Panasonic®

Instruction manual **Temperature Controller KT7**

No.KT71E3 2006.08

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

SAFETY PRECAUTIONS

Be sure to read these precautions before using our products.

The safety precautions are classified into categories: "Warning" and "Caution".

⚠ 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

- When using this controller on occasions which serious injury would be expected to occur or when damage is likely to expand or proliferate, make sure to take safety measures such as installing double safety structures.
- Do not use this controller in an environment with flammable gases, or it may cause explosion.

⚠ Caution

- Fasten the electric wire with the terminal screws securely. Imperfect connection may cause abnormal heating or fumes.
- Use this controller according to the rating and environmental conditions. Otherwise abnormal heating or fumes may occur.
- Do not touch the terminals while the power is supplied to the controller, as this may cause electric shock.
- Do not disassemble or modify the controller, as this may cause electric shock or fumes.

⚠ Caution

- This instrument should be used according to the specifications described in this manual. If it is not used according to the specifications, it may malfunction or cause fire.
- Be sure to follow the warnings, cautions and notice. If not, it could cause serious injury or accidents.
- The contents of this instruction manual are subject to change without notice.
- This instrument is designed to be installed in a control panel. If not, measures must be taken to ensure that the operator cannot touch power terminals or other high voltage sections.
- Be sure to turn the power supplied to the instrument OFF before cleaning this instrument.
- Use a soft, dry cloth when cleaning the instrument. (Alcohol based substances may tarnish or deface the unit.)
- As the display section is vulnerable, do not strike or scratch it with a hard object.
- Any unauthorized transfer or copying of this document, in part or in whole, is prohibited.
- Matsushita Electric Works, Ltd. is not liable for any damage or secondary damage(s) incurred as a result of using this product, including any indirect damage.

1. Model number

1.1 Explanation of model number

A K T 7 □ 1 □ 1 0 □ □

(1) (2) (3) (4) (5) (6)

(1) Supply voltage ---------- 1: 100 to 240V AC, 2: 24V AC/DC

(2) Input type ---------- 1: Multi-input (Thermocouple, RTD, DC current and DC voltage can be selected by keypad operation)

(3) Control output (OUT) ---- 1: Relay contact, 2: Non-contact voltage, 3: DC current

(4) Alarm output ---------- 1: Alarm output (1 point) (The alarm type and Energized /Deenergized can be selected by keypad operation)

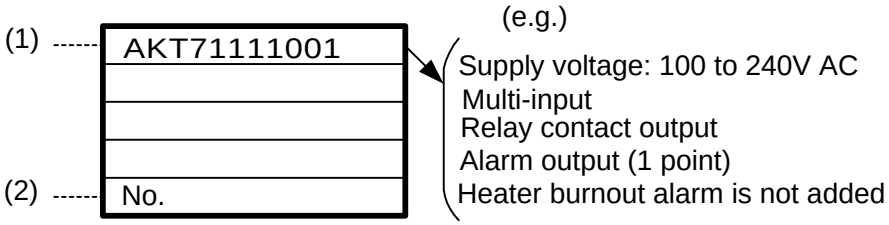
(5) Heater burnout alarm ---- 0: Not available, 1: Available (5A), 2: Available (10A), 3: Available (20A), 4: Available (50A) (Heater burnout alarm is not available for the DC current output)

(6) Serial communication --- 1: Applied (The number is indicated only when Serial communication is added.)

1.2 How to read the rated label

The rated label is attached to the case.

When Heater burnout alarm is added, CT rated current is written in the bracket ( ).



(1) Model number, supply voltage, input type, output type, etc. are entered.
(2) Lot number is entered.

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.

(2) OUT indicator
When OUT (control output) is ON, the green LED lights.
For DC current output type, this flashes corresponding to the output manipulated variable.

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

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

(5) PV display
Indicates the PV (input value) with a Red LED.

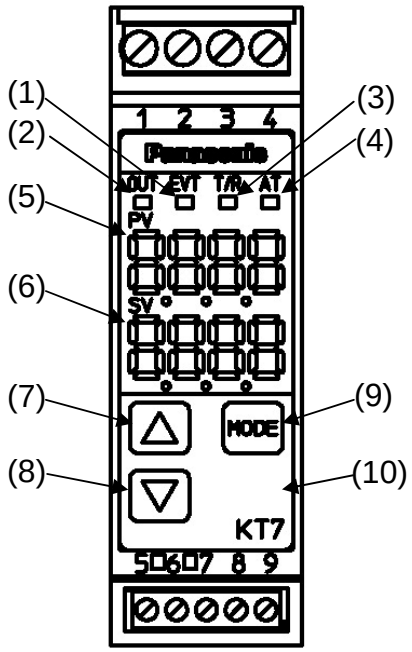
(6) SV display
Indicates the SV (main set value) with a Green LED.

(7) Increase key
Increases the numeric value.

(8) Decrease key
Decreases the numeric value.

(9) Mode key
Selects the setting mode or registers the set value.
(By pressing the Mode key, the set value can be registered)

(10) Sub mode key
Enters Auxiliary function setting mode 2 in combination with the Mode key.



(Fig. 2-1)

⚠ Notice

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” and “6. Operation flowchart” before performing “3. Mounting to the control panel” and“4. Wiring”.

3. Mounting to the control panel

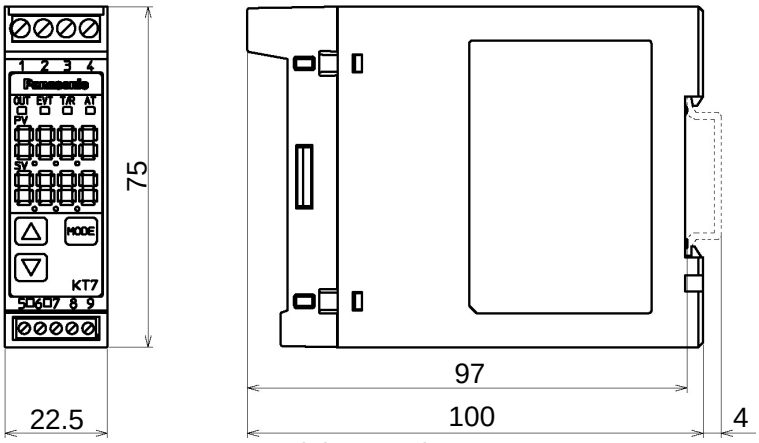
3.1 Site selection

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:

