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 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 shall 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 performing 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 wiring, output lines from high currents with a suitable overcurrent protection device with adequate breaking capacity such as a 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 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 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.
- Proper 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

<table>
<thead>
<tr>
<th>CB103</th>
<th>CB403</th>
<th>CB903</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>(7)</td>
<td>(8)</td>
<td>(9)</td>
</tr>
<tr>
<td>(10)</td>
<td>(11)</td>
<td></td>
</tr>
</tbody>
</table>

(1) **Control action**

- F: PID action with autotuning (Reverse action)
- D: PID action with autotuning (Direct action)

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

(4) **Control output [OUT1]**

- M: Relay contact
- T: Triac
- V: Voltage pulse
- B: Current (4 to 20 mA DC)
- G: Trigger for triac driving

(5) **Alarm 1 [ALM1], (6) 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
- F: Deviation low alarm
- G: Deviation high/low alarm with hold action

(7) **Auxiliary output [DO]**

- N: No auxiliary output
- A: L: Temperature alarm output
- (Refer to the above alarm code)
- 1: STEP function (SV1/SV2 switching)
- 2: RUN/STOP

(8) **Contact input**

- N: No contact input
- 1: Function input (SV1/SV2 switching)

(9) **Waterproof/Dustproof**

- N: No waterproof/Dustproof
- 1: Waterproof/Dustproof

(10) **Case color**

- N: White
- A: Black

(11) **Version symbol**

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

---

### 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:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>0 to 50 °C</td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>5 to 95 %RH</td>
</tr>
<tr>
<td>(Absolute humidity)</td>
<td>MAX. W. C. 2.29 g/m³ dry air at 101.3 kPa</td>
</tr>
<tr>
<td>Installation environment</td>
<td>Indoor use, Altitude up to 2000 m</td>
</tr>
</tbody>
</table>

(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 at least 200 mm.
- 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.

**Accessories**

- Mounting frame (CB103): 1 (KCA100-526)
- Mounting brackets (CB403/CB903): 2 * (KCA400-532)
- Instruction manual (IMCB35-E1): 1
- CB903 waterproof/dustproof (optional): 4 pieces
2.2 Dimensions

Fig. 4

3. Mounting Procedures

2.3 Mounting Procedures

zc

*2 Up to four mounting brackets can be used.
* For mounting of the instrument, panel thickness must be between 1 to 10 mm.
* Waterproof and dustproof are not effective when instruments are closely spaced.
* When mounting multiple instruments close together, the panel strength should be checked to ensure proper support.
* For mounting of the instrument, panel thickness must be between 1 to 10 mm.

<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. Do not push the mounting bracket forward. (Fig. 1)
4. Secure the bracket to the instrument by tightening the screw. Take care to refrain from moving the bracket forward.
5. Only turn about one full revolution after the screw touches the panel. (Fig. 2)
6. The other mounting bracket should be installed in the same way as described in 3. to 5.

<Removal Procedures>
1. Turn the power OFF.
2. Remove the wiring.
3. Loosen the screw of the mounting bracket.
4. Hold the mounting bracket by the edge (①) and tilt it (②) to remove from the case. (Fig. 3)
5. The other mounting bracket should be removed in the same way as described in 3. and 4.
6. Pull out the instrument from the mounting cutout while holding the front panel frame of this instrument. (Fig. 4)

<Removal Procedures>
1. Turn the power OFF.
2. Remove the wiring.
3. Loosen the screw of the mounting bracket.
4. Hold the mounting bracket by the edge (①) and tilt it (②) to remove from the case. (Fig. 3)
5. The other mounting bracket should be removed in the same way as described in 3. and 4.
6. Pull out the instrument from the mounting cutout while holding the front panel frame of this instrument. (Fig. 4)

3. WIRING

3.1 Wiring Cautions

- For thermocouple input, use the appropriate compensation wire.
- Use 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.
- For the current input specification, an external resistor (250 Ω ±0.02 %, 0.25 W or more, ±10 ppm/°C) must be connected between the input terminals. For external resistor (short resistor), use the KD100-55: sold separately (RKC product). If this resistor is installed, close horizontal mounting is not possible.
- 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 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 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).
- Use the solderless terminal appropriate to the screw size.
- Screw size: M3 x 6
- Recommended tightening torque: 0.4 N·m [4 kgf·cm]
- Solderless terminals: With insulation
- Applicable wire: Solid/twisted wire of 0.25 to 1.65 mm²
- Make sure that during field wiring parts of conductors can not come into contact with adjacent conductive parts.
3.2 Terminal Configuration

