Instruction Manual

# Model UP750 Program Controller

## User's Manual for Cascade Control with Two Universal Inputs

IM 05E01B02-53E

YOKOGAWA
Yokogawa M&C Corporation

IM 05E01B02-53E
1st Edition

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# Introduction

**Thank you for purchasing the UP750 program controller.**

## ■ How to Use the Manuals

| Purpose | Manual Title | Description |
|---|---|---|
| Setup | 1. Installation | Describes the tasks (installation, wiring, and others) required to make the controller ready for operations. |
| Basic operation | 2. Initial Settings | Describes examples of setting PV input types and control output types. Making settings described herein and program creation in “3. Programming” allows you to carry out basic control. |
| Program creation | 3. Programming | Describes examples of creating basic programs. The use of the program pattern setup charts included in the “3.7 Program Pattern Setup Charts” is recommended. |
| General understanding of programming operations | 3.5 Program Parameter Map<br>3.6 Lists of Program Parameter | Contains a parameter map that serves as a guide to creating programs. Also includes a brief explanation of the functions of program parameters. |
| Operating procedures and troubleshooting | 4. Operations | Describes key operation sequences. For operation control through external contact inputs, see “1.5 Terminal Wiring Diagrams.” |
| Brief operation | 6.1 Parameter Map | Contains the parameter map used as a guideline for setting parameters. |
| Function description and setpoint recording | 6.2 List of Parameters | Briefly describes the functions of parameters. In addition, each parameter table has a User Setting column, where you can record your setpoints when setting them in the controller. |

## ■ Controllers Applicable to Cascade Control with Two Universal Inputs

The specification codes of the UP750 applicable to cascade control with two universal inputs are given in the table below.

| | |
|---|---|
| UP750-50 | UP750-51 |

## ■ 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 M&C 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.

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## ■ 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 instruction 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.

## ■ Regarding Force Majeure

Yokogawa M&C Corporation assumes no liability for any loss or damage, direct or indirect, caused by the use of or unpredictable defects of the product.

# Model UP750
# Program Controller User's Manual for Cascade Control with Two Universal Inputs

IM 05E01B02-53E 1st Edition

# CONTENTS

# 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.

| Model | Suffix Code | | Description |
|---|---|---|---|
| UP750 | | | Program controller (provided with Custom Computing Function*) |
| Type | -0 | | Single-loop type |
| | -5 | | Dual-loop type |
| Optional functions | | 0 | None |
| | | 1 | With communication, auxiliary analog input |

Check that the following items are provided:

- Program controller (of ordered model) ..... 1
- Brackets (mounting hardware) ..... 1 pair
- Unit label ..... 1
- User's Manuals for Single-loop Control ..... 7 (A2 size)
- User's Manual (Reference) (CD-ROM version) ..... 1

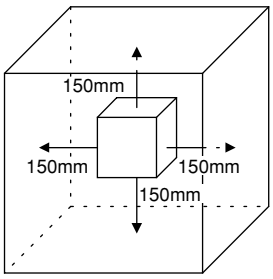
* Using an optional custom computation building tool (Model LL200-E10) that runs on a personal computer, you can build a variety of computations (e.g., four arithmetic operations, logical operations, ten-segment linearizer computations, temperature correction factor computations, and pressure correction factor computations) to be applied to the controller's I/O signals.

# 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,

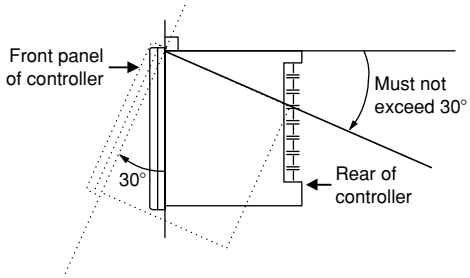



Never place the controller directly on flammable items or equipment.

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.

### ● Installation Position

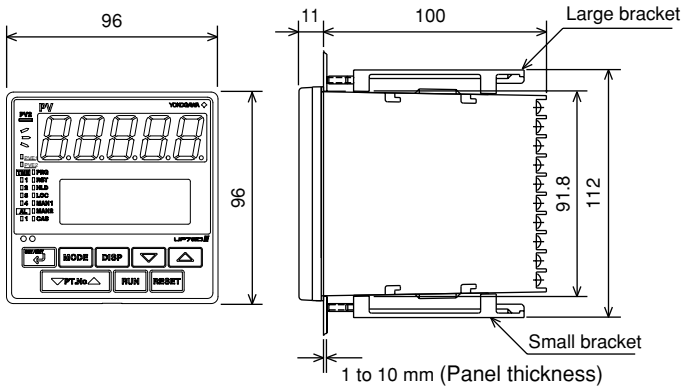
Install the controller at an angle within 30° from horizontal with the front panel facing upward. Do not install it facing downward. The position of right and left sides should be horizontal.



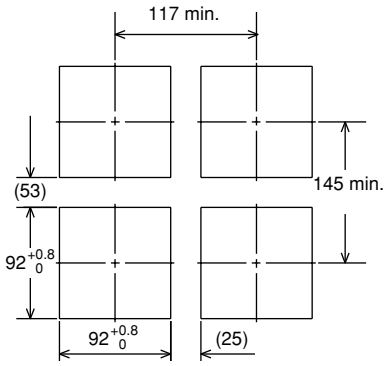
# ■ External Dimensions and Panel Cutout Dimensions

UP750

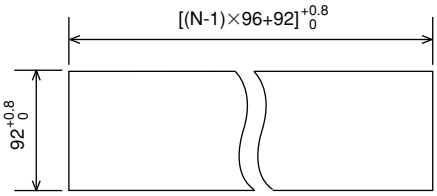
Unit: mm




General installation




Side-by-side close installation




"N" stands for the number of controllers to be installed.
However, the measured value applies if N ≥ 5.

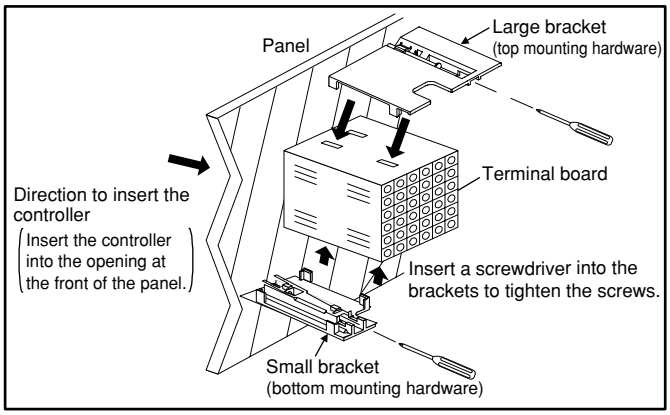
## ■ How to Install

**CAUTION**

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

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.



# 1.3 How to Connect Wires

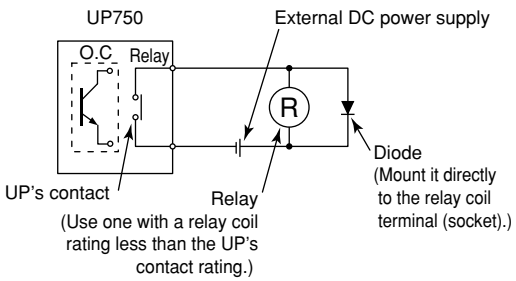
**CAUTION**

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

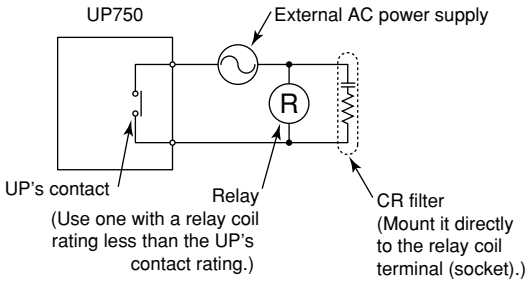
## NOTE

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.

### ■ For DC Relay Wiring




### ■ For AC Relay Wiring

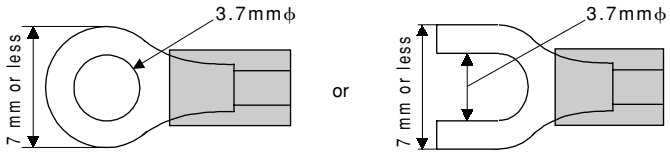


## ● Cable Specifications and Recommended Cables

| Purpose | Name and Manufacturer |
|---|---|
| Power supply, grounding, relay contact outputs | 600 V PVC insulated wires, JIS C 3307, 0.9 to 2.0 $mm^2$ |
| Thermocouple | Shielded compensating lead wires, JIS C 1610, □X-□-□-□ (See Yokogawa Electric's GS 6B1U1-E.) |
| RTD | Shielded wires (three conductors), UL2482 (Hitachi Cable) |
| Other signals | Shielded wires |

## ● Recommended Terminal Lugs

| Applicable wire size | Tightening torque |
|---|---|
| 0.3 to 1.65 $mm^2$ | 0.8 N·m or less |




## ● Terminal Covers

| Target Model | Part Number | Sales Unit |
|---|---|---|
| For UP750 | T9115YD | 1 |

# 1.4 Hardware Specifications

## PV Input Signals (Primary PV Input and Secondary PV Input)

- Number of inputs: 2 (primary-loop: terminals ⑪-⑫-⑬, secondary-loop: terminals ㊶-㊷-㊸)
- Input type: Universal input system. The input type can be selected with the software.
- Sampling period: Can be selected from 100, 200 and 500 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 MΩ or more for thermocouple or mV input
  About 1 MΩ for DC voltage input
  Secondary PV input of 0.00 to 1.25 V range is about 8 MΩ
- 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

## Auxiliary Analog Input Signals

Available only for controllers with auxiliary analog input terminals.

- Number of inputs: 1 (terminals ㉑-㉒)
- Input type: Settable in a range of 0-2, 0-10, 0.4-2.0, or 1-5 V DC
- Sampling period: 100, 200 and 500 ms
  The sampling period of a remote input signal is associated with the PV input's sampling period.
- Input resistance: About 1 MΩ
- Input accuracy: ±0.3% ±1 digit of input span for 0 to 2 V DC
  ±0.2% ±1 digit of input span for 0 to 10 V DC
  ±0.375% ±1 digit of input span for 0.4 to 2.0 V DC
  ±0.3% ±1 digit of input span for 1 to 5 V DC
  Under standard operating conditions (23±2°C, 55±10% RH, power frequency of 50/60 Hz)

## Loop Power Supply

Power is supplied to a two-wire transmitter.
(15 V DC: terminals ⑭-⑮)
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)

## Retransmission Output

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

- Number of outputs: 1 or 2 (terminals ⑭-⑮, terminals ⑯-⑰)
- Output signal: 4-20, 0-20, 20-4, or 20-0 mA DC (where, outputting signal levels of less than 0 mA is not feasible)
- Load resistance: 600 Ω or less
- Output accuracy: ±0.1% of span (±5% of span for 1 mA or less.)
  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
  (Dual-loop type: terminals ⑯-⑰; heating-side output: terminals ⑯-⑰, cooling-side output: 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, 0-20, 20-4, or 20-0 mA DC |
| Load resistance | 600 Ω or less |
| Output accuracy | ±0.1% of span (±5% of span for 1 mA or less) Under standard operating conditions (23±2°C, 55±10% RH, power frequency of 50/60 Hz) |

- Voltage pulse output
  (Dual-loop type: terminals ⑯-⑰; heating-side output: terminals ⑯-⑰, cooling-side output: not select)

| | |
|---|---|
| Number of outputs | 1 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 or 0.1% of output, whichever is larger |

- Relay contact output
  (Dual-loop type: terminals ①-②-③, heating-side output: terminals ①-②-③, cooling-side output: terminals ④-⑦)

| | |
|---|---|
| Number of outputs | 1 or 2 (two for heating/cooling type) |
| Output signal | Three terminals (NC, NO, and common) |
| Contact rating | 250 V AC or 30 V DC, 3 A (resistance load) |
| Resolution | 10 ms or 0.1% of output, whichever is larger |

## Contact Inputs

- Purpose: Program pattern no. selection, and run/reset switching
- Number of inputs: 7
- 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: PV input’s sampling period ×3

## Contact Outputs

- Purpose: Event output, FAIL output, and others
- Number of outputs: 7
- Relay contact rating: 240 V AC, 1 A, or 30 V DC, 1 A
- Transistor contact rating: 24 V DC, 50 mA

## Display Specifications

- PV display: 5-digit, 7-segment, red LEDs, character height of 20 mm
- Setpoint display: 32×128 dot LCD with back lighting
- Status indicating lamps: LEDs

## Safety and EMC Standards

- Safety: Compliant with IEC1010-1: 1990 and EN61010-1: 1992
  Approved by CSA1010
  CSA1010 installation category (overvoltage category) : CATII (IEC1010-1)
  Approved by UL508
- EMC standards: This instrument complies with the following EMC standards (the instrument continues to operate at a measuring accuracy of within ±20% of the range during tests):
  - EMI (emission), EN55011: Class A Group 1
  - EMS (immunity), EN50082-2: 1995

## Construction, Installation, and Wiring

- Construction: Only the front panel is dust-proof and drip-proof (protection class 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: 96 (W) × 96 (H) × 100 (depth from panel face) mm
- Installation: Panel-mounting type. With top and bottom mounting hardware (1 each)
- Panel cutout dimensions: $92^{+0.8}_{0}$ (W) × $92^{+0.8}_{0}$ (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.)
- Data backup: Lithium cell with life expectancy of 10 years
- Withstanding voltage
  - Between primary terminals* and secondary terminals**: At least 1500 V AC for 1 minute (Note)
  - Between primary terminals* and grounding terminal: At least 1500 V AC for 1 minute (Note)
  - 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

  Note: The withstanding voltage is specified as 2300 V AC per minute to provide a margin of safety.
- Insulation resistance: 20 MΩ or more at 500 V DC between power terminals and grounding terminal
- Grounding: Class 3 grounding (grounding resistance of 100 Ω or less)

## Signal Isolations

- Primary PV input terminals: Isolated from other input/output terminals. Not isolated from the internal circuit.
- Secondary PV input 2 terminals: Isolated from Primary PV input terminals, other input/output terminals and internal circuit.
- Auxiliary analog input terminals: Isolated from other input/output terminals and the internal circuit.
- 15 V DC loop power supply terminals: Not isolated from analog current output and voltage pulse control output. Isolated from other input/output terminals and internal circuit.
- Analog output terminals (for control output and retransmission): Not isolated between analog 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 analog 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 output terminals: Not isolated between relay contact outputs. Isolated from other input/output terminals and internal circuit.
- Transistor contact output terminals: Not isolated between transistor contact 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)
  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 $m/s^2$ or less
  Short-period vibration: 14.7 $m/s^2$, 15 seconds or less
  Shock: 14.7 $m/s^2$ 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 auxiliary analog input, ±0.02% of F.S./°C
    - 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

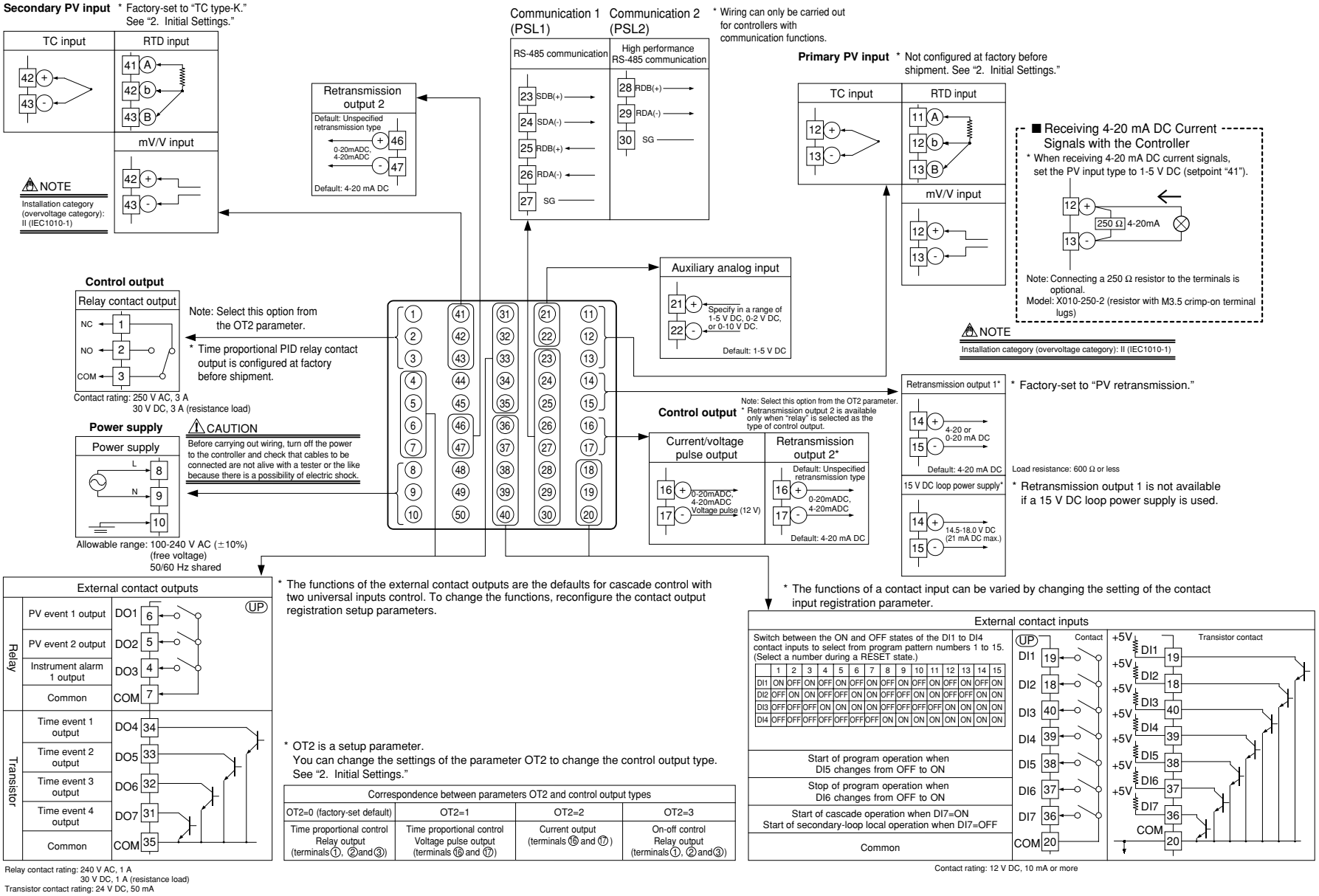
# 1.5 Terminal Wiring Diagrams

## NOTE

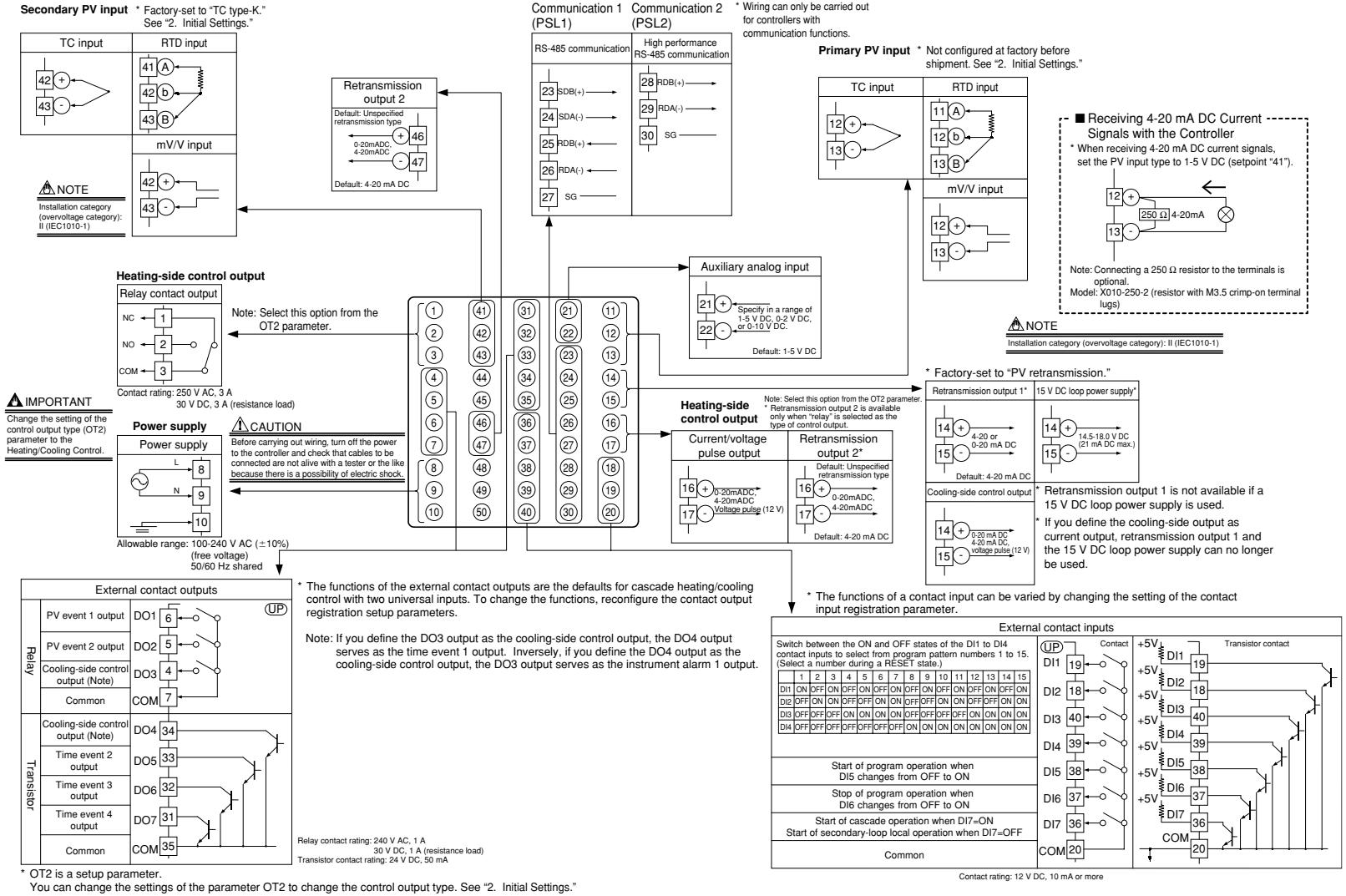
Do not use unassigned terminals as relay terminals.

Terminal wiring diagrams are shown on and after the next page.

