“Notice”

Please ensure that this instruction manual is given to the final user of the instrument.

Preface

This instruction manual is meant for those who will be involved in the wiring, installation, operation and routine maintenance of the SR73A and 74A series. This manual describes the care, installation, wiring, function, and proper procedures for the operation of SR73A and 74A series. Keep this manual at the work site during operation of the SR73A and 74A series. While using this instrument, you should always follow the guidance provided herein.

For matters regarding safety, potential damage to equipment and/or facilities, additional instructions are indicated by the following headings:

⚠️ WARNING
Exercise extreme caution as indicated. This heading indicates hazardous conditions that could cause injury or death of personnel.

⚠️ CAUTION
Exercise extreme caution as indicated. This heading indicates hazardous conditions that could cause damage to equipment and/or facilities.

NOTE
This heading indicates additional instructions and/or notes.
The mark ☢️ designates a protective conductor terminal. Make sure to properly ground it.

The Matters regarding Safety

⚠️ WARNING
SR73A and 74A series controllers are designed for controlling temperature, humidity and other physical subjects. It must not be used in any way that may adversely affect the safety, health or working conditions of those who come into contact with the effects of its usage. When used, adequate and effective safety countermeasures must be provided at all times. No warranty, express or implied, is valid in the case of usage without having implemented proper safety countermeasures.

⚠️ CAUTION
To avoid damage to the connected equipment, facilities or the product itself due to a fault of the product, safety countermeasure must be taken before usage, such as proper installation of the fuse and the overheating protection device. No warranty, express or implied, is valid in the case of usage without having implemented proper safety countermeasures.
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1. Introduction

1-1. Check before use

This product has been fully checked for quality assurance prior to shipment. Nevertheless, you are requested to make sure that there is no error, damage or shortage of delivered items by confirming the model codes and checking the external view of the product and the number of accessories.

Confirmation of Model Codes:
Check the model codes stuck to the case of the product to ascertain if the respective codes designate what was specified when you ordered the product, referring to the following code table:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Series</td>
</tr>
<tr>
<td>2</td>
<td>Input</td>
</tr>
<tr>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>4</td>
<td>Optional function</td>
</tr>
<tr>
<td>5</td>
<td>Communication function</td>
</tr>
<tr>
<td>6</td>
<td>Remarks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR73A and 74A</td>
<td></td>
</tr>
<tr>
<td>AT (Auto tuning)</td>
<td></td>
</tr>
<tr>
<td>Alarm + Heater break alarm (30, 0A)</td>
<td></td>
</tr>
<tr>
<td>Alarm + Heater break alarm (30, 0A) + Set value bias</td>
<td></td>
</tr>
<tr>
<td>Alarm + Heater break alarm (30, 0A) + Set value bias</td>
<td></td>
</tr>
<tr>
<td>Alarm + Heater break alarm (0<del>5V input, corresponding to 0</del>500A)</td>
<td></td>
</tr>
<tr>
<td>Alarm + Heater break alarm (0~5V input) + set value bias</td>
<td></td>
</tr>
</tbody>
</table>

Checking accessories:
Instruction manual 1 set
Unit decal 1 sheet
Current transformer (CT) for heater break alarm:
included with the heater break alarm option (Except when 0~5V DC input has been selected, though.)
TYPE CTL-6 for 30A selection
TYPE CTL-12-36-8 for 30A selection

Note: Contact our representative concerning any problems with the product, accessories or related items.

1-2. Caution for use
(1) Avoid operating keys of the front panel with hard or sharp objects or motions. Lightly touch the operating keys with finger tip for operation.
(2) Avoid using solvents such as thinner; wipe gently with a dry cloth.

2. Installation and wiring

2-1. Installation site (environmental conditions)

In the case where there is an intention to operate this product at one of the following sites, be aware that the occurrence of fire and/or other dangerous situations is considerable. Exercise caution and avoid these places when selecting an operational site:

(1) Where flammable gas, corrosive gas, oil mist and particles that can deteriorate electrical insulation are generated or are abundant.
(2) Where the temperature is below -10 °C or above 50 °C.
(3) Where the relative humidity is 90% RH or below dew point.
(4) Where highly intense vibration or impact is generated or transferred.
(5) Near high voltage power lines or where inductive interference can affect the operation of the product.
(6) Dew drops or direct exposure to sun light.
(7) Where the elevation is in excess of 2,000 m.

**Note:** The environmental conditions belong to the installation category II of IEC 664 and the degree of pollution is 2.

### 2-2. Mounting

1. Machine the mounting hole by referring to panel cutout in section 2-4.
2. Applicable thickness of the mounting panel is from 1.0 to 3.5 mm.
3. As this product provides mounting fixture, insert the product from the front panel for installation.

### 2-3. How to remove the instrument out of the case

**CAUTION**

When the instrument is removed/replaced in the case, make sure the power is off. If it is done while the power is on, it may lead to problems with the product and/or other problems.

There is no need to remove your SR73A and 74A series controllers out of the case. Nevertheless, should the need arise, for example, for replacement, follow the steps described below:

- Insert a minus screwdriver of 6mm ~ 9mm into the opening (where packing is exposed) of the front case and rotate the screwdriver while pushing up the lock lever behind the packing. Once the instrument comes out by a few millimeters, you can remove it by hand.

### 2-4. External dimensions and panel cutout

- **SR73A External dimensions**
- **SR73A Panel cutout**

- **SR74A External dimensions**
- **SR74A Panel cutout**

### 2-5. Wiring

**WARNING**

- Always disconnect this product from any power source during wiring operation to prevent electrical shock.
- Be certain that the protective conductor terminal (      ) is properly grounded. Otherwise, a serious electric shock may result.
- Avoid touching the wired terminal and charged devices while supplying power.

1. Wiring operation should be done according to the instruction for the terminal arrangement in section 2-6. Exercise care that no wrong connection is made.
2. Crimp terminal should accommodate the M3.5 screw and should have a width of less than 7mm.
3. For thermocouple input, select the compensation wire suitable to the thermocouple type.
4. For R. T. D. input, leads should be less than 5Ω in resistance and three leads should have the same resistance.
5. Input signal line should be conducted safely apart from the high voltage power line.
6. Shield wiring (single point grounding) is effective for static induction noise.
7. Short interval twisted pair wire for input signal is effective for electromagnetic induction noise.
8. For power line, use wire or cable which is 1mm² or more in sectional area and of which the performance is equal to or higher than that of 600V vinyl insulated wire.
9. Earth grounding should be performed with earth resistance less than 100Ω and with wire thicker than 2mm².

