Before operating this instrument, please carefully read this manual and fully understand its contents. And always keep it around you to make it available easily anytime.

**WARNING**

- If failure or error of this instrument could result in a critical accident of the system, install an external protection circuit to prevent such an accident.
- Do not turn on the power supply until all of the wiring is completed. Otherwise electric shock, fire or malfunction may result.
- Use this instrument within the scope of its specifications. Otherwise fire or malfunction may result.
- Do not use this instrument in the places subject to flammable or explosive gas.
- Do not touch high-voltage blocks such as power supply terminals, etc. Otherwise electric shock may result.
- Never disassemble, repair or modify the instrument. This may cause electric shock, fire or malfunction.

**CAUTION**

- This is a Class A instrument. In a domestic environment this instrument may cause radio interference, in which case the user is required to take adequate measures.
- This instrument is protected from electric shock by reinforced insulation. So please arrange reinforced insulation to the wire for input signal against the wires for instrument power supply, source of power and loads as far as possible.
- This instrument is manufactured on the assumption that it is used in the condition of being mounted on the instrumentation panel. Therefore, take the necessary measures on the equipment side mounted with this instrument so that the operator or other personnel are not accessible to high-voltage blocks in this instrument such as power supply terminals, etc.
- Always observe precautions described in this manual. Otherwise serious injury or accident may result.
- Do not disassemble, repair or modify the instrument. This may cause electric shock, fire or malfunction.
- Firmly tighten each terminal screw at the specified torque. Otherwise electric shock or fire may result.
- Do not place any obstacle around this instrument in order not to impede radiation of heat. And do not close ventilation holes.
- Do not connect wires to unused terminals.
- Before cleaning the instrument, always turn off the power supply.
- Remove stains from this instrument using a soft, dry cloth. Do not use a volatile solvent such as thinner in order to avoid deformation or discoloration.
- Do not rub nor strike the display unit of this instrument with a hard object.

**Notice**

- This manual is subject to change without prior notice.
- Examples of figures, diagrams and numeric values used in this manual are for a better understanding of the text, but not for assuring the resultant operation.
- RKC assumes no responsibility for any of the following damage which the user or third party may suffer.
- Damage incurred as a result of using this product
- Damage caused by product failure which cannot be predicted by RKC
- Other indirect damage
- In order to use this instrument continuously and safely, periodic maintenance is required. Some of components and parts used in this instrument have a limited service life, or deteriorate over time.

1. PRODUCT CHECK

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

<table>
<thead>
<tr>
<th>CB400</th>
<th>CB500</th>
<th>CB700</th>
<th>CB900</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Control action**

F: PID action with autotuning (Reverse action)
D: PID action with autotuning (Direct action)
W: Heat/cool PID action with autotuning (Water cooling)  *1
A: Heat/cool PID action with autotuning (Air cooling)  *1

**Input type, Range code**

See “8. INPUT RANGE TABLE.”

**First control output [OUT1] (Heat-side)**

M: Relay contact T: Triac V: Voltage pulse 8 : Current (4 to 20 mA DC) G: Trigger (for triac driving)

**Second control output [OUT2] (Cool-side)**

No symbol: When control action is F or D M: Relay contact T: Triac V: Voltage pulse 8 : Current (4 to 20 mA DC)

**First alarm [ALM1], Second alarm [ALM2]**


**Communication function**

N: No communication function 5: RS-485 (2-wire system)

**Waterproof/dustproof construction**

N: No waterproof/dustproof construction 1: Waterproof/dustproof construction

**Case color**

N: Off-white A: Off-black

*1: No self-tuning function is provided in the W or A control action type.
*2: Heater break alarm cannot be specified in case of ALM1. Also, it isn’t possible to specify when control output is current output.
*3: As control loop break alarm, only either the first alarm or second alarm is selected.