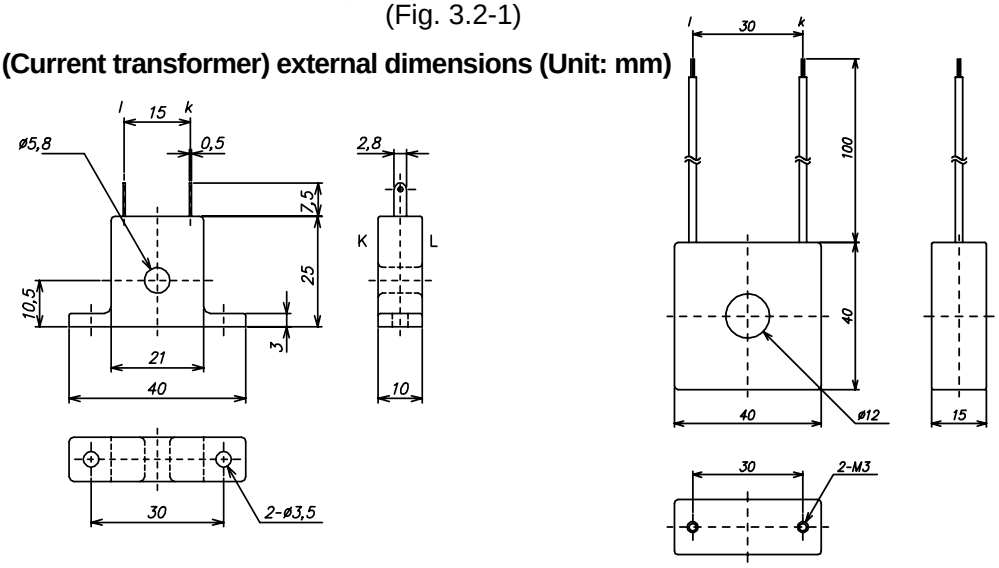
- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gases
- Few mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of 0 to 50℃ (32 to 122℉) that does not change rapidly
- An ambient non-condensing humidity of 35 to 85%RH
- No large capacity electromagnetic switches or cables through which large current is flowing
- No water, oil or chemicals or where the vapors of these substances can come into direct contact with the controller

3.2 External dimensions (Unit: mm)



(Fig. 3.2-1)

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



AKT4815 (for 20A)

AKT4816 (for 50A)

(Fig. 3.3-1)

3.4 Mounting to DIN rail

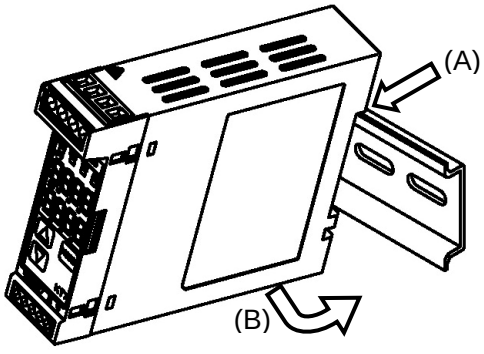
⚠ Caution

Mount the DIN rail horizontally.
When DIN rail is mounted vertically, be sure to use commercially available fastening plates at both ends of KT7 series. Mount the KT7 series to the DIN rail so that the KT7 series cannot move.
However, if the DIN rail is mounted horizontally in a position susceptible to vibration or shock, the fastening plates must be used as well.

Recommended fastening plate

Matsushita Electric Works, Ltd.	Fastening plate ATA4806

(1) Hook (A) of KT7 series on the upper side of the DIN rail. (Fig. 3.4-1)
(2) Making (B) part of the KT7 series as a support, fit the lower part of the KT7 series to the DIN rail. KT7 series will be completely fixed to DIN rail with a “Click” sound. (Fig. 3.4-1)



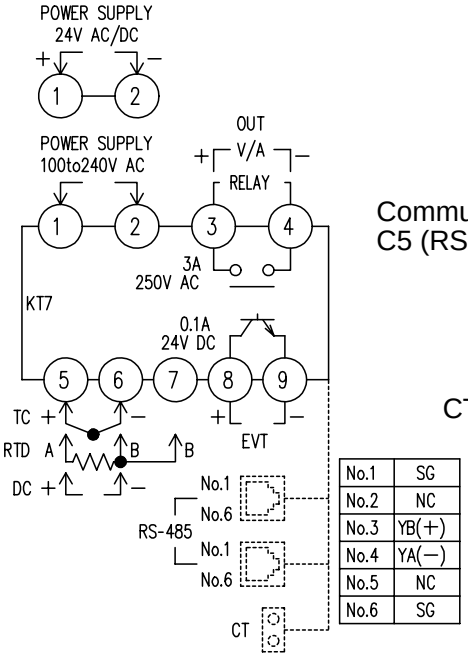
(Fig. 3.4-1)

4. Wiring

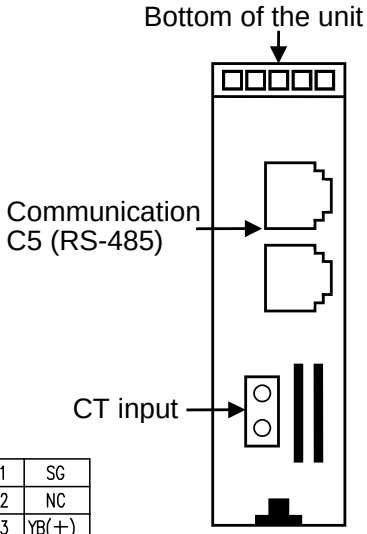
⚠ Warning

Turn the power supplied 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.

● **Terminal arrangement**



No.1	SG
No.2	NC
No.3	YB(+)
No.4	YA(−)
No.5	NC
No.6	SG



(Fig. 4-1)

- OUT : Control output
- RELAY : Relay contact output
- V/A : DC voltage output/ DC current output
- EVT : Event output [Activated when Alarm, Loop break alarm or Heater burnout alarm (option) is ON]
- TC : Thermocouple
- RTD : Resistance temperature detector
- DC : DC current or DC voltage
- RS-485: Serial communication

⚠ Caution

- Do not leave bits of wire in the KT7 series when wiring, because they could cause fire or malfunction.
- Insert the connecting cable into the designated connector securely. Otherwise malfunction may occur due to imperfect contact.
- Connect the AC power wire to the designated terminal as is written in this instruction manual, otherwise it may burn and damage the KT7 series.
- 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 input types, do not confuse the 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 to avoid external interference.
- To prevent the unit from harmful effects of the unexpected level noise, it is recommended that a surge absorber be installed between the electromagnetic switch coils.
- This unit does not have built-in power switch, circuit breaker or fuse. Therfore, it is necessary to install them in the circuit near the external unit.
  (Recommended fuse: Time-lag fuse, rated voltage 250V AC, rated current 2A)

Note: Tighten the terminal screw properly referring to the table below.

Recommended ferrules

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		

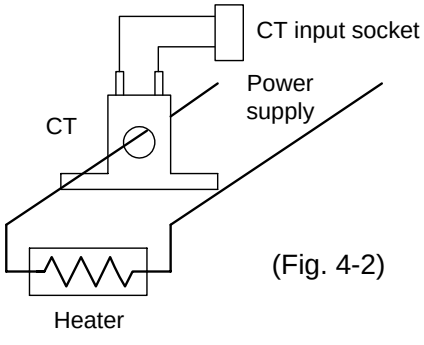
Option: Heater burnout alarm

(1) **This alarm is not available for detecting heater current under phase control.**

(2) **This alarm is not available for detecting 3-phase heater current.**

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

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



(Fig. 4-2)

5. Setup

Wire the power terminals only. After the power is turned on, the 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 for approx. 3 seconds (Table 5-1).
(If any other value is set during the scaling high limit value setting, the value is indicated on the SV display.)
During this time all outputs and the LED indicators are in OFF status.
Control will then start indicating the input value on the PV display and SV on the SV display.
(While control output OFF function is working, oFF is indicated on the PV display.)
(Table 5-1)

