Digital Controller

REX-C100/C400/C410/C700/C900
INSTRUCTION MANUAL

IMNZC22-E1

Thank you for purchasing this RKC product. In order to achieve maximum performance and ensure proper operation of your new instrument, carefully read all the instructions in this manual. Please place the manual in a convenient location for easy reference.

WARNING

- To prevent injury to persons, damage to instrument and equipment, a suitable external protection device shall be required.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to instrument and equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to instrument and equipment.
- This instrument is not intended for use in locations subject to flammable or explosive gases.
- Do not touch high-voltage connections such as power supply terminals, etc. to avoid electric shock.
- RKC is not responsible if this instrument is repaired, modified or disassembled by other than factory-approved personnel. Malfunction can occur and warranty is void under these conditions.

CAUTION

- This product is intended for use with industrial machines, test and measuring equipment. (It is not designed for use with medical equipment and nuclear energy.)
- This is a Class A instrument. In a domestic environment, this instrument may cause radio interference, in which case the user may be required to take additional measures.
- This instrument is protected from electric shock by reinforced insulation. Provide reinforced insulation between the wire for the input signal and the wires for instrument power supply, source of power and loads.
- Be sure to provide an appropriate surge control circuit respectively for the following:
  - If input/output or signal lines within the building are longer than 30 meters.
  - If input/output or signal lines leave the building, regardless the length.
- This instrument is designed for installation in an enclosed instrumentation panel. All high-voltage connections such as power supply terminals must be enclosed in the instrumentation panel to avoid electric shock by operating personnel.
- All precautions described in this manual should be taken to avoid damage to the instrument or equipment.
- All wiring must be in accordance with local codes and regulations.
- All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action. The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.
- To prevent instrument damage as a result of failure, protect the power line and the input/output lines from high currents with a suitable overcurrent protection device with adequate breaking capacity such as fuse, circuit breaker, etc.
- Prevent metal fragments or lead wire scraps from falling inside instrument case to avoid electric shock, fire or malfunction.
- Tighten each terminal screw to the specified torque found in the manual to avoid electric shock, fire or malfunction.
- For proper operation of this instrument, provide adequate ventilation for heat dispensation.
- Do not connect wires to unused terminals as this will interfere with proper operation of the instrument.
- Turn off the power supply before cleaning the instrument.
- Do not use a volatile solvent such as paint thinner to clean the instrument. Deformation or discoloration will occur. Use a soft, dry cloth to remove stains from the instrument.
- To avoid damage to instrument display, do not rub with an abrasive material or push front panel with a hard object.
- When high alarm with hold action is used for Alarm function, alarm does not turn on while hold action is in operation. Take measures to prevent overheating which may occur if the control device fails.

NOTICE

- This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.
- The figures, diagrams and numeric values used in this manual are only for purpose of illustration.
- RKC is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- RKC is not responsible for any damage and/or injury resulting from the use of instruments made by imitating this instrument.
- Periodic maintenance is required for safe and proper operation of this instrument. Some components have a limited service life, or characteristics that change over time.
- Every effort has been made to ensure accuracy of all information contained herein. RKC makes no warranty expressed or implied, with respect to the accuracy of the information. The information in this manual is subject to change without prior notice.
- No portion of this document may be reprinted, modified, copied, transmitted, digitized, stored, processed or retrieved through any mechanical, electronic, optical or other means without prior written approval from RKC.

1. PRODUCT CHECK

C100 □□□□-□∗□□
(1)(2) (3) (4) (6)(7)

C400 C410 C700 C900 □□□□-□□∗□□
(1)(2) (3) (4)(5) (6)(7)

(1) Control action
F: PID action with autotuning (Reverse action)
D: PID action with autotuning (Direct action)
W: Heat/Cool PID action with autotuning (Water cooling) [1]
A : Heat/Cool PID action with autotuning (Air cooling) [1]

(2) Input type, (3) Range code
Refer to "9. INPUT RANGE TABLE."

(4) First control output [OUT1] (Heat-side)
M: Relay contact
V: Voltage pulse
G: Trigger for triac driving [2]
8: Current (4 to 20 mA DC)

(5) Second control output [OUT2] (Cool-side) [3]
No symbol: When control action is F or D.
M: Relay contact
V: Voltage pulse
8: Current (4 to 20 mA DC)

(6) Alarm 1 [ALM1], (7) Alarm 2 [ALM2]
N: No alarm
A: Deviation high alarm
B: Deviation low alarm
C: Deviation high/low alarm
D: Band alarm
E: Deviation high alarm with hold action
F: Deviation low alarm with hold action
G: Deviation high/low alarm with hold action
H: Process high alarm
J: Process low alarm
K: Process high alarm with hold action
L: Process low alarm with hold action
P: Heater break alarm (HBA)[CTL-6] [4]
S: Heater break alarm (HBA)[CTL-12] [4]
R: Control loop break alarm (LBA) [5]

[1] C100 cannot be specified in Heat/Cool PID action.
[2] For the C100, when control output is trigger output for triac driving, only the ALM1 is available.
[3] For the C100, there is no second control output.
[4] Heater break alarm (HBA) cannot be specified in case of ALM1. Also, it isn't possible to specify when control output is current output.
[5] As control loop break alarm (LBA), only either the ALM1 or ALM2 is selected.

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

<Accessories>

- **Mounting brackets (C100/400/410/700/900):** 2
- **Instruction manual (IMNZC22-E1):** 1

2. MOUNTING

2.1 Mounting Cautions

(1) This instrument is intended to be used under the following environmental conditions. **(IEC61010-1)**
[OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]

(2) Use this instrument within the following environment conditions:
- Allowable ambient temperature: 0 to 50 °C
- Allowable ambient humidity: 45 to 85 % RH
- Installation environment conditions: Indoor use, Altitude up to 2000 m

(3) Avoid the following conditions when selecting the mounting location:
- Rapid changes in ambient temperature which may cause condensation.
- Corrosive or inflammable gases.
- Direct vibration or shock to the mainframe.
- Water, oil, chemicals, vapor or steam splashes.
- Excessive dust, salt or iron particles.
- Excessive induction noise, static electricity, magnetic fields or noise.
- Direct air flow from an air conditioner.
- Exposure to direct sunlight.
- Excessive heat accumulation.

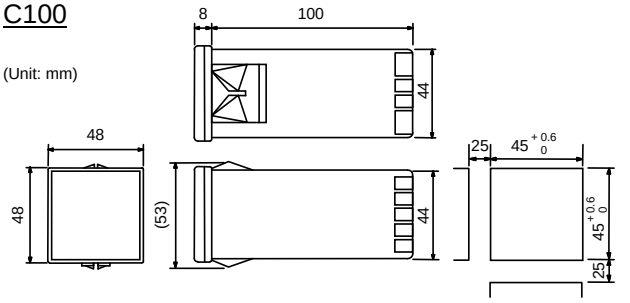
(4) Mount this instrument in the panel considering the following conditions:
- Provide adequate ventilation space so that heat does not build up.
- Do not mount this instrument directly above equipment that generates large amount of heat (heaters, transformers, semi-conductor functional devices, large-wattage resistors.)
- If the ambient temperature rises above 50 °C, cool this instrument with a forced air fan, cooler, etc. Cooled air should not blow directly on this instrument.
- In order to improve safety and the immunity to withstand noise, mount this instrument as far away as possible from high voltage equipment, power lines, and rotating machinery.
  High voltage equipment: Do not mount within the same panel.
  Power lines: Separate at least 200 mm.
  Rotating machinery: Separate as far as possible.
- For correct functioning mount this instrument in a horizontal position.

