Introduction

Thank you for purchasing the UT351/UT321 digital indicating controllers.

How to Use the Manuals

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<th>Title</th>
<th>Description</th>
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<td>Setup</td>
<td>1. Installation</td>
<td>Describes the tasks (installation, wiring, and others) required to make the controller ready for operations.</td>
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<tr>
<td>Basic operation</td>
<td>2. Initial Settings</td>
<td>Describes examples of setting PV input types, control output types, and alarm types. Making settings described herein allows you to carry out basic control.</td>
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<td>Brief operation</td>
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<td>Contains the parameter map used as a guideline for setting parameters and lists of parameters for recording User Settings.</td>
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<td>and setpoint recording</td>
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</table>

Regarding This User’s Manual

(1) This manual should be provided to the end user. Keep an extra copy or copies of the manual in a safe place.

(2) Read this manual carefully to gain a thorough understanding of how to operate this product before starting operation.

(3) This manual describes the functions of this product. Yokogawa Electric Corporation (hereinafter simply referred to as Yokogawa) does not guarantee the application of these functions for any particular purpose.

(4) Under absolutely no circumstances may the contents of this manual, in part or in whole, be transcribed or copied without permission.

(5) The contents of this manual are subject to change without prior notice.

(6) Every effort has been made to ensure that the details of this manual are accurate. However, should any errors be found or important information be omitted, please contact your nearest Yokogawa representative or our sales office.
Safety Precautions

The following symbol is indicated on the controller to ensure safe use.

CAUTION

This symbol on the controller indicates that the operator must refer to an explanation in the user’s manual in order to avoid the risk of injury or death of personnel or damage to the instrument. The manual describes how the operator should exercise special care to avoid electric shock or other dangers that may result in injury or loss of life.

The following symbols are used in the hardcopy user’s manuals and in the user’s manual supplied on the CD-ROM.

NOTE

Indicates that operating the hardware or software in a particular manner may damage it or result in a system failure.

IMPORTANT

Draws attention to information that is essential for understanding the operation and/or features of the controller.

Force Majeure

(1) Yokogawa assumes no liability to any party for any loss or damage, direct or indirect, caused by the use or any unpredictable defect of the product.

(2) No portion of the software supplied by Yokogawa may be transferred, exchanged, leased or sublet for use by any third party without the prior permission of Yokogawa.

(3) Be sure to use the spare parts approved by Yokogawa when replacing parts or consumables.

(4) Use this software with one specified computer only. You must purchase another copy of the software for use on each additional computer.

(5) Copying this software for purposes other than backup is strictly prohibited.

(6) Store the floppy disk(s) (original medium or media) containing this software in a secure place.
Regarding Protection, Safety, and Prohibition Against Unauthorized Modification

(1) In order to protect the product and the system controlled by it against damage and ensure its safe use, make certain that all of the instructions and precautions relating to safety contained in this document are strictly adhered to. Yokogawa does not guarantee safety if products are not handled according to these instructions.

(2) Modification of the product is strictly prohibited.

(3) Reverse engineering such as the disassembly or decompilation of software is strictly prohibited.
Model UT351/UT321
Digital Indicating Controllers
User’s Manual

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1. Installation

This chapter describes installation, wiring, and other tasks required to make the controller ready for operation.

1.1 Model and Suffix Codes

Before using the controller, check that the model and suffix codes match your order.

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<tr>
<th>Model</th>
<th>Suffix Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UT351</td>
<td>-0</td>
<td>Digital indicating controller (provided with retransmission output and 15 V DC loop power supply as standard)</td>
</tr>
<tr>
<td>UT321</td>
<td>-2</td>
<td>Standard type</td>
</tr>
<tr>
<td></td>
<td>-3</td>
<td>Heating/cooling type</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Standard type (with 24 V DC loop power supply)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>With communication, heater burnout alarm</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>With heater burnout alarm</td>
</tr>
</tbody>
</table>

Check that the following items are provided:

- Digital indicating controller (of ordered model) .................. 1
- Brackets (mounting hardware) ........................................... 1 pair
- Unit label ........................................................................ 1
- User’s Manuals ................................................................ 3 (A2 size)
- User’s Manuals
  Setting/Explanation of Active Color PV Display ................. 1 (A3 size)
- User’s Manual (Reference) (CD-ROM version) .................... 1
1.2 How to Install

⚠️ NOTE

To install the controller, select a location where:
1. no one may accidentally touch the terminals,
2. mechanical vibrations are minimal,
3. corrosive gas is minimal,
4. temperature can be maintained at about 23°C and the fluctuation is minimal,
5. no direct radiant heat is present,
6. no magnetic disturbances are caused,
7. no wind blows against the terminal board (reference junction compensation element),
8. no water is splashed,
9. no flammable materials are around,

Never place the controller directly on flammable items or equipment.

If the controller has to be installed close to flammable items or equipment, be sure to provide shielding panels all around the controller, at least 150 mm away from every side; the panels should be made of either 1.43 mm-thick metal-plated steel plates or 1.6 mm-thick uncoated steel plates.

⚠️ NOTE

Never touch the opening at the bottom of the case. It is to be used in the factory at shipping.

● Installation Position

Install the controller at an angle within 30° from horizontal with the front panel facing upward. Do not install it facing downward. The position of right and left sides should be horizontal.
### External Dimensions and Panel Cutout Dimensions

#### UT351

**General installation**

- **UT351**
- Unit: mm
- Dimensional details: 96 x 96
- 117 min.

**Side-by-side close installation**

- Dimensional details: \([(N-1) \times 96 + 92]\) mm
- "N" stands for the number of controllers to be installed. However, the measured value applies if \(N \geq 5\).

### UT321

**General installation**

- Dimensional details: 48 x 96
- 70 min.

**Side-by-side close installation**

- Dimensional details: \([(N-1) \times 48 + 45]\) mm
- "N" stands for the number of controllers to be installed. However, the measured value applies if \(N \geq 5\).
How to Install

Turn off the power to the controller before installing it on the panel because there is a possibility of electric shock.

CAUTION

After opening the mounting hole on the panel, follow the procedures below to install the controller:

1. Insert the controller into the opening from the front of the panel so that the terminal board on the rear is at the far side.
2. Set the brackets in place on the top and bottom of the controller as shown in the figure below, then tighten the screws of the brackets. Take care not to overtighten them.

![Diagram of controller installation](image)

Recommended tightening torque: 0.4 N·m
1.3 How to Connect Wires

**CAUTION**

1) Before carrying out wiring, turn off the power to the controller and check that the cables to be connected are not alive with a tester or the like because there is a possibility of electric shock.

2) For the protection and safe use of the controller, be sure to place a circuit breaker (conforms with IEC60947, 5A, 100V or 220V AC) near the controller where the breaker can easily be operated. In addition, be sure to indicate that it is the instrument to cut the power supply of the controller.

3) Wiring must be carried out by personnel who have basic electrical knowledge and practical experience.

**NOTE**

1) Provide power from a single-phase instrument power supply. If there is a lot of noise in the power line, insert an insulating transformer into the primary side of the line and use a line filter (recommended part: ZAC2205-00U from TDK) on the secondary side. As a countermeasures against noise, do not place the primary and secondary power cables close to each other.

2) For thermocouple input, use shielded compensating lead wires for wiring. For RTD input, use shielded wires that have low conductor resistance and cause no significant differences in resistance between the three wires. The cables to be used for wiring, terminal specifications, and recommended parts are as shown below.

3) Control output relays may be replaced. However, because they have a life of 100,000 times that of the resistance load, use auxiliary relays to turn on/off a load.

4) The use of inductance (L) loads such as auxiliary relays, motors and solenoid valves causes malfunction or relay failure; always insert a CR filter for use with alternating current or a diode for use with direct current, as a spark-removal surge suppression circuit, into the line in parallel with the load.

5) When there is possibility of being struck by external lightening surge, use the arrester to protect the instrument.

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**For DC Relay Wiring**

- UT351/UT321
- UT's contact
- Diode
- Relay
- External DC power supply

(Use one with a relay coil rating less than the UT's contact rating.)

**For AC Relay Wiring**

- UT351/UT321
- UT's contact
- Relay
- CR filter
- External AC power supply

(Use one with a relay coil rating less than the UT's contact rating.)
### Cable Specifications and Recommended Cables

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Name and Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply, grounding, relay contact outputs</td>
<td>600 V PVC insulated wires, JIS C 3307, 0.9 to 2.0 mm²</td>
</tr>
<tr>
<td>Thermocouple</td>
<td>Shielded compensating lead wires, JIS C 1610, X-</td>
</tr>
<tr>
<td>RTD</td>
<td>Shielded wires (three conductors), UL2482 (Hitachi Cable)</td>
</tr>
<tr>
<td>Other signals</td>
<td>Shielded wires</td>
</tr>
</tbody>
</table>

### Recommended Terminal Lugs

<table>
<thead>
<tr>
<th>Applicable wire size</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3 to 1.65 mm²</td>
<td>0.8 N·m or less</td>
</tr>
</tbody>
</table>

![Diagram of terminal lugs](attachment:terminal_lugs.png)

### Terminal Covers (Optional parts)

<table>
<thead>
<tr>
<th>Target Model</th>
<th>Part Number</th>
<th>Sales Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>For UT351</td>
<td>T9115YD</td>
<td>1</td>
</tr>
<tr>
<td>For UT321</td>
<td>T9115YE</td>
<td>1</td>
</tr>
</tbody>
</table>

1. Before attaching the terminal cover, bend the side with the groove inward as shown in Fig. A. Be careful not to bend it backwards. This not only marks it harder to attach the cover but will also weaken its hold.

2. Fit the holes on the top and bottom of the terminal cover the projections on the brackets (Fig. B) and lock in place. The figure right shows the attachment of a terminal cover to UT controller.

![Diagram of terminal cover attachment](attachment:terminal_cover_attachment.png)
1.4 Hardware Specifications

PV Input Signals

- Number of inputs: 1 (terminals 11-12-13)
- Input type: Universal input system. The input type can be selected with the software.
- Sampling period: 250 ms
- Burnout detection: Functions at TC, RTD, standard signal (0.4 to 2 V or 1 to 5 V) Upscale, downscale, and off can be specified. For standard signal, burnout is determined to have occurred if it is 0.1 V or less.
- Input bias current: 0.05 μA (for TC or RTD b-terminal)
- Measurement current (RTD): About 0.13 mA
- Input resistance: 1 Ω or more for thermocouple or mV input About 1 MΩ for DC voltage input
- Allowable signal source resistance: 250 Ω or less for thermocouple or mV input Effects of signal source resistance: 0.1 μV/Ω or less 2 kΩ or less for DC voltage input Effects of signal source resistance: About 0.01%/100 Ω
- Allowable wiring resistance: for RTD input Maximum 150 Ω/wire: Conductor resistance between three wires should be equal. However, 10 Ω/wire for a maximum range of -150.0 to 150.0°C. Wire resistance effect: ±0.1°C/10 Ω
- Allowable input voltage: ±10 V DC for thermocouple, mV, or RTD input ±20 V DC for DC voltage input
- Noise rejection ratio: 40 dB (50/60 Hz) or more in normal mode 120 dB (50/60 Hz) or more in common mode
- Reference junction compensation error: ±1.0°C (15 to 35°C) ±1.5°C (0 to 15°C, 35 to 50°C)
- Applicable standards: JIS, IEC, DIN (ITS-90) for thermocouples and RTD

Loop Power Supply

Supplies power to a two-wire transmitter. (15 V DC: terminals 14-15; 24 V DC: terminals 21-22)
A resistor (10 to 250 Ω) connected between the controller and transmitter converts a current signal into a voltage signal, which is then read via the PV input terminal. Supply voltage: 14.5 to 18.0 V DC, max. 21 mA (provided with a protection circuit against a field short-circuit); 21.6 to 28.0 V DC, max. 30 mA (only for models with 24 V DC loop power supply)
When using the 24 V DC loop power supply of the UT321, keep the operating ambient temperature between 0°C and 40°C.
### Retransmission Output

Either PV, target setpoint, or control output is output. Either the retransmission output or the 15 VDC loop power supply can be used with terminals 14-15.

- Number of outputs: 1 (terminals 14-15)
- Output signal: 4-20 mA DC
- Load resistance: 600 Ω or less
- Output accuracy: ±0.3% of span under standard operating conditions (23±2°C, 55±10% RH, power frequency of 50/60 Hz)

### Control Output

Universal output system, The output type can be selected with the software.

- **Current output**
  (Standard type: terminals 16-17; Heating/cooling type: Heating side: terminals 16-17; Cooling side: terminals 14-15)
  - Number of outputs: 1 or 2 (two for heating/cooling type), switched between a voltage pulse output and current output.
  - Output signal: 4-20 mA DC
  - Load resistance: 600 Ω or less
  - Output accuracy: ±0.3% of span under standard operating conditions (23±2°C, 55±10% RH, power frequency of 50/60 Hz)

- **Voltage pulse output**
  (Standard type: terminals 16-17; Heating/cooling type: Heating side: terminals 16-17; Cooling side: terminals 14-15)
  - Number of outputs: 1 or 2 (two for heating/cooling type), switched between a voltage pulse output and current output.
  - Output signal:
    - On-voltage = 12 V or more (load resistance: 600 Ω or more)
    - Off-voltage = 0.1 V DC or less
  - Resolution: 10 ms

- **Relay contact output**
  (Standard type: terminals 1-2-3; Heating/cooling type: Heating side: terminals 1-2-3; Cooling side: terminals 4-7)
  - Number of outputs: 1 or 2 (two for heating/cooling type)
  - Output signal: Three terminals (NC, NO, and common) / Two terminals
  - Contact rating:
    - Terminals 1-2-3: 250 V AC or 30 V DC, 3 A (resistance load)
    - Terminal 4-7: 240 V AC or 30 V DC, 1 A (resistance load)
  - Resolution: 10 ms
Contact Inputs

- **Purpose:** Selection between target setpoints or Auto/Man modes, or for other purposes
- **Number of inputs:** 2
- **Input type:** Non-voltage contact or transistor open collector input
- **Input contact rating:** 12 V DC, 10 mA or more
- **On/off determination:** For non-voltage contact input, contact resistance of 1 kΩ or less is determined as “on” and contact resistance of 20 kΩ or more as “off.” For transistor open collector input, input voltage of 2 V or less is determined as “on” and leakage current must not exceed 100 μA when “off.”
- **Minimum status detection hold time:** About 1 second.

Contact Outputs

- **Purpose:** Alarm output, FAIL output, and others
- **Number of outputs:** 3
- **Relay contact rating:** 240 V AC/1 A or 30 V DC/1 A (COM terminal is common.) (FAIL output : 1b)

Display Specifications

- **PV display:**
  - UT351: 4-digit, 7-segment green or red LED display, character height of 20 mm
  - UT321: 4-digit, 7-segment green or red LED display, character height of 12 mm
- **Setpoint display:** 4-digit, 7-segment red LED display, character height of 9.3 mm (for both UT351 and UT321)
- **Status indicating lamps:** LEDs
Safety and EMC Standards

- Safety: Complies with IEC/EN61010-1 (CE), approved by C22.2 No.61010-1, approved by UL508.

  Installation category : CAT. II  Pollution degree : 2 (IEC/EN61010-1, C22.2 No.61010-1)

  Measurement category : I (CAT. I : IEC/EN61010-1)

  Rated measurement input voltage : 10V DC max.(across terminals), 300V AC max.(across ground)

  Rated transient overvoltage : 1500V (Note)

  Note : It is a value on the safety standard which is assumed by IEC/EN61010-1 in Measurement category I, and is not the value which guarantees an apparatus performance.

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This equipment has Measurement category I, therefore do not use the equipment for measurements within Measurement categories II, III and IV.