Sensor input	℃		℉	
	PV display	SV display	PV display	SV display
K	K C	1370	K F	2500
	K .C	400.0	K .F	750.0
J	J C	1000	J F	1800
R	r C	1760	r F	3200
S	S C	1760	S F	3200
B	b C	1820	b F	3300
E	E C	800	E F	1500
T	T .C	400.0	T .F	750.0
N	n C	1300	n F	2300
PL-Ⅱ	PL2C	1390	PL2F	2500
C (W/Re5-26)	c C	2315	c F	4200
Pt100	Pt .C	850.0	Pt .F	999.9
	Pt C	850	Pt F	1500
JPt100	JPt.C	500.0	JPt.F	900.0
	JPtC	500	JPtF	900
4 to 20mA DC	420A	Scaling high limit value	420A	Scaling high limit value
0 to 20mA DC	020A		020A	
0 to 1V DC	0 1V		0 1V	
0 to 5V DC	0 5V		0 5V	
0 to 10V DC	0 10V		0 10V	
1 to 5V DC	1 5V		1 5V	

5.1 Main setting mode

Character (PV display)	Name, Description, Setting range	Default value (SV display)
S	**SV** • Sets the SV. • SV low limit to SV high limit or scaling low limit value to scaling high limit value (For DC voltage and current inputs, the placement of the decimal point follows the selection)	0℃

5.2 Sub setting mode

Character (PV display)	Name, Description, Setting range	Default value (SV display)
AT	**AT setting** • Performs PID auto-tuning. However when PID auto-tuning has not finished after 4 hours, PID auto-tuning is cancelled automatically. • If Auto-tuning is cancelled during the process, P, I, D values return to the previous value. • PID auto-tuning cancellation: ----, PID auto-tuning performance: AT	----
P	**OUT proportional band setting** • Sets the OUT proportional band. • The control action becomes ON/OFF action when set to 0 or 0.0. • 0.0 to 110.0%	2.5%
I	**Integral time setting** • Sets the integral time. • Setting the value to 0 disables the function. • Not available for ON/OFF action. • 0 to 1000 seconds	200 seconds
d	**Derivative time setting** • Sets the derivative time. • Setting the value to 0 disables the function. • Not available for ON/OFF action. • 0 to 300 seconds	50 seconds
rn	**Anti-reset windup setting** • Sets anti-reset windup. • Available only for PID action. • 0 to 100%	50%

c	**OUT proportional cycle setting** • Sets the proportional cycle value for OUT. • Not available for ON/OFF action or DC current output type **With the relay contact type, if the proportional cycle time is decreased, the frequency of the relay action increases and the life of the relay action increases and the life of the relay contact is shortened.** • 1 to 120 seconds	Relay contact output: 30sec Non-contact voltage output: 3sec
rSET	**Manual reset setting** • Sets the reset value manually. • Available only for P and PD action. • ±Proportional band converted value (For DC voltage and current inputs, 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 the function (excluding Process high and Process low alarm). • Alarm, Loop break alarm and Heater burnout alarm (option) utilize common output terminals. • Not available if No alarm action is selected during the Alarm type selection. • See (Table 5.2-1).	0℃
H□□□ and measured current value are indicated alternately.	**Heater burnout alarm value setting** • Sets the heater current value for Heater burnout alarm. • Available only when Heater burnout alarm (option) is added. • Setting the value to 0.0 disables the function. • It is recommended to set approx. 80% of the heater current value (set value) considering the voltage fluctuation of power supply. • Upon returning to set limits, the alarm will stop. • Heater burnout alarm (option), Alarm and Loop break alarm utilize common output terminals. • Rating 5A : 0.0 to 5.0A Rating 10A: 0.0 to 10.0A Rating 20A: 0.0 to 20.0A Rating 50A: 0.0 to 50.0A	0.0A
LP_T	**Loop break alarm action time setting** • Sets the action time to assess the Loop break alarm. • Setting the value to 0 disables the function. • Loop break alarm, Alarm and Heater burnout alarm (option) utilize common output terminals. • 0 to 200 minutes	0 minutes
LP_H	**Loop break alarm action span setting** • Sets the action span to assess the Loop break alarm. • Setting the value to 0 disables the function. • Loop break alarm, Alarm and Heater burnout alarm (option) utilize common output terminals. • 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 5.2-1)

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

• When input has a decimal point, negative low limit value is –199.9, and positive high limit value is 999.9.
• All alarm types except process alarm are ±deviation setting from the SV.
*1: For DC input, input span is the same as the scaling span.
*2: For DC input, input range low (or high) limit value is the same as scaling low (or high) limit value.

5.3 Auxiliary function setting mode 1

Character (PV display)	Name, Description, Setting range	Default value (SV display)
Lock	**Set value lock selection** • Locks the set value to prevent setting errors. The setting item to be locked depends on the selection. • If Lock 1 or Lock 2 is selected, PID auto-tuning or auto-reset cannot be carried out. • ---- (Unlock): All set values can be changed. Loc 1 (Lock 1): None of 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, they return to their previous value after power is turned off because they are not saved in the non-volatile memory. Be sure to select Lock 3 when changing the set values frequently via communication function, (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.) Do not change any setting item in Auxiliary function setting mode 2. If any item in the mode is changed, it will affect other setting items such as SV and Alarm value.	Unlock
to	**Sensor correction setting** • Sets the sensor correction value for the sensor. • Thermocouple, RTD input: –100.0 to 100.0℃ (℉) DC voltage, current input: –1000 to 1000 (The placement of the decimal point follows the selection)	0.0℃
cmwL	**Communication protocol selection** • Selects the communication protocol. • Available only when Serial communication (option) is applied. • Not available if nonL is indicated • Modbus ASCII mode: modA, Modbus RTU mode: modr	modA
cmno	**Instrument number setting** • Sets the instrument number. (Communication cannot be carried out unless an instrument number is individually set when communicating by connecting plural instruments in serial communication.) • Available only when Serial communication (option) is added. • 0 to 95	0
cmwP	**Communication speed selection** • Selects a speed to be equal to the speed of the host computer. • Available only when Serial communication (option) is added. • 2400bps: 24, 4800bps: 48, 9600bps: 96, 19200bps: 192	9600bps
cmPr	**Parity selection** • Selects the parity. • Not available if Serial communication (option) is not added or if nonL is selected during the Communication protocol selection. • No parity: nonE, Even parity: EvEn, Odd parity: odd	Even parity
cmwF	**Stop bit selection** • Selects the stop bit. • Not available if Serial communication (option) is not added or if nonL is selected during the Communication protocol selection. • 1 or 2	1

5.4 Auxiliary function setting mode 2

Character (PV display)	Name, Description, Setting range	Default value (SV display)
inty	**Input type selection** • The input type can be selected from thermocouple (10 types), RTD (2 types), DC current(2 types) and DC voltage(4 types), and the unit ℃/℉ can be selected.	K (–200 to 1370℃)

K	–200 to 1370℃:	tC	K	–320 to 2500 ℉:	tF
	–199.9 to 400.0℃:	t.C		–199.9 to 750.0℉:	t.F
J	–200 to 1000 ℃:	JC	J	–320 to 1800 ℉:	JF
R	0 to 1760 ℃:	rC	R	0 to 3200 ℉:	rF
S	0 to 1760 ℃:	SC	S	0 to 3200 ℉:	SF
B	0 to 1820 ℃:	bC	B	0 to 3300 ℉:	bF
E	–200 to 800 ℃:	EC	E	–320 to 1500 ℉:	EF
T	–199.9 to 400.0℃:	t.C	T	–199.9 to 750.0℉:	t.F
N	–200 to 1300 ℃:	nC	N	–320 to 2300 ℉:	nF
PL-Ⅱ	0 to 1390 ℃:	PL2C	PL-Ⅱ	0 to 2500 ℉:	PL2F
C (W/Re5-26)	0 to 2315 ℃:	CC	C (W/Re5-26)	0 to 4200 ℉:	CF
Pt100	–199.9 to 850.0℃:	P1.C	Pt100	–199.9 to 999.9℉:	P1.F

