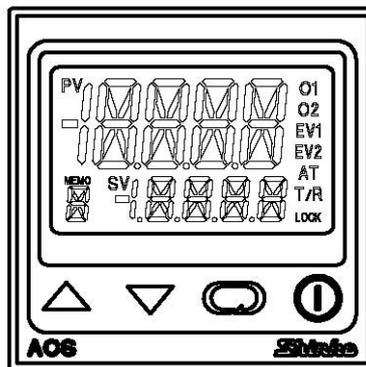


MICRO-COMPUTER BASED
DIGITAL INDICATING CONTROLLER

ACS-13A

INSTRUCTION MANUAL



Shinko

Preface

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

Characters used in this manual:

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

Notes

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

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

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

Warning

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

Caution

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

Warning

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

Safety precautions

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

Caution with respect to Export Trade Control Ordinance

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

1. Installation precautions



Caution

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

Ensure the mounting location corresponds to the following conditions:

- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gases
- No mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of 0 to 50°C (32 to 122°F) that does not change rapidly, and without icing
- An ambient non-condensing humidity of 35 to 85%RH
- No large capacity electromagnetic switches or cables through which large current is flowing.
- No water, oil or chemicals or where the vapors of these substances can come into direct contact with the unit

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

2. Wiring precautions



Caution

- Do not leave bits of wire in the instrument, because they could cause fire or malfunction.
- Use the solderless terminal with an insulation sleeve in which the M3 screw fits when wiring the ACS-13A.
- The terminal block of this instrument is designed to be wired from the left side. The lead wire must be inserted from the left side of the terminal, and fastened with the terminal screw.
- Tighten the terminal screw to within the specified torque. If excessive force is applied to the screw when tightening, the terminal screw or case may be damaged.
- When using a terminal cover, pass terminal wires numbered 7 to 12 into the holes of the terminal cover.
- This instrument does not have a built-in power switch, circuit breaker or fuse.
It is necessary to install them near the controller.
(Recommended fuse: Time-lag fuse, rated voltage 250V AC, rated current 2A)
- For a 24V AC/DC power source, do not confuse polarity when using direct current (DC).
- 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.
- (+) side input terminal number of 0 to 5V DC, 1 to 5V DC, 0 to 10V DC differs from that of 0 to 1V DC.
(+) side input terminal number of 0 to 5V DC, 1 to 5V DC, 0 to 10V DC: 9
(+) side input terminal number of 0 to 1V DC: 10
- When using a relay contact output type, externally use a relay according to the capacity of the load to protect the built-in relay contact.
- When wiring, keep input wires (thermocouple, RTD, etc.) away from AC sources or load wires to avoid external interference.

3. Operation and maintenance precautions



Caution

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

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1. Model

1.1 Model

ACS - 1 3 □-□/□ □ □ □ □			Series name: ACS-13A (W48 x H48 x D62mm)		
Control action	3		PID		
A1	A		Alarm type can be selected by keypad. *1		
Control output, Heating output: O1 (OUT1)	R		Relay contact: 1a		
	S		Non-contact voltage (for SSR drive): 12V DC±15%		
	A		DC current: 4 to 20mA DC		
Input	M		Multi-range *2		
Supply voltage			100 to 240V AC (standard)		
	1		24V AC/DC *3		
Option (Multiple options are selectable. See pages 35, 36 for option combinations.)	A2		Alarm 2 output (A2) *1		
	W(20A)	Heater burnout alarm	CT rated current: 20A (Single phase)		
	W(50A)		CT rated current: 50A (Single phase)		
	W3(20A)		CT rated current: 20A (3-phase)		
	W3(50A)		CT rated current: 50A (3-phase)		
	DR	Heating/Cooling control	Relay contact: 1a		
	DS	Cooling output: O2 (OUT2)	Non-contact voltage: 12V DC±15%		
	C5	Serial communication (RS-485)			
	SM	Set value memory external selection			

*1: Alarm types (9 types and No alarm action) and Energized/Deenergized can be selected by keypad.

*2: Thermocouple, RTD, DC current and DC voltage can be selected by keypad.

For DC current input, connect 50Ω shunt resistor (sold separately) externally.

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

1.2 How to read the model label

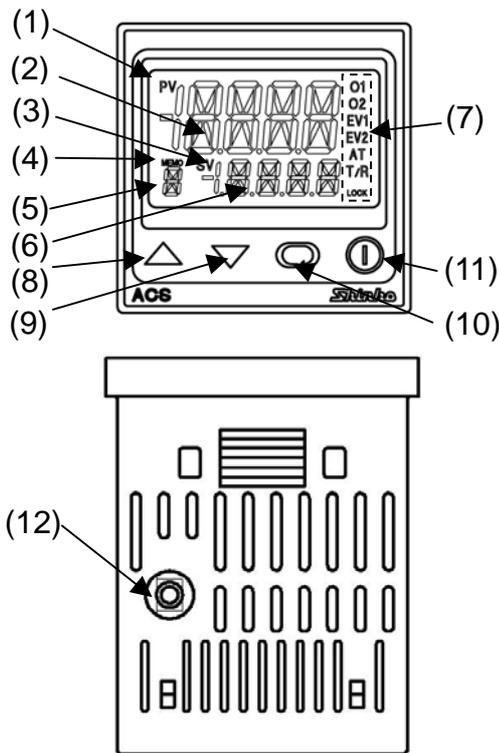


- (1) The model label is attached to the left side of the case.
For Heater burnout alarm output, CT rated current is written in the bracket.
- (2) (1): Model, Power supply (For 24V AC/DC, "1" is entered), Options
(2): Serial number

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

(Fig.1.2-1)

2. Name and functions of the sections



(Fig. 2-1)

Display

- (1) **PV indicator** : Lights when PV is indicated in the PV/SV display mode.
- (2) **PV display** : Indicates the PV (process variable).
- (3) **SV indicator** : Lights when SV is indicated in the PV/SV display mode.
- (4) **MEMO indicator** : Lights when Set value memory external selection (SM option) is added.
- (5) **MEMO display** : Indicates the set value memory number.
- (6) **SV display** : Indicates the SV (Main set value).
- (7) **Action indicators**
- O1 (OUT1)** : Lights when control output is ON or when Heating output (D□ option) is ON. For DC current output type, flashes corresponding to the MV in 0.25 second cycles.
 - O2 (OUT2)** : Lights when cooling output (D□ option) is ON.
 - EV1** : Lights when Alarm 1 output is ON.
 - EV2** : Lights when Alarm 2 output (A2 option) is ON or when Heater burnout alarm (W, W3 option) is ON.
 - AT** : Flashes while AT (auto-tuning) or auto-reset is performing.
 - T/R** : Lights during Serial communication (C5 option) (TX output).
 - LOCK** : Lights when Lock 1, Lock 2 or Lock 3 is selected.

Key operations

- (8) **△ Increase key** : Increases the numeric value.
- (9) **▽ Decrease key** : Decreases the numeric value.
- (10) **○ Mode key** : Selects the setting mode, or registers the set value.
To register the set (selected) value, press this key.
- (11) **Ⓜ OUT/OFF key** : Switches control output ON/OFF or Auto/Manual control.
To release the control output ON/OFF, press this key for approx. 1sec.

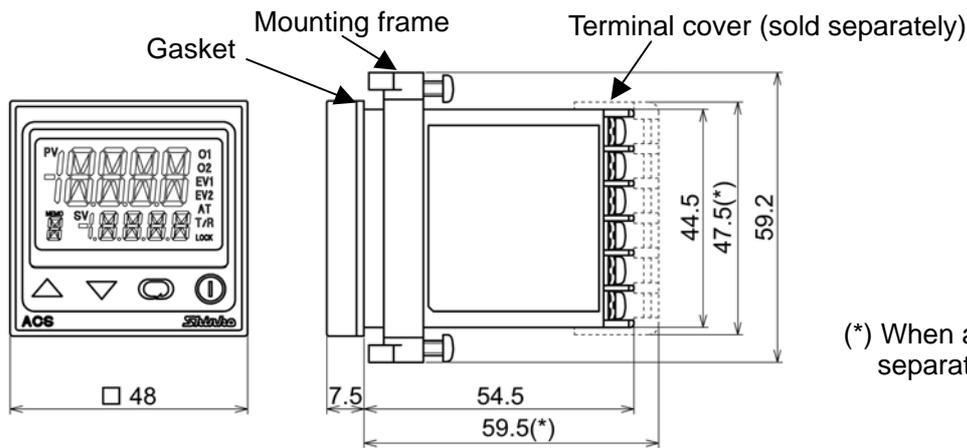
(12) **Console connector:**

By connecting to the USB communication cable (CMA, sold separately), the following operations can be conducted from the external computer using the Console software SWS-ACS01M.

- 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 (Unit: mm)

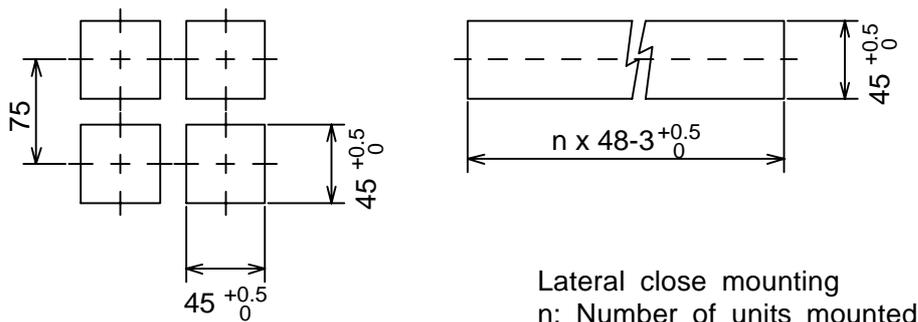


(*) When a terminal cover (sold separately) is used.

(Fig. 3.1-1)

3.2 Panel cutout (Unit: mm)

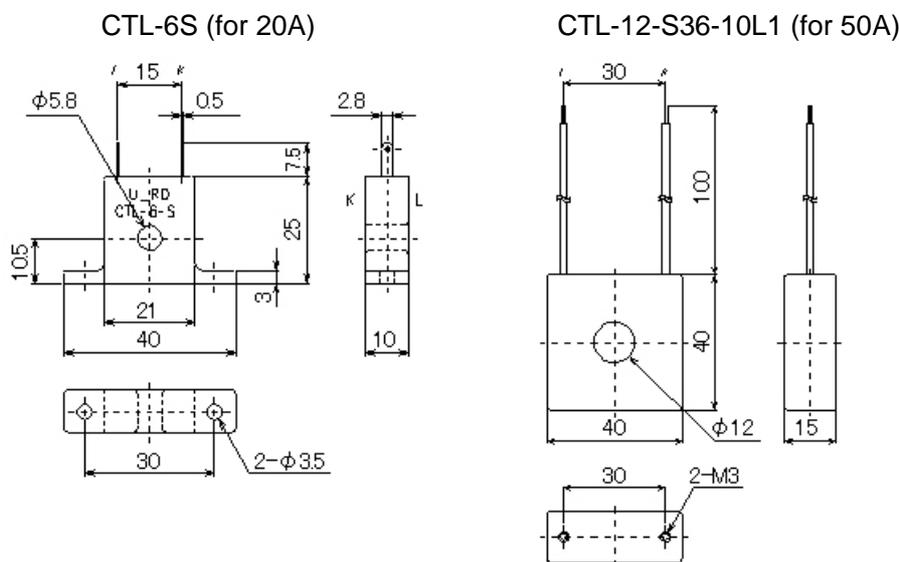
⚠ Caution
 If lateral close mounting is used for the controller, IP66 specification (Dust-proof/Drip-proof) may be compromised, and all warranties will be invalidated



Lateral close mounting
 n: Number of units mounted

(Fig. 3.2-1)

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



(Fig. 3.3-1)

3.4 Mounting and removal to/from the control panel



Caution

As the mounting frame is made of resin, do not use excessive force while tightening screws, or the mounting frame could be damaged.

Tighten screws with one rotation upon the screw tips touching the panel.

The torque is approximately 0.05 to 0.06 N•m.

How to mount the ACS-13A

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

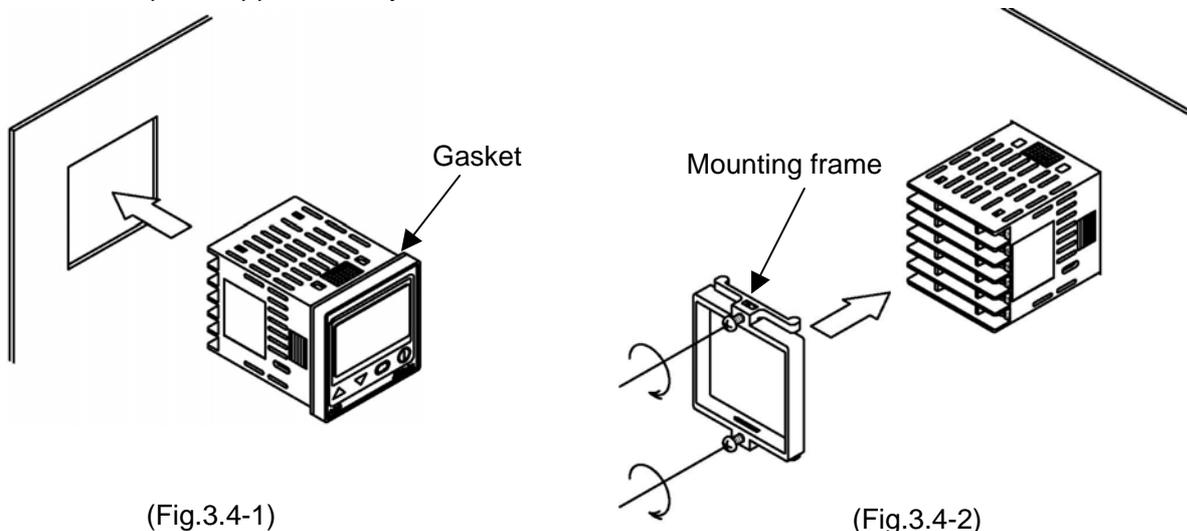
Mountable panel thickness: Within 1 to 5mm

(1) Insert the controller from the front side of the panel. (Fig.3.4-1)

(2) Insert the unit until mounting frame comes into contact with the panel, and fasten with the screw.

