

Temperature Controller

SA200

Instruction Manual

IMR01D01-E2

Thank you for purchasing the 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 this manual in a convenient location for easy reference.

SYMBOLS

WARNING : This mark indicates precautions that must be taken if there is danger of electric shock, fire, etc., which could result in loss of life or injury.

CAUTION : This mark indicates that if these precautions and operating procedures are not taken, damage to the instrument may result.



: This mark indicates that all precautions should be taken for safe usage.



: This mark indicates important information on installation, handling and operating procedures.



: This mark indicates supplemental information on installation, handling and operating procedures.



: This mark indicates where additional information may be located.



WARNING

- An external protection device must be installed if failure of this instrument could result in damage to the instrument, equipment or injury to personnel.
- 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 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 adequate 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 or failure, protect the power line and the input/output lines from high currents with a protection device 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.
- Do not connect modular connectors to telephone line.

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.
- 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

SA200□□□□-□□-□ * □□-□□/□□□/□
 (1) (2) (3)(4) (5) (6) (7) (8)(9) (10) (11)

- (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)
 A: Heat/cool PID action with autotuning (Air cooling)
- (2) Input type/Range code: See 9. INPUT RANGE TABLE
- (3) Output 1 (control output or alarm output)
 M: Relay contact output V: Voltage pulse output
- (4) Output 2 (control output or alarm output)
 N: No output M: Relay contact output
 V: Voltage pulse output
- (5) Power supply voltage
 3: 24 V AC/DC 4: 100 to 240 V AC
- (6) Alarm 1 [ALM1] and (7) Alarm 2 [ALM2]
 N: No alarm H: Process high alarm
 A: Deviation high alarm J: Process low alarm
 B: Deviation low alarm K: Process high alarm¹
 C: Deviation high/low alarm L: Process low alarm¹
 D: Band alarm R: Control loop break alarm²
 E: Deviation high alarm¹ V: SV high alarm
 F: Deviation low alarm¹ W: SV low alarm
 G: Deviation high/low alarm¹
- (8) Option function
 N: No function
 D: Contact input (RUN/STOP, STEP)
 5: RS-485 (RKC communication)
 6: RS-485 (Modbus)
- (9) Waterproof/dustproof
 N: No waterproof/dustproof 1: Waterproof/dustproof
- (10) Case color
 N: Off-white A: Off-black
- (11) Output assignment code
 No symbol: Standard output³
 03: PID action + ALM1
 [OUT1: Control output OUT2: ALM1 output⁴]
 04: PID action + ALM1, ALM2
 [OUT1: Control output OUT2: AND output of ALM1 and ALM2⁵]
 05: PID action + ALM1, ALM2
 [OUT1: Control output OUT2: OR output of ALM1 and ALM2⁴]
 06: PID action + ALM1, ALM2
 [OUT1: Control output OUT2: AND output of ALM1 and ALM2⁴]
 07: PID action + ALM1, ALM2 or ALM1 only
 [OUT1: Control output OUT2: No output (The alarm state can be checked via communication or by lamp lighting)]
 08: PID action + ALM1, ALM2
 [OUT1: Control output OUT2: ALM1 output⁵
 (ALM2 can be checked via communication or by lamp lighting)]
 09: ALM1 + ALM2
 [OUT1: ALM1 output⁵ OUT2: ALM2 output⁵]
 10: ALM1 + ALM2
 [OUT1: ALM1 output⁵ OUT2: ALM2 output⁴]
 11: ALM1 + ALM2
 [OUT1: ALM1 output⁴ OUT2: ALM1 output⁴]

¹ With hold action
² LBA can be selected for only ALM1.
³ PID action:
 OUT1: Control output, OUT2: No alarm, ALM1(Energized), or OR output of ALM1 and ALM2 (Energized)
 Heat/cool PID action:
 OUT1: Heat-side control output, OUT2: Cool-side control output
⁴ De-energized
⁵ Energized

