Safety information

Alerts declared in the manual are classified as Danger, Warning, and Caution by their criticality.

**Danger**
- Indicates an extremely hazardous situation which, if not avoided, will result in death or serious injury.

**Warning**
- Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

**Caution**
- Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

**Danger**

The electric shock may occur in the input/output terminal so please never let your body and/or conductive substance to be contacted by the input/output terminals.

**Warning**

- Always use the product with the correct input/output voltages.
- Do not exceed the rated input/output currents.
- Do not overload the product.
- Do not tamper with the internal components.
- Do not disassemble or repair the product unless authorized by the manufacturer.

**Caution**

- The contents of this manual may be changed without prior notification.
- Always use the correct input/output voltages.
- Always use the correct input/output currents.
- Always use the correct input/output frequencies.
- Always use the correct input/output phases.
- Always use the correct input/output impedances.
- Always use the correct input/output waveforms.

**Suffix code**

<table>
<thead>
<tr>
<th>Model</th>
<th>Code</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX</td>
<td>-</td>
<td>Digital temperature controller</td>
</tr>
<tr>
<td>2</td>
<td>AX2</td>
<td>48 X 96 mm</td>
</tr>
<tr>
<td>3</td>
<td>AX3</td>
<td>96 X 48 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dimension</td>
</tr>
<tr>
<td>4</td>
<td>AX4</td>
<td>48 X 48 mm</td>
</tr>
<tr>
<td>7</td>
<td>AX7</td>
<td>72 X 72 mm</td>
</tr>
<tr>
<td>9</td>
<td>AX9</td>
<td>96 X 96 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Output selection</td>
</tr>
<tr>
<td>2</td>
<td>SS2</td>
<td>Relay 1 + Relay2</td>
</tr>
<tr>
<td>2</td>
<td>SS2</td>
<td>Relay 1 + Relay2 + Relay3</td>
</tr>
<tr>
<td>4</td>
<td>4-20 mA + Relay2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4-20 mA + Relay2 + Relay3</td>
<td></td>
</tr>
</tbody>
</table>

**Performance**

- Display accuracy: ±0.3 % of F.S. ±1 digit
- Insulation resistance: More than 20 MΩ, 500 VAC for 1 min (Primary terminal-Secondary terminal)
- Breakdown voltage: 2000 VAC, 50/60 Hz, for 1 min (Primary terminal-Secondary terminal)

**Range and input code**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Code</th>
<th>Input type</th>
<th>Range (°C)</th>
<th>Range (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermocouple</td>
<td>J</td>
<td>K</td>
<td>-196 ~ 1200</td>
<td>-321 ~ 2120</td>
</tr>
<tr>
<td></td>
<td>J</td>
<td>R</td>
<td>-196 ~ 1200</td>
<td>-321 ~ 2120</td>
</tr>
<tr>
<td></td>
<td>J</td>
<td>T</td>
<td>-196 ~ 1200</td>
<td>-321 ~ 2120</td>
</tr>
<tr>
<td>RTD</td>
<td>Pt100</td>
<td>T</td>
<td>-196 ~ 1200</td>
<td>-321 ~ 2120</td>
</tr>
</tbody>
</table>

**Control function and output**

- Control type: PID control, P control, ON/OFF control
- Auto-tuning: PID operation by the auto-tuning
- ON/OFF control: When PV SV, generates 0% output, When PV SV, generates 100% output (Only when control 0=0)
- Manual reset: Limits the output range 0 to 100%
- Control output operation: Direct action/Reverse action (selected by the parameter setting)

* Relay output operates as control output, alarm output and LB output depending on the external parameter setting.
Relay
- Relay output can be selected maximum 3 and relay control output is displayed as RL1Y.
- Alarm output 2 contacts (AL1, AL2) and LBA output are assigned by the user among RL1Y, RL2Y and RL13

S.S.R
- 4~20 mA
- Accuracy: 0.5% of F.S, Ripple Up-p: 0.3% of F.S, Resistance load : Max 600 Ω

<table>
<thead>
<tr>
<th>Model</th>
<th>AX2</th>
<th>AX3</th>
<th>AX4</th>
<th>AX7</th>
<th>AX9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply voltage</td>
<td>100~240 V a.c 50/60 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage fluctuation</td>
<td>±10% of power supply voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>5.5 VA max</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-5~50 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>35~85% RH (But without dew condensation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration (resistance)</td>
<td>10~55 Hz, 0.75 m, X, Y, Z each in X, Y and Z directions for 2 hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock (resistance)</td>
<td>300 m/s² to 6 directions each 3 times</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>320 g</td>
<td>320 g</td>
<td>180 g</td>
<td>300 g</td>
<td>400 g</td>
</tr>
</tbody>
</table>

Function and name of each part
- Operation indicators
  - ① Process value (PV)
  - ② Set value (SV)
  - ③ Up Key
  - ④ Down Key
  - ⑤ Shift Key
  - ⑥ Mode Key
  - ⑦ Operation indicators

Main function explanation

**Input type selection (Sensor type selection)**
- AX series is designed as multi input type so users can select the desired sensor among thermocouple K, thermocouple J, thermocouple R, thermocouple T and RTD (ΩΩΩΩΩΩ) depending on the input selecting parameter of operating setting mode disregarding the suffix code.

