INSTRUCTION MANUAL

DIN RAIL MOUNTING TYPE INDICATING CONTROLLER **DCL-33A DC**

No.DCL33DCE1 2007.01

Thank you for purchasing our DIN rail mounting type indicating controller DCL-33A DC.
This manual contains instructions for the mounting, functions, operations and notes when operating the DCL-33A.
To prevent accidents arising from the misuse of this controller, please ensure the operator receives this manual.

Notes

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

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

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

⚠ Warning

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

⚠ Safety precautions

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

Caution with respect to Export Trade Control Ordinance

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

Characters used in this manual

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

1. Model

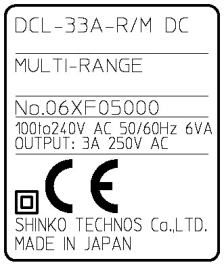
1.1 Model

DCL - 3 3 A - □/□ □, DC, □, □							Series name: DCL-300 (W22.5 x H75 x D100mm)	
Control action	3						PID	
Alarm		A					Selectable by keypad *1	
Control output (OUT1)			R				Relay contact: 1a	
			S				Non-contact voltage (for SSR): 12^{+2}_{-0}V DC	
			A				DC current: 4 to 20mA DC	
Input				M			Multi-range *2	
Supply voltage							100 to 240V AC (standard) *3	
					1		24V AC/DC *3	
Control output (OUT2)						DC	Open collector	
Option						W (5A)	Heater burnout alarm	CT rated current: 5A
						W (10A)		CT rated current: 10A
						W (20A)		CT rated current: 20A
						W (50A)		CT rated current: 50A
						C5	Serial communication	EIA RS-485

*1: Alarm type (9 types and No alarm) and status Energized/Deenergized can be selected by keypad.
*2: Thermocouple, RTD, DC current and DC voltage can be selected by keypad.
For DC current input, **50Ω** shunt resistor must be connected between input terminals.
*3: Standard supply voltage is 100 to 240V AC. Enter "1" after the input code only when ordering 24V AC/DC.

1.2 How to read the model label

The model label is attached to the left side of the case.
For Heater burnout alarm output, CT rated current value is written in the bracket ( ).



(Fig. 1.2-1)

(1) Model, Supply voltage (Enter "1" only for 24V AC/DC), Option
(e.g.) Relay contact output, Multi-range input
(2) Serial number

2. Name and functions of the sections

(1) EVT indicator
The red LED lights when Event output (Alarm, Loop break alarm or Heater burnout alarm option) is ON or OUT2 is ON.

(2) OUT indicator
The green LED lights when OUT1 is ON.
For DC current output type, this flashes in 0.25 second cycles corresponding to the output MV (manipulated variable).

(3) T/R indicator
The yellow LED flashes during serial communication TX output (transmission).

(4) AT indicator
The yellow LED flashes while auto-tuning is being performed.

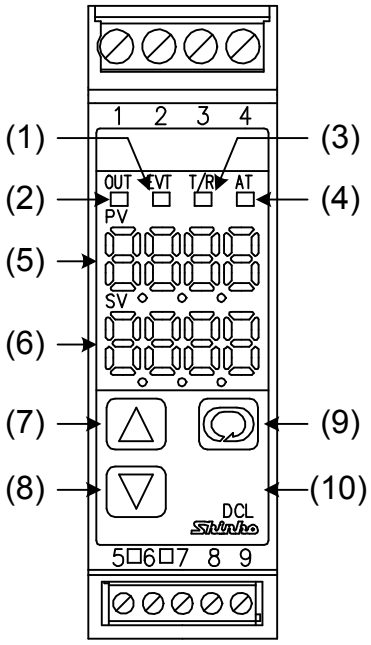
(5) PV display: Indicates the PV (process variable) or setting characters (in each setting mode) with a Red LED.

(6) SV display: Indicates the SV (desired value) or each set value (in each setting mode) with a Green LED.

(7) Increase key (△): Increases the numeric value.

(8) Decrease key (▽): Decreases the numeric value.

(9) Mode key (◯):Changes the setting mode or registers set values.
[Registers set values by pressing the Mode (◯) key.]



(Fig. 2-1)

(10) Sub-mode key (Unmarked)
Brings up Auxiliary function setting mode 2 when used in combination with the Mode (◯) key.

⚠ Caution

When setting the specifications and functions of this controller, connect terminals 1 and 2 for power source first, then set them referring to "5. Setup" before performing "3. Mounting to the control panel" and "4. Wiring".

3. Mounting to the control panel

3.1 Site selection

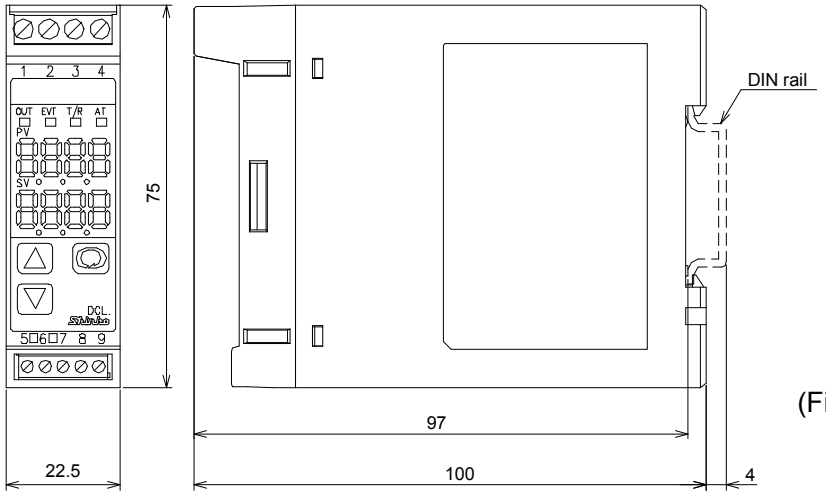
This instrument is intended to be used under the following environmental conditions (IEC61010-1): Overvoltage category Ⅱ, Pollution degree 2

Ensure the mounting location corresponds to the following conditions:

- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gases
- Few mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of 0 to 50℃ (32 to 122℉) without rapid change, and without icing
- An ambient non-condensing humidity of 35 to 85%RH
- No large capacity electromagnetic switches or cables through which large current is flowing
- No water, oil or chemicals or where the vapors of these substances can come into direct contact with the controller
- Take note that ambient temperature of this unit as well as the control panel must not exceed 50℃(122℉) if mounted within the control panel. Otherwise the life of electronic components (especially electrolytic capacitors) may be shortened.

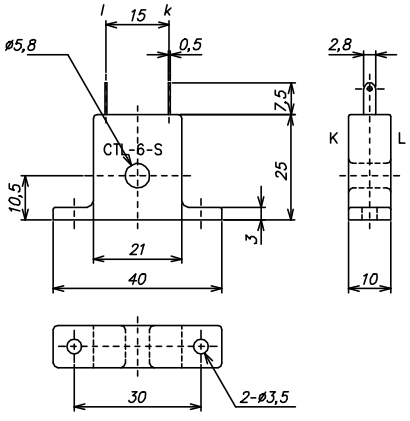
3.2 External dimensions

(Unit: mm)

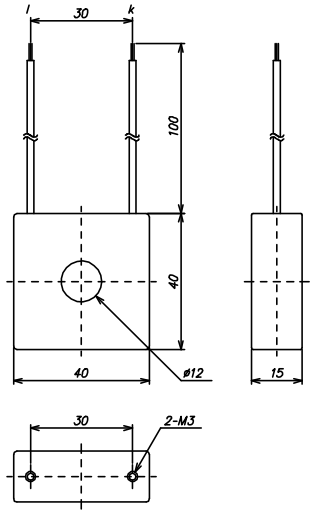


(Fig. 3.2-1)

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



CTL-6S (for 20A)



CTL-12-S36-10L1U (for 50A)

(Fig. 3.3-1)

3.4 Mounting to and removal from the DIN rail

⚠ Caution

- Mount the DIN rail horizontally.
  When the DIN rail is mounted vertically, be sure to use commercially available fastening plates at both ends of the DCL-33A.
  However, if the DIN rail is mounted horizontally in a position susceptible to vibration or shock, the fastening plates must be used as well.
- To remove this instrument, a flat blade screwdriver is required for pulling down the lever.
  Never turn the screwdriver when inserting it into the release lever.
  If excessive power is applied to the lever, it may break.

• **Recommended fastening plate**

Manufacturer	Model	
Omron corporation	End plate	PFP-M
IDEC corporation	Fastening plate	BNL6
Matsushita electric works, LTD.	Fastening plate	ATA4806

Mounting to the DIN rail (Fig. 3.4-1)

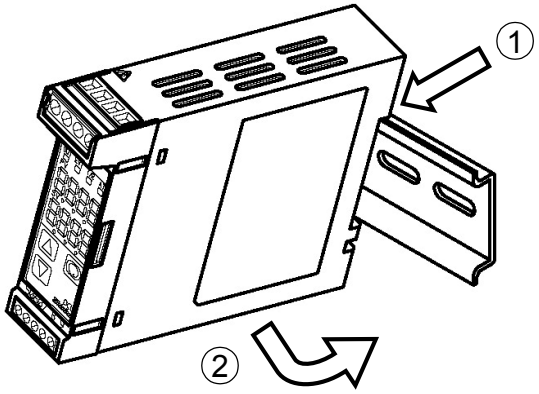
First, hook ① of the DCL-33A on the upper side of the DIN rail.

Second, making ① part of the DCL-33A as a support, fit the lower part ② of the DCL-33A to the DIN rail. DCL-33A will be completely fixed to DIN rail with a “Click” sound.

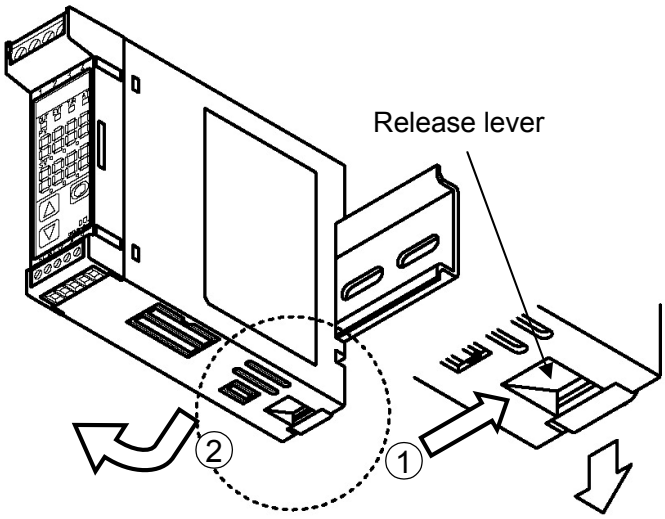
Removal from the DIN rail (Fig. 3.4-2)

① Insert a flat blade screwdriver into the release lever, and pull it down.

② The lock to the DIN rail will be released, then remove the unit from the DIN rail. Be sure to hold onto the unit or it will drop to the ground.



