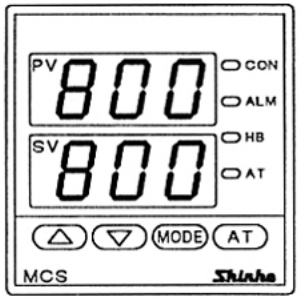
INSTRUCTION MANUAL FOR MICROCOMPUTER BASED TEMPERATURE CONTROLLER

MCS-100 series



Thank you for your purchase of our Microcomputer based Temperature Indicating Controller MCS-100 series.

This manual contains instructions for the mounting, the functions, the operations and the notes when operating the MCS-100 series.

For your confirmation of the model and specifications of the controller, peruse and understand this instruction manual before starting operation.

To prevent the accident by mis-handling of this controller, please arrange to give this manual into the hands of the operator who actually uses our product.

・・・ Notes to users ・・・

Before operating this controller, please understand about following matters.

⚠ Warning

Turn the power supplied to the instrument off before wiring or checking. If working or touching the terminal on the power on status, there is a possibility of Electric Shock which can cause severe injury or death.

⚠ Notices

Do not operate the keys during warm-up status (for approx. 8 seconds after the power on), and do not turn the power on while the key is pressing, or the specification contents of the instrument will have possibles to change.

PID auto-tuning does not function if setting value lock is designated.
It is recommended that the PID auto-tuning is performed on the trial run.

It is advised to provide the protective device against unexpected event owing to the using condition and aged change of the parts.

If you start to mount this controller to the control panel or machine, read this manual from the item "8. Mounting to control panel" or "9. Wiring connection" after checking the model name by "1. Model names".

If you operate this controller already mounted, read this manual from the item "2. Name and functions of the sections" or "3. Operations".

1. Model names

1.1 Model names

Alphanumeric character to represent the functions or type is applied to the □.

[Example] MCS−13 [2] − [R] / [E] , [W]

- [W]: Heater burnout alarm
- [E]: Thermocouple input
- [R]: Relay contact output
- [2]: High limit alarm

▪ Standard models

MCS−1	3	□−□/□	Series name: MCS-130 series
Control action	3		PID action (with auto-tuning function)
Temperature alarm action	0		No alarm action
	2		High limit alarm
	3		Low limit alarm
	4		High/low limits alarm
	6		High/low limit range alarm
	8		Process value alarm
Output	R		Relay contact, 1a
	S		Non-contact voltage 15±3Vdc (for SSR drive)
Input		E	Thermocouple, K or J
		R	RTD, Pt100 or JPt-100

Optional code

Code	Description
H	Temperature alarm output with standby function
W	Heater burnout alarm output (including Sensor burnout alarm)
CM	Cooling action
SK	Specified hysteresis
F	Function selection
BK	Color: Black (Face plate, Dark-gray)
BL	Screw type mounting bracket

(See page 42 for the contents of the options in detail.)

1.2 How to indicate the model nameplate

Model nameplates are put on the right side of the case and the left side of the inner assembly.

Model nameplate [Example]

① … 130−R/E — Relay output/Thermocouple input

② { F — Function selection; W (10A) — Heater burnout alarm (10A) function

③ … No.

①: Standard model name
②: Option codes, Special order No., etc.
③: Serial No. (Indicated only inner assembly)

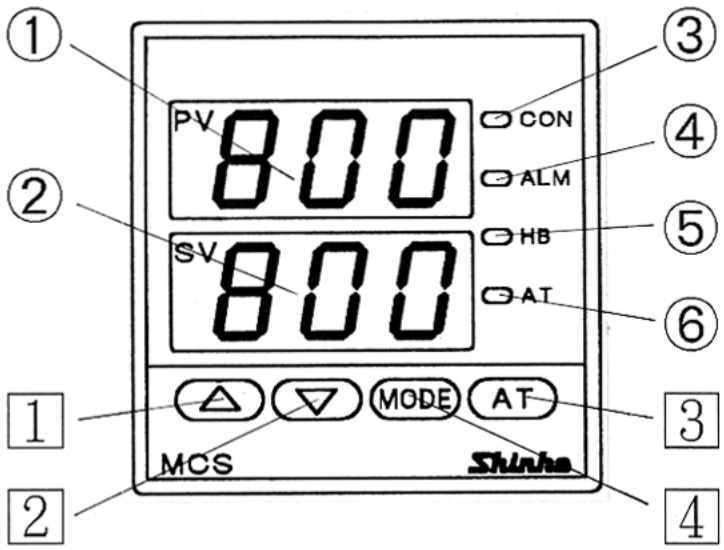
If the option has a specified value, it is entered in ( ).

⚠ Warning

Do not take the inner assembly out or touch the terminal when the status of power supply is on. If you touch the terminal, there is possibility of Electric Shock which can cause severe injury or death.

2. Name and functions of the sections

2.1 Names and Displays



① Process variable (PV) display
It indicates the Process variable with red LED.

② Setting value (SV) display
It indicates the Setting value with green LED.

③ ▭ CON Control output indicator
Green LED lights when the control output is ON.

④ ▭ ALM Temperature alarm output indicator
Red LED lights when Temperature alarm output is ON.

⑤ ▭ HB Heater burnout alarm (Option) or Sensor burnout alarm output indicator
Red LED lights when Heater burnout alarm or Sensor burnout alarm output is ON.

⑥ ▭ AT PID auto-tuning action indicator
Yellow LED blinks during PID auto-tuning.

2.2 Keys

Main functions are described here, however, the key has other functions on the mode. Refer to the item "3. Operation" (Page 9 ff).

1 (▲) Increase key : It increases the setting value (SV) being displayed. Continuous pressing makes the value change faster.

2 (▼) Decrease key : It decreases the setting value (SV) being displayed. Continuous pressing makes the value change faster.

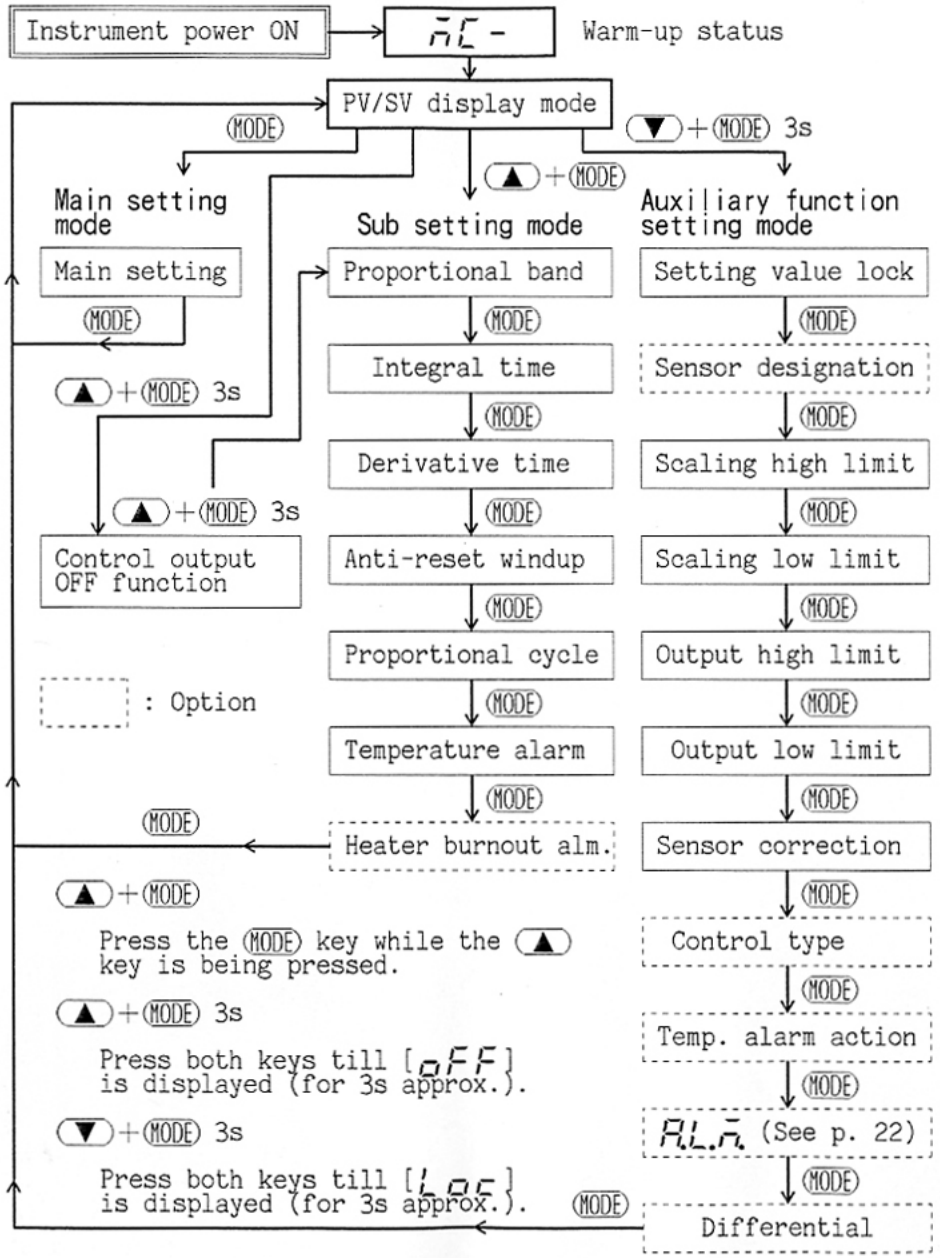
3 (AT) PID auto-tuning key: It performs or cancels the PID auto-tuning.