	JPt100 –199.9 to 500.0℃: JPT.C JPt100 –199.9 to 900.0℉: JPT.F Pt100 –200 to 850 ℃: PT C Pt100 –300 to 1500℉: PT F JPt100 –200 to 500 ℃: JPTC JPt100 –300 to 900 ℉: JPTF 4 to 20mA –1999 to 9999: 420A 0 to 20mA –1999 to 9999: 020A 0 to 1V –1999 to 9999: 0 1V 0 to 5V –1999 to 9999: 0 5V 1 to 5V –1999 to 9999: 1 5V 0 to 10V –1999 to 9999: 0 10V	
SCLH	**Scaling high limit setting** • Sets the scaling high limit value. • Available only for DC input • Scaling low limit value to input range high limit value (The placement of the decimal point follows the selection.)	1370℃
SCLL	**Scaling low limit setting** • Sets the scaling low limit value. • Available only for DC input • Input range low limit value to scaling high limit value (The placement of the decimal point follows the selection.)	–200℃
dP	**Decimal point place selection** • Selects decimal point place. • Available only for DC input. • No decimal point: 0 1 digit after decimal point: 0.0 2 digits after decimal point: 0.00 3 digits after decimal point: 0.000	No decimal point
FILT	**PV filter time constant setting** • Sets PV filter time constant. (If the set value is too large, it affects control result due to the delay of response) • 0.0 to 10.0 seconds	0.0 seconds
oLH	**OUT high limit setting** • Sets OUT high limit value. • Not available for ON/OFF action. • OUT low limit value to 105% (Setting higher than 100% is effective to DC current output type)	100%
oLL	**OUT low limit setting** • Sets OUT low limit value. • Not available for ON/OFF action. • –5% to OUT high limit value (Setting less than 0% is effective to DC current output type)	0%
HYS	**OUT ON/OFF action hysteresis setting** • Sets OUT ON/OFF action Hysteresis. • Available only when the control action is ON/OFF action • Thermocouple, RTD input: 0.1 to 100.0℃(℉) DC input: 1 to 1000 (The placement of the decimal point follows the selection)	1.0℃
AL 1F	**Alarm type selection** • Selects an alarm type. No alarm action : ---- Process high alarm : PS High limit alarm : H Process low alarm : rPS Low limit alarm : L High limit alarm with standby : H _u High/Low limits alarm : HL Low limit alarm with standby : L _u High/Low limit range alarm: oId High/Low limits alarm w/standby: HL _u	No alarm action
AILA	**Alarm action Energized/Deenergized selection** • Selects the alarm action Energized/Deenergized. • Not available if No alarm action is selected during the Alarm type selection. • Energized: nonL Deenergized: rEVS	Energized
AHLd	**Alarm HOLD function selection** • Selects either [Holding] or [Not Holding] of alarm HOLD function. If alarm HOLD function is set to [Holding], once the alarm functions, alarm output remains until the power is turned off. • Not available if No alarm action is selected during the Alarm type selection • Alarm Not Holding: nonE Alarm Holding: HoLd	Alarm Not Holding
A1HY	**Alarm hysteresis setting** • Sets the alarm hysteresis. • Not available if No alarm action is selected during the Alarm type selection • Thermocouple, RTD input: 0.1 to 100.0℃(℉) DC 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 time. When the setting time has passed after the input enters alarm output range, the alarm is activated. • Not available if No alarm action is selected during the Alarm type selection. • 0 to 9999 seconds	0 seconds
conF	**Direct/Reverse control action selection** • Selects either Reverse (Heating) or Direct (Cooling) control action. • Reverse (Heating) action : HEAt Direct (Cooling) action : cooL	Reverse (Heating) action
AT_b	**AT bias setting** • Sets bias value during PID auto-tuning. • Not available for the DC voltage or current input • 0 to 50℃ (0 to 100℉) or 0.0 to 50.0℃ (0.0 to 100.0℉)	20℃
EoUt	**Output status selection when input abnormal** • Selects the output status of OUT when DC input is overscale or underscale. See “Input abnormality indication” on page 18. • Available only for DC current output with DC input • oFF: OFF(4mA) or OUT low limit on: Outputs a value between OFF (4mA) and ON (20mA) or between OUT low limit value and OUT high limit value, depending on a 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. • Controller function: cnFr Converter function: cnVt	Controller function

ARW function

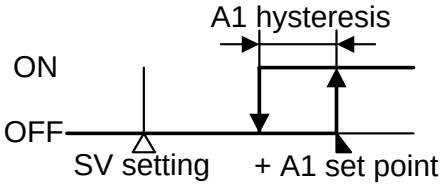
ARW (Anti-reset windup) prevents overshoot caused by the integral action. The smaller the ARW value, the less the overshoot caused by the integral action in the transition status, however it takes time until stabilization.

Sensor correction function

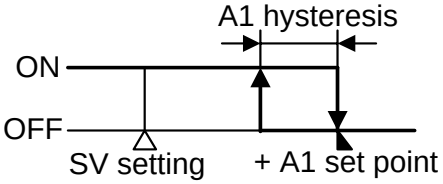
This corrects the input value from the sensor. When a sensor cannot be set at a location where control is desired, the sensor measuring temperature may deviate from the temperature in the controlled location. When controlling with plural controllers, the accuracy of sensors affects the control. Therefore, sometimes the measured temperatures (input value) do not concur.
In such a case, the control can be set at the desired temperature by adjusting the input value of sensors.

Energized/Deenergized function

When [alarm action Energized] is selected, the alarm output (between terminals 8-9) is conducted (ON) while the alarm output indicator is lit.
The alarm output is not conducted (OFF) while the alarm output indicator is not lit.
When [alarm action Deenergized] is selected, the alarm output (between terminals 8-9) is not conducted (OFF) while the alarm output indicator is lit.
The alarm output is conducted (ON) while the alarm output indicator is not lit.



High limit alarm (When Energized is set)
(Fig. 5.4-1)



High limit alarm (When Deenergized is set)
(Fig. 5.4-2)

5.5 Output MV (manipulated variable) indication

Name and Description
Output MV (manipulated variable) indication • **In the PV/SV display mode, press the MODE key for approx. 3 seconds.** Keep pressing the MODE key until the output manipulated variable appears, though the main setting mode appears temporarily during the process. (The SV display indicates output manipulated variable and the 1st decimal point from the right flashes in 0.5 second cycles) If the MODE key is pressed again, the unit reverts to the PV/SV display mode.

6. Operation flowchart

Outline of operation procedure

Operation before running

[Step 1 Initial setting] : Set Input type, Alarm type, control action, etc. in Auxiliary function setting mode 2.

↓

[Step 2 Adjusting item] : Set PID values and Alarm value in the Sub setting mode.

↓

[Step 3 Lock setting] : Set the Set value Lock in Auxiliary function setting mode 1 (If Step 3 is not necessary, skip this step.)

↓

[Step 4 Run setting] : Set the SV(desired value) in the Main setting mode.

Alarm setting procedure
(Numbers (1) to (6) are indicated on the flowchart.)

(1) [Alarm type]: Select an alarm type
(If an alarm type except for ---- is selected, items (2) to (6) are indicated and they can be set if necessary.

