



Temperature Controller

SA100

Instruction Manual

IMR01J01-E6

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

- To prevent injury to persons, damage to the 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 the instrument and the equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to the instrument and the 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 may 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 plant.)
- 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 basic insulation between the power supply and the input/output. 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 to operating personnel.
- All precautions described in this manual should be taken to avoid damage to the instrument or equipment.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- 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 a fuse, circuit breaker, etc.
- A malfunction in this product may occasionally make control operations impossible or prevent alarm outputs, resulting in a possible hazard. Take appropriate measures in the end use to prevent hazards in the event of malfunction.
- 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 dissipation.
- 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 may occur. Use a soft, dry cloth to remove stains from the instrument.
- To avoid damage to the instrument display, do not rub with an abrasive material or push the front panel with a hard object.

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 explanation purpose.
- 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

SA100□□□□ - □□ - □ * □□ - □□/□□/□
 (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

Refer to 10. INPUT RANGE TABLES.

(3) Output 1 (Control output, Alarm output or Transmission output)

M: Relay contact output V: Voltage pulse output
 7: Current output (0 to 20 mA DC) 8: Current output (4 to 20 mA DC)

(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) Optional 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) 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: ALM2 output⁴]
 12: Transmission output + PID action
 [OUT1: Transmission output OUT2: Control output]
 13: Transmission output + ALM1, ALM2
 [OUT1: Transmission output OUT2: OR output of ALM1 and ALM2⁵]
 14: Transmission output + ALM1, ALM2
 [OUT1: Transmission output OUT2: OR output of ALM1 and ALM2⁴]
 15: Transmission output + ALM1, ALM2
 [OUT1: Transmission output OUT2: AND output of ALM1 and ALM2⁵]
 16: Transmission output + ALM1, ALM2
 [OUT1: Transmission output OUT2: AND output of ALM1 and ALM2⁴]
 17: Transmission output + ALM1
 [OUT1: Transmission output OUT2: ALM1⁵]
 18: Transmission output + ALM1
 [OUT1: Transmission output OUT2: ALM1⁴]
 19: Heat/Cool PID action
 [OUT1: Cool-side control output OUT2: Heat-side control output]

¹With hold action
²LBA can be selected for only ALM1.
³PID 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
⁴De-energized
⁵Energized

(11) Version symbol

No code: For Japanese domestic market /Y: For International market

2. MOUNTING



WARNING

To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.

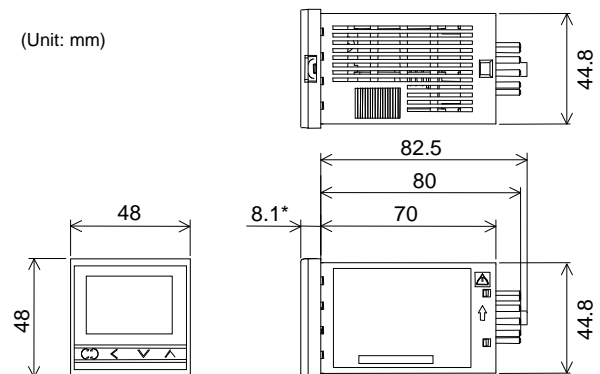
2.1 Mounting Cautions

- This instrument is intended to be used under the following environmental conditions. (IEC 61010-1)
 [OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]
- Use this instrument within the following environment conditions:
 - Allowable ambient temperature: 0 to 50 °C
 - Allowable ambient humidity: 45 to 85 %RH
 (Absolute humidity: MAX. W. C 29.3 g/m³ dry air at 101.3 kPa)
 - Installation environment conditions: Indoor use, Altitude up to 2000 m
- Avoid the following 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.
- 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.
- 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

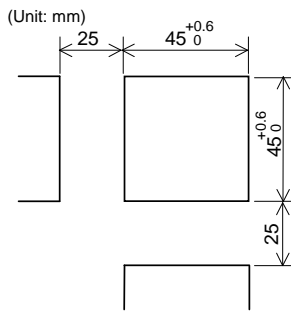
External dimension

(Unit: mm)



* Waterproof/Dustproof (IP66) type: 9.1 mm

■ Panel cutout



Installation Conditions:
The display cannot be seen from the outside of the visual field range. The visual field range of SA100 is 40° to the upper side, and 30° to the lower side from the center of the display vertically.

For mounting of the SA100, panel thickness must be between 1 to 10 mm.

