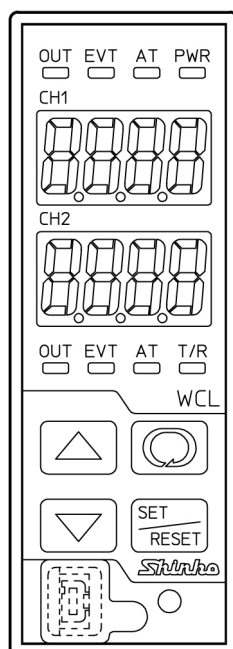# PLUG-IN
2ch DIGITAL INDICATING CONTROLLER
WCL-13A
INSTRUCTION MANUAL

Shinko

Preface

Thank you for purchasing our WCL-13A Plug-in 2ch Digital Indicating Controller.

This manual contains instructions for the mounting, functions, operations and notes when operating the WCL-13A. To ensure safe and correct use, thoroughly read and understand this manual before using this controller.

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

Abbreviations used in this manual

Symbol	Term
PV	Process Variable
SV	Desired Value
MV	Output Manipulated Variable
AT	Auto-tuning
Alarm	Temperature Alarm

Characters used in this manual

Indication	ᵬ	₀	₁	₂	₃	₄	₅	₆	₇	₈	₉	Ϲ	F	
Number, ℃/℉	-1	0	1	2	3	4	5	6	7	8	9	℃	℉	
Indication	A	∩	b	c	d	E	F	G	H	i	J	E	L	ñ
Alphabet	A	B	C	D	E	F	G	H	I	J	K	L	M
Indication	n	o	P	q	r	ϟ	Γ	U	ꙮ	ꙮ	Y	y	₌	
Alphabet	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	

⚠ Caution

- This instrument should be used in accordance with the specifications described in the manual.
  If it is not used according to the specifications, it may malfunction or cause a fire.
- Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- The contents of this instruction manual are subject to change without notice.
- Care has been taken to ensure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform our sales department.
- This instrument is designed to be installed on a DIN rail 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 2 categories: "Warning" and "Caution". Depending on the circumstances, procedures indicated by ⚠ Caution may result in serious consequences, so be sure to follow the directions for usage.

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

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

⚠ Warning

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

⚠ SAFETY PRECAUTIONS

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

⚠ Caution with Respect to Export Trade Control Ordinance

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

1. Installation Precautions

⚠ Caution

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

Ensure the mounting location corresponds to the following conditions:

• A minimum of dust, and an absence of corrosive gases
• No flammable, explosive gases
• No mechanical vibrations or shocks
• No exposure to direct sunlight, an ambient temperature of 0 to 50℃ (32 to 122℉) that does not change rapidly, and no icing
• An ambient non-condensing humidity of 35 to 85 %RH
• No large capacity electromagnetic switches or cables through which large current is flowing.
• No water, oil or chemicals or where the vapors of these substances can come into direct contact with the unit
• If the WCL-13A is installed within a control panel, the ambient temperature of the unit – not the ambient temperature of the control panel – must be kept to under 50℃. Otherwise the life of electronic parts (especially electrolytic capacitors) of the unit will be shortened.

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

2. Wiring Precautions

⚠ Caution

• Do not leave wire remnants in the instrument, because they could cause a fire or a malfunction.
• Use a solderless terminal with an insulation sleeve in which the M3 screw fits when wiring the WCL-13A.
• Tighten the terminal screw using the specified torque. If excessive force is applied to the screw when tightening, the terminal screw may be damaged.
• This instrument does not have a built-in power switch, circuit breaker and fuse.
  It is necessary to install a power switch, circuit breaker and fuse near the controller.
  (Recommended fuse: Time-lag fuse, rated voltage 250 V AC, rated current 2 A)
• For a 24 V AC/DC power source, do not confuse polarity when using direct current (DC).
• Do not apply a commercial power source to the sensor which is connected to the input terminal nor allow the power source to come into contact with the sensor.
• Use a thermocouple and compensating lead wire according to the sensor input specifications of this controller.
• Use the 3-wire RTD according to the sensor input specifications of this controller.
• When using a relay contact output type, externally use a relay according to the load capacity to protect the built-in relay contact.
• When wiring, keep input wires (thermocouple, RTD, etc.) away from AC power sources or load wires.

3. Operation and Maintenance Precautions

⚠ Caution

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

Contents

1. Model

1.1 Model

WCL-1 3 A - □ □ / □ □ □ , □□□□										Series name: WCL-13A
Control action	3									PID
Alarm action		A								Alarm type can be selected by keypad. (*1)
CH1 control output			R							Relay contact: 1a
			S							Non-contact voltage (for SSR drive): 12 V DC±15%
			A							Direct current: 4 to 20 mA DC
CH2 control output				R						Relay contact: 1a [Timer spec (*2)]
				S						Non-contact voltage (for SSR drive): 12 V DC±15%
				A						Direct current: 4 to 20 mA DC (*3)
CH1 input					M					Multi-range (*4)
					I					Infrared thermocouple (*5)
CH2 input						M				Multi-range (*4)
						I				Infrared thermocouple (*5)
						P				Potentiometer
						T				Timer spec (*2)
Power supply voltage										100 to 240 V AC (standard)
							1			24 V AC/DC (*6)
Option								W(20A)	Single-phase 20 A	Heater burnout alarm (*7)
								W(100A)	Single-phase 100 A	
								W3(20A)	3-phase 20 A	
								W3(100A)	3-phase 100 A	
								AO	Alarm output [2-points open collector output + 4-points status flag (for each channel)] (*8)	
								AW(20A)	Heater burnout alarm (single-phase 20 A) + Alarm output [1-point open collector output + 4-points status flag (for each channel)] (*7) (*8) (*9)	
								AW(100A)	Heater burnout alarm (single-phase 100 A) + Alarm output [1-point open collector output + 4-points status flag (for each channel)] (*7) (*8) (*9)	
								C5	RS-485	Serial communication

(*1) Alarm types (9 types and No Alarm action) can be selected by keypad.
(*2) If Timer spec is designated for CH2 input, CH2 control output will be Relay contact (Timer spec).
(*3) When using Transmission output spec, specify direct current output for CH2 control output.
(*4) Thermocouple (10 types), RTD (2 types), direct current (2 types), or DC voltage (4 types) can be selected by keypad.
(*5) 8 types of Infrared thermocouple input (RD-300 series, RD-401) can be selected by keypad.
(*6) Power supply voltage 100 to 240 V AC is standard. When ordering 24 V AC/DC, enter "1" after the CH2 input code.
(*7) Heater burnout alarm cannot be added to the direct current output type.
(*8) If CH2 input is potentiometer or timer spec, this cannot be added.
(*9) Options [W], [W3], [AO], [AW] cannot be added simultaneously.

1.2 How to Read the Model Label
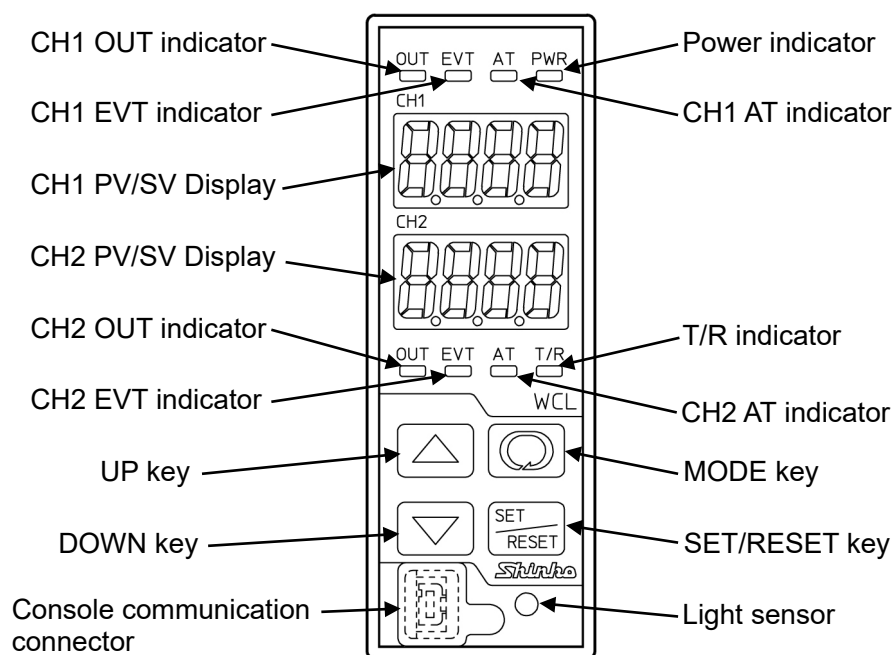
The model label is attached to the left side of case.
• Label on the case

(Fig. 1.2-1)

6

2. Names and Functions of Controller

CH1 OUT indicator —
CH1 EVT indicator —
CH1 PV/SV Display —
CH2 PV/SV Display —
CH2 OUT indicator —
CH2 EVT indicator —
UP key —
DOWN key —
Console communication connector —

— Power indicator
— CH1 AT indicator
— T/R indicator
— CH2 AT indicator
— MODE key
— SET/RESET key
— Light sensor

(Fig. 2-1)

Displays

CH1 PV/SV Display (Red): PV, SV, MV or setting characters in setting mode of CH1 are indicated. Indications differ depending on the spec and selections in [Display selection (p.37)].

CH2 PV/SV Display (Red): PV, SV, MV or set values in setting mode of CH2 are indicated. Indications differ depending on the spec and selections in [Display selection (p.37)].

Indicators

CH1 OUT indicator (Green): Lights when CH1 control output is ON. For direct current output type, it flashes corresponding to the MV in 125 ms cycles.

CH1 EVT indicator (Red): Lights when Alarm, Loop Break Alarm or Heater Burnout Alarm output (W, W3 option) on CH1 is ON.

CH1 AT indicator (Yellow): Flashes when CH1 is performing AT or Auto-reset.

PWR indicator (Yellow): Lights when power supply to the instrument is turned ON.

CH2 OUT indicator (Green): Lights when CH2 control output is ON. For direct current output type, it flashes corresponding to the MV in 125ms cycles. For Timer spec, it lights when timer output is ON.

CH2 EVT indicator (Red): Lights when Alarm, Loop Break Alarm or Heater Burnout Alarm output (W, W3 option) on CH2 is ON.

CH2 AT indicator (Yellow): Flashes when CH2 is performing AT or Auto-reset.

T/R indicator (Yellow): Lights during Serial communication (C5 option) TX output (transmitting).

Keys

△ **UP key**:   Increases the numeric value.

▽ **DOWN key**:   Decreases the numeric value. While this key is pressed in PV/SV Display Mode, the SV can be indicated when PV is indicated, and vice versa.

◯ **MODE key**:   Selects the setting group. If the MODE key is pressed for 3 sec in PV/SV Display Mode, the unit moves to MV indication mode. The 1st decimal point from the right flashes in 500 ms cycles during the MV indication. By pressing the MODE key again, the unit reverts to PV/SV Display Mode.

SET/RESET key: Switches the setting modes, and registers the set value. For Timer spec, resets the timer action when Control timer is working.

Console communication connector: By connecting to the USB communication cable (CMB-001, sold separately), the following operations can be conducted from an external computer using the Console software SWS-WCL01M: Reading and setting of SV, PID and various set values, Reading of PV and action status, Function change

Light sensor: Automatically measures and controls brightness of the CH1, CH2 PV/SV Displays.

7

3. Mounting to the Control Panel

3.1 Site Selection

⚠ **Caution**

Use within the following temperature and humidity ranges.
Temperature: 0 to 50℃ (32 to 122℉) (No icing), Humidity: 35 to 85 %RH (Non-condensing)
If the WCL-13A is installed within a control panel, the ambient temperature of the unit – not the ambient temperature of the control panel – must be kept under 50℃. Otherwise the life of electronic components (especially electrolytic capacitors) may be shortened.

This instrument is intended to be used under the following environmental conditions
(IEC61010-1): Overvoltage category Ⅱ, Pollution degree 2
Ensure the mounting location corresponds to the following conditions:
• A minimum of dust, and an absence of corrosive gases
• No flammable, explosive gases
• No mechanical vibrations or shocks
• No exposure to direct sunlight, an ambient temperature of 0 to 50℃ (32 to 122℉) that does not change rapidly
• An ambient non-condensing humidity of 35 to 85 %RH
• No large capacity electromagnetic switches or cables through which large current is flowing
• No water, oil, chemicals or the vapors of these substances can come into direct contact with the unit

3.2 External Dimensions (Scale: mm)

Socket (sold separately)

DIN rail

(Fig. 3.2-1)
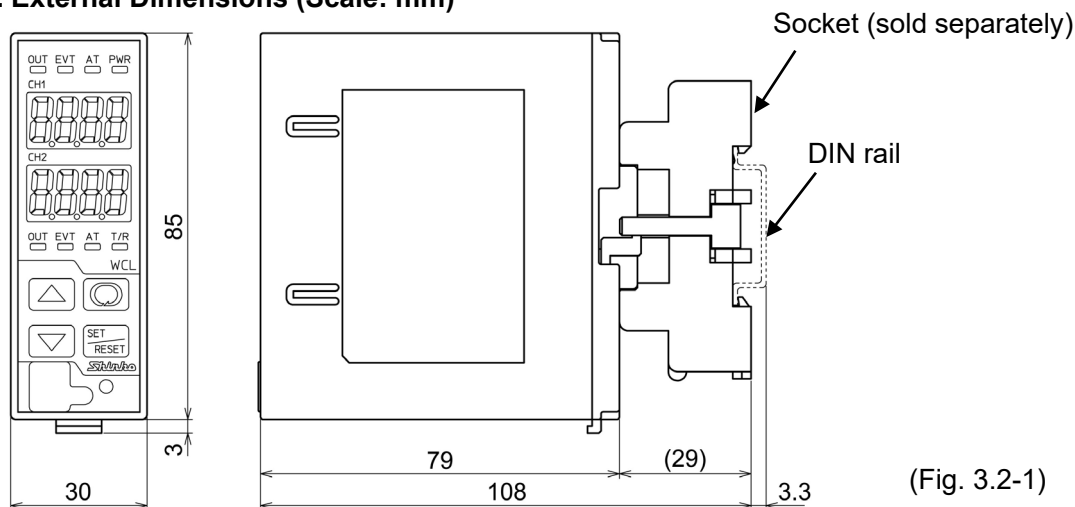
3.3 Current Transformer (CT) Dimensions (Scale: mm)

CTL-6-S-H (for 20 A)

CTL-12-S36-10L1U (for 100 A)

(Fig. 3.3-1)
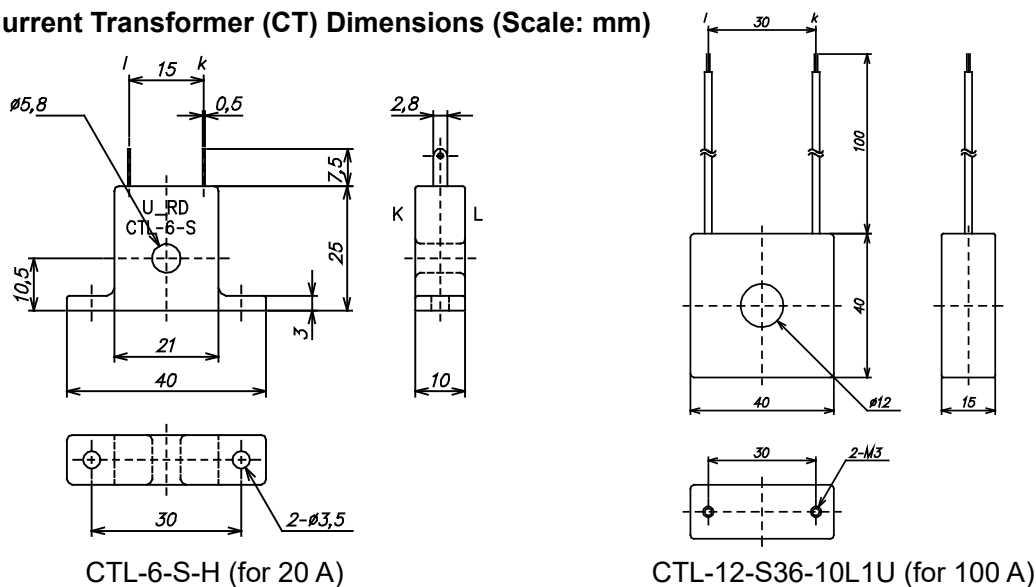
3.4 Mounting to a DIN Rail

(1) Hook the upper part of the socket on the DIN rail, and mount it (A clicking sound is heard).

Hook the upper part of the socket on the DIN rail.
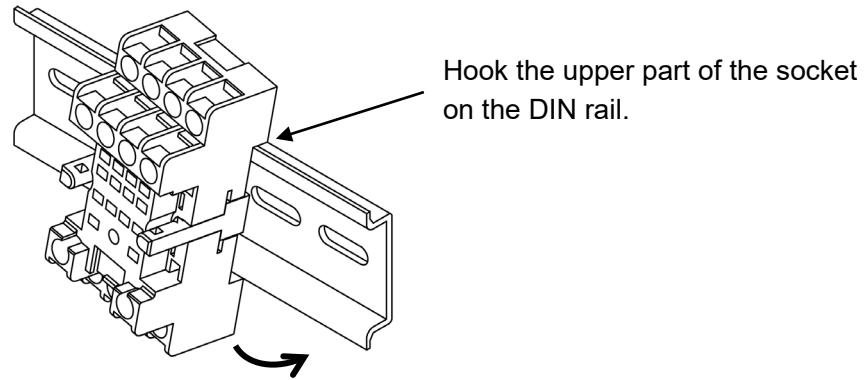
(Fig. 3.4-1)

⚠ Caution

Before inserting the WCL-13A into the socket, wire the unit while referring to Section "5. Wiring".

(2) Check that the Lock Release has been lowered.
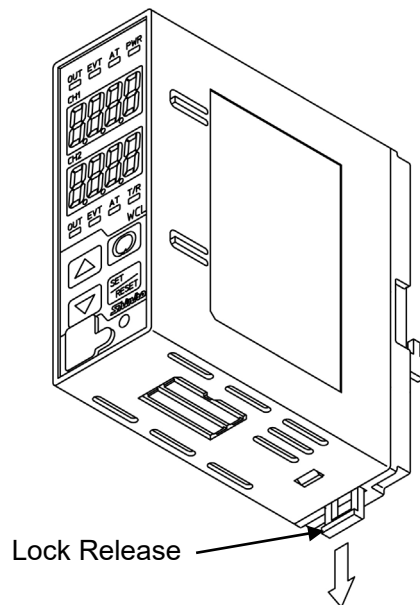
Lock Release

(Fig. 3.4-2)

(3) Insert the WCL-13A into the socket.

When inserting, be careful about
the position of pins and slots.
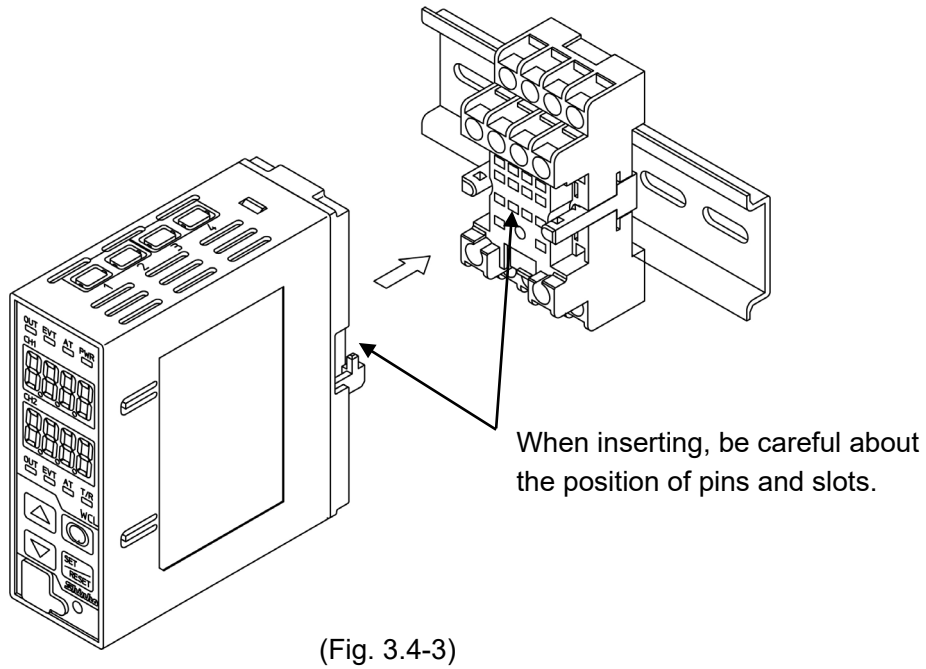
(Fig. 3.4-3)

(4) Fix the WCL-13A and the socket by pushing the Lock Release up.

Check that the WCL-13A and the socket
are locked by pushing the Lock Release up.
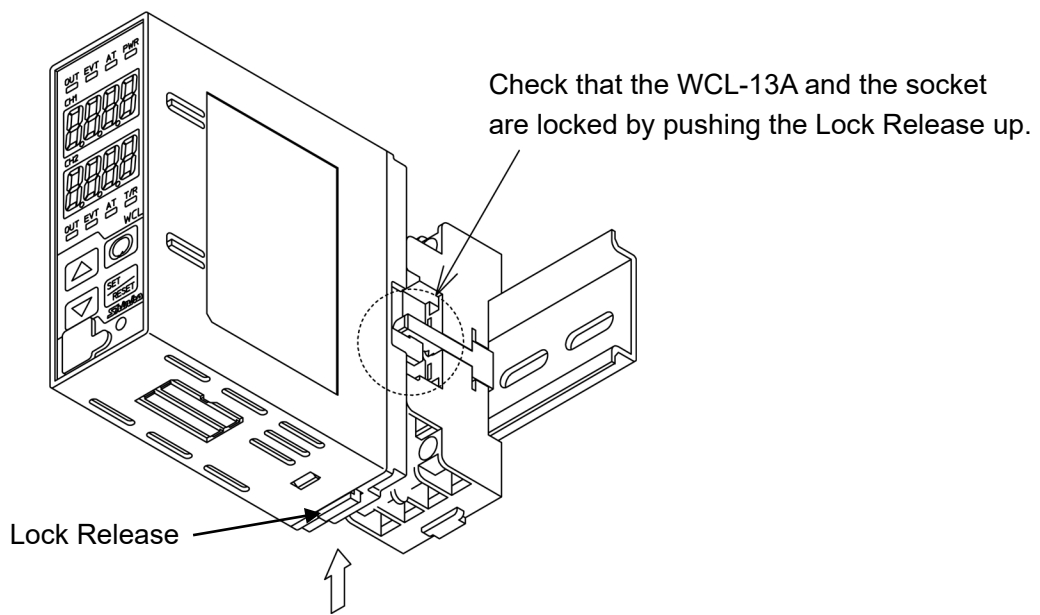
Lock Release

(Fig. 3.4-4)

4. Removal from a DIN Rail

(1) Turn the power supply to the unit OFF.
(2) Pull the Lock Release down, and release the WCL-13A from the socket.

Check that the WCL-13A and the socket are unlocked by pulling the Lock Release down.
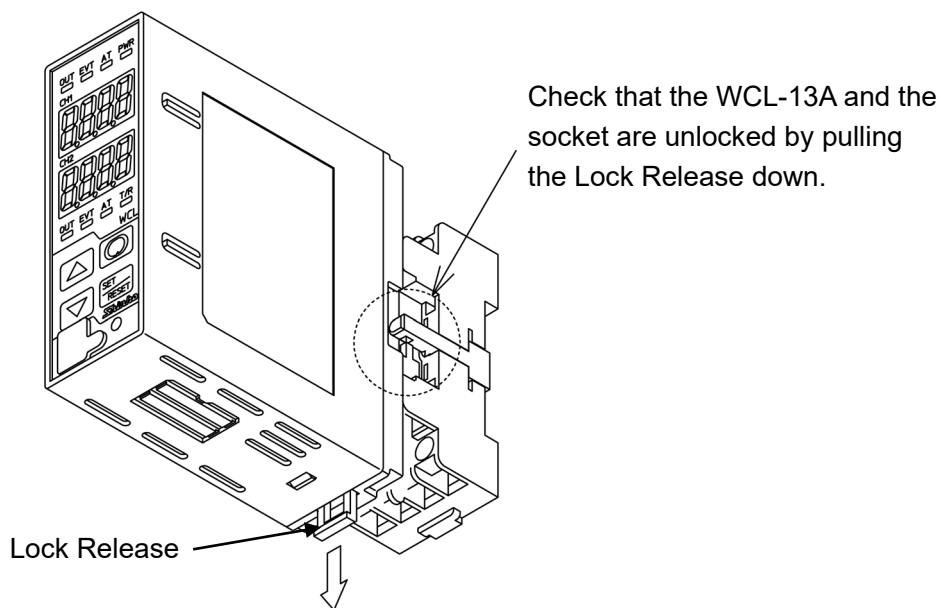
Lock Release

(Fig. 4-1)

(3) Separate the WCL-13A from the socket.

(Fig. 4-2)

(4) Remove the socket from the DIN rail by pulling the Socket Lock Release (at the bottom of the socket) down.