(5) In case this instrument is connected to a supply by means of a permanent connection, a switch or circuit-breaker shall be included in the installation. This shall be in close proximity to the equipment and within easy reach of the operator. It shall be marked as the disconnecting device for the equipment.

2.2 Dimensions

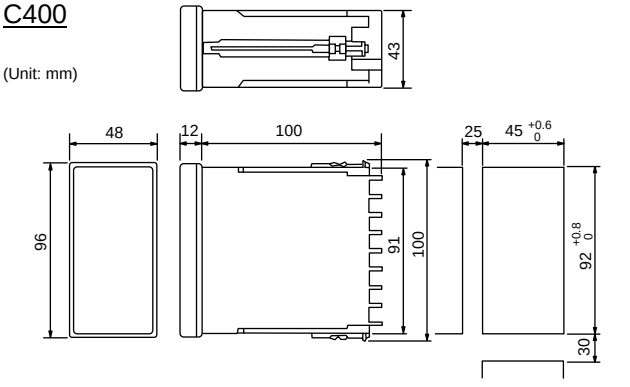
C100

(Unit: mm)



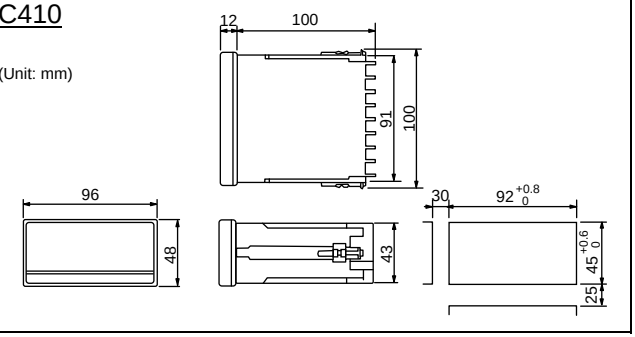
C400

(Unit: mm)



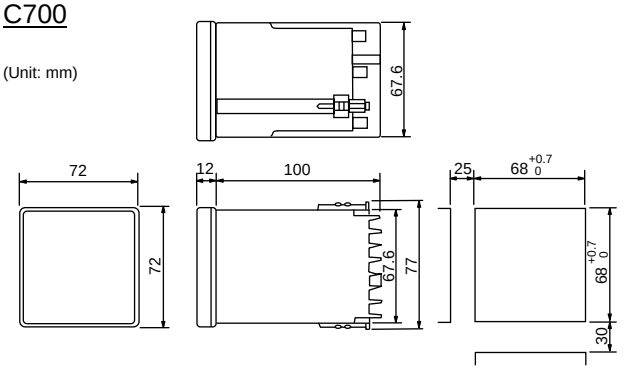
C410

(Unit: mm)



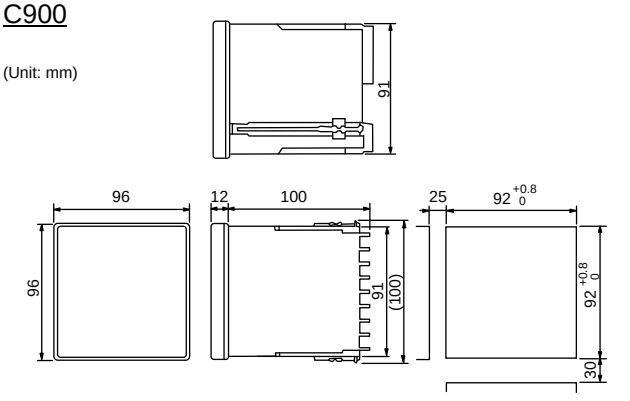
C700

(Unit: mm)



C900

(Unit: mm)



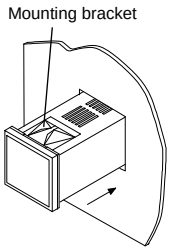
Panel thickness: 1 to 5 mm or 5 to 9 mm (C100)
1 to 8 mm (C400/410/700/900)

2.3 Mounting procedures

■ C100

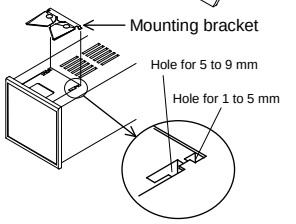
● When the controllers are mounted on panel with 1 to 5 mm in thickness

Since the mounting brackets are already installed on the controller, insert the controller into the panel front without removal of the brackets.



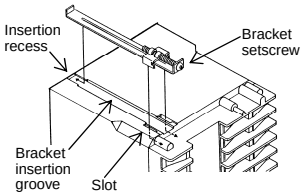
● When the controllers are mounted on panel with 5 to 9 mm in thickness

Remove the mounting brackets from the controller with a slotted screwdriver.
Engage each mounting bracket with holes marked with 5-9 on the housing and then insert the controller into the panel from the panel front.



■ C400/410/700/900

1. Prepare the panel cutout as specified in **2.2 Dimensions**.
2. Insert the instrument through the panel cutout.
3. Insert an upper mounting bracket along the bracket insertion groove from the back, and then engage a projection at the bracket end with a recess at the groove front and also insert metal fitting legs into slots.



4. Tighten a bracket setscrew from the rear of the bracket with Phillips screwdriver. Do not overtighten the bracket setscrew.
5. The other mounting bracket should be installed the same way described in ***3.*** and ***4***.

C900 is used in the above figures for explanation, but the same mounting procedures also apply to C400/410/700.

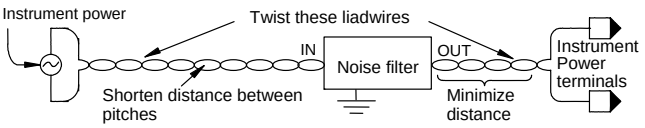
3. WIRING

⚠ WARNING

To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.

