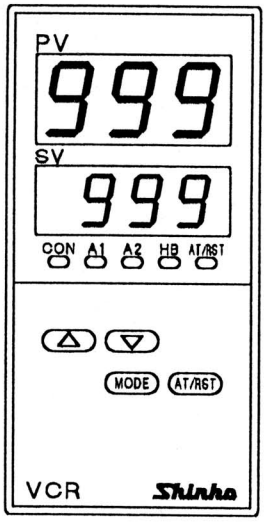
Shinko

INDUSTRIAL MEASURING INSTRUMENTS

INSTRUCTION MANUAL
FOR
MICROCOMPUTER BASED
TEMPERATURE INDICATING CONTROLLER
VCR-100 SERIES



Thank you for your purchase of our Microcomputer based Temperature Indicating Controller **VCR-100 Series.**
This controller is delivered after its production and inspection on the basis of severe quality control in our factory.
Further to your confirmation of the model and specifications of the controller, peruse this instruction manual before starting operation.

Note:
Please arrange to give this manual into the hands of the operator who actually uses our product.

SHINKO TECHNOS CO., LTD. OSAKA, JAPAN

⚠ Warning

Turn the power supplied to the instrument OFF before wiring or checking.
If working on the power ON status, there is possibilty of Electric Shock which can cause severe injury or death.

— CONTENTS —

When you begin to mount this instrument to the control panel or machine, read this manual from the item [7. Mounting to control panel] or the item [8. Wiring] after confirmed the model name with the item [1. Model names].

When you operate this instrument 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] VCR-13□-□/□

- E: Thermocouple input
- R: Relay contact output
- 2: High limit alarm

(1) Standard models

VCR-13□-□/□				Series name: VCR-100 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
		S		Non-contact voltage
		A		DC Current
Input			E	Thermocouple K, J
			R	RTD Pt100, JPt-100

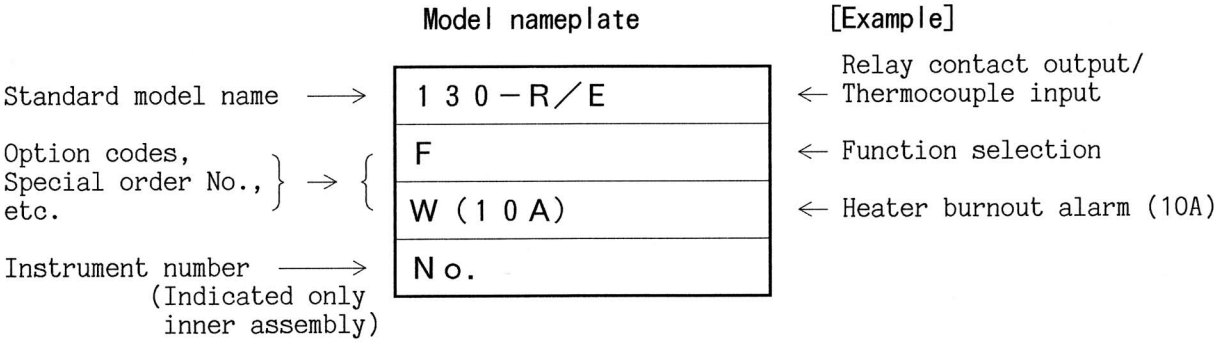
(2) Optional code

Code	Description
H	Temperature alarm (ALM) output with standby function
AL□	Temperature alarm (A2) output
AL□H	Temperature alarm (A2) output with standby function
D□	Heating/Cooling control output (Relay contact : DR) (Non-contact voltage: DS)
W	Heater burnout alarm function (including Sensor burnout alarm)
CM	Cooling control action
SK	Specified differential
F	Function selection
PD	Control action (PD action w/Auto-reset function)
BK	Color Black
BL	Screw type mounting bracket
TC	Electrical shock protecting terminal cover

See page 31 for the optional specifications in detail.

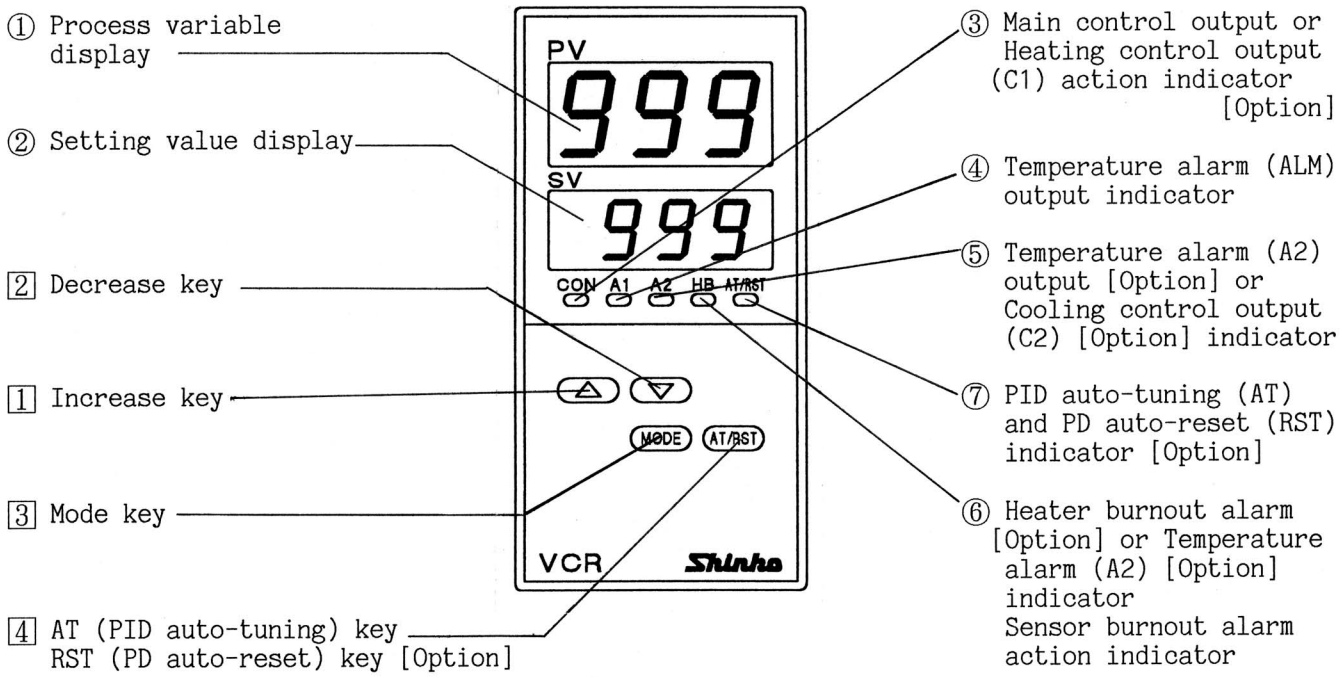
1.2 Indication of the model nameplate

The model nameplates are on the right side of the case and the left side of the inner assembly.



- Optional specifications are specified with the code besides the model name. When plural functions are specified, commas are used between the codes.
- As to specified Heater burnout alarm action W, etc., the specified value is to be indicated following to the option code in ( ).

2. Name and functions of the sections



The letter of the indicator changes on the option as follows.

- When the option Heating and Cooling control output is applied.

CON A1 C2 HB AT/RST

- When the options both Heating and Cooling control output and Temperature alarm (A2) output are applied.

CON A1 C2 A2 AT/RST

2.1 Displays

① Process variable display
It indicates the process variable (actual temperature) with red display.

② Setting value display
It indicates the setting value with green display.

③ Main control output or Heating (C1) output [Option] indicator
Green lights when the control output is ON or heating (C1) output is ON.
With the current output type, it always lights while the instrument power is ON.

④ Temperature alarm (ALM) output indicator
Red lights when temperature alarm (ALM) output is ON.

⑤ Temperature alarm (A2) output [Option] or Cooling (C2) output [Option] indicator
Red lights when temperature alarm (A2) output is ON, or Cooling control (C2) output is ON.

⑥ Heater burnout alarm (HB) [Option] and Sensor burnout alarm or Temperature alarm (A2) output [Option] indicator
Red lights when Heater burnout alarm output or Sensor burnout alarm output is ON, and, Temperature alarm output (A2) is ON (In case the options both Cooling control output (C2) and Temperature alarm (A2) are applied).

⑦ PID auto-tuning or PD auto-reset [Option] indicator
Yellow blinks when PID auto-tuning is performing or when PD auto-reset function (Offset correction) is performing.

2.2 Key functions

Main functions are described here, depending on the mode, it works other function too.

1 (▲) Increase key : It increases the setting value (SV) being displayed in setting mode. If this key is kept pressing, it causes the setting value to change faster.

In PV/SV display mode,

If the (MODE) key is pressed while this key is being pressed, the Sub setting mode will be selected.

If the (MODE) key is pressed for approx. 3 seconds while this key is being pressed, Control output OFF function works. ([P] is displayed, however, keep pressing until [oFF] is displayed.)

2 (▼) Decrease key : It decreases the setting value (SV) being displayed in setting mode. If this key is kept pressing, it causes the setting value to change faster.

In PV/SV display mode,

If the (MODE) key is pressed for approx. 3 seconds while this key is being pressed, Auxiliary function setting mode will be selected.