2.3 Mounting Procedures

■ DIN rail mounting

1. Mounting the socket to the DIN rail. (Fig. 1)
2. Wiring to the socket. Then, mounting the instrument to the socket.
3. Secure the instrument by locking it with the hooks at the top and bottom of the socket. (Fig. 2)

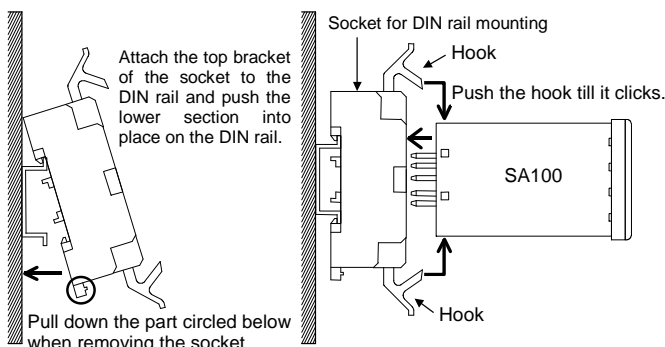


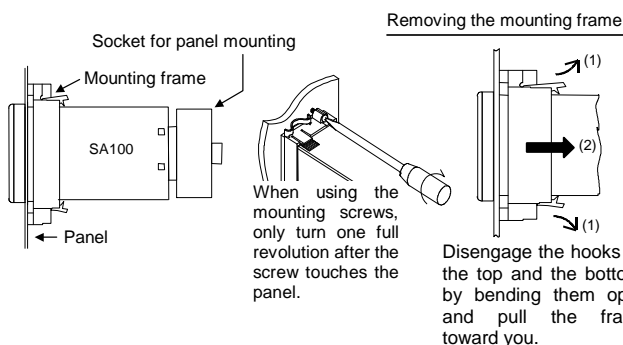
Fig. 1

Fig. 2

The socket must be provided by the customer.
Recommended socket for DIN rail mounting:
ATC180041 (Panasonic product)

■ Panel mounting

1. Prepare the panel cutout as specified in 2.2 Dimensions.
2. Insert the instrument through the panel cutout.
3. Put the mounting frame onto the instrument from the rear.
4. Push the mounting frame forward until the frame is firmly secured to the panel.
5. Mount the socket to the instrument.



The mounting frame and the socket must be provided by the customer.
Mounting frame type:
KCA100-526 (RKC product, Sold separately)
Recommended socket for panel mounting:
AT78051 (Panasonic product)

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 the instrument and the panel without any gap. If the gasket is damaged, please contact RKC sales office or the agent.

3. WIRING

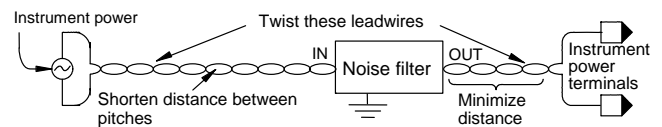


WARNING

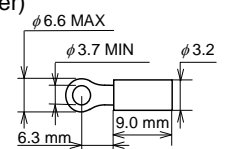
To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.

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.