4 (MODE) Mode key : It selects the setting mode.

- In any mode, PID auto-tuning will be started by pressing the (AT) key. It will not start if lock is specified by Setting value lock designating mode (See page 17).
  If the (AT) key is pressed by mistake, press the key again to cancel the tuning.
- The setting value is registered by pressing the (MODE) key. If it is left without the key operation for approx. 30 seconds, the mode will return to PV/SV display mode automatically and the values left will be registered.

3. Operations

3.1 Operating flow chart



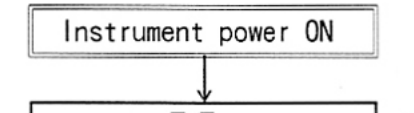
3.2 Operations

Process variable display (PV) indicates [nC -] for approx. 8 seconds after the power is turned on. During this time, all outputs, (SV) display and LED indicators are in their off status. After that, it displays actual temperature on the PV display, setting value on the SV display and starts control.

⚠ Notice

Do not operate the keys during warm-up status (for approx. 8 seconds after the power on), and do not turn the power on while the key is pressing, or the specification contents of the instrument will have possibles to change.

(1) PV/SV display mode



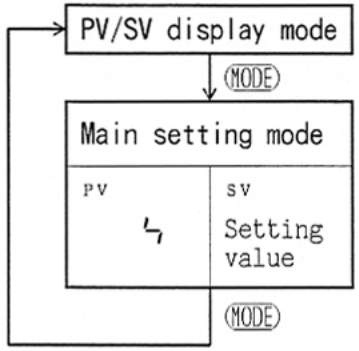
Warm-up status (For approx. 8s)

PV display	SV display	Mode during control
Actual temperature	Main setting value	No contents of setting items nor setting values can be changed.

(2) Main setting mode

The setting value can be increased or decreased by pressing the (▲) or (▼) key.

If the (MODE) key is pressed, the setting value is registered and the mode returns to PV/SV display mode.



A mode to set the setting value of the main control.

Setting range:
from scaling high limit value to scaling low limit value.

[Factory adjusted as 0℃(℉)]

(3) Sub setting mode

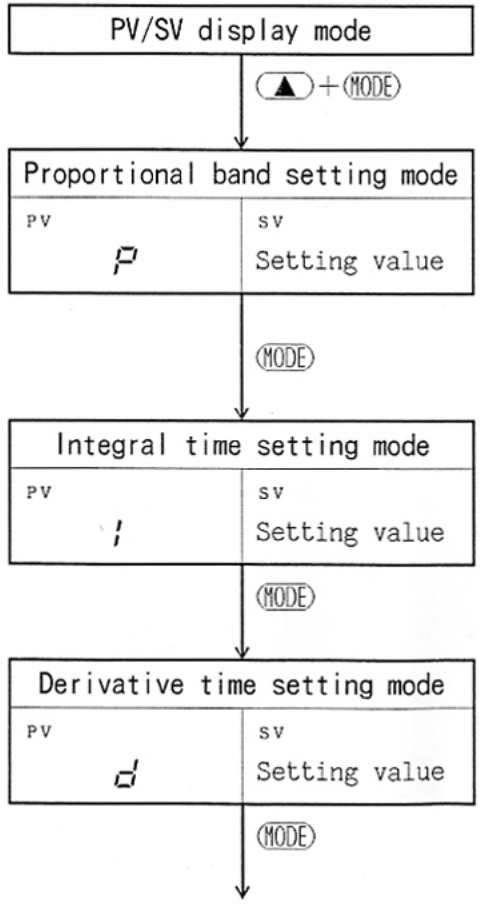
The setting value can be increased or decreased by pressing the (▲) or (▼) key.

If the (MODE) key is pressed, the setting value is registered and the setting mode is changed.

If the PID auto-tuning is performed, the values P, I, D and ARW will be set automatically.

Setting the proportional band to 0.0 causes the instrument to act as an ON/OFF controller.

Setting the integral or derivative to 0 disables the function.



Mode to set proportional band

Setting range: 0.1 to 99.9%
[Factory adjusted as 2.5%]
In case Option F is applied, differential (hysteresis between ON and OFF) can be set (p. 22)

Mode to set integral time

Setting range: 1 to 999s
[Factory adjusted as 200s]

Mode to set derivative time

Setting range: 1 to 999s
[Factory adjusted as 50s]

Anti-reset windup setting mode

PV	SV
n	Setting value

Mode to set ARW value

Setting range: 0 to 100%
[Factory adjusted as 50%]

(MODE)

Proportional cycle setting mode

PV	SV
c	Setting value

Mode to set proportional cycle

Setting range: 1 to 120s
[Factory adjusted as 30s to Relay contact output type, and 3s to Non-contact voltage output type]

(MODE)

With Relay contact output type, if setting the time of Proportional cycle shorter, the number of times of the relay action becomes much, it causes the life of relay contact shorter.

Temperature alarm setting mode

PV	SV
A	Setting value

Mode to set the action point of the alarm output.

If no alarm is specified, this mode is not available.
[Factory adjusted as 0℃(℉)]

(MODE)

Setting the value to 0 (0.0), disables the temperature alarm function excepting the Process value alarm.

See page 15 and 16 in detail.

Heater burnout alarm setting mode

PV	SV
b	Setting value

Mode to set the alarm action point for Heater burnout

This mode is not available if the option (code: W) is not applied.

(MODE)

- Once alarm action operates, the output is held.
- To cancel the output, turn the power OFF, and ON again, or set the value to 0, and set the value again.
- Setting range is 0 to 100%.
  (Factory adjusted as 0%)

Setting the value to 0, disables the function. However, the Burnout function works.

Calculating equation

$$Ap = \frac{Hc}{Rv} \times 100$$

Ap: Action point (Setting value) %
Hc: Heater current
Maximum current during operation
Rv: Rated value
Specified current, 5A, 10A or 20A

The setting value can be calculated with above mentioned, however, it is recommended to set about 80% of the value considering the voltage fluctuation.

PV/SV display mode

Setting range of temperature alarm is as follows

	High limit alarm	: −100 to 100℃, −199 to 200℉
	Low limit alarm	: −100 to 100℃, −199 to 200℉
*	High/Low limits alarm	: ±(1 to 100℃) 1 to 200℉, −1 to −199℉
*	High/Low limit range alarm	: ±(1 to 100℃) 1 to 200℉, −1 to −199℉
	Process value alarm	: Scaling low limit setting value to Scaling high limit setting value

When the decimal point is applied (RTD input)

	High limit alarm	: −19.9 to 99.9℃, −19.9 to 99.9℉
	Low limit alarm	: −19.9 to 99.9℃, −19.9 to 99.9℉
*	High/Low limits alarm **	: ±(1.0 to 99.9℃), ±(1.0 to 99.9℉)
*	High/Low limit range alarm	: ±(0.1 to 99.9℃), ±(0.1 to 99.9℉)
	Process value alarm	: Scaling low limit setting value to Scaling high limit setting value

*: The same values are set to the both sides (+ and −).

**: Related to the hysteresis, avoid setting 0.9 or less, or the normal action will be disturbed.

- If the Temperature alarm output is applied with a combination of Heater burnout alarm output, the output terminal is common.

- Temperature alarm with standby function (Option code: H)

When power is applied to the controller, the function disables alarm action even if the input value is in the range in which the alarm action works, and this also prevents the alarm even if the alarm action point enters the above range as a result of the main setting value change during control.