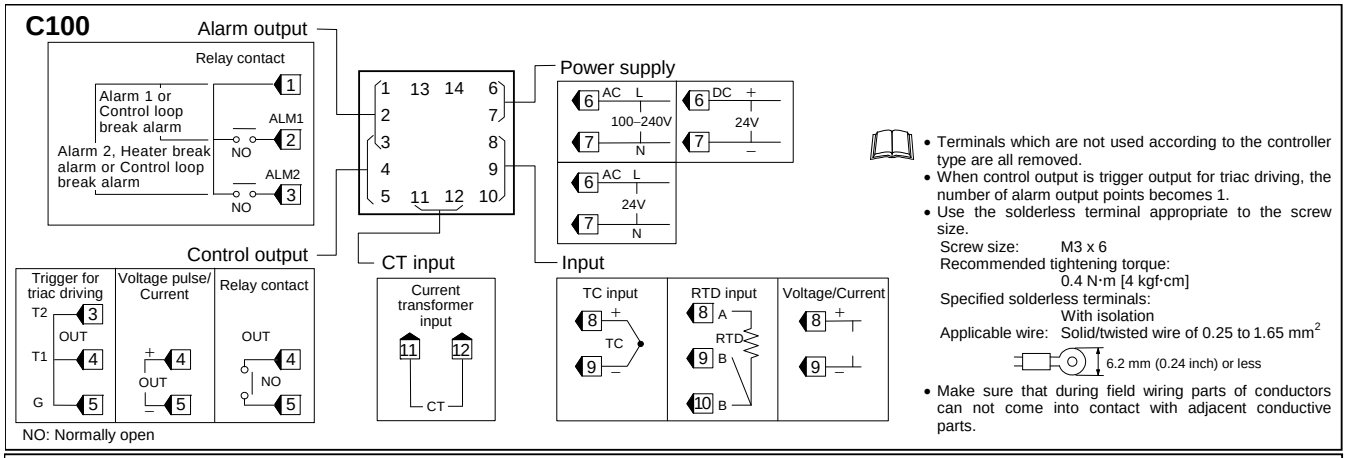
3.1 Wiring Cautions

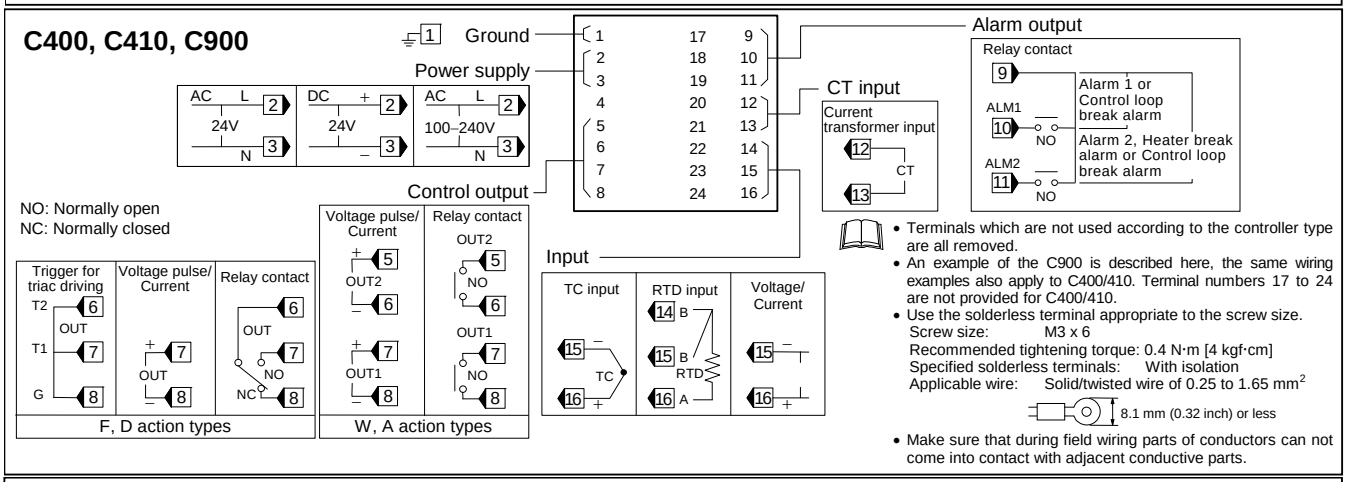
- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three lead wires.
- To avoid noise induction, keep input signal wire away from instrument power line, load lines and power lines of other electric equipment.
- Signal connected to Voltage input and Current input shall be low voltage defined as “SELV” circuit per IEC 60950-1.
- If there is electrical noise in the vicinity of the instrument that could affect operation, use a noise filter.
  - Shorten the distance between the twisted power supply wire pitches to achieve the most effective noise reduction.
  - Always install the noise filter on a grounded panel. Minimize the wiring distance between the noise filter output and the instrument power supply terminals to achieve the most effective noise reduction.
  - Do not connect fuses or switches to the noise filter output wiring as this will reduce the effectiveness of the noise filter.

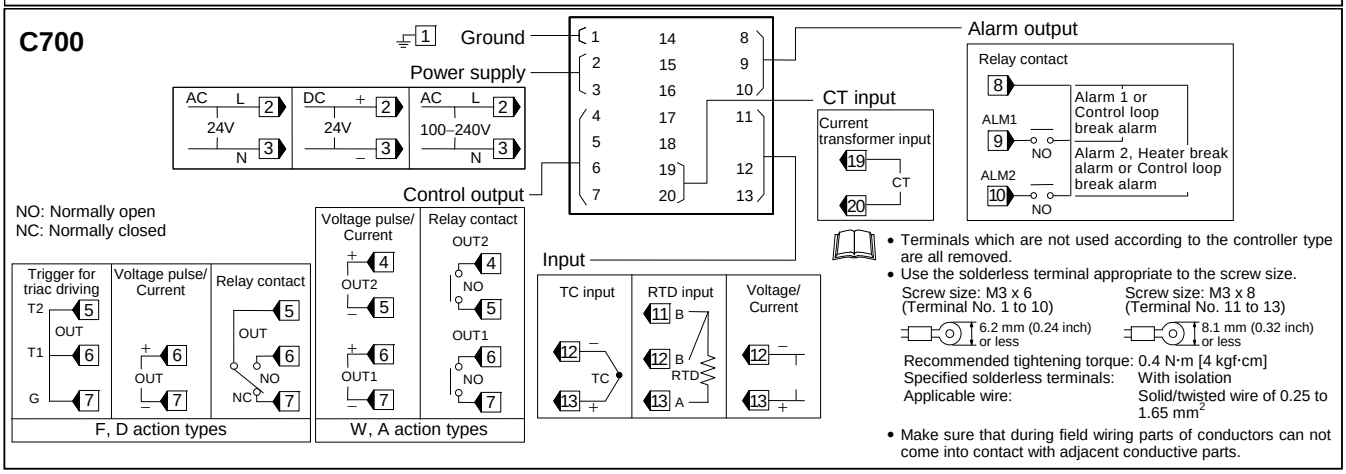


- Allow approximately 5 to 6 seconds for contact output when the instrument is turned on. Use a delay relay when the output line is used for an external interlock circuit.
- Power supply wiring must be twisted and have a low voltage drop.
- This instrument with 24 V power supply is not provided with an overcurrent protection device. For safety install an overcurrent protection device (such as fuse) with adequate breaking capacity close to the instrument.
  - Fuse type: Time-lag fuse (Approved fuse according IEC60127-2 and/or UL248-14)
  - Fuse rating: Rated current: 0.5 A
- For an instrument with 24 V power supply input, supply power from “SELV” circuit defined as IEC 60950-1.
- A suitable power supply should be considered in end-use equipment. The power supply must be in compliance with a limited-energy circuits (maximum available current of 8 A).

3.2 Terminal Configuration







■ Specifications

Input:
Input type:
Thermocouple: K, J, R, S, B, E, T, N, PLII, W5Re/W26Re, U, L
Input impedance: Approx. 1 MΩ
RTD: Pt100, JPt100
Voltage: 0 to 5 V DC, 1 to 5 V DC
Input impedance: 250 kΩ or more
Current: 0 to 20 mA DC, 4 to 20 mA DC
Input impedance: Approx. 250 Ω
Sampling cycle: 0.5 seconds
Input range: Refer to **Input range table**
Control method: PID control
ON/OFF, P, PI, or PD actions is available

Control output:
Relay contact output: 250 V AC, 3A (Resistive load)
Electrical life:
300,000 times or more (Rated load)
Voltage pulse output: 0/12 V DC
(Load resistance 600 Ω or more)
Current output: 4 to 20 mA DC
(Load resistance 600 Ω or less)
Trigger output for triac driving:
Zero cross method for medium capacity triac driving (100 A or less)
Load voltage used:
100 V AC line, 200 V AC line
Load used: Resistive load

Alarm output:
Relay contact output:
250 V AC, 1A (Resistive load)
Electrical life: 50,000 times or more (Rated load)

Heater break alarm function:
Measured current:
0 to 30 A (CTL-6-P-N)
0 to 100 A (CTL-12-S56-10L-N)
Input rating: Maximum current rating: 120 mA
Input impedance: Approx. 2.5 Ω