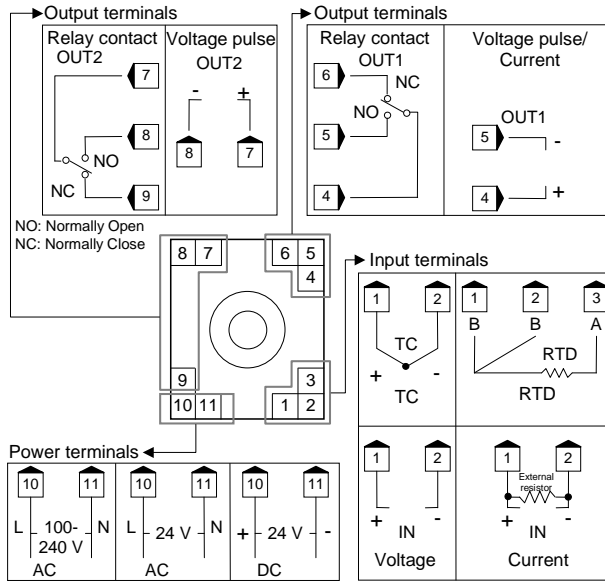


- The instrument has a basic Insulation between the power supply and inputs/outputs. Additional Supplementary insulation is required between the mains supply and the mains connections on the SA100 (mains input and relay outputs) by adding a separating safety transformer, providing at least a supplementary insulation for 240 V AC in accordance with IEC/UL/CSA 61010-1.
- Allow approximately 4 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 is not provided with an overcurrent protection device. For safety install an overcurrent protection device (such as a 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 0.4 A
- For an instrument with 24 V power supply input, supply power from "SELV" circuit defined as IEC 60950-1.
- For the current input specification, a resistor of $250 \Omega \pm 0.02 \%$ (Temperature characteristics: $\pm 10 \text{ ppm}/^\circ\text{C}$, Rated power: 0.25 W or more) must be connected between the input terminals. This resistor must be provided by the customer.
- The input and output terminals for the voltage pulse output/current output are not isolated. Always use an isolating type SSR and operating unit. 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.
- Use the solderless terminal appropriate to the screw size.
 - Screw size: M3.5 × 7 (with 7.4 × 7.4 square washer)
 - Recommended tightening torque: 0.8 N·m [8 kgf·cm]
 - Specified solderless terminals: With isolation
 - Applicable wire: Solid/twisted wire of 0.25 to 1.65 mm²
- Make sure that during field wiring parts of conductors cannot come into contact with adjacent conductive parts.

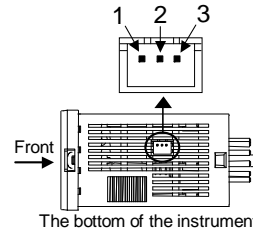


3.2 Terminal Configuration

■ Socket for DIN rail mounting (ATC180041)



<Connector position>



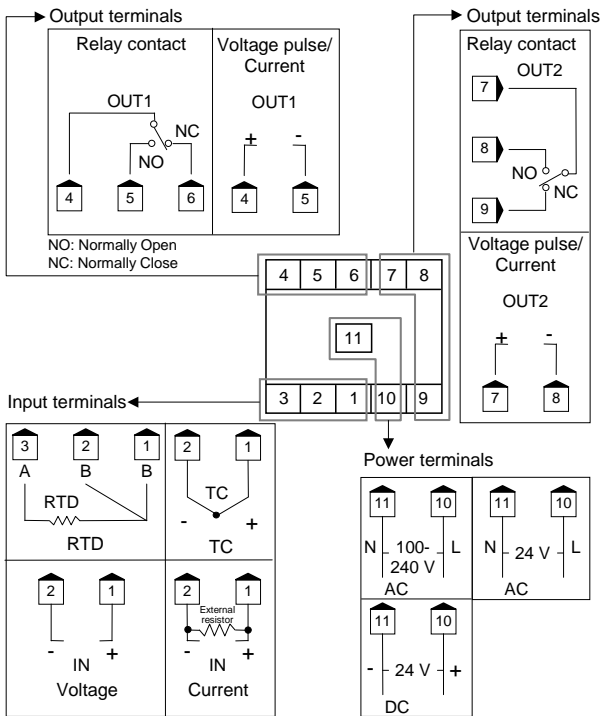
Power supply voltage:

- 85 to 264 V AC [Including power supply voltage variation], (Rating: 100 to 240 V AC), 50/60 Hz
- 21.6 to 26.4 V AC [Including power supply voltage variation], (Rating: 24 V AC), 50/60 Hz
- 21.6 to 26.4 V DC [Including power supply voltage variation], (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)

■ Socket for panel mounting (AT78051)

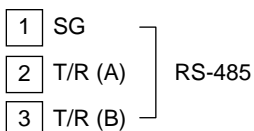


■ Option

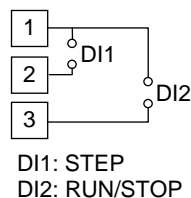
Communication function and contact input are optional. Connect the connector to the bottom of instrument. The connector and the connector cable for connecting the input block are necessary to be prepared by the customer.

Housing: XHP-3 (J.S.T. Mfg. Co., Ltd. product)
Recommended cable size: AWG30 to 22

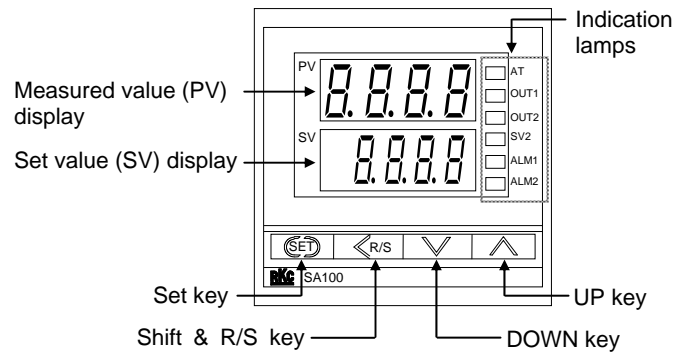
Communication



Contact input



4. PARTS DESCRIPTION



Measured value (PV) display [Green]

Displays PV or various parameter symbols.

