Temperature Indicating Controller, Model CS3S

WIKA Operating Instructions CS3S   V1.1 · 09/2003

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

⚠ Caution
- This instrument should be used according to the specifications described in the manual.
  If it is used outside 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 malfunction.
- Specifications of the CS3S and the contents of this instruction manual are
  subject to change without notice.
- Care has been taken to assure that the contents of this instruction manual are correct, but if
  there are any doubts, mistakes or questions, please inform our sales department.
- Be sure to turn the power supplied to the instrunment OFF when cleaning.
- Wipe the instrument dry using soft cloth or cotton.
  (If the paint thinner is used for wiping, the instrument may be deformed or discolored.)
- The display parts are more easily damaged. Do not strike them with hard objects or
  press hard on them.
- Any unauthorized transfer or copying of this document, in part or in whole, is prohibited.
- WIKA is not responsible for any damages or secondary damages incurred as a result
  of using this product, including any indirect damages.

List of contents

1. Model names

CS3S	- 3	☐	-☐ / M	- ☐	☐	☐	- ☐,☐,...	Series name CS3S
	3							Control action PID [1]
Alarm 1	0							without
	A							Alarm action, output relais [2]
Control output		R						Relais contact output
		S						Non contact voltage output (0/12 VDC)
		A						Current output 4 ... 20 mA
Input			M					Multi-range input
Power supply				H				AC 100 ... 240 V, 50 ... 60 Hz
				L				AC/DC 24 V
Mounting provision					FT			One-touch mounting bracket
					FS			Screw bracket
Instrument configuration						B		Factory adjustment
						# (?)		To customers specification
Options							2AS [4]	Alarm output 2: process value monitoring
							2AR [4]	Alarm output 2: control loop monitoring
							2AL [4]	Alarm output 2: process value and control loop monitoring with common terminals
							W10 [4]	Heater burnout alarm for 1 phase (max. 5 A)
							W11 [4]	Heater burnout alarm for 1 phase (max. 10 A)
							W12 [4]	Heater burnout alarm for 1 phase (max. 20 A)
							W15 [4]	Heater burnout alarm for 1 phase (max. 50 A)
							CR5 [4]	Serial communication RS 485
							SV2 [4]	Parameter memory for 2 set values, external selectable by connection terminals
							IP4 [5]	IP 54 front protection
							IS5 [5]	IP 55 (additional plastic cover on the front)
							KAB	Terminal cover

(1)   PID, PD and ON/OFF action are programmable.
(2)   9 types of alarm action and no alarm action are selectable.
(3)   The input configuration can be selected from the user by the front keys.
(4)   Please note, that from these options only one can be selected.
(5)   Condition for this option is the screw type mounting bracket (FS).

2. Name and functions of the sections

(1) PV: PV display
  Indicates the Process variable (PV) with a red LED.
(2) SV: SV display
  Indicates the Setting value (SV) with a green LED.
(3) AT: Auto-tuning action indicator
  The dot at the end of the PV display blinks while the Auto-tuning or Auto-reset is performing.
(4) OUT: Control output action indicator
  A green LED lights when the control output is on.
(5) A1: Alarm 1 (A1) output action indicator
  A red LED lights when the Alarm 1 (A1) output is on.
(6) A2: Alarm 2 (A2) output action indicator (Option: A2)
  A red LED lights when the Alarm 2 (A2) output is on.
(7) HB: Heater burnout alarm output action indicator (including Sensor burnout alarm) [Options: W1x]
  A yellow LED lights when the Heater burnout alarm or Sensor burnout alarm output is on.
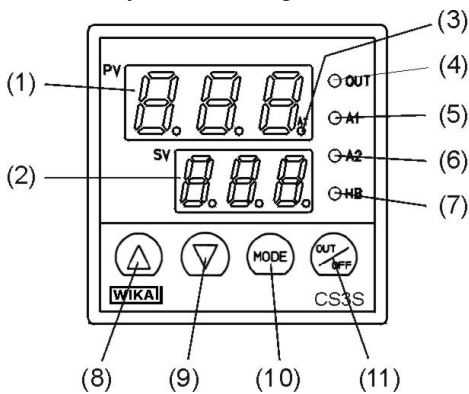
(8) Increase key: Increases the numeric value or selects the setting value.
(9) Decrease key: Decreases the numeric value or selects the setting value.
(10) Mode key: Selects the setting mode or registers the setting value by pressing this key.
(11) OUT/OFF key: Turns the control output on or off.

[Fig. 2-1]

3. Operation

3.1 Messages on the displays after power on

The PV display indicates the character of the sensor type and temperature unit, and the SV display indicates the rated scale maximum value for approx. 2 seconds after the power is turned on. See [table 3.1-1]. (When any other value is set at the Main setting value high limit setting, the SV display indicates the value.) During this time, all outputs and LED indicators are in their off status. After that, the PV display indicates actual temperature, SV display indicates main setting value and control starts.
(When the control output OFF function is working, oFF is indicated on the PV display.
To release the control output OFF function, press the key for 1 second.)

Input	°C		°F	
	PV	SV	PV	SV
K	$t C$	999	$t F$	999
J	$J C$	999	$J F$	999
E	$E C$	600	$E F$	999
Pt100	$P r C$	400	$P r F$	999
	$P r.C$	99.9		
JPt100	$J P C$	400	$J P F$	999
	$J P.C$	99.9		

[Table 3.1-1]

3.2 Operation flow chart

PV/SV display mode

(OUT/OFF) (Approx. 1s)

Control output OFF function [oFF]

(MODE) Output manipulating value display

(MODE)

(MODE) (Approx. 3s)

(MODE)

(△)+(MODE)

(▽)+(MODE) (Approx. 3s)

(△)+(▽)+(MODE) (Approx. 3s)

[Main setting mode]

Main setting 1 [5]

(MODE)

Main setting 2 [52]

(MODE)

[Sub setting mode]

AT Perform/Cancel or Auto reset Perform [AT/r5T]

(MODE)

Proportional band setting [P]

(MODE)

Integral time setting [I]

(MODE)

Derivative time setting [d]

(MODE)

Proportional cycle setting [c]

(MODE)

Alarm 1 (A1) setting [A 1]

(MODE)

Alarm 2 (A2) setting [A2]

(MODE)

Heater burnout alarm setting [H]

(MODE)

Loop break alarm action time setting [LPT]

(MODE)

Loop break alarm action span setting [LPH]

(MODE)

[Auxiliary function setting mode 1]

Setting value lock designation [Loc]

(MODE)

Main setting value high limit setting [5H]

(MODE)

Main setting value low limit setting [5L]

(MODE)

Sensor correction setting [5o]

(MODE)

Instrument number setting [cno]

(MODE)

Transfer rate setting [cn5]

(MODE)

[Auxiliary function setting mode 2]

Sensor selection [5En]

(MODE)

PV filter time constant setting [FIT]

(MODE)

Output high limit setting [oH]

(MODE)

Output low limit setting [oL]

(MODE)

Output ON/OFF hysteresis setting [HY]

(MODE)

Alarm 1 (A1) action selection [AL1]

(MODE)

Alarm 2 (A2) action selection [AL2]

(MODE)

Alarm 1 (A1) Energized/ Deenergized selection [A1L]

(MODE)

Alarm 2 (A2) Energized/ Deenergized selection [A2L]

(MODE)

Alarm 1 (A1) hysteresis setting [A1H]

(MODE)

Alarm 2 (A2) hysteresis setting [A2H]

(MODE)

Alarm 1 (A1) action delayed timer setting [A1d]

(MODE)

Alarm 2 (A2) action delayed timer setting [A2d]

(MODE)

Output Direct/Reverse change [cnT]

(MODE)

Auto-tuning bias setting [ATb]

(MODE)

- (△)+(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 pressed.
- (△)+(▽)+(MODE) (Approx. 3s): Press the (MODE) key for 3 seconds while the (△) and (▽) key are being pressed.