Tighten screws with one rotation upon the screw tips touching the panel. (Fig.3.4-2)

The torque is approximately 0.05 to 0.06N•m.



(Fig.3.4-1)

(Fig.3.4-2)

How to remove the mounting frame and unit (Fig. 3.4-3)

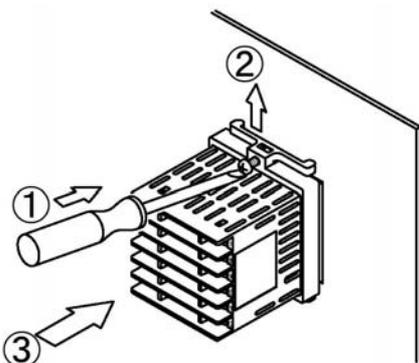
(1) Turn the power to the unit OFF, and disconnect all wires before removing the mounting frame.

(2) Insert a flat blade screwdriver between the screw frame and unit ①.

(3) Slowly push the frame upward using the screwdriver ②, while pushing the unit toward the panel ③.

(4) Repeat step (2) and slowly push the frame downward using the screwdriver for the other side.

The frame can be removed little by little by repeating these steps.



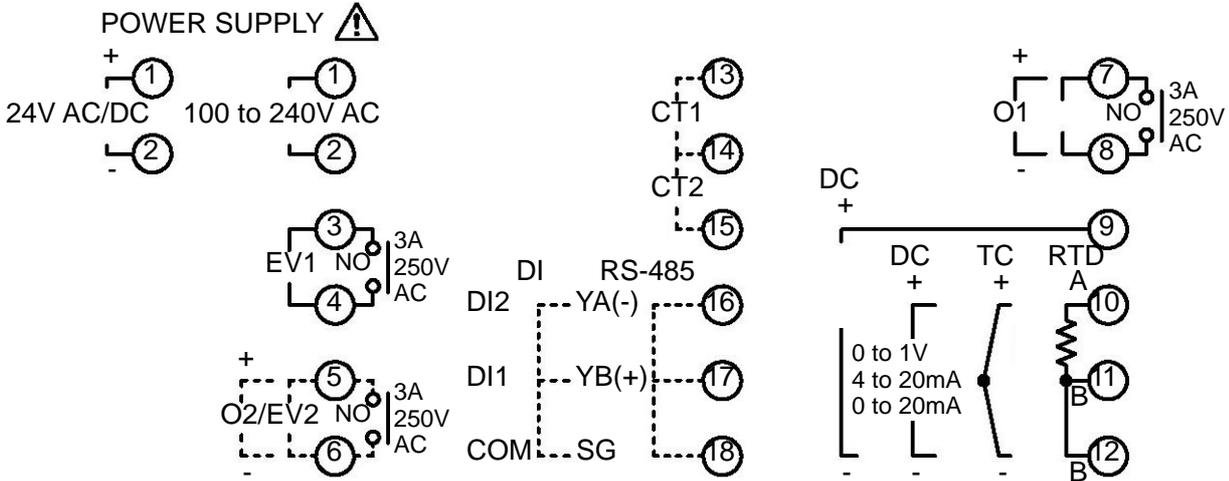
(Fig.3.4-3)

4. Wiring

Warning

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

4.1 Terminal arrangement



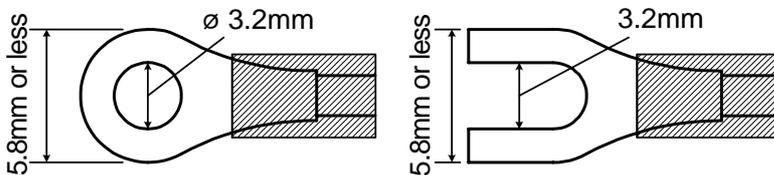
(Fig. 4-1)

- **POWERSUPPLY:** For a 24V AC/DC power source, do not confuse polarity when using direct current (DC).
- EV1 : Alarm 1 output
- O2/EV2: Cooling output (D□ option), Alarm 2 output (A2 option) or Heater burnout alarm output (W, W3 option)
- O1 : Control output or Heating output (D□ option)
- DC : DC current, DC voltage input
(For DC voltage input, + side terminal number differs depending on the voltage input.)
(+) side input terminal number of 0 to 5V DC, 1 to 5V DC, 0 to 10V DC: 9
(+) side input terminal number of 0 to 1V DC: 10
- TC : Thermocouple input
- RTD : Resistance temperature detector input
- CT1 : CT input 1 (W, W3 option)
- CT2 : CT input 2 (W3 option)
- DI : Contact input (SM option)
- RS-485: Serial communication RS-485 (C5 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 is approximately 0.6N•m to 1.0N•m.

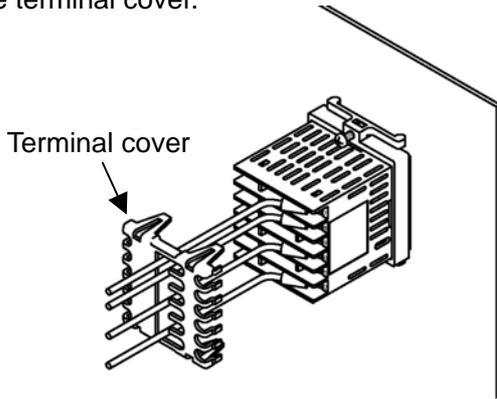
Solderless terminal	Manufacturer	Model	Tightening torque
Y type	Nichifu Terminal Industries CO.,LTD.	1.25Y-3	0.6N•m Max. 1.0N•m
	Japan Solderless Terminal MFG CO.,LTD.	VD1.25-B3A	
Round type	Nichifu Terminal Industries CO.,LTD.	1.25-3	
	Japan Solderless Terminal MFG CO.,LTD.	V1.25-3	



(Fig. 4.2-1)

4.3 Terminal cover

When using a terminal cover (sold separately), pass terminal wires numbered 7 to 12 into the holes of the terminal cover.



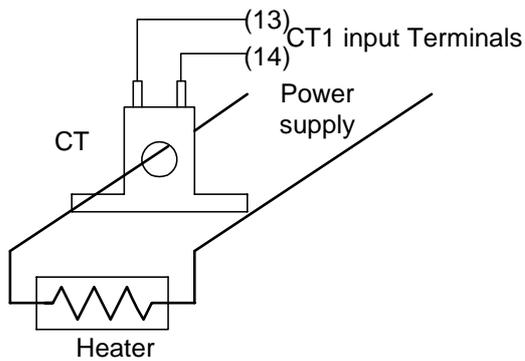
(Fig. 4.3-1)

4.4 Wiring Heater burnout alarm output (W, W3 option)

This alarm is not usable for detecting heater current under phase control.

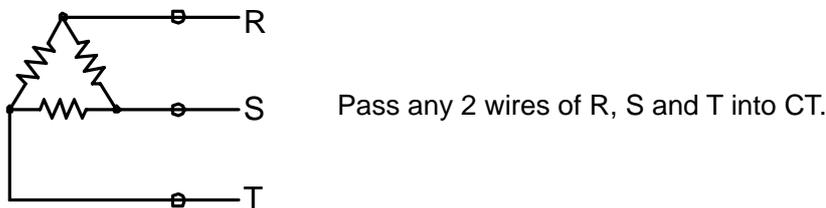
Use the CT (current transformer) provided, and pass one lead wire of the heater circuit into the hole of the CT. (Fig. 4.4-1).

When wiring, keep the CT wire away from AC sources or load wires to avoid the external interference.



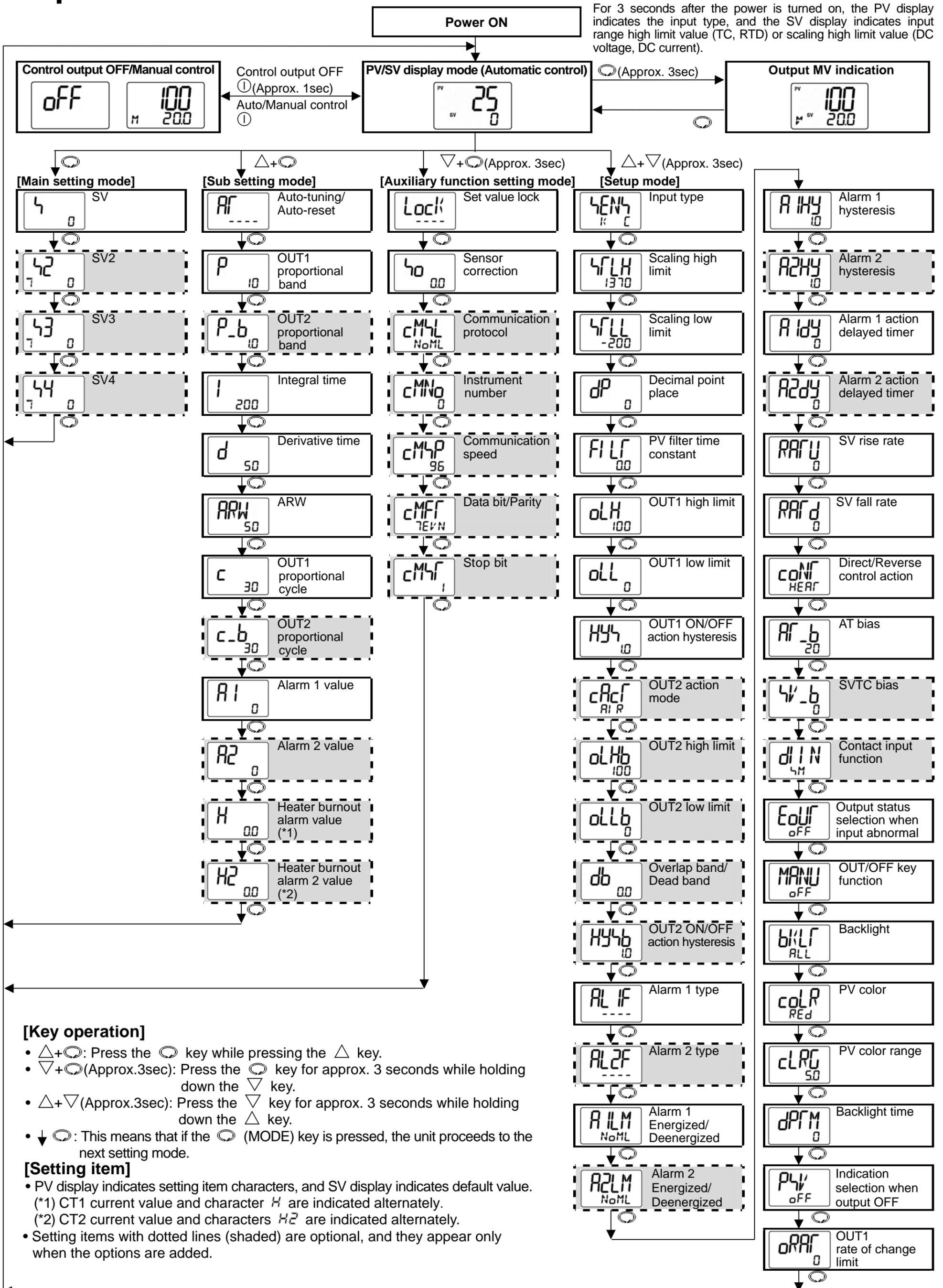
(Fig. 4.4-1)

In the case of 3-phase (W3 option), pass any 2 lead wires of R, S, T into the CT, and connect them with CT1 (13, 14) and CT2 terminals (14, 15). (Fig.4.4-2)



(Fig. 4.4-2)

5. Operation flowchart



6. Setup

Setup should occur before using this controller, to set the Input type, Alarm type, Control action, etc. according to the users' conditions.

Default values: Input (K, -200 to 1370°C), Alarm 1 (No alarm action), Reverse (Heating) action

If the users' specification is the same as the default value of the ACS-13A, it is not necessary to set up the controller. Proceed to Chapter "7. Settings".

6.1 Turn the power supply to the ACS-13A ON.

After the power is turned on, the PV display indicates the input type, and the SV display indicates the input range high limit value (thermocouple, RTD input) or scaling high limit value (DC input) for approximately 3 seconds. (Table 6.1-1)

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

Control will then start indicating the PV (process variable) on the PV display and SV (main set value) on the SV display.

While control output OFF function is working, the PV display indicates *OFF*.

(Indication depends on the selection during "Output status selection when input abnormal".)

(Table 6.1-1)

Sensor input	°C		°F	
	PV display	SV display	PV display	SV display
K	K□□□	1370	K□□F	2500
	K□□□	4000	K□□F	7500
J	J□□□	1000	J□□F	1800
R	R□□□	1760	R□□F	3200
S	S□□□	1760	S□□F	3200
B	B□□□	1820	B□□F	3300
E	E□□□	□800	E□□F	1500
T	T□□□	4000	T□□F	7500
N	N□□□	1300	N□□F	2300
PL-II	PL□□	1390	PL□□	2500
C (W/Re5-26)	C□□□	23 15	C□□□	4200
Pt100	Pt□□	8500	Pt□□	15000
	Pt□□	□850	Pt□□	1500
JPt100	JPt□□	5000	JPt□□	9000
	JPt□□	□500	JPt□□	□900
4 to 20mA DC	420A	Scaling high limit value		
0 to 20mA DC	020A			
0 to 1V DC	0□1V			
0 to 5V DC	0□5V			
1 to 5V DC	□5V			
0 to 10V DC	0□10V			

6.2 Basic key operations

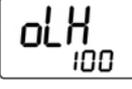
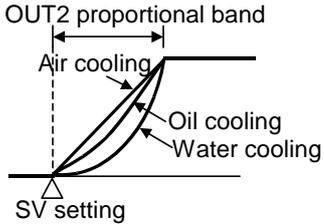
To enter each setting mode, refer to respective setting modes.

