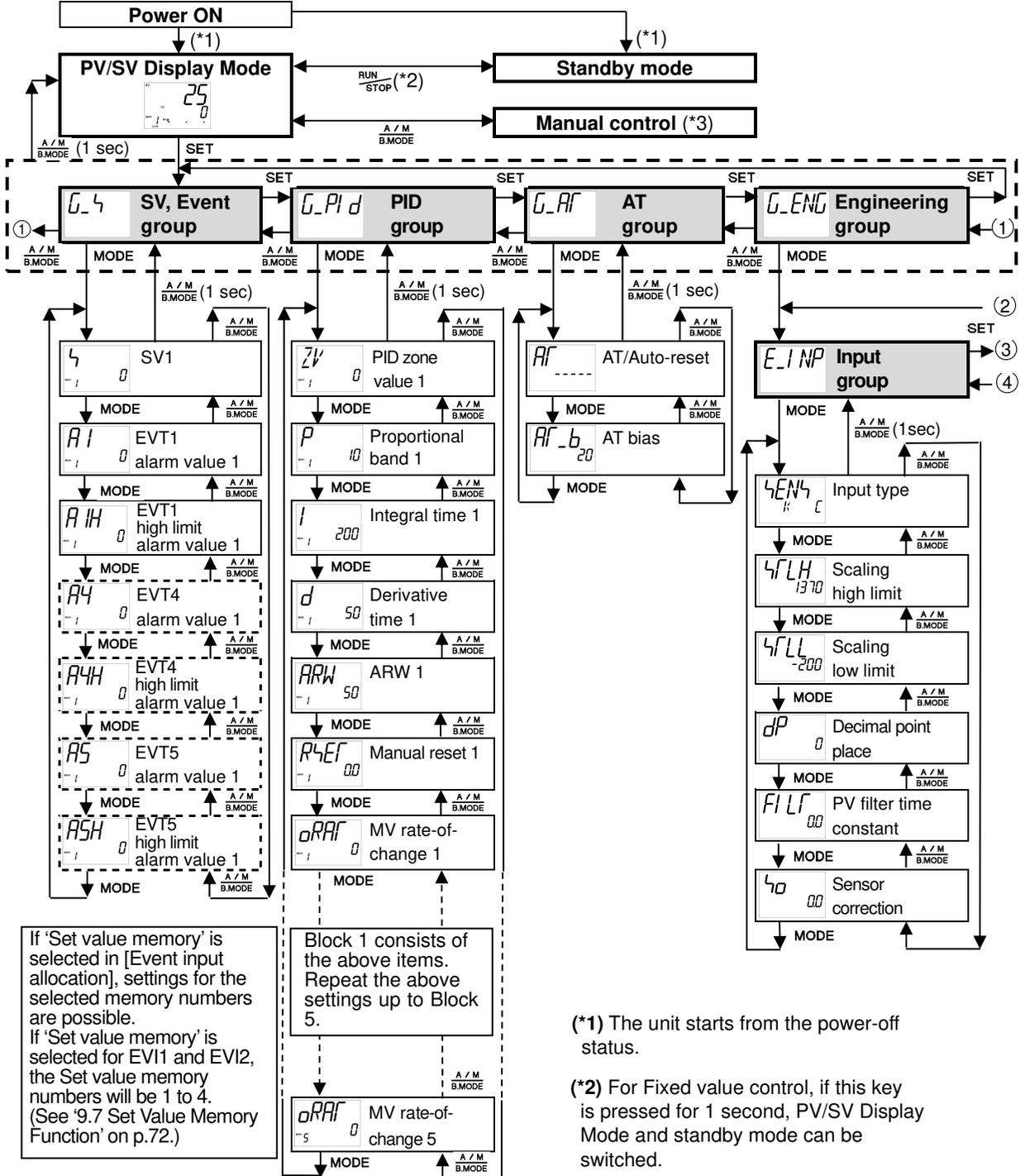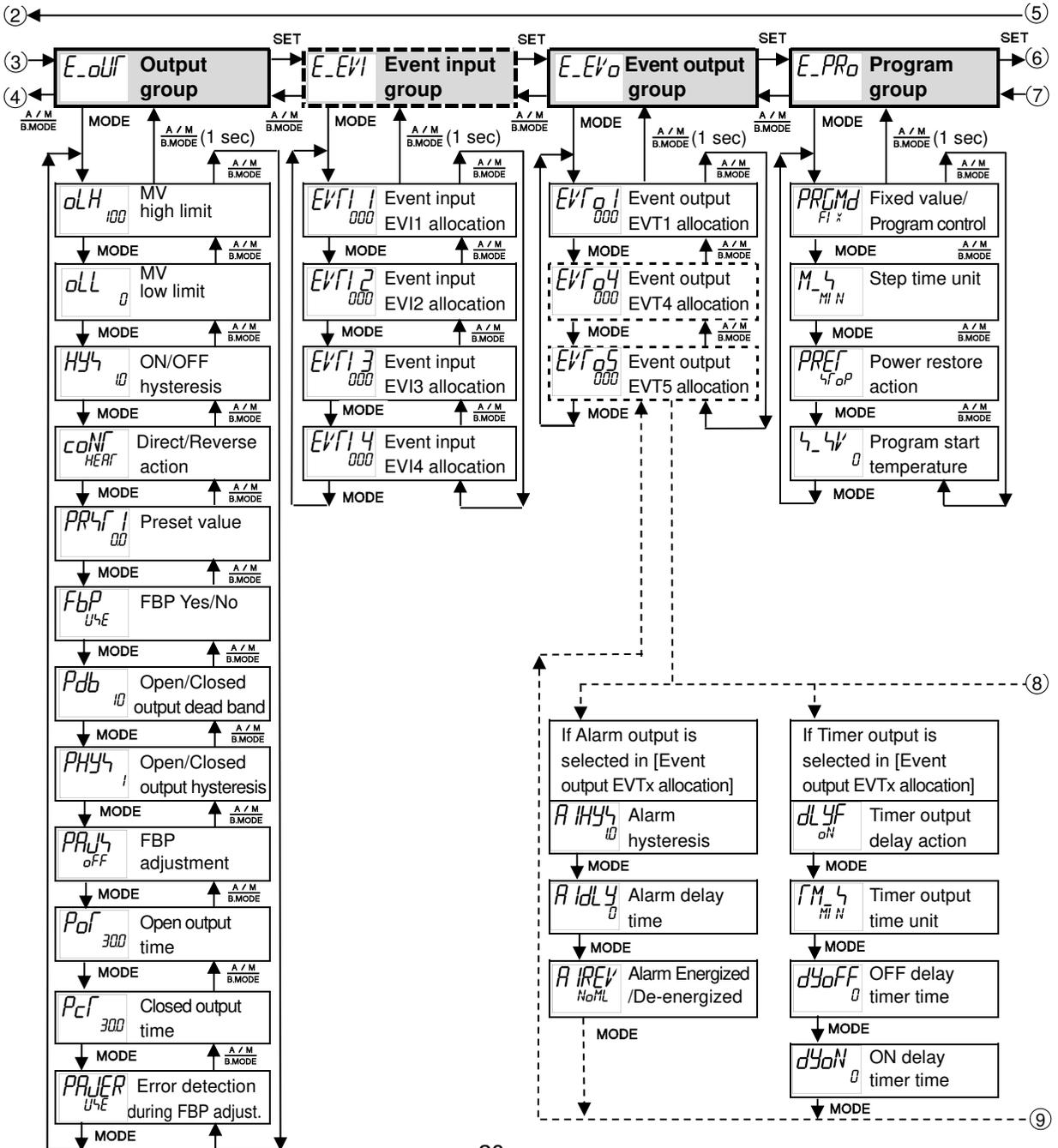**[Key operation]**

- ↓MODE : This means that if the MODE key is pressed, the unit proceeds to the next setting mode.
- Pressing the A/M B.MODE key for 1 second reverts to the previous setting level.
- If the MODE key is pressed for 3 seconds at any group or setting item, the unit reverts to PV/SV Display Mode.

[Setting item]

- The PV Display indicates setting characters, and the SV/MV/TIME Display indicates factory default.
- Setting items with dotted lines are optional, and they appear only when the corresponding option is ordered.

Abbreviation: Adjust: Adjustment

⑤◄

⑥► | E_coM **Communication group** | SET ► | E_EXT **External setting group** | SET ► | E_TRA **Transmission output group** | SET ► | E_oTH **Other function group** | SET ►
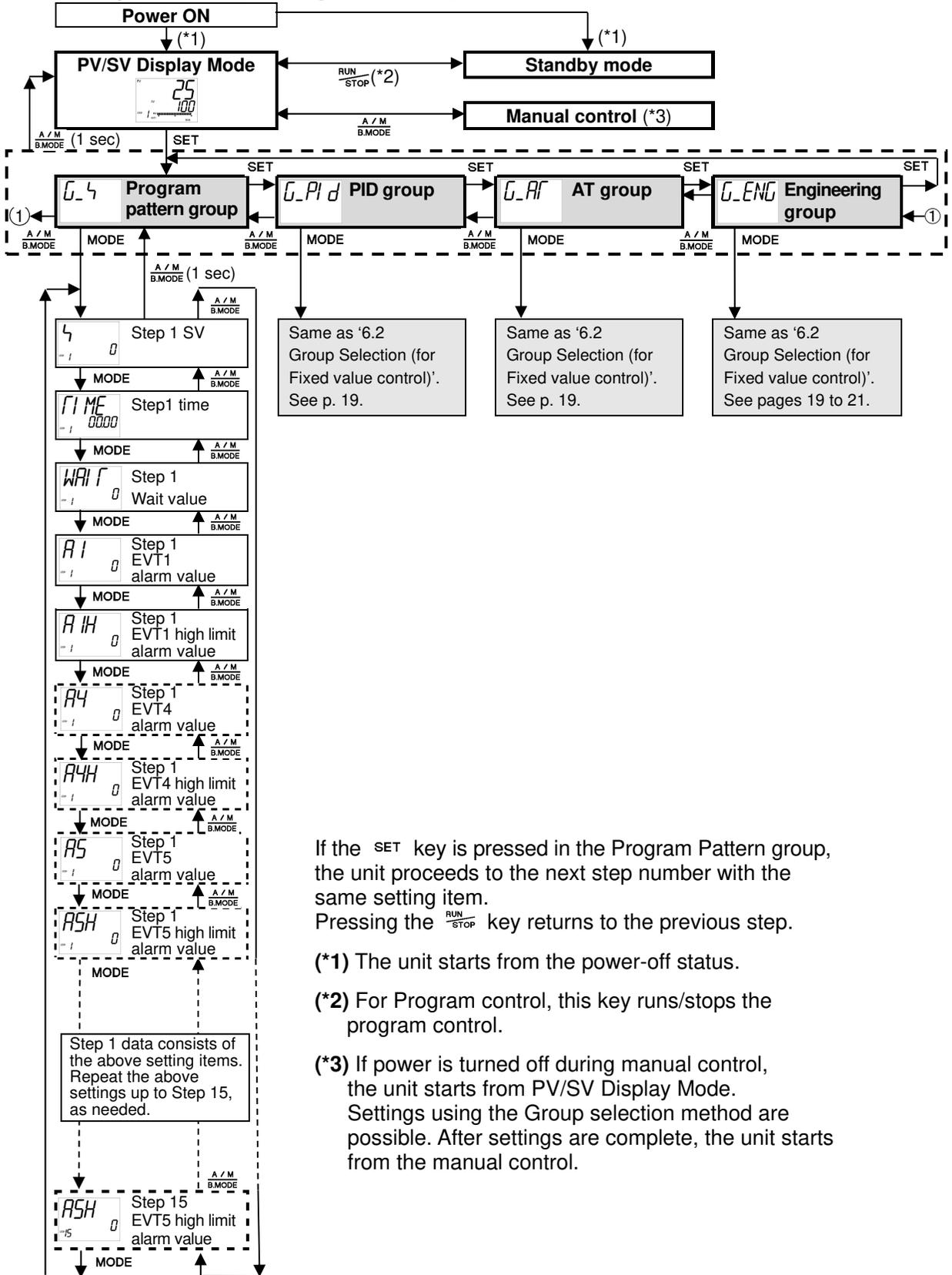
⑦◄

A/M B.MODE   MODE   A/M B.MODE (1 sec)   A/M B.MODE   MODE   A/M B.MODE (1 sec)   A/M B.MODE   MODE   A/M B.MODE (1 sec)   A/M B.MODE   MODE   A/M B.MODE (1 sec)   A/M B.MODE

cMSL NoML	Communication protocol
cMNo 0	Instrument number
cMSP 96	Communication speed
cMFT 7EVN	Data bit/Parity
SToP 1	Stop bit
SV_b 0	SVTC bias

REMoT LocAL	Remote/Local
RTLH 1370	External setting input high limit
RTLL -200	External setting input low limit
RT_b 0	Remote bias

TRoY PV	Transmission output type
TRLH 1370	Transmission output high limit
TRLL -200	Transmission output low limit

LocK -----	Set value lock
PI dZN NoNE	PID zone function
RATU 0	SV rise rate
RATd 0	SV fall rate
PSV oFF	Indication when output OFF
bKLT ALL	Backlight selection
coLR REd	PV color
cLRG 50	PV color range
dPTM 0	Backlight time
bARSL MV	Bar graph
dVWI d 1	Deviation unit

MODE A/M B.MODE (between each of the above items)

⑧------

| If Loop break alarm output is selected in [Event output EVTx allocation] | If Time signal output is selected in [Event output EVTx allocation] |

| LP_T 0 | Loop break alarm time |
| LP_H 0 | Loop break alarm band |

TS_No 1	Time signal output step
TS_oF 0000	Time signal output OFF time
TS_oN 0000	Time signal output ON time

⑨------

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6.3 Group Selection (for Program Control)

```
                    ┌──────────────────────┐
                    │      Power ON        │────────────────────────┐
                    └──────────────────────┘                        │
                        (*1)                              (*1)       │
         ┌──────────────────────────┐   RUN        ┌──────────────────────────┐
         │   PV/SV Display Mode      │◄──STOP(*2)──►│      Standby mode        │
         │         25                │               └──────────────────────────┘
         │      100                  │   A/M        ┌──────────────────────────┐
         └──────────────────────────┘◄──B.MODE────►│   Manual control (*3)    │
         A/M  (1 sec)    SET                        └──────────────────────────┘
         B.MODE
```

If the **SET** key is pressed in the Program Pattern group, the unit proceeds to the next step number with the same setting item.
Pressing the **RUN/STOP** key returns to the previous step.

(*1) The unit starts from the power-off status.

(*2) For Program control, this key runs/stops the program control.

(*3) If power is turned off during manual control, the unit starts from PV/SV Display Mode. Settings using the Group selection method are possible. After settings are complete, the unit starts from the manual control.

Group row (SET between groups):

G_5 Program pattern group	G_PId PID group	G_AT AT group	G_ENG Engineering group

Program pattern group items:

Display	Description
5 / 0	Step 1 SV
TIME / 00.00	Step1 time
WAIT / 0	Step 1 Wait value
A1 / 0	Step 1 EVT1 alarm value
A1H / 0	Step 1 EVT1 high limit alarm value
A4 / 0	Step 1 EVT4 alarm value
A4H / 0	Step 1 EVT4 high limit alarm value
A5 / 0	Step 1 EVT5 alarm value
A5H / 0	Step 1 EVT5 high limit alarm value
A5H / 0 (-15)	Step 15 EVT5 high limit alarm value

Step 1 data consists of the above setting items. Repeat the above settings up to Step 15, as needed.

PID group / AT group / Engineering group:
Same as '6.2 Group Selection (for Fixed value control)'. See p. 19. (Engineering group: See pages 19 to 21.)

7. Setup

Factory default values of this controller:
Input type: K, -200 to 1370℃
Control action: PID control (with AT), Reverse (Heating) action
                FBP (Feedback potentiometer) Yes
Event output (EVT1): No event

Setup should occur before using this controller according to the user's conditions.
    Setting the input type, control action, Event output action, etc.
Setup is conducted in the Engineering group.

The Engineering group contains; Input group, Output group, Event input group, Event output group, Program group, Communication group, External setting group, Transmission output group and Other function group.

The control motor is connected to the actuator for this controller.
Select "FBP (Feedback potentiometer) Yes/No" in the Output group, and be sure to set the following. (Pages 30, 32)
• If "FBP Yes" is selected, perform the FBP adjustment.
  FBP specifications are shown below.
    Resolution: 1000 (Corresponds to Fully Open and Fully Closed after FBP adjustment.)
    Feedback resistance: 100 Ω to 10 kΩ
• If "FBP No" is selected, set the Open and Closed output time.

If the user's specification is the same as the factory default of the instrument, or if user's instrument has already been installed in a system after setup, it is not necessary to set up the controller.
Proceed to Section "8. Settings" (pp. 51 to 63).

Factory default values of the Engineering group
• **Input group (pages 27 to 29)**

Setting Item	Factory Default
Input type	K, -200 to 1370℃
Scaling high limit	1370℃
Scaling low limit	-200℃
Decimal point place	No decimal point
PV filter time constant	0.0 seconds
Sensor correction	0.0℃

• **Output group (pages 30 to 31)**

Setting Item	Factory Default
MV high limit	100%
MV low limit	0%
ON/OFF hysteresis	1.0℃
Direct/Reverse action	Reverse action
Preset output	0.0%
FBP Yes/No	Yes
Open/Closed output dead band	10%
Open/Closed output hysteresis	1%
FBP adjustment	Stop
Open output time	30.0 seconds
Closed output time	30.0 seconds
Error detection during FBP adjustment	Error detection Yes

• **Event input group (EI option) (pages 32 to 33)**

Setting Item	Factory Default
Event input EVI1 allocation	No event
Event input EVI2 allocation	No event
Event input EVI3 allocation	No event
Event input EVI4 allocation	No event

• **Event output group (pages 34 to 40)**

Setting Item	Factory Default
Event output EVT1 allocation	No event
Event output EVT4 allocation (A5 option)	No event
Event output EVT5 allocation (A5 option)	No event

• **Program group (p. 41)**

Setting Item	Factory Default
Fixed value control/Program control	Fixed value control
Step time unit	Hours:Minutes
Power restore action	Stops after power is restored.
Program start temperature	0℃

• **Communication group (C or C5 option) (p. 42)**

Setting Item	Factory Default
Communication protocol	Shinko protocol
Instrument number	0
Communication speed	9600 bps
Data bit/Parity	7 bits/Even
Stop bit	1
SVTC bias	0℃

• **External setting group (EA☐ or EV☐ option) (p. 43)**

Setting Item	Factory Default
Remote/Local	Local
External setting input high limit	1370℃
External setting input low limit	-200℃
Remote bias	0℃

• **Transmission output group (TA1 or TV1 option) (p. 44)**

Setting Item	Factory Default
Transmission output type	PV transmission
Transmission output high limit	1370℃
Transmission output low limit	-200℃

• **Other function group (pages 45-50)**

Setting Item	Factory Default
Set value lock	Unlock
PID zone function	Not used
SV rise rate	0 ℃/minute
SV fall rate	0 ℃/minute
Indication when output OFF	OFF indication
Backlight selection	All are backlit.
PV color	Red
PV color range	5.0℃
Backlight time	0 minutes
Bar graph	MV indication
Deviation unit	1℃

7.1 Turn the Power Supply to the Unit ON.

After the power is turned on, the PV Display indicates the input type, and the SV/MV/TIME display indicates the input range high limit value (thermocouple, RTD inputs) or scaling high limit value (DC voltage, current inputs) for approximately 3 seconds. (Table 7.1-1)

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

Control will then start, indicating the PV on the PV Display and SV on the SV/MV/TIME Display.

While the control output OFF function is working, the PV Display indicates $oFF\square$.

(Indication depends on the selection in [Indication when output OFF].)

(Table 7.1-1)

Sensor Input	℃		℉	
	PV Display	SV/MV/TIME Display	PV Display	SV/MV/TIME Display
K	K□□□℃	□1370	K□□□℉	□2498
	K□□.℃	□400.0	K□□.℉	□752.0
J	J□□□℃	□1000	J□□□℉	□1832
R	R□□□℃	□1760	R□□□℉	□3200
S	5□□□℃	□1760	5□□□℉	□3200
B	b□□□℃	□1820	b□□□℉	□3308
E	E□□□℃	□□800	E□□□℉	□1472
T	r□□.℃	□400.0	r□□.℉	□752.0
N	N□□□℃	□1300	N□□□℉	□2372
PL-Ⅱ	PL2□℃	□1390	PL2□℉	□2534
C(W/Re5-26)	c□□□℃	□2315	c□□□℉	□4199
Pt100	Pr□□.℃	□850.0	Pr□□.℉	1562.0
JPt100	JPr□.℃	□500.0	JPr□.℉	□932.0
Pt100	Pr□□℃	□□850	Pr□□℉	□1562
JPt100	JPr□℃	□□500	JPr□℉	□□932
Pt100	Pr1□.℃	□100.0	Pr2□.℉	□212.0
Pt100	Pr5□.℃	□500.0	Pr9□.℉	□932.0
4 to 20 mA DC	420MA	Scaling high limit value		
0 to 20 mA DC	020MA			
0 to 10 mV DC	□10MV			
-10 to 10 mV DC	-10MV			
0 to 50 mV DC	□50MV			
0 to 100 mV DC	100MV			
0 to 1 V DC	0□1□V			
0 to 5 V DC	0□5□V			
1 to 5 V DC	1□5□V			
0 to 10 V DC	0 10□V			

7.2 Basic Operation of Settings

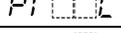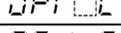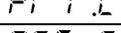To proceed to each setting mode, refer to each setting mode.

- To set each setting item, use the △ or ▽ key.
- If the MODE key is pressed, the set value is registered, and the unit proceeds to the next setting item.

  If the MODE key is pressed at the last setting item, the unit proceeds to the first setting item.
- Pressing the A/M B.MODE key returns to the previous setting item.
- Pressing the A/M B.MODE key for 1 second returns to the previous setting level (returns from a setting item to each group).
- If the MODE key is pressed for 3 seconds at the setting group or item, the unit reverts to PV/SV Display Mode.
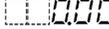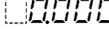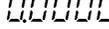
7.3 Engineering Group
7.3.1 Input Group
To enter the Input group, follow the procedure below.

(1) `G_ENG` Press the `SET` key 4 times in PV/SV Display Mode.
The unit will enter the Engineering group.

