NAiS

To prevent accidents arising from the misuse of this controller, please ensure the operator using it 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 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 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.
   (If paint thinner is used, it might deform or tarnish 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.

• Tatsuno Matsushita Electric Works, Ltd. is not liable for any damages or secondary damages incurred as a result of using this product, including any indirect damages.

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1. Model number

1.1 Explanation of model number

```
    A   K   T   4      1
                    ↑   ↑   ↑   ↑   ↑   ↑
                   (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 key operation)

(3) Control output (OUT1) ------------   1: Relay contact, 2: Non-contact voltage, 3: DC current

(4) Alarm output ------------------------ 1: A1 output, 2: A1 output + A2 output
                                          (The alarm action and Energized /Deenergized can be selected
                                          by key operation)
                                          (When A2 output is applied, Heating/Cooling control cannot be
                                          added)

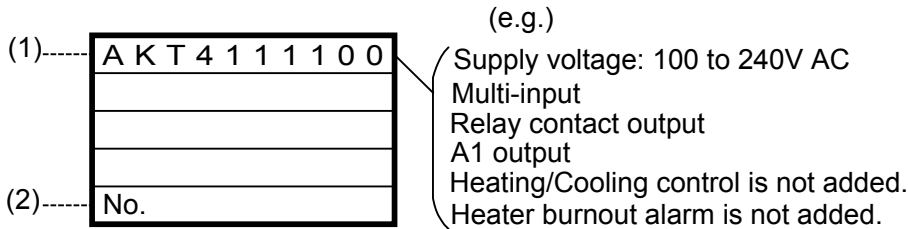(5) Heating/Cooling control (OUT2)--0: Not available, 4: Non-contact relay output

(6) 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)

1.2 How to indicate the rated label
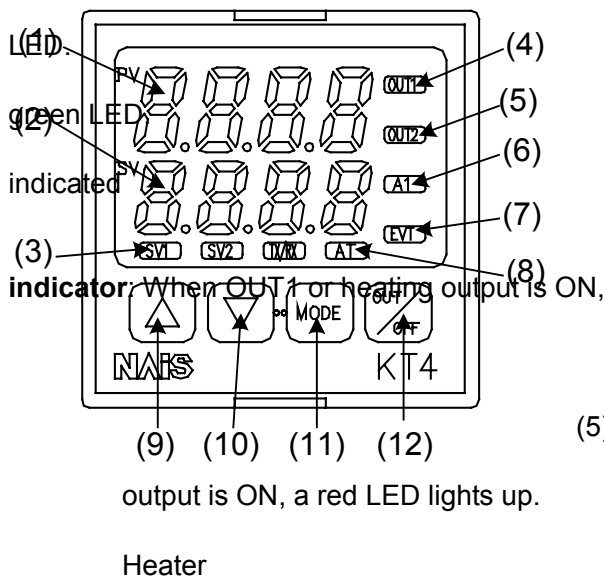
The rated label is put on the case.

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

(e.g.)

(1)------ | A K T 4 1 1 1 1 0 0 |

(2)------ No.

Supply voltage: 100 to 240V AC
Multi-input
Relay contact output
A1 output
Heating/Cooling control is not added.
Heater burnout alarm is not added.

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

2. Name and functions of the sections

(Fig. 2-1)

(1) **PV display**: Indicates the input value with a red LED.

(2) **SV display**: Indicates the setting value with a green LED.

(3) **SV1 indicator**: A green LED lights up when SV is indicated on the SV display.

(4) **OUT1 indicator**: When OUT1 or heating output is ON, a green LED lights up. (For DC current output type, it blinks corresponding to the manipulated variable in a 0.25 second cycle.

(5) **OUT2 indicator**: When OUT2 is ON, a yellow LED lights up.

(6) **A1 indicator**: When A1 output is ON, a red LED lights up.

(7) **EVT indicator**: When Event output (A2 output, Heater burnout alarm output) is ON, a red LED lights up.

(8) **AT indicator**: When auto-tuning or auto-reset is being performed, a yellow LED blinks.

(9) **Increase key** : Increases the numeric value.
(10) **Decrease key** : Decreases the numeric value.
(11) **Mode key** : Selects the setting mode or registers the setting value.
 (By pressing the Mode key, the setting value can be registered)
(12) **OUT/OFF key** : The control output is turned on or off. If this key is pressed for approx. 1 second, control output off function works.
 (To cancel the function, press the OUT/OFF key again for approx. 1 second.)

⚠ Notice

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

---

3. Mounting to control panel

3.1 Site selection

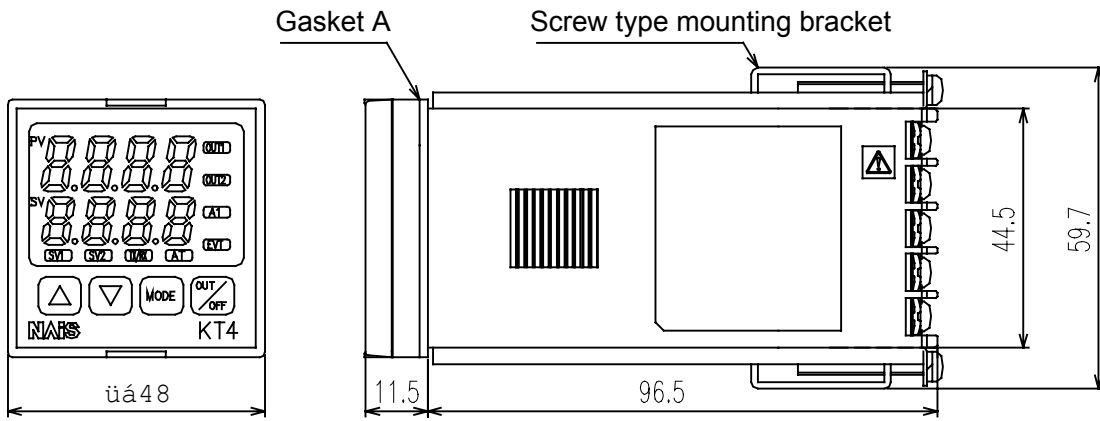**This instrument is intended to be used under the following environmental conditions (IEC61010-1): Overvoltage category Ⅱ, Pollution degree 2**

Mount the controller in a place with:
 • A minimum of dust, and an absence of corrosive gases
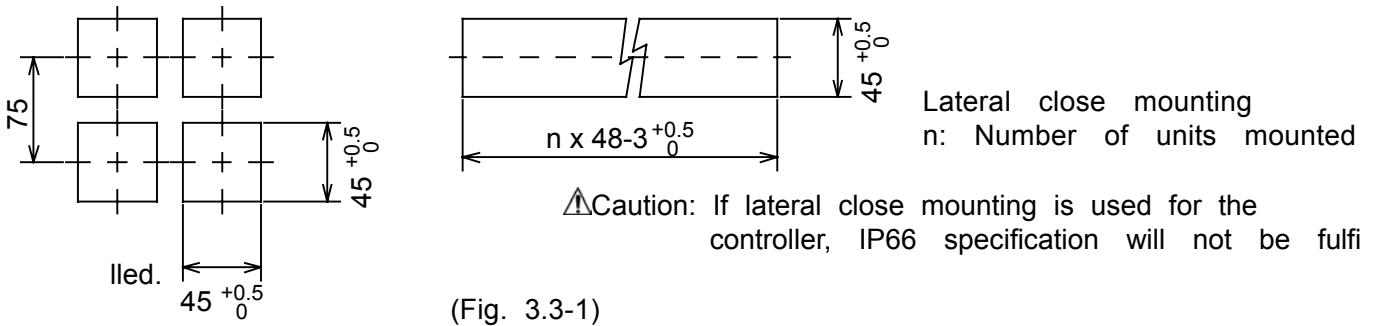 • No flammable, explosive gasses

- 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
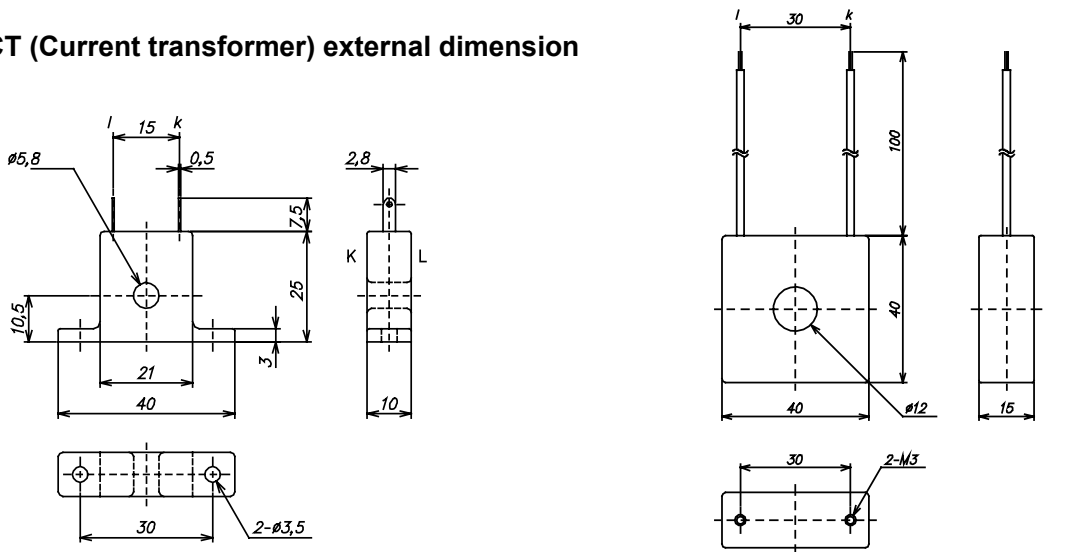
3.2 External dimension

Gasket A   Screw type mounting bracket

KT4

üá48

11.5   96.5

44.5

59.7

(Fig.　3.2-1)

3.3 Panel cutout

75

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

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

lled.