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

In PV/SV display mode,

If this key is pressed, the mode turns to Main setting mode.

If this key is pressed while the (▲) key is being pressed, the Sub setting mode will be selected.

If this key is pressed for approx. 3 seconds while the (▲) key is being pressed, Control output OFF function works.

If this key is pressed for approx. 3 seconds while the (▼) key is being pressed, Auxiliary function setting mode will be selected.

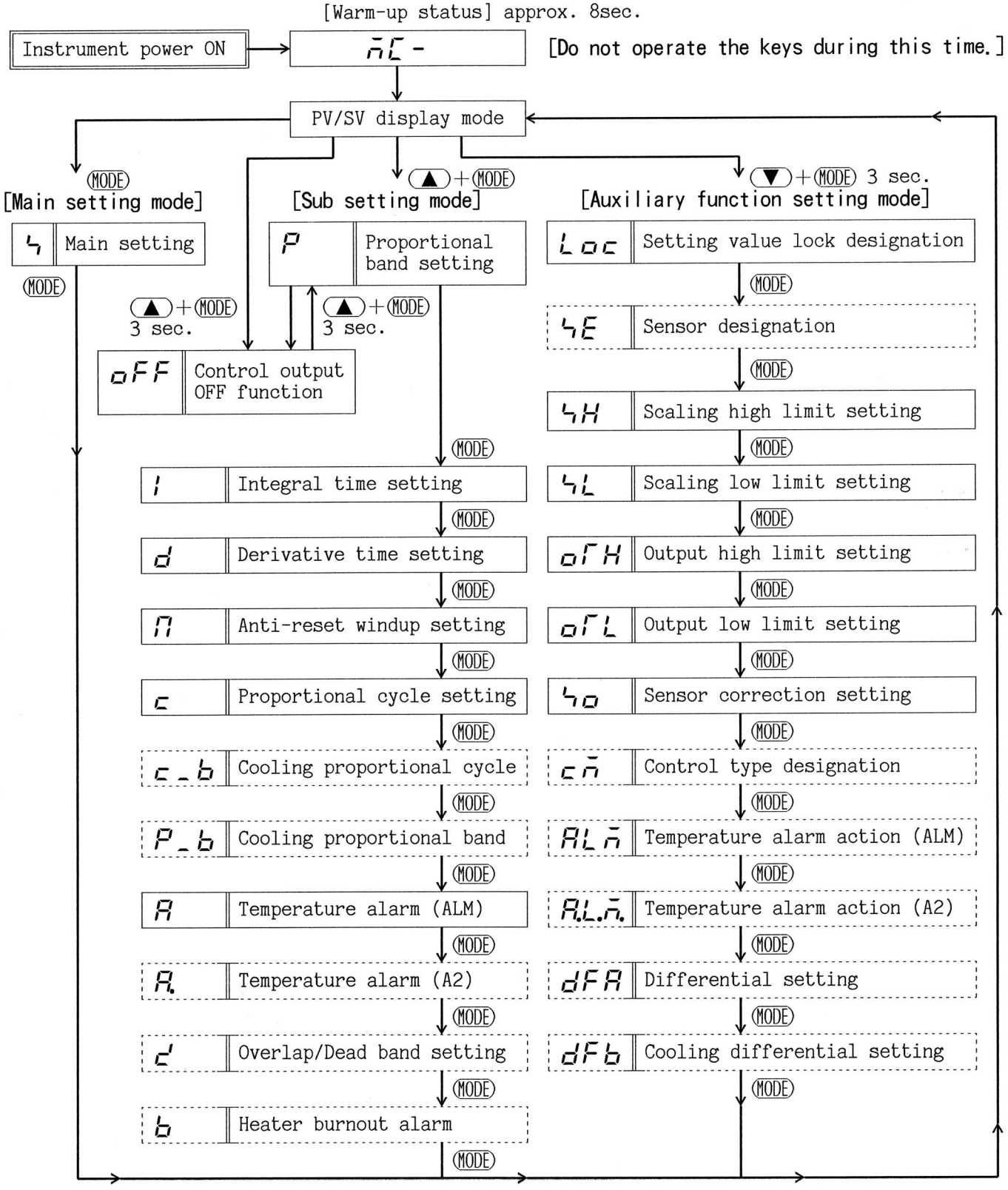
4 (AT/RST) PID auto-tuning key
or PD auto-reset key : It performs or cancels the PID auto-tuning.
[Option] PD auto-reset key:

When the process value is in the proportional band, if this key is pressed for more than 1 seconds, it starts the offset correction. This key is effective only when the option Control action PD is specified.

Notes:
- In any mode, if the (AT/RST) key is pressed, it performs the PID auto-tuning. However, if the lock is designated in the setting value lock designating mode the auto-tuning is not performed. (See page 13)
  If the (AT/RST) key is pressed by mistake, press the key again to cancel.
- To register the setting value, there are 2 ways as follows.
  - The numerical values or selected items are registered by pressing the (MODE) key.
  - If the system is left without key operation for approx. 30 seconds, the mode will return to PV/SV display mode automatically and the values and items will be registered.

3. Operations

3.1 Operation flow chart



- Dotted line shows the option. If the option is not specified, the mode cannot be selected.
- (▲)+(MODE) indicates that press the (MODE) key while the (▲) key is being pressed.
- (▲)+(MODE) 3 sec., (▼)+(MODE) 3 sec. indicates that press these keys ((▲) or (▼) key is pressed first) until the character [oFF] or [Loc] is displayed.

3.2 Operations

Process variable display (PV) indicates [-] for approx. 8 seconds (warm-up time) after the power is turned ON.
During this time, all outputs, SV display and LED indicators are in their off status.

Meanwhile, avoid key operations, and do not turn the power supply ON while the key is operated, or there is a possibility of change on the specification.

After that, it displays actual temperature on the PV display, setting value on the SV display and starts control.

(1) PV/SV display mode

A mode to indicate the control status.

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

(2) Main setting mode

In PV/SV display mode, if the (MODE) key is pressed, the main setting mode will be selected indicating [ ] on the PV display.

① Main setting mode 《》

A mode to set the setting value of the main control.
Setting range: The scaling low to high limit setting values.

PV display	SV display	Change of setting value
	Main setting value	The value can be increased or decreased with the (▲) or (▼) key.

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

(3) Sub setting mode

In PV/SV display mode, if the (MODE) key is pressed while the (▲) key is being pressed, the mode will be changed to Sub setting and the Proportional band setting mode is selected indicating [ ] on the PV display.
If the (MODE) key is pressed, the setting value is registered and the mode is changed.

① Proportional band setting mode 《》

A mode to set the proportional band value. (Automatically set by PID auto-tuning)
Setting range: 0.1 to 99.9%. Setting the proportional band to 0.0 causes the instrument to act as an ON/OFF controller, and when the option F is specified, the differential (hysteresis of ON and OFF action point) can be set in the differential setting mode.
(Factory adjusted as 2.5%.)

PV display	SV display	Change of setting value
	Proportional band setting value	The value can be increased or decreased with the (▲) or (▼) key.

② Integral time setting mode 《》

A mode to set the integral time value. (Automatically set by PID auto-tuning)
Setting range: 1 to 999 seconds.
Setting the integral to 0 disables the function. (Factory adjusted as 200 seconds.)

PV display	SV display	Change of setting value
	Integral time setting value	The value can be increased or decreased with the (▲) or (▼) key.

③ Derivative time setting mode 《d》

A mode to set the derivative time value. (Automatically set by PID auto-tuning)
Setting range: 1 to 999 seconds.
Setting the derivative to 0 disables the function. (Factory adjusted as 50 seconds.)

PV display	SV display	Change of setting value
d	Derivative time setting value	The value can be increased or decreased with the (▲) or (▼) key.

④ Anti-reset windup (ARW) setting mode 《n》

A mode to set the ARW value. (Automatically set by PID auto-tuning)
Setting range: 0 to 100%. (Factory adjusted as 50%.)

PV display	SV display	Change of setting value
n	ARW setting value	The value can be increased or decreased with the (▲) or (▼) key.

⑤ Proportional cycle setting mode 《c》

A mode to set the proportional cycle.
(This mode is inapplicable to the current output type.)
Setting range: 1 to 120 seconds. (Factory adjusted as 30sec. for relay output type, and 3sec. for non-contact voltage output type.)

PV display	SV display	Change of setting value
c	Proportional cycle setting value	The value can be increased or decreased with the (▲) or (▼) key.

⑥ Sub control proportional cycle setting mode 《c_b》 [Cooling control output (C2)]

A mode to set the proportional cycle of the cooling control.
If the option DR or DS is not specified, this mode is not available.
Setting range: 1 to 120 seconds. (Factory adjusted as 30sec. for relay output type, and 3sec. for non-contact voltage output type.)

PV display	SV display	Change of setting value
c_b	Sub proportional cycle setting value	The value can be increased or decreased with the (▲) or (▼) key.

Note: With Relay output type, if the time of proportional cycle is set shorter, the frequency of the relay action becomes more, and the life of relay will be shortened.