Lock Release

(Fig. 4-3)

5. Wiring

⚠ **Warning**

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

⚠ **Caution**

- Do not leave wire remnants in the instrument, because they could cause a fire and/or malfunction.
- Use a solderless terminal with an insulation sleeve in which an M3 screw fits when wiring the instrument.
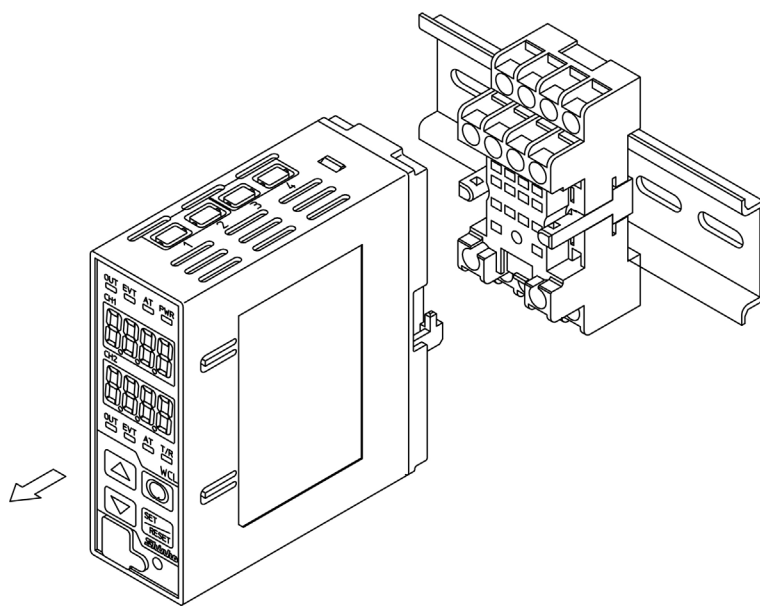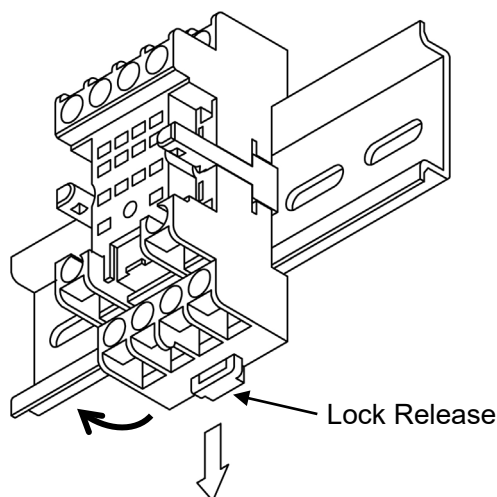- Tighten the terminal screw using the specified torque. If excessive force is applied to the screw when tightening, the terminal screw may be damaged.
- This controller does not have a built-in power switch, circuit breaker and fuse. Therefore, it is necessary to install a power switch, circuit breaker and fuse in a circuit near the external controller.(Recommended fuse: Time-lag fuse, rated voltage 250 V AC, rated current 2 A)
- For a 24 V AC/DC power source, do not confuse polarity when using direct current (DC).
- Do not apply a commercial power source to the sensor connected to the input terminal nor allow the power source to come into contact with the sensor.
- Use a thermocouple and compensating lead wire that correspond to the sensor input specification of this controller.
- Use the 3-wire RTD corresponding to the input specification of this controller.
- 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.

5.1 Lead Wire Solderless Terminal

Use a solderless terminal with an insulation sleeve in which an M3 screw fits as follows.
For the sockets with finger-safe & screw fall prevention functions, the ring terminals are unusable.
The tightening torque should be 0.63 N•m.

Solderless Terminal	Manufacturer	Model
Y-type	Nichifu Terminal Industries CO.,LTD.	TMEV1.25Y-3S
Ring-type	Nichifu Terminal Industries CO.,LTD.	TMEV1.25-3
	Japan Solderless Terminal MFG CO.,LTD.	V1.25-3
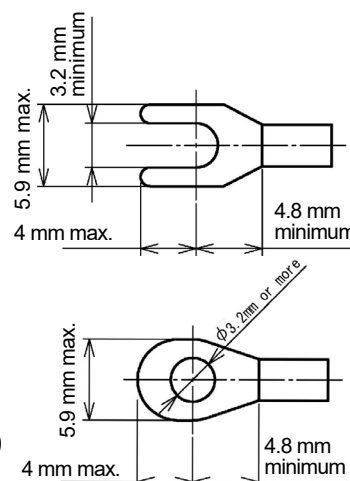
(Fig. 5.1-1)

5.2 2ch Controller Spec.

(Fig. 5.2-1)
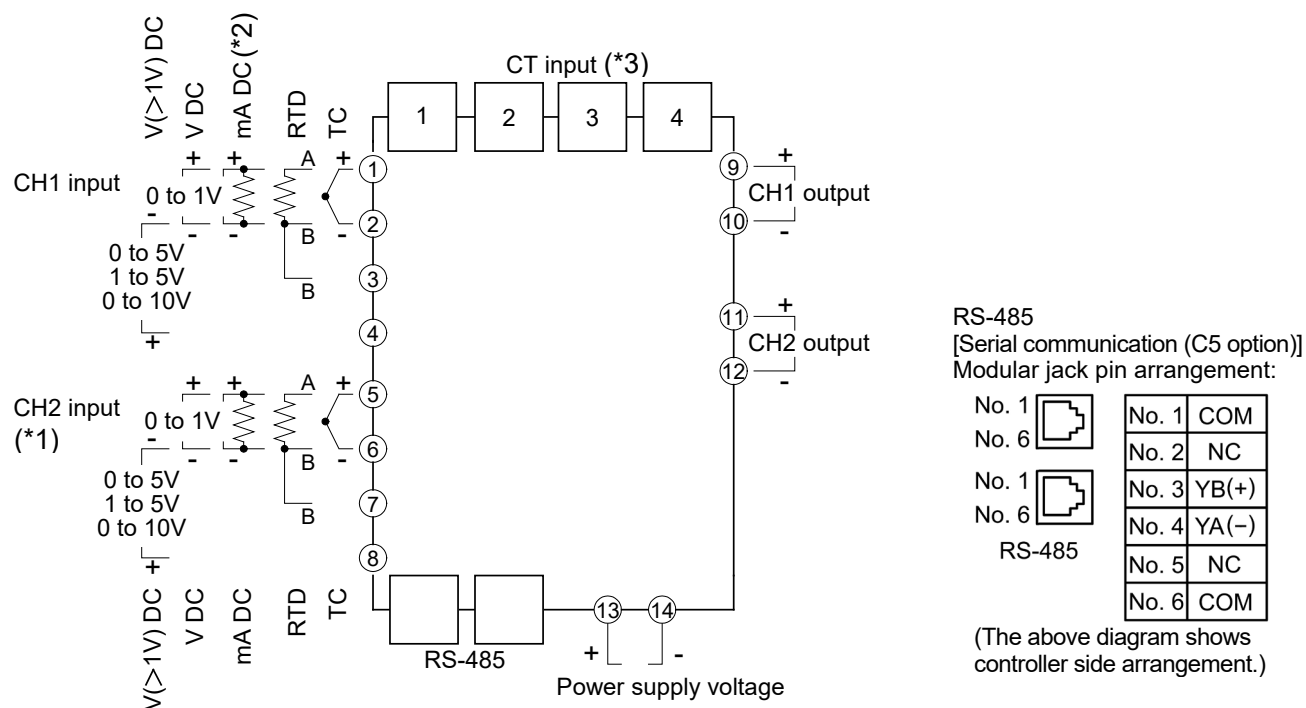
(*1) If the following is selected from Console software Block Function, close CH2 input terminals ⑤ and ⑥.

If nothing is connected to CH2 input terminals, which will be read as an input error, control will be disabled and control output will be turned OFF.

• When Heating/Cooling control output spec is selected for Control 1 block.
• When Output 2 output spec is selected for Output 1 block.
• When 1-input 2-output spec is selected.

(*2) For direct current input, connect a 50 Ω shunt resistor (sold separately) between input terminals.

(*3) If Alarm output (AO option) is added, 4-points of Alarm output are available.

If the AW option [Heater Burnout alarm (Single-phase) + Alarm output] is added, 2-points Heater Burnout alarm (CT) input and 2-points Alarm output are available.
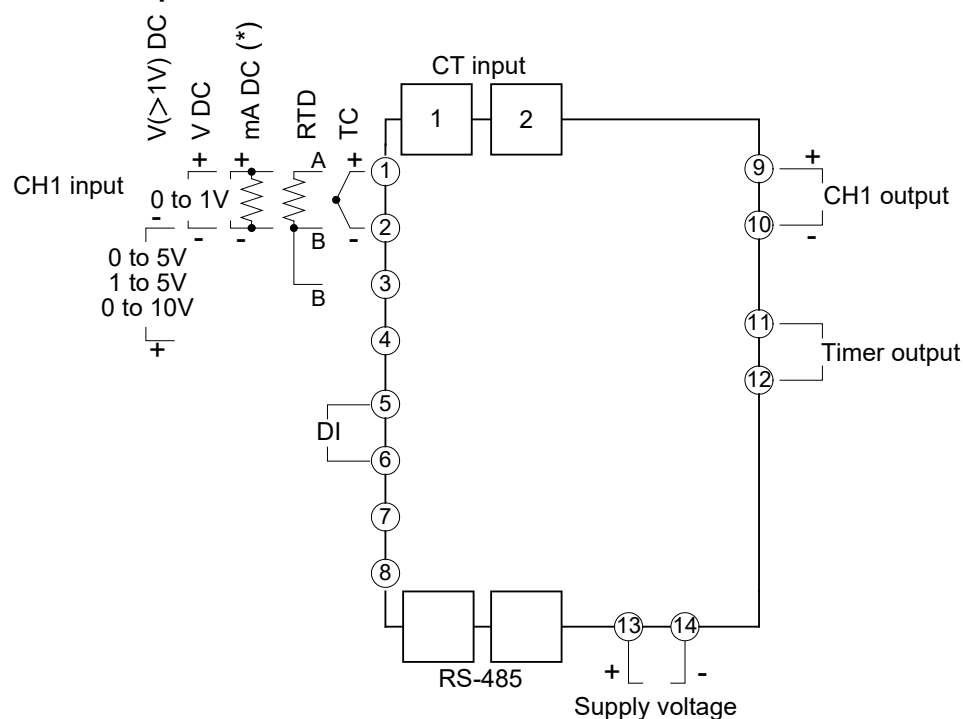
5.3 Timer Spec.

(*) For direct current input, connect a 50 Ω shunt resistor (sold separately) between input terminals.

(Fig. 5.3-1)

5.4 Potentiometer Input Spec.
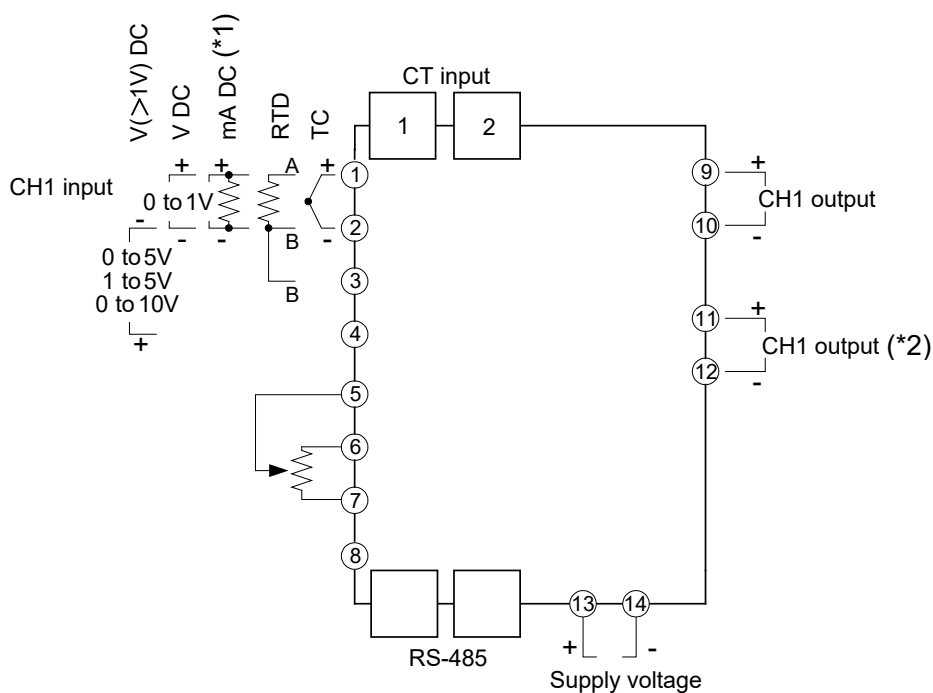
(*1) For direct current input, connect a 50 Ω shunt resistor (sold separately) between input terminals.

(*2) Effective when "Heating/Cooling control output" for Control 1 block or "1-input 2-output" for Output 1 block is selected (Console software Block function).

(Fig. 5.4-1)

14

5.5 Wiring Example

• **WCL-13A-RR/MM** (2ch controller spec: Relay contact output and Multi-range input for both CH1 and CH2)

To prevent the unit being damaged by the harmful effects of unexpected high level noise, it is recommended that a surge absorber be installed between the electromagnetic switch coils.
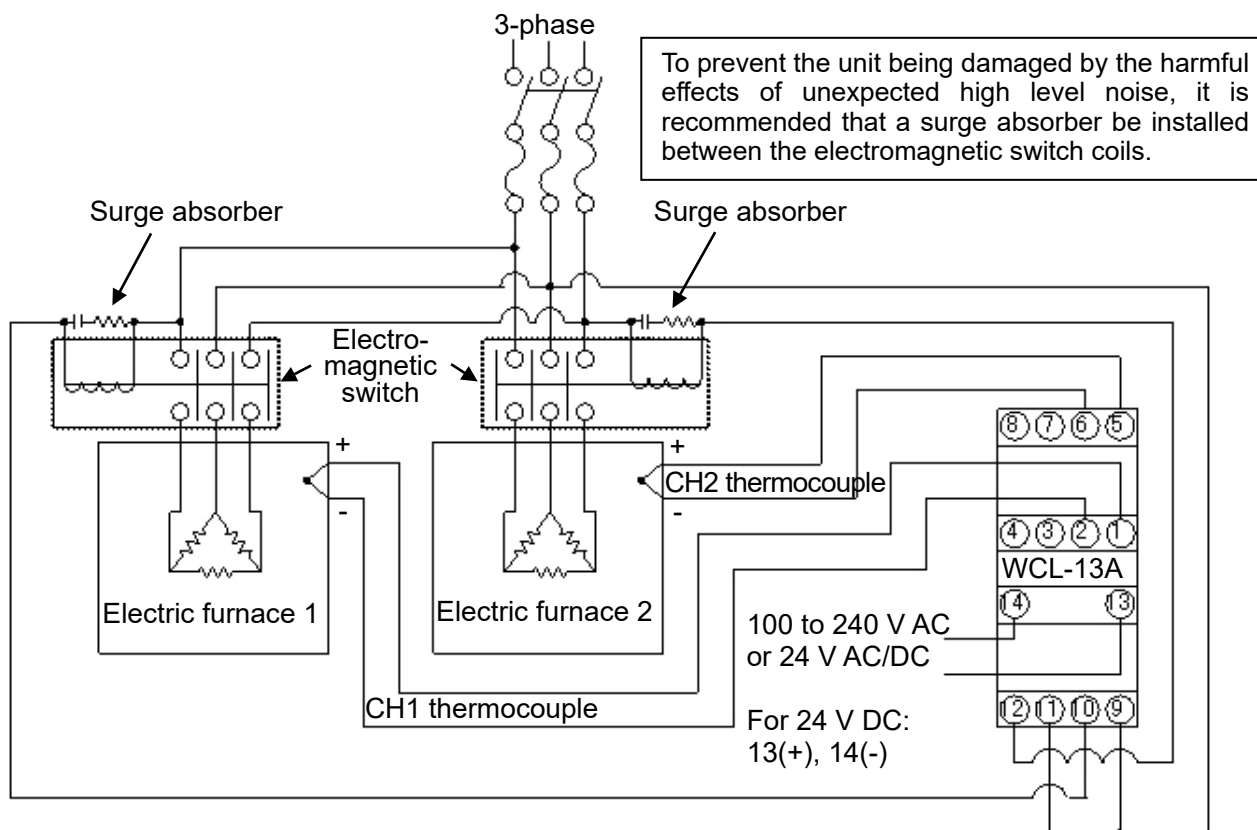
(Fig. 5.5-1)

• **WCL-13A-SS/MM** (2ch controller spec: Non-contact voltage output and Multi-range input for both CH1 and CH2)

Number of units when connecting Shinko SSR in parallel:
SA-400 series: 5 units
SA-500 series: 2 units
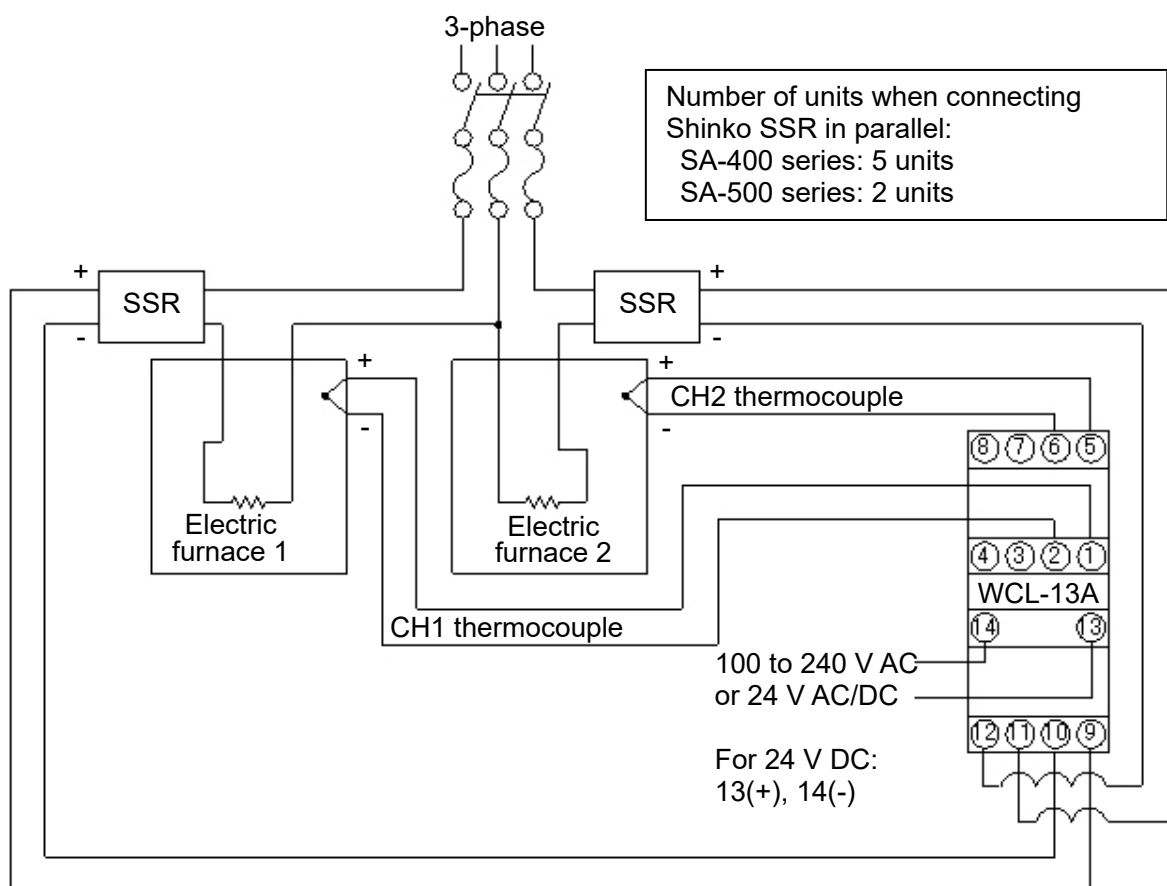
(Fig. 5.5-2)

5.6 Wiring Example of Heater Burnout Alarm (W, W3 option)

When Heater burnout alarm (W, W3 option) is added: Heater burnout alarm (CT) input connectors for CH1 and CH2 are equipped on the top of the unit.

Single-phase 20 A, 100 A: CT1 (CT input for CH1),   CT3 (CT input for CH2)

3-phase   20 A, 100 A: CT1, CT2 (CT input for CH1),   CT3, CT4 (CT input for CH2)

Single-phase Heater:

(1) Pass the heater wire into the CT hole, and solder the wires of the wire harness provided.

(2) CH1: Insert the wire harness into the CT1 input connector.

   CH2: Insert the wire harness into the CT3 input connector.
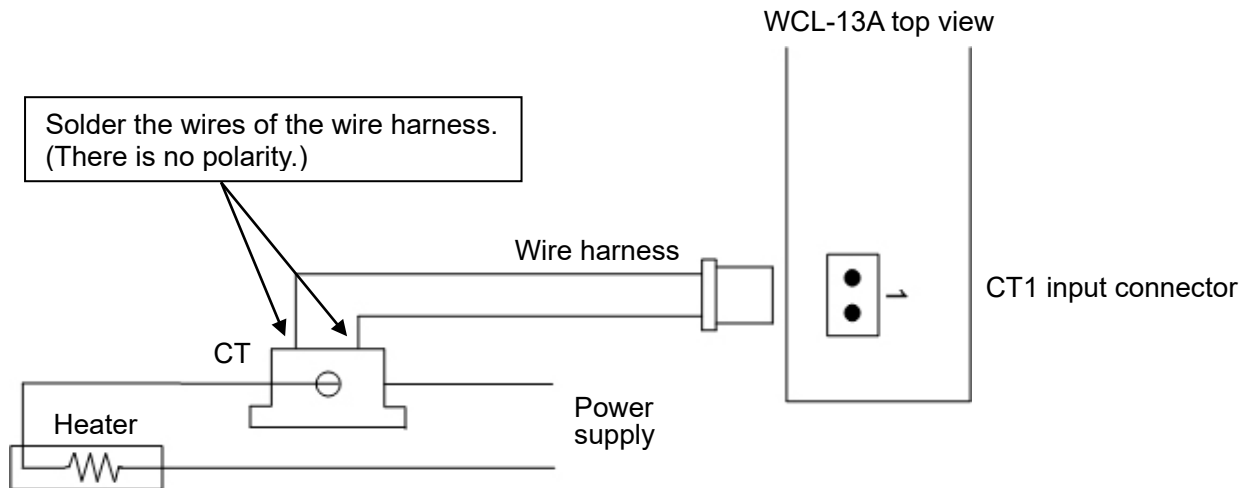
(Fig. 5.6-1)

3-phase Heater:

(1) Pass any 2 heater wires of R, S and T into the holes of CT1 and CT2, and solder the wires of the wire harness provided.

(2) CH1: Insert the wire harness into the CT1 and CT2 input connectors.

   CH2: Insert the wire harness into the CT3 and CT4 input connectors.

(Fig. 5.6-2)

16
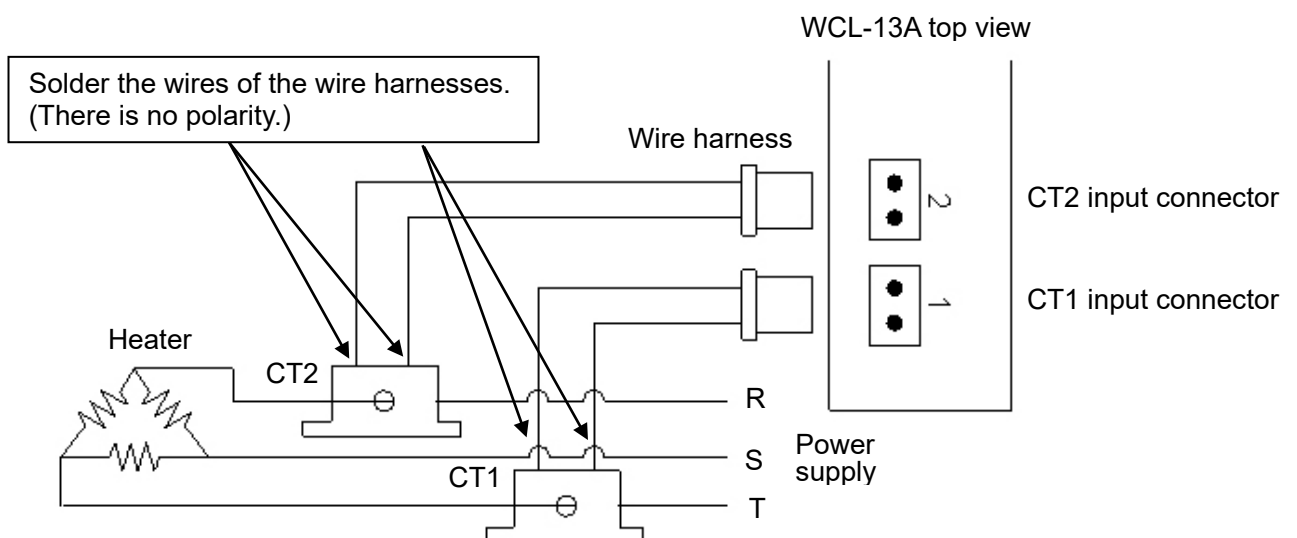
5.7 Wiring Example of Alarm Output (AO option)

If Alarm output (AO option) is added, Alarm output connectors will be equipped on the top of the unit.

The following shows connector numbers and corresponding alarm output.
(Table 5.7-1)

Connector No.	Alarm Output
1	CH1 Event 1 output
2	CH1 Event 2 output
3	CH2 Event 1 output
4	CH2 Event 2 output

Select an alarm type for Event 1 output in [Event 1 output]. (pp. 28, 32)
Select an alarm type for Event 2 output in [Event 2 output]. (pp. 28, 32)
If any alarm is active, the output will be turned ON. The output is OR output.