n x 48-3 $^{+0.5}_{0}$

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

Lateral close mounting
n: Number of units mounted

⚠Caution: If lateral close mounting is used for the
controller, IP66 specification will not be fulfi

(Fig.　3.3-1)

3.4 CT (Current transformer) external dimension

l   15   k
ø5,8   0,5
2,8
K   L

7,5
25
10,5
3
21
40
10

30
2-ø3,5

l   30   k

100
40

40   ø12
15

K   L

30   2-M3

AKT4815 (for 5A, 10A, 20A)

AKT4816 (for 50A)
(Fig. 3.4-1)

3.5 Mounting

Mount the controller vertically to fulfill the dust-proof/Drip-proof specification (IP66).
Mountable panel thickness: Within 1 to 15mm
Insert the controller from the front side of the panel.
Attach the mounting brackets by the holes at the top and bottom of the case and secure the controller
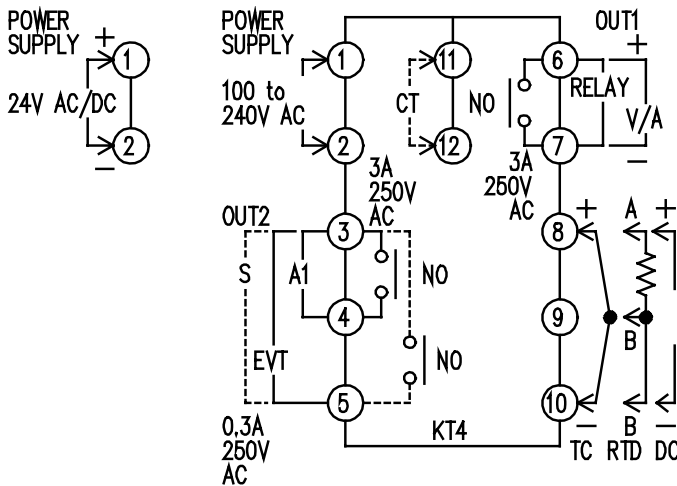in place with the screws.
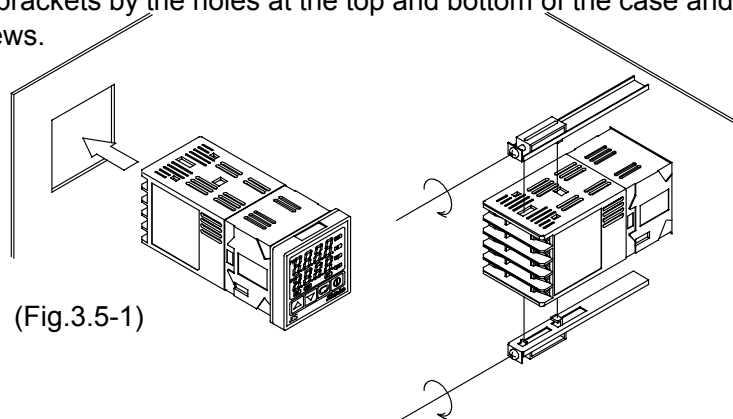
(Fig.3.5-1)

4. Wiring connection

• OUT1 : Control output 1 (Heating output)

• OUT2 : Control output 2 (Cooling output)
• RELAY : Relay contact output

• V/A : DC voltage output/ DC current output
• S : Non-contact relay output

• A1 : Alarm 1 output
• EVT : Event output (A2 output, Heater burnout alarm output)
• CT : CT input
• TC : Thermocouple
• RTD : Resistance temperature detector
• DC : DC current or DC voltage

(Fig. 4-1)

Lead wire solderless terminal

Use a solderless terminal with insulation sleeve that fits in the M3 screw as shown below.
The torque is approximately 0.6N•m to 1.0N•m.

| Solderless terminal	Manufacturer	Model name	Tightening torque
Y type	Nichifu Terminal Industries CO.,LTD.	1.25Y-3	

	Japan Solderless Terminal MFG CO.,LTD.	VD1.25-B3A	0.6N•m
Round type	Nichifu Terminal Industries CO.,LTD.	1.25-3	Max. 1.0N•m
	Japan Solderless Terminal MFG CO.,LTD.	V1.25-3	
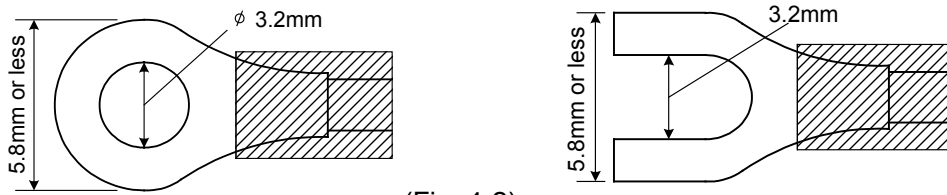
(Fig. 4-2)

Option: Heater burnout alarm

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

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

(3) When wiring, keep CT wire away from AC sources or load wires to avoid the external interference.