⑦ Sub control proportional band setting mode 《P_b》 [Cooling control output (C2)]

A mode to set the proportional band of the cooling control.
If the option DR or DS is not specified, this mode is not available.
Setting range: −10 to 10
[1/10 to 10 times as much as the proportional band of main control.]
(Factory adjusted as 1.)

PV display	SV display	Change of setting value
P_b	Sub proportional band setting value	The value can be increased or decreased with the (▲) or (▼) key.

- The values of integral time and the derivative time of the cooling control follow the setting values of the main control.

● Example to set Sub proportional band

・ In case, the rated scale is 0 to 400℃ and main proportional band is 10.0% (40℃), and 8℃ is desired for the sub proportional band.

[Formula] **SPBV = MPBV × SPBS (SPBF)** where SPBV: Sub proportional band value
[Example] 8℃ = 40℃ × −5 (1/5) MPBV: Main proportional band value
SPBS: Sub proportional band setting
SPBF: Sub proportional band setting multiplying factor

・ The Sub proportional band value is set in the range −10 to 10, however, if the Main proportional band value is changed to the same value, the Sub proportional band value is changed as well.

Sub control Proportional band setting value	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	0
Sub control Proportional band multiplying factor	1/10	1/9	1/8	1/7	1/6	1/5	1/4	1/3	1/2	1/1	0
Sub control Proportional band value (℃) [*]	4.0	4.4	5.0	5.7	6.7	8.0	10.0	13.3	20.0	40.0	0

Sub control Proportional band setting value	0	1	2	3	4	5	6	7	8	9	10
Sub control Proportional band multiplying factor	0	1	2	3	4	5	6	7	8	9	10
Sub control Proportional band value (℃) [*]	0	40	80	120	160	200	240	280	320	360	400

[*] The values of Sub control Proportional band are in case of above example.
Rated scale: 0 to 400℃, Main proportional band: 10.0% (40℃)

⑧ Temperature alarm (ALM) setting mode 《A》

A mode to set the temperature alarm (ALM) setting value.
If the type No alarm action (VCR-130-) is specified, this mode is not available.
(Factory adjusted as 0℃[℉])

PV display	SV display	Change of setting value
A	Temperature alarm setting value	The value can be increased or decreased with the (▲) or (▼) key.

Setting the value to 0 (0.0: In case of RTD input, and if with decimal point) disables the alarm function. However, in case of Process value alarm, it works even if 0 is set.

No alarm action	(VCR-130-)	
High limit alarm	(VCR-132-)	−100 to 100℃ [−199 to 200℉]
Low limit alarm	(VCR-133-)	−100 to 100℃ [−199 to 200℉]
High/Low limits alarm	(VCR-134-)	±(1 to 100)℃ [1 to 200℉, -1 to -199℉] *1
High/Low limit range alarm	(VCR-136-)	±(1 to 100)℃ [1 to 200℉, -1 to -199℉] *1
Process value alarm	(VCR-138-)	Scaling low to high limit setting value

● In case the decimal point is applied to the scale for the RTD input.

High limit alarm	(VCR-132-)	−19.9 to 99.9℃ [−19.9 to 99.9℉]
Low limit alarm	(VCR-133-)	−19.9 to 99.9℃ [−19.9 to 99.9℉]
High/Low limits alarm	(VCR-134-)	±(1.0 to 99.9)℃ [±(1.0 to 99.9℉)] *1, *2
High/Low limit range alarm	(VCR-136-)	±(0.1 to 99.9)℃ [±(0.1 to 99.9℉)] *1
Process value alarm	(VCR-138-)	Scaling low to high limit setting value

*1 The same values are set to both side (+ and −).

*2 Avoid setting to the value 0.9 or less, or it will prevent the normal action concerning the hysteresis.

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

  When power is initially 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.

High limit alarm	w/standby	−100 to 100℃	[−199 to 200℉]
Low limit alarm	w/standby	−100 to 100℃	[−199 to 200℉]
High/Low limits alarm	w/standby	±(1 to 100)℃	[1 to 200 ℉, -1 to -199℉] *1

- **In case the decimal point is applied to the scale for the RTD input.**

High limit alarm	w/standby	−19.9 to 99.9℃	[−19.9 to 99.9℉]
Low limit alarm	w/standby	−19.9 to 99.9℃	[−19.9 to 99.9℉]
High/Low limits alarm	w/standby	±(1.0 to 99.9)℃	[±(1.0 to 99.9℉)] *1, *2

*1 The same values are set to both side (+ and −).

*2 Avoid setting to the value 0.9 or less, or it will prevent the normal action concerning the hysteresis.

⑨ **Temperature alarm (A2) setting mode 《A2》**

A mode to set the temperature alarm (A2) setting value.
This mode is applicable when the option AL□ is applied.
The setting range is the same as temperature alarm (ALM).

PV display	SV display	Change of setting value
A2	Temperature alarm setting value	The value can be increased or decreased with the (▲) or (▼) key.

- **Temperature alarm (A2) with standby function (Option code: AL□H)**

  See the above item (Option H) for the standby function.
  The setting range is the same as temperature alarm (ALM).

⑩ **Overlap band or Dead band setting mode 《oL》**

A mode to set the Overlap band or Dead band value.
If the option DR or DS is not specified, this mode is unavailable.
Setting range: −10.0 to 10.0% of scaling range full scale
Setting by +: Dead band, by −: Overlap band

[Factory adjusted as 0.0%]

PV display	SV display	Change of setting value
oL	Overlap band or Dead band setting value	The value can be increased or decreased with the (▲) or (▼) key.

⑪ Heater burnout alarm setting mode 《b》

A mode to set the alarm action point.
If the option W is not specified, this mode is unavailable.
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: 0 to 100% (Factory adjusted as 0%)

PV display	SV display	Change of setting value
b	Heater burnout alarm setting value	The value can be increased or decreased with the (▲) or (▼) key.

Note: Setting the value to 0 disables the function. However, the sensor burnout function will work.

$$\text{Action point(setting value)\%} = \frac{\text{Heater current}}{\text{Rated current}} \times 100\%$$

Heater current: Maximum current value during operation
Rated current : Specified current (5A, 10A or 20A)

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

(4) Auxiliary function setting mode

In PV/SV display mode, if the (MODE) key is pressed for approx. 3 seconds while the (▼) key is being pressed, the mode turns to Auxiliary function setting showing the character [Loc] on the PV display, and Setting value lock designating mode will be selected.
Each time the (MODE) key alone is pressed, the value is registered and the mode is switched in order, and the setting value, etc. necessary for each mode can be set.

① Setting value lock designating mode 《Loc》

A mode to designate the function to prevent values from wrong setting by locking the setting function.
The setting items to be locked are different from the designating status.
(Factory adjusted as lock cancelled status)

Character	Function
--	Lock cancelled status. All setting values are settable.
LcA	Main and Sub setting modes are locked. Values of each item in these modes cannot be set.
Lc5	Sub setting mode is locked. Values of each item in this mode cannot be set.

PV display	SV display	Change of setting
Loc	-- / LcA / Lc5	With the (▲) key, -- ⇨ LcA ⇨ Lc5 With the (▼) key, Lc5 ⇨ LcA ⇨ --

Note: PID auto-tuning function or PD auto-reset function does not work in the locking status [LcA] or [Lc5].

② Sensor designating mode 《5E》

Input type or scale can be changed within the type (thermocouple or RTD input) respectively (6 types of thermocouple or 8 types of RTD).
If the option F is not specified, this mode is unavailable.

Character	Input	Scaling range	Applicable model
ñt	K	0 to 999℃	Thermocouple input (-□/E)
ñtF	K	0 to 999℉	
ñJ	J	0 to 800℃	
ñJF	J	0 to 999℉	
PJ	JPt100 (JIS'81)	−199 to 400℃	RTD input (-□/R)
PJF	JPt100 (JIS'81)	−199 to 999℉	
Pd	Pt100 (JIS'89, IEC)	−199 to 400℃	
PdF	Pt100 (JIS'89, IEC)	−199 to 999℉	
PJc.	JPt100 (JIS'81)	−19.9 to 99.9℃	
PJF.	JPt100 (JIS'81)	−19.9 to 99.9℉	
Pdc.	Pt100 (JIS'89, IEC)	−19.9 to 99.9℃	
PdF.	Pt100 (JIS'89, IEC)	−19.9 to 99.9℉	

PV display	SV display	Change of setting
5E	ñt ñtF ñJ ñJF PJ PJF Pd PdF PJc. PJF. Pdc. PdF.	With the (▲) key: ñt ⇨ ñtF ⇨ ñJ ⇨ ñJF ⇨ PJ ⇨ PJF ⇨ Pd ⇨ PdF ⇨ PJc. ⇨ PJF. ⇨ Pdc. ⇨ PdF. ⇨ With the (▼) key: PdF. ⇨ Pdc. ⇨ PJF. ⇨ PJc. ⇨ PdF ⇨ Pd ⇨ PJF ⇨ PJ ⇨ ñJF ⇨ ñJ ⇨ ñtF ⇨ ñt ⇨ If the (▲) or (▼) key is kept pressing, it moves forwardly.

Note: Do not change the designation between the thermocouple and RTD.

③ Scaling high limit setting mode 《5H》

A mode to set the high limit of scale range.
Setting range differs from the type of sensor.
(Factory adjusted as specified rated value.)