(2) `E_INP` Press the `MODE` key. The unit will proceed to the Input group.

(3) `SENS` Press the `MODE` key.
The unit will proceed to the 'Input type'.

Character	Name, Function, Setting Range	Factory Default
`SENS` `K` `C`	**Input type**	K (-200 to 1370℃)
	• The input type can be selected from thermocouple (10 types), RTD (2 types), Direct current (2 types) and DC voltage (8 types), and the unit ℃/℉ can be selected as well.	
	• If the input type is changed, scaling high and low limit also change to the high and low limit value of the altered input range.	
	• **When changing the input from DC voltage to other inputs, remove the sensor connected to this controller first, then change the input. (If the input is changed with the sensor connected, the input circuit may break.)**	
	• **With DC voltage input, the (+) side input terminal number differs as follows.**	
	(+) side input terminal number of 0 to 5 V DC, 1 to 5 V DC, 0-10 V DC: 16	
	(+) side input terminal number of 0 to 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 0 to 1 V DC: 18	
	• **Input types**	

Character	Type	Low		High	Unit
`K    C`	K	-200	to	1370	℃
`K   .C`	K	-200.0	to	400.0	℃
`J    C`	J	-200	to	1000	℃
`R    C`	R	0	to	1760	℃
`S    C`	S	0	to	1760	℃
`b    C`	B	0	to	1820	℃
`E    C`	E	-200	to	800	℃
`T   .C`	T	-200.0	to	400.0	℃
`N    C`	N	-200	to	1300	℃
`PL2  C`	PL-Ⅱ	0	to	1390	℃
`c    C`	C(W/Re5-26)	0	to	2315	℃
`Pt  .C`	Pt100	-200.0	to	850.0	℃
`JPt .C`	JPt100	-200.0	to	500.0	℃
`Pt   C`	Pt100	-200	to	850	℃
`JPt  C`	JPt100	-200	to	500	℃
`Pt1 .C`	Pt100	-100.0	to	100.0	℃
`Pt5 .C`	Pt100	-100.0	to	500.0	℃

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Character	Name, Function, Setting Range			Factory Default
K F	K	-328	to	2498 ℉
K .F	K	-328.0	to	752.0 ℉
J F	J	-328	to	1832 ℉
R F	R	32	to	3200 ℉
S F	S	32	to	3200 ℉
b F	B	32	to	3308 ℉
E F	E	-328	to	1472 ℉
T .F	T	-328.0	to	752.0 ℉
N F	N	-328	to	2372 ℉
PL2 F	PL-Ⅱ	32	to	2534 ℉
c F	C(W/Re5-26)	32	to	4199 ℉
Pt .F	Pt100	-328.0	to	1562.0 ℉
JPt .F	JPt100	-328.0	to	932.0 ℉
Pt F	Pt100	-328	to	1562 ℉
JPt F	JPt100	-328	to	932 ℉
Pt2 .F	Pt100	-148.0	to	212.0 ℉
Pt9 .F	Pt100	-148.0	to	932.0 ℉
420MA	4 to 20 mA DC	-2000	to	10000
020MA	0 to 20 mA DC	-2000	to	10000
10MV	0 to 10 mV DC	-2000	to	10000
- 10MV	-10 to 10 mV DC	-2000	to	10000
50MV	0 to 50 mV DC	-2000	to	10000
100MV	0 to 100 mV DC	-2000	to	10000
0 1V	0 to 1 V DC	-2000	to	10000
0 5V	0 to 5 V DC	-2000	to	10000
1 5V	1 to 5 V DC	-2000	to	10000
0 10V	0 to 10 V DC	-2000	to	10000

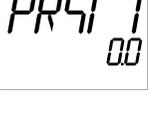| Character	Name, Function, Setting Range	Factory Default
SCLH 1370	**Scaling high limit (*)**	1370℃

	• Sets scaling high limit value.
	• Setting range: Scaling low limit value to input range high limit value
	  DC voltage, current inputs: -2000 to 10000 (The placement of the
	                                   decimal point follows the selection.)	

SCLL -200	**Scaling low limit (*)**	-200℃

	• Sets scaling low limit value.
	• Setting range: Input range low limit value to scaling high limit value
	  DC voltage, current inputs: -2000 to 10000 (The placement of the
	                                   decimal point follows the selection.)	

(*) In the case of DC voltage, current inputs, if Scaling high limit value< Scaling low limit value is set, PV scaling decrease/input increase is possible.

Character	Name, Function, Setting Range	Factory Default

dP 0	**Decimal point place**
	 • Selects decimal point place.
	   Available only for DC voltage and current inputs.
	 • ⬚⬚⬚⬚0 : No decimal point
	    ⬚⬚⬚0.0 : 1 digit after the decimal point
	    ⬚⬚0.00 : 2 digits after the decimal point
	    ⬚0.000 : 3 digits after the decimal point
	    0.0000 : 4 digits after the decimal point
		No decimal point

FILT 0.0	**PV filter time constant**
	 • Sets PV filter time constant.
	   If the value is set too large, it affects control result due to the delay of
	   response.
	 • Setting range: 0.0 to 100.0 seconds
		0.0 seconds

4o 0.0	**Sensor correction**
	 • Sets the correction value for the sensor.
	   This corrects the input value from the sensor. When a sensor cannot be
	   set at the exact location where control is desired, the sensor-measured
	   temperature may deviate from the temperature in the controlled location.
	   When using plural controllers, sometimes the measured temperatures 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)
	 • Setting range: -200.0 to 200.0℃ (℉)
	   DC voltage, current inputs: -2000 to 2000 (The placement of the
	                             decimal point follows the selection.)
		0.0℃

7.3.2 Output Group

To enter the Output group, follow the procedure below.

(1) `ᴳ_ENG` Press the `SET` key 4 times in PV/SV Display Mode.
The unit will enter the Engineering group.

(2) `E_INP` Press the `MODE` key. The unit will proceed to the Input group.

(3) `E_oUᴿ` Press the `SET` key. The unit will proceed to the Output group.

(4) `oLH ₁₀₀` Press the `MODE` key.
The unit will proceed to the 'MV high limit'.

Character	Name, Function, Setting Range	Factory Default
`oLH` `100`	**MV high limit** • Sets the MV high limit value. Not available for ON/OFF control • Setting range: MV low limit value to 100%	100%
`oLL` `0`	**MV low limit** • Sets the MV low limit value. Not available for ON/OFF control • Setting range: 0% to MV high limit value	0%
`HYႽ` `10`	**ON/OFF hysteresis** • Sets ON/OFF hysteresis. Available only for ON/OFF control • Setting range: 0.1 to 1000.0℃ (℉), DC voltage, current inputs: 1 to 10000 (The placement of the decimal point follows the selection.)	1.0℃
`coNᴿ` `HEAᴿ`	**Direct/Reverse action** • Selects either Reverse (Heating) or Direct (Cooling) control action. • `HEAᴿ☐` : Reverse (Heating) action `cooL☐` : Direct (Cooling) action	Reverse (Heating) action
`PRႽᴿ1` `0.0`	**Preset output** • If the Preset output 1 or 2 is selected in [Event input allocation], MV can be set. **Preset output 1**: Control is performed with the preset MV if sensor is burnt out during Event Input ON. **Preset output 2**: Control is performed with the preset MV when Event Input is ON. • Available only when EI option is added. • Setting range:0.0 to 100.0%	0.0%
`FbP` `USE`	**FBP Yes/No** • Selects FBP (feedback potentiometer) Yes or No. • `USE☐☐`: FBP Yes `NoNE☐`: FBP No	FBP Yes
`Pdb` `10`	**Open/Closed output dead band** • Sets Open/Closed output dead band. Not available if "FBP No" is selected in [FBP Yes/No]. • Setting range: 0 to 100%	10%

Character	Name, Function, Setting Range	Factory Default
$PHY5$ $_1$	**Open/Closed output hysteresis** • Sets Open/Closed output hysteresis. Not available if "FBP No" is selected in [FBP Yes/No]. • Setting range: 0 to 100%	1%

$PAY5$ oFF	**FBP adjustment**
	• Adjusts the position of FBP (feedback potentiometer) fully closed and fully open.
	  Not available if "FBP No" is selected in [FBP Yes/No].
	  When program control is selected, cannot be performed while the program is stopped.
	• $oFF\square$: FBP adjustment Stop
	  $AdJ5\Gamma$: FBP adjustment Perform
		Stop
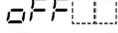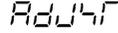
Note about FBP adjustment

• If 'Error detection Yes' is selected in [Error detection during FBP adjustment], and if one of the following occurs during FBP adjustment, the unit considers that errors have occurred.

The unit stops FBP adjustment, reverts to PV/SV Display Mode, and turns the control output OFF, indicating [$FbPER$] on the PV Display. To cancel error indication, press the **MODE** key.

   (1) When change span from fully closed to fully open is 10% of FBP input span or less

   (2) When fully closed counting > Fully open counting

   (3) When time from fully closed to fully open is 5 seconds or less

   (4) If FBP input at the time of fully closed and fully open does not stabilize within 5 minutes.

If FBP adjustment is impossible due to errors, select "Error detection No" in [Error detection during FBP adjustment], and perform FBP adjustment again.

• If there is no change in the input value from the FBP for 2 seconds while adjusting, the unit considers the motor to be fully open or fully closed, and finishes automatic adjustment.

If a delay circuit has been installed between this unit and a motor, turn the delay circuit off before FBP adjustment.

FBP adjustment procedure

1. Press the $\triangle$ key for 3 seconds. Control action stops, the SV/MV/TIME Display indicates "$AdJ5\Gamma$", and FBP automatic adjustment starts.

 (1) Closed output is turned ON for approx. 3 seconds.

 (2) Open output is turned ON.

   At the moment when the motor valve is fully open, the fully open input value of the feedback resistance is obtained.

 (3) Closed output is turned ON.

   At the moment when the motor valve is fully closed, the fully closed input value of the feedback resistance is obtained.

2. After automatic adjustment is complete, the SV/MV/TIME Display indicates $oFF\square$. Thus, the FBP adjustment has just finished.

Character	Name, Function, Setting Range	Factory Default
$Po\Gamma$ 30.0	**Open output time**	30.0 seconds
	• Sets time from the motor valve "fully closed" to "fully open". Not available if "FBP Yes" is selected in [FBP Yes/No]. • Setting range: 0.1 to 1000.0 seconds	
$Pc\Gamma$ 30.0	**Closed output time**	30.0 seconds
	• Sets time from the motor valve "fully open" to "fully closed". Not available if "FBP Yes" is selected in [FBP Yes/No]. • Setting range: 0.1 to 1000.0 seconds	
$PAUER$ USE	**Error detection during FBP adjustment**	Error detection Yes
	• Selects Error detection Yes or No under the given conditions [See (1) to (4) of "Note about FBP adjustment" in the FBP adjustment] during FBP adjustment. Not available if "FBP No" is selected in [FBP Yes/No]. • $USE\square$: Error detection Yes $NoNE\square$: Error detection No	

7.3.3 Event Input Group

This group is available only when EI option is added.

To enter the Event input group, follow the procedure below.

(1) $\boxed{L\_ENL}$ Press the **SET** key 4 times in PV/SV Display Mode.
The unit will enter the Engineering group.

(2) $\boxed{E\_I NP}$ Press the **MODE** key. The unit will proceed to the Input group.

(3) $\boxed{E\_EVI}$ Press the **SET** key twice. The unit will proceed to the Event input group.

(4) $\boxed{\begin{array}{l} EVTI\ I \\ 000 \end{array}}$ Press the **MODE** key.
The unit will proceed to 'Event input EVI1 allocation'.

Character	Name, Function, Setting Range	Factory Default
$EVTI\ I$ 000	**Event input EVI1 allocation**	000 (No event)
	• Selects Event input EVI1 from the Event input allocation table.	
	• Refer to the Event input allocation table.	
$EVTI\ 2$ 000	**Event input EVI2 allocation**	000 (No event)
	• Selects Event input EVI2 from the Event input allocation table.	
	• Refer to the Event input allocation table.	
$EVTI\ 3$ 000	**Event input EVI3 allocation**	000 (No event)
	• Selects Event input EVI3 from the Event input allocation table.	
	• Refer to the Event input allocation table.	
$EVTI\ 4$ 000	**Event input EVI4 allocation**	000 (No event)
	• Selects Event input EVI4 from the Event input allocation table.	
	• Refer to the Event input allocation table.	

Event input allocation table

Selected value	Event input function	Input ON (Closed)	Input OFF (Open)	Remarks
000	No event			
001	Set value memory	2^n	1	n=0 to 3 (*1)
002	Control ON/OFF	Control OFF	Control ON	Control output OFF function
003	Direct/Reverse action	Direct action	Reverse action	Always effective
004	Timer Start/Stop	Start	Stop	
005	PV Display; PV holding	Holding	Not holding	Ineffective when controlling
006	PV Display; PV peak value holding	Holding	Not holding	Ineffective when controlling
007	Preset output 1	Preset output (*2)	Standard control	In case of sensor burnout, the unit maintains control with the preset output MV.

Selected value	Event input function	Input ON (Closed)	Input OFF (Open)	Remarks
008	Auto/Manual control	Manual control	Automatic control	
009	Remote/Local	Remote	Local	Effective only when EA☐ or EV☐ option is added
010	Program mode; RUN/STOP	RUN	STOP	Level action when power is turned on
011	Program mode; Holding/Not holding	Holding	Not holding	Level action when power is turned on
012	Program mode; Advance function	Advance	Standard control	Level action when power is turned on
013	Integral action holding	Integral action Holding	Standard integral action	Control continues with the integral value being held.
014	Preset output 2	Preset output (*2)	Standard control	The unit maintains control with the preset output MV.

Signal edge action from OFF to ON or from ON to OFF is engaged.

If "010 (Program mode RUN/STOP)" is selected in [Event input EVI1 allocation], the following action will be performed. However, only when power is turned ON, Level action [ON (Closed) or OFF (Open)] is engaged.

(Fig. 7.3.3-1)
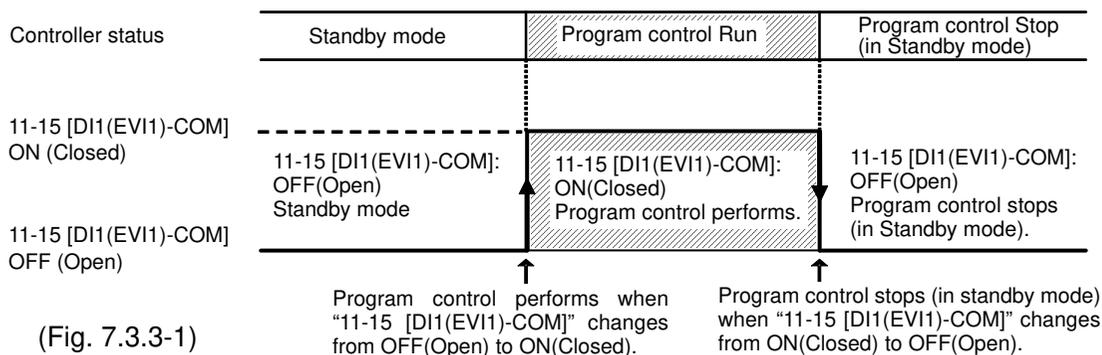
OR calculation [if any one is ON (closed), the function activates] begins if the same functions except "001(Set value memory)" have been selected for plural Event inputs.

(*1) The value that 1 (one) is added to 2^n, is indicated on the MEMO/STEP Display.
   (e.g.) If EVI1(2^0)=OFF, EVI2(2^1)=ON, then 3 (2^1 +1) is indicated.

   2^0, 2^1, 2^2 and 2^3 will be allocated to Event input EVI1 to EVI4 respectively, and the Set value memory number will be determined by each value of EVI1 to EVI4.
   (Refer to Section "9.7 Set Value Memory Function" on p.72.)

(*2) Preset value can be set in [Preset output] (p.30) in the Output group.

7.3.4 Event Output Group

To enter the Event output group, follow the procedure below.

(1) `[G_ENG]` Set the **SET** key 4 times in PV/SV Display Mode.
The unit will enter the Engineering group.

(2) `[E_INP]` Press the **MODE** key. The unit will proceed to the Input group.

(3) `[E_EVo]` Press the **SET** key several times until the Event output group characters appear.

(4) `[EVTo1 / 000]` Press the **MODE** key.
The unit will proceed to 'Event output EVT1 allocation'.

Character	Name, Function, Setting Range	Factory Default
EVTo1 000	**Event output EVT1 allocation** • Selects Event output EVT1 from the Event output allocation table. • Refer to the Event output allocation table.	000 (No event)
EVTo4 000	**Event output EVT4 allocation** • Selects Event output EVT4 from the Event output allocation table. Available only when A5 option is added • Refer to the Event output allocation table.	000 (No event)
EVTo5 000	**Event output EVT5 allocation** • Selects Event output EVT5 from the Event output allocation table. Available only when A5 option is added • Refer to the Event output allocation table.	000 (No event)

Event output allocation table

Selected value	Event output function	Proceeding to the lower level with the **MODE** key	Remarks
000	No event		
001	Alarm output; High limit alarm	Alarm hysteresis ↓ MODE Alarm delay time ↓ MODE Alarm Energized/De-energized	
002	Alarm output; Low limit alarm	Same as the High limit alarm	
003	Alarm output; High/Low limits	Same as the High limit alarm	
004	Alarm output; High/Low limits independent	Same as the High limit alarm	
005	Alarm output; High/Low limit range	Same as the High limit alarm	
006	Alarm output; High/Low limit range independent	Same as the High limit alarm	

Selected value	Event output function	Proceeding to the lower level with the MODE key	Remarks
007	Alarm output; Process high alarm	Same as the High limit alarm	
008	Alarm output; Process low alarm	Same as the High limit alarm	
009	Alarm output; High limit with standby	Same as the High limit alarm	
010	Alarm output; Low limit with standby	Same as the High limit alarm	
011	Alarm output; High/Low limits with standby	Same as the High limit alarm	
012	Alarm output; High/Low limits with standby independent	Same as the High limit alarm	
013	Timer output linked with "Timer Start/Stop" in [Event input allocation].	Timer output delay action ↓ MODE Timer output time unit ↓ MODE OFF delay time ↓ MODE ON delay time	Select "Timer Start/Stop" in [Event input allocation]. (pp.33, 34)
014	Timer output linked with "Timer Start/Stop" in [Event input allocation]. Control ON during timer operation. Control OFF after time is up.	Same as the above	Same as the above
015	No event		
016	Loop break alarm output	Loop break alarm time ↓ MODE Loop break alarm band	
017	Time signal output	Time signal output step ↓ MODE Time signal OFF time ↓ MODE Time signal ON time	Time signal output is turned off when the performing step is complete.
018	Output during AT		Outputs during AT
019	Pattern end output		Program control

• **If an alarm type is changed, the alarm set value defaults to 0 (0.0).**
• If "001 to 012 (Alarm output)" is selected : Individual setting for the event output
 If "013 to 019" is selected: Common setting to the plural event outputs

Pattern end output

After the program control is completed, pattern end output is turned ON.

The following program pattern shows that the temperature rises to 200℃ for 1 hour, and stays at 200℃ for 2 hours after program control starts.

Step	1	2
Step SV	200℃	200℃
Step time (hours)	1:00	2:00

Pattern end output is shown below in (Fig. 7.3.4-1).
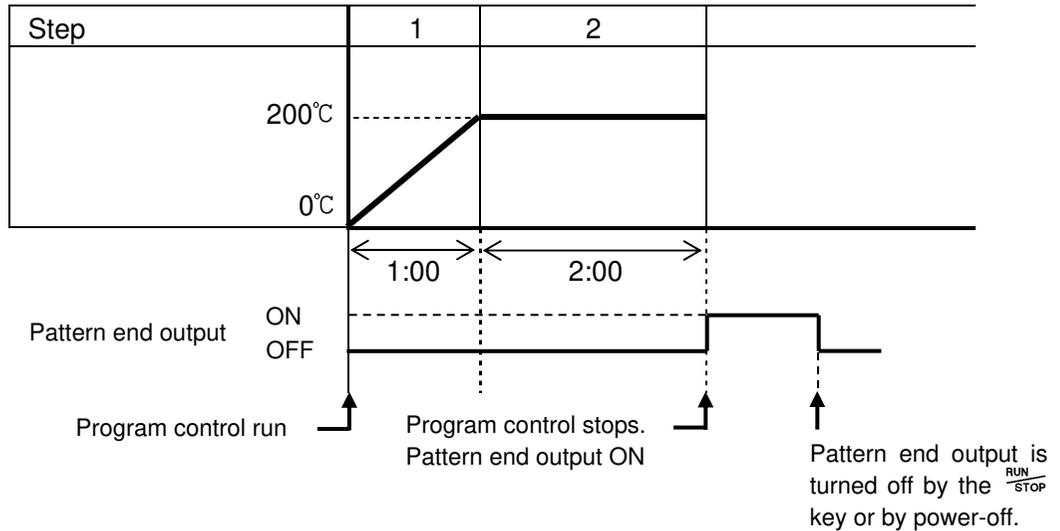
(Fig. 7.3.4-1)

• **Alarm output setting items [When Alarm output (001 to 012) is selected]**

Character	Name, Function, Setting Range	Factory Default

R $IHYS$
 $I0$
 	
 (*)
	Alarm hysteresis
	 • Sets Alarm hysteresis.
	 • Setting range: 0.1 to 1000.0℃(℉)
	     DC voltage, current inputs: 1 to 10000 (The placement of the
	                     decimal point follows the selection.)
		1.0℃

R $IdLY$
 0
 	
 (*)
	Alarm delay time
	 • Sets Alarm action delay time.
	   When setting time has elapsed after the input enters the Alarm output
	   range, the Alarm is activated.
	 • Setting range: 0 to 10000 seconds
		0 seconds

R $IREV$
 $NoML$
 	
 (*)
	Alarm Energized/De-energized
	 • Selects Alarm action Energized/De-energized status.
	   (Refer to "Alarm action Energized/De-energized".)
	 • $NoML\square$: Energized
	    $REV5\square$: De-energized
		Energized

(*): If "001 (Alarm output; High limit alarm) to 012 (Alarm output; High/Low limits with
standby independent" is selected in [Event output EVT4 and EVT5 allocation],
their setting characters will be $R4$xxx and $R5$xxx.