Accessories

Mounting brackets:	2
Mounting screws:	2
Instruction Manual (IMR01D01-E2):	1

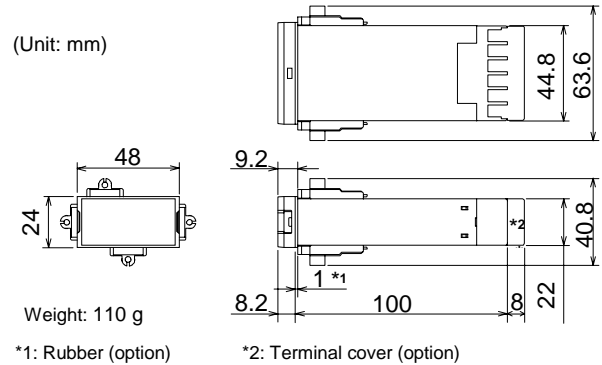
2. MOUNTING

2.1 Installation Environment

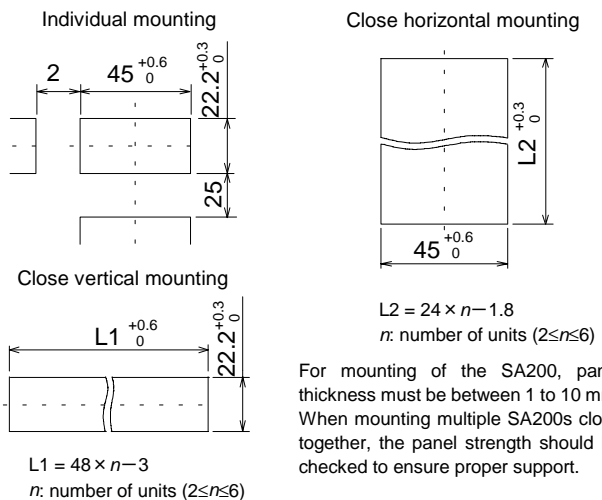
- (1) This instrument is intended to be used under the following environmental conditions. **(IEC61010-1)**
 [OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]
- (2) Avoid the following when selecting the mounting location.
- Ambient temperature of less than 0 °C or more than 50 °C.
 - Ambient humidity of less than 45 % or more than 85 % RH.
 - 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.

2.2 Dimensions

External dimension



Panel cutout



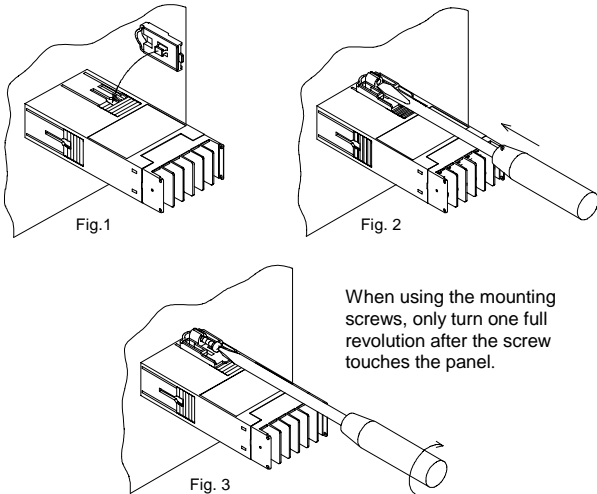
Installation Conditions:

The display can not be seen from the outside of the visual field range. The visual field range of SA200 is 40 degrees to the upper side, and 30 degrees to the lower side from the center of the display vertically.

Continued on the next page.

2.3 Mounting Procedures

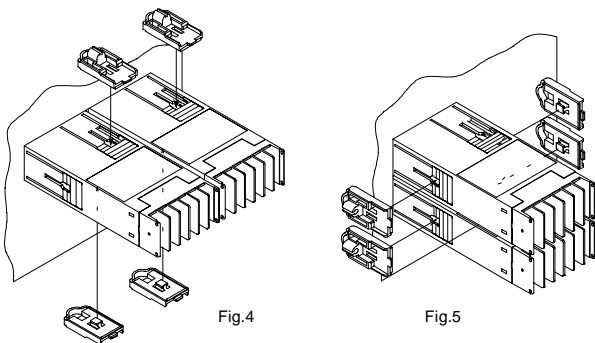
1. Prepare the panel cutout as specified in 2.2 Dimensions.
2. Insert the instrument through the panel cutout.
3. Insert the mounting bracket into the mounting groove of the instrument. (Fig.1)
4. Push the mounting bracket forward with a blade screwdriver until the bracket is firmly secured to the panel. (Fig.2)
5. The other mounting bracket should be installed the same way described in 3 and 4.