The functions with dashed frames are optional and not active for every controller !

3.3 Main setting mode

Character	Name, Description, Setting range	Initial
५	**Main setting 1** · Sets the 1st main setting value for the main control. · Main setting value low limit to main setting value high limit	0°C
५२	**Main setting 2** · Sets the 2nd main setting value for the main control. · This setting item is not available if option [SV2] is not applied. · Main setting value low limit to main setting value high limit	0°C

Parameter memory for 2 set values (External selection)

If the option [SV2] is applied, the setting value memory number can be selected by external operation.
To select the setting value memory number 2, connect the terminals between 13 and 14.
Memory number cannot be changed during setting mode or PID auto-tuning.

3.4 Sub setting mode

Character	Name, Description, Setting range	Initial
𝘈𝘍 𝘳५𝘍	**Auto-tuning Perform/Cancel, or Auto-reset Perform** · Designates auto-tuning perform/cancel, or auto-reset perform. · Auto-reset will be cancelled in approx. 4 minutes automatically.	– – –
𝘗	**Proportional band value setting** · Sets the proportional band for the control output. · ON/OFF action when setting the value to 0 or 0.0. · 0 to 999°C (°F), or 0.0 to 99.9°C	10°C
𝘪	**Integral time setting** · Sets the integral time for the control output. · Setting the value to 0 disables the function. · With PD action (I value is set to 0), auto-reset can be performed. · 0 to 999 seconds	200s
𝘥	**Derivative time setting** · Sets the derivative time for the control output. · Setting the value to 0 disables the function. · 0 to 300 seconds	50s
𝘤	**Proportional cycle setting** · Sets the proportional cycle value for the control output. · This setting item is not available for ON/OFF action or current output type. · 1 to 120 seconds	R/□: 30s S/□: 3s
𝘈1	**Alarm 1 (A1) setting** · Sets the set point for the temperature alarm 1 (A1) output. · This setting item is not available for the CS3S-30 type. · This setting item is not available, if no alarm action is selected in Temperature alarm 1 (A1) action type selection (see table [3.3-1]).	0°C
𝘈2	**Alarm 2 (A2) setting** · Sets the set point for the temperature alarm 2 (A2) output. · This setting item is not available if option [2AS] or [2AL] is not applied, or no alarm action is selected in Temperature alarm 2 (A2) action type selection (see table [3.3-1]).	0°C

𝘏	**Heater burnout alarm output setting**
	· Sets the heater current value for Heater burnout alarm.
	· This setting item is available only when one of the options [W1x] is applied.
	· Self-holding is not available to the alarm output.
	· For the rated current 5A [W10] : 0.0 to 5.0A
	  For the rated current 10A [W11] : 0.0 to 10.0A
	  For the rated current 20A [W12] : 0.0 to 20.0A
	  For the rated current 50A [W15] : 0.0 to 50.0A
		0.0A

L P⌐	**Loop break alarm time setting** · Sets the time to assess the Loop break alarm. · This setting item is available only when the option [2AR] or [2AL] is applied. · 0 to 200 minutes	0 min.
L PH	**Loop break alarm action span setting** · Sets the temperature span to assess the Loop break alarm. · This setting item is available only when the option [2AR] or [2AL] is applied. · 0 to 150 °C (°F)	0°C

Loop break alarm

The alarm will be activated when the process variable (PV) does not rise as much value as the span or greater within the time it takes to assess the loop break alarm after the manipulated variable has reached 100% or the output high limit value.

The alarm output will also be activated when the process variable (PV) does not fall as much value as the span or greater within the time it takes to assess the loop break alarm after the manipulated variable has reached 0% or the output low limit value.

When the control action is Direct (Cooling), the alarm acts conversely.

[Table 3.3-1]

Type of alarm action	Setting range (without decimal point)	Setting range (with decimal point)
High limit alarm	-199 to Input range maximum value °C (°F)	-19.9 to 99.9°C
Low limit alarm	-199 to Input range maximum value °C (°F)	-19.9 to 99.9°C
High/Low limits alarm	$\pm$(0 to Input range maximum value) °C (°F)	$\pm$ (0.0 to 99.9)°C
High/Low limit range	$\pm$ (0 to Input range maximum value) °C (°F)	$\pm$ (0.0 to 99.9)°C
Process high limit	Input range minimum to Input range maximum	Input range minimum to Input range maximum
Process low limit	Input range minimum to Input range maximum	Input range minimum to Input range maximum
High limit with standby	-199 to Input range maximum value °C (°F)	-19.9 to 99.9°C
Low limit with standby	-199 to Input range maximum value °C (°F)	-19.9 to 99.9°C
Hi/Lo limits with standby	$\pm$ (0 to Input range maximum value) °C (°F)	$\pm$ (0.0 to 99.9)°C

3.5 Auxiliary function setting mode 1

Character	Name, Description, Setting range	Initial

L oc	**Setting value lock designation**
	· Locks the setting value to prevent errors.
	  The setting item to be locked is dependant on the designation.
	· PID auto-tuning or auto-reset will not function if Lock 1 or Lock 2
	  is designated.
	· ⁻ ⁻ ⁻ (Unlock): All setting values can be changed.
	  L c 1 (Lock 1): None of the setting values can be changed.
	  L c 2 (Lock 2): Only main setting value is changeable.
	  L c 3 (Lock 3): All setting values can be changed,
	              however, they returns to their former value after
	              the power is turned off because they are not stored
	              in the non-volatile memory.
		Unlock

4H	**Main setting value high limit setting** · Sets the high limit value for the main setting. · Main setting value low limit to Rated maximum value	Rated maximum value
4L	**Main setting value low limit setting** · Sets the low limit value for the main setting. · Rated minimum value to Main setting value high limit	Rated minimum value

Character	Name, Description, Setting range	Initial
`5o`	**Sensor correction setting** · Sets sensor correction value of the sensor. · -199 to 200°C (°F), or -19.9 to 20.0°C	0°C
`c̄ān`	**Instrument number setting** · Sets the Instrument number individually to each instrument when communicating by connecting multiple instruments in serial communication. · This setting item is available only when the option [CR5] is applied. · 0 to 95	0

`c̄ā5`	**Transfer rate selection**
	· Selects the communication transfer rate to meet the rate of the host computer.
	· This setting item is available only when the option [CR5] is applied.
	    2400bps: `24`
	    4800bps: `48`
	    9600bps: `96`
	    19200bps: `192`
		9600bps

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 multiple controllers, the accuracy of sensors has influence on the control. Therefore, sometimes the measuring temperature (input value) does not concur with the same setting value. In such a case, the control can be set with desired temperature by shifting the input value of sensors.