Once the input value exceeds the alarm action point continuing the control, the standby function will be released and when the input value reaches the point again, the alarm action output will work.

Setting range of temperature alarm is as follows

	High limit alarm with standby function	: −100 to 100℃, −199 to 200℉
	Low limit alarm with standby function	: −100 to 100℃, −199 to 200℉
*	High/Low limits alarm with standby function	: ±(1 to 100℃) 1 to 200℉, −1 to −199℉

When the decimal point is applied (RTD input)

	High limit alarm with standby function	: −19.9 to 99.9℃, −19.9 to 99.9℉
	Low limit alarm with standby function	: −19.9 to 99.9℃, −19.9 to 99.9℉
*	High/Low limits alarm with standby function **	: ±(1.0 to 99.9℃), ±(1.0 to 99.9℉)

*: The same values are set to the both sides (+ and −).

**: Related to the hysteresis, avoid setting 0.9 or less, or the normal action will be disturbed.

(4) Auxiliary function setting mode

If the option (code: F) is not applied, the modes: Sensor designation, Control type designation, Temperature alarm action designation and Differential setting are not available.

The designation or setting value can be increased or decreased by pressing the (▲) or (▼) key.

If the (MODE) key is pressed, the designation or setting value is registered and the setting mode is changed.

PV/SV display mode

(▼)+(MODE) for approx. 3s

Setting value lock designating mode

PV	SV
Loc	Setting value

Mode to lock the setting function and prevents mis-setting.
Setting items to be locked is different from the designation.
[Factory adjusted as lock cancelled]

(MODE)

PID auto-tuning will not function in the status LcA or Lc1 (lock).
Perform the PID auto-tuning in the status -- (lock cancelled).

SV --	Lock cancelled status. All setting values can be set.
SV LcA	Main and Sub setting are locked, and the values are unchangeable.
SV Lc1	Sub setting mode is locked, and the values are unchangeable.

Sensor designating mode

PV	SV
SE	Designation

Mode to change the input type and scale within respective input types: Thermocouple (4 types) and RTD (8 types)

(MODE)

Do not designate the sensor type from the thermocouple type to the RTD type, and vice versa. (It is ineffective.)

SV ntC	K	0 to 999℃
SV ntF	K	0 to 999℉
SV nJ	J	0 to 800℃
SV nJF	J	0 to 999℉
SV PJ	JPt100	−199 to 400℃
SV PJF	JPt100	−199 to 999℉
SV Pd	Pt100	−199 to 400℃

SV PdF	Pt100	−199 to 999°F
SV PJc.	JPt100	−19.9 to 99.9°C
SV PJF.	JPt100	−19.9 to 99.9°F
SV Pdc.	Pt100	−19.9 to 99.9°C
SV PdF.	Pt100	−19.9 to 99.9°F

Scaling high limit setting mode

PV: SH — SV: Setting value

Mode to set the high limit of the scale value.

Setting range is different from the type of sensor.
[Factory adjusted as specified]

(MODE)

Scaling low limit setting mode

PV: SL — SV: Setting value

Mode to set the low limit of the scale value.

Setting range is different from the type of sensor.
[Factory adjusted as specified]

(MODE)

Output high limit setting mode

PV: orH — SV: Setting value

Mode to set the high limit of the control output.

Setting range: Output low limit value to 100%.
(Indication: to 110%)
[Factory adjusted as 100%]

(MODE)

Output low limit setting mode

PV: orL — SV: Setting value

Mode to set the low limit of the control output.

Setting range: 0% to Output high limit value
(Indication: from −10%)
[Factory adjusted as 0%]

Sensor correction setting mode

PV: So — SV: Setting value

Mode to set the correction value of the sensor.

Setting range: −19.9 to 30.0°C
−19.9 to 50.0°F
[Factory adjusted as 0.0°C(°F)]

(MODE)

- Sensor correction function

It 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 have influence on the control. Therefore, sometimes measuring temperature (input value) does not accord with the same setting value.

In such a case, the control can be accorded with desired temperature by shifting the input value of sensors.