### 2-6. Terminal arrangement

- **SR73A**

- **SR74A**

### Dimension of current transformer (CT) for heater break alarm

- For 0-30A (CTL-6-S)
- For 0-50A (CTL-12-S36-8)

- **(unit : mm)**

**Note:**

The environmental conditions belong to the installation category II of IEC 664 and the degree of pollution is 2.
2-7. Terminal arrangement table

<table>
<thead>
<tr>
<th>Name of terminal and description</th>
<th>Terminal number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power terminal</td>
<td></td>
</tr>
<tr>
<td>100-260V AC±10% 50/60Hz 12VA</td>
<td>10-12</td>
</tr>
<tr>
<td>Protective conductor terminal</td>
<td>13</td>
</tr>
<tr>
<td>R. T. D. A, Thermocouple, Voltage, Current +</td>
<td>7</td>
</tr>
<tr>
<td>R. T. D. B, Thermocouple, Voltage, Current –</td>
<td>8</td>
</tr>
<tr>
<td>R. T. D. B</td>
<td>10</td>
</tr>
<tr>
<td>Input terminal</td>
<td></td>
</tr>
<tr>
<td>Contact: COM, SSR Drive voltage, Voltage, Current +</td>
<td>14</td>
</tr>
<tr>
<td>Contact: NO, SSR Drive voltage, Voltage, Current –</td>
<td>15</td>
</tr>
<tr>
<td>Contact: NC</td>
<td>16</td>
</tr>
<tr>
<td>Communication terminal</td>
<td></td>
</tr>
<tr>
<td>For RS-422A</td>
<td>1</td>
</tr>
<tr>
<td>For RS-485</td>
<td>2</td>
</tr>
<tr>
<td>SG</td>
<td>3</td>
</tr>
<tr>
<td>SD+</td>
<td>4</td>
</tr>
<tr>
<td>SD-</td>
<td>5</td>
</tr>
<tr>
<td>RD+</td>
<td>6</td>
</tr>
<tr>
<td>RD-</td>
<td>7</td>
</tr>
<tr>
<td>Alarm output (option) terminal</td>
<td></td>
</tr>
<tr>
<td>COM Contact rating 240V AC 1.5A (resistive load)</td>
<td>18</td>
</tr>
<tr>
<td>AH Higher limit alarm</td>
<td>19</td>
</tr>
<tr>
<td>AL/HB Lower limit alarm or heater break alarm</td>
<td>20</td>
</tr>
<tr>
<td>Set value bias (option) input terminal</td>
<td>21-22</td>
</tr>
<tr>
<td>Heater break alarm (option) CT input terminal</td>
<td>23-24</td>
</tr>
</tbody>
</table>

Note: For Thermocouple, Voltage, and Current input, measurement error results by connection between B and B terminal.

3. Instruction for front panel

3-1. Drawing and the name of the parts

This is an example of the front panel of SR73A.

Name of parts

1: Measured value (PV) display
2: Set value (SV) display
3: Monitor LED
4: Key switches

3-2. Instruction for front panel

1: Measured value (PV) display (green)
   - Displays current measured value on the mode 0 basic screen.
   - Displays parameter type on each parameter screen.

2: Set value (SV) display (orange)
   - Displays set value on the mode 0 basic screen.
   - Displays selected item and set value on each parameter screen.

3: Monitor LED
   - OUT (output) monitor LED (green)
     - For contact or SSR drive voltage output, a light turns on for output ON and turns off for output OFF.
     - For current or voltage output, the light intensity changes proportionally to the output altitude.
   - AT (auto tuning) monitor LED (green)
     - On selection by , ON turns on AT waiting key, flashes on AT execution.
   - AH alarm output monitor LED (red)
     - Turns on for higher limit alarm output ON.
   - AL/HB alarm output monitor LED (red)
     - Turns on for lower alarm output ON or heater break alarm ON.
   - MAN (manual control output) monitor LED (green)
     - Flashes when control output is in manual operation.
   - STBY (control output stop) monitor LED (green)
     - Turns on when the control output stop mode is selected.
   - COM (communication) monitor LED (green)
     - Turns on when the remote communication mode is selected.

4: Key switches

1: (parameter) key
   - Press on set screen to move to next set screen.
   - Keep pressing three (3) seconds for function of move key between basic screen of the mode 0 screen group and direct call screen of mode 1 screen group.

2: (down) key
   - Press on the set screen to flash the point of the least digit and to reduce data or back increment data.

3: (up) key
   - Press on the set screen to flash the point of the least digit and to increase data of increment data.

4: (entry/registration) key
   - Press on the set screen of the mode 0 screen group and mode 1 screen group to fix the data changed by the , keys and to extinguish flash of the point.
   - The function selecting screen, of the mode 2 screen group, registers data of the point flashing digit and simultaneously shifts a data changeable digit (the point flashing digit).
   - The input scaling screen, of the mode 2 screen group, registers data and shifts a parameter capable of being set (in the row in which the rightmost point is flashing).
   - Press the key for five seconds and it functions to change the basic screen of the mode 0 screen group to the function selecting screen of the mode 2 screen group and vice versa.

5: (manual) key
   - Pressing this key on the control output screen changes automatic control output to manual control output and vice versa. During manual control output, the MAN monitor LED flashes.
   - The key does not function in the control output stop mode.
4. Screen instruction

4-1. Power on and initial screen display

After turning on power, the display shows each power on initial screen for approx. 1.5 seconds, then moves into the basic screen of the mode 0 screen group.

<table>
<thead>
<tr>
<th>Mode 0 screen group</th>
<th>Basic screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power on initial screen</td>
<td>0-0</td>
</tr>
</tbody>
</table>

Series type ( \( T : \) Thermocouple, \( R : \) R. T. D., \( V : \) Voltage (mV), \( P : \) Voltage (V), \( I : \) Current (mA))

Input type ( : Voltage (mV), \( P : \) SS drive voltage, \( C : \) Current, \( V : \) Voltage)

Control output type ( : Contact, \( S : \) SSR drive voltage)

4-2. Alarm type code table

<table>
<thead>
<tr>
<th>Alarm code</th>
<th>AH assignment</th>
<th>With/Without inhibit action</th>
<th>AH-LB assignment</th>
<th>With/Without inhibit action</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ( ( O ) )</td>
<td>Not assigned</td>
<td>-</td>
<td>Not assigned</td>
<td>-</td>
</tr>
<tr>
<td>1 ( ( T ) )</td>
<td>Higher limit deviation value</td>
<td>Without inhibit action</td>
<td>Lower limit deviation value</td>
<td>Without inhibit action</td>
</tr>
<tr>
<td>2 ( ( \hat{E} ) )</td>
<td>Higher limit absolute value</td>
<td>Without inhibit action</td>
<td>Lower limit absolute value</td>
<td>Without inhibit action</td>
</tr>
<tr>
<td>3 ( ( \hat{A} ) )</td>
<td>Higher limit deviation value</td>
<td>With</td>
<td>Lower limit deviation value</td>
<td>With</td>
</tr>
<tr>
<td>4 ( ( \hat{Y} ) )</td>
<td>Higher limit absolute value</td>
<td>With</td>
<td>Lower limit absolute value</td>
<td>With</td>
</tr>
<tr>
<td>5 ( ( \hat{S} ) )</td>
<td>Higher limit deviation value</td>
<td>Without inhibit action</td>
<td>Heating break</td>
<td>-</td>
</tr>
<tr>
<td>6 ( ( \hat{B} ) )</td>
<td>Higher limit absolute value</td>
<td>Without inhibit action</td>
<td>Heating break</td>
<td>-</td>
</tr>
<tr>
<td>7 ( ( \hat{\theta} ) )</td>
<td>Higher limit deviation value</td>
<td>With</td>
<td>Heating break</td>
<td>-</td>
</tr>
<tr>
<td>8 ( ( \hat{\beta} ) )</td>
<td>Higher limit absolute value</td>
<td>With</td>
<td>Heating break</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: In the above table, the alarm codes 5 through 8 are selectable when the apparatus has the optional function of heater break alarm.