(2) [Alarm action Energized/Deenergized]: Select Alarm contact output ON (Energized: nonE) or OFF (Deenergized: rEVS).

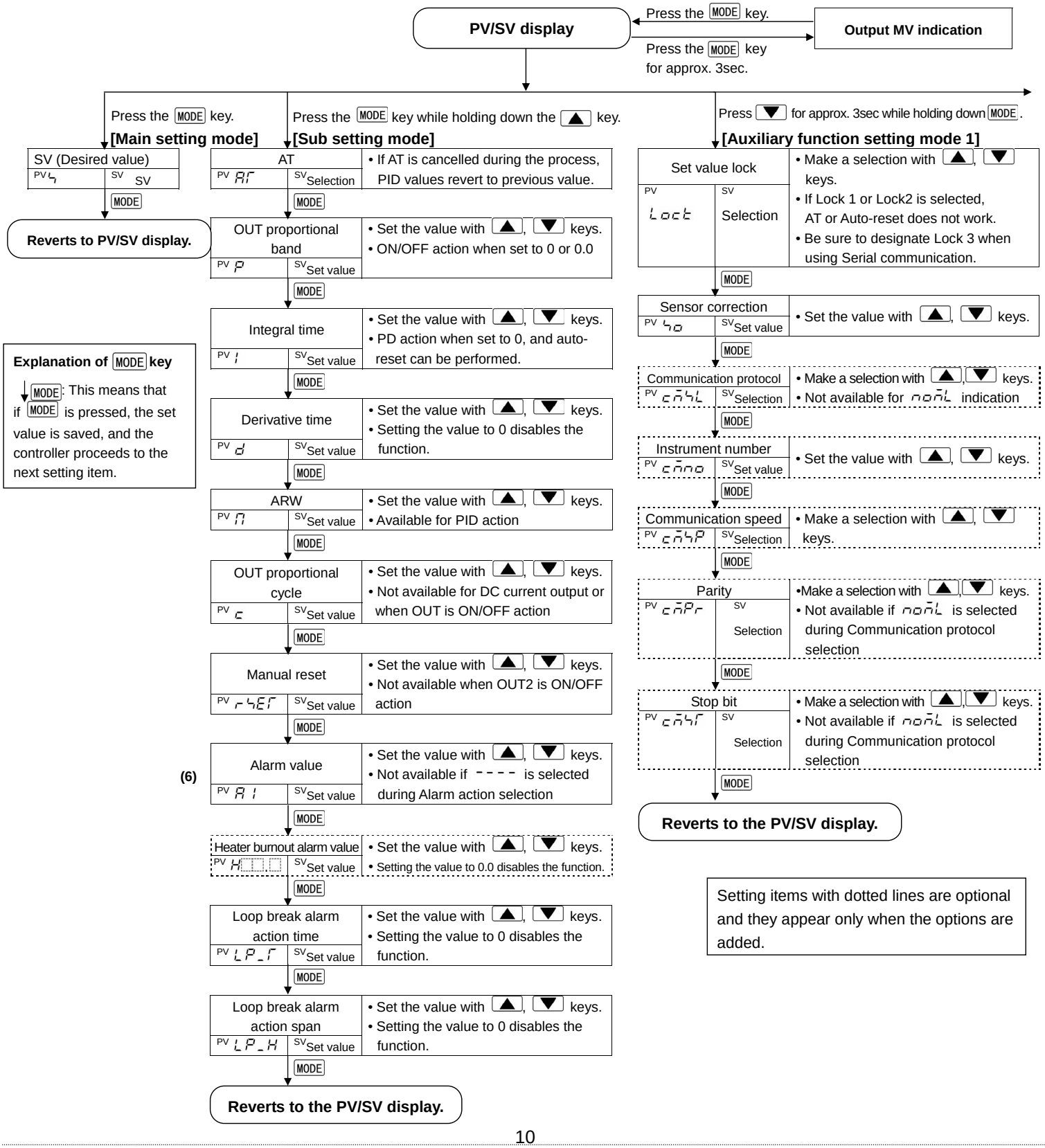
(3) [Alarm HOLD function]: Select the alarm output Holding or Not Holding.

(4) [Alarm hysteresis]: Set the Alarm hysteresis.

(5) [Alarm action delayed timer]: Set Alarm action delayed time.
(If input enters alarm action range and setting time has passed, the alarm is activated.)

(6) [Alarm value]: Set action point of Alarm output.

[Note] If an alarm type is changed, the alarm set value becomes 0 (0.0). Therefore it is necessary to reset it.



Input type (character indication) and range

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

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

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. Character indication: H

Low limit alarm: The alarm action is ±deviation setting to the SV. The alarm is activated if the input value goes under the low limit set value. Character indication: L

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. Character indication: HL

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

Process 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.
Character indication: Process high alarm AH, Process low alarm rAH

Alarm with standby function: 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.)
Character indication:
High limit alarm with standby : H u
Low limit alarm with standby : L u
High/Low limits alarm with standby : HL u

Press the MODE key for approx. 3sec while holding down the ⟨⟩ key.

[Auxiliary function setting mode 2]

Input type
PV SEnS / SV Selection
• Make a selection with ▲, ▼ keys.
• Default value: E C

MODE

Scaling high limit
PV SCLH / SV Set value
• Set the value with ▲, ▼ keys.
• Available for DC current, DC voltage input

MODE

Scaling low limit
PV SCLL / SV Set value
• Set the value with ▲, ▼ keys.
• Available for DC current, DC voltage input

MODE

Decimal point place
PV dP / SV Selection
• Select the value with ▲, ▼ keys.
• Available for DC current, DC voltage input

MODE

PV filter time constant
PV FILC / SV Set value
• Set the value with ▲, ▼ keys.

MODE

OUT high limit
PV oLH / SV Set value
• Set the value with ▲, ▼ keys.
• Not available for ON/OFF action

MODE

OUT low limit
PV oLL / SV Set value
• Set the value with ▲, ▼ keys.
• Not available for ON/OFF action

MODE

OUT ON/OFF action hysteresis
PV HYS / SV Set value
• Set the value with ▲, ▼ keys.
• Available for ON/OFF action

MODE

(1) **Alarm type**
PV AL 1F / SV Selection
• Make a selection with ▲, ▼ keys.
• Default value: ----

MODE

(2) **Alarm action Energized/Deenergized**
PV A 1LA / SV Selection
• Make a selection with ▲, ▼ keys.
• Not available if ---- is selected during Alarm type selection

MODE

(3) **Alarm HOLD function**
PV AHLd / SV Selection
• Make a selection with ▲, ▼ keys.
• Not available if ---- is selected during Alarm type selection

MODE

(4) **Alarm hysteresis**
PV A 1HY / SV Set value
• Set the value with ▲, ▼ keys.
• Not available if ---- is selected during Alarm type selection

MODE

(5) **Alarm action delayed timer**
PV A 1dY / SV Set value
• Set the value with ▲, ▼ keys.
• Not available if ---- is selected during Alarm type selection

MODE

Direct/Reverse control
PV conF / SV Selection
• Make a selection with ▲, ▼ keys.
• Default value: HEAT

MODE

AT bias
PV AT_b / SV Set value
• Set the value with ▲, ▼ keys.
• Available for thermocouple, RTD input

MODE

Setting item not used
PV SU_b / SV Set value
• Do not set this item even if SU_b is indicated on the PV display.