<table>
<thead>
<tr>
<th>Measurement category</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>CAT. I</td>
<td>For measurements performed on circuits not directly connected to MAINS.</td>
</tr>
<tr>
<td>II</td>
<td>CAT. II</td>
<td>For measurements performed on circuits directly connected to the low voltage installation.</td>
</tr>
<tr>
<td>III</td>
<td>CAT. III</td>
<td>For measurements performed in the building installation.</td>
</tr>
<tr>
<td>IV</td>
<td>CAT. IV</td>
<td>For measurements performed at the source of the low-voltage installation.</td>
</tr>
</tbody>
</table>

- EMC standards: Complies with EN61326, EN61000-3-2, EN61000-3-3 and EN55011 (CE).
- AS/NZS 2064 compliant (C-Tick).
- Class A Group 1.

  The instrument continues to operate at a measuring accuracy of within ±20% of the range during tests.

Construction, Installation, and Wiring

- Construction: Dust-proof and drip-proof pront panel conforming to IP55. For side-by-side close installation the controller loses its dust-proof and drip-proof protection.

- Material: ABS resin and polycarbonate

- Case color: Black

- Weight: About 1 kg or less

- Dimensions:
  - UT351: 96 (W) × 96 (H) × 100 (depth from panel face) mm
  - UT321: 48 (W) × 96 (H) × 100 (depth from panel face) mm

- Installation: Panel-mounting type. With top and bottom mounting hardware (1 each)
Panel cutout dimensions:
- UT351 — $92^{+0.8}_0 (W) \times 92^{+0.8}_0 (H)$ mm
- UT321 — $45^{+0.6}_0 (W) \times 92^{+0.8}_0 (H)$ mm

Installation position: Up to 30° upward facing (not designed for facing downward)

Wiring: M3.5 screw terminals (for signal wiring and power/ground wiring as well)

### Power Supply Specifications

- **Power supply:** Rated voltage of 100 to 240 V AC (±10%), 50/60 Hz
- **Power consumption:** Max. 20 VA (8.0 W max.)
- **Internal fuse rating:** 250 V AC, 1.6A time-lug fuse
- **Data backup:** Non-volatile memory (can be written to up to 100,000 times)
- **Withstanding voltage**
  - Between primary terminals* and secondary terminals**: At least 1500 V AC for 1 minute
  - Between primary terminals* and grounding terminal: At least 1500 V AC for 1 minute
  - Between grounding terminal and secondary terminals**: At least 1500 V AC for 1 minute
  - Between secondary terminals**: At least 500 V AC for 1 minute
* Primary terminals indicate power terminals and relay output terminals
** Secondary terminals indicate analog I/O signal, voltage pulse output, and contact input terminals
- **Insulation resistance:** 20 MΩ or more at 500 V DC between power terminals and grounding terminal
- **Grounding:** Class D grounding (grounding resistance of 100 Ω or less)

### Signal Isolations

- **PV input terminals:** Isolated from other input/output terminals. Not isolated from the internal circuit.
- **15 V DC loop power supply terminals:** Not isolated from 4-20 mA analog output and voltage pulse control output. Isolated from other input/output terminals and internal circuit.
- **24 V DC loop power supply terminals:** Isolated from the 15 V DC loop power supply terminals, 4-20 mA analog output terminals and voltage pulse control output terminals, other I/O terminals and the internal circuitry.
- **4-20 mA analog output terminals (for control output and retransmission):** Not isolated between 4-20 mA outputs and from 15 V DC loop power supply and voltage pulse control output. Isolated from other input/output terminals and internal circuit.
- **Voltage pulse control output terminals:** Not isolated from 4-20 mA outputs and 15 V DC loop power supply. Isolated from other input/output terminals and internal circuit.
- **Relay contact control output terminals:** Isolated between contact output terminals and from other input/output terminals and internal circuit.
- **Contact input terminals:** Not isolated between contact input terminals and from communication terminals. Isolated from other input/output terminals and internal circuit.
• Relay contact alarm output terminals: Not isolated between relay contact alarm outputs. Isolated from other input/output terminals and internal circuit.

• RS-485 communication terminals: Not isolated from contact input terminals. Isolated from other input/output terminals and internal circuit.

• Power terminals: Isolated from other input/output terminals and internal circuit.

• Grounding terminals: Isolated from other input/output terminals and internal circuit.

Environmental Conditions

• Normal operating conditions:
  Ambient temperature: 0 to 50°C (40°C or less for side-by-side close installation)
  The operating ambient temperature range is between 0°C and 40°C when the 24 V DC loop power supply of the UT321 is used.
  Temperature change rate: 10°C/h or less
  Ambient humidity: 20 to 90% RH (no condensation allowed)
  Magnetic field: 400 A/m or less
  Continuous vibration at 5 to 14 Hz: Full amplitude of 1.2 mm or less
  Continuous vibration at 14 to 150 Hz: 4.9 m/s² or less
  Short-period vibration: 14.7 m/s², 15 seconds or less
  Shock: 147 m/s² or less, 11 ms
  Installation height: Height above sea level of 2000 m or less
  Warm-up time: 30 minutes or more after power on

• Transportation and storage conditions:
  Temperature: -25 to 70°C
  Temperature change rate: 20°C/h or less
  Humidity: 5 to 95% RH (no condensation allowed)

• Effects of changes in operating conditions
  - Effects from changes in ambient temperature:
    - On voltage or thermocouple input, ±1 μV/°C or ±0.01% of F.S./°C, whichever is larger
    - On RTD input, ±0.05°C/°C (ambient temperature) or less
    - On analog output, ±0.05% of F.S./°C or less
  - Effects from power supply fluctuation (within rated voltage range)
    - On analog input, ±1 μV/10 V or ±0.01% of F.S./10 V, whichever is larger
    - On analog output, ±0.05% of F.S./10 V or less
1.5 Terminal Wiring Diagrams

⚠️ NOTE

Do not use unassigned terminals as relay terminals.

Terminal wiring diagrams are shown on and after the next page.
# UT351 Standard Type (Model UT351-0 or UT351-3)

**Control output**

- **Relay contact output**
  - Note: Select this option from the OT parameter. Time proportional P/I relay contact output is configured at factory before shipment.
  - RS-485 communication
  - Contact rating: 250 V AC, 3 A; 30 V DC, 3 A (resistance load)

**Alarm output**

- **Alarm-1 output**
- **Alarm-2 output**
- **Alarm-3 output**
- **Common**
  - Relay contact rating: 240 V AC, 1 A; 30 V DC, 1 A (resistance load)

**Power supply**

- **Power supply**
  - CAUTION: Before carrying out wiring, turn off the power to the controller and check that cables to be connected are not alive with a tester or the like because there is a possibility of electric shock.
  - Allowable range: 100 to 240 V AC (±10%); free voltage 50/60 Hz shared

**Note:**

- This wiring is only possible for a controller with a heater burnout alarm.

**Heater current detection input**

- **DIS** is a setup parameter. Changing DIS setpoint allows you to change the function of external contact input.

**Correspondence between parameter DIS and external contact input functions**

- **When DIS=OFF**
  - No function
  - Common

- **When DIS=1** (Factory-set default)
  - 2.SP when DI1=ON
  - AUTO when DI2=ON
  - MAN when DI2=OFF
  - Common

- **When DIS=2**
  - Hides the LOCK parameter when DI1=ON. Shows the LOCK parameter when DI1=OFF.
  - Common

- **When DIS=3**
  - 2.SP when DI1=ON
  - AUTO when DI2=ON
  - MAN when DI2=OFF
  - No function
  - Common

- **When DIS=4**
  - 2.SP when DI1=ON
  - AUTO when DI2=ON
  - MAN when DI2=OFF
  - STOP when DI2=OFF
  - PLN when DI2=OFF
  - Common

**Correspondence between parameter OT and control output types**

- **OT=0 (factory-set default)**
  - Time proportional control
  - Relay output (terminals 1, 2, and 3)

- **OT=1**
  - Voltage pulse output (terminals 2 and 3)
  - On-off control

- **OT=2**
  - Time proportional control
  - Relay output (terminals 1, 2, and 3)

**Correspondence between parameter PV and ret-transmission output type**

- **PV retransmission is configured at factory before shipment**
  - Load resistance: 600 Ω or less

**Note:**

- External Contact Input
  - If the power is turned on when the external contact input is OFF, the mode (SP no or A/M) existing before the power is turned on will be continued (except for RUN/STOP)
**UT351 Heating/Cooling Type (Model UT351-2)**

### Heating-side control output
- **Relay contact output**
  - DIN5, DIN6, DIN7
  - Contact rating: 250 V AC, 3 A (resistance load)

### Alarm output/cooling-side control output
- **Alarm-1 output**
- **Alarm-2 output**
- **Alarm-3 output**
- **Common**
  - Relay contact rating: 240 V AC, 1 A

### Power supply
- **Power supply**
- **CAUTION**
  - When handling wiring, turn off the power to the controller and check that cables to be connected are not alive with a tester or the like because there is a possibility of electric shock.

### PV input
- **PV input**
  - Not configured at factory before shipment.
  - See “2. Initial Settings,” for more information.

### Heating-side control output
- **Current/voltage pulse output**
- **Relay contact output**
  - DIN15, DIN16, DIN17
  - Contact rating: 250 V AC, 1 A (resistance load)

### Cooling-side control output
- **Relay contact output**
  - DIN14, DIN15, DIN16, DIN17
  - Contact rating: 250 V AC, 1 A (resistance load)

### Correspondence between parameter DIS and external contact input functions
- **DIS** is a setup parameter.
- Changing DIS setpoint allows you to change the function of external contact input.

### Correspondence between parameter OT and heating-side/cooling-side output types
- **OT=4** (factory-set default)
- **OT=5**
- **OT=6**
- **OT=7**
- **OT=8**
- **OT=9**
- **OT=10**
- **OT=11**
- **OT=12**

### The control output types, “relay output” and “voltage pulse output” shown in the table above refer to those of time proportional control.

To change the type to a relay output for on-off control, select “Relay Terminals” and change the setpoint of the proportional band to “0.”
UT321 Standard Type (Model UT321-0 or UT321-3)

Control output
- Relay contact output
  - Time proportional PID relay contact output is configured at factory before shipment.
  - Wiring can only be carried out for controllers with communication functions. Maximum baud rate: 19200 bps.
- Control output
  - NC NO COM Contact rating: 250 V AC, 3 A or 30 V DC, 3 A (resistance load).
  - Select this option from the OT parameter.
- Relay contact rating: 250 V AC, 1 A (resistance load).
- Terminales: 2A05 - 2A07

Alarm output
- Alarm-1 output
- Alarm-2 output
- Alarm-3 output
- Common
- Relay contact rating: 250 V AC, 1 A (resistance load).

Power supply
- Power supply
- Allowable range: 100 to 240 V AC (±10%)
  - Free voltage 50/60 Hz shared.
- Wiring can only be carried out for controllers with communication functions. Maximum baud rate: 9600 bps.
- Wiring can only be carried out for controllers with communication functions. Maximum baud rate: 9600 bps.

Alarm-1 output
- AL1
- AL2
- AL3
- Common
- Contact rating: 250 V AC, 1 A (resistance load).

Alarm-2 output
- 2A01
- 2A02
- 2A03
- 2A04
- 2A05
- 2A06
- 2A07

Alarm-3 output
- 2A01
- 2A02
- 2A03
- 2A04
- 2A05
- 2A06
- 2A07

Note: Selecting the option from the OT parameter.

OT=0 (factory-set default)
- Time proportional control
- Relay output (terminals 1, 2, and 3)
- Voltage pulse output (terminals 4 and 5)
- Current output
- OT-1
- OT-2
- OT-3

OT=1
- Time proportional control
- Relay output (terminals 1, 2, and 3)
- Voltage pulse output (terminals 4 and 5)
- Current output

OT=2
- Time proportional control
- Relay output (terminals 1, 2, and 3)
- Voltage pulse output (terminals 4 and 5)
- Current output

OT=3
- Time proportional control
- Relay output (terminals 1, 2, and 3)
- Voltage pulse output (terminals 4 and 5)
- Current output

Relay contact output
- NC
- NO
- COM
- Time proportional PID relay contact output is configured at factory before shipment.

Note: Selecting the option from the OT parameter.

* This wiring is only possible for a controller with a heater burnout alarm.

* OT is a setup parameter. You can change the settings of the parameter OT to change the control output type.

Correspondence between parameter OT and control output types

<table>
<thead>
<tr>
<th>OT-0 (factory-set default)</th>
<th>OT-1</th>
<th>OT-2</th>
<th>OT-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>OT=0 (factory-set default)</td>
<td>Time proportional control</td>
<td>Relay output (terminals 1, 2, and 3)</td>
<td>Voltage pulse output (terminals 4 and 5)</td>
</tr>
<tr>
<td>OT=1</td>
<td>Time proportional control</td>
<td>Relay output (terminals 1, 2, and 3)</td>
<td>Voltage pulse output (terminals 4 and 5)</td>
</tr>
<tr>
<td>OT=2</td>
<td>Time proportional control</td>
<td>Relay output (terminals 1, 2, and 3)</td>
<td>Voltage pulse output (terminals 4 and 5)</td>
</tr>
<tr>
<td>OT=3</td>
<td>Time proportional control</td>
<td>Relay output (terminals 1, 2, and 3)</td>
<td>Voltage pulse output (terminals 4 and 5)</td>
</tr>
</tbody>
</table>

Note: Selecting the option from the OT parameter.

* DIS is a setup parameter. Changing DIS setpoint allows you to change the function of external contact input.

Heater current detection input
- 2A01
- 2A02
- 2A03
- 2A04
- 2A05
- 2A06
- 2A07

Correspondence between parameter DIS and external contact input functions

<table>
<thead>
<tr>
<th>DIS=0</th>
<th>DIS=1</th>
<th>DIS=2</th>
<th>DIS=3</th>
<th>DIS=4</th>
</tr>
</thead>
<tbody>
<tr>
<td>No function</td>
<td>2 SP when D1=ON</td>
<td>1 SP when D1=OFF</td>
<td>Hides the LOCK parameter when D1=ON</td>
<td>Shows the LOCK parameter when D1=OFF</td>
</tr>
<tr>
<td>No function</td>
<td>AUTO when D2=ON</td>
<td>MAN when D2=OFF</td>
<td>No function</td>
<td>No function</td>
</tr>
<tr>
<td>Common</td>
<td>Common</td>
<td>Common</td>
<td>Common</td>
<td>Common</td>
</tr>
</tbody>
</table>

1. SP when D1=ON, 2 SP when D1=OFF
2. AUTO when D2=ON, MAN when D2=OFF
3. STOP when D2=ON, RUN when D2=OFF

Note: External Contact Input
- When the power is turned on when the external contact input is OFF, the mode (SP, no A/M) existing before the power is turned off will be continued. (except for RUN/STOP)
# UT321 Heating/Cooling Type (Model UT321-2□)

## Heating-side control output

- **Relay contact output**: When the proportional PID relay contact output is configured at factory before shipment.  
  - Available if 4, 7 or 10 is set in the OT (Control Output Type) setup parameter.

  - Contact rating: 300 V AC, 3 A, 30 V DC, 3 A (resistance load)
  - PV input
  - PV retransmission is configured at factory before shipment. See '2. Initial Settings,' for more information.

- **Alarm output**: When configured at factory before shipment.

  - Available if 4, 5 or 6 is set in the OT (Control Output Type) setup parameter.

## Cooling-side control output

- **Current/voltage pulse output**: Available if 5, 6, 8, 9, 11 or 12 is set in the OT (Control Output Type) setup parameter.

## PV input

- PV input is not configured at factory before shipment. See '2. Initial Settings,' for more information.

## Power supply

- **Power supply**: 36 V DC, 1 A

## Wiring Considerations

- **Wiring** can only be carried out for controllers with communication functions. Maximum baud rate: 9600 bps.