Output specifications are shown below.
Open collector: Control capacity, 0.1 A 24 V DC

Wiring Example of Alarm Output

(Fig. 5.7-1)

17
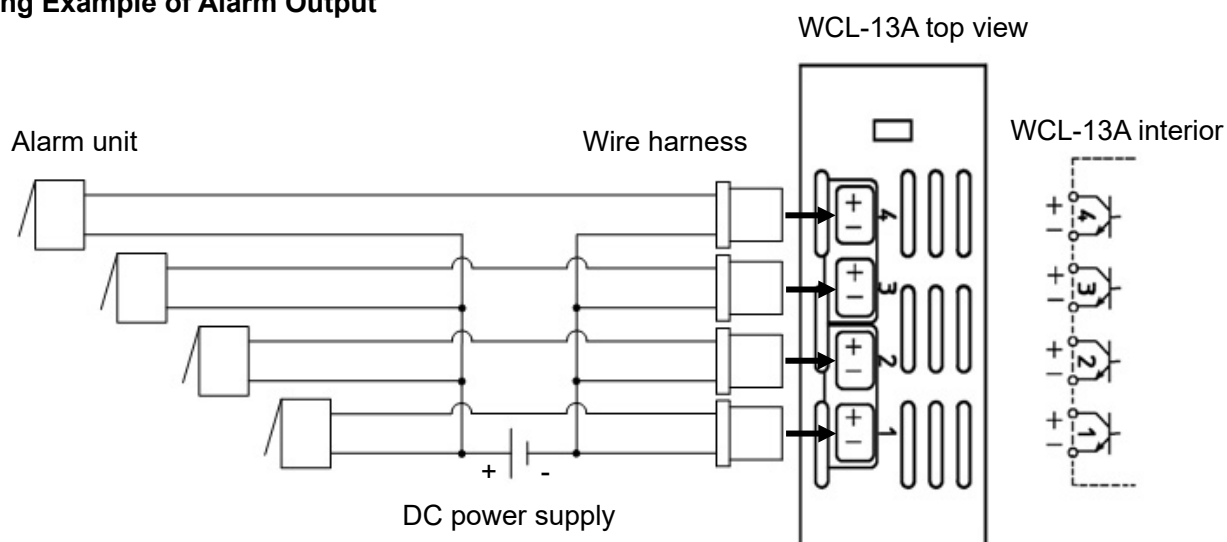
5.8 Wiring Example of Heater Burnout Alarm (single-phase) + Alarm Output (AW option)

If the AW option [Heater burnout alarm (single-phase) + Alarm output] is added, connectors for the Heater burnout alarm (CT) input and Alarm output will be equipped on the top of the unit.

The following shows connector numbers and corresponding Heater burnout alarm (CT) input and Alarm output.

(Table 5.8-1)

Connector No.	CT Input, Alarm Output
1	CH1 CT input
2	CH1 Event 2 output
3	CH2 CT input
4	CH2 Event 2 output

Select an alarm type for Event 2 output in [Event 2 output]. (pp. 28, 32)
If any alarm is active, the output will be turned ON. The output is OR output.

Output specifications are shown below.
Open collector: Control capacity, 0.1 A 24 V DC

Wiring Method of CT
 (1) Pass the heater wire into the hole of CT, and solder the wires of the wire harness provided.
     There is no polarity.
 (2) CH1: Insert the wire harness into the CH1 CT input connector.
     CH2: Insert the wire harness into the CH2 CT input connector.

Wiring Example of Heater Burnout Alarm (CT) input and Alarm Output
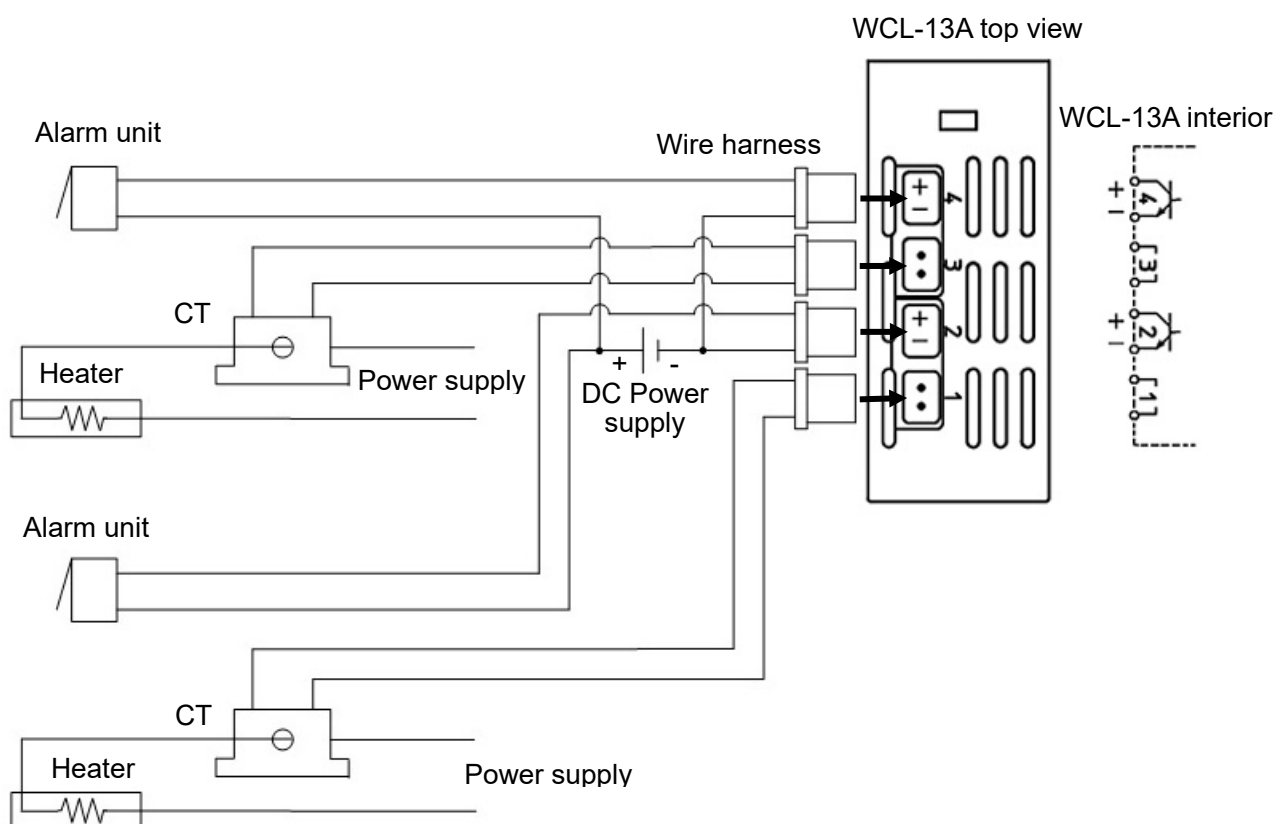
(Fig. 5.8-1)

5.9 Wiring Example of Serial Communication (C5 option)

When the Serial Communication (C5 option) is added, a modular jack is equipped at the bottom of the controller.

Wiring example using the IF-400 communication converter

• D-sub 9-pin Connector
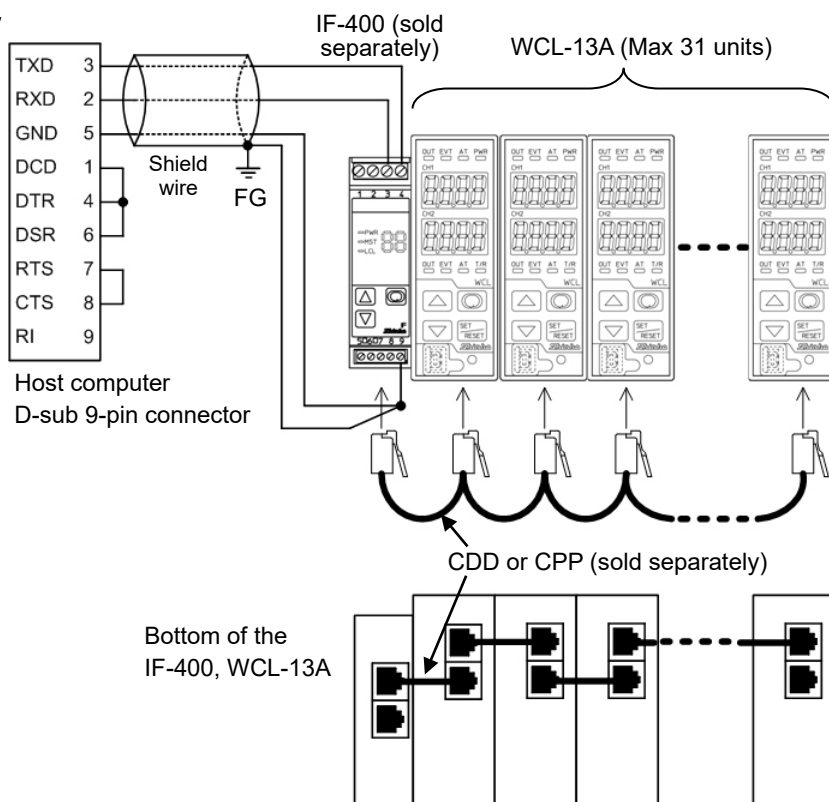
(Fig. 5.9-1)

• D-sub 25-pin Connector
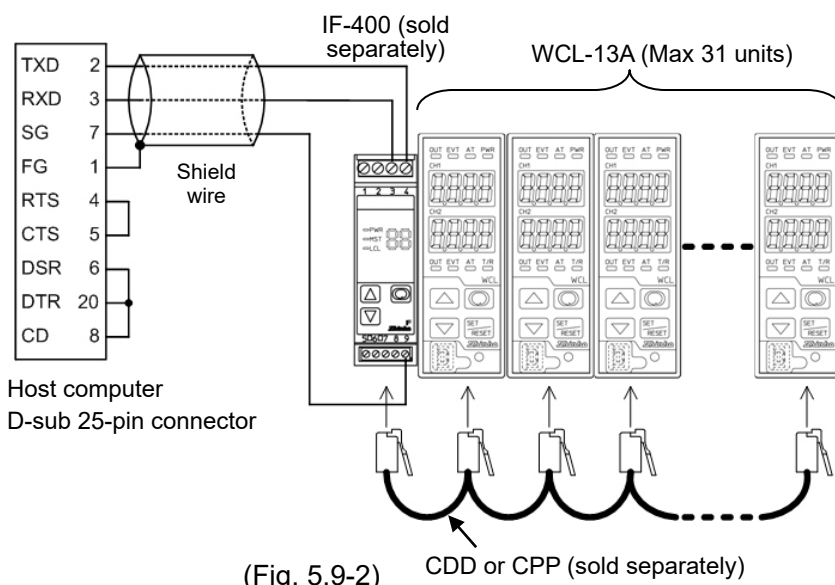
(Fig. 5.9-2)

Shield Wire

Connect only one end of the shield wire so that current cannot flow to the shield wire. If both ends of the shield wire are connected, the circuit will be closed, resulting in a ground loop. This may cause noise.
Recommended cable: OTSC-VB 2PX0.5SQ (made by Onamba Co., Ltd.) or equivalent (Use a twisted pair cable.)

Terminator (Terminal Resistor)

The terminator is mounted at the end of the wire when connecting multiple peripheral devices to a personal computer. The terminator prevents signal reflection and disturbance.
Do not connect a terminator to the communication line because the WCL-13A has built-in pull-up and pull-down resistors.

6. Outline of Key Operation and Setting Groups

6.1 Outline of Key Operation

Setting items are divided into groups, and group selection has to be made with keypads.
Press the ⃝ key in PV/SV Display Mode. The unit enters Group selection mode.
Select a group with the ⃝, and press the [SET/RESET]. The unit enters each setting item.
To set each setting item, use the △ or ▽ key, and register the value with the [SET/RESET] key.

6.2 Setting Groups

The following shows the setting group configuration.

```
┌─────────────────────────┐
│        Power ON         │
└─────────────────────────┘
              │
              ▼
┌─────────────────────────┐   PV(SV) switches while ▽ is pressed.   ┌──────────────────────────┐
│ PV/SV Display Mode (*1) │◄─────────────────────────────────────►│ PV/SV switching mode (*3)│
│                         │   Returns automatically if ▽ is released.└──────────────────────────┘
│ Standby Mode (*2)       │
│ Manual Control Mode (*2)│   ⃝(3 sec)                             ┌──────────────────────────┐
└─────────────────────────┘◄─────────────────────────────────────►│    MV indication mode     │
              │ ⃝                                       ⃝         └──────────────────────────┘
              ▼
┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┬ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─
  Group selection mode        See pages 21-45 for details of each setting item.
```

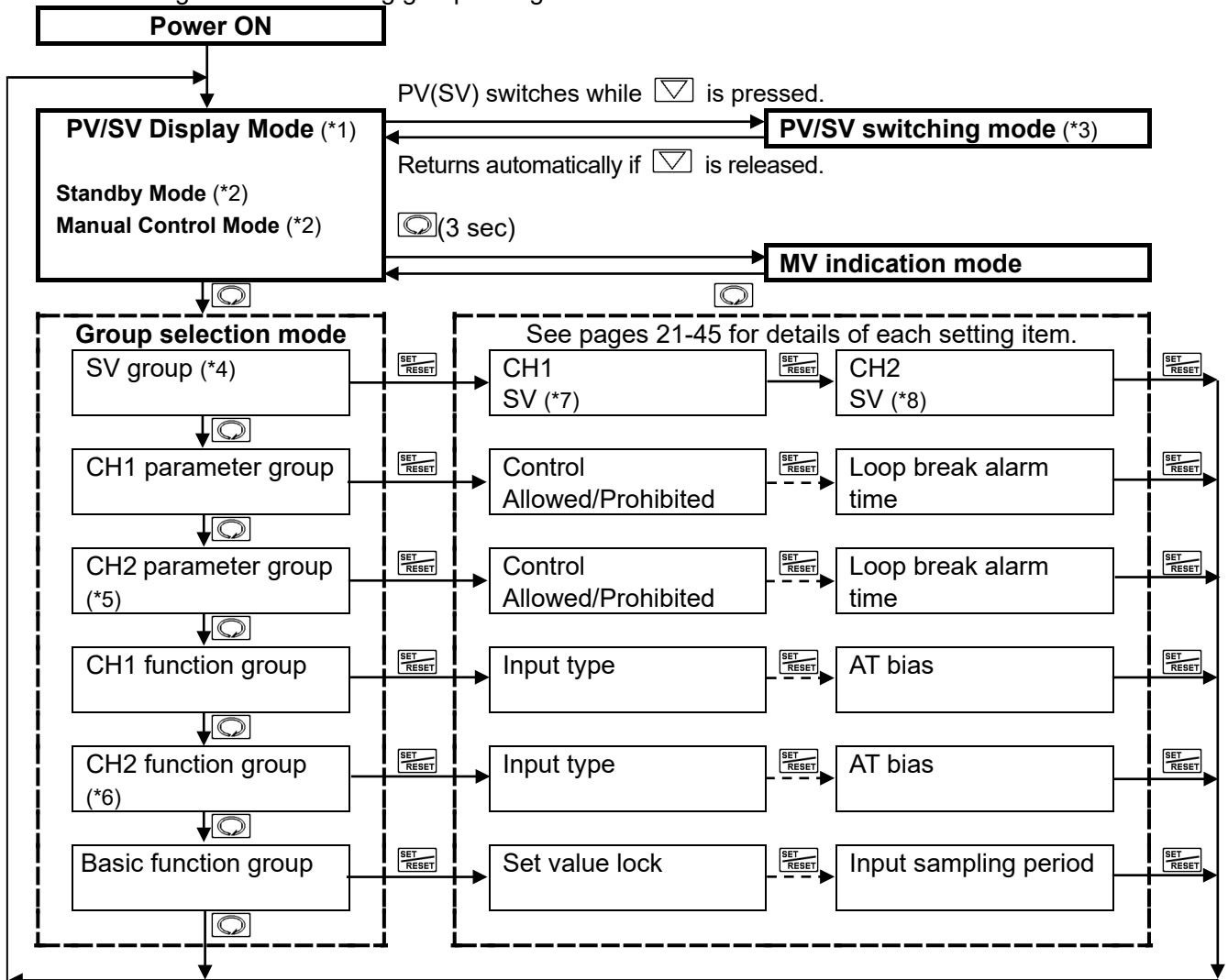| Group selection mode		CH1		CH2	
SV group (*4)	[SET/RESET] →	SV (*7)	[SET/RESET] →	SV (*8)	[SET/RESET]
CH1 parameter group	[SET/RESET] →	Control Allowed/Prohibited	[SET/RESET] →	Loop break alarm time	[SET/RESET]
CH2 parameter group (*5)	[SET/RESET] →	Control Allowed/Prohibited	[SET/RESET] →	Loop break alarm time	[SET/RESET]
CH1 function group	[SET/RESET] →	Input type	[SET/RESET] →	AT bias	[SET/RESET]
CH2 function group (*6)	[SET/RESET] →	Input type	[SET/RESET] →	AT bias	[SET/RESET]
Basic function group	[SET/RESET] →	Set value lock	[SET/RESET] →	Input sampling period	[SET/RESET]

• ↓⃝, [SET/RESET]→: This means that if the ⃝ or [SET/RESET] key is pressed, the unit proceeds to the next setting item.

• [SET/RESET]--→ : This means "Press the [SET/RESET] key until the desired setting mode appears".

(*1) In PV/SV Display Mode, indicates a setting item selected in [Display selection].
(*2) Indications differ depending on the selection in the CH1, CH2 parameter group.
(*3) In PV/SV Display Mode, the PV/SV indications will switch.
       PV(SV) does not switch if a CH1, CH2 difference or addition inclusive item is selected in [Display selection] in the Basic function group.
(*4) Not available for Potentiometer input spec.
(*5) Not available for Timer spec, Potentiometer input spec. Not available if Heating/Cooling control or External setting input is selected from the Block function (Console software).
(*6) Not available for Timer spec, Potentiometer input spec. Not available if Heating/Cooling control is selected from the Block function (Console software).
(*7) If Cascade control spec is selected from the Block function (Console software), CH1 SV will become the AT point of the slave.
(*8) Not available for Timer spec. Not available if Heating/Cooling control or External setting input is selected from the Block function (Console software).

6.3 Basic Operation Procedure

Basic operation procedure is shown below.

Setting Example

CH2 function: Used as a CH2 controller (2ch controller spec).
Input: Pt100: -199.9 to 850.0℃ (for CH1, CH2)
Control action: PID control (P, I, D and ARW values are automatically set by performing AT)
                     (for CH1, CH2)
Alarm 1 type: High limit alarm (for CH1, CH2)
Alarm 1 value: 10.0℃ (for CH1, CH2)
SV: CH1: 200.0℃
                     CH2: 210.0℃

Operation Procedure

1. Operation before running	Turn the load circuit power OFF, and turn the power supply to the controller ON.

2. CH1 function group
   CH2 function group
	Select each input type, Alarm 1 type, etc. in the CH1, CH2 function groups.
	① Select [Pr .C : Pt100 -199.9 to 850.0℃] in [$5En5$: Input type].
	② Select [H : High limit alarm] in [$A IFn$: Alarm 1 type].
	   Setting items ③ and ④ will be indicated.
	   Set them as needed.
	[Note]
	When Alarm 1 type is changed, Alarm 1 value defaults to 0 (0.0). Therefore, set it again.
	③ Set Alarm 1 hysteresis in [$A IHY$: Alarm 1 hysteresis].
	④ Set Alarm 1 delay time in [$A IdY$: Alarm 1 delay time].

3. SV group	Set the SV in the SV group. ⑤ Set to 200.0℃ in [$5 I$: CH1 SV]. ⑥ Set to 210.0℃ in [52 : CH2 SV].
4. Start the controller	Turn the load circuit power ON. Control action starts so as to keep the control target at the SV.

5. AT Perform	Perform AT in the CH1, CH2 parameter groups respectively.
	⑦ Select [Ar : AT Perform] in [Ar : AT/Auto-reset Perform/Cancel].
	   The AT indicator flashes while AT is performing.
	   The AT indicator turns off after AT is finished.
	[Note]
	After AT is finished, P, I, D and ARW values are automatically set. Since these values are internally memorized, it is not necessary to perform AT again as long as the process is the same.

6. CH1 parameter group CH2 parameter group	Set each Alarm 1 value in the CH1, CH2 parameter groups after AT is finished. ⑧ Set the value to 10.0℃ in [$A I$: Alarm 1 value].

Setting items ① to ⑧ are indicated in Section "7. Key Operation Flowchart" (Pages 22, 23).

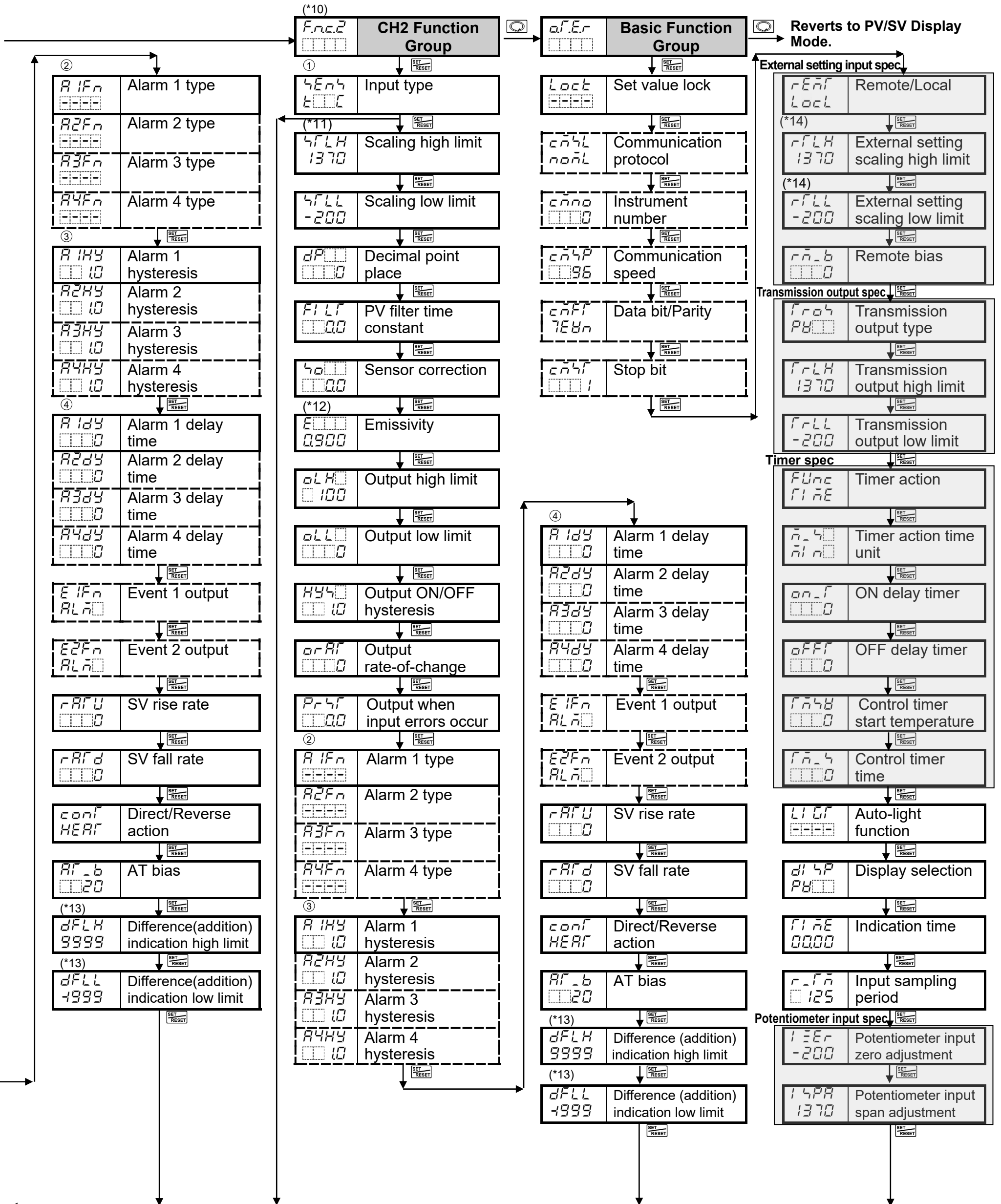# 7. Key Operation Flowchart

Power ON

PV/SV Display Mode

Indications differ depending on the selection in CH1, CH2 parameter groups.

Display	Mode
`25` / `25`	**PV/SV Display Mode**
`oFF` / `oFF`	**Standby Mode**
`200` / `200`	**Manual Control Mode** (MV flashes.)

Indicates the item selected in [Display selection] in the Basic function group.

(e.g.) When 'Control Prohibited' is selected for CH1 and CH2.

(e.g.) When 'Manual control MV' is set to 20.0% for CH1 and CH2.

PV(SV) switches while ▽ is pressed.

Returns automatically if ▽ is released.

⊙ (3 seconds)

PV/SV Switching Mode
In PV/SV Display Mode, the SV can be indicated when PV is indicated, and vice versa.

MV Indication Mode
(The 1st point from the right flashes.)

(*1)

SV Group
`5.`

⑤ (*2) — `51` / `0` — **CH1 SV**

⑥ (*3) — `52` / `0` — **CH2 SV**

CH1 Parameter Group
`PId1`

Display	Parameter
`oFF` / `on`	Control Allowed/Prohibited
(*4) `AUto` / `AUto`	Auto/Manual control
(*5) `mAnU` / `0.0`	Manual control MV
⑦ (*6) `At` / `----`	AT/Auto-reset Perform/Cancel
(*7) `P` / `10`	Proportional band

Heat/Cool control output
| `P_b` / `10` | OUT2 proportional band |

`I` / `200`	Integral time
`d` / `50`	Derivative time
`n` / `50`	ARW
`rSEt` / `0.0`	Manual reset value
`c` / `30`	Proportional cycle

Heat/Cool control output
| `c_b` / `30` | OUT2 proportional cycle |

⑧
`A1` / `0`	Alarm 1 value
`A2` / `0`	Alarm 2 value
`A3` / `0`	Alarm 3 value
`A4` / `0`	Alarm 4 value
`H1` / `0.0`	Heater burnout alarm 1 value
`H2` / `0.0`	Heater burnout alarm 2 value
`LP_H` / `0`	Loop break alarm band
`LP_r` / `0`	Loop break alarm time

CH2 Parameter Group
(*8) `PId2`

Display	Parameter
`oFF` / `on`	Control Allowed/Prohibited
(*4) `AUto` / `AUto`	Auto/Manual control
(*5) `mAnU` / `0.0`	Manual control MV
⑦ (*6) `At` / `----`	AT/Auto-reset Perform/Cancel
(*7) `P` / `10`	Proportional band
`I` / `200`	Integral time
`d` / `50`	Derivative time
`n` / `50`	ARW
`rSEt` / `0.0`	Manual reset value
`c` / `30`	Proportional cycle

⑧
`A1` / `0`	Alarm 1 value
`A2` / `0`	Alarm 2 value
`A3` / `0`	Alarm 3 value
`A4` / `0`	Alarm 4 value
`H1` / `0.0`	Heater burnout alarm 1 value
`H2` / `0.0`	Heater burnout alarm 2 value
`LP_H` / `0`	Loop break alarm band
`LP_r` / `0`	Loop break alarm time

CH1 Function Group
① `Fnc.1`

Display	Parameter
`SEnS` / `tC`	Input type
`SLH` / `1370`	Scaling high limit
`SLL` / `-200`	Scaling low limit
`dP` / `0`	Decimal point place
`FILt` / `0.0`	PV filter time constant
`So` / `0.0`	Sensor correction
(*12) `E` / `0.900`	Emissivity
`oLH` / `100`	Output high limit
`oLL` / `0`	Output low limit
`HYS` / `10`	Output ON/OFF hysteresis

Heat/Cool control output
`cAcr` / `Air`	OUT2 cooling method
`oLHb` / `100`	OUT2 high limit
`oLLb` / `0`	OUT2 low limit
`HYSb` / `10`	OUT2 ON/OFF hysteresis
`db` / `0.0`	Overlap/Dead band

| `orAt` / `0` | Output rate-of-change |
| `PrSt` / `0.0` | Output when input errors occur |

(*1) This group is not available for Potentiometer input spec,

(*2) If Cascade control is selected from the Block function (Console software), CH1 SV will be the AT point of the slave.