- When the instrument is individually mounted, always secure with two mounting brackets either top and bottom or right and left.
- In addition, the mounting assembly also include two screws which can be used with the brackets to secure the instrument to the panel. See Fig. 3.
- The waterproof/dustproof option on the front of the instrument conforms to IP66 when mounted on the panel. For effective waterproof/dustproof, the gasket must be securely placed between instrument and panel without any gap. If gasket is damaged, please contact RKC sales office or the agent.

■ Close Mounting

Secure the mounting brackets in the positions as shown in Fig.4 and Fig.5.



- If the SA200s have waterproof/dustproof options, protection will be compromised and not meet IP66 by close mounting.
- Two SA200s cannot be inserted into a panel cutout of 48×48 mm.

3. WIRING

CAUTION

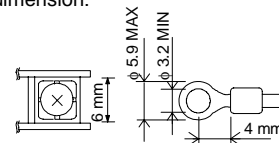
- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three lead wires.
- To avoid noise induction, keep input signal wire away from instrument power line, load lines and power lines of other electric equipment.
- 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.
- About four seconds are required as preparation time for contact output every time 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.
- For an instrument with 24 V power supply, supply power from a SELV circuit.
- This instrument is not furnished with a power supply switch or fuse. Therefore, if a fuse or power supply switch is required, install close to the instrument.

[Recommended fuse rating: Rated voltage 250 V, Rated current 1 A Fuse type: Time-lag fuse]
- For the current input specification, a resistor of 250 Ω (±0.02 % ±10 ppm, 0.25 W or more) must be connected between the input terminals. If this resistor is installed, close vertical mounting is not possible. This resistor must be provided by the customer.
- The input and output terminals for the voltage pulse output are not isolated. Always use an isolating type SSR. If the grounded type sensor is used, do not ground output wiring. Do not connect any output wires to the terminals with any other output wires.

3.1 Restrictions on Wiring

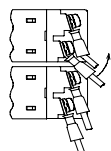
- Always use recommended solderless terminal lugs or equal.

Screw size:	M3×6 (With 5.8×5.8 square washer)
Recommended tightening torque:	0.4 N·m (4 kgf·cm)
Applicable wire:	Solid/twisted wire of 2 mm ²
Recommended dimension:	

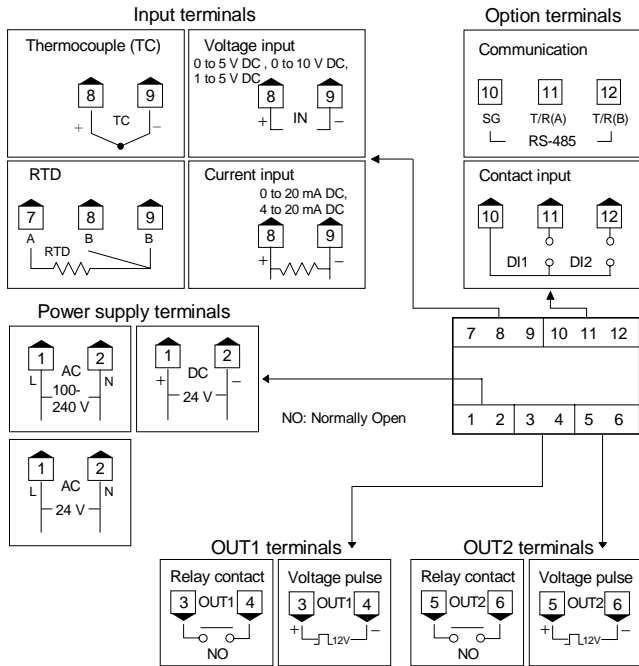


Recommended solderless terminals: Circular terminal with isolation (M3 screw, width 5.5 mm, hole diameter 3.2 mm)

- Always connect external wires starting from the lower terminals (No.1 to 6). Disconnect the wires starting from the upper terminals (No.7 to 12).
- When multiple instruments are vertically closely mounted, do not connect two or more solderless terminal lugs to one terminal.
- If multiple instruments are vertically closely mounted, it is necessary to bend the terminal lugs when they are connected to the lower terminals.