(Fig. 3.4-1) Mounting



(Fig. 3.4-2) Removal

4. Wiring

⚠ Warning

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

⚠ Caution

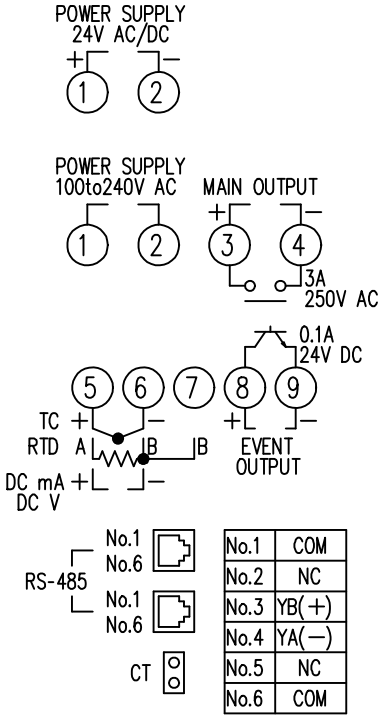
- Do not leave bits of wire in the DCL-33A when wiring, because they could cause fire or malfunction.
- Insert the connecting cable into the designated connector securely. Not doing so could cause malfunction due to imperfect contact.
- Connect the AC power to the designated terminal as is written in this instruction manual. Otherwise it may burn and damage the DCL-33A.
- Tighten the terminal screw with the specified torque. Excessive force could damage the terminal screw and deface the case.
- Use a thermocouple and compensating lead wire that corresponds to the sensor input specification of this unit.
- Use the 3-wire RTD that corresponds to the sensor input specification of this unit.
- When using DC voltage and current inputs, be careful not to confuse polarity when wiring.
- For a 24V AC/DC power source, do not confuse polarity when using direct current (DC).
- Keep input wires (Thermocouple, RTD, etc.) away from power source and load wires when wiring.
- 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.
- To prevent the unit from harmful effects of unexpected level noise, it is recommended that a surge absorber be installed between the electromagnetic switch coils.
- This unit does not have a built-in power switch, circuit breaker or fuse. Therefore it is necessary to install them in the circuit near the unit.
  (Recommended fuse: Time-lag fuse, Rated voltage 250V AC, Rated current 2A)

When using ferrules, use the following ferrules and crimping pliers made by Phoenix Contact GMBH &CO.

• Recommended ferrules and tightening torque

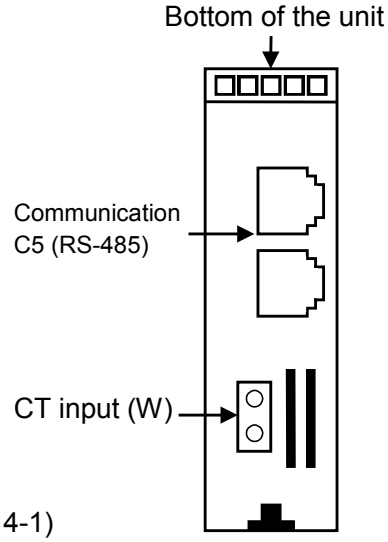
Terminal number	Terminal screw	Ferrules with insulation sleeve	Conductor cross sections	Tightening torque	Crimping pliers
1 to 4	M2.6	AI 0.25-8 YE	0.2 to 0.25mm^2	0.5 to 0.6N•m	CRIMPFOX ZA3 CRIMPFOX UD6
		AI 0.34-8 TQ	0.25 to 0.34mm^2		
		AI 0.5-8 WH	0.34 to 0.5mm^2		
		AI 0.75-8 GY	0.5 to 0.75mm^2		
		AI 1.0-8 RD	0.75 to 1.0mm^2		
		AI 1.5-8 BK	1.0 to 1.5mm^2		
5 to 9	M2.0	AI 0.25-8 YE	0.2 to 0.25mm^2	0.22 to 0.25N•m	
		AI 0.34-8 TQ	0.25 to 0.34mm^2		
		AI 0.5-8 WH	0.34 to 0.5mm^2		

• Terminal arrangement



- MAIN OUTPUT : Control output (OUT1)
- EVENT OUTPUT: Control output (OUT2)
- RS-485: Serial communication
- TC : Thermocouple
- RTD : Resistance temperature detector
- DC : DC current or DC voltage

For DC current input, 50Ω shunt resistor must be connected between input terminals.



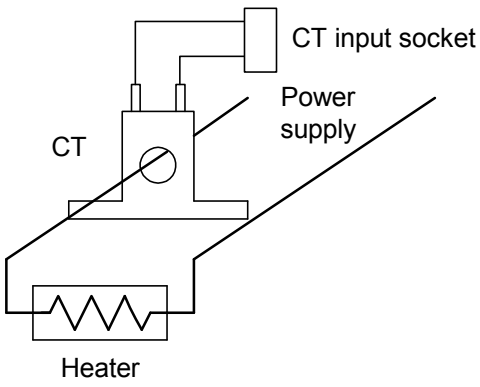
(Fig. 4-1)

• Heater burnout alarm (option)

This alarm is not available for detecting current under phase control.

Use the current transformer (CT) provided, and pass a lead wire of the heater circuit into a hole of the CT.

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



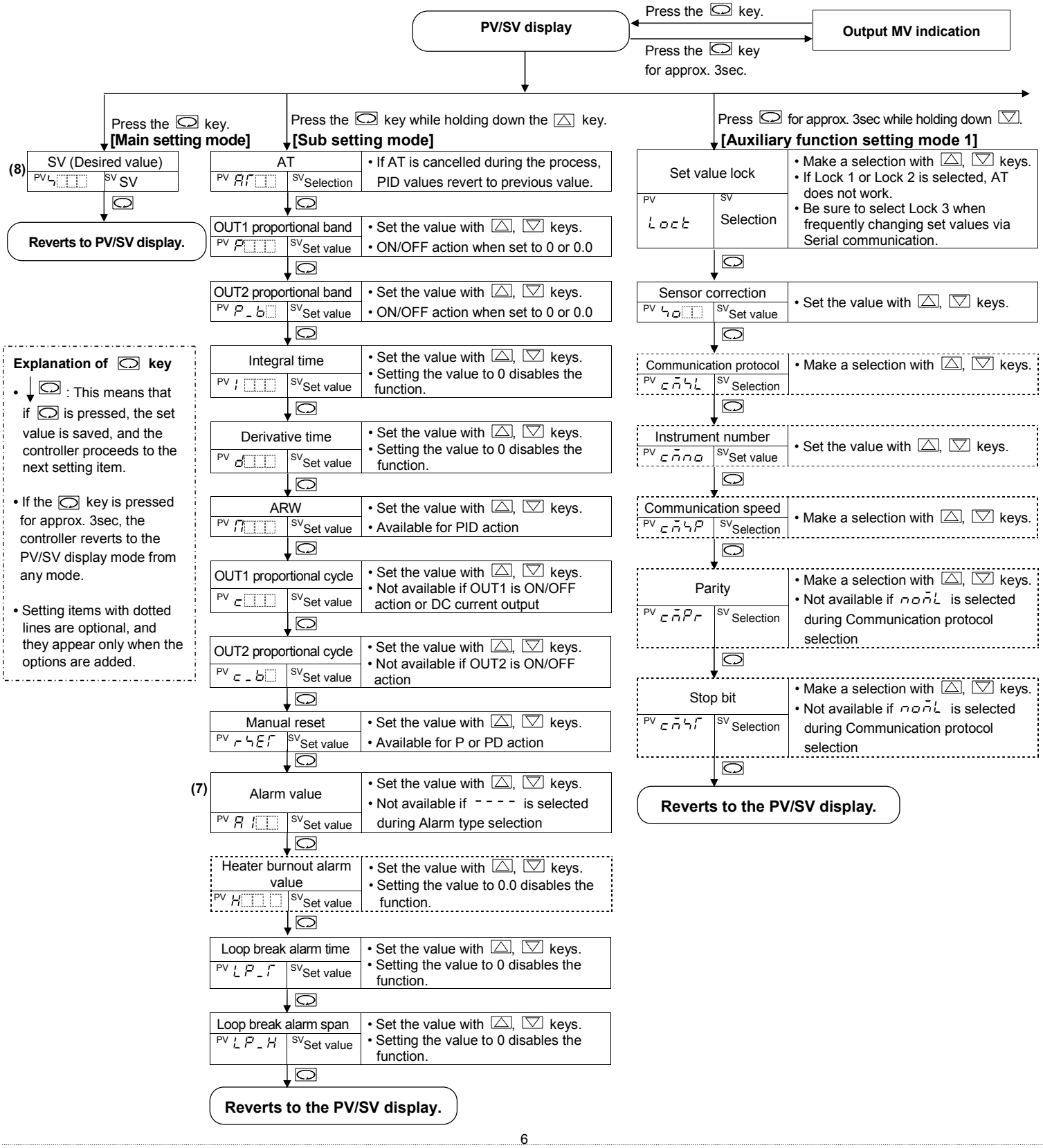
(Fig. 4-2)

5 Operation flowchart

Outline of operation procedure

Set Input type, Alarm (type, value, etc.) and SV (desired value), following the procedures below. Setting item numbers (1) to (8) are indicated on the flowchart.

[Step 1 Operation before run]	Turn the load circuit power OFF, and turn the power supply to the DCL-33A ON.
[Step 2 Auxiliary function setting mode 2]	Set Input type and Alarm type, etc. in Auxiliary function setting mode 2. **(1) Input type**: Select an input type. Refer to "Input type (character indication) and range" on page 9. **(2) Alarm type**: Select an alarm type. Refer to "Alarm type" on page 9. [If an alarm type except for "- - - -" is selected, items (3) to (6) will be indicated and they can be set if necessary.] **Note: If an alarm type is changed, the alarm set value becomes 0 (0.0). Therefore it is necessary to set it again.** **(3) Alarm action Energized/Deenergized**: Select Alarm Energized/Deenergized.(Unusable due to no alarm output) **(4) Alarm HOLD function**: Select either Alarm Not holding or Alarm Holding. **(5) Alarm hysteresis**: Set Alarm hysteresis. **(6) Alarm action delayed timer**: Set Alarm action delayed timer.
[Step 3 Sub setting mode]	**(7) Alarm value**: Set Alarm action point in the Sub setting mode.
[Step 4 Main setting mode]	**(8) SV**: Set SV (desired value) in the Main setting mode.
[Step 5 Run]	Turn the load circuit power ON. Control action starts so as to keep the control target at the SV (desired value).