# ■ UP750 Cascade Control with Two Universal Inputs (Model UP750-5□)



# ■ UP750 Cascade Heating/Cooling Control with Two Universal Inputs (Model UP750-5□)




* OT2 is a setup parameter.
You can change the settings of the parameter OT2 to change the control output type. See "2. Initial Settings."

| Correspondence between parameters OT2 and heating-side output types/cooling-side output types | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| OT2=4 | OT2=5 | OT2=6 | OT2=7 | OT2=8 | OT2=9 | OT2=10 | OT2=11 | OT2=12 |
| Heating side: Relay output (terminals ①, ② and ③)<br>Cooling side: Relay output (terminals ④ and ⑦) | Heating side: Voltage pulse output (terminals ⑯ and ⑰)<br>Cooling side: Relay output (terminals ④ and ⑦) | Heating side: Current output (terminals ⑯ and ⑰)<br>Cooling side: Relay output (terminals ④ and ⑦) | Heating side: Relay output (terminals ①, ② and ③)<br>Cooling side: Transistor output (terminals ㉞ and ㉟) | Heating side: Voltage pulse output (terminals ⑯ and ⑰)<br>Cooling side: Transistor output (terminals ㉞ and ㉟) | Heating side: Current output (terminals ⑯ and ⑰)<br>Cooling side: Transistor output (terminals ㉞ and ㉟) | Heating side: Relay output (terminals ①, ② and ③)<br>Cooling side: Current output (terminals ⑭ and ⑮) | Heating side: Voltage pulse output (terminals ⑯ and ⑰)<br>Cooling side: Current output (terminals ⑭ and ⑮) | Heating side: Current output (terminals ⑯ and ⑰)<br>Cooling side: Current output (terminals ⑭ and ⑮) |

The types of control output, "relay output" and "voltage pulse output" shown in the table above refer to those of time proportional control.
To change to a relay output for on-off control, select "Relay Terminals" and change the setpoint of the proportional band to "0."

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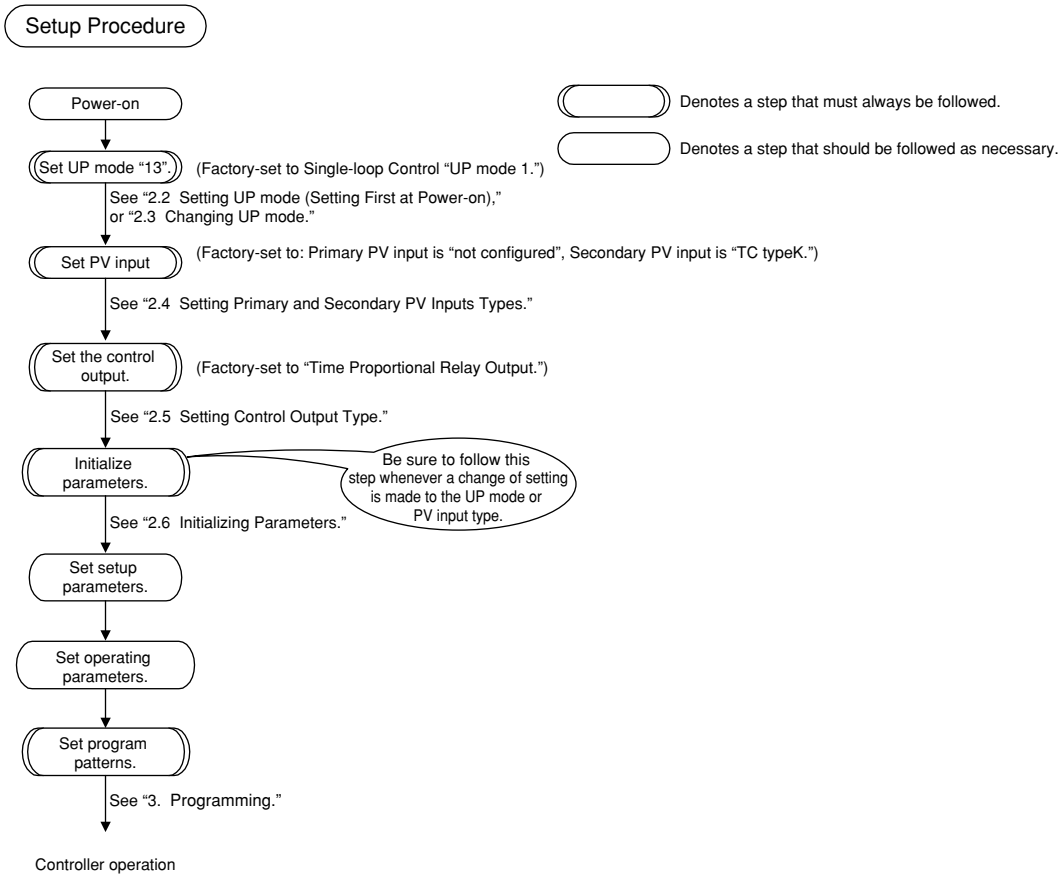
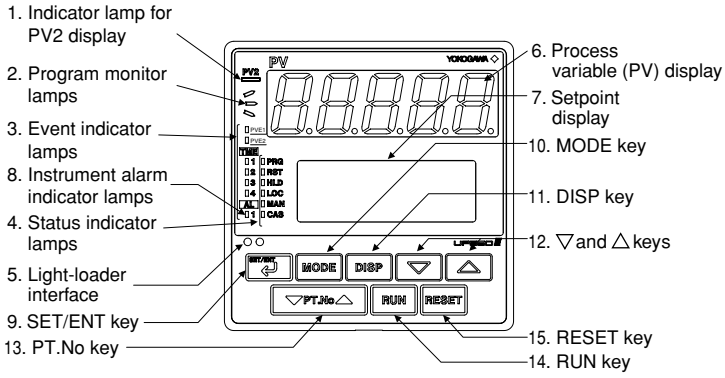
# 2. Initial Settings

**This chapter describes examples of setting PV input types, control output 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 "6.1 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 DISP key no more than four times. This brings you to the display (operating display) that appears at power-on.**



# 2.1 Names and Functions of Front Panel Parts




| | Name of Part | | Function |
|---|---|---|---|
| 1. | Indicator lamp for PV2 display | | Is lit when secondary PV is displayed on PV display. |
| 2. | Program monitor lamps | | : Is lit (in green) when a program setpoint is increasing.<br>: Is lit (in green) when a program setpoint is constant.<br>: Is lit (in green) when a program setpoint is decreasing. |
| 3. | Event indicator lamps | | Display the statuses of PV events, time events and instrument alarms in orange.<br>PVE1 and PVE2 lamps: Come on when PV event 1 and PV event 2 turn on.<br>TME1 to TME4 lamps: Come on when time event 1 to time event 4 turn on.<br>AL1 lamp: Comes on when instrument alarm 1 turns on. |
| 4. | Status indicator lamps | | Is lit (in green) to indicate the status of operation or control.<br>PRG:Is lit when in program mode.<br>RST:Is lit when in reset mode.<br>HLD:Is lit when in hold mode.<br>LOC:Is lit when in local mode.<br>MAN1:Not used in cascade control with two universal inputs.<br>MAN2:Is lit when in manual mode.<br>CAS:Is lit when in cascade mode. |
| 5. | Light-loader interface | | Interface for an adapter cable used when setting and storing parameters from a PC.<br>This requires an optional parameter setting tool. |
| 6. | Process variable (PV) display | | Displays PV.<br>Displays an error code (in red) if an error occurs. |
| 7. | Setpoint display (LCD) | | Displays the name and value of a target setpoint (SP), output (OUT), deviation trend, or a parameter.<br>Displays an error code if an error occurs. |
| 8. | Instrument alarm indicator lamps | | The AL1 lamp comes on in orange if instrument alarm 1 turns on. |
| 9. | SET/ENT key | SET/ENT | 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 main menu for operating parameter setting display alternately. |
| 10. | MODE key | MODE | Presents a display for switching between the hold, advance, local, AUTO and MAN modes. |
| 11. | DISP key | DISP | Used to switch between displays. Pressing this key while any operating display is shown lets you switch to another prearranged operating display. Pressing this key while any display other than an operating display is shown lets you go one display back.<br>(One to four presses (maximum) of this key lets you return to the current operating display, though the number of presses depends on the operating status.) |
| 12. | ▽and △keys | △<br>▽ | 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. These keys also switch between menu displays when a main menu or submenu of parameter setting display is shown. |
| 13. | PT.No key | ▽PT.No△ | Use this key when the controller is at a stop to select a program pattern number on an operating display. |
| 14. | RUN key | RUN | Pressing this key for more than 2 seconds while an operating display is shown starts the controller. |
| 15. | RESET key | RESET | Pressing this key for more than 2 seconds while an operating display is shown stops the controller. |

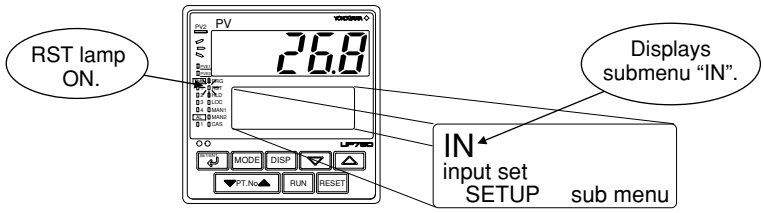
# 2.2 Setting UP mode (Setting First at Power-on)

## NOTE

The controller displays an operating display when the power is turned on. The submenu "IN" appears at this point if the type of PV input has not been defined yet. In this case, set a UP mode to "Cascade Control with Two Universal Inputs," following the operating procedure described below. Then, set PV input type and others.

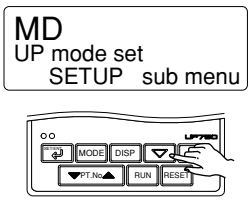
The following operation describes a procedure of setting a UP mode to "Cascade Control with Two Universal Inputs" (set "13").

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

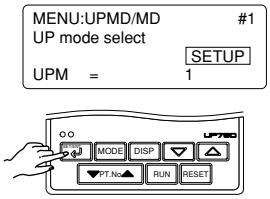



**In steps 2 and later, illustrations of the LCD are cited to explain the procedure.**

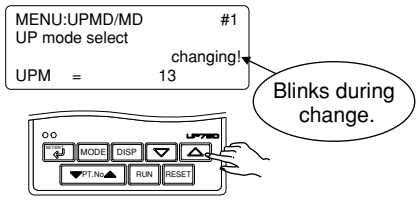
**2. Press the ▽ key once to display the submenu "MD".**



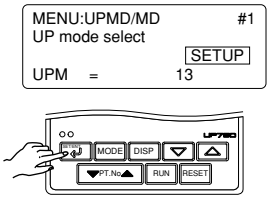

**3. Press the SET/ENT key once to display the parameter "UPM" (controller mode).**



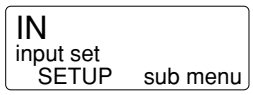

**4. Press the △ or ▽ key to display the required setpoint "13".**




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



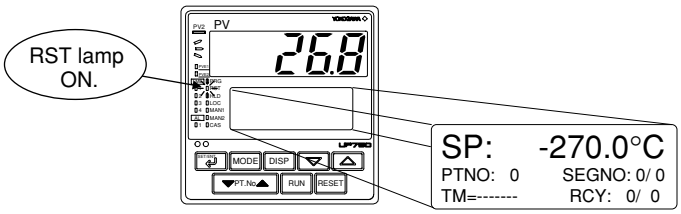

**6. The controller re-starts (which is normal). Then, set PV input type. See step 8 and later of "2.4 Setting Primary and Secondary PV Input Types."**



# 2.3 Changing UP mode

The following operation describes a procedure of changing a UP mode to “Cascade Control with Two Universal Inputs” (set “13”).

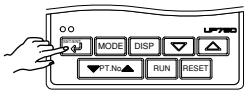
**1. Bring the operating display into view (display appears at power-on).**




**In steps 2 and later, illustrations of the LCD are cited to explain the procedure.**

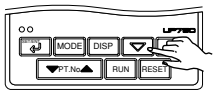
**2. Press the SET/ENT key for more than 3 seconds to call up the main menu “PROG”.**

PROG
programming
main menu



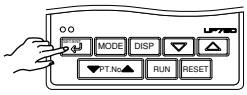
**3. Press the ▽ key once to display the main menu “STUP”.**

STUP
password input
main menu



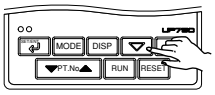
**4. Press the SET/ENT key once to display the main menu “PARA”.**

PARA
setup parameter
SETUP main menu



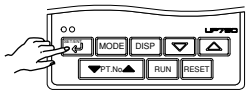
**5. Press the ▽ key once to display the main menu “UPMD”.**

UPMD
UP750 configuration
SETUP main menu



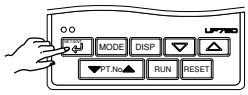
**6. Press the SET/ENT key once to display the submenu “MD”.**

MD
UP mode set
SETUP sub menu

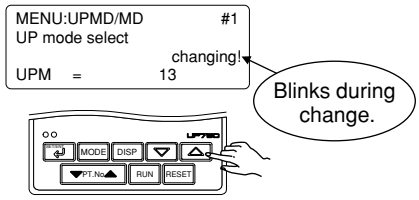


**7. Press the SET/ENT key once to display the parameter “UPM” (controller mode).**

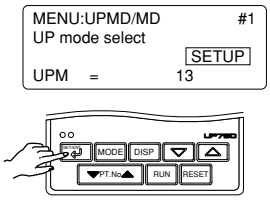
MENU:UPMD/MD #1
UP mode select
SETUP
UPM = 1



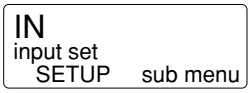
**8.** **Press the [△] or [▽] key to display the setpoint "13".**




**9.** **Press the [SET/ENT] key once to register the setpoint.**




**10.** **The controller re-starts (which is normal). Then, set PV input type. See step 8 and later of "2.4 Setting Primary and Secondary PV Input Types."**




## How to return to a menu

**Press the [DISP] keys once during parameter setting. This lets you return to the parameter menu.**

# 2.4 Setting Primary and Secondary PV Input Types

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

You can take the same steps for the secondary-loop PV input type (IN2), range (RH2, RL2) and scale (SH2, SL2) that are displayed after the primary-loop related parameters.

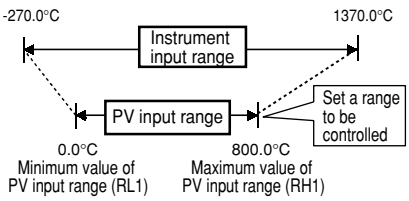
**Primary PV input (Factory-set: Unspecified)**

PV input terminal
Thermocouple/mV/V input..... ⑫-⑬
RTD input ..... ⑪-⑫-⑬

**Secondary PV input (Factory-set: typeK1)**

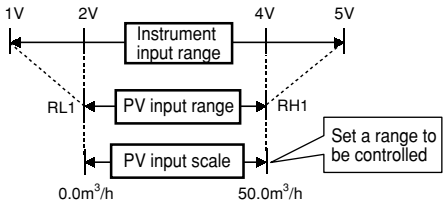
PV input terminal
Thermocouple/mV/V input..... ㊷-㊸
RTD input ..... ㊶-㊷-㊸

Example of Temperature Input




Parameters to be set for temperature input
1. PV input type (IN1): Set according to a sensor
2. Maximum value of PV input range (RH1): Set the maximum value of the range to be controlled.
3. Minimum value of PV input range (RL1): Set the minimum value of the range to be controlled.

Example of Voltage Input

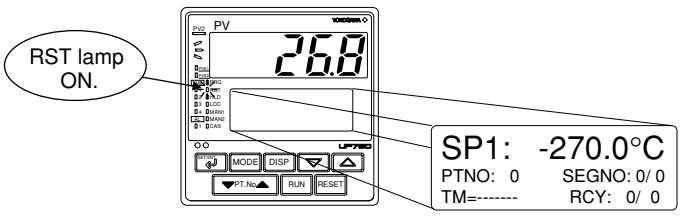



Parameters to be set for voltage input
1. PV input type (IN1): Set according to an input signal
2. Maximum value of PV input range (RH1): Set the maximum value of an input signal.
3. Minimum value of PV input range (RL1): Set the minimum value of an input signal.
4. Position of PV input decimal point (SDP1): Set the position of the decimal point for PV input display.
5. Maximum value of PV input scale (SH1): Set the maximum value of the scale to be controlled. (Set a reading for the maximum value of the input signal.)
6. Minimum value of PV input scale (SL1): Set the minimum value of the scale to be controlled. (Set a reading for the minimum value of the input signal.)

## NOTE

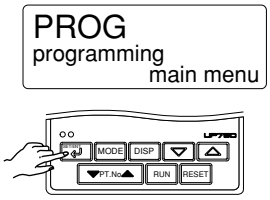
The controller may automatically initialize the registered operating parameter setpoints if any change is made to the data item PV Input Type (IN1), Maximum Value of PV Input Range (RH1), Minimum Value of PV Input Range (RL1), PV Input Decimal Point Position (SDP1), Maximum Value of PV Input Scale (SH1) or Minimum Value of PV Input Scale (SL1). 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.

**1. Bring the operating display into view (display appears at power-on).**
**The PV display in the figure below shows the error code for input burnout ( b.oUt ) if PV input wiring is not yet complete. The error code disappears when you wire the PV input terminals correctly.**

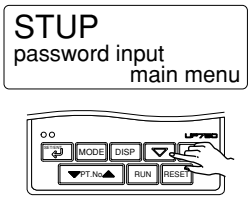



**In steps 2 and later, illustrations of the LCD are cited to explain the procedure.**

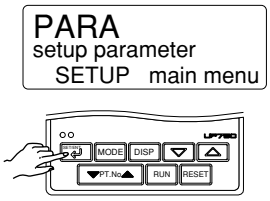
**2.** **Press the [SET/ENT] key for more than 3 seconds to call up the main menu "PROG".**



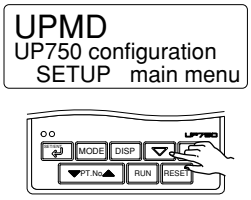

**3.** **Press the [▽] key once to display the main menu "STUP".**



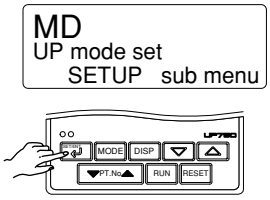

**4.** **Press the [SET/ENT] key once to display the main menu "PARA".**



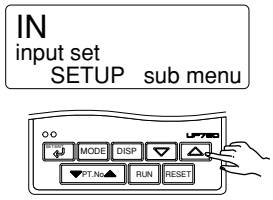

**5.** **Press the [▽] key once to display the main menu "UPMD".**



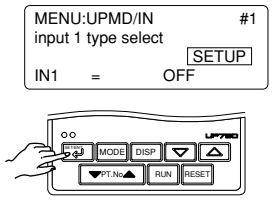

**6.** **Press the [SET/ENT] key once to display the submenu "MD".**



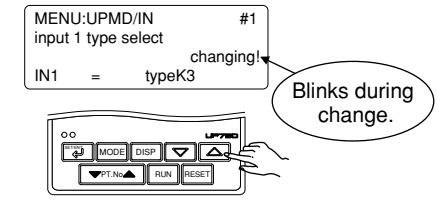

**7.** **Press the [△] key once to display the submenu "IN".**



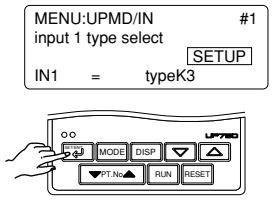

**8.** **Press the [SET/ENT] key once to display the parameter "IN1" (primary PV input type).**



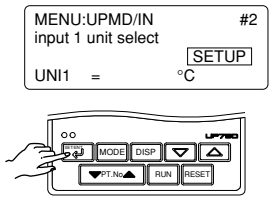

**9.** **Press the [△] or [▽] key to display the required setpoint. The figure below shows an example of setting the PV input type to a K-type thermocouple (-200.0°C to 500.0°C).**



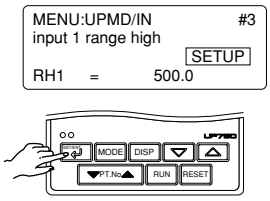

**10.** **Press the [SET/ENT] key once to register the setpoint.**



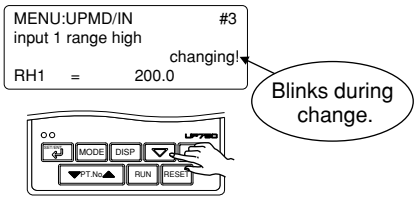

**11.** **Press the [SET/ENT] key once to display the parameter "UNI1".**



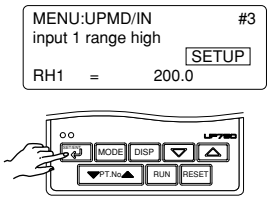
**12.** **Press the SET/ENT key once to display the parameter "RH1" (maximum value of primary PV input range).**



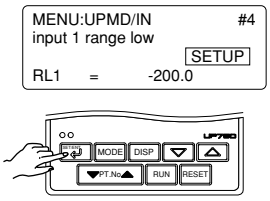

**13.** **Press the ▲ or ▼ key to display the required setpoint. The figure below shows an example of setting the maximum value of the PV input range to 200.0°C.**



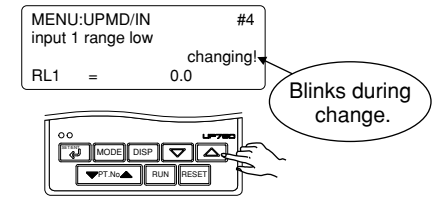

**14.** **Press the SET/ENT key once to register the setpoint.**



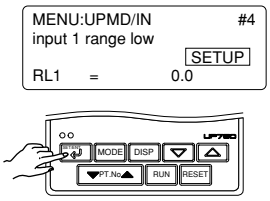

**15.** **Press the SET/ENT key once to display the parameter "RL1" (minimum value of primary PV input range).**




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

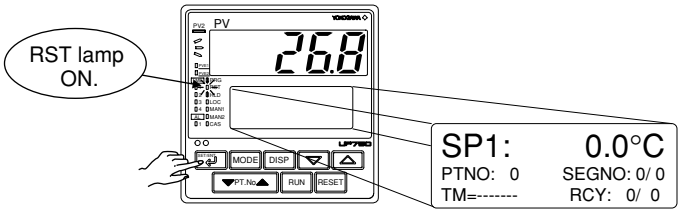



**17.** **Press the SET/ENT key once to register the setpoint.**




**If the type of input is voltage, also configure the Primary PV Input Decimal Point Position (SDP1), Maximum Value of Primary PV Input Scale (SH1) and Minimum Value of Primary PV Input Scale (SL1) parameters are that displayed after this.**