**<Accessories>**

- Mounting bracket: 2 pieces  *1,*2
- Mounting screws (with hexagon nuts): 2 pieces  *1,*2
- Instruction manual [IMCB02-E5] (1 copy)

*1 CB400/CB500/CB700 waterproof/dustproof construction specification.: Same quantities as those on the above side also for waterproof/dustproof construction
*2 CB900 waterproof/dustproof construction spec.: 4 pieces

2. MOUNTING

2.1 Mounting cautions

(1) This instrument is intended to be used under the following environmental conditions. (IEC1010)

*OVERVOLTAGE CATEGORY II  *POLLUTION DEGREE 2

(2) Avoid the following when selecting the mounting location.

- Ambient temperature of less than 0 °C (32 °F) or more than 50 °C (122 °F).
- 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.
- Should be used indoors where the system is not exposed to direct sunlight.
- Heat to be accumulated radiation heat.

**Installation**

- This instrument is intended to be used under the following environmental conditions. (IEC1010)

- Ambient humidity of less than 45 % or more than 85 % RH.
- Rapid changes in ambient temperature which may cause condensation.
- Corrosive or inflammable gases.
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*1 CB400/CB500/CB700 waterproof/dustproof construction specification.: Same quantities as those on the above side also for waterproof/dustproof construction
*2 CB900 waterproof/dustproof construction spec.: 4 pieces

**Communication function**

- N: No communication function 5: RS-485 (2-wire system)

**Waterproof/dustproof construction**

- N: No waterproof/dustproof construction 1: Waterproof/dustproof construction

**Case color**

- N: Off-white A: Off-black

**<Accessories>**

- Mounting bracket: 2 pieces  *1,*2
- Mounting screws (with hexagon nuts): 2 pieces  *1,*2
- Instruction manual [IMCB02-E5] (1 copy)

*1 CB400/CB500/CB700 waterproof/dustproof construction specification.: Same quantities as those on the above side also for waterproof/dustproof construction
*2 CB900 waterproof/dustproof construction spec.: 4 pieces

**Second alarm [ALM2]**


**Communication function**

- N: No communication function 5: RS-485 (2-wire system)

**Waterproof/dustproof construction**

- N: No waterproof/dustproof construction 1: Waterproof/dustproof construction

**Case color**

- N: Off-white A: Off-black

**<Accessories>**

- Mounting bracket: 2 pieces  *1,*2
- Mounting screws (with hexagon nuts): 2 pieces  *1,*2
- Instruction manual [IMCB02-E5] (1 copy)

*1 CB400/CB500/CB700 waterproof/dustproof construction specification.: Same quantities as those on the above side also for waterproof/dustproof construction
*2 CB900 waterproof/dustproof construction spec.: 4 pieces

2. MOUNTING

2.1 Mounting cautions

(1) This instrument is intended to be used under the following environmental conditions. (IEC1010)

*OVERVOLTAGE CATEGORY II  *POLLUTION DEGREE 2

(2) Avoid the following when selecting the mounting location.

- Ambient temperature of less than 0 °C (32 °F) or more than 50 °C (122 °F).
- 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.
- Should be used indoors where the system is not exposed to direct sunlight.
- Heat to be accumulated radiation heat.

**Installation**

- This instrument is intended to be used under the following environmental conditions. (IEC1010)

- Ambient humidity of less than 45 % or more than 85 % RH.
- Rapid changes in ambient temperature which may cause condensation.
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- Direct vibration or shock to the mainframe.
- Water, oil, chemicals, vapor or steam splashes.
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- Excessive induction noise, static electricity, magnetic fields or noise.
- Direct air flow from an air conditioner.
- Should be used indoors where the system is not exposed to direct sunlight.
- Heat to be accumulated radiation heat.
2.2 Dimensions

![CB400 Diagram](image)

![CB500 Diagram](image)

![CB700 Diagram](image)

![CB900 Diagram](image)

1°: Rubber packing (option)

This instrument corresponds to a panel thickness of 1 to 10 mm.

2.3 Mounting procedures

1) Make a rectangular holes corresponding to the number of instruments to be mounted through the panel by referring to the panel cutout dimensions.

2) Insert the instrument into the panel from the panel cutout.