PV display	SV display	Change of setting value
5H	High limit value of the scale range	The value can be increased or decreased with the (▲) or (▼) key.

④ Scaling low limit setting mode 《SL》

A mode to set the low limit of scale range.
Setting range differs from the types of sensor.
(Factory adjusted as specified rated value.)

PV display	SV display	Change of setting value
SL	Low limit value of the scale range	The value can be increased or decreased with the (▲) or (▼) key.

⑤ Output high limit setting mode 《oTH》

A mode to set the high limit value of control output. (Effective to main output only)
Setting range is Output low limit value to 100%. (The indication is to 110)
(For the current output type, the range is Output low limit value to 110%.)
(Factory adjusted as 100%.)

PV display	SV display	Change of setting value
oTH	High limit value of the output	The value can be increased or decreased with the (▲) or (▼) key.

⑥ Output low limit setting mode 《oTL》

A mode to set the low limit value of control output. (Effective to main output only)
Setting range is 0% to Output high limit value. (The indication is from -10)
(For the current output type, the range is -10% to Output high limit value.)
(Factory adjusted as 0%.)

PV display	SV display	Change of setting value
oTL	Low limit value of the output	The value can be increased or decreased with the (▲) or (▼) key.

⑦ Sensor correction setting mode 《So》

A mode to set the sensor corrective value. Setting range is -19.9 to 30.0℃,
(-19.9 to 50.0℉) (Factory adjusted as 0.0℃[℉])

PV display	SV display	Change of setting value
So	Sensor corrective value	The value can be increased or decreased with the (▲) or (▼) key.

Explanation of the 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.

⑧ Control type designating mode 《cn̄》

A mode to designate the types (Heating[reverse] action or cooling[direct] action) of the control. If the option F is not specified, this mode is unavailable.

PV display	SV display	Control type	Change of status
cn̄	HE	Heating [reverse] action	The (▲) key, for heating action.
	Co	Cooling [direct] action	The (▼) key, for cooling action.

⑨ Temperature alarm (ALM) action designating mode 《AL-n》

⑩ Temperature alarm (A2) action designating mode 《AL.n》

The modes to designate the temperature alarm actions for ALM and A2.
[AL-n] is displayed only when the option F [Function selection] is applied, and
[AL.n] is displayed only when the options both F and AL□ [Temperature alarm (A2) output] are applied.

Character	Temperature alarm action	Setting range	
--	No alarm action	———	
H	High limit alarm action	−100 to 100℃ [−199 to 200°F]	
L	Low limit alarm action	−100 to 100℃ [−199 to 200°F]	
HL	High/Low limits alarm action	±(1 to 100)℃ [1 to 200°F, -1 to -199°F]	*
oId	High/Low limit range alarm action	±(1 to 100)℃ [1 to 200°F, -1 to -199°F]	*
Ho	High limit alarm action w/standby	−100 to 100℃ [−199 to 200°F]	
Lo	Low limit alarm action w/standby	−100 to 100℃ [−199 to 200°F]	
HLo	High/Low limits alarm w/standby	±(1 to 100)℃ [1 to 200°F, -1 to -199°F]	*
Abs	Process value alarm action	Scaling low to high limit setting value	

*: The value is set to both + and − sides simultaneously.

See page 11 for the setting ranges in case the input is RTD and the decimal point is applied.

PV display	SV display	Change of alarm action
AL-n (ALM) AL.n (A2)	-- H L HL oId Ho Lo HLo Abs	With the (▲) key: -- ⇨ H ⇨ L ⇨ HL ⇨ oId ⇨ Ho ⇨ Lo ⇨ HLo ⇨ Abs With the (▼) key: Abs ⇨ HLo ⇨ Lo ⇨ Ho ⇨ oId ⇨ HL ⇨ L ⇨ H ⇨ -- If the (▲) or (▼) key is kept pressing, it moves forwardly.

⑪ Differential setting mode 《dFA》 [Main control output (C1)]

⑫ Cooling control differential setting mode 《dFb》 [Sub control output (C2)]

[dFA] is displayed only when the option F [Function selection] is applied, and [dFb] is displayed only when the options both F and D□ [Heating/Cooling control output] are applied.

Differential (hysteresis between ON and OFF action point for the control) is settable when the instrument acts as an ON/OFF controller.

[dFA] is for the Main control output.
[dFb] is for the Sub control output.

Settable from 0.1 to 10.0℃ (0.1 to 20.0℉). (Factory adjusted as 1.0℃[℉])

PV display	SV display	Change of setting value
dFA	Differential setting value for Main control output(C1)	Increase or decrease the numerical value with the (▲) and (▼) keys.
dFb	Differential setting value for Sub control output (C2)	

Note: This action is effective only when the controller acts ON/OFF action.
(Proportional band = 0%)

(5) Control output OFF function

A function to make the control output OFF even the power to the instrument is supplied. For example, when the VCR-100 is not used or required to halt the control action. (The function is not released even if the power to the instrument is turned OFF and turned ON again.)
When the function is working, SV display indicates [oFF] and PV display indicates [0].

PV display	SV display	Change of the function
0	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. 3 seconds) To cancel the function, carry out the same key operation as above, and the mode returns to the Proportional band setting mode. • In Proportional band setting mode, press the (MODE) key for approx. 3 seconds while the (▲) key is being pressed. To cancel the function, carry out the same operation.

4. Running

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

(1) Instrument power ON

Turn the power supplied to the VCR-100 ON.

(2) Warmup status

For approx. 8 seconds after the power on, [ ] is displayed on PV display. During this time, all output, SV display and LED indicators are in their OFF status.

> **Meanwhile, avoid key operations, and do not turn the power supply ON while the key is operated, or there is a possibility of change on the specification.**

After that, it displays the actual temperature on the process variable (PV) display and setting value on the setting value (SV) display, and starts the control.

(3) Setting value input

Input the setting value, referring to [3. Operations]. (See on and after page 8)

(4) Load power ON

Turn the load circuit power ON.

(5) Control start

The controller starts the control action so as to maintain the controlled object at the setting value.

● Performance and cancellation of the PID auto-tuning

▪ Performance of the PID auto-tuning

Auto-tuning starts by pressing the (AT/RST) key in PV/SV display mode, Main setting mode, Sub setting mode or Auxiliary function setting mode. During auto-tuning is operated, auto-tuning indicator (Yellow LED) blinks.
The (MODE) key becomes null during PID auto-tuning, and other setting cannot be operated.
After the auto-tuning ends, the Proportional band, the Integral time, the Derivative time and the ARW value are automatically set, and each value can be confirmed at each setting item in Sub setting mode.

▪ Cancellation of the PID auto-tuning

Auto-tuning is cancelled when the (AT/RST) key is pressed again while the auto-tuning is operating, however, since the auto-tuning is not completed, the values of P, I, D and ARW are left as former value.

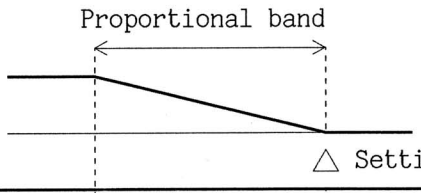
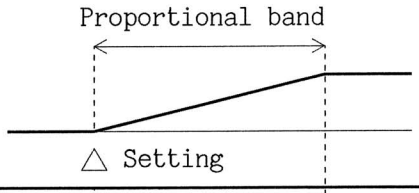
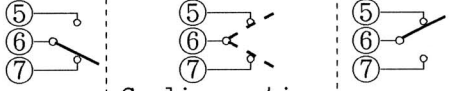
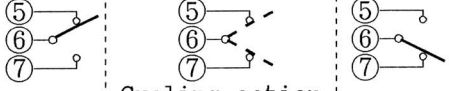
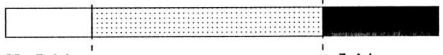
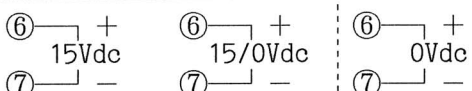
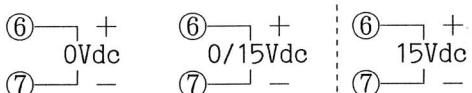
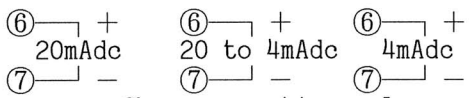
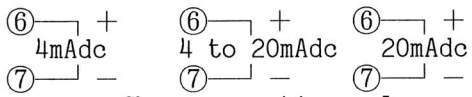
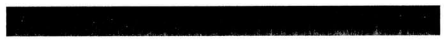
Notes: ▪ **Auto-tuning will not function if lock is specified in the setting value lock designation mode. (See page 13)**

▪ **It is recommended that the PID auto-tuning is to be performed on test running.**