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



# ■ Instrument Input Range Codes

| Input | Type | Instrument Input Range Code | Instrument Input Range | Measurement Accuracy |
|---|---|---|---|---|
| Unspecified | | OFF (0) | Set the data item PV Input Type "IN1" to the OFF option to leave the PV input type undefined. | |
| Thermocouple | K | typeK1 (1) | -270.0 to 1370.0°C<br>-450.0 to 2500.0°F | ±0.1% of instrument range ±1 digit at 0°C or more<br>±0.2% ±1 digit for temperatures below 0°C,<br>where the accuracy is: ±2% of instrument range ±1 digit for temperatures below -200.0°C for a type-K thermocouple, or ±1% of instrument range ±1 digit for temperatures below -200.0°C for a type-T thermocouple. |
| | | typeK2 (2) | -270.0 to 1000.0°C<br>-450.0 to 2300.0°F | |
| | | typeK3 (3) | -200.0 to 500.0°C<br>-200.0 to 1000.0°F | |
| | J | typeJ (4) | -200.0 to 1200.0°C<br>-300.0 to 2300.0°F | |
| | T | typeT1 (5) | -270.0 to 400.0°C<br>-450.0 to 750.0°F | |
| | | typeT2 (6) | 0.0 to 400.0°C<br>-200.0 to 750.0°F | |
| | B | typeB (7) | 0.0 to 1800.0°C<br>32 to 3300°F | ±0.15% of instrument range ±1 digit at 400°C or more<br>±5% of instrument range ±1 digit at less than 400°C |
| | S | typeS (8) | 0.0 to 1700.0°C<br>32 to 3100°F | ±0.15% of instrument range ±1 digit |
| | R | typeR (9) | 0.0 to 1700.0°C<br>32 to 3100°F | |
| | N | typeN (10) | -200.0 to 1300.0°C<br>-300.0 to 2400.0°F | ±0.1% of instrument range ±1 digit<br>±0.25% of instrument range ±1 digit for temperatures below 0°C |
| | E | typeE (11) | -270.0 to 1000.0°C<br>-450.0 to 1800.0°F | ±0.1% of instrument range ±1 digit at 0°C or more<br>±0.2% ±1 digit for temperatures below 0°C, where the accuracy is:±1.5% of instrument range ±1 digit for temperatures below -200.0°C for a type-E thermocouple. |
| | L(DIN) | typeL (12) | -200.0 to 900.0°C<br>-300.0 to 1600.0°F | |
| | U(DIN) | typeU1 (13) | -200.0 to 400.0°C<br>-300.0 to 750.0°F | |
| | | typeU2 (14) | 0.0 to 400.0°C<br>-200.0 to 1000.0°F | |
| | W | typeW (15) | 0.0 to 2300.0°C<br>32 to 4200°F | ±0.2% of instrument range ±1 digit |
| | Platinel 2 | Plati2 (16) | 0.0 to 1390.0°C<br>32 to 2500.0°F | ±0.1% of instrument range ±1 digit |
| | PR20-40 | PR2040 (17) | 0.0 to 1900.0°C<br>32 to 3400°F | ±0.5% of instrument range ±1 digit at 800°C or more<br>No accuracy is guaranteed at less than 800°C |
| | W97Re3-W75Re25 | W97Re3 (18) | 0.0 to 2000.0°C<br>32 to 3600°F | ±0.2% of instrument range ±1 digit |
| RTD | JPt100 | JPt1 (30) | -200.0 to 500.0°C<br>-300.0 to 1000.0°F | ±0.1% of instrument range ±1 digit (Note 1) (Note 2) |
| | | JPt2 (31) | -150.00 to 150.00°C<br>-200.0 to 300.0°F | ±0.2% of instrument range ±1 digit (Note 1) |
| | Pt100 | Pt1 (35) | -200.0 to 850.0°C<br>-300.0 to 1560.0°F | ±0.1% of instrument range ±1 digit (Note 1) (Note 2) |
| | | Pt2 (36) | -200.0 to 500.0°C<br>-300.0 to 1000.0°F | |
| | | Pt3 (37) | -150.00 to 150.00°C<br>-200.0 to 300.0°F | ±0.2% of instrument range ±1 digit (Note 1) |
| Standard signal | 0.4 to 2 V | 0.4 to 2 V (40) | 0.400 to 2.000 V | ±0.1% of instrument range ±1 digit<br>Display range is scalable in a range of -19999 to 30000.<br>Display span is 30000 or less. |
| | 1 to 5 V | 1 to 5 V (41) | 1.000 to 5.000 V | |
| DC voltage | 0 to 2 V | 0 to 2 V (50) | 0.000 to 2.000 V | |
| | 0 to 10 V | 0 to 10 V (51) | 0.00 to 10.00 V | |
| | 0.00 to 1.25 V (Note 3) | 0.00 to 1.25 V (52) | 0.000 to 1.200 V | |
| | -10 to 20 mV | mV1 (55) | -10.00 to 20.00 mV | |
| | 0 to 100 mV | mV2 (56) | 0.0 to 100.0 mV | |

Numbers in ( ) are the setting value that apply when the communication is used.

* Performance in the standard operating conditions (at 23±2°C, 55±10%RH, and 50/60 Hz 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 range from -100°C to 200°C.

Note 3: Only used for PV input of Loop2 (IN2).

* 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)

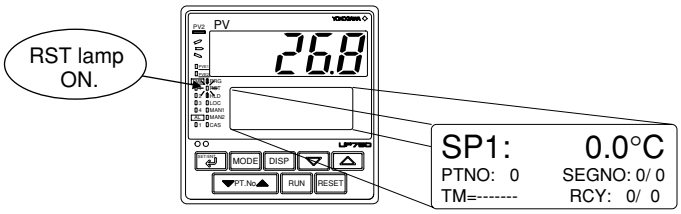
# 2.5 Setting Control Output Type

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..... ⑯-⑰

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

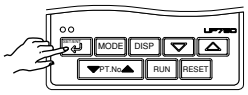
**1. Bring the operating display into view (display appears at power-on).**




**In steps 2 and later, illustrations of the LCD are cited to explain the procedure.**

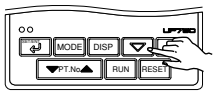
**2. Press the [SET/ENT] key for more than 3 seconds to call up the main menu "PROG".**

PROG
programming
main menu



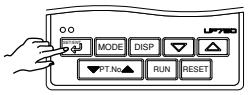
**3. Press the [▽] key once to display the main menu "STUP".**

STUP
password input
main menu



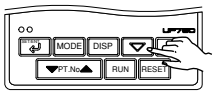
**4. Press the [SET/ENT] key once to display the main menu "PARA".**

PARA
setup parameter
SETUP main menu



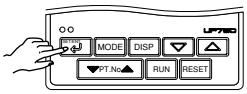
**5. Press the [▽] key once to display the main menu "UPMD".**

UPMD
UP750 configuration
SETUP main menu



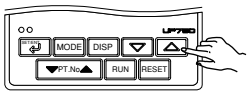
**6. Press the [SET/ENT] key once to display the submenu "MD".**

MD
UP mode set
SETUP sub menu

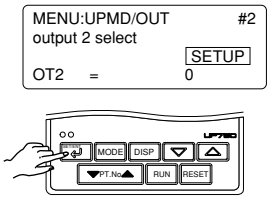


**7. Press the [△] key twice to display the submenu "OUT".**

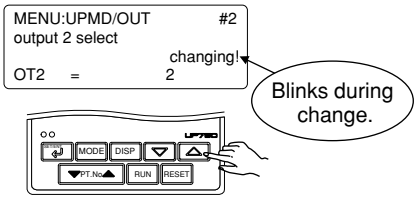
OUT
output set
SETUP sub menu



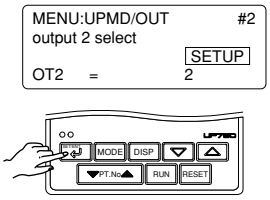
**8.** **Press the SET/ENT key once to display the parameter "OT2" (control output type).**



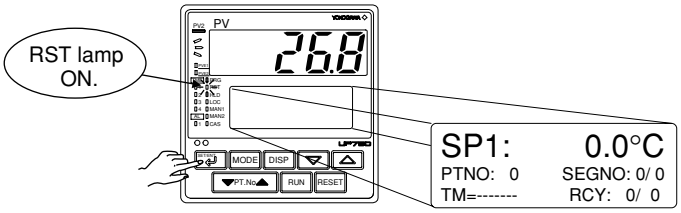

**9.** **Press the ▲ or ▼ key to display the required setpoint. The figure below shows an example of setting to current output (4 to 20 mA DC).**




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




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



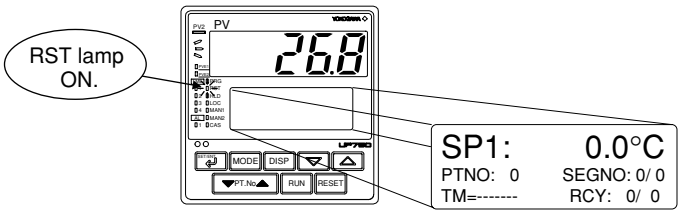

## ● List of Control Output Types

| Parameter Symbol | Name of Parameter | Setpoint | Control Output Type |
|---|---|---|---|
| OT2 | Control output type | 0 | Time proportional PID relay contact output (terminals ① - ② - ③) |
| | | 1 | Time proportional PID voltage pulse output (terminals ⑯ - ⑰) |
| | | 2 | Current output (terminals ⑯ - ⑰) |
| | | 3 | On/off control relay contact output (terminals ① - ② - ③) |
| | | 4 | Heating-side relay output (terminals ① - ② - ③), cooling-side relay output (terminals ④ - ⑦) |
| | | 5 | Heating-side pulse output (terminals ⑯ - ⑰), cooling-side relay output (terminals ④ - ⑦) |
| | | 6 | Heating-side current output (terminals ⑯ - ⑰), cooling-side relay output (terminals ④ - ⑦) |
| | | 7 | Heating-side relay output (terminals ① - ② - ③), cooling-side transistor output (terminals ㉞ - ㉟) |
| | | 8 | Heating-side pulse output (terminals ⑯ - ⑰), cooling-side transistor output (terminals ㉞ - ㉟) |
| | | 9 | Heating-side current output (terminals ⑯ - ⑰), cooling-side transistor output (terminals ㉞ - ㉟) |
| | | 10 | Heating-side relay output (terminals ① - ② - ③), cooling-side current output (terminals ⑭ - ⑮) |
| | | 11 | Heating-side pulse output (terminals ⑯ - ⑰), cooling-side current output (terminals ⑭ - ⑮) |
| | | 12 | Heating-side current output (terminals ⑯ - ⑰), cooling-side current output (terminals ⑭ - ⑮) |

# 2.6 Initializing Parameters

Be sure to follow the steps below after a change of setting has been made to the data item PV Input Type, PV Input Range or PV Input Scale.

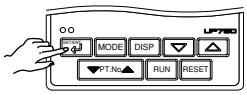
**1. Bring the operating display into view (display appears at power-on).**




**In steps 2 and later, illustrations of the LCD are cited to explain the procedure.**

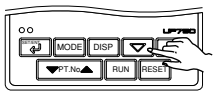
**2. Press the [SET/ENT] key for <u>more than 3 seconds</u> to call up the main menu "PROG".**

PROG
programming
main menu



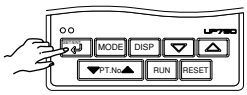
**3. Press the [▽] key once to display the main menu "STUP".**

STUP
password input
main menu



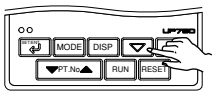
**4. Press the [SET/ENT] key once to display the main menu "PARA".**

PARA
setup parameter
SETUP main menu



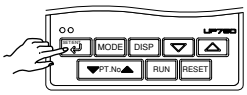
**5. Press the [▽] key once to display the main menu "UPMD".**

UPMD
UP750 configuration
SETUP main menu



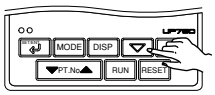
**6. Press the [SET/ENT] key once to display the submenu "MD".**

MD
UP mode set
SETUP sub menu

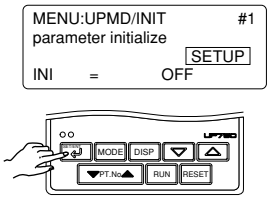


**7. Press the [▽] key twice to display the submenu "INIT".**

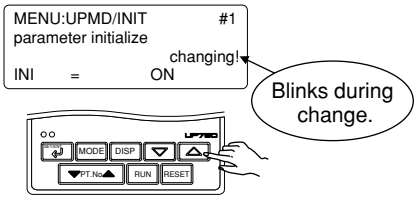
INIT
parameter initialize
SETUP sub menu



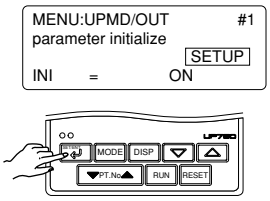
**8.** **Press the SET/ENT key once to display the parameter "INI".**



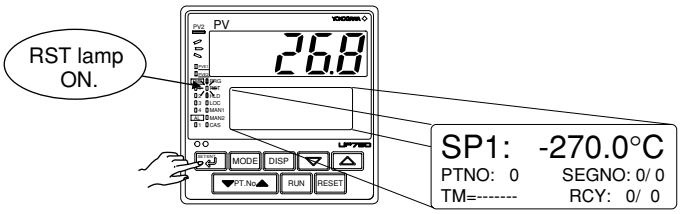

**9.** **Press the ▲ key to display "ON".**




**10.** **Press the SET/ENT key once. The display momentarily becomes blank (which is normal), indicating the parameters have been initialized.**




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



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# 3. Programming

**This chapter explains how to create programs by citing specific examples. Create user programs by referring to the given programming examples. Use the parameter map included in "3.5 Program Parameter Map," in order to further familiarize yourself with the required operations.**

**Be sure to carry out the settings instructed in "2. Initial Settings" before beginning any of the tasks discussed in this chapter.**

## 3.1 Overview of Program Patterns

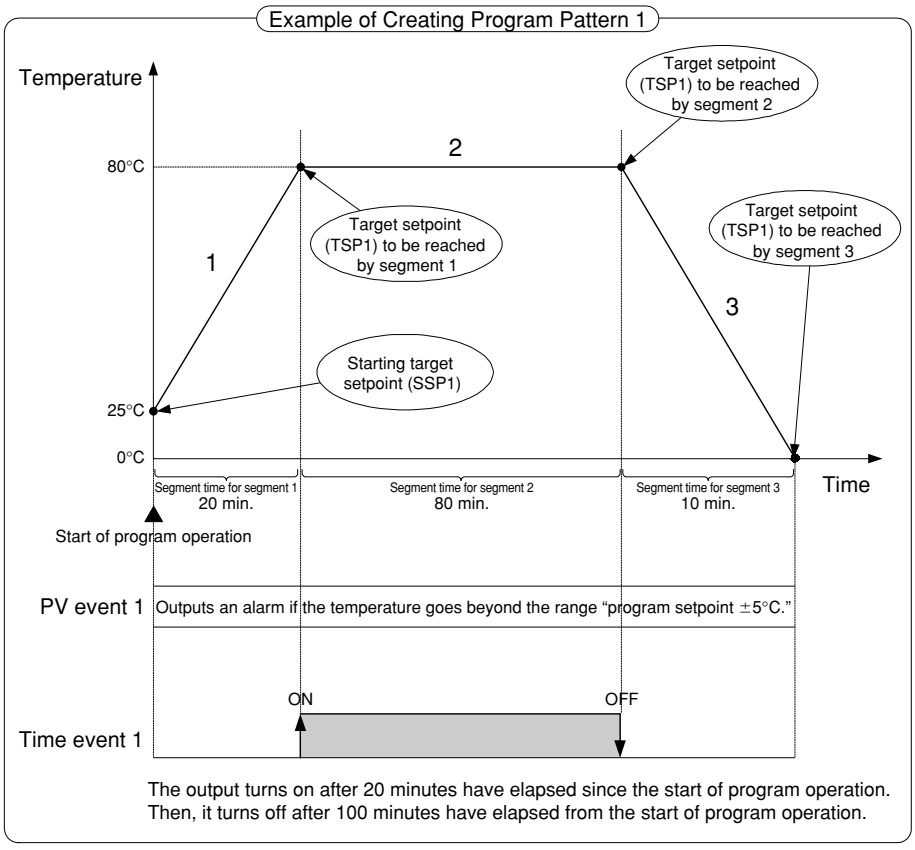
### ■ Programming Overview

The programming example given here demonstrates how to do the tasks outlined below.

1. Program the controller to start program operation at 25°C and raise the temperature up to 80°C in 20 minutes.
2. When the temperature reaches 80°C, keep it at this level for 80 minutes.
3. Finally, lower the temperature to 0°C in 10 minutes.

**Event output**

- Set a deviation of 5°C on both the positive and negative sides of a program setpoint to allow the controller to output an event signal if the temperature goes beyond the deviation range.
- Let the controller output an event signal when the temperature stabilizes to 80°C.



# 3.2 Example of Program Pattern Setup Charts

Complete the following setup chart before setting programs in the controller. Filling in the chart makes it easier for you to input program data into the controller. See “3.7 Program Pattern Setup Charts.”

In the following chart, fill in the fields with bold-face borders.

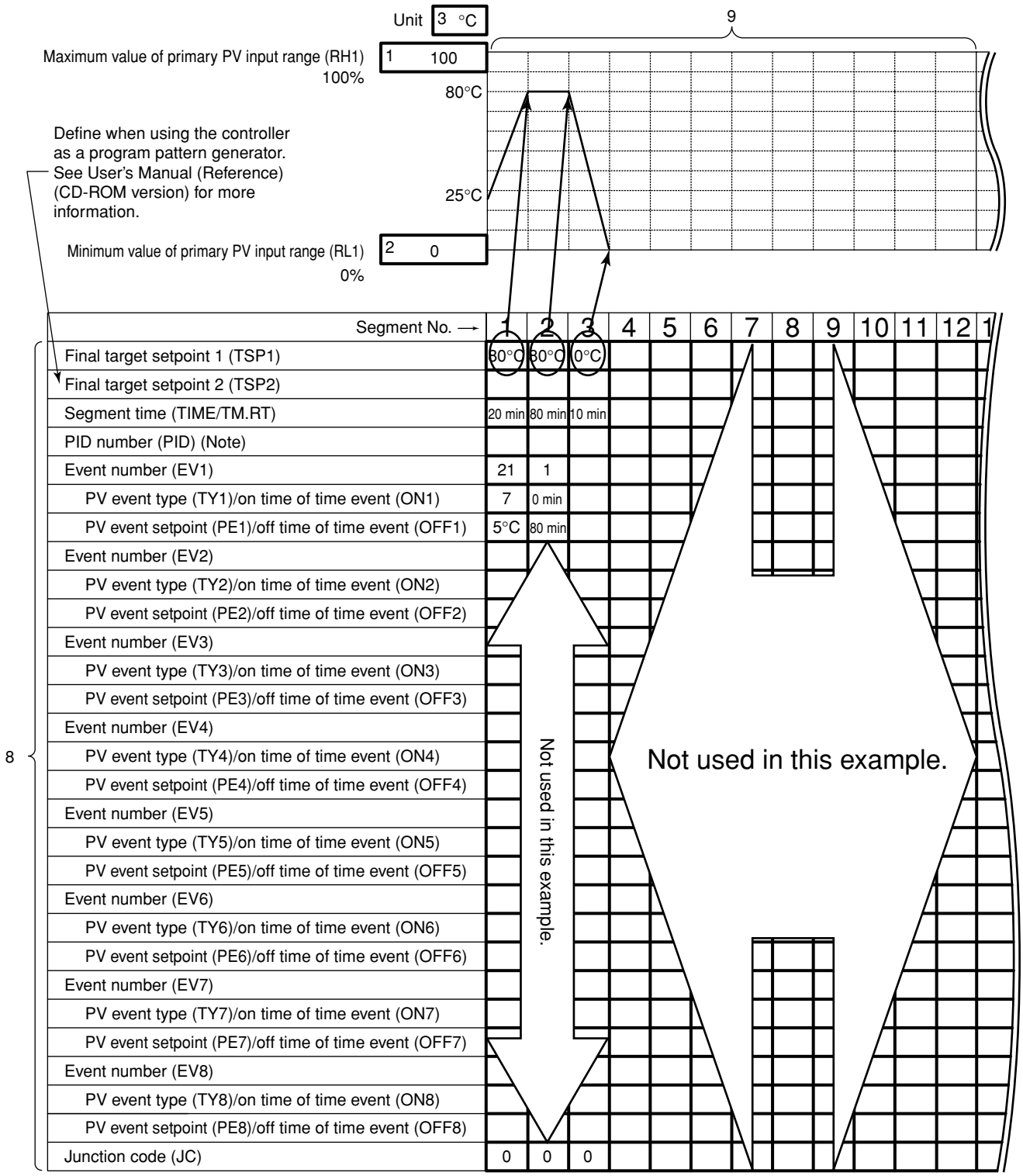
1. Maximum value of primary PV input range: Setpoint of the “Maximum Value of Primary PV Input Range (RH1)” setup parameter
2. Minimum value of primary PV input range: Setpoint of the “Minimum Value of Primary PV Input Range (RL1)” setup parameter
3. Primary PV input unit: Setpoint of the “Primary PV Input Unit (UNI1)” setup parameter
4. Program time unit: Setpoint of the “Program Time Unit (TMU)” setup parameter
5. Segment setting method: Setpoint of the “Segment Setting Method (SEG.T)” setup parameter
6. Starting target setpoint: Setpoint of the “Starting Target Setpoint (SSP1)” program parameter
7. Start code: Setpoint of the “Start Code (STC)” program parameter
8. Final target setpoint, Segment time, Events (PV event and Time event) and Junction code: Setpoint of each program parameter
9. Draw the program pattern.

| | |
|---|---|
| Program time unit (TMU) | 4 Hour, minute |
| Segment setting method (SEG.T) | 5 Time setting |

| | |
|---|---|
| Starting target setpoint 1 (SSP1) | 6 25°C |
| Starting target setpoint 2 (SSP2) | |
| Start code (STC) | 7 0 |
| 1st group of wait zones (1.WZ1) | |
| 1st group of wait times (1.WTM) | |
| 2nd group of wait zones (2.WZ1) | |
| 2nd group of wait times (2.WTM) | |
| 3rd group of wait zones (3.WZ1) | |
| 3rd group of wait times (3.WTM) | |
| 4th group of wait zones (4.WZ1) | |
| 4th group of wait times (4.WTM) | |
| 5th group of wait zones (5.WZ1) | |
| 5th group of wait times (5.WTM) | |
| Number of repetitions (RCY) | |
| Start-of-repetition segment number (RST) | |
| End-of-repetition segment number (REN) | |

Define this parameter when using the controller as a program pattern generator. See User’s Manual (Reference) (CD-ROM version) for more information.