3.6 Auxiliary function setting mode 2

Character	Name, Description, Setting range	Initial

`5En`	**Sensor selection**
	· With the multi-range input the following input configurations for thermocouples and RTD with the units °C or °F are selectable:
	  K 0 to 999°C: `t C`
	  J 0 to 999°C: `J C`
	  E 0 to 600°C: `E C`
	  Pt100 -199 to 400°C: `PrC`
	  JPt100 -199 to 400°C: `JPC`
	  Pt100 -19.9 to 99.9°C: `Pr.C`
	  JPt100 -19.9 to 99.9°C: `JP.C`
	  K 0 to 999°F: `t F`
	  J 0 to 999°F: `J F`
	  E 0 to 999°F: `E F`
	  Pt100 -199 to 999°F: `PrF`
	  JPt100 -199 to 999°F: `JPF`
		K (0 to 999 °C)

`Fi r`	**PV filter time constant setting** · Sets PV filter time constant setting value. If the value is set too large, it affects control result due to the delay of response. · 0.0 to 10.0 seconds	0.0s
`oH`	**Output high limit setting** · Sets the output high limit value. · This setting item is not available for ON/OFF action. · Output low limit setting value to 105% (Setting greater than 100% is only effective to the current output type.)	100%

oL	**Output low limit setting** · Sets the output low limit value. · This setting item is not available for ON/OFF action. · -5% to Output high limit setting value (Setting less than 0% is only effective to the current output type.)	0%
HY	**Output ON/OFF hysteresis setting** · Sets the ON/OFF action hysteresis for the control output. · This setting item is available only when ON/OFF action. · 0.1 to 99.9°C	1.0°C

AL 1	**Temperature alarm 1 (A1) action selection**
	· Selects temperature alarm 1 (A1) action.
	· This setting item is not available for the CS3S-30 type.
	  No alarm : - - -
	  High limit alarm : *H*
	  Low limit alarm : *L*
	  High/Low limits alarm : *HL*
	  High/Low limit range alarm : *Ui d*
	  Process high alarm : *A4*
	  Process low alarm : *rA4*
	  High limit alarm w/standby : *H u*
	  Low limit alarm w/standby : *L u*
	  High/Low limits alarm w/standby : *HLu*
		No alarm

AL2	**Temperature alarm 2 (A2) action selection** · Selects temperature alarm 2 (A2) action. · This setting item is available only when the option [2AS] or [2AL] is applied. · Alarm action types are the same as those of Temperature alarm 1(A1) action.	No alarm

A 1L	**Temperature alarm 1 (A1) Energized/Deenergized selection**
	· Selects the status as Energized or Deenergized for the temperature alarm 1 (A1) output.
	· This setting item is not available for the CS3S-30 type or if "no alarm" is selected in Temperature alarm 1 (A1) action selection.
	  Energized: *non*
	  Deenergized: *rEu*
		Energized

A2L	**Temperature alarm 2 (A2) Energized/Deenergized selection** · Selects the status as Energized or Deenergized for the temperature alarm 2 (A2) output. · This setting item is not available if the option [2AS] or [2AL] is not applied, or "no alarm" is selected in Temperature alarm 2 (A2) action selection. · Selectable items are the same as those of Temperature alarm 1 (A1) Energized/Deenergized selection.	Energized
A 1H	**Temperature alarm 1 (A1) hysteresis setting** · Sets hysteresis value for temperature alarm 1 (A1) output. · This setting item is not available for the CS3S-30 type or if "no alarm" is selected in Temperature alarm 1 (A1) action selection. · 0.1 to 99.9°C (°F)	1.0°C
A2H	**Temperature alarm 2 (A2) hysteresis setting** · Sets hysteresis value for temperature alarm 2 (A2) output. · This setting item is not available if the option [2AS] or [2AL] is not applied, or "no alarm" is selected in Temperature alarm 2 (A2) action selection. · 0.1 to 99.9°C(°F)	1.0°C

$A1d$	**Temperature alarm 1 (A1) action delayed timer setting**
	· Sets the action delayed timer for temperature alarm 1 (A1).
	  Alarm will be activated when the setting time is passed after
	  the input enters the alarm output range.
	· This setting item is not available for the CS3S-30 type or if
	  "no alarm" is selected in Temperature alarm 1 (A1) action selection.
	· 0 to 999 seconds
		0s

$A2d$	**Temperature alarm 2 (A2) action delayed timer setting**
	· Sets the action delayed timer for temperature alarm 2 (A2).
	  Alarm will be activated when the setting time is passed after
	  the input enters the alarm output range.
	· This setting item is not available if option [2AS] or [2AL] is not applied,
	  or "no alarm" is selected in Temperature alarm 2 (A2) action selection.
	· 0 to 999 seconds
		0s

cnr	**Output Direct/Reverse change**
	· Changes the output action Reverse (Heating) or Direct (Cooling).
	  Reverse (Heating) action: HE
	  Direct (Cooling) action: co
		Reverse (Heating) action

ATb	**Auto-tuning bias setting** · Sets PID auto-tuning bias value by which the auto-tuning point is decided automatically by the deviation between PV and SV. · 0 to 50°C (0 to 100°F), or 0.0 to 5.0°C	20°C

Energized/Deenergized function
[If the temperature alarm action Energized is selected]
When the alarm output indicator is lit, the alarm output (between terminal 3-4, or 3-5) is conducted (ON).
When the alarm output indicator is unlit, the alarm output is not conducted (OFF).
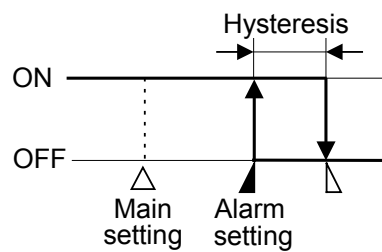[If the temperature alarm action Deenergized is selected]
When the alarm output indicator is lit, the alarm output (between terminal 3-4, or 3-5) is not conducted (OFF).
When the alarm output indicator is unlit, the alarm output is conducted (ON).
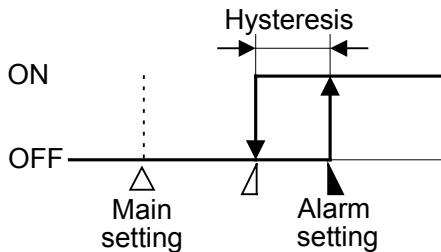

(High limit alarm Energized)
[Fig. 3.5-1]

(High limit alarm Deenergized)
[Fig. 3.5-2]

3.7 Control output OFF function

Character	Name, Descriptions

oFF	**Control output OFF function**
	· This is the function to make the control output OFF even if the power to the
	  instrument is supplied.
	  The function is used when required to halt the control action or the CS3S is not
	  used in multiple controllers.
	  [oFF] is indicated on the PV display while the function is working.
	· This function can be selected from any mode or from any setting item by pressing
	  the $\overset{OUT}{OFF}$ key for approx. 1 second.
	· Once the function is worked, the function cannot be released even if the power to
	  the instrument is turned off and on again.
	  To cancel the function, press the $\overset{OUT}{OFF}$ key again for approx. 1 second.

3.8 Output manipulated variable indication

Name, Descriptions
Output manipulated variable indication
· **Press the ⓜ key for 3 seconds on the PV/SV display mode.**
The main setting mode appears in the process, however, if the ⓜ key is pressed continuously, output manipulated variable is indicated on the SV display and the decimal point blinks every 0.5 seconds. By pressing the ⓜ key again, the mode reverts to the PV/SV display mode.

4. Running

After the mounting to the control panel and wiring connections are complete,
start running in the following manner.