Set value (SV) display [Orange]

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

Indication lamps:

Autotuning (AT) lamp [Green]

Flashes during autotuning execution.

Output lamps (OUT1, OUT2) [Green]

OUT1: Lights when output1 is turned on.
OUT2: Lights when output2 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 alarm1 is turned on.
ALM2: Lights when alarm2 is turned on.

Set key

Used for calling up parameters and set value registration.

Shift & R/S key

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

DOWN key

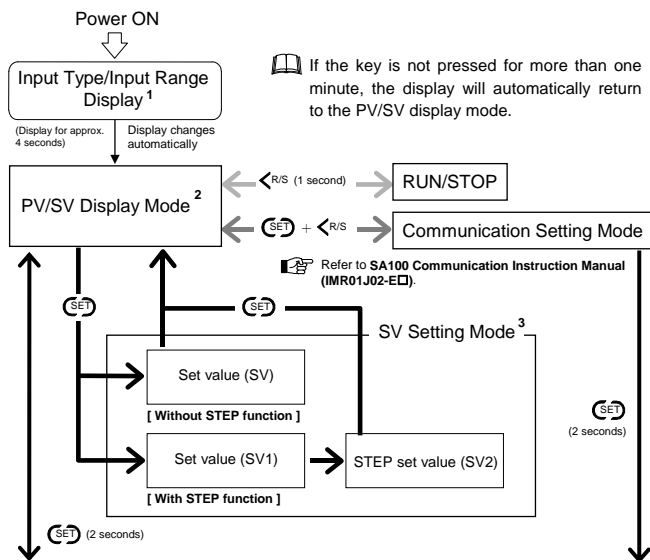
Decreases numerals.

UP key

Increases 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: Thermocouple K Input range: 0 to 1372 °C



Input type symbol (Refer to Table)
Engineering unit (Voltage/Current inputs: No display)

Input Type Symbol Table

SYMBOL	U	V	r	S	b	E	r	n	P	̄	U	L	JP	Pt	U
INPUT TYPE	Thermocouple (TC)										RTD		Voltage (Current)		
	K	J	R	S	B	E	T	N	PL	W5Re/W26Re	U	L		JPt 100	Pt 100

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: TC/RTD inputs 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