Performance:
Display accuracy
(at the ambient temperature 23 °C ± 2 °C):
Thermocouple (TC):
± (0.5 % of display value + 1 digit) or ± 3 °C [6 °F] Whichever is greater
R and S input: 0 to 399 °C [0 to 799 °F]:
± 6 °C [12 °F]
B input: 0 to 399 °C [0 to 799 °F]:
Accuracy is not guaranteed.
RTD: ± (0.5 % of display value + 1 digit) or ± 0.8 °C [1.6 °F] whichever is greater
Voltage/Current: ± (0.5 % of input span + 1 digit)

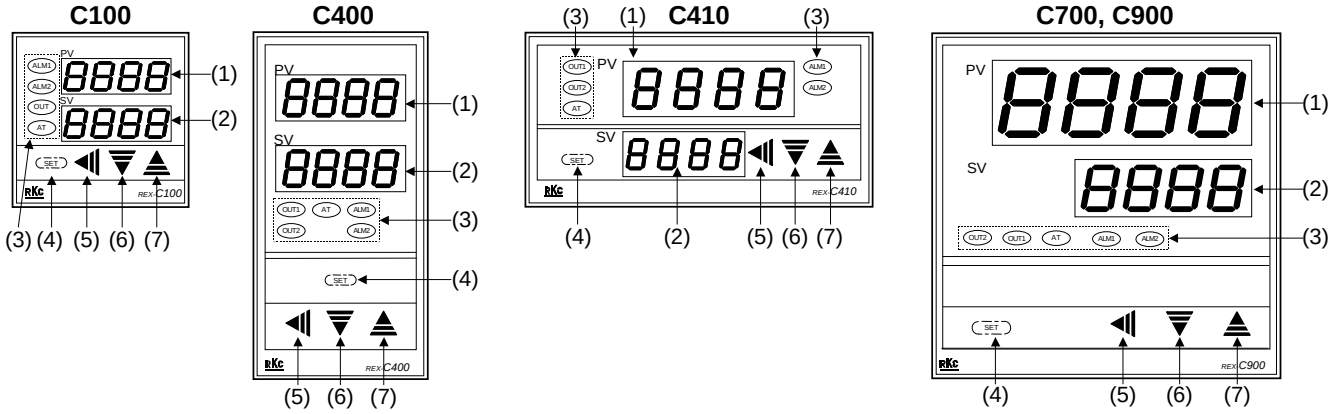
Memory backup:
Backed up by Nonvolatile Memory
Number of write times:
Approx. 100,000 times
Data storage period:
Approx. 10 years

Power:
Power supply voltage:
85 to 264 V AC (Power supply voltage range), 50/60 Hz
Rating: 100 to 240 V AC
21.6 to 26.4 V AC (Power supply voltage range), 50/60 Hz
Rating: 24 V AC
21.6 to 26.4 V DC (Power supply voltage range)
Rating: 24 V DC

Power consumption:
6 VA max. (at 100 V AC)
9 VA max. (at 240 V AC)
6 VA max. (at 24 V AC)
145 mA max. (at 24 V DC)

Weight:
C100: Approx. 170 g
C700: Approx. 250 g
C400/410: Approx. 260 g
C900: Approx. 340 g

4. PARTS DESCRIPTION



(1) Measured value (PV) display [Green]
Displays PV or various parameter symbols.

(2) Set value (SV) display [Orange]
Displays SV or various parameter set values (or CT input value).

(3) Indication lamps
Alarm output lamps (ALM1, ALM2) [Red]
ALM1: Lights when alarm 1 output is turned on.
ALM2: Lights when alarm 2 output is turned on.

Autotuning (AT) lamp [Green]
Flashes when autotuning is activated. (After autotuning is completed: AT lamp will go out)

Control output lamps
(OUT1 [Yellow], OUT2 [Green])
OUT1: Lights when control output is turned on.*
OUT2: Lights when cool-side control output is turned on.

(4) (SET) **(Set key)**
Used for parameter calling up and set value registration.

(5) ◀ (**Shift key**)
Shift digits when settings are changed.

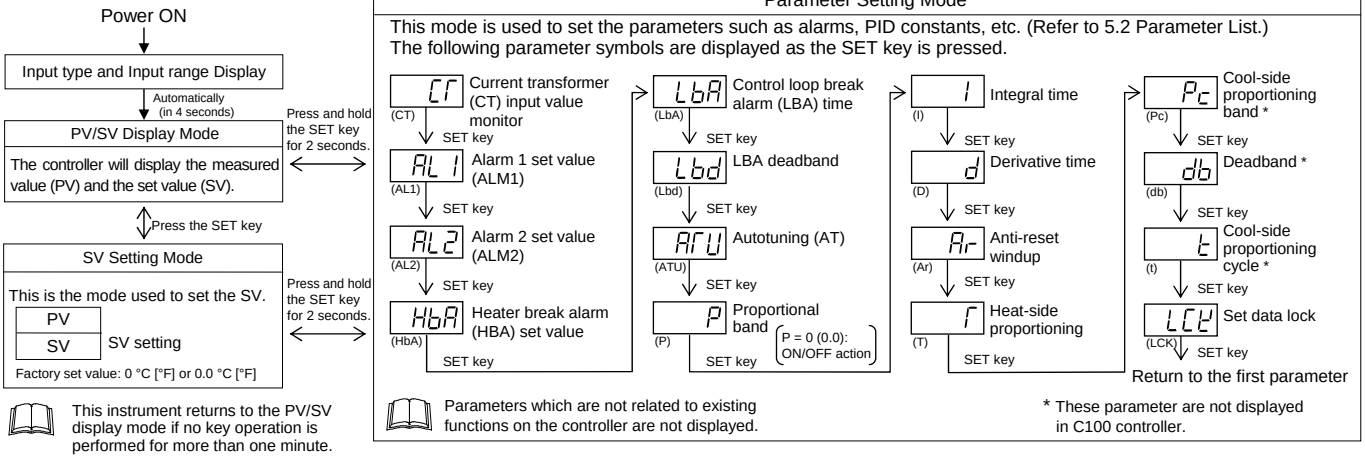
(6) ▼ (**DOWN key**)
Decrease numerals.

(7) ▲ (**UP key**)
Increase numerals.

To avoid damage to the instrument, never use a sharp object to press keys.

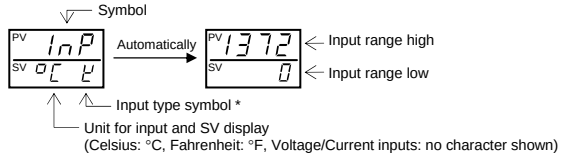
5. SETTING

5.1 Operation Menu



■ Input type and input range display

This instrument immediately confirms the input type symbol and input range following power ON.
Example: When sensor type of input is K thermocouple.



* Input Type Symbol Table

Symbol	K	J	R	S	B	E	T	N	PL II	W5Re/W26Re	U	L	JPt 100	Pt 100	Voltage input	Current input
Input type	Thermocouple (TC)												RTD			

5.2 Parameter List

The following parameter symbols are displayed as the SET key is pressed.

Parameter symbols which are not related to existing functions on the controller are not displayed.