(1) Turn the power supplied to the CS3S ON.

For approx. 2s after the power on, the characters of the sensor type and temperature unit are indicated on the PV display, and the rated maximum value is indicated on the SV display See [table 3.1-1]. (If any other value is set at the main setting value high limit setting, SV display indicates the value.)
During this time, all outputs and LED indicators are in their off status.
After that, the PV display indicates the current temperature, and the SV display indicates the main setting value.
While the Control output OFF function is working, [ɒϜϜ] is indicated on the PV display.

(2) Input the setting value

Referring to Chapter 3. Operation, input each setting value.

(3) Turn the load circuit power ON.

Starts the control action so as to maintain the controlled object at the main setting value.

5. Other functions

(1) Input burnout indicating function

When the input value rises to the value greater than 999 or 99.9, the PV display blinks 3 digits.
When the input value exceeds [the rated scale maximum value + 50°C (100°F)], the controlling output is turned OFF (for the current output type, output low limit value), and the PV display blinks [‾ ‾ ‾].
When the input falls below –199 (–19.9), the PV display blinks 3 digits.
When the thermocouple input value falls below –50°C (–100°F), the controlling output is turned OFF (for the current output type, output low limit value), and the PV display blinks [_ _ _].

For the RTD input whose rated scale minimum value is –19.9, if the input value falls below –50°C (–100°F), the controlling output is turned OFF (for the current output type, output low limit value), and the PV display blinks [_ _ _].
For the RTD input whose rated scale minimum value is –199, if the input value falls below [–199°C –1% of rated scale span], the controlling output is turned OFF (for the current output type, output low limit value), and the PV display blinks [_ _ _].

(2) Sensor burnout function

When the thermocouple or RTD is burnt out, the controlling output is turned OFF (for the current output type, output low limit value), and the PV display blinks [‾ ‾ ‾].

(3) Self-diagnosis function

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.

(4) Automatic cold junction temperature compensation (thermocouple input type)

This detects the temperature at the connection terminal between thermocouple and the instrument, and always keeps it on the same status at which the reference junction is located at 0°C (32°F).

6. Action drawings

6.1 Standard action drawings

Action	Heating (reverse) action	Cooling (direct) action
Control action		
Relay contact output	Cycle action according to deviation	Cycle action according to deviation
Non-contact voltage output	+ ⑥ 12Vdc / 12/0Vdc / 0Vdc − ⑦ Cycle action according to deviation	+ ⑥ 0Vdc / 0/12Vdc / 12Vdc − ⑦ Cycle action according to deviation
Current output	+ ⑥ 20mAdc / 20 to 4mAdc / 4mAdc − ⑦ Changes continuously according to deviation	+ ⑥ 4mAdc / 4 to 20mAdc / 20mAdc − ⑦ Changes continuously according to deviation
Indicator (OUT) Green	Lit ────── Unlit	Unlit ────── Lit

▭ part: Acts ON or OFF.

6.2 ON/OFF action drawings

Action	Heating (reverse) action	Cooling (direct) action
Control action		
Relay contact output		
Non-contact voltage output	+ ⑥ 12Vdc / + ⑥ 0Vdc − ⑦	+ ⑥ 0Vdc / + ⑥ 12Vdc − ⑦
Current output	+ ⑥ 20mAdc / + ⑥ 4mAdc − ⑦	+ ⑥ 4mAdc / + ⑥ 20mAdc − ⑦
Indicator (OUT) Green	Lit ────── Unlit	Unlit ────── Lit

▭ part: Acts ON or OFF.

6.3 Alarm action drawings

	High limit alarm action	Low limit alarm action	High/Low limits alarm action
Alarm action	Hysteresis — ON / OFF — Main setting value / Alarm setting	Hysteresis — ON / OFF — Alarm setting / Main setting value	Hysteresis — ON / OFF — Alarm setting / Main setting value / Alarm setting
Output	③④	③④	③④
Indicator	Unlit / Lit	Lit / Unlit	Lit / Unlit / Lit

	High/Low limit range alarm action	Process high alarm action	Process low alarm action
Alarm action	Hysteresis — ON / OFF — Alarm setting / Main setting value / Alarm setting	Hysteresis — ON / OFF — Alarm setting	Hysteresis — ON / OFF — Alarm setting
Output	③④	③④	③④
Indicator	Unlit / Lit / Unlit	Unlit / Lit	Lit / Unlit

	High limit alarm with standby	Low limit alarm with standby	High/Low limits alarm with standby
Alarm action	Hysteresis — ON / OFF — Main setting value / Alarm setting	Hysteresis — ON / OFF — Alarm setting / Main setting value	Hysteresis — ON / OFF — Alarm setting / Main setting value / Alarm setting
Output	③④	③④	③④
Indicator	Unlit / Lit	Lit / Unlit	Lit / Unlit / Lit

▓▓▓ part: Acts ON or OFF.

▨▨▨ part: The standby functions.
The Alarm 2 (A2) activates between terminals ③ and ⑤.

6.4 Heater burnout alarm action drawing

	Heater burnout alarm action
Alarm action	ON / OFF ---- Setting — Small ← Load current → Large
Output	③⑤
Indicator	Lit / Unlit

7. PID auto-tuning of the CS3S

In order to decide each value of P, I, D and ARW automatically, this system gives the fluctuation to the controlled object.
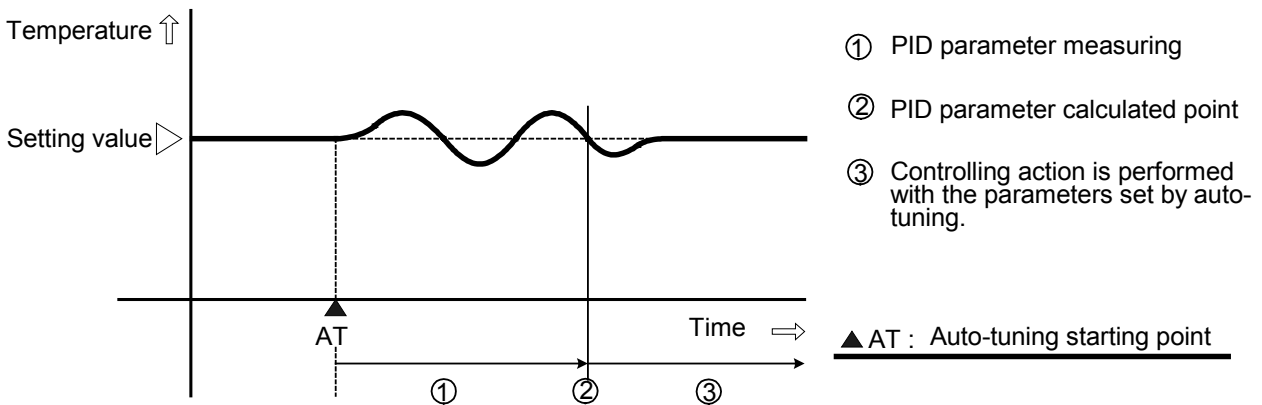
• **When the difference between setting value and processing temperature is large when the temperature rises.**