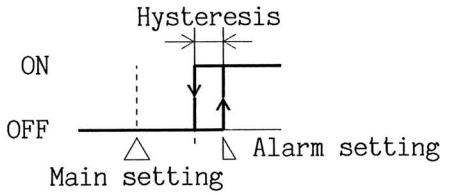
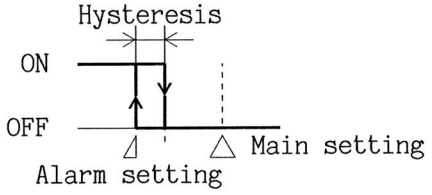
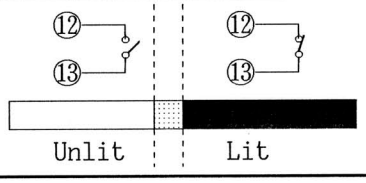
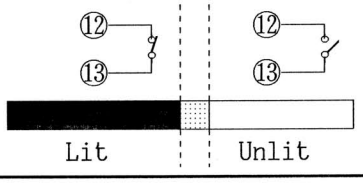
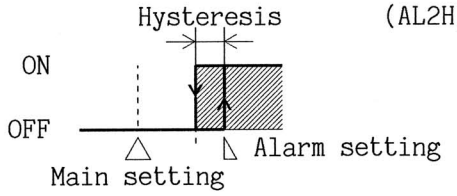
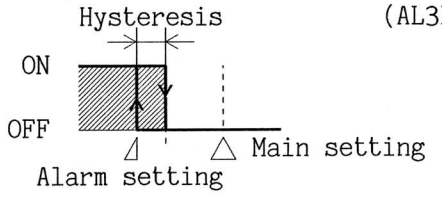
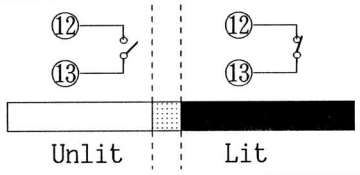
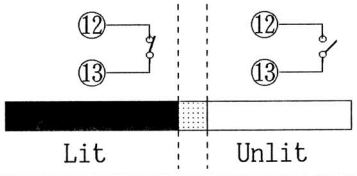
5. Control actions

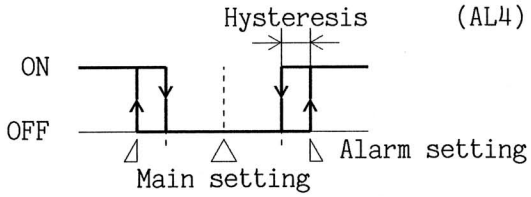
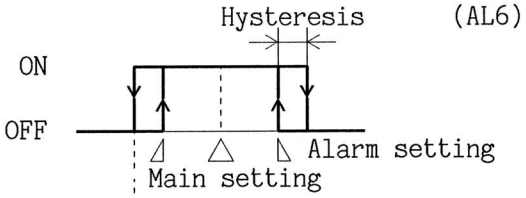
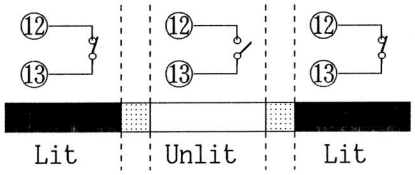
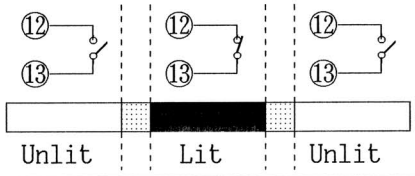
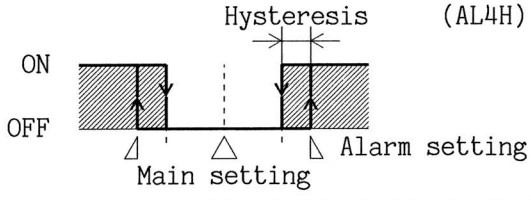
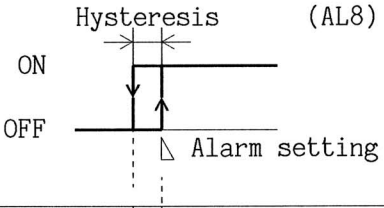
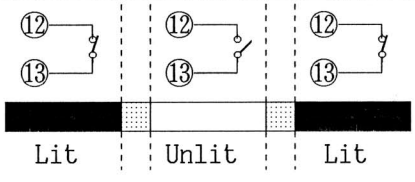
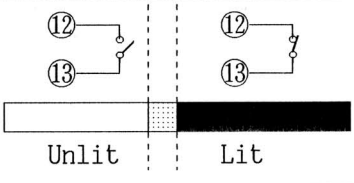
5.1 Action drawings

Heating (reverse) and Cooling (direct) action drawings

Action		Heating (Reverse) action [HE]	Cooling (Direct) action [co]
Main control action			
Relay contact	Output		
	Indication (Green)		
Non-contact voltage	Output		
	Indication (Green)		
Current	Output		
	Indication (Green)		

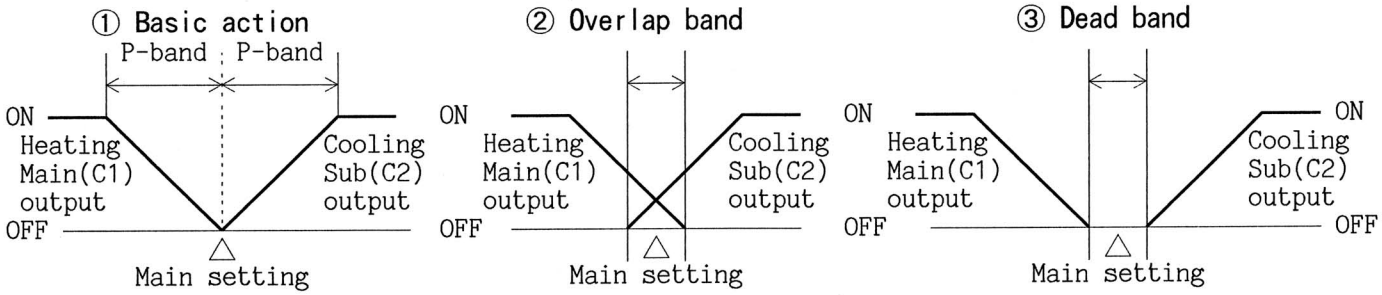
● Temperature alarm actions [ ]: Model name of Alarm ALM, ( ): Option code for Alarm A2

Alarm action	High limit alarm action [132] (AL2) 	Low limit alarm action [133] (AL3) 
Output Indication		
Alarm action	High limit alarm w/standby [132,H] (AL2H) 	Low limit alarm w/standby [133,H] (AL3H) 
Output Indication		

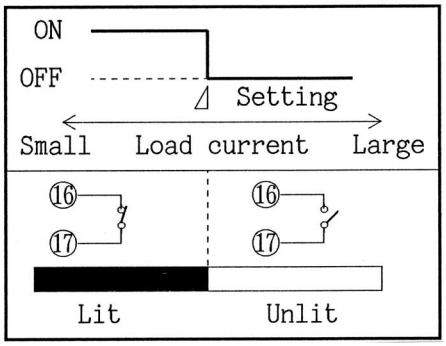
Alarm action	High/Low limits alarm action [134] (AL4) 	Hi/Lo limit range alarm action [136] (AL6) 
Output Indication		
Alarm action	Hi/Lo limits alarm w/standby [134,H] (AL4H) 	Process value alarm action [138] (AL8) 
Output Indication		

The standby function works at ▨ part. See page 27 to the terminal number for option AL□.

● Heating and Cooling control output actions (Option: D□)



● Heater burnout alarm action (Option: W)



● ON/OFF action drawings (Proportional band is set to 0.0)

Action		Heating control [HE] (Reverse)	Cooling control [co] (Direct)	Heating/Cooling control [Option: D□]
Main control action		[dFA] Hysteresis, ON, OFF, Setting	[dFA] Hysteresis, ON, OFF, Setting	[dFA] Hysteresis, Heating control; Dead band; [dFb] Hysteresis, Cooling control; ON, OFF, Setting
Relay contact	Output	⑤⑥⑦ / ⑤⑥⑦	⑤⑥⑦ / ⑤⑥⑦	⑥⑦ / ⑥⑦ ⑭⑮ / ⑭⑮
	Indication	Green; Lit, Unlit	Green; Unlit, Lit	Green, Red; Lit, Unlit, Lit
Non-contact voltage	Output	⑥(+) 15Vdc ⑦(−) / ⑥(+) 0Vdc ⑦(−)	⑥(+) 0Vdc ⑦(−) / ⑥(+) 15Vdc ⑦(−)	+⑥ 15Vdc −⑦ / +⑥ 0Vdc −⑦ +⑭ 0Vdc −⑮ / +⑭ 15Vdc −⑮
	Indication	Green; Lit, Unlit	Green; Unlit, Lit	Green, Red; Lit, Unlit, Lit
Current	Output	⑥(+) 20mAdc ⑦(−) / ⑥(+) 4mAdc ⑦(−)	⑥(+) 4mAdc ⑦(−) / ⑥(+) 20mAdc ⑦(−)	
	Indication	Green; Lit	Green; Lit	

5.2 PID

(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 due 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% (Factory adjusted) for test running, if the duty factor is unknown.