4-3. Screen change

(1) Screen change from mode 0 group to mode 1 group

- Pressing the \( \sqrt{ } \) key for three seconds on the basic screen of the mode 0 screen group changes it to the direct call screen of the mode 1 screen group and vice versa.

0-0 Basic Screen → 1-0 direct call screen

3 seconds

(2) Screen change from mode 0 group to mode 2 screen group

- Pressing the \( \sqrt{ } \) key for five seconds on the basic screen of the mode 0 screen group changes it to the function selecting screen of the mode 2 screen group and vice versa.

0-0 Basic Screen → 2-0 Function selecting screen

5 seconds

Note: In the above table, the alarm codes 5 through 8 are selectable when the apparatus has the optional function of heater break alarm.

(3) Screen change within mode 0 screen group

- By pressing the \( \sqrt{ } \) key, the screen changes.

(4) Screen change within mode 1 screen group

- Two methods are used for screen change within mode 1 screen group. One is to press the \( \sqrt{ } \) key as shown on above mode 0 screen group. The other is to mode the screen directly by indicating screen No. on the top direct call screen.

Example: Direct calling the screen No.8 PV bias value set screen

1-0 direct call screen → 1-0 direct call screen → 1-8 PV bias value set screen

5 seconds

(5) Selecting and setting digit to change of function selecting screen of mode 2 screen group

- When the function selecting screen is displayed, the point of selectable digit flashes.

- By pressing \( \sqrt{ } \) key, the selectable digit (digit whose point is flashing) moves.

- In case of changing the set value, flash the point to be changed with \( \sqrt{ } \) key, select data with the \( \sqrt{ } \) and \( \sqrt{ } \) keys and press \( \sqrt{ } \) key again to register the set value and move selectable digit.

Example: changing the control output characteristics from \( \sqrt{ } \) (heating) to \( \sqrt{ } \) (cooling)

<table>
<thead>
<tr>
<th>( \sqrt{ } )</th>
<th>( \sqrt{ } )</th>
<th>( \sqrt{ } )</th>
<th>( \sqrt{ } )</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
</tbody>
</table>

* “.” on the screen shows the selectable digit (digit whose point is flashing).

Note: In case of changing data and pressing \( \sqrt{ } \) key longer than 5 seconds, the screen moves to mode 0 basic screen without a data registration. It requires a data verification with \( \sqrt{ } \) key and screen change.

(6) Shifting setting items on input scaling screen of mode 2 screen group and setting method

- Pressing the \( \sqrt{ } \) key on the function selecting screen calls the input scaling screen onto the display. The decimal point in the rightmost position on the top row flashes. Press the \( \sqrt{ } \) or \( \sqrt{ } \) key to change the lower limit value and press the \( \sqrt{ } \) key to register the data.

- Upon registering the lower limit value data, the decimal point in the rightmost digit in the bottom row begins to flash. Change the higher limit value by pressing the \( \sqrt{ } \) or \( \sqrt{ } \) key and register it by means of the \( \sqrt{ } \) key.

- Upon registering the higher limit value data, the decimal points in the rightmost digits of the bottom and top rows flash. Change the positions of the decimal points by pressing the \( \sqrt{ } \) or \( \sqrt{ } \) key and register it by means of the \( \sqrt{ } \) key.

- Each time the \( \sqrt{ } \) key is pressed, the flashing decimal point in the rightmost digit moves from the top row to bottom row→top and bottom rows→top row→.

- In case the lower limit value and the higher limit value are set to produce a difference which is less than 100 counts or more than 5000 counts, the higher limit value is forced to change to +100 or +5000 counts. The higher limit cannot be set to be less than a lower limit value +100 counts or more than a lower limit value +5000 counts.
### 4.4. Instruction for screen change and each screen

#### Mode 0 Screen Group

- **Basic screen**
  - SV initial value: lower limit of measuring range
  - Upper row displays measured value (PV) and lower row displays changes in the set value (SV). Refer to Item 5-1 for detail.

- **Control output screen**
  - Initial value for manual operation: The value immediately before switch to manual
  - Setting range for manual operation: 0~100%
  - The measured value (PV) is displayed on the top and the control output value on the bottom. Pressing the MAN key on this screen switches auto to manual, and vice versa. Refer to Item 4-6 (1) for detail.

- **Control execution/stop selecting screen**
  - Initial value: EXEC
  - Setting range: OFF, ON

#### Mode 1 Screen Group

- **Direct call screen**
  - Initial value: 0
  - Setting range: 0~19

- **Proportional band set screen**
  - Initial value: 3.0%
  - Setting range: OFF, 0.1~999.9%

- **Integral time set screen**
  - Initial value: 120 seconds
  - Setting range: OFF, 1~600 seconds

- **Derivative time set screen**
  - Initial value: 30 seconds
  - Setting range: OFF, 1~3600 seconds

- **Proportional band set screen**
  - Initial value: 3.0%
  - Setting range: OFF, 0.1~999.9%

- **Integral time set screen**
  - Initial value: 120 seconds
  - Setting range: OFF, 1~600 seconds

- **Derivative time set screen**
  - Initial value: 30 seconds
  - Setting range: OFF, 1~3600 seconds

#### MODE 1 Screen Group

- **Display**
  - This screen appears only when P=OFF action.

- **Action hysteresis set screen**
  - Initial value: 3 or 0.3
  - Setting range: 1~999 unit

#### Key lock mode set screen

- **Lock Nos. and Ranges to be locked are as follows:**
  - **OFF**: Release of lock
  - **1**: Other screens than basic, control output, AT action control and communication mode screens
  - **2**: All except basic screen
  - **3**: All screens
For details of communication, refer to the instructions on output or the setting status of control action mode.

- Refer to Item 4-6 (4).
- Refer to Item 4-6 (5).
- Select from 4-2. Alarm type code table.
- Select from Item 6-3.
- Refer to Item 4-6 (6).
- Refer to Item 4-6 (7).
- Refer to Item 4-3 (6).
- Refer to Item 4-6 (8).
- Refer to Item 4-3 (7).
- Refer to Item 4-4 (3) for details.