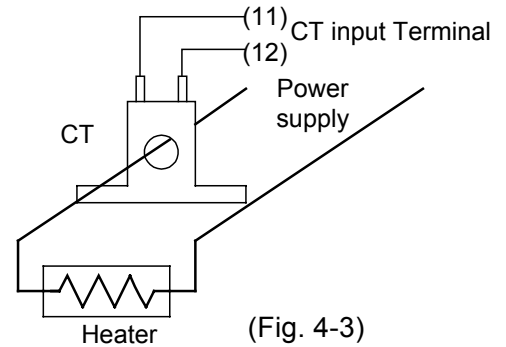
(Fig. 4-3)

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 approximately 3 seconds. (Table 5-1)

(If any other value is set in the scaling high limit setting, the set value is indicated on the SV display)

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

Control will then start and the input value will be indicated on the PV display and main setting value will be indicated 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	t C	1370	t F	2500
	t .C	400.0	t . 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	r .C	400.0	r . 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		Pt F	1500
JPt100	JPt.C	850	JPt.F	900.0
	JPt C	500.0	JPt F	900
		500		
4 to 20mA DC	420A		420A	
0 to 20mA DC	020A		020A	
0 to 1V DC	0 1U	Scaling high limit value	0	Scaling high limit value
0 to 5V DC	0 5U		1U	
0 to 10V DC	010U		0 5U	
1 to 5V DC	1 5U		010U	

| | | | RS | |

5.1 Setup flow chart
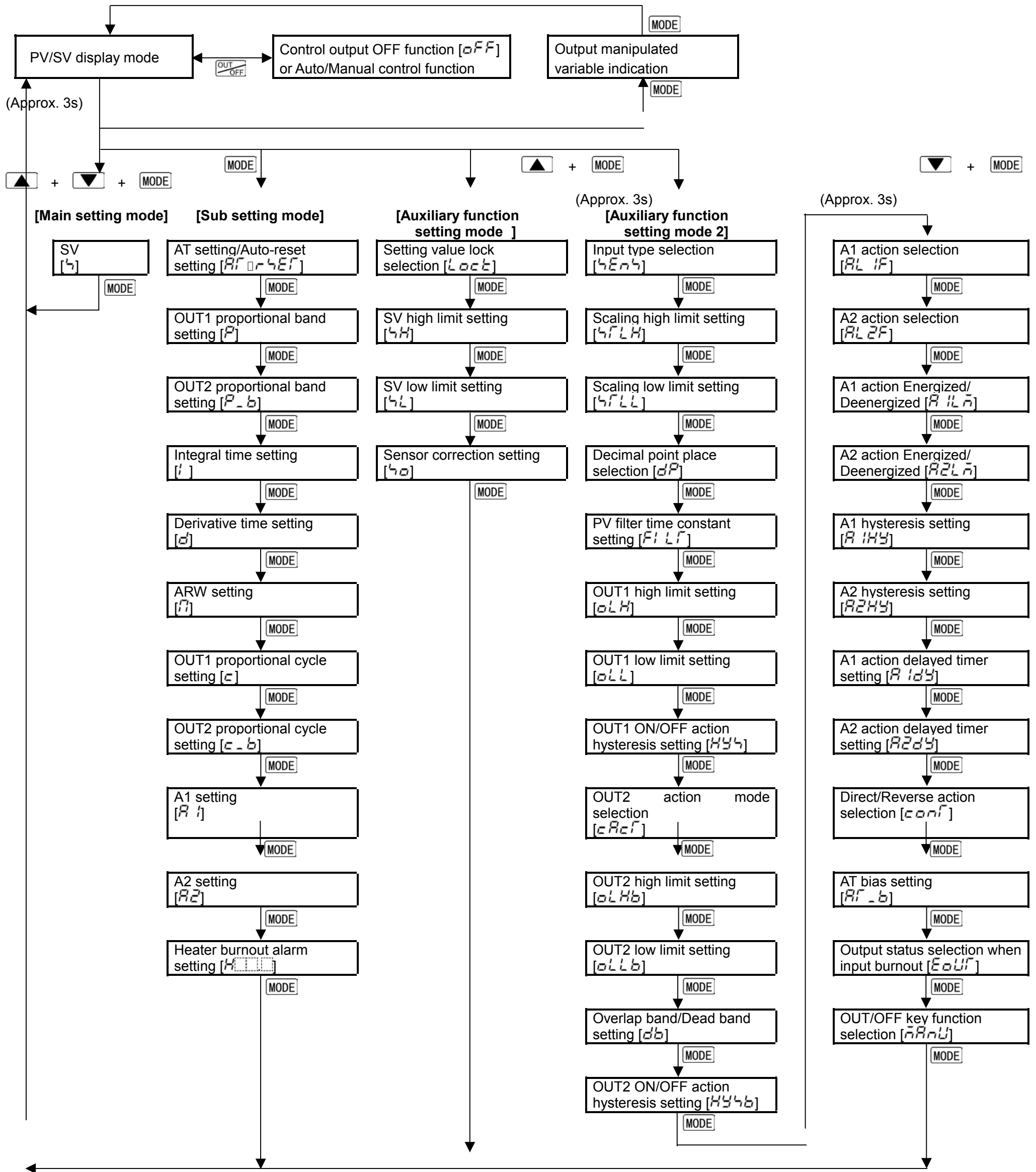
[Key operation]
- ▲ + MODE Press the MODE key while the ▲ key is being pressed.
- ▼ + MODE (Approx. 3s) Press the MODE key for 3 seconds while the ▼ key is being presed.
- ▲ + ▼ + MODE (Approx. 3s) Press the MODE for 3 seconds while the ▲ and ▼ keys are being pressed.

There are some setting characters which are not indicated depending on the specification.

5.2 Main setting mode

Character	Name, Function, Setting range	Default value
५	**SV** • Sets main control setting value. • Setting range: SV low limit to SV high limit	0℃

5.3 Sub-setting mode

Character	Name, Function, Setting range	Default value
Rſ ⲅ५Eſ	**Auto-tuning setting** • Designates auto- tuning Performance or auto-reset Performance • If the auto-tuning is cancelled during the process, P, I and D values revert to the former value. • When auto- tuning has not finished after 4 hours, it is cancelled automatically. • Auto- reset is cancelled in approximately 4 minutes.	- - - -
P	**OUT1 proportional band setting** • Sets the proportional band for OUT1. • The control action becomes ON/OFF action when set to 0 or 0.0 • Setting range: 0 to 1000℃(2000℉), 0.0 to 999.9℃(℉) or 0.0 to 100.0%	10℃
P_b	**OUT2 proportional band setting** • Sets the proportional band for OUT2. • The control action becomes ON/OFF action when OUT1 proportional band is set to 0 or 0.0 • Setting range: 0.0 to 10.0 times (multiplying factor to OUT1 proportional band)	1.0 times
¡	**Integral time setting** • Sets integral time for OUT1. • Setting the value to 0 disables the function. • Auto-reset can be performed when PD action (I=0). • Setting range: 0 to 1000 seconds	200 seconds
d	**Derivative time setting** • Sets derivative time for OUT1. • Setting the value to 0 disables the function. • Setting range: 0 to 300 seconds	50 seconds
⋒	**ARW setting** • Sets ARW for OUT1. • Setting the value to 0 disables the function. • Available only when PID is the control action. • Setting range: 0 to 100%	50%
c	**OUT1 proportional cycle setting** • Sets proportional cycle for OUT1. • Not available for ON/OFF action or DC current output type. • Setting range: 1 to 120 seconds	30 seconds or 3 seconds
c_b	**OUT2 proportional cycle setting** • Sets proportional cycle for OUT2. • Not available when OUT2 is ON/OFF action • Setting range: 1 to 120 seconds	3 seconds
R¡	**A1 setting** • Sets action point for A1 output. • Not available if No alarm action is selected in A1 action selection • Refer to (Table 5.3-1).	0℃
R2	**A2 setting** • Sets action point for A2 output. • Not available if No alarm action is selected in A2 action selection • Refer to (Table 5.3-1).	0℃
H☐☐☐, ☐XX.X displayed alternately	**Heater burnout alarm setting** • Sets the heater current value for Heater burnout alarm. • Self-holding is not available for the alarm output. • 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

(Table 5.3-1)

Alarm action 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 alarm 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 actions except process alarms are ±deviation setting to the main setting.
*1: For DC input, the input span is the same as the scaling span.
*2: For DC input, input range low (high) limit value is the same as scaling low (high) limit value.

5.4 Auxiliary function setting mode 1

Character	Name, Function, Setting range	Default value

Lock	**Setting value lock designation**
	• Locks the setting values to prevent setting errors.