Symbol	Name	Setting range	Description	Factory set value
CT	Current transformer (CT) input value monitor	0.0 to 100.0 A [Display only]	Display input value from the current transformer. [Displayed only when the instrument has the heater break alarm (HBA)]	
AL1	Alarm 1 set value (ALM1)	TC/RTD inputs: Deviation alarm, Process alarm: −1999 to +9999 °C [°F] or −199.9 to +999.9 ° C [°F] Voltage/Current inputs: Deviation alarm: −199.9 to +200.0 % Process alarm: −199.9 to +300.0 %	Set the alarm 1 set value and alarm 2 set value. For the alarm action type, refer to page 7. Alarm differential gap: TC/RTD inputs: 2 or 2.0 °C [°F] Voltage/Current inputs: 0.2 % of input span	TC/RTD inputs: 50 (50.0) Voltage/Current inputs: 5.0
AL2	Alarm 2 set value (ALM2)			

Symbol	Name	Setting range	Description	Factory set value
HbA	Heater break alarm (HBA) set value [1]	0.0 to 100.0 A	Alarm value is set by referring to input value from the current transformer (CT). Used only for single-phase.	0.0
LbA	Control loop break alarm (LBA) time [2]	0.1 to 200.0 minutes	Set control loop break alarm (LBA) set value.	8.0
Lbd	LBA deadband [3]	TC/RTD inputs: 0 to 9999 °C [°F] Voltage/Current inputs: 0 to 100 % of input span	Set the area of not outputting LBA. No LBA deadband functions with 0 set. Differential gap : TC/RTD inputs: 0.8 °C [°F] Voltage/Current inputs: 0.8 % of input span	0
ATU	Autotuning (AT)	0: AT end or cancel 1: AT start or execution	Turns the autotuning ON/OFF.	0
P	Proportional band	TC/RTD inputs: 1 (0.1) to span 0.1 °C [°F] resolution: Within 999.9 °C [°F] Voltage/Current inputs: 0.1 to 100.0 % of input span 0 (0.0): ON/OFF action	Set when PI, PD or PID control is performed. Heat/Cool PID action: Proportional band setting on the heat-side. ON/OFF action differential gap: TC/RTD inputs: 2 (0.2) °C [°F] Voltage/Current inputs: 0.2 % of input span	TC/RTD inputs: 30 (30.0) Voltage/Current inputs: 3.0
I	Integral time	1 to 3600 seconds (0 second: PD action)	Set the time of integral action to eliminate the offset occurring in proportional control.	240
d	Derivative time	1 to 3600 seconds (0 second: PI action)	Set the time of derivative action to improve control stability by preparing for output changes.	60
Ar	Anti-reset windup (ARW)	1 to 100 % of heat-side proportional band (0 %: Integral action OFF)	Overshooting and undershooting are restricted by the integral effect.	100
T	Heat-side proportioning cycle	1 to 100 seconds (Not displayed if the control output is current output.)	Set control output cycle. Heat/Cool PID action: Heat-side proportioning cycle	Relay contact output: 20 Voltage pulse output/ Trigger output for triac driving: 2
Pc	Cool-side proportional band	1 to 1000 % of heat-side proportional band	Set cool-side proportional band when Heat/Cool PID action.	100
db	Deadband	TC/RTD inputs: −10 to +10 °C [°F] or −10.0 to +10.0 °C [°F] Voltage/Current inputs: −10.0 to +10.0 % of input span	Set control action deadband between heat-side and cool-side proportional bands. Minus (−) setting results in overlap.	0 or 0.0
t	Cool-side proportioning cycle	1 to 100 seconds (Not displayed if the control output is current output.)	Set control cool-side output cycle for Heat/Cool PID action.	Relay contact output: 20 Voltage pulse output: 2
LCK	Set data lock (LCK)	0100: No set data locked (All parameters changeable) 0101: Set data locked (All parameters locked) 0110: Only the set value (SV) is changeable with the set data locked	Performs set data change enable/disable.	0100

[1] Heater Break Alarm (HBA) function

The HBA function monitors the current flowing through the load by a dedicated current transformer (CT), compares the measured value with the HBA set value, and detects a fault in the heating circuit.

Low or No current flow (Heater break, malfunction of the control device, etc.):

When the control output is ON and the current transformer input value is equal to or less than the heater break determination point for the preset number of consecutive sampling cycle, an alarm is activated.

Over current or short-circuit:

When the control output is OFF and the current transformer input value is equal to or greater than the heater break determination point for the preset number of consecutive sampling cycle, an alarm is activated.

Precaution for HBA setting:

- Displayed only for when HBA is selected as Alarm 2.
- HBA is not available on a current output.
- Set the set value to approximately 85 % of the maximum reading of the CT input.
- Set the set value to a slightly smaller value to prevent a false alarm if the power supply may become unstable.
- When more than one heater is connected in parallel, it may be necessary to increase the HBA set value to detect a single heater failure.
- When the current transformer is not connected or the HBA set value is set to “0.0,” the HBA is turned on.

[2] Control Loop Break Alarm (LBA) function

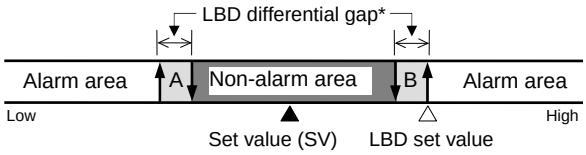
The LBA function is used to detect a load (heater) break or a failure in the external actuator (power controller, magnet relay, etc.), or a failure in the control loop caused by an input (sensor) break. The LBA function is activated when control output reaches 0 % or 100 %. LBA monitors variation of the measured value (PV) for the length of LBA time. When the LBA time has elapsed and the PV is still within the alarm determination range, the LBA will be ON.

Precaution for LBA setting:

- Displayed only for when LBA is selected as Alarm 1 or Alarm 2.
- No LBA function can be used at Heat/Cool PID control action.
- The LBA function can not be activated when AT function is turned on.
- The LBA function is activated when control output reaches 0 % or 100 %. The time required for the LBA output to turn on includes both the time from the initial occurrence of loop failure and the LBA setting time. Recommended setting for LBA is for the set value of the LBA to be twice the value of the integral time (I).
- If LBA setting time does not match the controlled object requirements, the LBA selling time should be lengthened.
  If setting time is not correct, the LBA will malfunction by turning on or off at inappropriate times or not turning on at all.

[3] LBA Deadband function

The LBA may malfunction due to external disturbances. To prevent malfunctioning due to external disturbance, LBA deadband (LBD) sets a neutral zone in which LBA is not activated. When the measured value (PV) is within the LBD area, LBA will not be activated. If the LBD setting is not correct, the LBA will not work correctly.



A: During temperature rise: Alarm area
During temperature fall: Non-alarm area

B: During temperature rise: Non-alarm area
During temperature fall: Alarm area

* TC and RTD inputs: 0.8 °C [°F] (fixed)
Voltage/Current inputs: 0.8 % of input span (fixed)

5.3 Changing Parameter Settings

Procedures to change parameter settings are shown below.

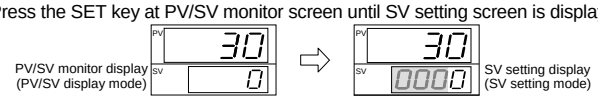
To store a new value for the parameter, always press the SET key.
The display changes to the next parameter and the new value will be stored.
- A new value will not be stored without pressing SET key after the new value is displayed on the display.
- After a new value has been displayed by using the UP and DOWN keys, the SET key must be pressed within 1 minute, or the new value is not stored and the display will return to the PV/SV monitor screen.

● Change the set value (SV)

Change the set value (SV) from 0 ºC to 200 ºC

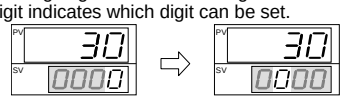
1. Select the SV setting mode

Press the SET key at PV/SV monitor screen until SV setting screen is displayed.



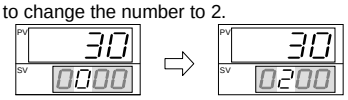
2. Shift the high-lighted digit

Press the shift key to high-light the hundreds digit.
The high-lighted digit indicates which digit can be set.