3.2 Terminal Configuration



■ Specifications

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:

- 4 VA max. (at 100 V AC) 7 VA max. (at 240 V AC)
- 4 VA max. (at 24 V AC)
- 100 mA max. (at 24 V DC)

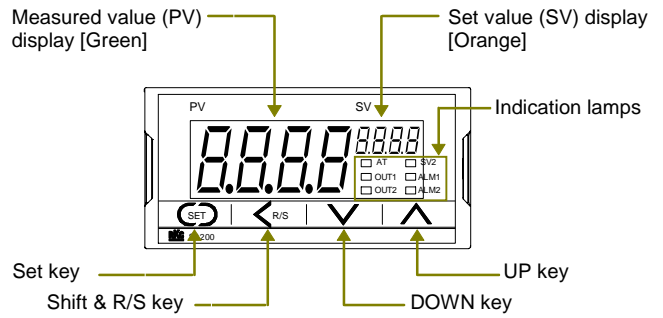
Outputs (OUT1,OUT2):

- Relay contact output:
240 V AC, 2 A (Resistive load) 1a contact
Electrical life 300,000 times or more (Rated load)
- Voltage pulse output:
Input/output terminals are not isolated.
0/12 V DC (Load resistance 600 Ω or more)

Contact input (option):

- Dry contact input: At open 500 kΩ or more
At close 10 Ω or less

4. PARTS DESCRIPTION



Set value (SV) display [Orange]

- Displays SV or STEP set value (SV1, SV2).
- Displays various parameter set values.

Measured value (PV) display [Green]

- Displays PV or various parameter symbols.

Indication lamps:

Autotuning (AT) lamp [Green]

- Flashes during autotuning execution.

Output lamps (OUT1, OUT2) [Green]

- OUT1: Lights when output 1 is turned on.
- OUT2: Lights when output 2 is turned on.

STEP set value (SV2) lamp [Orange]

- Lights when the SV2 of STEP function is selected.

Alarm lamps (ALM1, ALM2) [Orange]

- ALM1: Lights when alarm 1 is turned on.
- ALM2: Lights when alarm 2 is turned on.

Shift & R/S key

- Shift digits when settings are changed.
- Selects the RUN/STOP function.

Set key

- Used for parameter calling up and set value registration.

UP key

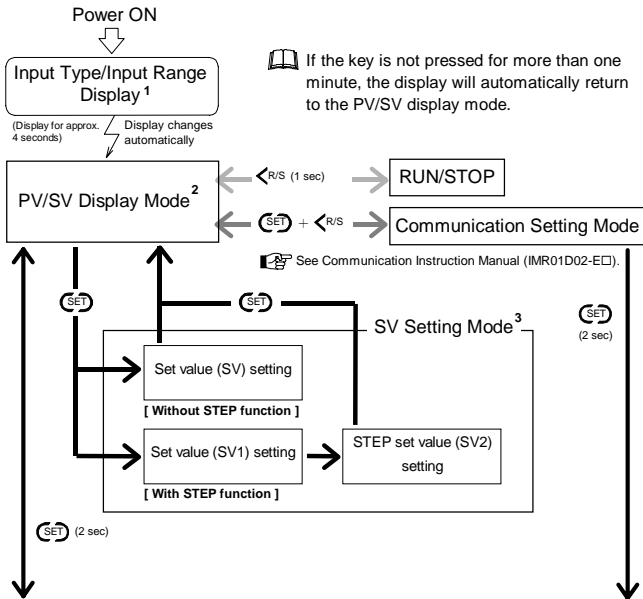
- Increase numerals.

DOWN key

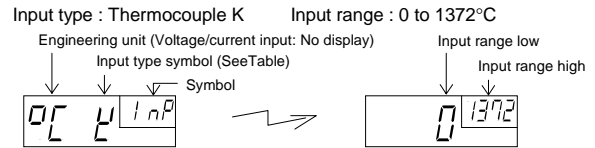
- Decrease numerals.