<table>
<thead>
<tr>
<th>CB403</th>
<th>CB903</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power terminals</td>
<td></td>
</tr>
<tr>
<td>AC L</td>
<td>DC +</td>
</tr>
<tr>
<td>24 V</td>
<td></td>
</tr>
<tr>
<td>No: Normally open NC: Normally closed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CB103</th>
<th>CB403/CB903</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm output terminals (optional)</td>
<td></td>
</tr>
<tr>
<td>Trigger</td>
<td>Trig. out</td>
</tr>
<tr>
<td>OUT1</td>
<td>OUT2</td>
</tr>
<tr>
<td>Alarm output (ALM3)</td>
<td>RUN/STOP state output</td>
</tr>
<tr>
<td>No auxiliary output is provided when control output is trigger output.</td>
<td></td>
</tr>
</tbody>
</table>

### 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, 0 to 10 V DC (Z-1010)
  - 0 to 20 mA DC, 4 to 20 mA DC
- **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, 1 A (Resistive load), 1A contact
  - Electrical life: 50,000 times or more (Rated load)
- **Voltage pulse output:** 0/12 V DC
- **Current output:**
  - 0 to 20 mA DC (Load resistance 600 Ω or less)
  - 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 or less
- **Load resistance:** 600 Ω or less
- **Voltage:**
  - 250 V AC, 3 A (Resistive load), 1A contact
- **Current output rated:**
  - 0 to 20 mA DC or 4 to 20 mA DC (Load resistance 600 Ω or less)
- **Contact input (optional):**
  - Dry contact input rated:
    - At open 500 kΩ or more
    - At close 10 Ω or less
  - **Performance:**
    - **Display accuracy:** (at the ambient temperature 23 ℃ ± 2 ℃):
      - Thermocouple: ± (0.3 % of display value + 1 digit) or ± 2 ℃ [± 4 °F] Whatever is greater
      - R, S and B input: 0 to 399 ℃ [0 to 799 °F]
      - Accuracy is not guaranteed.
      - T and U input: −199.9 to 100.0 ℃ [−199.9 to −150.0 °F]
      - Accuracy is not guaranteed.
      - RTD: ± (0.3 % of display value + 1 digit) or ± 0.8 ℃ [± 1.6 °F] Whichever is greater
- **Voltage/Current:** ± (0.3 % of Input span + 1 digit)

#### Memory backup
- **Backed up by Nonvolatile Memory**
- **Number of write times:** Approx. 1,000,000 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
  - 216 to 264 V AC (Power supply voltage range), 50/60 Hz
  - Rating: 24 V AC
  - 21.6 to 26.4 V AC (Power supply voltage range)
  - Rating: 24 V DC
- **Power consumption:**
  - 7 VA max. (at 100 V AC), 10 VA max. (at 240 V AC)
  - 5 VA max. (at 24 V AC), 160 mA max. (at 24 V DC)
- **Weight:**
  - CB103: Approx. 170 g
  - CB403: Approx. 250 g
  - CB903: Approx. 340 g

### 4. PARTS DESCRIPTION

- **Measured value (PV) display [Green]:** Displays PV or various parameter symbols. The decimal point at the least significant digit lights in the step state (while the contact input closed).
- **Set value (SV) display [Orange]:** Displays SV, STEP set value (SV2), or various parameter set values (or CT input value).
- **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) [Green]:
    - OUT1: Lights when control output is turned on.*
      - "Lamp indication becomes as follows for current output:
        - For an output of less than 0 %: Extended
        - For an output of more than 100 %: Lit
        - For an output of more than 0 % but less than 100 %: Dimly lit.
  - Auxiliary output lamp (DO) [Green]:
    - DO: Lights when first auxiliary output (alarm 3 [ALM3], RUN/STOP state output) is turned on. When the analog output is selected as an auxiliary output, the DO lamp does not light.
- **[Set key]:**
  - Used for parameter calling up and set value registration.
- **R/S (Shift & R/S key):**
  - Shift digits when settings are changed.
  - Select the RUN/STOP function.
- **[DOWN key]:**
  - Decrease numerals.
- **[UP key]:**
  - Increase numerals.
- **To avoid damage to the instrument, never use a sharp object to press keys.**
## 5. SETTING

### 5.1 Operation Menu

![Image of operation menu]

**Input type and Input range Display**

When the sensor type of input is K thermocouple.