- **Two-wire transmitter**: 4-20 mA DC

- **15 V DC Power Supply Wiring to Two-wire Sensor**

- **24 V DC Power Supply Wiring to Two-wire Sensor**

## Relays

- **Relay Terminals**

## Cooling-side control output

- **Contact rating**: 250 V AC, 3 A

## Cooling-side control output

- **Contact rating**: 30 V DC, 3 A (resistance load)

## Relay output

- **Relay contact setting**: 12 V DC, 10 mA or more

## CAUTION

- Connecting a 250 Ω resistor to the terminals is optional. Model: X010-250-2 (resistor with M3.5 crimp-on terminal lugs)

---

**Note:** The control output types, "relay output" and "voltage pulse output," should be taken into consideration in terms of time proportional control.

To change the type to a relay output for on-off control, select "Relay Terminals" and change the setpoint of the proportional band to "0."
2. Initial Settings

This chapter describes examples of setting PV input types, control output types, and alarm types. Carrying out settings described herein allows you to perform basic control. Refer to examples of various settings to understand how to set parameters required. Refer to “5.1 Parameter Map” for an easy to understand explanation of setting various parameters. If you cannot remember how to carry out an operation during setting, press the \textit{SET/ENT} key for more than 3 seconds. This brings you to the display (operating display) that appears at power-on.

\begin{itemize}
  \item \textbf{Power-on} \hfill \text{Denotes a step that must always be followed.}
  \item \textbf{Set PV input.} \hfill \text{Denotes a step that should be followed as necessary.}
  \item \textbf{Set the control output.} \hfill \text{Factory-set to "Unspecified."}
  \item \textbf{Set the alarm type and other setup parameters.}
  \item \textbf{Set operating parameters.}
\end{itemize}

Controller operation
## 2.1 Names and Functions of Front Panel Parts

<table>
<thead>
<tr>
<th>Name of Part</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Process variable (PV) display</td>
<td>Displays PV. Displays color can be switched between red and green according to the setting of “PCMD” setup parameter. Displays a parameter symbol when you set a parameter. Displays an error code (in red or green) if an error occurs.</td>
</tr>
<tr>
<td>2. Setpoint display</td>
<td>Displays the setpoint (SP) or the output value (OUT) during operation. Displays the set value of parameters on the parameter setting display.</td>
</tr>
<tr>
<td>3. Target setpoint (SP) number indicator lamps</td>
<td>When the SP number currently used for operation is 2, 3 or 4, the respective SP No. indicator lamp lights. When the SP number is 1, the lamp does not light.</td>
</tr>
<tr>
<td>5. Alarm indicator lamps</td>
<td>If any of alarms 1 to 3 occurs, the respective alarm indicator lamp (AL1 to AL3) is lit (in orange).</td>
</tr>
<tr>
<td>6. Light-loader interface</td>
<td>Interface for an adapter cable used when setting and storing parameters from a PC. This requires an optional parameter setting tool.</td>
</tr>
<tr>
<td>7. A/M key</td>
<td>Used to switch between the AUTO and MAN modes. Each time you press the key, it switches to the AUTO or MAN mode alternately.</td>
</tr>
<tr>
<td>8. SET/ENT key</td>
<td>Used to switch or register a parameter. Pressing the key for more than 3 seconds allows you to switch between the operating display and the menu for operating parameter setting display alternately.</td>
</tr>
<tr>
<td>9. ▼ and △ keys</td>
<td>Used to change numerical values. On setting displays for various parameters, you can change target setpoints, parameters, and output values (in manual operation). Pressing the ▼ key decreases a numerical value, while pressing the △ key causes it to increase. You can hold down a key to gradually increase the speed of change.</td>
</tr>
</tbody>
</table>

⚠️ **IMPORTANT**

The controller automatically returns to the display at the time of power-on (i.e., operating display) if no key is operated for at least one minute.

### Setting of Main Parameters at the Factory Before Shipment

<table>
<thead>
<tr>
<th>Item</th>
<th>Factory-set defaults for standard type controllers</th>
<th>Factory-set defaults for heating/cooling type controllers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control output</td>
<td>Time proportional PID relay output (variable)</td>
<td>Heating side: Time proportional PID relay output (variable) Cooling side: Time proportional PID relay output (variable)</td>
</tr>
<tr>
<td>Control action</td>
<td>Reverse action (variable)</td>
<td>Not specified</td>
</tr>
<tr>
<td>PID parameter</td>
<td>P = 5.0%, I = 240 seconds, D = 60 seconds.</td>
<td></td>
</tr>
<tr>
<td>Alarm output</td>
<td>Alarm-1: PV high limit, Alarm-2: PV low limit, Alarm-3: PV high limit</td>
<td></td>
</tr>
</tbody>
</table>
### 2.2 Setting PV Input Type (Setting First at Power-on)

**NOTE**

- The controller displays the operating display when the power is turned on. However, if PV input type has not been set, “IN” appears. In this case, first use the key to display the input range code to use, then press the key to register it. Then, set the maximum value (RH) and minimum value (RL) of the PV input range (for voltage input, set the maximum value (SH) and minimum value (SL) of the PV input scale).

- The controller is configured to the initial value of each parameter at the factory before shipment. First check the initial values shown in “5.2 Lists of Parameters,” and change parameter values as necessary.

---

#### Example of Temperature Input

- Minimum value of PV input range (RL): -200°C to 1370°C
- Maximum value of PV input range (RH): 0°C to 800°C

#### Example of Voltage Input

- Minimum value of PV input scale (SL): 1V to 5V
- Maximum value of PV input scale (SH): 2V to 4V

The following operating procedure describes an example of setting the controller to a K-type thermocouple (-199.9°C to 500.0°C) and the measurement range of 0.0°C to 200.0°C.

1. **Display screen at power-on**  
The parameter “IN” for setting the PV input type appears.

2. **Press the or key to display the required setpoint.**  
The figure below is an example of the controller set to a K-type thermocouple (-199.9°C to 500.0°C). See “Instrument Input Range Codes.”  

---

IM 05D01D12-41E  6th Edition: Mar. 25, 2005-00
3. Press the \text{SET/ENT} key once to register the required setpoint.

4. Press the \text{SET/ENT} key once to display the parameter “UNIT” (PV Input Unit).

5. Press the \text{SET/ENT} key once to display the parameter “RH” (maximum value of PV input range).

6. Press the \text{ or } \text{ key to display the required setpoint. The figure below shows an example of setting the maximum value of PV input range to 200.0°C.

7. Press the \text{SET/ENT} key once to register the setpoint.

8. Press the \text{SET/ENT} key once to display the parameter “RL” (minimum value of PV input range).

9. Press the \text{ or } \text{ key to display the required setpoint. The figure below shows an example of setting the minimum value of PV input range to 0.0°C.

10. Press the \text{SET/ENT} key once to register the setpoint.

If the type of input is voltage, also configure the PV Input Decimal Point Position (SDP), Maximum Value of PV Input Scale (SH) and Minimum Value of PV Input Scale (SL) that follow this step.

11. To set the type of control output, see steps 7 and later in “2.4 Setting Control Output Type.” To finish settings, press the \text{SET/ENT} key for more than 3 seconds. This returns you to the display shown at power-on (figure below).

The PV display in the figure above shows the error code for input burnout (\text{fail}) if PV input wiring is not yet complete. The error code disappears when you wire the PV input terminals correctly.
### Instrument Input Range Codes

<table>
<thead>
<tr>
<th>Input</th>
<th>Type</th>
<th>Instrument Input Range Code</th>
<th>Instrument Input Range</th>
<th>Measurement Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unspecified</td>
<td>K</td>
<td>OFF</td>
<td>-200 to 1300°C -300 to 2500°F</td>
<td>±0.1% of instrument range ±1 digit for temperatures equal to or higher than 0°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>-199.9 to 999.9°C 0 to 2300°F</td>
<td>±0.2% of instrument range ±1 digit for temperatures below 0°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>-199.9 to 999.9°C 0 to 2300°F</td>
<td>±0.1% of instrument range ±1 digit at 400°C or more</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>-199.9 to 999.9°C 0 to 2300°F</td>
<td>±0.5% of instrument range ±1 digit at less than 400°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>J</td>
<td>-199.9 to 999.9°C -300 to 2500°F</td>
<td>±0.1% of instrument range ±1 digit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T</td>
<td>-199.9 to 400.0°C -300 to 750°F</td>
<td>±0.2% of instrument range ±1 digit for temperatures equal to or higher than 0°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>0.0 to 400.0°C -199.9 to 750.0°F</td>
<td>±0.15% of instrument range ±1 digit at 400°C or more</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>0 to 1800°C 32 to 3000°F</td>
<td>±0.15% of instrument range ±1 digit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S</td>
<td>0 to 1700°C 32 to 3100°F</td>
<td>±0.15% of instrument range ±1 digit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R</td>
<td>0 to 1700°C 32 to 3100°F</td>
<td>±0.15% of instrument range ±1 digit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>-200 to 1300°C -300 to 2400°F</td>
<td>±0.1% of instrument range ±1 digit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
<td>-199.9 to 999.9°C -300 to 1800°F</td>
<td>±0.15% of instrument range ±1 digit for temperatures equal to or higher than 0°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L(DIN)</td>
<td>-199.9 to 900.0°C -300 to 1300°F</td>
<td>±0.1% of instrument range ±1 digit for temperatures equal to or higher than 0°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U(DIN)</td>
<td>-199.9 to 400.0°C -300 to 750°F</td>
<td>±0.2% of instrument range ±1 digit for temperatures below 0°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14</td>
<td>0.0 to 400.0°C -199.9 to 750.0°F</td>
<td>±0.1% of instrument range ±1 digit at 400°C or more</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W</td>
<td>0 to 2300°C 32 to 4200°F</td>
<td>±0.2% of instrument range ±1 digit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Platinel 2</td>
<td>0 to 1300°C 32 to 2500°F</td>
<td>±0.1% of instrument range ±1 digit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PR20-40</td>
<td>0 to 1800°C 32 to 3400°F</td>
<td>±0.15% of instrument range ±1 digit at 800°C or more</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W97/H50-W75R625</td>
<td>0 to 2000°C 32 to 3600°F</td>
<td>±0.2% of instrument range ±1 digit</td>
</tr>
<tr>
<td>RTD</td>
<td>JPt100</td>
<td>30</td>
<td>0 to 500.0°C -199.9 to 999.9°F</td>
<td>±0.1% of instrument range ±1 digit (Note 1) (Note 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>31</td>
<td>-150.0 to 150.0°C -199.9 to 999.9°F</td>
<td>±0.2% of instrument range ±1 digit (Note 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35</td>
<td>-199.9 to 850.0°C -300 to 1500°F</td>
<td>±0.1% of instrument range ±1 digit (Note 1) (Note 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>36</td>
<td>-199.9 to 500.0°C -199.9 to 999.9°F</td>
<td>±0.2% of instrument range ±1 digit (Note 1) (Note 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>37</td>
<td>-199.9 to 500.0°C -199.9 to 999.9°F</td>
<td>±0.2% of instrument range ±1 digit (Note 1) (Note 2)</td>
</tr>
<tr>
<td>Standard</td>
<td>signal</td>
<td>0.4 to 2 V</td>
<td>0.400 to 2.000 V</td>
<td>±0.1% of instrument range ±1 digit</td>
</tr>
<tr>
<td>DC voltage</td>
<td>0 to 5 V</td>
<td>41</td>
<td>1.000 to 2.000 V</td>
<td>The read-out range can be scaled between -1999 to 9999.</td>
</tr>
<tr>
<td></td>
<td>0 to 10 V</td>
<td>51</td>
<td>0.00 to 10.00 V</td>
<td>-10.00 to 20.00 mV</td>
</tr>
<tr>
<td></td>
<td>0 to 100 mV</td>
<td>55</td>
<td>0.00 to 100.0 mV</td>
<td>0.1 to 100.0 mV</td>
</tr>
</tbody>
</table>

* Performance in the standard operating condition (at 23 ± 2°C, 55 ± 10%RH, and 50/60Hz power frequency)

Note 1: The accuracy is ±0.3°C of instrument range ±1 digit for a temperature range from 0°C to 100°C.

Note 2: The accuracy is ±0.5°C of instrument range ±1 digit for a temperature ranges from -100°C to 0°C and 100°C to 200°C.

* To receive a 4-20 mA DC signal, select a standard signal of 1 to 5 V DC and connect it to a 250 Ω resistor. This resistor is optional.

Model: X010-250-2 (resistor with M3.5 crimp-on terminal lugs)

**NOTE**

The controller may automatically initialize the registered operating parameter setpoints if any change is made to the data item PV Input Type (IN), Maximum Value of PV Input Range (RH), Minimum Value of PV Input Range (RL), PV Input Decimal Point Position (SDP), Maximum Value of PV Input Scale (SH) or Minimum Value of PV Input Scale (SL). After a change has been made to any of these data items, be sure to verify the registered operating parameter setpoints to ensure that they are correct. If any data item has been changed to its default, set it to a required value.
2.3 Changing PV Input Type

The following operating procedure describes an example of changing the K-type thermocouple (-199.9°C to 500.0°C) to a Pt100 resistance temperature detector (-199.9°C to 500.0°C) and setting the measurement range of 0.0°C to 200.0°C.

PV input terminal
Thermocouple/mV/V input.............................. ①-②-③
RTD input .................................................. ④-⑤-⑥

1. Bring the operating display into view (display appears at power on).

2. Press the key for more than 3 seconds to call up the menu “OP.PA”.

3. Press the key once to display the menu “STUP”.

4. Press the key once to display the parameter “PWD”.

5. Press the key once to display the menu “FUNC”.

6. Press the key once to display the menu “I/O”.

7. Press the key once to display the parameter “IN” (PV input type).

8. Press the or key to display the required setpoint. The figure below is an example of the controller set to a Pt 100 resistance temperature detector (-199.9°C to 500.0°C).
9. Press the  key once to register the setpoint.

10. Press the  key once to display the parameter “UNIT” (PV input unit).

11. Press the  key once to display the parameter “RH” (maximum value of PV input range).

12. Press the  or  key to display the required setpoint. The figure below shows an example of setting the maximum value of PV input range to 200.0°C.

13. Press the  key once to register the setpoint.

14. Press the  key once to display the parameter “RL” (minimum value of PV input range).

15. Press the  or  key to display the required setpoint. The figure below shows an example of setting the minimum value of PV input range to 0.0°C.

16. Press the  key once to register the setpoint.

17. Press the  key for more than 3 seconds. This returns you to the display shown at power-on (figure below).

The PV display in the figure above shows the error code for input burnout ( ) if PV input wiring is not yet complete. The error code disappears when you wire the PV input terminals correctly.
2.4 Setting Control Output Type

The following operating procedure describes an example of changing time proportional PID relay output (0: factory-set default) to current output (2).

Control output terminal Values in parentheses are setpoints
Time proportional PID relay (0)/on-off(3) output ......................... (1)-(2)-(3)
Current (2)/time proportional PID voltage pulse (1) output .......... (2)-(3)

For details on the heating/cooling control output terminals, see “1.5 Terminal Wiring Diagrams.”

1. Bring the operating display into view (display appears at power on).

2. Press the \[ \text{SET/ENT} \] key for more than 3 seconds to call up the menu “OP.PA”.

3. Press the \[ \text{A} \] key once to display the menu “STUP”.

4. Press the \[ \text{A} \] key once to display the parameter “PWD”.

5. Press the \[ \text{SET/ENT} \] key once to display the menu “FUNC”.

6. Press the \[ \text{A} \] key once to display the menu “I/O”.

7. Press the \[ \text{A} \] key several times to display the parameter “OT” (control output type).

8. Press the \[ \text{A} \text{ or } \text{V} \] key to display the required setpoint. The figure below shows an example of setting to current output (4 to 20 mA DC).
2.5 Changing Alarm Type

The following operating procedure describes an example of changing alarm-1 (factory-set default: PV high limit alarm) to PV low limit alarm. When you have changed alarm type, the alarm setpoint will be initialized; set the alarm setpoint again.

### Alarm output terminals

- **Alarm-1 (terminal numbers):** PV high limit alarm
- **Alarm-2 (terminal numbers):** PV low limit alarm
- **Alarm-3 (terminal numbers):** PV high limit alarm

1. **Bring the operating display into view** (appears at power-on).

