# *REX-C100* SERIES

## INSTRUCTION MANUAL

**Notes:**

Make sure that this Instruction Manual is always readily available to personnel who use the REX-C100 series.
The contents of the Instruction Manual are subject to change without notice. If you have any questions regarding the manual, contact one of our sales people, our nearest sales office, or the place where you have purchased the controller.

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## 1.    PRODUCT CHECK

Check whether the delivered product is as specified by referring to the following model code list.

**O**    **Model code**

## C100 QQQ - Q✳ QQ
① ② ③    ④    ⑤ ⑥

① Control action
F : PID action [Reverse action]
D : PID action [ Direct action]

② Input type
See input range table "Model code" page 9

③ Input range
See input range table "Model code" page 9

④ Control output [OUT]
M : Relay contact
V : Voltage pulse
8 : Current 4 to 20mA DC
G : Trigger (for triac driving) *1

⑤ First alarm [ALM1]
N : No first alarm
A : Deviation high alarm *2

B : Deviation low alarm *2
C : Deviation high / low alarm *2
D : Band alarm
E : Deviation high alarm *3

F : Deviation low alarm *3
G : Deviation high / low alarm *3
H : Process high alarm *2
J : Process low alarm *2
K : Process high alarm *3

L : Process low alarm *3
R : Control loop break alarm *4

⑥ Second alarm [ALM2]
N : No second alarm
A : Deviation high alarm *2
B : Deviation low alarm *2
C : Deviation high / low alarm *2
D : Band alarm
E : Deviation high alarm *3
F : Deviation low alarm *3
G : Deviation high / low alarm *3
H : Process high alarm *2
J : Process low alarm *2
K : Process high alarm *3
L : Process low alarm *3
            P : Heater break alarm (CTL-6)
S : Heater break alarm (CTL-12)
R : Control loop break alarm *4

*1    When control output is trigger output for triac driving, only the first alarm is
available.
*2    Without hold action.
*3    With hold action
*4    As control loop break alarm, only either
the first alarm or second alarm is selected.

• Confirm that power supply voltage is also the same as that specified when ordering.

Accessories

• Mounting brackets      (2 pcs.)
• Instruction manual      (1 copy)

## 2. MOUNTING

■ **Dimensions**                                                          Unit : mm (inch)

8(0.31)   100(3.94)   44(1.73)

5-9

48(1.89)   54(2.13)   48(1.89)   44(1.73)

Panel cutout

25(0.98)

$45^{+0.6}_{0}$
$(1.772^{+0.023}_{0})$

$45^{+0.6}_{0}$   25(0.98)
$(1.772^{+0.023}_{0})$

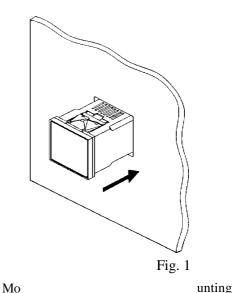\* Dimensions in inches are shown for reference

■ **Mounting procedures**

⊙ When the controllers are mounted on panel with 1 to 5mm in thickness
   ① Make a rectangular cutout corresponding to the number of controllers to be mounted on panel by referring to the panel cutout dimensions.
   ② Since the mounting brackets are already installed on the controller, insert the controller into the panel from the panel front without removal of the brackets (Fig. 1).

⊙ When the controllers are mounted on panel with 5 to 9m in thickness
   ① Remove the mounting brackets from the controller with a slotted screwdriver.
   ② Engage each mounting bracket with holes marked with "5.9" on the housing (Fig. 2) and then insert the controller into the panel from the panel front.
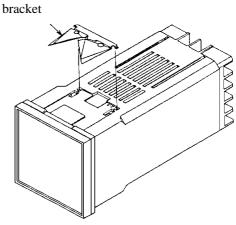
**O Cautions for mounting**

Avoid the following location where the controller is mounted.

• Location where ambient temperature is more than 50°C (122°F) or less than 0°C (32°F).
• Location where humidity is high.
• Location where corrosive gas is generated.
• Location where strong vibration and shock exist.
• Location where flooding and oil splash exist.
• Location where much dust exists.
• Location where inductive disturbance is large and other location where bad influence is exerted on electric instrument.