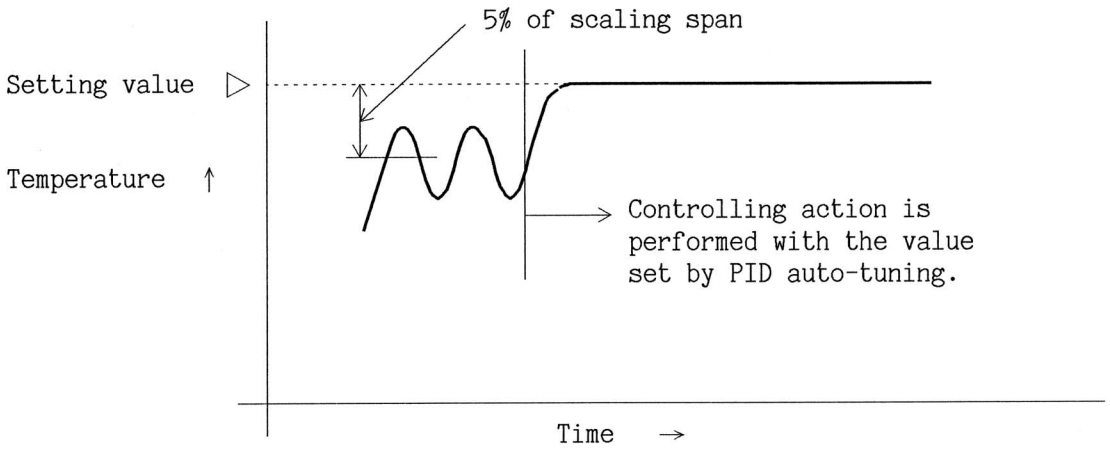
- **Each value for the Proportional band, the Integral time, the Derivative time and the ARW are automatically set when the PID auto-tuning is completed.**

5.3 PID auto-tuning

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 the instrument.

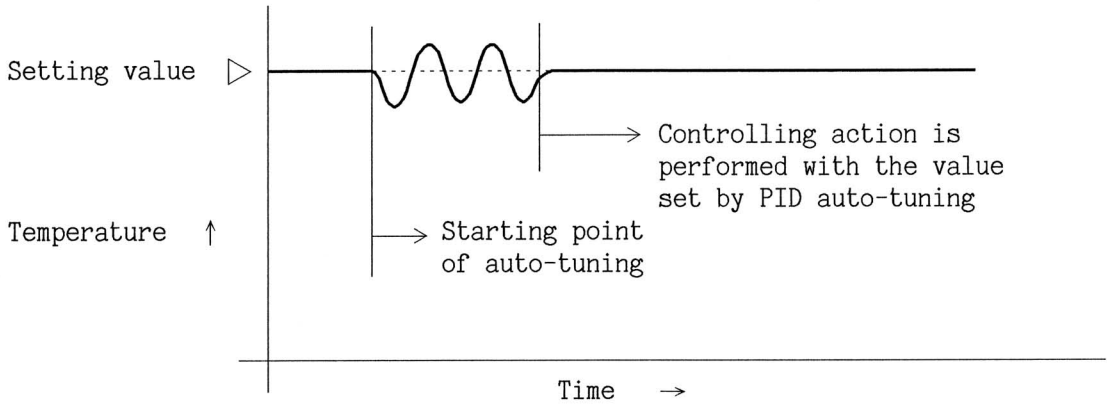
(1) In case the difference between setting value and processing temperature is large when the temperature rises;

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



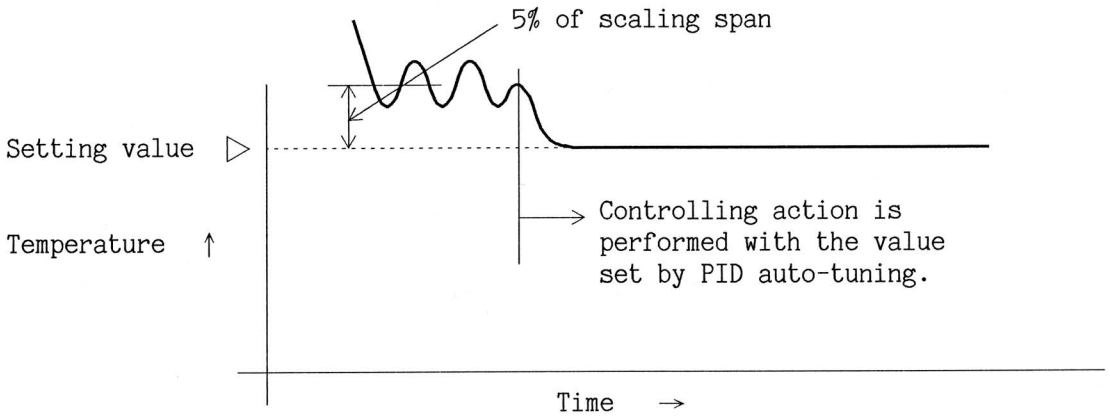
(2) In case of the stable situation during control or when control temperature is within ±10% of scaling span;

Fluctuation is given at the setting value.



(3) In case control temperature is 10% or greater of scaling span;

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



6. Other functions

(1) Tamper-proof function

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

(2) Burnout alarm (upscale) (Thermocouple input)

When the thermocouple is burnout, or if the input value exceeds 1.125 times as much values as 999 or 99.9, the PV display blinks [‾ ‾ ‾] and HB indicator (red) lights.
At this time, in case the main control output is reverse (heating), the output turns to OFF, and if it is direct (cooling), the output turns to ON.
In case heater burnout alarm function is specified, the alarm output is added and heater burnout alarm output turns ON.

(3) Self-diagnostic function

It watches the CPU by watchdog timer, and when occurred any abnormal status on the CPU, it makes the controller to warmup status [‾ ‾ -] by making the all output off.

(4) Automatic cold junction temperature compensation (Thermocouple input)

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℉].

(5) Power failure compensation

In case the power failure time exceeds 30ms, the data are kept with non-volatile IC memory.

7. Mounting to control panel

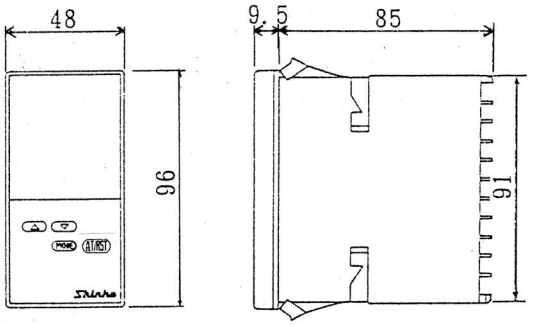
7.1 Site selection

Mount the controller in a place with:

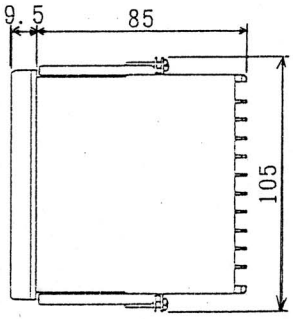
(1) A minimum of dust and an absence of corrosive gases.
(2) No mechanical vibrations or shocks.
(3) No exposure to direct sunlight, ambient temperature within 0 to 50℃ (32 to 122℉) and it does not change suddenly.
(4) Ambient humidity 85%RH or less and non-condensing.
(5) The controller should be away from the electromagnetic switch of large capacity or cables through which large current flows.
(6) No water or oil and their vapor directly splash.

7.2 External dimension drawing

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

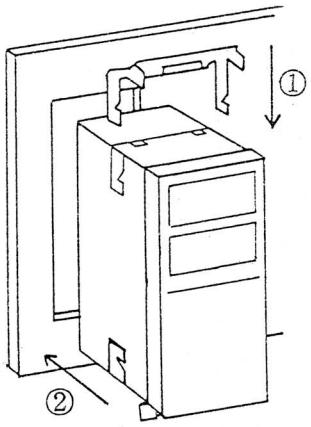


- Screw type mounting bracket (Option: BL)
(Mounting panel thickness 1 to 8mm)

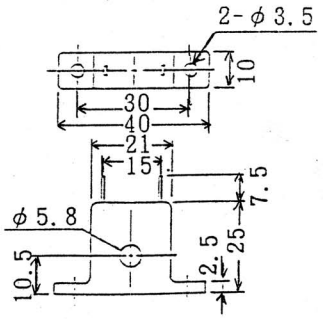


Note:
Do not screw with excessive force, or the case may be bent, since it is made of resin.

- Mount the one-touch mounting bracket ① to the body in advance, and then insert the VCR-100 ② from the front of panel.