	  The setting item to be locked depends on the designation.
	• When Lock 1 or Lock 2 is designated, PID Auto- tuning and
	  Auto-reset cannot be carried out.
		Unlock status

	• ‐ ‐ ‐ ‐ (Unlock) : All setting values can be changed.
	  Loc1 (Lock 1): None of the setting values can be changed.
	  Loc2 (Lock 2): Only main setting mode can be changed.
	  Loc3 (Lock 3): All setting values can be changed. However, they return to their
	
	                former value after power is turned off because they are not
	                saved in the non-volatile memory.	

5H	**SV high limit setting** • Sets the SV high limit. • Setting range: SV low limit to input range high limit value or SV low limit to scaling high limit value	1370℃
5L	**SV low limit setting** • Sets the SV low limit. • Setting range: Input range low limit value to SV high limit or scaling low limit value to SV high limit	–200℃
5o	**Sensor correction setting** • Sets the correction value for the sensor. • Setting range: –100.0 to 100.0℃ （℉), or –1000 to 1000	0.0℃

5.5 Auxiliary function setting mode 2

Character	Name, Function, Setting range	Default value

5En5	**Input type selection**
	• The input type can be selected from thermocouple (22 types),
	  RTD (8 types), DC current (2 types) and DC voltage (4 types),
	  and the unit ℃/℉ can be selected as well.
		K
		(–200 to 1370℃)

	K –200 to 1370℃: t C −199.9 to 400.0℃: t $.C$ J –200 to 1000 ℃: J C R 0 to 1760 ℃: r C S 0 to 1760 ℃: 5 C B 0 to 1820 ℃: b C E –200 to 800 ℃: E C T –199.9 to 400.0℃: r $.C$ N –200 to 1300 ℃: n C r $.F$ PL-Ⅱ 0 to 1390 ℃: $PL2C$ C (W/Re5-26)0 to 2315 ℃: c C	K –320 to 2500 ℉: t F −199.9 to 750.0℉: t $.F$ J –320 to 1800 ℉: J F R 0 to 3200 ℉: r F S 0 to 3200 ℉: 5 F B 0 to 3300 ℉: b F E –320 to 1500 ℉: E F T −199.9 to 750.0℉: F N –320 to 2300 ℉: n F PL-Ⅱ 0 to 2500 ℉: $PL2F$ C (W/Re5-26) 0 to 4200 ℉: c F	
	Pt100 −199.9 to 850.0℃: $Pr.C$ JPt100 −199.9 to 500.0℃: $JPr.C$ Pt100 −200 to 850 ℃: Pr C JPt100 −200 to 500 ℃: $JPrC$ 4 to 20mA −1999 to 9999: $420A$ 0 to 20mA −1999 to 9999: $020A$ 0 to 1V −1999 to 9999: 0 $1U$ 0 to 5V −1999 to 9999: 0 $5U$ 1 to 5V −1999 to 9999: 1 $5U$ 0 to 10V −1999 to 9999: 0 $10U$	Pt100 −199.9 to 999.9℉: $Pr.F$ JPt100 −199.9 to 900.0℉: $JPr.F$ Pt100 −300 to 1500℉: Pr F JPt100 −300 to 900 ℉: $JPrF$	
$5rLH$	**Scaling high limit setting** • Sets scaling high limit value. • Available only for DC input type • Setting range: Scaling low limit value to input range high limit value		9999
$5rLL$	**Scaling low limit setting** • Sets scaling low limit value. • Available only for DC input type • Setting range: Input range low limit value to scaling high limit value		−1999

dP	**Decimal point place selection**
	 • Selects decimal point place.
	 • Available only for DC input
	 • No decimal point: 00 1 digit after decimal point: 0.0
	   2 digits after decimal point: 0.00
	   3 digits after decimal point: 0.000
			No decimal point

$FILr$	**PV filter time constant setting** • Sets PV filter time constant. (If the value is set too large, it affects control result due to the delay of response) • Setting range: 0.0 to 10.0 seconds		0.0 seconds
oLH	**OUT1 high limit setting** • Sets the high limit value of OUT1. Not available for ON/OFF action • Setting range: OUT1 low limit value to 105% (Setting greater than 100% is effective to the current output type)		100%

oLL	**OUT1 low limit setting**
	 • Sets the low limit value of OUT1.
	   Not available for ON/OFF action.
	 • Setting range: –5% to OUT1 high limit value
	   (Setting less than 0% is effective to the current output type)
			0%

$HY5$	**OUT1 ON/OFF action hysteresis setting** • Sets ON/OFF action hysteresis for OUT1. Available only when the control action is ON/OFF action • Setting range: 0.1 to 100.0℃ （℉), or 1 to 1000		1.0℃
$cAcr$	**OUT2 action mode selection** • Selects OUT2 action from air cooling, oil cooling and water cooling. • Air cooling: Air, oil cooling: oiL, water cooling: JAr		Air cooling

oLHb	**OUT2 high limit setting** • Sets the high limit value of OUT2. • Setting range: OUT2 low limit value to 105% (Setting greater than 100% is effective to DC current output type)	100%
oLLb	**OUT2 low limit setting** • Sets the low limit value of OUT2. • Setting range: -5% to OUT2 high limit value (Setting less than 0% is effective to DC current output type)	0%

db	**Overlap band/Dead band setting**
	• Sets the overlap band or dead band for OUT1 and OUT2.
	  + setting value: Dead band
	  – setting value: Overlap band
	• Setting range: –100.0 to 100.0℃ （℉）, or 1 to 1000
		0℃

HYSb	**OUT2 ON/OFF action hysteresis setting** • Sets ON/OFF action hysteresis for OUT2. • Setting range: 0.1 to 100.0℃ （℉）, or 1 to 1000	1.0℃
AL1F	**A1 action selection** • Selects an action for A1. 　No alarm action　　　　　　　　　　:　- - - - 　High limit alarm action　　　　　　　:　H 　Low limit alarm action　　　　　　　:　L 　High/Low limits alarm action　　　　:　HL 　High/Low limit range alarm action　:　Ld 　Process high alarm action　　　　　:　AЧ 　Process low alarm action　　　　　　:　rAЧ 　High limit alarm action with standby　:　H　　u 　Low limit alarm action with standby　:　L　　u 　High/Low limits alarm action with standby:　HL　u	No alarm action
AL2F	**A2 action selection** • Selects an action for A2. • Action selection and default value are the same as those of A1 　action selection.	No alarm action
A1Lm	**A1 action Energized/Deenergized selection** • Selects Energized/Deenergized for A1. • Not available if No alarm is selected in A1 action selection • Energized:　nonL　　　Deenergized:　rEЧЬ	Energized
A2Lm	**A2 action Energized/Deenergized selection** • Selects Energized/deenergized for A2. • Not available if No alarm is selected in A2 action selection • Action selection and default value are the same as those of A1 　action Energized/Deenergized selection.	Energized
A1HY	**A1 hysteresis setting** • Sets hysteresis for A1. • Not available if No alarm is selected in A1 action selection • Setting range: 0.1 to 100.0℃(℉), or 1 to 1000	1.0℃
A2HY	**A2 hysteresis setting** • Sets hysteresis for A2. • Not available if No alarm is selected in A2 action selection • Setting range: 0.1 to 100.0℃(℉)or 1 to 1000	1.0℃
A1dY	**A1 action delayed timer setting** • Sets action delayed timer for A1. 　When setting time has passed after entering alarm output area, 　alarm output activates. • Not available if No alarm is selected in A1 action selection • Setting range: 0 to 9999 seconds	0 seconds
A2dY	**A2 action delayed timer setting** • Sets action delayed timer for A2. 　When setting time passes after the input enters alarm output 　range, alarm output activates. • Not available if No alarm is selected in A2 action selection • Setting range: 0 to 9999 seconds	0 seconds

$conf$	**Direct/ Reverse action selection** • Selects Reverse (Heating) or Direct (Cooling) action. • Reverse (Heating) : $HEAF$ Direct (Cooling) : $cool$	Reverse (Heating) action
AF_b	**AT bias setting** • Sets bias value during PID auto-tuning. • Not available if input is DC current type or DC voltage type. • Setting range: 0 to 50℃ (0 to 100℉) or 0.0 to 50.0℃ (0.0 to 100.0℉)	20℃
$EoUF$	**Output status selection when input burnout** • Selects whether OUT1 output is OFF or not when DC input is overscale or underscale. • Available only for DC current output type • oFF (Output OFF) on (Output ON)	Output OFF

$\bar{n}A\bar{n}U$	**OUT/OFF key function selection**
	• Selects whether OUT/OFF key is used for control output
	  OUT/OFF function or for Auto/Manual control function.
