Thank you for your purchase of our Microcomputer based Temperature Indicating Controller FCD-15A.
This manual contains instructions for the mounting, functions, operations and notes when operating the FCD-15A.
Please read and understand this instruction manual before starting operation.

To prevent accidents arising from the use of this controller, please ensure the operator who uses it receives this manual.
***** Note to users *****
Before operating this controller, please understand about following matters.

⚠️ **Warning**
Turn the power supplied to the instrument OFF before wiring or checking.
Working or touching the terminal with the power switched to ON may result in Electric Shock, which can cause severe injury or death. Moreover, the instrument must be grounded before the power supply to the instrument is turned on.

⚠️ **Caution**
Do not apply a commercial power source to the sensor connecting to the input terminal nor allow the power source to come into contact with the sensor.

⚠️ **Notices**
Set-up by the DIP switch and the rotary switch internal of the controller is required before the power is turned on.
The product is factory adjusted as [Sensor input: K, Control action: Fuzzy self-tuning PID, Heating action, Alarm (A1): No alarm action, no standby function, Unit: °C and Program starting form: manual]. Refer to page 11 “Set-up”.

It is recommended that the PID auto-tuning be performed on the trial run.
It is advised to provide the protective device against such environmental conditions as may cause damage to the device or contribute to the deterioration of its parts.

If you start to mount this controller to the control panel or machine, read this manual from Chapter “10. Mounting to control panel” or “11. Wiring connection” after checking the model name at “1. Model names”.

If you operate this controller already mounted, read this manual from Chapter “2. Name and functions of the sections” or “4. Operations”.
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1. Model names

1.1 Model names

Standard models

<table>
<thead>
<tr>
<th>F</th>
<th>C</th>
<th>D - 1</th>
<th>5</th>
<th>A</th>
<th>R</th>
<th>M</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control action</td>
<td>5</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>ON/OFF servo ((1))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm</td>
<td>A</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>Alarm action ((2))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>R</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>Relay contact output</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input</td>
<td>M</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>Multi-range input ((3))</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1: Fuzzy self-tuning PID, PID action are selectable by internal DIP switch.
*2: 12 types of alarm action or no alarm action are selectable by internal rotary switch and DIP switch.
*3: 15 types of input, Thermocouple, RTD, Current and Voltage are selectable by internal rotary switch and DIP switch.

Alphanumeric character to represent the functions or type is applied to the □.

[Example]

FC\(D\)-15A- \(R\) / \(M\), \(SA\), \(TV\)

- Transmission output (voltage)
- Alarm 3 and 4 output
- Relay contact output
- 96 x 96 x 100 mm (W x H x D)
Optional code

<table>
<thead>
<tr>
<th>Code</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA</td>
<td>Alarm 3 and 4 output</td>
</tr>
<tr>
<td>TA</td>
<td>Current (4 to 20mA)dc</td>
</tr>
<tr>
<td>TV</td>
<td>Voltage (0 to 1Vdc)</td>
</tr>
<tr>
<td>C5</td>
<td>Based on EIA RS-485</td>
</tr>
<tr>
<td>C</td>
<td>Based on EIA RS-232C</td>
</tr>
<tr>
<td>SM</td>
<td>Setting value memory number external selection</td>
</tr>
<tr>
<td>EA</td>
<td>Current (0 to 20mA, 4 to 20mA)</td>
</tr>
<tr>
<td>EV</td>
<td>Voltage (0 to 1Vdc, 1 to 5Vdc)</td>
</tr>
<tr>
<td>BK</td>
<td>Color: Black</td>
</tr>
<tr>
<td>IP</td>
<td>Dust-proof•Drip-proof</td>
</tr>
<tr>
<td>TC</td>
<td>Terminal cover</td>
</tr>
</tbody>
</table>

(See page 59ff for the contents of the options in detail.)

⚠️ Warning

Do not take the inner assembly out nor touch the terminal with the power supply on.
Touching the terminal with the power switched to on may result in Electric Shock, which can cause severe injury or death.

1.2 How to indicate the model name plate

Model nameplates are put on the case and the left side of the inner assembly.

[Model name plate] [Example]

(1) F C D – 1 5 A – R / M ➔ Relay contact output/Multi-range input
(2) SA, TV ➔ Alarm 3 and 4 (A3, A4) output and Transmission output (voltage)
(3) No.  

(1): Model name
(2): Option codes
(3): Instrument number (Indicated only on internal assembly)
2 Name and functions of the sections

(1) PV display
   It indicates the Process variable (PV) with red LED.

(2) SV display
   It indicates the Setting value (SV), Manipulating value (MV) or Time (TIME) with green LED.

(3) Setting value memory number display
   It indicates the Setting value memory number with yellow LED.

(4) SV indicator (SV    )
   Green LED is lit when the Setting value (SV) is being displayed on the SV display.

(5) MV indicator (MV    )
   Red LED is lit when the Manipulating value (MV) is being displayed on the SV display.

(6) Time indicator (TIME    )
   Red LED is lit when the Time (TIME) is being displayed on the SV display.

(7) Manual control indicator (MANUAL    )
   Red LED is lit when Manual control.

(8) Control motor Open output ON indicator (OUT 1    )
   Green LED is lit when the Control motor Open output is on.

(9) Control motor Closed output ON indicator (OUT 2    )
   Yellow LED is lit when the Control motor Closed output is on.

(10) Serial communication output indicator (TX/RX    ) [Option]
   Green LED is lit when transmitting serial communication (TX).
(11) Alarm 1 output action or Pattern end (A1) output indicator ( □ A1)
Red LED is lit when the Alarm 1 (A1) output or Pattern end (A1) output is on.

(12) Alarm 3 output action indicator ( □ A3) [Option]
Red LED is lit when the Alarm 3 (A3) output is on.

(13) Alarm 4 output action indicator ( □ A4) [Option]
Red LED is lit when the Alarm 4 (A4) output is on.

(14) Remote indicator ( □ REMOTE) [Option]
Red LED is lit during Remote action.

(15) Sensor burnout indicator ( □ SB)
Red LED is lit when the Sensor burnout.

(16) Loop break alarm output action indicator ( □ LA)
Red LED is lit when abnormal status such as Sensor burnout, Electromagnetic switch or Control motor trouble is found on the loop.

(17) Auto-tuning action indicator ( □ AT)
Yellow LED blinks during auto-tuning.

Keys

Main functions are described below, however, the key has other functions on the mode. Refer to Section 4.1 Operating flow chart (Page 14ff).

1 ▲ Increase key : It increases the numeric value on the SV display during setting mode. If pressed continuously, it makes the numerical value change faster.

2 ▼ Decrease key : It decreases the numeric value on the SV display during setting mode. If pressed continuously, it makes the numerical value change faster.

3 MODE Mode key : It selects a setting mode.

4 OUT/OFF key : It performs the control output ON or OFF. Besides, it starts or stops the program control.

5 AUTO/Manual key : It switches the control between Automatic and Manual.

6 FAST Fast key : It makes the numerical value change faster by pressing the (or ) key simultaneously.

In any mode, if the OUT/OFF key is pressed for approx. 1 second, the Control output OFF function will work.

When the function works, the function cannot be released even if the instrument power is turned off and on again, and the function is remained.

To release the function, press the OUT/OFF key for approx. 1 second.

The setting value is registered by pressing the MODE key.

In any setting item, if the MODE key is pressed for approx. 3 seconds, the mode returns to PV/SV display.
3. Set-up

3.1 Taking the internal assembly out
Before the power supply to this instrument is turned on, take the internal assembly out from the case by pushing the hook (bottom of the instrument) to arrow direction and holding the notches.

![Fig. 3.1-1]

3.2 Switch setting (multi-function)
Using small slotted screwdriver and tweezers, set the Sensor input, Alarm 1 action, Alarm 2 action, Control action, Heating (reverse)/Cooling (direct) action, Alarm 1 standby function, Unit °C or °F and Program starting form Auto/Manual by rotary switch and DIP switch by following procedure.

![Fig. 3.2-2]
The following items can be designated by the DIP switch (SW304).
Factory adjusted as all switches OFF.[

**Table 3.2-1**

<table>
<thead>
<tr>
<th>Item</th>
<th>DIP Sw. No.</th>
<th>Designation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control action</td>
<td>1</td>
<td>Fuzzy self-tuning PID action</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PID action</td>
<td>ON</td>
</tr>
<tr>
<td>Heating/Cooling action</td>
<td>3</td>
<td>Heating (reverse) action</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cooling (direct) action</td>
<td>ON</td>
</tr>
<tr>
<td>Alarm 1 (A1) standby action</td>
<td>4</td>
<td>No standby action</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standby action</td>
<td>ON</td>
</tr>
<tr>
<td>°C/°F</td>
<td>6</td>
<td>°C</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>°F</td>
<td>ON</td>
</tr>
<tr>
<td>Sensor input *1</td>
<td>7</td>
<td>K, J, R, B, N, PL-II, Pt100, JPt100</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S, E, T, C, 4 to 20mA, 0 to 20mA,</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 to 1V,</td>
<td></td>
</tr>
<tr>
<td>Program start Auto/Manual *2</td>
<td>8</td>
<td>Manual start</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Automatic start</td>
<td>ON</td>
</tr>
</tbody>
</table>

**Note:** The switches No. 2 and No. 5 are not used. They will not function even if setting to ON side.

*1: The sensor input can be designated by the combination of this item and the rotary switch sensor input (SW303). (See page 12.)

*2: Program start (This item is available for the program control.)
  Manual start: Program start is available by pressing the key.
  Automatic start: Program is automatically started by turning the power supply to the instrument on (after warm-up status).
Select the sensor type by rotary switch sensor input (SW303).
Factory adjusted as K, [   ].