See User’s Manual (Reference) (CD-ROM version) for more information.




Note: This parameter is shown for segment PID parameter when the setup parameter "ZON" is set to 0.

# 3.3 Creating Program Patterns

The following operating procedure describes an example of creating the program discussed in “3.1 Overview of Program Patterns.”

## NOTE

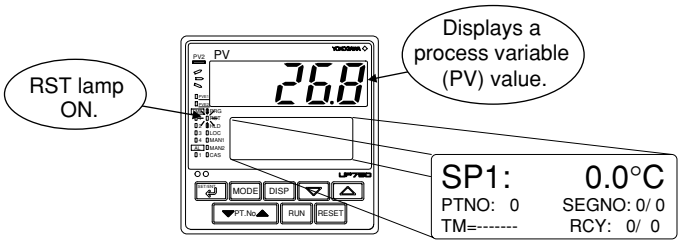
Before creating the program, reverify the Maximum Value of primary PV Input Range (RH1), Minimum Value of primary PV Input Range (RL1), Program Time Unit (TMU), and Segment Setting Method (SEG.T) parameters.

If the setting of the setup parameter “SEG.T” is changed, the program patterns created and stored so far will be all cleared (initialized)!! Be careful.

The programming example given in this section includes the following steps.

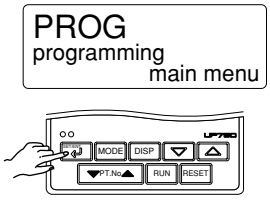
- Step 5 selects the program pattern number (PTN).
- Steps 7 to 9 configure the parameter Starting Target Setpoint (SSP1) (so that the program starts from 25°C).
- Steps 11 to 13 configure the Final Target Setpoint (TSP1) parameter for segment 1.
- Steps 14 to 16 configure the Segment Time (TIME) parameter for segment 1.
- Steps 17 to 25 configure the PV Event parameters (EV1, TY1 and PE1).
- Step 28 configures the Final Target Setpoint (TSP1) parameter for segment 2 (not changed in this example).
- Steps 29 to 31 configure the Segment Time (TIME) parameter for segment 2.
- Steps 32 to 40 configure the Time Event parameters (EV1, ON1 and OFF1).
- Steps 43 to 45 configure the Final Target Setpoint (TSP1) parameter for segment 3.
- Steps 46 to 48 configure the Segment Time (TIME) parameter for segment 3.

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

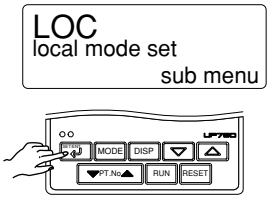



**For steps 2 and later, illustrations of the LCD are cited to explain the procedure.**

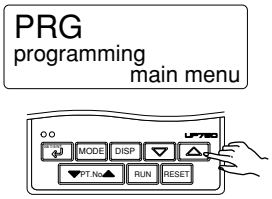
**2. Press the SET/ENT key for more than 3 seconds to call up the main menu “PROG”.**



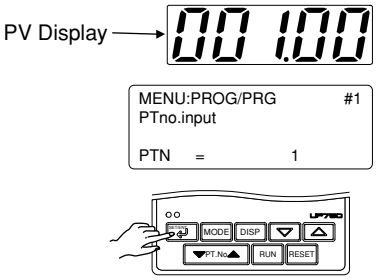

**3. Press the SET/ENT key once to display the submenu “LOC”.**



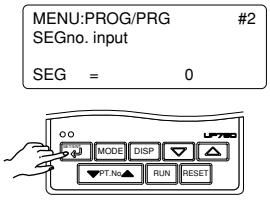
**4.** **Press the ▲ key once to display the submenu "PRG".**



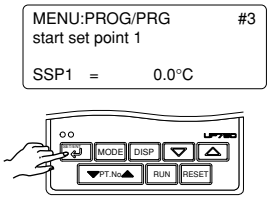

**5.** **Press the SET/ENT key once to display the Pattern Number parameter "PTN". At this point, the PV display shows "001.00" (the first three digits denote the pattern number and the last two digits the segment number).**



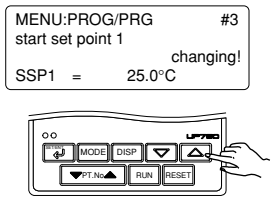

**6.** **Press the SET/ENT key once to display the Segment Number parameter "SEG".**



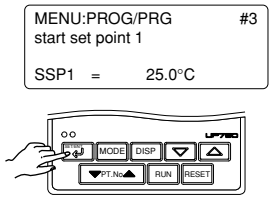

**7.** **Press the SET/ENT key once to display the Starting Target Setpoint parameter "SSP1".**



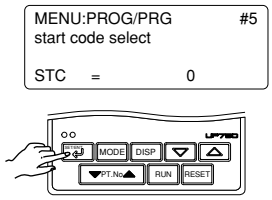

**8.** **Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "25.0°C".**



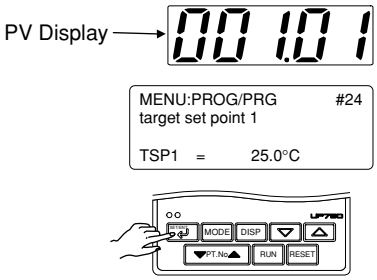

**9.** **Press the SET/ENT key once to register the setpoint.**



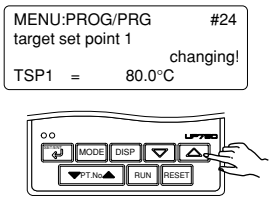

**10.** **Press the SET/ENT key once to display the Start Code parameter "STC".**



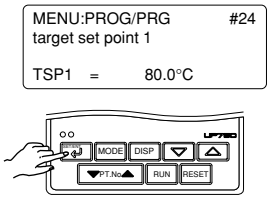

**11.** **Press the SET/ENT key once to display the Target Setpoint parameter "TSP1" for segment 1. At this point, the PV display shows "001.01" (the first three digits denote the pattern number and the last two digits the segment number).**



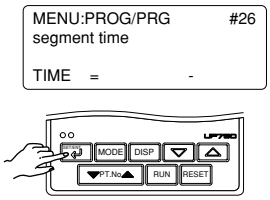
**12.** **Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "80.0°C".**



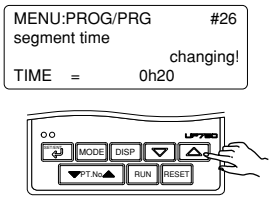

**13.** **Press the SET/ENT key once to register the setpoint.**



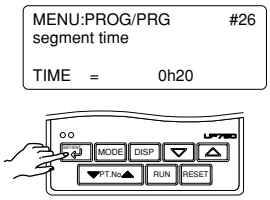

**14.** **Press the SET/ENT key once to display the Segment Time parameter "TIME" for segment 1.**



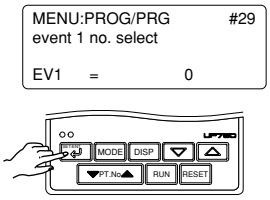

**15.** **Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "20 min. (0h20)".**



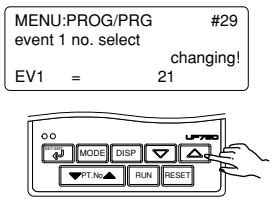

**16.** **Press the SET/ENT key once to register the setpoint.**



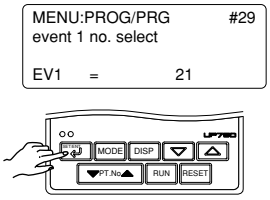

**17.** **Press the SET/ENT key once to display the Event Number parameter "EV1".**



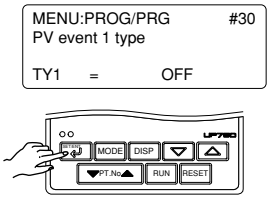

**18.** **Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "PV event 1" (setpoint 21).**



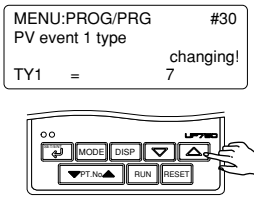

**19.** **Press the SET/ENT key once to register the setpoint.**



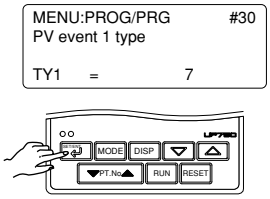

**20.** **Press the SET/ENT key once to display the PV Event Type parameter "TY1".**



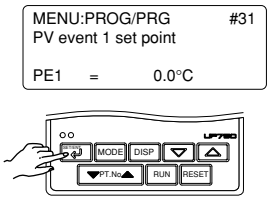
**21.** **Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "Deviation high and low limits Alarm" (setpoint 7).**



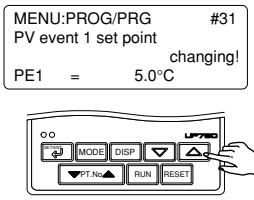

**22.** **Press the SET/ENT key once to register the setpoint.**



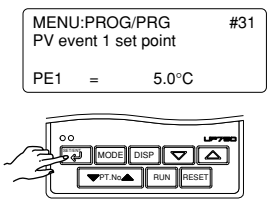

**23.** **Press the SET/ENT key once to display the PV Event Setpoint parameter "PE1".**



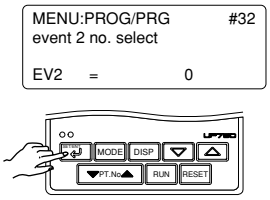

**24.** **Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "5.0°C".**



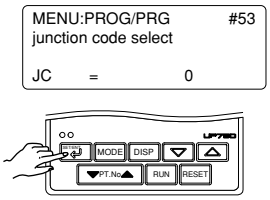

**25.** **Press the SET/ENT key once to register the setpoint.**



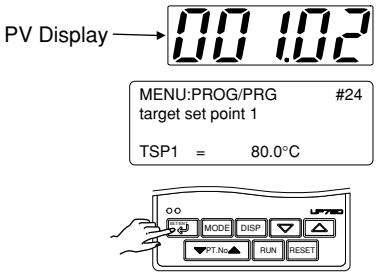

**26.** **Press the SET/ENT key once to display the Event Number parameter "EV2".**



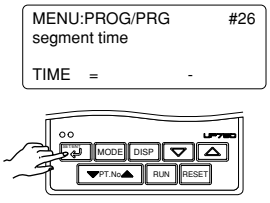

**27.** **Press the SET/ENT key once to display the Junction Code parameter "JC" for segment 1.**
**The setpoint of this parameter is not changed in this example.**



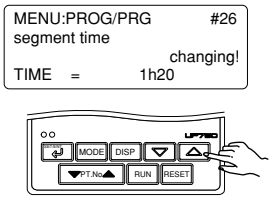

**28.** **Press the SET/ENT key once to display the Target Setpoint parameter "TSP1" for segment 2.**
**The setpoint of this parameter is not changed in this example.**
**At this point, the PV display shows "001.02" (the first three digits denote the pattern number and the last two digits the segment number).**



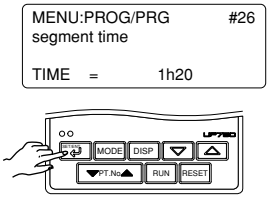

**29.** **Press the SET/ENT key once to display the Segment Time parameter "TIME" for segment 2.**



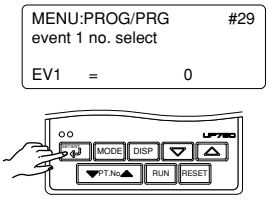
**30.** **Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "1 hr. and 20 min. (setpoint 1h20)".**



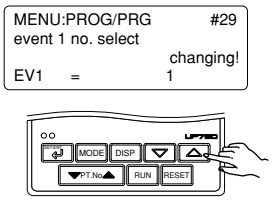

**31.** **Press the SET/ENT key once to register the setpoint.**



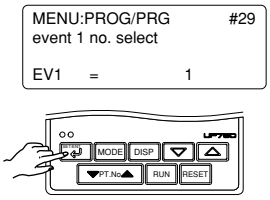

**32.** **Press the SET/ENT key once to display the Event Number parameter "EV1".**



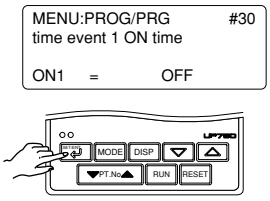

**33.** **Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "time event 1 (setpoint 1)".**



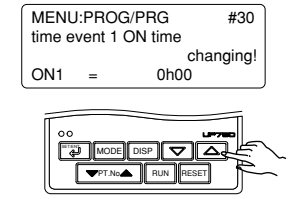

**34.** **Press the SET/ENT key once to register the setpoint.**



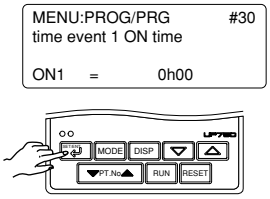

**35.** **Press the SET/ENT key once to display the On Time of Time Event parameter "ON1".**



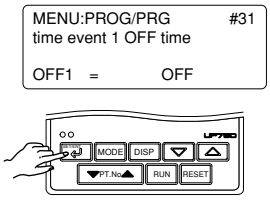

**36.** **Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "0 min. (setpoint 0h00)".**



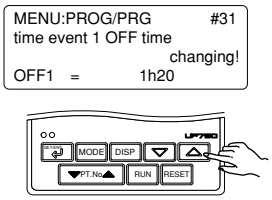

**37.** **Press the SET/ENT key once to register the setpoint.**



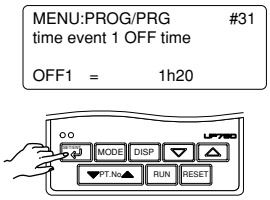
**38.** **Press the SET/ENT key once to display the Off Time of Time Event parameter "OFF1".**



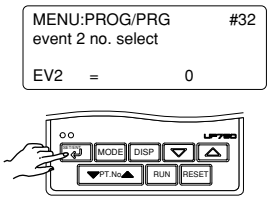

**39.** **Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "1 hr. and 20 min. (setpoint 1h20)".**



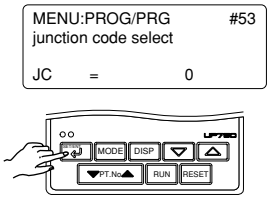

**40.** **Press the SET/ENT key once to register the setpoint.**



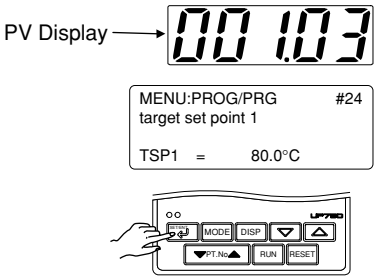

**41.** **Press the SET/ENT key once to display the Event Number parameter "EV2".**



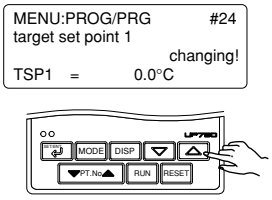

**42.** **Press the SET/ENT key once to display the Junction Code parameter "JC" for segment 2.**
**The setpoint of this parameter is not changed in this example.**



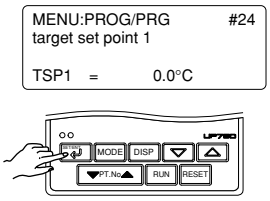

**43.** **Press the SET/ENT key once to display the Target Setpoint parameter for segment 3. At this point, the PV display shows "001.03" (the first three digits denote the pattern number and the last two digits the segment number).**



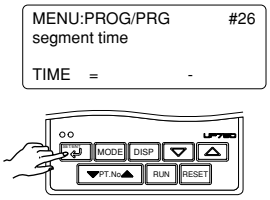

**44.** **Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "0.0°C".**



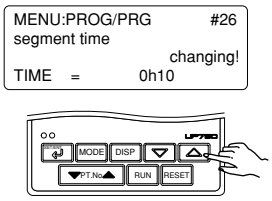

**45.** **Press the SET/ENT key once to register the setpoint.**



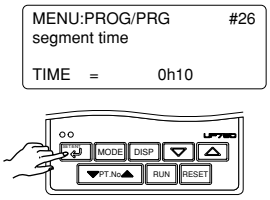

**46.** **Press the SET/ENT key once to display the Segment Time parameter "TIME" for segment 3.**



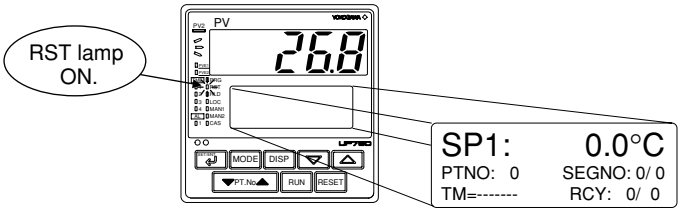
**47.** **Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "10 min. (setpoint 0h10)".**




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



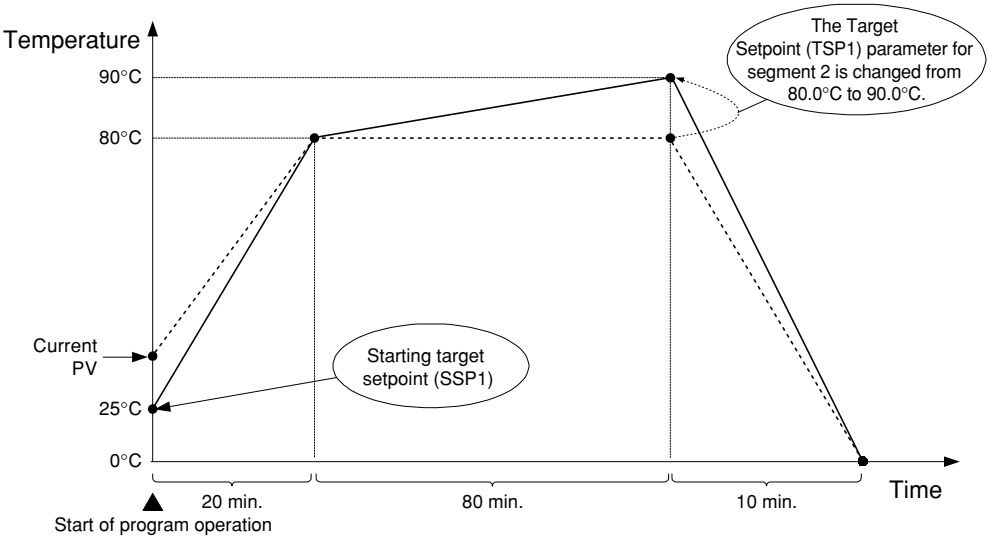

**49.** **Programming is now complete. Press the SET/ENT key for more than 3 seconds. This returns you to the display shown at power-on (figure below).**



# 3.4 Changing Program Patterns

The following operating procedure describes an example of changing the program pattern created in “3.3 Creating Program Patterns” to the program pattern shown in the figure below.

Example of Changing Program Pattern 1




■ Details of the Change

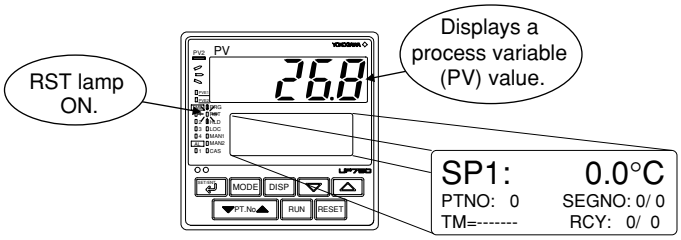
Before change: Program operation begins with the starting target setpoint (SSP1).
After change: Program operation begins with the current PV value. The time setpoints of segment 1 precede others.

→ Change the setpoint of the Start Code (STC) program parameter to “2”.

Before change: The Target Setpoint (TSP1) program parameter for segment 2 was set to “80.0°C”.
After change: The Target Setpoint (TSP1) program parameter for segment 2 is set to “90.0°C”.

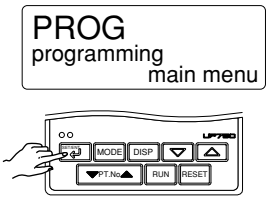
→ Change the setpoint of the Target Setpoint (TSP1) program parameter for segment 2 to “90.0”.