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

5. SETTING



1 Input type/Input Range Display



Input Type Symbol Table

SYMBOL	K	J	R	S	B	E	T	N	PL II	W5Re/W26Re	U	L	JPt 100	Pt 100	Voltage (Current)
INPUT TYPE	Thermocouple (TC)										RTD				

2 PV/SV Display Mode

The controller will display the measured value (PV) and the set value (SV).
 ● If the STEP function is provided, the SV display will show the set value (SV1) or STEP set value (SV2) depending on whether the contact input is opened or closed.
 ● The controller can be switched to RUN or STOP mode.

3 SV Setting Mode

The blinking digit on the SV display indicates which digit can be set.
 Setting range: Within input range
 Factory set value: Temperature input 0 (0.0) °C [°F], Voltage/current inputs 0.0 %
 If the STEP function is provided, the following parameter symbols are displayed on the PV.
 Set value (SV1): 5H1 STEP set value (SV2): 5H2

Parameter Setting Mode

LbA Control loop break alarm (LBA)
Setting range: 0.0 to 200.0 min.
Factory set value: 8.0

Lbd LBA deadband (LBD)
Setting range: 0 to span
Factory set value: Temperature input: 0 (0.0)
Voltage/current inputs: 0.0

AL1 Alarm 1 (ALM1)
Setting range: Process alarm, SV alarm: Same as input range.
Deviation alarm: -span to +span
Factory set value: Temperature input: 50 (50.0)
Voltage/current inputs: 5.0

AL2 Alarm 2 (ALM2)
Setting range: Process alarm, SV alarm: Same as input range.
Deviation alarm: -span to +span
Factory set value: Temperature input 50 (50.0)
Voltage/current inputs 5.0 %

ARU Autotuning (AT)
Setting range: on: AT start or execution
off: AT end or cancel
Factory set value: off

STU Self-tuning (ST)
Setting range: on: Self-tuning ON
off: Self-tuning OFF
Factory set value: off

P Heat-side proportional band (P)
Setting range: 0 to span
(0 or 0.0: ON/OFF action)
Factory set value: Temperature input: 30 (30.0)
Voltage/current inputs: 3.0

I Integral time (I)
Setting range: 0 to 3600 sec. (0: PD action)
Factory set value: 240

d Derivative time (D)
Setting range: 0 to 3600 sec. (0: PI action)
Factory set value: 60

Ar Anti-reset windup (ARW)
Setting range: 0 to 100 % of heat-side proportional band
(0: Integral action OFF)
Factory set value: 100

T Heat-side proportioning cycle time (T)
Setting range: 1 to 100 sec.
Factory set value: Relay contact output: 20 Voltage pulse output: 2

Pc Cool-side proportional band (Pc)
Setting range: 1 to 1000 % of heat-side proportional band
Factory set value: 100

db Overlap/Deadband (db)
Setting range: -span to +span
Factory set value: Temperature input: 0 (0.0)
Voltage/current inputs: 0.0

t Cool-side proportioning cycle time (t)
Setting range: 1 to 100 sec.
Factory set value: Relay contact output: 20 Voltage pulse output: 2

Pb PV bias (Pb)
Setting range: -span to +span
Factory set value: Temperature input: 0 (0.0)
Voltage/current inputs: 0.0

dF Digital filter (dF)
Setting range: 0 to 100 sec. (0: Digital filter OFF)
Factory set value: 0

LCK Set data lock (LCK)
Setting range: 0 (Unlock) 1 (Lock)
Factory set value: 0000 See Lock Level Table

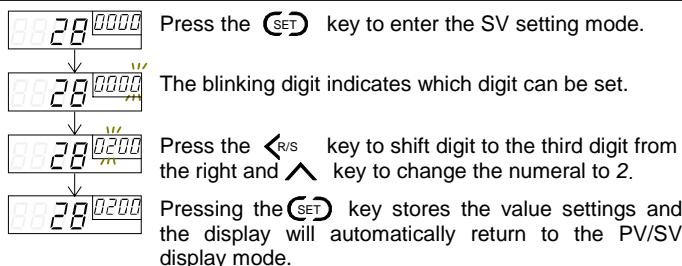
Setting	Lock level
0000	SV and all parameter can be set.
0001	Only SV and alarms can be set.
0010	Only setting items other than alarms can be set.
0100	Only setting items other than SV can be set.
0011	Only SV can be set.
0101	Only alarms can be set.
0110	Only setting items other than SV and alarms can be set.
0111	SV and all parameter cannot be set.