(*3) Not available for Timer spec. Not available if Heating/Cooling control output or External setting input is selected from the Block function (Console software).

(*4) If Control Prohibited is selected, the unit reverts to PV/SV Display Mode by pressing the SET/RESET key.

(*5) Not available if Automatic control is selected. Default: MV of the Automatic control

(*6) If SET/RESET key is pressed after Manual control MV is set, the unit reverts to the Manual Control Mode.

(*7) If SET/RESET key is pressed after AT/Auto-reset Perform is selected, the unit reverts to PV/SV Display Mode.

(*8) Not available for Timer spec or Potentiometer input spec. Not available if Heating/Cooling control output or External setting input is selected from the Block function (Console software).

(*9) PV (SV) does not switch if a CH1, CH2 difference or addition inclusive item is selected in [Display selection] in the Basic function group.

(*10) Not available for Timer spec or Potentiometer input spec. Not available if Heating/Cooling control output is selected from the Block function (Console software).

(*11) If External setting input is selected from the Block function (Console software), and if SET/RESET is pressed after input type selection, the unit reverts to PV/SV Display Mode.

(*12) Available only for infrared thermocouple input.

(*13) Available for Difference (addition) input & when Base channel is DC input.

(*14) External setting scaling high, low limit settings: Common to External setting input spec, Cascade control spec and Potentiometer input spec.

[About Setting Items]

`5 1`	CH1 SV
`0`	

- Upper left (CH1 PV/SV Display): Indicates setting item characters.
  Lower left (CH2 PV/SV Display): Indicates factory default value.
  Right side: Indicates the setting item.
- Setting items with dotted lines are optional, and they appear when the corresponding option is ordered.
- ☐ : Available when each spec is selected from the Block function (Console software).

[Key Operation]
- ↓◯, ↓[SET/RESET] : If the ◯ or [SET/RESET] key is pressed, the unit proceeds to the next setting item, illustrated by an arrow.
- If the ◯ key is pressed for 3 seconds at any setting item, the unit reverts to PV/SV Display Mode.

(*10)

`Fnc.2`	**CH2 Function Group**

◯

`oF.Er`	**Basic Function Group**

◯ **Reverts to PV/SV Display Mode.**

②

`A1Fn`	Alarm 1 type
`A2Fn`	Alarm 2 type
`A3Fn`	Alarm 3 type
`A4Fn`	Alarm 4 type

③

`A1HY` `10`	Alarm 1 hysteresis
`A2HY` `10`	Alarm 2 hysteresis
`A3HY` `10`	Alarm 3 hysteresis
`A4HY` `10`	Alarm 4 hysteresis

④

`A1dY` `0`	Alarm 1 delay time
`A2dY` `0`	Alarm 2 delay time
`A3dY` `0`	Alarm 3 delay time
`A4dY` `0`	Alarm 4 delay time

`E1Fn` `ALA`	Event 1 output
`E2Fn` `ALA`	Event 2 output
`rArU` `0`	SV rise rate
`rArd` `0`	SV fall rate
`conf` `HEAr`	Direct/Reverse action
`At_b` `20`	AT bias

(*13)
`dFLH` `9999`	Difference(addition) indication high limit

(*13)
`dFLL` `-1999`	Difference(addition) indication low limit

CH2 Function Group

①
`SEnS` `t  C`	Input type

(*11)
`SFLH` `1370`	Scaling high limit
`SFLL` `-200`	Scaling low limit
`dP` `0`	Decimal point place
`FILt` `0.0`	PV filter time constant
`So` `0.0`	Sensor correction

(*12)
`E` `0.900`	Emissivity
`oLH` `100`	Output high limit
`oLL` `0`	Output low limit
`HYS` `10`	Output ON/OFF hysteresis
`orAt` `0`	Output rate-of-change
`PrST` `0.0`	Output when input errors occur

②
`A1Fn`	Alarm 1 type
`A2Fn`	Alarm 2 type
`A3Fn`	Alarm 3 type
`A4Fn`	Alarm 4 type

③
`A1HY` `10`	Alarm 1 hysteresis
`A2HY` `10`	Alarm 2 hysteresis
`A3HY` `10`	Alarm 3 hysteresis
`A4HY` `10`	Alarm 4 hysteresis

Basic Function Group

`Loct`	Set value lock
`cnSL` `nonL`	Communication protocol
`cnno` `0`	Instrument number
`cnSP` `96`	Communication speed
`cnFt` `7E8n`	Data bit/Parity
`cnSt` `1`	Stop bit

④
`A1dY` `0`	Alarm 1 delay time
`A2dY` `0`	Alarm 2 delay time
`A3dY` `0`	Alarm 3 delay time
`A4dY` `0`	Alarm 4 delay time

`E1Fn` `ALA`	Event 1 output
`E2Fn` `ALA`	Event 2 output
`rArU` `0`	SV rise rate
`rArd` `0`	SV fall rate
`conf` `HEAr`	Direct/Reverse action
`At_b` `20`	AT bias

(*13)
`dFLH` `9999`	Difference (addition) indication high limit

(*13)
`dFLL` `-1999`	Difference (addition) indication low limit

External setting input spec

`rEAT` `LocL`	Remote/Local

(*14)
`rFLH` `1370`	External setting scaling high limit

(*14)
`rFLL` `-200`	External setting scaling low limit

`rn_b` `0`	Remote bias

Transmission output spec

`Trot` `P8`	Transmission output type
`TrLH` `1370`	Transmission output high limit
`TrLL` `-200`	Transmission output low limit

Timer spec

`FUnc` `t1 AE`	Timer action
`n_S` `Al n`	Timer action time unit
`on_t` `0`	ON delay timer
`oFFt` `0`	OFF delay timer
`tnSU` `0`	Control timer start temperature
`tn_S` `0`	Control timer time
`L1Gt`	Auto-light function
`diSP` `P8`	Display selection
`t1AE` `00.00`	Indication time
`r_Cn` `125`	Input sampling period

Potentiometer input spec

`1ZEr` `-200`	Potentiometer input zero adjustment
`1SPA` `1370`	Potentiometer input span adjustment

23

8. Setup

Setup (setting the input type, Alarm type, and control action, etc. of CH1 and CH2) should be done before using this controller, according to the user's conditions.

Setup can be conducted in the CH1, CH2 function groups and Basic function group.

If the user's specification is the same as the factory default value of the WCL-13A, or if setup has already been complete, it is not necessary to set up the controller. Proceed to Chapter "9. Settings".

8.1 Turn the Power Supply to the WCL-13A ON.

• For approx. 4 seconds after the power is switched ON, the sensor input characters and temperature unit are indicated on PV/SV Display of CH1 and CH2. (Table. 8.1-1) (Table. 8.1-2)
During this time, all outputs and LED indicators are in OFF status.

• After that, the item selected in [Display selection] is indicated.

(Table. 8.1-1) Multi-range Input

Sensor Input	℃		℉	
	PV/SV Display	Setting Range	PV/SV Display	Setting Range
K	t⎵⎵C	-200 to 1370 ℃	t⎵⎵F	-320 to 2500 ℉
	t⎵.C	-199.9 to 400.0 ℃	t⎵.F	-199.9 to 750.0 ℉
J	J⎵⎵C	-200 to 1000 ℃	J⎵⎵F	-320 to 1800 ℉
R	r⎵⎵C	0 to 1760 ℃	r⎵⎵F	0 to 3200 ℉
S	5⎵⎵C	0 to 1760 ℃	5⎵⎵F	0 to 3200 ℉
B	b⎵⎵C	0 to 1820 ℃	b⎵⎵F	0 to 3300 ℉
E	E⎵⎵C	-200 to 800 ℃	E⎵⎵F	-320 to 1500 ℉
T	r⎵.C	-199.9 to 400.0 ℃	r⎵.F	-199.9 to 750.0 ℉
N	n⎵⎵C	-200 to 1300 ℃	n⎵⎵F	-320 to 2300 ℉
PL-Ⅱ	PL2C	0 to 1390 ℃	PL2F	0 to 2500 ℉
C(W/Re5-26)	c⎵⎵C	0 to 2315 ℃	c⎵⎵F	0 to 4200 ℉
Pt100	Pr.C	-199.9 to 850.0 ℃	Pr.F	-199.9 to 999.9 ℉
JPt100	JPr.C	-199.9 to 500.0 ℃	JPr.F	-199.9 to 900.0 ℉
Pt100	Pr⎵C	-200 to 850 ℃	Pr⎵F	-300 to 1500 ℉
JPt100	JPrC	-200 to 500 ℃	JPrF	-300 to 900 ℉
4 to 20 mA DC	420A			
0 to 20 mA DC	020A			
0 to 1 V DC	0⎵1U	-1999 to 9999		
0 to 5 V DC	0⎵5U			
1 to 5 V DC	1⎵5U			
0 to 10 V DC	010U			

(Table 8.1-2) Infrared Thermocouple (Infrared TC) Input
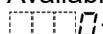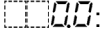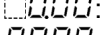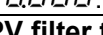
RD-300 Series, RD-401	PV/SV Display	Setting Range
-18 to 25℃	1 10C	-50 to 500 ℃
5 to 45℃	1 27C	-50 to 500 ℃
25 to 80℃	1 60C	-50 to 500 ℃
70 to 105℃	1 90C	-50 to 500 ℃
90 to 120℃	1 12C	-50 to 500 ℃
115 to 155℃	1 14C	-50 to 500 ℃
145 to 190℃	1 17C	-50 to 500 ℃
180 to 250℃	1 22C	-50 to 500 ℃
-18 to 25℃	1 10F	-58 to 932 ℉
5 to 45℃	1 27F	-58 to 932 ℉
25 to 80℃	1 60F	-58 to 932 ℉
70 to 105℃	1 90F	-58 to 932 ℉
90 to 120℃	1 12F	-58 to 932 ℉
115 to 155℃	1 14F	-58 to 932 ℉
145 to 190℃	1 17F	-58 to 932 ℉
180 to 250℃	1 22F	-58 to 932 ℉
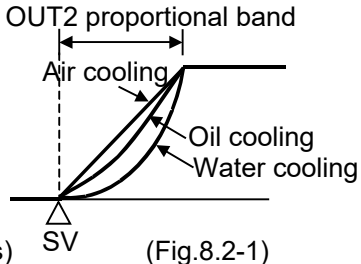
8.2 CH1 Function Group
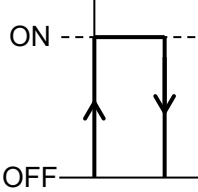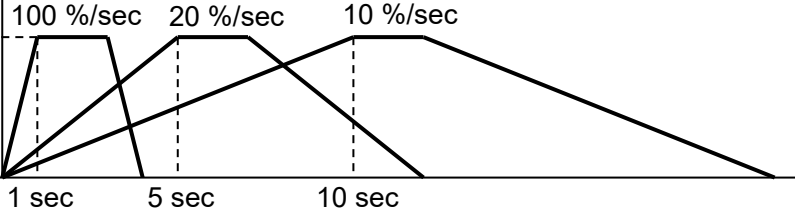
To enter the CH1 function group, follow the procedure below.

(1) ꓱ.ᴨᴄ.ꓲ   Press the ⟲ key in PV/SV Display Mode until the left characters appear.

(2) ꓱᴇᴨꓱ   Press the ⟨SET/RESET⟩ key. The CH1 input type will appear.

Character	Name, Function, Setting Range	Factory Default
ꓱᴇᴨꓱ	**Input type** • Selects an input type.	Multi-range input: K (-200 to 1370℃) Infrared TC input: 180 to 250℃

	• **Multi-range input**:
	  Selects an input type from thermocouple (10 types), RTD (2 types), Direct current (2 types), and DC voltage (4 types), and the unit ℃/℉.
	  Setting range: Refer to (Table 8.1-1) on p.24.
	  When changing the input from DC voltage to other inputs, remove the sensor connected to this controller first, then change the input.
	• **Infrared thermocouple (TC) input**:
	  Selects an input type from 8 types of Infrared thermocouple (RD-300 series, RD-401) and the unit ℃/℉.
	  Setting range: Refer to (Table 8.1-2) on p.24.	

ꓱᴦᴸH	**Scaling high limit** • Sets Scaling high limit value.	Multi-range input: 1370℃ Infrared TC input: 500℃

	• For thermocouple, RTD, Infrared TC inputs, this matches SV high limit value.
	• Setting range: Scaling low limit to Input range high limit
	
	[Note] If CH difference input is selected for Input 1 block (Block function of Console software), set the Scaling high limit to Span value, and set the Scaling low limit to 0 (zero).
	
	(e.g. 1) 1 to 5 V DC input, 0 to 100
	    Scaling high limit: 100
	    Scaling low limit: 0 0 (Span: 100) 100
	(e.g. 2) 1 to 5 V DC input, -100 to 100
	    Scaling high limit: 200
	    Scaling low limit: 0 -100 (Span: 200) 100	

ꓱᴦᴸᴸ	**Scaling low limit** • Sets Scaling low limit value.	Multi-range input: -200℃ Infrared TC input: -50℃
	• For thermocouple, RTD, Infrared TC inputs, this matches SV low limit value. • Setting range: Input range low limit to Scaling high limit	
ᴅP▢	**Decimal point place**	No decimal point

	• Selects decimal point place.
	  Available for DC voltage, current inputs.
	• ▢▢▢0: No decimal point
	  ▢▢0.0: 1 digit after decimal point
	  ▢0.00: 2 digits after decimal point
	  0.000: 3 digits after decimal point	

ꓳꓲ ᴸᴦ	**PV filter time constant**	0.0 seconds
	• Sets PV filter time constant. If the value is set too high, it affects control results due to the delay of response. • Setting range: 0.0 to 10.0 seconds	
ꓱᴏ▢	**Sensor correction**	0.0℃

	• Sets the sensor correction value.
	• Setting range: -100.0 to 100.0℃ (℉) DC voltage, current inputs: -1000 to 1000 (The placement of the decimal point follows the selection.)
	
	[Sensor correction function]
	This corrects the input value from the sensor. When a sensor cannot be set at the exact location where control is desired, the sensor-measured temperature may deviate from the temperature in the controlled location. When using multiple controllers, sometimes the measured temperatures do not concur due to differences in sensor accuracy or dispersion of load capacities. In such a case, the control can be set at the desired temperature by adjusting the input value of sensors. However, it is effective within the input rating range regardless of the sensor correction value.
	PV after sensor correction= Current PV+ (Sensor correction value)
	(e.g.) When PV is 198℃:
	    If sensor correction value is set to 2.0℃, PV will be 198 + (2.0) = 200.0℃.
	    If sensor correction value is set to -2.0℃, PV will be 198 + (-2.0) = 196.0℃.	

Character	Name, Function, Setting Range	Factory Default

E☐☐☐	**Emissivity**
	• Sets infrared emissivity.
	  Setting characters and PV are alternately indicated on the CH1 PV/SV Display.
	  Available only for Infrared thermocouple input.
	• Setting range: 0.100 to 1.000 times
		0.900 times

oLH☐	**Output high limit**
	• Sets the output high limit value.
	  Not available if output is in ON/OFF control.
	  If Heating/Cooling control output is selected from the Block function (Console software),
	  CH1 output will be OUT1, and CH2 output will be OUT2.
	• Setting range: Output low limit to 100%
	            (Direct current output: Output low limit to 105%)
		100%

oLL☐	**Output low limit**
	• Sets the output low limit value.
	  Not available if output is in ON/OFF control.
	  If Heating/Cooling control output is selected from the Block function (Console software),
	  CH1 output will be OUT1, and CH2 output will be OUT2.
	• Setting range: 0% to Output high limit
	            (Direct current output: -5% to Output high limit)
		0%

HYS☐	**Output ON/OFF hysteresis**
	• Sets the output ON/OFF hysteresis.
	  Available only when output is in ON/OFF control.
	  If Heating/Cooling control output is selected from the Block function (Console software),
	  CH1 output will be OUT1, and CH2 output will be OUT2.
	• Setting range: 0.1 to 100.0℃ (℉),
	  DC voltage, current inputs: 1 to 1000 (The placement of the decimal point follows the
	                                selection.)
		1.0℃

cAcr	**OUT2 cooling method**
	• Selects OUT2 cooling method from air, oil and water
	  cooling.
	• Available when Heating/Cooling control output is
	  selected from the Block function (Console software).
	  Not available if OUT2 is in ON/OFF control.
	• A℩r☐: Air cooling (linear characteristics)
	  oℓ L☐: Oil cooling (1.5th power of the linear characteristics)
	  ⊔Ar☐: Water cooling (2nd power of the linear characteristics)
		Air cooling
		
		OUT2 proportional band
		Air cooling
		Oil cooling
		Water cooling
		SV (Fig.8.2-1)

oLHb	**OUT2 high limit**
	• Sets OUT2 high limit value.
	• Available when Heating/Cooling control output is selected from the Block function
	  (Console software).
	  Not available if OUT2 is in ON/OFF control.
	• Setting range: OUT2 low limit to 100%
	            (Direct current output: OUT2 low limit to 105%)
		100%

oLLb	**OUT2 low limit**
	• Sets OUT2 low limit value.
	• Available when Heating/Cooling control output is selected from the Block function
	  (Console software).
	  Not available if OUT2 is in ON/OFF control.
	• Setting range: 0% to OUT2 high limit
	            (Direct current output: -5% to OUT2 high limit)
		0%

HYSb	**OUT2 ON/OFF hysteresis**
	• Sets ON/OFF hysteresis for OUT2.
	  Available when Heating/Cooling control output is selected from the Block function
	  (Console software).
	  Available only when OUT2 is in ON/OFF control.
	• Setting range: 0.1 to 100.0℃ (℉), DC voltage, current inputs: 1 to 1000 (The placement
	                of the decimal point follows the selection.)
		1.0℃

Character	Name, Function, Setting Range	Factory Default
db□□	**Overlap/Dead band** • Sets the overlap band or dead band for OUT1 and OUT2. 　+ Set value: Dead band,　−Set value: Overlap band • Available when Heating/Cooling control output is selected from the Block function (Console software). • Setting range: -100.0 to 100.0℃（℉）, 　DC voltage, current inputs: -1000 to 1000 (The placement of the decimal point follows the selection.)	0.0℃
or-AℾΓ	**Output rate-of-change** • Sets the change value of output MV for 1 second. • Setting the value to 0 disables the function. 　Not available if the output is in ON/OFF control. • Setting range: 0 to 100 %/second **[Output rate-of-change]** 　For Heating control, if PV is lower than SV, output is generally turned from OFF to ON as shown in (Fig. 8.2-2). 　If Output rate-of-change is set, the output can be changed by the rate-of-change (Fig. 8.2-3). 　This control is suitable for high temperature heaters (which are made from molybdenum, tungsten or platinum, etc., and used at approx. 1500 to 1800℃) which are easily burnt out from turning on electricity rapidly. ● **Usual output**　　● **Output when Output rate-of-change is set** ON　　　　　　100 %/sec　20 %/sec　10 %/sec OFF　　1 sec　5 sec　10 sec (Fig. 8.2-2)　　(Fig. 8.2-3)	0 %/second
Pr-SΓ	**Output when input errors occur** • Sets the output MV when input errors occur. 　Available only for direct current output type. • Setting range: Output low limit to Output high limit	0.0%
A1Fn	**Alarm 1 type** • Selects an Alarm 1 type. **Note: If Alarm 1 type is changed, Alarm 1 value defaults to 0 (0.0).** 　－ － － －: No Alarm action 　H□□□: High limit alarm 　L□□□: Low limit alarm 　HL□□: High/Low limits alarm 　□I d□: High/Low limit range alarm 　AᒥコH: Process high alarm 　ſAᒥコ: Process low alarm 　H□□ᒎ: High limit with standby alarm 　L□□ᒎ: Low limit with standby alarm 　HL□ᒎ: High/Low limits with standby alarm	No Alarm action
A2Fn	**Alarm 2 type** • Selects an Alarm 2 type. (Refer to Alarm 1 type.) • Available only when the AO or AW option is added.	No Alarm action
A3Fn	**Alarm 3 type** • Selects an Alarm 3 type. (Refer to Alarm 1 type.) • Available only when the AO option is added.	No Alarm action

Character	Name, Function, Setting Range	Factory Default
A4Fn	**Alarm 4 type**	No Alarm action
	• Selects an Alarm 4 type. (Refer to Alarm 1 type.)	
	• Available only when the AO option is added.	
A1HY	**Alarm 1 hysteresis**	1.0℃
	• Sets Alarm 1 hysteresis.	
	• Not available if No Alarm action is selected in [Alarm 1 type]	
	• Setting range: 0.1 to 100.0℃ (℉)	
	DC voltage, current inputs: 1 to 1000 (The placement of the decimal point follows the selection.)	
A2HY	**Alarm 2 hysteresis**	1.0℃
	• Sets Alarm 2 hysteresis. (Refer to Alarm 1 hysteresis.)	
	• Available only when the AO or AW option is added.	
A3HY	**Alarm 3 hysteresis**	1.0℃
	• Sets Alarm 3 hysteresis. (Refer to Alarm 1 hysteresis.)	
	• Available only when the AO option is added.	
A4HY	**Alarm 4 hysteresis**	1.0℃
	• Sets Alarm 4 hysteresis. (Refer to Alarm 1 hysteresis.)	
	• Available only when the AO option is added.	
A1dY	**Alarm 1 delay time**	0 seconds
	• Sets Alarm 1 action delay time. 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 in [Alarm 1 type]	
	• Setting range: 0 to 9999 seconds	
A2dY	**Alarm 2 delay time**	0 seconds
	• Sets Alarm 2 action delay time. (Refer to Alarm 1 delay time.)	
	• Available only when the AO or AW option is added.	
A3dY	**Alarm 3 delay time**	0 seconds
	• Sets Alarm 3 action delay time. (Refer to Alarm 1 delay time.)	
	• Available only when the AO option is added.	
A4dY	**Alarm 4 delay time**	0 seconds
	• Sets Alarm 4 action delay time. (Refer to Alarm 1 delay time.)	
	• Available only when the AO option is added.	
E1Fn	**Event 1 output**	Alarm

	• Selects Event 1 output.
	  Available only when the AO option is added.
	• AL_m⬚: Alarm
	  LP⬚: Loop break alarm
	  ALLP: Alarm + Loop break alarm	

E2Fn	**Event 2 output**	Alarm

	• Selects Event 2 output.
	  Available only when the AO or AW option is added.
	• AL_m⬚: Alarm
	  LP⬚: Loop break alarm
	  ALLP: Alarm + Loop break alarm
	  Hb⬚: Heater burnout alarm
	  ALHb: Alarm + Heater burnout alarm
	  LPHb: Loop break alarm + Heater burnout alarm
	  ALL⬚: Alarm+ Loop break alarm + Heater burnout alarm	

Character	Name, Function, Setting Range	Factory Default
rAtU	**SV rise rate**	0 ℃/minute
	• Sets SV rise rate (rising value for 1 minute). Setting to 0 or 0.0 disables the function. • Setting range: 0 to 9999 ℃/min. (℉/min.) Thermocouple, RTD input with a decimal point: 0.0 to 999.9 ℃/min. (℉/min.) DC voltage, current input: 0 to 9999/min. (The placement of the decimal point follows the selection.)	
rAtd	**SV fall rate**	0 ℃/minute
	• Sets SV fall rate (falling value for 1 minute). Setting to 0 or 0.0 disables the function. • Setting range: 0 to 9999 ℃/min. (℉/min.) Thermocouple, RTD input with a decimal point: 0.0 to 999.9 ℃/min. (℉/min.) DC voltage, current input: 0 to 9999/min. (The placement of the decimal point follows the selection.)	
cont	**Direct/Reverse action**	Reverse action
	• Selects either Reverse (Heating) or Direct (Cooling) control action. • HEAt : Reverse action (Heating) cooL : Direct action (Cooling)	
At_b	**AT bias**	20℃
	• Sets bias value for the AT. (See Section "12.1 AT" on p.53.) • Available for PID control Not available for DC voltage, current inputs. • Setting range: 0 to 50℃ (0 to 100℉) Thermocouple, RTD inputs with a decimal point: 0.0 to 50.0℃ (0.0 to 100.0℉)	
dFLH	**Difference (addition) indication high limit**	9999
	• Sets difference (addition) indication high limit value. • Available for Difference (addition) input & when Base channel (*) is DC input. • Setting range: Difference (addition) indication low limit to Input range high limit	
dFLL	**Difference (addition) indication low limit**	-1999
	• Sets difference (addition) indication low limit value. • Available for Difference (addition) input & when Base channel (*) is DC input. • Setting range: Input range low limit to Difference (addition) indication high limit	

(*) If Difference (addition) input is selected for Input 1 block (Console software), CH1 (Input 1) will be the Base channel.

If Difference (addition) input is selected for Input 2 block (Console software), CH2 (Input 2) will be the Base channel.