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

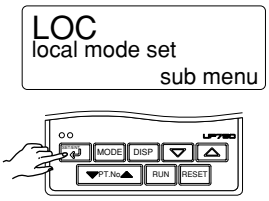



**For steps 2 and later, illustrations of the LCD are cited to explain the procedure.**

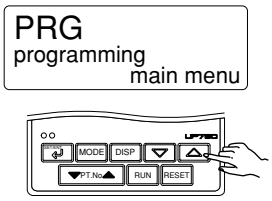
**2. Press the SET/ENT key for more than 3 seconds to call up the main menu "PROG".**



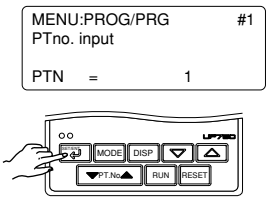

**3. Press the SET/ENT key once to display the submenu "LOC".**



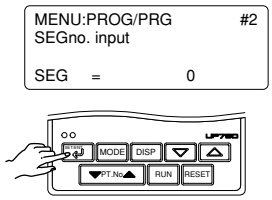

**4. Press the ▲ key once to display the submenu "PRG".**



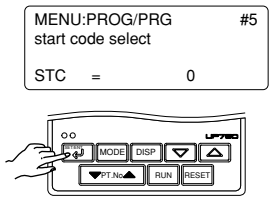

**5. Press the SET/ENT key once to display the Pattern Number parameter "PTN".**



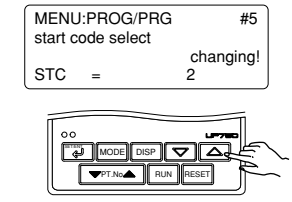

**6. Press the SET/ENT key once to display the Segment Number parameter "SEG".**



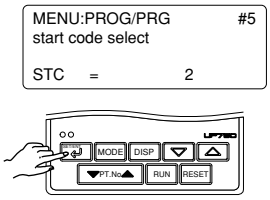

**7. Press the SET/ENT key twice to display the Start Code parameter "STC".**



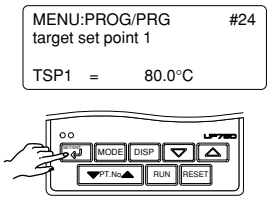

**8. Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "time-prioritized PV start (setpoint 2)".**



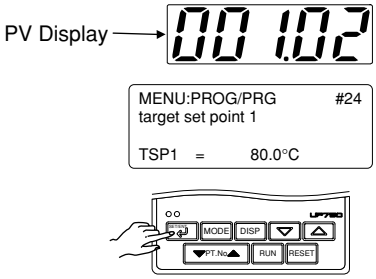
**9.** **Press the SET/ENT key once to register the setpoint.**



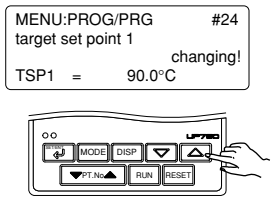

**10.** **Press the SET/ENT key once to display the Target Setpoint parameter "TSP1" for segment 1.**



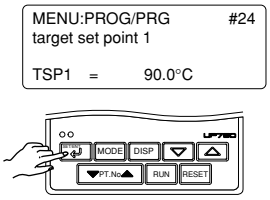

**11.** **Press the SET/ENT key seven times to display the Target Setpoint parameter "TSP1" for segment 2.**
**At this point, the PV display shows "001.02" (the first three digits denote the pattern number and the last two digits the segment number).**



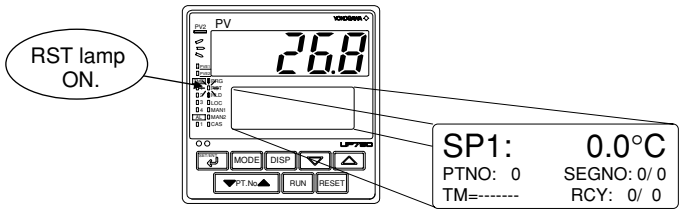

**12.** **Press the ▲ or ▼ key to display the required setpoint.**
**The figure below shows an example of the parameter set to "90.0°C".**



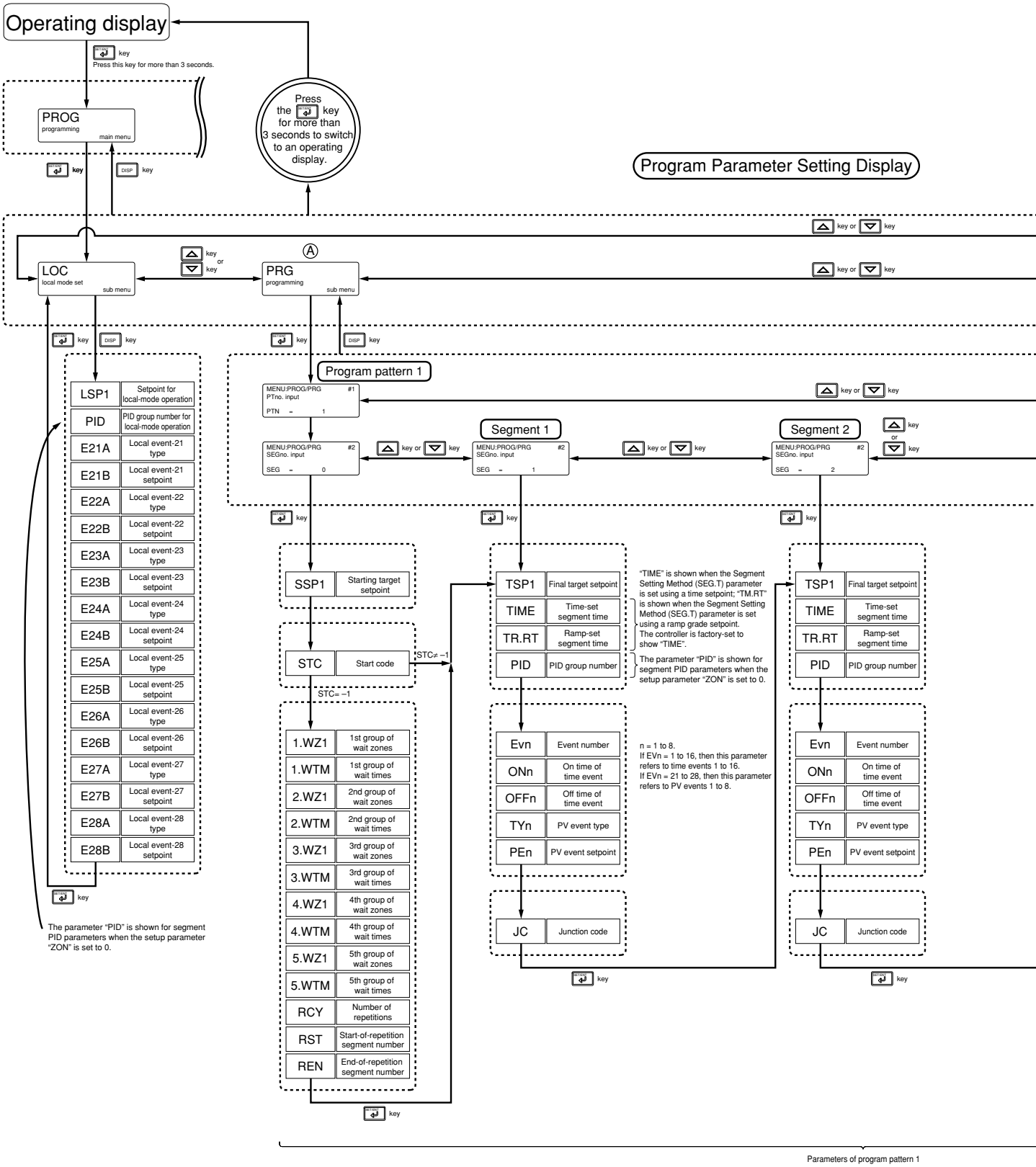

**13.** **Press the SET/ENT key once to register the setpoint.**

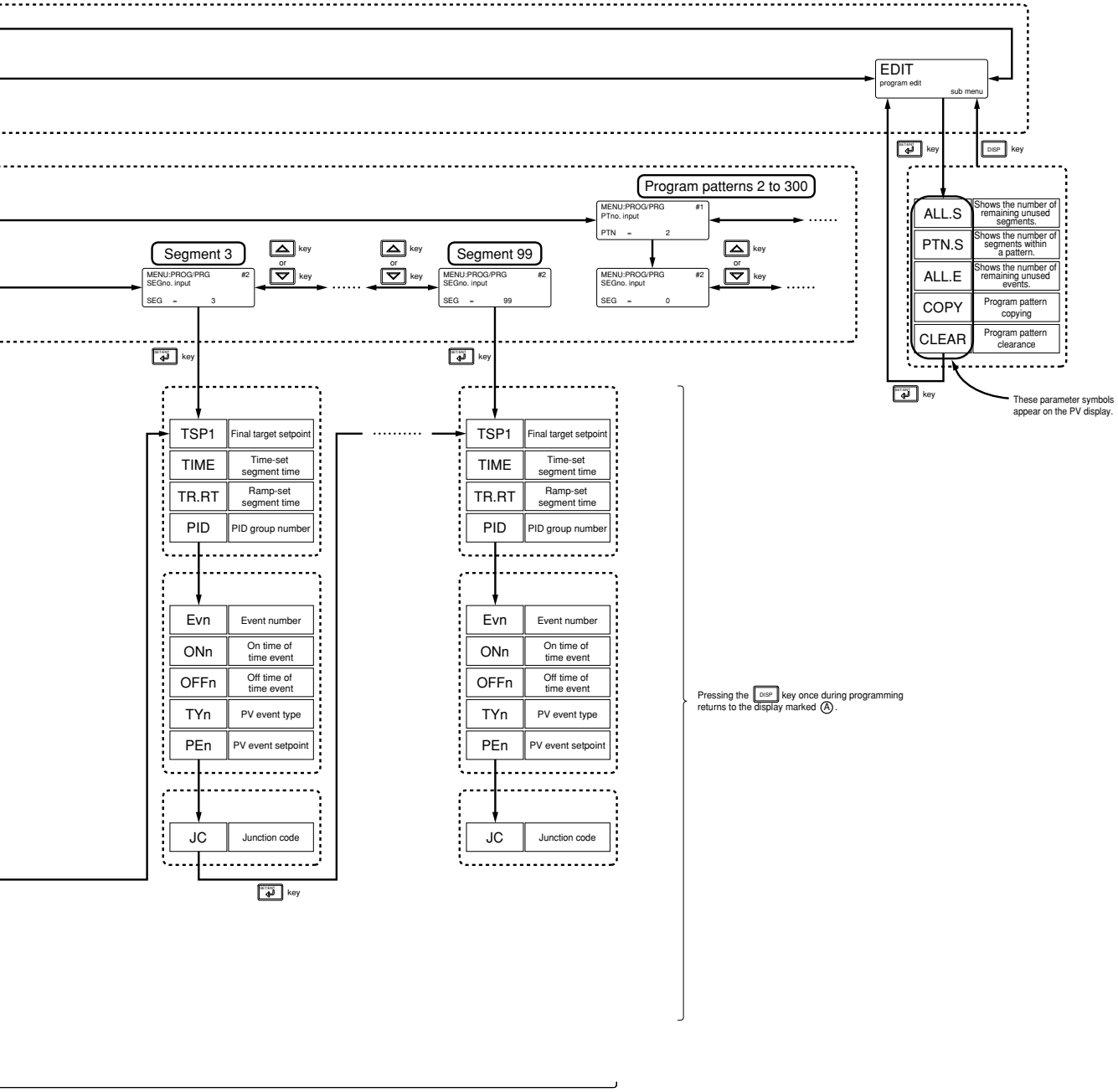



**14.** **Changing the program is now complete. Press the SET/ENT key for <u>more than 3 seconds</u>. This returns you to the display shown at power-on (figure below).**



# 3.5 Program Parameter Map




EDIT
program edit
sub menu
key
DISP key
Program patterns 2 to 300
MENU:PROG/PRG #1
PTno. input
PTN – 2
Segment 3
MENU:PROG/PRG #2
SEGno. input
SEG – 3
key
or
key
Segment 99
MENU:PROG/PRG #2
SEGno. input
SEG – 99
MENU:PROG/PRG #2
SEGno. input
SEG – 0
ALL.S
Shows the number of remaining unused segments.
PTN.S
Shows the number of segments within a pattern.
ALL.E
Shows the number of remaining unused events.
COPY
Program pattern copying
CLEAR
Program pattern clearance
These parameter symbols appear on the PV display.
TSP1
Final target setpoint
TIME
Time-set segment time
TR.RT
Ramp-set segment time
PID
PID group number
Evn
Event number
ONn
On time of time event
OFFn
Off time of time event
TYn
PV event type
PEn
PV event setpoint
JC
Junction code
Pressing the DISP key once during programming returns to the display marked Ⓐ.

# 3.6 Lists of Program Parameters

* Parameters relating to PV or program setpoints should all be set in real numbers. For example, use temperature values to define program setpoints and PV event setpoints for temperature input.
* The “User Setting” column in the table below is provided for the customer to record setpoints.

## ● Local Setpoint Parameters

**Located in: Main menu = PROG ; Submenu = LOC**

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| LSP1 | Setpoint for local-mode operation of primary-loop | 0.0 to 100.0% of primary PV input range | 0.0% of primary PV input range | |
| LSP2 | Setpoint for local-mode operation of secondary-loop | 0.0 to 100.0% of secondary PV input range | 0.0% of secondary PV input range | |
| PID | PID group number for local-mode operation | Shown for segment PID parameters when the setup parameter “ZON” is set to 0. This parameter is factory-set so as not to appear.<br>1: Uses the 1st group of PID parameters.<br>2: Uses the 2nd group of PID parameters.<br>3: Uses the 3rd group of PID parameters.<br>4: Uses the 4th group of PID parameters.<br>5 to 8: Likewise, selecting these numbers uses the 5th to 8th groups of PID parameters. | 1 | |
| E21A | Local event-21 type | OFF (0), 1 to 10, 28 to 31<br>1: PV high limit (energized, no stand-by action)<br>2: PV low limit (energized, no stand-by action)<br>3: Deviation high limit (energized, no stand-by action)<br>4: Deviation low limit (energized, no stand-by action)<br>5: Deviation high limit (de-energized, no stand-by action)<br>6: Deviation low limit (de-energized, no stand-by action)<br>7: Deviation high/low limits (energized, no stand-by action)<br>8: Deviation within high/low limits (energized, no stand-by action)<br>9: PV high limit (de-energized, no stand-by action)<br>10: PV low limit (de-energized, no stand-by action) | OFF (0) | |
| E21B | Local event-21 setpoint | PV/SP alarm: -100.0 to 100.0% of PV input range<br>Deviation alarm: -100.0 to 100.0% of PV input range span<br>Output value alarm: -5.0 to 105.0% | PV/SP high limit alarm: 100.0% of PV input range.<br>Deviation alarm: 0.0% of PV input range span.<br>Other PV/SP low limit alarms: 0.0% of PV input range.<br>Output high limit alarm: 100.0%<br>Output low limit alarm: 0.0% | |

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| E22A | Local event-22 type | Same as the E21A parameter. | | |
| E22B | Local event-22 setpoint | Same as the E21B parameter. | | |
| E23A | Local event-23 type | Same as the E21A parameter. | | |
| E23B | Local event-23 setpoint | Same as the E21B parameter. | | |
| E24A | Local event-24 type | Same as the E21A parameter. | | |
| E24B | Local event-24 setpoint | Same as the E21B parameter. | | |
| E25A | Local event-25 type | Same as the E21A parameter. | | |
| E25B | Local event-25 setpoint | Same as the E21B parameter. | | |
| E26A | Local event-26 type | Same as the E21A parameter. | | |
| E26B | Local event-26 setpoint | Same as the E21B parameter. | | |
| E27A | Local event-27 type | Same as the E21A parameter. | | |
| E27B | Local event-27 setpoint | Same as the E21B parameter. | | |
| E28A | Local event-28 type | Same as the E21A parameter. | | |
| E28B | Local event-28 setpoint | Same as the E21B parameter. | | |

## ● Program Parameters (Parameters for Setting the Conditions of Program Operation Startup)

Use the program pattern setup chart discussed in “3.2 Example of Program Pattern Setup Charts” of this chapter, to record your setpoints of program parameters.

**Located in: Main menu = PROG ; Submenu = PRG**

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| PTN | Pattern number | 1: Program pattern 1 2: Program pattern 2<br>3: Program pattern 3<br>4 to 300: Likewise, specifying these numbers sets their corresponding program pattern numbers. | | |
| SEG | Segment number | 0: Shows parameters for setting the starting target setpoint, start code, etc.<br>1 to 99: Specify the corresponding segment numbers.<br>Specify “0” when creating a program for the first time. | 0 | |
| SSP1 | Starting target setpoint | 0.0 to 100.0% of primary PV input range | 0.0% of primary PV input range | |
| STC | Start code | -1: Shows parameters for setting the wait and repeat actions.<br>0: Program operation begins with the starting target setpoint.<br>1: Ramp-prioritized PV start (program operation begins with the PV value by giving priority to the ramp of segment 1)<br>2: Time-prioritized PV start (program operation begins with the PV value by giving priority to the time of segment 1)<br>TIP: The option “-1” is not a setpoint. | 0 | |

## ● Program Parameters (Parameters for Setting the Wait and Repeat Actions)

The parameters listed below are shown when the Start Code (STC) parameter is set to "-1."

**Located in: Main menu = PROG ; Submenu = PRG**

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| 1.WZ1 | 1st group of wait zones | OFF: No function<br>0.0 to 10.0% of primary PV input range span | OFF | |
| 1.WTM | 1st group of wait times | OFF: No function<br>0.01 to 99.59 ("hour, minute" or "minute, second")<br>Use the TMU setup parameter to set the time unit. | OFF | |
| 2.WZ1 | 2nd group of wait zones | Same as the 1st group of wait zones. | | |
| 2.WTM | 2nd group of wait times | Same as the 1st group of wait times. | | |
| 3.WZ1 | 3rd group of wait zones | Same as the 1st group of wait zones. | | |
| 3.WTM | 3rd group of wait times | Same as the 1st group of wait times. | | |
| 4.WZ1 | 4th group of wait zones | Same as the 1st group of wait zones. | | |
| 4.WTM | 4th group of wait times | Same as the 1st group of wait times. | | |
| 5.WZ1 | 5th group of wait zones | Same as the 1st group of wait zones. | | |
| 5.WTM | 5th group of wait times | Same as the 1st group of wait times. | | |
| RCY | Number of repetitions | 0 to 999: The controller repeats the segment specified by the RST and REN parameters as many times as defined by this parameter.<br>CONT: The controller indefinitely repeats the segment specified by the RST and REN parameters. | 0 | |
| RST | Start-of-repetition segment number | 1≤RST≤REN≤99 | 1 | |
| REN | End-of-repetition segment number | | 1 | |

## ● Program Parameters (Parameters for Setting the Final Target Setpoints and Segment Times)

**Located in: Main menu = PROG ; Submenu = PRG**

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| TSP1 | Final target setpoint | The final target setpoint of each segment. | | |
| TIME | Time-set segment time | Time setpoint: - (unregistered)<br>0.00 to 99.59 ("hour, minute" or "minute, second")<br>Without a time setpoint, it is not possible to create programs. | | |
| TM.RT | Ramp-set segment time | For ramp segments (ramp setpoint): - (unregistered), 0.0 to 100.0% of PV input range span per hour or minute<br>For soak segments: 0.00 to 99.59 ("hour, minute" or "minute, second")<br>Without a time setpoint or a ramp grade setpoint, it is not possible to create programs. | | |
| PID | Segment PID group number | This parameter is shown for segment PID parameters when the setup parameter "ZON" is set to 0.<br>This parameter is factory-set so as not to appear.<br>1 to 8 | 1 | |

## ● Program Prameters (Parameters for Setting the Event Action)

You can set a maximum of eight units each for the parameters listed below for each individual segment.

**Located in: Main menu = PROG ; Submenu = PRG**

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| EVn | Event number | 0: Unregistered.<br>1: Time event 1 (terminal numbers ㉞-㉟)<br>2: Time event 2 (terminal numbers ㉝-㉟)<br>3: Time event 3 (terminal numbers ㉜-㉟)<br>4: Time event 4 (terminal numbers ㉛-㉟)<br>5 to 16: Time events 5 to 16 (see the CD-ROM version user's manual for details on the terminal number)<br>21: PV event 1 (terminal numbers ⑥-⑦)<br>22: PV event 2 (terminal numbers ⑤-⑦)<br>23 to 28: PV events 3 to 8 (see the CD-ROM version user's manual for details on the terminal number) | 0 | |
| ONn | On time of time event | OFF: Unused.<br>0.00 to 99.59 ("hour, minute" or "minute, second") | OFF | |
| OFFn | Off time of time event | OFF: Unused.<br>0.00 to 99.59 ("hour, minute" or "minute, second") | OFF | |
| TYn | PV event type | OFF:<br>OFF, 1 to 10, 28 to 31<br>1: PV high limit (energized, no stand-by action)<br>2: PV low limit (energized, no stand-by action)<br>3: Deviation high limit (energized, no stand-by action)<br>4: Deviation low limit (energized, no stand-by action)<br>5: Deviation high limit (de-energized, no stand-by action)<br>6: Deviation low limit (de-energized, no stand-by action)<br>7: Deviation high/low limits (energized, no stand-by action)<br>8: Deviation within high/low limits (energized, no stand-by action)<br>9: PV high limit (de-energized, no stand-by action)<br>10: PV low limit (de-energized, no stand-by action)<br>See the next page for details on other alarm types. | OFF | |
| PEn | PV event setpoint | PV/SP alarm: -100.0 to 100.0% of primary PV input range<br>Deviation alarm: -100.0 to 100.0% of primary PV input range span<br>Output value alarm: -5.0 to 105.0% | PV/SP high limit alarm: 100.0% of primary PV input range.<br>Deviation alarm: 0.0% of primary PV input range span.<br>Other PV/SP low limit alarms: 0.0% of primary PV input range.<br>Output high limit alarm: 100.0%<br>Output low limit alarm: 0.0% | |

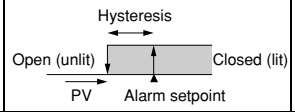
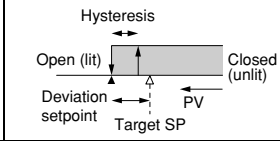
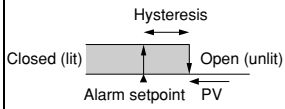
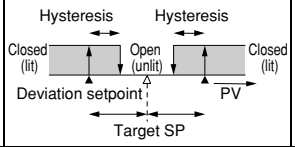
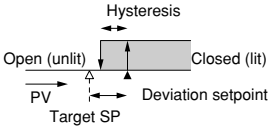
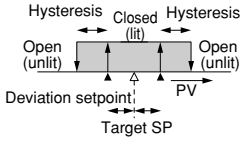
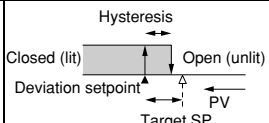
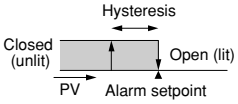
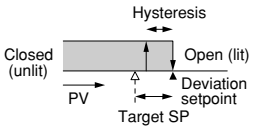
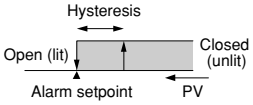
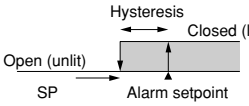
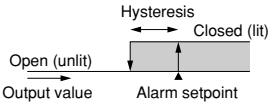
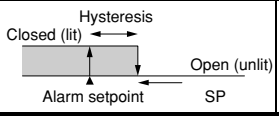
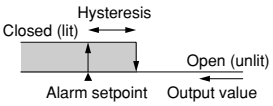
## ● Program Parameters (Junction Code Parameter)

**Located in: Main menu = PROG ; Submenu = PRG**

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| JC | Junction code | 0: Switching for continuation<br>1: Hold-on switching (the controller holds the end-of-segment setpoint when the segment is completed, to perform control).<br>2: Local-mode end (the controller switches to a local setpoint when the segment is completed).<br>11 to 15: Wait during switching between segments (see the CD-ROM version user's manual).<br>21 to 25: Wait within a segment interval (see the CD-ROM version user's manual).<br>INSERT: Allows a segment to be added to the end of a specified segment.<br>DELETE: Allows a specified segment to be deleted. | 0 | |

## List of PV Event and Local Event Types

The table below shows the types and actions of PV event and Local event.

| Alarm type | Alarm action<br>"Open/close" shows status of relay contact, and "lit" and "unlit" shows status of lamp | Alarm type code<br>Contact closes if alarm occurs | Alarm type code<br>Contact opens if alarm occurs | Alarm type | Alarm action<br>"Open/close" shows status of relay contact, and "lit" and "unlit" shows status of lamp | Alarm type code<br>Contact closes if alarm occurs | Alarm type code<br>Contact opens if alarm occurs |
|---|---|---|---|---|---|---|---|
| No alarm | | OFF | | | | | |
| PV high limit |  | 1 | | De-energized on deviation low limit alarm |  | | 6 |
| PV low limit |  | 2 | | Deviation high and low limits |  | 7 | |
| Deviation high limit |  | 3 | | Deviation within high and low limits |  | 8 | |
| Deviation low limit |  | 4 | | De-energized on PV high limit |  | | 9 |
| De-energized on deviation high limit alarm |  | | 5 | De-energized on PV low limit |  | | 10 |
| SP high limit |  | 28 | | Output high limit |  | 30 | |
| SP low limit |  | 29 | | Output low limit |  | 31 | |

## ● Program Parameters (Parameters for Editing Programs)

### Located in: Main menu = PROG ; Submenu = EDIT

| Symbol on PV Display | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| ALL.S<br>(ALL.S) | Number of remaining unused segments. | Read-only | | |
| PtN.S<br>(PTN.S) | Number of segments within a pattern. | | | |
| ALL.E<br>(ALL.E) | Number of remaining unused events. | | | |
| CoPY<br>(COPY) | Program pattern copying | Specify the numbers of the source-of-copying program pattern and target-of-copying program pattern. (1 to 300) | | |
| CLEAr<br>(CLEAR) | Program pattern clearance | Specify the number of the program pattern to be cleared.<br>(1 to 300) | | |

# 3.7 Program Pattern Setup Charts

For details on how to use the program pattern setup chart, see “3.1 Overview of Program Patterns,” and “3.2 Example of Program Pattern Setup Charts.”