### 4-5. Measuring range code table

<table>
<thead>
<tr>
<th>Input type</th>
<th>Code</th>
<th>Measuring Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>B</em></td>
<td>01</td>
<td>0~1800°F</td>
</tr>
<tr>
<td>R</td>
<td>02</td>
<td>0~1700°C</td>
</tr>
<tr>
<td>S</td>
<td>03</td>
<td>0~1700°C</td>
</tr>
<tr>
<td>K</td>
<td>04</td>
<td>-100~400°C</td>
</tr>
<tr>
<td>T</td>
<td>05</td>
<td>-100~1200°C</td>
</tr>
<tr>
<td>E</td>
<td>06</td>
<td>0~700°C</td>
</tr>
<tr>
<td>J</td>
<td>07</td>
<td>0~600°C</td>
</tr>
<tr>
<td>N</td>
<td>08</td>
<td>199.9~200.0°C</td>
</tr>
<tr>
<td>L</td>
<td>11</td>
<td>0~600°C</td>
</tr>
<tr>
<td>Pt 100</td>
<td></td>
<td>30~600°C</td>
</tr>
<tr>
<td>R.T.D.</td>
<td></td>
<td>30~600°C</td>
</tr>
<tr>
<td>J.P. 100</td>
<td></td>
<td>30~600°C</td>
</tr>
</tbody>
</table>

### Input scaling screen

- Lower limit value (top row) 0.0
- Higher limit value (bottom row) 100.0
- Position of decimal point 0.0
- Setting range
- Setting range: -9999~9999 units
- Setting range: 100~5000 counts
- Position of decimal point: No decimal point, 0.0, 0.00 and 0.000

Scaling is done for linear input (mV, V or mA).

The screen is only for monitoring and no setting is possible in the case of sensor input.

Refer to Item 4-3 (6) for details.

---

**NOTE:**

- Screen flame on Item 4-4 is as follows:
  - Screens always shown during key operation.
  - Screens shown during case with option or selected option.
  - Screens shown depending on the type of output or the setting status of control action mode.
- In case measuring range is modified, set values, alarm action point and other related values are all initialized.

**NOTE:** If it is on auto ranging execution or key lock is set on lock No.1, 2 or 3, no selection can be performed even if the digit point is flashing.

Digits of ① and ② are not shown in case of no option. Digits of ③, ④ and ⑤ are not displayed.

### Mode 2 Screen Group (Function selecting screen)

- Use [●] key to move select digit and data registration. The selectable digit is indicated by flashing point.

<table>
<thead>
<tr>
<th>Mode 2 Screen Group (Function selecting screen)</th>
<th>2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use [●] key to move select digit and data registration. The selectable digit is indicated by flashing point.</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:**

- If it is on auto ranging execution or key lock is set on lock No.1, 2 or 3, no selection can be performed even if the digit point is flashing.
4-6. Supplementary explanation of screens

(1) 0-1 Control Output Screen
• During manual control an output value is set on this screen. In automatic control, it is only for monitoring.
• For switching automatic control to manual, press the [ENT] key on the control output screen.
• The MAN monitor LED flashes during manual control and goes out when control is changed to auto.
• This screen is only for monitoring in the stop mode, when AT is ON, or keylock is set to 2 or 3.
• Manual control output is released if the stop mode is selected or the type of input or the measuring range is changed during manual control.
• For changing the manual output value, the [A] and [B] keys are used. It is not necessary to press the [ENT] key.
• During manual control, the setting range of control output is between 0 and 100%. In case an output limiter has been set, that value serves as the higher/lower limit of the setting range.
• In ON/OFF action (P=0), manual control output should be at 0% or 100% (For V and I output, lower limit output limiter or higher limit output limiter).
• When auto is changed to manual, the action becomes balanceless and bumpless. If the measured value (PV) is out of the proportional band, it does not attain balanceless and bumpless action.
• If power is turned off during manual control output and is turned on again, the condition is stored in the memory.

Note: Moving to another screen while maintaining the manual mode is possible. In this case, it should be noted that control output is made manually. The apparatus is in the manual mode when the MAN monitor LED is flashing.

(2) 0-2 Control Execution/Stop Screen
• Use the [A] and [B] keys to select control execution (EXEC) or stop (STBY). Then register it by means of the [ENT] key.
• Upon selecting stop, the STBY monitor LED turns on and the control output display turns to 0%.
• Upon selecting execution, the mode changes to automatic control; it is not possible to go directly from the stop to the manual mode. When control is being executed, the STBY monitor LED remains unlit.
• Even at stop, the alarm works.
• When AT is ON or 1, 2 or 3 of keylock has been selected, no change is allowed.

(3) 1-6 Manual Reset Value Setting Screen
• In the PID operation, an offset is corrected automatically by I, i.e., integral calculation. When I is set at OFF, this correction is not made and output is manually increased or decreased for correction. This is called manual reset (MR).

(4) 1-11 Proportional Cycle Setting Screen
• In the case of contact output or SSR drive voltage output, time in which output is ON + time in which it is OFF in the proportional band, that is, proportional cycle time is set.

(5) 1-12, 1-13 Lower Limit and Higher Limit Output Limiters Setting Screens
• The output limiters function effectively to maintain the lowest temperature, to suppress control overshoot by limiting control output to minimum and maximum values set.
• In the output limiters, priority is given to the lower limit value. Therefore, when the lower limit is set at a value higher than the higher limit value, the higher limit value is forced to be the lower limit value + 1%. Therefore, the higher limit value cannot be set to be less than the lower limit value + 1%.

(6) 1-14 Soft Start Time Setting Screen
• Soft start is the function selected to raise control output gradually in the beginning of control. It is effective in preventing excessive current from flowing into a heater or similar apparatus.
• Soft start functions in the following cases:
  ① Upon applying power in the auto mode
  ② When control stop (STBY) is changed to control execution (EXEC)
  ③ When scale-over is restored to the normal state (in auto mode)
The above are on condition that soft start time and proportional band are not set at OFF.
• In the following cases, the soft start function is released.
  ① Soft start time has elapsed without problem.
  ② Auto is changed to stop or manual mode during the execution of soft start.
  ③ Soft start time or proportional band is changed to OFF during the execution of soft start.
  ④ The measurement range code is changed during the execution of soft start.
  ⑤ Control output characteristic is changed during the execution of soft start.
  ⑥ Scale-over of a measured value occurs during the execution of soft start.
  ⑦ Control output falls to a level below the output value of soft start during the execution of soft start.
• Auto tuning is unable to be carried out during the execution of soft start.

5. Operation

5-1. Setting of set value (SV)

(1) Press the [A] or [B] key to set set value. Keep pressing it to flash the point of the least digit of set value and increase (or decrease) value.
(2) After confirming the value to coincide the set value, press [ENT] to register the data.
(3) After registration of the data, the point of the least digit goes off.

Example: Setting set value to 500 °C.

5-2. AT (Auto tuning)

(1) Execution of AT action
• By pressing the [A] or [B] key on AT action control screen, the display on lower row turns into AT and the point of the least digit starts flashing, then the LED for AT monitoring turns on to indicate AT standby. Press [ENT] key to start AT action with point going off and LED for AT monitoring flashing.

When AT is carried out, ON/OFF action of output is repeated several times, with the set value as the border line, to make PID values stored in the memory and terminates. At the same time, control is started by using stored PID constants.