Thickness of panel board:
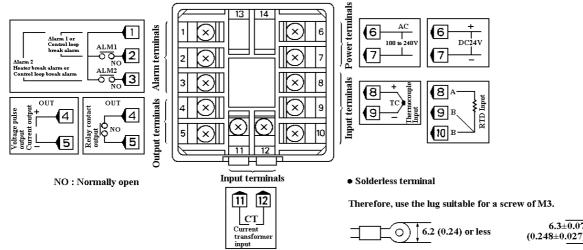1 to 5mm or 5 to 9mm (0.04 to 0.20 inch or 0.20 to 0.35 inch)

Fig. 1

Mounting bracket

Fig. 2

■      **Rear terminals**



NO : Normally open

● **Solderless terminal**

**Therefore, use the lug suitable for a screw of M3.**

6.2 (0.24) or less

6.3±0.07
(0.248±0.027)

## Notes

**1.**     Terminals which are not used according to the controller type are all removed.

**2.**     For thermocouple input, no metal piece is attached to terminal No. 10.  Instead, the temperature compensation element in the internal assembly is projected through a hole at terminal No. 10.
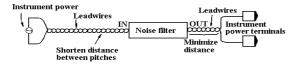Do not damage the above temperature compensation element when the internal assembly is removed from the case.

## O     Cautions for wiring

(1)     Conduct input signal wiring away from instrument, electric equipment power and load lines as such as possible to avoid noise induction.

(2)     Conduct instrument power wiring so as not to be influenced by noise from the electric equipment power.

     If it is assumed that a noise generation source is located near the controller and the controller is influenced by noise, use a noise filter (select the filter by checking instrument power supply voltage.)
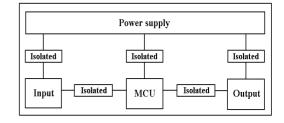
     • 	Sufficient effect may not be obtained depending on the filter.  Therefore, select the filter by referring to its frequency characteristic, etc.
     ① 	For instrument power wiring, if it is assumed that noise exerts a bad influence upon the controller, shorten the distance between twisted power supply wire pitches.
(The shorter the distance between the pitches, the more effective for noise reduction).
     ② 	Install the noise filter on the panel which is always grounded and minimize the wiring distance between the noise filter output side and the controller power terminals.  Otherwise, the longer the distance between output side and instrument power terminals, the less effective for noise.
     ③ 	Do not install fuses and / or switches on the filter output signal since this may lessen filter effect.

(3)     For wiring, use wires conforming to domestic standard of each country.

(4)     About 5 to 6 sec. are required as the preparation time of contact output during power ON.  Use a delay relay when the output line, is used for an external interlock circuit.

(5)     The figures below show the REX-C100 circuit configuration.  When connecting wires, note that the power, input, MCU and output circuits are isolated independently, while the inside of the input and outputcircuits are not isolated.
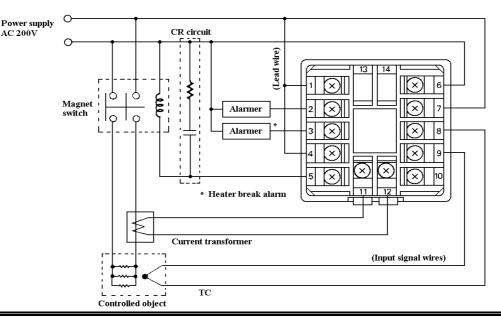


REX-C100 circuit configuration

## WIRING AND NAME OF PARTS

■ **Wiring example**

### REX-C100F**GG**-M*-✳2N-HA



Power supply AC 200V

CR circuit

Magnet switch

Alarmer

Alarmer *

* Heater break alarm

Current transformer

(Lead wire)

(Input signal wires)

TC

Controlled object

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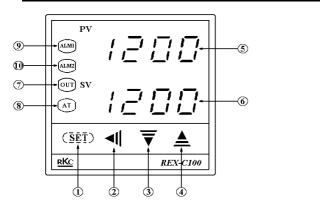## 1. NAME OF PARTS



① Set (SET) key
• The set-value thus changed is entered
• Parameters in the parameter setting mode are

  selected in due order.
• Can select PV / SV display mode, SV setting mode, and parameter setting modes.