2. **Press the SET/ENT key for more than 3 seconds** to call up the menu “OP.PA”.

3. **Press the SET/ENT key once** to display the menu “STUP”.

4. **Press the SET/ENT key once** to display the parameter “PWD”.

5. **Press the SET/ENT key once** to register the setpoint.

6. **Press the SET/ENT key for more than 3 seconds**. This returns you to the display shown at power-on (figure below).
5. Press the \( \text{SET/ENT} \) key once to display the menu “FUNC”.

6. Press the \( \text{SET/ENT} \) key several times to display the parameter “AL1” (alarm-1 type).

7. Press the \( \text{A} \) or \( \text{A} \) key to display the required setpoint. The figure below shows an example of setting PV low limit alarm.

8. Press the \( \text{SET/ENT} \) key once to register the setpoint. You can take the same steps for alarm-2 type (AL2), and alarm-3 type (AL3) that are displayed after this.

9. Press the \( \text{SET/ENT} \) key for more than 3 seconds. This returns you to the display shown at power-on (figure below).

10. When setting an alarm setpoint, see “3.4 Setting Alarm Setpoints.”
### List of Alarm Types

The table below shows the alarm types and alarm actions.

In the table, codes 1 to 10, 33 to 38 are not provided with stand-by actions, while codes 11 to 20, 43 to 48 are provided with stand-by actions.

<table>
<thead>
<tr>
<th>Alarm type</th>
<th>Alarm action</th>
<th>Contact closes if alarm occurs</th>
<th>Contact opens if alarm occurs</th>
<th>Alarm type</th>
<th>Alarm action</th>
<th>Contact closes if alarm occurs</th>
<th>Contact opens if alarm occurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>No alarm</td>
<td>Hysteresis</td>
<td>Off</td>
<td></td>
<td>Hysteresis</td>
<td>Dev-energized on deviation low limit alarm</td>
<td>Closed (ll) SP</td>
<td>PV high limit</td>
</tr>
<tr>
<td>PV high limit</td>
<td>Open (unlit) PV Alarm setpoint</td>
<td>1</td>
<td>11</td>
<td>PV low limit</td>
<td>Hysteresis</td>
<td>Deviation high and low limits</td>
<td>Closed (ll) Open (unlit) PV</td>
</tr>
<tr>
<td>PV low limit</td>
<td>Closed (ll) Alarm setpoint</td>
<td>2</td>
<td>12</td>
<td>Deviation high limit</td>
<td>Hysteresis</td>
<td>Deviation within high and low limits</td>
<td>Open (unlit) PV</td>
</tr>
<tr>
<td>Deviation high limit</td>
<td>Open (unlit) PV Alarm setpoint</td>
<td>3</td>
<td>13</td>
<td>Deviation low limit</td>
<td>Hysteresis</td>
<td>De-energized on PV high limit</td>
<td>Closed (ll) Open (unlit) PV</td>
</tr>
<tr>
<td>Deviation low limit</td>
<td>Closed (ll) Deviation setpoint</td>
<td>4</td>
<td>14</td>
<td>De-energized on deviation high limit alarm</td>
<td>Hysteresis</td>
<td>De-energized on PV low limit</td>
<td>Open (unlit) PV</td>
</tr>
<tr>
<td>Fault diagnosis output (Note 1)</td>
<td>Fault diagnosis output</td>
<td>21</td>
<td></td>
<td>Sensor grounding alarm</td>
<td>Sensor grounding alarm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAIL output (Note 2)</td>
<td>Heater burnout alarm 1</td>
<td>22</td>
<td></td>
<td>SP high limit</td>
<td>Hysteresis</td>
<td>Output high limit</td>
<td>Open (unlit) SP</td>
</tr>
<tr>
<td>SP low limit</td>
<td>Hysteresis</td>
<td>Output low limit</td>
<td>Closed (ll)</td>
<td>29</td>
<td>Open (unlit) SP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deviation high limit for target setpoint (Note 3)</td>
<td>Hysteresis</td>
<td>Deviation high limit for target setpoint (Note 3)</td>
<td>Open (unlit) Target SP</td>
<td>30</td>
<td>Deviation high limit for target setpoint (Note 3)</td>
<td>Open (unlit) Target SP</td>
<td></td>
</tr>
<tr>
<td>Deviation low limit for target setpoint (Note 3)</td>
<td>Hysteresis</td>
<td>Deviation low limit for target setpoint (Note 3)</td>
<td>Open (unlit) Target SP</td>
<td>36</td>
<td>Deviation low limit for target setpoint (Note 3)</td>
<td>Open (unlit) Target SP</td>
<td></td>
</tr>
<tr>
<td>De-energized on deviation high limit alarm for target setpoint (Note 3)</td>
<td>Hysteresis</td>
<td>Deviation high limit for target setpoint (Note 3)</td>
<td>Open (unlit) Target SP</td>
<td>37</td>
<td>Deviation high limit for target setpoint (Note 3)</td>
<td>Open (unlit) Target SP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Note 1) The controller stops when in a FAIL state, and alarm output is set to "OFF".

(Note 2) See page 33 for details on alarm actions and output values.

(Note 3) See page 34 for details on alarm actions and output values.
Note 1: The fault diagnosis output turns on in case of input burnout, A/D converter failure, or reference junction compensation (RJC) failure. The control output in case of input burnout or A/D converter failure is set to the value of the PO (Preset Output Value) setup parameter. In case of RJC failure, the controller continues control under the condition of “RJC = OFF”.

Note 2: The FAIL output is on during normal operation and turns off in case of failure.

Note 3: The difference of alarm action between the alarm type codes 3 to 8, 13 to 18 and 33 to 38, 43 to 48 in the table above is as follows:

The codes 3 to 8, 13 to 18 are effective for current setpoints. (For example, they are effective for the ramp rate setpoint at SP switching.)

The codes 33 to 38, 43 to 48 are effective for target setpoints. (For example, they are not effective for the ramp rate setpoint at SP switching.)

Stand-by Action

- The alarm output does not turn on in this region even if the PV value is below the low limit of the alarm setpoint.
- The alarm output turns on.
- It is effective in the following cases where:
  - the power is turned on
  - the target setpoint is changed
  - the target setpoint number is switched (however, except for remote setpoint)
  - the alarm type is changed
2.6 Setting the PV Display Color Changing Function
“Active Color PV Display”

The following operating procedure describes an example of changing the PV color mode (factory-set default: Fixed in red mode) to Link to alarm 1 mode.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Bring the operating display into view (appears at power on).</td>
</tr>
<tr>
<td>2.</td>
<td>Press the key for more than 3 seconds to call up the menu “OP.PA.”</td>
</tr>
<tr>
<td>3.</td>
<td>Press the key once to display the menu “STUP.”</td>
</tr>
<tr>
<td>4.</td>
<td>Press the key once to display the parameter “PWD.”</td>
</tr>
<tr>
<td>5.</td>
<td>Press the key once to display the menu “FUNC.”</td>
</tr>
<tr>
<td>6.</td>
<td>Press the key several times to display the menu “PCMD” (PV color mode).</td>
</tr>
<tr>
<td>7.</td>
<td>Press the key or key to display the required setpoint. The figure below shows an example of setting Link to alarm 1 mode.</td>
</tr>
<tr>
<td>8.</td>
<td>Press the key once to register the setpoint.</td>
</tr>
<tr>
<td>9.</td>
<td>Press the key for more than 3 seconds. This returns you to the display shown at power-on (figure below).</td>
</tr>
</tbody>
</table>

*If PCMD = 6, 7, 8 or 9, also set the relating parameters PCCH (High limit for PV color change) and PCCL (Low limit for PC color change).*
2.7 Setting the High Limit and Low limit for PV Color Change

The following operating procedure describes an example of changing the PV display color by PV limit(s). Set the High limit and/or Low limit for PV color change.

(1) Bring the operating display into view (appears at power-on).

(2) Press the key for more than 3 seconds to call up the menu “OP.PA.”

(3) Press the key several times to display the parameter “PCCH.”

(4) Press the key or key to display the required setpoint.

(5) Press the key once to register the setpoint.

(6) Press the key for more than 3 seconds. This returns you to the display shown at power-on (figure below).

2.8 Description of Multiple Setpoints and PID

The UT351/UT321 controllers have a maximum of four target setpoint (SP) parameters and has PID for each of these setpoints. The following shows the correspondence between the target setpoint numbers (SP.NO), target setpoints (SP), and PID parameters.

For example, if you have set “2” to the target setpoint number (SP.NO), the control parameters available are target setpoint (2.SP), proportional band (heating-side proportional band) (2.P), integral time (heating-side integral time) (2.I), derivative time (heating-side derivative time) (2.D), cooling-side proportional band (2.Pc), cooling-side integral time (2.Ic), and cooling-side derivative time (2.Dc).

To use multiple target setpoints, see the table below to check the corresponding parameters.

<table>
<thead>
<tr>
<th>Target setpoint number (SP.NO)</th>
<th>Target setpoint (SP)</th>
<th>Proportional band (heating-side proportional band)</th>
<th>Integral time (heating-side integral time)</th>
<th>Derivative time (heating-side derivative time)</th>
<th>Cooling-side proportional band</th>
<th>Cooling-side integral time</th>
<th>Cooling-side derivative time</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP.NO=1</td>
<td>1.SP</td>
<td>1.P</td>
<td>1.I</td>
<td>1.D</td>
<td>1.Pc</td>
<td>1.Ic</td>
<td>1.Dc</td>
</tr>
</tbody>
</table>
3. Operations

This chapter describes key entries for operating the controller. For operations using external contact inputs, see “1.5 Terminal Wiring Diagrams.” If you cannot remember how to carry out an operation during setting, press the SET/ENT key for more than 3 seconds. This brings you to the display (operating display) that appears at power-on.

**NOTE**

Do not use the instrument generating strong magnetic field such as radio equipment and the like near the controller. This may cause the fluctuation of the PV value.

3.1 Monitoring-purpose Operating Displays Available during Operation

The monitoring-purpose operating displays available during operation are roughly classified into two groups depending on the types of controller. One group is operating displays for a standard controller and the other group is operating displays for a heating/cooling controller.

### Operating Displays for a Standard Controller

- **SP Display**
  - The PV input value appears on the PV display.
  - The target setpoint (1.SP) appears on the Setpoint display.

- **OUT Display**
  - The PV input value appears on the PV display.
  - The control output value (OUT) appears on the Setpoint display.
Operating Displays for a Heating/Cooling Controller

- **SP Display**
  The PV input value appears on the PV display.
  The target setpoint (1.SP) appears on the Setpoint display.

- **Heating/Cooling OUT Display**
  The PV input value appears on the PV display.
  The heating (H) and cooling (C) sides control output values appear on the Setpoint display.

![Diagram of Operating Displays for Heating/Cooling Control]

Power-on

- **Heating-side OUT display**
  (allows the control output value to be changed in manual operation)

- **Cooling-side OUT display**
  (allows the control output value to be changed in manual operation)
3.2 Setting Target Setpoint (SP)

The following operating procedure describes an example of setting 120.0 to a target setpoint. In automatic operation, the controller starts control using set target setpoints.

⚠️ NOTE

When the target setpoint is set through communication, the target setpoint cannot be changed by keystroke.

1. **Bring the operating display into view** (display appears at power on).

2. **Press the ▲ or ▼ key to display the required setpoint.**

3. **Press the SET/ENT key once to register the setpoint.**
3.3 Performing/Canceling Auto-tuning

Auto-tuning should be carried out after setting a target setpoint (SP). Make sure the controller is in automatic operation mode (AUTO) and running state (RUN) before carrying out auto-tuning. See “3.8 Switching between AUTO and MAN,” to change to AUTO and “3.7 Switching between Run and Stop,” to change to Run.

**NOTE**

When on-off control is being used, auto-tuning cannot be carried out. Moreover, do not perform auto-tuning when controlling any of the following processes.

- Control processes with quick response such as flow control or pressure control
- Processes where even temporary output on/off results in inconvenience
- Processes where a large output change at control element results in inconvenience
- Processes where variations in PV may exceed an allowable range, adversely affecting product quality

1. Bring the operating display into view (display appears at power on).

2. Press the key for more than 3 seconds to call up the menu “OP.PA”.

3. Press the key five times to display the parameter “AT”.

4. Press the or key to display the required setpoint. Tuning for 1.SP is AT = 1.

To cancel auto-tuning, set AT = OFF.
5. Press the \textit{SET/ENT} key once to register the setpoint. (This starts auto-tuning.) If the \textit{SET/ENT} key is pressed when AT = OFF, auto-tuning will be cancelled. In this case, PID contains the value existing before auto-tuning.

6. During auto-tuning, the panel indications become as shown below.

Auto-tuning is complete when the MAN lamp goes off.

3.4 Setting PID Manually

If you know the values to be set or if suitable PID constants cannot be obtained by auto-tuning, follow the procedure below to set values.

1. Bring the operating display into view (display appears at power on).

2. Press the \textit{SET/ENT} key for more than 3 seconds to call up the menu “OP.PA”.

3. Press the \textit{SET/ENT} key several times to display the parameter “PID”.

4. Press the \textit{key once to display “1Gr”.

5. Press the \textit{key once to register the setpoints.

6. Press the \textit{key once to display the parameter “1.P” (proportional band for 1.SP).
3-6

7. Press the $\uparrow$ or $\downarrow$ key to display the required setpoint.

8. Press the $\uparrow$ key once to register the setpoint.

The same steps can be used for integral time (1.I) and derivative time (1.D) that are displayed after this.

[TIP]
The PID parameter numbers set in step 4 should be set as follows:
- In case of PID for 1.SP, PID = 1Gr
- In case of PID for 2.SP, PID = 2Gr
- In case of PID for 3.SP, PID = 3Gr
- In case of PID for 4.SP, PID = 4Gr

9. Press the $\uparrow$ key for more than 3 seconds. This returns you to the display shown at power-on (figure below).

---

### 3.5 Setting Alarm Setpoints

The following operating procedure describes an example of setting 160.0 to alarm-1 setpoint. Check alarm type before setting the alarm setpoint. To change the type of alarm, see “2.5 Changing Alarm Type.”

#### Alarm output terminals | Factory-set defaults
- Alarm-1 (terminal numbers ⑥-⑨) | PV high limit alarm
- Alarm-2 (terminal numbers ⑩-⑬) | PV low limit alarm
- Alarm-3 (terminal numbers ⑦-⑩) | PV high limit alarm

1. Bring the operating display into view (display appears at power on).
2. Press the $\uparrow$ key for more than 3 seconds to call up the menu “OP.PA”.

---
3. Press the SET/ENT key twice to display the parameter “A1”.

4. Press the ▲ or ▼ key to display the required setpoint.

5. Press the SET/ENT key once to register the setpoint.

Also configure the Alarm-2 Setpoint (A2) and Alarm-3 Setpoint (A3) parameters that follow this step.

6. Press the SET/ENT key for more than 3 seconds. This returns you to the display shown at power-on (figure below).

3.6 Selecting Target Setpoint Numbers (SP.NO)

The following operating procedure describes an example of changing a target setpoint number (SP.NO) from 1 to 2.

**NOTE**

If a target setpoint number has been switched using contact input, when the contact input is on, that number cannot be selected by keystroke.

When using target setpoint ramp setting function, PV tracking works if the target setpoint number is switched.

1. Bring the operating display into view (display appears at power on).

2. Press the SET/ENT key for more than 3 seconds to call up the menu “OP.PA”.
3. Press the \[ SET/ENT \] key several times to display the parameter “SP.NO”.

4. Press the \[ \text{ or } \text{ } \] key to display the required setpoint.

5. Press the \[ SET/ENT \] key once to register the setpoint.

6. Press the \[ SET/ENT \] key for more than 3 seconds. This returns you to the display shown at power-on (figure below).

### 3.7 Switching between Run and Stop

Switching between the RUN and STOP states can be performed only using external contact input.