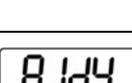
To set or select each setting item, use the \triangle or ∇ key, then register the value with the  key.

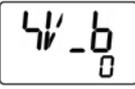
6.3 Setup mode

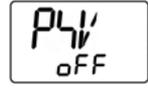
To enter the Setup mode, press the ∇ key for approx. 3 seconds while holding down the \triangle key in the PV/SV display mode.

Character	Name, Function, Setting range	Default value																																																																																																																														
	Input type selection <ul style="list-style-type: none"> The input type can be selected from thermocouple (10 types), RTD (2 types), DC current (2 types) and DC voltage (4 types), and the unit °C/°F can be selected as well. When changing the input from DC voltage to other inputs, remove the sensor connected to this controller first, then change for the input. If the input is changed with the sensor connected, the input circuit may break. (+) side input terminal number of 0 to 5V DC, 1 to 5V DC, 0 to 10V DC differs from that of 0 to 1V DC. (+) side input terminal number of 0 to 5V DC, 1 to 5V DC, 0 to 10V DC: 9 (+) side input terminal number of 0 to 1V DC: 10 	K (-200 to 1370°C)																																																																																																																														
	<table border="1"> <tbody> <tr> <td>K□□□</td> <td>K</td> <td>-200 to 1370 °C</td> <td>K□□□</td> <td>K</td> <td>-320 to 2500 °F</td> </tr> <tr> <td>K□□.</td> <td>K</td> <td>-200.0 to 400.0 °C</td> <td>K□□.</td> <td>K</td> <td>-320.0 to 750.0 °F</td> </tr> <tr> <td>J□□□</td> <td>J</td> <td>-200 to 1000 °C</td> <td>J□□□</td> <td>J</td> <td>-320 to 1800 °F</td> </tr> <tr> <td>R□□□</td> <td>R</td> <td>0 to 1760 °C</td> <td>R□□□</td> <td>R</td> <td>0 to 3200 °F</td> </tr> <tr> <td>S□□□</td> <td>S</td> <td>0 to 1760 °C</td> <td>S□□□</td> <td>S</td> <td>0 to 3200 °F</td> </tr> <tr> <td>B□□□</td> <td>B</td> <td>0 to 1820 °C</td> <td>B□□□</td> <td>B</td> <td>0 to 3300 °F</td> </tr> <tr> <td>E□□□</td> <td>E</td> <td>-200 to 800 °C</td> <td>E□□□</td> <td>E</td> <td>-320 to 1500 °F</td> </tr> <tr> <td>T□□.</td> <td>T</td> <td>-200.0 to 400.0 °C</td> <td>T□□.</td> <td>T</td> <td>-320.0 to 750.0 °F</td> </tr> <tr> <td>N□□□</td> <td>N</td> <td>-200 to 1300 °C</td> <td>N□□□</td> <td>N</td> <td>-320 to 2300 °F</td> </tr> <tr> <td>PL2□</td> <td>PL-II</td> <td>0 to 1390 °C</td> <td>PL2□</td> <td>PL-II</td> <td>0 to 2500 °F</td> </tr> <tr> <td>C□□□</td> <td>C(W/Re5-26)</td> <td>0 to 2315 °C</td> <td>C□□□</td> <td>C(W/Re5-26)</td> <td>0 to 4200 °F</td> </tr> <tr> <td>Pt□□</td> <td>Pt100</td> <td>-200.0 to 850.0 °C</td> <td>Pt□□</td> <td>Pt100</td> <td>-320.0 to 1500.0 °F</td> </tr> <tr> <td>JPt□</td> <td>JPt100</td> <td>-200.0 to 500.0 °C</td> <td>JPt□</td> <td>JPt100</td> <td>-320.0 to 900.0 °F</td> </tr> <tr> <td>Pt□□</td> <td>Pt100</td> <td>-200 to 850 °C</td> <td>Pt□□</td> <td>Pt100</td> <td>-320 to 1500 °F</td> </tr> <tr> <td>JPt□</td> <td>JPt100</td> <td>-200 to 500 °C</td> <td>JPt□</td> <td>JPt100</td> <td>-320 to 900 °F</td> </tr> <tr> <td>420A</td> <td>4 to 20mA DC</td> <td>-2000 to 10000</td> <td></td> <td></td> <td></td> </tr> <tr> <td>020A</td> <td>0 to 20mA DC</td> <td>-2000 to 10000</td> <td></td> <td></td> <td></td> </tr> <tr> <td>0□1V</td> <td>0 to 1V DC</td> <td>-2000 to 10000</td> <td></td> <td></td> <td></td> </tr> <tr> <td>0□5V</td> <td>0 to 5V DC</td> <td>-2000 to 10000</td> <td></td> <td></td> <td></td> </tr> <tr> <td>1□5V</td> <td>1 to 5V DC</td> <td>-2000 to 10000</td> <td></td> <td></td> <td></td> </tr> <tr> <td>0□10V</td> <td>0 to 10V DC</td> <td>-2000 to 10000</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	K□□□	K	-200 to 1370 °C	K□□□	K	-320 to 2500 °F	K□□.	K	-200.0 to 400.0 °C	K□□.	K	-320.0 to 750.0 °F	J□□□	J	-200 to 1000 °C	J□□□	J	-320 to 1800 °F	R□□□	R	0 to 1760 °C	R□□□	R	0 to 3200 °F	S□□□	S	0 to 1760 °C	S□□□	S	0 to 3200 °F	B□□□	B	0 to 1820 °C	B□□□	B	0 to 3300 °F	E□□□	E	-200 to 800 °C	E□□□	E	-320 to 1500 °F	T□□.	T	-200.0 to 400.0 °C	T□□.	T	-320.0 to 750.0 °F	N□□□	N	-200 to 1300 °C	N□□□	N	-320 to 2300 °F	PL2□	PL-II	0 to 1390 °C	PL2□	PL-II	0 to 2500 °F	C□□□	C(W/Re5-26)	0 to 2315 °C	C□□□	C(W/Re5-26)	0 to 4200 °F	Pt□□	Pt100	-200.0 to 850.0 °C	Pt□□	Pt100	-320.0 to 1500.0 °F	JPt□	JPt100	-200.0 to 500.0 °C	JPt□	JPt100	-320.0 to 900.0 °F	Pt□□	Pt100	-200 to 850 °C	Pt□□	Pt100	-320 to 1500 °F	JPt□	JPt100	-200 to 500 °C	JPt□	JPt100	-320 to 900 °F	420A	4 to 20mA DC	-2000 to 10000				020A	0 to 20mA DC	-2000 to 10000				0□1V	0 to 1V DC	-2000 to 10000				0□5V	0 to 5V DC	-2000 to 10000				1□5V	1 to 5V DC	-2000 to 10000				0□10V	0 to 10V DC	-2000 to 10000				
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	Scaling high limit setting <ul style="list-style-type: none"> Sets scaling high limit value. Setting range: Scaling low limit value to input range high limit value DC voltage, current input: -2000 to 10000 (The placement of the decimal point follows the selection.) 	1370°C																																																																																																																														
	Scaling low limit setting <ul style="list-style-type: none"> Sets scaling low limit value. Setting range: Input range low limit value to scaling high limit value DC voltage, current input: -2000 to 10000 (The placement of the decimal point follows the selection.) 	-200°C																																																																																																																														
	Decimal point place selection <ul style="list-style-type: none"> Selects decimal point place. Available only for DC input □□□□: No decimal point □□□□: 1 digit after decimal point □□□□: 2 digits after decimal point □□□□: 3 digits after decimal point 	No decimal point																																																																																																																														

	PV filter time constant setting <ul style="list-style-type: none"> 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 10.0 seconds 	0.0 seconds
	OUT1 high limit setting <ul style="list-style-type: none"> Sets the high limit value of OUT1. Not available if OUT1 is ON/OFF action Setting range: OUT1 low limit value to 100% (DC current output type: OUT1 low limit value to 105%) 	100%
	OUT1 low limit setting <ul style="list-style-type: none"> Sets the low limit value of OUT1. Not available if OUT1 is ON/OFF action. Setting range: 0% to OUT1 high limit value (DC current output type: -5% to OUT1 high limit value) 	0%
	OUT1 ON/OFF action hysteresis setting <ul style="list-style-type: none"> Sets ON/OFF action hysteresis for OUT1. Available only when OUT1 is ON/OFF action Setting range: 0.1 to 100.0°C (°F), DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection.) 	1.0°C
	OUT2 action mode selection <ul style="list-style-type: none"> Selects OUT2 action from air, oil and water cooling. Not available if the D□ option is not added or if OUT2 is ON/OFF action AIR□ Air cooling (linear characteristic) oIL□ Oil cooling (1.5th power of the linear characteristic) WAT□ Water cooling (2nd power of the linear characteristic) 	Air cooling  (Fig. 6.3-1)
	OUT2 high limit setting <ul style="list-style-type: none"> Sets OUT2 high limit value. Not available if the D□ option is not added or if OUT2 is ON/OFF action Setting range: OUT2 low limit value to 100% 	100%
	OUT2 low limit setting <ul style="list-style-type: none"> Sets OUT2 low limit value. Not available if the D□ option is not added or if OUT2 is ON/OFF action Setting range: 0% to OUT2 high limit value 	0%
	Overlap band/Dead band setting <ul style="list-style-type: none"> Sets the overlap band or dead band for OUT1 and OUT2. + Set value: Dead band, -Set value: Overlap band Available only when the D□ option is added Setting range: -100.0 to 100.0°C(°F), DC voltage, current input: -1000 to 1000 (The placement of the decimal point follows the selection.) 	0.0°C
	OUT2 ON/OFF action hysteresis setting <ul style="list-style-type: none"> Sets ON/OFF action hysteresis for OUT2. Available when the D□ option is added, and when OUT2 is ON/OFF control action. Setting range: 0.1 to 100.0°C (°F), DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection.) 	1.0°C

	<p>Alarm 1 type selection</p> <ul style="list-style-type: none"> • Selects an Alarm 1 type. (Refer to “11.4 Alarm action” on p.29.) ---- : No alarm action H--- : High limit alarm L--- : Low limit alarm HL-- : High/Low limits alarm HL d : High/Low limit range alarm RA-- : Process high alarm RA d : Process low alarm H---W : High limit alarm with standby L---W : Low limit alarm with standby HL--W : High/Low limits alarm with standby 	<p>No alarm action</p>
	<p>Alarm 2 (A2) type selection</p> <ul style="list-style-type: none"> • Selects an Alarm 2 type. (Refer to “11.4 Alarm action” on p.29.) Available only when Alarm 2 (A2) option is added • Selection items are the same as those of Alarm 1. 	<p>No alarm action</p>
	<p>Alarm 1 Energized/Deenergized selection</p> <ul style="list-style-type: none"> • Selects Energized/Deenergized status for Alarm 1. (See p.18.) Not available if No alarm action is selected during Alarm 1 type selection • NoML : Energized • RE d : Deenergized 	<p>Energized</p>
	<p>Alarm 2 Energized/Deenergized selection</p> <ul style="list-style-type: none"> • Selects Energized/Deenergized status for Alarm 2. (See p.18.) Not available if Alarm 2 (A2) option is not added or if No alarm action is selected during Alarm 2 type selection • Selection items are the same as those of Alarm 1 Energized/Deenergized selection. 	<p>Energized</p>
	<p>Alarm 1 hysteresis setting</p> <ul style="list-style-type: none"> • Sets hysteresis for Alarm 1. Not available if No alarm action is selected during Alarm 1 type selection • Setting range: 0.1 to 100.0°C(°F), DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection.) 	<p>1.0°C</p>
	<p>Alarm 2 hysteresis setting</p> <ul style="list-style-type: none"> • Sets hysteresis for Alarm 2. Not available if Alarm 2 (A2) option is not added or if No alarm action is selected during Alarm 2 type selection • Setting range: 0.1 to 100.0°C(°F), DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection.) 	<p>1.0°C</p>
	<p>Alarm 1 action delayed timer setting</p> <ul style="list-style-type: none"> • Sets action delayed timer for Alarm 1. When setting time has elapsed after the input enters the alarm output range, the alarm is activated. Not available if No alarm action is selected during Alarm 1 type selection • Setting range: 0 to 10000 seconds 	<p>0 seconds</p>
	<p>Alarm 2 action delayed timer setting</p> <ul style="list-style-type: none"> • Sets action delayed timer for Alarm 2. When setting time has elapsed after the input enters the alarm output range, the alarm is activated. Not available if Alarm 2 (A2) option is not added or if No alarm action is selected during Alarm 2 type selection • Setting range: 0 to 10000 seconds 	<p>0 seconds</p>