Input type (character indication) and range			
K	–200 to 1370℃	K	–320 to 2500℉
	–199.9 to 400.0℃		–199.9 to 750.0℉
J	–200 to 1000℃	J	–320 to 1800℉
R	0 to 1760℃	R	0 to 3200℉
S	0 to 1760℃	S	0 to 3200℉
B	0 to 1820℃	B	0 to 3300℉
E	–200 to 800℃	E	–320 to 1500℉
T	–199.9 to 400.0℃	T	–199.9 to 750.0℉
N	–200 to 1300℃	N	–320 to 2300℉
PL-Ⅱ	0 to 1390℃	PL-Ⅱ	0 to 2500℉
C(W/Re5-26)	0 to 2315℃	C(W/Re5-26)	0 to 4200℉
Pt100	–199.9 to 850.0℃	Pt100	–199.9 to 999.9℉
JPt100	–199.9 to 500.0℃	JPt100	–199.9 to 900.0℉
Pt100	–200 to 850℃	Pt100	–300 to 1500℉
JPt100	–200 to 500℃	JPt100	–300 to 900℉

4 to 20mA DC –1999 to 9999
0 to 20mA DC –1999 to 9999
0 to 1V DC –1999 to 9999
0 to 5V DC –1999 to 9999
1 to 5V DC –1999 to 9999
0 to 10V DC –1999 to 9999

Alarm type

(High limit alarm): The alarm action is ±deviation setting from the SV. The alarm is activated if the input value reaches the high limit set value.

(Low limit alarm): The alarm action is ±deviation setting from the SV. The alarm is activated if the input value goes under the low limit set value.

(High/Low limits alarm): Combines High limit and Low limit alarm actions. When input value reaches high limit set value or goes under the low limit set value, the alarm is activated.

(High/Low limit range alarm): When input value is between the high limit set value and low limit set value, the alarm is activated.

(Process high alarm), (Process low alarm): Within the scale range of the controller, alarm action points can be set at random and if the input reaches the randomly set action point, the alarm is activated.

(High limit alarm with standby), (Low limit alarm with standby),
(High/Low limits alarm with standby):
When the power to the controller is turned on, even if the input enters the alarm action range, the alarm is not activated. (If the controller is allowed to keep running, once the input exceeds the alarm action point, the standby function will be released.)

Press the key for approx. 3sec while holding down the key.

[Auxiliary function setting mode 2]

(1) **Input type** — PV: SEn, SV: Selection
- Make a selection with △, ▽ keys.
- Default: C

Scaling high limit — PV: SCLH, SV: Set value
- Set the value with △, ▽ keys.

Scaling low limit — PV: SCLL, SV: Set value
- Set the value with △, ▽ keys.

Decimal point place — PV: dP, SV: Selection
- Make a selection with △, ▽ keys.
- Available for DC current, DC voltage input

PV filter time constant — PV: FILT, SV: Set value
- Set the value with △, ▽ keys.

OUT1 high limit — PV: oLH, SV: Set value
- Set the value with △, ▽ keys.
- Not available if OUT1 is ON/OFF action

OUT1 low limit — PV: oLL, SV: Set value
- Set the value with △, ▽ keys.
- Not available if OUT1 is ON/OFF action

OUT1 ON/OFF action hysteresis — PV: HYS, SV: Set value
- Set the value with △, ▽ keys.
- Available only when OUT1 is ON/OFF action

OUT2 action mode — PV: cAct, SV: Selection
- Make a selection with △, ▽ keys.

OUT2 high limit — PV: oLHb, SV: Set value
- Set the value with △, ▽ keys.
- Not available if OUT2 is ON/OFF action

OUT2 low limit — PV: oLLb, SV: Set value
- Set the value with △, ▽ keys.
- Not available if OUT2 is ON/OFF action

Overlap/Dead band — PV: db, SV: Set value
- Set the value with △, ▽ keys.

OUT2 ON/OFF action hysteresis — PV: HYSb, SV: Set value
- Set the value with △, ▽ keys.
- Available only when OUT2 is ON/OFF action

(2) **Alarm type** — PV: AL 1F, SV: Selection
- Make a selection with △, ▽ keys.
- Default value: ----

(3) **Alarm action Energized/Deenergized** — PV: A 1LA, SV: Selection
- Make a selection with △, ▽ keys.
- Not available if ---- is selected during Alarm type selection (This item cannot be used because alarm output does not occur.)

(4) **Alarm HOLD function** — PV: AHLd, SV: Selection
- Make a selection with △, ▽ keys.
- Not available if ---- is selected during Alarm type selection

(5) **Alarm hysteresis** — PV: A 1HY, SV: Set value
- Set the value with △, ▽ keys.
- Not available if ---- is selected during Alarm type selection

(6) **Alarm action delayed timer** — PV: A 1dY, SV: Set value
- Set the value with △, ▽ keys.
- Not available if ---- is selected during Alarm type selection

Direct/Reverse control — PV: conT, SV: Selection
- Make a selection with △, ▽ keys.
- Default: HEAT

AT bias — PV: AT_b, SV: Set value
- Set the value with △, ▽ keys.
- Available for thermocouple, RTD input

SVTC bias — PV: SV_b, SV: Set value
- Set the value with △, ▽ keys.

Output status selection when input abnormal — PV: EoUT, SV: Selection
- Make a selection with △, ▽ keys.
- Available only for DC current output (OUT1) with DC voltage, current input.

Controller/Converter — PV: FUnc, SV: Selection
- Make a selection with △, ▽ keys.
- Available for DC current output

Reverts to the PV/SV display.

6. Setup

The sensor input characters and temperature unit are indicated on the PV display for approx. 3 seconds after the power is turned on, and the input range high limit value is indicated on the SV display. (Table 6-1) (If any other value is set during the Scaling high limit setting, it is indicated on the SV display.)
During this time all outputs and the LED indicators are in OFF status. After that, the control starts indicating PV (process variable) on the PV display, and SV (desired value) on the SV display.

(Table 6-1)

Input	Input range		Resolution
K	–200 to 1370 ℃	–320 to 2500 ℉	1℃ (℉)
	–199.9 to 400.0℃	–199.9 to 750.0℉	0.1℃ (℉)
J	–200 to1000 ℃	–320 to1800 ℉	1℃ (℉)
R	0 to 1760 ℃	0 to 3200 ℉	1℃ (℉)
S	0 to 1760 ℃	0 to 3200 ℉	1℃ (℉)
B	0 to 1820 ℃	0 to 3300 ℉	1℃ (℉)
E	–200 to 800 ℃	–320 to 1500 ℉	1℃ (℉)
T	–199.9 to 400.0℃	–199.9 to 750.0℉	0.1℃ (℉)
N	–200 to 1300 ℃	–320 to 2300 ℉	1℃ (℉)
PL-Ⅱ	0 to 1390 ℃	0 to 2500 ℉	1℃ (℉)
C (W/Re5-26)	0 to 2315 ℃	0 to 4200 ℉	1℃ (℉)
Pt100	–199.9 to 850.0 ℃	–199.9 to 999.9℉	0.1℃ (℉)
	–200 to 850 ℃	–300 to 1500 ℉	1℃ (℉)
JPt100	–199.9 to 500.0 ℃	–199.9 to 900.0℉	0.1℃ (℉)
	–200 to 500 ℃	–300 to 900 ℉	1℃ (℉)
4 to 20mA DC	–1999 to 9999 *1, *2		1
0 to 20mA DC	–1999 to 9999 *1, *2		1
0 to 1V DC	–1999 to 9999 *1		1
0 to 5V DC	–1999 to 9999 *1		1
1 to 5V DC	–1999 to 9999 *1		1
0 to 10V DC	–1999 to 9999 *1		1

*1: Input range and decimal point place can be changed.

*2**: 50Ω shunt resistor (sold separately) must be connected between the input terminals.**

6.1 Main setting mode

Character	Name, Description, Setting range	Default value
SV	**SV setting** • Sets the SV (desired value) for control target. • Setting range: Scaling low limit value to scaling high limit value (For DC voltage, current input, the placement of the decimal point follows the selection)	0℃

6.2 Sub setting mode

Character	Name, Description, Setting range	Default value
AT	**AT selection** • Selects auto-tuning Perform/Cancel. However, if auto-tuning does not finish after 4 hours, it will be automatically shut down. • - - - -: Auto-tuning Cancel AT: Auto-tuning Perform	- - - -
P	**OUT1 proportional band setting** • Sets the OUT1 proportional band. • ON/OFF action when set to 0.0 • Setting range: 0.0 to 110.0%	2.5%
P_b	**OUT2 proportional band setting** • Sets the OUT2 proportional band. Sets multiplying factor of OUT1 proportional band. (e.g.) If OUT1 proportional band is set to 2.5%, and if OUT2 proportional band is set to 2.0, then OUT2 proportional band will be 5.0% (2.5% x 2.0=5.0%). • ON/OFF action when OUT1 proportional band is set to 0.0. • ON/OFF action when set to 0.0. • Setting range: 0.0 to 10.0 times OUT1 proportional band	1.0 times
I	**Integral time setting** • Sets the integral time. • Setting the value to 0 disables this function. • Not available for ON/OFF action. • Setting range: 0 to 1000 seconds	200 seconds

d□□□	**Derivative time setting** • Sets the derivative time. • Setting the value to 0 disables this function. • Not available for ON/OFF action. • Setting range: 0 to 300 seconds	50 seconds
n□□□	**Anti-reset windup setting** • Sets anti-reset windup. • Available only for PID action. • Setting range: 0 to 100%	50%
c□□□	**OUT1 proportional cycle setting** • Sets the proportional cycle for OUT1. • Not available if OUT1 is ON/OFF action or DC current output. • Setting range: 1 to 120 seconds	Relay contact: 30sec Non-contact voltage: 3sec
c_b□	**OUT2 proportional cycle setting** • Sets the proportional cycle for OUT2. • Not available if OUT2 is in ON/OFF action. • Setting range: 1 to 120 seconds	3 seconds
rSET	**Manual reset setting** • Sets the reset value manually. • Available only for P and PD action. • Setting range: ±Proportional band converted value (For DC voltage, current input, the placement of the decimal point follows the selection)	0.0
A1□□	**Alarm value setting** • Sets the action point for the alarm output. • Setting the value to 0 or 0.0 disables this function (excluding Process high and Process low alarms) • Output does not occur from EVT terminals. However, status can be read through Serial communication (C5 option) function. • Not available if No alarm action is selected during Alarm type selection. • Setting range: See (Table 6.2-1). (For DC voltage, current input, the placement of the decimal point follows the selection.)	0℃
H□□□ and □XX.X alternating display	**Heater burnout alarm value setting** • Sets the heater current value for Heater burnout alarm. • Setting the value to 0.0 disables this function. • Output does not occur from EVT terminals. However, status can be read through Serial communication (C5 option) function. • Rated current 5A : 0.0 to 5.0A Rated current 10A: 0.0 to10.0A Rated current 20A: 0.0 to 20.0A Rated current 50A: 0.0 to 50.0A	0.0A
LP_T	**Loop break alarm time setting** • Sets time to assess the Loop break alarm. • Setting the value to 0 disables this function. • Output does not occur from EVT terminals. However, status can be read through Serial communication (C5 option) function. • Setting range: 0 to 200 minutes	0 minutes
LP_H	**Loop break alarm span setting** • Sets the span to assess the Loop break alarm. • Setting the value to 0 disables this function. • Output does not occur from EVT terminals. However, status can be read through Serial communication (C5 option) function. • Thermocouple, RTD input: 0 to 150℃ (℉) or 0.0 to 150.0℃ (℉) DC voltage, current input: 0 to 1500 (The placement of the decimal point follows the selection)	0℃