The AT monitor LED goes out and the display on the AT action control screen changes to OFF.
(2) Abort of AT
To abort the AT action, by showing the AT action control screen, press the \(\text{A}^1\) or \(\text{B}^1\) key to select \(\text{OFF}\) and press \(\text{ENT}\) key to abort AT and LED for AT monitoring also goes off.

Note: When the AT action is aborted, each value for PID is not changed.

(3) AT unable for following conditions.
- When the control stop mode is on (The AT screen is not displayed.)
- During manual output control (The AT screen is not displayed.)
- The proportional band is \(\text{OFF}\) setting (ON/OFF action). (The AT screen is not displayed.)
- Lock No.2 or 3 is selected on the key lock set screen.
- PV (measured) value is over the scale.
- During the execution of soft start

(4) AT is automatically canceled in the following condition during AT execution.
- Duration equal or longer than 2 hours passed in the output level of 0% or 100%.
- Power shutdown.
- PV (measured) value is over the scale during AT execution.

(5) The items enable to be set are as follows:
- Level setting of the higher limit alarm.
- Level setting of the lower limit alarm or heater break alarm.
- Screen number setting and key lock setting on the direct call screen of mode 1 screen group.

(6) Relationship between AT and set value bias is as follows;
- When SB terminal is shorted before AT execution, AT executes in the condition with SV+set value bias.
- When SB terminal is opened during AT execution mentioned in the above, AT executes with SV+set value bias condition, then controlled with SV condition after completing AT execution.
- When SB terminal is opened, AT executes with SV condition.
- When SB terminal is shorted during AT execution mentioned in the above, AT executes with SV condition, then controlled with SV+set value bias condition after completing AT execution.

5-3. Setting of alarm

(1) Higher limit alarm setting
- The higher limit alarm set screen is shown in case where alarm option is added and the higher limit alarm of the alarm type select digit on the function selecting screen of the mode 2 screen group is selected.
- Higher limit deviation value alarm is output for measured value to be greater than set value + alarm set value.
- For higher limit deviation value alarm, if set value + alarm set value exceeds the higher limit of the measuring range, the action point is the higher limit of the measuring range.
- Higher limit absolute value alarm outputs alarm signal for the measured value exceeding the alarm set value.
- With the \(\text{A}^1\) or \(\text{B}^1\) key, value at which the alarm signal should be output is selected and registered with \(\text{ENT}\) key.

Example 1:
In case of setting the alarm action point at 600 °C for higher limit absolute value alarm.
The set point is action point.

Example 2:
In case of setting the alarm action point at 600 °C for higher limit absolute value alarm.

(2) Lower limit alarm setting
- The lower limit alarm set screen is shown in case where alarm option is added and the lower limit alarm of the alarm type select digit on the function selecting screen of the mode 2 group screen group is selected.
- Lower limit deviation value alarm is output for measured value to be less than set value + (alarm set value).
- For lower limit deviation value alarm, if set value + (alarm set value) is less than the lower limit of the measuring range, the action point is lower limit of the measuring range.
- Lower limit absolute value alarm outputs alarm signal for the measured value is less than the alarm set value.
- With the \(\text{A}^1\) or \(\text{B}^1\) key, value at which the alarm signal should be output is selected and registered with \(\text{ENT}\) key.

(3) Heater break alarm setting
- The heater break alarm value setting screen is displayed when the apparatus is equipped with the optional heater break alarm function and heater break alarm is selected in the alarm type selection digit of the function selecting screen of the mode 2 screen group. The top row shows for monitoring purposes the value of the presently flowing current detected by CT and the bottom row shows the set value of the alarm current.
- When OFF is set as the heater break alarm value, the heater break alarm does not function.
- By setting OFF during heater break alarm signal output, heater break alarm output is terminated.
- For set value other than OFF, heater break alarm signal is output if the current that flows in case where control output (contact or SSR drive voltage) is ON, is less than set value.
- If LOCK mode is selected at heater break alarm action mode select digit on the function selecting screen of the mode 2 screen group and the break alarm signal is output, alarm signal is only terminated by changing the break alarm value into OFF or shutting down power.
- If REAL mode is selected and heater current is less than current value being set, break alarm signal is generated. If heater current exceeds the current threshold (0.1A), output of break alarm is terminated.
- Set the heater break alarm current value by means of the of the \(\text{A}^1\) or \(\text{B}^1\) key and register it by using the \(\text{ENT}\) key.

6. Supplement
6-1. Auto return function
In case there is no key operation for three minutes on each of the screens except the control output screen and the heater break alarm value setting screen, the basic screen of the mode 0 screen group is displayed (auto return).

6-2. PID (Screen No.2, 4 and 5 of mode 1 screen group)
PID values are automatically set by performing auto tuning, modification may be required for object to be controlled.
If auto tuning is not performed, PID value should be set.
(1) P (proportional action)
Control output rate (%) is set for measuring range.
Control output value changes in proportion with measured value (PV) and set value (SV).
For wide proportional band, change of control output is small relative to deviation. The narrower the proportional band is, the larger the output variation is and the more intense proportional action is. Too narrow proportional band causes ON-OFF like action with oscillation.

(2) I (integral time)
A function that compensates the offset created by proportional action. Effect of compensation is weaker for longer integral time and is intensified by shortening time. Too short integral time causes integrating hunting and may result in wavy operation.

(3) D (derivative time)
Improves stability of control by reducing overshooting of integration from expected change of the control output. Effect of compensation is weaker for shorter derivative time and is intensified for longer time. Too long derivative time may result in oscillating operation.

6-3. Control output characteristics (δ) digit of function selecting screen of mode 2 screen group
Control output characteristics determines the control output direction according to the measured value (PV) relative to the set value (SV).

1) ρ (RA characteristics)
Control output increases for lower measured value relative to set value, it is used for heating on temperature control.

2) ω (DA characteristics)
Control output decreases for lower measured value relative to set value, it is used for cooling on temperature control.

6-4. Error message
(1) Defect of measuring input
In case of thermocouple break, R.T.D. A break and PV being approx. 10% greater than higher limit of measuring range.
In case of PV being approx. 10% less than the lower limit of measuring range with inverted polarity of input wiring.
Cold junction (CJ) defect to higher side for thermocouple input.
Cold junction (CJ) defect to lower side for thermocouple input.
Break of B or B and multiple break of A, B, B upon R.T.D. input
(2) Defect of Heater Break Alarm CT Input
The CT input value exceeds 55A (550A for 0–5V DC input).
The CT input value falls to -5A (-50A for 0–5V DC input) or lower.

Note: Message of heater break alarm is only displayed on heater break alarm set screen. --- --- is shown when output is OFF. It is not defective.

Note: Contact to us or our representative in case of any defect regarding this product.

7. Instructions on Communication
7-1. General
Section 7 deals with communication interface, which is an optional function, and communication procedure.
For the SR73A and 74A series, two types of communication interface, RS-422A and RS-485 are available. Each enables a personal computer or the like to set and read various data by the use of signals which conform with EIA standards.
RS-422A and RS-485 are communication standards established by the Electric Industries Association (EIA), which are meant for electrical or mechanical matters, the so-called hardware, but not for the software portion of the data transmission procedure.
Accordingly, communication even with an apparatus having the same interface cannot be made unconditionally. It requires a thorough understanding of specifications and procedures.
The use of RS-422A or RS-485 allows a plurality of apparatuses to be connected in a parallel configuration. It is also possible to use a line converter for conversion of RS-232C to/from RS-422A and RS-232C to/from RS-485.