	SV rise rate setting <ul style="list-style-type: none"> Sets SV rise rate (rising value for 1 minute). Setting to 0 disables the function. Setting range: 0 to 10000°C/min. (°F/min.) Thermocouple, RTD input with a decimal point: 0.0 to 1000.0°C/min. (°F/min.) DC voltage, current input: 0 to 10000/min. (The placement of the decimal point follows the selection.) 	0°C/min.
	SV fall rate setting <ul style="list-style-type: none"> Sets SV fall rate (falling value for 1 minute). Setting to 0 disables the function. Setting range: 0 to 10000°C/min. (°F/min.) Thermocouple, RTD input with a decimal point: 0.0 to 1000.0°C/min. (°F/min.) DC voltage, current input: 0 to 10000/min. (The placement of the decimal point follows the selection.) 	0°C/min.
	Direct/Reverse control action selection <ul style="list-style-type: none"> Selects either Reverse (Heating) or Direct (Cooling) control action. <i>HEAT</i>: Reverse (Heating) control action <i>COOL</i>: Direct (Cooling) control action 	Reverse (Heating) action
	AT bias setting <ul style="list-style-type: none"> Sets bias value during PID auto-tuning. (Refer to Chapter "10. Auto-tuning" on p.27.) Not available for DC input Setting range: 0 to 50°C (0 to 100°F) (Thermocouple, RTD input with a decimal point: 0.0 to 50.0°C(0.0 to 100.0°F)) 	20°C
	SVTC bias setting <ul style="list-style-type: none"> SV adds SVTC bias value to the value received by the SVTC command. Available only when the C5 option is added Setting range: Converted value of ±20% of the input span DC voltage, current input: ±20% of the scaling span (The placement of the decimal point follows the selection.) 	0°C
	Contact input function selection <ul style="list-style-type: none"> Contact input terminals DI2 can be used for a "Set value memory external selection" or for an "OUT/OFF external selection". See "Contact input function selection" on p.18. If Auto/Manual control function is selected during OUT/OFF key function selection, externally Auto/Manual control can be switched. Available only when the SM option is added. <i>5M</i>: Set value memory external selection <i>OUT1</i>: OUT/OFF external selection 1 (SV and SV2 can be switched) <i>OUT2</i>: OUT/OFF external selection 2 	Set value memory external selection
	Output status selection when input abnormal <ul style="list-style-type: none"> Selects whether OUT1 (OUT2) is turned OFF or not when DC input is overscale or underscale. Available only for DC current output type with DC input <i>OFF</i>: Outputs OFF(4mA) or OUT1(OUT2) low limit <i>ON</i>: Outputs a value between OFF(4mA) and ON(20mA) or between OUT1(OUT2) low limit value and OUT1(OUT2) high limit value, depending on a deviation. 	Output OFF
	OUT/OFF key function selection <ul style="list-style-type: none"> Selects whether OUT/OFF key is used for control output "OUT/OFF function" or for "Auto/Manual control function". <i>OFF</i>: OUT/OFF function <i>MANU</i>: Auto/Manual control function 	OUT/OFF function

	<p>Backlight selection</p> <ul style="list-style-type: none"> • Selects the display to backlight. • <i>ALL</i>: All (displays and indicators) are backlit. • <i>PV</i>: Only PV display is backlit. • <i>SV</i>: Only SV display is backlit. • <i>Ac</i>: Only Action indicators are backlit. • <i>PV SV</i>: PV and SV displays are backlit. • <i>PV Ac</i>: PV display and Action indicators are backlit. • <i>SV Ac</i>: SV display and Action indicator are backlit. 	<p>All are backlit</p>
	<p>PV color selection</p> <ul style="list-style-type: none"> • Selects PV display color. See “PV display color selection” on p.19. • <i>GRN</i>: Green • <i>REd</i>: Red • <i>oRD</i>: Orange • <i>ALGR</i>: When Alarm 1 or Alarm 2 is ON, PV color turns from green to red. • <i>ALoR</i>: When Alarm 1 or Alarm 2 is ON, PV color turns from orange to red. • <i>PVGR</i>: PV color changes continuously (Orange → Green → Red). • <i>APGR</i>: PV color changes continuously (Orange → Green → Red), and at the same time Alarm 1 or Alarm 2 is ON (Red). 	<p>Red</p>
	<p>PV color range setting</p> <ul style="list-style-type: none"> • When <i>PVGR</i> (PV color changes continuously) or <i>APGR</i> (PV color changes continuously + Alarm 1 or Alarm 2 is ON) is selected during PV color selection, the value of green PV color range can be set. See “PV display color selection” on p.19. • Setting range: 0.1 to 100.0°C(°F), DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection.) 	<p>5.0°C</p>
	<p>Backlight time setting</p> <ul style="list-style-type: none"> • 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 	<p>0 minutes</p>
	<p>Indication selection when output OFF</p> <ul style="list-style-type: none"> • Selects the indication when control output is OFF. • <i>oFF</i>: OFF indication • <i>RoFF</i>: No indication • <i>PV</i>: PV indication • <i>PV AL</i>: PV indication+ Alarm output (Alarm 1, Alarm 2, Heater burnout alarm) active 	<p>OFF indication</p>
	<p>OUT1 rate of change limit</p> <ul style="list-style-type: none"> • Sets changing value of OUT1 MV for 1 second. • Not available if OUT1 is ON/OFF action, or when set to 0. See “OUT1 rate of change limit” on p.19. • Setting range: 0 to 100%/second 	<p>0%/second</p>

[Alarm action Energized/Deenergized]

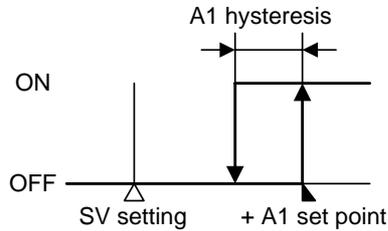
When [Alarm Energized (*NOML*)] is selected, the alarm output (between terminals 3-4, or 5-6) is conductive (ON) while the alarm output indicator is lit.

The alarm output is not conductive (OFF) while the alarm output indicator is not lit.

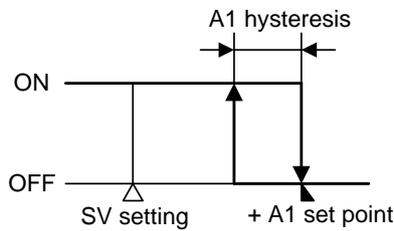
When [Alarm Deenergized (*REVL*)] is selected, the alarm output (between terminals 3-4, or 5-6) is not conductive (OFF) while the alarm output indicator is lit.

The alarm output is conductive (ON) while the alarm output indicator is not lit.

High limit alarm (when Energized is set) High limit alarm (when Deenergized is set)



(Fig. 6.1-2)



(Fig. 6.1-3)

A1: Alarm 1
For Alarm 2(A2), read "A2" for "A1".

[Contact input function selection]

Actions differ depending on OUT/OFF key function selection in the Setup mode.

- When OUT/OFF function (*OFF*) is selected during OUT/OFF key function selection mode

(Table 6.3-1)

Connecting terminal No.		Contact input function		
Between 17-18 (DI1-COM)	Between 16-18 (DI2-COM)	Set value memory external selection (<i>LM</i>)	OUT/OFF external selection 1 (<i>OFF1</i>)	OUT/OFF external selection 2 (<i>OFF2</i>)
Open	Open	SV	SV	SV
Closed	Open	SV2	SV2	
Open	Closed	SV3	Control output OFF	Control output OFF
Closed	Closed	SV4		

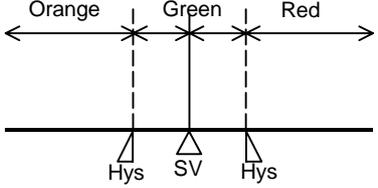
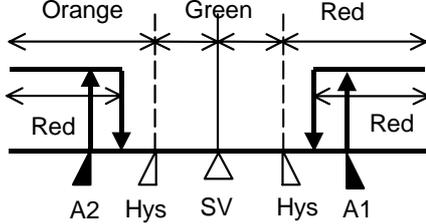
- When Auto/Manual control (*MANU*) is selected during OUT/OFF key function selection mode.

(Table 6.3-2)

Connecting terminal No.		Contact input function		
Between 17-18 (DI1-COM)	Between 16-18 (DI2-COM)	Set value memory external selection (<i>LM</i>)	OUT/OFF external selection 1 (<i>OFF1</i>)	OUT/OFF external selection 2 (<i>OFF2</i>)
Open	Open	SV	SV (Automatic control)	SV (Automatic control)
Closed	Open	SV2	SV2 (Automatic control)	
Open	Closed	SV3	Manual control	Manual control
Closed	Closed	SV4		

[PV display color selection]

(Table 6.3-3)

PV color selection		PV color
<i>GRN</i>	Green	Constantly green
<i>RED</i>	Red	Constantly red
<i>OR</i>	Orange	Constantly orange
<i>ALOR</i>	When Alarm 1 or Alarm 2 is ON: Green → Red	When alarm OFF: Green When Alarm 1 or Alarm 2 is ON, the PV color turns from green to red.
<i>ALOR</i>	When Alarm 1 or Alarm 2 is ON: Orange → Red	When alarm OFF: Orange When Alarm 1 or Alarm 2 is ON, the PV color turns from orange to red.
<i>PVCR</i>	PV color changes continuously (Orange → Green → Red)	PV color changes depending on the color range setting. <ul style="list-style-type: none"> • 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  <p style="text-align: right;">(Fig. 6.3-4)</p> <p style="text-align: center;">Hys: Set point of PV color range</p>
<i>APCR</i>	PV color changes continuously (Orange → Green → Red), and at the same time Alarm 1 or Alarm 2 is ON (Red).	PV color changes depending on the color range setting. When Alarm 1 or Alarm 2 is ON, PV display turns red. <ul style="list-style-type: none"> • 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 • Alarm 1 or Alarm 2 is ON: Red  <p style="text-align: right;">(Fig. 6.3-5)</p> <p style="text-align: center;">Hys: Set point of PV color range A1: Alarm 1 set point (High limit alarm) A2: Alarm 2 set point (Low limit alarm)</p>

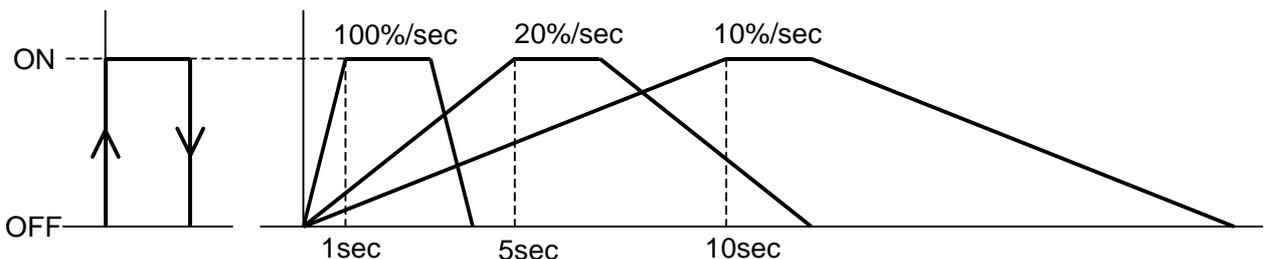
[OUT1 rate of change limit]

For Heating control, if PV is lower than SV, output is generally turned from OFF to ON as shown in (Fig.6.3-6).

If OUT1 rate of change limit is set, the output can be changed by the rate of change (Fig.6.3-7).

This control is suitable for high temperature heaters (which are made from molybdenum, tungsten or platinum, etc., and used at approx. 1500 to 1800°C) which are easily burnt out from turning on electricity rapidly.

- Usual output
- Output when Output rate of change limit is set



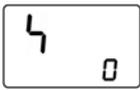
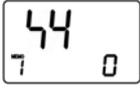
(Fig.6.3-6)

(Fig.6.3-7)

7. Settings

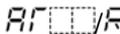
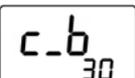
7.1 Main setting mode

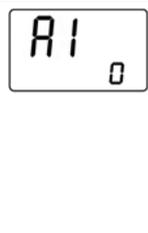
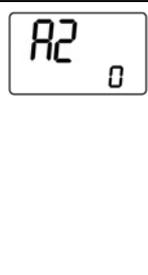
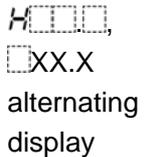
To enter the Main setting mode, press the  key in the PV/SV display mode.

Character	Name, Function, Setting range	Default value
	SV <ul style="list-style-type: none"> • Sets SV. • Setting range: Scaling low limit to Scaling high limit 	0°C
	SV2 <ul style="list-style-type: none"> • Sets SV2. Not available if the SM option is not applied, if C5 option is applied or if “OUT/OFF external selection 2” is selected during Contact input function selection. • Setting range: Scaling low limit to Scaling high limit 	0°C
	SV3 <ul style="list-style-type: none"> • Sets SV3. Not available if the SM option is not applied, if C5 option is applied or if “OUT/OFF external selection 1 or 2” is selected during Contact input function selection. • Setting range: Scaling low limit to Scaling high limit 	0°C
	SV4 <ul style="list-style-type: none"> • Sets SV4. Not available if the SM option is not applied, if C5 option is applied or if “OUT/OFF external selection 1 or 2” is selected during Contact input function selection. • Setting range: Scaling low limit to Scaling high limit 	0°C

7.2 Sub setting mode

To enter the Sub setting mode, press the  key while pressing the  key in the PV/SV display mode.