② Setting digit shift key
• Used when the cursor (brightly lit) is moved to the digit whose number needs to be changed for set-value change.

③ Set-value decrement key
• Used when the number needs to be decreased for set-value change.

④ Set-value increment key
• Used when the number needs to be increased for set-value change.

⑤ Measured-value (PV) display unit [Green]
• Displays measured-value (PV)
• Displays a parameter symbol in the parameter setting mode.

⑥ Set-value (SV) display unit [Orange]
• Displays set-value (SV)
• Displays set-value corresponding to the parameter symbol displayed on the measured-value (PV) display unit.

Control output (OUT) lamp [Green]
• Lights up when the control output is turned ON.

Auto-tuning (AT) lamp [Green]
• Flashes during auto-tuning.
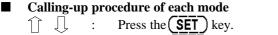
First alarm (ALM1) lamp [Red]
• Lights up when the first alarm is turned ON.
• When a control loop break alarm (LBA) is selected as the first alarm, this lamp lights up.
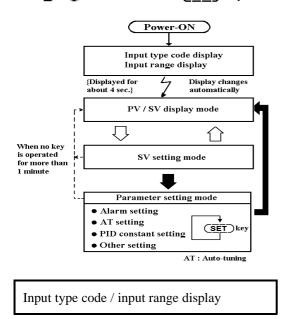
Second alarm (ALM2) lamp [Red]
• Lights up when second alarm is turned ON.
• When either a heater break alarm (HBA) or control loop break alarm (LBA) is selected as the second alarm, this lamp lights up.

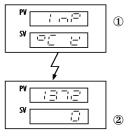## ■ Calling-up procedure of each mode

⇧ ⇩ : Press the (SET) key.

⬆ ⬇ : Press the (SET) key for more than 5 sec



Input type code / input range display

This controller, with the power turned ON, displays automatically the input type code on the measured-value (PV) display unit and the input range, on the set-value (SV) display unit, respectively.

Example : For a controller with the K thermocouple input type and input range from 0 to 1372°C.



① Displays the input type code.

⌐⌐⌐ : Indicates input abbreviation.

°C : Indicates engineering unit. (°F : °F)

⌐ : Indicates input type. (See the input type code table).

② Displays the input range.

< Input type code >

| Code | Input Type | Code | Input type |
|------|-----------|------|-----------|
| ⌐ | K | ⌐ | R |
| ⌐ | J | ⌐ | S |
| ⌐ | L | ⌐ | B |
| ⌐ | E | ⌐ | W5Re/W26Re |
| ⌐ | N | ⌐ | PLII |
| ⌐ | T | ⌐⌐ | Pt100 |
| ⌐ | U | ⌐⌐ | JPt100 |

PV / SV display mode

• Displays measured-value (PV) on the measured-value (PV) display unit and set-value (SV) on the set-value (SV) display unit. Usually the control is set to this mode excepting that the set-value (SV) and/or the parameter set-value are changed.

PV / SV display mode

• Pressing the (SET) key lights the least significant digit on the set-value (SV) display unit brightly.

• Pressing the ◀‖ , ⬆ and ⬇ keys can change the set-value (SV).
In order to register the value whose setting was changed, always press the (SET) key after the value is changed.

< Initial value prior to shipment >

| * Set-value (SV) | 0°C (°F) or 0.0°C (°F) |
|------------------|------------------------|

*    Desired value for control.

• When key operation is not performed for more than 1 minute, the controller returns to the PV / SV display mode.

Parameter setting mode

• If the (SET) key is pressed in succession for more than 5 sec. in the PV / SV display or SV setting mode, the controller is set to the parameter setting mode.

• Parameters in the parameter setting mode changes in due order every time the (SET) key is pressed (See page 6). However, some parameters may not be displayed depending on the specification.