Return to first parameter setting item

Some parameter symbols may not be displayed depending on the specification.

The setting range is from -1999 to +9999 regardless of the position of the decimal point.

Basic operation procedure (Following is an example of SV to 200 °C)









When the set value is changed, it is not automatically stored. To store it, press the SET key.

When the set data is locked, the digits on the SV display are brightly lit and the set value cannot be changed.

6. OPERATION

6.1 Operating Precautions

-  All mounting and wiring must be completed before the power is turned on.
-  Connect the input signal wiring and turn the power on. If the input signal wiring is not complete prior to turning the power on, the instrument determines that burnout has occurred.
-  The settings for the SV and all parameters should be appropriate for the controlled object.
-  A power supply switch is not furnished with this instrument. It is ready to operate as soon as the power is turned on. [Factory set value: RUN (operation start)]
-  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 the power is turned on or the SV is changed, including an SV change made with the STEP function.

6.2 RUN/STOP

RUN/STOP can be selected by key operation or by open or closed contact input (option).

■ Conditions when changed to STOP mode

Control, Alarm : Control OFF, Alarm OFF
 Output : OUT1 output OFF (OPEN),
 OUT2 output OFF (OPEN)
 Autotuning (AT): AT canceled
 (The PID constants are not updated)

■ Display when changed to STOP mode

RUN/STOP mode with Key operation	RUN/STOP Mode with Contact input ¹	
	RUN Mode (Contact closed)	STOP Mode (Contact open)
RUN	RUN	STOP (dSP) ²
STOP	STOP (uSP) ²	STOP (sf aP) ²

¹ Contact input: Terminal No.10, 12

² Characters in parentheses are those shown on the PV display:

dSP : Only contact input is in the STOP mode

uSP : Only key operation is in the STOP mode

sf aP : Both key operation and contact input are in the STOP mode

7. FUNCTIONS

7.1 STEP (option)

The instrument has two set values (SV). This STEP function selects these two set values (SV) by contact input (Terminal No.10, 11).

Contact open: Set value (SV1)
 Contact closed: STEP set value (SV2)

7.2 Set Data Lock (LCK)

The set data lock function permits locking of critical parameters and prevents unauthorized personnel from changing parameters.

7.3 Autotuning (AT)

The AT function automatically measures, computes and sets the optimum PID and LBA constants.

■ Requirements for AT start


Start AT when all the following conditions are satisfied:


- Prior to starting the AT, end all the parameter settings other than PID and LBA.
- Confirm that the LCK function has not been engaged.

■ Requirements for AT cancellation

The AT is canceled if any of the following conditions exist:


- When the SV (SV1, SV2) is changed.
- When the PV becomes abnormal when burnout occurs.
- When the power is turned off.
- When a power failure longer than 20 ms occurs.
- When the PV bias value is changed.
- When the AT does not end in nine hours after autotuning started.
- When the RUN/STOP is changed to the STOP mode.


 If the AT is canceled, the controller immediately changes to PID control. The PID and LBA constants 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, do not use AT and set each PID constant to meet the needs of the application.


7.4 Self-tuning (ST)


The ST function is used to automatically calculate and set adaptive PID constants anytime the power is turned on, the SV is changed or the controller detects unstable control conditions.


 The ST function should be turned off when the controlled system is affected by rippling that occurs due to periodic external disturbances.

 The power to the controlled system must be turned on before the power to the instrument is turned on or SV is changed. This is required when ST function is on.

 To activate the ST function, the following parameters must not be set to zero: P≠0, I≠0, D≠0, ARW≠0.