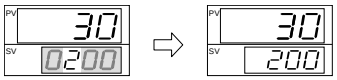
3. Change the set value

Press the UP key to change the number to 2.



4. Store the set value

Press the SET key to store the new set value. The display returns to the PV/SV monitor screen.



● Change parameters other than the set value (SV)

The changing procedures are the same as those of example 2 to 4 in the above "**● Change the set value (SV)**". Pressing the SET key after the setting end shifts to the next parameter. When no parameter setting is required, return the instrument to the PV/SV display mode.

6. OPERATION

CAUTIONS

- **All mounting and wiring must be completed before the power is turned on. If the input signal wiring is disconnected or short-circuited (RTD input only), the instrument determines that burnout has occurred.**
  - Displays:
    - Upscale: Thermocouple input, RTD input (when input break)
    - Downscale: Thermocouple input (specify when ordering), RTD input (when short-circuited), Voltage input (1 to 5 V DC), Current input (4 to 20 mA DC)
    - For the voltage (0 to 5 V DC) or current (0 to 20 mA DC) input, the display becomes indefinite (display of about zero value).
  - Outputs:
    - Control output: OFF (Heat/Cool control: the control output on both heat-side and cool-side is turned off)
    - Alarm output: Both of the Alarm 1 and Alarm 2 outputs of this instrument are turned on when burnout occurs regardless of any of the following actions taken. (High alarm, low alarm, etc.) In addition, when used for any purposes other than these alarms (event, etc.), specify the Z-124 specification (not to be forcibly turned on).
- **A power failure of 20 ms or less will not affect the control action. When a power failure of more than 20 ms occurs, the instrument assumes that the power has been turned off. When power returns, the controller will retain the conditions that existed prior to shut down.**
- **The alarm hold action is activated when not only the power is turned on, but also the SV is changed.**

6.1 Operating Precautions

(1) All mounting and wiring must be completed before the power is turned on.
(2) The settings for the SV and all parameters should be appropriate for the controlled object.
(3) A power supply switch is not furnished with this instrument. It is ready to operate as soon as the power is turned on.

6.2 Set Data Lock (LCK) Function

The set data lock restricts parameter setting changes by key operation. This function prevents the operator from making errors during operation.

Set value	Parameters which can be changed
0100	All parameters [Factory set value]
0101	No parameters [All Locked]
0110	SV

Parameters protected by Set Data Lock function are still displayed for monitoring.

6.3 Autotuning (AT) Function

Autotuning (AT) automatically measures, calculates and sets the optimum PID and LBA constants. The following conditions are necessary to carry out autotuning and the conditions which will cause the autotuning to stop.

Caution for using the Autotuning (AT)
When a temperature change (UP and/or Down) is 1 ºC or less per minute during Autotuning, Autotuning may be cancelled before calculating PID values. In that case, adjust the PID values manually. It is possible to happen when the set value is around the ambient temperature or is close to the maximum temperature achieved by the load.

■ Requirements for AT start

Start the autotuning when all following conditions are satisfied:
- Prior to starting the AT function, end all the parameter settings other than PID and LBA.
- Confirm the LCK function has not been engaged.

When the autotuning is finished, the controller will automatically returns to PID control.

■ Requirements for AT cancellation

The autotuning is canceled if any of the following conditions exist.
- When the set value (SV) is changed.
- When the PV bias value is changed.
- When the PV becomes abnormal due to burnout.
- When the power is turned off.
- When power failure longer than 20 ms occurs.

If the AT is canceled, the controller immediately changes to PID control. The PID values will be the same as before AT was activated.

When AT is completed, the controller immediately changes to PID control. If the control system does not allow the AT cycling process, set each PID constant manually to meet the needs of the application.

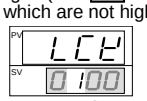
7. INITIAL SETTING

WARNING

Parameters in the Initialization mode should be set according to the application before setting any parameter related to operation. Once the Parameters in the Initialization mode are set correctly, no further changes need to be made to parameters for the same application under normal conditions. If they are changed unnecessarily, it may result in malfunction or failure of the instrument. RKC will not bear any responsibility for malfunction or failure as a result of improper changes in the Initialization mode.

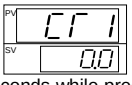
7.1 Go to Initialization Mode

1. Turn on the power to this controller. The instrument goes to the PV/SV display after confirming input type symbol and input range.
2. Press and hold the SET key for 5 seconds to go to the Parameter setting mode from the PV/SV display.
3. Press the SET key until "LCK" (Set Data Lock display) will be displayed.
4. The high-lighted digit indicates which digit can be set. Press shift key to high-light the hundreds digit. (The ▭ section in each image of the controller shows the digits which are not high-lighted.)

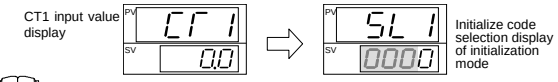


5. Press the DOWN key to change 1 to 0.

6. Press the SET key to store the new set value. The display goes to the next parameter, and the Initialization mode is unlocked.



7. Press the shift key for 5 seconds while pressing the SET key to go to the Initialization mode. When the controller goes to the Initialization mode, "SL1" will be displayed.



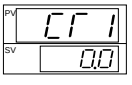
If the control is set to the initial set mode, all outputs are turned OFF.

7.2 Exit Initialization Mode

When any parameter setting is changed in the Initialization mode, check all parameter set values in SV setting mode and Parameter setting mode.

1. Press the shift key for 5 seconds while pressing the SET key from any display in the Initialization mode. The controller goes back to the operation mode and the PV/SV display will be displayed.
2. Press and hold the SET key for 5 seconds in the PV/SV display.
3. Press the SET key until "LCK" (Set Data Lock display) will be displayed.
4. The high-lighted digit indicates which digit can be set. Press shift key to high-light the hundreds digit.

5. Press the SET key to store the new set value. The display goes to the next parameter, and the Initialization mode is locked.



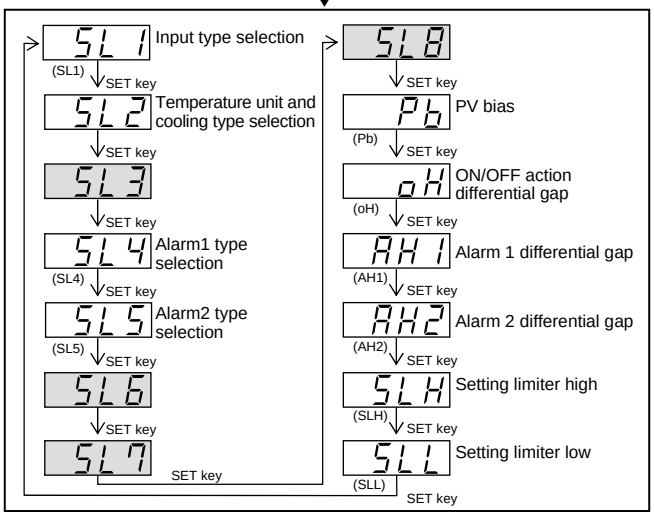
7.3 Initial Setting Menu

Display flowcharts in Initialization mode are shown in the following.

Do not change to the ▭ section parameters and any parameter in the Initialization mode which is not described in the initial setting menu below. It may result in malfunction or failure of the instrument.

PV/SV display mode or Parameter setting mode

Press the shift key while pressing the SET key for 5 seconds with the unlocked.



7.4 Input Type Selection (SL1)

When any parameter setting is changed in the Initialization mode, check all parameter set values in SV setting mode and Parameter setting mode.

Factory set value varies depending on the input type.