• The value in the digit brightly lit can be changed. Each parameter set-value can be changed every time the ◀‖ , ⬆ and ⬇ keys are pressed.

• In order to register the value whose setting was changed, press the (SET) key after change to shift to the next parameter.

• The following procedures are available in order to return the parameter setting mode to the PV / SV display mode.
◇ Press the (SET) key in succession for more than 5 sec.
◇ When no key is operated for more than 1 minute.

The following parameter symbols are displayed one by one every time the (**SET**) key is pressed.
However, some parameter symbols may not be displayed depending on the specification.

| Symbol | Name | Setting Range | Description | Initial value prior to shipment |
|---|---|---|---|---|
| ⊏ � CT | Current transformer input (CT) | Setting is not possible. Set heater break alarm value by referring to this value. | Display input value from the current transformer | |
| AL 1 AL1 | First alarm | Deviation alarm • Process alarm: -1999 to +9999°C[°F] or -199.9 to +999.9°C[°F] Differential gap : 2 or 2.0°C[°F] | Set alarm set-value of first alarm. | 50 or 50.0 |
| AL 2 AL2 | Second alarm | | Set alarm set-value of second alarm. | |
| HbA HbA | Heater break alarm (HBA) | 0.0 to 100.0A | Alarm value is set by referring to input value from the current transformer (CT) | 0.0 |
| LbA LbA | Control loop break alarm (LBA) | 0.0 to 200.0 min. | Set control loop break alarm set-value. Cannot be set to "0.0". | 8.0 |
| Lbd Lbd | LBA dead band (LBD) | 0 to 9999°C[°F] Differential gap : 0.8°C[°F] | Set the area of not outputting LBA. No LBA deadband functions with "0" set. | 0 |
| ATU ATU | Auto-tuning (AT) | 0 : Auto-tuning end or stop 1 : Auto-tuning start | Turns the auto-tuning ON/OFF. | 0 |
| P P | Proportional band (P) | 1 to span or 0.1 to span | Set heating-side proportional band. ON/OFF action with P set to "0" or "0.0". | 30 or 30.0 |
| I I | Integral time (I) | 1 to 3600 sec. | Eliminates offset occurring control is performed. I action turns OFF with I set to "0". | 240 |
| d D | Derivative time (D) | 1 to 3600 sec. | Prevents ripples by predicting output change thereby improving control stability. D action turns OFF with D set to "0". | 60 |
| Ar Ar | Anti-reset windup (ARW) | 1 to 100% of proportional band. | Prevents overshoot and/or undershoot caused by integral action. I action turns OFF with this action set to "0". | 100 |
| T T | Proportional cycle | 1 to 100 sec. | Set control output cycle. | |
| LCK LCK | Set data lock | 0100 : No set data locked (All parameters changeable) 0101 : Set data locked (All parameters not changeable) 0110 : Only the set-value (SV) is changeable with the set data locked. | Performs set data change enable / disable. | 0100 |

\* The second alarm (or first alarm), heater break alarm, control loop break alarm parameter symbols are not simultaneously displayed.
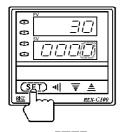
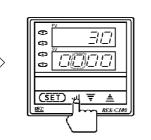\* Heater break alarm is not available on a current output.

- **Parameter setting procedure**

**Setting set-value (SV)**

Following is an example of setting the set-value (SV) to 200°C. (PV : 30°C)

① Set to the set mode      ② Shift of the digit brightly lit    ③ Set-value increase or decrease ④ Set-value entry



Press the (**SET**) key to
enter the SV setting mode.
The digit which lights
brightly is settable.

Press the ◂◗▌ key to shift
the digit which lights brightly
up to the hundreds digit.

$\quad \boxed{\, 0 \!-\! 0 \!-\! 0 \!-\! 0 \,}$

Press the ▲ key to set "2".

After finishing the setting,
press the (**SET**) key. All of
the set-value digits light
brightly and as a result the
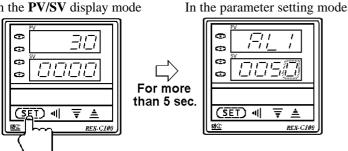Controller returns to the
PV/SV display mode.

| Set-value increase or decrease | Example : When a temperature of 199°C is changed to 200°C.