You can register as many as 300 program patterns with the UP750 controller. Create as many copies of the chart as necessary.

First fill in the fields with bold-face borders in the order from number 1 to number 9. Then, input the data into the controller.

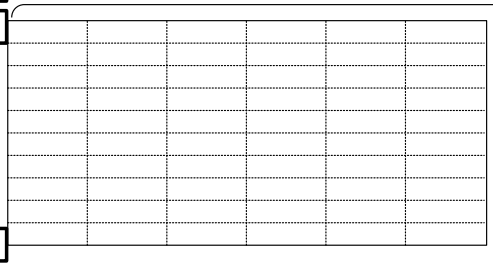
1. Maximum value of primary PV input range: Setpoint of the “Maximum Value of Primary PV Input Range (RH1)” setup parameter
2. Minimum value of primary PV input range: Setpoint of the “Minimum Value of Primary PV Input Range (RL1)” setup parameter
3. Primary PV input unit: Setpoint of the “Primary PV Input Unit (UNI1)” setup parameter
4. Program time unit: Setpoint of the “Program Time Unit (TMU)” setup parameter
5. Segment setting method: Setpoint of the “Segment Setting Method (SEG.T)” setup parameter
6. Starting target setpoint: Setpoint of the “Starting Target Setpoint (SSP1)” program parameter
7. Start code: Setpoint of the “Start Code (STC)” program parameter
8. Final target setpoint, segment time, Events (PV event and Time event) and Junction code: Setpoint of each program parameter
9. Draw the program pattern.

| | |
|---|---|
| System name | |
| Program No. | |
| Program name | |
| Model | UP750 - |
| Serial No. | |

| | |
|---|---|
| Program time unit (TMU) | 4 |
| Segment setting method (SEG.T) | 5 |

Unit 3

Maximum value of primary PV input range (RH1) 1
100%



Minimum value of primary PV input range (RL1) 2
0%

Define this parameter when using the controller as a program pattern generator. See User’s Manual (Reference) (CD-ROM version) for more information.

Time setting (TIME) when the Segment Setting Method (SEG.T) parameter is set as SEG.T = 0; ramp setting (TM.RT) when the parameter is set as SEG.T = 1 Factory-set to Time setting (TIME).

Shown for segment PID parameters when the setup parameter “ZON” is set to 0.

8

| Segment No. → | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Final target setpoint 1 (TSP1) | | | | | | |
| Final target setpoint 2 (TSP2) | | | | | | |
| Segment time (TIME/TM.RT) | | | | | | |
| PID number (PID) | | | | | | |
| Event number (EV1) | | | | | | |
| PV event type (TY1)/on time of time event (ON1) | | | | | | |
| PV event setpoint (PE1)/off time of time event (OFF1) | | | | | | |
| Event number (EV2) | | | | | | |
| PV event type (TY2)/on time of time event (ON2) | | | | | | |
| PV event setpoint (PE2)/off time of time event (OFF2) | | | | | | |
| Event number (EV3) | | | | | | |
| PV event type (TY3)/on time of time event (ON3) | | | | | | |
| PV event setpoint (PE3)/off time of time event (OFF3) | | | | | | |
| Event number (EV4) | | | | | | |
| PV event type (TY4)/on time of time event (ON4) | | | | | | |
| PV event setpoint (PE4)/off time of time event (OFF4) | | | | | | |
| Event number (EV5) | | | | | | |
| PV event type (TY5)/on time of time event (ON5) | | | | | | |
| PV event setpoint (PE5)/off time of time event (OFF5) | | | | | | |
| Event number (EV6) | | | | | | |
| PV event type (TY6)/on time of time event (ON6) | | | | | | |
| PV event setpoint (PE6)/off time of time event (OFF6) | | | | | | |
| Event number (EV7) | | | | | | |
| PV event type (TY7)/on time of time event (ON7) | | | | | | |
| PV event setpoint (PE7)/off time of time event (OFF7) | | | | | | |
| Event number (EV8) | | | | | | |
| PV event type (TY8)/on time of time event (ON8) | | | | | | |
| PV event setpoint (PE8)/off time of time event (OFF8) | | | | | | |
| Junction code (JC) | | | | | | |

| | |
|---|---|
| Starting target setpoint 1 (SSP1) | 6 |
| Starting target setpoint 2 (SSP2) | |
| Start code (STC) | 7 |
| 1st group of wait zones (1.WZ1) | |
| 1st group of wait times (1.WTM) | |
| 2nd group of wait zones (2.WZ1) | |
| 2nd group of wait times (2.WTM) | |
| 3rd group of wait zones (3.WZ1) | |
| 3rd group of wait times (3.WTM) | |
| 4th group of wait zones (4.WZ1) | |
| 4th group of wait times (4.WTM) | |
| 5th group of wait zones (5.WZ1) | |
| 5th group of wait times (5.WTM) | |
| Number of repetitions (RCY) | |
| Start-of-repetition segment number (RST) | |
| End-of-repetition segment number (REN) | |

Define this parameter when using the controller as a program pattern generator.
See User's Manual (Reference) (CD-ROM version) for more information.

See User's Manual (Reference) (CD-ROM version) for more information.

9

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# 3.8 Explanation of Program Functions

## ■ Programming

You can create programs using either method 1 or 2 described below.

The controller is factory-set to “method 1.” To create programs using method 2, change the setpoint of the SEG.T (Segment Setting Method) setup parameter to “1.”

Before you begin programming, determine whether your programs are created using the time unit of “hour and minute” or “minute and second.” The controller is factory-set to the “hour and minute” time unit. To create programs using the “minute and second” time unit, change the setpoint of the TMU (Program Time Unit) setup parameter to “mm:ss.”

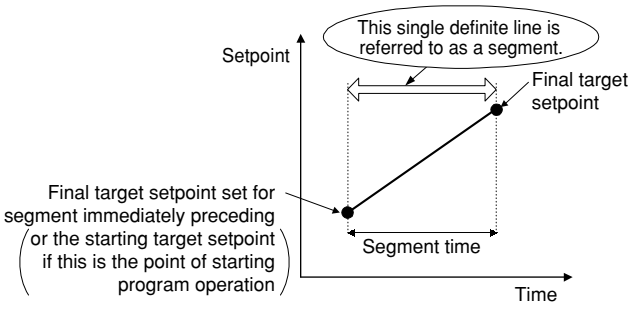
**<Controller Settings>**

| | Setpoint of SEG.T (Segment Setting Method) Setup Parameter |
|---|---|
| Time setting (method 1) | 0 (factory-set default) |
| Ramp setting (method 2) | 1 |

Choose the desired method and unit from the two programming methods and time unit options discussed above. Then, create programs according to the chosen options.

### 1. Creating programs by setting final target setpoint and time unit

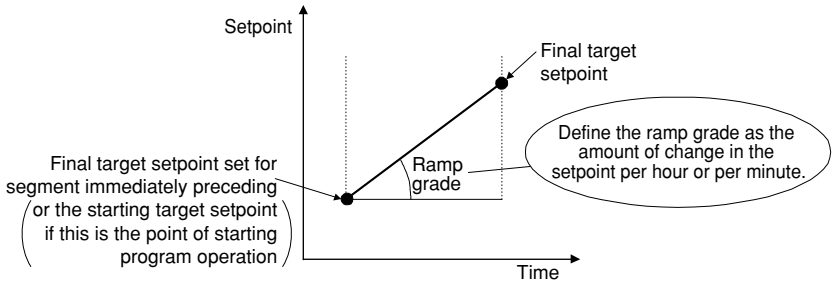
As shown in the figure below, this method creates programs by setting a segment time and a final target setpoint on a segment-by-segment basis.




### 2. Creating programs by setting final target setpoint and ramp

As shown in the figure below, this method creates programs by setting a final target setpoint and a ramp grade on a segment-by-segment basis.

Define the ramp grade as the amount of change in the setpoint per hour or per minute.

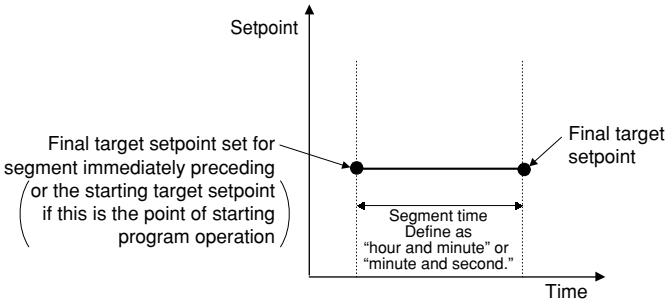


### <Controller Settings>

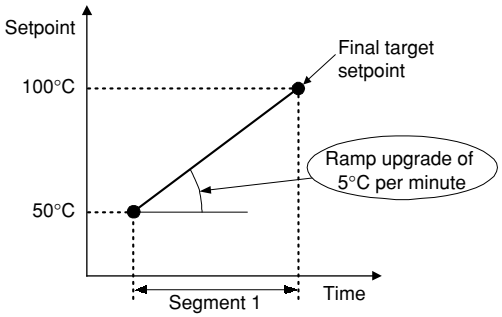
| | Setpoint of TMU (Program Time Unit) Setup Parameter |
|---|---|
| When changing the setpoint linearly over an hour | hh:mm (factory-set default) |
| When changing the setpoint linearly over a minute | mm:ss |

Note: The “Program Time Unit (TMU)” parameter is the time unit you use when creating programs.

When creating a soak segment during programming, set a time (“hour and minute” or “minute and second”) rather than a ramp grade.




For example, configure segment 1 so the temperature rises in increments of 5°C per minute from 50°C to 100°C, as shown in the figure below.




To change the temperature linearly over a minute, set the TMU parameter to “mm:ss” (minute and second) before you begin programming.

When programming the controller, set the Segment Time (TIME) parameter for segment 1 to 5°C.

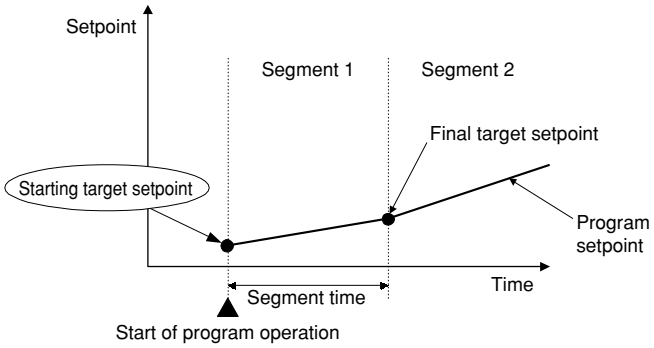
This allows the controller to raise the setpoint in increments of 5°C per minute during the interval of segment 1.

# ■ Controller Behavior at the Start of Program Operation

You can determine how the controller should behave at the start of program operation.

## 1. Letting the controller run from a starting target setpoint

A starting target setpoint refers to a setpoint from which program operation begins. The controller operates in such a manner that the setpoint changes to the final target setpoint over the segment time set for segment 1, irrespective of what the PV value is.



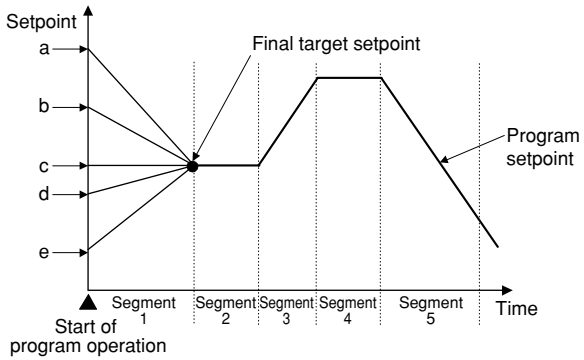

### <Controller Settings>

| Set the STC (Start Code) program parameter to “0”. |
|---|

## 2. Letting the controller start from the current setpoint and run according to time settings defined for segment 1

This method is not available if the SEG.T (Segment Setting Method) parameter is set to “ramp setting.”

| Starting Point of Operation | Controller Behavior |
|---|---|
| a | Begins to run from point a according to the time setting defined for segment 1. |
| b | Begins to run from point b according to the time setting defined for segment 1. |
| c | Begins to run from point c according to the time setting defined for segment 1. |
| d | Begins to run from point d according to the time setting defined for segment 1. |
| e | Begins to run from point e according to the time setting defined for segment 1. |

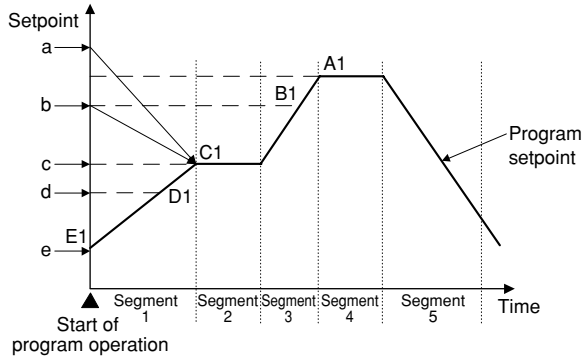



### <Controller Settings>

| Set the STC (Start Code) program parameter to “2”. |
|---|

### 3. Letting the controller start from the current setpoint and run according to ramp settings defined for segment 1 of the created program

| Starting Point of Operation | Controller Behavior |
|---|---|
| a | Begins to run from point C1 (ignores the time setting defined for segment 1). |
| b | Begins to run from point C1 (ignores the time setting defined for segment 1). |
| c | Begins to run from point C1 (ignores the time setting defined for segment 1). |
| d | Begins to run from point D1 according to the preset ramp setting (the time setting defined for segment 1 is reduced). |
| e | Begins to run from point E1 according to the preset ramp setting. |




**<Controller Settings>**

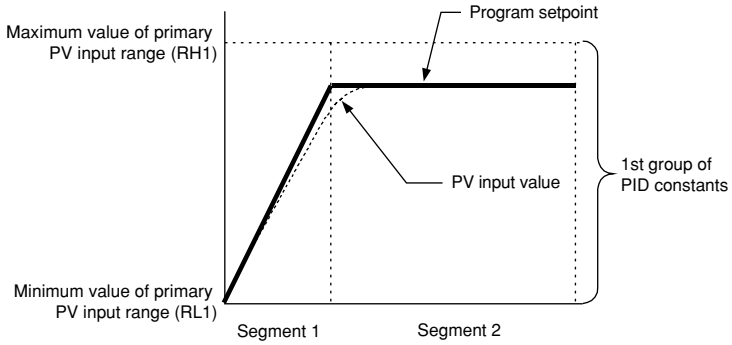
Set the STC (Start Code) program parameter to “1”.

## ■ PID Switching (Zone PID)

The UP750 offers two methods of PID switching. One of the methods is to automatically switch between groups of PID constants according to the temperature zone. The other method is to automatically switch between groups of PID constants on a segment-by-segment basis. This paragraph explains the method of switching between groups of PID constants according to the temperature zone. You can set a maximum of seven temperature zones. When shipped from the factory, the UP750 is configured so that it operates in zone 1 only and uses only one group of PID constants.

### ● When One Group of PID Constants is Used (factory-set default)

As shown in the figure below, the controller uses one group of PID constants over the range from the minimum value to the maximum value of the primary PV input range.




**<Controller Settings>**

- Configure the 1st group of PID constants (1.P, 1.I and 1.D operating parameters).

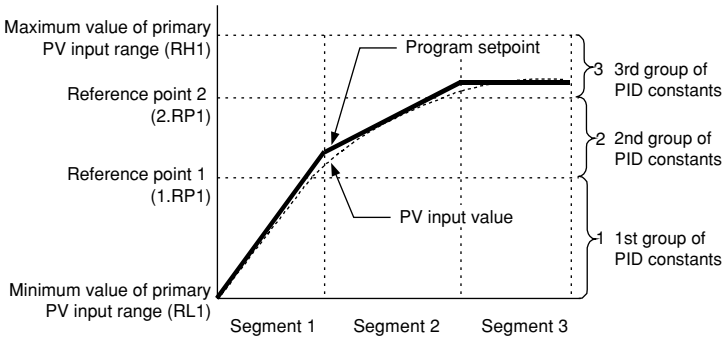
## ● Selection of PID Constants when the Control Range is Split into Three Zones

As shown in the figure below, three zones are set for the controller to automatically switch from one group of PID constants to another. Two zones can also be set for the controller to switch between two groups of PID constants.

[1] The controller uses the 1st group of PID constants if the PV input value is within the zone set off by the minimum value of the primary PV input range and reference point 1.

[2] The controller uses the 2nd group of PID constants if the PV input value is within the zone set off by reference point 1 and reference point 2.

[3] The controller uses the 3rd group of PID constants if the PV input value is within the zone set off by reference point 2 and the maximum value of the primary PV input range.




**<Controller Settings>**

- Splitting the control range into two zones
  - To split the control range into two zones, define reference point 1 (i.e., the 1.RP1 setup parameter).
  - Define the 1st and 2nd groups of PID constants (i.e., the 1.P, 1.I and 1.D operating parameters for the 1st group and the 2.P, 2.I and 2.D operating parameters for the 2nd group).
- Splitting the control range into three zones
  - To split the control range into three zones, define reference points 1 and 2 (i.e., the 1.RP1 and 2.RP1 setup parameters).
  - Define the 1st, 2nd and 3rd groups of PID constants (i.e., the 1.P, 1.I and 1.D operating parameters for the 1st group, the 2.P, 2.I and 2.D operating parameters for the 2nd group and the 3.P, 3.I and 3.D operating parameters for the 3rd group).

## ● Selecting PID Constants According to the Deviation

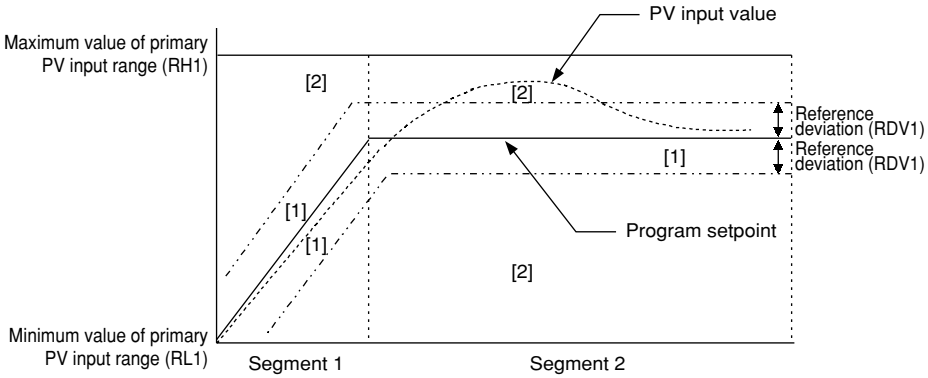
PID constants can be selected according to the deviation in two ways. One method is to select a group of PID constants only by a deviation from a program setpoint. The other method is to use a reference point, as discussed earlier, as well as a deviation from a program setpoint, to switch between groups of PID constants.

### [Method 1]

As shown in the figure below, the controller selects the PID constants of the group number set in PID group number (GRP) if the PV input value goes beyond the given deviation from the program setpoint.

[1] The controller uses the 1st group of PID constants.

[2] The controller uses the PID constants of the group number set in PID group number (GRP).



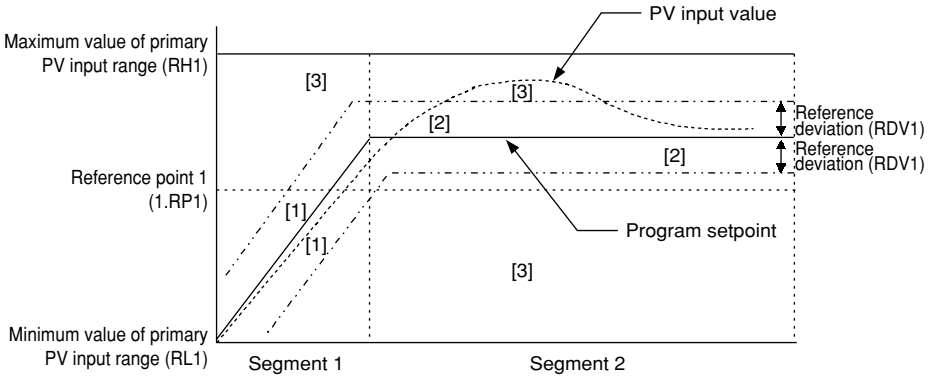

### [Method 2]

As shown in the figure below, the controller selects an appropriate group of PID constants for each zone and, if the PV input value goes beyond the given deviation from the program setpoint, selects the PID constants of the group number set in PID group number (GRP).

[1] The controller uses the 1st group of PID constants if the PV input value is both within the zone set off by the minimum value of the primary PV input range and reference point 1 and within the given reference deviation bandwidth.