7-2. How to connect SR73A or 74A with host computer
7-2-1. Control signals
Since the apparatus is provided with input/output transmitting and receiving data lines and an earthing line for signals but not with any other signal line, control signals should be processed by the host side.
The method of processing differs from system to system and connection details should meet requirements of the host computer. Examples of connection are shown in the following.

7-2-2. Connection of RS-422A
(1) The logical levels of input and output of this apparatus are basically as follows:
Mark state **~<**~*+ (Example: SD- < SD+)
(including the state in which communication is not carried out)
Space state **~<**~*+ (Example: SD- > SD+)
However, since the impedance of SD+ and SD- of this apparatus is high until just before transmission, the above levels are output just before commencing transmission.
(2) Example of Connection of RS-422A

---
Note: Some line converters between RS-232C and RS-422A may have the following indication for terminal (connector) output. If that is the case, logical levels should be checked before connection.
7-2. Connection of RS-485

7-2-3. Connection of RS-485

(1) The logical levels of input and output of this apparatus are basically as follows:
   Mark state: -Terminal < +Terminal (including the state in which communication is not carried out)
   Space state: -Terminal > +Terminal

   However, since the impedance of +terminal and -terminal of this apparatus is high until just before transmission, the above levels are output just before commencing transmission.

(2) Example of Connection of RS-485

7-2-4. Terminal resistance

As SR73A and SR74A are not provided with terminal resistance, connect a 510Ω resistance to only the last (furthest from the host) station.

Note: If terminal resistance is connected to two or more, correct action is not guaranteed.

7-2-5. Control of 3-state output

(1) Since RS-422A and RS-485 employ the multi-drop system, in order to prevent signals from colliding, transmission output should be controlled to maintain high impedance while communication is not being made or signals are being received.

(2) It should be controlled so that high impedance turns to the normal state of output immediately before starting transmission and high impedance is restored immediately when transmission ends. Because 3-state control is delayed by about 3 msec. maximum from the transmission of the end bit of the end character, a delay time of about 4 msec. should be provided in case transmission is started immediately.

7-3. Setting of communication parameters

There are four communication-related parameters to be set as shown below. They are set by means of front keys except for changing the communication mode from remote to local.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[COMM]</td>
<td>Communication mode</td>
</tr>
<tr>
<td>[ADDR]</td>
<td>Communication address</td>
</tr>
<tr>
<td>[DRFR]</td>
<td>Communication data format</td>
</tr>
<tr>
<td>[BPS]</td>
<td>Communication rate</td>
</tr>
<tr>
<td>[DELAY]</td>
<td>Delay</td>
</tr>
</tbody>
</table>

7-3-1. Communication mode selecting screen (COMM)

(1) Local Mode (COMM:LOCAL)
   The COM lamp on the front panel goes out to allow the setting to be changed by the use of the front keys. In communication, only the change from local to remote and the read commands are valid.

(2) Remote Mode (COMM:REMOTE)
   The COM lamp on the front panel turns on and the commands for read and write through communication become valid. Front key operation works only to change from remote to local.

7-3-2. Communication address (ADDR) setting screen

RS-422A and RS-485 allow connection of a plurality of apparatuses but in fact, communication is carried out between two apparatuses. Therefore, the address of each apparatus is designated by a number between 00 and 99 so as to enable the designated apparatus to respond.

7-3-3. Communication data format (DRFR) selecting screen

Select data format of communication from 7b_E (data bit length: 7 bits, parity: even, stop bit: 1) or 8b_n (data bit length: 8 bits, parity: none, stop bit: 1).

7-3-4. Communication rate (BPS) selecting screen

A rate of transmission from the controller to the host is selected from among 1200, 2400, 4800 and 9600 bps.

7-3-5. Delay (DELAY) setting screen

In the case of RS-485, a minimum delay time for transmission from receiving a communication command is set. Delay time is a set value (0~255) × 0.1 msec. Nevertheless, actual delay time includes time for processing the command added to the above delay time.

7-4. Communication protocol

7-4-1. Communication procedure

Communication is carried out for each block and the communication right alternates between the controller and the host from block to block.