(Table 6.2-1)

Alarm type	Setting range
High limit alarm	–(Scaling span) to scaling span
Low limit alarm	–(Scaling span) to scaling span
High/Low limits alarm	0 to scaling span
High/Low limit range alarm	0 to scaling span
Process high alarm	Scaling low limit value to scaling high limit value
Process low alarm	Scaling low limit value to scaling high limit value
High limit alarm with standby	–(Scaling span) to scaling span
Low limit alarm with standby	–(Scaling span) to scaling span
High/Low limits with standby	0 to scaling span

Minimum negative value: –199.9 or –1999

Maximum positive value: 999.9 or 9999

6.3 Auxiliary function setting mode 1

Character	Name, Description, Setting range	Default value
Lock	**Set value lock selection** • Locks set values to prevent setting errors. The setting item to be locked differs depending on the selection. • Auto-tuning cannot be carried out if Lock 1 or Lock 2 is selected. • **Be sure to select Lock 3 when changing the set values frequently via communication function** considering the life of non-volatile memory. (If the value set by the communication function is the same as the value before the setting, the value will not be written in the non-volatile memory.) • ---- (Unlock): All set values can be changed. Loc 1 (Lock 1): None of the set values can be changed. Loc2 (Lock 2): Only main setting mode can be changed. Loc3 (Lock 3): All set values except Input type and Controller/Converter function can be changed. However, changed values revert to their previous values after power-off because they are not saved in the non-volatile memory. **Do not change any setting item in Auxiliary function setting mode 2. If any item in Auxiliary function setting mode 2 is changed, it will affect other setting items such as the SV and Alarm value.**	Unlock
Sn□□	**Sensor correction setting** • Sets the sensor correction value. • Thermocouple and RTD input: –100.0 to 100.0℃ (℉) DC voltage, DC current input: –1000 to 1000 (The placement of the decimal point follows the selection.)	0.0℃
cnnL	**Communication protocol selection** • Selects communication protocol. • Available only when the C5 option is added. • nonL: Shinko protocol, nodA: Modbus ASCII mode, nodr: Modbus RTU mode	Shinko protocol
cnno	**Instrument number setting** • Sets an individual instrument number to each DCL-33A when connecting plural DCL-33A units in serial communication. • Available only when the C5 option is added. • Setting range: 0 to 95	0
cnsp	**Communication speed selection** • Selects the speed in accordance with the host computer. • Available only when the C5 option is added. • □□24: 2400bps, □□48: 4800bps, □□96: 9600bps, □192: 19200bps	9600bps
cnPr	**Parity selection** • Selects the parity. • Not available if the C5 option is not added, or if Shinko protocol is selected during Communication protocol selection • nonE: No parity, EvEn: Even parity, odd□: Odd parity	Even
cnsT	**Stop bit selection** • Selects the stop bit. • Not available if the C5 option is not added, or if Shinko protocol is selected during Communication protocol selection • Setting range: 1 or 2	1

6.4 Auxiliary function setting mode 2

Character	Name, Description, Setting range	Default value
SENS	**Input type selection** • Selects a sensor type and temperature unit from thermocouple (10 types), RTD (2 types), DC current (2 types) and DC voltage (4 types). • When changing the input from DC voltage input to other inputs, remove the sensor connected to this unit first, then change for the input. If the input is changed with the sensor connected, the input circuit may break.	K (–200 to 1370℃)

TC K	K	–200 to 1370℃	TC K F	–320 to 2500℉
TC K .C		–199.9 to 400.0℃	TC K .F	–199.9 to 750.0℉
TC J	J	–200 to 1000℃	TC J F	–320 to 1800℉
TC R	R	0 to 1760℃	TC R F	0 to 3200℉
TC S	S	0 to 1760℃	TC S F	0 to 3200℉
TC B	B	0 to 1820℃	TC B F	0 to 3300℉
TC E	E	–200 to 800℃	TC E F	–320 to 1500℉
TC T .C	T	–199.9 to 400.0℃	TC T .F	–199.9 to 750.0℉
TC N	N	–200 to 1300℃	TC N F	–320 to 2300℉
PL2C	PL-Ⅱ	0 to 1390℃	PL2F	0 to 2500℉
TC C	C (W/Re5-26)	0 to 2315℃	TC C F	0 to 4200℉
PT .C	Pt100	–199.9 to 850.0℃	PT .F	–199.9 to 999.9℉
JPT.C	JPt100	–199.9 to 500.0℃	JPT.F	–199.9 to 900.0℉
PT C	Pt100	–200 to 850℃	PT F	–300 to 1500℉
JPT C	JPt100	–200 to 500℃	JPT F	–300 to 900℉

420A	4 to 20mA	–1999 to 9999
020A	0 to 20mA	–1999 to 9999
0 1V	0 to 1V	–1999 to 9999
0 5V	0 to 5V	–1999 to 9999
1 5V	1 to 5V	–1999 to 9999
0 10V	0 to 10V	–1999 to 9999

SCLH	**Scaling high limit setting** • Sets the scaling high limit value. • Setting range: Scaling low limit value to Input range high limit value (For DC voltage, current input, the placement of the decimal point follows the selection.)	1370℃
SCLL	**Scaling low limit setting** • Sets the scaling low limit value. • Setting range: Input range low limit value to scaling high limit value (For DC voltage, current input, the placement of the decimal point follows the selection.)	–200℃
DP	**Decimal point place selection** • Selects the decimal point place. • Available only 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
FILT	**PV filter time constant setting** • Sets the PV filter time constant. If the value is set too large, it affects control result due to the response delay. • Setting range: 0.0 to 10.0 seconds	0.0 seconds
OLH	**OUT1 high limit setting** • Sets the OUT1 high limit value. • Not available if OUT1 is in ON/OFF action. • Setting range: OUT1 low limit value to 100% (DC current output type: OUT1 low limit value to 105%)	100%
OLL	**OUT1 low limit setting** • Sets the OUT1 low limit value. • Not available if OUT1 is in ON/OFF action. • Setting range: 0% to OUT1 high limit value (DC current output type: –5% to OUT1 high limit value)	0%
HYS	**OUT1 ON/OFF action hysteresis setting** • Sets the ON/OFF action hysteresis for OUT1. • Available only when OUT1 is in ON/OFF action (P=0). • Thermocouple, RTD input: 0.1 to 100.0℃(℉), DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection)	1.0℃

cAcf	**OUT2 action mode selection** • Selects OUT2 action from air, oil and water cooling. • AIr□: Air cooling (linear characteristic) oIL□: Oil cooling (1.5th power of the linear characteristic) WAT□: Water cooling (2nd power of the linear characteristic)	Air cooling
oLHb	**OUT2 high limit setting** • Sets OUT2 high limit value. Not available if OUT2 is in ON/OFF action • Setting range: OUT2 low limit value to 100%	100%
oLLb	**OUT2 low limit setting** • Sets OUT2 low limit value. Not available if OUT2 is in ON/OFF action • Setting range: 0% to OUT2 high limit value	0%
db□□	**Overlap/Dead band setting** • Sets the overlap band or dead band for OUT1 and OUT2. + Set value: Dead band – Set value: Overlap band • Setting range: Thermocouple, RTD input: –100.0 to 100.0℃(℉) DC voltage, current input: –1000 to 1000 (The placement of the decimal point follows the selection.)	0℃
HYSb	**OUT2 ON/OFF action hysteresis setting** • Sets the ON/OFF action hysteresis for the OUT2. • Available only when OUT2 is in ON/OFF action (P=0). • Thermocouple, RTD input: 0.1 to 100.0℃(℉), DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection)	1.0℃
AL 1F	**Alarm type selection** • Selects an alarm type. **Note: If an alarm type is changed, the alarm set value becomes 0 (0.0).** ----: No alarm action H□□□: High limit alarm L□□□: Low limit alarm HL□□: High/Low limits alarm oId□: High/Low limit range alarm PSH□: Process high alarm rPSH□: Process low alarm H□□□: High limit alarm with standby L□□□: Low limit alarm with standby HL□□: High/Low limits alarm with standby	No alarm action
A1LA	**Alarm action Energized/Deenergized** (This item cannot be used because alarm output does not occur.) • Selects the alarm action Energized/Deenergized. • Not available if No alarm action is selected during Alarm type selection. • nonn: Energized, rEVS: Deenergized	Energized
AHLd	**Alarm HOLD function selection** • Selects either Alarm Not holding or Alarm Holding. When set to “Alarm Holding”, once alarm is activated, the alarm output remains ON until the power is turned off. • Not available if No alarm action is selected during Alarm type selection. • nonE: Alarm Not holding, HoLd: Alarm Holding	Alarm Not holding
A1HY	**Alarm hysteresis setting** • Sets the alarm hysteresis. • Not available if No alarm action is selected during Alarm type selection. • Setting range: Thermocouple, RTD input: 0.1 to 100.0℃(℉), DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection.)	1.0℃
A1dY	**Alarm action delayed timer setting** • Sets the alarm action delayed timer. When the setting time has elapsed after the input enters the alarm output range, the alarm is activated. • Not available if No alarm action is selected during Alarm type selection. • Setting range: 0 to 9999 seconds	0 seconds
conf	**Direct/Reverse control action selection** • Selects either reverse (heating) or direct (cooling) control action. • HEAT: Reverse (Heating) control action cooL: Direct (Cooling) control action	Reverse (Heating) control

AT_b	**AT bias setting** • Set the auto-tuning bias value. • Not available if DC voltage or current input is selected during Input type selection, or if PID is not control action. • Setting range: 0 to 50℃ (0 to 100℉) or 0.0 to 50.0℃ (0.0 to 100.0℉)	20℃
SHb	**SVTC bias setting** • Control desired value adds SVTC bias value to the value received by the SVTC command. • Available only when the C5 option is added. • Setting range: Converted value of ±20% of the scaling span	0
EoUT	**Output status selection when input abnormal** • Selects OUT1(OUT2) status when DC voltage, current input is overscale or underscale. • Available only for DC current output type with DC voltage, current input. • oFF: Outputs OFF(4mA) or OUT1 (OUT2) low limit value. on: Outputs a value between OFF (4mA) and ON (20mA) or between OUT1 (OUT2) low limit value and OUT1 (OUT2) high limit value, depending on deviation.	Output OFF
FUnc	**Controller/Converter function selection** • Selects either controller or converter function. • Available only when the control output is DC current output type. • cntr: Controller function, cnVT: Converter function	Controller function

[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 controlling with plural controllers, sometimes the measured temperatures (input value) do not concur due to differences in sensor accuracy or dispersion of load capacities. In such a case, the control can be set at the desired temperature by adjusting the input value of sensors.
However, it is effective within the input rated range regardless of the sensor correction value.