	• oFF(OUT/OFF function)
	   $\bar{n}A\bar{n}U$ (Auto/Manual control function)
		OUT/OFF
		function

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 temperature (input value) does not concur with the same setting value. In such a case, the control can be set at the desired temperature by adjusting the input value of sensors.

Energized/Deenergized

When [alarm action energized] is selected, the alarm output (between terminals 3-4, or 3-5) 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 3-4, or 3-5) 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.
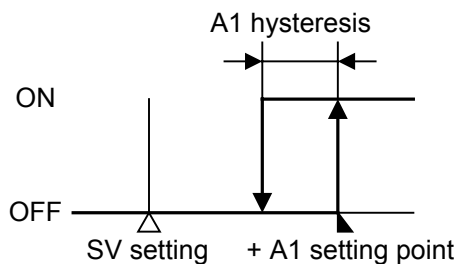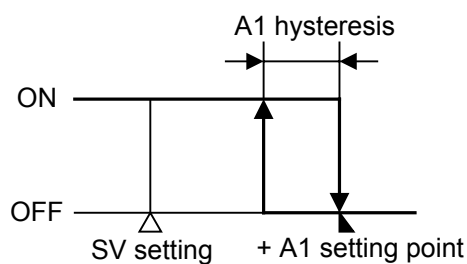

High limit alarm (When Energized is set)

(Fig. 5.5-2)

High limit alarm (When Deenergized is set)

(Fig. 5.5-1)

5.6 Auto/Manual control function

Name, Functions

Auto/Manual control function
• If Auto/Manual control function is selected in the OUT/OFF key function selection,
  Automatic or Manual control function can be switched by pressing the [OUT/OFF] key in the PV/SV
  display mode.
  If control action is switched from automatic to manual or vice versa, balanceless-bumpless
  function works to prevent sudden change of manipulated variable.
  When automatic control is switched to manual control, the least significant digit of the decimal
  point blinks on the SV display, and the output manipulated variable (MV) can be increased or
  decreased by pressing [▲] or [▼] key to perform the control.
  By pressing the [OUT/OFF] key again, the mode reverts to the PV/SV display mode (automatic
  control). (Whenever the power to the controller is turned on, automatic control starts.)

5.7 Control output OFF function

Character	Name, Functions

oFF	**Control output OFF function**
	• A function to pause the control action or turn the control output of the unused
	  instrument of the plural units OFF even if the power to the instrument is supplied.
	  [oFF] is indicated on the PV display while the function is working.
	• **Pressing the [OUT/OFF] key for approximately 1 second turns the control output**
	  OFF.
	• **Once the control output OFF function is enabled, the function cannot be**
	  released even if the power to the instrument is turned OFF and ON again.
	  Control output OFF function keeps working.
	  To cancel the function, press the [OUT/OFF] key again for approx. 1 second.

5.8 Output manipulated variable (MV) indication

Name and function

Output 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 shows up, though the main
  setting mode appears temporarily during the process.
  (The SV display indicates output manipulated variable and a decimal point blinks in a 0.5 second
  cycle.)
  If the [MODE] key is pressed again, the mode reverts to the PV/SV display.

6. Running

After the controller has been mounted to the control panel and wiring is completed, it can be started
in the following manner.

(1) Turn the power supply to the KT4 Series ON.
  Turn the power supply to the KT4 Series ON.
  • For approx. 3s after the power is switched ON, the sensor input character and the temperature unit
    will be indicated on the PV display and input range high limit value on the SV display. See (Table
    5-1). (If any other value has been set in the scaling high limit setting, the SV display indicates it)
    During this time, all outputs and LED indicators are in OFF status.
  • After that, control starts indicating input value on the PV display, and main setting value on the SV
    display.
  • While the Control output OFF function is working, oFF is indicated on the PV display.

(2) Input each setting value.
  Input each setting value, referring to "5. Setup".

(3) Turn the load circuit power ON.
  Starts the control action so as to keep the controlled object at the main setting value.

7. Action explanation

7.1 OUT1 action

	Heating (Reverse) action	Cooling (Direct) action
Control action	ON / OFF — Proportional band — SV setting	Proportional band — ON / OFF — SV setting
Relay contact output	⑥⑦ ⑥⑦ ⑥⑦ Cycle action is performed according to deviation	⑥⑦ ⑥⑦ ⑥⑦ Cycle action is performed according to deviation
Non-contact voltage output	+⑥ 12V DC −⑦ | +⑥ 12/0V DC −⑦ | +⑥ 0V DC −⑦ Cycle action is performed according to deviation	+⑥ 0V DC −⑦ | +⑥ 0/12V DC −⑦ | +⑥ 12V DC −⑦ Cycle action is performed according to deviation
DC current output	+⑥ 20mA DC −⑦ | +⑥ 20 to 4mA DC −⑦ | +⑥ 4mA DC −⑦ Changes continuously according to deviation	+⑥ 4mA DC −⑦ | +⑥ 4 to 20mA DC −⑦ | +⑥ 20mA DC −⑦ Changes continuously according to deviation
Indication (OUT1) Green	Lit ... Unlit	Unlit ... Lit

▨ part : Acts ON or OFF.

7.2 EVT (Heater burnout alarm) action

Alarm action	ON / OFF — Setting Small ← Load current → Large	Output Indication	③⑤ ③⑤ Lit ... Unlit

7.3 OUT1 ON/OFF action

	Heating (Reverse) action	Cooling (Direct) action
Control action	Hysteresis ON / OFF — SV setting	Hysteresis ON / OFF — SV setting
Relay contact output	⑥⑦ ⑥⑦	⑥⑦ ⑥⑦
Non-contact voltage output	+⑥ 12V DC −⑦ | +⑥ 0V DC −⑦	+⑥ 0V DC −⑦ | +⑥ 12V DC −⑦
DC current output	+⑥ 20mA DC −⑦ | +⑥ 4mA DC −⑦	+⑥ 4mA DC −⑦ | +⑥ 20mA DC −⑦
Indication (OUT1) Green	Lit ... Unlit	Unlit ... Lit

▨ part: Acts ON or OFF.

7.4 Temperature alarm action

	High limit alarm	Low limit alarm	High/Low limits alarm
Alarm action	A1 hysteresis ON / OFF −A1 setting point, SV setting, + A1 setting point	A1 hysteresis ON / OFF −A1 setting point, SV setting, + A1 setting point	A1 hysteresis ON / OFF A1 setting point, SV setting, A1 setting point
Alarm output	+ side / − side	+ side / − side	

	High/Low limit range alarm	Process high alarm	Process low alarm
Alarm action	A1 hysteresis ON / OFF A1 setting point, SV setting, A1 setting point	A1 hysteresis ON / OFF A1 setting point	A1 hysteresis ON / OFF A1 setting point
Alarm output			

	High limit alarm with standby	Low limit alarm with standby	High/Low limit alarm with standby
Alarm action	A1 hysteresis ON / OFF −A1 setting point, SV setting, + A1 setting point	A1 hysteresis ON / OFF −A1 setting point, SV setting, + A1 setting point	A1 hysteresis ON / OFF A1 setting point, SV setting, A1 setting point
Alarm output	+ side / − side	+ side / − side	

■ : Alarm output terminals between 3 and 4 is ON.