Character	Name, Function, Setting range	Default value
	Auto-tuning/Auto-reset selection <ul style="list-style-type: none"> • Selects Auto-tuning Perform/Cancel (PID) or Auto-reset Perform/Cancel (P, PD action). Not available for ON/OFF and PI actions. • If the auto-tuning is cancelled during the process, P, I and D values revert to the values before auto-tuning was performed. • If the auto-tuning is not finished after 4 hours, it is cancelled automatically. • Auto-reset is cancelled in approximately 4 minutes. It cannot be released while performing this function. • ----- : Auto-tuning/Auto-reset Cancel  : Auto-tuning/Auto-reset Perform 	-----
	OUT1 proportional band setting <ul style="list-style-type: none"> • Sets the proportional band for OUT1. OUT1 becomes ON/OFF action when set to 0 or 0.0. • Setting range: 0 to 1000°C(2000°F), TC or RTD input with decimal point: 0.0 to 1000.0°C(1999.9°F) (DC voltage, current input: 0.0 to 100.0%) 	10°C
	OUT2 proportional band setting <ul style="list-style-type: none"> • Sets the proportional band for OUT2. OUT2 becomes ON/OFF action when set to 0.0. Not available if D□ option is not added, or if OUT1 is ON/OFF action. • Setting range: 0.0 to 10.0 times (multiplying factor to OUT1 proportional band) 	1.0 times
	Integral time setting <ul style="list-style-type: none"> • Sets integral time for OUT1. Setting the value to 0 disables the function. Not available if OUT1 is ON/OFF action. Auto-reset can be performed when PD is control action (I=0). • Setting range: 0 to 1000 seconds 	200 seconds
	Derivative time setting <ul style="list-style-type: none"> • Sets derivative time for OUT1. Setting the value to 0 disables the function. Not available if OUT1 is ON/OFF action. • Setting range: 0 to 300 seconds 	50 seconds
	ARW setting <ul style="list-style-type: none"> • Sets anti-reset windup (ARW) for OUT1. Available only when PID is control action. • Setting range: 0 to 100% 	50%
	OUT1 proportional cycle setting <ul style="list-style-type: none"> • Sets proportional cycle for OUT1. For relay contact output, if the proportional cycle time is decreased, the frequency of the relay action increases, and the life of the relay contact is shortened. Not available if OUT1 is ON/OFF action or DC current output type. • Setting range: 1 to 120 seconds 	Relay contact: 30sec Non-contact voltage: 3sec
	OUT2 proportional cycle setting <ul style="list-style-type: none"> • Sets proportional cycle for OUT2. For relay contact output, if the proportional cycle time is decreased, the frequency of the relay action increases, and the life of the relay contact is shortened. Not available if the D□ option is not added or if OUT2 is ON/OFF action. • Setting range: 1 to 120 seconds 	Relay contact: 30sec Non-contact voltage: 3sec

	<p>Alarm 1 value setting</p> <ul style="list-style-type: none"> Sets action point for Alarm 1 output. Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm). Not available if No alarm action is selected during Alarm 1 type selection Refer to (Table 7.2-1). 	0°C
	<p>Alarm 2 value setting</p> <ul style="list-style-type: none"> Sets action point for Alarm 2 output. Setting the value to 0 or 0.0 disables the function (except Process high and Process low alarm). Not available if Alarm 2 (A2) option is not added or if No alarm action is selected during Alarm 2 type selection. Refer to (Table 7.2-1). 	0°C
 <p>H 00  alternating display</p>	<p>Heater burnout alarm value setting</p> <ul style="list-style-type: none"> Sets the heater current value for Heater burnout alarm. Setting to 0.0 disables the alarm. CT1 current value and character <i>H</i> are indicated alternately on the PV display. When OUT1 is ON, the CT1 current value is updated. When OUT1 is OFF, the ACS-13A memorizes the previous value when OUT1 was ON. Upon returning to set limits, the alarm will stop. Available only when the W or W3 option is added. Rated current: 20A (0.0 to 20.0A), 50A (0.0 to 50.0A) 	0.0A
 <p>H2 00  alternating display</p>	<p>Heater burnout alarm 2 value setting</p> <ul style="list-style-type: none"> Sets the heater current value for Heater burnout alarm. Setting to 0.0 disables the alarm. CT2 current value and characters <i>H2</i> are indicated alternately on the PV display. When OUT1 is ON, the CT2 current value is updated. When OUT1 is OFF, the ACS-13A memorizes the previous value when OUT1 was ON. Upon returning to set limits, the alarm will stop. Available only when the W3 option is added. Rated current: 20A (0.0 to 20.0A), 50A (0.0 to 50.0A) 	0.0A

(Table 7.2-1)

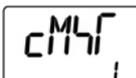
Alarm type	Setting range
High limit alarm	-(Input span) to input span°C(F) *1
Low limit alarm	-(Input span) to input span°C(F) *1
High/Low limits alarm	0 to input span°C(F) *1
High/Low limit range alarm	0 to input span°C(F) *1
Process high alarm	Input range low limit value to input range high limit value *2
Process low alarm	Input range low limit value to input range high limit value *2
High limit alarm with standby	-(Input span) to input span°C(F) *1
Low limit alarm with standby	-(Input span) to input span°C(F) *1
High/Low limits alarm with standby	0 to input span°C(F) *1

*1: For DC voltage, current input, the input span is the same as the scaling span.

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

7.3 Auxiliary function setting mode

To enter the Auxiliary function setting mode, press the  key for 3 seconds while holding down the  key in the PV/SV display mode.

Character	Name, Function, Setting range	Default value
	Set value lock selection <ul style="list-style-type: none"> Locks the set values to prevent setting errors. The setting item to be locked depends on the selection. When Lock 1 or Lock 2 is selected, PID Auto-tuning and Auto-reset cannot be carried out. ---- (Unlock): All set values can be changed. <i>Loc 1</i> (Lock 1): None of the set values can be changed. <i>Loc 2</i> (Lock 2): Only main setting mode can be changed. <i>Loc 3</i> (Lock 3): All set values except Input type can be changed. However, changed values revert to their previous value after power is turned off because they are not saved in the non-volatile memory. Do not change any setting item in Setup mode. If any item in Setup mode is changed, it will affect other setting items such as the SV and Alarm value. 	Unlock
	Sensor correction setting <ul style="list-style-type: none"> 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 controlling with plural controllers, sometimes the measured temperatures (input value) do not concur due to differences in sensor accuracy or dispersion of load capacities. In such a case, the control can be set at the desired temperature by adjusting the input value of sensors. PV= Current PV+ Sensor correction value Setting range: -100.0 to 100.0°C (°F) DC voltage, current input: -1000 to 1000 (The placement of the decimal point follows the selection.) 	0.0°C
	Communication protocol selection <ul style="list-style-type: none"> Selects communication protocol. Not available if the C5 option is not added or if SM option is added <i>NoML</i>: Shinko protocol <i>ModA</i>: Modbus ASCII mode <i>ModR</i>: Modbus RTU mode 	Shinko protocol
	Instrument number setting <ul style="list-style-type: none"> Sets the instrument number individually to each instrument when communicating by connecting plural instruments in serial communication. Not available if C5 option is not added or if SM option is added Setting range: 0 to 95 	0
	Communication speed selection <ul style="list-style-type: none"> Selects a communication speed equal to that of the host computer. Not available if C5 option is not added or if the SM option is added <input type="checkbox"/> <i>24</i>: 2400bps <input type="checkbox"/> <i>48</i>: 4800bps <input checked="" type="checkbox"/> <i>96</i>: 9600bps <input type="checkbox"/> <i>192</i>: 19200bps 	9600bps
	Data bit/Parity selection <ul style="list-style-type: none"> Selects data bit and parity. Not available if the C5 option is not added or if SM option is added <i>8NoN</i>: 8 bits/No parity <i>7NoN</i>: 7 bits/No parity <i>8EVN</i>: 8 bits/Even parity <i>7EVN</i>: 7 bits/Even parity <i>8odd</i>: 8 bits/Odd parity <i>7odd</i>: 7 bits/Odd parity 	7 bits/Even parity
	Stop bit selection <ul style="list-style-type: none"> Selects the stop bit. Not available if C5 option is not added or if SM option is added <input type="checkbox"/> <i>1</i>: 1 <input checked="" type="checkbox"/> <i>2</i>: 2 	1

8. Running

8.1 Starting operation

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

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

After the power is turned on, the PV display indicates the input type, and the SV display indicates the input range high limit value (for thermocouple, RTD input) or scaling high limit value (for DC voltage, current input) for approximately 3 seconds. See (Table 8.1-1).

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

Control will then start indicating the PV (process variable) on the PV display and SV (main set value) on the SV display.

While control output OFF function is working, PV display indicates OFF□. (Indication of the PV display depends on the selection during “Indication selection when output OFF” mode.)

(Table 8.1-1)

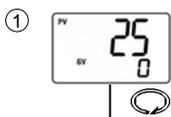
Sensor input	°C		°F	
	PV display	SV display	PV display	SV display
K	K□□C	1370	K□□F	2500
J	K□□C	4000	K□□F	7500
R	J□□C	1000	J□□F	1800
S	R□□C	1760	R□□F	3200
B	4□□C	1760	4□□F	3200
E	6□□C	1820	6□□F	3300
T	8□□C	800	8□□F	1500
N	1□□C	4000	1□□F	7500
PL-II	N□□C	1300	N□□F	2300
C (W/Re5-26)	PL2C	1390	PL2F	2500
Pt100	□□□C	2315	□□□F	4200
JPt100	Pt□□C	8500	Pt□□F	15000
	Pt□□C	□850	Pt□□F	1500
4 to 20mA DC	4□□□	5000	4□□□	9000
0 to 20mA DC	0□□□	□500	0□□□	□900
0 to 1V DC	0□□V	Scaling high limit value		
0 to 5V DC	0□□V			
1 to 5V DC	1□□V			
0 to 10V DC	0□□V			

(2) Input each set value. Input each set value. Refer to “7. Settings”.

(3) Turn the load circuit power ON.

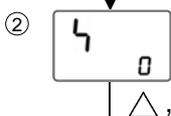
Control action starts so as to keep the control target at the SV.

Main setting mode (When setting the SV to 100°C):



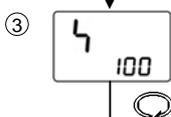
Proceed to the Main setting mode.

Press the key in the PV/SV display mode. The unit proceeds to the Main setting mode.



Set SV.

Set SV with the or key.



Register the SV.

Register the SV by pressing the key. The unit reverts to the PV/SV display mode.



Control starts.

Control starts so as to keep the measuring temperature at 100°C.

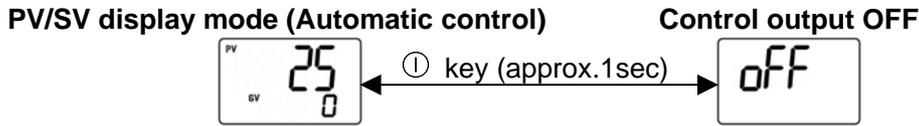
8.2 Control output OFF function (Control output OUT/OFF function)

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.

To turn the control output OFF, press the  key for approximately 1 second in the PV/SV display mode. [OFF] is indicated on the PV display while the function is working.

(However, indication of the PV display depends on the selection during "Indication selection 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  key again for approx. 1 second.



8.3 Auto/Manual control switching

Select "Auto/Manual control function" during "OUT/OFF key function selection" in the Setup mode.

By pressing the  key in the PV/SV display mode, Auto/Manual control function can be switched.

If control action is switched from automatic to manual and vice versa, balance/bumpless function works to prevent a sudden change in manipulated variables.

When automatic control is switched to manual control, the MEMO display indicates [*m*].

The output MV (manipulated variable) can be increased or decreased by pressing the  or  key to perform the control.

By pressing the  key again, the unit reverts to the PV/SV display mode (automatic control).

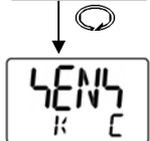
Whenever the power to the controller is turned on, automatic control starts.

● Selecting Auto/Manual control in the OUT/OFF key function selection mode:



Proceed to the Main setting mode.

Press the  key while pressing the  key in the PV/SV display mode. The unit proceeds to the Setup mode.



Proceed to OUT/OFF key function selection item.

Press the  key several times until OUT/OFF key function selection item appears.

 (Several times)



OUT/OFF key function selection

Select "MANU (Auto/Manual control function)" with the  key.

OFF: OUT/OFF function

MANU: Auto/Manual control function



Register the selected function.

Press the  key to register the selected function.

The unit reverts to the PV/SV display mode.



● Switching from Automatic to Manual control, and vice versa:

PV/SV display mode
(Automatic control)



Manual control



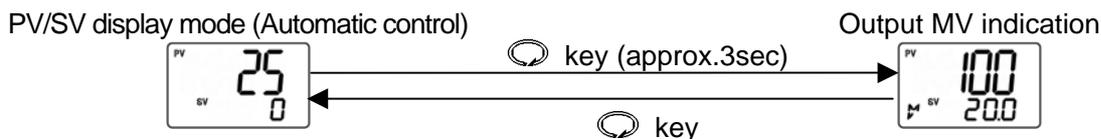
 key

Increases or decreases Output MV (manipulated variable) with the ,  key.

8.4 Indicating output MV (manipulated variable)

To indicate output MV (manipulated variable), press the key for approximately 3 seconds in the PV/SV display mode. The MEMO display indicates [P^M].

By pressing the key again, the unit reverts to the PV/SV display mode.



8.5 Auto-tuning/Auto-reset Perform, Auto-tuning Cancel

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

Auto-tuning/Auto-reset can be performed or cancelled in “Auto-tuning/Auto-reset selection” in the Sub setting mode.

Auto-reset can be performed when P or PD is control action. Auto-reset ends 4 minutes after starting. It cannot be released while performing this function.

How to perform Auto-tuning/Auto-reset

- (1) To enter the Sub setting mode, press the key while pressing the Δ key in the PV/SV display. Auto-tuning/Auto-reset selection item appears.
- (2) Select Auto-tuning/Auto-reset “Perform [AT □□/PERF]” with the Δ key, and press the key. Auto-tuning/Auto-reset will initiate. While performing Auto-tuning/Auto-reset, the AT indicator is flashing. When auto-tuning is not finished after 4 hours, it is automatically cancelled. Auto-reset is cancelled in approximately 4 minutes. It cannot be released while performing this function.

How to cancel Auto-tuning

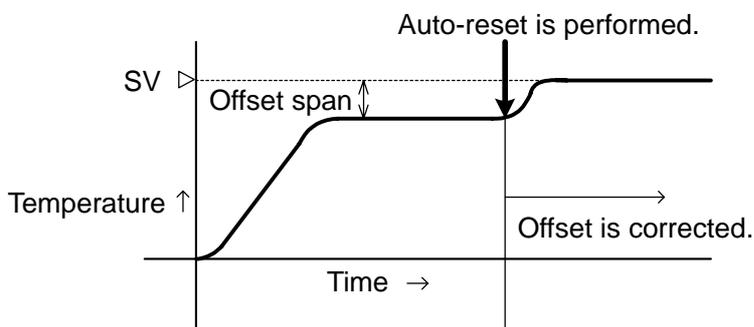
- (1) To enter the Sub setting mode, press the key while pressing the Δ key in the PV/SV display. Auto-tuning/Auto-reset selection item appears.
- (2) Select Auto-tuning/Auto-reset “Cancel [- - - -]” with the ∇ key, and press the key. Auto-tuning will stop. If Auto-tuning is cancelled during this process, each value of P, I, D and ARW reverts to the values before the Auto-tuning was performed.