*Input type symbol Table*

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current transformer</td>
<td>0.0 to 100.0 A</td>
<td>Display input value from the current transformer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ALM1</td>
<td>TC/RTD inputs: 0 to 9999 [°F]</td>
<td>Set the ALM1 set value, Alm2 set value, and Alm3 set value.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alarm 2 set value</td>
<td>TC/RTD inputs: 0 to +Input span [°F]</td>
<td>Alarm differential gap: TC/RTD inputs: 2 or 2.0 [°F]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alarm 3 set value</td>
<td>TC/RTD inputs: 0.8 % of Input span</td>
<td>Alarm differential gap: Voltage/Current inputs: 0.2 % of Input span</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heater break alarm 1</td>
<td>TC/RTD inputs: 0.1 to +Input span [°F]</td>
<td>Alarm set value (HBA) time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LBA deadband</td>
<td>TC/RTD inputs: 0.0 to 100 % of Input span</td>
<td>Alarm set value (LBA) time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Autotuning (AT)</td>
<td>0 to 100.0 A</td>
<td>Alarm value is set by referring to input value from the Current transformer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-tuning (ST)</td>
<td>0 to 100.0 A</td>
<td>Alarm value is set by referring to input value from the Current transformer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proportional band (P)</td>
<td>TC/RTD inputs: 0 to +Input span [°F]</td>
<td>Set when PI, PD, or PID control is performed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Integral time (I)</td>
<td>0 to 1000 minutes</td>
<td>Integral time (I) set value (I)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Derivative time (D)</td>
<td>0 to 1000 seconds</td>
<td>Derivative time (D) set value (D)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anti-reset windup (ARW)</td>
<td>0 to 100 % proportional band</td>
<td>Set control output cycle.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proportional cycle (T)</td>
<td>0 to 100 seconds</td>
<td>Proportional cycle (T) set value (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PV bias (Pb)</td>
<td>0 to 1000</td>
<td>PV bias</td>
<td></td>
</tr>
</tbody>
</table>

### 5.2 Parameter List

- **Symbol**
  - Input type symbol
  - Unit for input and SV display
  - For the alarm action type, refer to page 7.

- **Parameter Setting Mode**
  - The following parameter symbols are displayed when the SET key is pressed.

- **Parameter Setting Mode Table**
  - Parameters which are not related to existing functions on the controller are not displayed.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Display input value from the current transformer.</td>
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<tr>
<td></td>
<td>ALM1</td>
<td>TC/RTD inputs: 0 to 9999 [°F]</td>
<td>Set the ALM1 set value, Alm2 set value, and Alm3 set value.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alarm 2 set value</td>
<td>TC/RTD inputs: 0 to +Input span [°F]</td>
<td>Alarm differential gap: TC/RTD inputs: 2 or 2.0 [°F]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alarm 3 set value</td>
<td>TC/RTD inputs: 0.8 % of Input span</td>
<td>Alarm differential gap: Voltage/Current inputs: 0.2 % of Input span</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heater break alarm 1</td>
<td>TC/RTD inputs: 0.1 to +Input span [°F]</td>
<td>Alarm set value (HBA) time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LBA deadband</td>
<td>TC/RTD inputs: 0.0 to 100 % of Input span</td>
<td>Alarm set value (LBA) time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Autotuning (AT)</td>
<td>0 to 100.0 A</td>
<td>Alarm value is set by referring to input value from the Current transformer.</td>
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</tr>
<tr>
<td></td>
<td>Self-tuning (ST)</td>
<td>0 to 100.0 A</td>
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</tr>
<tr>
<td></td>
<td>Proportional band (P)</td>
<td>TC/RTD inputs: 0 to +Input span [°F]</td>
<td>Set when PI, PD, or PID control is performed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Integral time (I)</td>
<td>0 to 1000 minutes</td>
<td>Integral time (I) set value (I)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Derivative time (D)</td>
<td>0 to 1000 seconds</td>
<td>Derivative time (D) set value (D)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anti-reset windup (ARW)</td>
<td>0 to 100 % proportional band</td>
<td>Set control output cycle.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proportional cycle (T)</td>
<td>0 to 100 seconds</td>
<td>Proportional cycle (T) set value (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PV bias (Pb)</td>
<td>0 to 1000</td>
<td>PV bias</td>
<td></td>
</tr>
</tbody>
</table>
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.