[Table 3.2-2]

<table>
<thead>
<tr>
<th>Rotary Sw. No.</th>
<th>DIP Sw. No. 7</th>
<th>Type of sensor</th>
<th>Scale range</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>OFF</td>
<td>K</td>
<td>-200 to 1370°C, -320 to 2500°F</td>
</tr>
<tr>
<td>1</td>
<td>OFF</td>
<td>J</td>
<td>-200 to 1000°C, -320 to 1800°F</td>
</tr>
<tr>
<td>2</td>
<td>OFF</td>
<td>R</td>
<td>0 to 1760°C, 0 to 3200°F</td>
</tr>
<tr>
<td>3</td>
<td>OFF</td>
<td>B</td>
<td>0 to 1820°C, 0 to 3300°F</td>
</tr>
<tr>
<td>4</td>
<td>OFF</td>
<td>PL-II</td>
<td>0 to 1390°C, 0 to 2500°F</td>
</tr>
<tr>
<td>5</td>
<td>OFF</td>
<td>N</td>
<td>0 to 1300°C, 0 to 2300°F</td>
</tr>
<tr>
<td>6</td>
<td>OFF</td>
<td>Pt100</td>
<td>-199.9 to 850.0°C, -199.9 to 999.9°F</td>
</tr>
<tr>
<td>7</td>
<td>OFF</td>
<td>JPt100</td>
<td>-199.9 to 500.0°C, -199.9 to 900.0°F</td>
</tr>
<tr>
<td>0</td>
<td>ON</td>
<td>S</td>
<td>0 to 1760°C, 0 to 3200°F</td>
</tr>
<tr>
<td>1</td>
<td>ON</td>
<td>E</td>
<td>0 to 1000°C, 0 to 1800°F</td>
</tr>
<tr>
<td>2</td>
<td>ON</td>
<td>T</td>
<td>-199.9 to 400.0°C, -199.9 to 750.0°F</td>
</tr>
<tr>
<td>3</td>
<td>ON</td>
<td>C (W/Re5-26)</td>
<td>0 to 2315°C, 0 to 4200°F</td>
</tr>
<tr>
<td>4</td>
<td>ON</td>
<td>4 to 20mAdc</td>
<td>-1999 to 9999</td>
</tr>
<tr>
<td>5</td>
<td>ON</td>
<td>0 to 20mAdc</td>
<td>-1999 to 9999</td>
</tr>
<tr>
<td>6</td>
<td>ON</td>
<td>0 to 1Vdc</td>
<td>-1999 to 9999</td>
</tr>
</tbody>
</table>
The type of alarm action and the pattern end output when program control can be designated by the rotary switch A1 (SW302).
In case the input range has a decimal point, the minimum value on minus side will be –199.9.
When using the FCD-15A as a Simplified program controller, the Pattern end output generated when the program control is ended can be selected instead of the Alarm 1 (A1) action

Factory adjusted as No alarm action, [ ].

[Table 3.2-3]

<table>
<thead>
<tr>
<th>Alarm 1 action</th>
<th>Rotary Sw. (Sw302) No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No alarm action</td>
<td>0</td>
</tr>
<tr>
<td>High limit alarm</td>
<td>1</td>
</tr>
<tr>
<td>Low limit alarm</td>
<td>2</td>
</tr>
<tr>
<td>High/Low limits alarm</td>
<td>3</td>
</tr>
<tr>
<td>Hi/Lo limit range alarm</td>
<td>4</td>
</tr>
<tr>
<td>Process high alarm</td>
<td>5</td>
</tr>
<tr>
<td>Process low alarm</td>
<td>6</td>
</tr>
<tr>
<td>Pattern end output</td>
<td>7</td>
</tr>
</tbody>
</table>

3.3 Insertion of the internal assembly
When the set-up is completed, insert the internal assembly into the case.
Surely insert the assembly until it is locked by the hook at the bottom of the instrument. (sounds click.)

⚠️ Notice
Do not confuse the top and bottom of the internal assembly.
If inserting the assembly into the case by force in the wrong direction, the PCB may be damaged.
4 Operations

4.1 Operating flow chart

Instrument power ON

Warm-up status

(For approx. 2s) See page 17 for the display.

Control output OFF function

Manual control

Output manipulating value

Step rest time

PV/SV display mode

Main setting mode

Main setting

PV

Sub setting mode

Setting value memory No. selection

PV

Auto-tuning Perform/Cancel

PV

Proportional band setting

PV

Integral time setting

PV

Derivative time setting

PV

Open/Closed output dead band set

PV

Alarm 1 (A1) setting

PV

Alarm 3 (A3) setting

PV

Alarm 4 (A4) setting

PV

Loop break alarm time setting

PV

Loop break alarm span setting

PV
Options:

+ MODE: Press the MODE key while the ▲ key is being pressed.

+ MODE 3s: Press the MODE key for approx. 3 seconds while the ▼ key is being pressed.

+ + MODE 3s: Press the MODE key for approx. 3 seconds while the ▲ and ▼ key are being pressed.

*1: Step rest time is indicated only when program control.

*2: If the Auto-tuning is performed, the mode returns to PV/SV display.

If the Auto-tuning is released, the mode moves to Proportional band setting.

---

[Auxiliary function setting mode 1]

Setting value lock designation

PVLOC MODE

Main setting value high limit setting

PV IH MODE

Main setting value low limit setting

PV IL MODE

Sensor correcting value setting

PV SC MODE

Remote/Local changing

PV L/M MODE

Instrument number setting

PV ENO MODE

Communication transfer rate selection

PV ERS MODE

---

[Auxiliary function setting mode 2]

Scaling high limit setting

PV SLH MODE

Scaling low limit setting

PV SLL MODE

Decimal point place selection

PD MODE

PV filter time constant setting

PFI MODE

Alarm 3 (A3) action form selection

PVR 3F MODE

Alarm 4 (A4) action form selection

PVR 4F MODE

Alarm 1 (A1) action hysteresis setting

PVR 1HY MODE

Alarm 3 (A3) action hysteresis setting

PV A3HY MODE

Alarm 4 (A4) action hysteresis setting

PV A4HY MODE

Alarm 1 (A1) action delayed timer setting

PV R 1ddy MODE

Alarm 3 (A3) action delayed timer setting

PV R 3ddy MODE

Alarm 4 (A4) action delayed timer setting

PV R 4ddy MODE

External setting input high limit setting

PV RILH MODE

External setting input low limit setting

PV RILL MODE
Options

1. Press the **FAST** key for approx. 3 seconds while the **▲** key and the **▼** key are being pressed.
2. Pressing the **▲** key, press the **▼** key for approx. 3 seconds.

*3: In the mode Program control change, if **OFF** is selected and the **MODE** key is pressed, the display returns to PV/ SV display mode.

The temperature setting of program can be set by the Sub setting Mode and Auxiliary function setting mode 1 and 2.
4.2 Operations

Process variable display (PV) indicates the type of Sensor and setting value display (SV) indicates the rated value selected by Sensor input designation (page 12, 13) for approx. 2 seconds after the power is turned on. See below [table 4.2-1].

During this time, all outputs and LED indicators are in their off status. After that, it displays actual temperature on the PV display, main setting value on the SV display and starts control.

(1) PV/SV display mode

Instrument power ON

<table>
<thead>
<tr>
<th>Warm-up status (For 2s)</th>
<th>PV/SV display mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>(See below table for the PV and SV displays)</td>
<td>Actual Temperature</td>
</tr>
</tbody>
</table>

• Mode during control.
• No contents of setting items nor setting values can be changed.

[Table 4.2-1]

<table>
<thead>
<tr>
<th>Input</th>
<th>PV display</th>
<th>SV display</th>
<th>PV display</th>
<th>SV display</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>°C</td>
<td>1370</td>
<td>°F</td>
<td>2500</td>
</tr>
<tr>
<td>J</td>
<td>°C</td>
<td>1000</td>
<td>°F</td>
<td>1800</td>
</tr>
<tr>
<td>R</td>
<td>°C</td>
<td>1760</td>
<td>°F</td>
<td>3200</td>
</tr>
<tr>
<td>B</td>
<td>°C</td>
<td>1820</td>
<td>°F</td>
<td>3300</td>
</tr>
<tr>
<td>PL-II</td>
<td>°C</td>
<td>1330</td>
<td>°F</td>
<td>2500</td>
</tr>
<tr>
<td>N</td>
<td>°C</td>
<td>1300</td>
<td>°F</td>
<td>2300</td>
</tr>
<tr>
<td>S</td>
<td>°C</td>
<td>1760</td>
<td>°F</td>
<td>3200</td>
</tr>
<tr>
<td>E</td>
<td>°C</td>
<td>1000</td>
<td>°F</td>
<td>1800</td>
</tr>
<tr>
<td>T</td>
<td>°C</td>
<td>4000</td>
<td>°F</td>
<td>1500</td>
</tr>
<tr>
<td>C</td>
<td>°C</td>
<td>23.15</td>
<td>°F</td>
<td>42.00</td>
</tr>
<tr>
<td>Pt100</td>
<td>°C</td>
<td>8500</td>
<td>°F</td>
<td>99.99</td>
</tr>
<tr>
<td>JPt100</td>
<td>°C</td>
<td>5000</td>
<td>°F</td>
<td>90.00</td>
</tr>
<tr>
<td>4 to 20mAdc</td>
<td>42A</td>
<td>Scaling high limit value</td>
<td>42A</td>
<td>Scaling high limit value</td>
</tr>
<tr>
<td>0 to 20mAdc</td>
<td>02A</td>
<td>02A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 to 1Vdc</td>
<td>018</td>
<td>018</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(2) Main setting mode

In PV/SV display mode, if the [MODE] key is pressed, Main setting mode can be selected.

The setting value can be increased or decreased by pressing the [▲], [▼] and [FAST] key.

If the [MODE] key is pressed, the setting value is registered and the mode returns to PV/SV display.

<table>
<thead>
<tr>
<th>PV/SV display mode</th>
<th>Actual Temperature</th>
<th>Main setting value</th>
<th>MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MODE</td>
<td></td>
</tr>
</tbody>
</table>

Main setting

<table>
<thead>
<tr>
<th>Setting value</th>
<th>MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mode to set the setting value of the main control.

Setting range: From Main setting value low limit to Main setting value high limit

[Factory adjusted as 0°C]

(3) Sub setting mode

In PV/SV display mode, if the [MODE] key is pressed while the [▲] key is being pressed, Sub setting mode can be selected.

The setting value can be increased or decreased by pressing the [▲], [▼] and [FAST] key. If the [MODE] key is pressed, the setting value is registered and the setting item is changed to the next.

<table>
<thead>
<tr>
<th>PV/SV display mode</th>
<th>Actual temperature</th>
<th>Main setting value</th>
<th>[▲] + [MODE]</th>
</tr>
</thead>
</table>

Setting value memory number selection

<table>
<thead>
<tr>
<th>Selected value</th>
<th>[MODE]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mode to select the memory number (file) to be set or to be called.

Selecting items: 1 to 7

[Factory adjusted as Memory number 1.]