[Loop break alarm]

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

6.5 OUT1 (OUT2) MV (manipulated variable) indication

Name, Description
OUT1 (OUT2) MV (manipulated variable) indication **Press the key for approx. 3 seconds during PV/SV display mode.** Keep pressing the key until OUT1 (OUT2) MV appears, though the main setting mode appears during the process. (OUT1 (OUT2) MV is indicated on the SV display, and the 1st decimal point from the right on the SV display flashes in 0.5 second cycles.) 0.0 to 100.0% : OUT1 MV -100.0 to 0.0% : OUT2 MV Pressing the key again, the instrument reverts to the PV/SV display mode.

7. Simplified converter function

⚠ Caution

- When using this controller as a converter, take 1 second into consideration since input/output response time is approx. 1 second.
- When switching from converter function to controller function, the control parameters and values set by converter function are held even if the function is switched to controller function.
  So, correct the control parameters and values which have been set by converter function to the values necessary for the controller function after switching to the controller function.

The converter function of this instrument converts each input (thermocouple, RTD, DC voltage and DC current inputs) value to "4 to 20mA DC" using the control parameters of the controller, and outputs it.
When this instrument is used as a converter, follow steps (1) to (7) described on the next page.
After steps (1) to (7) are finished, this instrument can be used as a converter.

(1) Wire this unit (Power supply, Input and Output).
(2) Turn the power supply to this unit ON.
(3) Bring up “Auxiliary function setting mode 2” by pressing the ⬭ and ⟲ key (for approx. 3sec).
(4) Select the sensor type from “Input type selection (sEnS)”.
(5) Set the high limit of the value to be converted during “Scaling high limit setting (SrLH)”.
(6) Set the low limit of the value to be converted during “Scaling low limit setting (SrLL)”.
(7) Select converter (cnvr) from “Controller/Converter function selection (Func)”.

• To activate the alarm action by Converter function, set the alarm type to Process alarm.
If converter function is selected during “Controller/Converter function selection” in Auxiliary function setting mode 2, parameters below are automatically set. (Table 7-1)
However, this is applicable only to the DC current output.

(Table 7-1)

Setting item	Set value	Setting item	Set value
SV	Scaling low limit	Alarm value	0
OUT1 proportional band	100.0%	Loop break alarm time	0 seconds
Integral time	0 seconds	Loop break alarm span	0
Derivative time	0 seconds	Direct/Reverse control action	Direct action
Manual reset	0.0		

7.1 Fine adjustment method of converter output (4 to 20mA DC)

“4 to 20mA DC” is outputted from the input of scaling low to high limit value.
Fine adjustment rate is 1/1000 of the scaling span.

Fine adjustment method

Be sure to adjust the zero side first. Then adjust the span side.
Adjust zero at the setting item “Manual reset (rSET)”, and span at “Proportional band (P□□□)”.

(1) Zero adjustment

① Input the value so that the PV display can indicate the same value as the scaling low limit value.
② Press the ⟲ key while pressing the △ key. The unit proceeds to the Sub setting mode.
③ Press the ⟲ key several times until “Manual reset (rSET)” appears.
④ Adjust the converter output value so that it can become 4mA DC by increasing and decreasing the value with △ and ▽ keys.
Pressing the △ key increases the value, and the ▽ key decreases it.
⑤ Revert to the PV/SV display mode by pressing the ⟲ key several times.

(2) Span adjustment

① Input the value so that the PV display can indicate the same value as the scaling high limit value.
② Press the ⟲ key while pressing the △ key. The unit proceeds to the Sub setting mode.
③ Proceed to the “Proportional band (P□□□)” by pressing the ⟲ key.
④ Adjust the converter output value so that it can become 20mA DC by increasing and decreasing the value with △ and ▽ keys.
Pressing the △ key increases the value, and the ▽ key decreases it.
⑤ Revert to the PV/SV display mode by pressing the ⟲ key several times.

(3) Repeat steps (1) and (2) several times.

7.2 Converter setting example

7.2.1 Inputs other than 4 to 20mA DC

Desired value

Input : 6 to 14mA DC (Indication: 30.0 to 130.0)
Output : 4 to 20mA DC

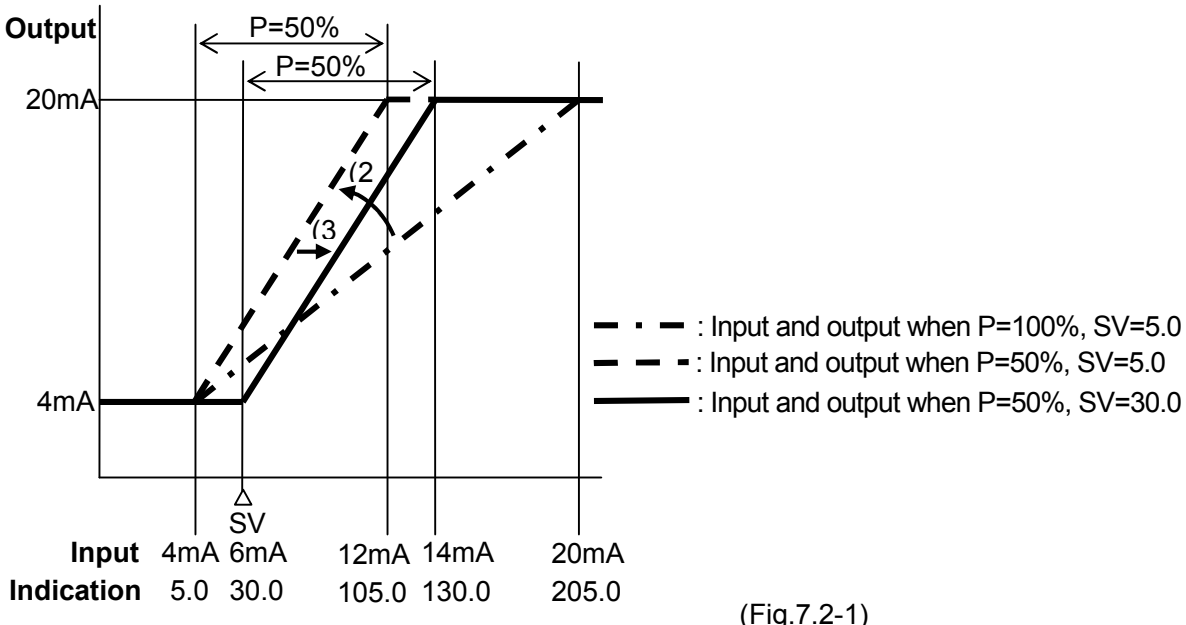
Setting method

(1) Calculating Scaling high and low limit value of 4 to 20mA DC
Indication value per mA DC: (130.0–30.0)÷(14–6)=100÷8=12.5
Scaling high limit value : 130.0+(20–14) x 12.5=205.0
Scaling low limit value : 30.0–(6–4) x 12.5=5.0

(2) Calculating P (OUT1 proportional band) value of 6 to 14mA DC
P={(14–6)÷(20–4)} x 100=0.5 x 100=50(%)

(3) Calculating SV so that output can become 4mA DC from 6mA DC input (Parallel shift setting)
SV={(6–4) x 12.5}+5.0 (Scaling low limit)=30.0

Input, output and indication



(Fig.7.2-1)

8. Running

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

(1) Turn the power supply to the DCL-33A ON.

For approx. 3 seconds after power-on, sensor input characters and temperature unit are indicated on the PV display, and the input range high limit value is indicated on the SV display. See (Table 6-1).
(If any other value is set during the scaling high limit value setting, SV display indicates it.)
During this time, all outputs and LED indicators are in OFF status.
After that, PV display indicates PV (process variable) and SV display indicates the SV (desired value).

(2) Input each set value.

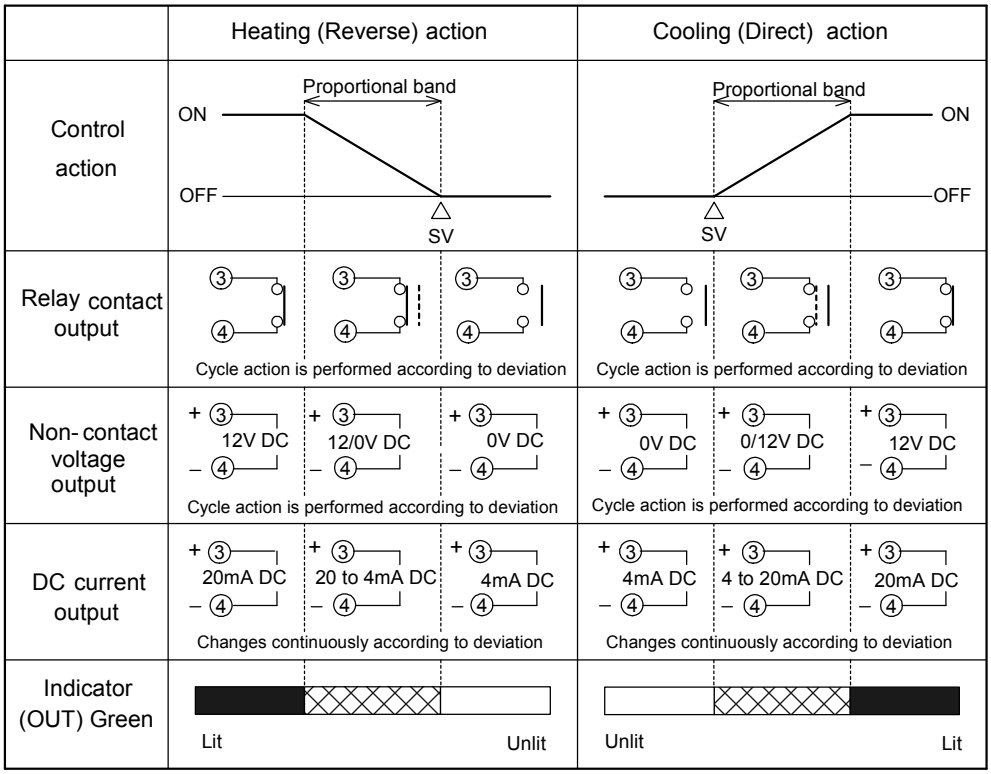
Input each set value referring to “6. Setup”.

(3) Turn the load circuit power ON.

Control action starts so as to keep the control target at the SV (desired value).