8.3 CH2 Function Group
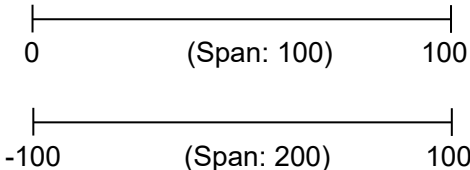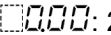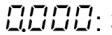
Not available for Timer spec or Potentiometer input spec.
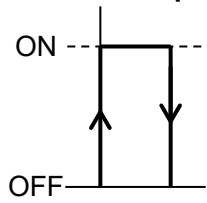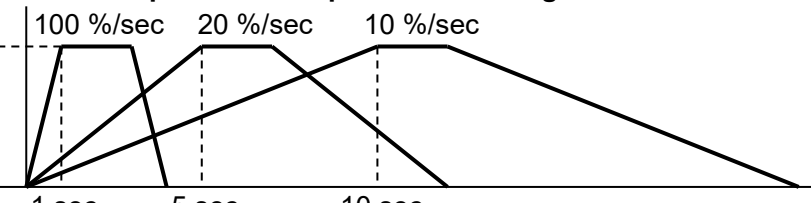
Not available if Heating/Cooling control output is selected from the Block function (Console software).

To enter the CH2 function group, follow the procedure below.

(1) F.n.c.2.   Press the ⟳ key in PV/SV Display Mode until the left characters appear.

(2) ꜱEnꜱ   Press the SET/RESET key. CH2 input type will appear.

Character	Name, Function, Setting Range	Factory Default
ꜱEnꜱ	**Input type** • Selects an input type.	Multi-range input: K (-200 to 1370℃) Infrared TC input: 180 to 250℃

	If External setting input spec is selected from the Block function (Console software), and if the SET/RESET key is pressed after selecting an input type, the unit reverts to PV/SV Display Mode.
	• **Multi-range input**:
	  Selects an input type from thermocouple (10 types), RTD (2 types), Direct current (2 types), and DC voltage (4 types), and the unit ℃/℉. See (Table 8.1-1) on p.24.
	• **Infrared thermocouple (TC) input**:
	  Selects an input type from 8 types of Infrared thermocouple (RD-300 series, RD-401) and the unit ℃/℉. See (Table 8.1-2) on p.24.	

ꜱⲄLH	**Scaling high limit** • Sets Scaling high limit value.	Multi-range input: 1370℃ Infrared TC input: 500℃

	• For thermocouple, RTD, Infrared TC inputs, this matches SV high limit value.
	• Setting range: Scaling low limit to Input range high limit
	[Note] If CH difference input is selected for Input 2 block (from the Block function of Console software), set the scaling high limit to span value, and set the scaling low limit to 0 (zero).
	  (e.g. 1) 1 to 5V DC input, 0 to 100
	    Scaling high limit: 100
	    Scaling low limit: 0 0 (Span: 100) 100
	  (e.g. 2) 1 to 5V DC input, -100 to 100
	    Scaling high limit: 200
	    Scaling low limit: 0 -100 (Span: 200) 100	

ꜱⲄLL	**Scaling low limit** • Sets Scaling low limit value.	Multi-range input: -200℃ Infrared TC input: -50℃
	• For thermocouple, RTD, Infrared TC inputs, this matches SV low limit value. • Setting range: Input range low limit to Scaling high limit	

dP□	**Decimal point place**
	• Selects decimal point place.
	  Available for DC voltage, current input
	• □□□0: No decimal point □□0.0: 1 digit after decimal point
	  □0.00: 2 digits after decimal point 0.000: 3 digits after decimal point
		No decimal point

FiLⲄ	**PV filter time constant** • Sets PV filter time constant. If the value is set too large, it affects control results due to the delay of response. • Setting range: 0.0 to 10.0 seconds	0.0 seconds

ꜱo□	**Sensor correction**
	• Sets the correction value for the sensor.
	• Setting range: -100.0 to 100.0℃ (℉),
	           DC voltage, current input: -1000 to 1000 (The placement of the decimal
	                              point follows the selection.)
	[Sensor correction function]
	  This corrects the input value from the sensor. When a sensor cannot be set at the exact location where control is desired, the sensor-measured temperature may deviate from the temperature in the controlled location. When using multiple controllers, sometimes the measured temperatures do not concur due to differences in sensor accuracy or dispersion of load capacities. In such a case, the control can be set at the desired temperature by adjusting the input value of sensors. However, it is effective within the input rating range regardless of the sensor correction value.
	  PV after sensor correction= Current PV+ (Sensor correction value)
	(e.g.) When PV is 198℃:
	    If sensor correction value is set to 2.0℃, the PV will be 198 + (2.0) = 200.0℃.
	    If sensor correction value is set to -2.0℃, the PV will be 198 + (-2.0) = 196.0℃.
		0.0℃

Character	Name, Function, Setting Range	Factory Default

E□□□	**Emissivity**
	 • Sets infrared emissivity.
	  Setting characters and PV are alternately indicated on the CH1 PV/SV Display.
	  Available only for Infrared thermocouple input
	 • Setting range: 0.100 to 1.000 times
		0.900 times

oLH□	**Output high limit** • Sets the output high limit value. Not available if output is in ON/OFF control. • Setting range: Output low limit to 100% (Direct current output: Output low limit to 105%)	100%
oLL□	**Output low limit** • Sets the output low limit value. Not available if output is in ON/OFF control. • Setting range: 0% to Output high limit (Direct current output: -5% to Output high limit)	0%
HYS□	**Output ON/OFF hysteresis** • Sets the output ON/OFF hysteresis. Available only when output is in ON/OFF control. • Setting range: 0.1 to 100.0℃ (℉), DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection.)	1.0℃

orAr	**Output rate-of-change**
	 • Sets the change value of output MV for 1 second.
	 • Setting the value to 0 disables the function.
	  Not available if the output is in ON/OFF control.
	 • Setting range: 0 to 100 %/second
	 [Output rate-of-change]
	  For Heating control, if PV is lower than SV, output is generally turned from OFF to ON as shown in (Fig. 8.3-1).
	  If Output rate-of-change is set, the output can be changed by the rate-of-change (Fig. 8.3-2).
	  This control is suitable for high temperature heaters (which are made from molybdenum, tungsten or platinum, etc., and used at approx. 1500 to 1800℃) which are easily burnt out from turning on electricity rapidly.
	
	 ● **Usual output** ● **Output when Output rate-of-change is set**
	 100 %/sec 20 %/sec 10 %/sec
	 ON
	 OFF
	 1 sec 5 sec 10 sec
	 (Fig. 8.3-1) (Fig. 8.3-2)
		0 %/second

Pr-Sr	**Output when input errors occur** • Sets the output MV when input errors occur. Available only for direct current output type. • Setting range: Output low limit to Output high limit	0.0%

A1Fn	**Alarm 1 type**
	 • Selects Alarm 1 type.
	 Note: If Alarm 1 type is changed, Alarm 1 value defaults to 0 (0.0).
	  − − − −: No Alarm action
	  H□□□: High limit alarm
	  L□□□: Low limit alarm
	  HL□□: High/Low limits alarm
	  ui d□: High/Low limit range alarm
	  AS□: Process high alarm
	  rAS□: Process low alarm
	  H□□u: High limit with standby alarm
	  L□□u: Low limit with standby alarm
	  HL□u: High/Low limits with standby alarm
		No Alarm action

Character	Name, Function, Setting Range	Factory Default
A2Fn	**Alarm 2 type** • Selects Alarm 2 type. (Refer to Alarm 1 type.) • Available only when the AO or AW option is added.	No Alarm action
A3Fn	**Alarm 3 type** • Selects Alarm 3 type. (Refer to Alarm 1 type.) Available only when the AO option is added.	No Alarm action
A4Fn	**Alarm 4 type** • Selects Alarm 4 type. (Refer to Alarm 1 type.) Available only when the AO option is added.	No Alarm action
A1HY	**Alarm 1 hysteresis** • Sets Alarm 1 hysteresis. • Not available if No Alarm action is selected in [Alarm 1 type] • Setting range: 0.1 to 100.0℃ (℉) DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection)	1.0℃
A2HY	**Alarm 2 hysteresis** • Sets Alarm 2 hysteresis. (Refer to Alarm 1 hysteresis.) • Available only when the AO or AW option is added.	1.0℃
A3HY	**Alarm 3 hysteresis** • Sets Alarm 3 hysteresis. (Refer to Alarm 1 hysteresis.) • Available only when the AO option is added.	1.0℃
A4HY	**Alarm 4 hysteresis** • Sets Alarm 4 hysteresis. (Refer to Alarm 1 hysteresis.) • Available only when the AO option is added.	1.0℃
A1dY	**Alarm 1 delay time** • Sets Alarm 1 action delay time. 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 in [Alarm 1 type] • Setting range: 0 to 9999 seconds	0 seconds
A2dY	**Alarm 2 delay time** • Sets Alarm 2 action delay time. (Refer to Alarm 1 delay time.) • Available only when the AO or AW option is added.	0 seconds
A3dY	**Alarm 3 delay time** • Sets Alarm 3 action delay time. (Refer to Alarm 1 delay time.) • Available only when the AO option is added.	0 seconds
A4dY	**Alarm 4 delay time** • Sets Alarm 4 action delay time. (Refer to Alarm 1 delay time.) • Available only when the AO option is added.	0 seconds

E1Fn	**Event 1 output**
	• Selects Event 1 output.
	  Available only when the AO option is added.
	  • ALm☐ : Alarm
	    LP☐☐ : Loop break alarm
	    ALLP : Alarm + Loop break alarm
		Alarm

E2Fn	**Event 2 output**
	• Selects Event 2 output.
	  Available only when the AO option or AW option is added.
	  • ALm☐ : Alarm
	    LP☐☐ : Loop break alarm
	    ALLP : Alarm + Loop break alarm
	    Hb☐☐ : Heater burnout alarm
	    ALHb : Alarm + Heater burnout alarm
	    LPHb : Loop break alarm + Heater burnout alarm
	    ALL☐ : Alarm + Loop break alarm + Heater burnout alarm
		Alarm

Character	Name, Function, Setting Range	Factory Default
`rArU`	**SV rise rate**	0 ℃/minute
	• Sets SV rise rate (rising value for 1 minute). Setting to 0 or 0.0 disables the function. • Setting range: 0 to 9999 ℃/min. (℉/min.) Thermocouple, RTD inputs with a decimal point: 0.0 to 999.9 ℃/min. (℉/min.) DC voltage, current inputs: 0 to 9999/min. (The placement of the decimal point follows the selection.)	
`rArd`	**SV fall rate**	0 ℃/minute
	• Sets SV fall rate (falling value for 1 minute). Setting to 0 or 0.0 disables the function. • Setting range: 0 to 9999 ℃/min. (℉/min.) Thermocouple, RTD inputs with a decimal point: 0.0 to 999.9 ℃/min. (℉/min.) DC voltage, current inputs: 0 to 9999/min. (The placement of the decimal point follows the selection.)	
`conT`	**Direct/Reverse action**	Reverse action
	• Selects either Reverse (Heating) or Direct (Cooling) control action. • `HEAT`: Reverse action (Heating) `cooL`: Direct action (Cooling)	
`AT_b`	**AT bias**	20℃
	• Sets bias value for AT. (See Section "12.1 AT" on p.53.) • Available for PID control. Not available for DC voltage, current inputs. • Setting range: 0 to 50℃ (0 to 100℉) Thermocouple, RTD input with a decimal point: 0.0 to 50.0℃ (0.0 to 100.0℉)	
`dFLH`	**Difference (addition) indication high limit**	9999
	• Sets difference (addition) indication high limit value. • Available for Difference (addition) input & when Base channel (*) is DC input. • Setting range: Difference (addition) indication low limit to Input range high limit	
`dFLL`	**Difference (addition) indication low limit**	-1999
	• Sets difference (addition) indication low limit value. • Available for Difference (addition) input & when Base channel (*) is DC input. • Setting range: Input range low limit to Difference (addition) indication high limit	

(*) If Difference (addition) input is selected for Input 1 block (Console software), CH1 (Input 1) will be the Base channel.
If Difference (addition) input is selected for Input 2 block (Console software), CH2 (Input 2) will be the Base channel.

8.4 Basic Function Group

To enter the Basic function group, follow the procedure below.

(1) $o\Gamma.E.\Gamma$ Press the ⟳ key in PV/SV Display Mode until the left characters appear.

(2) $Loct$ Press the ⬚ key. The 'Set value lock' will appear.

Character	Name, Function, Setting Range	Factory Default

$Loct$	**Set value lock**
	 • Locks the set values to prevent setting errors.
	   Selects Unlock or Lock.
	 • When Lock is selected, AT and Auto-reset cannot be carried out.
	 • $----$ (Unlock) : All set values can be changed.
	   $Loc\ 1$ (Lock 1) : None of the set values can be changed.
	   $Loc2$ (Lock 2) : Only SV can be changed.
	   $Loc3$ (Lock 3) : All set values except input type can be changed.
	      However, they revert to their previous value after the power is turned off because they are not saved in the non-volatile memory.
	      Do not change any setting item in CH1, CH2 function groups. If any item in CH1, CH2 function groups is changed, it will affect other setting items such as the SV (desired value) and Alarm value.
	      Be sure to select Lock 3 when changing the set value frequently via software communication. (If a value set via software communication is the same as the value before the setting, the value will not be written in non-volatile memory.)
		Unlock

$c\bar{n}4L$	**Communication protocol**
	 • Selects communication protocol.
	 • Available when the Serial communication (C5 option) is added.
	 • $no\bar{n}L$: Shinko protocol
	   $\bar{n}odA$: MODBUS ASCII mode
	   $\bar{n}od\Gamma$: MODBUS RTU mode
		Shinko protocol

$c\bar{n}no$	**Instrument number** • Sets the instrument number of this unit. (The instrument numbers should be set one by one when multiple instruments are connected in Serial communication, otherwise communication is impossible.) • Available when the Serial communication (C5 option) is added. • Setting range: 0 to 95	0

$c\bar{n}4P$	**Communication speed**
	 • Selects a communication speed equal to that of the host computer.
	 • Available when the Serial communication (C5 option) is added.
	 • $\Box\Box96$: 9600 bps
	   $\Box 192$: 19200 bps
	   $\Box384$: 38400 bps
		9600 bps

$c\bar{n}F\Gamma$	**Data bit/Parity**
	 • Selects data bit and parity.
	 • Available when the Serial communication (C5 option) is added.
	 • $8non$: 8 bits/No parity
	   $7non$: 7 bits/No parity
	   $8E4n$: 8 bits/Even parity
	   $7E4n$: 7 bits/Even parity
	   $8odd$: 8 bits/Odd parity
	   $7odd$: 7 bits/Odd parity
		7 bits/Even parity

$c\bar{n}4\Gamma$	**Stop bit** • Selects the stop bit. • Available when the Serial communication (C5 option) is added. • $\Box\Box\Box 1$: 1 $\Box\Box\Box 2$: 2	1

Character	Name, Function, Setting Range	Factory Default
$rE\overline{n}\Gamma$	**Remote/Local** • SV can be set with either the Remote (Remote operation) or Local method (keypad operation). • Available when the External setting input is selected from the Block function (Console software). • $L\,\sigma cL$: Local (The SV can be set by the front keypad as usual.) $rE\overline{n}\Gamma$: Remote (The SV can be set in analog by external remote operation.)	Local
$r\Gamma LH$	**External setting scaling high limit** • Sets the high limit value when External setting input is selected from the Block function (Console software). (e.g. For 4 to 20 mA DC, the value corresponds to 20 mA input.) When the Cascade control spec is selected, this sets the high limit value corresponding to the master (CH2) MV 100%. For Potentiometer input spec, this sets the Potentiometer scaling high limit value. Available for Potentiometer input spec or when External setting input or Cascade control spec is selected from the Block function (Console software). • Setting range: External setting scaling low limit to Input range high limit	1370℃
$r\Gamma LL$	**External setting scaling low limit** • Sets the low limit value when External setting input is selected from the Block function (Console software). (e.g. For 4 to 20 mA DC, the value corresponds to 4 mA input.) When the Cascade control spec is selected, this sets the low limit value corresponding to the master (CH2) MV 0%. For Potentiometer input spec, this sets the Potentiometer scaling low limit value. Available for Potentiometer input spec or when External setting input or Cascade control spec is selected from the Block function (Console software). • Setting range: Input range low limit to External setting scaling high limit	-200℃
$r\overline{n}\_b$	**Remote bias** • Sets remote bias value. During remote action, the control desired value adds SV to the remote bias value. Available when External setting input is selected from the Block function (Console software). • Setting range: Converted value of ±20% of the input span DC voltage, current inputs: ±20% of the scaling span (The placement of the decimal point follows the selection.)	0℃

$\Gamma r\sigma4$	**Transmission output type**
	 • Selects transmission output type.
	 Available only when Transmission output is selected from the Block function (Console software).
	 • $P8\boxed{}$: PV transmission
	  $48\boxed{}$: SV transmission
	  $\overline{n}8\boxed{}$: MV transmission
		Selection from the Block function

ΓrLH	**Transmission output high limit** • Sets the Transmission output high limit value. (For 4 to 20 mA DC, the value correponds to 20 mA output.) Available when Transmission output is selected from the Block function (Console software). • Setting range: PV, SV transmission: Transmission output low limit to Input range high limit MV transmission: Transmission output low limit to 105.0 (%)	PV, SV transmission: 1370℃ MV transmission: 100.0%
ΓrLL	**Transmission output low limit** • Sets the Transmission output low limit value. (For 4 to 20 mA DC, the value correponds to 4 mA output.) Available when Transmission output is selected from the Block function (Console software). • Setting range: PV, SV transmission: Input range low limit to Transmission output high limit MV transmission: -5.0% to Transmission output high limit	PV, SV transmission: -200℃ MV transmission: 0.0%

Character	Name, Function, Setting Range	Factory Default
FUnc	**Timer action**	Control timer
	• Selects the timer action. (Refer to the 'Control timer' and 'Delay timer' on p.38) Available for Timer spec. • *ΓI ΠΕ* : Control timer *ΓI Π I*: Delay timer 1 *ΓI Π2*: Delay timer 2	
Π_Y	**Timer action time unit**	Minute
	• Selects the time unit for the Control timer, Delay timer 1 and Delay timer 2. Available only for Timer spec. • *ΠI n*: Minute *SEc*: Second	
on_Γ	**ON delay timer**	0
	• Sets ON delay timer time. Available for Timer spec. Available when Delay timer 1 or 2 is selected in [Timer action]. • Setting range: 0 to 9999 (Time unit follows the selection in [Timer action time unit].)	
oFFΓ	**OFF delay timer**	0
	• Sets OFF delay timer time. Available for Timer spec. Available when Delay timer 1 or 2 is selected in [Timer action]. • Setting range: 0 to 9999 (Time unit follows the selection in [Timer action time unit].)	
ΓΠSΒ	**Control timer start temperature**	0℃
	• Sets Control timer start temperature. Available for Timer spec. Available when Control timer is selected in [Timer action]. • Setting range: Scaling low limit to Scaling high limit	
ΓΠ_Y	**Control timer time**	0
	• Sets the control time after temperature achieves Control Timer Start temperature. Available for Timer spec. Available when Control timer is selected in [Timer action]. • Setting range: 0 to 9999 (Time unit follows the selection in [Timer action time unit].)	
LIGΓ	**Auto-light function**	Disabled
	• Selects Auto-light Enabled/Disabled. • *----*: Disabled *USE*: Enabled	

Character	Name, Function, Setting Range	Factory Default
di5P	**Display selection**	CH1 PV / CH2 PV

• Selects items to be indicated on the PV/SV Display.
 PV (SV) switches while ▽ is pressed in PV/SV Display Mode. However, if CH1 or
 CH2 difference or addition inclusive item is selected, PV (SV) does not switch.
• Selection range:

	CH1 PV/SV Display	CH2 PV/SV Display
PV□□	CH1 PV (*)	CH2 PV (*)
SV□□	CH1 SV	CH2 SV
cH□1	CH1 PV (*)	CH1 SV
cH□2	CH2 PV (*)	CH2 SV
5IP1	CH1 difference (addition)	CH1 PV
5IP2	CH1 difference (addition)	CH2 PV
P151	CH1 PV	CH1 difference (addition)
P251	CH2 PV	CH1 difference (addition)
52P1	CH2 difference (addition)	CH1 PV
52P2	CH2 difference (addition)	CH2 PV
P152	CH1 PV	CH2 difference (addition)
P252	CH2 PV	CH2 difference (addition)
nonE	No indication	No indication

 (*) If CH difference or addition is selected for Input 1 (Input 2) block from the Block
   function (Console software), CH1 and CH2 PV/SV Displays do not indicate CH1 PV
   (CH2 PV) but CH difference or addition value.

For the Timer spec, if any item except "No indication" is selected, the CH2 PV/SV Display
will indicate timer time.

If CH2 inclusive item is selected in [Display selection], the CH2 PV/SV Display will turn off
(ineffective) for Potentiometer input spec or if Heating/Cooling control output spec, External
setting input spec or Transmission output spec is selected from the Block function
(Console software).

Character	Name, Function, Setting Range	Factory Default
TImE	**Indication time**	00.00

• Sets the indication time of the displays from the final key operation till displays turn off.
 Displays remain lit when setting to 00.00.
 Lights when any key is pressed while in unlit status.
• Setting range:
 00.00 (Remains lit)
 00.01 to 60.00 (Minute.Second)

Character	Name, Function, Setting Range	Factory Default
r_Tm	**Input sampling period**	125 ms

• Selects the input sampling period.
• □□25 : 25 ms
  □125 : 125 ms
  □250 : 250 ms

Character	Name, Function, Setting Range	Factory Default
IZEr	**Potentiometer input zero adjustment**	-200℃

• Adjusts potentiometer input zero (External setting scaling low limit value).
 Available only for the Potentiometer input spec.
• **Adjustment method**:
 Turn the potentiometer to the MIN side (counterclockwise) until the pointer matches the
 minimum value, and press the ▽ key. Automatically the potentiometer input zero will be
 adjusted.

Character	Name, Function, Setting Range	Factory Default
I5PA	**Potentiometer input span adjustment**	1370℃

• Adjusts potentiometer input span (External setting scaling high limit value).
 Available only for the Potentiometer input spec.
• **Adjustment method**:
 Turn the potentiometer to the MAX side (clockwise) until the pointer matches the maximum
 value, and press the △ key. The potentiometer input span will be adjusted automatically.

● **Control Timer**

Control timer starts when CH1 input exceeds Control timer start temperature, and after Control timer set time has passed, the control (Output low limit value for direct current output) and Alarm action stop. However, for the Direct control action, Control timer starts when CH1 input drops below the Control timer start temperature.

CH1 PV/SV Display indicates (lights) CH1 PV, and CH2 PV/SV Display flashes timer remaining time. To start control again after timer time is up, turn the power ON again or press the [SET/RESET] key for 1 second. If the Control timer time is set to 0 (zero), the Control timer will not work.

Even though CH1 input does not reach Control timer start temperature, the Control timer can start by the DI input ON (Closed) or by pressing the [SET/RESET] key for 1 second.

If the Control timer set value has been changed while the Control timer is working, the setting will come into effect next time.

If the Control timer time has passed during AT, the AT will be forcibly stopped, and each parameter returns to the previous value at which AT was performed.

● **Delay Timer**

When Delay timer 1 is selected:

ON delay timer starts when DI input is ON (Closed), and timer remaining time will be indicated on the CH2 PV/SV Display.

Timer output turns ON after ON delay timer time has passed.

After that, if DI input is turned OFF (Open), OFF delay timer starts, and timer remaining time will be indicated on the CH2 PV/SV Display.

Timer output turns OFF after OFF delay timer time has passed.

When Delay timer 2 is selected:

Control and Alarm action start/stop are interlocked with the timer output.

If Delay timer is restarted, Alarm action will return to its initial status (for the Alarm with standby, it returns to standby status again).

Between DI terminals Open: OFF
Between DI terminals Closed: ON
Circuit current when closed: 12 mA

Delay timer 1

ON DLY : ON delay timer setting
OFF DLY: OFF delay timer setting

(Fig. 8.4-2)

Delay timer 2

ON DLY : ON delay timer setting
OFF DLY : OFF delay timer setting
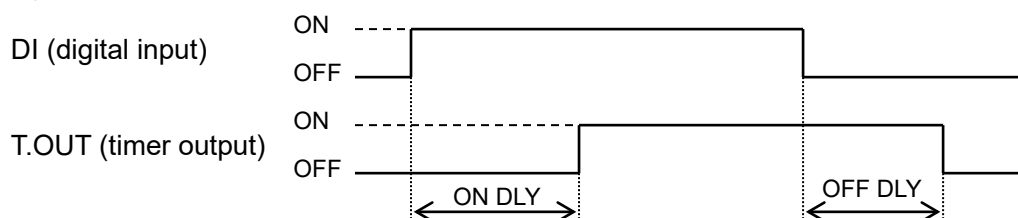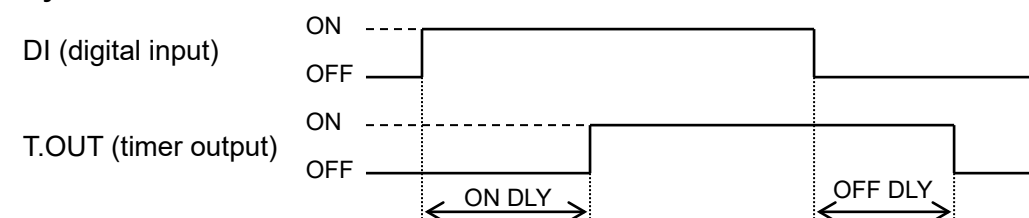
(Fig. 8.4-3)

9. Settings

9.1 SV Group

Not available for Potentiometer input spec.

To proceed to the SV group, follow the procedure below.

(1) ㄣ . ☐   To enter the SV group, press the ⊚ key once in PV/SV Display Mode.

(2) ㄣ /☐☐   Press the [SET/RESET] key. 'CH1 SV' will appear.