[Alarm action Energized/De-energized]
When [Alarm Energized ($NoML\square$)] is selected, EVT1 output (terminals 9, 10)
is conductive (ON) while the EVT1 indicator is lit.
EVT1 output is not conductive (OFF) while EVT1 indicator is not lit.

When [Alarm De-energized ($REV5\square$)] is selected, EVT1 output (terminals 9, 10)
is not conductive (OFF) while EVT1 indicator is lit.
EVT1 output is conductive (ON) while EVT1 indicator is not lit.

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

EVT1 hysteresis   EVT1 hysteresis

ON   ON

OFF   OFF
    SV   + EVT1 value   SV   + EVT1 value
    (Fig. 7.3.4-2)   (Fig. 7.3.4-3)
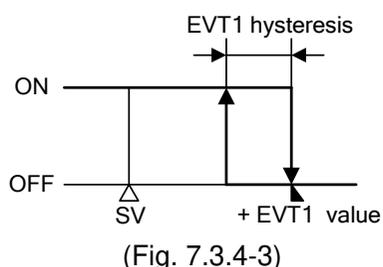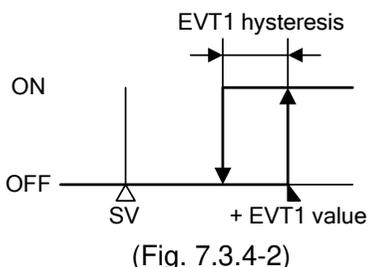
For EVT4 and EVT5, the alarm action is the same as that of EVT1.
For EVT4, read "EVT4" for "EVT1".
For EVT5, read "EVT5" for "EVT1".

• EVT4 output: Terminals 29, 30
• EVT5 output: Terminals 28, 30

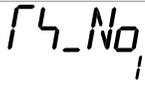• **Timer output setting items [When Timer output (013, 014) is selected]**
  Available only when the EI option is added.

Character	Name, Function, Setting Range	Factory Default

dL 4F oN	**Timer output delay action**
	• Selects a Timer output action.
	• oN◻◻ : ON delay time
	  oFF◻ : OFF delay time
	  oNoFF : ON/OFF delay time
	• Delay action
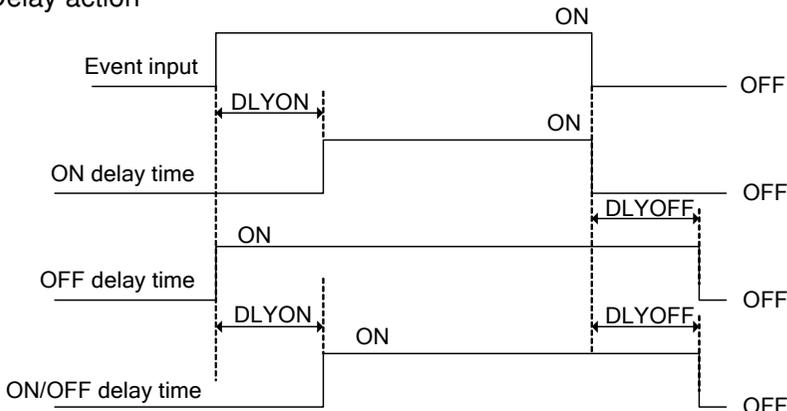	
	DLYON: ON delay time
	DLYOFF: OFF delay time
	(Fig. 7.3.4-4)
		ON delay time

ГM 5 MI N	**Timer output time unit** • Selects Timer output time unit. • MI N◻: Minutes 5Ec◻: Seconds	Minutes
d4oFF 0	**OFF delay time** • Sets OFF delay time. • Setting range: 0 to 10000 (Time unit follows the selection in [Timer output time unit].)	0
d4oN 0	**ON delay time** • Sets ON delay time. • Setting range: 0 to 10000 (Time unit follows the selection in [Timer output time unit].)	0

• **Loop break alarm output setting items [When Loop break alarm output (016) is selected]**

Character	Name, Function, Setting Range	Factory Default
LP_Г 0	**Loop break alarm time** • Sets the time to assess the Loop break alarm. • Setting to 0 (zero) disables the alarm. • Setting range: 0 to 200 minutes	0 minutes
LP_H 0	**Loop break alarm band** • Sets the temperature to assess the Loop break alarm. • Setting to 0 (zero) disables the alarm. • Setting range: 0 to 150℃ (℉), 0.0 to 150.0℃ (℉) DC voltage, current inputs: 0 to 1500 (The placement of the decimal point follows the selection.)	0℃

• **Time signal output setting items [When Time signal output (017) is selected]**

Character	Name, Function, Setting Range	Factory Default
┌┐_No	**Time signal output step**	1
	• Sets the step number for time signal output performance. • Setting range: 1 to 15	
┌┐_oF 00.00	**Time signal output OFF time**	00:00
	• Sets the Time signal output OFF time. • Setting range: 00:00 to 99:59 (Time unit follows the selection in [Step time unit] in the Program group.)	
┌┐_oN 00.00	**Time signal output ON time**	00:00
	• Sets the Time signal output ON time. • Setting range: 00:00 to 99:59 (Time unit follows the selection in [Step time unit] in the Program group.)	

Time signal output

Time signal output activates during Time signal output ON time within the set step for which Time signal output is performed.
Time signal output ON time follows Time signal output OFF time after the program control starts.
The following program pattern shows that the temperature rises to 200℃ for 1 hour, and stays at 200℃ for 2 hours after program control starts.

Step	1	2
Step SV	200℃	200℃
Step time	1:00	2:00

Time signal output (Fig. 7.3.4-5) is shown when set as follows.
• Time signal output step: 2
• Time signal output OFF time : 0:30
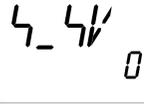• Time signal output ON time: 1:00
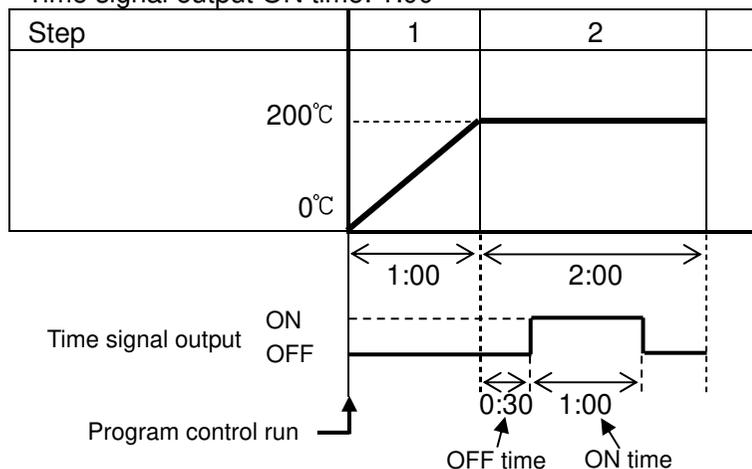
(Fig. 7.3.4-5)

Time signal output is effective within the step set in [Time signal output step].
For example, if Time signal output ON time is set to "2:00" at the above,
Time signal output is turned OFF when step 2 is completed.

7.3.5 Program Group

To enter the Program group, follow the procedure below.

(1) `G_ENG` Set the **SET** key 4 times in PV/SV Display Mode.
The unit will enter the Engineering group.

(2) `E_INP` Press the **MODE** key. The unit will proceed to the Input group.

(3) `E_PRo` Press the **SET** key several times until the Program group characters appear.

(4) `PRGMd FIX` Press the **MODE** key.
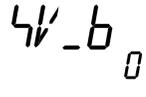The unit will proceed to 'Fixed value control/Program control'.

Character	Name, Function, Setting Range	Factory Default
PRGMd FIX	**Fixed value control/Program control**	Fixed value control
	• Selects Fixed value control or Program control.	
	• FIX : Fixed value control	
	$PRoG$: Program control	
M_ MIN	**Step time unit**	Hours:Minutes
	• Selects the Step time unit for the program control.	
	• Available only for the program control.	
	• MIN : Hours:Minutes	
	SEc : Minutes:Seconds	
PRES SToP	**Power restore action**	Stops (in standby) after power is restored.
	• Selects the program status if a power	
	failure occurs mid-program and it is restored.	
	• Available only for the program control.	
	• $SToP$: Stops (in standby) after power is restored.	
	$coNT$: Continues (resumes) after power is restored.	
	$HoLd$: Suspends (on hold) after power is restored.	
S_SV 0	**Program start temperature**	0℃
	• Sets the step temperature when program starts.	
	• Available only for the program control.	
	• Setting range: Scaling low limit value to Scaling high limit value	

7.3.6 Communication Group

Available when C, C5 option is added.

To enter the Communication group, follow the procedure below.

(1) `G_ENG` Set the **SET** key 4 times in PV/SV Display Mode.
The unit will enter the Engineering group.

(2) `E_INP` Press the **MODE** key. The unit will proceed to the Input group.

(3) `E_coM` Press the **SET** key several times until Communication group characters appear.

(4) `cM५L` Press the **MODE** key.
The unit will proceed to 'Communication protocol'.

Character	Name, Function, Setting Range	Factory Default

`cM५L`
`NoML`
	Communication protocol
	• Selects communication protocol.
	• `NoML`: Shinko protocol
	  `ModA`: MODBUS ASCII mode
	  `ModR`: MODBUS RTU mode
		Shinko protocol

`cMNO` `0`	**Instrument number** • Sets the instrument number. The instrument numbers should be set one by one when multiple instruments are connected in Serial communication, otherwise communication is impossible. • Setting range: 0 to 95	0

`cM५P`
`96`
	Communication speed
	• Selects a communication speed equal to that of the host computer.
	• `96` : 9600 bps
	  `192` : 19200 bps
	  `384` : 38400 bps
		9600 bps

`cMFr`
`7EVN`
	Data bit/Parity
	• Selects data bit and parity.
	• `8NoN`: 8 bits/No parity
	  `7NoN`: 7 bits/No parity
	  `8EVN`: 8 bits/Even
	  `7EVN`: 7 bits/Even
	  `8odd`: 8 bits/Odd
	  `7odd`: 7 bits/Odd
		7 bits/Even

`५roP` `1`	**Stop bit** • Selects the stop bit. • `1`: 1 `2`: 2	1
`५V_b` `0`	**SVTC bias** • Control desired value (SV) adds SVTC bias value to the value received by the SVTC command. • Available only when Shinko protocol is selected in [Communication protocol]. • Setting range: Converted value of ±20% of input span DC voltage, current inputs: ±20% of scaling span (The placement of the decimal point follows the selection.)	0℃

7.3.7 External Setting Group

Available only when the EA☐ or EV☐ option is added.
To enter the External setting group, follow the procedure below.

(1) $\boxed{G\_ENG}$ Set the **SET** key 4 times in PV/SV Display Mode.
    The unit will enter the Engineering group.

(2) $\boxed{E\_INP}$ Press the **MODE** key. The unit will proceed to the Input group.

(3) $\boxed{E\_EXT}$ Press the **SET** key several times until External setting group characters
    appear.

(4) $\boxed{\substack{REMoT \\ LocAL}}$ Press the **MODE** key.
    The unit will proceed to 'Remote/Local'.

Character	Name, Function, Setting Range	Factory Default

$\boxed{\substack{REMoT \\ LocAL}}$	**Remote/Local**
	• Selects Remote or Local setting of the SV.
	• $LocAL$: Local (The SV can be set by front keypad.)
	  $REMoT$: Remote (The SV can be set in analog by the remote
	            operation.)
		Local

$\boxed{\substack{RTLH \\ 1370}}$	**External setting input high limit**
	• Sets External setting input high limit value.
	  [For EA1 (4-20 mA) option, the value corresponds to 20 mA input.]
	• Setting range: External setting input low limit to Input range high limit
	            (The placement of the decimal point follows the selection.)
		1370℃

$\boxed{\substack{RTLL \\ -200}}$	**External setting input low limit**
	• Sets External setting input low limit value.
	  [For EA1 (4-20 mA) option, the value corresponds to 4 mA input.]
	• Setting range: Input range low limit to External setting input high limit
	            (The placement of the decimal point follows the selection.)
		-200℃
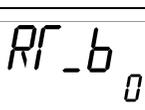
$\boxed{\substack{RT\_b \\ 0}}$	**Remote bias**
	• During remote action, SV adds the remote bias value.
	• Setting range: Converted value of ±20% of input span
	  DC voltage, current inputs: ±20% of scaling span (The placement
	                  of the decimal point follows the selection.)
		0℃

7.3.8 Transmission Output Group

Available only when TA1 or TV1 option is added.
To enter the Transmission output group, follow the procedure below.

(1) $\boxed{G\_ENG}$ Set the **SET** key 4 times in PV/SV Display Mode.
The unit will enter the Engineering group.

(2) $\boxed{E\_INP}$ Press the **MODE** key. The unit will proceed to the Input group.

(3) $\boxed{E\_TRA}$ Press the **SET** key several times until the Transmission output
group characters appear.

(4) $\boxed{TRoS \atop PV}$ Press the **MODE** key.
The unit will proceed to the Transmission output selection.

Character	Name, Function, Setting Range	Factory Default
$\boxed{TRoS \atop PV}$	**Transmission output type** • Selects transmission output type. • $PV\square\square\square$: PV transmission 　$SV\square\square\square$: SV transmission 　$MV\square\square\square$: MV transmission 　$dV\square\square\square$: DV transmission	PV transmission
$\boxed{TRLH \atop 1370}$	**Transmission output high limit** • Sets the Transmission output high limit value. 　[For TA1 (4-20 mA) option, the value correponds to 20 mA output.] • Setting range: 　PV, SV transmission: Transmission output low limit to Input range 　　　　　　　　　　　high limit value 　MV transmission: Transmission output low limit value to 105.0% 　DV transmission: Transmission output low limit value to Scaling span	1370℃
$\boxed{TRLL \atop -200}$	**Transmission output low limit** • Sets the Transmission output low limit value. 　[For TA1 (4-20 mA) option, the value correponds to 4 mA output.] • Setting range: 　PV, SV transmission: Input range low limit to Transmission output 　　　　　　　　　　　high limit value 　MV transmission: -5.0% to Transmission output high limit value 　DV transmission: -Scaling span to Transmission output high limit value	-200℃

7.3.9 Other Function Group

To enter Other function group, follow the procedure below.

(1) $\boxed{\textit{G\_ENG}}$ Set the **SET** key 4 times in PV/SV Display Mode.
The unit will enter the Engineering group.

(2) $\boxed{\textit{E\_INP}}$ Press the **MODE** key. The unit will proceed to the Input group.

(3) $\boxed{\textit{E\_oTH}}$ Press the **SET** key several times until Other function group characters appear, or press the $\overset{\text{A / M}}{\text{B.MODE}}$ key.

(4) $\boxed{\textit{Lock}}$ Press the **MODE** key.
The unit will proceed to 'Set value lock'.

Character	Name, Function, Setting Range	Factory Default
$\boxed{\textit{Lock}}$	**Set value lock**	Unlock
	• Locks the set values to prevent setting errors. The setting item to be locked depends on the selection. • When any selection from Lock 1 to Lock 4 is made, AT or Auto-reset cannot be carried out. • – – – – – (Unlock): All set values can be changed. $Loc~1$ (Lock 1): None of the set values can be changed. $Loc~2$ (Lock 2): Only SV can be changed. $Loc~3$ (Lock 3): None of the set values can be changed as Lock 1. $Loc~4$ (Lock 4): SV and Alarm value can be changed. Other set values cannot be changed.	
$\boxed{\begin{array}{c}\textit{PI dZN}\\\textit{NoNE}\end{array}}$	**PID zone function**	Not used
	• Selects "Not used/Used" of the PID zone function. Control is performed by automatic change of PID zone parameters, which are linked with the SV (or step SV for program control). PID zone value can be set in the PID group. Refer to "PID zone function" on p. 48. • $NoNE$: Not used USE: Used	
$\boxed{\begin{array}{c}\textit{RATU}\\\textit{0}\end{array}}$	**SV rise rate**	0 ℃/minute
	• Sets SV rise rate (rising value for 1 minute). When the SV is adjusted, it approaches the new SV by the preset rate-of-change (℃/minute, ℉/minute). When the power is turned on, the control starts from the PV and approaches the SV by the rate-of-change. • Setting to 0 or 0.0 disables the function. • Setting range: 0 to10000 ℃/minute (℉/minute) Thermocouple, RTD inputs with a decimal point: 0.0 to1000.0 ℃/minute (℉/minute) DC voltage, current inputs: 0 to 10000/minute (The placement of the decimal point follows the selection.)	

Character	Name, Function, Setting Range	Factory Default
$RAFd$ 0	**SV fall rate** • Sets SV fall rate (falling value for 1 minute). (Refer to "SV rise rate".) Setting to 0 or 0.0 disables the function. • Setting range: 0 to10000 ℃/minute (℉/minute) Thermocouple, RTD inputs with a decimal point: 0.0 to1000.0 ℃/min(℉/min) DC voltage, current inputs: 0 to 10000/minute (The placement of the decimal point follows the selection.)	0 ℃/minute
$P4V$ oFF	**Indication when output OFF** • Selects the indication when control output is OFF. • $oFF\square$:OFF indication $RoFF\square$: No indication $PV\square\square$: PV indication $PV RL\square$: PV indication + Any event output (EVT1, EVT4, EVT5)	OFF indication
$bKLF$ RLL	**Backlight selection** • Selects the display to backlight. • $RLL\square$: All (Displays and indicators) are backlit. $PV\square\square$: PV Display is backlit. $4V\square\square$: SV/MV/TIME + MV/DV/Valve Bar Graph Displays are backlit. $Rc\square\square$: Action indicators are backlit. $PV 4V\square$: PV + SV/MV/TIME + MV/DV/Valve Bar Graph Displays are backlit. $PV Rc\square$: PV Display + Action indicators are backlit. $4V Rc\square$: SV/MV/TIME + MV/DV/Valve Bar Graph Displays + Action indicators are backlit.	All are backlit
$coLR$ REd	**PV color** • Selects PV Display color. See "PV Display color selection" on p.49. • $GRN\square$: Green $REd\square$: Red $oRG\square$: Orange $RL GR\square$: When any alarm output (EVT1, EVT4, EVT5) is ON, PV color turns from green to red. $RL oR\square$: When any alarm output (EVT1, EVT4, EVT5) is ON, PV color turns from orange to red. $PV GR\square$: PV color changes continuously (Orange → Green → Red). $RPGR\square$: PV color changes continuously (Orange → Green → Red), and simultaneously when any alarm output (EVT1, EVT4, EVT5) is ON (Red).	Red
$cLRG$ 5.0	**PV color range** • When $PV GR\square$ (PV color changes continuously) or $RPGR\square$ [PV color changes continuously + Any alarm output (EVT1, EVT4, EVT5) occurs] is selected in [PV color], the value of green PV color range can be set. See "PV Display color selection" on p.49. • Setting range: 0.1 to 200.0℃(℉), DC voltage, current inputs: 1 to 2000 (The placement of the decimal point follows the selection.)	5.0℃

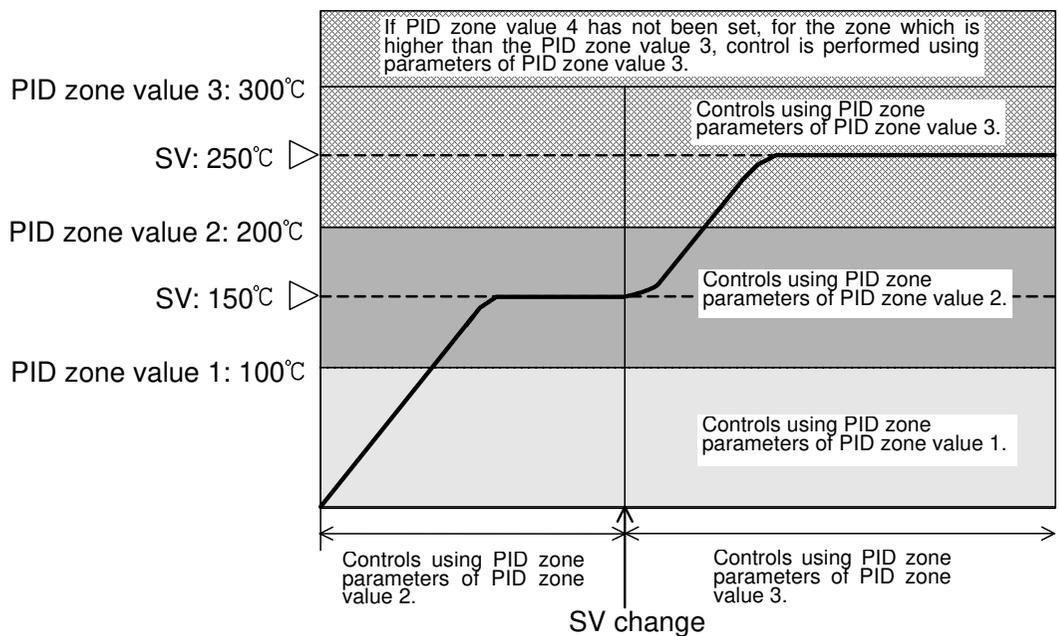| Character	Name, Function, Setting Range	Factory Default
$dP\Gamma M$ 0	**Backlight time** • Sets time to backlight from no operation status until backlight is switched off. When set to 0, the backlight remains ON. Backlight relights by pressing any key while backlight is OFF. • Setting range: 0 to 99 minutes	0 minutes
$bAR4L$ MV	**Bar graph** • Selects an indication item (MV, DV, degree of valve opening or no indication) on the bar graph. (See p.50.) • $MV\square\square\square$: MV indication $dV\square\square\square$: DV indication $NoNE\square$: No indication $FbP\square\square$: Degree of valve opening is indicated.	MV indication
$dVWI\ d$ 1	**Deviation unit** • Sets deviation unit of positive (or negative) side for one division of the bar graph. (See p.50.) • Setting range: 1 to Converted value of 20% of input span	1℃

[PID zone function]

When PID zone function "Used" is selected, and if SV (or Step SV for the program control) is lower than PID zone value, the control is performed with PID zone parameters of the relevant PID zone value.

If the next PID zone value is lower than the current one, the next PID zone parameters will not be effective.