Control type designating mode

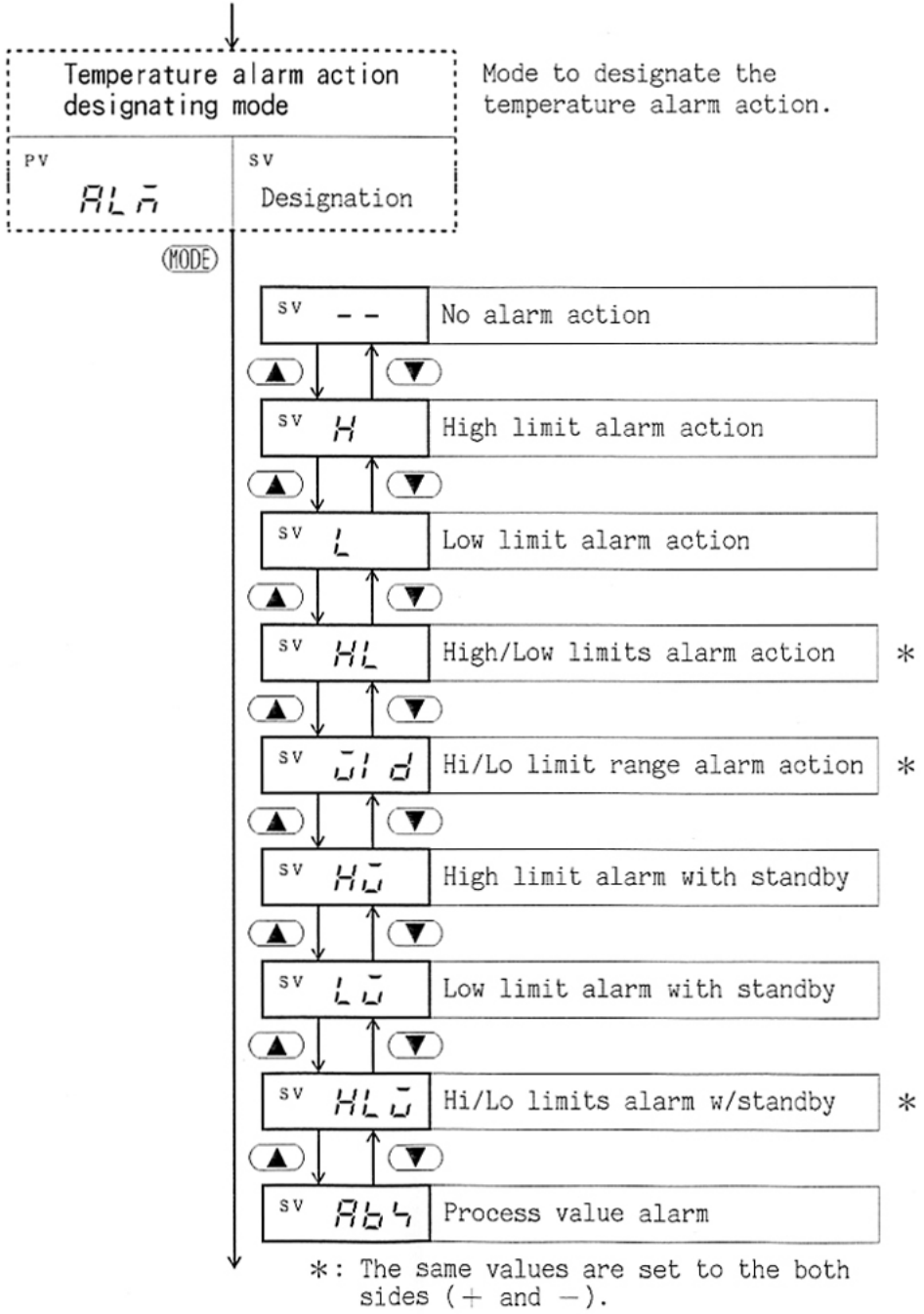
PV: cn — SV: Setting value

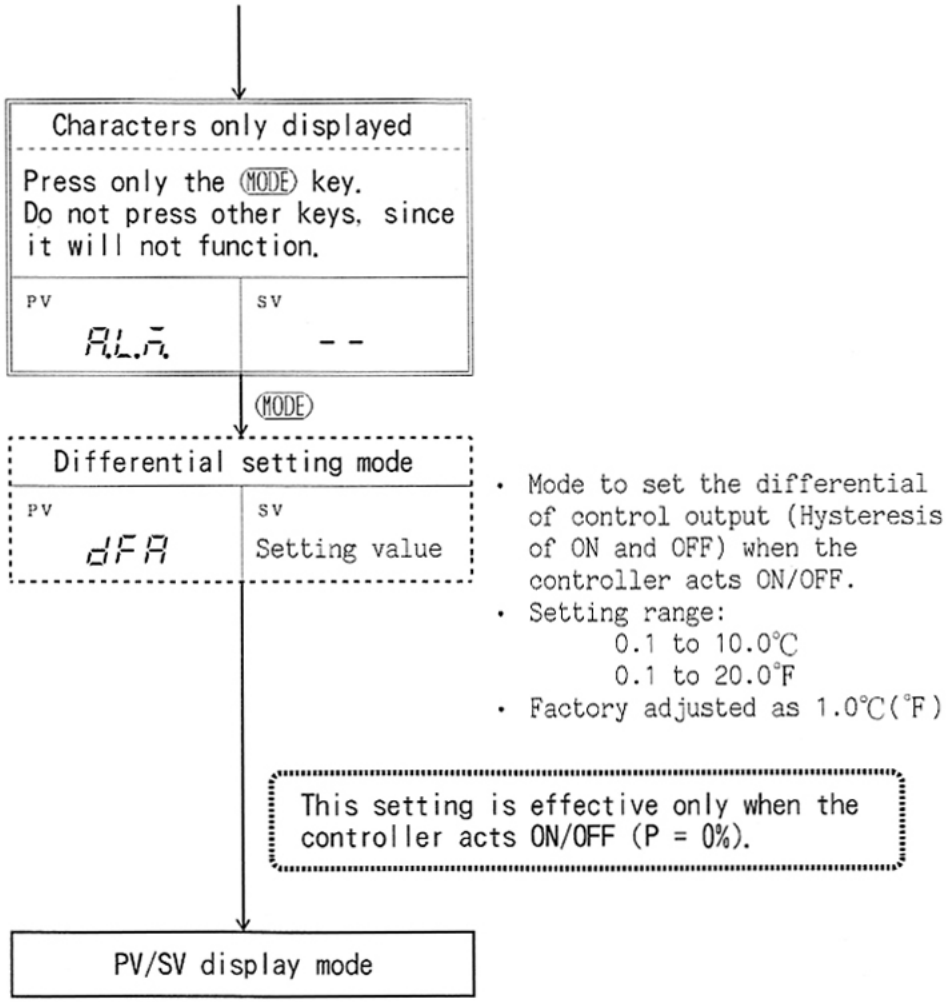
Mode to designate the control type (Heating or Cooling).

[Factory adjusted as Heating]

(MODE)

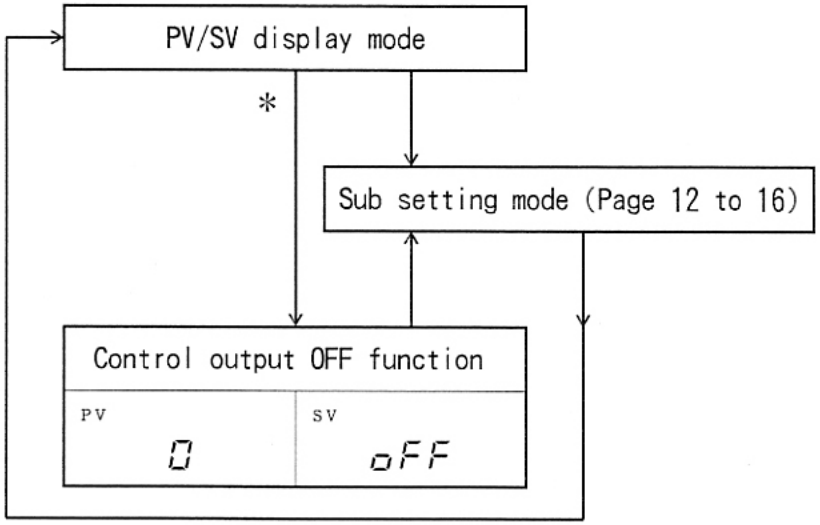
SV HE	Heating (reverse) action
SV co	Cooling (direct) action


Temperature alarm action designating mode
PV
ALA
SV
Designation
Mode to designate the temperature alarm action.
MODE
SV -- No alarm action
SV H High limit alarm action
SV L Low limit alarm action
SV HL High/Low limits alarm action *
SV oId Hi/Lo limit range alarm action *
SV HS High limit alarm with standby
SV LS Low limit alarm with standby
SV HLS Hi/Lo limits alarm w/standby *
SV Ab Process value alarm
*: The same values are set to the both sides (+ and −).


Characters only displayed
Press only the MODE key.
Do not press other keys, since it will not function.
PV
ALA
SV
--
MODE
Differential setting mode
PV
dFA
SV
Setting value
• Mode to set the differential of control output (Hysteresis of ON and OFF) when the controller acts ON/OFF.
• Setting range:
0.1 to 10.0℃
0.1 to 20.0℉
• Factory adjusted as 1.0℃(℉)
This setting is effective only when the controller acts ON/OFF (P = 0%).
PV/SV display mode

(5) Control output OFF function

A function to make the control output OFF even the power to the instrument is supplied. The function is used when required to halt the control action or the MCS-100 is not used in plural controllers. When the function is working, SV display indicates [oFF].



* In PV/SV display mode, if the (MODE) key is pressed while the (▲) key is being pressed, the mode turns to Sub setting mode showing the character [P], however, keep pressing until the character [oFF] is displayed. (It is for approx. 3s.)
To cancel the function, carry out the same key operation.

⚠ Notice

The function is not released even if the power to the instrument is turned off and turned on again.

4. Running

After completion of the mounting to the control panel and wiring connections, start running in the following manner:

(1) Turn the power supplied to this instrument MCS-130 ON.

(2) For approx. 8s after the power on, [INI-] is displayed on process variable display. During this time, all output, setting value display and LED indicators are in their OFF status. After that, it displays actual temperature on the process variable display, setting value on the display, and starts control.

⚠ Notice

Do not operate the keys during warm-up status (for approx. 8 seconds after the power on), and do not turn the power on while the key is pressing, or the specification contents of the instrument will have possibles to change.

(3) Input the setting value, referring to item "3. Operation" (page 9 ff).

(4) Turn the load circuit power ON.

(5) It starts the control action so as to maintain the controlled object at the setting value.

- PID auto-tuning performance and cancellation

▪ PID auto-tuning performance

PID auto-tuning is started by pressing the (AT) key, and auto-tuning indicator (Yellow LED) blinks.

The (MODE) key turns into ineffective during auto-tuning and other settings cannot be set in this status.

When the auto-tuning ends, the indicator will go off and the Proportional band (P), Integral time (I), Derivative time (D) and ARW value correspond to the controlling process are set automatically.

Each setting value: P, I, D and ARW value can be confirmed or changed by calling each setting mode of sub setting.

▪ PID auto-tuning cancellation

To cancel the auto-tuning on its process, press the (AT) key again. However, if released from the tuning unfinished, values correspond to the controlling process cannot be gotten, but returns to the former values.

> ▪ PID auto-tuning will not function if any lock mode is specified.
>
> ▪ It is recommended that the PID auto-tuning is performed on the trial run.

5. Action explanations

5.1 Standard action drawings

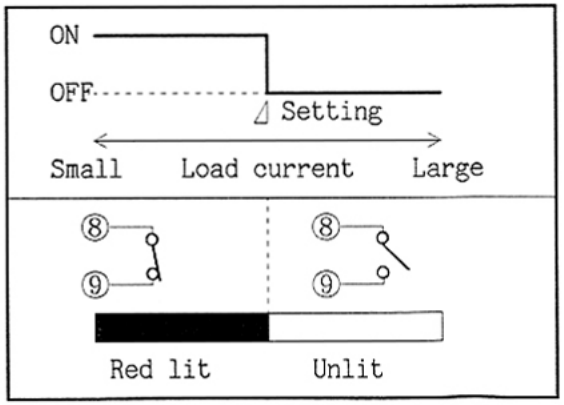
Action		Heating (reverse) [HE]	Cooling (direct) [Co]
Main control action		P. band, Setting △	P. band, △ Setting
Relay contact	Output	⑥ ⑦ Cycle action is performed according to deviation	⑥ ⑦ Cycle action is performed according to deviation
	Indi-cation	Green lit / Unlit	Unlit / Green lit
Non-contact voltage	Output	⑥ + 15Vdc / 15/0Vdc / 0Vdc, ⑦ − Cycle action is performed according to deviation	⑥ + 0Vdc / 0/15Vdc / 15Vdc, ⑦ − Cycle action is performed according to deviation
	Indi-cation	Green lit / Unlit	Unlit / Green lit

5.2 ON/OFF action drawings (Setting proportional band to 0.0)

Action		Heating (reverse) [HE]	Cooling (direct) [Co]
Main control action		Hysteresis, ON, OFF, Setting △	Hysteresis, ON, OFF, △ Setting
Relay contact	Output	⑥ ⑦	⑥ ⑦
	Indication	Green lit / Unlit	Unlit / Green lit
Non-contact voltage	Output	⑥ + 15Vdc ⑦ − / ⑥ + 0Vdc ⑦ −	⑥ + 0Vdc ⑦ − / ⑥ + 15Vdc ⑦ −
	Indication	Green lit / Unlit	Unlit / Green lit

In the range ▭ , controller acts ON or OFF.