Auto-tuning Perform/ Cancel

<table>
<thead>
<tr>
<th>Designation</th>
<th>[MODE]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mode to designate the auto-tuning Perform or Cancel.

If Auto-tuning Perform is designated, and the [MODE] key is pressed, the mode returns to PV/SV display.

To set the other values, cancel the Auto-tuning.

In case the auto-tuning is released on the process, the PID value returns to the former value.
OPERATIONS (Sub setting mode) FCD-15A

(Auto-tuning Cancel)
(Auto-tuning Perform)
[Factory adjusted as Auto-tuning Cancel]

Proportional band setting

Mode to set the proportional band.
Setting range: 0.1 to 999.9%
[Factory adjusted as 2.5%]

Integral time setting

Mode to set the integral time.
Setting range: 0 to 3600s
[Factory adjusted as 200s]

Derivative time setting

Mode to set the derivative time.
Setting range: 0 to 3600s
[Factory adjusted as 50s]
Setting the value to 0 disables the function.

Open/Closed output dead band setting

Mode to set the dead band value of the Open output and Closed output
Setting range: 0.1 to 100.0% of proportional band
[Factory adjusted as 3.0%]

Alarm 1 (A1) setting

Mode to set the action point of the Alarm 1 (A1) output.
This item is not displayed if setting the rotary switch to No. 0 or No. 7 (See page 12.)
Setting range: See [table 4.2-2].
[Factory adjusted as 0°C]

Alarm 3 (A3) setting

Mode to set the action point of the Alarm 3 (A3) output.
This item is not displayed if the option [SA] is not applied or even if it is applied, in case [- - - -] is selected.
(See page 25.)
Setting range: See [table 4.2-2].
[Factory adjusted as 0°C]
Alarm 4 (A4) setting

Mode to set the action point of the Alarm 4 (A4) output.
This item is not displayed if the option [SA] is not applied or even if it is applied, in case [- - - -] is selected.
(See page 26.)
Setting range: See [table 4.2-2].
[Factory adjusted as 0℃]

Loop break alarm time setting

Mode to set the time to judge Loop break alarm.
Setting range: 0 to 200 minutes
[Factory adjusted as 0 minutes.]

Loop break alarm span setting

Mode to set the span to judge Loop break alarm.
Setting range:
0 to 100℃ (TC input except T type)
0.0 to 100.0℃ (TC input and RTD)
0 to 1000 (DC input)
[Decimal point place follows the setting.]
[Factory adjusted as 0℃]

PV/SV display mode

Setting range of Alarm 1, 3 or 4
(The setting range is the same when the Standby function is added.)
[Table 4.2-2]

<table>
<thead>
<tr>
<th>Alarm type</th>
<th>Setting range</th>
</tr>
</thead>
<tbody>
<tr>
<td>High limit alarm</td>
<td>Input range span to Input range span</td>
</tr>
<tr>
<td>Low limit alarm</td>
<td>Input range span to Input range span</td>
</tr>
<tr>
<td>High/Low limits alarm</td>
<td>0 to Input range span</td>
</tr>
<tr>
<td>High/Low limit range alarm</td>
<td>0 to Input range span</td>
</tr>
<tr>
<td>Process high alarm</td>
<td>Input range minimum to Input range maximum</td>
</tr>
<tr>
<td>Process low alarm</td>
<td>Input range minimum to Input range maximum</td>
</tr>
</tbody>
</table>

In the case of DC input, the Input range span is to be the Scaling span.
(4) Auxiliary function setting mode 1
In the PV/SV display mode, if the [MODE] key is pressed for approx. 3 seconds while the [▼] key is being pressed, Auxiliary function setting mode 1 can be selected. The setting value can be increased or decreased by pressing the [▲], [▼] and [FAST] key.
If the [MODE] key is pressed, the setting value is registered and the setting item is changed to the next.

<table>
<thead>
<tr>
<th>PV/SV display mode</th>
<th>Setting value lock designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Temperature</td>
<td>Main setting value</td>
</tr>
<tr>
<td></td>
<td>▼ + [MODE] for approx. 3s</td>
</tr>
</tbody>
</table>

Mode to lock the setting value to prevent error.
The setting item to be locked is different by the designation.
[Factory adjusted as Unlock status.]

Unlock status. All setting values are changeable.
All setting items cannot be changed.
Only main setting value is changeable.
All setting items can be changed, however, the value returns to the former value after the power off because the value is not written on the non-volatile memory.
This mode is used when changing the value temporarily.
Since it has no relation to the memory life, it is suitable when the option [C or C5] is applied.

Fuzzy self-tuning or Auto-tuning PID action will not function if [Lc1] or [Lc2] is designated.
When designating Lock, designate Lock 1, 2 or 3 after setting the necessary items in the status Unlock.
As to the Lock mode 3
When using the FCD-15A as a Fixed value controller.
The setting values can temporarily be changed by the selected setting value memory number, however, when the number is changed, the setting values changed by the previous number are canceled and returns to the former values.

When using the FCD-15A as a Program controller.
The setting values can temporarily be changed by the step number performing, however, when the step number is changed, the setting values are canceled and returns to the former values. Setting value change is null when the controller is waiting for running. It starts the running by the values memorized.

<table>
<thead>
<tr>
<th>Main setting value</th>
<th>Mode to set the high limit of main setting value.</th>
</tr>
</thead>
<tbody>
<tr>
<td>high limit setting</td>
<td>Setting range: Main setting value low limit to</td>
</tr>
<tr>
<td>Setting value</td>
<td>Input range maximum value</td>
</tr>
<tr>
<td></td>
<td>When DC input,</td>
</tr>
<tr>
<td></td>
<td>Main setting value low limit to</td>
</tr>
<tr>
<td></td>
<td>Scaling high limit.</td>
</tr>
<tr>
<td></td>
<td>The decimal point place follows the selection.</td>
</tr>
<tr>
<td></td>
<td>[Factory adjusted as 400°C]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main setting value</th>
<th>Mode to set the low limit of main setting value.</th>
</tr>
</thead>
<tbody>
<tr>
<td>low limit setting</td>
<td>Setting range: Input range minimum value to</td>
</tr>
<tr>
<td>Setting value</td>
<td>Main setting value high limit</td>
</tr>
<tr>
<td></td>
<td>When DC input,</td>
</tr>
<tr>
<td></td>
<td>Scaling low limit to</td>
</tr>
<tr>
<td></td>
<td>Main setting value high limit</td>
</tr>
<tr>
<td></td>
<td>The decimal point place follows the selection.</td>
</tr>
<tr>
<td></td>
<td>[Factory adjusted as 0°C]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensor correction setting</th>
<th>Mode to set the correct value of the sensor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting value</td>
<td>Setting range: -100.0 to 100.0°C</td>
</tr>
<tr>
<td>[Factory adjusted as 0.0°C]</td>
<td></td>
</tr>
</tbody>
</table>
Remote/Local change

Mode to change the method (Remote or Local) to set the Main setting value.
[Factory adjusted as Local]

Local status. The main setting value can be set by the front key operation as usual.

Remote status. The main setting value can be set in analog value by the remote control from external operation.

When the option [EA or EV] is not applied, this display is not available.

Instrument number setting

Mode to set the Instrument number individually to each instrument when communicating by connecting plural instruments in serial communication.

Setting range: 0 to 95 [Factory adjusted as 0]

When the option [C or C5] is not applied, this display is not available.

Transfer rate setting

Mode to select the communication transfer rate to meet the rate of the host computer.
[Factory adjusted as 9600bps]

2400bps
4800bps
9600bps
19200bps

When the option [C or C5] is not applied, this display is not available.

PV/SV display mode

Actual Temperature Main setting value
(4) Auxiliary function setting mode 2

In the PV/SV display mode, if the [MODE] key is pressed for approx. 3 seconds while the [▲] and [▼] key are being pressed, Auxiliary function setting mode 2 can be selected.

The setting value can be increased or decreased by pressing the [▲], [▼] and [FAST] key.

If the [MODE] key is pressed, the setting value is registered and the setting item is changed to the next.

<table>
<thead>
<tr>
<th>PV/SV display mode</th>
<th>Actual Temperature</th>
<th>Main setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scaling high limit setting</td>
<td>[H] Setting value</td>
<td>+ [MODE] for approx. 3s Mode to set the high limit value of the scale. Setting range: Scaling low limit setting to Input range maximum value [Factory adjusted as 9999] This display is indicated only when the input type is selected to DC.</td>
</tr>
<tr>
<td>Scaling low limit setting</td>
<td>[L] Setting value</td>
<td>Mode to set the low limit value of the scale. Setting range: Input range minimum value to Scaling high limit setting [Factory adjusted as -1999] This display is indicated only when the input type is selected to DC</td>
</tr>
<tr>
<td>Decimal point place selection</td>
<td>[dp] Selection</td>
<td>Mode to select the Decimal point place. Factory adjusted as XXXX. [No decimal point]</td>
</tr>
</tbody>
</table>

This display is indicated only when the input type is selected to DC type. 

XXX. (No decimal point) 
XXX.X (1-digit below the decimal point) 
XX.XX (2-digit below the decimal point) 
X.XXX (3-digit below the decimal point)
PV filter time constant
Setting

Mode to suppress the PV fluctuation caused by such as disturbance.
Set the value larger by degrees, and find the setting value at which the value does not fluctuate.
If the value is set too large, it affects control result due to the delay of response.
Setting range: 0.0 to 10.0s
[Factory adjusted as 0.0s]

Alarm 3 action form selection
Selection

Mode to select the action form of the Alarm 3.
[Factory adjusted as No alarm action]
When the option [SA] is not applied, this display is not indicated.

No alarm action
High limit alarm
High limit alarm with standby
Low limit alarm
Low limit alarm with standby
High/Low limits alarm
High/Low limits alarm with standby
High/Low limit range alarm
High/Low limit range alarm with standby
Process high alarm
Process high alarm with standby
Process low alarm
Process low alarm with standby
OPERATIONS (Auxiliary function setting mode 2) FCD-15A

Alarm 4 action form selection
- **RL 4F** Selection

Mode to select the action form of the Alarm 4. Selecting items are the same as Alarm 3. [Factory adjusted as No alarm action]

When the option [SA] is not applied, this display is not indicated.

Alarm 1 hysteresis setting
- **R 1HY** Selection

Mode to set the hysteresis value for Alarm 1. Setting range: 0.1 to 100.0°C
[Factory adjusted as 1.0°C]

This display is not indicated if the rotary switch is set to No. 0 or No. 7 in Alarm 1 action designation (page 13).