Press the ◂◗▌ key to shift the digit brightly lit to the least significant digit. Press the ▲ key to change "9" to "0", thereby
obtaining 200°C. The same applies to set-value decrease.

| Minus (-) value setting | Example : For changing 200 to -100.

Press the ◂◗▌ key to shift the digit brightly lit to the hundreds digit. Press the ▼ key to decrement figures in order of
1   0   -1.

**Setting parameters other than set-value**

In the **PV/SV** display mode      In the parameter setting mode



**For more
than 5 sec.**

Press the (**SET**) key for more than 5 sec. to set controller to
the parameter setting mode.

Press the (**SET**) key by the required number of times until
the parameter symbol to be set is displayed.

The setting procedures are the same as those of example ② to
④ in the above "Setting set-value (SV)" (Pressing the (**SET**)
key after the setting is finished in the parameters).

When no parameter setting is required, return the controller to
the PV/SV display mode.

**Key operational cautions**

- For this controller, the value whose setting was changed is not registered. It is registered for the first time it is shifted
  to the next parameter by pressing the (**SET**) key.

- When the controller is not set to the SV mode (the set-value (SV) does not light brightly or dimly even with the
  (**SET**) key pressed) or each value does not lightly brightly or dimly even with the controller moved to the parameter
  setting mode, set data lock is activated.

  In this case, change the "⌐ ⌐ ⌐" parameter set-value to "0100".
- This controller returns to the PV/SV display mode status if key operation is not performed for more than 1 minute.

⊙        Pay attention to the following when the parameters described below are set.

## Auto-tuning (AT)

•       Prior to starting the auto-tuning function, end all the parameter settings other than PID and control loop break alarm (LBA).

## Heater break alarm (HBA)

•       Set heater break alarm set-value to a value about 85% current transformer input value. However, when power supply variations are large, set the alarm to a slightly smaller value.
In addition, when two or more heaters are connected in parallel, set the alarm to a slightly larger value so that it is activated even with only one heater is broken. (However, within the value of a current transformer input value).

•       When the heater break alarm set-value is set to "0.0" or the current transformer is not connected, the heater break alarm is turned ON.

## Control loop break alarm (LBA)

•       Usually set the set-value of the LBA to a value twice the integral time (I).

**O**      **Set data locking procedure**

This controller is provided with a set data locking function which disables each set-value change by the front key and also the auto-tuning function. Use this function for malfunction prevention at the end of each setting.

•       Press the $\boxed{\text{SET}}$ key by the required number of times to show "$L \ C \ k$" on the measured-value (PV) display unit.

•       Press the ⅠⅠ , ▲ and ▼ keys to set the number in the table at right. Thus the set data lock state can be selected.

| 0100 | No set data locked. (All parameters changeable) |
|------|--------------------------------------------------|
| 0101 | Set data locked. (All parameters not changeable) |
| 0110 | Only the set-value (SV) is changeable with the set data |

*Cautions*

**1.**      Do not change the upper 2 digits "01" of the set-value, as it may cause malfunction.
**2.**      Checking each set-value is possible during data locked.

**O**      **Cautions for operation**

•       Do not use the auto-tuning function in a control system where hunting causes trouble. In this case, set each PID constant appropriate to the controlled object.

•       Connect the input signal wiring, and then turn ON the power. If the input signal wiring opens, the controller judges that input is disconnected to cause the upscale or downscale of measured-value display.
           Upscale ............... For TC or RTD input
           Downscale .......... For TC (To be specified when ordering)

•       No influence is exerted upon the controller for power failure of 20 msec. or less. For power failure of 20 msec. or more, the controller performs the same operation as that at the time of power-ON after power recovery. (This applies only when alarm action is turned OFF).

•       When the set-value (SV) is changed during progress in the auto-tuning function, suspend the auto-tuning to perform PID control using the values before auto-tuning start.