9. Action explanations

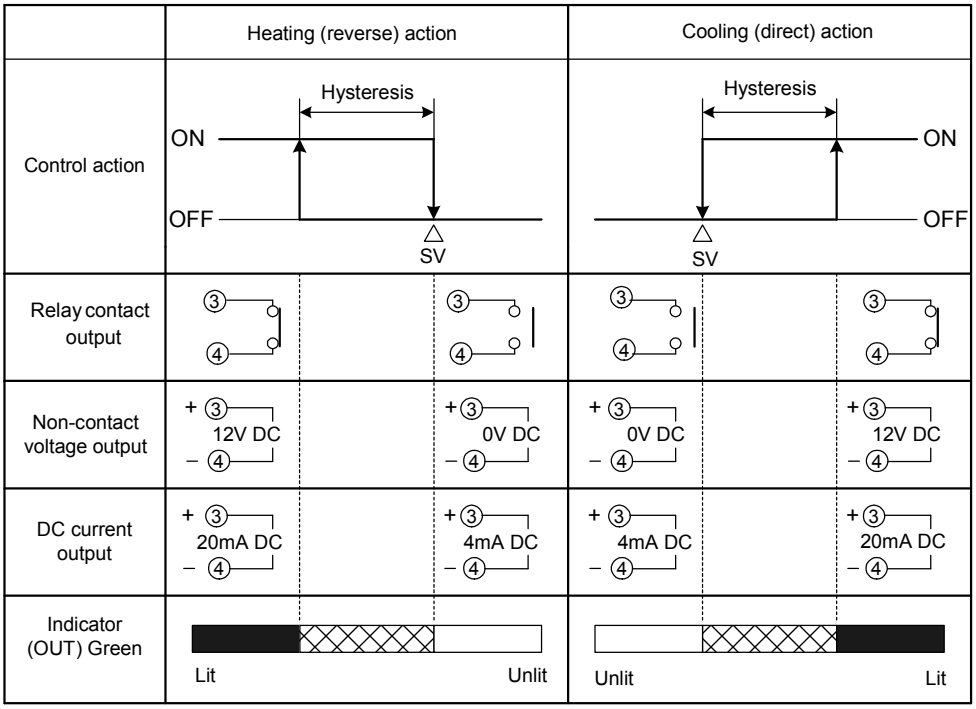
9.1 OUT1 action



(Fig. 9.1-1)

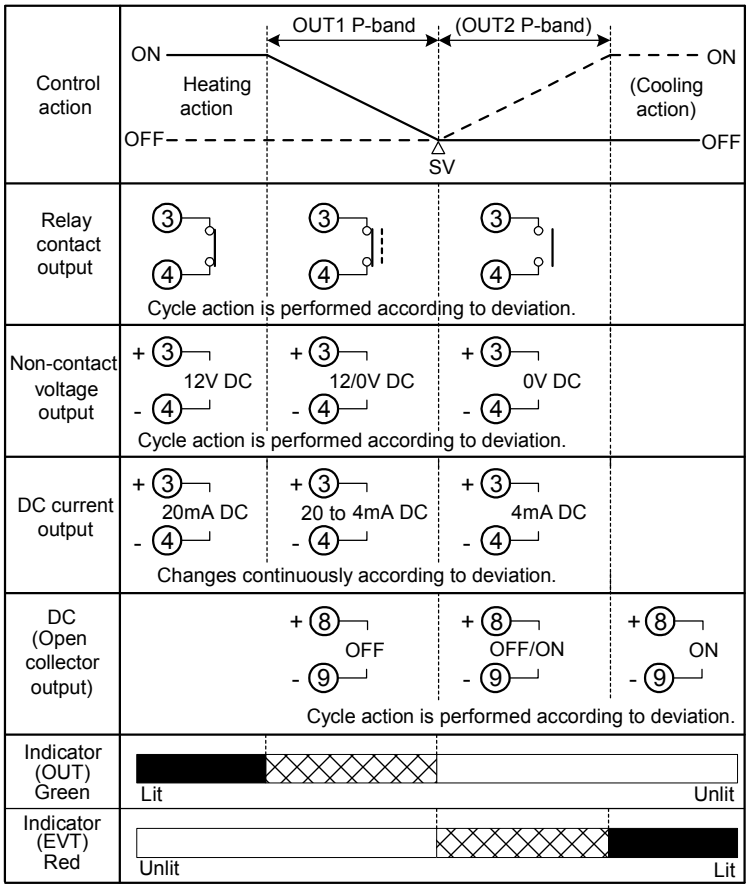
: Alternates between ON or OFF.

9.2 OUT1 ON/OFF action



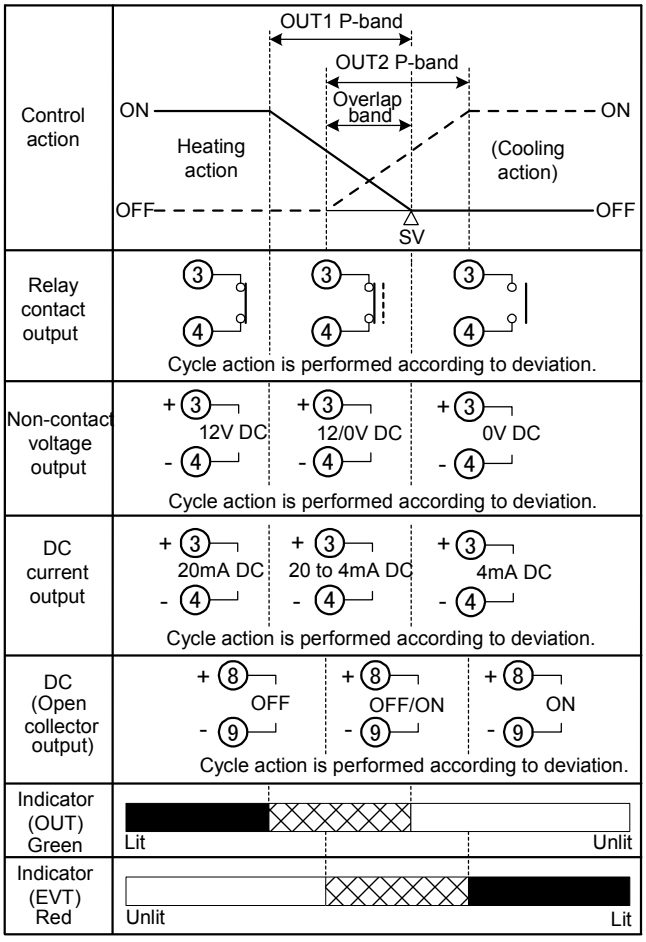
(Fig. 9.2-1)

9.3 Heating/Cooling control (OUT1, OUT2) action



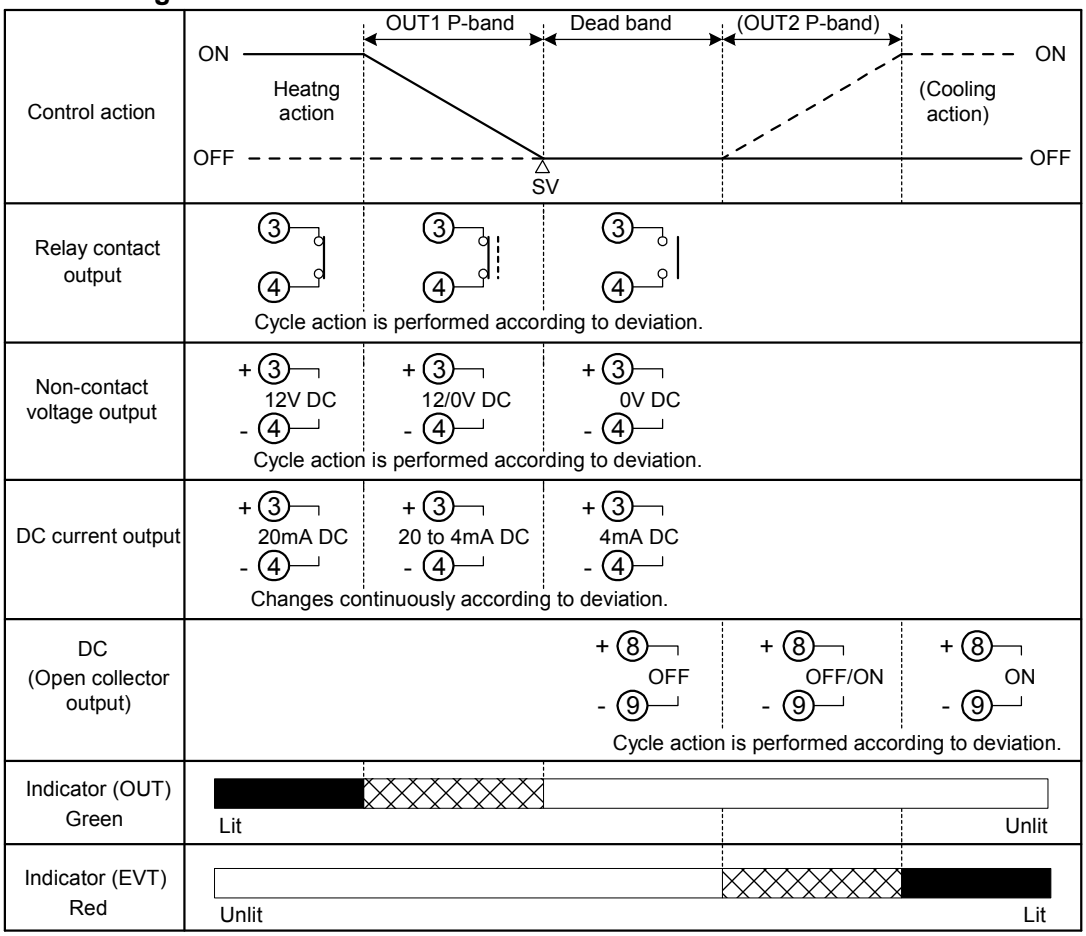
(Fig. 9.3-1)

When setting overlap band



(Fig. 9.3-2)

When setting Dead band



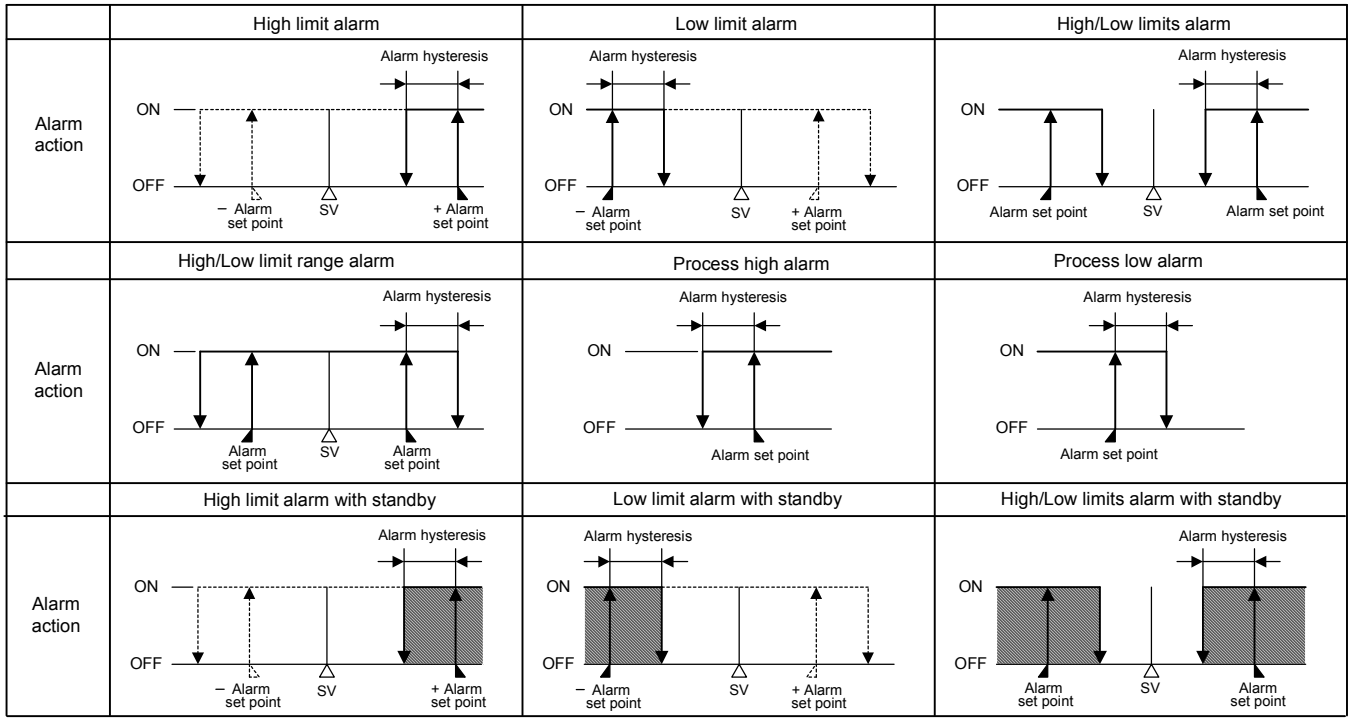
: Alternates between ON (lit) and OFF (unlit).