<p>LbA Control loop break alarm (LBA) Setting range: 0.0 to 200.0 minutes (0.0: OFF) Factory set value: 8.0</p> <p>LbD LBA deadband (LBD) Setting range: 0 to span Factory set value: TC/RTD inputs: 0 (0.0) Voltage/Current inputs: 0.0</p> <p>AL1 Alarm 1 (ALM1) Setting range: Process alarm, SV alarm: Same as input range. Deviation alarm: -span to +span (Within -1999 to +9999 digits) Factory set value: TC/RTD inputs: 50 (50.0) Voltage/Current inputs: 5.0</p> <p>AL2 Alarm 2 (ALM2) Setting range: Process alarm, SV alarm: Same as input range. Deviation alarm: -span to +span (Within -1999 to +9999 digits) Factory set value: TC/RTD inputs: 50 (50.0) Voltage/Current inputs: 5.0</p> <p>ATU Autotuning (AT) Setting range: on: AT start or execution off: AT end or cancel Factory set value: off</p> <p>STU Self-tuning (ST) Setting range: on: Self-tuning ON off: Self-tuning OFF Factory set value: off</p> <p>P Heat-side proportional band (P) Setting range: 0 to span (9999 digits or less) 0 or 0.0: ON/OFF action Factory set value: TC/RTD inputs: 30 (30.0) Voltage/Current inputs: 3.0</p> <p>I Integral time (I) Setting range: 0 to 3600 seconds (0: PD action) Factory set value: 240</p> <p>D Derivative time (D) Setting range: 0 to 3600 seconds (0: PI action) Factory set value: 60</p> <p>Ar Anti-reset windup (ARW) Setting range: 0 to 100 % of heat-side proportional band (0: Integral action OFF) Factory set value: 100 %</p> <p>r Heat-side proportioning cycle time Setting range: 1 to 100 seconds Factory set value: Relay contact output: 20 Voltage pulse output: 2</p> <p>Pc Cool-side proportional band Setting range: 1 to 1000 % of heat-side proportional band Factory set value: 100</p> <p>db Overlap/Deadband Setting range: -span to +span (Within -1999 to +9999 digits) Factory set value: TC/RTD inputs: 0 (0.0) Voltage/Current inputs: 0.0</p>	<p>t Cool-side proportioning cycle time Setting range: 1 to 100 seconds Factory set value: Relay contact output: 20 Voltage pulse output: 2</p> <p>Pb PV bias Setting range: -span to +span (Within -1999 to +9999 digits) Factory set value: TC/RTD inputs: 0 (0.0) Voltage/Current inputs: 0.0</p> <p>df Digital filter Setting range: 0 to 100 seconds (0: OFF) Factory set value: 0</p> <p>AO Analog output specification Item:</p> <table border="1"> <tr> <th>Symbol</th> <th>Contents of output</th> </tr> <tr> <td>PH</td> <td>Measured value (PV)*</td> </tr> <tr> <td>SH</td> <td>Set value (SV)</td> </tr> <tr> <td>DEB</td> <td>Deviation (DEV)</td> </tr> <tr> <td>MB</td> <td>Manipulated output value (MV)</td> </tr> </table> <p>* Factory set value</p> <p>AHS Analog output scale high Setting range: Measured value (PV): Same as input range Set value (SV): Same as input range Deviation (DEV): -span to +span (Within -1999 to +9999 digits) Manipulated output value (MV): 0.0 to 100.0 % Factory set value: TC/RTD inputs: Input range (high limit) Voltage/Current inputs: 100.0</p> <p>ALS Analog output scale low Setting range: Measured value (PV): Same as input range Set value (SV): Same as input range Deviation (DEV): -span to +span (Within -1999 to +9999 digits) Manipulated output value (MV): 0.0 to 100.0 % Factory set value: TC/RTD inputs: Input range (low limit) Voltage/Current inputs: 0.0</p> <p>LCU Set data lock Setting range: 0 (Unlock) 1 (Lock) Factory set value: 0000 Refer to Lock Level Table</p> <table border="1"> <tr> <th>Setting</th> <th>Lock level</th> </tr> <tr> <td>0000</td> <td>SV and all parameter can be set.</td> </tr> <tr> <td>0001</td> <td>Only SV and alarms can be set.</td> </tr> <tr> <td>0010</td> <td>Only setting items other than alarms can be set.</td> </tr> <tr> <td>0100</td> <td>Only setting items other than SV can be set.</td> </tr> <tr> <td>0011</td> <td>Only SV can be set.</td> </tr> <tr> <td>0101</td> <td>Only alarms can be set.</td> </tr> <tr> <td>0110</td> <td>Only setting items other than SV and alarms can be set.</td> </tr> <tr> <td>0111</td> <td>SV and all parameter cannot be set.</td> </tr> </table> <p>Return to first parameter setting item</p> <p>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.</p>	Symbol	Contents of output	PH	Measured value (PV)*	SH	Set value (SV)	DEB	Deviation (DEV)	MB	Manipulated output value (MV)	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.
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0111	SV and all parameter cannot be set.																												

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



Press the **SET** key to enter the SV setting mode.



The blinking digit indicates which digit can be set.



Press the **←/R/S** key to shift digit to the third digit from the right and **∧** key to change the numeral to 2.



Pressing the **SET** key stores the value settings and the display will automatically return to the PV/SV display mode.

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 when 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 (optional).

■ Conditions when changed to STOP mode

Control, Alarm: Control OFF, Alarm OFF
Output: OUT1 output OFF (OPEN),
OUT2 output OFF (OPEN)

Autotuning (AT): The AT is 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 (SP) ²

¹ Contact input: Connector pin No.1, 3

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

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

7. FUNCTIONS

7.1 STEP (optional)

The instrument has two set values (SV). This STEP function selects these two set values (SV) by contact input (Connector pin No.1, 2).

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 the 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. (LCK must be 0000)

■ 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 the AT was activated.

When the AT is completed, the controller immediately changes to PID control. If the control system does not allow the AT cycling process, do not use the 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 the ST function is on.

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

When the Heat/Cool PID action is selected, the ST function cannot be activated.