•       When the auto-tuning function is suspended halfway, no values of PID and control loop break alarm are changed. (The value before auto-tuning function start is maintained).

■ **Display at error occurrence**

< Heater break alarm >

| Display | Cause | Measure |
|---|---|---|
| ┌─H B A─┐<br>(ALM2)<br>**(Lights)** | Current transformer input value is below heater break alarm set-value at control output ON (Heater break, imperfect relay contact, etc). | Heater break alarm set-value check. Current transformer connection check. Replacement of heater and/or relay. |
| | Current transformer input value is above heater break alarm set-value at control output ON (Weld relay contact etc). | |

Note that if the control output ON time (or OFF time) is not at least 0.5 sec., there may be case in which the heater break alarm does not operate correctly.

< Control loop break alarm >

| Display | Cause | Measure |
|---|---|---|
| ┌─L B A─┐<br>(ALM1)<br>or<br>┌─L B A─┐<br>(ALM2)<br>**(Lights)** | • Controlled object trouble (No power supply, incorrect wiring, etc).<br>• Sensor trouble (Sensor disconnected, shorted, etc).<br>• Actuator trouble (Weld relay contact, incorrect wiring, relay contact not closed, etc).<br>• Output circuit trouble (Weld internal relay contact, relay contact not opened or closed, etc).<br>• Input circuit trouble (The measured-value does not change even if input changes, etc). | Control system check (Error cause cannot be specified)<br><br>Check whether there is no effect by disturbances (Other heat source, etc).<br><br>LBA set time check |

< Overscale, Underscale >

| Display | Cause | Measure |
|---|---|---|
| ⌐⌐⌐⌐<br>(Flashing) | Overscale<br>(Measured-value exceeds the high input display range limit). | Sensor or input lead check. |
| ⌐⌐⌐⌐<br>(Flashing) | Underscale<br>(Measured-value below the low input display range limit). | Sensor or input lead check. |

| | Input type | Input display range | |
|---|---|---|---|
| **TC** | K | -30 to +1372°C | -30 to +2502°F |
| | J | -30 to +1200°C | -30 to +2192°F |
| | R, S | -30 to +1769°C | -30 to +3216°F |
| | B | -30 to +1820°C | -30 to +3308°F |
| | E | -30 to +1000°C | -30 to +1832°F |
| | T | -199.9 to +400.0°C | -199.9 to +752.0°F |
| | N | -30 to +1300°C | -30 to +2372°F |
| | PLII | -30 to +1390°C | -30 to +2534°F |
| | L | -30 to +800°C | -30 to +1600°F |
| | U | -199.9 to +600.0°C | -199.9 to +999.9°F |
| | W5Re/W26Re | -30 to +2320°C | -30 to +4000°F |
| **RTD** | Pt100<br>JPT100 | -199.9 to +649.0°C | |
| | Pt100 | -199.9 to +999.9°F | |