[2] The controller uses the 2nd group of PID constants if the PV input value is both within the zone set off by reference points 1 and the maximum value of the primary PV input range, and within the given reference deviation bandwidth.

[3] The controller uses the PID constants of the group number set in PID group number (GRP).

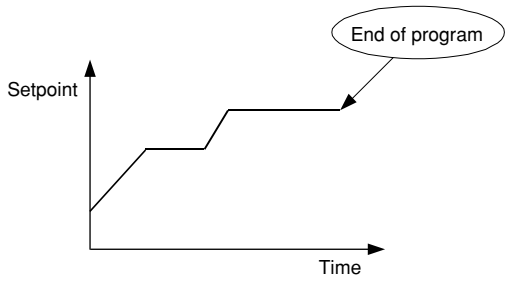


## ■ Retaining the End-of-Program State (Hold-mode End)

This function keeps the controller in the same state as when program operation was completed.

When in hold operation, the controller retains its states of control output and event output. To cancel hold operation, use either key operation or external contact input. When the hold operation is cancelled, the control output is set to 0% or OFF, and the event output is set to OFF.

To retain the end-of-program state, set the Junction Code program parameter of the segment in question to “1.”




## ■ Suspending the Progress of a Program (Wait Function)

When a running program moves from one segment to another, the wait function places the program in a wait (stand-by) state, by using a wait zone and a wait time, until any deviation is cancelled.

A wait zone is a deviation bandwidth from which the degree of PV input tracking is judged.

A wait time is the length of time that elapses until the PV input enters the wait zone. The program progresses if the PV input fails to re-enter the wait zone within the wait time.

When the program is in wait state, the time setpoints of Segment Time and Time Event parameters temporarily cease to be passed. At this point, the output based on the Time Event parameter is retained.

# 4. 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 DISP key no more than four times. This brings you to the display (operating display) that appears at power-on.**

## 4.1 Monitoring-purpose Operating Displays Available during Operation

The monitoring-purpose operating displays available during operation include those for cascade control and those for cascade heating/cooling control.

### ■ Operating Displays for Cascade Control

### ○ In Cascade and Program Operation

#### ● SP1 Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the current target setpoint (SP1), the program pattern number (PTNO) selected, the segment number (SEGNO) for which operation is in progress, the number of segments included in the selected program pattern, the remaining time of the segment for which operation is in progress, the current number of repetitions (RCY), and the total sum of repetitions.

#### ● CSP2 Display (PV2 lamp ON)

The PV input value of the secondary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the cascade setpoint of the secondary-loop (CSP2), the program pattern number (PTNO) selected, the segment number (SEGNO) for which operation is in progress, the number of segments included in the selected program pattern, the remaining time of the segment for which operation is in progress, the current number of repetitions (RCY), and the total sum of repetitions.

#### ● Target SP1 Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the current target setpoint (SP1) and final target setpoint (TSP), the program pattern number (PTNO) selected, the segment number (SEGNO) for which operation is progress, the number of segments included in the selected program pattern, the program pattern name (only displayed when setting the program pattern name using an optional parameter setting tool (model: LL100-E10)).

#### ● PV2/SP/OUT2 Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the PV input value of the secondary-loop (PV2), the program setpoint of the primary-loop (SP1), the cascade setpoint of the secondary-loop (C.SP2), and the control output value of the secondary-loop (OUT2).

## ● Deviation Trend Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the deviation trend.

## ● Pattern Display

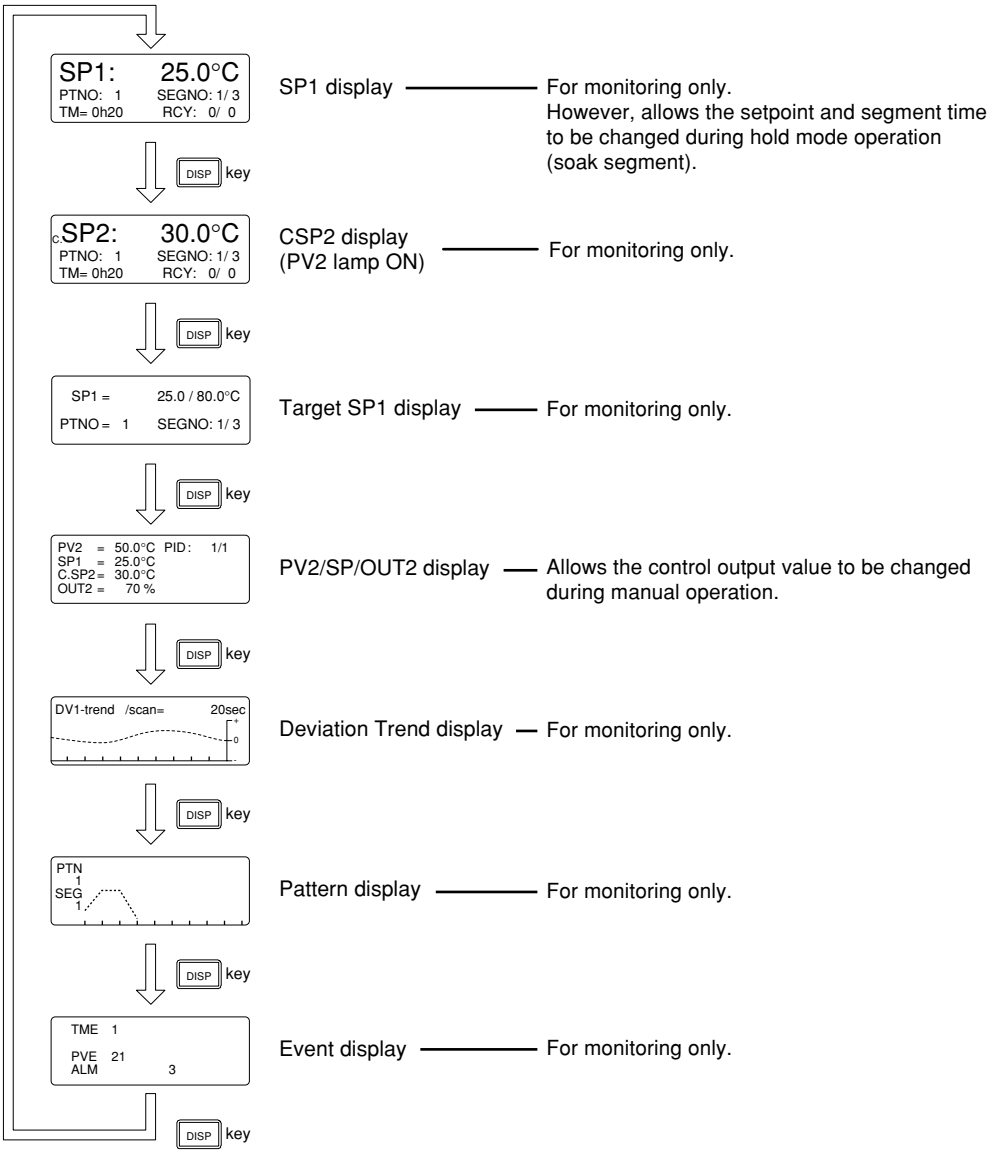
The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the selected program pattern.

## ● Event Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the event number for which an event has occurred.



## ○ In Cascade and Local of Primary-loop Operation

### ● LSP1 Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the current target setpoint (LSP1), the program pattern number (PTNO) selected, the segment number (SEGNO) for which operation is in progress, the number of segments included in the selected program pattern, the remaining time of the segment for which operation is in progress, the current number of repetitions (RCY), and the total sum of repetitions.

### ● CSP2 Display (PV2 lamp ON)

The PV input value of the secondary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the cascade setpoint of the secondary-loop (CSP2), the program pattern number (PTNO) selected, the segment number (SEGNO) for which operation is in progress, the number of segments included in the selected program pattern, the remaining time of the segment for which operation is in progress, the current number of repetitions (RCY), and the total sum of repetitions.

### ● Target SP1 Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the current target setpoint (SP1) and final target setpoint (TSP), the program pattern number (PTNO) selected, the segment number (SEGNO) for which operation is progress, the number of segments included in the selected program pattern, the program pattern name (only displayed when setting the program pattern name using an optional parameter setting tool (model: LL100-E10)).

### ● PV2/SP/OUT2 Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the PV input value of the secondary-loop (PV2), the program setpoint of the primary-loop (SP1), the cascade setpoint of the secondary-loop (C.SP2), and the control output value of the secondary-loop (OUT2).

### ● Deviation Trend Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the deviation trend.

### ● Pattern Display

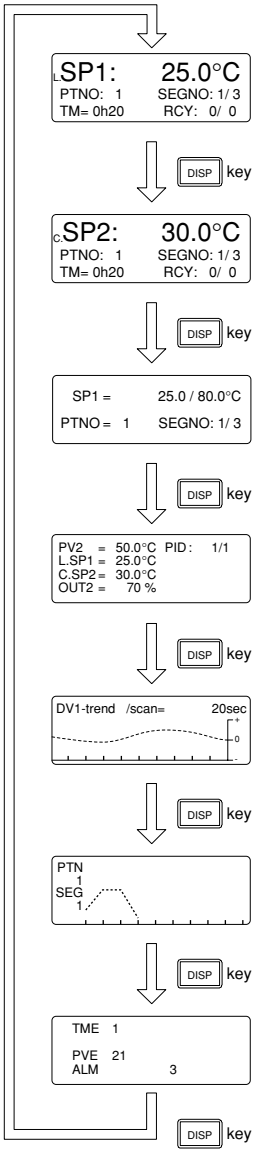
The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the selected program pattern.

### ● Event Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the event number for which an event has occurred.




LSP1 display ——— Allows the local setpoint of the primary-loop to be changed.

CSP2 display (PV2 lamp ON) ——— For monitoring only.

Target SP1 display ——— For monitoring only.

PV2/SP/OUT2 display ——— Allows the control output value to be changed during manual operation.

Deviation Trend display ——— For monitoring only.

Pattern display ——— For monitoring only.

Event display ——— For monitoring only.

# ■ Operating Displays for Cascade Heating/Cooling Control

## ○ In Cascade and Program Operation

### ● SP1 Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the current target setpoint (SP1), the program pattern number (PTNO) selected, the segment number (SEGNO) for which operation is in progress, the number of segments included in the selected program pattern, the remaining time of the segment for which operation is in progress, the current number of repetitions (RCY), and the total sum of repetitions.

### ● CSP2 Display (PV2 lamp ON)

The PV input value of the secondary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the cascade setpoint of the secondary-loop (CSP2), the program pattern number (PTNO) selected, the segment number (SEGNO) for which operation is in progress, the number of segments included in the selected program pattern, the remaining time of the segment for which operation is in progress, the current number of repetitions (RCY), and the total sum of repetitions.

### ● Target SP1 Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the current target setpoint (SP1) and final target setpoint (TSP), the program pattern number (PTNO) selected, the segment number (SEGNO) for which operation is progress, the number of segments included in the selected program pattern, the program pattern name (only displayed when setting the program pattern name using an optional parameter setting tool (model: LL100-E10)).

### ● Heating/Cooling PV2/SP/OUT2 Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the PV input value of the secondary-loop (PV2), the program setpoint of the primary-loop (SP1), the cascade setpoint of the secondary-loop (C.SP2), and the heating-side control output value (H2) and cooling-side control output value (C2) of the secondary-loop.

### ● Deviation Trend Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the deviation trend.

### ● Pattern Display

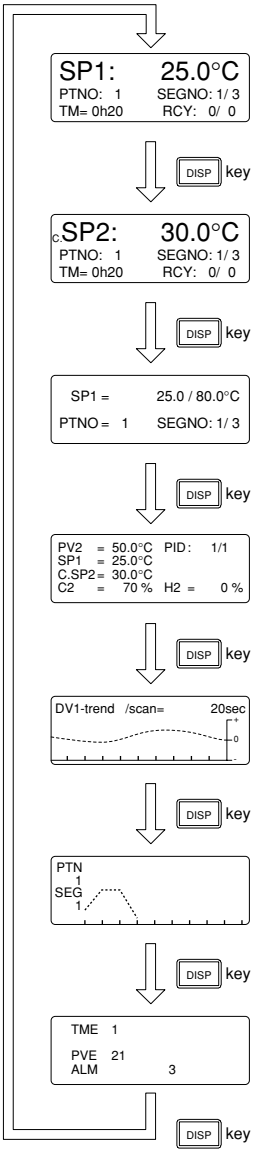
The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the selected program pattern.

### ● Event Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the event number for which an event has occurred.




SP1 display — For monitoring only.
However, allows the setpoint and segment time to be changed during hold mode operation (soak segment).

CSP2 display (PV2 lamp ON) — For monitoring only.

Target SP1 display — For monitoring only.

Heating/Cooling PV2/SP/OUT2 display — Allows the control output value to be changed during manual operation.

Deviation Trend display — For monitoring only.

Pattern display — For monitoring only.

Event display — For monitoring only.

## ○ In Cascade and Local of Primary-loop Operation

### ● LSP1 Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the current target setpoint (LSP1), the program pattern number (PTNO) selected, the segment number (SEGNO) for which operation is in progress, the number of segments included in the selected program pattern, the remaining time of the segment for which operation is in progress, the current number of repetitions (RCY), and the total sum of repetitions.

### ● CSP2 Display (PV2 lamp ON)

The PV input value of the secondary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the cascade setpoint of the secondary-loop (CSP2), the program pattern number (PTNO) selected, the segment number (SEGNO) for which operation is in progress, the number of segments included in the selected program pattern, the remaining time of the segment for which operation is in progress, the current number of repetitions (RCY), and the total sum of repetitions.

### ● Target SP1 Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the current target setpoint (SP1) and final target setpoint (TSP), the program pattern number (PTNO) selected, the segment number (SEGNO) for which operation is progress, the number of segments included in the selected program pattern, the program pattern name (only displayed when setting the program pattern name using an optional parameter setting tool (model: LL100-E10)).

### ● Heating/Cooling PV2/SP/OUT2 Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the PV input value of the secondary-loop (PV2), the program setpoint of the primary-loop (SP1), the cascade setpoint of the secondary-loop (C.SP2), and the heating-side (HEAT) control output (H2) and cooling-side (COOL) control output (C2) of the secondary-loop.

### ● Deviation Trend Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the deviation trend.

### ● Pattern Display

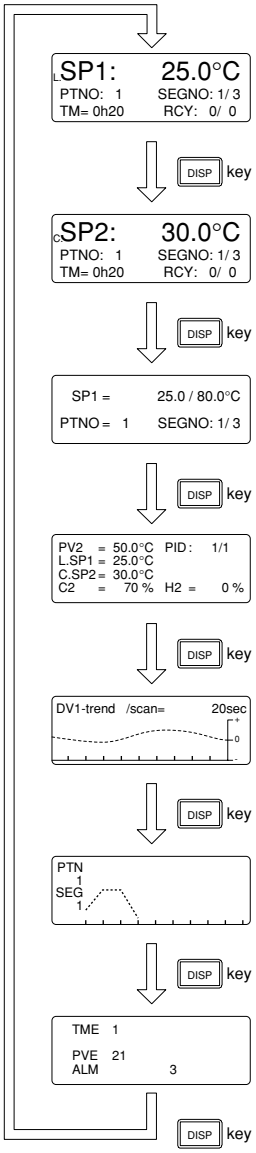
The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the selected program pattern.

### ● Event Display

The PV input value of the primary-loop appears on the PV display.

On the Setpoint display (LCD), the controller displays the event number for which an event has occurred.




LSP1 display ——— Allows the local setpoint of the primary-loop to be changed.

CSP2 display (PV2 lamp ON) ——— For monitoring only.

Target SP1 display ——— For monitoring only.

Heating/Cooling PV2/SP/OUT2 display ——— Allows the control output value to be changed during manual operation.

Deviation Trend display ——— For monitoring only.

Pattern display ——— For monitoring only.

Event display ——— For monitoring only.

# 4.2 Performing/Canceling Auto-tuning of Secondary-loop

Perform auto-tuning when you have finished setting local setpoint of secondary-loop. Make sure the controller is in program (RUN) mode, in local (LOCAL) mode and in automatic (AUTO) mode of the secondary-loop before carrying out auto-tuning of secondary-loop. See “4.7 Switching between RUN and RESET Modes,” to change to RUN, “4.8 Switching between Cascade (CAS) and Local (LSP)” to change to LSP, and “4.9 Switching between AUTO and MAN of Secondary-loop” to change to AUTO.

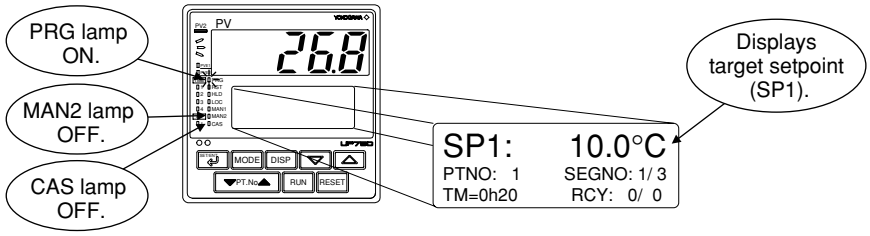
PID constants are obtained by using the current program setpoint value at the start of auto-tuning.

## 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

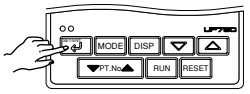
**1. Bring the operating display into view (display appears at power on).**




**In steps 2 and later, illustrations of the LCD are cited to explain the procedure.**

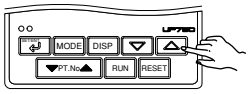
**2. Press the [SET/ENT] key for <u>more than 3 seconds</u> to call up the main menu “PROG”.**

PROG
programming
main menu

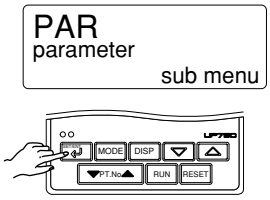



**3. Press the [▲] key three times to display the main menu “LP2”.**

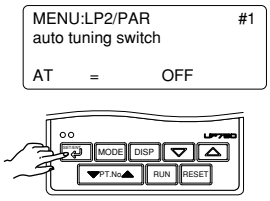
LP2
loop 2 parameter
main menu



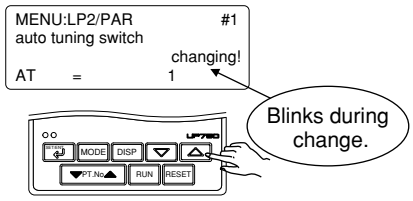
**4.** **Press the SET/ENT key once to display the submenu "PAR".**




**5.** **Press the SET/ENT key once again to display the parameter "AT".**

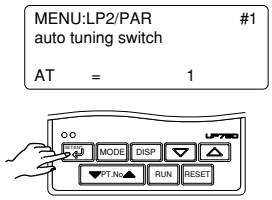



**6.** **Press the ▲ or ▼ key to display the required setpoint. Tuning for 1st group of PID is AT = 1.**

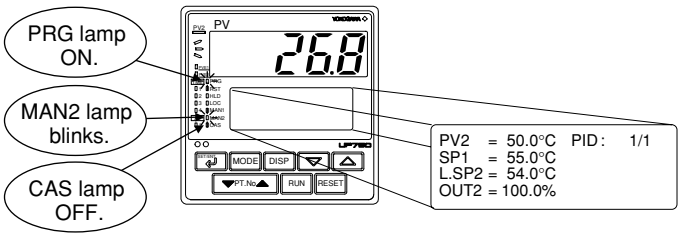



**To cancel auto-tuning, set AT = OFF.**

**7.** **Press the SET/ENT key once to register the value. (This starts auto-tuning.)**
**If the SET/ENT key is pressed when AT = OFF, auto-tuning will be cancelled. In this case, PID contains the value existing before auto-tuning.**




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




**Auto-tuning is complete when the MAN2 lamp goes off.**

# 4.3 Performing/Canceling Auto-tuning of Primary-loop

Perform auto-tuning when you have finished creating program patterns. Make sure the controller is in program (RUN) mode and in cascade (CAS) mode before carrying out auto-tuning. See “4.7 Switching between RUN and RESET Modes,” to change to RUN or “4.8 Switching between Cascade (CAS) and Local (LSP)” to change to CAS.

PID constants are obtained by using the current program setpoint value at the start of auto-tuning.

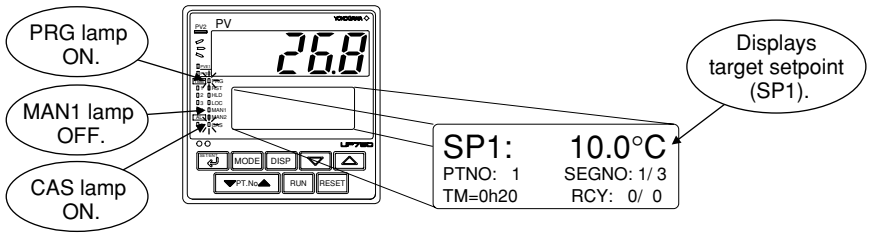
* To perform auto-tuning of the primary-loop, PID of the secondary-loop should be the appropriate value.