3) Insert the mounting bracket into the mounting groove of the instrument. (Fig.1)

4) Push the mounting bracket into the instrument until the instrument is firmly fixed to the panel. (Fig.2)

![Mounting bracket Diagram](image)

When mounting the instrument by tightening screw

5) After inserting the CB900 in the panel, fix it to the panel rear surface with the two mounting brackets so that the upper and lower mounting brackets are positioned diagonally.

NOTES

- The front of the instrument of the waterproof and dustproof construction type (CB900: mounting bracket 4 pieces) conforms to IP65 with the instrument mounted on the control panel. In order to assure the waterproof and dustproof properties, check that there is no dislocation of the packing nor clearance between the instrument and mounting frame with the instrument mounted.
- If the packing is damaged, contact your nearest RKC agent or our sales office.
- The instrument can also be mounted by tightening screws. Insert a hexagon nut in the mounting bracket according to the above procedure (Fig.3) to mount the bracket, then fix the instrument with the screw. Use the hexagon nuts and screws attached.
- CB900 is used in the above figures for explanation, but the same mounting procedures also apply to CB400/CB500/CB700.

3. Wiring

3.1 Wiring cautions

1) For thermocouple input, use the specified compensation wire.

2) For RTD input, use leads with low resistance and having no resistance differences among the 3 leads.

3) Conduct input signal wiring away from instrument power, electric equipment power and load lines to avoid noise induction.

4) Conduct instrument power wiring so as not to be influenced by noise from the electric equipment power. If the instrument may be affected by external noise, a noise filter should be used.
- Shorten the distance between twisted power supply wire pitches. The shorter the distance between the pitches, the more effective for noise reduction.
- Install the noise filter on the panel which is always grounded and minimize the wiring distance between the noise filter output side and the instrument power terminals.

5) Do not install fuses and/or switches on the filter output signal since this may lessen filter effect.
3.2 Terminal configuration

### CB400
- Control output terminals
- Triac: Voltage pulse
- Relay contact: NO
- W.A action types
- Current input: 0 to 20 mA DC
- Voltage input: 0 to 5 V DC
- RTD input: A
- TC input: B
- Communication terminals
- RS-485
- T/R(A)

### CB700
- Control output terminals
- Triac: Voltage pulse
- Relay contact: NO
- W.A action types
- Current input: 0 to 20 mA DC
- Voltage input: 0 to 5 V DC
- RTD input: A
- TC input: B
- Communication terminals
- RS-485
- T/R(A)

### CB900
- Control output terminals
- Triac: Voltage pulse
- Relay contact: NO
- W.A action types
- Current input: 0 to 20 mA DC
- Voltage input: 0 to 5 V DC
- RTD input: A
- TC input: B
- Communication terminals
- RS-485
- T/R(A)

### Specifications
- **Power supply voltage:** 90 to 264 V AC [including power supply voltage variation] (Power frequency: 50/60 Hz) (Rating: 100 to 240 V AC)
  - 21.6 to 26.4 V AC (Rating: 24 V AC)
  - 21.6 to 26.4 V DC (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)
- **Alarm output rated:** Relay contact output: 250 V AC, 1A (Resistive load)
- **Control output rated:** Relay contact output: 250 V AC, 3A (Resistive load)
- **Voltage pulse output:** 0/12 V DC (Load resistance 600 Ω or more)
- **Current output:** 4 to 20 mA DC (Load resistance 600 Ω or less)
- **Trigger output (for triac driving):** Zero cross method for medium capacity triac driving (100 A or less)
- **Load voltage used:** 100 V AC line, 200 V AC line
- **Load used:** Resistive load
- **Triac output:** 0.5 A (Ambient temperature 40 °C or less)
- **Weight:**
  - Approx. 250g (CB400, CB500)
  - Approx. 290g (CB700)
  - Approx. 340g (CB900)

**NOTE**

The terminal arrangement of CB500 is as shown in the following diagram, but the terminal configuration of CB500 is the same as that of CB400.
4. NAME OF PARTS

![Diagram of CB400, CB500, and CB700,CB900]