5. Change parameters other than the Set value (SV)
The changing procedures are the same as those of example 2 to 4 in the above.

6. OPERATIONS

6.1 Operation Procedures

1. Prior to starting operation, check that the mounting and wiring have been finished, and that the SV and various parameters have been set.

2. 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). This instrument holds the conditions that exist just before the power is turned on. For example, if the power is turned off in STOP mode, the instrument starts in STOP mode when the power is turned on again.

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, 0 to 10 V DC*) or current (0 to 20 mA DC) input, the display becomes indefinite (display of about zero value).
  - Z-1010 specification

- Z-1010 specification

- Outputs
  - Control output: OFF
  - Auxiliary output: Analog output:
    - For 4 to 20 mA DC, a current of 4 mA is output and for 0 to 20 mA, the output becomes indefinite (output of about 0 mA).

- RUN/STOP status output:
  - Outputs the STOP state (OPEN).

- Alarm 3 output:
  - Becomes the same as the following alarm output.

- 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 or the SV is changed, including an SV change made with the STEP function.

### 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.

### Symbol Name Setting range Description Factory set value

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ro</td>
<td>Analog output</td>
<td>0: Measured value (PV) 1: Set value (SV) 2: Deviation value (DEV) 3: Manipulated output value (MV)</td>
<td>Select the analog output type. Analog output is auxiliary output.</td>
<td>0</td>
</tr>
<tr>
<td>AHS</td>
<td>Analog output scale high (AHS)</td>
<td>PV,SV: ALS to Setting limiter high (SLH) DEV: ALS to -Input span (within 9999) MV: ALS to 100.0</td>
<td>Set the analog output scale high.</td>
<td>Input range (high limit)</td>
</tr>
<tr>
<td>ALS</td>
<td>Analog output scale low (ALS)</td>
<td>PV,SV: Setting limiter low (SLL) to AHS DEV: Input span (within -9999) to AHS MV: 0.0 to AHS</td>
<td>Set the analog output scale low.</td>
<td>Input range (low limit)</td>
</tr>
<tr>
<td>LCP</td>
<td>Set data lock (LOCK)</td>
<td></td>
<td>Performs set data change enable/disable.</td>
<td>0000</td>
</tr>
</tbody>
</table>

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.

### 6. OPERATIONS

**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.

### 6.1 Operation Procedures

1. Prior to starting operation, check that the mounting and wiring have been finished, and that the SV and various parameters have been set.

2. 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). This instrument holds the conditions that exist just before the power is turned on. For example, if the power is turned off in STOP mode, the instrument starts in STOP mode when the power is turned on again.
6.2 RUN/STOP

RUN/STOP can be selected by contact input (optional) other than the key operation. In addition, at STOP the key operation and contact state are displayed on the PV display. Relationships between key operation, RUN/STOP and the characters to indicate the STOP state are shown in the following.

<table>
<thead>
<tr>
<th>RUN/STOP with Key Operation</th>
<th>RUN (Contact closed)</th>
<th>STOP (Contact open)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contact input</strong></td>
<td><strong>RUN</strong></td>
<td><strong>STOP</strong></td>
</tr>
<tr>
<td>Terminal No.13, 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Character in parentheses</strong></td>
<td><strong>Only contact input is in the STOP mode</strong></td>
<td><strong>Only key operation is in the STOP mode</strong></td>
</tr>
<tr>
<td><strong>Set data lock</strong></td>
<td><strong>Both contact inputs are in the STOP mode</strong></td>
<td><strong>Both key and contact inputs are in the STOP mode</strong></td>
</tr>
</tbody>
</table>

When operation is changed to the STOP mode by RUN/STOP selection, a autotuning and the conditions which will cause the autotuning to stop.

6.6 Autotuning (AT) Function

The autotuning is canceled if any of the following conditions exist.

- When AT is canceled, the controller immediately changes to PID control.
- If the autotuning is canceled by any of the above conditions, the controller will automatically return to PID control.

6.7 Self-tuning (ST) Function

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 operates under unstable control conditions.

- **Conditions when changed to STOP mode:**
  - RUN/STOP can be selected by contact input (optional) other than the key operation.
  - Autotuning (AT) is canceled if any of the following conditions exist.