▨ : Alarm output terminals between 3 and 4 is ON or OFF.

☐ : Alarm output terminals between 3 and 4 is OFF.

▥ : Standby functions in this section.

A1 indicator lights up when output terminals between
3 and 4 is ON, and goes out when between them is OFF.

8. PID auto-tuning of this controller

In order to set each value of P, I, D and ARW automatically, this system gives a fluctuation
to the controlled object to get an optimal value.
One of 3 types of fluctuation below is automatically selected.

(1) When the difference between the setting value and processing temperature is large as the temperature rises.

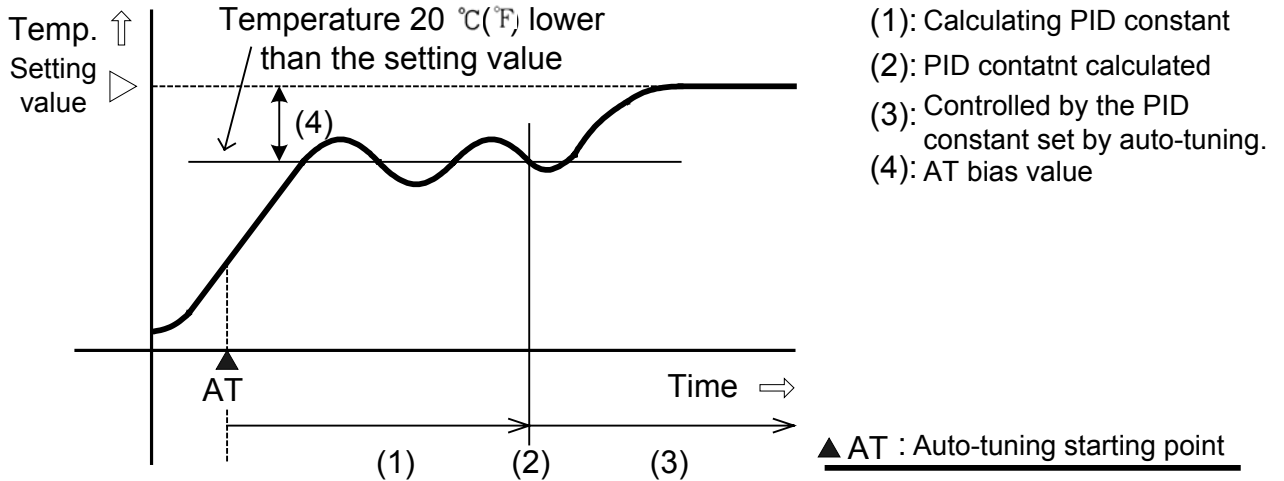When AT bias is set to 20℃(℉), fluctuation is applied at the temperature 20℃　lower than the setting value.

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

▲ AT : Auto-tuning starting point

(2) When the control is stable

Fluctuation is applied at the setting value.

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

▲AT：Auto-tuning starting point
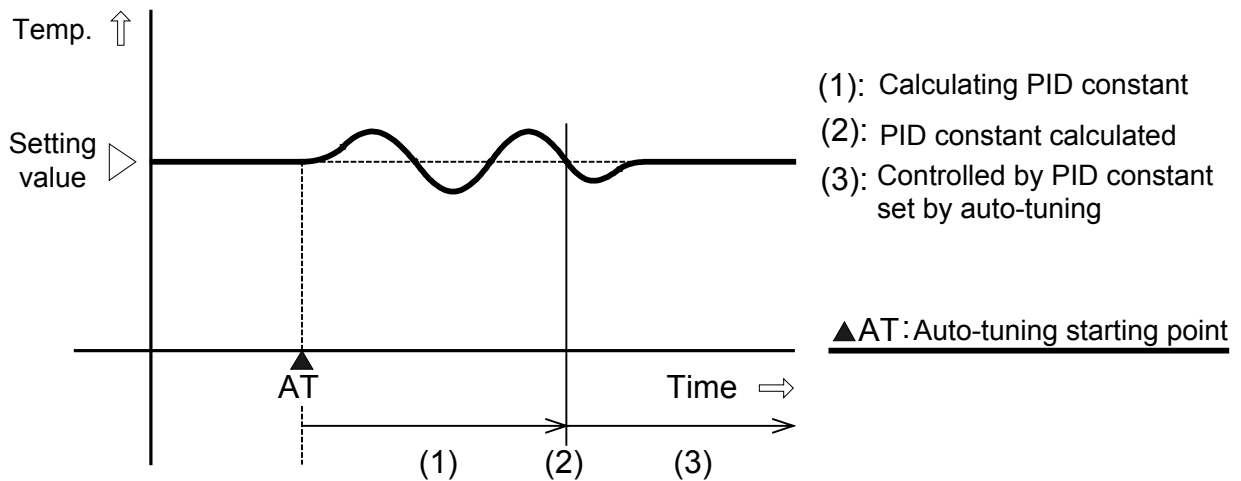
(3) When the difference between the setting value and processing temperature is large as the temperature falls.

When AT bias is set to 20℃(℉), fluctuation is applied at the temperature 20℃ (℉) higher than the setting value.
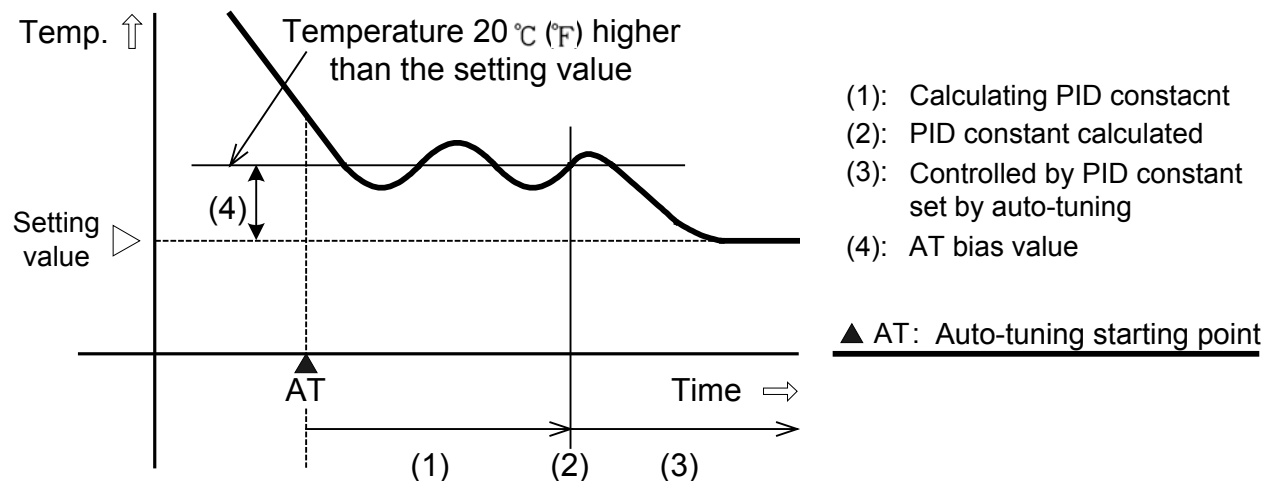

(1): Calculating PID constacnt
(2): PID constant calculated
(3): Controlled by PID constant set by auto-tuning
(4): AT bias value

▲ AT: Auto-tuning starting point

9. Specifications

9.1 Standard specifications

Mounting method   : Flush

Setting method : Input system using membrane sheet key

Display   PV display   : Red LED 4 digits, character size 10.2 x 4.9 mm (H x W)

          SV display   : Green LED 4 digits, character size 8.8 x 4.9 mm (H x W)

Accuracy (Setting and Indication):

          Thermocouple : Within $\pm$0.2% of input span $\pm$1digit, or within $\pm$2℃(4℉), whichever is greater

                     However R, S input 0 to 200℃ (400℉): Within $\pm$6℃ (12℉)

                     B input 0 to 300℃ (600℉): Accuracy is not guaranteed

                     K, J, E, N input less than 0℃ (32℉): Within $\pm$0.4% of input span $\pm$1digit

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

          DC current   : Within $\pm$0.2% of input span $\pm$1digit

          DC voltage   : Within $\pm$0.2% of input span $\pm$1digit

Input sampling period   : 0.25 seconds

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

                     (However, B input: External resistance, 40Ω or less)

          RTD   : Pt100, JPt100, 3-wire system

                     Allowable input lead wire resistance (10Ω or less per wire)

          DC current   : 0 to 20mA DC, 4 to 20mA DC

                     Input impedance: External shunt resistor (AKT4810) 50Ω

                     Allowable input current (50mA or less)

          DC voltage   : 0 to 1V DC   Input impedance (1MΩ or greater)

                     Allowable input voltage (5V or less)

                     Allowable signal source resistance (2kΩ or less)

                     : 0 to 5V DC, 1 to 5V DC, 0 to 10V DC   Input impedance (100kΩ or greater)

                     Allowable input voltage (15V or less)

                     Allowable signal source resistance (100Ω or less)

Control output

                   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 maximum 40mA (short circuit protected)

          Current   : 4 to 20mA DC, Load resistance, maximum 550Ω

A1 output

                   Action   : ON/OFF action

          Hysteresis   : 0.1 to 100.0℃ (℉), or 1 to 1000

                   Output   : Relay contact 1a

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

                   Electrical life, 100,000 times

Control action

                   PID action (with auto-tuning function)

       PI action: When derivative time is set to 0

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

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