AT (Auto-tuning) Perform/Cancel (PID action):

- (1) **Proceed to the Sub setting mode.**
Press the key while pressing the Δ key in the PV/SV display mode. The unit proceeds to the Sub setting mode.
- (2) **Select AT Perform/Cancel.**
Select “AT □□ (Perform)” with the Δ , or select “- - - - (Cancel)” with the ∇ .
- - - -: AT Cancel
AT □□: AT Perform
- (3) **Confirm AT Perform/Cancel.**
Press the key. The unit reverts to the PV/SV display mode.
- (4) **AT Perform/Cancel**
While AT is performing, the AT indicator flashes, and it goes off if AT is cancelled.

9. 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 action. 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 OUT1 proportional band is set to 0 or 0.0, the corrected value is cleared.



(Fig. 9-1)

10. Auto-tuning

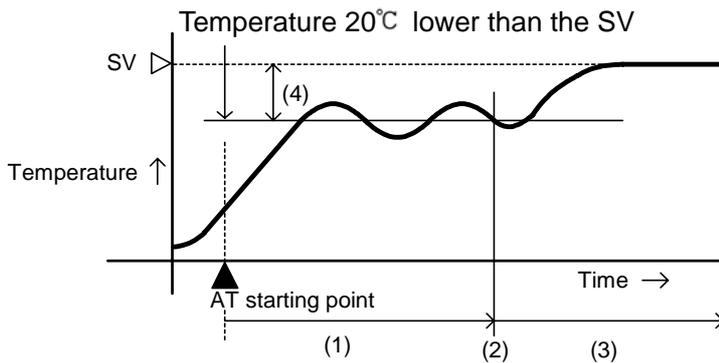
In order to set each value of P, I, D and ARW automatically, the auto-tuning process should be made to fluctuate to obtain an optimal value. One of 3 types of fluctuation below is automatically selected. For DC input, the AT process will fluctuate around the set value for conditions of [1], [2] and [3] below.

⚠ Notice

- Perform the auto-tuning during the trial run.
- During the auto-tuning, none of the setting items can be set.
- If power failure occurs during the auto-tuning, the tuning stops.

[1] In the case of a large difference between the SV and processing temperature as the temperature is rising

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

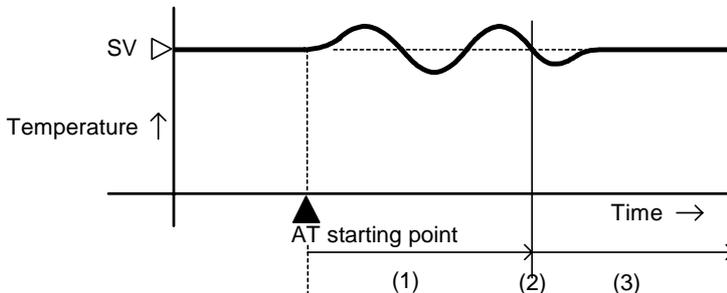


(Fig. 10-1)

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

[2] When the control is stable or when control temperature is within ±20°C of the SV

The AT process will fluctuate around the SV.

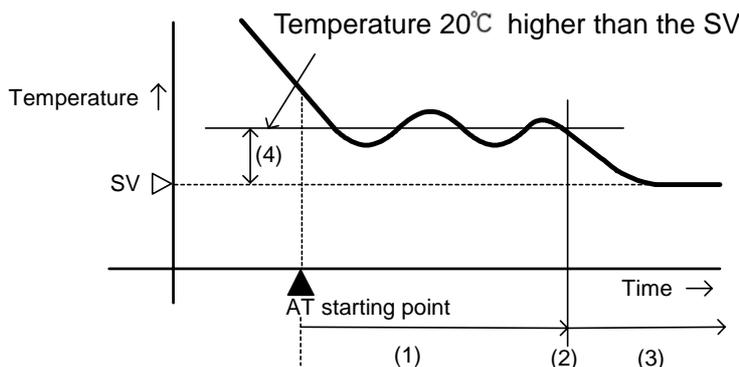


(Fig. 10-2)

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

[3] In the case of a large difference between the SV and processing temperature as the temperature is falling

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



(Fig. 10-3)

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

11. Action explanation

11.1 OUT1 action

	Reverse (Heating) action	Direct (Cooling) action
Control action		
Relay contact output	<p>Cycle action is performed according to deviation</p>	<p>Cycle action is performed according to deviation</p>
Non-contact voltage output	<p>Cycle action is performed according to deviation</p>	<p>Cycle action is performed according to deviation</p>
DC current output	<p>Changes continuously according to deviation</p>	<p>Changes continuously according to deviation</p>
Indicator (O1) Green	<p>Lit Unlit</p>	<p>Unlit Lit</p>

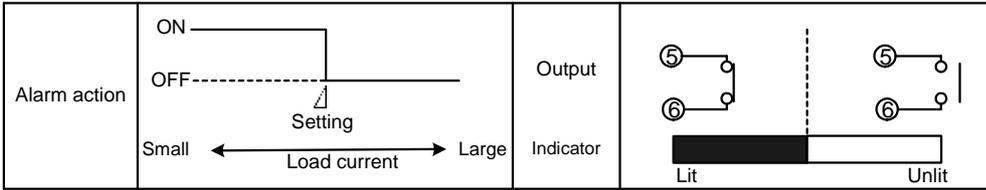
Alternates between ON and OFF.

11.2 OUT1 ON/OFF action

	Reverse (Heating) action	Direct (Cooling) action
Control action		
Relay contact output		
Non-contact voltage output		
DC current output		
Indicator (O1) Green	<p>Lit Unlit</p>	<p>Unlit Lit</p>

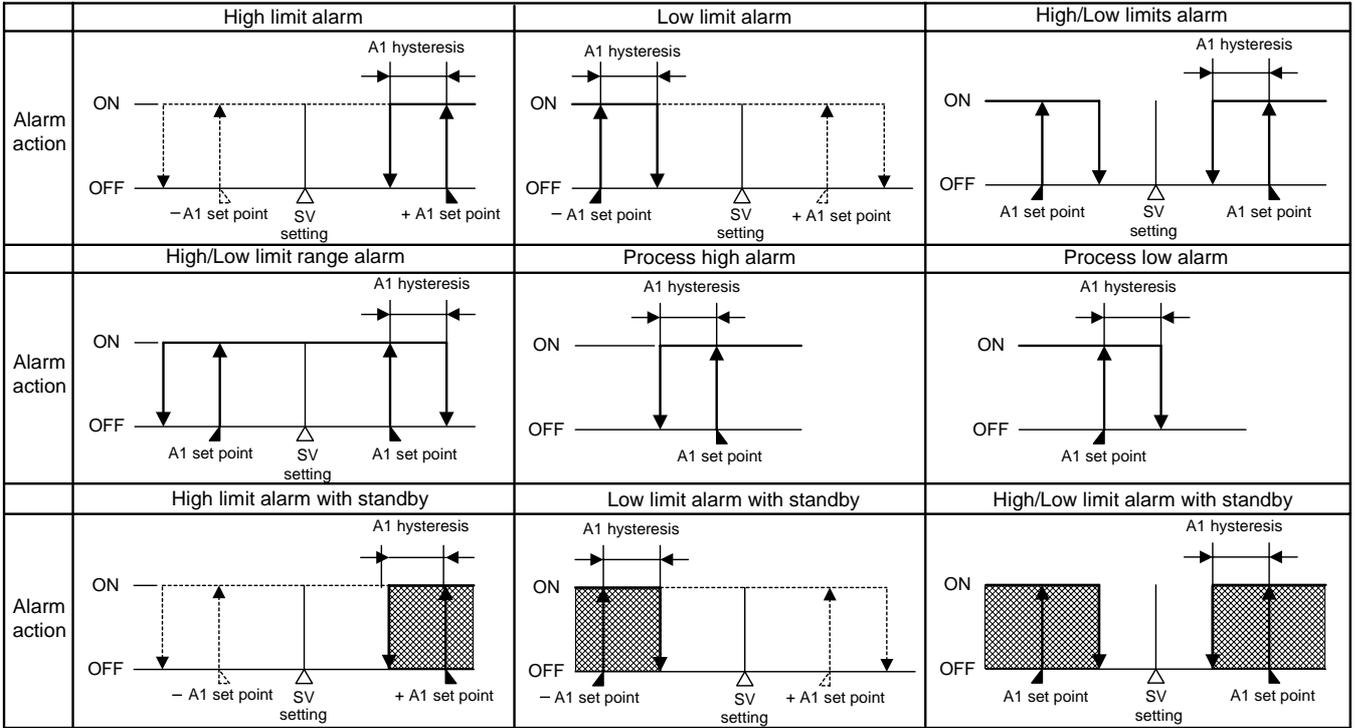
Acts either ON or OFF.

11.3 Heater burnout alarm action



If Heater burnout alarm and Alarm 2 (A2) option are applied together, they utilize common output (EV2) terminals.

11.4 Alarm action



: Standby functions.

“A1” means Alarm 1. For Alarm 2, read “A2” for “A1”.

EV1 indicator is for Alarm 1, and EV2 indicator is for Alarm 2.

EV1 indicator lights when output terminals 3 and 4 are connected, and goes off when they are disconnected.

EV2 indicator lights when output terminals 5 and 6 are connected, and goes off when they are disconnected.

11.5 OUT2 (Heating/Cooling control) action

Control action			
Relay contact output (OUT1)	<p>Cycle action is performed according to deviation.</p>		
Non-contact voltage output (OUT1)	<p>Cycle action is performed according to deviation.</p>		
DC current output (OUT1)	<p>Changes continuously according to deviation.</p>		
Relay contact output (OUT2)	<p>Cycle action is performed according to deviation.</p>		
Non-contact voltage output (OUT2)	<p>Cycle action is performed according to deviation.</p>		
Indicator (O1)			
Indicator (O2)			

: Alternates between ON (lit) and OFF (unlit).

: Represents Heating control action.

: Represents Cooling control action.

11.6 OUT2 (Heating/Cooling control) action (When setting Dead band)

Control action			
Relay contact output (OUT1)	<p>Cycle action is performed according to deviation.</p>		
Non-contact voltage output (OUT1)	<p>Cycle action is performed according to deviation.</p>		
DC current output (OUT1)	<p>Changes continuously according to deviation.</p>		
Non-contact relay output (OUT2)	<p>Cycle action is performed according to deviation.</p>		
Non-contact voltage output (OUT2)	<p>Cycle action is performed according to deviation.</p>		
Indicator (O1)			
Indicator (O2)			

: Alternates between ON (lit) and OFF (unlit).

: Represents Heating control action.

: Represents Cooling control action.

11.7 OUT2 (Heating/Cooling control) action (When setting Overlap band)

Control action			
Relay contact output (OUT1)	<p>Cycle action is performed according to deviation.</p>		
Non-contact voltage output (OUT1)	<p>Cycle action is performed according to deviation.</p>		
DC current output (OUT1)	<p>Changes continuously according to deviation.</p>		
Relay contact output (OUT2)	<p>Cycle action is performed according to deviation.</p>		
Non-contact voltage output (OUT2)	<p>Cycle action is performed according to deviation.</p>		
Indicator (O1)			
Indicator (O2)			

: Alternates between ON(lit) or OFF(unlit).
 — : Represents Heating control action.
 - - - : Represents Cooling control action.

12. Specifications

12.1 Standard specifications

Mounting method	:	Flush
Setting method	:	Input system using membrane sheet key
Display	PV display	: 11-segment backlight LCD Red/Green/Orange, character size 12.0 x 5.4 mm (H x W)
	SV display	: 11-segment backlight LCD Green, character size 6.0 x 3.5 mm (H x W)
	MEMO display	: 11-segment backlight LCD Green, character size 4.8 x 2.8 mm (H x W)
	Indicators	: Backlight Orange

Accuracy (Setting and Indication):

Thermocouple	:	Within $\pm 0.2\%$ of each input span ± 1 digit, or within $\pm 2^{\circ}\text{C}$ (4°F), whichever is greater
		However R, S input, 0 to 200°C (0 to 400°F): Within $\pm 6^{\circ}\text{C}$ (12°F)
		B input, 0 to 300°C (0 to 600°F): Accuracy is not guaranteed
		K, J, E, T, N input, less than 0°C (32°F): Within $\pm 0.4\%$ of input span ± 1 digit
RTD	:	Within $\pm 0.1\%$ of each input span ± 1 digit, or within $\pm 1^{\circ}\text{C}$ (2°F), whichever is greater
DC current	:	Within $\pm 0.2\%$ of each input span ± 1 digit
DC voltage	:	Within $\pm 0.2\%$ of each input span ± 1 digit

Input sampling period : 0.25 seconds

Input	Thermocouple	: K, J, R, S, B, E, T, N, PL-II, C(W/Re5-26)
		External resistance, 100Ω or less
		(However, B input: External resistance, 40Ω or less)
	RTD	: Pt100, JPt100, 3-wire system
		Allowable input lead wire resistance (10Ω or less per wire)
	DC current	: 0 to 20mA DC, 4 to 20mA DC
		Input impedance: 50Ω [50Ω shunt resistor (sold separately) must be connected between input terminals.]
		Allowable input current, 50mA or less [When 50Ω shunt resistor (sold separately) is used]
	DC voltage	: 0 to 1V DC Input impedance ($1\text{M}\Omega$ or more)
		Allowable input voltage (5V DC or less)
		Allowable signal source resistance ($2\text{k}\Omega$ or less)
		: 0 to 5V DC, 1 to 5V DC, 0 to 10V DC Input impedance ($100\text{k}\Omega$ or more)
		Allowable input voltage (15V DC or less)
		Allowable signal source resistance (100Ω or less)

Control output or Heating output (OUT1)

Relay contact	:	1a, Control capacity 3A 250V AC (resistive load)
		1A 250V AC (inductive load $\cos\phi=0.4$)
		Electrical life, 100,000 times
		Non-contact voltage (For SSR drive): 12V DC $\pm 15\%$, Maximum 40mA (short circuit protected)
DC current	:	4 to 20mA DC, Load resistance, Maximum 550Ω

Alarm 1 output

Action	:	ON/OFF action
Hysteresis	:	0.1 to 100.0°C ($^{\circ}\text{F}$) (Default: 1.0°C)
		DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection.)
Output	:	Relay contact 1a
		Control capacity, 3A 250V AC (resistive load)
		Electrical life, 100,000 times

Control action

PID action (with auto-tuning function)

PI action: When derivative time is set to 0

PD action (with auto-reset function): When integral time is set to 0

P action (with auto-reset function): When derivative and integral time are set to 0.