Fluctuation is given at the temperature, which is the adjusted bias setting value (e.g. 20°C) lower than the setting value.
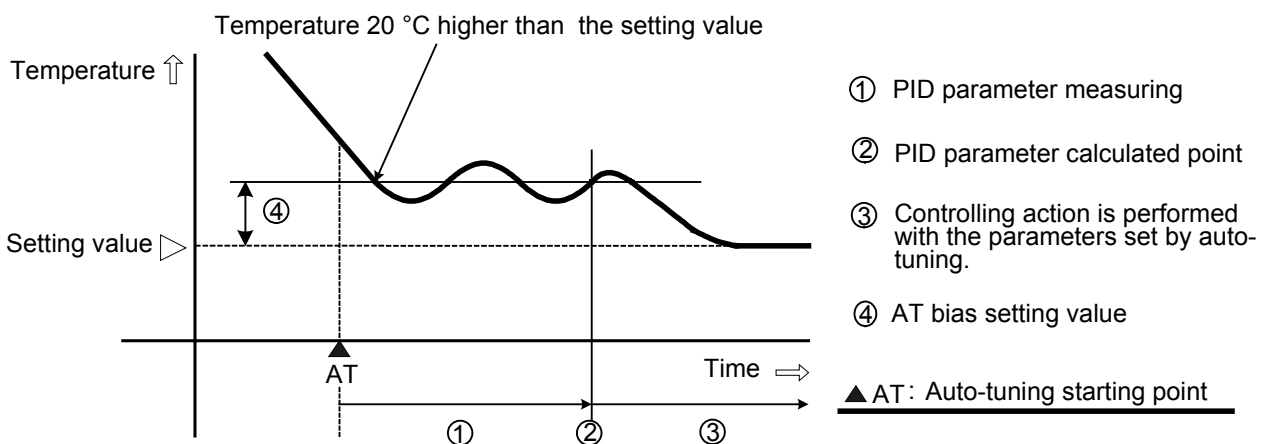
Temperature 20 °C lower than the setting value

① PID parameter measuring

② PID parameter calculated point

③ Controlling action is performed with the parameters set by auto-tuning.

④ AT bias setting value

▲ AT : Auto-tuning starting point
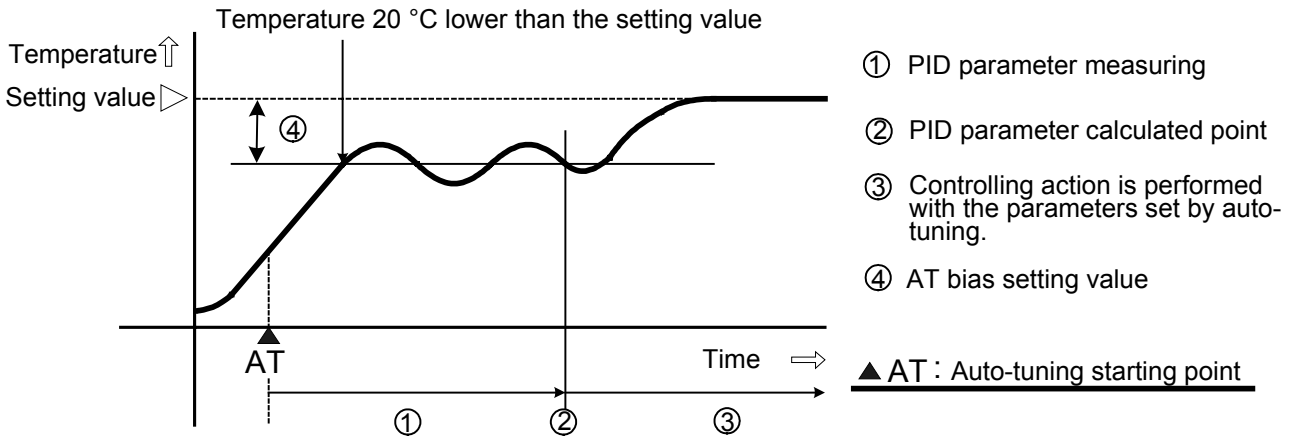
• **When the control is stable**

Fluctuation is given at the setting value.

① PID parameter measuring

② PID parameter calculated point

③ Controlling action is performed with the parameters set by auto-tuning.

▲ AT : Auto-tuning starting point

• **When the difference between the setting value and processing temperature is large when the temperature falls.**

Fluctuation is given at the temperature, which is the adjusted bias setting value (e.g. 20°C) higher than the setting value.

Temperature 20 °C higher than the setting value

① PID parameter measuring

② PID parameter calculated point

③ Controlling action is performed with the parameters set by auto-tuning.

④ AT bias setting value

▲ AT : Auto-tuning starting point

8. Mounting to the control panel

8.1 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:

(1) A minimum of dust, and an absence of corrosive gases
(2) No flammable, explosive gasses
(3) No mechanical vibrations or shocks
(4) No exposure to direct sunlight
(5) An ambient temperature of 0 to 50°C (32 to 122°F) that does not change suddenly
(6) An ambient non-condensing humidity of 35 to 85%RH
(7) The controller away from large capacity electromagnetic switches or cables through which
   large current is flowing
(8) No water, oil or chemicals or where the vapors of these substances can come
   into direct contact with the controller

8.2 External dimension drawing

When one-touch type mounting bracket is used
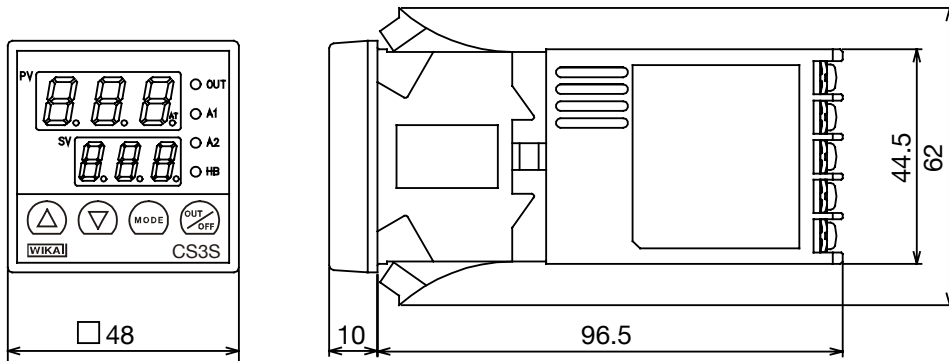
[Fig. 8.2-1]

When screw type mounting bracket is used
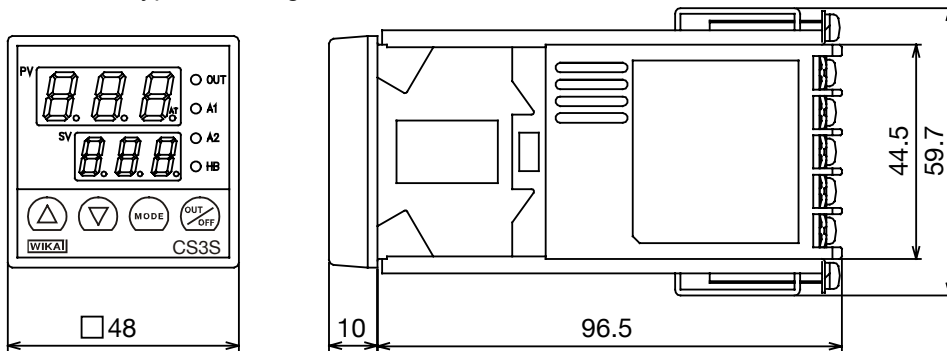
[Fig. 8.2-2]

8.3 Panel cut out drawing

$45 {}^{+0.5}_{0}$ [Fig. 8.3-1]