Alarm 3 hysteresis setting
- **R 3HY** Selection

Mode to set the hysteresis value for Alarm 3. Setting range: 0.1 to 100.0°C
[Factory adjusted as 1.0°C]

This display is not indicated if No alarm action [ - - - - ] is selected in Alarm 3 action form selection, besides the option [SA] is not applied.

Alarm 4 hysteresis setting
- **R 4HY** Selection

Mode to set the hysteresis value for Alarm 4. Setting range: 0.1 to 100.0°C
[Factory adjusted as 1.0°C]

This display is not indicated if No alarm action [ - - - - ] is selected in Alarm 4 action form selection, besides the option [SA] is not applied.
### Alarm 1 action
**delayed timer setting**

- **R1dy** Setting value

  Mode to set the action delayed timer for Alarm 1.
  Setting range: 0 to 60s
  
  [Factory adjusted as 0s]

  Alarm output turns on when the setting time is passed after the input gets into the alarm output range.

  This display is not indicated if the rotary switch is set to No. 0 or No. 7 in Alarm 1 action designation (page 13).

### Alarm 3 action
**delayed timer setting**

- **R3dy** Setting value

  Mode to set the action delayed timer for Alarm 3.
  Setting range: 0 to 60s
  
  [Factory adjusted as 0s]

  Alarm output turns on when the setting time is passed after the input gets into the alarm output range.

  This display is not indicated if No alarm action [ ] is selected in Alarm 3 action form selection (page 25), besides the option [SA] is not applied.

### Alarm 4 action
**delayed timer setting**

- **R4dy** Setting value

  Mode to set the action delayed timer for Alarm 4.
  Setting range: 0 to 60s
  
  [Factory adjusted as 0s]

  Alarm output turns on when the setting time is passed after the input gets into the alarm output range.

  This display is not indicated if No alarm action [ ] is selected in Alarm 4 action form selection (page 26), besides the option [SA] is not applied.

### External setting input
**high limit setting**

- **H.H** Setting value

  Mode to set the high limit value of external setting input.

  (In case of Option EA [4 to 20mA], the value corresponds to 20mA input.)

  Setting range: External setting input low limit value to Input range maximum value
  
  [Factory adjusted as 400°C]

  When the option [EA, EV] is not applied, this display is not indicated.
External setting input
low limit setting

Mode to set the low limit value of external setting input.
(In case of Option EA [4 to 20mA], the value corresponds to 4mA input.)
Setting range: Input range minimum value to External setting input high limit value
[Factory adjusted as 0°C]
When the option [EA, EV] is not applied, this display is not indicated.

Transmission output selection

Mode to select the type of Transmission output.
[Factory adjusted as Process variable transmission]
When the option [TA or TV] is not applied, this display is not indicated.

Process variable (PV) transmission
Main setting value (SV) transmission
Manipulating value (MV) transmission

Transmission output high limit setting

Mode to set the high limit value of Transmission output.
(In case of option TA, the value is when 20mA is input.)
Setting range: Transmission output low limit value to Input range maximum value
[Factory adjusted as 400°C]
When the option [TA or TV] is not applied, this display is not indicated.
Transmission output when standby:
PV➔PV, SV➔0 value, MV➔0 value
**Operations (Auxiliary Function Setting Mode 2)**

**Transmission Output Low Limit Setting**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Setting Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLL</td>
<td>Setting Value</td>
</tr>
</tbody>
</table>

Mode to set the low limit value of Transmission output. (In case of option TA, the value is when 4mA is input.)

Setting range: Input range minimum value to Transmission output high limit value

[Factory adjusted as 0°C]

When the option [TA or TV] is not applied, this display is not indicated.

Transmission output when standby:

PV ➔ PV, SV ➔ 0 value, MV ➔ 0 value

**Display Selection When Control Output Is Off**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>PKY</td>
<td>Selection</td>
</tr>
</tbody>
</table>

Mode to select the display when the control output is off.

[Factory adjusted as OFF is indicated on PV display]

OFF is indicated on PV display.

No indication (all unlit).

Only process variable (PV) is indicated.

**Manipulating Value Operating Period Setting**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Setting Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>P┩c</td>
<td>Setting Value</td>
</tr>
</tbody>
</table>

Mode to set the operating period of manipulating value for Open output and Closed output

Setting range: 1 to 120s

[Factory adjusted as 3s]

**Main Setting Value Rising Rate Setting**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Setting Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pány</td>
<td>Setting Value</td>
</tr>
</tbody>
</table>

Mode to set the rising rate of the main setting value. (Rising value per minute)

Setting the value to 0 or 0.0 disables the function.

Setting range:
- 0 to 9999°C, Thermocouple input except T type
- 0.0 to 999.9°C, Thermocouple T type and RTD input
- 0 to 9999, DC input (Decimal point place follows the setting.)

[Factory adjusted as 0°C]
Main setting value
falling rate setting

Setting value

MODE

Mode to set the falling rate of the main setting value. (Falling value per minute)
Setting the value to 0 or 0.0 disables the function.

Setting range:
0 to 9999°C, Thermocouple input except T type
0.0 to 999.9°C, Thermocouple T type and RTD input
0 to 9999, DC input (Decimal point place follows the setting.)

[Factory adjusted as 0°C]

PV/SV display mode

Actual temperature  Main setting value
(6) **Time required to Open/Closed setting mode**

In **PV/SV display mode**, if the **FAST** key is pressed for approximately 3 seconds while the **▲** and **▼** keys are being pressed, Time required to Open/Closed setting mode can be selected. The setting value can be increased or decreased by pressing the **▲**, **▼** and **MODE** keys. If the **MODE** key is pressed, the setting value is registered and the setting item is changed to the next.

<table>
<thead>
<tr>
<th>PV/SV display mode</th>
<th>Actual temperature</th>
<th>Main setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time required to Open setting</td>
<td><strong>▲</strong> + <strong>▼</strong> + <strong>FAST</strong> for approx. 3s</td>
<td>Mode to set the time from the valve full closed to the valve full open.</td>
</tr>
<tr>
<td>Setting range: 0.1 to 999.9s</td>
<td><strong>MODE</strong></td>
<td><strong>FACTORY adjusted as 30.0s</strong></td>
</tr>
</tbody>
</table>

**Automatic measuring method**

1. Check that the valve is at the full closed position, and press the **▲** and **▼** keys simultaneously. It measures the time required to Open, and starts the count from 0 seconds. When the count is started, the control motor Open output turns ON and the valve is moved to Open direction.

2. Press the **FAST** key when the valve is full open. The count will be stopped, the time required to Open is registered and the control motor Open output turns OFF.

<table>
<thead>
<tr>
<th>PV/SV display mode</th>
<th>Actual temperature</th>
<th>Main setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time required to Closed setting</td>
<td><strong>Pc</strong></td>
<td>Mode to set the time from the valve full open to the valve full closed.</td>
</tr>
<tr>
<td>Setting range: 0.1 to 999.9s</td>
<td><strong>MODE</strong></td>
<td><strong>FACTORY adjusted as 30.0s</strong></td>
</tr>
</tbody>
</table>

**Automatic measuring method**

1. Check that the valve is at the full open position, and press the **▲** and **▼** keys simultaneously. It measures the time required to Closed, and starts the count from 0 seconds. When the count is started, the control motor Closed output turns ON and the valve is moved to Closed direction.

2. Press the **FAST** key when the valve is full closed. The count will be stopped, the time required to Closed is registered and the control motor Closed output turns OFF.
(7) Program mode

In PV/SV display mode, if the ▼ key is pressed for approximately 3 seconds while the ▲ key is being pressed, the Program mode can be selected. The setting value can be increased or decreased by pressing the, ▲, ▼ and FAST key. If the MODE key is pressed, the setting value is registered and the setting item is changed to the next.

• As for the setting values for the step 1 to 7, each setting value for setting value memory number 1 to 7 set while the Fixed value control is assigned respectively. For example, values in memory number 1 are assigned to the values for step 1, and number 2 for step 2.

• If the Pattern end output is designated and the program control is performed the Pattern end output turns on when the program is completed.

• When the Pattern end output is on and if the ▼ key is pressed, the Pattern end output turns off. If the ▲ key is pressed again, the program will be performed.

• Example of the Program pattern is as shown below. In case all 7 steps are unnecessary, set the times to 00.00 for the step numbers not used.

<table>
<thead>
<tr>
<th>Step number (Setting value memory number)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main setting value</td>
<td>500</td>
<td>500</td>
<td>1000</td>
<td>1000</td>
<td>200</td>
<td>200</td>
<td>100</td>
</tr>
<tr>
<td>Proportional band</td>
<td>2.0</td>
<td>1.8</td>
<td>2.0</td>
<td>1.8</td>
<td>2.5</td>
<td>1.8</td>
<td>2.0</td>
</tr>
<tr>
<td>Integral time</td>
<td>180</td>
<td>80</td>
<td>180</td>
<td>80</td>
<td>200</td>
<td>80</td>
<td>200</td>
</tr>
<tr>
<td>Derivative time</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>20</td>
<td>50</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>Open/Closed dead band</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Alarm 1</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Alarm 3</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Alarm 4</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Step time</td>
<td>00:30</td>
<td>01:00</td>
<td>00:40</td>
<td>01:00</td>
<td>02:00</td>
<td>00:30</td>
<td>01:00</td>
</tr>
</tbody>
</table>

![Graph showing Program pattern]
OPERATIONS (Program mode) FCD-15A

PV/SV display mode

Actual temperature Main setting value

Program control change

Proc Changed value

for approx. 3s

Control form is changed between Fixed value and Program.

In Fixed value control, if the MODE key is pressed, the mode returns to PV/SV display mode.

Fixed value control

Program control

[Factory adjusted as Fixed value control]

Step 1 Time setting

Mode to set the Time for step 1.

Setting value

[Factory adjusted as 00.00]

Step 2 Time setting

Mode to set the Time for step 2.

Setting value

[The setting range and the factory adjusted value are the same as Step 1.]

Step 3 Time setting

Mode to set the Time for step 3.

Setting value

[The setting range and the factory adjusted value are the same as Step 1.]

Step 4 Time setting

Mode to set the Time for step 4.

Setting value

[The setting range and the factory adjusted value are the same as Step 1.]

Step 5 Time setting

Mode to set the Time for step 5.