ON/OFF action: When proportional band is set to 0 or 0.0

OUT1 proportional band : 0 to 1000°C (2000°F), 0.0 to 1000.0°C (1999.9°F) or 0.0 to 100.0%
(ON/OFF action when set to 0 or 0.0) (Default: 10°C)

Integral time : 0 to 1000sec. (OFF when set to 0) (Default: 200sec.)

Derivative time : 0 to 300sec. (OFF when set to 0) (Default: 50sec.)

OUT1 proportional cycle : 1 to 120sec. (Default: 30sec for Relay contact, 3sec for Non-contact voltage,
Not available for DC current)

ARW : 0 to 100% (Default: 50%)

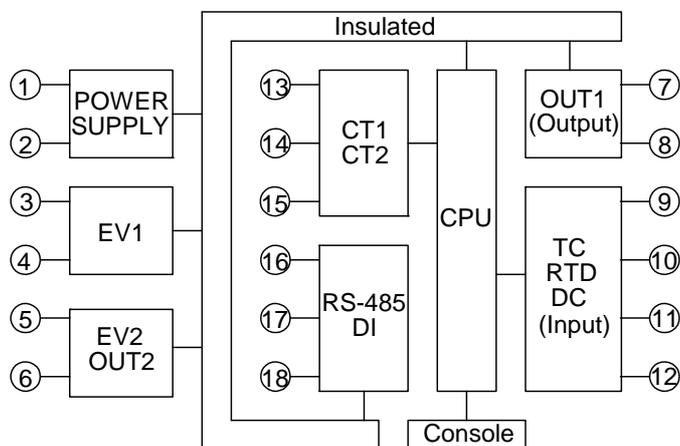
OUT1 ON/OFF action hysteresis: 0.1 to 100.0°C (°F) (Default: 1.0°C)

DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection.)

OUT1 high limit setting : 0 to 100% (DC current: -5 to 105%) (Default: 100%)

OUT1 low limit setting : 0 to 100% (DC current: -5 to 105%) (Default: 0%)

Circuit insulation configuration



When OUT1 is a non-contact voltage or DC current and OUT2 is a non-contact voltage, OUT1 is not insulated from OUT2.

When OUT1 is a non-contact voltage or DC current, OUT1 is not insulated from RS-485, DI.

When OUT2 is a non-contact voltage, OUT2 is not insulated from RS-485, DI.

Insulation resistance: 10MΩ or more, at 500V DC

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

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

Power consumption : Approx. 8VA

Ambient temperature : 0 to 50°C (32 to 122°F)

Ambient humidity : 35 to 85%RH (no condensation)

Weight : Approx. 120g

External dimensions : 48 x 48 x 62mm (W x H x D)
(Depth of control panel interior when gasket is used: 54.5mm)
(Depth of control panel interior when gasket is not used: 56.0mm)

Material : Flame-resistant resin (Case)

Color : Black (Case)

Dust-proof/Drip-proof : IP66

Attached functions:

[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 the CPU's status becomes abnormal, the controller is switched to warm-up status with 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 the same status as when the reference junction is located at 0°C (32°F).

[Warm-up indication]

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

[Indication range and Control range]

Thermocouple input: [Input range low limit value – 50°C(100°F)] to [Input range high limit value + 50°C(100°F)]

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

DC current, voltage input:

[Scaling low limit value -Scaling span x 1%] to [Scaling high limit value +Scaling span x 10%]

[Burnout]

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

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

When the DC current or DC voltage is disconnected, PV display flashes " _ _ _ _ " for 4 to 20mA DC and 1 to 5V DC inputs, and " _ _ _ _ " for 0 to 1V DC input. For 0 to 20mA DC, 0 to 5V DC and 0 to 10V DC inputs, the PV display indicates the value corresponding with 0mA or 0V input.

[Input abnormality indication]

Output status selection when input abnormal	Contents and Indication	Output status			
		OUT1		OUT2	
		Direct(Cooling) action	Reverse(Heating) action	Direct(Cooling) action	Reverse(Heating) action
	Overscale Measured value has exceeded Indication range high limit value. " _ _ _ _ " flashes.	ON (20mA) or OUT1 high limit value (*)	OFF (4mA) or OUT1 low limit value	OFF or OUT2 low limit value	ON or OUT2 high limit value (*)
		OFF (4mA) or OUT1 low limit value			OFF or OUT2 low limit value
	Underscale Measured value has dropped below Indication range low limit value. " _ _ _ _ " flashes.	OFF (4mA) or OUT1 low limit value	ON (20mA) or OUT1 high limit value (*)	OFF or OUT2 low limit value	OFF or OUT2 low limit value
			OFF (4mA) or OUT1 low limit value		

Only for DC input and DC current output type, [Output status selection when input abnormal] is usable.

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

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

[Auto/Manual control switching]

Select "Auto/Manual control" during OUT/OFF key function selection in the Setup mode, then press the  key in the PV/SV display mode. Auto/manual control can be switched.

[Console communication]

By connecting the USB communication cable (Model CMA) to the Console connector of the ACS-13A, the following operations can be conducted from the external computer using the Console software SWS-ACS01M.

(1) Reading and setting of SV, PID and various set values, (2) Reading of PV and action status, (3) Function change

Console communication and Serial communication (C5 option) cannot be used together.

Communication interface: C-MOS level

Accessories included:

Mounting frame 1 piece, Gasket (Front mounted to the ACS-13A) 1 piece

Instruction manual (A3 unfolded, English/Japanese) 1 copy

CT (Current transformer):

CTL-6S: 1 piece [W (20A) option] CTL-12-S36-10L1: 1 piece [W (50A) option]

CTL-6S: 2 pieces [W3 (20A) option] CTL-12-S36-10L1: 2 pieces [W3 (50A) option]

Accessories sold separately: Terminal cover,

50 Ω Shunt resistor (for DC current input)

USB communication cable (CMA)

12.2 Optional specifications

Alarm 2 output (Option code: A2)

If this option is added, Heating/Cooling control (D□ option) cannot be added.

Alarm 2 and Heater burnout alarm (W, W3 option) utilize common output terminals.

Action : ON/OFF action

Hysteresis: 0.1 to 100.0°C(°F) (Default: 1.0°C)

DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection.)

Output : Relay contact, 1a Control capacity, 3A 250V AC (Resistive load) Electric life, 100,000 times

Heater burnout alarm (including sensor burnout alarm) [Option code: W(20A), W(50A), W3(20A), W3(50A)]

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

This alarm is also activated when indication is overscale and underscale.

This option cannot be applied to DC current output type.

If this alarm is added, Heating/Cooling control (D□ option) cannot be added.

Heater burnout alarm and Alarm 2 (A2) option utilize common output terminals.

Rating : Single phase 20A [W(20A)], Single phase 50A [W(50A)],

3-phase 20A [W3(20A)], 3-phase 50A [W3(50A)] (Must be specified)

Detects burnout with CT1 input for single phase, with CT1 and CT2 input for 3-phase.

Setting range : 20A [W(20A)], [W3(20A)]: 0.0 to 20.0A (Off when set to 0.0)

50A [W(50A)], [W3(50A)]: 0.0 to 50.0A (Off when set to 0.0)

Setting accuracy: Within $\pm 5\%$ of the rated value

Action : ON/OFF action

Output : Relay contact, 1a Control capacity, 3A 250V AC (resistive load), Electric life, 100,000 times

Heating/Cooling control (Option code: D□)

If this option is added, Alarm 2 (A2) option and Heater burnout alarm [W(20A), W(50A), W3(20A), W3(50A) option] cannot be added.

The specifications of Heating side is the same as those of OUT1.

OUT2 proportional band: 0.0 to 10.0 times OUT1 proportional band (ON/OFF action when set to 0.0)

OUT2 integral time : The same as that of OUT1.

OUT2 derivative time : The same as that of OUT1.

OUT2 proportional cycle: 1 to 120 seconds [Default: 30sec for Relay contact (DR), 3sec for Non-contact voltage (DS)]

Overlap/Dead band setting range:

Thermocouple, RTD input: -100.0 to 100.0°C (°F)

DC current, voltage input : -1000 to 1000 (The placement of the decimal point follows the selection)

OUT2 ON/OFF action hysteresis

Thermocouple, RTD input: 0.1 to 100.0°C (°F) (Default: 1.0°C)

DC current, voltage input : 1 to 1000 (The placement of the decimal point follows the selection)

OUT2 high limit: 0 to 100% (Default: 100%)

OUT2 low limit : 0 to 100% (Default: 0%)

OUT2 action mode selection:

One cooling action can be selected from Air cooling (linear characteristic), Oil cooling (1.5th power of the linear characteristic) and Water cooling (2nd power of the linear characteristic) by keypad operation.

Cooling output (OUT2): DR Relay contact, 1a Control capacity: 3A 250V AC(resistive load) Electric life, 100,000 times

DS Non-contact voltage (for SSR) 12V DC $\pm 15\%$, Max. 40mA (short circuit protected)

Serial communication (Option code: C5)

If this option is added, Set value memory external selection (SM option) cannot be added.

This option and Console communication cannot be used together.

The following operations can be carried out from the 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. communication distance 1.2km
Cable resistance: Within 50Ω
(Terminator is not necessary or 120Ω or more on one side.)

Communication interface : EIA RS-485

Communication method : Half-duplex communication start-stop synchronous

Communication speed : 2400/4800/9600/19200bps (Selectable by keypad) (Default: 9600bps)

Data bit/Parity : 7 bits, 8bits/Even, Odd and No parity (Selectable by keypad)
(Default: 7 bits/Even parity)

Stop bit : 1, 2 (Selectable by keypad) (Default: 1)

Communication protocol : Shinko protocol/Modbus RTU/Modbus ASCII (Selectable by keypad)
(Default: Shinko protocol)

Data format

Communication protocol	Shinko protocol	Modbus ASCII	Modbus RTU
Start bit	1	1	1
Data bit	7	7 or 8	8
Parity	Yes (Even)	Yes (Even, Odd) No parity	Yes (Even, Odd) No parity
Stop bit	1	1 or 2	1 or 2

Number of connectable units : Maximum 31 units to 1 host computer

Communication error detection: Parity, checksum (Shinko protocol), LRC (Modbus ASCII),
CRC-16 (Modbus RTU)

Digital external setting : Receives digital set values from Shinko programmable controllers
(PC-900, PCD-33A with SVTC option)

Set value memory external selection (Option code: SM)

If this option is added, Serial communication (C5 option) cannot be added.

SV, SV2, SV3 or SV4 can be selected by the external contact.

The MEMO display indicates the selected memory number.

Select the function of "Contact input terminals DI2" in the "Contact input function selection" of the Setup mode.
Contact input terminals DI2 can be used for a "Set value memory external selection" or for an "OUT/OFF external selection". (Refer to "Contact input function selection on p.18.)

If "Auto/Manual control function" is selected during OUT/OFF key function selection in the Setup mode,
externally Auto/Manual control can be switched.

Circuit current when closed: Approx. 12mA

13. Troubleshooting

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

13.1 Indication

Problem	Presumed cause and solution
[FF], nothing or PV is indicated on the PV display.	<ul style="list-style-type: none"> Control output OFF function is working. Press the  key for approx. 1 second to release the function.
[----] is flashing on the PV display.	<ul style="list-style-type: none"> Burnout of thermocouple, RTD or disconnection of DC voltage (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. 100Ω of resistance is connected to the input terminals between A-B of the instrument and between B-B is shorted, and if a value around 0°C (32°F) is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out. [DC voltage (0 to 1V 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 1V 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.	<ul style="list-style-type: none"> Check whether input signal wire for DC voltage (1 to 5V DC) or DC current (4 to 20mA DC) is disconnected. How to check whether the input signal wire is disconnected [DC voltage (1 to 5V DC)] If the input to the input terminals of the instrument is 1V 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. [DC current (4 to 20mA DC)] If the input to the input terminals of the instrument is 4mA 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 5V DC) or DC current (4 to 20mA 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 agree with the instrument terminals.
The PV display keeps indicating the value which was set during Scaling low limit setting.	<ul style="list-style-type: none"> Check whether the input signal wire for DC voltage (0 to 5V DC, 0 to 10V DC) and DC current (0 to 20mA DC) is disconnected. How to check whether the input signal wire is disconnected [DC voltage (0 to 5V DC, 0 to 10V DC)] If the input to the input terminals of the instrument is 1V DC and if the value corresponding to 1V DC is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected. [DC current (0 to 20mA DC)] If the input to the input terminals of the instrument is 1mA DC and if the value corresponding to 1mA DC is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected. Check whether the input lead wire terminals for DC voltage (0 to 5V DC, 0 to 10V DC) or DC current (0 to 20mA DC) are securely mounted to the instrument input terminals.