Character	Name, Function, Setting Range	Factory Default

ㄣ /☐☐	**CH1 SV**
	• Sets CH1 SV.
	  If Cascade control spec is selected from the Block function (Console software), CH1 SV will be AT point for slave.
	• Setting range: CH1 scaling low limit to CH1 scaling high limit
	  For Cascade control spec: External setting scaling low limit to External setting scaling high limit
	  For Difference (addition) input & when Base channel (*) is DC input: CH1 difference (addition) indication low limit to CH1 difference (addition) indication high limit
		0℃

ㄣ2☐☐	**CH2 SV**
	• Sets CH2 SV.
	• Not available for Timer spec.
	  Not available if Heating/Cooling control output or External setting input is selected from the Block function (Console software).
	• Setting range: CH2 scaling low limit to CH2 scaling high limit
	  For Difference (addition) input & when Base channel (*) is DC input: CH2 difference (addition) indication low limit to CH2 difference (addition) indication high limit
		0℃

(*) If Difference (addition) input is selected for Input 1 block (Console software), CH1 (Input 1) will be the Base channel.

If Difference (addition) input is selected for Input 2 block (Console software), CH2 (Input 2) will be the Base channel.

9.2 CH1 Parameter Group

To proceed to CH1 parameter group, follow the procedure below.

(1) ⎕⎓⎓⎕⎓ *PI.d I*　　Press the ⭕ key twice in PV/SV Display Mode. The unit will proceed to the CH1 parameter group.

(2) *oFF⎕*　　Press the [SET/RESET] key. 'Control Allowed/Prohibited' will appear.

Character	Name, Function, Setting Range	Factory Default
oFF⎕	**Control Allowed/Prohibited** • Selects Control Allowed or Prohibited. 　When Control Prohibited is selected, the unit reverts to PV/SV Display Mode by pressing the [SET/RESET] key. • *on⎕*: Control Allowed 　*oFF⎕*: Control Prohibited	Control Allowed
AUˌ o	**Auto/Manual control** • Selects Automatic or Manual control. • *AUˌ o*: Automatic control 　*ᴍAnU*: Manual control	Automatic control
ᴍAnU	**Manual control MV** • Sets manual control MV. 　If the [SET/RESET] key is pressed after manual control MV is set, the unit will revert to PV/SV Display Mode. 　Not available if automatic control is selected. 　Factory Default of manual control is the MV of the automatic control. (After the power is turned on, the preset MV will be used.) • Setting range: CH1 output low limit to CH1 output high limit	MV of the automatic control
Aˌ⎕	**AT/Auto-reset Perform/Cancel** • Selects AT Perform/Cancel or Auto-reset Perform/Cancel. 　If the [SET/RESET] key is pressed after "AT/Auto-reset Perform" is selected, the unit will revert to PV/SV Display Mode. • If the AT is cancelled during the process, P, I, D and ARW values revert to the previous value at which AT was performed. • AT will be forced to stop if it has not been completed within 4 hours. • Auto-reset can be performed when the P (I=0, D=0) or PD (I=0) is control action. 　Auto-reset is finished in approximately 4 minutes. It cannot be released while performing this function. • ----:　　　　AT/Auto-reset Cancel 　*Aˌ⎕*/ *rˌEˌ*:　AT/Auto-reset Perform	AT/Auto-reset Cancel
P⎕⎕⎕	**Proportional band** • Sets the proportional band. • Control action becomes ON/OFF control when set to 0 or 0.0. • If Heating/Cooling control output is selected from the Block function (Console software), this will be OUT1 proportional band. • Setting range: 0 to 9999℃ (℉) 　Range with a decimal point: 0.0 to 999.9℃ (℉) 　DC voltage, current inputs: 0.0 to 999.9% [Corresponds to the scaling span. 　For Difference (addition) input & when Base channel is DC input: Corresponds to the Difference (addition) indication span.]	10℃
P_b⎕	**OUT2 proportional band** • Sets OUT2 proportional band. • OUT2 becomes ON/OFF control when OUT1 proportional band is set to 0 or 0.0. • Available only when Heating/Cooling control output is selected from the Block function (Console software). • Setting range: 0.0 to 10.0 times OUT1 (CH1) proportional band	1.0 times
I ⎕⎕⎕	**Integral time** • Sets the integral time. • Setting the value to 0 disables the function. • When PD (I=0) is control action, Auto-reset can be performed, or Manual reset value can be set. • Not available for ON/OFF control. • Setting range: 0 to 3600 seconds	200 seconds

Character	Name, Function, Setting Range	Factory Default
d□□□	**Derivative time** • Sets the derivative time. • Setting the value to 0 disables the function. • Not available for ON/OFF control. • Setting range: 0 to 3600 seconds	50 seconds
Π□□□	**ARW** • Sets the ARW (Anti-reset windup). • Available only when PID is the control action. • Setting range: 0 to 100%	50%
r5EΓ	**Manual reset value** • Sets the Manual reset value. • Available when P (I=0, D=0) or PD (I=0) is the control action. • Setting range: -100.0 to 100.0℃ (℉) 　DC voltage, current inputs: -1000 to 1000 (The placement of the decimal point follows the selection.)	0.0℃
c□□□	**Proportional cycle** • Sets the proportional cycle. • Not available for ON/OFF control or direct current output type. 　This will be OUT1 proportional cycle when Heating/Cooling control output is selected from the Block function (Console software). • Setting range: 1 to 120 seconds	Relay contact output: 30 seconds Non-contact voltage output: 3 seconds
c_b□	**OUT2 proportional cycle** • Sets OUT2 proportional cycle. • Available only when Heating/Cooling control output is selected from the Block function (Console software). 　Not available for direct current output type or if OUT2 is in ON/OFF control. • Setting range: 1 to 120 seconds	Relay contact output: 30 seconds Non-contact voltage output: 3 seconds
A1□□	**Alarm 1 value** • Sets Alarm 1 value. • 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 in [Alarm 1 type]. • Setting range:	0℃

(Table 9.2-1)

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

*1: For DC voltage, current input, the input span is the same as the scaling span.
　　For Difference (addition) input & when Base channel is DC input: Corresponds to the Difference (addition) indication span.
*2: For DC voltage, current inputs, input range low (or high) limit value is the same as the scaling low (or high) limit value.
　　For Difference (addition) input & when Base channel is DC input: Corresponds to the Difference (addition) indication low (or high) limit value.
• When input has a decimal point, the negative low limit value is –199.9, and the positive high limit value is 999.9.
• All Alarm actions except process alarm are the ±deviation setting from the SV.

Character	Name, Function, Setting Range	Factory Default
$A2$	**Alarm 2 value** • Sets Alarm 2 value. (Refer to Alarm 1 value.) Available only when the AO or AW option is added.	0℃
$A3$	**Alarm 3 value** • Sets Alarm 3 value. (Refer to Alarm 1 value.) Available only when the AO option is added.	0℃
$A4$	**Alarm 4 value** • Sets Alarm 4 value. (Refer to Alarm 1 value.) Available only when the AO option is added.	0℃

H
 	
H and CT1 current, alternating indication on the PV/SV Display
	Heater burnout alarm 1 value
	• Sets the heater current value for Heater burnout alarm 1 (CT1).
	  Setting to 0.0 disables the alarm.
	  CT1 current value and character H are indicated alternately on the PV/SV Display.
	  When the output is ON, the CT1 current value is updated.
	  When the output is OFF, the WCL-13A memorizes the previous value when the output was ON.
	• It is recommended to set approx. 80% of the heater current value in consideration of the voltage fluctuation.
	• Available only when Heater burnout alarm (W, W3 option) is added.
	• Setting range:
	  Rated current 20 A: 0.0 to 20.0 A, 100 A: 0.0 to 100.0 A
		0.0 A

$H2$
 	
$H2$ and CT2 current, alternating indication on the PV/SV Display
	Heater burnout alarm 2 value
	• Sets the heater current value for Heater burnout alarm 2 (CT2).
	  Setting to 0.0 disables the alarm.
	  CT2 current value and characters $H2$ are indicated alternately on the PV/SV Display.
	  When the output is ON, the CT2 current value is updated.
	  When the output is OFF, the WCL-13A memorizes the previous value when the output was ON.
	• It is recommended to set approx. 80% of the heater current value in consideration of the voltage fluctuation.
	• Available only when Heater burnout alarm (W3 option) is added.
	• Setting range:
	  Rated current 20 A: 0.0 to 20.0 A, 100 A: 0.0 to 100.0 A
		0.0 A

LP_H	**Loop break alarm band**
	• Sets the temperature to assess the Loop break alarm.
	• Setting to 0 (zero) disables the alarm.
	• Setting range: 0 to 150℃（℉）
	  Range with a decimal point: 0.0 to 150.0℃（℉）
	  DC voltage, current inputs: 0 to 1500 (The placement of the decimal point follows the selection)
		0℃

LP_T	**Loop break alarm time** • Sets the time to assess the Loop break alarm. • Setting to 0 (zero) disables the alarm. • Setting range: 0 to 200 minutes	0 minutes

9.3 CH2 Parameter Group

Not available for Timer spec or Potentiometer input spec.

Not available if Heating/Cooling control output or External setting input is selected from the Block function (Console software).

To proceed to CH2 parameter group, follow the procedure below.

(1) *PI.d2*   Press the ⊙ key 3 times in PV/SV Display Mode. The unit will proceed to the CH2 parameter group

(2) *oFF*   Press the 🔲 key. 'Control Allowed/Prohibited' will appear.

Character	Name, Function, Setting Range	Factory Default
oFF	**Control Allowed/Prohibited**	Control Allowed
	• Selects Control Allowed/Prohibited. When Control Prohibited is selected, the unit reverts to PV/SV Display Mode by pressing the 🔲 key. • *on*: Control Allowed *oFF*: Control Prohibited	
AUTo	**Auto/Manual control**	Automatic control
	• Selects Automatic or Manual control. • *AUTo*: Automatic control *MAnU*: Manual control	
MAnU	**Manual control MV**	MV of the automatic control
	• Sets manual control MV. If the 🔲 is pressed after the manual control MV has been set, the unit will revert to PV/SV Display Mode. Not available if automatic control is selected. Factory Default of manual control is the MV of the automatic control. (After the power is turned on, the preset MV will be used.) • Setting range: CH2 output low limit to CH2 output high limit	
Ar	**AT/Auto-reset Perform/Cancel**	AT/Auto-reset Cancel
	• Selects AT Perform/Cancel or Auto-reset Perform/Cancel. • If the AT is cancelled during the process, P, I, D and ARW values revert to the previous value at which AT was performed. • AT will be forced to stop if it has not been completed within 4 hours. • Auto-reset can be performed when P (I=0, D=0) or PD (I=0) is control action. Auto-reset is finished in approximately 4 minutes. It cannot be released while performing this function. • - - - -: AT/Auto-reset Cancel *Ar* / *rhET*: AT/Auto-reset Perform	
P	**Proportional band**	10℃
	• Sets the proportional band. • Control action becomes ON/OFF control when set to 0 or 0.0. • Setting range: 0 to 9999℃ (℉), Range with a decimal point: 0.0 to 999.9℃ (℉) DC voltage, current inputs: 0.0 to 999.9% [Corresponds to the scaling span. For Difference (addition) input & when Base channel is DC input: Corresponds to the Difference (addition) indication span.]	
I	**Integral time**	200 seconds
	• Sets the integral time. • Setting the value to 0 disables the function. • When PD (I=0) is control action, Auto-reset can be performed, or Manual reset value can be set. • Not available for ON/OFF control. • Setting range: 0 to 3600 seconds	
d	**Derivative time**	50 seconds
	• Sets the derivative time. • Setting the value to 0 disables the function. • Not available for ON/OFF control. • Setting range: 0 to 3600 seconds	
A	**ARW**	50%
	• Sets the ARW (Anti-reset windup). • Available only when PID is the control action. • Setting range: 0 to 100%	

Character	Name, Function, Setting Range	Factory Default
⌐५ЕΓ	**Manual reset value** • Sets the Manual reset value. • Available when P (I=0, D=0) or PD (I=0) is the control action. • Setting range: -100.0 to 100.0℃ （℉） 　DC voltage, current input: -1000 to 1000 (The placement of the decimal point follows the selection.)	0.0℃
c☐☐☐	**Proportional cycle** • Sets the proportional cycle.	Relay contact output: 30 seconds Non-contact voltage output: 3 seconds
	• Not available for ON/OFF control or direct current output type. • Setting range: 1 to 120 sec	
A ꓼ☐☐	**Alarm 1 value** • Sets Alarm 1 value. • 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 in [Alarm type]. • Setting range: See (Table 9.2-1) on p.41.	0℃
A₂☐☐	**Alarm 2 value** • Sets Alarm 2 value. (Refer to Alarm 1 value.) 　Available only when the AO or AW option is added.	0℃
A₃☐☐	**Alarm 3 value** • Sets Alarm 3 value. (Refer to Alarm 1 value.) 　Available only when the AO option is added.	0℃
A₄☐☐	**Alarm 4 value** • Sets Alarm 4 value. (Refer to Alarm 1 value.) 　Available only when the AO option is added.	0℃
H☐☐☐ H and CT3 current, alternating display on the PV/SV Display	**Heater burnout alarm 1 value** • Sets the heater current value for Heater burnout alarm 1 (CT3). 　Setting to 0.0 disables the alarm. 　CT3 current value and character H are alternately indicated on the PV/SV Display. 　When the output is ON, the CT3 current value is updated. 　When the output is OFF, the WCL-13A memorizes the previous value when the output was ON. • It is recommended to set approx. 80% of the heater current value in consideration of the voltage fluctuation. • Available only when Heater burnout alarm (W, W3 option) is added. • Setting range: 　Rated current 20 A: 0.0 to 20.0 A,　100 A: 0.0 to 100.0 A	0.0 A
H₂☐☐ H₂ and CT4 current, alternating display on the PV/SV Display	**Heater burnout alarm 2 value** • Sets the heater current value for Heater burnout alarm 2 (CT4). 　Setting to 0.0 disables the alarm. 　CT4 current value and characters H₂ are indicated alternately on the PV/SV Display. 　When the output is ON, the CT4 current value is updated. 　When the output is OFF, the WCL-13A memorizes the previous value when the output was ON. • It is recommended to set approx. 80% of the heater current value in consideration of the voltage fluctuation. 　Available only when Heater burnout alarm (W3 option) is added. • Setting range: 　Rated current 20 A: 0.0 to 20.0 A,　100 A: 0.0 to 100.0 A	0.0 A

Character	Name, Function, Setting Range	Factory Default

LP_H	**Loop break alarm band**
	• Sets the temperature to assess the Loop break alarm.
	• Setting to 0 (zero) disables the alarm.
	• Setting range: 0 to 150℃ (℉),
	   Range with a decimal point: 0.0 to 150.0℃ (℉)
	   DC voltage, current inputs: 0 to 1500 (The placement of the decimal point follows the selection)
		0℃

LP_r	**Loop break alarm time** • Sets the time to assess the Loop break alarm. • Setting to 0 (zero) disables the alarm. • Setting range: 0 to 200 minutes	0 minutes

10. Operation

10.1 Starting Operation

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

(1) Switch power supply to the WCL-13A ON.

For approx. 4 seconds after the power is switched ON, the sensor input characters and temperature unit are indicated on the PV/SV Display of each channel. See (Table 8.1-1), (Table 8.1-2) on . During this time, all outputs and LED indicators are in OFF status.

After that, a setting item selected in [Display selection] will be indicated.

(2) Input each set value.

Refer to "9. Settings".

(3) Turn the load circuit power ON.

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

10.2 Switching PV/SV

To indicate SV constantly:

To indicate SV constantly, select "�ㄴㅂ⬜⬜" in [Display selection] in Basic function group as follows.

(1) ⌐.Ε.⌐ Press the ▢ key several times in PV/SV Display Mode until the left characters appear.

(2) ᗡ! ㄴㄹ Press the ▢ key multiple times until the left characters (Display selection) appear.

(3) Select "ㄴㅂ⬜⬜ (CH1 SV/CH2 SV)" by pressing the △ key.

(4) Press the ▢ key several times. The unit reverts to PV/SV Display Mode, and CH1 and CH2 displays always indicate SV.

To indicate SV temporarily:

Press the ▽ key in PV/SV Display Mode.

While the ▽ key is pressed, the PV/SV indications will switch.

PV(SV) does not switch if a CH1, CH2 difference or addition inclusive item is selected in [Display selection] in the Basic function group.

10.3 Indicating MV

To indicate MV:

Press the ▢ key for 3 seconds in PV/SV Display Mode.

Keep pressing the key even though the SV group appears during the process.

The 1st decimal point from the right flashes in 500 ms cycles during MV indication.

To cancel MV indication:

Press the ▢ key again, or turn the power to the unit OFF and ON again.

10.4 AT Perform/Cancel

How to perform AT (e.g. CH1)

AT can be performed in [AT/Auto-reset Perform/Cancel] in the CH1 parameter group.

(1) P!.ᗡ! Press the ▢ key twice in PV/SV Display Mode. The unit proceeds to the CH1 parameter group.

(2) Ηⲅ⬜⬜ Press the ⟦SET/RESET⟧ key 3 times. "AT/Auto-reset Perform/Cancel" will appear.

(3) Select "Ηⲅ⬜⬜ (AT Perform)" with the △ key.

(4) Press the ⟦SET/RESET⟧ key. The unit reverts to PV/SV Display Mode, and initiates AT.

The AT indicator flashes while AT is performing.

How to cancel AT (e.g. CH1)

AT can be cancelled in [AT/Auto-reset Perform/Cancel] in the CH1 parameter group.

(1) P!.ᗡ! Press the ▢ key twice in PV/SV Display Mode. The unit proceeds to the CH1 parameter group.

(2) Ηⲅ⬜⬜ Press the ⟦SET/RESET⟧ key 3 times. "AT/Auto-reset Perform/Cancel" will appear.

(3) Select "- - - - (AT Cancel)" with the ▽ key.

(4) Press the ⟦SET/RESET⟧ key multiple times. The unit reverts to PV/SV Display Mode, and AT stops.

If AT is cancelled during this process, each value of P, I, D and ARW reverts to the values before the Auto-tuning was performed.
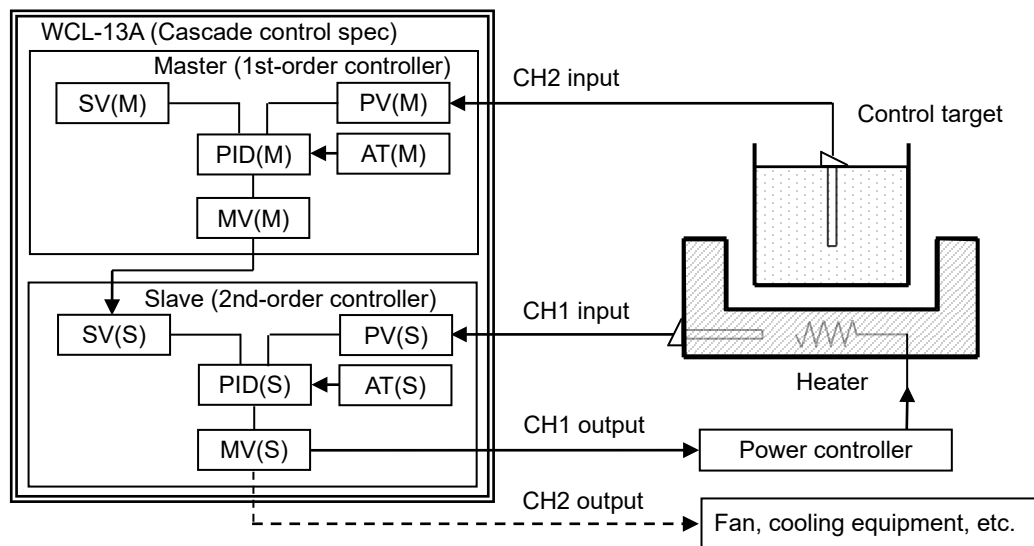
10.5 Performing Cascade Control

Cascade control of the WCL-13A

To control one process, 2 inputs [CH2 as a master (1st-order controller), and CH1 as a slave (2nd-order controller)] are used for more advanced control.

MV is calculated from PV and SV of the master (CH2), and is used as SV of the slave (CH1), with which CH1 control calculation is carried out, then outputs from CH1 control output.

[CH2 control output will be turned OFF (0 mA for direct current output) or will become OUT2 for Heating/Cooling control. See the "CH2 output" in (Fig. 10.5-1).]

MV (0 to 100%) of the master (CH2) corresponds to the SV (External setting scaling low limit to External setting scaling high limit) of the slave (CH1).

(Fig. 10.5-1)

How to perform AT in Cascade control

Perform AT in the Cascade control as follows.

• **AT of the slave (CH1)**

(1) Set the slave AT point in [CH1 (slave) SV].

(2) Perform AT by selecting "AT Perform" in [AT/Auto-reset Perform/Cancel] in the CH1 parameter group.

P, I, D and ARW values of the slave (CH1) will be automatically set after AT is finished.

• **AT of the master (CH2)**

(1) Set the External setting scaling high and low limit values of the slave (CH1).

(2) Set the SV of the master (CH2).

(3) Perform AT by selecting "AT Perform" in [AT/Auto-reset Perform/Cancel] in the CH2 parameter group.

P, I, D and ARW values of the master (CH2) will be automatically set after AT is finished.

Depending on the control target, optimal P, I, D and ARW values might not be obtained. In this case, manually set P, I, D and ARW values while referring to those values after AT performance.

11. Action Explanation

11.1 CH1, CH2 Output Action

	Heating (Reverse) action	Cooling (Direct) action
Control action	Proportional band — ON at SV region sloping to OFF at SV	Proportional band — OFF at SV region sloping up to ON
Relay contact output	⑨⑩ Cycle action is performed according to deviation.	⑨⑩ Cycle action is performed according to deviation.
Non-contact voltage output	+⑨ 12V DC –⑩ │ +⑨ 12/0V DC –⑩ │ +⑨ 0V DC –⑩ Cycle action is performed according to deviation.	+⑨ 0V DC –⑩ │ +⑨ 0/12V DC –⑩ │ +⑨ 12V DC –⑩ Cycle action is performed according to deviation.
Direct current output	+⑨ 20mA DC –⑩ │ +⑨ 20 to 4mA DC –⑩ │ +⑨ 4mA DC –⑩ Changes continuously according to deviation.	+⑨ 4mA DC –⑩ │ +⑨ 4 to 20mA DC –⑩ │ +⑨ 20mA DC –⑩ Changes continuously according to deviation.
Indicator CH1 OUT Green	Lit ▓▓▓ Unlit	Unlit ▓▓▓ Lit

▓▓▓ : Turns ON or OFF.

For CH2 output, use terminals 11 and 12.

11.2 CH1, CH2 Output ON/OFF Control Action

	Heating (Reverse) action	Cooling (Direct) action
Control action	Hysteresis — ON to OFF at SV	Hysteresis — OFF to ON at SV
Relay contact output	⑨⑩ │ ⑨⑩	⑨⑩ │ ⑨⑩
Non-contact voltage output	+⑨ 12V DC –⑩ │ +⑨ 0V DC –⑩	+⑨ 0V DC –⑩ │ +⑨ 12V DC –⑩
Direct current output	+⑨ 20mA DC –⑩ │ +⑨ 4mA DC –⑩	+⑨ 4mA DC –⑩ │ +⑨ 20mA DC –⑩
Indicator CH1 OUT Green	Lit ▓▓▓ Unlit	Unlit ▓▓▓ Lit

▓▓▓ : Turns ON or OFF.

For CH2 output, use terminals 11 and 12.

48

11.3 CH1, CH2 Alarm Action

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

▨ : Alarm output is in standby.

CH1 EVT indicator: Lights when CH1 Alarm output is ON, and turns off when the output is OFF.
CH2 EVT indicator: Lights when CH2 Alarm output is ON, and turns off when the output is OFF.

11.4 Heating/Cooling Control Action

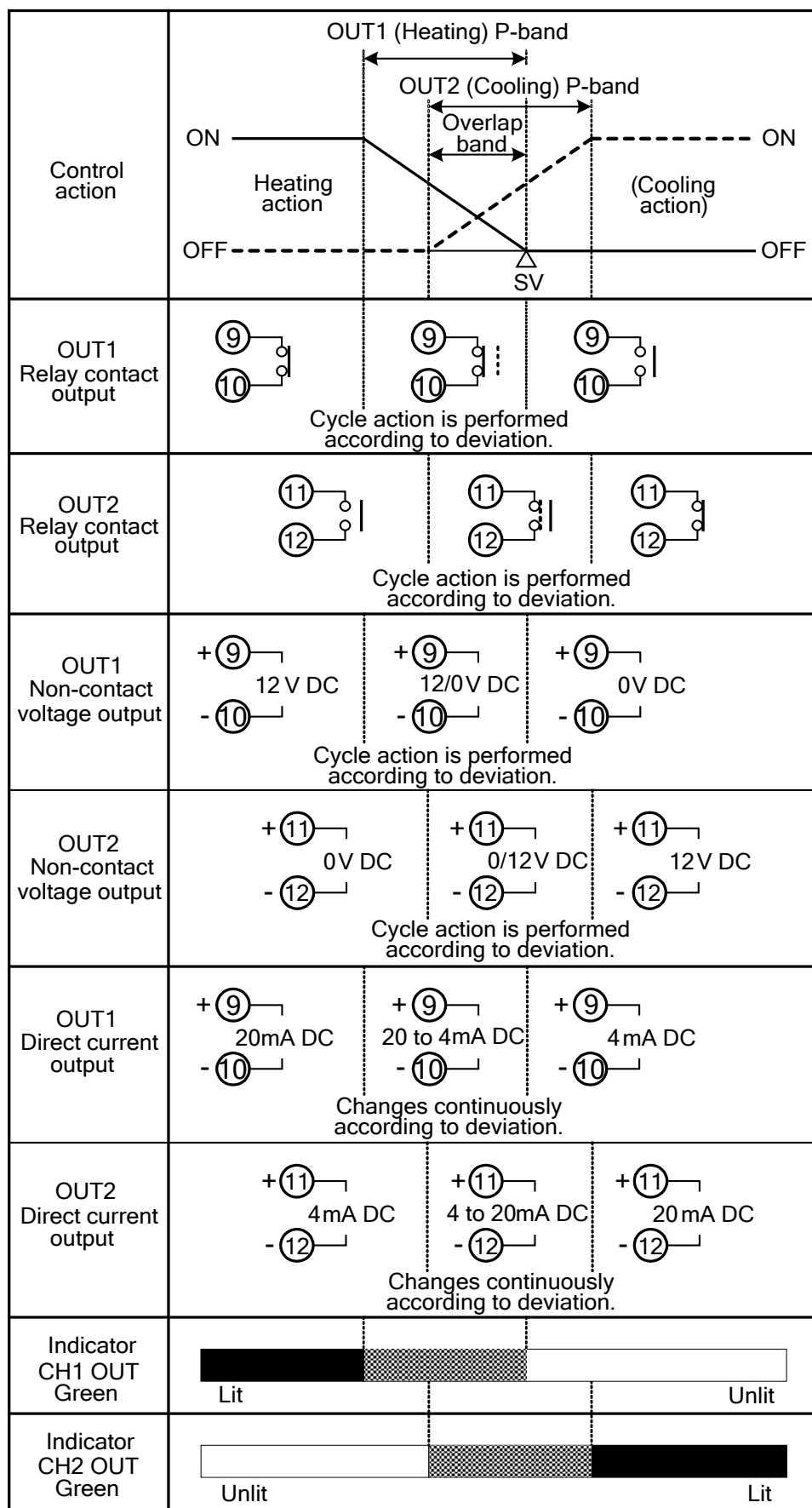|	
Control action	OUT1 (Heating) P-band / OUT2 (Cooling) P-band graph. ON — Heating action — OFF at SV; Cooling action ON.
OUT1 Relay contact output	⑨—⑩ / ⑨—⑩ / ⑨—⑩ — Cycle action is performed according to deviation.
OUT2 Relay contact output	⑪—⑫ / ⑪—⑫ / ⑪—⑫ — Cycle action is performed according to deviation.
OUT1 Non-contact voltage output	+⑨ 12V DC -⑩ / +⑨ 12/0 V DC -⑩ / +⑨ 0V DC -⑩ — Cycle action is performed according to deviation.
OUT2 Non-contact voltage output	+⑪ 0V DC -⑫ / +⑪ 0/12 V DC -⑫ / +⑪ 12 V DC -⑫ — Cycle action is performed according to deviation.
OUT1 Direct current output	+⑨ 20mA DC -⑩ / +⑨ 20 to 4mA DC -⑩ / +⑨ 4mA DC -⑩ — Changes continuously according to deviation.
OUT2 Direct current output	+⑪ 4 mA DC -⑫ / +⑪ 4 to 20 mA DC -⑫ / +⑪ 20mA DC -⑫ — Changes continuously according to deviation.
Indicator CH1 OUT Green	Lit ... Unlit
Indicator CH2 OUT Green	Unlit ... Lit

▨ : Turns ON (lit) or OFF (unlit).