MODE

Output status selection when input abnormal
PV EoUT / SV Selection
• Make a selection with ▲, ▼ keys.
• Available only when input is DC current and DC voltage with DC current output

MODE

Controller/Converter
PV FUnC / SV Selection
• Make a selection with ▲, ▼ keys.

MODE

Reverts to the PV/SV display.

7. 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 parameter 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 has 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 input) value to “4 to 20mA DC” using the control parameter of the controller, and outputs it.

When this instrument is used as a converter, follow steps (1) to (7) described below.
After steps (1) to (7) are finished, this instrument can be used as a converter.

(1) Wire this controller (Power supply, Input and Output).
(2) Turn the power of this controller ON.
(3) Enter “Auxiliary function setting mode 2” by pressing the ⬭ and MODE key (for approx. 3sec).
(4) Select the sensor type from “Input type selection (SEnS)”.
(5) Set the high limit of the value that is going to be converted during “Scaling high limit setting (SrLH)”.
(6) Set the low limit of the value that is going 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 from “Controller/Converter function selection” in Auxiliary function setting mode 2, the parameter below is automatically set. (Table 7-1)
However, this is applied only to the DC current output type.

(Table 7-1)

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

8. Running

After mounting and wiring in the control panel (DIN rail) are completed, operate the unit following the procedures below.

(1) Turn the power supply to the KT7 Series ON.

For approx. 3sec after power is turned on, the character of the sensor type and temperature unit are indicated on the PV display, and the input range high limit value is indicated on the SV display.
(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 actual temperature and SV display indicates the SV (main set value).

(2) Input each set value.

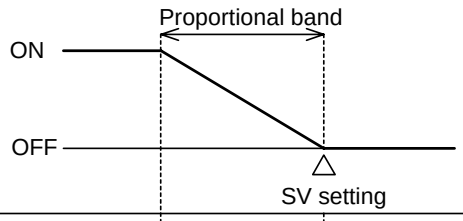
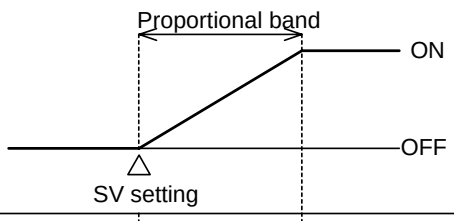
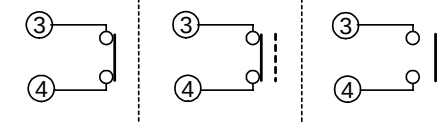
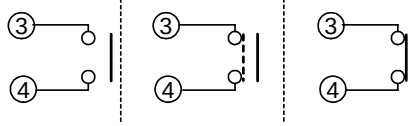
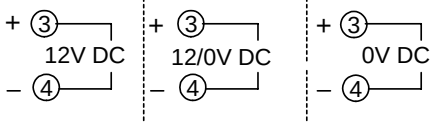
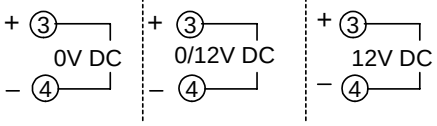
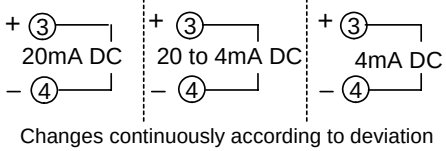
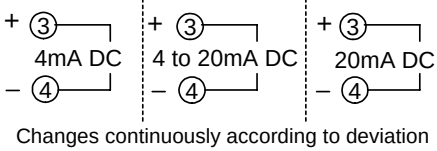
Input each set value, referring to “5. Setup”.

(3) Turn the load circuit power ON.

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

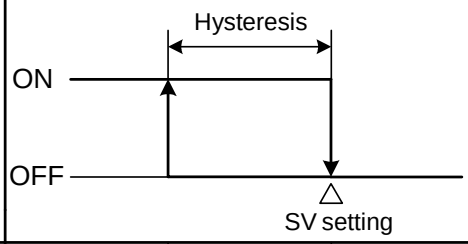
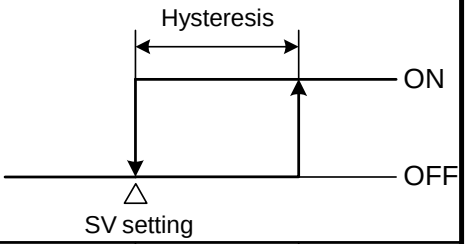
9. Action explanation

9.1 OUT action

	Heating (Reverse) action	Cooling (Direct) action
Control action		
Relay contact output	 Cycle action is performed according to deviation	 Cycle action is performed according to deviation
Non-contact voltage output	 Cycle action is performed according to deviation	 Cycle action is performed according to deviation
DC current output	 Changes continuously according to deviation	 Changes continuously according to deviation
Indicator (OUT) Green		

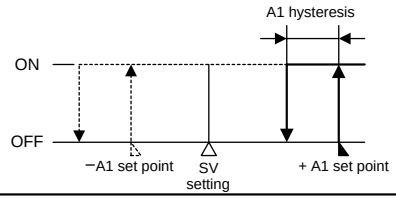
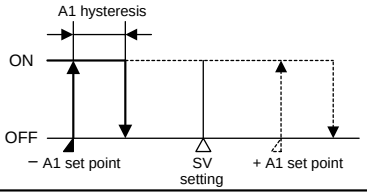
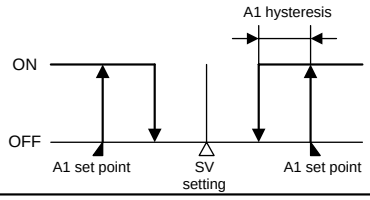
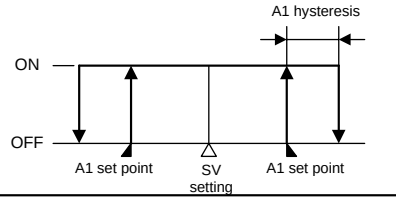
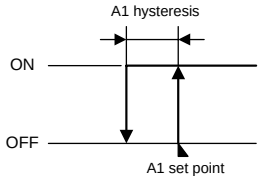
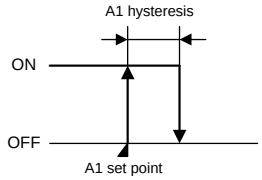
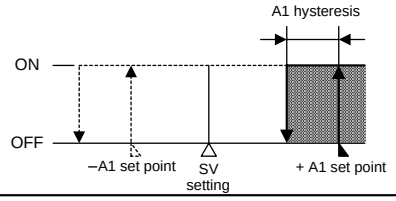
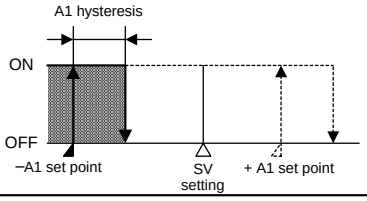
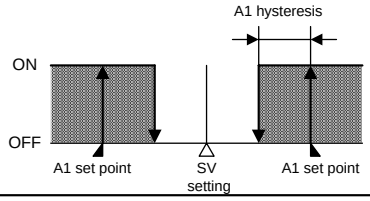
: Acts ON or OFF.

9.2 OUT ON/OFF action

	Heating (reverse) action	Cooling (direct) action
Control action		
Relay contact output		
Non-contact voltage output		
DC current output		
Indicator (OUT) Green		

: Acts ON or OFF.