$nx48-3 {}^{+0.5}_{0}$
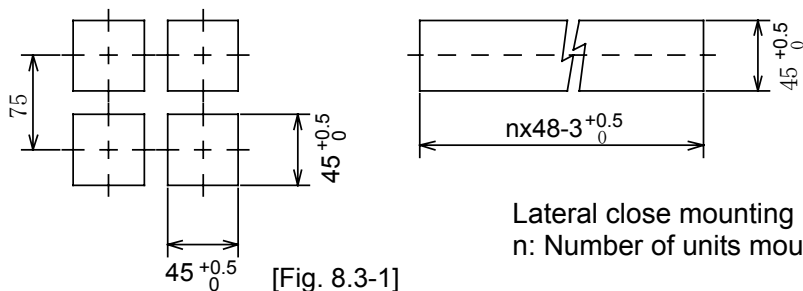
Lateral close mounting
n: Number of units mounted

8.4 Current transformer (CT) dimension drawings

CTL-6-S (for 20A)   CTL-12-S36-10L1 (for 50A)
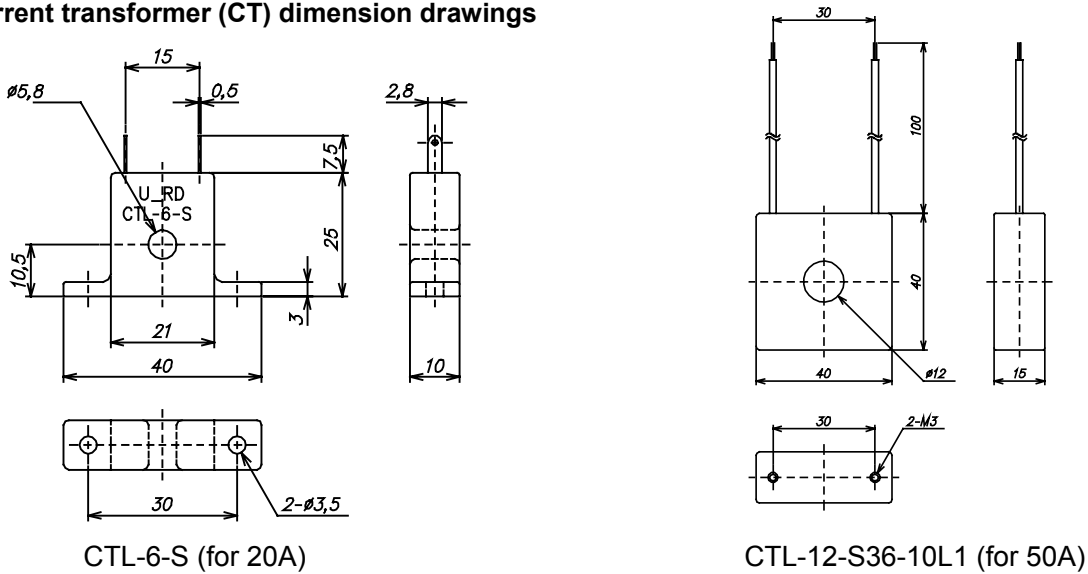
[Fig. 8.4-1]

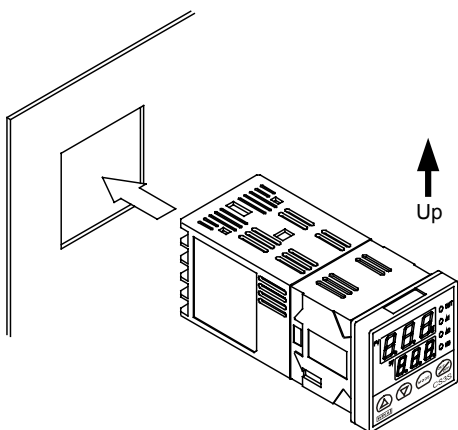### 8.5 Mounting

When the **one-touch mounting bracket** is used:
Mounting panel thickness is 1 to 3mm.
Catch the mounting bracket ① to the
top and bottom of the instrument first.
Then, insert the CS3S ② from the
front of the mounting panel.
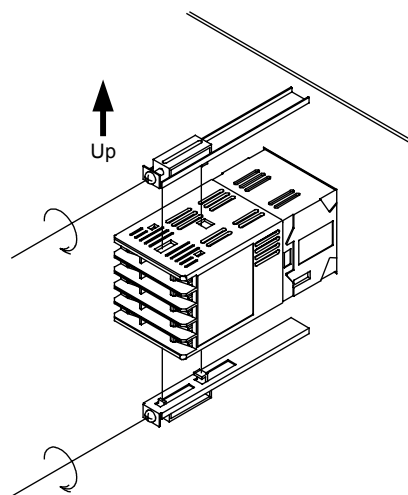

[Fig. 8.5-1]

When the **screw bracket** is used:
Mounting panel thickness is 1 to 15mm.
Insert the CS3S from the front of the panel.
Catch the mounting bracket to the holes
top and bottom of the case, and screw to fix.
When the Soft-type Front-cover (option [IS5]) is
applied, mounting panel thickness is 1 to 14.5mm.
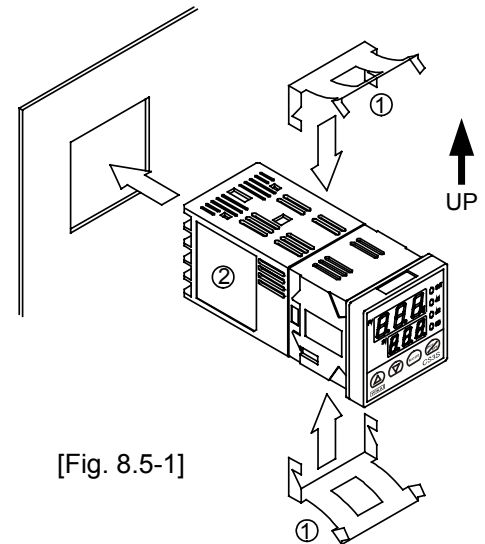
[Fig. 8.5-2]

⚠ **Notice**
As the case is made of resin, do not use excessive force while screwing in the mounting bracket.
The torque is approximately 0.12 Nm.

9. Terminal arrangement

> ⚠ # Warning
>
> **Turn the power supply to the instrument OFF before wiring or checking.**
>
> **Working or touching the terminal with the power switched ON may result in an**
>
> **Electric Shock which could cause severe injury or death.**
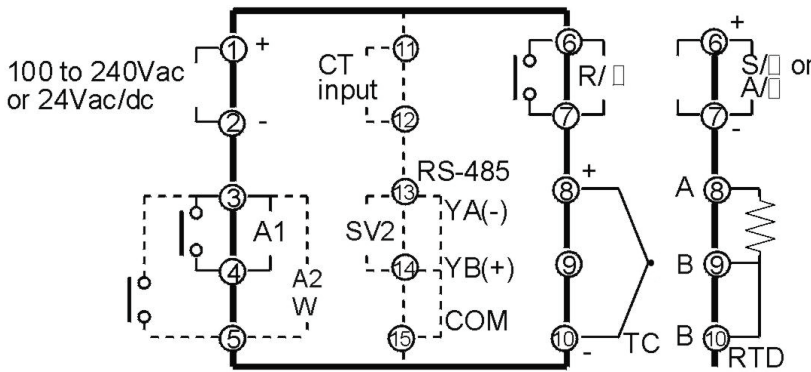
[Fig. 9-1]

R/☐ : Relay contact output
S/☐ : Non-contact voltage output
A/☐ : Current output
A1 : Alarm 1
A2 : Alarm 2 [2AS], [2AR], [2AL]
W : Heater burnout alarm
      [W10], [W11], [W12], [W15]
SV2 : Setting value memory
      (external selection)
RS-485 : Serial communication [CR5]
Dotted line: Option
(Designation is required.)