6.3 STEP Function (optional)

The controller has two Set value (SV). This STEP function selects these two Set values (SV) by contact input (terminal No.13, 15). Contact open: Set value (SV1) Contact closed: Set value (SV2)

6.4 Auxiliary Output Function (optional)

One auxiliary output can be selected from among ALM3, analog output, and RUN/STOP mode output. RUN: contact closed, STOP: contact open.

6.5 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. There are 8 set data lock levels. (refer to below)

<table>
<thead>
<tr>
<th>Set value</th>
<th>Parameters which can be changed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>All parameters [Factory set value]</td>
</tr>
<tr>
<td>0001</td>
<td>SV, Alarms (ALM1, ALM2, ALM3)</td>
</tr>
<tr>
<td>0010</td>
<td>All parameters except for Alarms (ALM1, ALM2, ALM3)</td>
</tr>
<tr>
<td>0011</td>
<td>SV</td>
</tr>
<tr>
<td>0100</td>
<td>All parameters except for SV</td>
</tr>
<tr>
<td>0101</td>
<td>Alarms (ALM1, ALM2, ALM3)</td>
</tr>
<tr>
<td>0110</td>
<td>All parameters except for SV and Alarms (ALM1, ALM2, ALM3)</td>
</tr>
<tr>
<td>0111</td>
<td>No parameters (All Locked)</td>
</tr>
</tbody>
</table>

When the ST function is activated, the PID and ARW settings can be changed. When the AT function is activated, the ST function cannot be turned on.

When the AT function is activated, the SV is changed to zero and the controller shows the digits which are not highlighted.

- The ST function should be turned off when the controlled system is affected by ripple 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.

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, 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 and input range.
2. Press and hold the SET key for 2 seconds to go to the Parameter setting mode from the PV/SV display.
3. Press the SET key until “LCK” (Data lock display) will be displayed.
4. The high-lighted digit indicates which digit can be set. Press <R/S key to high-light the thousands digit. (The section in each image of the controller shows the digits which are not high-lighted.)
5. Press the UP key to change 0 to 1.
6. Press the SET key to store the new set value.
7. When the controller goes to the Initialization mode, “Cod” will be displayed.

7.2 Exit Initialization Mode

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

1. The ST function is turned off.
2. The controller goes to the operation mode.
3. Press and hold the SET key for 2 seconds.
4. Press the SET key until “LCK” (Data lock display) will be displayed.
5. When the controller goes to the Initialization mode.
6. Press the DOWN key to change 1 to 0.
7. Press the SET key to store the new set value.
8. The display goes to the next parameter, and the Initialization mode is unlocked. (The parameter displayed varies on the instrument specification.)
9. Press the <R/S key for 2 seconds while pressing the SET key to go to the Initialization mode.
10. When the controller goes to the Initialization mode, “Cod” will be displayed.

- The ST function should be turned off when the controlled system is affected by ripple 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: Pd, I, D, Dv, ARW.
- When the AT function is activated, the ST function cannot be turned on.
- When the ST function is activated, the PID and ARW settings can be monitored, but not changed.
### 7.3 Initial Setting Menu

The "Cod" display will be displayed when the controller goes to the Initialization mode.

Do not change any parameter in the Initialization mode which is not described in the initial setting menu above. It may result in malfunction or failure of the instrument.

Press the <RS> key while pressing the SET key for 2 seconds with the unlocked.

### 7.4 Input Type Selection (SL1)

When any parameter setting is changed in the Initialization mode, all parameter set values in SV setting mode and Parameter setting mode go to 0000. Factory set value varies depending on the instrument specification.

#### Change Settings

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

1. Set "Cod" to 0000, and press the SET key. The display will go to SL1.
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 Alarm 1 [ALM1] Type Selection (SL4)

Alarm 1 [ALM1] is provided when the instrument does not have ALM1 output.

Alarm 1 [ALM1] is provided when the ALM1 output is used for Process/Deviation/Band alarm or Control loop break alarm (LBA).

#### Setup Settings

1. Press the SET key several times at SL1 until SL4 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 SV Alarm Type Selection (SL11)

For ALM1 setting, the first digit from the right is set to "0" in the following cases.

- When the instrument does not have ALM1 output.
- When the ALM1 output is used for Process/Deviation/Band alarm or Control loop break alarm (LBA).