5.3 Heater burnout alarm action drawing

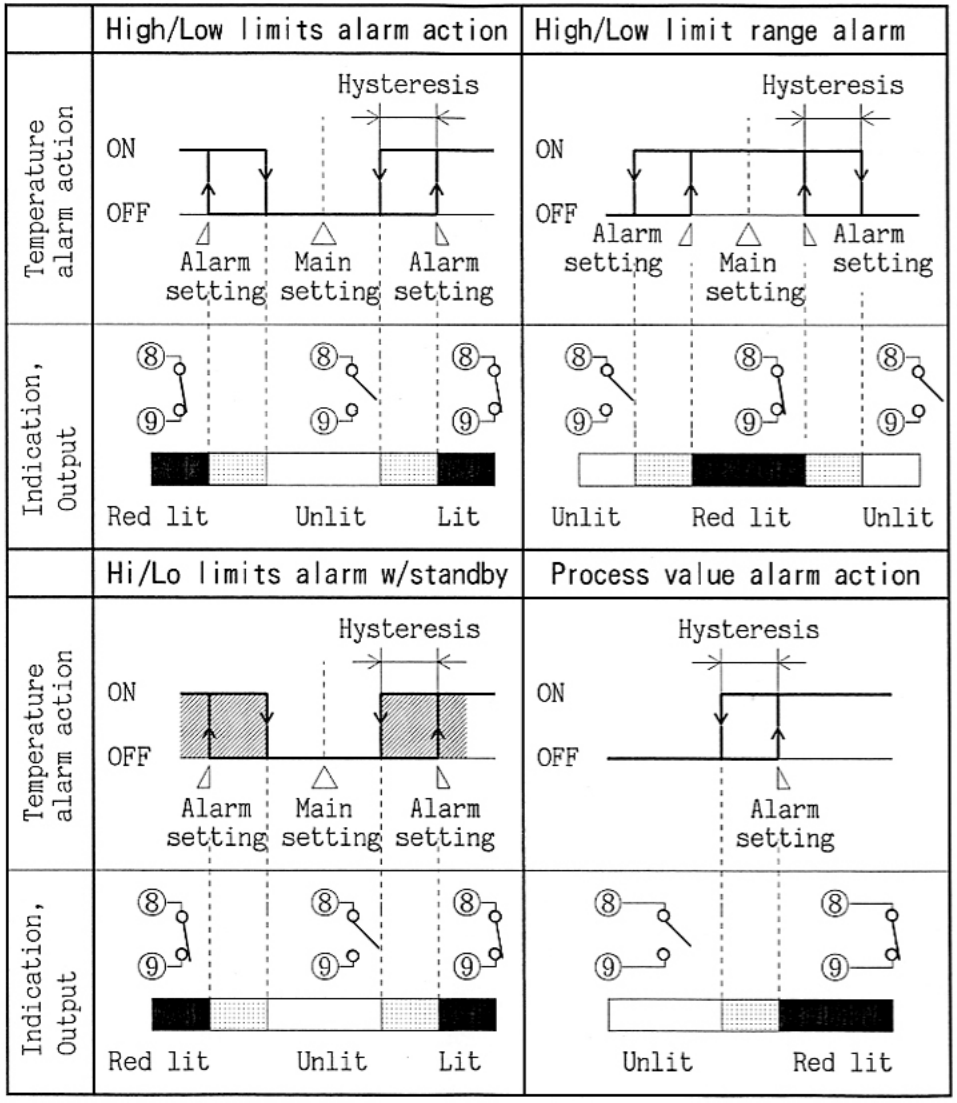


5.4 Temperature alarm action drawing

	High limit alarm action	Low limit alarm action
Temperature alarm action	Hysteresis, ON, OFF, Main setting △, Alarm setting ◺	Hysteresis, ON, OFF, Alarm setting ◺, Main setting △
Indication, Output	⑧ ⑨ Unlit / Red lit	⑧ ⑨ Red lit / Unlit
	High limit alarm w/standby	**Low limit alarm w/standby**
Temperature alarm action	Hysteresis, ON, OFF, Main setting △, Alarm setting ◺	Hysteresis, ON, OFF, Alarm setting ◺, Main setting △
Indication, Output	⑧ ⑨ Unlit / Red lit	⑧ ⑨ Red lit / Unlit

Standby function works at ▨ part.

In the range ▭ , alarm acts ON or OFF.



Standby function works at ▨ part.

6. Control actions

6.1 Explanations of PID and ARW

(1) Proportional band (P)

Proportional action is the action of which the control output varies in proportion to the deviation between setting value and processing temperature. If the proportional band is narrowed, the output changes according to even by a slight variation of the processing temperature, and better control result can be obtained as the offset decreases. However, if when the proportional band is extremely far too narrowed, it may cause variation in the processing temperature even by slight disturbance, and turns into control such as ON/OFF action of the so called hunting phenomenon. Therefore, when the processing temperature comes to the balanced position near the setting value and a constant temperature is maintained, the most suitable value is selected by gradually narrowing the proportional band while observing the control results.

(2) Integral time (I)

Integral action is to eliminate offset. When the integral time is shortened, the returning speed to the setting point is quickened. However, the cycle of oscillation is also quickened and stability becomes unfavorable.

(3) Derivative time (D)

Derivative action is to restore the change of processing temperature according to the changing rate. It reduces the amplitude of overshoot and undershoot width. If the derivative time is shortened, restoring value comes small, and if the derivative time is adjusted longer, a phenomenon of returning too much may occur and the control system may be oscillated.

(4) Anti-reset windup (ARW)

ARW prevents overshoot caused owing to the integral action. The less ARW value is, the less excess integral action becomes at transition status, however, it needs time till stabilized. If operating by manual, duty factor of load for the setting is of standard value to fix controlling aim.

How to get the duty factor for ARW when manual controlling.

$$\text{Duty factor}(\%) = \frac{\text{ON action time}}{\text{Proportional cycle}} \times 100(\%)$$

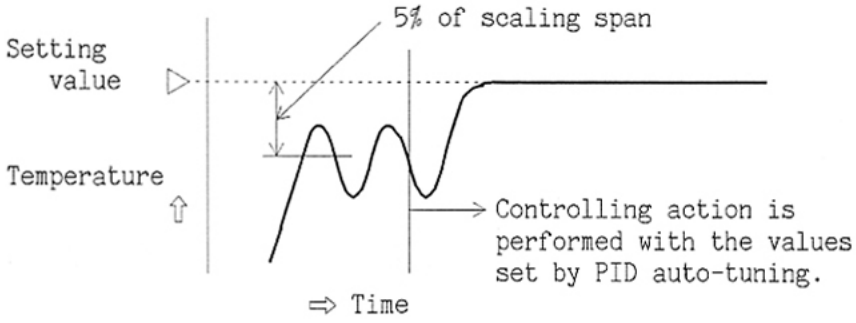
- Set to 50% (the same as factory adjusted), if duty factor is unknown.

6.2 PID auto-tuning of this instrument

In order to decide each value of P, I, D and ARW automatically, this system gives the fluctuation to the control object by force. Three kinds of undermentioned systems are automatically selected by this instrument.

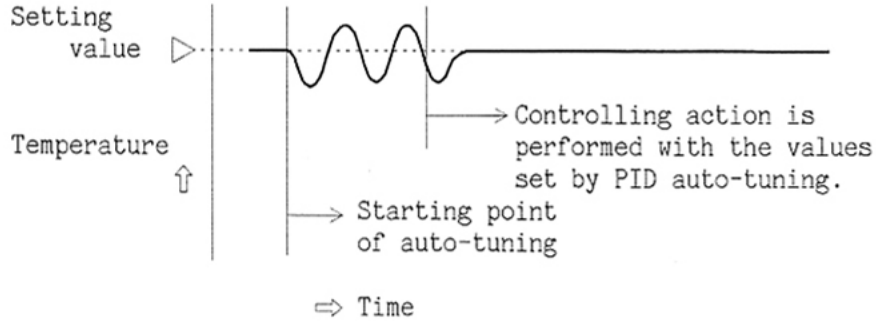
(1) In case the difference between setting value and processing temperature is large when the temperature rises.