——— : Represents Heating control action.

- - - - : Represents Cooling control action.

(Fig. 9.3-3)

9.4 EVT (Alarm) action

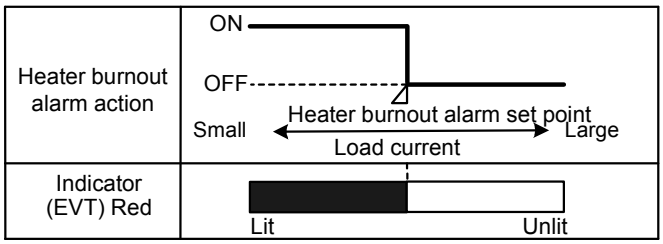


: Standby functions in this section.

The EVT indicator lights when the Alarm is ON, and goes off when the Alarm is OFF [Output does not occur from EVT terminals. However, status can be read through Serial communication (C5 option) function.]

(Fig. 9.4-1)

9.5 EVT (Heater burnout alarm) action



Output does not occur from EVT terminals. However, status can be read through Serial communication (C5 option) function.
the EVT indicator lights when the alarm is ON, and goes off when the alarm is OFF.

(Fig. 9.5-1)

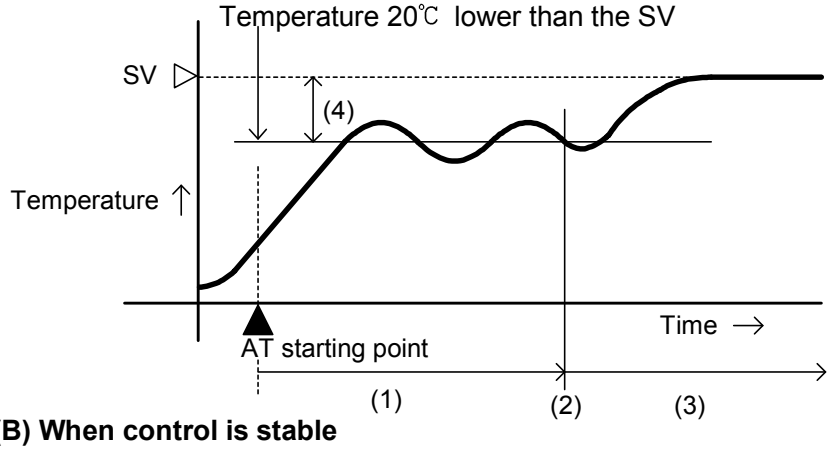
10. Auto-tuning

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

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

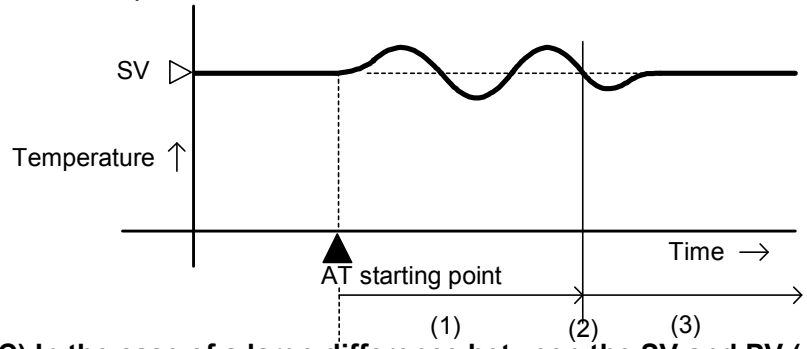
When AT bias is set to 20℃, the AT process will fluctuate at the temperature 20℃ lower than the SV.



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

(B) When control is stable

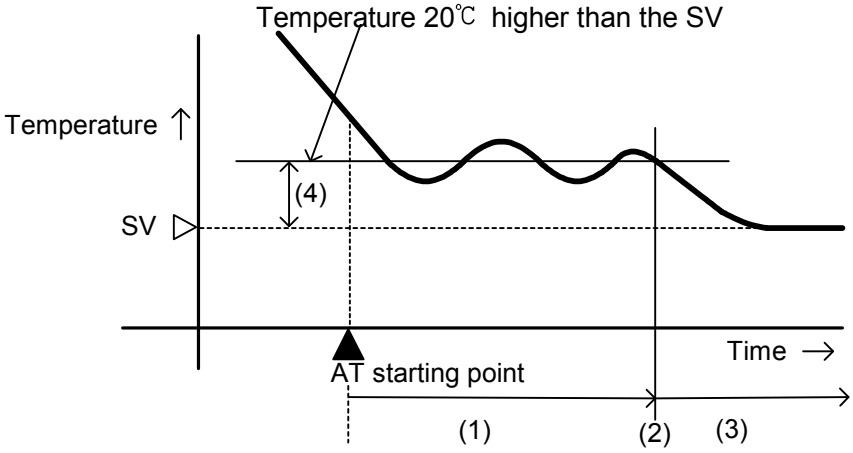
The AT process will fluctuate around the SV.



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

(C) In the case of a large difference between the SV and PV (process variable) 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) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by auto-tuning
(4) AT bias value

11. Specifications

11.1 Standard specifications

Model : DIN rail mounting type indicating controller
Mounting : DIN rail mounting
Setting : Input system using membrane sheet key
Display PV display : Red LED 4 digits, character size 7.4 x 4mm (H x W)
SV display : Green LED 4 digits, character size 7.4 x 4mm (H x W)

Input

Thermocouple : K, J, R, S, B, E, T, N, PL-Ⅱ, C (W/Re5-26) External resistance: 100Ω or less
However, for thermocouple B, external resistance, 40Ω or less

RTD : Pt100, JPt100, 3-wire system
Allowable input lead wire resistance (10Ω or less per wire)

DC current : 0 to 20mA DC, 4 to 20mA DC, input impedance 50Ω
Connect 50Ω shunt resistor (sold separately) between input terminals 5 and 6.
Allowable input current: 50mA or less

DC voltage :

	0 to 1V DC	0 to 5V DC, 1 to 5V DC, 0 to 10V DC
Input impedance	1MΩ or more	100kΩ or more
Allowable input voltage	5V or less	15V or less
Allowable signal source resistance	2kΩ or less	100Ω or less

Accuracy (Setting and Indication)

Thermocouple : Within±0.2% of each input span±1 digit, or within±2℃(4℉) whichever is greater
R, S inputs, 0 to 200℃(0 to 400℉): Within ±6℃(12℉)
B input, 0 to 300℃(0 to 600℉): Accuracy is not guaranteed.
K, J, E, T, N input, less than 0℃(32℉): Within±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
DC voltage : Within±0.2% of each input span±1 digit
DC current : Within±0.2% of each input span±1 digit

Input sampling period : 0.25 seconds

Control

Control action

- PID action (with auto-tuning function)
- PI action: When derivative time is set to 0
- PD action (with manual reset function): When integral time is set to 0
- P action (with manual reset function): When derivative and integral times are set to 0
- ON/OFF action: When proportional band is set to 0

OUT1 proportional band: 0.0 to 110.0% (ON/OFF action when set to 0.0)
Integral time : 0 to 1000 seconds (Off when set to 0)
Derivative time : 0 to 300 seconds (Off when set to 0)
OUT1 proportional cycle: 1 to 120 seconds
ARW : 0 to 100%
Manual reset : ±Proportional band converted value
OUT1 high limit, OUT1 low limit: 0 to 100% (DC current output type: –5 to 105%)
OUT1 ON/OFF hysteresis: Thermocouple, RTD input: 0.1 to 100.0℃ (℉)
DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection)

Control output (OUT1)

- Relay contact: 1a, Control capacity 3A 250V AC (Resistive load)
  1A 250V AC (Inductive load cosø =0.4)
  Electrical life, 100,000 times
- Non-contact voltage (for SSR drive): 12^{+2}_{-0}V DC Max. 40mA (Short circuit protected)
- DC current: 4 to 20mA DC, Load resistance: Max. 550Ω
  Output accuracy: Within ±0.3% of output span
  Resolution : 12000

EVT output (control output OUT2)

OUT2 proportional band: 0.0 to 10.0 times OUT1 proportional band (ON/OFF action when set to 0.0)
Integral time : The same as that of OUT1
Derivative time : The same as that of OUT1
OUT2 proportional cycle: 1 to 120 seconds
Overlap/dead band : Thermocouple, RTD input: –100.0 to 100.0℃
DC voltage, current input: –1000 to 1000 (The placement of the decimal point follows the selection)
OUT2 ON/OFF action hysteresis: Thermocouple, RTD input: 0.1 to 100.0℃(℉) (Default: 1.0℃),
DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection)
OUT2 high limit, OUT2 low limit: 0 to 100%
OUT2 action mode selection: Air cooling (Linear characteristic), Oil cooling (1.5th power of the linear characteristic), Water cooling (2nd power of the linear characteristic)
Output: Open collector, control capacity: 24V DC 0.1A (Max)

Alarm output:

Output does not occur from EVT terminals. However, status can be read through Serial communication (C5 option) function.

The alarm action point is set by ±deviation from the SV (excluding Process alarm), and when input goes outside the range, alarm (EVT) is turned ON or OFF (High/Low limit range alarm). When Deenergized is selected during the Energized/Deenergized selection, alarm (EVT) is activated conversely.

Setting accuracy : The same as indication accuracy
Action : ON/OFF action
Hysteresis : Thermocouple, RTD input: 0.1 to 100.0℃(℉)
DC voltage, current input: 1 to 1000 (The placement of the decimal point follows the selection)
Alarm output action : One alarm type can be selected from below by front keypad operation: High limit, Low limit, High/Low limits, High/Low limit range, Process high, Process low, High limit with standby, Low limit with standby, High/Low limits with standby and No alarm action.
Alarm HOLD function selection: Once the alarm is activated, alarm output is maintained until the power is turned off.