During program control, the currently performing step SV is applicable to the PID zone. In the case of (Fig. 7.3.9-1), "SV: 150℃" is higher than "PID zone value 1: 100℃", and lower than "PID zone value 2: 200℃", so control is performed using PID zone parameters of PID zone value 2.
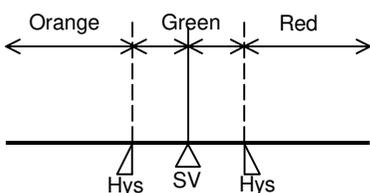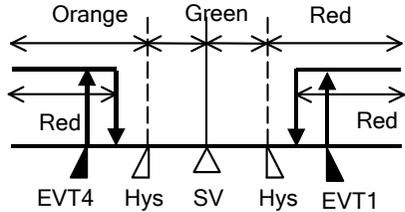
As PID zone value 4 has not been set, even in the case SV is higher than PID zone value 3, control is performed using PID zone parameters of PID zone value 3.

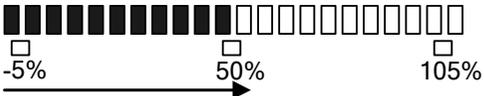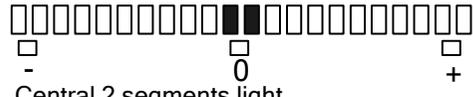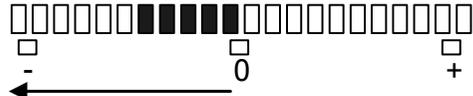If PID zone value 4 has not been set, for the zone which is higher than the PID zone value 3, control is performed using parameters of PID zone value 3.

PID zone value 3: 300℃

Controls using PID zone parameters of PID zone value 3.

SV: 250℃ ▷

PID zone value 2: 200℃

SV: 150℃ ▷

Controls using PID zone parameters of PID zone value 2.

PID zone value 1: 100℃

Controls using PID zone parameters of PID zone value 1.

Controls using PID zone parameters of PID zone value 2.

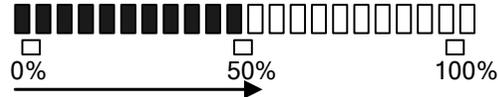Controls using PID zone parameters of PID zone value 3.

SV change

(Fig. 7.3.9-1)

[PV Display color selection]

(Table 7.3.9-1)

PV Color Selection		PV Color
`GRN`	Green	Constantly green
`REd`	Red	Constantly red
`oRG`	Orange	Constantly orange
`ALGR`	When any alarm output (EVT1, EVT4, EVT5) is ON: Green → Red	When alarm output OFF: Green When any alarm output (EVT1, EVT4, EVT5) is ON, the PV color turns from green to red.
`ALoR`	When any alarm output (EVT1, EVT4, EVT5) is ON: Orange → Red	When alarm output OFF: Orange When any alarm output (EVT1, EVT4, EVT5) is ON, the PV color turns from orange to red.
`PVGR`	PV color changes continuously (Orange → Green → Red)	PV color changes depending on the color range setting. • PV is lower than [SV-PV color range]: Orange • PV is within [SV±PV color range]: Green • PV is higher than [SV+PV color range]: Red Orange ┆ Green ┆ Red Hys ┆ SV ┆ Hys Hys: Set point of PV color range (Fig. 7.3.9-2)
`APGR`	PV color changes continuously (Orange → Green → Red), and at the same time any alarm output (EVT1, EVT4, EVT5) is ON (Red).	PV color changes depending on the color range setting. When any alarm output (EVT1, EVT4, EVT5) is ON, the PV Display turns red. • PV is lower than [SV-PV color range]: Orange • PV is within [SV±PV color range]: Green • PV is higher than [SV+PV color range]: Red • Any alarm output (EVT1, EVT4, EVT5) is ON: Red Orange ┆ Green ┆ Red Red ┆ ┆ Red EVT4 Hys SV Hys EVT1 Hys : Set point of PV color range EVT1: EVT1 value (High limit alarm) EVT4: EVT4 value (Low limit alarm) (Fig. 7.3.9-3)

[Bar Graph Indication]

MV, DV or Degree of valve opening is indicated on the bar graph.

Function	Contents	Indication
MV indication	Scale is -5 to 105%. Segments light from left to right in accordance with the output MV.	(e.g.) Output MV 50% ■■■■■■■■■□□□□□□□□□ -5%　　　　　50%　　　　　105% Increases to the right in accordance with the output MV.
DV indication	In the case of deviation zero (0), central 2 segments light. For positive deviation, segments light increasingly to the right. For negative deviation, segments light increasingly to the left.	When deviation unit is set to 1: (e.g.) Deviation 0 (SV=200, PV=200) □□□□□□□□□■■□□□□□□□□ -　　　　　0　　　　　+ Central 2 segments light. (e.g.) Negative deviation (SV=200, PV=196) □□□□□□■■■■■□□□□□□□□ -　　　　　0　　　　　+ 4 segments of deviation except the central segment light increasingly to the left in accordance with the deviation.
Degree of valve opening is indicated.	Scale is 0 to 100%. Segments light from left to right in accordance with the degree of valve opening. Without feedback potentiometer, 0% is constantly indicated.	(e.g.) 50% of Valve opening ■■■■■■■■■■□□□□□□□□□ 0%　　　　　50%　　　　　100% Segments light increasingly to the right in accordance with the degree of valve opening. (e.g.) Without Feedback potentiometer ■□□□□□□□□□□□□□□□□□□ 0%　　　　　50%　　　　　100% Indicates 0% constantly.
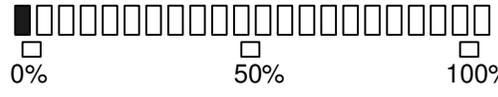
8. Settings

There are 2 setting methods for this controller: Simplified setting, Group selection.

8.1 Simplified Setting Method

Simplified setting method, which is effective for the Fixed value control, is the same method as when setting standard Shinko controllers.

8.1.1 SV Setting Mode

To enter SV setting mode, press the MODE key in PV/SV Display Mode.
If 'Set value memory' is selected in [Event input allocation], only the memory number selected via terminal connection can be set.
To set any other Set value memory number, select it again by connecting terminals.
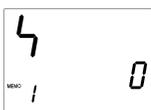
Character	Name, Function, Setting Range	Factory Default
ᵇ₁ 0 (MEMO)	**SV** • Sets SV. • Setting range: Scaling low limit to Scaling high limit value	0℃

8.1.2 Event Setting Mode

To enter the Event setting mode, press the △ and MODE keys (in that order) together in PV/SV Display Mode.
If 'Set value memory' is selected in [Event input allocation], only the memory number selected via terminal connection can be set.
To set any other Set value memory number, select it again by connecting terminals.

Character	Name, Function, Setting Range	Factory Default
A1 0 (MEMO)	**EVT1 alarm value** • Sets EVT1 alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm)**. Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT1 allocation]. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃
A1H 0 (MEMO)	**EVT1 high limit alarm value** • Sets EVT1 high limit alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm)**. Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT1 allocation]. For the independent alarms such as High/Low limits independent, High/Low limit range independent and High/Low limits with standby independent, the EVT alarm value matches the low limit side, and EVT high limit alarm value matches the high limit side. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃

Character	Name, Function, Setting Range	Factory Default
R4 MEMO 1 0	**EVT4 alarm value** • Sets EVT4 alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT4 allocation]. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃
R4H MEMO 1 0	**EVT4 high limit alarm value** • Sets EVT4 high limit alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT4 allocation]. For the independent alarms such as High/Low limits independent, High/Low limit range independent and High/Low limits with standby independent, the EVT alarm value matches the low limit side, and EVT high limit alarm value matches the high limit side. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃
R5 MEMO 1 0	**EVT5 alarm value** • Sets EVT5 alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT5 allocation]. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃
R5H MEMO 1 0	**EVT5 high limit alarm value** • Sets EVT5 high limit alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT5 allocation]. For the independent alarms such as High/Low limits independent, High/Low limit range independent and High/Low limits with standby independent, the EVT alarm value matches the low limit side, and EVT high limit alarm value matches the high limit side. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃

(Table 8.1.2-1)

Alarm type	Setting range
High limit alarm (deviation setting)	-(Input span) to input span℃(℉) *1
Low limit alarm (deviation setting)	-(Input span) to input span℃(℉) *1
High/Low limits alarm (deviation setting)	0 to input span℃(℉) *1
High/Low limits independent alarm (deviation setting)	0 to input span℃(℉) *1
High/Low limit range alarm (deviation setting)	0 to input span℃(℉) *1
High/Low limit range independent alarm (deviation setting)	0 to input span℃(℉) *1
Process high alarm	Input range low limit to input range high limit value *2
Process low alarm	Input range low limit to input range high limit value *2
High limit with standby alarm (deviation setting)	-(Input span) to input span℃(℉) *1
Low limit with standby alarm (deviation setting)	-(Input span) to input span℃(℉) *1
High/Low limits with standby alarm (deviation setting)	0 to input span℃(℉) *1
High/Low limits with standby independent alarm (deviation setting)	0 to input span℃(℉) *1

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

8.1.3 PID Setting Mode

To enter the PID setting mode, press the $\triangledown$ and MODE keys (in that order) together for 3 seconds in PV/SV Display Mode.
If PID zone function "Used" is selected, PID zone parameters depends on the SV.
PID zone numbers are indicated on the MEMO/STEP Display.

| Character	Name, Function, Setting Range	Factory Default
P MEMO 1　　10	**Proportional band** • Sets the proportional band. 　ON/OFF control when set to 0 or 0.0. • Setting range: 0 to Input span℃（℉） 　(DC voltage, current inputs: 0.0 to 1000.0%)	10℃
I MEMO 1　　200	**Integral time** • Sets the integral time. 　Setting the value to 0 disables the function. 　Not available for ON/OFF control 　Auto-reset can be performed when PD is control action (I=0). • Setting range: 0 to 3600 seconds 　When 'FBP No' is selected in [FBP Yes/No]: 1 to 3600 seconds	200 seconds
d MEMO 1　　50	**Derivative time** • Sets derivative time. 　Setting the value to 0 disables the function. 　Not available for ON/OFF control • Setting range: 0 to 1800 seconds	50 seconds
ARW MEMO 1　　50	**ARW** • Sets anti-reset windup (ARW). 　Available only when PID is control action. • Setting range: 0 to 100%	50%
R4Er MEMO 1　　0.0	**Manual reset** • Sets the reset value manually. 　Available only when P or PD is control action. • Setting range: ±1000.0 　DC voltage, current inputs: The placement of the decimal point 　　　　　　　　　　　　follows the selection.	0.0℃
oRAr MEMO 1　　0	**MV rate-of-change** • Sets changing value of the MV for 1 second. 　Setting the value to 0 disables the function. 　Not available for ON/OFF control 　See "MV rate-of-change" on p.55. • Setting range: 0 to 100 %/second	0 %/second

[MV rate-of-change]

For Heating control, if PV is lower than SV, output is generally turned from OFF to ON as shown in (Fig. 8.1.3-1).

If MV rate-of-change is set, the output can be changed by the rate-of-change (Fig. 8.1.3-2). This control is suitable for high temperature heaters (which are made from molybdenum, tungsten or platinum, etc., and used at approx. 1500 to 1800℃) which are easily burnt out from turning on electricity rapidly.

● **Usual output**　　● **Output when MV rate-of-change is set**
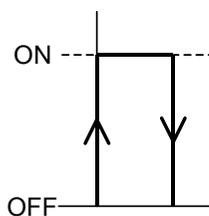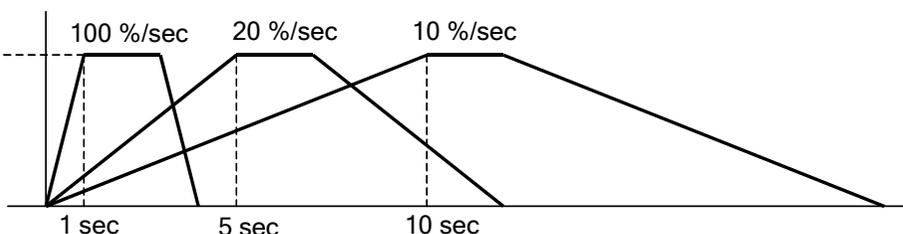
(Fig. 8.1.3-1)　　　　　　　　　(Fig. 8.1.3-2)

8.2 Group Selection

There are 4 groups to be set for the controller; SV, Event group, PID group, AT group and Engineering group.

Select a group with the `SET` key, and set each item in the group with the `MODE` key.

PV Display	Group	Setting Items
⊏_4☐☐	• SV, Event group (Fixed value control)	• SV, Event (EVT1, EVT4, EVT5) (Fixed value control)
	• Program Pattern group (Program control)	• Step SV, Step time, Wait value, Event (EVT1, EVT4, EVT5) (Program control)
⊏_Pl d	PID group	PID parameters
⊏_AΓ☐	AT group	AT/Auto-reset Perform/Cancel, AT bias
⊏_ENⰃ	Engineering group	Input parameters, Output parameters, Event output parameters, Program parameters, Other functions

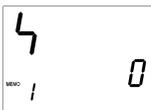For details of the Engineering group, see pages 27 to 50.

8.2.1 SV, Event Group (for Fixed Value Control)

Sets SV and Event (EVT1, EVT4, EVT5) in this group.
If 'Set value memory' is selected in [Event input allocation], the setting items
in this group can be set for the selected memory numbers.

To enter the 'SV, Event group', follow the procedure below.

(1) | `L-5` | Press the **SET** key in PV/SV Display Mode.
The unit proceeds to the 'SV, Event group'.

(2) | `5` `-1` `0` | Press the **MODE** key. The unit proceeds to 'SV1'.

Character	Name, Function, Setting Range	Factory Default
`5` `MEMO 1` `0`	**SV1** • Sets SV1. • Setting range: Scaling low limit to Scaling high limit	0℃
`A1` `MEMO 1` `0`	**EVT1 alarm value** • Sets EVT1 alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT1 allocation]. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃
`A1H` `MEMO 1` `0`	**EVT1 high limit alarm value** • Sets EVT1 high limit alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT1 allocation]. For the independent alarms such as High/Low limits independent and High/Low limit range independent, the EVT alarm value matches the low limit side, and EVT high limit alarm value matches the high limit side. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃
`A4` `MEMO 1` `0`	**EVT4 alarm value** • Sets EVT4 alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT4 allocation]. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃

Character	Name, Function, Setting Range	Factory Default
A4H MEMO *1* *0*	**EVT4 high limit alarm value** • Sets EVT4 high limit alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT4 allocation]. For the independent alarms such as High/Low limits independent and High/Low limit range independent, the EVT alarm value matches the low limit side, and EVT high limit alarm value matches the high limit side. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃
A5 MEMO *1* *0*	**EVT5 alarm value** • Sets EVT5 alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT5 allocation]. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃
A5H MEMO *1* *0*	**EVT5 high limit alarm value** • Sets EVT5 high limit alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT5 allocation]. For the independent alarms such as High/Low limits independent and High/Low limit range independent, the EVT alarm value matches the low limit side, and EVT high limit alarm value matches the high limit side. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃
	Up to 15 files (up to 15 Set value memory numbers) can be set when 'Set value memory' is selected in [Event input allocation].	
A5H MEMO *15* *0*	**EVT5 high limit alarm value** • Sets EVT5 high limit alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT5 allocation]. For the independent alarms such as High/Low limits independent and High/Low limit range independent, the EVT alarm value matches the low limit side, and EVT high limit alarm value matches the high limit side. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃

8.2.2 Program Pattern Group (for Program Control)

Sets Step SV, Step time, Wait value and Event (EVT1, EVT4, EVT5) in this group.
A maximum of 15 steps of program pattern can be created.

Step number	1	2
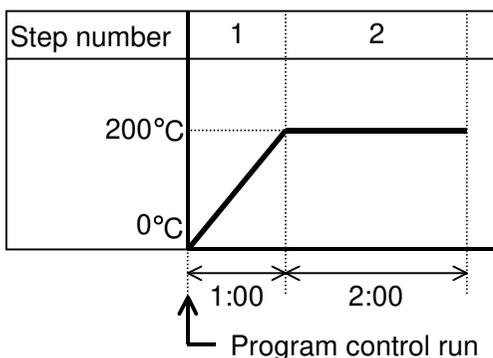
This program pattern shows that the temperature rises to 200℃ for 1 hour, and stays at 200℃ for 2 hours.

In this case, Step 1 SV is 200℃, and Step 1 time is 1 hour.

Program control run

(Fig. 8.2.2-1)

[Wait function]

During the program control run, the program does not proceed to the next step until the deviation between PV and SV enters SV±Wait value at the end of step. The STEP indicator flashes while the Wait function is working.

The Wait function is released on the condition that:
When program pattern is rising: PV is higher than SV- Wait value
When program pattern is falling: PV is lower than SV+ Wait value

Step	1	2	3	4	5
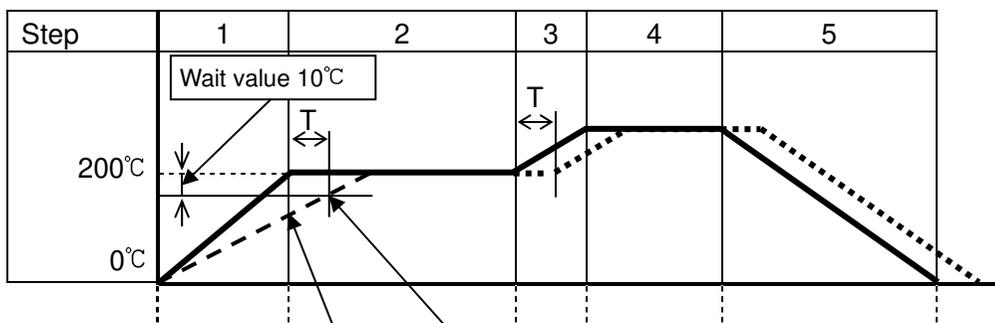
Wait value 10℃

If PV becomes higher than 190℃, the wait function will be released and proceed to Step 2.

As PV is not in the range of SV±Wait value, the unit is in Wait status, and does not proceed to Step 2. The STEP indicator flashes during Wait action (T time).

– – – – – : PV

———— : Program pattern

.... : Program pattern delayed by T due to the Wait function

(Fig. 8.2.2-2)

To enter the Program Pattern group, follow the procedure below.

(1) | ⌐ㄴ | Press the **SET** key in PV/SV Display Mode.
The unit proceeds to the Program Pattern group.

(2) | �ㄴ ⬚ | Press the **MODE** key.
The unit proceeds to 'Step1 SV'.

Character	Name, Function, Setting Range	Factory Default
� STEP 1 0	**Step 1 SV** • Sets Step 1 SV. • Setting range: Scaling low limit value to Scaling high limit value	0℃
⌐I ME 00.00 STEP 1	**Step 1 time** • Sets Step 1 time. • Setting range: 00:00 to 99:59	00:00

WAI ⌐
 	
STEP 1   0
	Step 1 wait value
	• Sets Step 1 wait value.
	  This function prevents the step from proceeding to the next one until
	  PV enters the range of SV±Wait value regardless of the step time.
	  Setting the value to 0 or 0.0 disables the function.
	• Setting range: 0 to Converted value of 20% of input span
		0℃

A I STEP 1 0	**Step 1 EVT1 alarm value** • Sets Step 1 EVT1 alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT1 allocation]. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃
A IH STEP 1 0	**Step 1 EVT1 high limit alarm value** • Sets Step 1 EVT1 high limit alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm)**. Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT1 allocation]. For the independent alarms such as High/Low limits independent alarm and High/Low limit range independent alarm, the EVT alarm value matches the low limit side, and EVT high limit alarm value matches the high limit side. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃
A4 STEP 1 0	**Step 1 EVT4 alarm value** • Sets Step 1 EVT4 alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm)**. Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT4 allocation]. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃

Character	Name, Function, Setting Range	Factory Default
A4H STEP 1 0	**Step 1 EVT4 high limit alarm value** • Sets Step 1 EVT4 high limit alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT4 allocation]. For the independent alarms such as High/Low limits independent alarm and High/Low limit range independent alarm, the EVT alarm value matches the low limit side, and EVT high limit alarm value matches the high limit side. • Setting range: Refer to (Table 8.1.2-1) on p.53	0℃
A5 STEP 1 0	**Step 1 EVT5 alarm value** • Sets Step 1 EVT5 alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT5 allocation]. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃
A5H STEP 1 0	**Step 1 EVT5 high limit alarm value** • Sets Step 1 EVT5 high limit alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT5 allocation]. For the independent alarms such as High/Low limits independent alarm and High/Low limit range independent alarm, the EVT alarm value matches the low limit side, and EVT high limit alarm value matches the high limit side. • Setting range: Refer to (Table 8.1.2-1) on p.53	0℃
Step 1 data contains from Step 1 SV to Step 1 EVT5 high limit alarm value. Can be set repeatedly up to Step 15.		
A5H STEP 15 0	**Step 15 EVT5 high limit alarm value** • Sets Step 15 EVT5 high limit alarm value. **Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm).** Not available if No event is selected. Available only when Alarm output is selected in [Event output EVT5 allocation]. For the independent alarms such as High/Low limits independent alarm and High/Low limit range independent alarm, the EVT alarm value matches the low limit side, and EVT high limit alarm value matches the high limit side. • Setting range: Refer to (Table 8.1.2-1) on p.53.	0℃

Step SV and EVT1, EVT4 and EVT5 values from Steps 1 to 15 are common to
SV and EVT1, EVT4 and EVT5 values of Set value memory numbers 1 to 15.

8.2.3 PID Group

PID parameters can be set in this group.

PID group is common to Fixed value control and program control.

To enter the PID group, follow the procedure below.

(1) $\boxed{G\_PI\ d}$ Press the **SET** key twice in PV/SV Display Mode.

The unit proceeds to the PID group.

(2) $\boxed{P \quad 10}$ Press the **MODE** key.

If PID zone function "Not used" is selected in [PID zone function],

$\boxed{ZV \quad 0}$ the unit proceeds to 'Proportional band 1'.

If PID zone function "Used" is selected in [PID zone function],

the unit proceeds to 'PID zone value 1'.