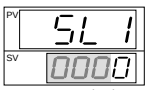
Set value	Input type		Hardware
0000	K	Thermocouple (TC)	A
0001	J		
0010	L		
0011	E		
0100	N		
0111	R		
1000	S		
1001	B		
1010	W5Re/W26Re		
1011	PL II		
0101	T		B
0110	U		
1100	Pt100 (JIS/IEC)	RTD	C
1101	JPt100 (JIS)		
1110	0 to 5 V DC	Voltage	D
1111	1 to 5 V DC		
1110	0 to 20 mA DC	Current	E
1111	4 to 20 mA DC		

Conduct setting so as to meet the instrument specification (input type). Setting change between different symbols may cause malfunction, but the setting can be changed when hardware types have the same symbol. However, when the setting is changed, always reset "SLH" and "SLL" (Refer to page 8).

■ Change Settings

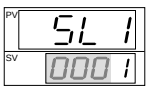
Example: Change the input type from "K" to "J"

1. Press the SET key. The display will go to SL1.



Input type selection

2. Press the UP key to change the number to 1.



3. Press the SET key to store the new set value. The display goes to the next parameter.

7.5 Temperature Unit and Cooling Type Selection (SL2)

Inappropriate settings may result in malfunction. Control type between Heat Only and Heat/Cool cannot be changed by this parameter.

Factory set value varies depending on the instrument specification.

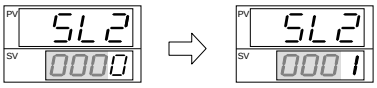
Set value	Description	
	Temperature unit	Cooling type selection
0000	°C	Air cooling (A type) or Heat only type (F, D type)
0001	°F	Air cooling (A type) or Heat only type (F, D type)
0010	°C	Water cooling (W type)
0011	°F	Water cooling (W type)

■ Change Settings

Example: Change the temperature unit of the Heat only type from "°C (0000)" to "°F (0001)"

1. Press the SET key until SL2 is displayed.

2. Press the UP key to change the number to 1.



3. Press the SET key to store the new set value. The display goes to the next parameter.

7.6 Alarm 1 [ALM1] Type Selection (SL4) Alarm 2 [ALM2] Type Selection (SL5)

If the alarm function is not provided with the instrument when shipped from the factory, no alarm output is available by changing SL4 and/or SL5.

SL4 is set to 0000 in the following cases.
- **When the instrument does not have ALM1 output**
- **When Control Loop Break Alarm (LBA) is provided and assigned to ALM1**

SL5 is set to 0000 in the following cases.
- **When the instrument does not have ALM2 output**
- **When Control Loop Break Alarm (LBA) is provided and assigned to ALM2**
- **When the SV alarm is provided and assigned to ALM2**
- **When the Heater Break Alarm (HBA) is provided**

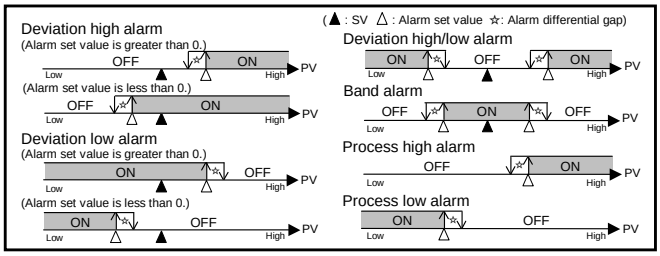
Factory set value varies depending on the instrument specification.

Set value	Details of setting
0000	No alarm
0001	Deviation high alarm
0101	Deviation low alarm
0010	Deviation high/low alarm
0110	Band alarm
0011	Process high alarm
0111	Process low alarm
1001	Deviation high alarm with hold action *
1101	Deviation low alarm with hold action *
1010	Deviation high/low alarm with hold action *
1011	Process high alarm with hold action *
1111	Process low alarm with hold action *

* Hold action:
When Hold action is ON, the alarm action is suppressed at start-up or the control set value change until the measured value enters the non-alarm range.

● Alarm action type

Both of the Alarm 1 and Alarm 2 outputs of this instrument are turned on when burnout occurs regardless of any of the following actions taken (High alarm, low alarm, etc.). In addition, when used for any purposes other than these alarms (event, etc.), specify the Z-124 specification (not to be forcibly turned on).



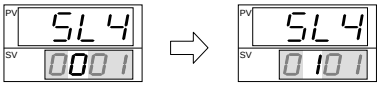
■ Change Settings

Example: Change the ALM1 type from "Deviation high alarm (0001)" to "Deviation low alarm (0101)"

1. Press the SET key three times at SL1 until SL4 is displayed.

2. Press the shift key to high-light the hundreds digit.

3. Press the UP key to change the number to 1.



4. Press the SET key to store the new set value. The display goes to the next parameter.

7.7 PV bias (Pb)

The value set in the PV bias is added to the input value (actual measured value) to correct the input value. The PV bias is used to correct the individual variations in the sensors or when there is difference between the measured values (PV) of other instruments.

Setting range:	TC/RTD inputs:	−1999 to +9999 °C [°F] or −199.9 to +999.9 °C [°F]
	Voltage/Current inputs:	−199.9 to +200.0 %
Factory set value:	TC/RTD inputs:	0 °C [°F] or 0.0 °C [°F]
	Voltage/Current inputs:	0.0 %

Continued on the next page.

Continued from the previous page.

■ Change Settings

Example: When the temperature is measured by two instruments

When the measured values (PV) are as shown in the following:

Main unit = 198 °C

Recorder = 200 °C

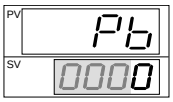
If a PV bias correction value of +2 °C is added to the measured value the main unit, the displayed value become:

Displayed value = Measured value (PV) + PV bias

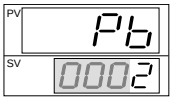
= 198 °C + 2 °C = 200 °C

The setting procedures is described in the following.

1. Press the SET key at "Pb" is displayed.



2. Press the UP key to change the number to 2.



3. Press the SET key to store the new set value.
The display goes to the next parameter.

7.8 ON/OFF Action Differential Gap (oH)

Setting range:	TC/RTD inputs:	0 to 100 °C [°F] or 0.0 to 100.0 °C [°F]
	Voltage/Current inputs:	−199.9 to +200.0 %
Factory set value:	TC/RTD inputs:	2 °C [°F] or 2.0 °C [°F]
	Voltage/Current inputs:	0.2 % of input span

■ Change Settings

Example: Change the On/Off Action differential gap from "2 °C" to "4 °C"

1. Press the SET key at "oH" is displayed.
2. Press the UP key to change the number to 4.
3. Press the SET key to store the new set value. The display goes to the next parameter.

7.9 Alarm 1 Differential Gap (AH1) Alarm 2 Differential Gap (AH2)

Setting range:	TC/RTD inputs:	0 to 100 °C [°F] or 0.0 to 100.0 °C [°F]
	Voltage/Current inputs:	0.0 to 10.0 %
Factory set value:	TC/RTD inputs:	2 °C [°F] or 2.0 °C [°F]
	Voltage/Current inputs:	0.2 % of input span

■ Change Settings

Example: Change the Alarm 1 differential gap from "2 °C" to "4 °C"

1. Press the SET key at "AH1" is displayed.
2. Press the UP key to change the number to 4.
3. Press the SET key to store the new set value. The display goes to the next parameter.

7.10 Setting Limiter High (SLH) Setting Limiter Low (SLL)

For voltage or current input, set scaling within the input range.

Refer to 9. INPUT RANGE TABLE.

Factory set value varies depending on the instrument specification.