**NOTE**

When the controller is shipped from the factory, it is configured so that switching between the RUN and STOP states cannot be performed. To make the switching possible, configure the DIS setup parameter as “DIS = 4”.

When the controller is stopped, input and outputs are as follows:

<table>
<thead>
<tr>
<th>PV input</th>
<th>Displays PV.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control output</td>
<td>Preset output value (factory-set default: 0%)</td>
</tr>
<tr>
<td>Alarm output</td>
<td>ON in the event of an alarm</td>
</tr>
</tbody>
</table>

When the controller is stopped, control output display is “Stop”.
3.8 Switching between AUTO and MAN

⚠️ NOTE

If AUTO and MAN have been switched using contact input, when the contact input is ON, switching between AUTO and MAN cannot be achieved by keystroke.

1. Bring the operating display into view (display appears at power on).

![Display Diagram]

- Displays PV.
- Displays target setpoint.

2. Each time you press the A/M key on the front panel of the instrument, AUTO and MAN is switched alternately.

![In automatic operation/In manual operation]

- In automatic operation
  - Displays target setpoint.
  - MAN lamp OFF.
- In manual operation
  - Displays output value.
  - Displays output-value symbol "o".
  - MAN lamp ON.
3.9 Manipulating Control Output in Manual Operation

**NOTE**

Control output cannot be changed if the controller is stopped. In this case, the preset output value (setup parameter PO) will be output.

A control output value is linked with a display value changed using the \( \downarrow \) or \( \uparrow \) key. Note that the control output changes as displayed without requiring the \( \text{SET/ENT} \) key.

1. Bring manual operating display into view. For switching to manual operation, see “3.8 Switching between AUTO and MAN.”

   - Displays output-value symbol “o”.
   - Displays output value.
   - MAN lamp ON.

2. Press the \( \downarrow \) or \( \uparrow \) key to change a control output value. You don’t need to press the \( \text{SET/ENT} \) key.

   - MAN lamp ON.

**Manipulating the Control Output during Heating/Cooling Control**

Either of the following two displays appears when the mode is switched to MAN during heating/cooling control.

- **Heating-side OUT display**
  
  - Symbol “H” represents the heating-side output.
  
  - Heating-side output.

- **Cooling-side OUT display**
  
  - Symbol “C” represents the cooling-side output.
  
  - Cooling-side output.
Controller Behavior and Control Output Manipulation when the Dead Band is Positive

The following is an example when the DB parameter is set at 12.4%.

If you hold down the key with the heating-side output under manipulation (i.e., cooling-side output $C = 0.0\%$), the heating-side output ($H =$ ) decreases. Consequently, both the heating-side and cooling-side outputs change to 0.0%. If you keep the key held down longer, you enter the state of manipulating the cooling-side output, and its value begins to increase.

Inversely, if you hold down the key with the cooling-side output under manipulation (i.e., heating-side output $H = 0.0\%$), the cooling-side output ($C =$) decreases. Consequently, both the heating-side and cooling-side outputs go to 0.0%. If you keep the key held down longer, you enter the state of manipulating the heating-side output, and its value begins to increase.

![Diagram showing change in manipulated output when the dead band is positive](image-url)
4. Troubleshooting and Maintenance

4.1 Troubleshooting

**Troubleshooting Flow**

If the operating display does not appear after turning on the controller’s power, follow the measures in the procedure below.

If a problem appears complicated, contact our sales representative.

- Is the instrument defective?
  - Yes
    - Totally inoperable?
      - Yes
        - Check wiring on the power supply terminals.
      - No
        - Check the supply voltage.
  - No
    - Is key operation faulty?
      - Yes
        - Check the key lock setting.
      - No
        - Is display faulty?
          - Yes
            - Turn off power, and then turn it on again.
          - No
            - Is I/O signal faulty?
              - Yes
                - Check the specifications of I/O counterpart for wrong polarity.
              - No
                - Check the communication-related parameters.
        - No
          - Is communication link faulty?
            - Yes
              - Check the instrument’s suffix code.
            - No
              - Does the code include a communication option?
                - Yes
                  - Check communication wiring.
                - No
                  - Check the communication-related parameters.

- Correct?
  - Yes
    - Disable key lock.
  - No
    - Correct?
      - Yes
        - Ask the vendor for repair.
      - No
        - Find the cause.

**IMPORTANT**

Take note of the parameter settings when asking the vendor for repair.
### Errors at Power on

The following table shows errors that may be detected by the fault diagnosis function when the power is turned on.

<table>
<thead>
<tr>
<th>Error indication (on PV display unit)</th>
<th>Description of error</th>
<th>PV</th>
<th>Control output</th>
<th>Alarm output</th>
<th>Retransmission output</th>
<th>Communication</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>E000 (E000)</td>
<td>Faulty RAM</td>
<td>None</td>
<td>0% or less or OFF</td>
<td>OFF</td>
<td>0% or less</td>
<td>Stopped</td>
<td>Faulty Contact us for repair.</td>
</tr>
<tr>
<td>E001 (E001)</td>
<td>Faulty ROM</td>
<td>None</td>
<td>0% or less or OFF</td>
<td>OFF</td>
<td>0% or less</td>
<td>Stopped</td>
<td>Faulty Contact us for repair.</td>
</tr>
<tr>
<td>E002 (E002)</td>
<td>System data error</td>
<td>0%</td>
<td>Normal action (out of accuracy)</td>
<td>Normal action (out of accuracy)</td>
<td>Normal action (out of accuracy)</td>
<td>Normal action</td>
<td>Normal action</td>
</tr>
<tr>
<td>PV decimal point blinks</td>
<td>Faulty calibration value</td>
<td></td>
<td>Normal action (out of accuracy)</td>
<td>Normal action (out of accuracy)</td>
<td>Normal action (out of accuracy)</td>
<td>Normal action</td>
<td>Normal action</td>
</tr>
<tr>
<td>E400 (E400)</td>
<td>Parameter error</td>
<td>0%</td>
<td>Preset value output</td>
<td>OFF</td>
<td>0%</td>
<td></td>
<td>Check and set the parameters, as they have been set to the limited values.</td>
</tr>
</tbody>
</table>

### Possible Errors during Operation

The following shows possible errors occurring during operations.

<table>
<thead>
<tr>
<th>Error indication (on PV display unit)</th>
<th>Description of error</th>
<th>PV</th>
<th>Control output</th>
<th>Alarm output</th>
<th>Retransmission output</th>
<th>Communication</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displays &quot;RJC&quot; and PV alternately</td>
<td>RJC error</td>
<td></td>
<td>Normal action</td>
<td>Normal action</td>
<td>Normal action</td>
<td>Faulty Contact us for repair.</td>
<td></td>
</tr>
<tr>
<td>PV value blinks</td>
<td>EEPROM error</td>
<td></td>
<td>Normal action</td>
<td>Normal action</td>
<td>Normal action</td>
<td>Faulty Contact us for repair.</td>
<td></td>
</tr>
<tr>
<td>E300 (E300)</td>
<td>A/DC error</td>
<td>105%</td>
<td>Normal action</td>
<td>Normal action</td>
<td>Normal action</td>
<td>Normal action</td>
<td>Check wires and sensor.</td>
</tr>
<tr>
<td>E300 (E300)</td>
<td>PV burnout error</td>
<td></td>
<td>Normal action</td>
<td>Normal action</td>
<td>Normal action</td>
<td>Normal action</td>
<td>Check process.</td>
</tr>
<tr>
<td>E200 (E200)</td>
<td>Auto-tuning failure</td>
<td></td>
<td>Normal action</td>
<td>Normal action</td>
<td>Normal action</td>
<td>Normal action</td>
<td>Check process. Press any key to erase error indication.</td>
</tr>
<tr>
<td>SP decimal point blinks</td>
<td>Faulty communication line</td>
<td></td>
<td>Normal action</td>
<td>Normal action</td>
<td>Normal action</td>
<td>Normal action</td>
<td>Check wires and communication parameters, and make resetting. Recovery at normal receipt</td>
</tr>
<tr>
<td>All indications off</td>
<td>Runaway (due to defective power or noise)</td>
<td></td>
<td>None</td>
<td>0% or less or OFF</td>
<td>OFF</td>
<td>0% or less</td>
<td>Stopped</td>
</tr>
<tr>
<td>All indications off</td>
<td>Power off</td>
<td></td>
<td>None</td>
<td>OFF</td>
<td>0%</td>
<td>Stopped</td>
<td>Check for abnormal power.</td>
</tr>
</tbody>
</table>
■ If a Power Failure Occurs during Operation

- **Momentary Power Failures shorter than 20 ms**
  The controller is not affected at all and continues normal operation.

- **Power Failures of 20 ms or longer**
  - The alarm function of the controller continues to work normally. (Alarms with the stand-by feature temporarily return to their stand-by state, however.)
  - Setting parameters that have already been configured retain their settings.
  - Auto-tuning is cancelled.
  - After recovery from a power failure, control action resumes in the same mode as the one before the occurrence of the power failure. The control output begins with the preset output value.
Troubleshooting when the Controller Fails to Operate Correctly

If your control tasks are not successful, check the preset parameters and controller wiring before concluding the controller to be defective. The following show some examples of troubleshooting you should refer to in order to avoid the possibility of other problems.

- **The Controller does not Show the measured input (PV).**
  - The UT351/UT321 controllers have a universal input. The type of PV input can be set/changed using the parameter “IN”. At this point, the controller must be wired correctly according to the selected type of PV input. Check the wiring first if the controller fails to show the correct PV. To do this, refer to “2. Initial Settings.”
  - With the parameters “RH”, “RL”, “SDP”, “SH” and “SL”, it is possible to scale the input signal and change its number of decimal places. Also check that these parameters are configured correctly.

- **The Controller does not Provide any Control Output or the Control Output does not Change at all.**
  - The UT351/UT321 controllers have a universal output. The type of control output can be set/changed using the parameter “OT”. At this point, the controller must be wired correctly according to the selected type of control output. Check the wiring first if the controller provides no control output. To do this, refer to “1.5 Terminal Wiring Diagrams.”
  - With the parameters “OH” and “OL”, it is possible to set/change the high and low limits of control output. The control output may not change at all, however, because of restrictions on these parameters. Also check the restrictions on these parameters.
  - The control output can only be changed when the controller is in the MAN mode. If the MAN lamp is off (i.e., the controller is in the AUTO mode), you cannot change the control output using key operation.

- **The control output does not change soon after the target setpoint (SP) has been changed.**
  - If this happens, check the setpoint of the parameter “C.MD”. In cases where fixed-point control is selected as the PID control mode (C.MD = 1), tracking based on the I-term works to prevent the control output from changing suddenly even if the target setpoint SP is varied. The control output therefore may appear to be working incorrectly at first; however it gradually adapts itself to the new target setpoint.
4.2  Maintenance

This section describes the cleaning and maintenance of the UT351/UT321.

4.2.1  Cleaning

The front panel and operation keys should be gently wiped with a dry cloth.

NOTE

Do not use alcohol, benzine, or any other solvents.

4.2.2  Replacing Brackets

When the brackets are broken or lost, purchase the following brackets for replacement.

<table>
<thead>
<tr>
<th>Target Model</th>
<th>Part No.</th>
<th>Sales Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>UT351</td>
<td>T9115NL</td>
<td>A large bracket and small bracket in pair</td>
</tr>
<tr>
<td>UT321</td>
<td>T9115NK</td>
<td>Two small brackets in pair</td>
</tr>
</tbody>
</table>

SEE ALSO

“1.2  How to Install,” for how to replace brackets.
4.2.3 Attaching Terminal Cover

When a terminal cover is necessary, purchase the following part.

<table>
<thead>
<tr>
<th>Target Model</th>
<th>Part No.</th>
<th>Sales Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>UT351</td>
<td>T9115YD</td>
<td>1</td>
</tr>
<tr>
<td>UT321</td>
<td>T9115YE</td>
<td>1</td>
</tr>
</tbody>
</table>

Attaching Terminal Cover

The procedure for attaching the terminal cover is as follows.

**CAUTION**

Do not touch the terminals on the rear panel when power is being supplied to the controller. Doing so may result in electric shock.

Before attaching the terminal cover, turn off the source circuit breaker and use a tester to check that the power cable is not conducting any electricity.

1. Before attaching the terminal cover, fold it once or twice so that the side which has the “Handle With Care” symbol (⚠️), is on the outside.

Folding Direction of Terminal Cover

**NOTE**

Do not fold the terminal cover the wrong way, doing so not only reduces the cover’s strength but may also cause the hinge to crack, thereby disabling attachment.
2. With the cover properly folded, fit its top and bottom holes to the protrusions of the mounting brackets.

Fit the hole of the terminal cover to the protrusion on the mounting bracket.

Attaching Terminal Cover

4.2.4 Replacing Parts with a Limited Service Life

The following UT351/UT321 parts have a limited service life. The service life given in the table assume that the controller is used under normal operating conditions.

<table>
<thead>
<tr>
<th>Part</th>
<th>Service life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum electrolytic condenser</td>
<td>About 10 years (rated)</td>
</tr>
<tr>
<td>EEPROM</td>
<td>About 100,000 times of writings</td>
</tr>
<tr>
<td>Alarm output relays</td>
<td>About 100,000 more ON-OFF operations or with resistance load</td>
</tr>
<tr>
<td>Control output relays</td>
<td>About 100,000 more ON-OFF operations or with resistance load</td>
</tr>
</tbody>
</table>

If any of these parts, except control output relays, cause a controller failure due to deterioration, contact your dealer for replacement at your cost.

SEE ALSO

“4.2.5 Replacing Control Output Relays,” for how to replace the control output relays.
4.2.5 Replacing Control Output Relays

This subsection describes how to replace the control output relays. Since inspection is needed in case of parts replacement, the replacement work should be carried out by a YOKOGAWA engineer or an engineer certified by YOKOGAWA. When replacement is required, contact your nearest YOKOGAWA dealer.

CAUTION

Always turn off the power before starting the work in order to avoid electric shock.

Do not pull out the internal unit for any other purpose other than to replace the control output relays.

1. Insert a flat-blade screwdriver (tip width of 6 mm is recommended) into the opening with the tip in parallel with the front panel, and then turn the screwdriver gently. Take this procedure to four openings 1, 2, 3 and 4 (see the figure below) on the upper and lower parts of the bezel, in order. The bezel slightly moves forward from the housing.

2. Push up the center of the bottom gasket of bezel by a finger to release the latch.

3. Insert the screwdriver into the four openings and flip the tip forward to move the bezel more forward.
4. Hold the bezel and pull it along with the internal unit out of the housing.  
   (Note) Be careful not to damage the RJC sensor.

5. The location and number of the relays differ depending on the model code of the UT351/UT321. 
   Confirm the location of the control output relay to be replaced before pulling out the relay.

6. Pull out the relay to be replaced. 
   The control output relays are easy to remove and mount, since they are connected via a 
   socket onto the print boards.

Insert the new relay in the socket. Use the following relay.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>OMRON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>G6B-2114P-FD-US-P6B</td>
</tr>
<tr>
<td>Power supply</td>
<td>12 V DC</td>
</tr>
</tbody>
</table>
7. Insert the internal unit into the housing. Apply power to the controller and confirm that the initial operating display is shown. If the operating display is not shown properly, turn off the controller and pull out the internal unit. Then, insert it into the housing again.

This completes replacement of the control output relay.
5. Parameters

This chapter contains a parameter map as a guideline for setting parameters, and lists of parameters for recording User Settings.

5.1 Parameter Map
Changing the registered value of a setup parameter may cause the registered value of an operating parameter to be initialized automatically. Thus, when you have changed a setup parameter, always check that the registered value of the operating parameter is appropriate. If it is initialized to default, reset it to the required value.

NOTE
When shipped from the factory, this parameter appears first after power-on.

Password input

Password check display

(No password is required when PWD = 0.)

Password input

Control function related

Displayed for heating/cooling control.

Developed only for controllers with communication functions.

This parameter is not to be set.