For ALM2 setting, the third digit from the right is set to "0" in the following cases.

- When the instrument does not have ALM2 output.
- When the ALM1 output is used for Process/Deviation/Band alarm, Heater break alarm (HBA) or Control loop break alarm (LBA).

To make SV alarm setting effective, set SL4 to "0000" when using ALM1 for SV alarm, or set SL5 to "0000" when using ALM2 for SV alarm. SL4 and SL5 have priority to SL11 setting.

Factory set value varies depending on the instrument specification.

### 7.7 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.
Factory set value varies depending on the instrument specification.

### Input type | Setting range
<table>
<thead>
<tr>
<th>TC/RTD/PLII</th>
<th>Setting limiter high</th>
<th>Setting limiter low</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 20 mA DC</td>
<td>SLL to 2000 °C</td>
<td>SLL to 0.0 °C</td>
</tr>
<tr>
<td>4 to 20 mA DC</td>
<td>SLL to 499.9 °C</td>
<td>SLL to 0.0 °C</td>
</tr>
<tr>
<td>Voltage</td>
<td>SLL to 499.9 °C</td>
<td>SLL to 0.0 °C</td>
</tr>
</tbody>
</table>

### Change Settings

**Example:** When the display range is scaled to 0.0 to 400.0 for a voltage input of 1 to 5 V DC.

1. Set Cod to 0001, and press the SET key. The display will go to SLL.

2. The high-lighted digit indicates which digit can be set. Press <RS to highlight the first digit from the left. (The section in each image of the controller shows the digits which are not high-lighted.)

3. Press the UP key to change the number to 4.

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

5. Set SLL to 0.0.

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

### 7.8 Decimal Point Position (PGdP)

Use to select a Decimal point position of the input range (voltage input and current input). PGdP is displayed only for voltage or current input.

**Inappropriate settings may result in malfunction.**

<table>
<thead>
<tr>
<th>Set value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>No decimal place (0000)</td>
</tr>
<tr>
<td>0001</td>
<td>One decimal place (0001) (Factory set value)</td>
</tr>
<tr>
<td>0002</td>
<td>Two decimal places (0002)</td>
</tr>
<tr>
<td>0003</td>
<td>Three decimal places (0003)</td>
</tr>
</tbody>
</table>

### Change Settings

**Example:** Change the Decimal point position from “One decimal place (0001)” to “No decimal place (0000)”

1. Press the SET key two times at SLL until PGdP is displayed.

2. Press the UP key to change the number to 0.

3. 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 when the power is turned on again, please contact RKC sales office or the agent.

**Over-scale and Underscale**

<table>
<thead>
<tr>
<th>Measured value (PV) [Flashing]</th>
<th>Over-scale: PV is above the high input display range limit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 [Flashing]</td>
<td>Underscale: PV is below the low input display range limit.</td>
</tr>
</tbody>
</table>

**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.

### 9. INPUT RANGE TABLE

#### TC/RTD inputs

<table>
<thead>
<tr>
<th>Input type</th>
<th>Range</th>
<th>Code</th>
<th>Range</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>0 to 200 °C</td>
<td>K 01</td>
<td>0 to 400 °C</td>
<td>K 02</td>
</tr>
<tr>
<td>J</td>
<td>0 to 200 °C</td>
<td>K 03</td>
<td>0 to 800 °C</td>
<td>K 04</td>
</tr>
<tr>
<td>L</td>
<td>0 to 200 °C</td>
<td>K 05</td>
<td>0 to 1000 °C</td>
<td>K 06</td>
</tr>
</tbody>
</table>

#### Voltage

<table>
<thead>
<tr>
<th>Range</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 5 V DC</td>
<td>01</td>
</tr>
<tr>
<td>0 to 10 V DC</td>
<td>01</td>
</tr>
<tr>
<td>0 to 20 mA DC</td>
<td>01</td>
</tr>
</tbody>
</table>

### 10. REMOVING THE INTERNAL ASSEMBLY

**WARNING**

- To prevent electric shock or instrument failure, only qualified personnel should be allowed to pull out the internal assembly.
- To prevent electric shock or instrument failure, always turn off the power before pulling out the internal assembly.
- To prevent injury or instrument failure, do not touch the internal printed wiring board.

Generally press down on the handle for the upper lock and lift up for the lower lock.

Unlocking points (marked with “○”) depend on the model as follows.

- CB303
- CB403
- CB903

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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