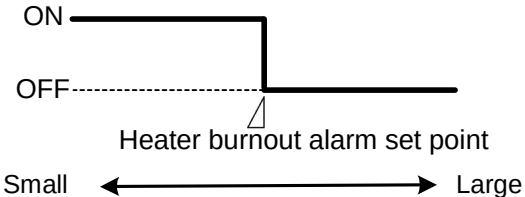
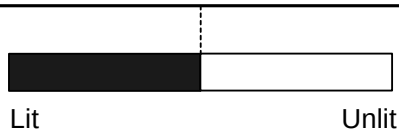
9.3 EVT (Alarm) action

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

: Standby functions in this section.

Event (EVT) output indicator lights when output terminals 8 and 9 are connected (ON) and goes off when they are not connected (OFF).

9.4 EVT (Heater burnout alarm) action

Heater burnout alarm action	
Indicator (EVT) Red	

: Event (EVT) output terminals 8 and 9 are connected (ON).

: Event (EVT) output terminals 8 and 9 are not connected (OFF).

Event (EVT) output indicator lights when output terminals 8 and 9 are connected (ON) and goes off when they are not connected (OFF).

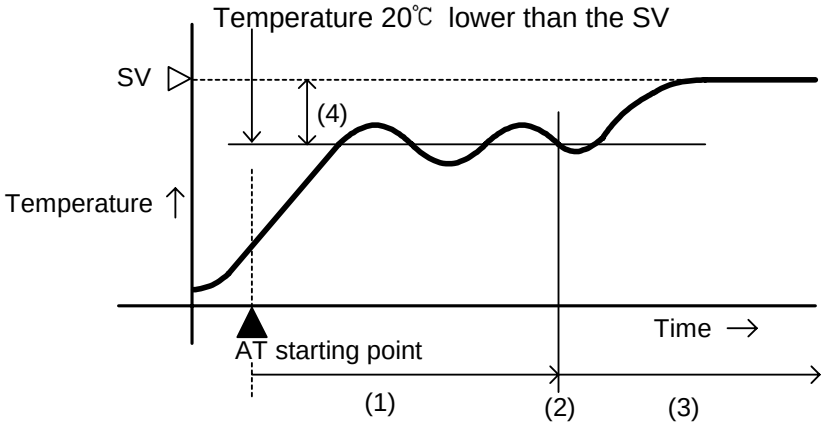
10. PID auto-tuning of this controller

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.

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 processing temperature 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.

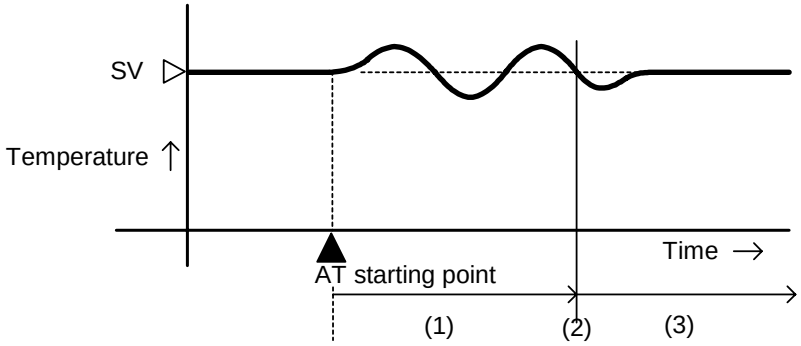


(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by auto-tuning
(4) AT bias value

(Fig. 10-1)

(B) When control is stable

The AT process will fluctuate around the SV.

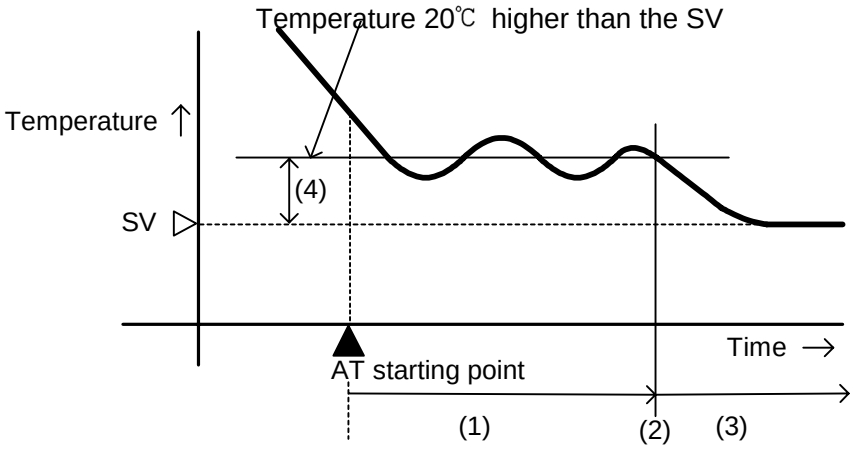


(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by auto-tuning

(Fig. 10-2)

(C) In the case of a large difference between the SV and processing temperature as the temperature is falling

When AT bias is set to 20℃, 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

(Fig. 10-3)

11. Specifications

11.1 Standard specifications

Model : Temperature 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 (AKT4811, 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 input span ±1 digit, or within ±2℃ (4℉) whichever is greater
However, for R, S input, 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 input span ±1 digit

RTD : Within ±0.1% of input span ±1 digit, or within ±1℃ (2℉) whichever is greater

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

DC current : Within ±0.2% of 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 time are set to 0
- ON/OFF action: When proportional band is set to 0

OUT 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)
OUT proportional cycle : 1 to 120 seconds
ARW : 0 to 100%
Manual reset : ±Proportional band converted value
Output limit : 0 to 100% (DC current output type: –5 to 105%)
(Not available for 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)

Control output (OUT)

- Relay contact: 1a, Control capacity 3A 250V AC (Resistive load)
  1A 250V AC (Inductive load COS ø =0.4)
  Electrical life, 100,000 cycles
- 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

- Alarm output

[Alarm, Loop break alarm and Heater burnout alarm (option) utilize common output terminals.]
The alarm action point is set by ± deviation from the SV (excluding Process alarm) and when input is out of the alarm setting range, alarm (EVT) turns ON or OFF (High/Low limit range alarm). When Deenergized is selected in 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)
Output : Open collector, Control capacity 24V DC 0.1A (Max.)
Alarm type : One alarm type is selectable 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 Energized/Deenergized: Alarm (EVT) output Energized/Deenergized can be selected.

	Alarm Energized	Alarm Deenergized
Red (EVT) LED	Lights	Lights
EVT output	ON	OFF

Alarm HOLD function: Once the alarm is activated, alarm output is held until the power is turned off.

• Loop break alarm output

[Loop break alarm, Alarm and Heater burnout alarm (option) utilize common output terminals.]

Detects heater burnout, sensor burnout and actuator trouble.