Fluctuation is given at the temperature 5% of scaling span less than the setting value.



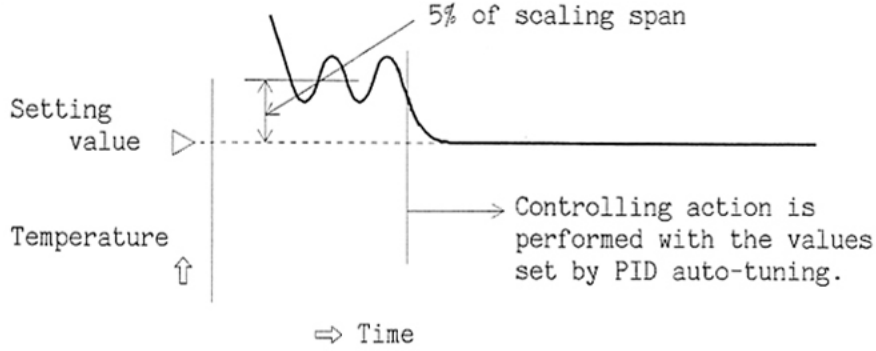
(2) In case of the stable situation during control or when control temperature is within ±10% of scaling span.

Fluctuation is given at the setting value.



(3) In case control temperature is 10% or more of scaling span higher than the setting value.

Fluctuation is given at the temperature 5% of scaling span higher than the setting value.



7. Other functions

(1) Tamper-proof function

In any mode excepting PV/SV display mode, if no keys are pressed for approx. 30s, the controller will automatically return to PV/SV display mode, and the values and the designated items are registered.

(2) Burnout alarm (upscale)

When the thermocouple or RTD (between A and B) is burnt out or input value exceeds 1.125 times as much as the rated scale high limit value, PV display blinks [- - -] and HB indicator (red) lights.

At this time, in case the control is Heating (reverse) action, it makes the output to OFF, and in case the control is Cooling (direct), it makes the output to ON.

In case heater burnout alarm function is applied, the alarm output is added and heater burnout alarm output turns ON as sensor burnout alarm output.

(3) Self-diagnostic function

It watches the CPU by watchdog timer, and when any abnormal status is found on the CPU, it makes the controller to warm-up status [ER-] by making all output off.

(4) Automatic cold junction temperature compensation (-□/E)

It detects the temperature at the connecting terminal between thermocouple and instrument, and always makes it the same status at which the reference junction located at 0℃[32℉].

8. Mounting to control panel

8.1 Site selection

Mount the controller in a place with:

(1) A minimum of dust, and an absence of corrosive gases.

(2) No mechanical vibrations or shocks.

(3) No exposure to direct sunlight, an ambient temperature is 0 to 50℃ (32 to 122℉) and it does not change suddenly.

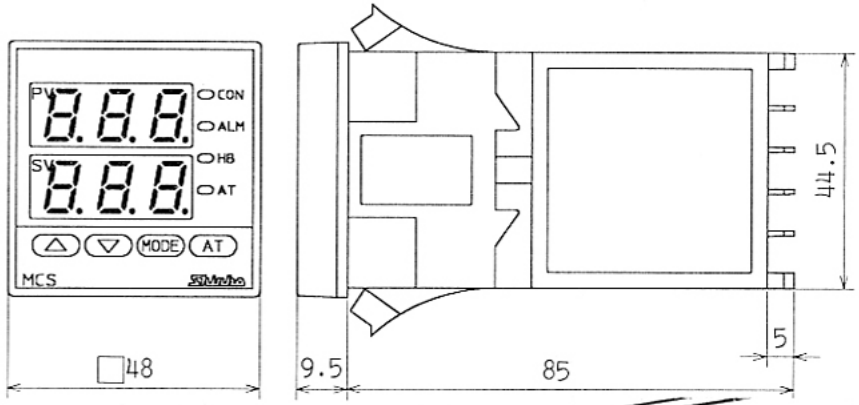
(4) An ambient humidity is 85%RH or less, and non-condensing.

(5) The controller should be away from the electromagnetic switch of large capacity or cables through which large current flows.

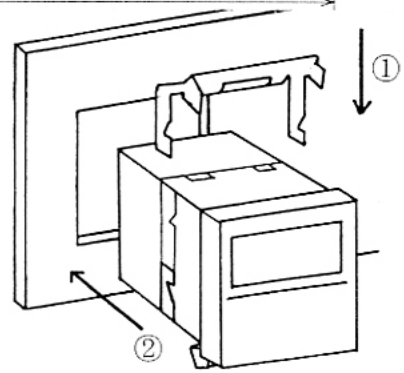
(6) No water, oil or chemicals and their vapor directly splash.

8.2 External dimension drawing

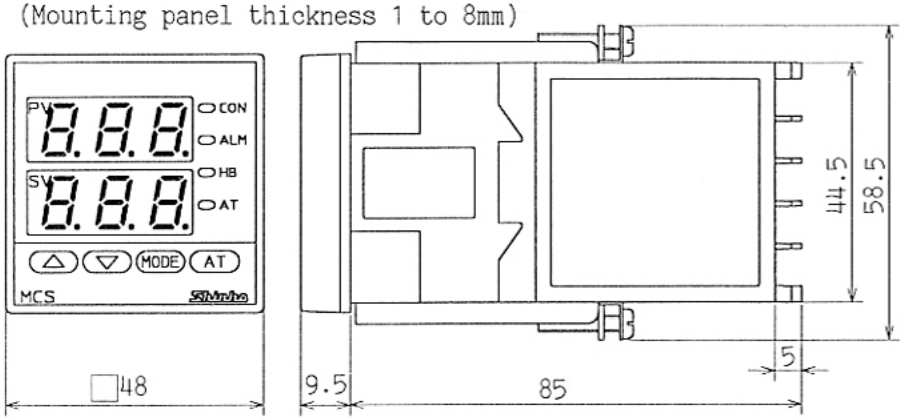
- One-touch type mounting bracket
  (Mounting panel thickness is 1 to 3mm.)



- Mount the one-touch mounting bracket ① to the body in advance, and then insert the MCS-130 ② from the front of panel.
- Soft cover for drip-proof and dust-proof is provided. (sold separately)

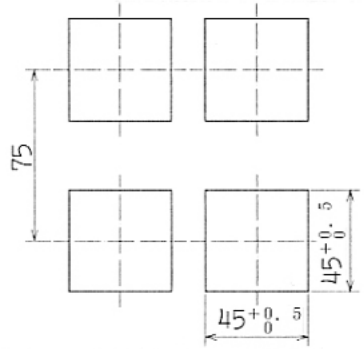


- Screw type mounting bracket (Option: BL)
  (Mounting panel thickness 1 to 8mm)

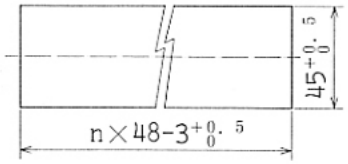


Do not screw with excessive force, or the case may be bent, since it is made of resin.
Torque to screw is approximately 0.4N·m.