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

                     OUT1 proportional band   : 0 to 1000℃ (2000℉), 0.0 to 999.9℃ (℉) or 0.0 to 100.0%

                     (ON/OFF action when set to 0 or 0.0)

                   Integral time   : 0 to 1000s (OFF when set to 0)

                   Derivative time   : 0 to 300s (OFF when set to 0)

                   OUT1 proportional cycle   : 1 to 120s (Not available for the current

output type)
ARW   : 0 to 100%
OUT1 output hysteresis : 0.1 to 100.0℃ （℉), or 1 to 1000
OUT1 output limit   : 0 to 100% (DC current output type: –5 to 105%)

Circuit insulation configuration
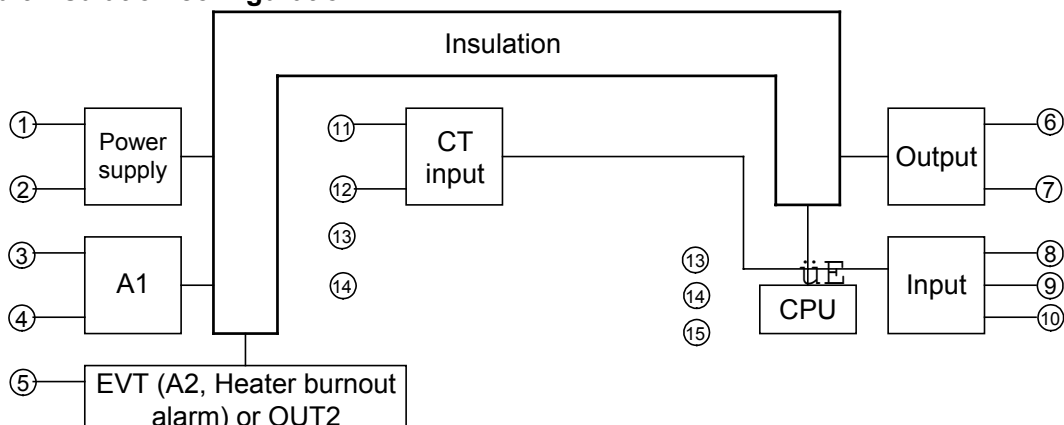
Insulated resistance : 10MΩ or greater at 500V DC
Dielectric strength : 1.5kV AC for 1minute between input terminal and power terminal
                           1.5kV AC for 1minute between output terminal and power terminal
Supply voltage   : 100 to 240V AC   50/60Hz, 24V AC/DC   50/60Hz
Allowable voltage fluctuation:
                           100 to 240V AC : 85 to 264V AC
                           24V AC/DC   : 20 to 28V AC/DC
Power consumption : Approx. 8VA
Ambient temperature : 0 to 50℃   (32 to 122℉)
Ambient humidity   : 35 to 85%RH (no condensation)
Weight   : Approx. 150g
External dimension : 48 x 48 x 96.5mm (W x H x D)
Material   : Flame resistant resin (Case)
Color   : Ash gray (Case)
Attached function
  [Setting value lock]
  [Sensor correction]
  [Auto/manual control switching]
  [Input burnout]
    Thermocouple and RTD inputs
    If the input value exceeds the Indication range high limit value, the PV display blinks " ‾ ‾ ‾ ‾ ",
    and if the input value exceeds the Indication range low limit value, the PV display blinks "_ _ _ _".
    If the input value exceeds the Control range, OUT1 and OUT2 are turned off (for DC current
    output type, OUT1 low limit value and OUT2 low limit value).
    (However, for manual control, it outputs the preset manipulated variable)

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℉
K	−200 to 1370℃	−250 to 1420℃	−250 to 1420℃
	−320 to 2500℉	−370 to 2550℉	−370 to 2550℉
J	−200 to 1000℃	−250 to 1050℃	−250 to 1050℃
	−320 to 1800℉	−370 to 1850℉	−370 to 1850℉
R S	0 to 1760℃	−50 to 1810℃	−50 to 1810℃

Input	Input range	Indication range	Control range
	0 to 3200℉	−50 to 3250℉	−50 to 3250℉
B	0 to 1820℃	−50 to 1870℃	−50 to 1870℃
	0 to 3300℉	−50 to 3350℉	−50 to 3350℉
E	−200 to 800℃	−250 to 850℃	−250 to 850℃
	−320 to 1500℉	−370 to 1550℉	−370 to 1550℉
N	−200 to 1300℃	−250 to 1350℃	−250 to 1350℃
	−320 to 2300℉	−370 to 2350℉	−370 to 2350℉
PL-Ⅱ	0 to 1390℃	−50 to 1440℃	−50 to 1440℃
	0 to 2500℉	−50 to 2550℉	−50 to 2550℉
C(W/Re5-26)	0 to 2315℃	−50 to 2365℃	−50 to 2365℃
	0 to 4200℉	−50 to 4250℉	−50 to 4250℉
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℉
Input	Input range	Indication range	Control range
JPt100	−199.9 to 500.0℃	−199.9 to 550.0℃	−206.0 to 550.0℃
	−200 to 500℃	−206 to 550℃	−206 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℉

DC current and voltage inputs

If input value exceeds Indication range high limit value, PV display blinks " ‾ ‾ ‾ ‾ ", and if input value exceeds the Indication low limit range, the PV display blinks "₋ ₋ ₋ ₋".

If input value exceeds the Control range, OUT1 and OUT2 is turned ON or OFF, depending on which has been selected in the [Output status selection on input burnout] (for DC current output type, OUT1 high or low limit value, OUT2 high or low limit value). However, for manual control, it outputs the preset manipulated variable.

Indication range : [Scaling low limit value – Scaling span x 1%] to [Scaling high limit value +Scaling span x 10%]
(If the input value exceeds the range −1999 to 9999, the PV display blinks " ‾ ‾ ‾ ‾ " or "₋ ₋ ₋ ₋")

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

DC input burnout: When DC input is burnt out, PV display blinks "₋ ₋ ₋ ₋" 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 corresponding value for which 0mA or 0V is inputted.