 When the heat/cool PID action is selected, the ST function can not be activated.


 When the AT function is activated, the ST function can not be turned on.

 When the ST function is activated, the PID and ARW settings cannot be changed, only monitored.

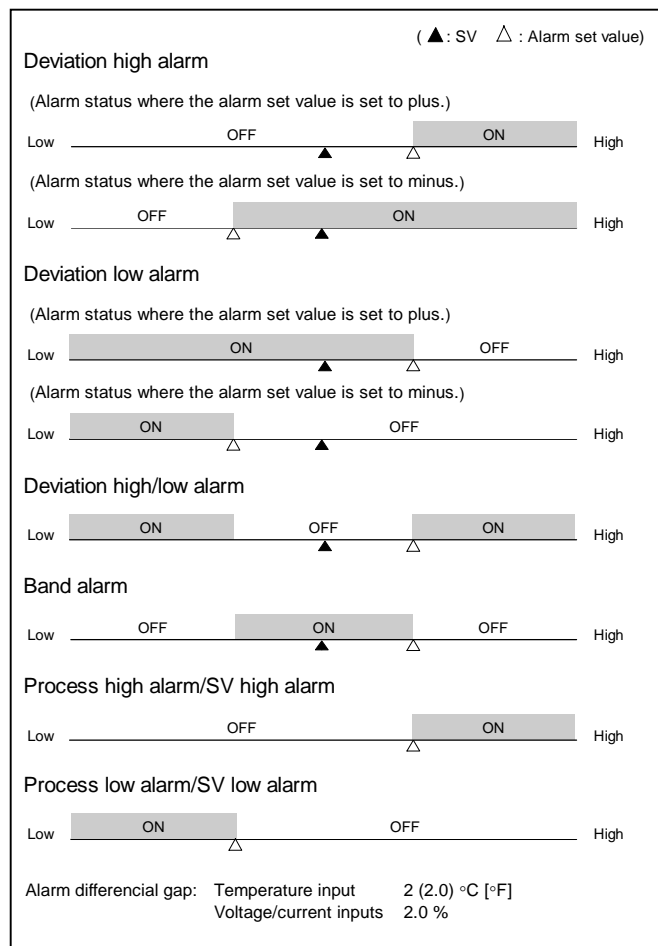
7.5 Control Loop Break Alarm (LBA)

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. We recommend that the set value of LBA be twice the value of the integral time (I).

 When AT function is turned on, the LBA function can not be activated.

 If LBA setting time does not match the controlled object requirements, the LBA setting 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.

7.6 Alarms (ALM)



The alarm outputs are assigned to OUT1/OUT2.

8. ERROR DISPLAYS

■ Error display

Display	Description	Solution
Err 	The error codes are shown in the SV display. When two or more errors occur simultaneously, the error code numbers are totaled and displayed as one number.	Turn off the power once. If an error occurs after the power is turned on again, please contact RKC sales office or the agent.

■ Overscale and Underscale

Display	Description	Solution
Measured value (PV) is flashing	PV is outside of input range.	 To prevent electric shock, always turn off the power before replacing the sensor.
oooo flashing 	Overscale - PV is above the high input display range limit.	
uuuu flashing 	Overscale - PV is below the low input display range limit.	Check the sensor or input lead.