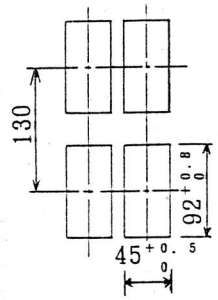


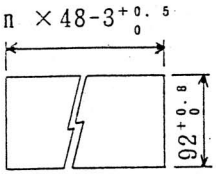
[Optional (W) accessory]



Dimension drawing of Current transformer for [Heater burnout alarm]

7.3 Panel cutout

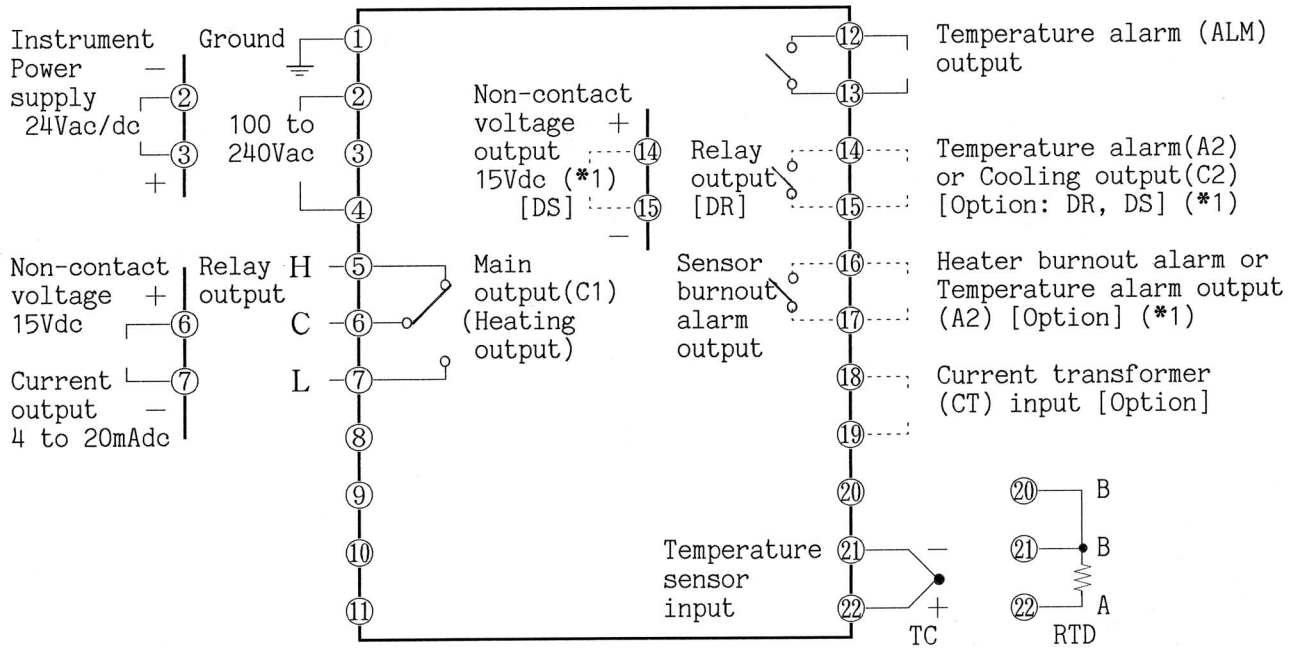




Lateral close mounting
n: Number of units installed

8. Wiring

8.1 Terminal arrangements



(*1) When the Heating and Cooling control output (Option: D□) is applied.

- Dotted line shows the case the option is designated, no terminal is equipped if the option is not specified.

Notes:

(1) With the product of which the supply voltage is 24V, the voltage is indicated as 24V. Do not apply other voltage without failure.

(2) The terminal block of this instrument is designed to wire from the left side. Lead wire must be inserted from the left side to the terminal, and fasten by terminal screw.

(3) Use a thermocouple and compensating lead wire applicable to the input specifications (K, J, etc.) of this controller.

(4) Use a 3-wire system of RTD applicable to the input specifications (Pt100) of this controller.

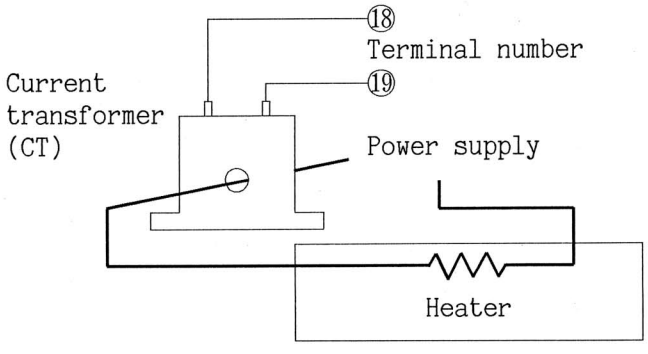
(5) This controller has no built-in power switch nor fuse. It is therefore recommended to provide them in the external circuit near the controller.

(6) When wiring, keep input wire (Thermocouple, RTD, etc.) away from AC source and load wire to avoid external interference.

(7) With relay output type controller, if the load is directly connected, even if the load capacity is smaller than the built-in contact capacity, the life of the relay will be shortened by rush current and so on.
Therefore, it is recommended to provide appropriate relay to protect the built-in relay.

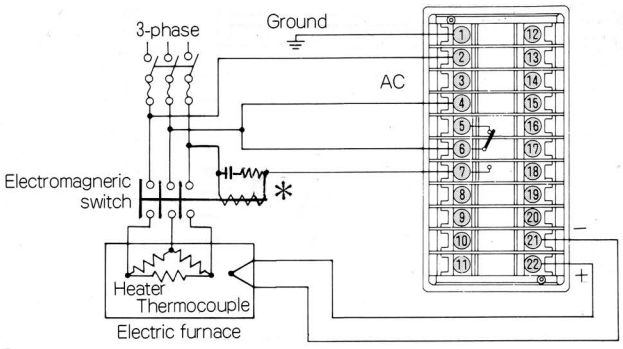
[Option W: Heater burnout alarm function]

- **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.

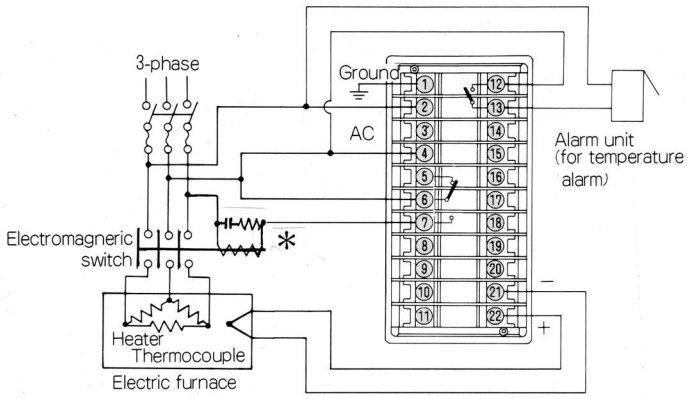


8.2 Wiring examples

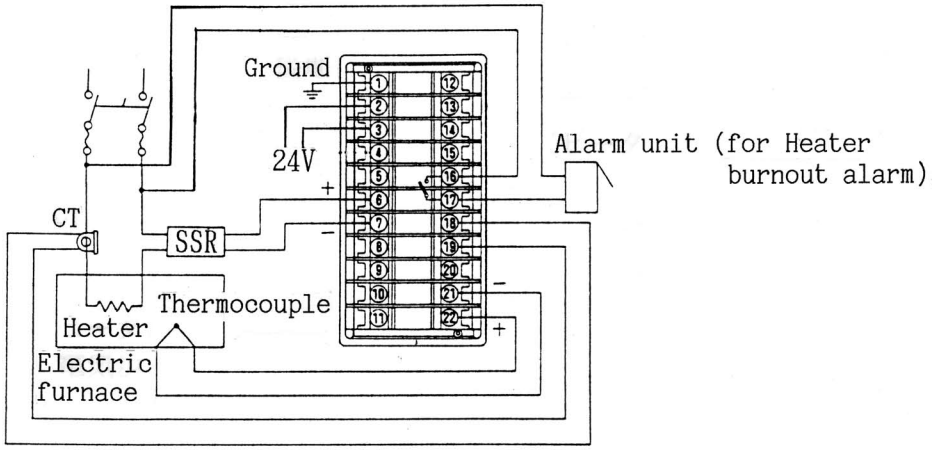
VCR-130-R/E



VCR-132-R/E



VCR-130-S/E, W (Supply voltage: 24V)



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

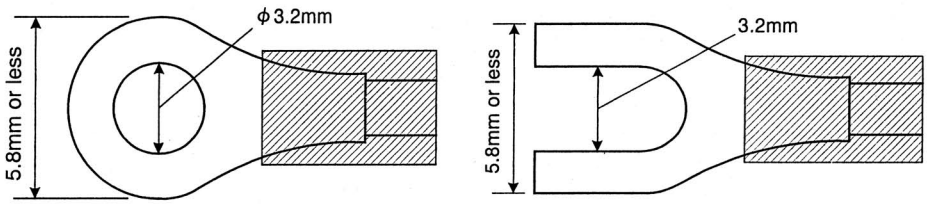
Notes: 1. To prevent from a bad influence to the instrument owing to the unexpected level noise, it is recommended that the surge absorber be provided between the coil of the external relay.