Character	Name, Function, Setting Range	Factory Default
$\boxed{ZV \atop \text{MEMO } 1 \quad 0}$	**PID zone value 1** • Sets PID zone value 1 (Reference value 1) to change PID zone parameters of the PID zone function. Available when the PID zone function "Used" is selected in [PID zone function]. One zone contains from "PID zone value 1" to "MV rate-of-change 1". When SV is lower than Reference value 1, control is performed with these PID zone parameters. • Setting range: Scaling low limit value to Scaling high limit value	0℃
$\boxed{P \atop \text{MEMO } 1 \quad 10}$	**Proportional band 1** • Sets proportional band 1. ON/OFF control when set to 0 or 0.0. • Setting range: 0 to Input span ℃(℉) DC voltage, current inputs: 0.0 to 1000.0%	10℃
$\boxed{I \atop \text{MEMO } 1 \quad 200}$	**Integral time 1** • Sets integral time 1. Setting the value to 0 disables the function. Auto-reset can be performed when PD is control action (I=0). • Setting range: 0 to 3600 seconds When "FBP No" is selected in [FBP Yes/No]: 1 to 3600 seconds	200 seconds
$\boxed{d \atop \text{MEMO } 1 \quad 50}$	**Derivative time 1** • Sets derivative time 1. Setting the value to 0 disables the function. • Setting range: 0 to 1800 seconds	50 seconds
$\boxed{ARW \atop \text{MEMO } 1 \quad 50}$	**ARW 1** • Sets ARW 1 (anti-reset windup 1). • Setting range: 0 to 100%	50%

Character	Name, Function, Setting Range	Factory Default

R4EF
MEMO 1   0.0
	Manual reset 1
	• Sets reset value 1 manually.
	• Setting range: ±1000.0
	  DC voltage, current inputs: The placement of the decimal point
	                               follows the selection.
		0.0℃

oRAr
MEMO 1   0
	MV rate-of-change 1
	• Sets MV rate-of-change 1 (changing value of MV for 1 second).
	  Setting the value to 0 disables the function.
	  See "MV rate-of-change" on p.55.
	• Setting range: 0 to 100 %/second
		0 %/second

	When PID zone function "Used" is selected in [PID zone function], one zone contains from "PID zone value 1" to "MV rate-of-change 1". Can be set repeatedly up to 5 zones.	

oRAr
MEMO 5   0
	MV rate-of-change 5
	• Sets MV rate-of-change 5 (changing value of MV for 1 second).
	  Setting the value to 0 disables the function.
	  See "MV rate-of-change" on p.55.
	• Setting range: 0 to 100 %/second
		0 %/second

[MV rate-of-change]

For Heating control, if PV is lower than SV, output is generally turned from OFF to ON as shown in (Fig. 8.2.3-1).

If MV rate-of-change is set, the output can be changed by the rate-of-change (Fig. 8.2.3-2). This control is suitable for high temperature heaters (which are made from molybdenum, tungsten or platinum, etc., and used at approx. 1500 to 1800℃) which are easily burnt out from turning on electricity rapidly.

● **Usual output**   ● **Output when MV rate-of-change is set**
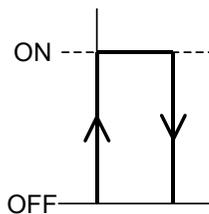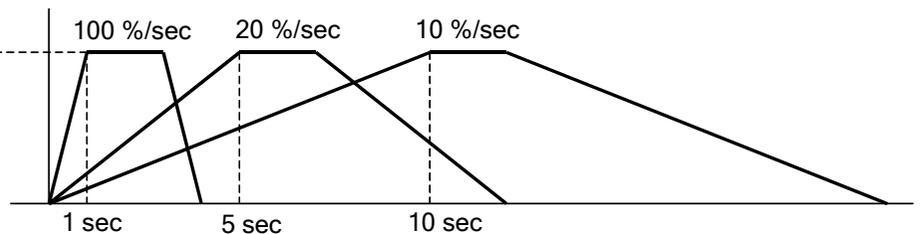
(Fig. 8.2.3-1)   (Fig. 8.2.3-2)

8.2.4 AT Group

AT/Auto-reset Perform/Cancel, AT bias can be set in this group.

AT group is common to Fixed value control and program control.

During ON/OFF control or PI control, the unit cannot proceed to any setting items in this group.

If PID zone function "Used" is selected, and if control action of the PID zone number used for control is ON/OFF or PI, the unit cannot proceed to any setting items in this group.

To enter the AT group, follow the procedure below.

(1) $\boxed{L\_RT}$ Press the SET key 3 times in PV/SV Display Mode.
                The unit proceeds to the AT group.

(2) $\boxed{RT_{\_\_\_\_\_}}$ Press the MODE key.
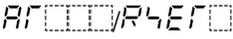   The unit proceeds to 'AT/Auto-reset'.

Character	Name, Function, Setting Range	Factory Default

RT
 $-----$
	AT/Auto-reset
	 • Selects AT Perform/Cancel (PID control) or
	    Auto-reset Perform/Cancel (P, PD control).
	 • If PID zone function "Used" is selected, values such as P, I, D, ARW of
	    the PID block number which are used for control are changed after AT
	    is finished.
	 • If the AT is cancelled during the process, P, I, D and ARW values
	    revert to the values before AT was performed.
	 • AT will be forced to stop if it has not been completed within 4 hours.
	 • Auto-reset is cancelled in approximately 4 minutes. It cannot be
	    released while performing this function.
	 • $-----$: AT/Auto-reset Cancel
	    $RT\square\square\square$/$R4ET\square$: AT/Auto-reset Perform
	    If AT/Auto-reset Perform is selected, and the MODE key is pressed,
	    the unit reverts to PV/SV Display Mode.
		$-----$
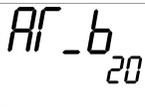
RT_b_{20}	**AT bias**
	 • Sets bias value for the AT.
	    Refer to "11. AT" on pages 73, 74.
	    Not available for DC voltage, current inputs.
	 • Setting range: 0 to 50℃ (0 to 100℉)
	    With a decimal point: 0.0 to 50.0℃ (0.0 to 100.0℉)
		20℃

9. Operation

9.1 Starting Operation

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

(1) Turn the power supply to the unit ON.

After the power is turned on, the PV Display indicates the input type, and the SV/MV/TIME Display indicates the input range high limit value (thermocouple, RTD inputs) or scaling high limit value (DC voltage, current inputs) for approximately 3 seconds.
See (Table 9.1-1).

(Table 9.1-1)

Sensor Input	℃		℉	
	PV Display	SV/MV/TIME Display	PV Display	SV/MV/TIME Display
K	K□□□℃	□1370	K□□□℉	□2498
	K□□.℃	□400.0	K□□.℉	□752.0
J	J□□□℃	□1000	J□□□℉	□1832
R	R□□□℃	□1760	R□□□℉	□3200
S	5□□□℃	□1760	5□□□℉	□3200
B	b□□□℃	□1820	b□□□℉	□3308
E	E□□□℃	□□800	E□□□℉	□1472
T	┌□□.℃	□400.0	┌□□.℉	□752.0
N	N□□□℃	□1300	N□□□℉	□2372
PL-Ⅱ	PL2□℃	□1390	PL2□℉	□2534
C(W/Re5-26)	c□□□℃	□2315	c□□□℉	□4199
Pt100	Pr□.℃	□850.0	Pr□.℉	1562.0
JPt100	JPr□.℃	□500.0	JPr□.℉	□932.0
Pt100	Pr□□℃	□□850	Pr□□℉	□1562
JPt100	JPr□℃	□□500	JPr□℉	□□932
Pt100	Pr1.℃	□100.0	Pr2.℉	□212.0
Pt100	Pr5.℃	□500.0	Pr9.℉	□932.0
4 to 20 mA DC	420MA			
0 to 20 mA DC	020MA			
0 to 10 mV DC	□10MV			
-10 to 10 mV DC	-10MV			
0 to 50 mV DC	□50MV	Scaling high limit value		
0 to 100 mV DC	100MV			
0 to 1 V DC	0□1□V			
0 to 5 V DC	0□5□V			
1 to 5 V DC	1□5□V			
0 to 10 V DC	0 10□V			

During this time, all outputs and indicators are in OFF status.
Control will then start, indicating as follows.

• Fixed value control status

The PV Display indicates PV, the SV/MV/TIME Display indicates SV, and the MEMO/STEP Display indicates the memory number if selected in [Event input allocation].

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- **When Control output OFF function is working**

  The PV Display indicates [$⌐FF$]. (Indication of the PV Display depends on the selection in [Indication when output OFF].)

- **Program control standby status**

  The PV Display indicates the PV, and the SV/MV/TIME Display and MEMO/STEP Display turn off.

- **When program control is operating**

  The PV Display indicates PV, the SV/MV/TIME Display indicates the Step SV, and the MEMO/STEP Display indicates the step number.

(2) Set up the unit.

Refer to "6. Operation Flowchart" (pp. 18 to 22) and "7. Setup" (pp. 23 to 50).
Setup should occur in the Engineering group before using this controller according to the user's conditions:

   Setting the Input type, Event output type, Control action, etc.

The control motor is connected to the actuator for the controller.
Select FBP (Feedback potentiometer) Yes/No in the Output group, and be sure to set the following. (Pages 30, 32)
- If "FBP Yes" is selected, perform the FBP adjustment.
- If "FBP No" is selected, set the Open and Closed output time.

If the user's specification is the same as the factory default value of the instrument, or if setup has already been completed, it is not necessary to set up the controller. Proceed to Step (3).

(3) Input each set value.

Refer to "6. Operation flowchart" (pp. 18 to 22) and "8. Settings" (pp. 51 to 63).

(4) Turn the load circuit power ON.

The controller works as follows depending on the control (Fixed value control/Program control).

- **Fixed value control**

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

- **Program control**

  Perform program control

   To perform Program control, press the $\overset{\text{RUN}}{\text{STOP}}$ key.
   Program control starts ("PV start" is used).

   PV start: When the program control starts, the step SV and time are advanced to the PV, and the control starts.

   If "Program start temperature" has been set in the Program group, Program control starts from the preset temperature.
   While the Wait function is working, the STEP indicator flashes.

  Stop program control

   To stop Program control, press the $\overset{\text{RUN}}{\text{STOP}}$ key for 1 second.
   Program control stops, and the unit reverts to Program control standby.

Advance function (proceeds to the next step during program operation)

If the △ key is pressed for 1 second during program control, it interrupts the performing step, and proceeds to the next step.

While the Wait function is working, the Wait function is cancelled, and the unit proceeds to the next step.

Control after power restoration

If power failure occurs during the Program control and is restored, control stops (standby), continues or is suspended depending on the selection in [Power restore action].

To cancel the "Suspension (on hold) after power is restored", press the $\overset{\text{RUN}}{\text{STOP}}$ key.

(e.g.) **When setting the SV to 100℃ in the Fixed value control.**

①

Proceed to the SV setting mode.

Press the MODE key in PV/SV Display Mode.

The unit proceeds to SV setting mode.

②

Set SV.

Set SV with the △ or ▽ key.

③

Register the SV.

Press the MODE key to register the SV.

The unit reverts to PV/SV Display Mode.

④

Control starts.
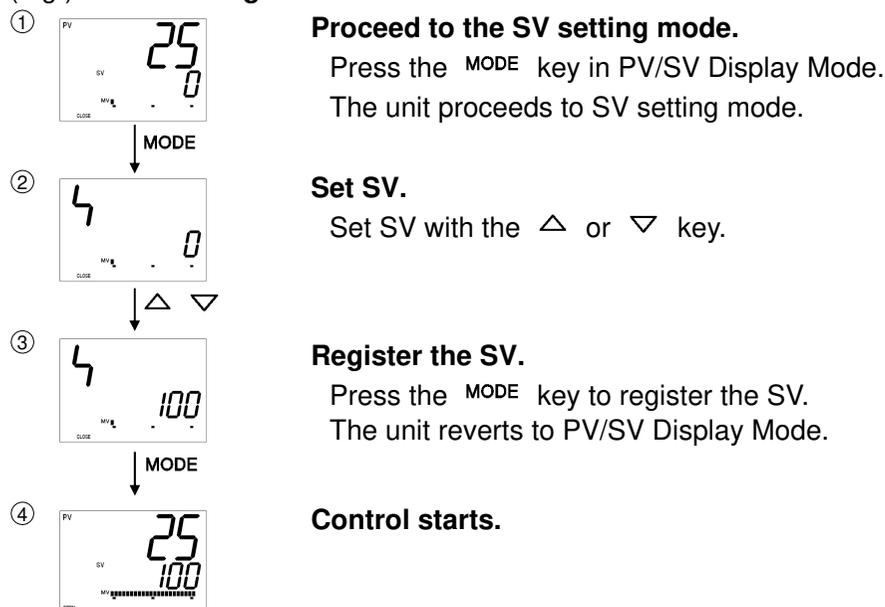
9.2 Control Output OFF Function

This is a function to pause the control action or turn the control output of the unused instrument of the plural units OFF even if the power to the instrument is supplied.

This function is available for Fixed value control.

To turn the control output OFF, press the $\frac{RUN}{STOP}$ key for 1 second in PV/SV Display Mode.

[ᴏFF⏘] is indicated on the PV Display while the function is working.

(However, indication on the PV Display depends on the selection in [Indication when output OFF].)
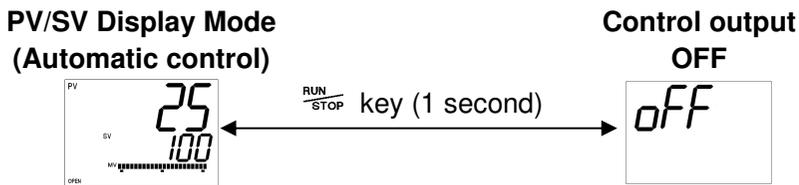
Once the control output OFF function is enabled, the function cannot be released even if the power to the instrument is turned OFF and ON again.

To cancel the function, press the $\frac{RUN}{STOP}$ key again for approx. 1 second.

PV/SV Display Mode　　　　　　　　**Control output**
(Automatic control)　　　　　　　　　　　**OFF**

9.3 Switching Auto/Manual Control

By pressing the $\frac{A/M}{B.MODE}$ key in PV/SV Display Mode, Auto/Manual control can be switched.

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

When automatic control is switched to manual control, the MEMO/STEP Display indicates [ᴹ].

The MV on the SV/MV/TIME Display can be increased or decreased by pressing the △ or ▽ key to perform the control.

By pressing the $\frac{A/M}{B.MODE}$ key again, the unit reverts to PV/SV Display Mode (automatic control).

Whenever the power to the controller is turned on, automatic control starts.

Switching from Automatic to Manual control, and vice versa

PV/SV Display Mode　　　　　　　　　**Manual control**
(Automatic control)

Increases or decreases MV with the △ , ▽ key.

9.4 Indicating MV and Remaining Step Time (program control)

To indicate MV, press the MODE key for approximately 3 seconds in PV/SV Display Mode. The SV/MV/TIME Display indicates output MV and the MEMO/STEP Display indicates [Ɱ]. SV and TIME of the SV/MV/TIME indicator are unlit, and MV of the SV/MV/TIME indicator is lit.

If the MODE key is pressed again during Fixed value control, the unit reverts to PV/SV Display Mode.

If the MODE key is pressed during program control, remaining step time is indicated on the SV/MV/TIME Display.

SV and MV of the SV/MV/TIME indicator are unlit, and TIME of the SV/MV/TIME indicator is lit. By pressing the MODE key again, the unit reverts to PV/SV Display Mode.

During Fixed value control:

9.5 AT/Auto-reset Perform, AT Cancel
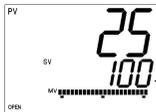
In order to set each value of P, I, D and ARW automatically, the AT process should be made to fluctuate to obtain an optimal value. (See pages 73, 74.)

AT/Auto-reset Perform and AT Cancel can be set in [AT/Auto-reset] in the AT group. Auto-reset can be performed when the unit is in P or PD control action. (See p.73.)

Auto-reset takes approximately 4 minutes. It cannot be released while performing this function.

How to perform AT/Auto-reset

(1) Press the SET key 3 times in PV/SV Display Mode.

The unit proceeds to the AT group.

(2) Press the MODE key.

The unit proceeds to 'AT/Auto-reset'.

(3) Select [Ar⎕⎕/R5Er⎕] (AT/Auto-reset Perform) with the △ key, and press the MODE key.

The unit returns to PV/SV Display Mode, and AT/Auto-reset will initiate.

While performing AT/Auto-reset, the AT indicator is flashing.

AT will be forced to stop if it has not been completed within 4 hours.

During AT, if Direct/Reverse action (003) is switched in [Event input allocation], the AT stops.

Auto-reset is cancelled in approximately 4 minutes. It cannot be released while performing this function.

How to cancel AT

(1) Press the SET key 3 times in PV/SV Display Mode.
   The unit proceeds to the AT group.

(2) Press the MODE key.
   The unit proceeds to 'AT/Auto-reset'.

(3) Select [− − − − −] (AT/Auto-reset Cancel) with the ▽ key, and press the MODE key
   for 3 seconds. AT will stop, and the unit will revert to PV/SV Display Mode.
   If AT is cancelled during this process, each value of P, I, D and ARW reverts to the
   values before AT was performed.

AT Perform/Cancel (PID control):
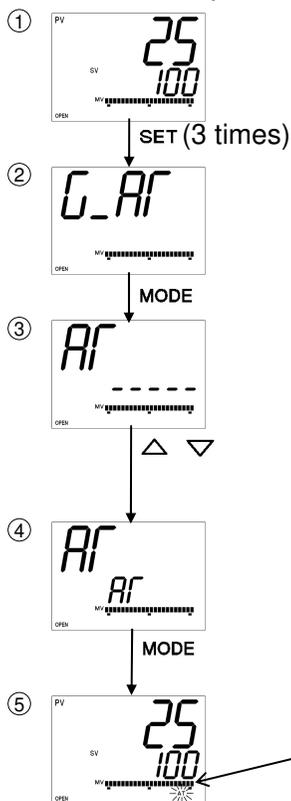
①   **Proceed to the AT group.**
           Press the SET key 3 times in PV/SV Display Mode.
           The unit proceeds to the AT group.

SET (3 times)

②   **Proceed to 'AT/Auto-reset'.**
           Press the MODE key.
           The unit proceeds to 'AT/Auto-reset'.

MODE

③   **Select AT Perform/Cancel.**
           Select [Ar] (AT Perform) with the △, or
           select [− − − − −] (AT Cancel)" with the ▽.
           − − − − − : AT Cancel
           Ar : AT Perform

△ ▽

④   **Confirm AT Perform/Cancel.**
           If "AT Perform" is selected, press the MODE key.
           If "AT Cancel" is selected, press the MODE key for 3
           seconds. The unit reverts to PV/SV Display Mode.

MODE

⑤   **AT Perform/Cancel**
           While AT is performing, the AT indicator flashes, and
           it turns off when AT is cancelled.

9.6 Using Event Output as a High/Low Limits Independent Alarm

To use the Event output as a High/Low limits independent alarm, set as follows.
(e.g.)

SV: 100℃
EVT1 (low limit) alarm value: 10℃
EVT1 high limit alarm value: 20℃

90℃ 100℃   120℃
(Fig. 9.6-1)
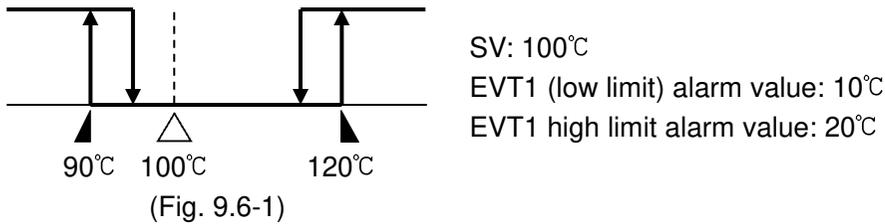
(1) Select [Engineering group] – [Event output group] – [Event output EVT1 allocation]
– [Alarm output; High/Low limits independent] in order.

① **Proceed to the Engineering group.**
Press the SET key 4 times in PV/SV Display Mode.
The unit proceeds to the Engineering group.

SET (4 times)
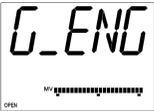
② **Proceed to the Input group.**
Press the MODE key.
The unit proceeds to the Input group.

MODE

③ **Proceed to the Event output group.**
Press the SET key several times until Event output
group characters appear.

SET (several times)

④ **Proceed to the Event output EVT1 allocation.**
Press the MODE key.
The unit proceeds to 'Event output EVT1 allocation'.

MODE

⑤ **Select Event output EVT1 allocation.**
Select [004: Alarm output; High/Low limits independent]
with the △ or ▽ key.

△ ▽

⑥ **Confirm the Event output EVT1 allocation.**
Press the MODE key.
The unit enters 'Event output EVT1 alarm hysteresis'.

MODE

⑦ **Set Event output EVT1 alarm hysteresis.**
Use the △ or ▽ key for settings, and press the
MODE key.
The unit proceeds to the 'Event output EVT1 alarm
delay time'.

MODE

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⑧ **A IdLY** 0
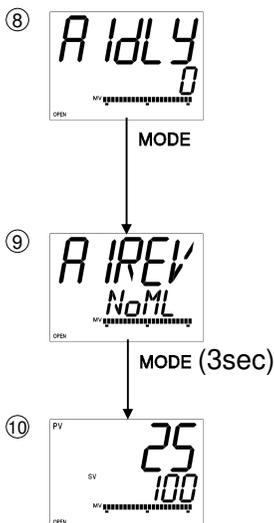
Set Event output EVT1 alarm delay time.
Use the △ or ▽ for settings, and press the MODE key.
The unit proceeds to 'Event output EVT1 alarm Energized/De-energized'.

| MODE

⑨ **A IREV** NoML

Select Event output EVT1 alarm Energized/De-energized.
Use the △ or ▽ for settings, and press the MODE key for 3 seconds.
The unit reverts to PV/SV Display Mode.

| MODE (3sec)

⑩ PV **25** SV **100**

PV/SV Display Mode

---

(2) Set EVT1 (low limit) alarm value and EVT1 high limit alarm value.