1. Measured value (PV) display unit [Green]
   - Displays measured value (PV).
   - Displays various parameter symbols depending on the instrument.
2. Set value (SV) display unit [Orange]
   - Displays set value (SV).
   - Displays various parameters set value (or CT input value) depending on the instrument.
3. Indication lamps
   - Alarm output lamps (ALM1, ALM2) [Red]
     - ALM1: Lights when first alarm output is turned on.
     - ALM2: Lights when second alarm output is turned on.
   - Autotuning (AT) lamp [Green]
     - Flashes during autotuning execution.
   - Control output lamps (OUT1, OUT2) [Green]
     - OUT1: Lights when control output is turned on. **
     - OUT2: Lights when cool-side control output is turned on. **
   - Lamp indication becomes as follows for continuous output.
     - For an output of less than 100 %: Extinguished
     - For an output of more than 100 %: Lit
     - For an output of more than 0 % but less than 100 %: Dimly lit.

5. SETTING

5.1 Calling up procedure of each mode

![Diagram of calling up procedure]

*1. Input type and input range display
This instrument immediately confirms input type and range following power on.
Example: For a controller with the K thermocouple input type and range from 0 to 1372 °C.

PV: Input symbol
SV: Engineering unit.
[°C : °F]

5.2 Detail of each mode

- PV/SV display mode
  Display measured value (PV) on the PV display unit and set value (SV) on the SV display unit. Usually the control is set to this mode excepting that the set value (SV) and/or the parameter set value are changed.
  In addition, in this mode, RUN/STOP can be selected.

- SV setting mode
  This is the mode used to set the set value (SV).
  Factory set value: 0 °C [=°F] or 0.0 °C [=°F]

- Parameter setting mode
  This is used to set the various parameters such as alarms, PIDs, constants, etc.
  The following parameter symbols are displayed one by one every time the SET key is pressed.