——— : Represents Heating control action (OUT1).

– – – – : Represents Cooling control action (OUT2).

## 11.5 Heating/Cooling Control Action (When Setting Dead Band)

Control action				
	OUT1 (Heating) P-band — Dead band — OUT2 (Cooling) P-band. ON: Heating action / (Cooling action). OFF at SV. Solid line = Heating; dashed line = Cooling.			
OUT1 Relay contact output	⑨—⑩ (closed)	⑨—⑩ (cycling)	⑨—⑩ (open)	Cycle action is performed according to deviation.
OUT2 Relay contact output		⑪—⑫ (open)	⑪—⑫ (cycling)	⑪—⑫ (closed) — Cycle action is performed according to deviation.
OUT1 Non-contact voltage output	+⑨ 12V DC −⑩	+⑨ 12/0V DC −⑩	+⑨ 0V DC −⑩	Cycle action is performed according to deviation.
OUT2 Non-contact voltage output		+⑪ 0V DC −⑫	+⑪ 0/12V DC −⑫	+⑪ 12V DC −⑫ — Cycle action is performed according to deviation.
OUT1 Direct current output	+⑨ 20mA DC −⑩	+⑨ 20 to 4mA DC −⑩	+⑨ 4mA DC −⑩	Changes continuously according to deviation.
OUT2 Direct current output		+⑪ 4mA DC −⑫	+⑪ 4 to 20mA DC −⑫	+⑪ 20mA DC −⑫ — Changes continuously according to deviation.
Indicator CH1 OUT Green	Lit	(Turns ON/OFF)	Unlit	
Indicator CH2 OUT Green	Unlit		(Turns ON/OFF)	Lit

▓▓▓ : Turns ON (lit) or OFF (unlit).

——— : Represents Heating control action (OUT1).

– – – – : Represents Cooling control action (OUT2).

11.6 Heating/Cooling Control Action (When Setting Overlap Band)

Control action	OUT1 (Heating) P-band OUT2 (Cooling) P-band Overlap band ON — Heating action — (Cooling action) — ON OFF — SV — OFF
OUT1 Relay contact output	Cycle action is performed according to deviation.
OUT2 Relay contact output	Cycle action is performed according to deviation.
OUT1 Non-contact voltage output	+⑨ 12 V DC / 12/0 V DC / 0 V DC -⑩ Cycle action is performed according to deviation.
OUT2 Non-contact voltage output	+⑪ 0 V DC / 0/12 V DC / 12 V DC -⑫ Cycle action is performed according to deviation.
OUT1 Direct current output	+⑨ 20 mA DC / 20 to 4 mA DC / 4 mA DC -⑩ Changes continuously according to deviation.
OUT2 Direct current output	+⑪ 4 mA DC / 4 to 20 mA DC / 20 mA DC -⑫ Changes continuously according to deviation.
Indicator CH1 OUT Green	Lit ██████ ▒▒▒▒▒▒ Unlit
Indicator CH2 OUT Green	Unlit ▒▒▒▒▒▒ ██████ Lit

▒▒▒▒ : Turns ON (lit) or OFF (unlit).
—— : Represents Heating control action (OUT1).
- - - - : Represents Cooling control action (OUT2).

52

12. AT/Auto-Reset of This Controller

12.1 AT (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 voltage, current input, the AT process will fluctuate around the SV for conditions of (A), (B), (C) below. **Sometimes the auto-tuning process will not fluctuate if auto-tuning is performed at or near room temperature. Therefore auto-tuning might not finish normally.**

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

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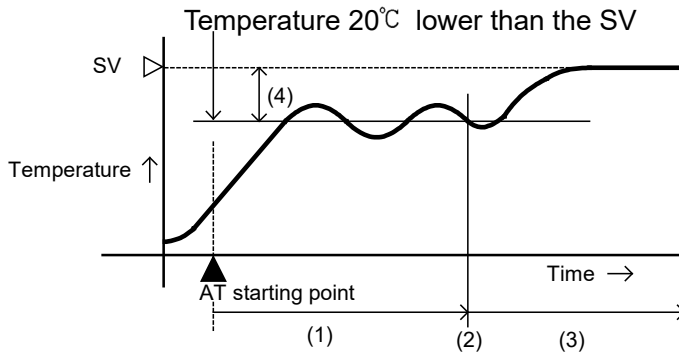
(1) Calculates PID constants
(2) PID constant calculated
(3) Controlled by the PID constant set by AT.
(4) AT bias value

(B) When the control is stable

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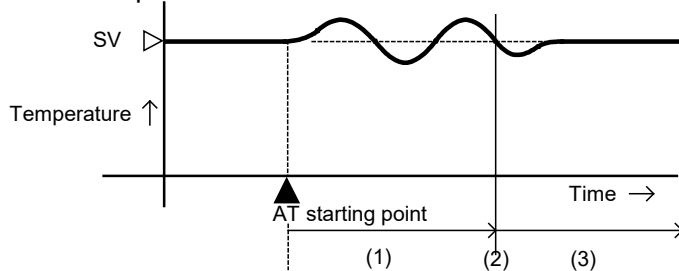
(1) Calculates PID constants
(2) PID constant calculated
(3) Controlled by the PID constant set by AT.

(C) If there is a large difference between the SV and PV as the temperature is falling

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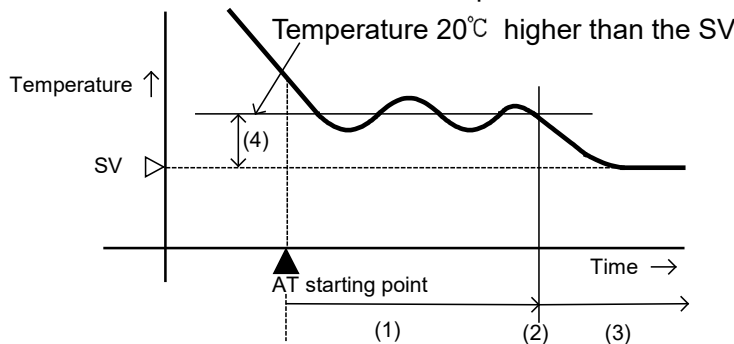
(1) Calculates PID constants
(2) PID constant calculated
(3) Controlled by the PID constant set by AT.
(4) AT bias value

12.2 Auto-reset (Offset Correction)

Auto-reset is performed to correct the offset at the point at which PV indication is stabilized within the proportional band during the PD control.

Since the corrected value is internally memorized, it is not necessary to perform auto-reset again as long as the process is the same.

However, when the proportional band (P) is set to 0 or 0.0, the corrected value is cleared.
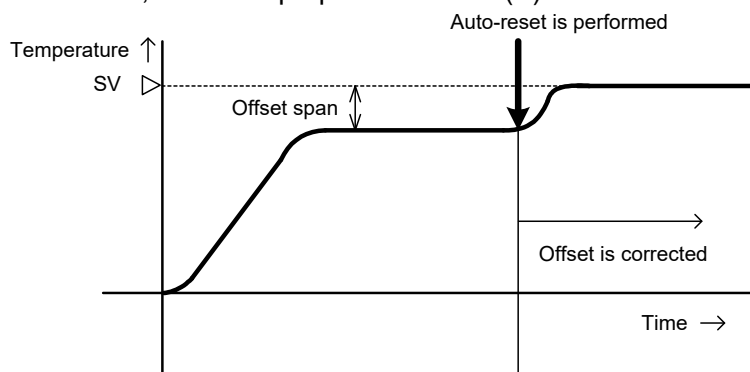
(Fig.12.2-1)

13. Specifications

13.1 Standard Specifications

Rating

Input (CH1, CH2)	Multi-range input:	
	Thermocouple	K, J, R, S, B, E, T, N, PL-Ⅱ, C(W/Re5-26): External resistance 100 Ω max. (However, B input: External resistance: 40 Ω max.)
	RTD	Pt100, JPt100 3-wire type Allowable input lead wire resistance (10 Ω max. per wire)
	Direct current	0 to 20 mA DC, 4 to 20 mA DC: Input impedance: 50 Ω [Connect 50 Ω shunt resistor (sold separately) externally] Allowable input current: 50 mA DC max.
	DC voltage	0 to 1 V DC: Input impedance: 1 MΩ minimum Allowable input voltage: 5 V DC max. Allowable signal source resistance: 2 kΩ max. 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC: Input impedance: 100 kΩ minimum Allowable input voltage: 15 V DC max. Allowable signal source resistance: 100 Ω max.
	Infrared thermocouple (Infrared TC) input:	
	Infrared TC	RD-300 series, RD-401
Power Supply Voltage	WCL-13A-☐☐/☐☐ 100 to 240 V AC 50/60 Hz WCL-13A☐☐/☐☐ 1 24 V AC/DC 50/60 Hz	
Allowable Voltage Fluctuation Range	WCL-13A-☐☐/☐☐ 85 to 264 V AC WCL-13A-☐☐/☐☐ 1 20 to 28 V AC/DC	

General Structure

External Dimensions	30 x 88 x 108 mm (W x H x D, including the socket)	
Mounting	DIN rail	
Case	Material: Flame-resistant resin, Color: Light gray	
Front Panel	Membrane sheet	
Indication Structure	Display	
	CH1 PV/SV Display	Red LED 4-digit, character size 10 x 4.6 mm (HxW)
	CH2 PV/SV Display	Red LED 4-digit, character size 10 x 4.6 mm (HxW)
Setting Structure	CH1, CH2: Input system using membrane sheet key	

Indication Performance

Indication Accuracy (CH1, CH2)	Thermocouple	Within ±0.2% of each input span ±1 digit or within ±2℃ (4℉), whichever is greater However, R, S input 0 to 200℃ (32 to 392℉): Within ±6℃ (12℉) B input, 0 to 300℃ (32 to 572℉): Accuracy is not guaranteed. K, J, E, T, N input, less than 0℃ (32℉): ±0.4% of each input span ±1 digit
	RTD	Within ±0.1% of each input span ±1 digit or within ±1℃ (2℉), whichever is greater
	Direct current	Within ±0.2% of each input span ±1 digit
	DC voltage	Within ±0.2% of each input span ±1 digit
	Infrared TC	Within ±0.2% of each input span ±1 digit or within ±2℃ (4℉), whichever is greater

Cold Junction Temperature Compensation Accuracy (CH1, CH2)	Within ±1℃ at 0 to 50℃	
Input Sampling Period (CH1, CH2)	25 ms, 125 ms, 250 ms, Selectable by keypad	
Potentiometer Input Setting Accuracy	Total resistance	1 to 10 kΩ
	Reference voltage	1 V DC
	Accuracy	Same as setting accuracy
	Temperature coefficient	±0.05 %/℃
	Potentiometer input sampling period	Depends on the selection of Input sampling period.
	Potentiometer input high limit and low limit value depend on External setting scaling high limit and low limit value.	

Timer Performance

Time Accuracy	Within ±0.5% of setting time

Controlling Performance

Setting Accuracy (CH1, CH2)	Same as indication accuracy	
Control Action (CH1, CH2)	PID control (with AT function) PI control: When derivative time is set to 0 PD control (with auto-reset function): When integral time is set to 0 P control (with auto-reset function): When derivative and integral time are set to 0. ON/OFF control: When proportional band is set to 0 or 0.0	
	Proportional band	0 to 9999℃ (℉) Range with a decimal point: 0.0 to 999.9℃ (℉), DC voltage, current input: 0.0 to 999.9% (ON/OFF control when set to 0 or 0.0)
	Integral time	0 to 3600 seconds (OFF when set to 0)
	Derivative time	0 to 3600 seconds (OFF when set to 0)
	Proportional cycle	1 to 120 sec (Direct current output: Not available)
	ARW	0 to 100%
	Manual reset	±100.0℃ (℉) DC voltage, current inputs: ±1000 (The placement of the decimal point follows the selection)
	ON/OFF hysteresis	0.1 to 100.0℃ (℉) DC voltage, current inputs: 1 to 1000 (The placement of the decimal point follows the selection)
	Output high limit, Output low limit	0 to 100% (Direct current output: -5 to 105%)
	Output rate-of-change	0 to 100%
Control Output (CH1, CH2)	Relay contact 1a	Control capacity 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load, cosφ=0.4) Electrical life: 100,000 cycles
	Non-contact voltage (For SSR drive)	12 V DC±15% Max 40 mA (short circuit protected)
	Direct current	4 to 20 mA DC, Load resistance: Max 550 Ω

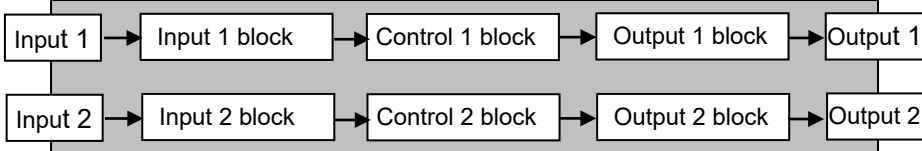**Standard Functions**

Alarm	Selectable from the following via keypad. • No Alarm action • High limit alarm • Low limit alarm • High/Low limits alarm • High/Low limit range alarm • Process high alarm • Process low alarm • High limit with standby alarm • Low limit with standby alarm • High/Low limits with standby alarm {alarm table below}

Setting accuracy	Same as Indication accuracy
Action	ON/OFF action
Hysteresis	Thermocouple, RTD inputs: 0.1 to 100.0℃（℉） DC voltage, current inputs: 1 to 1000 (The placement of the decimal point follows the selection.)
Output	No output (Can be read by the status flag when the Serial communication option is added.)
Alarm delay time	0 to 9999 seconds

Loop Break Alarm	Detects actuator trouble (Heater burnout, sensor burnout). {loop break table below}

Loop break alarm time	0 to 200 minutes
Loop break alarm band	Thermocouple, RTD inputs: 0 to 150℃（℉）or 0.0 to 150.0℃（℉） DC voltage, current inputs: 0 to 1500 (The placement of the decimal point follows the selection.)
Output	No output (Can be read by the status flag when the Serial communication option is added.)

SV Ramp	When the SV is adjusted, it approaches the new SV by the preset rate-of-change (℃/min, ℉/min). When the power is turned on, the control starts from the PV, and approaches the SV by the rate-of-change.
Auto/Manual Control Switching	Automatic or Manual control can be switched by keypad operation. If control action is switched from automatic to manual and vice versa, the balanceless-bumpless function works to prevent a sudden change in manipulated variable. When automatic control is switched to manual control, manual MV is indicated on the display. (The switched CH1 or CH2 display flashes.) When power is turned on, control action starts from its previous controller status (last shutdown).
Timer Spec.	Control timer or Delay timer is selectable via keypad. • **Control timer** 　Control timer starts if CH1 input exceeds Control timer start temperature, and after Control timer time has elapsed, control (Output low limit value for direct current output) and Alarm action will stop. • **Delay timer** 　Delay timer starts when DI input is ON (Closed). Timer output turns on after ON delay timer time has passed. 　Timer output turns off after OFF delay timer time has passed.
Cascade Control Spec. (Block Function)	To control one process, 2 inputs [CH2 as a master(1st-order controller), and CH1 as a slave (2nd-order controller)] are used for more advanced control. MV is calculated from PV and SV of the master (CH2), and is used as SV of the slave (CH1), with which CH1 control calculation is carried out, then outputs from CH1 control output. [CH2 control output will be turned OFF (0 mA for direct current output) or will become OUT2 for Heating/Cooling control.] CH2 will be a master (1st-order controller), CH1 will be a slave (2nd-order controller). MV (0 to 100%) of the master (CH2) corresponds to the SV (External setting scaling low limit to External setting scaling high limit) of the slave (CH1).

Heating/Cooling Control Output Spec. (Block Function)	This is 1ch Heating/Cooling control output spec. CH1 will be Heating output (OUT1) and CH2 will be Cooling output (OUT2), followed by control performance.		
	OUT2 proportional band	0.0 to 10.0 times OUT1 (CH1) proportional band (ON/OFF control when set to 0.0)	
	Integral time (I)	Same as that of CH1	
	Derivative time(D)	Same as that of CH1	
	OUT2 proportional cycle	1 to 120 seconds	
	ARW	Same as that of OUT1	
	Overlap/Dead band	Thermocouple, RTD inputs: -100.0 to 100.0℃ (℉) DC voltage, current inputs: -1000 to 1000 (The placement of the decimal point follows the selection.)	
	OUT2 ON/OFF hysteresis	Thermocouple, RTD inputs: 0.1 to 100.0℃ (℉) DC voltage, current inputs: 1 to 1000 (The placement of the decimal point follows the selection.)	
	OUT2 high limit, OUT2 low limit	0 to 100% (Direct current output: -5 to 105%)	
	OUT2 cooling method	Air cooling (linear characteristics), Oil cooling (1.5th power of the linear characteristics) and Water cooling (2nd power of the linear characteristics) via keypad	

External Setting Input (Block Function)	External analog signal will be the SV. Control desired value adds remote bias value to the SV. As a setting signal, select any DC range in [CH2 input type].		
	Setting signal	Direct current: 4 to 20 mA or 0 to 20 mA DC DC voltage: 1 to 5 V or 0 to 1 V DC	
	Allowable input	Direct current: 50 mA DC max. DC voltage (0 to 1 V): 5 V DC max. DC voltage (1 to 5 V): 10 V DC max.	
	Input impedance	Direct current: 50 Ω [Connect 50 Ω shunt resistor (sold separately) externally.] DC voltage: 100 kΩ	
	Input sampling period	Depends on the selection of Input sampling period.	

Transmission Output Spec. (Block Function)	Converting the value (PV, SV or MV transmission) to analog signal every input sampling period, outputs the value in current.		
	Resolution	10000	
	Current	4 to 20 mA DC (Load resistance, Max. 550 Ω)	
	Output accuracy	Within ±0.3% of transmission output span	

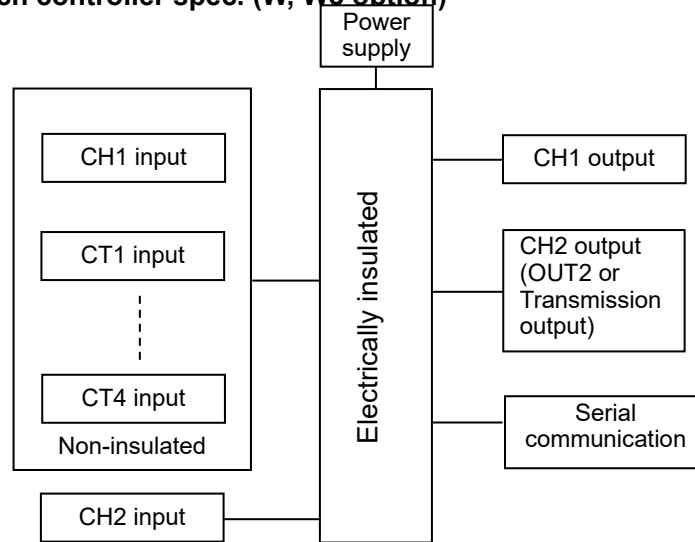|	
CH1 Difference Input (Block Function)	Temperature difference (CH1-CH2, CH2-CH1) will be the input value for CH1, and control for CH1 performs using this value. PV = (CH1 PV - CH2 PV) PV = (CH2 PV - CH1 PV) The set values such as input type, scaling and PV filter time constant can be set to CH1 and CH2 individually. However, if CH ranges differ from each other, indication and difference will be based on the Base channel.
CH1 Addition Input (Block Function)	Addition value of CH1 and CH2 will be the input value for CH1, and control for CH1 performs using this value. PV = (CH1 PV + CH2 PV) The set values such as input type, scaling and PV filter time constant can be set to CH1 and CH2 individually. However, if CH ranges differ from each other, indication and addition will be based on the Base channel.
CH2 Difference Input (Block Function)	Temperature difference (CH1-CH2, CH2-CH1) will be the input value for CH2, and control for CH2 performs using this value. PV = (CH1 PV - CH2 PV) PV = (CH2 PV - CH1 PV) The set values such as input type, scaling and PV filter time constant can be set to CH1 and CH2 individually. However, if CH ranges differ from each other, indication and difference will be based on the Base channel.

CH2 Addition Input (Block Function)	Addition value of CH1 and CH2 will be the input value for CH2, and control for CH2 performs using this value. PV = (CH1 PV + CH2 PV) The set values such as input type, scaling and PV filter time constant can be set to CH1 and CH2 individually. However, if CH ranges differ from each other, indication and addition will be based on the Base channel.

Attached Functions

Sensor Correction	When the sensor-measured temperature deviates from the temperature in the controller location, this corrects PV by adjusting the input value of sensors. However, it's only effective within the input rating range regardless of the sensor correction value. • Correction range: -100.0 to 100.0℃ (℉) DC voltage, current inputs: -1000 to 1000 (The placement of the decimal point follows the selection.)
Set Value Lock	Locks all set values so as not to be changed
Automatic Cold Junction Temperature Compensation (only thermocouple input)	This detects the temperature at the connecting terminal between the thermocouple and the instrument, and always maintains it at the same status as if the reference junction location temperature was at 0℃ (32℉).
Burnout (Overscale)	When the thermocouple or RTD input is burnt out, control output is turned OFF (for direct current output type, output low limit value), and the PV/SV Display flashes [‾ ‾ ‾ ‾]. However, the infrared thermocouple is excluded.
Indication Range, Control range	**Thermocouple, RTD inputs** (see below)

Thermocouple, RTD inputs

Input	Input Range	Indication Range	Control Range
K, T	-199.9 to 400.0 ℃	-199.9 to 450.0 ℃	-206.0 to 450.0 ℃
	-199.9 to 750.0 ℉	-199.9 to 850.0 ℉	-209.0 to 850.0 ℉
Pt100	-199.9 to 850.0 ℃	-199.9 to 900.0 ℃	-210.0 to 900.0 ℃
	-200 to 850 ℃	-210 to 900 ℃	-210 to 900 ℃
	-199.9 to 999.9 ℉	-199.9 to 999.9 ℉	-210.0 to 1099.9℉
	-300 to 1500 ℉	-318 to 1600 ℉	-318 to 1600 ℉
JPt100	-199.9 to 500.0 ℃	-199.9 to 550.0 ℃	-206.0 to 550.0 ℃
	-200 to 500 ℃	-207 to 550 ℃	-207 to 550 ℃
	-199.9 to 900.0 ℉	-199.9 to 999.9 ℉	-210.0 to 999.9 ℉
	-300 to 900 ℉	-312 to 1000 ℉	-312 to 1000 ℉

Indication range and Control range for thermocouple inputs other than the above: Input range low limit – 50℃ (100℉) to
        Input range high limit + 50℃ (100℉)

DC input:
Indication range and Control range:
  [Scaling low limit – (1% of Scaling span)] to
  [Scaling high limit + (10% of Scaling span)]
([ˍ ˍ ˍ ˍ] flashes when input drops below -1999, or [‾ ‾ ‾ ‾] flashes when input exceeds 9999.)

DC input disconnection:
When DC input is disconnected, the PV/SV Display flashes [ˍ ˍ ˍ ˍ] for 4 to 20 mA DC and 1 to 5 V DC inputs, and [‾ ‾ ‾ ‾] for 0 to 1 V DC input.
For 0 to 20 mA DC, 0 to 5V DC and 0 to 10 V DC inputs, the PV/SV Display indicates the value corresponding with 0 mA or 0 V input.