① PV **25** SV **100**
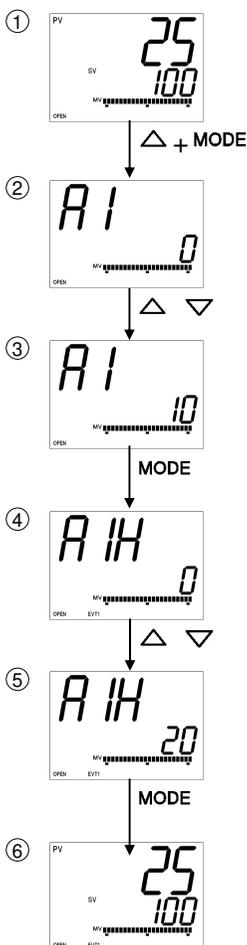
Proceed to Event setting mode.
Press the △ and MODE key (in that order) together in PV/SV Display Mode.
The unit enters Event setting mode.

| △ + MODE

② **A 1** 0

Set the EVT1 (low limit) alarm value.
Set the EVT1 (low limit) alarm value with the △ or ▽ key.

| △ ▽

③ **A 1** 10

Register the EVT1 (low limit) alarm value.
Press the MODE key. The EVT1 (low limit) alarm value will be registered, and the unit proceeds to 'EVT1 high limit alarm value'.

| MODE

④ **A 1H** 0

Set EVT1 high limit alarm value.
Set the EVT1 high limit alarm value with the △ or ▽ key.

| △ ▽

⑤ **A 1H** 20

Register the EVT1 high limit alarm value.
Press the MODE key. The EVT1 high limit alarm value will be registered, and the unit reverts to PV/SV Display Mode.

| MODE

⑥ PV **25** SV **100**

PV/SV Display Mode

9.7 Set Value Memory Function

If 'Set value memory' is selected in [Event input EVI1 to EVI4 allocation], memory file number can be selected by external operation. Up to 15 files with 9 pieces of data can be memorized. Control can be performed by selecting the desired file.

In one file, 9 pieces of data are included: SV, Step time, Wait value, EVT1 alarm value, EVT1 high limit alarm value, EVT4 alarm value, EVT4 high limit alarm value, EVT5 alarm value, EVT5 high limit alarm value.

If 'Set value memory' is selected for all from EVI1 to EVI4 in [Event input EVI1 to EVI4 allocation], the memory number can be set by connecting terminals 11 through 15 as follows.
A maximum of 50 units of controllers can be connected in parallel.

Set value memory numbers by connecting terminals: [●: Closed(ON), x: Open(OFF)]

Set value memory No. / Connecting terminals	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	(*)
11–15 [DI1(EVI1)-COM]	x	●	x	●	x	●	x	●	x	●	x	●	x	●	x	●
12–15 [DI2(EVI2)-COM]	x	x	●	●	x	x	●	●	x	x	●	●	x	x	●	●
13–15 [DI3(EVI3)-COM]	x	x	x	x	●	●	●	●	x	x	x	x	●	●	●	●
14–15 [DI4(EVI4)-COM]	x	x	x	x	x	x	x	x	●	●	●	●	●	●	●	●

(*): Works as Set value memory number 15.

If 'Set value memory' is selected for EVI1 and EVI2 in [Event input EVI1 to EVI4 allocation]: Set value memory number can be selected using terminals 11, 12 and 15 as shown below.

Set value memory numbers by connecting terminals: [●: Closed(ON), x: Open(OFF)]

Set value memory No. / Connecting terminals	1	2	3	4
11–15 [DI1(EVI1)-COM]	x	●	x	●
12–15 [DI2(EVI2)-COM]	x	x	●	●

During setting mode or while AT is performing, memory numbers cannot be changed by connecting terminals.

[Operation procedure]
Simplified setting
(1) Select the Set value memory number by connecting terminals in PV/SV Display Mode.
(2) Set the following values.
   SV (in SV setting mode), EVT1 alarm value, EVT1 high limit alarm value, EVT4 alarm value, EVT4 high limit alarm value, EVT5 alarm value, EVT5 high limit alarm value (in Event setting mode)

Group selection (Fixed value control)
(1) Proceed to the desired setting item of Set value memory number to be set in the SV, Event group.
(2) Set the following values.
   SV, EVT1 alarm value, EVT1 high limit alarm value, EVT4 alarm value, EVT4 high limit alarm value, EVT5 alarm value, EVT5 high limit alarm value

[Registration complete]
• Each set value is registered in the file number displayed on the MEMO/STEP Display.
• When any number is retrieved by connecting terminals, the selected number will be indicated, and the control is performed using the data (set values) of the indicated file number.
• To change the set values, repeat the "Operation procedure" above.

10. Auto-reset

Auto-reset is performed to correct the offset at the point at which PV indication is stabilized within the proportional band during the PD control. Since the corrected value is internally memorized, it is not necessary to perform the auto-reset again as long as the process is the same. However, when proportional band (P) is set to 0 or 0.0, the corrected value is cleared.
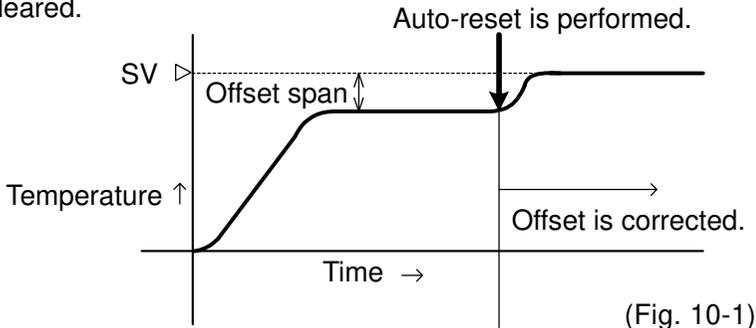
(Fig. 10-1)

11. AT (Auto-tuning)

In order to set each value of P, I, D and ARW automatically, the AT process should be made to fluctuate to obtain an optimal value. One of 3 types of fluctuation (p.74) is automatically selected.

For DC voltage, current inputs, the AT process will fluctuate around the SV for conditions of [1], [2] and [3]. (p.74)

⚠ Notice

• Perform AT during the trial run.

• If PID zone function is set to "Used", perform AT in each PID zone.
  In (Fig. 11-1), AT is performing at PID zone value 1 and PID zone value 2.

PID zone parameters of PID zone value 1 are calculated by performing AT.

PID zone parameters of PID zone value 2 are calculated by performing AT.
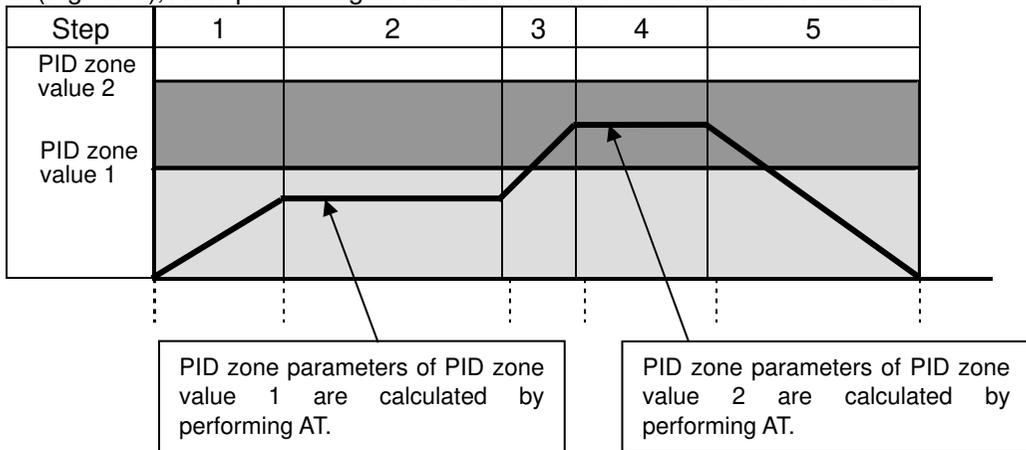
(Fig. 11-1)

• If AT is cancelled during this process, each value of P, I, D and ARW reverts to the values before the AT was performed.

• AT will be forced to stop if it has not been completed within 4 hours.

• During AT, if Direct/Reverse action (003) is switched in [Event input allocation], the AT stops.

• During AT, none of the setting items can be set.

• If power failure occurs during the AT, the tuning stops.

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

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[1] If there is a large difference between the SV and PV as the temperature is rising

When AT bias is set to 20℃, the AT process will fluctuate at the temperature 20℃ lower than the SV.
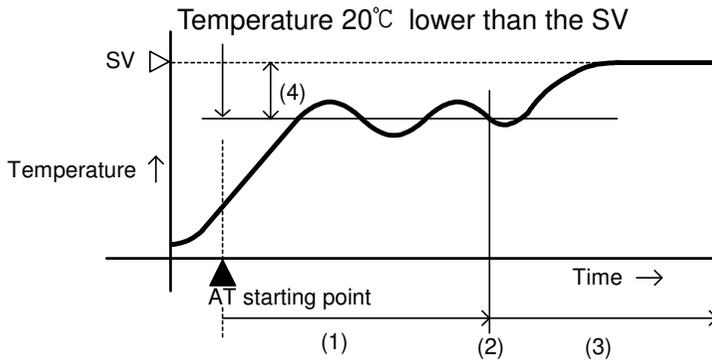
(1) Calculates PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by AT
(4) AT bias value

(Fig. 11-1)

[2] When the control is stable

The AT process will fluctuate around the SV.
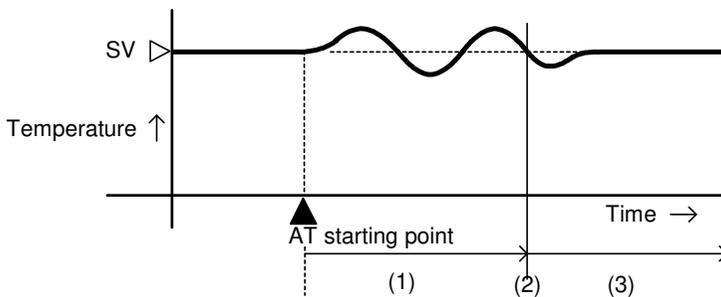
(1) Calculates PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by AT

(Fig. 11-2)

[3] If there is a large difference between the SV and PV as the temperature is falling

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

(1) Calculates PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by AT
(4) AT bias value

(Fig. 11-3)

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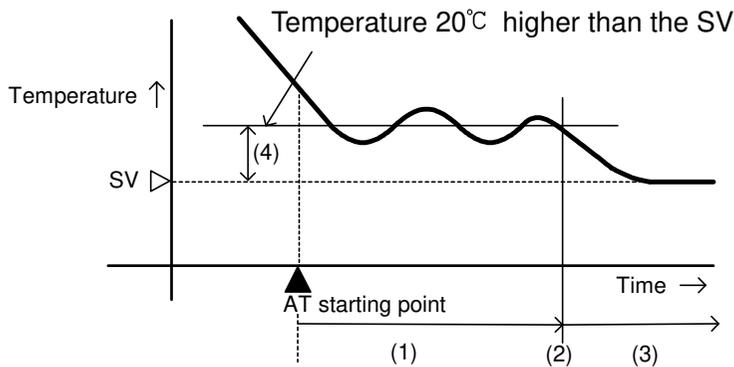
12. Action Explanation

12.1 Control Output Action

	Heating (reverse) action	Cooling (direct) action
Control action	ON / OFF with Proportional band, SV	ON / OFF with Proportional band, SV
Open output terminals ⑤ - ⑥ / Closed output terminals ⑥ - ⑦	⑤⑥⑦ Cycle action is performed according to deviation	⑤⑥⑦ Cycle action is performed according to deviation
Action indicator OPEN	Lit ▨ Unlit	Unlit ▨ Lit
Action indicator CLOSED	Unlit ▨ Lit	Lit ▨ Unlit

▨ : Turns ON (lit) or OFF (unlit)

12.2 Control Output ON/OFF Action

	Heating (reverse) action	Cooling (direct) action
Control action	ON / OFF with Hysteresis, SV	ON / OFF with Hysteresis, SV
Open output terminals ⑤ – ⑥ / Closed output terminals ⑥ – ⑦	⑤⑥⑦ ⑤⑥⑦	⑤⑥⑦ ⑤⑥⑦
Action indicator OPEN	Lit ▨ Unlit	Unlit ▨ Lit
Action indicator CLOSED	Unlit ▨ Lit	Lit ▨ Unlit

▨ : Turns ON (lit) or OFF (unlit)

12.3 Open/Closed Output Dead Band/Hysteresis

	Heating (reverse) action	Cooling (direct) action
Open output	Hysteresis Dead band, ON / OFF, MV	Dead band Hysteresis, ON / OFF, MV
Closed output	Dead band Hysteresis, ON / OFF, MV	Hysteresis Dead band, ON / OFF, MV

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12.4 Alarm Action

	High limit alarm	Low limit alarm
Alarm action	EVT1 hysteresis ON OFF -EVT1 value SV +EVT1 value	EVT1 hysteresis ON OFF -EVT1 value SV +EVT1 value
Alarm output	+side - side	+side - side

	High/Low limits alarm	High/Low limits independent alarm
Alarm action	EVT1 hysteresis ON OFF EVT1 value SV EVT1 value	EVT1 hysteresis ON OFF EVT1 low limit value SV EVT1 high limit value
Alarm output		

	High/ Low limit range alarm	High/ Low limit range independent
Alarm action	EVT1 hysteresis ON OFF EVT1 value SV EVT1 value	EVT1 hysteresis ON OFF EVT1 low limit value SV EVT1 high limit value
Alarm output		

	Process high alarm	Process low alarm
Alarm action	EVT1 hysteresis ON OFF EVT1 value	EVT1 hysteresis ON OFF EVT1 value
Alarm output		

	High limit alarm with standby	Low limit alarm with standby
Alarm action		
Alarm output	+ side / - side	+side / - side
	High/Low limits with standby	High/Low limits with standby independent
Alarm action		
Alarm output		

■ : EVT1 output terminals 9 and 10 are closed (ON).

▨ : EVT1 output terminals 9 and 10 are closed (ON) or opened (OFF).

□ : EVT1 output terminals 9 and 10 are opened (OFF).

▨ : Alarm output is in standby.

- EVT1 value means EVT1 alarm value, and EVT1 hysteresis means EVT1 alarm hysteresis.

- EVT1 indicator lights when their output terminals 9 and 10 are closed (ON), and turns off when their output terminals 9 and 10 are opened (OFF).
  For EVT4, read "EVT4" for "EVT1".
  For EVT5, read "EVT5" for "EVT1".

  EVT4 output (terminals 29, 30)
  EVT5 output (terminals 28, 30)

- For the alarm type (High limit alarm, High/Low limits alarm, High/Low limits independent, Process high alarm), the alarm is activated when the indication is overscale, and the standby function is released for the alarms with standby.
  For the alarm type (Low limit alarm, High/Low limits alarm, High/Low limits independent, Process low alarm), the alarm is activated when the indication is underscale, and the standby function is released for the alarms with standby.
  When the alarm action De-energized is selected, the output ON/OFF status acts conversely to the alarm action described above. (The Event indicator is the same as the action Energized.)

	Energized	De-energized
Event indicator	Lights	Lights
Event output	ON	OFF

13. Specifications

13.1 Standard Specifications

Rating

Input Thermocouple: K, J, R, S, B, E, T, N, PL-Ⅱ, C(W/Re5-26)
          External resistance, 100 Ω max.
          (However, B input: External resistance, 40 Ω max.)
      RTD: Pt100, JPt100, 3-wire type
          Allowable input lead wire resistance: 10 Ω max. per wire
     Direct current: 0 to 20 mA DC, 4 to 20 mA DC
          Input impedance: 50 Ω
          Allowable input current: 50 mA max.
      DC voltage: 0 to 10 mV DC, -10 to 10 V DC, 0 to 50 mV DC, 0 to 100 mV DC,
          0 to 1 V DC:
          Input impedance: 1 MΩ minimum
          Allowable input voltage: 5 V DC max.
          Allowable signal source resistance:
            0 to 10 mV DC: 20 Ω max.
            -10 to 10 mV DC: 40 Ω max.
            0 to 50 mV DC: 200 Ω max.
            0 to 100 mV DC: 200 Ω max.
            0 to 1 V DC: 2 kΩ max.
        0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC:
          Input impedance: 100 kΩ minimum
          Allowable input voltage: 15 V DC max.
          Allowable signal source resistance: 100 Ω max.

Power supply voltage: 100 to 240 V AC 50/60 Hz, 24 V AC/DC 50/60 Hz
         Allowable voltage fluctuation: 100 to 240 V AC: 85 to 264 V AC
                    24 V AC/DC: 20 to 28 V AC/DC

General structure

External dimensions: ACD-15A: 96 x 96 x 100 mm (W x H x D)
          ACR-15A: 48 x 96 x 100 mm (W x H x D)
Mounting: Flush
Material: Flame-resistant resin (Case)
Color: Black (Case)
Drip-proof/Dust-proof: IP66 (for front panel only)
Display
 PV Display: 11-segment LCD 5-digit, backlight Red/Green/Orange
          ACD-15A: Character size: 24.0 x 11.0 mm (H x W)
          ACR-15A: Character size: 14.0 x 5.4 mm (H x W)
 SV/MV/TIME Display: 11-segment LCD 5-digit, backlight Green
          ACD-15A: Character size: 14.0 x 7.0 mm (H x W)
          ACR-15A: Character size: 10.0 x 4.6 mm (H x W)
 MV/DV/Valve Bar Graph Display: 22-segment LCD bar graph, backlight Green
 MEMO/STEP Display: 11-segment LCD 2-digit, backlight Orange
          ACD-15A: Character size: 10.0 x 5.0 mm (H x W)
          ACR-15A: Character size: 10.0 x 4.6 mm (H x W)
 Action indicators: Backlight Orange
Setting structure
 Setting method: Digital setting using membrane sheet keys

Indication performance
Base accuracy:
Thermocouple : Within ±0.2% of each input span±1 digit,
However R, S inputs, 0 to 200℃ (32 to 392℉): Within ±6℃ (12℉)
B input, 0 to 300℃ (32 to 572℉): Accuracy is not guaranteed.
K, J, E, T, N inputs, less than 0℃ (32℉): Within ±0.4% of input span±1 digit

RTD: Within ±0.1% 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

External setting input accuracy: Within ±0.2% of External setting input span
Cold junction temperature compensation accuracy: Within ±1℃ at 0 to 50℃
Input sampling period: 125 ms (250 ms when EA□ or EV□ option is added)
Time accuracy: Within ±1.0% of the setting time

Control performance
Setting accuracy: Based on the base accuracy and Cold junction temperature compensation accuracy
Control action
PID control (with AT function)
PI control: When derivative time is set to 0
PD control (with Auto/Manual reset function): When integral time is set to 0
P control (with Auto/Manual reset function): When derivative and integral time are set to 0
ON/OFF control: When proportional band is set to 0 or 0.0
Proportional band: 0 to Input span ℃(℉)
DC voltage, current inputs: 0.0 to 1000.0%
(ON/OFF control when set to 0 or 0.0) (Default: 10℃)
Integral time: 0 to 3600 seconds (OFF when set to 0) (Default: 200 seconds)
1 to 3600 seconds (When "FBP No" is selected in [FBP Yes/No])
Derivative time: 0 to 1800 seconds (OFF when set to 0) (Default: 50 seconds)
ARW: 0 to 100% (Default: 50%)
ON/OFF hysteresis: 0.1 to 1000.0℃ (℉) (Default: 1.0℃)
DC voltage, current inputs: 1 to 10000 (The placement of the
decimal point follows the selection.)
MV high limit setting: 0 to 100% (Default: 100%)
MV low limit setting: 0 to 100% (Default: 0%)
Open output time: 0.1 to 1000.0 seconds (Default: 30.0 seconds)
Closed output time: 0.1 to 1000.0 seconds (Default: 30.0 seconds)
The output time corresponds to the MV 0 to 100%.
Open/Closed output dead band : 0 to 100% of the proportional band (Default: 10%)
Open/Closed output hysteresis : 0 to 100% of the proportional band (Default: 1%)

Control output
Relay contact: 1a x 2,
Control capacity: 3 A 250 V AC (resistive load)
1 A 250 V AC (inductive load $\cos\phi$=0.4)
Electrical life: 100,000 cycles

FBP resolution: 1000 (corresponds to Fully Open and Fully Closed after FBP adjustment.)

Feedback resistance: 100 Ω to 10 kΩ

Standard functions

EVT1 output

Output is turned ON or OFF depending on the conditions selected in [Event output allocation].

  Output: Relay contact 1a

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

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

        Electrical life: 100,000 cycles

Alarm action

When Alarm action (Energized) is selected in [Event output allocation], the alarm action point is set by the $\pm$ deviation from the SV (except Process alarm).
When the input goes outside the range, the output turns ON or OFF (in the case of High/Low limit range alarm).
When the alarm action is set as De-energized, the output acts conversely.

Types: High limit alarm, Low limit alarm, High/Low limits alarm, High/Low limits independent, High/Low limit range, High/Low limit range independent, Process high alarm, Process low alarm, High limit alarm with standby, Low limit alarm with standby, High/Low limits with standby, High/Low limits with standby independent
Energized/De-energized action are applied to the above alarms, totaling 24 alarm types. No event can also be selected.
(Factory default: No event)
Refer to '12.4 Alarm Action' on pages 76, 77.

Set value: Factory default: 0
Setting accuracy : Based on the Base accuracy and Cold junction temperature
                compensation accuracy
Action: ON/OFF action
          Hysteresis: Thermocouple, RTD inputs: 0.1 to 1000.0℃ (℉)
                      (Factory default: 1.0℃)
              DC voltage, current inputs: 1 to 10000 (The placement
                 of the decimal point follows the selection.)
Output: EVT output for which alarm is selected in [Event output allocation]

Loop break alarm

Detects the breaking status on the loop such as heater burnout, sensor burnout or actuator trouble.
Setting range : Loop break alarm time; 0 to 200 minutes
         Loop break alarm band; 0 to 150℃(℉), 0.0 to 150.0℃(℉),
             DC voltage, current inputs: 0 to 1500 (The placement
             of the decimal point follows the selection.)
Output: EVT output for which Loop break alarm is selected in [Event output allocation]

Insulation, Dielectric strength
  Circuit insulation configuration
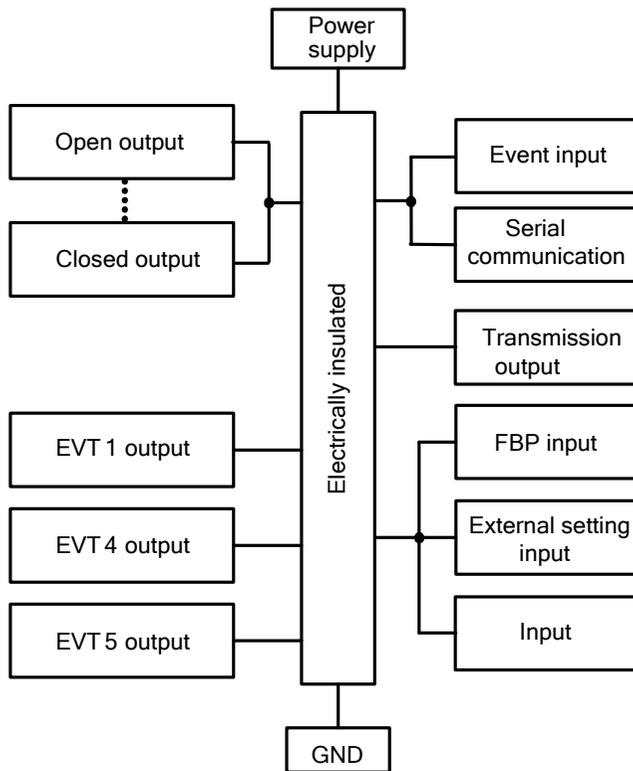
Insulation resistance: 10 MΩ minimum, at 500 V DC
Dielectric strength:
    Between power terminal and ground (GND): 1.5 kV AC for 1 minute
    Between input terminal and ground (GND):   1.5 kV AC for 1 minute
    Between input terminal and power terminal: 1.5 kV AC for 1 minute

Attached functions:

 [Sensor correction]
   Corrects sensor input value.