Setting value

[The setting range and the factory adjusted value are the same as Step 1.]
Step 6 Time setting
- \( \gamma_6 \) Setting value

Mode to set the Time for step 6.
[The setting range and the factory adjusted value are the same as Step 1.]

Step 7 Time setting
- \( \gamma_7 \) Setting value

Mode to set the Time for step 7.
[The setting range and the factory adjusted value are the same as Step 1.]

PV/SV display mode
- Actual temperature
- Main setting value
(8) Auto/Manual control change

A mode to change the output manipulating value by manual.

In case of proportional action, the manipulating value in proportion to the deviation is automatically generated. This is called an automatic control.

As compared with above, it is called manual control that the function to get the fixed amount of output by front key operation regardless of the deviation.

This function provides the balanceless-bumpless function, not to change the output suddenly when the control mode is changed from automatic to manual and vice versa.

Each time the key is pressed, the control form changes Auto  Manual.

<table>
<thead>
<tr>
<th>PV/SV display mode</th>
<th>Automatic control</th>
<th>Manual control (to set the Manipulating value by manual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual temperature</td>
<td>Main setting value</td>
<td></td>
</tr>
<tr>
<td>Manual control</td>
<td>Manipulating value</td>
<td></td>
</tr>
</tbody>
</table>

- If the Manipulating value is set to 0.0%, the valve will be full closed, and if it is set to 100.0%, the valve will be full open.

- In the case of other Manipulating values (0.1 to 99.9%), the Open output ON time and Closed output ON time are decided in relation to the Manipulating value at that time and the Setting values: Open/Closed output dead band, Manipulating value operation period, Time required to Open, Time required to Closed (page 31), etc.

- Setting range: 0.0 to 100.0%
(9) Control output OFF function
A function to make the control output OFF even the power to the instrument is supplied. The function is used when required to halt the control action or the FCD-15A is not used in plural controllers.

Control output OFF function can be selected from any mode by pressing the key for approx. 1 second.

The display is as selected in [Display selection when control output is off]. (See page 29.)

<table>
<thead>
<tr>
<th>PV/SV display mode</th>
<th>Main setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual temperature</td>
<td>Main setting value</td>
</tr>
<tr>
<td>Control output OFF function</td>
<td>[Unlit] 1s</td>
</tr>
<tr>
<td>Sensor correction setting</td>
<td>50 Setting value</td>
</tr>
</tbody>
</table>

(•) PV display indicates whichever [OFF indication], [No indication] or [Only PV] selected in Display selection when control output is off (page 29).

⚠️ Notices
Once the Control output OFF function is worked, the function is not released even if the power to the instrument is turned OFF and turned ON again.

To cancel the function, press the key again for approx. 1 second.

In program control, the Control output OFF function does not work because the key functions as Program Start/Stop key.
(9) Output manipulating value indication and Step rest time indication mode

In the PV/SV display mode, press the \text{MODE} key for approx. 3 seconds. The display will be changed to main setting mode on the process, however, keep pressing until the Output manipulating value is displayed.

If the \text{MODE} key is pressed again, the mode returns to PV/SV display.

When program control, if the \text{MODE} key is pressed in Output manipulating value indication, the Step rest time indication will be selected.

If the \text{MODE} key is pressed again, the mode returns to PV/SV display.
5. Setting value memory function [Option code: SM]

When the option SM is applied, maximum 7 files of data can be memorized, and selecting a desired file, the desired control can be performed.

In one (1) file, 8 kinds of data: Main setting value, PID each value, Open/Closed output dead band setting value and Alarm setting values (A1, A3, A4) can be memorized and selectable.

To select the setting value memory number (File number), connect the terminals between each of ⑩ to ⑬ as shown below table.

Up to approximately 50 of FCD-15A can be connected in parallel.

Terminal connection table for Setting value memory number selection

<table>
<thead>
<tr>
<th>Connective terminal</th>
<th>Setting value memory No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>⑩-⑬ (b₀-COM)</td>
<td>C</td>
<td>—</td>
<td>C</td>
<td>—</td>
<td>C</td>
<td>—</td>
<td>C</td>
<td>—</td>
</tr>
<tr>
<td>⑪-⑬ (b₁-COM)</td>
<td>—</td>
<td>C</td>
<td>C</td>
<td>—</td>
<td>—</td>
<td>C</td>
<td>C</td>
<td>—</td>
</tr>
<tr>
<td>⑫-⑬ (b₂-COM)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>—</td>
</tr>
</tbody>
</table>

C: Closed       —: Open

- When the Setting value memory number is selected by external operation, the number cannot be selected by front key operation.
- When selecting the memory number by front key operation, all terminals (b₀, b₁, b₂ and COM) should be open.
- Memory number cannot be changed during setting mode and PID auto-tuning.

Setting value memory function operating procedure

1. In the PV/SV display mode, select the setting value memory number by connecting the terminals.
2. In the setting mode, set each setting value: Main setting, PID each value, Open/Closed output dead band setting and Alarm setting values A1, A3, A4.
3. After setting, press the MODE key to return to PV/SV display mode.

Registration
- The setting data is registered to the file number of which the number is displayed.
- When the number is called up, the selected number by terminal connection is displayed, and the control is performed by the data of the file.
- To change the setting values, repeat the operation above-mentioned, and the values will be changed to new values.
6 Running

After completion of the mounting to the control panel and wiring connections, start running in the following manner:

6.1 When using the FCD-15A as a Temperature controller

(1) Turn the power supplied to the FCD-15A ON.

For approx. 2s after the power ON, the sensor type and the unit designated in Sensor input designation (page 11, 12) are indicated on PV display, and the rated maximum value is indicated on the SV display. See [table 6.1-1]. During this time, all outputs and LED indicators are in their OFF status. After that, the display turns to the PV/SV display.

In the status the Control output OFF function is working, the item selected in Display selection when control output is off is displayed on the PV display. (See page 29.)

(2) Input the setting value, referring to Chapter 4. Operation (page 14ff).

When controlling by Fuzzy self-tuning PID action, designate [Perform] in Auto-tuning Perform/Cancel when starting control to make the condition good when rising.

(3) Turn the load circuit power ON.

Starts the control action so as to maintain the controlling object at the main setting value.
6.2 When using the FCD-15A as a Simplified program controller

(1) **Turn the power supplied to the FCD-15A ON.**
   For approx. 2s after the power ON, the type of sensor and the unit designated in Sensor input designation (page 11, 12) is indicated on PV display, and the rated maximum value is indicated on SV display (page 39).

   During this time, all outputs and LED indicators are in their OFF status. After that, the display turns to PV/SV display.

   In the status the Control output OFF function is working, the item selected in Display selection when control output is off is displayed on PV display. (See page 29)

(2) **Input each setting value and each step time** referring to Chapter 4. Operation (page 14ff), especially page 38 (Setting value memory) and page 33 (Program control change, Step time setting). Then the PV display indicates the actual temperature and the status turns standby.

(3) **Turn the load circuit power ON.**

(4) **Program control start**
   When the Automatic start is designated in Program start Auto/Manual designation (page 11), it is in warm-up status for approx. 2 seconds after the power is turned on, and then automatically starts the program control from the step 1.

   In case Manual start is designated in Program start Auto/Manual designation (page 11), it is in warm-up status for approx. 2 seconds after the power is turned on, and then it goes to standby status. In this status, if the key is pressed, it starts the program control from the step 1.

   While program control performing, the change of Step number (by Setting value memory number) is ineffective.

**To make the step time progress faster.**
   The step time progress becomes 60 times as fast as usual while the key is being pressed.

**To end the program control on the process.**
   The program control is ended if the key is pressed for approx. 1 second or greater.

**To change the display.**
   In the PV/SV display, if the key is pressed for approximately 3 seconds, the mode turns Output manipulating value display, and if the key is pressed again, Step rest time display will be indicated (see page 37).

**Instrument status when power failure is restored.**
   When power failure occurs during program control and it is restored, the FCD-15A performs the program continuously. PV display blinks until the step at which the power failure occurs is ended.
## 7 Action explanations

### 7.1 Standard action drawings

<table>
<thead>
<tr>
<th>Action</th>
<th>Heating (reverse) action</th>
<th>Cooling (direct) action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control action</strong></td>
<td>![Diagram of Heating (reverse) action]</td>
<td>![Diagram of Cooling (direct) action]</td>
</tr>
<tr>
<td>ON</td>
<td>Proportional band setting</td>
<td>ON</td>
</tr>
<tr>
<td>OFF</td>
<td></td>
<td>OFF</td>
</tr>
</tbody>
</table>

| Open output | ![Diagram of Open output] | ![Diagram of Open output] |
| 5–6 | Cycle action is performed according to deviation. | Cycle action is performed according to deviation. |

| Closed output | ![Diagram of Closed output] | ![Diagram of Closed output] |
| 5–7 | | |

| Indicator | ![Diagram of Indicator OUT1] | ![Diagram of Indicator OUT1] |
| [OUT1] | | |
| Green | Lit | Unlit | Unlit | Lit |

| Indicator | ![Diagram of Indicator OUT2] | ![Diagram of Indicator OUT2] |
| [OUT2] | | |
| Yellow | Unlit | Lit | Lit | Unlit |

(Refer to page 53.)
7.2 Open/Closed output dead band action drawings

<table>
<thead>
<tr>
<th>Action</th>
<th>Heating (reverse) action</th>
<th>Cooling (direct) action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open output</td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td>Closed output</td>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
</tbody>
</table>

7.3 Pattern end action drawing

Program control end

Pattern end output is released by pressing the key.

Pattern end output is turned ON when the program control is ended, and it is not released until the key is pressed.
7.4 Alarm 1, 3 and 4 (A1, A3, A4) action drawings

<table>
<thead>
<tr>
<th>Temperature alarm action</th>
<th>High limit alarm</th>
<th>Low limit alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
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<td></td>
<td><img src="image" alt="Diagram" /></td>
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<td><img src="image" alt="Diagram" /></td>
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<tr>
<td></td>
<td><img src="image" alt="Diagram" /></td>
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</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
</tbody>
</table>

Standby function works at shaded part. 
▲ and ▼ shows the action point of the alarm output.