⟨ Input range table ⟩

| Input type | | Input range | Model code | |
|---|---|---|---|---|
| TC | K | 0 to 200°C | | 01 |
| | | 0 to 400°C | | 02 |
| | | 0 to 600°C | | 03 |
| | | 0 to 800°C | | 04 |
| | | 0 to 1000°C | K | 05 |
| | | 0 to 1200°C | | 06 |
| | | 0 to 1372°C | | 07 |
| | | 0 to 800°F | | A1 |
| | | 0 to 1600°F | | A2 |
| | | 0 to 2502°F | | A3 |
| | J | 0 to 200°C | | 01 |
| | | 0 to 400°C | | 02 |
| | | 0 to 600°C | | 03 |
| | | 0 to 800°C | | 04 |
| | | 0 to 1000°C | J | 05 |
| | | 0 to 1200°C | | 06 |
| | | 0 to 800°F | | A1 |
| | | 0 to 1600°F | | A2 |
| | | 0 to 2192°F | | A3 |
| | R #1 | 0 to 1600°C | | 01 |
| | | 0 to 1769°C | R | 02 |
| | | 0 to 3200°F | | A1 |
| | | 0 to 3216°F | | A2 |
| | S #1 | 0 to 1600°C | | 01 |
| | | 0 to 1769°C | S | 02 |
| | | 0 to 3200°F | | A1 |
| | | 0 to 3216°F | | A2 |
| | B #2 | 400 to 1800°C | | 01 |
| | | 0 to 1820°C | B | 02 |
| | | 800 to 3200°F | | A1 |
| | | 0 to 3308°F | | A2 |
| | E | 0 to 800°C | | 01 |
| | | 0 to 1000°C | | 02 |
| | | 0 to 1600°F | E | A1 |
| | | 0 to 1832°F | | A2 |
| | N | 0 to 1200°C | | 01 |
| | | 0 to 1300°C | | 02 |
| | | 0 to 2300°F | N | A1 |
| | | 0 to 2372°F | | A2 |
| | T | −199.9 to +400.0°C | | 01 |
| | | −199.9 to +100.0°C | | 02 |
| | | −100.0 to +200.0°C | | 03 |
| | | 0.0 to 350.0°C | | 04 |
| | | −199.9 to +752.0°F | T | A1 |
| | | −100.0 to +200.0°F | | A2 |
| | | −100.0 to +400.0°F | | A3 |
| | | 0.0 to 450.0°F | | A4 |
| | | 0.0 to 752.0°F | | A5 |

| Input type | | Input range | Model code | |
|---|---|---|---|---|
| TC | W5Re/W26Re | 0 to 2000°C | | 01 |
| | | 0 to 2320°C | W | 02 |
| | | 0 to 4000°F | | A1 |
| | PLII | 0 to 1300°C | | 01 |
| | | 0 to 1390°C | A | 02 |
| | | 0 to 2400°F | | A1 |
| | | 0 to 2534°F | | A2 |
| | U | −199.9 to +600.0°C | | 01 |
| | | −199.9 to +100.0°C | | 02 |
| | | 0.0 to 400.0°C | U | 03 |
| | | −199.9 to +999.9°F | | A1 |
| | | −100.0 to +200.0°F | | A2 |
| | | 0.0 to 999.9°F | | A3 |
| | L | 0 to 400°C | | 01 |
| | | 0 to 800°C | | 02 |
| | | 0 to 800°F | L | A1 |
| | | 0 to 1600°F | | A2 |
| RTD | Pt100 | −199.9 to +649.0°C | | 01 |
| | | −199.9 to +200.0°C | | 02 |
| | | −100.0 to +50.0°C | | 03 |
| | | −100.0 to +100.0°C | | 04 |
| | | −100.0 to +200.0°C | | 05 |
| | | 0.0 to 50.0°C | | 06 |
| | | 0.0 to 100.0°C | | 07 |
| | | 0.0 to 200.0°C | | 08 |
| | | 0.0 to 300.0°C | | 09 |
| | | 0.0 to 500.0°C | D | 10 |
| | Pt100 | −199.9 to +999.9°F | | A1 |
| | | −199.9 to +400.0°F | | A2 |
| | | −199.9 to +200.0°F | | A3 |
| | | −100.0 to +100.0°F | | A4 |
| | | −100.0 to +300.0°F | | A5 |
| | | 0.0 to 100.0°F | | A6 |
| | | 0.0 to 200.0°F | | A7 |
| | | 0.0 to 400.0°F | | A8 |
| | | 0.0 to 500.0°F | | A9 |
| | JPt100 | −199.9 to +500.0°C | | 01 |
| | | −199.9 to +200.0°C | | 02 |
| | | −100.0 to +50.0°C | | 03 |
| | | −100.0 to +100.0°C | | 04 |
| | | −100.0 to +200.0°C | P | 05 |
| | | 0.0 to 50.0°C | | 06 |
| | | 0.0 to 100.0°C | | 07 |
| | | 0.0 to 200.0°C | | 08 |
| | | 0.0 to 300.0°C | | 09 |
| | | 0.0 to 500.0°C | | 10 |

#1 Accuracy in the range of 0 to 399°C (0 to 799°F): Within ±6°C [12°F]
#2 Accuracy in the range of 0 to 399°C (0 to 799°F): Not guaranteed.