2. Whichever power supply AC or DC can be applied for 24V, however, when DC is applied, take care to the polarity.

● **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) Max. 1.0N·m (10kgf·cm)
	Japan Solderless Terminal MFG CO.,LTD.	VD1.25-B3A	
Round type	Nichifu Terminal Industries CO.,LTD.	1.25-3	
	Japan Solderless Terminal MFG CO.,LTD.	V1.25-3	

9. Specifications

Mounting method : Flush

Setting method : Input system using membrane sheet key

Display : Process variable (PV), 7-segment, Red LED, 3 digits
Size 14.3×8mm (H)×(W)
Setting value (SV), 7-segment, Green LED, 3 digits
Size 10×5.5mm (H)×(W)

Rated scale : Thermocouple K 0 to 400℃, 0 to 800℃, 0 to 999℃
(0 to 800°F, 0 to 999°F)
J 0 to 400℃, 0 to 800℃
(0 to 800°F, 0 to 999°F)
RTD Pt100, JPt100
−19.9 to 99.9℃ (−19.9 to 99.9°F)
−199 to 400.0℃ (−199 to 999°F)

Accuracy : Thermocouple, Within ±0.3% of scaling range full scale ±1 digit,
or ±2℃ [±4°F] (whichever is greater)
RTD, Within ±0.3% of scaling range full scale ±1 digit,
or ±1℃ [±2°F] (whichever is greater)

Input : Thermocouple K, J (100Ω or less)
RTD Pt100 (JIS'89, IEC), JPt100 (JIS'81)
3-wire system, resistance per wire, 4Ω or less

Output : Relay contact 1c 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)
DC current 4 to 20mAdc (isolation type)
Load resistance maximum 600Ω

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 999sec. (off when set to 0)
Derivative time 1 to 999sec. (off when set to 0)
Anti-reset windup 0 to 100%
Proportional cycle 1 to 120sec.

Temperature alarm : Setting accuracy: Within ±0.5% of full scale ±1 digit,
Action: ON/OFF action, Hysteresis: 1℃ (°F)
Output: Relay contact 1a
220Vac 0.5A (resistive load)
220Vac 0.2A (inductive load $\cos\phi$=0.4)

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

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

Dimension : 96×48×95mm (H×W×D)

Case : Polycarbonate resin, Color; Light-gray

Panel : Membrane sheet

Terminal arrangements: See page 27

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

Dielectric strength

	Between input terminal and power terminal,	500Vac for 1min.
	Between input terminal and ground terminal,	500Vac for 1min.
	Between power terminal and ground terminal,	1.5kVac for 1min.
*	Between output terminal and power terminal,	1.5kVac for 1min.
*	Between output terminal and ground terminal,	1.5kVac for 1min.

*: In case of Current output or Non-contact voltage output, voltage must not be applied between to these terminals.

Attached functions : Scaling function (scaling high limit and low limit setting)
Sensor correcting function
Setting value lock function
Power failure countermeasures
Self-diagnostic function
Automatic cold junction temperature compensation (-□/E)
Burnout function (upscale)
Output limit function
Control output OFF function

Power consumption : Approx. 2.2W

Instantaneous power failure : Within 30msec.

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

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

Weight : Approx. 250g

Accessories : Mounting brackets 1 set
Instruction manual 1 copy
Current transformer, Model CTL-6S 1 set [when the option W is applied]

Optional specifications

Temperature alarm output (ALM) with standby function : **[Code: H]**
This function is applicable to High limit, Low limit or High/Low limits alarm for the temperature alarm (ALM).

Temperature alarm output (A2) : **[Code: AL2 to AL4, AL6 and AL8]**
The same as the temperature alarm (ALM), one of the alarm is to be designated from High limit alarm, Low limit alarm, High/Low limits alarm, High/Low limit range alarm and Process value alarm.

Temperature alarm output (A2) with standby function : **[Code: AL2H to AL4H]**
This function is applicable to High limit, Low limit or High/Low limits alarm for the temperature alarm (A2).

Heater burnout alarm output : **[Code: W]** (including sensor burnout alarm)
This Heater burnout alarm output is not available with a combination of Temperature alarm (A2) output (option AL□) and Heating/Cooling control output (option D□). However, the Sensor burnout alarm works.

Setting 0 to 100% (off when set to 0)
(current 5A, 10A or 20A, specified)
Setting accuracy ±5%
Action ON/OFF action
Output Relay contact 1a
220Vac 0.5A (resistive load)
220Vac 0.2A (inductive load, $\cos\phi$=0.4)

Function selection : **[Code: F]**
Sensor, Temperature scale, Control type, Temperature alarm and Differential value can be selected or set.

Designated differential : **[Code: SK]**
Differential of main control action ON and OFF can be designated when ordering. (Designation range: 0.1 to 10.0℃ [0.1 to 20.0℉])

Heating/Cooling control output : **[Code: DR or DS]**
Cooling (Sub) control Proportional band
0.1 to 10 times as much as Heating (Main) control proportional band
Cooling (Sub) control Integral time
It follows the Main control integral time.
Cooling (Sub) control Derivative time
It follows the Main control derivative time.
Cooling (Sub) control Proportional cycle
1 to 120sec.
Overlap band or Dead band setting range
−10.0 to 10.0% of scaling range full scale

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

Cooling control action : [Code: CM]
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 999sec. (off when set to 0)
Derivative time 1 to 999sec. (off when set to 0)
Anti-reset windup 0 to 100%
Proportional cycle 1 to 120sec.

Color Black : [Code: BK]
Face plate: Dark gray, Frame and case: Black

Control action : [Code: PD]
PD action (with auto-reset function)
Proportional band 0.1 to 99.9% (acts ON/OFF when set to 0.0)
Derivative time 1 to 999sec. (off when set to 0)
Proportional cycle 1 to 120sec.

Mounting bracket : [Code: BL]
Screw type mounting bracket as the accessory

Terminal cover : [Code: TC]
Electrical shock protecting terminal cover

10. When troubled

Problem	Action
Power is not applied to the instrument.	• Check the power supply line. • The power is not connected to the instrument.
SV display indicates [oFF].	• Release the Control output OFF function. (See page 17)
Setting mode cannot be selected by pressing the (MODE) key.	• During PID auto-tuning. (See page 18) Cancel the auto-tuning if necessary.
Setting is impossible.	• Setting value lock function is working. Release the lock function if necessary. (See page 13)
Main setting value cannot be set. The (▲) and (▼) keys do not work.	• Setting value limit is working. (See page 15) The value can be increased or decreased only within the scaling setting range. • Setting value lock function is working. Release the lock function if necessary. (See page 13)
Process variable does not rise.	• Burnout or improper connection of thermocouple, compensation lead wire or RTD. Check the wiring. • The connection at input terminal is wrong. • Heater burnout or improper connection. • Trouble on electromagnetic switch, trigger, etc.
Process variable rises too much.	• Improper mounting (insertion) of thermocouple or RTD. Check the insertion. • Reverse polarity of thermocouple or compensating lead wire. Check the wiring. • Improper specification of RTD. Check the resistance value.
Display for process variable is unstable.	• Influence of inductive fault or noise. • AC leaks into RTD circuit. • Improper connection at input terminal. Check the wiring.

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

12. Character table

Character	Description	Character	Description
WC-	Warmup status	PJF.	JPt100(JIS'81) -19.9 to 99.9°F
SY	Main setting mode	Pdc.	Pt100(JIS'89,IEC)-19.9 to 99.9°C
P	Proportional band setting mode	PdF.	Pt100(JIS'89,IEC)-19.9 to 99.9°F
I	Integral time setting mode	SYH	Scaling high limit setting mode
d	Derivative time setting mode	SYL	Scaling low limit setting mode
n	ARW setting mode	orH	Output high limit setting mode
c	Proportional cycle setting mode	orL	Output low limit setting mode
c_b	Cooling P-cycle setting mode	Sno	Sensor correction setting mode
P_b	Cooling P-band setting mode	cn	Control type designation mode
A	Temperature alarm (ALM) setting	HE	Heating (reverse) action
A.	Temperature alarm (A2) setting	co	Cooling (direct) action
d	Overlap band and Dead band setting mode	ALn	Temperature alarm (ALM) action designation mode
b	Heater burnout alarm setting	AL.n.	Temperature alarm (A2) action designation mode
oFF	Control output off status	--	No alarm action
Loc	Setting value lock designation	H	High limit alarm action
--	Setting value lock is not designated	L	Low limit alarm action
LcA	All setting value lock	HL	High/Low limits alarm action
LcY	Lock except main setting value	oId	High/Low limit range alarm action
SnE	Sensor designation mode	Hu	High limit alarm action with standby function
nt	K 0 to 999°C	Lu	Low limit alarm action with standby function
ntF	K 0 to 999°F	HLu	High/Low limits alarm action with standby function
nJ	J 0 to 800°C	AbY	Process value alarm action
nJF	J 0 to 999°F	dFA	Differential setting mode
PJ	JPt100(JIS'81) -199 to 400°C	dFb	Cooling differential setting
PJF	JPt100(JIS'81) -199 to 999°F	---	Burnout (upscale) status
Pd	Pt100(JIS'89,IEC) -199 to 400°C		
PdF	Pt100(JIS'89,IEC) -199 to 999°F		
PJc.	JPt100(JIS'81) -19.9 to 99.9°C		

- Some characters are not displayed depending on the specifications.

MEMO (Use for your memory.)

		(Initial)			(Initial)
SL		0℃	Loc		Unlock
P		2.5%	SE		K or Pt100
I		200s	SH		Specified
d		50s	SL		Specified
n		50%	orH		100%
c		R/□: 30s S/□: 3s	orL		0%
c_b		R/□: 30s S/□: 3s	So		0.0℃
P_b		1	cn		Heating
A		0℃	ALn		
A.		0℃	AL.n.		
c'		0.0%	dFA		1.0℃
b		0%	dFb		1.0℃
oFF					

＊＊＊ 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	VCR-134-R/E
• Temperature specification	0 to 999℃
• Type of input	K

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

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OVERSEAS DIVISION

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