7-4-2. Explanation of block

(1) The data format in one block is shown below:

```
<table>
<thead>
<tr>
<th>Higher position</th>
<th>Lower position</th>
<th>Text</th>
<th>Higher position</th>
<th>Lower position</th>
<th>CR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```
(2) Write Data

The text format of write data contains a command and write data value.

<table>
<thead>
<tr>
<th>Command</th>
<th>Contents of Write Data</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>SV value</td>
<td>*2</td>
</tr>
<tr>
<td>E2</td>
<td>Control output value</td>
<td>Numerical value</td>
</tr>
<tr>
<td>E3</td>
<td>Stop status</td>
<td>1 byte</td>
</tr>
<tr>
<td>E4</td>
<td>Manual status</td>
<td>1 byte</td>
</tr>
<tr>
<td>E5</td>
<td>AT status</td>
<td>1 byte</td>
</tr>
<tr>
<td>E6</td>
<td>Higher limit alarm (AH) value</td>
<td>Numerical value</td>
</tr>
<tr>
<td>E7</td>
<td>Lower limit alarm (AL) value</td>
<td>Numerical value</td>
</tr>
<tr>
<td>E8</td>
<td>Heater break alarm (HB) value</td>
<td>Numerical value</td>
</tr>
<tr>
<td>E9</td>
<td>Set value bias (SB) value</td>
<td>Numerical value</td>
</tr>
<tr>
<td>EA</td>
<td>Proportional band (P) value</td>
<td>Numerical value</td>
</tr>
<tr>
<td>EB</td>
<td>Integral time (I) value</td>
<td>Numerical value</td>
</tr>
<tr>
<td>EC</td>
<td>Derivative time (D) value</td>
<td>Numerical value</td>
</tr>
<tr>
<td>ED</td>
<td>Target value function (SF) value</td>
<td>Numerical value</td>
</tr>
<tr>
<td>EE</td>
<td>Hysteresis (DF) value</td>
<td>Numerical value</td>
</tr>
<tr>
<td>EF</td>
<td>Manual reset (MR) value</td>
<td>Numerical value</td>
</tr>
</tbody>
</table>

(3) Response Data

Response data has different formats depending on whether read data has been received or write data has been received.

(1) Response data to read data received

<table>
<thead>
<tr>
<th>Command</th>
<th>Data 1</th>
<th>Data 2</th>
<th>Data n</th>
</tr>
</thead>
</table>

Appropriate read data contents of commands shown in the table of the read data text format are sent back.

(2) Response data to write data received

The same data as the received write data is sent back.

7-5. Text

7-5-1. Text format

The text format is classified into read data, write data and response data.

(1) Read Data

The text format of read data contains only of a command of two characters.

<table>
<thead>
<tr>
<th>Command</th>
<th>Contents of Read Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>PV value, Execution SV value*1, Control output value, Stop (STBY) status, Manual (MAN) status, AH status, AL/HL status, AT status, SB status.</td>
</tr>
<tr>
<td>D2</td>
<td>Set value of higher limit alarm (AH), Set value of lower limit alarm (AL).</td>
</tr>
<tr>
<td>D3</td>
<td>Load current value, Set value of heater break alarm (HB).</td>
</tr>
<tr>
<td>D4</td>
<td>Set value of set value bias (SB).</td>
</tr>
<tr>
<td>D5</td>
<td>Proportional band (P) value, Integral time (I) value, Derivative time (D) value, Set value of target value function (SF).</td>
</tr>
<tr>
<td>D6</td>
<td>Set value of hysteresis (DF).</td>
</tr>
<tr>
<td>D7</td>
<td>Set value of manual reset (MR).</td>
</tr>
<tr>
<td>D8</td>
<td>Set value of PV bias, Set value of PV filter.</td>
</tr>
<tr>
<td>D9</td>
<td>Set value of proportional cycle time.</td>
</tr>
<tr>
<td>DA</td>
<td>Set value of lower limit output limiter, Set value of higher limit output limiter.</td>
</tr>
<tr>
<td>DB</td>
<td>Set value of soft start time.</td>
</tr>
<tr>
<td>DC</td>
<td>Communication mode, Delay time.</td>
</tr>
</tbody>
</table>

*1 The execution SV value is a total of the SV value and the value bias.

7-5-2. Data format

The data format is divided to 3 categories; numerical data, 1 byte data and special data.

(1) Numerical Data (-2999~9999)

The length of numerical data in the text is fixed to six characters including a code and a decimal point. A code (+ or -) is attached to the head of the numerical data. In the case where the numerical value including a code is less than six characters, 0 is inserted between the code and the figure or figures to make the value six characters. When a code is excluded, each of the 5 characters is a figure or a decimal point.

*2 SV value is target set value.

Examples of numerical data

<table>
<thead>
<tr>
<th>1 2 3 4 5 6</th>
<th>1 2 3 4 5 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0 0 0</td>
<td>-1</td>
</tr>
<tr>
<td>-0.01</td>
<td>-0.01</td>
</tr>
<tr>
<td>123.4</td>
<td>-123.4</td>
</tr>
<tr>
<td>0.01</td>
<td>-0.001</td>
</tr>
</tbody>
</table>

0 or OFF
(2) One-Byte Data
One-byte data in the text has a fixed length of one character which is either 0 or 1. Seven items are covered, namely, stop status, manual status, AT status, AH status, AL/HB status and communication mode.

1. Stop (STBY), Manual (MAN), AT (ON), AH (ON), AL/HB (ON), SB (ON), Communication (when the remote mode is on).

2. Execution (EXEC), Auto (AUTO), AT (OFF), AH (OFF), AL/HB (OFF), SB (OFF), Communication (when the local mode is on).

(3) Special Data
Special data is data sent in response to numerical data which are outside of the ordinary range. Their patterns are shown in the following.

1. Numerical data is +10000~+10999.

2. Numerical data exceeds the indicated range.

3. Numerical data is over the scale.

4. CT temperature exceeded the higher limit value or fell below the lower limit value in the case of thermocouple input.

5. Wire breaking detected in the case of R.T.D. input

6. CT input value exceeded the higher limit value or fell below the lower limit value.

7. Control output either turned on or turned off while CT input measurement was ongoing.

8. Data is undeterminable due to a set value of alarm code, P=OFF, or some other reasons.
   - Data in the case where the alarm code is 0 and D2 (AH, AL) or D3 (CT, HB) command has been received.
   - Data in the case where the alarm code is 1~4 and D3 (CT, HB) command has been received.
   - AL data in the case where the alarm code is 5~8 and D2 (AH, AL) command has been received.
   - I, D, SF or MR data in the case where P=OFF and D5 (P, I, D, SF, MR) command has been received.

7-5-3. Communication error
When an error is found in the block after receiving data from the host, an error message is sent back. The format of error messages and the types of errors are described in the following.

1. Error Message Format

2. Error Types

<table>
<thead>
<tr>
<th>Error No.</th>
<th>Error Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>05</td>
<td>BCC error</td>
<td>Arithmetic value is not in accord with BCC.</td>
</tr>
<tr>
<td>06</td>
<td>Command error</td>
<td>Command other than prescribed one was received.</td>
</tr>
<tr>
<td>08</td>
<td>Data format error</td>
<td>The format is different from prescribed one.</td>
</tr>
<tr>
<td>09</td>
<td>Data error</td>
<td>Value is out of prescribed data range in the case of write command.</td>
</tr>
<tr>
<td>11</td>
<td>Write mode error</td>
<td>Write command was received when write command was invalid.</td>
</tr>
<tr>
<td>12</td>
<td>Option error</td>
<td>Command of unequipped option was received.</td>
</tr>
</tbody>
</table>

7-5-4. Non-response process
When an error is found in the block upon receiving data transmitted from the host, the next correct data block is waited for without transmission of response data. Therefore, the host has to retransmit the command block in any of the following cases:

1. The start character was not @ (40H).
2. The communication No. did not match.
3. The end character was not CR (0DH).
4. A hardware error such as a framing error, overrun or a parity error occurred.

7-5-5. Restrictions by commands, etc.

(1) Restrictions by Read Command
Upon receiving the D1 read command, the status of unequipped options (AH, AL/HB, SB) become 0 (30H).

(2) Restrictions by Write Command

<table>
<thead>
<tr>
<th>Command of unequipped option was received.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write command was received when write command was invalid.</td>
</tr>
<tr>
<td>Value is out of prescribed data range in the case of write command.</td>