Setting range: Loop break alarm action time setting: 0 to 200 minutes

Loop break alarm action span setting

Thermocouple, RTD input: 0 to 150℃(℉) or 0.0 to 150.0℃(℉)

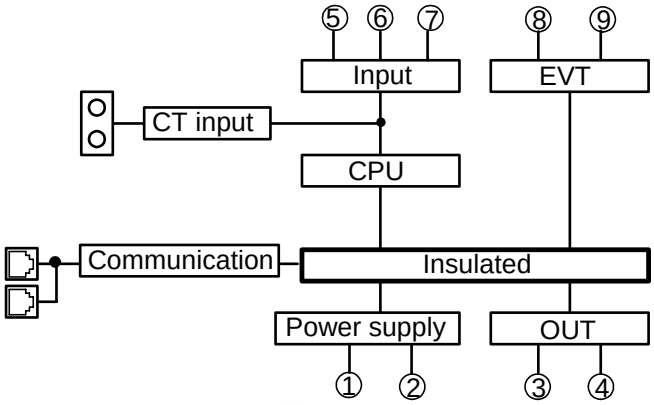
DC voltage, current input : 0 to 1500

(The placement of the decimal point follows the selection)

Output: Open collector, Control capacity, 24V DC 0.1A (Max.)

Converter function: See “7. Converter function”

Insulation • Dielectric strength: Circuit insulation configuration



When OUT is non-contact voltage output or DC current output, OUT 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 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 : Ash gray (Case)

Attached functions

[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 it on the same status as when the reference junction is located at 0℃ (32℉).

[Warm-up indication]

After the power supply to the instrument is turned on, the sensor input characters and temperature unit are indicated on the PV display and input range high limit value is indicated on the SV display for 3 seconds.

For DC current, voltage input, the scaling high limit value is indicated.

[Burnout]

When the thermocouple or RTD input is burnt out, OUT is turned OFF and PV display flashes “ ” (for DC current output type, OUT low limit value).

[Input abnormality indication]

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

[Output status selection when input abnormal] is available only for DC input and DC current output. For other inputs and outputs except for DC input and DC current output, the output status will be the same as when OFF is selected during [Output status selection when input abnormal].

(*): Outputs a value between OFF (4mA) and ON (20mA) or between OUT low limit value and OUT 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 above:
Input range low limit value–50℃ (100℉) to input range high limit value+50℃ (100℉)

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

Accessories included: Instruction manual 1 copy
When Heater burnout alarm option is added: Wire harness 3m, 1 length
When Heater burnout alarm option is added:
For rating 5A, 10A, 20A CT (AKT4815) 1 piece
For rating 50A CT (AKT4816) 1 piece

Accessories sold separately: 50Ω shunt resistor (AKT4811) for DC current input 1 piece

11.2 Optional specifications

Heater burnout alarm (option)

Watches the heater current with CT (Current transformer) and detects the burnout.
This alarm is also activated when indication is overscale and underscale.
(To detect Heater burnout, a CT for 50A can also be used for 5A, 10A and 20A ratings, however, this is not suitable for small ampere ratings due to a low degree of accuracy. For a 20A rating or less, use a CT designated for 20A.)

Heater burnout alarm (option), Loop break alarm and Alarm utilize common output terminals.
This option cannot be applied to DC current output type.
Rating : 5A, 10A, 20A, 50A (Must be specified)
Setting range : 5A, 0.0 to 5.0A (Off when set to 0.0) 10A, 0.0 to 10.0A (Off when set to 0.0)
20A, 0.0 to 20.0A (Off when set to 0.0) 50A, 0.0 to 50.0A (Off when set to 0.0)
Setting accuracy: ±5% of the rated value
Action : ON/OFF action
Output : Open collector, Control capacity, 24V DC 0.1A (Max.)

Serial communication (option)

The following operations can be carried out from the external computer.
(1) Reading and setting of SV, PID and various set values
(2) Reading of the PV and action status (3) Change of the functions

Cable length	: Max. communication distance 1000m, Cable resistance; Within 50Ω
Communication interface	: EIA RS-485
Communication method	: Half-duplex communication start-stop synchronous
Communication speed	: 2400, 4800, 9600, 19200bps (Selectable by keypad)
Parity	: Even, Odd and No parity (Selectable by keypad)
Stop bit	: 1, 2 (Selectable by keypad operation)
Communication protocol	: Modbus RTU, Modbus ASCII (Selectable by keypad)
Connectable number of units	: Maximum 31 units to 1 host computer
Communication error detection	: Parity, checksum (LRC, CRC)

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
PV display is indicating [oFF].	• Control output OFF function is working. Press the OUT/OFF key for approx. 1 second to release the function.
[- - - -] is flashing on the PV display.	• Burnout of thermocouple, RTD or disconnection of DC voltage (0 to 1V DC) Change each sensor. **How to check whether the sensor is burnt out** [Thermocouple] If the input terminals of the instrument are shorted, and if a value around room temperature is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out. [RTD] If approx. 100Ω of resistance is connected to the input terminals between A-B of the instrument and between B-B is shorted, and if a value around 0℃ (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 input terminal. Connect the sensor terminals to the instrument input terminals securely.
[- - - -] is flashing on the PV display.	• Check whether input signal source for DC voltage (1 to 5V DC) or DC current (4 to 20mA DC) is disconnected. **How to check whether the input signal wire is disconnected** [DC voltage (1 to 5V DC)] If the input to the input terminals of the instrument is 1V DC and if a scaling low limit value is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected. [DC current (4 to 20mA DC)] If the input to the input terminals of the instrument is 4mA DC and if a scaling low limit value is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected. • Check whether input signal wire for DC voltage (1 to 5V DC) or DC current (4 to 20mA DC) is securely connected to the instrument input terminals. • Check if polarity of thermocouple or compensating lead wire is correct. • Check whether codes (A, B, B) of RTD agree with the instrument terminals.

The PV display keeps indicating the value which was set during Scaling low limit setting.	• Check whether the input signal source for DC voltage (0 to 5V DC, 0 to 10V DC) and DC current (0 to 20mA DC) is disconnected. **How to check whether the input signal wire is disconnected** [DC voltage (0 to 5V DC, 0 to 10V DC)] If the input to the input terminals of the instrument is 1V DC and if the value corresponding to 1V DC is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected. [DC current (0 to 20mA DC)] If the input to the input terminals of the instrument is 1mA DC and if the value corresponding to 1mA DC is indicated, the instrument is likely to be operating normally, however, the signal wire may be disconnected. • Check whether the input lead wire terminals for DC voltage (0 to 5V DC, 0 to 10V DC) or DC current (0 to 20mA DC) are securely mounted to the instrument input terminals.
The indication of PV display is abnormal or unstable.	• Check whether sensor input or temperature unit (℃ or ℉) is correct. Select the sensor input and temperature unit (℃ or ℉) properly. • Sensor correcting value is unsuitable. Set it to a suitable value. • Check whether the specification of the sensor is correct. • AC leaks into the sensor circuit. Use an ungrounded type sensor. • There may be equipment that interferes with or makes noise near the controller. Keep equipment that interferes with or makes noise away from the controller.
[Err 1] is indicated on the PV display.	• Internal memory is defective. Please contact our agency or us.

12.2 Key operation

Problem	Presumed cause and solution
Unable to set SV, P, I, D, proportional cycle, alarm value, etc. The values do not change by the ▲, ▼ keys.	• Set value lock (Lock 1 or Lock 2) is selected. Release the lock selection. • During PID auto-tuning or auto-reset Cancel the auto-tuning if necessary. Auto-reset ends 4 minutes after starting.
The setting indication does not change within the 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
Temperature does not rise.	• Sensor is out of order. Replace the sensor. • Check whether the sensor is securely mounted to the instrument input terminal. Check whether control output terminals are securely mounted to the actuator input terminals. Mount the sensor or control output terminal securely. • Check whether the wiring of sensor or control output terminals is correct.
The control output remains in an ON status.	• OUT 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.	• OUT 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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