Input/Output related

When shipped from the factory, this parameter appears first after power-on.

Press the key once.

Press the key for 3 seconds.

Press the or key once.
5.2 Lists of Parameters

- Parameters relating to PV or setpoints should all be set in real numbers. For example, use temperature values to define target setpoints and alarm setpoints for temperature input.

- The “User Setting” column in the table is provided for the customer to record setpoints.

- The column “Target Item in CD-ROM” in the table provides references from User’s Manual (Reference) (CD-ROM version) which describes items in more detail and items that are not contained in this manual.

- Numbers in () are the parameter setpoints that apply when the communication function is used. ex. OFF (0), ON (1)

<table>
<thead>
<tr>
<th>Parameter Symbol</th>
<th>Name of Parameter</th>
<th>Setting Range and Description</th>
<th>Initial Value</th>
<th>User Setting</th>
<th>Target Item in CD-ROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>LL (LL)</td>
<td>LL communication interface selection</td>
<td>OFF (0): Communication is carried out via the RS485 communication terminals. ON (1): Communication is carried out via the light-leader adapter.</td>
<td>with communication: OFF (0) without communication: ON (1)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>RA1 (A1)</td>
<td>Alarm 1-setpoint</td>
<td>PV alarm / SP alarm: -100.0 to 100.0% of PV input range Deviation alarm: -100.0 to 100.0% of PV input range span</td>
<td>PV high limit/SP high limit alarm: 100.0% of PV input range Deviation alarm: 0.0% of PV input range span Other PV/SP low limit alarm: 0.0% of PV input range</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>RA2 (A2)</td>
<td>Alarm 2-setpoint</td>
<td>Output alarm: -5.0 to 105.0% An alarm common to the 1.SP to 4.SP parameters.</td>
<td>Output high limit alarm: 100.0% Output low limit alarm: 0.0%</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>RA3 (A3)</td>
<td>Alarm 3-setpoint</td>
<td></td>
<td></td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>RA4 (A4)</td>
<td>Auto-tuning</td>
<td>OFF (0): No auto-tuning 1: Auto-tuning for 1.SP 2: Auto-tuning for 2.SP 3: Auto-tuning for 3.SP 4: Auto-tuning for 4.SP AUTO (5): Performs auto-tuning to all groups 1 to 4.</td>
<td>OFF (0)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>SC (SC)</td>
<td>&quot;Super&quot; function</td>
<td>OFF (0): Disable 1: Overshoot suppressing function Suppresses overshoots generated by abrupt changes in the target setpoint or by disturbances. 2: Hunting suppressing function (Stable mode) Suitable to stabilize the state of control when the load varies greatly, or the target setpoint is changed. Enables to answer the wider characteristic changes compared with Response mode. 3: Hunting suppressing function (Response mode) Enables quick follow-up and short converging time of PV for the changed target setpoint.</td>
<td>OFF (0)</td>
<td>Ref.2.1(5) Ref.2.1(6)</td>
<td></td>
</tr>
<tr>
<td>SP_no (SP-NO)</td>
<td>Target setpoint number selection</td>
<td>0: Use target setpoint via communication. 1: Selects target setpoint 1 (1.SP). 2: Selects target setpoint 2 (2.SP). 3: Selects target setpoint 3 (3.SP). 4: Selects target setpoint 4 (4.SP).</td>
<td>1</td>
<td>Ref.4.1(1)</td>
<td></td>
</tr>
<tr>
<td>PID (PID)</td>
<td>PID parameter display number</td>
<td>MENU (0): Move to FL parameter display 1Gr (1) to 4Gr (4): Display of each PID parameter</td>
<td>MENU (0)</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
### Parameters

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting | Target Item
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FL (FL)</td>
<td>PV input filter</td>
<td>OFF (0), 1 to 120 second. Used when the PV input fluctuates.</td>
<td>OFF (0)</td>
<td></td>
<td>Ref.1.1(1)</td>
</tr>
<tr>
<td>BS (BS)</td>
<td>PV input bias</td>
<td>-100.0% to 100.0% of PV input range span. Used to correct the PV input range.</td>
<td>0.0% of PV input range span</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UPR (UPR)</td>
<td>Setpoint ramp-up-rate</td>
<td>OFF (0), 0% + 1 digit of PV input range span to 100.0% of PV input range span</td>
<td>OFF (0)</td>
<td></td>
<td>Ref.4.1(4)</td>
</tr>
<tr>
<td>DNR (DNR)</td>
<td>Setpoint ramp-down-rate</td>
<td>Set ramp-up-rate or ramp-down-rate per hour or minute. Sets unit in ramp-rate-time unit (TMU).</td>
<td>OFF (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OH (OH)</td>
<td>Output high limit (in heating/cooling control)</td>
<td>-5.0 to 105.0%. Heating-side limiter in heating/cooling control: 0.0 to 105.0% (OL &lt; OH)</td>
<td>100% Heating/cooling control: 100.0%</td>
<td></td>
<td>Ref.2.1(3)</td>
</tr>
<tr>
<td>OL (OL)</td>
<td>Output low limit (in heating/cooling control)</td>
<td>-5.0 to 105.0%. Cooling-side limiter in heating/cooling control: 0.0 to 105.0% (OL &lt; OH)</td>
<td>0.0% Heating/cooling control: 100.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H (H)</td>
<td>ON/OFF control hysteresis Heating-side/cooling-side (in heating/cooling control)</td>
<td>In ON/OFF control: 0.0 to 100.0% of PV input range span In heating/cooling control: 0.0 to 100.0%</td>
<td>ON/OFF control: 0.5% of PV input range span Heating/cooling control: 0.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dr (DR)</td>
<td>Direct/reverse action switching</td>
<td>0: reverse action, 1: direct action</td>
<td>0</td>
<td></td>
<td>Ref.2.1(1)</td>
</tr>
<tr>
<td>PCCH (PCCH)</td>
<td>High limit for PV color change</td>
<td>When PCMD (PV color mode parameter) = 6 or 7: -100.0 to 100.0% of PV input range When PCMD (PV color mode parameter) = 8 or 9: -100.0 to 100.0% of PV input range span</td>
<td>When PCMD = 6 or 7: PCCH = 100.0%, PCCL = 0.0%, When PCMD = 8 or 9: PCCH and PCCL = 1.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCEL (PCEL)</td>
<td>Low limit for PV color change</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HB1 (HB1)</td>
<td>Heater burnout current setpoint 1</td>
<td>OFF (0), or 1 to 50 A</td>
<td>OFF (0)</td>
<td></td>
<td>Ref.3.3(5)</td>
</tr>
<tr>
<td>HB2 (HB2)</td>
<td>Heater burnout current setpoint 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HC1 (HC1)</td>
<td>Heater burnout current measurement 1</td>
<td>These are not setpoints.</td>
<td>The current value of the heater burnout detector is shown on the display of the HC1 or HC2 parameter.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HC2 (HC2)</td>
<td>Heater burnout current measurement 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ORB (ORB)</td>
<td>ON/OFF rate detection band</td>
<td>0.0 to 100.0% of PV input range span</td>
<td>1.0% of PV input range span</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ORH (ORH)</td>
<td>ON/OFF rate high limit</td>
<td>ORL + 1 digit to 105.0%</td>
<td>100.0%</td>
<td></td>
<td>Ref.3.3(4)</td>
</tr>
<tr>
<td>ORL (ORL)</td>
<td>ON/OFF rate low limit</td>
<td>-5.0% to ORH - 1 digit</td>
<td>0.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR (OR)</td>
<td>ON/OFF rate</td>
<td>This is not a setpoint.</td>
<td>The moving average (for 5 cycle times) of the control output is shown.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISP (1.SP)</td>
<td>Target setpoint-1</td>
<td>0.0 to 100.0% of PV input range However, between target setpoint limiter lower limit (SPL) and upper limit (SPH).</td>
<td>0.0% of PV input range</td>
<td></td>
<td>Ref.4.1(1)</td>
</tr>
<tr>
<td>2SP (2.SP)</td>
<td>Target setpoint-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3SP (3.SP)</td>
<td>Target setpoint-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4SP (4.SP)</td>
<td>Target setpoint-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PID-related Parameters

The following parameters are displayed when “1Gr” is set to PID parameter display number (PID).

In this case, the corresponding target setpoint is 1.SP (target setpoint-1).

To set PID corresponding to target setpoint 2 to 4, set “2Gr”, “3Gr”, or “4Gr” to PID. The relevant parameters will then be displayed.

<table>
<thead>
<tr>
<th>Parameter Symbol</th>
<th>Name of Parameter</th>
<th>Setting Range and Description</th>
<th>Initial Value</th>
<th>User Setting</th>
<th>Target item in CD-ROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>( I ) (1.P)</td>
<td>Proportional band/Heating-side proportional band (in heating/cooling control)</td>
<td>0.1 to 999.9% In heating/cooling control: 0.0 to 999.9% (heating-side ON/OFF control applies when 0.0)</td>
<td>5.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I ) (1.I)</td>
<td>Integral time Heating-side integral time (in heating/cooling control)</td>
<td>OFF (0), 1 to 6000 second.</td>
<td>240 second.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I ) (1.D)</td>
<td>Derivative time Heating-side derivative time (in heating/cooling control)</td>
<td>OFF (0), 1 to 6000 second.</td>
<td>60 second.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I ) (1.Pc)</td>
<td>Cooling-side proportional band</td>
<td>0.0 to 999.9% (Cooling-side ON/OFF control applies when 0.0)</td>
<td>5.0%</td>
<td>Ref.4.1(1)</td>
<td></td>
</tr>
<tr>
<td>( I ) (1.ic)</td>
<td>Cooling-side integral time</td>
<td>OFF (0), 1 to 6000 second.</td>
<td>240 second.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I ) (1.Dc)</td>
<td>Cooling-side derivative time</td>
<td>OFF (0), 1 to 6000 second.</td>
<td>60 second.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I ) (1.db)</td>
<td>Deadband</td>
<td>-100.0 to 50.0% In heating/cooling control, a region where both of the heating- and cooling-side outputs are presented, or non of them is presented, can be set.</td>
<td>3.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I ) (1.RP)</td>
<td>Zone PID reference point-1</td>
<td>0.0 to 100.0% of PV input range. Note that 1.RP ≤ 2.RP.</td>
<td>100% value of PV input range</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Refer to the table below for recording setpoints when two sets or more of PID parameters are used.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>n=2</th>
<th>n=3</th>
<th>n=4</th>
</tr>
</thead>
<tbody>
<tr>
<td>n.P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n.I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n.D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n.MR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n.Pc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n.ic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n.Dc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n.db</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n.RP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| rdV (RDV) | Reference deviation | OFF (0), 0.0 to 100.0% of PV input range span Used to select PID constants according to a deviation from the setpoint. The 4th group of PID constants is used when the controller fails to keep track of the deviation. | OFF (0) | Ref.4.1(1) |
Auto-tuning

Auto-tuning is a function with which the controller automatically measures the process characteristics to automatically set the optimum PID constants. This function does not work when the controller is performing on-off control. The UT351/UT321 employ the “Limit Cycle Method.” As shown in the figure below, the controller temporarily changes its control output in a step-waveform manner. Then, it calculates the optimum proportional band (P), integral time (I) and derivative time (D) from the resulting response to set them in their respective parameters.

![Diagram of Auto-tuning](image)

If the Output High Limit (OH) and Output Low Limit (OL) parameters are already configured, the control output turns on and off only between the output’s high and low limits during auto-tuning.

- **Auto-tuning Using Zone PID** (see “PID Switching (Zone PID)” later in this chapter)

<table>
<thead>
<tr>
<th>Setting of AT Parameter</th>
<th>Auto-tuned Setpoint</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>-</td>
<td>Auto-tuning is turned off (disabled).</td>
</tr>
<tr>
<td>1</td>
<td>The setpoints when auto-tuning is started</td>
<td>Determines the values of 1.P, 1.I and 1.D parameters by auto-tuning.</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Determines the values of 2.P, 2.I and 2.D parameters by auto-tuning.</td>
</tr>
<tr>
<td>AUTO</td>
<td>Median value of each zone width</td>
<td>Determines the values of all PID parameters in use by auto-tuning.</td>
</tr>
</tbody>
</table>

The AT parameter settings numbered 1 to 4 in the table above are dependent on how many zones have been set. For example, if you have set two zones, you can use AT parameter settings 1 and 2. Likewise, if you have set three zones, you can use AT parameter settings 1, 2 and 3.
**Hysteresis (for Target Setpoints (On-Off Control) and Alarm Setpoints)**

Hysteresis can be set in on-off control setpoints and alarm setpoints as well. With the hysteresis settings, it is possible to prevent relays from chattering.

- When hysteresis is set in a target setpoint

![Diagram showing hysteresis in target setpoint](image)

- When hysteresis is set in an alarm setpoint

![Diagram showing hysteresis in alarm setpoint](image)

**Target Setpoint Ramp Setting Function**

Use this function to prevent the target setpoint from changing suddenly. The ramp setting function works when:

1. The target setpoint is changed (example: change in “1.SP” from 100°C to 150°C);
2. The target setpoint number is switched (example: switch from “1.SP” to “3.SP”);
3. The power is turned on or the controller is recovered from power failure;
4. A change is made from manual operation to automatic operation; or
5. A change is made from the STOP state to the RUN state.

If the target setpoint before switching is smaller than the target setpoint after switching, the controller operates according to the settings of the Setpoint Ramp UP (UPR) and Ramp Time Unit (TMU) parameters. If the target setpoint before switching is greater than the target setpoint after switching, the controller operates according to the settings of the Setpoint Ramp Down (DNR) and Ramp Time Unit (TMU) parameters.

**NOTE**

When using target setpoint ramp setting function, PV tracking works in case of the above conditions [2] to [5].
The figure below shows an example when the Target Setpoint Number (SP.NO) parameter is switched. The 1.SP and 2.SP parameters are set to 500°C and 640°C, respectively. Thus, there is a temperature difference of 140°C between the 1.SP and 2.SP parameters. This example shows how the temperature is changed by as much as this temperature difference over a period of two minutes. In this example, the UPR parameter is 70°C and the TMU parameter is 1 minute.

**PID Switching (Zone PID)**

Using a zone PID, you can automatically switch between groups of PID constants according to the temperature zone. You can set a maximum of three temperature zones.

<Setting Method>

1. Set the Zone PID Selection (ZON) parameter to “ON”.
2. Define a reference point.
   - When using two zones, define only reference point 1 (1.RP) between the minimum and maximum values of the PV input range.
   - When using three zones, define reference points 1 and 2 (1.RP and 2.RP) in the same way as noted above.