<table>
<thead>
<tr>
<th>Temperature alarm action</th>
<th>High/Low limits alarm with standby</th>
<th>High/Low limit range alarm with standby</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td><img src="image" alt="Temperature alarm ON diagram" /></td>
<td><img src="image" alt="Temperature alarm ON diagram" /></td>
</tr>
<tr>
<td>OFF</td>
<td><img src="image" alt="Temperature alarm OFF diagram" /></td>
<td><img src="image" alt="Temperature alarm OFF diagram" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output Indication</th>
<th>Process high alarm</th>
<th>Process low alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Output Indication diagram" /></td>
<td><img src="image" alt="Output Indication diagram" /></td>
<td><img src="image" alt="Output Indication diagram" /></td>
</tr>
</tbody>
</table>

Standby function works at part. ▲ and ▼ shows the action point of the alarm output.

Output terminals for Alarm 3: 2, 9, Alarm 4: 28, 30
8. Control actions

8.1 Fuzzy self-tuning

Fuzzy self-tuning is a function to perform a fine adjustment of PID values automatically. The stable control can be carried out even if the conditions of the process are changed due to things like various and variable production.

(1) When the control is rising, the controller performs the control by the PID values tuned in advance.

(2) When the control result is disordered by the disturbance or the process change, the controller checks the converging status, and performs the fine adjustment of PID values if necessary.
   (a) If the convergence is performed smoothly, the PID values are not changed.
   (b) If the convergent speed is slow, the controller corrects the PID values to make the convergence faster.
   (c) When overshoot is generated during the convergence, the controller corrects the PID values so as not to generate the overshoot.
   (d) When hunting is generated, the controller checks the waveform and performs the fine adjustment of PID values.

(3) The controller can be used without Fuzzy self-tuning by designating the internal switch.

(4) When using the controller for the first time, perform the PID auto-tuning or set the proper PID values by key operation.

- The instrument is always in self-tuning status itself, and when deviation is created it starts the tuning. Even if in Fuzzy self-tuning status, when very large hunting is caused and the control is not stabilized, it starts auto-tuning automatically.

- When the auto-tuning performance is designated by key operation, tuning is initiated, and when the control is stabilized, the auto-tuning is released and returns to self-tuning status.

- When lock mode [LOCK] or [FREE] is designated, Fuzzy self-tuning or Auto-tuning PID action cannot work.

- With the control system in which load fluctuation periodically occurs, the Fuzzy self-tuning may fall into malfunction. In such a case, use the controller with the PID auto-tuning mode.
8.2 Explanations of PID

(1) Proportional band (P)
Proportional action is the action which the control output varies in proportion to the deviation between the setting value and the processing temperature. If the proportional band is narrowed, even if the output changes by a slight variation of the processing temperature, better control results can be obtained as the offset decreases. However, if when the proportional band is narrowed too much, even slight disturbances may cause variation in the processing temperature, and control action changes to ON/OFF action and the so called hunting phenomenon occurs. Therefore, when the processing temperature comes to the balanced position near the setting value and a constant temperature is maintained, the most suitable value is selected by gradually narrowing the proportional band while observing the control results.

(2) Integral time (I)
Integral action is used to eliminate offset. When the integral time is shortened, the returning speed to the setting point is quickened. However, the cycle of oscillation is also quickened and stability becomes unfavorable.

(3) Derivative time (D)
Derivative action is used to restore the change in the processing temperature according to the rate of change. It reduces the amplitude of overshoot and undershoot width. If the derivative time is shortened, restoring value becomes small, and if the derivative time is adjusted to be longer, a phenomenon of excessive returning may occur and the control system may be oscillated.
8.3 PID auto-tuning
In order to decide each value of P, I, D and ARW automatically, this system gives the fluctuation to the control object by force.

(1) **When the difference between setting value and processing temperature is large when the temperature rises.**
Fluctuation is given at the temperature 1.5% of scaling span less than the setting value.

![Diagram showing fluctuation based on temperature difference](image)

(2) **When the control is stable or when control temperature is within ±1.5% of scaling span.**
Fluctuation is given at the setting value.

![Diagram showing fluctuation at setting value](image)

(3) **When the control temperature is 1.5% or greater of scaling span higher than the setting value.**
Fluctuation is given at the temperature 1.5% of scaling span higher than the setting value.

![Diagram showing fluctuation based on temperature increase](image)
9. Other functions

(1) Burnout alarm
(Upscale)
When the thermocouple or RTD is burnt out or the input value reaches [Rated scale maximum value +1% of rated scale span] or greater, PV display blinks [-----] and the control output is turned OFF (Closed output ON).
With the input RTD Pt100 (F) or DC, the rated scale maximum value is 999.9 or 9999, if the input value is greater than the maximum value, PV display blinks [-----], however, the control is performed to [rated scale maximum value +10% of rated scale span].

(Downscale)
When the input value falls [Rated scale minimum value -1% of rated scale span] or less, PV display blinks [-----] and the control output is turned OFF (Closed output ON).

With the input Thermocouple T, RTD or DC, the rated scale minimum value is −199.9 or −1999, if the input value is less than the minimum value, PV display blinks [-----], however, the control is performed to rated scale minimum value −1% of rated scale span.

(2) Self-diagnostic function
The CPU is monitored by a watchdog timer, and when any abnormal status is found on the CPU, the controller is switched to warm-up status.

(3) Automatic cold junction temperature compensation (Thermocouple input type)
This detects the temperature at the connecting terminal between thermocouple and instrument, and always keeps it the same status at which the reference junction is located at 0°C [32°F].

(4) Warm-up indication
For approximately 2s after the power supplied to the instrument is turned on, the type of input and the unit are indicated on the PV display, and the maximum input rated value (for DC input, scaling high limit value) on the SV display.

(5) Setting value ramp function
When the main setting value is adjusted, it approaches the new setting value by the set rate of change.
When the power is turned on, the control starts from the PV (process variable) and approaches the main setting value by the rate of change.
10. Mounting to control panel

10.1 Site selection

Mount the controller in a place with:

1. A minimum of dust and an absence of corrosive gases.
2. No mechanical vibrations or shocks.
3. No exposure to direct sunlight, an ambient temperature of 0 to 50°C (32 to 122°F) that does not change suddenly.
4. An ambient non-condensing humidity of 85%RH or less.
5. The units away from large capacity electromagnetic switches or cables through which large current is flowing.
6. No water, oil or chemicals or where their vapors of these substances can come into direct contact with the unit.

10.2 External dimension drawing

![External Dimension Drawing]

[Fig. 10.2-1]

10.3 Panel cutout drawing

Lateral close mounting

n: Number of units mounted

![Panel Cutout Drawing]

[Fig. 10.3-1]
10.4 Mounting
Mounting panel thickness is 1 to 15mm.
Insert the FCD-15A from the front of the panel. Slot the mounting bracket into the holes at the top and bottom of the case, and screw in place.

⚠️ Notice
As the case is made of resin, do not use excessive force while screwing in the mounting bracket. Torque is approximately 0.12N•m.
11. Wiring connection

⚠️ Warning
Turn the power supply to the instrument off before wiring or checking. Working or touching the terminal with the power switched to on may result in Electric Shock, which can cause severe injury or death. Moreover, the instrument must be grounded before the power supply to the instrument is turned on.

11.1 Terminal arrangement

[Fig. 11.1-1]

The terminal block of this instrument is designed to wire from the left side. Lead wire must be inserted from the left side of the terminal, and fasten by the terminal screw. Dotted lines show options, no terminal is equipped if it is not specified.
11.2 Wiring connection examples

⚠️ Notices

- Use a thermocouple and compensating lead wire according to the input specifications of this controller.
- Use a 3-wire RTD system according to the input specifications of this controller.
- This controller has no built-in power switch or fuse. It is necessary to install them in the circuit near the external controller.
- In case of 24Vdc, do not confuse the polarity.
- When wiring, keep input wire (Thermocouple, RTD, etc.) away from AC source and the load wire to avoid external interference.
- Use a thick wire (1.25 to 2.0mm²) for the earth ground.
- Use an auxiliary electromagnetic switch between the FCD-15A and the control motor.

* To prevent the unit from harmful effects of the unexpected level noise, it is recommended that a surge absorber be installed between the coils of the external relay.
### External operation input

**Contact input**

<table>
<thead>
<tr>
<th>Setting item</th>
<th>External operation</th>
<th>Key operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote setting</td>
<td>25 - 27 Closed</td>
<td>Not required (invalid)</td>
</tr>
<tr>
<td>Local setting</td>
<td>25 - 27 Open</td>
<td>See page 23</td>
</tr>
<tr>
<td>Manual control setting</td>
<td>26 - 27 Closed</td>
<td>Not required (invalid)</td>
</tr>
<tr>
<td>Automatic control setting</td>
<td>26 - 27 Open</td>
<td>See page 35</td>
</tr>
</tbody>
</table>

External operation takes priority to key operation.

[Fig 11.2-2]
12. Specifications
12.1 Standard specifications

Mounting method : Flush
Setting : Input system using membrane sheet key
Display
  PV display : Red LED display 4 digits, size, 14.3(H) x 8(W)mm
  SV/MV/TIME display: Green LED display 4 digits, size, 10(H) x 5.5(W)mm
  Setting value memory number display:
    Yellow LED display 1 digit, size, 8(H) x 4(W)mm

Indicating accuracy
  Thermocouple input : Within ±0.2% of input range full scale ±1digit
    however, for R or S input, range 0 to 200°C (400°F)
    Within ±4°C (8°F)
    when B input, range 0 to 300°C (600°F)
  Without the range of accuracy guarantee
  when K, J, T input, range less than 0°C (32°F),
    Within ±0.4% of full scale ±1digit
    (Cold junction compensating accuracy, ±1°C, at 0 to 50°C)
  RTD input : Within ±0.2% of input range full scale ±1digit
  Current input : Within ±0.2% of input range full scale ±1digit
  Voltage input : Within ±0.2% of input range full scale ±1digit

Setting accuracy : The same as indicating accuracy
Input sampling period : 0.125 seconds
  (In the case of option EA, EV, it is 0.25 seconds)
Input
Thermocouple: K, J, R, S, B, E, T [JIS, IEC], C (W/Re5-26) [ASTM],
N (IEC) and PL-II (NBS)
   External resistance, 100Ω or less
   When input burnout, Upscale
RTD: Pt100 (JIS, IEC), JPt100 3-wire system
   Allowable input lead wire resistance, 10Ω or less per wire
   When input burnout, Upscale
Current: 0 to 20mAdc, 4 to 20mAdc
   Input impedance, 50Ω
   Allowable input current, 100mA or less
   When input burnout, 0 to 20mA, the same as 0mA
   4 to 20mA, Downscale
Voltage: 0 to 1Vdc
   Input impedance, 1MΩ or greater
   Allowable input voltage, 5V or less
   Allowable signal source resistance, 2kΩ or less
   When input burnout, Upscale

Control output
Relay contact: 1a x 2
   Control capacity, 250Vac 3A (resistive load)
   250Vac 1A (inductive load cos φ=0.4)

Alarm 1 output
Deviation setting by ± to main setting (except Process value alarm),
and when the input exceeds the range the output turns ON or OFF (in the case
of High/Low limit range alarm). One of the alarms is selectable by the rotary
switch and DIP switch from 14 types of alarm; High limit alarm, Low limit alarm,
High/Low limits alarm, High/Low limit range alarm, Process high alarm and
Process low alarm, and the standby function is applied to them respectively,
as well as No alarm and Pattern end output.
Setting accuracy: Within ±0.2% of input range full scale ±1digit
Action: ON/OFF action
   Hysteresis setting range
   When thermocouple or RTD input, 0.1 to 100.0°C (°F)
   When DC input, 1 to 1000
   (Decimal point place follows selection.)
Output: Relay contact 1a
   Control capacity, 250Vac 3A (resistive load)
   250Vac 1A (inductive load cosφ=0.4)
Controlling action
Fuzzy self-tuning PID or PID action is selectable by the DIP switch.