 [Set value lock]:
   Lock 1, Lock 2, Lock 3, Lock 4

 [Auto/Manual control switching]
   Auto/Manual control can be switched using the $\frac{A/M}{B.MODE}$ key in PV/SV Display Mode.

 [Program control function]
   Number of steps: 15
   Program control starts or stops with the $\frac{RUN}{STOP}$ key.
   If Pattern end output is selected in [Event output allocation] (pp. 35, 36), the Event
   output to which Pattern end output is allocated is turned ON when program is finished.
   Advance function: If the △ key is pressed for 1 second during program control, it
                       interrupts the performing step, and proceeds to the next step.

 [SV ramp function]
   When the SV is adjusted, it approaches the new SV by the preset rate-of-change
   (℃/minute, ℉/minute).
   When the power is turned on, the control starts from the PV and approaches the SV
   by the rate-of-change.

 [Power failure countermeasure]
   The setting data is backed up in the non-volatile IC memory.

 [Self-diagnosis]
   The CPU is monitored by a watchdog timer, and if an abnormal status occurs, the
   controller is switched to warm-up status, turning all outputs OFF.

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

 [Burnout]
   If the thermocouple or RTD input is burnt out, control output is turned OFF and the PV
   display flashes [‾ ‾ ‾ ‾ ‾].
   However, for the manual control, the preset MV is output.
   If DC voltage or current input is disconnected, PV Display flashes [_ _ _ _ _]
   for 4 to 20 mA DC and 1 to 5 V DC inputs, and flashes [‾ ‾ ‾ ‾ ‾] for 0 to 10 mV DC,
   -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 0 to 1 V DC.
   For 0 to 20 mA DC, 0 to 5 V DC and 0 to 10 V DC inputs, the PV Display indicates the
   value corresponding with 0 mA or 0 V input.

[Input error indication]

Contents and Indication	Output status	
	Direct (Cooling) action	Reverse (Heating) action
Overscale Measured value has exceeded Indication range high limit value. [¯ ¯ ¯ ¯ ¯] flashes.	OFF or MV low limit value	OFF or MV low limit value
Underscale Measured value has dropped below Indication range low limit value. [_ _ _ _ _] flashes.	OFF or MV low limit value	OFF or MV low limit value

For manual control, the preset MV is output.

[Indication range and Control range]

 Thermocouple input: [Input range low limit value – 50℃(100℉)] to [Input range high limit value + 50℃ (100℉)]

 RTD input: [Input range low limit value -Input span x 1%] to [Input range high limit value + 50℃ (100℉)]

 DC voltage, current inputs:
  [Scaling low limit value -Scaling span x 1%] to [Scaling high limit value +Scaling span x 10%]

[Warm-up indication]

 After the power supply to the instrument is turned on, the PV Display indicates the sensor input type, and SV/MV/TIME Display indicates input range high limit value (for thermocouple, RTD inputs) or Scaling high limit value (for DC voltage, current inputs) for approximately 3 seconds.

[Console communication]

 By connecting the USB communication cable (CMB-001) to the Console connector of the instrument, the following operations can be conducted from an external computer using the Console software SWS-AC001M.
 Console communication and Serial communication (C, C5 option) cannot be used together.
 (1) Reading and setting of SV, PID and various set values
 (2) Reading of PV and action status
 (3) Function change
 Communication interface: C-MOS level

[PV color selection]

 PV Display color can be selected.

[Timer function (linked with the Event input)]

If Timer output, which is linked with Event input, is selected in [Event output allocation], and if Timer Start/Stop is selected in [Event input allocation], this function activates.

If Event input turns ON, timer counting starts, and Event output turns ON or OFF after delay time has passed.

If the timer function is allocated to the Event input, which is linked with control, control turns ON while Event output is ON, and turns OFF if Event output is OFF.

[Bar graph]

The bar graph lights depending on the selection of MV, DV or Degree of valve opening.

[Action after power restoration]

Selects program status when power failure occurs during program control RUN and is restored.

Progressing time error after power is restored: 1 minute

[Error detection during FBP adjustment]

Selects Error detection Yes/No under given conditions while in FBP adjustment.

Power consumption:	ACD-15A: Approx. 16 VA
	ACR-15A: Approx. 15 VA
Ambient temperature:	0 to 50℃ (32 to 122℉)
Ambient humidity:	35 to 85 %RH (Non-condensing)
Weight:	ACD-15A: Approx. 460 g
	ACR-15A: Approx. 330 g

Accessories included

For the ACD-15A and ACR-15A:
Mounting brackets: 1 set
Gasket A (Front mounted to the unit): 1 piece
Instruction manual: 1 copy
For the ACR-15A only:
Harness FBP: 1 piece
Harness EVT5: 1 piece [When Event output (A5 option) is added]
Harness E: 1 piece [when External setting input (EA□, EV□ option) is added]
Harness VT: 1 piece [When Transmission output (TA1, TV1 option) is added]

Accessories sold separately

Terminal cover
USB communication cable (CMB-001)

13.2 Optional Specifications

Event input (Option code: EI)

An Event input contains events from EVI1 to EVI4.

Events selected from [Event input allocation] will be performed depending on the Input ON (Closed) or OFF (Open) status. See (Fig 7.3.3-1) on page 34.

If 'Set value memory' is selected:

2^0, 2^1, 2^2 and 2^3 will be allocated to Event input EVI1 to EVI4 respectively, and the Set value memory number (SV1 to SV15) will be determined by each value of EVI1 to EVI4.

The selected Set value memory number, the added value of 2^n +1, is indicated on the MEMO/STEP Display. See '9.7 Set Value Memory Function' on page 72.

Circuit current when Closed: Approx. 16 mA

Event output (Option code: A5)

Event output, EVT4 and EVT5 can be added.
Output will be turned ON or OFF depending on the conditions selected from [Event output allocation].
Output: Relay contact, 1a
        Control capacity: 3 A 250 V AC (Resistive load)
                    1 A 250 V AC (Inductive load, $\cos\phi$=0.4)
        Electrical life: 100,000 cycles

Serial communication (Option code: C, C5)

This option and Console communication cannot be used together.
The following operations can be carried out 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

Cable length:	Max.15 m (C)
	Max.1.2 km (C5)
	Cable resistance: Within 50 Ω
	(Terminators are not necessary, but if used, use a terminator of 120 Ω minimum on both sides.)
Communication line:	EIA RS-232C (C)
	EIA RS-485 (C5)
Communication method:	Half-duplex communication
Synchronization method:	Start-stop synchronization
Communication speed:	9600/19200/38400 bps (Selectable by keypad)
	(Factory default: 9600 bps)
Data bit/Parity:	7 bits, 8 bits/Even, Odd and No parity (Selectable by keypad)
	(Factory default: 7 bits/Even)
Stop bit:	1, 2 (Selectable by keypad) (Factory default: 1)
Communication protocol:	Shinko protocol/MODBUS ASCII/MODBUS RTU
	Selectable by keypad
	(Factory default: Shinko protocol)

Data format:

Communication protocol	**Shinko Protocol**	**MODBUS ASCII**	**MODBUS RTU**
Start bit	1	1	1
Data bit	7	7 (8) Selectable	8
Parity	Even	Even (No parity, Odd) Selectable	No parity (Even, Odd) Selectable
Stop bit	1	1 (2) Selectable	1 (2) Selectable

Number of connectable units: 1 unit to 1 host computer (C)
                       Maximum 31 units to 1 host computer (C5)
Communication error detection: Parity, checksum (Shinko protocol), LRC (MODBUS ASCII), CRC-16 (MODBUS RTU)
Digital external setting: Receives Step SV from Shinko programmable controllers PCA1 or PCB1 ('SV digital transmission' should be selected in [Communication protocol]).
                     SV adds Step SV to SVTC bias value.

External setting input (option code: EA☐, EV☐)

SV adds external analog signal to remote bias value.

Setting signal: Direct current: 4 to 20 mA DC [Option code: EA1]

0 to 20 mA DC [Option code: EA2]

DC voltage: 0 to 1 V DC [Option code: EV1]

1 to 5 V DC [Option code: EV2]

Allowable input: EA☐: 50 mA DC max.

EV1: 5 V DC max.

EV2: 10 V DC max.

Input impedance: EA☐: 50 Ω

EV☐: 100 kΩ

Input sampling period: 250 ms

Transmission output (option code: TA1, TV1)

Converting the value (PV, SV, MV or DV transmission) to analog signal every 125ms, outputs the value in current or voltage. (Factory default: PV transmission)

Outputs Transmission output low limit value (4 mA DC or 0 V DC) if Transmission output high limit and low limit value are the same.

Resolution: 12000

Output: 4 to 20 mA DC (load resistance, Maximum 500 Ω)

0 to 1 V DC (load resistance, Minimum 100 kΩ)

Output accuracy: Within ±0.3% of the Transmission output span

14. Troubleshooting

If any malfunctions occur, refer to the following items after checking the power supply to the controller.

14.1 Indication

Problem	Possible Cause and Solution
[o⌐F F⎕⎕], nothing or PV is indicated on the PV display.	• Control output OFF function is working. Press the [RUN/STOP] key for approx. 1 second to release the function.

[⎺ ⎺ ⎺ ⎺ ⎺] is flashing on the PV Display.	• Burnout of thermocouple, RTD or disconnection of DC voltage (0 to 10mV DC, -10 to 10mV DC, 0 to 50mV DC, 0 to 100mV DC, 0 to 1V DC)
	  Change each sensor.
	  How to check whether the sensor is burnt out
	  [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 approx. 100 Ω 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.
	  [DC voltage (0 to 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 0 to 1 V DC)]
	    If the input terminals of the instrument are shorted, and if a scaling low limit value is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected.
	• Check whether the input terminals of thermocouple, RTD or DC voltage (0 to 10 mV DC, -10 to 10 mV DC, 0 to 50 mV DC, 0 to 100 mV DC, 0 to 1 V DC) are securely mounted to the instrument input terminal.
	  Connect the sensor terminals to the instrument input terminals securely.

[_ _ _ _ _] is flashing on the PV Display.	• Check whether input signal wire for DC voltage (1 to 5 V DC) or Direct current (4 to 20 mA DC) is disconnected.
	  How to check whether the input signal wire is disconnected
	  [DC voltage (1 to 5 V DC)]
	    If the input to the input terminals of the instrument is 1 V DC and if a scaling low limit value is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected.
	  [Direct current (4 to 20 mA DC)]
	    If the input to the input terminals of the instrument is 4 mA DC and if a scaling low limit value is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected.
	• Check whether input signal wire for DC voltage (1 to 5 V DC) or Direct current (4 to 20 mA DC) is securely connected to the instrument input terminals.

	• Check if polarity of thermocouple or compensating lead wire is correct. • Check whether codes (A, B, B) of RTD match with the instrument terminals.

The PV Display keeps indicating the value which was set during Scaling low limit setting.	• Check whether the input signal wire for DC voltage (0 to 5 V DC, 0 to 10 V DC) and Direct current (0 to 20 mA DC) is disconnected.
	How to check whether the input signal wire is disconnected
	[DC voltage (0 to 5 V DC, 0 to 10 V DC)]
	  If the input to the input terminals of the instrument is 1 V DC and if a value (converted value from Scaling high, low limit setting) corresponding to 1 V DC is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected, or the sensor may be burnt out.
	[Direct current (0 to 20 mA DC)]
	  If the input to the input terminals of the instrument is 4 mA DC and if a value (converted value from Scaling high, low limit setting) corresponding to 4 mA DC is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected, or the sensor may be burnt out.
	• Check whether the input lead wire terminals for DC voltage (0 to 5 V DC, 0 to 10 V DC) or Direct current (0 to 20 mA DC) are securely mounted to the instrument input terminals.

The indication of PV display is irregular or unstable.	• Check whether sensor input or temperature unit (℃ or ℉) is correct.
	  Select the correct sensor input and temperature unit (℃ or ℉).
	• Sensor correcting value is unsuitable.
	  Set it to a suitable value.
	• Check whether the specification of the sensor is correct.
	• AC leaks into the sensor circuit. Use an ungrounded type sensor.
	• There may be equipment that interferes with or makes noise near the controller. Keep the equipment clear of any potentially disruptive equipment.

[$ERR\ 1$] is indicated on the PV Display.	• Internal memory is defective. Contact our agency or us.

14.2 Key Operation

Problem	Possible Cause and Solution

• Unable to set the SV, PID, Event alarm value, etc.
• The values do not change by the △, ▽ keys.
	• Set value lock (Lock 1 to Lock 4) is selected.
	  Release the lock in [Set value lock].
	• AT or auto-reset is performing.
	  In the case of AT, cancel the AT.
	  It takes approximately 4 minutes until auto-reset is finished.

Setting items of each Event output are not indicated.	Check if the desired action has been selected in [Event output allocation].

14.3 Control

Problem	Possible Cause and Solution
Temperature does not rise.	• Sensor is out of order. Replace the sensor. • Check whether the Sensor or control output terminals are securely mounted to the instrument input terminals. Ensure that the sensor or control output terminals are mounted to the instrument input terminals securely. • Check whether the wiring of sensor or control output terminals is correct.
The control output remains in an ON status.	• MV low limit value is set to 100% or higher. Set it to a suitable value.
The control output remains in an OFF status.	• MV high limit value is set to 0% or less. Set it to a suitable value.
The motor valve does not work at all. The motor valve does not work properly.	• If "FBP (feedback potentiometer) Yes" is selected, check if FBP adjustment has completed. See the FBP adjustment (p.31). • If "FBP (feedback potentiometer) No" is selected, check if Open and Closed output time are set to suitable values. Refer to Open and Closed output time settings (p.32).

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

15. Character Tables

The PV Display indicates setting characters, and the SV/MV/TIME Display indicates factory default value.

[Simplified setting]

SV setting mode
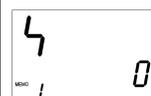
Character	Setting Item	Data
5 MEMO *1* *0*	**SV** Scaling low limit to Scaling high limit	

Event setting mode

Character	Setting Item	Data
A1 MEMO *1* *0*	**EVT1 alarm value** Setting range: Refer to (Table 15-1) on p.91.	
A1H MEMO *1* *0*	**EVT1 high limit alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
A4 MEMO *1* *0*	**EVT4 alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
A4H MEMO *1* *0*	**EVT4 high limit alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
A5 MEMO *1* *0*	**EVT5 alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
A5H MEMO *1* *0*	**EVT5 high limit alarm value** Setting range: Refer to (Table 15-1) on p. 91.	

(Table 15-1)

Alarm Type	Setting Range
High limit alarm (Deviation setting)	-(Input span) to Input span℃(℉) *1
Low limit alarm (Deviation setting)	-(Input span) to Input span℃(℉) *1
High/Low limits alarm (Deviation setting)	0 to Input span℃(℉) *1
High/Low limits independent alarm (Deviation setting)	0 to Input span℃(℉) *1
High/Low limit range alarm (Deviation setting)	0 to Input span℃(℉) *1
High/Low limit range independent alarm (Deviation setting)	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
High limit with standby alarm (Deviation setting)	-(Input span) to Input span℃(℉) *1
Low limit with standby alarm (Deviation setting)	-(Input span) to Input span℃(℉) *1
High/Low limits with standby alarm (Deviation setting)	0 to Input span℃(℉) *1
High/Low limits with standby independent alarm (Deviation setting)	0 to Input span℃(℉) *1

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

PID setting mode

Character	Setting Item, Setting Range	Data
P 10	**Proportional band** Setting range: 0 to Input span℃(℉) DC voltage, current inputs: 0.0 to 1000.0%	
I 200	**Integral time** Setting range: 0 to 3600 seconds When "FBP No" is selected in [FBP Yes/No]: 1 to 3600 seconds	
d 50	**Derivative time** Setting range: 0 to 1800 seconds	
ARW 50	**ARW** Setting range: 0 to 100%	
RYEГ 0.0	**Manual reset** Setting range: ±1000.0 DC voltage, current inputs: The placement of the decimal point follows the selection.	
oRAГ 0	**MV rate-of-change** Setting range: 0 to 100 %/second	

[Group selection]

SV, Event group (for Fixed value control)
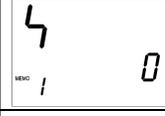
Character	Setting Item, Setting Range	Data
G_4	**SV, Event group**	
4 MEMO 1 0	**SV1** Setting range: Scaling low limit to Scaling high limit	
$A1$ MEMO 1 0	**EVT1 alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
$A1H$ MEMO 1 0	**EVT1 high limit alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
$A4$ MEMO 1 0	**EVT4 alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
$A4H$ MEMO 1 0	**EVT4 high limit alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
$A5$ MEMO 1 0	**EVT5 alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
$A5H$ MEMO 1 0	**EVT5 high limit alarm value** Setting range: Refer to (Table 15-1) on p. 91.	

Program Pattern group (for Program control)

Character	Setting Item, Setting Range	Data
ロ_5	**Program Pattern group**	
5 STEP 1 0	**Step 1 SV** Setting range: Scaling low limit to Scaling high limit	
TIME STEP 1 00.00	**Step 1 time** Setting range: 00:00 to 99:59	
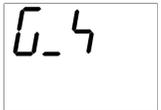
WAIT STEP 1 0	**Step 1 Wait value**
	  Setting range: 0 to Converted value of 20% of
	                    input span	
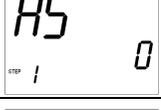
A1 STEP 1 0	**Step 1 EVT1 alarm value** Setting range: Refer to (Table 15-1) on p.91.	
A1H STEP 1 0	**Step 1 EVT1 high limit alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
A4 STEP 1 0	**Step 1 EVT4 alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
A4H STEP 1 0	**Step 1 EVT4 high limit alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
A5 STEP 1 0	**Step 1 EVT5 alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
A5H STEP 1 0	**Step 1 EVT5 high limit alarm value** Setting range: Refer to (Table 15-1) on p. 91.	
	Step 2 SV	
	Step 2 time	
	Step 2 Wait value	
	Step 2 EVT1 alarm value	
	Step 2 EVT1 high limit alarm value	
	Step 2 EVT4 alarm value	
	Step 2 EVT4 high limit alarm value	
	Step 2 EVT5 alarm value	
	Step 2 EVT5 high limit alarm value	
	Step 3 SV	
	Step 3 time	
	Step 3 Wait value	

	Step 3 EVT1 alarm value	
	Step 3 EVT1 high limit alarm value	
	Step 3 EVT4 alarm value	
	Step 3 EVT4 high limit alarm value	
	Step 3 EVT5 alarm value	
	Step 3 EVT5 high limit alarm value	
	Step 4 SV	
	Step 4 time	
	Step 4 Wait value	
	Step 4 EVT1 alarm value	
	Step 4 EVT1 high limit alarm value	
	Step 4 EVT4 alarm value	
	Step 4 EVT4 high limit alarm value	
	Step 4 EVT5 alarm value	
	Step 4 EVT5 high limit alarm value	
	Step 5 SV	
	Step 5 time	
	Step 5 Wait value	
	Step 5 EVT1 alarm value	
	Step 5 EVT1 high limit alarm value	
	Step 5 EVT4 alarm value	
	Step 5 EVT4 high limit alarm value	
	Step 5 EVT5 alarm value	
	Step 5 EVT5 high limit alarm value	
	Step 6 SV	
	Step 6 time	
	Step 6 Wait value	
	Step 6 EVT1 alarm value	
	Step 6 EVT1 high limit alarm value	
	Step 6 EVT4 alarm value	
	Step 6 EVT4 high limit alarm value	
	Step 6 EVT5 alarm value	
	Step 6 EVT5 high limit alarm value	
	Step 7 SV	
	Step 7 time	
	Step 7 Wait value	
	Step 7 EVT1 alarm value	
	Step 7 EVT1 high limit alarm value	
	Step 7 EVT4 alarm value	
	Step 7 EVT4 high limit alarm value	
	Step 7 EVT5 alarm value	
	Step 7 EVT5 high limit alarm value	
	Step 8 SV	
	Step 8 time	
	Step 8 Wait value	
	Step 8 EVT1 alarm value	
	Step 8 EVT1 high limit alarm value	
	Step 8 EVT4 alarm value	
	Step 8 EVT4 high limit alarm value	
	Step 8 EVT5 alarm value	
	Step 8 EVT5 high limit alarm value	