**Control output selection**
- AX series is divided into the SSR output and relay output or "current output" depending on the suffix code. In case of when suffix code is AX01 or AX02, please select the SSR or relay output in the "control output type" of "εεεεεεεε" of the operating setting mode and use it. However, when SSR control output is selected, users can able to assign the relay 1 (RL1Y output as the alarm output (alarm1 output, alarm2 output, LBA output). In case of when suffix code is AX03 or AX04, control output is fixed as the current output (4~20 mA dc).

<table>
<thead>
<tr>
<th>Model</th>
<th>Control output</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX01 or AX02</td>
<td>SSR or Relay(RLY 1)</td>
<td>Selected depending on the internal parameter(But, Able to assign the relay 1 as alarm output, when SSR output is selected)</td>
</tr>
<tr>
<td>AX03 or AX04</td>
<td>Current output (4~20 mA dc)</td>
<td>Fixed</td>
</tr>
</tbody>
</table>

- Heating/Cooling output action selection
  - Able to select the reverse action (heating control) or direct action (cooling control) output by the \( \text{εεεεεεεε} \) parameter.

- PID auto tuning (AT) function
  - Auto tuning function measures, compute and sets the optimum PID or ARR constant automatically. After supplying power in and while temperature is increasing, press the set key at 5 and 6 key synchronously for 2 sec, to begin the auto tuning. When auto tuning is finished, tuning operation will be ended automatically.

- ON/OFF control setting method
  - Usually temperature controller performs the temperature control by "PID control method" which is done by the AT auto tuning. However, ON/OFF control method is used when controlling the refrigerating, fan, solenoid valve and etc. When users want to set the temperature controller as ON/OFF control mode, set the setting value of proportional band as \( \text{εεεεεεεε} \) within the "general setting parameter". Here, \( \text{εεεεεεεε} \) (hysteresis) parameter will be displayed. Prevent such action to occur by selecting the desired ON/OFF action range.

- On/Off display
  - When input break (sensor break) occurs or exceeds the maximum temperature range, \( \text{εεεεεεεε} \) will be displayed in the measured value displaying unit.

- Alarm
  - Using the alarm
  - AX series supports two independent alarms (AL1 and AL2). These alarms can allocate AL1 or AL2 signal in the Y1Y, Y2Y and Y3Y and be used. If alarm signal is not allocated in the Y1Y to Y3Y then the menu related to the alarm will not be displayed.
  - Alarm hold action
    - If there is no standby action function, supply the power in then the LOW alarm will become ON while temperature is increasing.
    - In order to prevent the low alarm to become ON during temperature is increasing, add the standby action function so from the point when supplying power is until the value goes beyond the set value, it can prevent the low alarm to be operated.

- LBA (Loop Break Alarm)
  - LBA function starts to measure time from the moment when the PID computed value becomes 0 % or 100 %. Also, if this point, this function detects heater break, sensor break, manipulator malfunction and etc by comparing the changed amount of measured value in each set time. Also, it can set the LBA dead band in order to prevent any malfunction to happen in the normal control loop.
  - When control output value which obtained by PID operation is 100 %, if the temperature decreases more than \( \text{εεεεεεεε} \) within the LBA set time, LBA output will become ON.
  - When control output value which obtained by PID operation is 0 %, if the temperature decreases more than \( \text{εεεεεεεε} \) within the LBA set time, LBA output will become ON.

- Timeshare cycle control and phase control of Voltage pulse output
  - When selecting the control output type as SSR, users will be able to select the types for voltage pulse output. The timeshare cycle control turns ON/OFF the output by proportioning the certain time to an output amount in cycle. Set the cycle of control output in the \( \text{εεεεεεεε} \) parameter.

- Within the half cycle of power wave shape, the phase control (depending on an output amount) controls an output amount by computing the output ON phase. However, when using the phase control, users must use the RANDOM ON/OFF type SSR.
**Parameter composition**

- **Operation mode**
  - Supplying power after finishing wiring will display the current temperature. Pressing the key will display the set temperature and output amount alternatively on the set value (SV) display unit.

- **User setup mode**
  - User setup mode is the setting mode that sets the set value that is changed by users frequently such as alarm set value and loop break alarm (LBA). It makes the parameter of user setup mode to be displayed on the setup operation mode that allows users to set easily (divided the setting level).

- **SV setting**
  1. In Operator Setup Mode, When the value of Suv parameter is , you can change the value with and press the key to set up.
  2. In Operator Setup Mode, When the value of Suv is , you can change the value in Suv parameter with and Press key to set up.