8.3 Panel cutout drawing

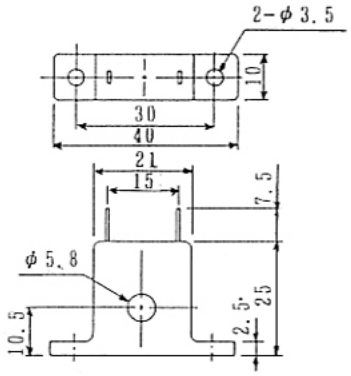


Lateral close mounting
n: Number of units installed



8.4 Current transformer

Weight: 11.5g

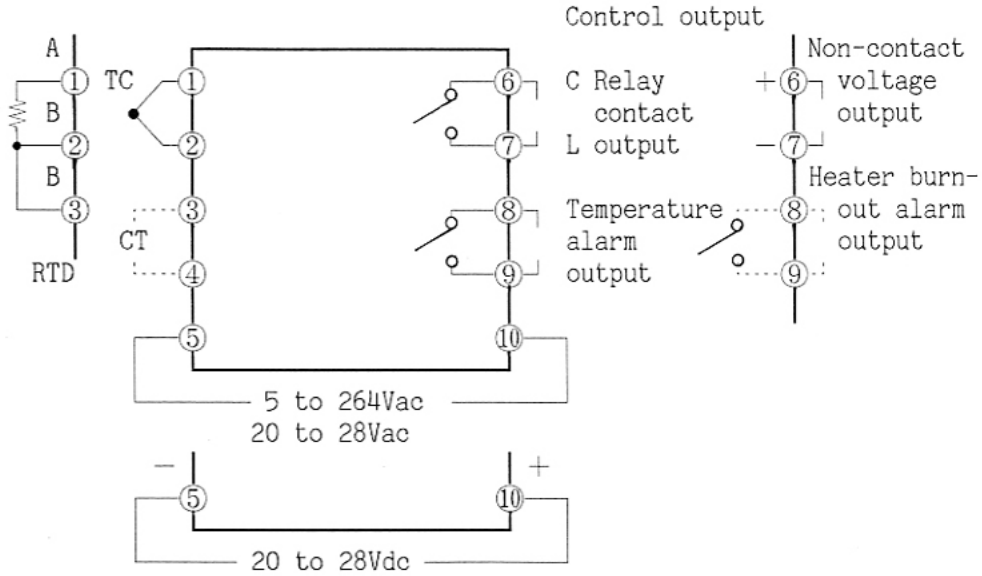


9. Wiring connection

⚠ Warning

Turn the power supplied to the instrument off before wiring or checking. If working or touching the terminal on the power on status, there is a possibility of Electric Shock which can cause severe injury or death.

9.1 Terminal arrangements



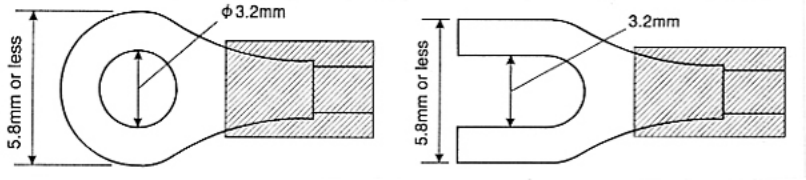
- Dotted line shows the case the option is designated, no terminal is equipped if the option is not specified.
- Whichever power supply AC or DC can be applied for 24V, however, when DC is applied, take care to the polarity.
- With the RTD input, if Heater burnout alarm output (option) is applied, the terminal ③ is common to the RTD input B and CT.

● Recommended terminal

Use a solderless terminal with insulation sleeve to fit to M3 screw as shown below.

Tightening torque: 0.6N•m to 1.0N•m

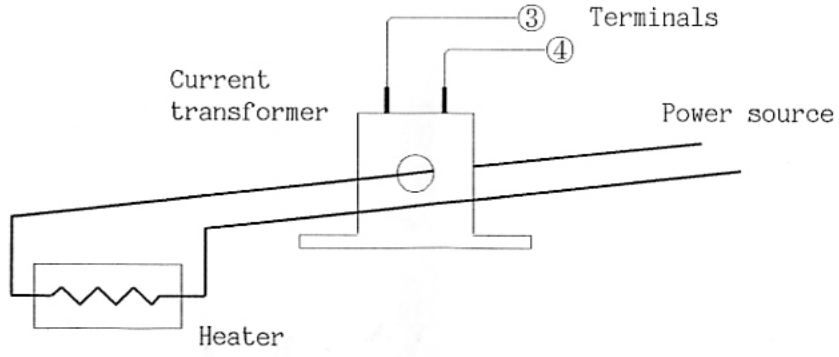
Solderless terminal	Manufacturer	Model name	Tightening torque
Y type	Nichifu Terminal Industries CO.,LTD.	1.25Y-3	0.6N•m (6kgf•cm)
	Japan Solderless Terminal MFG CO.,LTD.	VD1.25-B3A	
Round type	Nichifu Terminal Industries CO.,LTD.	1.25-3	Max. 1ON•m (10kgf•cm)
	Japan Solderless Terminal MFG CO.,LTD.	V1.25-3	



- Use a thermocouple and compensating lead wire applicable to the input specifications of this controller.
- Use a 3-wire system of RTD applicable to the input specifications of this controller.
- Check the specified voltage indicated on the voltage nameplate.
- This controller has no built-in power switch nor fuse. It is therefore recommended that these unit be provided in the circuit near the external controller.
- With relay output type of controller, it is recommended to provide the applicable relay 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.

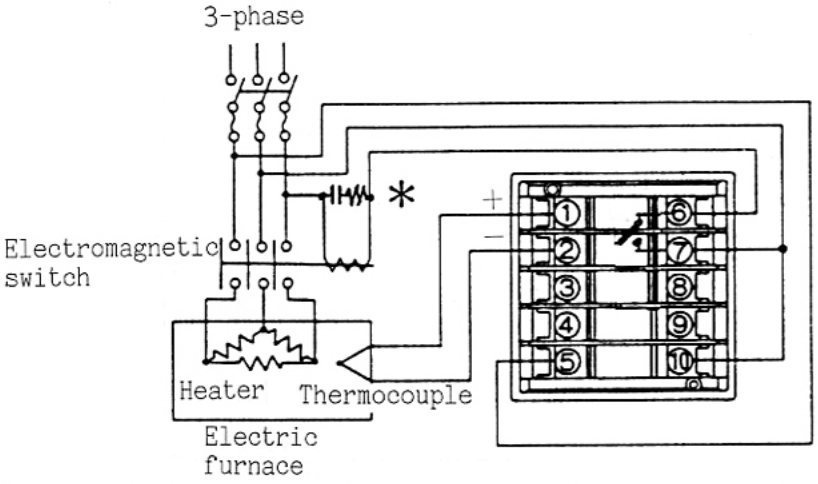
In case of Heater burnout alarm function (option code: W)

- This alarm is not available for detecting current under phase control.
- When using Current transformer (CT), select an accessory one.
- Pass a lead wire of heater circuit into the hole of the CT.
- When wiring, keep CT wire away from AC source and load wire.



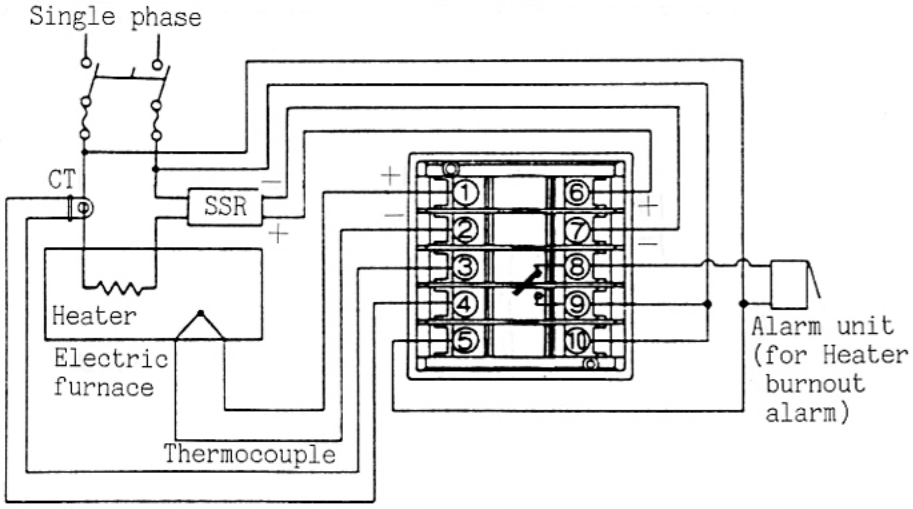
9.2 Wiring connection examples

MCS-130-R/E



* To prevent from a bad influence to the instrument owing to the unexpected level noise, it is recommended that the surge absorber be provided between the coil of the electromagnetic relay.

MCS-130-S/E, W



● Connectable SSRs in parallel are 4 units if the Shinko SSRs (SA-200 series) are used.