[Burnout]

When the thermocouple or RTD input is burnt out, OUT1 is turned off (for DC current output type, OUT1 low limit value) and PV display blinks " ‾ ‾ ‾ ‾ ".

[Self-diagnosis]

The CPU is monitored by a watchdog timer, and when any abnormal status is found on the CPU, the controller is switched to warm-up status.

[Automatic cold junction temperature compensation] (Only thermocouple input type)

This detects the temperature at the connecting terminal between the thermocouple and the instrument, and always keeps it set to the same status as when the reference junction is located at 0℃ (32℉).

[Power failure countermeasure]

The setting data is backed up in the non-volatile memory.

[Warm-up indication]

After the power supply to the instrument is turned on, the sensor input character 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 and voltage inputs, the scaling high limit value is indicated.

Accessories included: Screw type mounting bracket   1 set
           Instruction manual   1 copy
           CT (Current transformer)
               For rating 5A, 10A, 20A,   AKT4815   1 piece
               For rating 50A,   AKT4816   1 piece

Accessories sold separately: Terminal cover (AKT4801)   1 piece
               For DC current input, 50Ω shunt resistor (AKT4810)   1 piece

9.2 Optional specifications

Alarm 2 (A2)

Action   : ON/OFF action
Hysteresis   : 0.1 to 100.0℃ (℉), or 1 to 1000
Output   : Relay contact   1a
                     Control capacity, 3A   250V AC (Resistive load)
                     Electrical life, 100,000 times

Heater burnout alarm (including sensor burnout alarm)

Watches the heater current with CT (current transformer), and detects the burnout.
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: Within   ±5% of the rated value
Action   : ON/OFF action
Output   : Relay contact   1a
                     Control capacity, 3A   250V AC (resistive load)
   Electrical life, 100,000 times

Heating/Cooling control (OUT2)

• OUT2 side
   Proportional band: 0.0 to 10.0 times OUT1 proportional band (ON/OFF action when set to 0.0)
   Proportional cycle: 1 to 120 seconds
• Overlap band/Dead band setting range
   Thermocouple, RTD input: –100.0 to 100.0℃ (℉)
   DC current, DC voltage input: –1000 to 1000 (The placement of the decimal point follows the
                                           selection)
• OUT2 output ON/OFF action hysteresis setting
   Thermocouple, RTD input: 0.1 to 100.0℃ (℉)
   DC current, DC voltage input: 1 to 1000 (The placement of the decimal point follows the selection)
• Integral and derivative time are the same as those of OUT1.
• OUT2 action mode selection function
   Air cooling (linear characteristic), Oil cooling (1.5th power of the linear characteristic),
   Water cooling (2nd power of the linear characteristic)
• Output
   Non-contact relay, Control capacity   0.3A   250V AC

10. Troubleshooting

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

10.1 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 blinking on the PV display.	• Thermocouple, RTD or DC voltage (0 to 1V DC) is burnt out.
	 Change each sensor.
	 How to check sensor burnout
	  [Thermocouple]
	   If the input terminal of the instrument is shorted, and if nearby
	   room temperature is indicated, the instrument should be normal
	  and sensor may be burnt out.
	   [RTD]
	   If approx. 100Ω of resistance is connected to the input terminal
	   between A-B of the instrument and between B-B is shorted,
	   and if nearby 0℃ (32℉) is indicated, the instrument should be
	   normal and sensor may be burnout.
	   [DC voltage (0 to 1V DC)]
	  If the input terminal of the instrument is shorted, and if scaling low
	  limit value is indicated, the instrument should be normal
	  and the signal wire may be burnt out.
	• Is the input terminal of thermocouple, RTD or DC voltage (0 to 1V
	 DC) securely mounted to the instrument terminal?
	 Connect the sensor terminal to the instrument terminal securely.

[– – – –] is blinking on the PV display.	• Check if input signal source of DC voltage (1 to 5V DC) or DC
	 current (4 to 20mA DC) is normal.
	 How to check each signal wire
	 [DC voltage (1 to 5V DC)]
	  If the input to the input terminal of the instrument is 1V DC and
	  scaling low limit value is indicated, the instrument should be
	  normal and the signal wire may be disconnected.
	 [DC current (4 to 20mA DC)]
	  If the input to the input terminal of the instrument is 4mA DC and
	  scaling low limit value is indicated, the instrument should be
	  normal and the signal wire may be disconnected.

[– – – –] is blinking on the PV display.	• Is Input signal wire of DC voltage (1 to 5V DC), DC current (4 to 20mA DC) securely connected to the instrument terminal? Connect the signal lead wire to the instrument terminal securely. • Is polarity of thermocouple or compensating lead wire correct? Do codes (A, B, B) of RTD agree with the instrument terminal? Wire them properly.

The PV display keeps indicating the value which was set in scaling low limit value.	• Check if the input signal source for DC voltage (0 to 5V DC,
	 0 to 10V DC) and DC current (0 to 20mA DC) is normal.
	 How to check each signal wire
	 [DC voltage (0 to 5V DC, 0 to 10V DC)]
	  If the input to the input terminal of the instrument is 1V DC and
	  the value corresponding to 1V DC is indicated, the instrument
	  should be normal and the signal wire may be disconnected.
	 [DC current (0 to 20mA DC)]
	  If the input to the input terminal of the instrument is 1mA DC and
	  the value corresponding to 1mA DC is indicated, the instrument
	  should be normal and the signal wire may be disconnected.
	• Is the input terminal of DC voltage (0 to 5V DC, 0 to 10V DC) and
	 DC current (0 to 20mA DC) securely mounted to the instrument
	 terminal?
	 Mount the sensor terminal to the instrument terminal securely.

The indication of PV display is abnormal or unstable.	• Is sensor input or temperature unit (℃ or ℉) correct?
	  Select the proper sensor input and temperature unit (℃ or ℉).
	• Sensor correcting value is unsuitable.
	  Set the value suitably.
	• Is the specification of the sensor correct?
	     Set the sensor to the proper specification.
	• AC leaks into the sensor circuit.
	  Use an ungrounded type sensor.
	• There may be a piece of equipment producing inductive
	  interference or noise near the controller.
	  Keep the equipment producing inductive interference or noise
	  away from the controller.

The PV display is indicating [$Err\ 1$].	• Internal memory is defective. Contact our agency or us.

10.2 Key operation

Problem	Presumed cause and solution

• Unable to set the main setting, P, I, D, proportional cycle or alarm setting
• The values do not change by ▲ , ▼ key operation.
	• Setting value lock (Lock 1 or Lock 2) is designated.
	  Release the lock designation.
	• During PID auto-tuning or auto-reset.
	  In the case of PID auto-tuning, cancel the tuning.
	  It takes approximately 4 minutes until auto-reset is finished.

The setting indication does not change in the input range even if the ▲ , ▼ keys are pressed, and unable to set the value.	• SV high or low limit value in the Auxiliary function setting mode 1 may be set at the point the value does not change. Set the proper value while in the Auxiliary function setting mode 1.

10.3 Control

Problem	Presumed cause and solution

Temperature does not rise.	• Sensor is out of order.
	  Replace the sensor.
	• Sensor or control output terminal is not securely mounted to
	  the instrument terminal.
	    Mount the sensor or control output terminal to the instrument
	  terminal securely.
	• The wiring of sensor or control output terminal is mistaken.
	  Wire it properly..

The control output remains ON status.	• OUT1 or OUT2 low limit value is set to 100% or greater
	  in Auxiliary function setting mode 2.
	  Set the value appropriately.

The control output remains OFF status.	• OUT1 or OUT2 high limit value is set to 0% or less in Auxiliary function setting mode 2. Set the value appropriately.

• If you have any inquiries, please consult our agency or the shop where you purchased the unit.