> ⚠ # Notice
> · The terminal block of the CS3S is designed to be wired from the left side. The lead wire must be
>   inserted from the left side of the terminal, and fastened with the terminal screw.
> · Use a thermocouple and compensating lead wire according to the input specification of this controller.
> · Use a 3-wire system of RTD according to the input specification of this controller.
> · This controller has neither built-in power switch nor fuse. Therefore, it is necessary to install them
>   in the circuit near the external controller.
>   (Recommended fuse: Time-lag fuse, rated voltage 250V, rated current 2A)
> · **In the case of 24Vdc for power source, do not confuse the polarity.**
> · With the relay contact output type, externally use an auxiliary electromagnetic switch according to
>   the capacity of the load to protect the built-in relay contact.
> · When wiring, keep input wire (thermocouple, RTD, etc.) away from AC source and load wire to avoid
>   external interference.

Solderless terminal

Use a solderless terminal with an insulation sleeve that fits to an M3 screw as shown below.
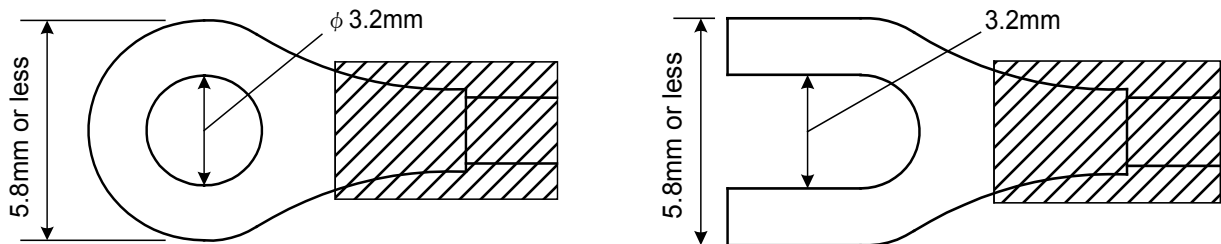
Option: Heater burnout alarm output

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

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

    (3) When wiring, keep the CT wire away from any AC sources or load wires to avoid the external interference.
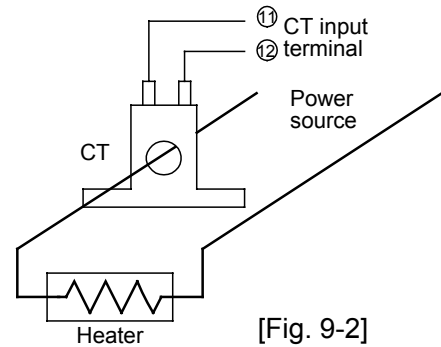
[Fig. 9-2]

10. Specifications

10.1 Standard specifications

Mounting method   : Flush

Setting   : Input system using membrane sheet key

Display
  PV display   : Red LED display 3 digits, size 5.5(W) x 10(H) mm
  SV display   : Green LED display 3 digits, size 4(W) x 8(H) mm

Accuracy (Setting and Indication)
  Thermocouple   : Within $\pm0.3\%$ of input range full scale ±1digit, or
                 within $2°C(4°F)$ whichever is greater
  RTD   : Within $\pm0.2\%$ of input range full scale ±1digit, or
                 within $1°C(2°F)$ whichever is greater

Input sampling period: 0.25 seconds

Input
  Thermocouple   : K, J, E
                 External resistance, 100Ω or less
                 When input burnout, Upscale
  RTD   : Pt100, JPt100 3-wire system
                 Allowable input lead wire resistance, 10Ω or less per wire
                 When input burnout, Overscale

Control output
  Relay contact   : 1a
                 Control capacity, 250Vac 3A (resistive load)
                              250Vac 1A (inductive load cosø=0.4)
  Non-contact voltage   : For SSR drive
                 $12\ _{0}^{+2}$ Vdc Maximum 40mA (short circuit protected)
  Current   : 4 to 20mAdc
                 Load resistance, maximum 550Ω

Temperature alarm 1 (A1) output
  Action   : ON/OFF action
                 Hysteresis, 0.1 to $99.9°C$ $(°F)$
  Output   : Relay contact, 1a
                 Control capacity, 250Vac 3A (resistive load)
                              250Vac 1A (inductive load cosø=0.4)

Control action
  PID action (with auto-tuning function)
  PD action (with auto-reset function) (When setting the integral time to 0.)
    Proportional band   : 0 to $999°C$ $(°F)$ or 0.0 to $99.9°C$
                          (ON/OFF action when set to 0 or 0.0)
    Integral time   : 0 to 999s (off when set to 0)
    Derivative time   : 0 to 300s (off when set to 0)
    Proportional cycle   : 1 to 120s (not available for the current output type)
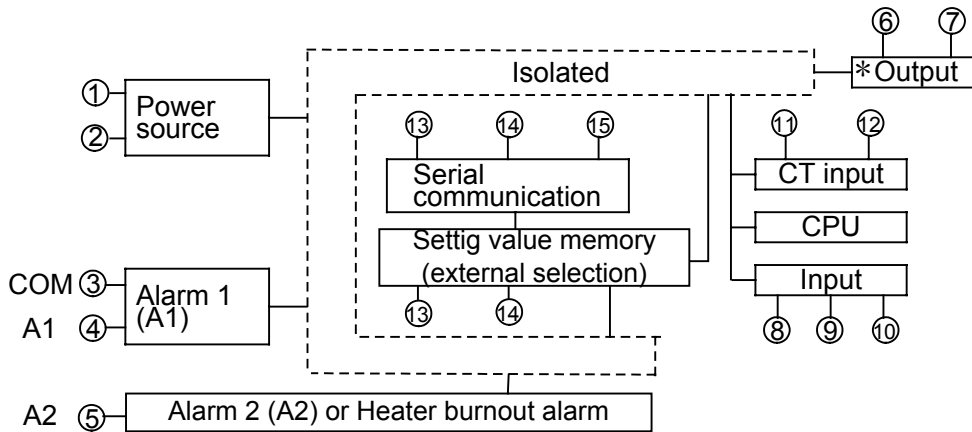   ARW   : Automatic
    Output limit   : 0 to 100% (–5 to 105% for the current output type)
  ON/OFF action (When setting proportional band value to 0 or 0.0.)
    Hysteresis   : 0.1 to $99.9°C$ $(°F)$

Circuit insulation configuration

* In the case the type of main output is Current output or Non-contact voltage output,
it is not isolated between output and input, and between output and CT input.

Insulation resistance

10MΩ or greater at 500Vdc

In the case of the above circuit insulation configuration (*), between the output and input, and between the output and CT input, the resistance insulation test **must not** be carried out because between them are not isolated.