Fuzzy self-tuning PID action
- Proportional band (P) : Automatic
- Integral time (I) : Automatic
- Derivative time (D) : Automatic
- Manipulating value operating period: 1 to 120s
- Anti-reset windup (ARW) : Automatic
- Dead band : 0.1 to 100.0% of proportional band
- Open output time setting : 0.1 to 999.9s
- Closed output time setting: 0.1 to 999.9s

PID action (with auto-tuning function)
- Proportional band (P) : 0.1 to 999.9%
- Integral time (I) : 0 to 3600s (off when set to 0)
- Derivative time (D) : 0 to 3600s (off when set to 0)
- Manipulating value operating period: 1 to 120s
- Anti-reset windup (ARW) : Automatic
- Dead band : 0.1 to 100.0% of proportional band
- Open output time setting : 0.1 to 999.9s
- Closed output time setting: 0.1 to 999.9s

Supply voltage : 100 to 240Vac, 50/60Hz, 24Vac/dc, 50/60Hz

Allowable voltage fluctuation:
- In the case of 100 to 240Vac ... 85 to 264Vac
- In the case of 24Vac/dc .......... 20 to 28Vac/dc

Ambient temperature : 0 to 50°C (32 to 122°F)
Ambient humidity : 35 to 85%RH (non-condensing)
Power consumption : Approx. 15VA
Circuit insulation configuration

Insulation resistance

10M\(\Omega\) or greater at 500Vdc

Insulation test **must not** be carried out between A-B and C-D of Circuit insulation configuration, because they are non-isolated.

Dielectric strength

- Between input terminal and ground terminal, 1.5kVac for 1 minute
- Between input terminal and power terminal, 1.5kVac for 1 minute
- Between power terminal and ground terminal, 1.5kVac for 1 minute
### SPECIFICATIONS

**Weight**: Approx. 500g

**External dimension**: 96 x 96 x 100mm (W x H x D)

**Material**: Base and Case, Flame resisting resin

**Color**: Base and Case, Gray

**Attached functions**:
- Control output OFF function
- Setting value lock function
- Setting value limit function
- Sensor correcting function
- Multi-range function
- Alarm action delayed timer function
- Multi-function
- Simplified program controller function
- Setting value memory function
- Loop break alarm indicating function
- Power failure compensating function
- Self-diagnostic function
- Automatic cold junction temperature compensation
- Setting value ramp function
- Sensor burnout [upscale, downscale]
- Warm-up display function

**Accessories**:
- Mounting bracket 1 set
- Instruction manual 1 copy
- Unit nameplate 1 sheet
- Terminal cover 2 pieces [When option TC is applied.]
12.2 Optional specifications

Alarm 3 and 4 output [SA]

Deviation setting by ± to the main setting (except Process value alarm), and when the input exceeds the range the output turns ON or OFF (in the case of High/Low limit range alarm).

Alarm 3 and 4 are selectable by key operation from 13 types of alarm; High limit alarm, Low limit alarm, High/Low limits alarm, High/Low limit range alarm, Process high alarm and Process low alarm and the standby function is applied to them respectively, as well as No alarm.

Setting accuracy: Within ±0.2% of input range full scale ±1digit

Action: ON/OFF action

Hysteresis setting range
When thermocouple or RTD input, 0.1 to 100.0°C (°F)
When DC input, 1 to 1000
Decimal point place follows the place setting value.

Output: Relay contact 1a x 2

Control capacity 250Vac 3A (resistive load)
250Vac 1A (inductive load cosø=0.4)
(However, to the common terminal A3 and A4, maximum 3A)

Transmission output [TA or TV]

Converting the value whichever Process variable transmission, Main setting value transmission or Main output manipulating value transmission to analog signal every 0.125 seconds, it outputs the value in current or voltage.

Transmission output is key selectable whichever Process variable, Main setting value or Main output manipulating value.

Resolution: 1/10000
Current (TA): 4 to 20mA (load resistance maximum 550Ω)
Voltage (TV): 0 to 1V (load resistance minimum 100kΩ)
Output accuracy: Within ±0.3% of full scale

Serial communication [C or C5]

Following operations can be executed from the external computer.

(1) Reading and setting of the Main setting value, PID value and various setting values.

(2) Reading of the input value and the action status.

(3) Change of the functions.

Communication circuit: Based on EIA RS-485 [Option code: C5] or Based on EIA RS-232C [Option code: C]

Communication method: Half-duplex communication start-stop synchronous

Data transfer rate: 2400, 4800, 9600 and 19200bps
(selectable by key operation)

Data format: Start bit: 1
Data bit: 7
Parity: Even parity
Stop bit: 1
Setting value memory number external selection [SM]
Selects the setting value memory number from 7 files (under mentioned data as 1 file) by external terminal.
(Main setting value, PID values, Open/Closed dead band setting value, Alarm 1, 3 and 4 setting values)
Memory number  1 to 7 (7 files)
Data           8

External setting [EA or EV]
Main setting value can be set by external analog signal.
Setting signal : Current [EA]
0 to 20mAdc, 4 to 20mAdc
Allowable input current, 100mA or less.
Input impedance, 50Ω (non-isolated with input)
: Voltage [EV]
0 to 1Vdc, 1 to 5Vdc
Allowable input voltage, When 0 to 1Vdc, 5V or less
When 1 to 5Vdc, 10V or less
Input impedance, 100kΩ (non-isolated with input)

Setting signal sampling period is 0.25 seconds
(When this function is applied, the input sampling period also changes to 0.25 seconds.)

External operation: When this option External setting is applied, external change of Remote/Local setting and Auto/Manual control can be executed.

Terminal  Closed : Remote setting
          Open  : Local setting

Terminal  Closed : Manual control
          Open  : Automatic control

Color black [BK]
Front panel : Dark gray
Case       : Black

Terminal cover [TC]
Electrical shock protecting terminal cover
Dust-proof •Drip-proof [IP]
Dust-proof and Drip-proof specification (IP54)
• Effective for only panel surface, case part is excluded.
• Effective only when the FCD-15A is mounted vertically.

Specified specifications
Input, Scale range : Shipped as specified range.
Alarm action : Shipped as specified alarm action. (A1, A3, A4)
Control action : Shipped as specified control action.
Transmission output : Shipped as specified output.
[Applied to option Transmission output]
External setting : Shipped as specified input.
[Applied to option External setting]
13. Troubleshooting

When any malfunctions occur, refer to the following items after checking the power and the wiring.

⚠️ **Warning**

Turn the power supply to the instrument off before wiring or checking. Working or touching the terminal with the power switched to on may result in Electric Shock, which can cause severe injury or death.

---

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Presumed cause and the action</th>
</tr>
</thead>
</table>
| If PV display is indicating \(\text{OFF}\) or no indication. | • Control output OFF function is working.  
  ➔ Press the \(\text{OFF}\) key for approx. 1s to release the function. (page 36) |
| If \([- - - -]\) is blinking on PV display. | • Thermocouple or RTD is burnt out.  
  [In the case of Thermocouple]  
  If the input terminal of the instrument is connected, and if nearby room temperature is indicated, the instrument should be normal and sensor may be burnt out.  
  \[\text{In the case of RTD}\]  
  If approx. 100\(\Omega\) of resistance is connected to the input terminal between A-B of the instrument and between B-B is shorted, and if nearby 0°C (32°F) is indicated, the instrument should be normal and sensor may be burnt out.  
  • Lead wire of thermocouple or RTD is not securely mounted to the instrument terminal. |
| If \([- - - -]\) is blinking on PV display. | • Polarity of thermocouple or compensating lead wire is reverse.  
  • Codes (A, B, B) of RTD does not agree with the instrument terminal. |
**<Indication>**

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Presumed cause and the action</th>
</tr>
</thead>
<tbody>
<tr>
<td>If indication of PV display is</td>
<td>• Designation of the Sensor input is improper.</td>
</tr>
<tr>
<td>abnormal or unstable.</td>
<td>➞ Set the Sensor input properly by Rotary switch and DIP switch. (page 11, 12)</td>
</tr>
<tr>
<td></td>
<td>• Temperature unit (°C or °F) is mistaken.</td>
</tr>
<tr>
<td></td>
<td>➞ Set the unit properly by DIP switch. (page 11)</td>
</tr>
<tr>
<td></td>
<td>• Sensor correcting value is unsuitable.</td>
</tr>
<tr>
<td></td>
<td>➞ Set the value suitably. (page 22)</td>
</tr>
<tr>
<td></td>
<td>• Specification of the Thermocouple or RTD is improper.</td>
</tr>
<tr>
<td></td>
<td>• AC leaks into thermocouple or RTD circuit.</td>
</tr>
<tr>
<td></td>
<td>• There is an equipment to send out inductive fault or noise near the controller.</td>
</tr>
</tbody>
</table>
### Key operation