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

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

7.5 Control Loop Break Alarm (LBA)

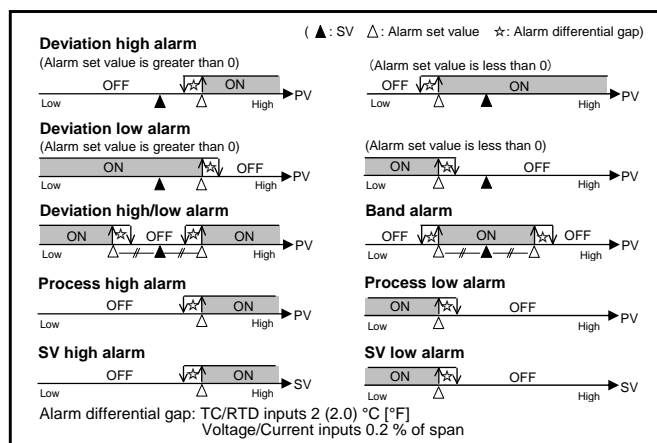
The LBA function is activated when control output reaches 0 % or 100 %. The time required for the LBA output to turn on includes both the time from the initial occurrence of loop failure and the LBA setting time. We recommend that the set value of LBA be twice the value of the integral time (I).

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

If the LBA setting time does not match the controlled object requirements, the LBA setting time should be lengthened. If the 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)

Each alarm action is shown below.



The alarm outputs are assigned to OUT1/OUT2.

8. ERROR DISPLAYS

Error display

Display	Description	Solution
	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.

Over-scale and Underscale

Display	Description	Solution
Measured value (PV) is flashing	PV is outside of input range.	WARNING To prevent electric shock, always turn off the power before replacing the sensor.
oooo 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. SPECIFICATIONS

Input

TC: K, J, R, S, B, E, T, N, PLII, W5Re/W26Re, U, L
 RTD: JPt100, Pt100
 Voltage: 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
 Current: 0 to 20 mA DC, 4 to 20 mA DC

Display accuracy

TC: ±(1 % of displayed value +1 digit) or ±2 °C
 RTD: ±(0.3 % of displayed value +1 digit) or ±0.8 °C
 Voltage/Current: ±(0.3 % of span +1 digit)

Control action

PID control: Direct action/reverse action, Heat/Cool control (Water cooling, Air cooling), ON/OFF, P, PI, PD Selectable
 With Autotuning (AT) and Self-tuning (ST) functions

Output (OUT1, OUT2)

Relay contact: 240 V AC, 3 A (Resistive load) 1c contact, Electric life 300,000 times or more (Rated load)
 Voltage pulse: Input/output terminals are not isolated 0/12 V DC (load resistance 600 Ω or more)
 Current: 0 to 20 mA DC, 4 to 20 mA DC (Load resistance: 400 Ω or less, Resolution: 10 bits or more)

Communication function (Optional)

Interface: Based on RS-485, EIA standard
 Protocol: • RKC communication
 • Modbus

Contact input (Optional)

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

Others

Dimension: 48 (W) × 48 (H) × 70 (D) mm
 Weight: Approx. 120 g

10. INPUT RANGE TABLES

Input Range Table 1

Input type	Input range	Code	
		Input	Range
Thermo-couple (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
		-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		

Continued on the next page.

Input type		Input range	Code	
			Input	Range
Thermo-couple (TC)	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 to 450 °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
	B	0 to 3216 °F ¹	S	A2
		400 to 1800 °C	B	01
		0 to 1820 °C ¹	B	02
	E	800 to 3200 °F	B	A1
		0 to 3308 °F	B	A2
		0 to 800 °C	E	01
	N	0 to 1000 °C	E	02
		0 to 1600 °F	E	A1
		0 to 1832 °F	E	A2
	T	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
	W5Re/ W26Re	0.0 to 999.9 °F	N	A5
		-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 +400.0 °F	T	A3
		0.0 to 450.0 °F	T	A4
		0.0 to 752.0 °F	T	A5
	PL II	0 to 2000 °C	W	01
		0 to 2320 °C	W	02
		0 to 4000 °F	W	A1
		0 to 1300 °C	A	01
	PL II	0 to 1390 °C	A	02
		0 to 1200 °C	A	03
		0 to 2400 °F	A	A1
		0 to 2534 °F	A	A2

Input type		Input range	Code	
			Input	Range
Thermo-couple (TC)	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
		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 Accuracy is not guaranteed between 0 to 399 °C (0 to 751 °F) for type R, S and B.

² Accuracy is not guaranteed less than -100.0 °C (-148.0 °F) for type T and U.

Input Range Table 2

Input type		Input range	Code	
			Input	Range
Voltage	0 to 5 V DC	0.0 to 100.0 %	4	01
	0 to 10 V DC		5	01
	1 to 5 V DC		6	01
Current	0 to 20 mA DC		7	01
	4 to 20 mA DC		8	01

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