</tr>
<tr>
<td>The format is different from prescribed one.</td>
</tr>
<tr>
<td>Arithmetic value is not in accord with BCC.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Received Write Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop mode (STBY)</td>
<td>E2 (Manual control output value)</td>
</tr>
<tr>
<td>Auto mode (AUTO)</td>
<td>E2 (Manual control output value)</td>
</tr>
<tr>
<td>Manual mode (MAN)</td>
<td>E5 (AT status)</td>
</tr>
<tr>
<td>Alarm code = 0</td>
<td>E6 (Set value of AH)</td>
</tr>
<tr>
<td>Alarm code = 1~4</td>
<td>E7 (Set value of AL)</td>
</tr>
<tr>
<td>Alarm code = 5~8</td>
<td>E8 (Set value of HB)</td>
</tr>
<tr>
<td>P=OFF</td>
<td>E9 (Set value of HB)</td>
</tr>
<tr>
<td>P=OFF</td>
<td>E9 (Set value of HB)</td>
</tr>
<tr>
<td>P=OFF</td>
<td>E9 (Set value of HB)</td>
</tr>
</tbody>
</table>

If a write command is invalid due to the local mode, a set value of keylock, AT or some other conditions, and that command is received, ER11 should be sent back. The following cases also require ER11 to be sent back.
Restrictions by Read/Write Commands Depending on Equipped Optional Functions

1. **ER12**

When a command which becomes invalid because an optional function is not equipped, ER12 should be sent back. (Read commands are included.)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Received Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without alarm option</td>
<td>D2 (AH/AL) read command</td>
</tr>
<tr>
<td>Without HB option</td>
<td>D3 (CT/HB) read command</td>
</tr>
<tr>
<td>Without SB option</td>
<td>D4 (Set value of SB) read command</td>
</tr>
</tbody>
</table>

**Others**

When P (proportional band)=OFF is prepared to be set, data is as follows:

\[
\begin{align*}
\text{OFF} & : \quad 0 \quad 0 \quad 0 \quad 0 \quad 0
\end{align*}
\]

or

\[
\begin{align*}
\text{OFF} & : \quad 0 \quad 0 \quad 0 \quad 0 \quad 0
\end{align*}
\]

7-6. A list of transmitted/received data

The text portions of data in read commands and write commands are listed below.

**Block Data Format**

<table>
<thead>
<tr>
<th>Address No.</th>
<th>Text Data</th>
<th>B&amp;C Data</th>
<th>CR Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ 40H</td>
<td>: 3AH</td>
<td>B&amp;C</td>
<td>CR=0DH</td>
</tr>
</tbody>
</table>

7-6-1. Read command

1. **D1**

   - Received data
   - Transmitted data

2. **D2**

   - Received data
   - Transmitted data

3. **D3**

   - Received data
   - Transmitted data

4. **D4**

   - Received data
   - Transmitted data

5. **D5**

   - Received data
   - Transmitted data

6. **D6**

   - Received data
   - Transmitted data

7. **D7**

   - Received data
   - Transmitted data

8. **D8**

   - Received data
   - Transmitted data

9. **D9**

   - Received data
   - Transmitted data

10. **DA**

    - Received data
    - Transmitted data

11. **DB**

    - Received data
    - Transmitted data

12. **DC**

    - Received data
    - Transmitted data

7-6-2. Write command

In write commands, received data and transmitted data are identical.

1. **E1**

   - Received data
   - Transmitted data

2. **E2**

   - Received data
   - Transmitted data

3. **E3**

   - Received data
   - Transmitted data

4. **E4**

   - Received data
   - Transmitted data

5. **E5**

   - Received data
   - Transmitted data

6. **E6**

   - Received data
   - Transmitted data

7. **E7**

   - Received data
   - Transmitted data

8. **E8**

   - Received data
   - Transmitted data

9. **E9**

   - Received data
   - Transmitted data

10. **EA**

   - Received data
   - Transmitted data

11. **EB**

   - Received data
   - Transmitted data

12. **EC**

   - Received data
   - Transmitted data

13. **ED**

   - Received data
   - Transmitted data
8. Specifications

Display
- Digital display: Measured value (PV)/7-segment green LED 4 digits
  Set value (SV) /7-segment orange LED 4 digits
- Parameter display: 7-segment LED for PV and SV
- Action display: Green LEDs for 5 points of output (OUT), auto tuning (AT), operating mode (STBY), remote (COM) and manual output (MAN). Red LEDs for 2 points of alarm (AH, AL/HB).
- Display accuracy: ±(0.3% FS+1 digit) excluding cold junction temperature compensation accuracy in the case of the thermocouple input. ±5% FS for temperatures below 400°C (750 °F) of thermocouple B.
- Display accuracy range: 23±5 °C (18~28 °C)
- Display resolution: Depends on measuring range (0.001, 0.01, 0.1, 1)
- Measured display range: -10~110% (-210~680 °C for -200~600 °C of R.T.D. input)

Setting
- Setting: By 5 front key switches
- Setting range: Same as measuring range.

Input
- Type of input: Multiple input of Thermocouple, R.T.D., Voltage (mV), or Voltage (V), or Current 4–20mA DC by code selection
- External resistance: 100Ω max.
- Input impedance: 500kΩ max.
- Burnout: Standard feature (up scale)
- Cold junction temperature compensation accuracy: ±2°C (°F) (5~45 °C)
  ±5 °C to the negative side of

- R.T.D:
  Amperage: Lead wire tolerable resistance:
  Voltage :
  Input impedance:
  Current:
  Receiving impedance:
  Input scaling function:
  Scaling range:
  Span:
  Position of decimal point:
  Sampling cycle:
  PV bias range:
  PV filter:

- Control:
  Control mode:
  Proportional band (P):
  Integral time (I):
  Derivative time (D):
  Manual reset (MR):
  Output limiter:
  Soft start of output:
  ON/OFF hysteresis:
  Proportional cycle:
  Control output characteristics:
  Set value function (SF):

- Contact output:
  Current output :
  SSR drive voltage output :
  Voltage output :

- Manual Control:
  Output setting range:
  Auto/manual switching:

- Communication (Optional):
  Signal level:
  Communication system:
  Synchronous system:
  Data format:
• Communication address: Machine numbers are set in a range from 0 to 99.
• Communication rate: 1200, 2400, 4800 and 9600 bps. (Setting possible only in the case of RS-485.)
• Communication delay: To be set in a range from 0 to 255 (Setting possible only in the case of RS-485.)
• Communication distance: RS-422A maximum 1200m (depending on conditions)
RS-485 maximum 500m (depending on conditions)
• Transmission procedure: No procedure.
• Communication code: Conforming with ASCII codes.
• Control signal: Not used.
• Error detection: Vertical parity (even parity) checking.
BCC (block check character) checking.
• Connectable number of apparatuses: Possible to connect 100 units maximum (including the host, depending on conditions)

Alarm Output (Optimal)
• Number of alarm points: 2 (AH and AL/HB, both for normal open and common)
• Alarm Type: Selectable from the following 9 combinations.
(5 through 8 are selectable only when apparatus has heater break alarm function.)
0. Not assigned
1. Higher limit deviation value + lower limit deviation value without inhibit action
2. Higher limit absolute value + lower limit absolute value without inhibit action
3. Higher limit deviation value + lower limit deviation value with inhibit action
4. Higher limit absolute value + lower limit absolute value with inhibit action
5. Higher limit deviation value without inhibit action + heater break
6. Higher limit absolute value without inhibit action + heater break
7. Higher limit deviation value with inhibit action + heater break
8. Higher limit absolute value with inhibit action + heater break
• Alarm setting range: Higher limit and lower limit absolute value alarms: Within full scale of measuring range
Deviation value: Higher limit: 0~2000 unit
Lower limit: -1999~0 unit
• Alarm action: On-Off action
• Alarm action hysteresis: Fixed to 0.2% of the measuring range
• Alarm output / rating: Contact 1a (common) / 240V AC 1.5A (resistive load)

Heater Break Alarm (option)
This function can be added if the instrument has an alarm option and the control output is the contact type or the SSR drive voltage type.
• Alarm action: Heater amperage detected by externally attached CT. (except 0~5V DC input)
Alarm output On upon detection of heater break while control output is On.

The contents of this manual are subject to change without notice.