- Communication setting mode
  This is the mode to conduct settings relating to the communication function. It is displayed for the instrument with the communication function. For details on protocol, identifiers and communication setting mode, see the separate instruction manual for “Communication” (IMCB03-ED).
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>#1: Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT1</td>
<td>Current transformer input 1 (CT1)</td>
<td>0.0 to 100.0 A [Only display]</td>
<td>Display input value from the current transformer. [Displayed only when the instrument has the heater break alarm ]</td>
<td></td>
</tr>
<tr>
<td>AL1</td>
<td>First alarm (ALM1)</td>
<td>Deviation alarm, Process alarm, SV alarm:</td>
<td>Set the first alarm set value and second alarm set value.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-1999 to +9999 °C [°F] or</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-199.9 to +999.9 °C [°F]</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>For voltage/current inputs:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Deviation alarm:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-span to +span (Within 9999)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Process alarm, SV alarm:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Same as input range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AL2</td>
<td>Second alarm (ALM2)</td>
<td>Alarm differential gap:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Temperature input:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 or 2.0 °C [°F]</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Voltage/current inputs:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2 % of span</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HBA</td>
<td>Heater break alarm 1 (HBA)</td>
<td>0.0 to 100.0 A</td>
<td>Alarm value is set by referring to input value from the current transformer (CT). Used only for single-phase.</td>
<td></td>
</tr>
<tr>
<td>LBA</td>
<td>Control loop break alarm</td>
<td>0.1 to 200.0 min.</td>
<td>Set control loop break alarm set value.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(LBA)</td>
<td>(0.0 can not be set.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LBD</td>
<td>LBA deadband (LBD)</td>
<td>Temperature input:</td>
<td>Set the area of not outputting LBA. No LBA deadband functions with &quot;0&quot; set.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 to 9999 °C [°F]</td>
<td>Differential gap :</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Voltage/current inputs:</td>
<td>Temperature input: 0.8 °C [°F]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 to 100 % of span</td>
<td>Voltage/current inputs 0.8 % of span</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>Autotuning (AT)</td>
<td>0: AT end or AT suspension</td>
<td>Turns the autotuning ON/OFF.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1: AT start</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST</td>
<td>Self-tuning (ST)</td>
<td>0: ST suspension</td>
<td>Turns the self-tuning ON/OFF.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1: ST start</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Proportional band (P)</td>
<td>Temperature input:</td>
<td>Set when PI, PD or PID control is performed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1(0.1) to span or 9999(999.9) °C [°F]</td>
<td>For heat/cool PID control on the heat-side.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Voltage/current inputs:</td>
<td>*ON/OFF action control when set to &quot;0(0.0).&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 to 100 % of span</td>
<td>Differential gap :</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Temperature input 2 or 2.0 °C [°F]</td>
<td>Voltage/current inputs 0.2 % of span</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Temperature input 30(30.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Voltage/current inputs: 3.0</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Integral time (I)</td>
<td>1 to 3600 sec</td>
<td>Set the time of integral action which eliminates the offset occurring in proportional control.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>*PD control when set to 0 sec.</td>
<td></td>
<td>240</td>
</tr>
<tr>
<td>D</td>
<td>Derivative time (D)</td>
<td>1 to 3600 sec</td>
<td>Set the time of derivative action which prevents ripples by predicting output changes and thus improves control stability.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>*PI control when set to 0 sec.</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>AR</td>
<td>Anti-reset windup (ARW)</td>
<td>1 to 100 % of heat-side proportional band.</td>
<td>Overshooting and undershooting are restricted by the integral effect.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>0</strong> setting: integral action OFF</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>T</td>
<td>Heat-side proportioning cycle (T)</td>
<td>1 to 100 sec (0 can not be set.)</td>
<td>Set control output cycle.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>*Not displayed if the control output is current output.</td>
<td>For heat/cool PID control:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>See *3.</td>
<td>Heat-side proportioning cycle</td>
<td></td>
</tr>
<tr>
<td>Pc</td>
<td>Cool-side proportional band (Pc)</td>
<td>1 to 1000 % of heat-side proportional band. (0 can not be set.)</td>
<td>Set cool-side proportional band when heat/cool PID action.</td>
<td></td>
</tr>
<tr>
<td>db</td>
<td>Deadband (db)</td>
<td>Temperature input:</td>
<td>Set control action deadband between heat-side and cool-side proportional bands. Minus (-) setting results in overlap.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-10 to +10 °C [°F]</td>
<td></td>
<td>0 or 0.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or -10.0 to +10.0 °C [°F]</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Voltage/current inputs:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-10.0 to +10.0 % of span</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Continued on the next page.)
**#1: Factory set value**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(E)</td>
<td>Cool-side proportioning cycle ((t))</td>
<td>1 to 100 sec (0 can not be set.) *Not displayed if the control output is current output.</td>
<td>Set control cool-side output cycle for heat/cool PID action.</td>
</tr>
<tr>
<td>(P_b)</td>
<td>PV bias ((P_b))</td>
<td>Temperature input: -1999°C to +9999°C [°C] or -199.99 to +999.9°C [°F] Voltage/current inputs: -span to +span</td>
<td>Sensor correction is made by adding bias value to measured value (PV).</td>
</tr>
<tr>
<td>(LCE)</td>
<td>Set data lock function (LCK)</td>
<td>See <em>5.</em></td>
<td>Performs set data change enable/disable.</td>
</tr>
</tbody>
</table>

**NOTE**

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

*1: Precautions for heater break alarm (HBA) setting*
- Displayed only for when HBA is selected as second alarm.
- HBA is not available on a current output.
- Set HBA set value to a value about 85% of current transformer input value (CT). However, when power supply variations are large, set the HBA to a slightly smaller value. In addition, when two or more heaters are connected in parallel, set the HBA to a slightly larger value so that it is activated even with only one heater is broken (However, within the value of CT).
- When the HBA set value is set to “0.0” or the current transformer is not connected, the HBA is turned on.

*2: Precautions for control loop break alarm (LBA) setting*
- Displayed only for when LBA is selected as first alarm or second alarm.
- Usually set the set value of the LBA to a value twice the integral time (I).
- No control loop break alarm can be used at heat/cool PID control action.
- No LBA function is activated while the AT function is activated.
- The LBA function is activated only at the 0% or 100% of PID computed value. Therefore, the time from trouble occurrence till the activation of the LBA function equals the time until the PID computed value becomes 0% or 100% plus the LBA setting time.
- If LBA setting time is too short or does not match the controlled object, the LBA may be turned on and off or not be turned on. In this case, depending on the situation, change the LBA setting time.