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Presumed cause and the action</th>
</tr>
</thead>
<tbody>
<tr>
<td>If setting mode cannot be selected.</td>
<td>Manual control is selected. <strong>Change the mode to Automatic control (page 35).</strong></td>
</tr>
<tr>
<td>If the mode cannot be changed from Remote setting to Local setting by key operation.</td>
<td>• The mode is selected to Remote setting by External operation [option code: EA or EV]. External operation takes priority.</td>
</tr>
<tr>
<td>If the mode cannot be changed from Manual control to Automatic control by key operation.</td>
<td>• The mode is selected to Manual control by External operation [option code: EA or EV]. External operation takes priority.</td>
</tr>
<tr>
<td>If settings are impossible. If the value does not change by the keys.</td>
<td>• Setting value lock (mode 1 or 2) is designated. <strong>Release the lock designation (page 21).</strong></td>
</tr>
<tr>
<td>If the setting indication does not change in the rated scale range even if the keys are pressed, and settings are impossible.</td>
<td>• Main setting value high limit or low limit may be set at the point the value does not change.  <strong>Set it again by Auxiliary function setting mode 1 (page 22).</strong></td>
</tr>
<tr>
<td>If it does not start even if the key is pressed in Program mode.</td>
<td>• Step time is not set. <strong>Set the step time (page 33).</strong></td>
</tr>
</tbody>
</table>
<Control>

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Presumed cause and the action</th>
</tr>
</thead>
</table>
| If process variable (Temperature) does not rise. | • Thermocouple or RTD is burnt out.  
[In the case of Thermocouple]  
If the input terminal of the instrument is connected, and if nearby room temperature is indicated, the instrument should be normal and sensor may be burnt out.  
[In the case of RTD]  
If approx. 100Ω of resistance is connected to the input terminals between A–B of the instrument and between B–B is connected, and if nearby 0℃ (32°F) is indicated, the instrument should be normal and sensor may be burnt out.  
• Lead wire of thermocouple or RTD is not securely mounted to the instrument terminal. |
| If it does not control. (Indicates only PV display) | • Program mode is selected.  
If running by Program mode, press the \[\text{Out}\] key.  
When performing by Fixed value control, press the \[\downarrow\] key for approx. 3s while the \[\text{}\] key is being pressed to select the Fixed value control mode (page 33). |
| If the value is full open of full closed regardless of the controlling temperature high or low. | • Time required to Open/Closed are set unsuitably.  
Set the time suitably (page 31). |

If any unexplained malfunctions occur other than the above mentioned, make inquiries at our agency or the shop where you purchased the unit.
### 14. Character table

#### <Main setting mode>

<table>
<thead>
<tr>
<th>Character</th>
<th>Item</th>
<th>Initial</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Main setting</td>
<td>0°C</td>
<td></td>
</tr>
</tbody>
</table>

#### <Sub setting mode>

<table>
<thead>
<tr>
<th>Character</th>
<th>Item</th>
<th>Initial</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Setting value memory number</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Auto-tuning Start/Cancel</td>
<td>Cancel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proportional band setting</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Integral time setting</td>
<td>200s</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Derivative time setting</td>
<td>50s</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Open/Closed output dead band</td>
<td>3.0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alarm 1 setting</td>
<td>0°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alarm 3 setting</td>
<td>0°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alarm 4 setting</td>
<td>0°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loop break alarm time setting</td>
<td>0 min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loop break alarm span setting</td>
<td>0°C</td>
<td></td>
</tr>
</tbody>
</table>

#### <Auxiliary function setting mode 1>

<table>
<thead>
<tr>
<th>Character</th>
<th>Item</th>
<th>Initial</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Setting value lock designation</td>
<td>Cancel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main setting value high limit</td>
<td>400°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main setting value low limit</td>
<td>0°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sensor correction setting</td>
<td>0.0°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Remote/Local change</td>
<td>Local</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Instrument number setting</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transfer rate selection</td>
<td>9600bps</td>
<td></td>
</tr>
</tbody>
</table>
**CHARACTER TABLE**

### <Auxiliary function setting mode 2>

<table>
<thead>
<tr>
<th>Character</th>
<th>Item</th>
<th>Initial</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>5FLH</td>
<td>Scaling high limit setting</td>
<td>9999</td>
<td></td>
</tr>
<tr>
<td>5LLL</td>
<td>Scaling low limit setting</td>
<td>−1999</td>
<td></td>
</tr>
<tr>
<td>dP</td>
<td>Decimal point place selection</td>
<td>No decimal point</td>
<td></td>
</tr>
<tr>
<td>F1 LF</td>
<td>PV filter time constant</td>
<td>0.0s</td>
<td></td>
</tr>
<tr>
<td>RL3F</td>
<td>Alarm 3 action form selection</td>
<td>No alarm</td>
<td></td>
</tr>
<tr>
<td>RL4F</td>
<td>Alarm 4 action form selection</td>
<td>No alarm</td>
<td></td>
</tr>
<tr>
<td>A1HY</td>
<td>Alarm 1 hysteresis setting</td>
<td>1.0°C</td>
<td></td>
</tr>
<tr>
<td>A3HY</td>
<td>Alarm 3 hysteresis setting</td>
<td>1.0°C</td>
<td></td>
</tr>
<tr>
<td>A4HY</td>
<td>Alarm 4 hysteresis setting</td>
<td>1.0°C</td>
<td></td>
</tr>
<tr>
<td>A1dY</td>
<td>Alarm 1 delayed timer setting</td>
<td>0s</td>
<td></td>
</tr>
<tr>
<td>A3dY</td>
<td>Alarm 3 delayed timer setting</td>
<td>0s</td>
<td></td>
</tr>
<tr>
<td>A4dY</td>
<td>Alarm 4 delayed timer setting</td>
<td>0s</td>
<td></td>
</tr>
<tr>
<td>rSLH</td>
<td>External setting high limit</td>
<td>400°C</td>
<td></td>
</tr>
<tr>
<td>rSLL</td>
<td>External setting low limit</td>
<td>0°C</td>
<td></td>
</tr>
<tr>
<td>Pmb</td>
<td>Transmission output selection</td>
<td>PV (PV)</td>
<td></td>
</tr>
<tr>
<td>PmLH</td>
<td>Transmission output high limit</td>
<td>400°C</td>
<td></td>
</tr>
<tr>
<td>PmlL</td>
<td>Transmission output low limit</td>
<td>0°C</td>
<td></td>
</tr>
<tr>
<td>P58</td>
<td>Display selection when control output is off</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>P_c</td>
<td>Manipulating value operating period setting</td>
<td>3s</td>
<td></td>
</tr>
<tr>
<td>rRgU</td>
<td>Main setting rising rate</td>
<td>0°C</td>
<td></td>
</tr>
<tr>
<td>rRgd</td>
<td>Main setting falling rate</td>
<td>0°C</td>
<td></td>
</tr>
</tbody>
</table>
### <Time required to Open/Closed setting mode>

<table>
<thead>
<tr>
<th>Character</th>
<th>Item</th>
<th>Initial</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_{o\Gamma}$</td>
<td>Time required to Open setting</td>
<td>30.0s</td>
<td></td>
</tr>
<tr>
<td>$P_{c\Gamma}$</td>
<td>Time required to Closed setting</td>
<td>30.0s</td>
<td></td>
</tr>
</tbody>
</table>

### <Program mode>

<table>
<thead>
<tr>
<th>Character</th>
<th>Item</th>
<th>Initial</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Pro_{c}$</td>
<td>Program control change</td>
<td>Fixed value</td>
<td></td>
</tr>
<tr>
<td>$\Gamma_1$</td>
<td>Step 1 time setting</td>
<td>00.00</td>
<td></td>
</tr>
<tr>
<td>$\Gamma_2$</td>
<td>Step 2 time setting</td>
<td>00.00</td>
<td></td>
</tr>
<tr>
<td>$\Gamma_3$</td>
<td>Step 3 time setting</td>
<td>00.00</td>
<td></td>
</tr>
<tr>
<td>$\Gamma_4$</td>
<td>Step 4 time setting</td>
<td>00.00</td>
<td></td>
</tr>
<tr>
<td>$\Gamma_5$</td>
<td>Step 5 time setting</td>
<td>00.00</td>
<td></td>
</tr>
<tr>
<td>$\Gamma_6$</td>
<td>Step 6 time setting</td>
<td>00.00</td>
<td></td>
</tr>
<tr>
<td>$\Gamma_7$</td>
<td>Step 7 time setting</td>
<td>00.00</td>
<td></td>
</tr>
</tbody>
</table>
[Glossary]

- **Loop break alarm**
  The alarm will be output when the process variable (PV) does not rise as much value as the span or greater within the time to access loop break alarm after the manipulating value reaches to 100% or output high limit value. The alarm will be also output when the process variable (PV) does not fall to as much value as the span or greater within the time to access loop break alarm after the manipulating value reaches to 0% or output low limit value. When the control action is Direct (Cooling), the alarm acts conversely.

- **Sensor correction function**
  Corrects the input value from the sensor. When a sensor cannot be set at a location where control is desired, the sensor measuring temperature may deviate from the temperature in the controlled location. When controlling with multiple controllers, the accuracy of sensors have influence on the control. Therefore, sometimes measuring temperature (input value) does not accord with the same setting value.
  In such a case, the control can be accorded with desired temperature by shifting the input value of sensors.

- **Manipulating value operating period**
  As to the process which has large input change by disturbance and so on, the Open output and Closed output will be ON or OFF frequently because the manipulating value change is large by the derivative action, and the control may not be stabilized.
  By setting the Manipulating value operating period, the manipulating value is decided every period, therefore, good result can be obtained.
  Take care to the setting time. If setting the time too longer, hunting phenomenon will be caused, and if setting the time too shorter, the control will be unstable.

- **Simplified program controller function**
  This function is different from usual Fixed value control (always controls by fixed setting value), and allows the setting value to change according to the time passing.
  The FCD-15A can be set 7 steps of setting, from starting to ending as 1 step.
  The setting time per step is from 0 to 99 hours 59 minutes.
  (Refer to page 32)
***** Inquiry *****

For any inquiries about this controller, after checking the following as to the controller, please contact the shop where you purchased the unit or our agency.

[Example]

Model .................................. FCD-15A-R/M
Type of input ........................... K
Option ................................. SA, TV
Instrument number .................... No. xxxxxx

In addition to the above, please let us know the details of malfunction, if any, and the operating conditions.

SHINKO TECHNOS CO., LTD.
OVERSEAS DIVISION
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E-mail : overseas@shinko-technos.co.jp
Tel : 81-727-21-2781
Fax: 81-727-24-1760