9. INPUT RANGE TABLE

●TC/RTD

Type	Range	Code	
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
	-199.9 to +300.0 °C	K	08
	0.0 to 400.0 °C	K	09
	0.0 to 800.0 °C	K	10
	0 to 100 °C	K	13
	0 to 300 °C	K	14
	0 to 450 °C	K	17
	0 to 500 °C	K	20
	0.0 to 200.0 °C	K	29
	0.0 to 600.0 °C	K	37
	-199.9 to +800.0 °C	K	38
	0 to 800 °F	K	A1
	0 to 1600 °F	K	A2
	0 to 2502 °F	K	A3
0.0 to 800.0 °F	K	A4	
20 to 70 °F	K	A9	
-199.9 to +999.9 °F	K	B2	
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
	-199.9 to +300.0 °C	J	07
	0.0 to 400.0 °C	J	08
	0.0 to 800.0 °C	J	09
	0.0 to 450.0 °C	J	10
	0.0 to 200.0 °C	J	22
	0.0 to 600.0 °C	J	23
	-199.9 to +600.0 °C	J	30
	0 to 800 °F	J	A1
	0 to 1600 °F	J	A2
	0 to 2192 °F	J	A3
	0 to 400 °F	J	A6
	-199.9 to +999.9 °F	J	A9
	0.0 to 800.0 °F	J	B6
	R	0 to 1600 °C ¹	R
0 to 1769 °C ¹		R	02
0 to 1350 °C ¹		R	04
0 to 3200 °F ¹		R	A1
0 to 3216 °F ¹		R	A2
S	0 to 1600 °C ¹	S	01
	0 to 1769 °C ¹	S	02
	0 to 3200 °F ¹	S	A1
0 to 3216 °F ¹	S	A2	
B	400 to 1800 °C	B	01
	0 to 1820 °C ¹	B	02
	800 to 3200 °F	B	A1
	0 to 3308 °F	B	A2

Continued on the next page.

Type	Range	Code	
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
	0.0 to 800.0 °C	N	06
	0 to 2300 °F	N	A1
	0 to 2372 °F	N	A2
	0.0 to 999.9 °F	N	A5
T	-199.9 to +400.0 °C ²	T	01
	-199.9 to +100.0 °C ²	T	02
	-100.0 to +200.0 °C	T	03
	0.0 to 350.0 °C	T	04
	-199.9 to +752.0 °F ²	T	A1
	-100.0 to +200.0 °F	T	A2
	-100.0 to +300.0 °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
0 to 2320 °C		W	02
0 to 4000 °F		W	A1
PL II	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 ²	U	01
	-199.9 to +100.0 °C ²	U	02
	0.0 to 400.0 °C	U	03
	-199.9 to +999.9 °F ²	U	A1
	-100.0 to +200.0 °F	U	A2
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
Pt100	-199.9 to +649.9 °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
	-199.9 to +100.0 °F	D	A4
	-199.9 to +300.0 °F	D	A5
	JPt100	-199.9 to +649.9 °C	P
-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

Type	Range	Code	
Pt100	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 Accuracy is not guaranteed between 0 to 399 °C (0 to 751 °F).

² Accuracy is not guaranteed between -199.9 to -100.0 °C (-199.9 to -148.0 °F).

●Voltage input

Type	Range	Code	
0 to 5 V DC	0.0 to 100.0 %	4	01
0 to 10 V DC	0.0 to 100.0 %	5	01
1 to 5 V DC	0.0 to 100.0 %	6	01

●Current input

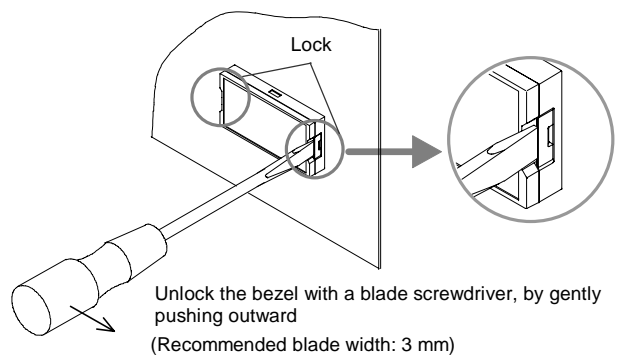
Type	Range	Code	
0 to 20 mA DC	0.0 to 100.0 %	7	01
4 to 20 mA DC	0.0 to 100.0 %	8	01

10. REMOVING THE INTERNAL ASSEMBLY



WARNING

- To prevent electric shock or instrument failure, only qualified personnel should be allowed to remove the internal assembly.
- To prevent electric shock or instrument failure, the power must be turned off before removing internal assembly.
- To prevent injury or instrument failure, do not touch the printed wiring boards when removing the internal assembly.



Apply pressure very carefully when removing internal assembly to avoid damage to the frame.

To conform to IEC61010-1 requirements for protection from electric shock, the internal assembly of this instrument can only be removed with an appropriate tool.

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