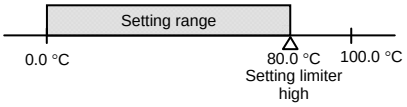
Input type		Setting range *	
TC	K	0 to 1372 °C	0 to 2502 °F
	J	0 to 1200 °C	0 to 2192 °F
	R	0 to 1769 °C	0 to 3216 °F
	S	0 to 1769 °C	0 to 3216 °F
	B	0 to 1820 °C	0 to 3308 °F
	E	0 to 1000 °C	0 to 1832 °F
	N	0 to 1300 °C	0 to 2372 °F
	T	−199.9 to +400.0 °C	−199.9 to +752.0 °F
	W5Re/W26Re	0 to 2320 °C	0 to 4208 °F
	PLII	0 to 1390 °C	0 to 2534 °F
	U	−199.9 to +600.0 °C	−199.9 to +999.9 °F
	L	0 to 800 °C	0 to 1600°F
RTD	Pt100	−199.9 to +649.0 °C	−199.9 to 999.9 °F
	JPt100	−199.9 to +649.0 °C	

* Limit setting becomes SLH ≥ SLL.

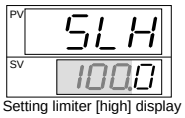
When changing the high-limit (SLH) and the low-limit (SLL) limiter settings, always set the set-value (SV) within the limiter range.

■ Change Settings

Example: The input range (input scale range) is from 0.0 to 100.0 °C, the setting limiter high is 80.0 °C.



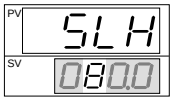
1. Press the SET key at "SLH" is displayed.



Setting limiter [high] display

2. Press the shift key to high-light the tens digit.

3. Press the DOWN key to change the number to 8.



4. Press the SET key to store the new set value.
The display goes to the next parameter.

8. ERROR DISPLAYS

■ Error display

Err	RAM failure (Incorrect set data write, etc.)	Turn off the power at once. If an error occurs after the power is turned on again, please contact RKC sales office or the agent.

■ Over-scale and Underscale

Measured value (PV) [Flashing]	PV is outside of input range.	**⚠ WARNING** **To prevent electric shock, always turn off the power before replacing the sensor.** Check Input type, Input range and connecting state of sensor. Confirm that the sensor or wire is not broken.
0000 [Flashing]	Over-scale: PV is above the high input display range limit.	
uuuu [Flashing]	Underscale: PV is below the low input display range limit.	

9. INPUT RANGE TABLE

●TC/RTD inputs

Input type		Range	Code		Range	Code		Range	Code	
TC	K	0 to 200 °C	K	01	0 to 400 °C	K	02	0 to 600 °C	K	03
		0 to 800 °C	K	04	0 to 1000 °C	K	05	0 to 1200 °C	K	06
		0 to 1372 °C	K	07	0 to 100 °C	K	13	0 to 300 °C	K	14
		0 to 450 °C	K	17	0 to 500 °C	K	20	0 to 800 °F	K	A1
		0 to 1600 °F	K	A2	0 to 2502 °F	K	A3	20 to 70 °F	K	A9
	J	0 to 200 °C	J	01	0 to 400 °C	J	02	0 to 600 °C	J	03
		0 to 800 °C	J	04	0 to 1000 °C	J	05	0 to 1200 °C	J	06
		0 to 450 °C	J	10	0 to 800 °F	J	A1	0 to 1600 °F	J	A2
		0 to 2192 °F	J	A3	0 to 400 °F	J	A6	0 to 300 °F	J	A7
	R [1]	0 to 1600 °C	R	01	0 to 1769 °C	R	02	0 to 1350 °C	R	04
		0 to 3200 °F	R	A1	0 to 3216 °F	R	A2	—	—	—
	S [1]	0 to 1600 °C	S	01	0 to 1769 °C	S	02	0 to 3200 °F	S	A1
		0 to 3216 °F	S	A2	—	—	—	—	—	—
	B [2]	400 to 1800 °C	B	01	0 to 1820 °C	B	02	800 to 3200 °F	B	A1
		0 to 3308 °F	B	A2	—	—	—	—	—	—
	E	0 to 800 °C	E	01	0 to 1000 °C	E	02	0 to 1600 °F	E	A1
		0 to 1832 °F	E	A2	—	—	—	—	—	—
	N	0 to 1200 °C	N	01	0 to 1300 °C	N	02	0 to 2300 °F	N	A1
		0 to 2372 °F	N	A2	—	—	—	—	—	—
	T	−199.9 to +400.0 °C	T	01	−199.9 to +100.0 °C	T	02	−100.0 to +200.0 °C	T	03
		0.0 to 350.0 °C	T	04	−199.9 to +752.0 °F	T	A1	−100.0 to +200.0 °F	T	A2
		−100.0 to +400.0 °F	T	A3	0.0 to 450.0 °F	T	A4	0.0 to 752.0 °F	T	A5
	W5Re/W26Re	0 to 2000 °C	W	01	0 to 2320 °C	W	02	0 to 4000 °F	W	A1
	PLII	0 to 1300 °C	A	01	0 to 1390 °C	A	02	0 to 1200 °C	A	03
		0 to 2400 °F	A	A1	0 to 2534 °F	A	A2	—	—	—
	U	−199.9 to +600.0 °C	U	01	−199.9 to +100.0 °C	U	02	0.0 to 400.0 °C	U	03
		−199.9 to +999.9 °F	U	A1	−100.0 to +200.0 °F	U	A2	0.0 to 999.9 °F	U	A3
	L	0 to 400 °C	L	01	0 to 800 °C	L	02	0 to 800 °F	L	A1
		0 to 1600 °F	L	A2	—	—	—	—	—	—
RTD	Pt100	−199.9 to +649.0 °C	D	01	−199.9 to +200.0 °C	D	02	−100.0 to +50.0 °C	D	03
		−100.0 to +100.0 °C	D	04	−100.0 to +200.0 °C	D	05	0.0 to 50.0 °C	D	06
		0.0 to 100.0 °C	D	07	0.0 to 200.0 °C	D	08	0.0 to 300.0 °C	D	09
		0.0 to 500.0 °C	D	10	−199.9 to +999.9 °F	D	A1	−199.9 to +400.0 °F	D	A2
		−199.9 to +200.0 °F	D	A3	−100.0 to +100.0 °F	D	A4	−100.0 to +300.0 °F	D	A5
		0.0 to 100.0 °F	D	A6	0.0 to 200.0 °F	D	A7	0.0 to 400.0 °F	D	A8
		0.0 to 500.0 °F	D	A9	—	—	—	—	—	—
	JPt100	−199.9 to +649.0 °C	P	01	−199.9 to +200.0 °C	P	02	−100.0 to +50.0 °C	P	03
		−100.0 to +100.0 °C	P	04	−100.0 to +200.0 °C	P	05	0.0 to 50.0 °C	P	06
		0.0 to 100.0 °C	P	07	0.0 to 200.0 °C	P	08	0.0 to 300.0 °C	P	09
		0.0 to 500.0 °C	P	10	—	—	—	—	—	—

[1] 0 to 399 °C [0 to 799 °F]: ±6 °C [12 °F]
[2] 0 to 399 °C [0 to 799 °F]: Accuracy is not guaranteed.

●Voltage/Current inputs

Type	Range	Code		Type	Range	Code	
0 to 5 V DC	0.0 to 100.0 (Fixed)	4	01	0 to 20 mA DC	0.0 to 100.0 (Fixed)	7	01
1 to 5 V DC	0.0 to 100.0 (Fixed)	6	01	4 to 20 mA DC	0.0 to 100.0 (Fixed)	8	01

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