	Step 9 SV	
	Step 9 time	
	Step 9 Wait value	
	Step 9 EVT1 alarm value	
	Step 9 EVT1 high limit alarm value	
	Step 9 EVT4 alarm value	
	Step 9 EVT4 high limit alarm value	
	Step 9 EVT5 alarm value	
	Step 9 EVT5 high limit alarm value	
	Step 10 SV	
	Step 10 time	
	Step 10 Wait value	
	Step 10 EVT1 alarm value	
	Step 10 EVT1 high limit alarm value	
	Step 10 EVT4 alarm value	
	Step 10 EVT4 high limit alarm value	
	Step 10 EVT5 alarm value	
	Step 10 EVT5 high limit alarm value	
	Step 11 SV	
	Step 11 time	
	Step 11 Wait value	
	Step 11 EVT1 alarm value	
	Step 11 EVT1 high limit alarm value	
	Step 11 EVT4 alarm value	
	Step 11 EVT4 high limit alarm value	
	Step 11 EVT5 alarm value	
	Step 11 EVT5 high limit alarm value	
	Step 12 SV	
	Step 12 time	
	Step 12 Wait value	
	Step 12 EVT1 alarm value	
	Step 12 EVT1 high limit alarm value	
	Step 12 EVT4 alarm value	
	Step 12 EVT4 high limit alarm value	
	Step 12 EVT5 alarm value	
	Step 12 EVT5 high limit alarm value	
	Step 13 SV	
	Step 13 time	
	Step 13 Wait value	
	Step 13 EVT1 alarm value	
	Step 13 EVT1 high limit alarm value	
	Step 13 EVT4 alarm value	
	Step 13 EVT4 high limit alarm value	
	Step 13 EVT5 alarm value	
	Step 13 EVT5 high limit alarm value	
	Step 14 SV	
	Step 14 time	
	Step 14 Wait value	
	Step 14 EVT1 alarm value	
	Step 14 EVT1 high limit alarm value	
	Step 14 EVT4 alarm value	
	Step 14 EVT4 high limit alarm value	
	Step 14 EVT5 alarm value	

	Step 14 EVT5 high limit alarm value	
	Step 15 SV	
	Step 15 time	
	Step 15 Wait value	
	Step 15 EVT1 alarm value	
	Step 15 EVT1 high limit alarm value	
	Step 15 EVT4 alarm value	
	Step 15 EVT4 high limit alarm value	
	Step 15 EVT5 alarm value	
	Step 15 EVT5 high limit alarm value	

PID group

Character	Setting Item, Setting Range	Data
G_PId	**PID group**	
ZV MEMO 1 0	**PID zone value 1** Setting range: Scaling low limit to Scaling high limit	
P MEMO 1 10	**Proportional band 1** Setting range: 0 to Input span℃(℉) DC voltage, current inputs: 0.0 to 1000.0%	
I MEMO 1 200	**Integral time 1** Setting range: 0 to 3600 seconds When "FBP No" is selected in [FBP Yes/No]: 1 to 3600 seconds:	
d MEMO 1 50	**Derivative time 1** Setting range: 0 to 1800 seconds	
ARW MEMO 1 50	**ARW 1** Setting range: 0 to 100%	
$R4Er$ MEMO 1 0.0	**Manual reset 1** Setting range: ±1000.0 DC voltage, current inputs: (The placement of the decimal point follows the selection.)	
$oRAr$ MEMO 1 0	**MV rate-of-change 1** Setting range: 0 to 100 %/second	
	PID zone value 2	
	Proportional band 2	
	Integral time 2	
	Derivative time 2	
	ARW 2	
	Manual reset 2	
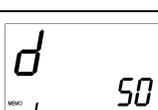
	MV rate-of-change 2	
	PID zone value 3	
	Proportional band 3	
	Integral time 3	
	Derivative time 3	
	ARW 3	
	Manual reset 3	
	MV rate-of-change 3	
	PID zone value 4	
	Proportional band 4	
	Integral time 4	
	Derivative time 4	
	ARW 4	
	Manual reset 4	
	MV rate-of-change 4	
	PID zone value 5	
	Proportional band 5	
	Integral time 5	
	Derivative time 5	
	ARW 5	
	Manual reset 5	
	MV rate-of-change 5	

AT group

Character	Setting Item, Setting Range	Data
$\mathit{G\_AT}$	**AT group**	
AT -----	**AT/Auto-reset** – – – – – : AT/ Auto-reset Cancel $\mathit{AT\square\square}$ / $\mathit{A4Er\square}$: AT/ Auto-reset Perform	
$\mathit{AT\_b_{20}}$	**AT bias** Setting range: 0 to 50℃ (0 to 100℉) With a decimal point: 0.0 to 50.0℃ (0.0 to 100.0℉)	

Engineering group

Character	Setting Item, Setting Range	Data
$\mathit{G\_ENG}$	**Engineering group**	

Input group

Character	Setting Item, Setting Range					Data
E_INP	**Input group**					
$5EN5$ K C	**Input type**					
	K▢▢▢C	K	-200	to	1370	℃
	K▢▢.C	K	-200.0	to	400.0	℃
	J▢▢▢C	J	-200	to	1000	℃
	R▢▢▢C	R	0	to	1760	℃
	5▢▢▢C	S	0	to	1760	℃
	b▢▢▢C	B	0	to	1820	℃
	E▢▢▢C	E	-200	to	800	℃
	r▢▢.C	T	-200.0	to	400.0	℃
	N▢▢▢C	N	-200	to	1300	℃
	PL2▢C	PL-Ⅱ	0	to	1390	℃
	c▢▢▢C	C(W/Re5-26)	0	to	2315	℃
	Pr▢.C	Pt100	-200.0	to	850.0	℃
	JPr.C	JPt100	-200.0	to	500.0	℃
	Pr▢▢C	Pt100	-200	to	850	℃
	JPr▢C	JPt100	-200	to	500	℃
	Pr1.C	Pt100	-100.0	to	100.0	℃
	Pr5.C	Pt100	-100.0	to	500.0	℃
	K▢▢▢F	K	-328	to	2498	℉
	K▢▢.F	K	-328.0	to	752.0	℉
	J▢▢▢F	J	-328	to	1832	℉
	R▢▢▢F	R	32	to	3200	℉
	5▢▢▢F	S	32	to	3200	℉
	b▢▢▢F	B	32	to	3308	℉
	E▢▢▢F	E	-328	to	1472	℉
	r▢▢.F	T	-328.0	to	752.0	℉
	N▢▢▢F	N	-328	to	2372	℉
	PL2▢F	PL-Ⅱ	32	to	2534	℉
	c▢▢▢F	C(W/Re5-26)	32	to	4199	℉
	Pr▢.F	Pt100	-328.0	to	1562.0	℉
	JPr.F	JPt100	-328.0	to	932.0	℉
	Pr▢▢F	Pt100	-328	to	1562	℉
	JPr▢F	JPt100	-328	to	932	℉
	Pr2.F	Pt100	-148.0	to	212.0	℉
	Pr9.F	Pt100	-148.0	to	932.0	℉

`420MA`	4 to 20 mA DC	-2000	to	10000
`020MA`	0 to 20 mA DC	-2000	to	10000
`10MV`	0 to 10 mV DC	-2000	to	10000
`-10MV`	-10 to 10 mV DC	-2000	to	10000
`50MV`	0 to 50 mV DC	-2000	to	10000
`100MV`	0 to 100 mV DC	-2000	to	10000
`0 1V`	0 to 1 V DC	-2000	to	10000
`0 5V`	0 to 5 V DC	-2000	to	10000
`1 5V`	1 to 5 V DC	-2000	to	10000
`0 10V`	0 to 10 V DC	-2000	to	10000

`SCLH`
`1370`
	Scaling high limit
	 Setting range: Scaling low limit to Input range high limit
	  DC voltage, current inputs: -2000 to 10000 (The
	  placement of the decimal point follows the selection.)	

`SCLL`
`-200`
	Scaling low limit
	 Setting range: Input range low limit to Scaling high limit
	  DC voltage, current inputs: -2000 to 10000 (The
	  placement of the decimal point follows the selection.)	

`dP`
`0`
	Decimal point place
	  `0` : No decimal point
	  `0.0` : 1 digit after the decimal point
	  `0.00` : 2 digits after the decimal point
	  `0.000` : 3 digits after the decimal point
	  `0.0000` : 4 digits after the decimal point	

`FILT` `0.0`	**PV filter time constant** Setting range: 0.0 to 100.0 seconds	

`Sc`
`0.0`
	Sensor correction
	  Setting range: -200.0 to 200.0℃（℉)
	   DC voltage, current inputs: -2000 to 2000 (The
	   placement of the decimal point follows the selection.)	

Output group

Character	Setting Item, Setting Range	Data
E_oUr	**Output group**	
oLH _100_	**MV high limit** Setting range: MV low limit to 100%	
oLL _0_	**MV low limit** Setting range: 0% to MV high limit value	
HYS _10_	**ON/OFF hysteresis** Setting range: 0.1 to 1000.0℃ (℉) DC voltage, current inputs: 1 to 10000 (The placement of the decimal point follows the selection.)	
$coNr$ _HEAr_	**Direct/Reverse action** $HEAr\square$: Reverse (Heating) action $cooL\square$: Direct (Cooling) action	
$PRSr1$ _0.0_	**Preset output** Setting range: 0.0 to 100.0%	
FbP _USE_	**FBP Yes/No** $USE\square\square$: FBP Yes $NoNE\square$: FBP No	
Pdb _10_	**Open/Closed output dead band** Setting range: 0 to 100%	
$PHYS$ _1_	**Open/Closed output hysteresis** Setting range: 0 to 100%	
$PAJS$ _oFF_	**FBP adjustment** $oFF\square\square$: FBP adjustment Stop $AdJSr$: FBP adjustment Perform	
Por _30.0_	**Open output time** Setting range: 0.1 to 1000.0 seconds	
Pcr _30.0_	**Closed output time** Setting range: 0.1 to 1000.0 seconds	
$PAJER$ _USE_	**Error detection during FBP adjustment** $USE\square\square$: Error detection Yes $NoNE\square$: Error detection No	

Event input group

Character	Setting Item, Setting Range	Data
E_EVI	**Event input group**	
$EVI\ 1$ 000	**Event input EVI1 allocation** 　Refer to the Event input allocation table.	
$EVI\ 2$ 000	**Event input EVI2 allocation** 　Refer to the Event input allocation table.	
$EVI\ 3$ 000	**Event input EVI3 allocation** 　Refer to the Event input allocation table.	
$EVI\ 4$ 000	**Event input EVI4 allocation** 　Refer to the Event input allocation table.	

Event input allocation table

Selected value	Event input function	Input ON (Closed)	Input OFF (Open)	Remarks
000	No event			
001	Set value memory	2^n	1	n=0 to 3
002	Control ON/OFF	Control OFF	Control ON	Control output OFF function
003	Direct/Reverse action	Direct action	Reverse action	Always effective
004	Timer Start/Stop	Start	Stop	
005	PV Display; PV holding	Holding	Not holding	Ineffective when controlling
006	PV Display; PV peak value holding	Holding	Not holding	Ineffective when controlling
007	Preset output 1	Preset output	Standard control	In case of sensor burnout, the unit maintains control with the preset output MV.
008	Auto/Manual control	Manual control	Automatic control	

Selected value	Event input function	Input ON (Closed)	Input OFF (Open)	Remarks
009	Remote/Local	Remote	Local	Effective only when EA☐ or EV☐ option is added
010	Program mode; RUN/STOP	RUN	STOP	Level action when power is turned on
011	Program mode; Holding/Not holding	Holding	Not holding	Level action when power is turned on
012	Program mode; Advance function	Advance	Standard control	Level action when power is turned on
013	Integral action holding	Integral action Holding	Standard integral action	Control continues with the integral value being held.
014	Preset output 2	Preset output	Standard control	The unit maintains control with the preset output MV.

Event output group
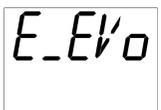
Character	Setting Item, Setting Range	Data
E_EVo	**Event output group**	
$EVTo1$ 000	**Event output EVT1 allocation** Refer to Event output allocation table.	
$EVTo4$ 000	**Event output EVT4 allocation** Refer to Event output allocation table.	
$EVTo5$ 000	**Event output EVT5 allocation** Refer to Event output allocation table.	

Event output allocation table

Selected value	Event output function	Proceeding to the lower level with the MODE key	Remarks
000	No event		
001	Alarm output; High limit alarm	Alarm hysteresis ↓ MODE Alarm delay time ↓ MODE Alarm Energized/De-energized	
002	Alarm output; Low limit alarm	Same as the High limit alarm	
003	Alarm output; High/Low limits	Same as the High limit alarm	
004	Alarm output; High/Low limits independent	Same as the High limit alarm	
005	Alarm output; High/Low limit range	Same as the High limit alarm	
006	Alarm output; High/Low limit range independent	Same as the High limit alarm	
007	Alarm output; Process high alarm	Same as the High limit alarm	
008	Alarm output; Process low alarm	Same as the High limit alarm	
009	Alarm output; High limit with standby	Same as the High limit alarm	
010	Alarm output; Low limit with standby	Same as the High limit alarm	
011	Alarm output; High/Low limits with standby	Same as the High limit alarm	
012	Alarm output; High/Low limits with standby independent	Same as the High limit alarm	
013	Timer output linked with 'Timer Start/Stop' in [Event input allocation].	Timer output delay action ↓ MODE Timer output time unit ↓ MODE OFF delay time ↓ MODE ON delay time	Select 'Timer Start/Stop' in [Event input allocation].
014	Timer output linked with 'Timer Start/Stop' in [Event input allocation]. Control ON during timer operation. Control OFF after time is up.	Same as the above	Same as the above

Selected value	Event output function	Proceeding to the lower level with the MODE key	Remarks
015	No event		
016	Loop break alarm output	Loop break alarm time ↓ MODE Loop break alarm band	
017	Time signal output	Time signal output step ↓ MODE Time signal OFF time ↓ MODE Time signal ON time	Time signal output is turned off when the performing step is complete.
018	Output during AT		Outputs during AT.
019	Pattern end output		Program control

Alarm output setting items (when Alarm output is selected in [Event output allocation])

Character	Setting Item, Setting Range	Data
A IHYS iO	**Alarm hysteresis** Setting range: 0.1 to 1000.0℃ (℉) DC voltage, current inputs: 1 to 10000 (The placement of the decimal point follows the selection.)	
A IdLY 0	**Alarm delay time** Setting range: 0 to 10000 seconds	
A IREV NoML	**Alarm Energized/De-energized** NoML☐ : Energized REV☐ : De-energized	

If "001 (Alarm output; High limit alarm) to 012 (Alarm output; High/Low limits with standby independent" is selected in [Event output EVT4, EVT5 allocation], their setting characters will be A4xxx and A5xxx.

Timer output setting items (when Timer output is selected in [Event output allocation])

Character	Setting Item, Setting Range	Data
dLYF oN	**Timer output delay action** oN☐ : ON delay time oFF☐ : OFF delay time oNoFF : ON/OFF delay time	
rM_S MI N	**Timer output time unit** MI N☐ : Minutes SEc☐ : Seconds	
dYoFF 0	**OFF delay time** Setting range: 0 to 10000 (Time unit follows the selection in [Timer output time unit].)	
dYoN 0	**ON delay time** Setting range: 0 to 10000 (Time unit follows the selection in [Timer output time unit].)	

Loop break alarm setting items (when Loop break alarm is selected in [Event output allocation])

Character	Setting Item, Setting Range	Data
LP_Γ 0	**Loop break alarm time** Setting range: 0 to 200 minutes	
LP_H 0	**Loop break alarm band** Setting range: 0 to 150℃（℉）or 0.0 to 150.0℃（℉） DC voltage, current inputs: 0 to 1500 (The placement of the decimal point follows the selection.)	

Time signal output setting items (when Time signal output is selected in [Event output allocation])

Character	Setting Item, Setting Range	Data
$\Gamma 4\_No$	**Time signal output step** Setting range: 1 to 15	
$\Gamma 4\_oF$ 00.00	**Time signal output OFF time** Setting range: 00:00 to 99:59 (Time unit follows the selection in [Step time unit] in the Program group.)	
$\Gamma 4\_oN$ 00.00	**Time signal output ON time** Setting range: 00:00 to 99:59 (Time unit follows the selection in [Step time unit] in the Program group.)	

Program group

Character	Setting Item, Setting Range	Data
E_PRo	**Program group**	
$PRGMd$ FIx	**Fixed value control/Program control** FIx: Fixed value control $PRoG$: Program control	
M_S MIN	**Step time unit** MIN: Hours:Minutes SEc: Minutes:Seconds	
$PRES$ $SToP$	**Power restore action** $SToP$: Stops (in standby) after power is restored. $coNT$: Continues after power is restored. $HoLd$: Suspends (on hold) after power is restored.	
S_SV 0	**Program start temperature** Setting range: Scaling low limit to Scaling high limit	

Communication group

Character	Setting Item, Setting Range	Data
E_coM	**Communication group**	
$cMSL$ $NoML$	**Communication protocol** $NoML$: Shinko protocol $ModA$: MODBUS ASCII mode $ModR$: MODBUS RTU mode	
$cMNo$ 0	**Instrument number** Setting range: 0 to 95	
$cMSP$ 96	**Communication speed** 96: 9600 bps 192: 19200 bps 384: 38400 bps	
$cMFS$ $7EVN$	**Data bit/Parity** $8NoN$: 8 bits/No parity $7NoN$: 7 bits/No parity $8EVN$: 8 bits/Even $7EVN$: 7 bits/Even $8odd$: 8 bits/Odd $7odd$: 7 bits/Odd	

Character	Setting Item, Setting Range	Data
`4roP 1`	**Stop bit** ☐☐☐☐ *1*: 1 ☐☐☐☐*2*: 2	
`4V-b 0`	**SVTC bias** Setting range: Converted value of ±20% of input span DC voltage, current inputs: ±20% of the scaling span (The placement of the decimal point follows the selection.)	

External setting group

Character	Setting Item, Setting Range	Data
`E_ExT`	**External setting group**	
`REMor` `LocAL`	**Remote/Local** `LocAL` : Local `REMor` : Remote	
`RrLH` `1370`	**External setting input high limit** Setting range: External setting input low limit to Input range high limit	
`RrLL` `-200`	**External setting input low limit** Setting range: Input range low limit to External setting input high limit	
`Rr-b 0`	**Remote bias** Setting range: Converted value of ±20% of input span DC voltage, current inputs: ±20% of scaling span (The placement of the decimal point follows the selection.)	

Transmission output group

Character	Setting Item, Setting Range	Data
$E\_\lceil RR$	**Transmission output group**	
$\lceil R_o 4$ $_{P\ell}$	**Transmission output type** $P\ell$⬚⬚⬚: PV transmission 4ℓ⬚⬚⬚: SV transmission $\Pi\ell$⬚⬚⬚: MV transmission $d\ell$⬚⬚⬚: DV transmission	
$\lceil RLH$ $_{1370}$	**Transmission output high limit** PV, SV transmission: Transmission output low limit to Input range high limit value MV transmission: Transmission output low limit to 105.0 (%) DV transmission: Transmission output low limit to Scaling span	
$\lceil RLL$ $_{-200}$	**Transmission output low limit** PV, SV transmission: Input range low limit to Transmission output high limit value MV transmission: -5.0 to Transmission output high limit value (%) DV transmission: -Scaling span to Transmission output high limit value	

Other function group

Character	Setting Item, Setting Range	Data
$E\_o\lceil H$	**Other function group**	
$LocK$ $_{-----}$	**Set value lock** $-----$ (Unlock): All set values can be changed.	
	Loc 1⬚ (Lock 1): None of the set values can be changed. $Loc2$⬚ (Lock 2): Only SV can be changed. $Loc3$⬚ (Lock 3): None of the set values can be changed as Lock 1. $Loc4$⬚ (Lock 4): SV and Alarm value can be changed. Other set values cannot be changed.	
$PI d2N$ $_{NoNE}$	**PID zone function** $NoNE$⬚: Not used $U4E$⬚: Used	
$RR\lceil U$ $_0$	**SV rise rate** Setting range: 0 to 10000 ℃/minute (℉/minute) Thermocouple, RTD input with a decimal point: 0.0 to 1000.0 ℃/minute (℉/minute) DC voltage, current inputs: 0 to 10000/minute (The placement of the decimal point follows the selection.)	

`RArd` `0`	**SV fall rate**
	Setting range: 0 to 10000 ℃/minute (℉/minute)
	  Thermocouple, RTD input with a decimal point:
	   0.0 to1000.0 ℃/minute (℉/minute)
	  DC voltage, current inputs: 0 to 10000/minute (The
	  placement of the decimal point follows the selection.)	

`P4V` `oFF`	**Indication when output OFF** `oFF`: OFF indication `AoFF`: No indication `PV`: PV indication `PVAL`: PV indication+ Any event output (EVT1, EVT4, EVT5)	

`bKLr` `ALL`	**Backlight selection**
	`ALL`: All (Displays and indicators) are backlit.
	`PV`: PV Display is backlit.
	`SV`: SV/MV/TIME+MV/DV/Valve Bar Graph
	     Displays are backlit.
	`Ac`: Action indicators are backlit.
	`PVSV`: PV+SV/MV/TIME +MV/DV/Valve Bar Graph
	     Displays are backlit.
	`PVAc`: PV Display + Action indicators are backlit.
	`SVAc`: SV/MV/TIME +MV/DV/Valve Bar Graph
	     Displays + Action indicators are backlit.	

`coLR` `REd`	**PV color**
	`GRN`: Green
	`REd`: Red
	`oRG`: Orange
	`ALGR`: When any alarm output (EVT1, EVT4, EVT5)
	      is ON, PV color turns from green to red.
	`ALoR`: When any alarm output (EVT1, EVT4, EVT5)
	      is ON, PV color turns from orange to red.
	`PVGR`: PV color changes continuously (Orange →
	      Green→Red).
	`APGR`: PV color changes continuously (Orange →
	      Green→ Red), and simultaneously when any
	      alarm output (EVT1, EVT4, EVT5) is ON (Red).	

`cLRG` `5.0`	**PV color range** Setting range: 0.1 to 100.0℃(℉) DC voltage, current inputs: 1 to 1000 (The placement of the decimal point follows the selection.)	
`dPrM` `0`	**Backlight time** Setting range: 0 to 99 minutes	
`bAR4L` `MV`	**Bar graph** `MV`: MV indication `dV`: DV indication `NoNE`: No indication `FbP`: Degree of valve opening is indicated.	
`dVWl d`	**Deviation unit** Setting range: 1 to Converted value of 20% of input span	

Program pattern table

Step number	1	2	3	4	5	6
Step SV						
Step time (:)						
Wait value						
EVT1 alarm value						
EVT1 high limit alarm value						
EVT4 alarm value						
EVT4 high limit alarm value						
EVT5 alarm value						
EVT5 high limit alarm value						
Time signal output ON						
OFF						

PID zone value	1	2	3	4	5
Proportional band					
Integral time					
Derivative time					
ARW					
Manual reset					
MV rate-of-change					

7	8	9	10	11	12	13	14	15

***** Inquiry *****

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

                                          [Example]
　　　• Model   ---------------------------- ACD-15A-R/M
　　　• Option   -------------------------- A5, C5
　　　• Serial number   ------------------ No. 198F05000

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