**NOTE**

Set the maximum and minimum values, as close as possible to those of the actual range to be controlled, in the Maximum Value of PV Input Range (RH) and Minimum Value of PV Input Range (RL) parameters. Otherwise, the controller may fail to determine the optimum values when auto-tuning is carried out.
### Setup Parameters

#### Control Function-related Parameters

<table>
<thead>
<tr>
<th>Parameter Symbol</th>
<th>Name of Parameter</th>
<th>Setting Range and Description</th>
<th>Initial Value</th>
<th>User Setting</th>
<th>Target Item in CD-ROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPH (SPL)</td>
<td>Target setpoint limiter upper limit</td>
<td>0.0 to 100.0% of PV input range where, SPL &lt; SPH. Places a limit on the range within which the target setpoint is changed.</td>
<td>100.0% of PV input range</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>SPL (SPL)</td>
<td>Target setpoint limiter lower limit</td>
<td>0.0% of PV input range</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>PCD (PCMD)</td>
<td>PV color mode</td>
<td>Off (0), 1 to 25, 28 to 31, 33 to 38, 43 to 48 1: Fixed in red 2: Link to alarm 1 (Alarm OFF: green, Alarm ON: red) 3: Link to alarm 1 (Alarm OFF: red, Alarm ON: green) 4: Link to alarm 1 and 2 (Alarm OFF: green, Alarm ON: red) 5: Link to alarm 1 and 2 (Alarm OFF: red, Alarm ON: green) 6: PV limit (Within PV range: green, Out of PV range: red) 7: PV limit (Within PV range: red, Out of PV range: green) 8: SP deviation (Within deviation: green, Out of deviation: red) 9: SP deviation (Within deviation: red, Out of deviation: green)</td>
<td>1</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>AL1 (AL1)</td>
<td>Alarm-1 type</td>
<td>Off (0)</td>
<td>1</td>
<td>—</td>
<td>Ref.3.3(4)</td>
</tr>
<tr>
<td>AL2 (AL2)</td>
<td>Alarm-2 type</td>
<td>1: PV high limit (energized, no stand-by action) 2: PV low limit (energized, no stand-by action) 3: Deviation high limit (energized, no stand-by action) 4: Deviation low limit (energized, no stand-by action) 5: Deviation high limit (de-energized, no stand-by action) 6: Deviation low limit (de-energized, no stand-by action)</td>
<td>2</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>AL3 (AL3)</td>
<td>Alarm-3 type</td>
<td>These Alarm Type parameters are common to the parameters 1.SP to 4.SP. See “2.5 Changing Alarm Type” for other alarm types.</td>
<td>1</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>HY1 (HY1)</td>
<td>Alarm-1 hysteresis</td>
<td>0.0 to 100.0% of PV input range span Output alarm: 0.0 to 100.0% Hysteresis for PV high limit alarm</td>
<td>0.5% of PV input range span Output alarm: 0.5%</td>
<td>—</td>
<td>Ref.3.3(2)</td>
</tr>
<tr>
<td>HY2 (HY2)</td>
<td>Alarm-2 hysteresis</td>
<td>Output Point of ON/OFF action (Alarm setpoint)</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>HY3 (HY3)</td>
<td>Alarm-3 hysteresis</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>DY1 (DY1)</td>
<td>Alarm-1 delay timer</td>
<td>An alarm is output when the delay timer expires after the alarm setpoint is reached. 0.00 to 99.59 (min, sec.) (enabled when alarm-1 type “AL1” is 1 to 20 or 28 to 31)</td>
<td>0.00</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>DY2 (DY2)</td>
<td>Alarm-2 delay timer</td>
<td>0.00 to 99.59 (min, sec.) (enabled when alarm-2 type “AL2” is 1 to 20 or 28 to 31)</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>DY3 (DY3)</td>
<td>Alarm-3 delay timer</td>
<td>0.00 to 99.59 (min, sec.) (enabled when alarm-3 type “AL3” is 1 to 20 or 28 to 31)</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>CT (CT)</td>
<td>Control output cycle time Heating-side control output cycle time (in heating/cooling control)</td>
<td>1 to 1000 second.</td>
<td>30 second.</td>
<td>—</td>
<td>Ref.3.3(4)</td>
</tr>
<tr>
<td>CTc (CTc)</td>
<td>Control output cycle time</td>
<td>1 to 1000 second.</td>
<td>30 second.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>PO (PO)</td>
<td>Preset output Heating-side preset output (in heating/cooling control)</td>
<td>-5.0 to 105.0%</td>
<td>—</td>
<td>0.0%</td>
<td>Ref.2.1(8)</td>
</tr>
<tr>
<td>POC (POc)</td>
<td>Cooling-side preset output</td>
<td>0.0 to 105.0%</td>
<td>—</td>
<td>0.0%</td>
<td>—</td>
</tr>
</tbody>
</table>
### 5. Parameters

<table>
<thead>
<tr>
<th>Parameter Symbol</th>
<th>Name of Parameter</th>
<th>Setting Range and Description</th>
<th>Initial Value</th>
<th>User Setting</th>
<th>Target Item in CD-ROM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cnd</strong>&lt;br&gt;(C.MD)</td>
<td>PID control mode</td>
<td>0: Standard PID control (with output bump at SP change)&lt;br&gt;1: Fixed Point control (without output bump at SP change)&lt;br&gt;Choose “Fixed Point Control” when controlling pressure or flow rate.</td>
<td>0</td>
<td></td>
<td>Ref.2.1(2)</td>
</tr>
<tr>
<td><strong>zon</strong>&lt;br&gt;(ZON)</td>
<td>Zone PID selection</td>
<td>OFF: SP selection&lt;br&gt;ON: Zone PID</td>
<td>OFF</td>
<td></td>
<td>Ref.4.1(2)</td>
</tr>
<tr>
<td><strong>AR</strong>&lt;br&gt;(AR)</td>
<td>Anti-reset windup (Excess integration prevention)</td>
<td>AUTO (0): 50.0 to 200.0%&lt;br&gt;Used when the control output travels up to 100% or down to 0% and stays at this point.&lt;br&gt;The larger SP, the sooner PID computation (integral computation) stops.</td>
<td>AUTO (0)</td>
<td></td>
<td>Ref.2.1(4)</td>
</tr>
<tr>
<td><strong>EnU</strong>&lt;br&gt;(TMU)</td>
<td>Ramp-rate time unit setting</td>
<td>0: hour, 1: minute&lt;br&gt;Time unit of setpoint ramp-up (UPR) and setpoint ramp-down (DNR)</td>
<td>0</td>
<td></td>
<td>Ref.4.1(4)</td>
</tr>
<tr>
<td><strong>PSL</strong>&lt;br&gt;(P.SL)</td>
<td>Protocol selection</td>
<td>0: PC link communication&lt;br&gt;1: PC link communication (with checksum)&lt;br&gt;2: Ladder communication&lt;br&gt;3: Coordinated master station&lt;br&gt;4: Coordinated slave station (loop-1 mode)&lt;br&gt;7: MODBUS (ASCII)&lt;br&gt;8: MODBUS (RTU)&lt;br&gt;10: Coordinated slave station (loop-2 mode)&lt;br&gt;(10, 11: When the master station is in dual-loop control, the slave station selects either of the loops to be controlled.)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>bps</strong>&lt;br&gt;(BPS)</td>
<td>Baud rate</td>
<td>0: 600, 1: 1200, 2: 2400, 3: 4800, 4: 9600 (bps)</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Prl</strong>&lt;br&gt;(PRI)</td>
<td>Parity</td>
<td>0: None&lt;br&gt;1: Even&lt;br&gt;2: Odd</td>
<td>1</td>
<td></td>
<td>Communication function</td>
</tr>
<tr>
<td><strong>Stp</strong>&lt;br&gt;(STP)</td>
<td>Stop bit</td>
<td>1, 2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>dln</strong>&lt;br&gt;(DLN)</td>
<td>Data length</td>
<td>7, 8;&lt;br&gt;Fixed at 7, when the P.SL parameter is set to MODBUS (ASCII), Fixed at 8, when the P.SL parameter is set to MODBUS (RTU) or Ladder Communication.</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Adr</strong>&lt;br&gt;(ADR)</td>
<td>Address</td>
<td>1 to 99&lt;br&gt;However, the maximum number of stations connectable is 31.</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>rPT</strong>&lt;br&gt;(RT: T)</td>
<td>Minimum response time</td>
<td>0 to 10 (× 10 ms)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TEST</strong>&lt;br&gt;(TEST)</td>
<td>If this parameter symbol appears, press the SET/ENT key to return to the FUNC menu.&lt;br&gt;Caution: Do not change the setpoint of the TEST parameter, otherwise the controller will be disabled.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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IM 05D01D12-41E  6th Edition: Mar. 25, 2005-00
Precautions for Use of Heater Burnout Alarm

(1) The heater burnout alarm can be used only in on-off control (relay output) or in time proportional PID control (relay output, voltage pulse output). It cannot be used in continuous PID control (current output). Only heating-side can be used in heating/cooling control. (Cooling-side cannot be used.)

(2) Timing which detects an alarm is as follows.
- In time proportional PID control: When on-state time of control output is 130 ms or longer, heater current value is detected and measured heater current value is updated. Heater current value is detected 100 ms after control output turns on.
- In on-off control output: Heater burnout is detected in on state. (Heater burnout is not detected in off state.)
- Heater burnout is not detected during Auto-tuning. However, if Auto-tuning is started when heater burnout alarm occurs, alarm state will be held during Auto-tuning.

(3) In time proportional PID output, control output is updated for every cycle time. When the controller is set to STOP state (preset output value POUT=0%), control output is actually turned off after the cycle time in progress elapses. When turning off heater in STOP state, wait for one or more of cycle times after the operation is stopped.
### Input-/Output-related Parameters

<table>
<thead>
<tr>
<th>Parameter Symbol</th>
<th>Name of Parameter</th>
<th>Setting Range and Description</th>
<th>Initial Value</th>
<th>User Setting</th>
<th>Target item in CD-ROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_CAR (IN)</td>
<td>PV input type (PV INPUT terminals)</td>
<td>OFF (0), 1 to 18, 30, 31, 35 to 37, 40, 41, 50, 51, 55, 56 See “Instrument Input Range Codes” in “2. Initial Settings.”</td>
<td>OFF (0)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>U_UNIT (UNIT)</td>
<td>PV input unit</td>
<td>°C (0): Degree Celsius °F (1): Fahrenheit (This parameter is not shown for voltage input.)</td>
<td>°C (0)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>r_H (RH)</td>
<td>Max. value of PV input range</td>
<td>Set the PV input range, however RL &lt; RH - Temperature input Set the range of temperature that is actually controlled.</td>
<td>Max. value of instrument input range</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>r_L (RL)</td>
<td>Min. value of PV input range</td>
<td>Set the range of a voltage signal that is applied. The scale across which the voltage signal is actually controlled should be set using the parameters Maximum Value of PV Input Scale (SH) and Minimum Value of PV Input Scale (SL).</td>
<td>Min. value of instrument input range</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>sDP (SDP)</td>
<td>PV input decimal point position (displayed at voltage input)</td>
<td>0 to 3 Set the position of the decimal point of voltage-mode PV input. 0: No decimal place 1: One decimal place 2: Two, three decimal places</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>S_H (SH)</td>
<td>Max. value of PV input scale (displayed at voltage input)</td>
<td>-9999 to 9999, however SL &lt; SH</td>
<td>100.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>S_L (SL)</td>
<td>Min. value of PV input scale (displayed at voltage input)</td>
<td></td>
<td>0.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>r_JC (RJC)</td>
<td>Presence/absence of PV input reference junction compensation</td>
<td>OFF (0), ON (1)</td>
<td>ON (1)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>E_RJC (ERJC)</td>
<td>External RJC setpoint</td>
<td>-50.0 to 50.0 °C -58.0 to 122.0 °F For thermocouple input, temperature compensation value outside the controller can be set. Available only when RJC=OFF</td>
<td>0.0 °C 32.0 °F</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>b_SL (BSL)</td>
<td>Selection of PV input burnout action</td>
<td>OFF (0)</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>o_T (OT)</td>
<td>Control output type</td>
<td>0 Time proportional PID relay contact output (terminals 1-2-3-4) 1 Time proportional PID voltage pulse output (terminals 5-6-7) 2 Current output (terminals 8-9-10) 3 ON/OFF control relay contact output (terminals 7-2-3) The following 4 to 12 are displayed only for heating/cooling type controllers.</td>
<td>0</td>
<td>Heating/cooling type: 4</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Alarm-3 cannot be used when OT=4 to 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional notes:
- See “Instrument Input Range Codes” for PV input types and units.
- The PV input range settings should be made according to the actual controlled variable range.
- For voltage input, the scale setting should be made using the parameters Maximum Value of PV Input Scale (SH) and Minimum Value of PV Input Scale (SL).
- The PV input decimal point position setting should be made according to the display format of the actual controlled variable.
## Parameters

### RET (RETransmit)

**Description:**
Retransmission output type

- **Type:** 1: PV, 2: SP, 3: OUT, 4: Loop power supply for sensor (15 V)
- In heating/cooling control, an output value before allocation to heating and cooling control (0 to 100%) is transmitted if setpoint “3” is selected (0 to 50%: Cooling-side output; 50 to 100%: Heating-side output).

**Initial Value:** 1

**Target Item in CD-ROM:** Ref. 2.2(1)

### RTH (RTherm)

**Description:**
Max. value of retransmit output scale

- **Range:** RET=1, 2: RTL + 1 digit to 100.0% of PV input range

### RTL (RTL)

**Description:**
Min. value of retransmit output scale

- **Range:** RET=1, 2: 0.0% of PV input range to RTH - 1 digit

### DIS (DI Selection)

**Description:**
DI function selection

- **Options:**
  1. Off: Disables the external contact input.
  2. DI1: 2.SP (on)/1.SP (off), DI2: AUTO (on)/MAN (off)
  3. DI1: Hides (on)/shows (off) the LOCK setup parameter.
  4. DI2: Unused.

**Target Item in CD-ROM:** Ref. 3.1(1)

### SP Selection when DIS = 3 is set

<table>
<thead>
<tr>
<th>DIS Setting</th>
<th>DI1</th>
<th>DI2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.SP</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>2.SP</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>3.SP</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>4.SP</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

## Parameters Table

<table>
<thead>
<tr>
<th>Parameter Symbol</th>
<th>Name of Parameter</th>
<th>Setting Range and Description</th>
<th>Initial Value</th>
<th>User Setting</th>
<th>Target Item in CD-ROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>C5.1 (C.S1)</td>
<td>SELECT display-1 registration</td>
<td>OFF (0), 201 to 1015 Select the desired parameter from among the operating and setup parameters, then register the number (D register No.) accompanying that parameter. For example, registering “231” for C.S1 allows you to change alarm-1 setpoint in operating display.</td>
<td>OFF (0)</td>
<td></td>
<td>Ref. 6.1(1)</td>
</tr>
<tr>
<td>C5.2 (C.S2)</td>
<td>SELECT display-2 registration</td>
<td>Numbers for registering alarm SP parameter for operating display: Alarm-1 setpoint: 231 Alarm-2 setpoint: 232 Alarm-3 setpoint: 233 Above numbers are alarm setpoint parameters for target setpoint-1 (1.SP),</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5.3 (C.S3)</td>
<td>SELECT display-3 registration</td>
<td>Key lock OFF (0): No key lock 1: Change to any parameter prohibited Prohibits any operating parameter or setup parameter from being changed. The setpoint of the LOCK parameter itself can be changed, however. 2: Change to and display of operating parameters prohibited Turns off the display for setting operating parameters, thus prohibiting any change to the parameter settings. (Hold down the SET/ENT key for more than 3 seconds to show the password check display.) 3: Disables the A/M key on the instrument’s front panel.</td>
<td>OFF (0)</td>
<td></td>
<td>Ref. 7.1(2)</td>
</tr>
<tr>
<td>C5.4 (C.S4)</td>
<td>SELECT display-4 registration</td>
<td>Password setting 0: Password not set 1 to 9999 Above numbers are alarm setpoint parameters for target setpoint-1 (1.SP), Password setting 0: Password not set 1 to 9999</td>
<td></td>
<td></td>
<td>Ref. 7.1(1)</td>
</tr>
</tbody>
</table>
Functions of Active Color PV Display

This part describes the functions of “Active Color PV Display.” PV display color is changed by the following four actions.

PV display is selectable from red-to-green or green-to-red changing action, or fixed color.

- Link to alarm 1 mode (when PCMD = 2, 3) (Setting example-1)
  - Link to alarm 1 and 2 mode (when PCMD = 4, 5) is the same. When either of the alarms occurs, the display color is changed.
- SP deviation mode (when PCMD = 8, 9) (Setting example-2)
- PV limit mode (when PCMD = 6, 7) (Setting example-3)
- Fixed color mode (when PCMD = 0, 1) (Setting example-4)

### Setting Example-1 : Link to Alarm

Works linking to alarm 1.
Set "PV high limit alarm" for alarm -1 type, and “80°C” for alarm -1 setpoint.
If PCMD (PV color mode parameter) = 2, PV display color is changed from green to red when PV input value exceeds alarm -1 setpoint.
The red-to-green changing action is selectable.
Setting parameters:
- PCMD (PV color mode parameter) = 2
- AL1 (Alarm -1 type parameter) = 1
- A1 (Alarm -1 setpoint parameter) = 80°C
- HY1 (Alarm -1 hysteresis parameter) = 5°C

![Alarm 1 setpoint](chart1)

Alarm 1 setpoint
A1=80°C

### Setting Example-2 : Change by Deviation

Set the high limit deviation band “10°C” for PCCH and the low limit deviation band “5°C” for PCCL, for the current setpoint “50°C.”
PV display color is changed from green to red when PV input value is out of the deviation.
The red-to-green changing action is selectable.
Setting parameters:
- PCMD (PV color mode parameter) = 8
- PCCH (High limit for PV color change parameter) = 10°C
- PCCL (Low limit for PV color change parameter) = 5°C
- HY 0.25% is inserted where PV display color is changed.