Difference (addition) spec
  When Base channel (*) is thermocouple or RTD input:

Input	Input Range	Indication Range	Control Range
K, T	-199.9 to 400.0 ℃	-199.9 to 450.0 ℃	-206.0 to 450.0 ℃
	-199.9 to 750.0 ℉	-199.9 to 850.0 ℉	-209.0 to 850.0 ℉
Pt100	-199.9 to 850.0 ℃	-199.9 to 900.0 ℃	-210.0 to 900.0 ℃
	-200 to 850 ℃	-210 to 900 ℃	-210 to 900 ℃
	-199.9 to 999.9 ℉	-199.9 to 999.9 ℉	-210.0 to 1099.9℉
	-300 to 1500 ℉	-318 to 1600 ℉	-318 to 1600 ℉
JPt100	-199.9 to 500.0 ℃	-199.9 to 550.0 ℃	-206.0 to 550.0 ℃
	-200 to 500 ℃	-207 to 550 ℃	-207 to 550 ℃
	-199.9 to 900.0 ℉	-199.9 to 999.9 ℉	-210.0 to 999.9 ℉
	-300 to 900 ℉	-312 to 1000 ℉	-312 to 1000 ℉

	Indication range and Control range for thermocouple inputs other than the above: [Input range low limit – 50℃ (100℉)] to [Input range high limit + 50℃ (100℉)]

When Base channel (*) is DC input:
 Indication range and Control range:
  [CH1(CH2) difference (addition) indication low limit – 1% of Difference (addition) indication span] to
  [CH1(CH2) difference (addition) indication high limit + 10% of Difference (addition) indication span]
  For any input, the PV/SV Display flashes [﹍ ﹍ ﹍ ﹍] when input drops below [CH1(CH2) difference (addition) indication low limit – 1% of Difference (addition) indication span].
  The PV/SV Display flashes [﹉ ﹉ ﹉ ﹉] when input exceeds [CH1(CH2) difference (addition) indication high limit + 10% of Difference (addition) indication span].

(*) Base channel:
  If Difference (or addition) input is selected for Input 1 block (console software), CH1 (Input 1) will become the Base channel, and Indication range and Control range will be based on the Base channel input range.

  If Difference (or addition) input is selected for Input 2 block (console software), CH2 (Input 2) will become the Base channel, and Indication range and Control range will be based on the Base channel input range.

Infrared thermocouple burnout:
If infrared thermocouple is burnt out, input will become irregular, so indication will be incorrect. |
| **Console Communication** | The following operations can be carried out via console connector (specific cable) from an external computer.
(1) Reading and setting of the SV, PID values and various set values
(2) Reading of PV and action status
(3) Function change
Cannot be used together with the Serial communication (C5 option). |
| **Block Function** | Console software function. Each channel has the following independent blocks, which can be combined freely.
(Cannot be set via keypad operation.)
• **Input block** (Channel difference input, Channel addition input)
• **Control block** [Heating/Cooling control output spec, External setting input (Remote) spec, Cascade control spec]
• **Output block** [Output 2 output spec, 1-input 2-output spec, Transmission output spec (Selectable when CH2 output is direct current output.)]

Initial Selection Status:

Input 1 → Input 1 block → Control 1 block → Output 1 block → Output 1

Input 2 → Input 2 block → Control 2 block → Output 2 block → Output 2 |
Power Failure Countermeasure	The setting data is backed up in the non-volatile IC memory.
Self-diagnosis	The CPU is monitored by a watchdog timer, and if an abnormal status occurs, the controller is switched to warm-up status, turning all outputs OFF.
Warm-up Indication	After the power supply to the instrument is turned on, the sensor input characters are indicated on the PV/SV Display for approx. 4 seconds.
Display Sleep Function	Indication item (PV, SV or No indication) on the PV/SV Display can be selected in [Display selection] by keypad.

When any item except No indication is selected, displays are turned off if operation does not take place for the time set in [Indication time].

If any key is pressed, displays will light again.

If indication time is set to 0 (zero), continuous indication will occur, and this function will be disabled. |
| **Auto-light Function** | Automatically measures and controls brightness of the CH1, CH2 PV/SV Displays. |

Insulation/Dielectric Strength

Circuit Insulation Configuration	**2ch controller spec. (W, W3 option)** Power supply CH1 input / CT1 input ⋮ CT4 input — Non-insulated — CH2 input ⟶ Electrically insulated ⟶ CH1 output, CH2 output (OUT2 or Transmission output), Serial communication **2ch controller spec. (AO option)** Power supply CH1 input — Non-insulated; Alarm output / CH2 input ⟶ Electrically insulated ⟶ CH1 output, CH2 output (OUT2 or Transmission output), Serial communication **2ch controller spec. (AW option)** Power supply CH1 input / CT1 input / CT2 input — Non-insulated; Alarm output / CH2 input ⟶ Electrically insulated ⟶ CH1 output, CH2 output (OUT2 or Transmission output), Serial communication
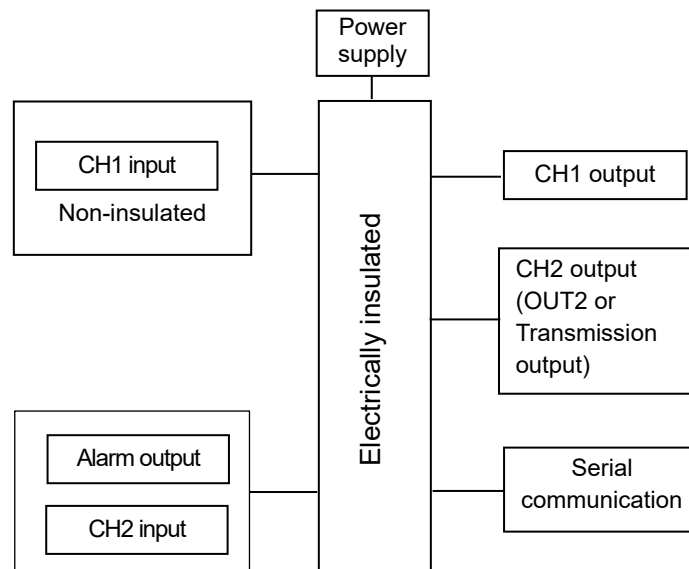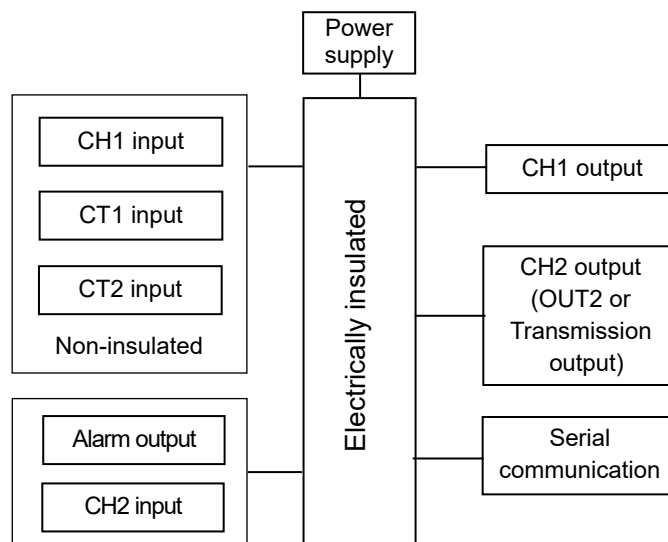
Circuit Insulation Configuration	**Timer spec.** **Potentiometer input spec.** *1: Effective when "Heating/Cooling control output" is selected for Control 1 block, or "1-input 2-output" is selected for Output 1 block (Block Function of Console software).
Insulation Resistance	10 MΩ minimum, at 500 V DC
Dielectric Strength	1.5 kV AC for 1 minute between power terminal and ground, between input terminal and ground, between input terminal and power terminal

Other

Power Consumption	Approx. 9 VA
Ambient Temperature	0 to 50℃
Ambient Humidity	35 to 85 %RH (non-condensing)
Weight	Approx. 200 g (including the socket)
Accessories Included	Instruction manual: 1 copy Communication instruction manual: 1 copy [When Serial communication (C5 option) is added]

Accessories Sold Separately	Socket	ASK-001-1 (Finger-safe, Ring terminals unusable)
		ASK-002-1 (Ring terminals usable)
	Shunt resistor	50 Ω (for direct current input)
	USB communication cable	CMB-001 (for SWS-WCL01M Console software)

When Heater burnout alarm [Option: W (20 A), W (100 A), W3 (20 A), W3 (100 A), AW (20 A), AW (100 A)] is added:

	W (20 A)	CTL-6-S-H (1 piece needed for each channel)
CT	W (100 A)	CTL-12-S36-10L1U (1 piece needed for each channel)
	W3 (20 A)	CTL-6-S-H (2 pieces needed for each channel)
	W3 (100 A)	CTL-12-S36-10L1U (2 pieces needed for each channel)
Connector harness		W 3 m
		W (20 A), W (100 A): 1 length needed for each channel
		W3 (20 A), W3 (100 A): 2 lengths needed for each channel

When Alarm output (AO option) is added

Connector harness	AO 3 m

13.2 Optional Specifications

Heater Burnout Alarm (Option code: W, W3)

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

This option cannot be applied to direct current output type.

Rated Current	Must be specified from below:
	Single-phase 20 A [W (20 A)], Single-phase 100A [W (100 A)],
	3-phase 20 A [W3 (20 A)], 3-phase 100A [W3 (100 A)]
	Single-phase: Detects with CT1 (CT input for CH1), CT3 (CT input for CH2).
	3-phase: Detects with CT1, CT2 (CT input for CH1), CT3, CT4 (CT input for CH2).
Setting Range	0.0 to 20.0 A [for W (20 A), W3 (20 A). Disabled when set to 0.0.]
	0.0 to 100.0 A [for W (100 A), W3 (100 A). Disabled when set to 0.0]
Setting Accuracy	±5% of the rated current
Action Point	Set value
Action	ON/OFF action
Output	No output (Can be read by the status flag when Serial communication is added.)

Serial Communication (Option code: C5)

The following operations can be carried out from an external computer.

Cannot be used together with the Console communication.

(1) Reading and setting of the SV, PID values and various set values

(2) Reading of the PV and action status

(3) Function change

Communication Line	EIA RS-485		
Communication Method	Half-duplex communication		
Synchronization Method	Start-stop synchronization		
Communication Speed	9600, 19200, 38400 bps (Selectable by keypad)		
Data bit/Parity	Data bit: 7 bits, 8 bits		
	Parity: Even, Odd, No parity (Selectable by keypad)		
Stop Bit	1 bit, 2 bits (Selectable by keypad)		
Communication Protocol	Shinko protocol, MODBUS (ASCII mode or RTU mode),		
	Selectable by keypad		
Data format	Communication protocol	Shinko Protocol	MODBUS ASCII	MODBUS RTU
	Start bit	1	1	1
	Data bit	7	7 (8) Selectable	8

			Even (No parity Odd) Selectable	No parity (Even, Odd) Selectable
	Parity	Even	Even (No parity Odd) Selectable	No parity (Even, Odd) Selectable
	Stop bit	1	1 (2) Selectable	1 (2) Selectable

Alarm Output (Option code: AO)

Adds 2-points open collector output and 4-points status flag for CH1 and CH2 respectively.

Event Output	• Alarm • Loop break alarm • Loop break alarm + Alarm (Selectable by keypad)	
Output	Open collector: Control capacity 0.1 A 24 V DC 2-points open collector output (for each channel)	
	Connector No.	**Alarm Output**
	1	CH1: Event 1 output
	2	CH1: Event 2 output
	3	CH2: Event 1 output
	4	CH2: Event 2 output
Status Flag	If the Serial communication option is added, 4-points status flag (for each channel) can be read.	

Heater Burnout Alarm (single-phase) + Alarm Output (Option code: AW)

Adds Heater burnout alarm (Single-phase 20 A or 100 A) + 1-point open collector output + 4-points status flag (for each channel) for CH1, CH2 respectively.
This option cannot be added to the direct current output type.

| Rated current	Single-phase 20A [AW (20 A)], Single-phase 100A [AW (100 A)] Must be specified.	
Setting Range	• 0.0 to 20.0 A [When AW (20 A) is selected.] (Disabled when set to 0.0.) • 0.0 to 100.0 A [When AW (100 A) is selected.] (Disabled when set to 0.0.)	
Setting Accuracy	±5% of rated value	
Action Point	Set value	
Action	ON/OFF action	
Event Output	• Alarm • Loop break alarm • Loop break alarm + Alarm • Heater burnout alarm • Heater burnout alarm + Alarm • Heater burnout alarm + Loop break alarm • Heater burnout alarm + Alarm + Loop break alarm, Selectable by keypad operation.	
Output	Open collector: Control capacity, 0.1 A 24 V DC 1-point open collector output (for each channel)	
	Connector No.	**CT input, Alarm Output**
	1	CH1: CT input
	2	CH1: Event 2 output
	3	CH2: CT input
	4	CH2: Event 2 output
Status Flag	If the Serial communication option is added, 4-points status flag (for each channel) can be read.	

14. Troubleshooting

If any malfunctions occur, refer to the following after checking that power is being supplied to the controller.

14.1 Indication

Problem	Possible Cause	Solution
[¯ ¯ ¯ ¯] is flashing on the PV/SV Display.	Burnout of thermocouple, RTD or disconnection of DC voltage (0 to 1 V DC)	Replace each sensor. **How to check whether the sensor is burnt out** [Thermocouple] If the input terminals of the instrument are shorted, and if a value around room temperature is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out. [RTD] If approx. 100 Ω resistance is connected to the input terminals between A-B of the instrument and between B-B is shorted, and if a value around 0℃ (32℉) is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out. [DC voltage (0 to 1 V DC)] If the input terminals of the instrument are shorted, and if a scaling low limit value is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected.
	Check whether the input terminals of thermocouple, RTD or DC voltage (0 to 1 V DC) are securely mounted to the instrument input terminals.	Connect the sensor terminals to the instrument input terminals securely.

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

	Check whether the input signal wire for DC voltage (1 to 5 V DC) or Direct current (4 to 20 mA DC) is securely connected to the controller input terminals.	Connect the signal wire to the controller input terminals securely.
	Check whether the polarity of thermocouple or compensating lead wire is correct. Check whether codes (A, B, B) of the RTD match with the controller input terminals.	Wire them correctly.

Problem	Possible Cause	Solution

The value set in [Scaling low limit] remains on the PV/SV Display.	Check whether the input signal wire for DC voltage (0 to 5 V DC, 0 to 10 V DC) or direct current (0 to 20 mA DC) is disconnected.	**How to check whether the input signal wire is disconnected**
		[DC voltage(0 to 5 V DC, 0 to 10 V DC)]
		  If the input to the input terminal of this controller is 1 V DC, and if a value (converted value from Scaling high, low limit setting) corresponding to 1 V DC is indicated, the controller is likely to be operating normally, however, the signal wire may be disconnected.
		[Direct current (0 to 20 mA DC)]
		  If the input to the input terminal of this controller is 4 mA DC, and if a value (converted value from Scaling high, low limit setting) corresponding to 4 mA DC is indicated, the controller is likely to be operating normally, however, the signal wire may be disconnected.

	Check whether the input signal wire for DC voltage (0 to 5 V DC, 0 to10 V DC) or direct current (0 to 20 mA DC) is securely connected to the controller input terminals.	Connect the signal wire to the controller input terminals securely.
The indication of the PV/SV Display is irregular or unstable.	Check whether the sensor input or temperature unit (℃, ℉) is correct.	Set the sensor input and the temperature unit (℃, ℉) correctly.
	Sensor correction value is not suitable.	Set it to a suitable value.
	Check whether the sensor specification is correct.	Set the sensor specification properly.
	AC leaks into the sensor circuit.	Use an ungrounded type sensor.
	There may be equipment that interferes with or makes noise near the instrument.	Keep the instrument clear of any potentially disruptive equipment.
The PV does not change.	SV may be selected in [Display selection] in the Basic function group.	Select any indications other than SV.
[$Err\ 1$] is indicated on the PV/SV Display.	The internal memory is defective.	Please contact our main office or dealers.

14.2 Key Operation

Problem	Possible Cause	Solution
• Settings (SV, P, I, D, proportional cycle, alarm value, etc.) are impossible. • The values do not change by the △ or ▽ key.	"Lock" is selected in [Set value lock] in the Basic function group.	Release the "Lock" selection.
	During AT or auto-reset.	In the case of AT, cancel AT. It takes approximately 4 minutes until auto-reset is finished.
The setting indication does not change within the rated input range even if the △ or ▽ key is pressed, and new values are unable to be set.	Scaling high or low limit value in the CH1, CH2 function group may be set at the point where the value does not change.	Set it to a suitable value.

Problem	Possible Cause	Solution
CH2 SV cannot be set.	Timer spec is selected, or Heating/Cooling control output or External setting input is selected from the Block function (Console software).	If Timer spec is selected, or if Heating/Cooling control output or External setting input is selected from the Block function (Console software), [CH2 SV] setting item will not be indicated.
CH2 parameter group is not indicated.	Timer spec or Potentiometer input spec is selected, or Heating/Cooling control output or External setting input is selected from the Block function (Console software).	If Timer spec or Potentiometer input spec is selected, or if Heating/Cooling control output or External setting input is selected from the Block function (Console software), CH2 parameter group will not be indicated.
CH2 function group is not indicated.	Timer spec or Potentiometer input spec is selected, or Heating/Cooling control output is selected from the Block function (Console software).	If Timer spec or Potentiometer input spec is selected, or if Heating/Cooling control output is selected from the Block function (Console software), CH2 function group will not be indicated.

14.3 Control

Problem	Possible Cause	Solution
The PV (temperature) does not rise.	The sensor is out of order.	Replace the sensor.
	Check whether the sensor is securely mounted to the instrument input terminals, or control output terminals are securely mounted to the actuator input terminals.	Mount the sensor or control output terminals securely.
	Ensure that wiring of sensor terminals or control output terminals is correct.	Wire them correctly.
The control output remains in an ON status.	OUT low limit value is set to 100% or higher in CH1, CH2 function group.	Set it to a suitable value.
The control output remains in an OFF status.	"Control Prohibited" has been selected in [Control Allowed/Prohibited] in CH1, CH2 parameter group.	Select "Control Allowed".
	OUT high limit value is set to 0% or less in the CH1, CH2 function group.	Set it to a suitable value.
Control timer does not work.	Control timer time is set to 0 (zero) seconds in the Basic function group.	Set it to a suitable value.
	Control timer start temperature in the Basic function group is not set to a suitable value.	Timer starts when CH1 input exceeds Control timer start temperature. (In the case of Direct control action, timer starts when CH1 input drops below Control timer start temperature.) Set it to a suitable value.
Delay timer does not work.	Timer action time unit, ON delay timer or OFF delay timer in the Basic function group is not set to a suitable value.	Set it to a suitable value.

15. Character Tables

SV Group

Character	Setting Item	Factory Default	Data
5 1	CH1 SV	0℃	
52	CH2 SV	0℃	

CH1 Parameter Group

Character	Setting Item	Factory Default	Data
oFF	Control Allowed/Prohibited	Control Allowed	
AUTo	Auto/Manual control	Automatic control	
ɱAnU	Manual control MV	MV of the automatic control	
Ar	AT/Auto-reset Perform/Cancel	AT/ Auto-reset Cancel	
P	Proportional band	10℃	
P_b	OUT2 proportional band	1.0 times	
I	Integral time	200 seconds	
d	Derivative time	50 seconds	
ɱ	ARW (Anti-reset windup)	50%	
r5Er	Manual reset value	0.0℃	
c	Proportional cycle	Relay contact output: 30 sec Non-contact voltage output: 3 sec	
c_b	OUT2 proportional cycle	Relay contact output: 30 sec Non-contact voltage output: 3 sec	
A 1	Alarm 1 value	0℃	
A2	Alarm 2 value	0℃	
A3	Alarm 3 value	0℃	
A4	Alarm 4 value	0℃	
H	Heater burnout alarm 1 value	0.0 A	
H2	Heater burnout alarm 2 value	0.0 A	
LP_H	Loop break alarm band	0℃	
LP_r	Loop break alarm time	0 minutes	

CH2 Parameter Group

Character	Setting Item	Factory Default	Data
oFF	Control Allowed/Prohibited	Control Allowed	
AUTo	Auto/Manual control	Automatic control	
ɱAnU	Manual control MV	MV of the automatic control	
Ar	AT/Auto-reset Perform/Cancel	AT/Auto-reset Cancel	
P	Proportional band	10℃	
I	Integral time	200 seconds	
d	Derivative time	50 seconds	
ɱ	ARW (Anti-reset windup)	50%	
r5Er	Manual reset value	0.0℃	
c	Proportional cycle	Relay contact output: 30 sec Non-contact voltage output: 3 sec	
A 1	Alarm 1 value	0℃	
A2	Alarm 2 value	0℃	
A3	Alarm 3 value	0℃	
A4	Alarm 4 value	0℃	
H	Heater burnout alarm 1 value	0.0 A	
H2	Heater burnout alarm 2 value	0.0 A	
LP_H	Loop break alarm band	0℃	
LP_r	Loop break alarm time	0 minutes	

CH1 Function Group

Character	Setting Item	Factory Default	Data
5En5	Input type	Multi-range input: K -200 to 1370℃ Infrared TC input: 180 to 250℃	
5ΓLH	Scaling high limit	Multi-range input: 1370℃ Infrared TC input: 500℃	
5ΓLL	Scaling low limit	Multi-range input: -200℃ Infrared TC input: -50℃	
dP▢	Decimal point place	No decimal point	
FILΓ	PV filter time constant	0.0 seconds	
5o▢	Sensor correction	0.0℃	
E▢	Emissivity	0.900 times	
oLH▢	Output high limit	100%	
oLL▢	Output low limit	0%	
HY5▢	Output ON/OFF hysteresis	1.0℃	
cAcΓ	OUT2 cooling method	Air cooling	
oLHb	OUT2 high limit	100%	
oLLb	OUT2 low limit	0%	
HY5b	OUT2 ON/OFF hysteresis	1.0℃	
db▢	Overlap/Dead band	0.0℃	
orAΓ	Output rate-of-change	0 %/second	
PΓ5Γ	Output when input errors occur	0.0%	
A1Fn	Alarm 1 type	No Alarm action	
A2Fn	Alarm 2 type	No Alarm action	
A3Fn	Alarm 3 type	No Alarm action	
A4Fn	Alarm 4 type	No Alarm action	
A1HY	Alarm 1 hysteresis	1.0℃	
A2HY	Alarm 2 hysteresis	1.0℃	
A3HY	Alarm 3 hysteresis	1.0℃	
A4HY	Alarm 4 hysteresis	1.0℃	
A1dY	Alarm 1 delay time	0 seconds	
A2dY	Alarm 2 delay time	0 seconds	
A3dY	Alarm 3 delay time	0 seconds	
A4dY	Alarm 4 delay time	0 seconds	
E1Fn	Event 1 output	Alarm	
E2Fn	Event 2 output	Alarm	
rAΓU	SV rise rate	0 ℃/minute	
rAΓd	SV fall rate	0 ℃/minute	
conΓ	Direct/Reverse action	Reverse action	
AΓ_b	AT bias	20℃	
dFLH	Difference (addition) indication high limit	9999	
dFLL	Difference (addition) indication low limit	-1999	

CH2 Function Group

Character	Setting Item	Factory Default	Data
5En5	Input type	Multi-range input: K -200 to 1370℃ Infrared TC input: 180 to 250℃	
5rLH	Scaling high limit	Multi-range input: 1370℃ Infrared TC input: 500℃	
5rLL	Scaling low limit	Multi-range input: -200℃ Infrared TC input: -50℃	
dP□□	Decimal point place	No decimal point	
FILr	PV filter time constant	0.0 seconds	
5o□□	Sensor correction	0.0℃	
E□□□	Emissivity	0.900 times	
oLH□	Output high limit	100%	
oLL□	Output low limit	0%	
HY5□	Output ON/OFF hysteresis	1.0℃	
orRr	Output rate-of-change	0 %/second	
Pr5r	Output when input errors occur	0.0%	
A1Fn	Alarm 1 type	No Alarm action	
A2Fn	Alarm 2 type	No Alarm action	
A3Fn	Alarm 3 type	No Alarm action	
A4Fn	Alarm 4 type	No Alarm action	
A1HY	Alarm 1 hysteresis	1.0℃	
A2HY	Alarm 2 hysteresis	1.0℃	
A3HY	Alarm 3 hysteresis	1.0℃	
A4HY	Alarm 4 hysteresis	1.0℃	
A1dY	Alarm 1 delay time	0 seconds	
A2dY	Alarm 2 delay time	0 seconds	
A3dY	Alarm 3 delay time	0 seconds	
A4dY	Alarm 4 delay time	0 seconds	
E1Fn	Event 1 output	Alarm	
E2Fn	Event 2 output	Alarm	
rRrU	SV rise rate	0 ℃/minute	
rRrd	SV fall rate	0 ℃/minute	
conr	Direct/Reverse action	Reverse action	
Ar_b	AT bias	20℃	
dFLH	Difference (addition) indication high limit	9999	
dFLL	Difference (addition) indication low limit	-1999	

Basic Function Setting Group

Character	Setting Item	Factory Default	Data
Lock	Set value lock	Unlock	
cā5L	Communication protocol	Shinko protocol	
cāno	Instrument number	0	
cā5P	Communication speed	9600 bps	
cāFr	Data bit/Parity	7 bits/Even	
cā5r	Stop bit	1	
rEār	Remote/Local	Local	
rГLH	External setting scaling high limit	1370℃	
rГLL	External setting scaling low limit	-200℃	
rā_b	Remote bias	0℃	
Гrо5	Transmission output type	Selection from the Block function	
ГrLH	Transmission output high limit	PV, SV transmission: 1370℃ MV transmission: 100.0%	
ГrLL	Transmission output low limit	PV, SV transmission: -200℃ MV transmission: 0.0%	
FUnc	Timer action	Control timer	
ā_5□	Timer action time unit	Minute	
on_Г	ON delay timer	0	
oFFГ	OFF delay timer	0	
Гā5ʁ	Control timer start temperature	0℃	
Гā_5	Control timer time	0	
LI ΓГ	Auto-light function	Disabled	
dI 5P	Display selection	CH1 PV/CH2 PV	
ГI āE	Indication time	00.00	
r_Гā	Input sampling period	125 ms	
I ΞEr	Potentiometer input zero adjustment	-200℃	
I 5PA	Potentiometer input span adjustment	1370℃	

*****   Inquiry   *****

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

<div align="center">[Example]</div>

     • Model   ----------------------------   WCL-13A-RR/MM
     • Serial number   ------------------   No. 094F05000

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