Loop break alarm

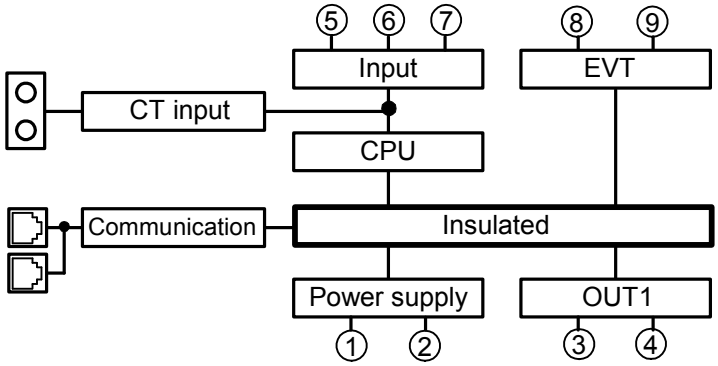
Output does not occur from EVT terminals. However, status can be read through Serial communication (C5 option) function.

Detects heater burnout, sensor burnout and actuator trouble.

Setting range: Loop break alarm time setting: 0 to 200 minutes
Loop break alarm span setting:
Thermocouple, RTD input: 0 to 150℃(℉) or 0.0 to 150.0℃(℉)
DC voltage, current input : 0 to 1500
(The placement of the decimal point follows the selection)

Simplified converter function: See "7. Simplified converter function"

Insulation/Dielectric strength: Circuit insulation configuration



*** When OUT1 is Non-contact voltage or DC current output, OUT1 is not insulated from Communication.**

Insulation resistance: 10MΩ or more, at 500V DC
Dielectric strength : 1.5kV AC for 1 minute between input terminal and power terminal
1.5kV AC for 1 minute between output terminal and power terminal

Power supply : 100 to 240V AC 50/60Hz, 24V AC/DC 50/60Hz
Allowable voltage fluctuation range: 100 to 240V AC: 85 to 264V AC, 24V AC/DC: 20 to 28V AC
Power consumption : Approx. 6VA
Ambient temperature: 0 to 50℃
Ambient humidity : 35 to 85%RH (no condensation)
Weight : Approx.120g
External dimensions : 22.5 x 75 x 100mm (W x H x D)
Material : Flame-resistant resin (Case)
Color : Light gray (Case)
Attached function:

[Set value lock]
[Sensor correction]
[Power failure countermeasure]
The setting data is backed up in non-volatile IC memory.
[Self diagnosis]
The CPU is monitored by a watchdog timer, and when an abnormal status is found on the CPU, the controller is switched to warm-up status with all outputs turned off.
[Automatic cold junction temperature compensation] (Only thermocouple input)
This detects the temperature at the connection terminal between the thermocouple and the instrument and always maintains the same status as when the reference junction is located at 0℃ (32℉).
[Burnout]
When the thermocouple or RTD input is burnt out, OUT1 (OUT2) is turned OFF and PV display flashes "- - - -" [for DC current output, OUT1 (OUT2) low limit value].

[Input abnormality indication]

Output status selection when input abnormal	Contents and Indication	Controller/Converter function selection					
		Output status					
		Controller				Converter	
		OUT1		OUT2		OUT1	
		Direct action	Reverse action	Direct action	Reverse action	Direct action	Reverse action
on	Overscale Measured value has exceeded Indication range high limit value. "- - - -" flashes.	ON (20mA) or OUT1 high limit value **(*1)**	OFF(4mA) or OUT1 low limit value	OFF	ON **(*2)**	20mA or OUT1 high limit value	4mA or OUT1 low limit value
oFF		OFF (4mA) or OUT1 low limit value			OFF		
on	Underscale Measured value has dropped below Indication range low limit value. "- - - -" flashes.	OFF (4mA) or OUT1 low limit value	ON (20mA) or OUT1 high limit value **(*1)**	ON **(*2)**	OFF	4mA or OUT1 low limit value	20mA or OUT1 high limit value
oFF			OFF(4mA) or OUT1 low limit value	OFF			

[Output status selection when input abnormal] is available only for DC voltage, current input and DC current output (OUT1).

For inputs and outputs other than DC voltage, current input and DC current output(OUT1), the output status will be the same as when OFF is selected during "Output status selection when input abnormal". For manual control, the preset MV is outputted.

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

(*2): Outputs OFF or ON, or outputs a value or between OUT2 low limit value and OUT2 high limit value, depending on deviation.

Thermocouple, RTD input

Input	Input range	Indication range	Control range
K, T	–199.9 to 400.0℃	–199.9 to 450.0℃	–205.0 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℉	–211.0 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℉	–211.0 to 999.9℉
	–300 to 900℉	–312 to 1000℉	–312 to 1000℉

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

DC voltage, current input

Indication range : [Scaling low limit value – Scaling span x 1%] to [Scaling high limit value + Scaling span x 10%]
However, if the input value is out of the range –1999 to 9999, the PV display flashes "- - - -" or "- - - -".

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

DC voltage, current input disconnection: When DC voltage, current input is burnt out, the PV display flashes "- - - -" for 4 to 20mA DC and 1 to 5V DC inputs, and "- - - -" for 0 to 1V DC input.
For 0 to 20mA DC, 0 to 5V DC and 0 to 10V DC inputs, the PV display indicates the value corresponding to 0mA or 0V input.

Accessories included: Instruction manual 1 copy
When the Heater burnout alarm option is added: Wire harness 3m, 1 length
When the Heater burnout alarm option is added:
For rated current 5A, 10A, 20A CT (CTL-6S) 1 piece
For rated current 50A CT (CTL-12-S36-10L1U) 1 piece

Accessories sold separately: 50Ω shunt resistor for DC current input 1 piece
120Ω terminator for serial communication: RES-T01-120

11.2 Optional specifications

Heater burnout alarm (Option code: W)

Watches the heater current with CT (Current transformer) and detects the burnout.
This alarm is also activated when indication is overscale and underscale.
Output does not occur from EVT terminals. However, status can be read through Serial communication (C5 option) function.
This option cannot be applied to DC current output type.
Rating : 5A [W (5A)], 10A [W (10A)], 20A [W (20A)], 50A [W (50A)] (Must be specified)
Setting range : 5A [W (5A)], 0.0 to 5.0A (Off when set to 0.0)
10A [W (10A)], 0.0 to 10.0A (Off when set to 0.0)
20A [W (20A)], 0.0 to 20.0A (Off when set to 0.0)
50A [W (50A)], 0.0 to 50.0A (Off when set to 0.0)
Setting accuracy: ±5% of the rated value
Action : ON/OFF action

Serial communication (Option code: C5)

The following operations are performed from external computer.
(1) Reading and setting of the SV, PID and other various set values
(2) Reading of the PV and action status (3) Function change
Cable length : Maximum 1.2km, Cable resistance: Within 50Ω (Terminator is not necessary or 120Ω or more on one side.)
Communication interface : EIA RS-485
Communication method : Half-duplex communication
Communication speed : 2400/4800/9600/19200bps (Selectable by keypad) (Default: 9600bps)
Synchronization : Start-stop synchronization
Code form : ASCII, binary
Communication protocol : Shinko protocol, Modbus ASCII, Modbus RTU
Data format

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

Error correction : Command request repeat system
Error detection : Parity, checksum(Shinko protocol),LRC(Modbus ASCII),CRC-16(Modbus RTU)
Digital external setting : SV of Shinko programmable controller (with SVTC option) can be digitally transmitted to the DCL-33A (with C5 option) by combining the programmable controller with the DCL-33A. When data from the programmable controller is larger than SV high limit or smaller than SV low limit, DCL-33A ignores the value and controls with the previous value.
The control desired value adds SVTC bias value to the value received by the SVTC command.

12. Troubleshooting

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

12.1 Indication

Problem	Presumed cause and solution
[- - - -] is flashing on the PV display.	• Burnout of thermocouple, RTD or disconnection of DC voltage (0 to 1V 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. 100Ω 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 1V DC)] If the input terminals of the instrument are shorted, and if a scaling low limit value is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected. • Check whether the input terminals of thermocouple, RTD or DC voltage(0 to 1V DC) are securely mounted to the instrument terminal. Connect the sensor terminals to the instrument terminals securely.

[- - - -] is flashing on the PV display.	• The input signal wire for DC voltage (1 to 5V DC) or DC current (4 to 20mA DC) may be disconnected. Replace each input signal wire. **How to check whether the input signal wire is disconnected** [DC voltage (1 to 5V DC)] If the input to the input terminals of this controller is 1V 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. [DC current (4 to 20mA DC)] If the input to the input terminals of this controller is 4mA 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 5V DC) or DC current (4 to 20mA DC) is securely connected to the input terminal of this controller. • Check whether the polarity of thermocouple or compensating lead wire is correct. • Check whether codes (A, B, B) of the RTD agree with controller input terminals.
The value set during the Scaling low limit setting remains on the PV display.	• Check whether the input signal wire for DC voltage (0 to 5V DC, 0 to 10V DC) or DC current (0 to 20mA DC) is disconnected. Replace each input signal wire. **How to check whether the input signal wire is disconnected** [DC voltage (0 to 5V DC, 0 to 10V DC)] If the input to the input terminal of this controller is 0V 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. [DC current (0 to 20mA DC)] If the input to the input terminal of this controller is 0mA DC, and if a scaling low limit 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 5V DC, 0 to10V DC) and DC current (0 to 20mA DC) is securely connected to the input terminal of this controller. Connect the signal wire to the controller terminal securely.
The indication of the PV display is abnormal or unstable.	• Check whether the sensor input or temperature unit (℃ or ℉) is correct. Set the sensor input and the temperature unit properly. • Sensor correcting value is unsuitable. Set it to a suitable value. • Check whether the sensor specification is correct. • AC is leaking into the sensor circuit. Use an ungrounded type sensor. • There may be equipment that interferes with or makes noise near the controller. Keep equipment that interferes with or makes noise away from the controller.
[Err 1] is indicated on the PV display.	• The internal memory is defective. Please contact our main office or dealers.

12.2 Key operation

Problem	Presumed cause and solution
Settings (SV, P, I, D, proportional cycle, alarm, etc.) are impossible. The values do not change with the △, ▽ keys.	• Set value lock (Lock 1 or Lock 2) is selected. Release the lock selection. • During auto-tuning Cancel auto-tuning if required.
The setting indication does not change within the rated input range even if the △, ▽ keys are pressed, and new values are unable to be set.	• Scaling high limit or low limit may be set at the point where the value does not change. Set it to a suitable value while in Auxiliary function setting mode 2.

12.3 Control

Problem	Presumed cause and solution
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 terminal, or control output terminal is securely mounted to the actuator input terminal. • Ensure that wiring of sensor terminals or control output terminals is correct.
The control output remains in an ON status.	• OUT1 or OUT2 low limit value is set to 100% or higher in Auxiliary function setting mode 2. Set it to a suitable value.
The control output remains in an OFF status.	• OUT1 or OUT2 high limit value is set to 0% or less in Auxiliary function setting mode 2. Set it to a suitable value.

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

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