*3: Relay contact output : 20 sec, Voltage pulse output/Trigger output for triac driving/Triac output : 2 sec

*4: Relay contact output : 20 sec, Voltage pulse output/Triac output : 2 sec

*5: Details of set data lock level selection*

<table>
<thead>
<tr>
<th>Setting</th>
<th>Details of lock level</th>
<th>Setting</th>
<th>Details of lock level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>SV and parameter can be set.</td>
<td>0011</td>
<td>Only SV can be set.</td>
</tr>
<tr>
<td>0001</td>
<td>Only SV and alarms (ALM1, ALM2) can be set.</td>
<td>0101</td>
<td>Only alarms (ALM1, ALM2) can be set.</td>
</tr>
<tr>
<td>0010</td>
<td>Only setting items other than alarms (ALM1, ALM2) can be set.</td>
<td>0110</td>
<td>Only setting items other than SV and alarms (ALM1, ALM2) can be set.</td>
</tr>
<tr>
<td>0100</td>
<td>Only setting items other than SV can be set.</td>
<td>0111</td>
<td>SV and parameter cannot be set.</td>
</tr>
</tbody>
</table>

- Each locked setting item can only be monitored.
- Each alarm setting item [HBA, LBA, LBD] can be locked when any of “0001,” “0011,” “0101” and “0111” is set.

5.3 Parameter setting procedure

**Key operational cautions**

- Even if the displayed value is changed, it is not registered. To register it, press the SET key.
- If the key is not operated for more than 1 minute, the present mode returns to the PV/SV display mode.

**Setting set value (SV)**

1. Set to the SV setting mode
2. Shift of the digit brightly lit
3. Numeric value change
4. Set value entry

Example: Following is an example of set value (SV) to 200 °C

- Press the SET key to enter the SV setting mode. The digit which light brightly is settable.
- Press the \(<R/S>\) key to shift the digit which lights brightly up to the hundreds digit.
- Press the UP key to set “2.” Pressing the UP key increase numerals, and pressing the DOWN key decrease numerals.
- After finishing the setting, press the SET key. All of the set value digits light brightly and as a result the instrument returns to the PV/SV display mode.

**Setting parameters other than set value (SV)**

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

6.1 Operation procedures

- **CAUTIONS**
  - Connect the input signal wiring, and then turn on the power. If the input signal wiring opens, the instrument judges the input is disconnected.
  - Upscale: TC input, RTD input (Downscale when the input is shorted.)
  - Downscale: TC input (To be specified when ordering), Voltage input (Current input)
  - "1: Alarm output ON (However, for the W or A control action type, the control output on both heat-side and cool-side is turned off.)
  - "2: For 0 to 5 V DC or 0 to 20 mA DC, both control and alarm outputs are indefinite.
  - No influence is exerted upon the instrument for power failure of 20 ms or less. For power failure of more than 20 ms, the instrument performs the same operation as that at the time of power on after power recovery (This applies only when alarm action is turned off).
  - The alarm hold action is activated when not only the power is turned on, but also the SV is changed.

6.2 Set data lock (LCK) function

The set data lock function is used to prevent misoperation by not setting any parameter which is not used frequently. The parameter thus locked cannot be set or changed, but can only be monitored.

6.3 Autotuning (AT) function

The AT function automatically measures, computes and sets the optimum PID and LBA constants. This function is activated after ON, during temperature rise and/or when control is stabilized from any process state.

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

- **Requirements for AT suspension**
  - When the SV is changed.
  - When the PV bias value is changed.
  - When the PV becomes abnormal. (According to the burnout.)
  - When the power is turned on.
  - When a power failure longer than 20 ms occurs.
  - When the AT function does not end in about 9 hours after tuning started.

- **NOTES**
  - If the AT suspension condition is established, the AT function is immediately suspended to be changed to PID control. The PID and LBA constants at this time are the same as before starting AT. In addition, even if the AT is completed, it is automatically transferred to PID control.
  - If any problems arise due to hunting exists in the control system, do not use the AT function. In this case, set each value to match the controlled object.