In the example below, where changed from red to green.

![Setpoint](chart2)

Setpoint
SP=50°C
Set high limit "70°C" for PCCH, and low limit "20°C" for PCCL. PV display color is changed from green to red when PV input value is out of the range. The red-to-green changing action is selectable.

Setting parameters
- PCMD (PV color mode parameter) = 6
- PCCH (High limit for PV color change parameter) = 70°C
- PCCL (Low limit for PV color change parameter) = 20°C

Hysteresis fixed to 0.25% is inserted where PV display color is changed. In the example below, where changed from red to green.

**Setting Example-3 : Link to PV**

Set the PV display color or fixed in green mode, setting of fixed to red mode is also possible.

**Setting Example-4 : Fixed in Red or Green**

Set the PV display color or fixed in green mode, setting of fixed to red mode is also possible.

Setting parameter
- PCMD (PV color mode parameter) = 0
The external RJC is not a compensation function built in a controller but a compensation function working outside the controller.

The external RJC is used when the input is thermocouple, and RJC=OFF.

Using external RJC makes the accuracy of RJC higher and shortens the compensating wire.

---

**External RJC**

The external RJC is not a compensation function built in a controller but a compensation function working outside the controller.

The external RJC is used when the input is thermocouple, and RJC=OFF.

Using external RJC makes the accuracy of RJC higher and shortens the compensating wire.

---

**Example:**

- Setting parameters
  - RJC = OFF
  - ERJC = 25.0°C

---

**Diagram:**

- Furnace
- Thermocouple
- Compensating wire
- Terminal block

**Diagram:**

- Furnace
- Thermocouple
- Compensating wire
- Terminal block

**Diagram:**

- Furnace
- Thermocouple
- Normal wiring
- Terminal block

**Diagram:**

- Furnace
- Thermocouple
- Compensating wire
- Terminal block

**Diagram:**

- Furnace
- Thermocouple
- Compensating wire
- Terminal block

---

Installed in an area where ambient temperature is fixed to 25°C.

Set the temperature in the area using ERJC parameter.
Useful Operating Displays (SELECT Display)

Registering frequently changed parameters in the SELECT display after ordinary operating displays will allow you to change settings easily. A maximum of four displays can be registered.

Ordinary operating displays (example)

![SP display](image)

![OUT display](image)

![Alarm-1 setting display (SELECT display)](image)

<Setting method>

Set the parameter numbers (D register numbers) you wish to register for setup parameters C.S1 to C.S4.

<table>
<thead>
<tr>
<th>Alarm parameter for target setpoint-1</th>
<th>Registration number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm-1 setpoint parameter</td>
<td>231</td>
</tr>
<tr>
<td>Alarm-2 setpoint parameter</td>
<td>232</td>
</tr>
<tr>
<td>Alarm-3 setpoint parameter</td>
<td>233</td>
</tr>
</tbody>
</table>

For any registration number other than those above, see User’s Manual (Reference) (CD-ROM version).
Heating/Cooling Control (for a Heating/Cooling Controller Only)

In heating/cooling control, the controller outputs the result of computation after splitting it into heating-purpose and cooling-purpose signals. In addition, the controller can perform PID control or on-off control on the heating and cooling sides separately. When performing on-off control, set the proportional band to "0".

The controller splits the result of computation (0 to 100%) into heating-side and cooling-side signals, as described below.

- 0% to 50% of the computation result is presented as a 0% to 100% cooling-side output.
- 50% to 100% of the computation result is presented as a 0% to 100% heating-side output.

Heating/cooling control provides two methods in which either none of the heating- and cooling-side outputs are presented or both of the heating- and cooling-side outputs are presented, as shown in the following figures.

Precautions in Heating/Cooling Control

- Keep the ratio of the heating-side proportional band (P) to the cooling-side proportional band (Pc) equal to or below 5.
- If neither the heating side nor the cooling side is performing on-off control, setting the integral time (I or Ic) of one side to "0" results in the Integral Time parameters of both sides being set to "OFF", irrespective of the integral time setting of the other side.
**Cycle Time**

A cycle time can only be set if the type of control output is time proportional PID relay output or time proportional voltage pulse output.

A cycle time refers to one period consisting of on-and off-state time lengths.

The ratio of the on-state time to the off-state time differs according to the value of the control output.

The figure below shows on-to-off time ratios of the control output when the cycle time is set to 10 seconds. Setting a shorter cycle time allows the controller to perform elaborate control at short time intervals. This significantly reduces the on-and off-state times, however it shortens the service life of a relay.

<table>
<thead>
<tr>
<th>Relay's Behavior when Cycle Time = 10 sec.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For 20% of Control Output</strong></td>
</tr>
<tr>
<td>On-state duration: 2 sec.</td>
</tr>
<tr>
<td>Off-state duration: 8 sec.</td>
</tr>
<tr>
<td><strong>For 50% of Control Output</strong></td>
</tr>
<tr>
<td>On-state duration: 5 sec.</td>
</tr>
<tr>
<td>Off-state duration: 5 sec.</td>
</tr>
<tr>
<td><strong>For 80% of Control Output</strong></td>
</tr>
<tr>
<td>On-state duration: 8 sec.</td>
</tr>
<tr>
<td>Off-state duration: 2 sec.</td>
</tr>
</tbody>
</table>
6. Function Block Diagram and Descriptions

This chapter contains the function block diagrams for “Standard type,” and “Heating/cooling type.” For details on these function block diagrams, refer to the descriptions mentioned later.
Function Block Diagram for Standard Type

PV input terminals ①, ② and ③

Communication terminals ② to ③

PV INPUT

RS485

REMOTE

LOCAL

SP.NO

Target setpoints 1 to 4

SP.NO=0

SP.NO=1 to 4

Target setpoint ramp-rate function

D1

D2

Contact input

AUTOMAN

AUTO (ON)/MAN (OFF) switching

PV INPUT terminals

SP.NO=0

IM 05D01D12-41E


Input selection

Unit selection

Input range conversion

Input bias

Input filter

AUTOCOMPUTATION

Manual operation

Control computation

A/M

A/M

Preset output

Output limiter

STOP

RUN

15 V loop power supply

Retransmission output

24 V loop power supply

LPS

Terminals ② and ③

Current or pulse terminals ①, ② and ③

Relay terminals ①, ② and ③

Current terminals ①, ② and ③

OUTPUT1

OUTPUT1

OUTPUT2 /RET

AL1

AL2

AL3

Alarm function

Alarm 1

Alarm 2

Alarm 3

*1: If the setup parameter DIS (DI function selection) is set to "4", when the contact input 2 is ON (stop state), that controller outputs the preset output value.
### Function Block Diagram for Heating/Cooling Type

- **PV input terminals** (1, 2, and 3)
- **Communication terminals** (2 to 3)
- **PV INPUT**
- **Input selection**
- **Unit selection**
- **Input range conversion**
- **Input bias**
- **Input filter**

- **DI1**
- **DI2**

- **Contact input**
  - **REMOTE**
  - **LOCAL**
  - **SP.NO = 0**
  - **SP.NO = 1 to 4**

- **Target setpoint ramp-rate function**

- **Manual operation**
- **Control computation**
- **AUTOMAN**
- **AUTO (ON)/MAN (OFF) switching**

- **Heating/cooling computation**

- **Heating-side output limiter**
- **Cooling-side output limiter**

- **Heating-side preset output**
- **Cooling-side preset output**

- **OT**
- **OUTPUT1**
  - Current or pulse terminals (1, 2, and 3)
- **OUTPUT1**
  - Relay terminals (1, 2, and 3)

- **OUTPUT1**
  - Current or pulse terminals (1, 2, and 3)

- **OUTPUT2/RET**
  - Current or pulse terminals (1, 2, and 3)

- **AL3**
- **Relay**

- **15 V loop power supply**
- **Retransmission output**
  - **RET**

- **OUTPUT2/LPS**
  - Current terminals (1, 2, and 3)

- **Alarm function**
  - **AL1**
  - **AL2**

*1: If the setup parameter DIS (DI function selection) is set to "4", when the contact input 2 is ON (stop state), that controller outputs the preset output value.

### Legend
- **Terminal**
- **Parameter**
- **Function**
- **Analog signal**
- **Contact signal**
- **Front panel key**
Functions and Parameters for “Standard Type” in Initial State (Factory-set default)

Functions and parameters in initial state are given in the tables below. For details on each parameter, refer to “5.2 Lists of Parameters.”

■ PV Input

PV input (INPUT) is a universal input, which can receive signals from thermocouple, RTD, or DC voltage signals. The controller is capable of biasing, and first-order lag computation (filtering) on input signals.

Each function can be set by the following parameters.

Setup Parameters

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input selection</td>
<td>IN</td>
<td>I/O</td>
</tr>
<tr>
<td>Unit selection</td>
<td>UNIT</td>
<td>I/O</td>
</tr>
<tr>
<td>Input range conversion</td>
<td>RH, RL (SDP, SH, SL)</td>
<td>I/O</td>
</tr>
</tbody>
</table>

Operating Parameters

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV input bias</td>
<td>BS</td>
<td>OP.PA</td>
</tr>
<tr>
<td>PV input filter</td>
<td>FL</td>
<td>OP.PA</td>
</tr>
</tbody>
</table>

■ Remote Input

Remote input can be received via communication. Set “0” in the parameter SP.NO (target setpoint number selection) for remote input. For more information, refer to GREEN Series Communication Functions (IM 05G01B02-01E).

Each function can be set by the following parameters.

Operating Parameters

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target setpoint number selection</td>
<td>SP.NO</td>
<td>OP.PA</td>
</tr>
</tbody>
</table>
Contact Input

Changing the setpoint of the parameter DIS (DI function selection) allows you to change the function of contact input.

- **When DIS=OFF**
  No function for contact input.

- **When DIS=1 (factory-set default)**
  Target setpoint 2 (ON)/Target setpoint 1 (OFF) switching function is assigned to DI1 (contact input 1).
  Automatic (ON)/Manual (OFF) switching function is assigned to DI2 (contact input 2).
  Manipulated output can be changed using the \[\text{react}\] and \[\text{reg}\] keys in manual mode.

- **When DIS=2**
  Hide (ON)/Show (OFF) the parameter LOCK (key lock) switching function is assigned to DI1 (contact input 1).
  No function is assigned to DI2 (contact input 2).

- **When DIS=3**
  It is possible to select one out of four setpoints by turning the two contact input signals ON or OFF. This function is assigned to DI1 (contact input 1) and DI2 (contact input 2).

<table>
<thead>
<tr>
<th>Contact input</th>
<th>Target setpoint number to be selected (SP.NO)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>DI1</td>
<td>OFF</td>
</tr>
<tr>
<td>DI2</td>
<td>OFF</td>
</tr>
</tbody>
</table>

For example, set contact input 1 (DI1) only to “ON” to change target setpoint 1 to 2. Set contact inputs 1 (DI1) and 2 (DI2) to “ON” to select target setpoint 4.

- **When DIS=4**
  Target setpoint 2 (ON)/Target setpoint 1 (OFF) switching function is assigned to DI1 (contact input 1).
  Run (OFF)/Stop (ON) switching function is assigned to DI2 (contact input 2). Preset output value is output when the operation is stopped. PV input and alarms remain functioning as normal.
Target Setpoint and PID

It is possible to use a maximum of four groups of target setpoints and PID parameters. The target setpoint can be selected by key operation or contact input. For selection by contact input, refer to “Contact Input.”

## Operating Parameters

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target setpoint number selection</td>
<td>SP.NO</td>
<td>OP.PA</td>
</tr>
<tr>
<td>Target setpoints 1 to 4</td>
<td>n.SP</td>
<td>OP.PA</td>
</tr>
<tr>
<td>Proportional band (P)</td>
<td>n.P</td>
<td>OP.PA</td>
</tr>
<tr>
<td>Integral time (I)</td>
<td>n.I</td>
<td>OP.PA</td>
</tr>
<tr>
<td>Derivative time (D)</td>
<td>n.D</td>
<td>OP.PA</td>
</tr>
</tbody>
</table>

Note: Parameters n.SP, n.P, n.I, n.D (n=1 to 4) correspond to the target setpoint number selected in the target setpoint number selection (SP.NO).

The target setpoint ramp rate setting function prevents the target setpoint form changing suddenly. It is possible to set the upward and downward changing rate (i.e., ramp rate) independently in the parameters UPR and DNR. The unit of the ramp rate (hour, or minute) is specified in TMU.

## Setup Parameters

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramp-rate time unit setting</td>
<td>TMU</td>
<td>FUNC</td>
</tr>
</tbody>
</table>

## Operating Parameters

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target setpoint ramp-rate setting</td>
<td>UPR, DNR</td>
<td>OP.PA</td>
</tr>
</tbody>
</table>
Control Output

Control output (OUTPUT1) selects the output type among the current output, voltage pulse output, and relay contact output signal.

Preset output value is output when the operation is stopped by key operation or contact input, which takes priority over the manual operation.

Each function can be set by the following parameters.

**Setup Parameters**

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control output type selection</td>
<td>OT</td>
<td>I/O</td>
</tr>
<tr>
<td>Control output cycle time</td>
<td>CT</td>
<td>FUNC</td>
</tr>
<tr>
<td>Preset output</td>
<td>PO</td>
<td>FUNC</td>
</tr>
</tbody>
</table>

**Operating Parameters**

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output limiter</td>
<td>OL, OH</td>
<td>OP.PA</td>
</tr>
</tbody>
</table>

Contact Output

Alarm 1 is output via DO1 (contact output 1).
Alarm 2 is output via DO2 (contact output 2).
Alarm 3 is output via DO3 (contact output 3).

**Setup Parameters**

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm 1 type</td>
<td>AL1</td>
<td>FUNC</td>
</tr>
<tr>
<td>Alarm 2 type</td>
<td>AL2</td>
<td>FUNC</td>
</tr>
<tr>
<td>Alarm 3 type</td>
<td>AL3</td>
<td>FUNC</td>
</tr>
</tbody>
</table>

**Operating Parameters**

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm 1 setpoint</td>
<td>A1</td>
<td>OP.PA</td>
</tr>
<tr>
<td>Alarm 2 setpoint</td>
<td>A2</td>
<td>OP.PA</td>
</tr>
<tr>
<td>Alarm 3 setpoint</td>
<td>A3</td>
<td>OP.PA</td>
</tr>
</tbody>
</table>
## Retransmission Output

PV, target setpoint, or control output can be output to retransmission output (OUTPUT2/RET).

Each function can be set by the following parameters.

### Setup Parameters

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retransmission output type</td>
<td>RET</td>
<td>I/O</td>
</tr>
<tr>
<td>Retransmission output scale</td>
<td>RTH, RTL</td>
<td>I/O</td>
</tr>
</tbody>
</table>

## 15 V DC Loop Power Supply

The 15 V DC loop power supply (OUTPUT2/RET) uses the same terminal as retransmission output. The 15 V DC loop power supply can not be used when retransmission output is used. To use the 15 V DC loop power supply, set “4” in retransmission output type selection parameter RET.

Each function can be set by the following parameters.

### Setup Parameters

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retransmission output type</td>
<td>RET</td>
<td>I/O</td>
</tr>
</tbody>
</table>
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