Dielectric strength

Between input terminal and ground ……………………… 1.5kVac for 1 minute
Between input terminal and power terminal …………… .....1.5kVac for 1 minute
Between output terminal and ground …………………... 1.5kVac for 1 minute
Between output terminal and power terminal………….. .....1.5kVac for 1 minute
Between power terminal and ground ………..…………......1.5kVac for 1 minute

Supply voltage	: 100 to 240Vac, 50/60Hz, 24Vac/dc, 50/60Hz
Allowable voltage fluctuation	: In the case of 100 to 240Vac, 85 to 264Vac In the case of 24Vac/dc, 20 to 28Vac/dc
Power consumption	: Approx. 8VA
Ambient temperature	: 0 to 50°C (32 to 122°F)
Ambient humidity	: 35 to 85%RH (non-condensing)
Weight	: Approx. 130g
External dimension	: 48 x 48 x 96.5mm (W x H x D)
Material	: Flame resistance resin (case)
Color	: Black (case)

Attached functions	: Control output OFF function
	   Setting value lock function
	   Sensor correction function
	   Power failure compensating function
	   Self-diagnosis function
	   Automatic cold junction compensating function
	   Sensor burnout function
	   Input burnout indicating function

Accessories	: One-touch mounting bracket 1 set
	   (When the mounting provision [FS] is applied, Screw bracket 1 set)
	   Terminal cover 1 piece (when option [KAB] is applied)
	   Current transformer 1 piece
	                          CTL-6S, when option [W10], [W11], [W12] is applied
	                          CTL-12-S36-10L1, when option [W15] is applied

10.2 Optional specifications

Alarm output 2 (A2) process value monitoring [Option codes: 2AS or 2AL]

The options [SV2] or [W1x] cannot be applied in combination with this option.
When the option [2AL] process value and loop monitoring is selected, the output terminal is common.
Action   :   ON/OFF action
Hysteresis, 0.1 to 99.9°C (°F)
Output   :   Relay contact, 1a
Control capacity,   250Vac 3A (resistive load)
250Vac 1A (inductive load cosø =0.4)

Alarm output 2 (A2) loop break alarm [Option codes: 2AR or 2AL]

The alarm will be activated when the process variable (PV) does not change as much value
as the setting span or greater within the time it takes to assess the loop break alarm after
the manipulating value reaches the maximum value or the minimum value.
Also, this detects heater burnout, sensor burnout and abnormality at operation end.
The options [CR5], [SV2] or [W1x] cannot be applied in combination with this option.
When the option [AL] process value and loop monitoring is selected, the output terminal is common.
Loop break alarm action time: 0 to 200 minutes
Loop break alarm action span: 0 to 150°C (°F)
Output   :   Relay contact, 1a
Control capacity, 250Vac 3A (resistive load), 250Vac 1A (inductive load, cosø=0.4)

Heater burnout alarm output [Option codes: W10, W11, W12, W15]

Watches the heater current with CT (current transformer), and detects the burnout.
The options [2AS], [2AR], [2AL], [SV2] or [CR5] cannot be applied in combination with this option.
This option cannot be applied to the current output type.
Rating   :   5A [Option W10], 10A [Option W11], 20A [Option W12]
or 50A [Option W15]   (Must be designated)
Setting range   :   In the case of 5A [W10], 0.0 to 5.0A (off when set to 0.0)
In the case of 10A [W11], 0.0 to 10.0A (off when set to 0.0)
In the case of 20A [W12], 0.0 to 20.0A (off when set to 0.0)
In the case of 50A [W15], 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, 250Vac 3A (resistive load)
250Vac 1A (inductive load cosø =0.4)

Serial communication [Option code: CR5]

The options [SV2], [2AR], [2AL] or [W1x] cannot be applied in combination with this option.
The following operations can be executed from the external computer.
(1)   Reading and setting of the main setting value, PID values and various setting values
(2)   Reading of the input value and action status
(3)   Change of the functions
Communication circuit   : Based on EIA RS-485
Communication method : Half-duplex communication start-stop synchronous
Transfer rate   : 2400, 4800, 9600 and 19200bps (selectable by key operation)
Data format   : Start bit   1
Data bit   7
Parity   Even
Stop bit   1

Setting value memory (external selection) [Option code: SV2]
If this option is applied, the main setting value 1 or main setting value 2 can be selected
by external contact.
The option [2AS], [2AR], [2AL], [CR5], or [W1x] cannot be applied in combination with this option.

Screw type mounting bracket [Mounting provision code: FS]
Mounting panel thickness: 1 to 15mm

Dust-proof · Drip-proof [Option code: IP4 or IS5]
Dust-proof and Drip-proof specification IP54 at option [IP4] by use of two additional gaskets.
Dust-proof and Drip-proof specification IP55 at option [IS5] by use of an additional front cover.
The IP-Protection is only effective to the front of the controller, case part is excluded.
To protect the controller from water leak between the control panel and controller, the control panel
surface to be mounted should be planar and vertical.

Terminal cover [Option code: KAB]
Electrical shock protecting terminal cover

11. Troubleshooting

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

<Indication>

Phenomena	Presumed cause and solution
If the PV display is indicating [oFF].	· Control output OFF function is working. ➡ Press the ⊙ key for approx. 1s to release the function.

If [¯ ¯ ¯] is blinking on the PV display.	· Thermocouple or RTD is burnt out.
	  [In the case of Thermocouple]
	  If the input terminal of the instrument is connected, and if near room
	  temperature is indicated, the instrument should be normal
	  and sensor may be burnout.
	  [In the case of RTD]
	  If approx. 100Ω of resistance is connected to the input terminal
	  between A-B of the instrument and between B-B is connected,
	  and if near 0°C (32°F) is indicated, the instrument should be normal
	  and sensor may be burnout.
	· Lead wire of thermocouple or RTD is not securely mounted to the
	  instrument terminal.

If [_ _ _] is blinking on the PV display.	· Polarity of thermocouple or compensating lead wire is reversed. · Codes (A, B, B) of RTD do not agree with the instrument terminal.
If indication of the PV display is abnormal or unstable.	· Designation of the sensor input is improper. · Temperature unit (°C or °F) is mistaken. · Sensor correction value is not appropriate. ➡ Set the value properly. · Specification of the thermocouple or RTD is improper. · AC leaks into the thermocouple or RTD circuit. · There may be an equipment producing an inductive fault or noise near the controller.

<Key operation>

Phenomena	Presumed cause and solution
If settings are impossible. If the value does not change by the △ or ▽ key.	· Setting value lock (mode 1 or 2) is designated. → Release the lock designation. · During PID auto-tuning or auto-reset. → In the case of PID auto-tuning, cancel the tuning if necessary. In the case of Auto-reset, it takes approx. 4 minutes until the auto-reset is completed.
If the setting indication does not change within the rated scale range even if the △ or ▽ key is pressed, and it is impossible to set.	· Main setting value high limit or low limit may be set at the point the value does not change. → Set it again by Auxiliary function setting mode 1.

<Control>

Phenomena	Presumed cause and solution
If process variable (PV) does not rise.	· Thermocouple or RTD is burnt out. · Lead wire of thermocouple or RTD is not securely mounted to the instrument terminal. · Check if the output wiring is securely performed.
If the control output remains in its ON status.	· Output low limit setting value is set to 100% or greater in Auxiliary function setting mode 2. → Set the proper value.
If the control output remains in its OFF status.	· Output high limit setting value is set to 0% or less in Auxiliary function setting mode 2. → Set the proper value.

If happened unclear phenomenon other than the above mentioned, make inquiries about the matters at our agency or dealers.