6.4 Self-tuning (ST) function

The ST function is used to automatically calculate and set adaptive PID constants anytime when the power is turned on; the SV is changed or the control system becomes oscillatory as the characteristic of the controlled system varies.

- **Requirements for ST start**
  - Start ST when all the following conditions is satisfied: The instrument should be in PID control. (P≠0, I≠0, D≠0 and ARW≠0.)

- **Requirements for ST stop**
  - The ST function is stopped if any of the following conditions is established:
    - When PV is out of the input range
    - When the AT function is activated.
    - When the power is turned off.

- **NOTES**
  - If the operation state is changed from the "RUN" to "STOP," the ST function re-starts from the stop state.
  - When control action is in heat/cool PID action, the ST function is not activated.
  - The PID and ARW settings cannot be changed while the ST function is being activated. However, they can only be monitored.
7. DISPLAY AT ERROR OCCURRENCE

- Error display
  - **Err**

- RAM failure (Incorrect set data write, etc.)
  - Please contact us or your nearest RKC agent.

- Overscale and Underscale
  - **0000**
    - Measurement value (PV) (Flashing)
      - Measured value (PV) exceeds the input range.
    - **UUUU**
      - Measured value (PV) exceeds the low input display range limit.

- **WARNING**
  - In order to prevent electric shock, prior to replacing the sensor, always turn off the power.
  - Sensor or input lead check.

8. INPUT RANGE TABLE

<table>
<thead>
<tr>
<th>Input type</th>
<th>Model code</th>
<th>Input type</th>
<th>Model code</th>
<th>Input type</th>
<th>Model code</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>200 01</td>
<td>0 to 200 C</td>
<td>K 02</td>
<td>0 to 400 C</td>
<td>K 03</td>
</tr>
<tr>
<td></td>
<td>0 to 500 C</td>
<td>K 04</td>
<td>0 to 200 C</td>
<td>K 05</td>
<td>0 to 200 C</td>
</tr>
<tr>
<td></td>
<td>0 to 200 C</td>
<td>K 06</td>
<td>0 to 400 C</td>
<td>K 07</td>
<td>0 to 400 C</td>
</tr>
<tr>
<td></td>
<td>0 to 400 C</td>
<td>K 08</td>
<td>0 to 600 C</td>
<td>K 09</td>
<td>0 to 600 C</td>
</tr>
<tr>
<td></td>
<td>0 to 800 C</td>
<td>K 10</td>
<td>0 to 800 C</td>
<td>K 11</td>
<td>0 to 800 C</td>
</tr>
<tr>
<td>J</td>
<td>0 to 200 F</td>
<td>J 01</td>
<td>0 to 200 F</td>
<td>J 02</td>
<td>0 to 200 F</td>
</tr>
<tr>
<td></td>
<td>0 to 400 F</td>
<td>J 03</td>
<td>0 to 400 F</td>
<td>J 04</td>
<td>0 to 400 F</td>
</tr>
<tr>
<td></td>
<td>0 to 600 F</td>
<td>J 05</td>
<td>0 to 600 F</td>
<td>J 06</td>
<td>0 to 600 F</td>
</tr>
<tr>
<td></td>
<td>0 to 800 F</td>
<td>J 07</td>
<td>0 to 800 F</td>
<td>J 08</td>
<td>0 to 800 F</td>
</tr>
<tr>
<td></td>
<td>0 to 800 F</td>
<td>J 09</td>
<td>0 to 800 F</td>
<td>J 10</td>
<td>0 to 800 F</td>
</tr>
</tbody>
</table>

9. HOW TO PULL OUT 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 circuit board.

- **NOTES**
  - Unlocking points (marked with “O”) depend on the model as follows:
    - CB500
    - CB700
    - CB900
  - Recommended tool: Minus-headed screwdriver (Recommended, head width: 6mm or less) 6mm

To conform to **IEC1010** requirements, this instrument has been designed so that the internal assembly can be pulled out by using an appropriate tool for protection from an electric shock.