The indication of PV display is abnormal or unstable.	<ul style="list-style-type: none"> • Check whether sensor input or temperature unit (°C or °F) is correct. Select the sensor input and temperature unit (°C or °F) properly. • 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 equipment that interferes with or makes noise away from the controller.
[Err 1] is indicated on the PV display.	<ul style="list-style-type: none"> • Internal memory is defective. Contact our agency or us.

13.2 Key operation

Problem	Presumed cause and solution
<ul style="list-style-type: none"> • Unable to set the SV, P, I, D, proportional cycle or alarm value. • The values do not change by Δ, ∇ keys. 	<ul style="list-style-type: none"> • Set value lock (Lock 1 or Lock 2) is selected. Release the lock during the "Set value lock selection". • Auto-tuning or auto-reset is performing. In the case of auto-tuning, cancel auto-tuning. It takes approximately 4 minutes until auto-reset is finished.
The setting indication does not change in the input range even if the Δ , ∇ keys are pressed, and new values are unable to be set.	<ul style="list-style-type: none"> • Scaling high or low limit value in the Setup mode may be set at the point where the value does not change. Set it to a suitable value while in the Setup mode.

13.3 Control

Problem	Presumed cause and solution
Temperature does not rise.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • OUT1 or OUT2 low limit value is set to 100% or higher in Setup mode. Set it to a suitable value.
The control output remains in an OFF status.	<ul style="list-style-type: none"> • OUT1 or OUT2 high limit value is set to 0% or less in Setup mode. Set it to a suitable value.

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

14. character table

The PV display indicates setting (selection) characters, and the SV display indicates default value.

[Main setting mode]

Character	Setting item	Data
	SV Scaling low limit to Scaling high limit	
	SV2 Scaling low limit to Scaling high limit	
	SV3 Scaling low limit to Scaling high limit	
	SV4 Scaling low limit to Scaling high limit	

[Sub setting mode]

Character	Setting (Selection) item	Data
	Auto-tuning/Auto-reset ---- : Auto-tuning/Auto-reset Cancel AR / R4ET : Auto-tuning/Auto-reset Perform	
	OUT1 proportional band 0 to 1000°C (2000°F) Thermocouple, RTD input with decimal point: 0.0 to 1000.0°C (1999.9°F) DC voltage, current input: 0.0 to 100.0%	
	OUT2 proportional band 0.0 to 10.0 times (OUT1 proportional band)	
	Integral time 0 to 1000sec	
	Derivative time 0 to 300sec	
	ARW 0 to 100%	
	OUT1 proportional cycle 1 to 120sec	
	OUT2 proportional cycle 1 to 120sec	

<div style="border: 1px solid black; padding: 5px; display: inline-block;"> A1 0 </div>	Alarm 1 value <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Alarm type</th> <th style="width: 50%;">Setting range</th> </tr> </thead> <tbody> <tr> <td>High limit alarm</td> <td>-(Input span) to Input span^{°C(°F)} *1</td> </tr> <tr> <td>Low limit alarm</td> <td>-(Input span) to Input span^{°C(°F)} *1</td> </tr> <tr> <td>High/Low limits alarm</td> <td>0 to Input span^{°C(°F)} *1</td> </tr> <tr> <td>H/L limit range alarm</td> <td>0 to Input span^{°C(°F)} *1</td> </tr> <tr> <td>Process high alarm</td> <td>Input range low limit to Input range high limit *2</td> </tr> <tr> <td>Process low alarm</td> <td>Input range low limit to Input range high limit *2</td> </tr> <tr> <td>High limit with standby</td> <td>-(Input span) to Input span^{°C(°F)} *1</td> </tr> <tr> <td>Low limit with standby</td> <td>-(Input span) to Input span^{°C(°F)} *1</td> </tr> <tr> <td>H/L limits with standby</td> <td>0 to Input span^{°C(°F)} *1</td> </tr> </tbody> </table> <p>1: For DC voltage, current input, the input span is the same as the scaling span. *2: For DC voltage, current input, input range low (or high) limit value is the same as scaling low (or high) limit value.</p>	Alarm type	Setting range	High limit alarm	-(Input span) to Input span ^{°C(°F)} *1	Low limit alarm	-(Input span) to Input span ^{°C(°F)} *1	High/Low limits alarm	0 to Input span ^{°C(°F)} *1	H/L limit range alarm	0 to Input span ^{°C(°F)} *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	-(Input span) to Input span ^{°C(°F)} *1	Low limit with standby	-(Input span) to Input span ^{°C(°F)} *1	H/L limits with standby	0 to Input span ^{°C(°F)} *1	
Alarm type	Setting range																					
High limit alarm	-(Input span) to Input span ^{°C(°F)} *1																					
Low limit alarm	-(Input span) to Input span ^{°C(°F)} *1																					
High/Low limits alarm	0 to Input span ^{°C(°F)} *1																					
H/L limit range alarm	0 to Input span ^{°C(°F)} *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	-(Input span) to Input span ^{°C(°F)} *1																					
Low limit with standby	-(Input span) to Input span ^{°C(°F)} *1																					
H/L limits with standby	0 to Input span ^{°C(°F)} *1																					
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> A2 0 </div>	Alarm 2 value The setting range is the same as that of Alarm 1 value.																					
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> H 00 </div>	Heater burnout alarm value Rated current: 20A (0.0 to 20.0A), 50A (0.0 to 50.0A)																					
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> H2 00 </div>	Heater burnout alarm 2 value Rated current: 20A (0.0 to 20.0A), 50A (0.0 to 50.0A)																					

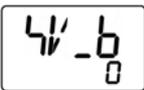
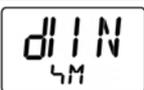
[Auxiliary function setting mode]

Character	Setting (Selection) item	Data
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> Lock ---- </div>	Set value lock <ul style="list-style-type: none"> • ---- (Unlock): All set values can be changed. <i>Loc1</i> (Lock 1): None of the set values can be changed. <i>Loc2</i> (Lock 2): Only main setting mode can be changed. <i>Loc3</i> (Lock 3): All set values except Input type can be changed. <p>However, changed values revert to their previous value after power is turned off because they are not saved in the non-volatile memory. Do not change any setting item in Setup mode. If any item in Setup mode is changed, it will affect other setting items such as the SV and Alarm value.</p>	
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> Lo 00 </div>	Sensor correction -100.0 to 100.0 ^{°C(°F)} DC voltage, current input: -1000 to 1000	
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> CM4L NoML </div>	Communication protocol <i>NoML</i> : Shinko protocol <i>ModA</i> : Modbus ASCII mode <i>ModR</i> : Modbus RTU mode	
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> CMNO 0 </div>	Instrument number 0 to 95	
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> CM4P 96 </div>	Communication speed <input type="checkbox"/> 24: 2400bps <input type="checkbox"/> 48: 4800bps <input type="checkbox"/> 96: 9600bps <input type="checkbox"/> 192: 19200bps	
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> CMFF 7EVN </div>	Data bit/Parity <i>8NoN</i> : 8 bits/No parity <i>7NoN</i> : 7 bits/No parity <i>8EVN</i> : 8 bits/Even parity <i>7EVN</i> : 7 bits/Even parity <i>8odd</i> : 8 bits/Odd parity <i>7odd</i> : 7 bits/Odd parity	
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> CM4F 1 </div>	Stop bit <input type="checkbox"/> 1: 1 <input type="checkbox"/> 2: 2	

[Setup mode]

Character	Setting (Selection) item	Data
	Input type K□□C: K -200 to 1370°C K□□F: K -200 to 1370°F K□.C: K -200.0 to 400.0°C K□.F: K -200.0 to 400.0°F J□□C: J -200 to 1000°C J□□F: J -200 to 1000°F R□□C: R 0 to 1760°C R□□F: R 0 to 1760°F S□□C: S 0 to 1760°C S□□F: S 0 to 1760°F B□□C: B 0 to 1820°C B□□F: B 0 to 1820°F E□□C: E -200 to 800°C E□□F: E -200 to 800°F T□.C: T -200.0 to 400.0°C T□.F: T -200.0 to 400.0°F N□□C: N -200 to 1300°C N□□F: N -200 to 1300°F PL2C: PL-II 0 to 1390°C PL2F: PL-II 0 to 1390°F C□□C: C(W/Re5-26) 0 to 2315°C C□□F: C(W/Re5-26) 0 to 2315°F Pt.C: Pt100 -200.0 to 850.0°C Pt.F: Pt100 -200.0 to 850.0°F JPt.C: JPt100 -200.0 to 500.0°C JPt.F: JPt100 -200.0 to 500.0°F Pt.C: Pt100 -200 to 850°C Pt.F: Pt100 -200 to 850°F JPt.C: JPt100 -200 to 500°C JPt.F: JPt100 -200 to 500°F 420A: 4 to 20mA DC -2000 to 10000 020A: 0 to 20mA DC -2000 to 10000 0□.V: 0 to 1V DC -2000 to 10000 0□.5V: 0 to 5V DC -2000 to 10000 1□.5V: 1 to 5V DC -2000 to 10000 0□.10V: 0 to 10V DC -2000 to 10000	
	Scaling high limit Scaling low limit to Input range high limit DC voltage, current input: -2000 to 10000	
	Scaling low limit Input range low limit to Scaling high limit DC voltage, current input: -2000 to 10000	
	Decimal point place □□□□: No decimal point □□□□: 1 digit after decimal point □□□□: 2 digits after decimal point □□□□: 3 digits after decimal point	
	PV filter time constant 0.0 to 10.0sec	
	OUT1 high limit OUT1 low limit to 100% DC current output: OUT1 low limit to 105%	
	OUT1 low limit 0% to OUT1 high limit value DC current output: -5% to OUT1 high limit value	
	OUT1 ON/OFF action hysteresis 0.1 to 100.0°C(°F) DC voltage, current input: 1 to 1000	
	OUT2 action mode Ai R□: Air cooling (Linear characteristic) oi L□: Oil cooling (1.5 th power of the linear characteristic) WAt□: Water cooling (2 nd power of the linear characteristic)	

Character	Setting (Selection) item	Data
	OUT2 high limit OUT2 low limit to 100%	
	OUT2 low limit 0% to OUT2 high limit value	
	Overlap band/Dead band -100.0 to 100.0°C(°F) DC voltage, current input: -1000 to 1000	
	OUT2 ON/OFF action hysteresis 0.1 to 100.0°C(°F) DC voltage, current input: 1 to 1000	
	Alarm 1 type ----: No alarm action H---: High limit alarm L---: Low limit alarm HL---: High/Low limits alarm W d: High Low limit range alarm R4---: Process high alarm RR4---: Process low alarm H---W: High limit alarm with standby L---W: Low limit alarm with standby HL---W: High/Low limits alarm with standby	
	Alarm 2 type Selecting types are the same as those of Alarm 1 type selection.	
	Alarm 1 Energized/Deenergized NoML: Energized REv4: Deenergized	
	Alarm 2 Energized/Deenergized Selection items are the same as those of the Alarm 1 Energized/Deenergized selection	
	Alarm 1 hysteresis 0.1 to 100.0°C(°F) DC voltage, current input: 1 to 1000	
	Alarm 2 hysteresis 0.1 to 100.0°C(°F) DC voltage, current input: 1 to 1000	
	Alarm 1 action delayed timer 0 to 10000sec	
	Alarm 2 action delayed timer 0 to 10000sec	
	SV rise rate 0 to 10000°C/minute (°F/minute) Thermocouple, RTD input with decimal point: 0.0 to 1000.0°C/minute(°F/minute) DC voltage, current input: 0 to 10000/minute	
	SV fall rate 0 to 10000°C/minute (°F/minute) Thermocouple, RTD input with decimal point: 0.0 to 1000.0°C/minute(°F/minute) DC voltage, current input: 0 to 10000/minute	

Character	Setting (Selection) item	Data
	Direct/Reverse control action HEAT: Reverse (Heating) action COOL: Direct (Cooling) action	
	AT bias 0 to 50°C (0 to 100°F) Thermocouple, RTD input with decimal point: 0.0 to 50.0°C (0.0 to 100.0°F)	
	SVTC bias Converted value of ±20% of the input span DC voltage, current input: ±20% of Scaling span	
	Contact input function 4M: Set value memory external selection OUT: OUT/OFF external selection 1 (SV, SV2 switchable) OUT2: OUT/OFF external selection 2	
	Output status selection when input abnormal OFF: Outputs OFF (4mA) or OUT1 (OUT2) low limit value ON: Outputs a value between OFF (4mA) and ON (20mA) or between OUT1 (OUT2) low limit value and OUT1 (OUT2) high limit value, depending on deviation.	
	OUT/OFF key function OFF: OUT/OFF function MANU: Auto/Manual control	
	Backlight ALL: All (displays and indicators) are backlit. PV: Only PV display is backlit. SV: Only SV display is backlit. Ac: Only Action indicators are backlit. PV SV: PV and SV displays are backlit. PV Ac: PV display and Action indicators are backlit. SV Ac: SV display and Action indicator are backlit	
	PV color GRN: Green RED: Red ORNG: Orange ALGR: When Alarm 1 or Alarm 2 is ON, PV color turns from green to red. ALOR: When Alarm 1 or Alarm 2 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) at the same time Alarm 1 or Alarm 2 is ON (Red).	
	PV color range 0.1 to 100.0°C(°F) For DC current, voltage input: 1 to 1000	
	Backlight time 0 to 99 minutes	
	Indication selection when output OFF OFF: OFF indication ROFF: No indication PV: PV indication PV AL: PV indication+ Alarm output (Alarm 1, Alarm 2, Heater burnout alarm) active	
	OUT1 rate of change limit 0 to 100%/sec	

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