10. Specifications

10.1 Standard specifications

Mounting system: Flush

Setting : Input system using membrane sheet key

Display (PV) : Red LED, 3 digits, Size 10(H)×5.5(W)mm

(SV) : Green LED, 3 digits, Size 10(H)×5.5(W)mm

Accuracy

Thermocouple: Within ±0.3% of scaling span ±1 digit, or ±2℃ (±4℉) [Whichever is greater]

RTD : Within ±0.3% of scaling span ±1 digit, or ±1℃ (±2℉) [Whichever is greater]

Rated scale

Thermocouple: K, 0 to 400℃, 0 to 800℃, 0 to 999℃
(0 to 800℉, 0 to 999℉)
J, 0 to 400℃, 0 to 800℃
(0 to 800℉, 0 to 999℉)

RTD : Pt100, JPt100
−19.9 to 99.9℃, (−19.9 to 99.9℉)
−199 to 400℃, (−199 to 999℉)

Input

Thermocouple: K and J (100Ω or less)

RTD : Pt100, JPt100 (3-wire system)
(Resistance per wire 4Ω or less)

Output : Relay contact 1a 220Vac 3A (resistive load)
220Vac 1A (inductive load $\cos\phi$=0.4)
Non-contact voltage (for SSR drive)
15±3Vdc (load resistance 1.5kΩ)
20mA (short-circuit protected)

Temperature alarm output : Relay contact 1a 220Vac 1A (resistive load)
220Vac 0.4A (inductive load $\cos\phi$=0.4)

Control action : Main control action
PID action (with auto-tuning function)
Proportional band 0.1 to 99.9%
(acts ON/OFF when set to 0.0)
Integral time 1 to 999s
(off when set to 0)
Derivative time 1 to 999s
(off when set to 0)
Anti-reset windup 0 to 100%
Proportional cycle 1 to 120s
Temperature alarm, ON/OFF action,
Hysteresis 1℃ (℉)

Supply voltage : 100 to 240Vac, 50/60Hz or 24Vac/dc, 50/60Hz

Allowable voltage fluctuation : In case of 100 to 240Vac, 85 to 264Vac
In case of 24Vac/dc, 20 to 28Vac/dc

Ambient temperature : 0 to 50℃ (32 to 122℉)

Ambient humidity : 35 to 85%RH (non-condensing)

Power consumption : Approx. 2.2W

Insulation resistance : 10MΩ or greater at 500Vdc
(However, the voltage must not be applied to the terminals for Current transformer input, Non-contact voltage output.)

Dielectric strength : Between Input terminal and Power terminal
500Vac for 1min.
Between Input terminal and Ground
1.5kVac for 1min.
Between Power terminal and Ground
1.5kVac for 1min.
Between Output terminal and Power terminal
1.5kVac for 1min. (*)
Between Output terminal and Ground
1.5kVac for 1min. (*)
(*) With the type Non-contact voltage output, the testing voltage must not be applied.

Weight : Approx. 150g

Dimension : 48×48×85mm (W×H×D)

Case : Polycarbonate resin (Color, Light gray)

Attached functions : Scaling function
(Scaling high limit and low limit setting)
Output limit function (setting range, 0 to 100%)
Sensor correcting function
Setting value lock function
Power failure compensation
(Data back-up by non-volatile IC memory)
Self-diagnostic function
Automatic cold junction temperature compensation
(Thermocouple input)
Sensor burnout alarm [upscale]
(Thermocouple input)
Control output OFF function

Accessories : Mounting brackets 1set
Instruction manual 1copy
Current transformer 1set [for option W]

10.2 Optional functions

[H] Temperature alarm output with standby function

Applicable to High limit, Low limit and High/Low limits

[W] Heater burnout alarm output

In case Temperature alarm output is applied, the output terminal is common.

Setting range : 1 to 100% (off when set to 0)
Current, 5A, 10A or 20A (specified)

Setting accuracy: ±5%

Action : ON/OFF action
Once alarm action operates, the output is held until the power is turned OFF.

Output : Relay contact 1a
Control capacity
220Vac 1A (resistive load)
220Vac 0.4A (inductive load, $\cos\phi$=0.4)

[SK] Specified hysteresis

Setting range: 0.1 to 10.0℃ (0.1 to 20.0℉)

[F] Function selection

- Sensor selection
  Thermocouple: K or J is selected in case of Thermocouple
  RTD : Pt100 or JPt100 is selected in case of RTD
- ℃ or ℉ selection
- Control type Heating (reverse)/Cooling (direct) selection
- Temperature alarm mode selection
  1 type of alarm is selected from High limit alarm, Low limit alarm, High/Low limits alarm and alarms applied standby function to them, besides High/Low limit range alarm and Process value alarm.
- ON/OFF hysteresis setting
  The hysteresis is set in the range 0.0 to 10.0℃ (0.0 to 20.0℉) for ON/OFF action.

[CM] Cooling action

Output turns OFF in the range in which the input value is lower than the setting value, and ON in the range higher than that.

PID action (with auto-tuning function)
Proportional band 0.1 to 99.9%
(acts ON/OFF when set to 0.0)
Integral time 1 to 999s
(off when set to 0)
Derivative time 1 to 999s
(off when set to 0)
Anti-reset windup 0 to 100%
Proportional cycle 1 to 120s

[BK] Color black

Faceplate : Dark gray
Base and case: Black

[BL] Mounting bracket

Accessory : Screw type mounting bracket

11. When troubled

When troubled, refer to the following items after checking the power and the wiring.

⚠ Warning

Turn the power supplied to the instrument off before wiring or checking. If working or touching the terminal on the power on status, there is a possibility of Electric Shock which can cause severe injury or death.

Phenomenon	Presumed cause
oFF is indicated on the SV display.	Control output OFF function is working. (See page 23)
Setting mode cannot be selected.	During PID auto-tuning. (See page 25)
Setting is impossible. The (▲), (▼) keys are ineffective.	Setting value lock function LcA or Lc5 is designated. (See page 17) Check the values Scaling high limit setting and Scaling low limit setting. (See page 19)

Phenomenon	Presumed cause
Process variable (Temperature) does not rise.	Burnout or improper connection of thermocouple, compensation lead wire or RTD. The connection at input terminal is wrong. Heater is burnt out or improper connection. Trouble on electromagnetic switch, trigger, etc.
Process variable (Temperature) rises too much.	Improper mounting (insertion) of thermocouple or RTD. Reverse polarity of thermocouple or compensating lead wire. Improper specification of RTD.
Process variable is unstable.	Influence of inductive fault or noise. AC leaks into thermocouple or RTD circuit. Improper connection at input terminal.

- If happened unclear phenomenon other than above mentioned, make inquiries at our agency or your shop where purchased about the matters.

12. Character table

Character	Description	Initial
ñC-	Warm-up status	
SL	Main setting mode	0℃
P	Proportional band setting mode	2.5%
I	Integral time setting mode	200s
d	Derivative time setting mode	50s
n	Anti-reset windup setting mode	50%
c	Proportional cycle setting mode	30s:R/□, 3s:S/□
A	Temperature alarm setting mode	0℃
b *	Heater burnout alarm setting mode	0%
oFF	Control output OFF status	
Loc	Setting value lock designation mode	Unlock
--	Setting value lock is not designated	
LcA	All setting value lock	
LcSL	Lock excepting main setting value	
SE *	Sensor designation mode	K or Pt100
ñE	K (See page 18)	
ñEF	K (See page 18)	
ñJ	J (See page 18)	
ñJF	J (See page 18)	
PJ	JPt100 (See page 18)	
PJF	JPt100 (See page 18)	
Pd	Pt100 (See page 18)	
PdF	Pt100 (See page 19)	
PJc.	JPt100 (See page 19)	

Character	Description	Initial
PJF.	JPt100 (See page 19)	
Pdc.	Pt100 (See page 19)	
PdF.	Pt100 (See page 19)	
SH	Scaling high limit setting mode	Specified
SL	Scaling low limit setting mode	rated value
oTH	Output high limit setting mode	100%
oTL	Output low limit setting mode	0%
So	Sensor correction setting mode	0.0℃
cn *	Control type designation mode	Heating
HE	Heating action (reverse)	
co	Cooling action (direct)	
ALn *	Temperature alarm action designation	
--	No alarm action	
H	High limit alarm action	
L	Low limit alarm action	
HL	High/Low limits alarm action	
Hld	High/Low limit range alarm action	
Hb	High limit alarm action w/standby	
Lb	Low limit alarm action w/standby	
HLb	Hi/Lo limits alarm action w/standby	
Ab5	Process value alarm action	
dFA *	Differential setting mode	1.0℃
---	Burnout (upscale) status	

*: Options

• • • Inquiry • • •

For any inquiry of this controller, after checking the following as to the controller, please contact your shop where purchased, or our agency.

[Example]

- Model ..... MCS-130-R/E, F
- Temperature specification ..... 0 to 999℃
- Type of input ..... K
- Option ..... F
- Instrument number ..... No.□□□□□□

In addition to the above, let us know the details of malfunction, if any, and the operating conditions specifically on job site.

For inquiry about the specification change of this products, please contact the agency mentioned below.

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