## 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.

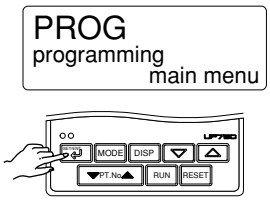
- Control processes with quick response such as flow control or pressure control
- Processes where even temporary output on/off results in inconvenience
- Processes where a large output change at control element results in inconvenience
- Processes where variations in PV may exceed an allowable range,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

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

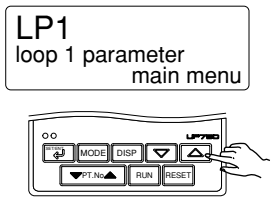



**In steps 2 and later, illustrations of the LCD are cited to explain the procedure.**

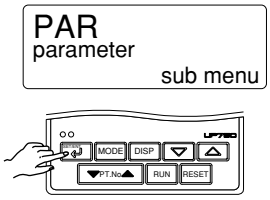
**2. Press the SET/ENT key for more than 3 seconds to call up the main menu “PROG”.**



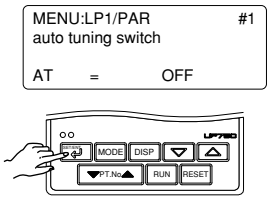

**3. Press the ▲ key twice to display the main menu “LP1”.**



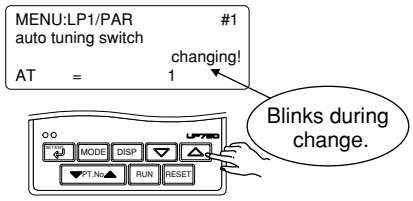
**4.** **Press the [SET/ENT] key once to display the submenu "PAR".**




**5.** **Press the [SET/ENT] key once again to display the parameter "AT".**

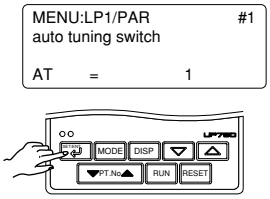



**6.** **Press the [▲] or [▼] key to display the required setpoint. Tuning for 1st group of PID is AT = 1.**

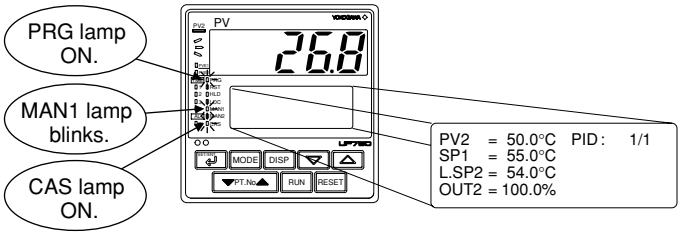



**To cancel auto-tuning, set AT = OFF.**

**7.** **Press the [SET/ENT] key once to register the value. (This starts auto-tuning.)**
**If the [SET/ENT] key is pressed when AT = OFF, auto-tuning will be cancelled. In this case, PID contains the value existing before auto-tuning.**




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

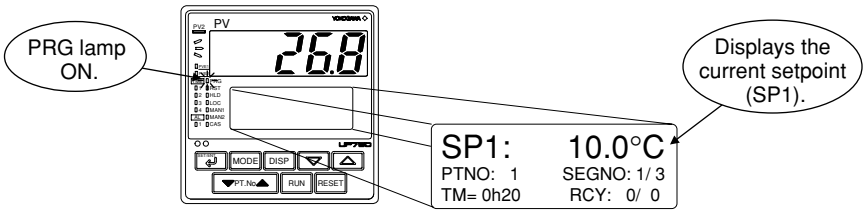



**Auto-tuning is complete when the MAN1 lamp goes off.**

# 4.4 Setting PID of Secondary-loop Manually

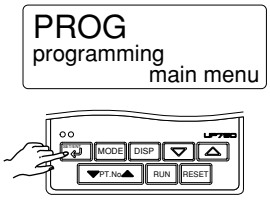
If you know the values to be set or if suitable PID constants cannot be obtained by auto-tuning, follow the procedure below to set values.

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

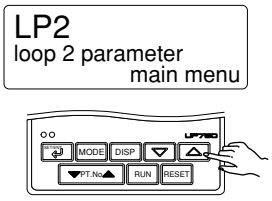



**In steps 2 and later, illustrations of the LCD are cited to explain the procedure.**

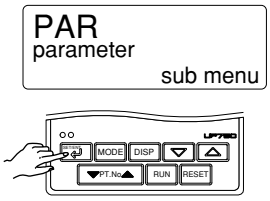
**2.** **Press the [SET/ENT] key for more than 3 seconds to call up the main menu "PROG".**



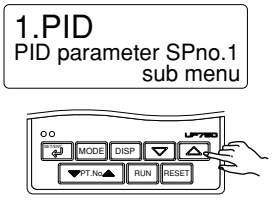

**3.** **Press the [▲] key three times to display the main menu "LP2".**



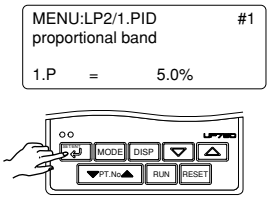

**4.** **Press the [SET/ENT] key once to display the submenu "PAR".**



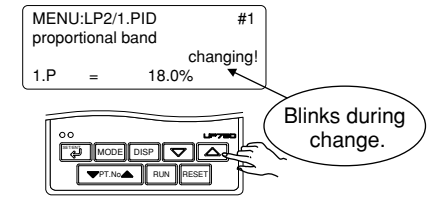

**5.** **Press the [▲] key once to display the submenu "1.PID".**



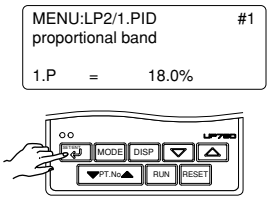

**6.** **Press the [SET/ENT] key once to display the parameter "1.P".**




**7.** **Press the [▲] or [▼] key to display the required setpoint.**

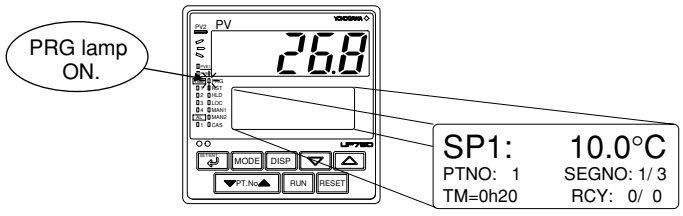



**8.** **Press the [SET/ENT] key once to register the setpoint.**




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

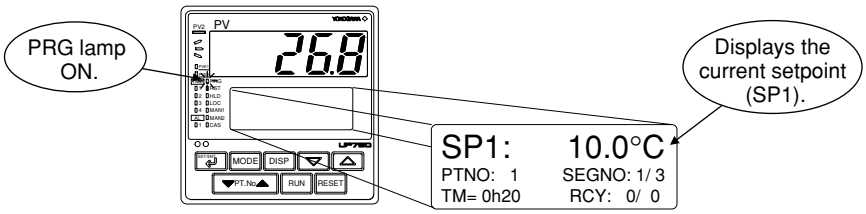
**9.** **Press the [SET/ENT] key for more than 3 seconds. This returns you to the display shown at power-on (figure below).**



# 4.5 Setting PID of Primary-loop Manually

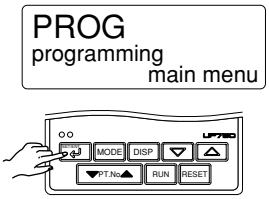
If you know the values to be set or if suitable PID constants cannot be obtained by auto-tuning, follow the procedure below to set values.

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

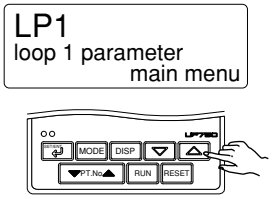



**In steps 2 and later, illustrations of the LCD are cited to explain the procedure.**

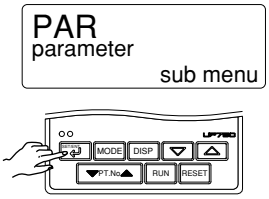
**2. Press the [SET/ENT] key for <u>more than 3 seconds</u> to call up the main menu "PROG".**



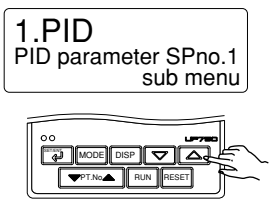

**3. Press the [△] key twice to display the main menu "LP1".**



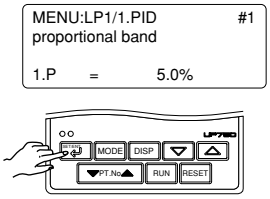

**4. Press the [SET/ENT] key once to display the submenu "PAR".**



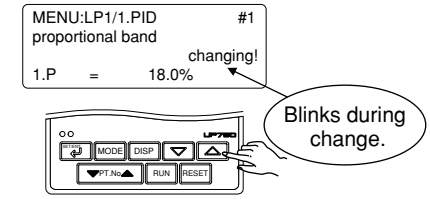

**5. Press the [△] key once to display the submenu "1.PID".**



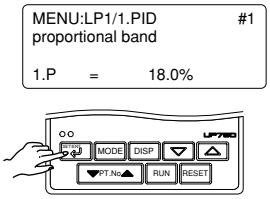

**6. Press the [SET/ENT] key once to display the parameter "1.P".**




**7. Press the [△] or [▽] key to display the required setpoint.**

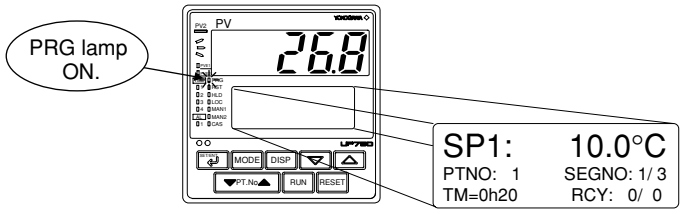



**8. Press the [SET/ENT] key once to register the setpoint.**




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

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



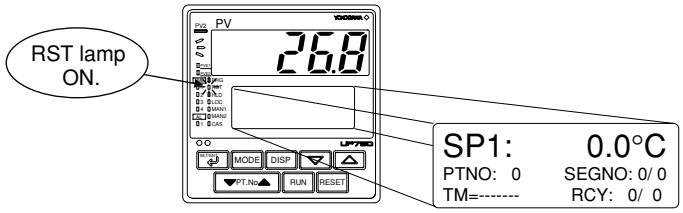

# 4.6 Selecting the Program Pattern Number (PT.No)

The following operating procedure selects program pattern 1. A program pattern number can only be selected when the controller is in a RESET mode.

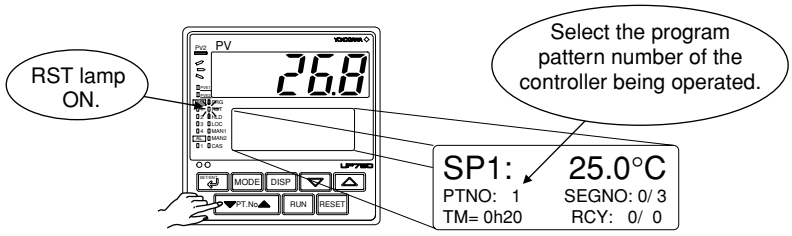
## NOTE

If contact input, which is used to select between program pattern numbers is on, any program pattern number cannot be selected by key operation.

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



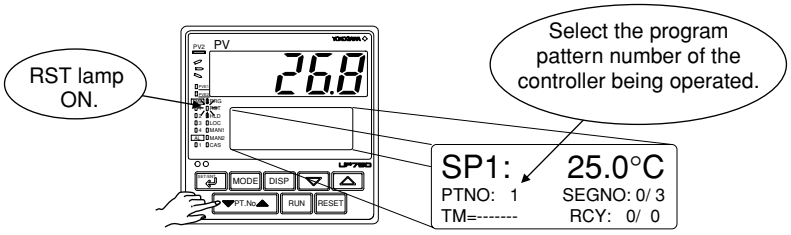

**2. Press the [▼PT.No▲] key. This selects the program pattern number.**



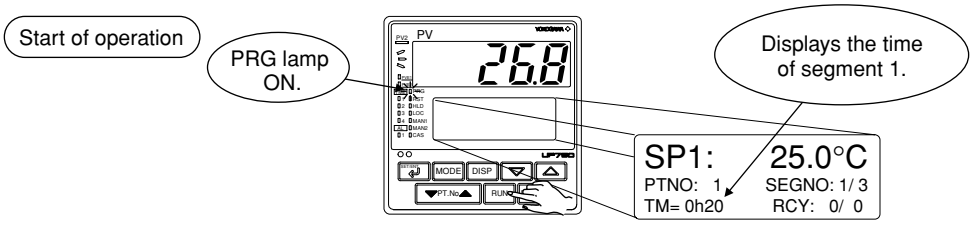
# 4.7 Switching between RUN and RESET Modes

The following operating procedure switches the RUN mode and the RESET mode.

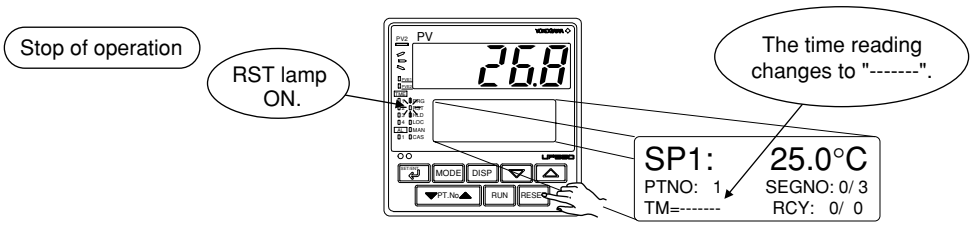
**1. Brings the operating display into view (appears at power-on).**




**2. Press the [RUN] key for 2 seconds. The selected program pattern starts.**




**3. Press the [RESET] key for 2 seconds. The running program stops.**




When in the RESET mode, the controller provides the following input/output values.

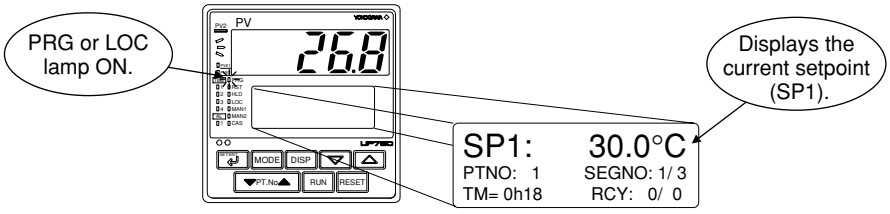
| | |
|---|---|
| PV input | Value of process variable |
| Control output | Preset output value (factory-set to 0%) |
| Event output | OFF, if there is any event. |

# 4.8 Switching between Cascade (CAS) and Local (LSP)

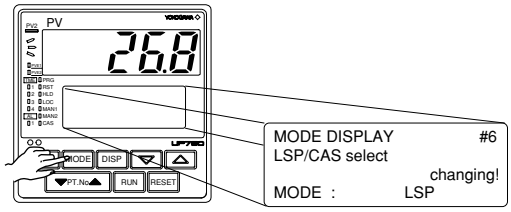
## NOTE

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

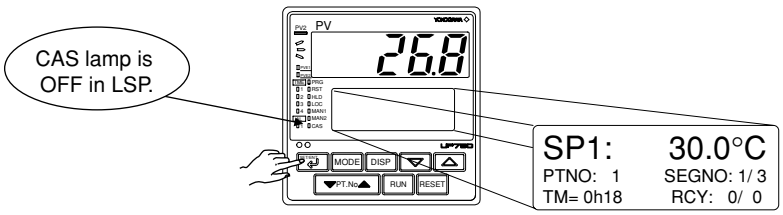
**1. Brings the operating display into view (appears at power-on).**




**2. Press the MODE key several times to display the MODE:LSP mode parameter. The figure below is an example of changing the CAS mode to the LSP mode.**




**3. Press the SET/ENT key once. The controller switches to the local setpoint of the secondary-loop. The figure below is an example of the display after a change from the CAS mode to the LSP mode.**



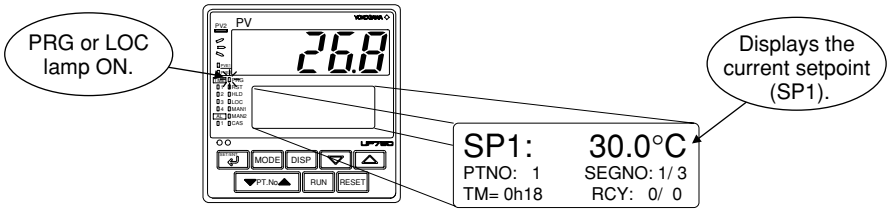

* CAS lamp is ON in CAS mode.

# 4.9 Switching between AUTO and MAN of Secondary-loop

## 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.

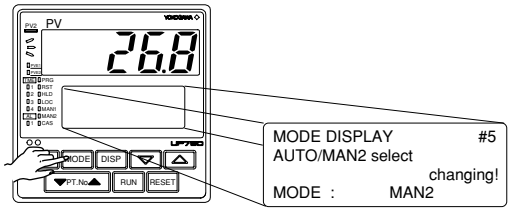
**1. Brings the operating display into view (appears at power-on).**



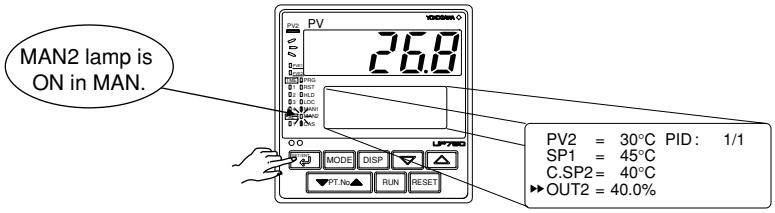

**2. [To change from AUTO to MAN mode]**
**Press the MODE key several times to display the MODE:MAN2 mode parameter.**

**[To change from MAN to AUTO mode]**
**Press the MODE key several times to display the MODE:AUTO2 mode parameter.**

**The figure below is an example of changing the AUTO mode to the MAN mode.**




**3. Press the SET/ENT key once. The controller switches to either MAN-mode or AUTO-mode operation. The figure below is an example of the display after a change from the AUTO mode to the MAN mode.**




* MAN2 lamp is OFF in AUTO.

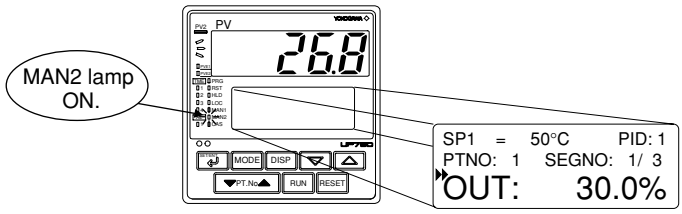
# 4.10 Manipulating Control Output during Manual Operation

## NOTE

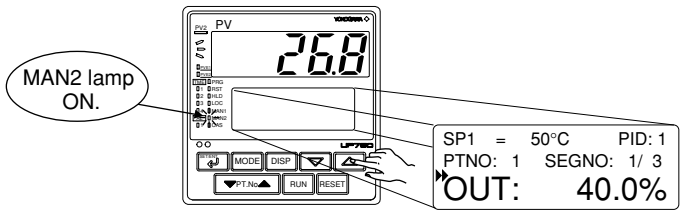
Control output cannot be changed if the controller is in the RESET mode. In this case, the preset output value (operating parameter PO) will be output.

A control output value is linked with a display value changed using the ▽ or △ key. Note that the control output changes as displayed without requiring the SET/ENT key.

**1. Bring manual operating display into view. For switching to manual operation, see "4.9 Switching between AUTO and MAN of Secondary-loop."**

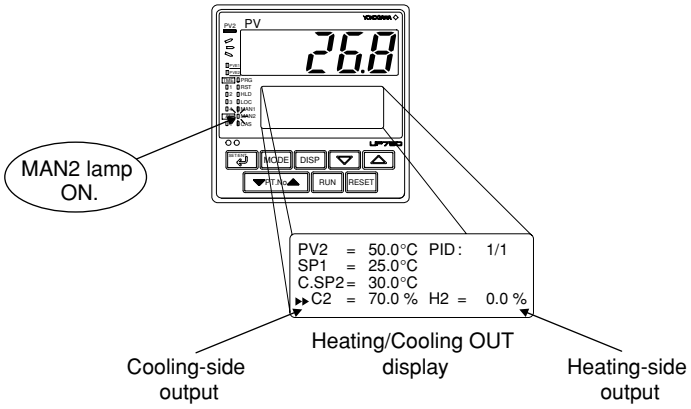



**2. Press the △ or ▽ key to change a control output value. You don't need to press the SET/ENT key.**




## ■ Manipulating the Control Output during Heating/Cooling Control

Showing the Heating/Cooling OUT display.

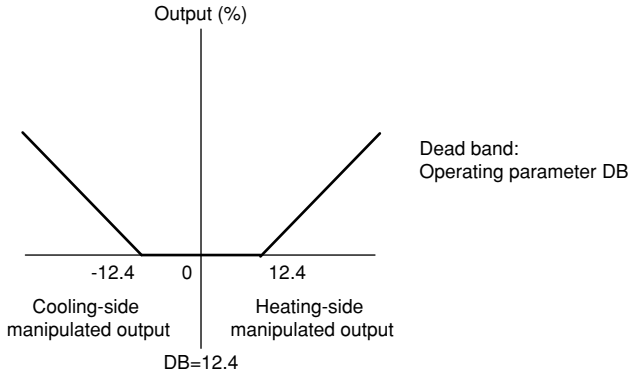


## ● Controller Behavior and Control Output Manipulation when the Dead Band is Positive

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 C2 = 0.0%), the heating-side output (H2 =) 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 H2 = 0.0%), the cooling-side output (C2 =) 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.

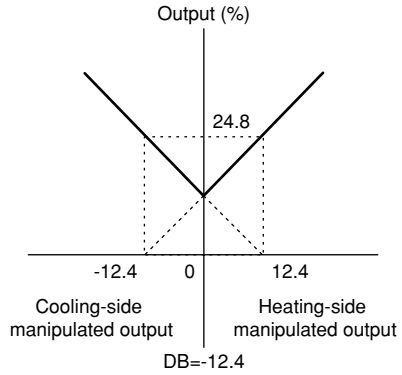



Change in manipulated output when the dead band is positive

## ● Controller Behavior and Control Output Manipulation when the Dead Band is Negative

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 C2 = 0.0%), the heating-side output (H2 =) decreases. If the output H2 falls below 24.8%, the cooling-side output C2 begins to increase from 0.0%. If you keep the ▽ key held down longer and the output C2 rises above 24.8%, the output H2 goes to 0.0% and you enter the state of manipulating the cooling-side output.



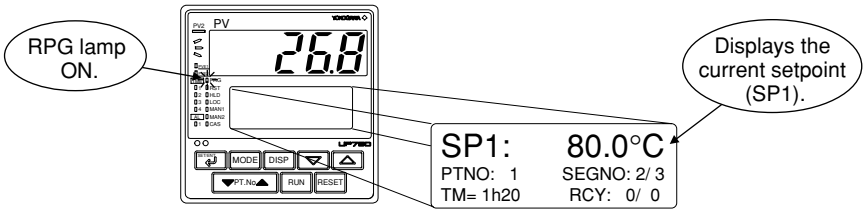

Change in manipulated output when the dead band is negative

# 4.11 Enabling/Disabling the Hold Mode of Program Operation

Enabling/disabling the hold mode of program operation should be done when the controller is in operation.

The following operating procedure is an example of setting program operation in the hold mode.

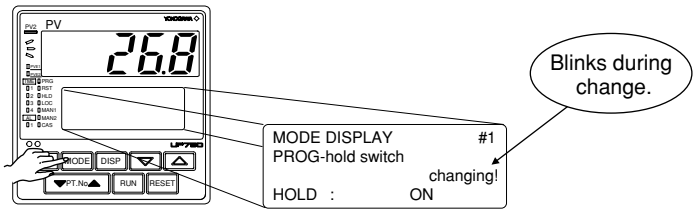
**1. Bring the operating display into view (appears at power-on).**



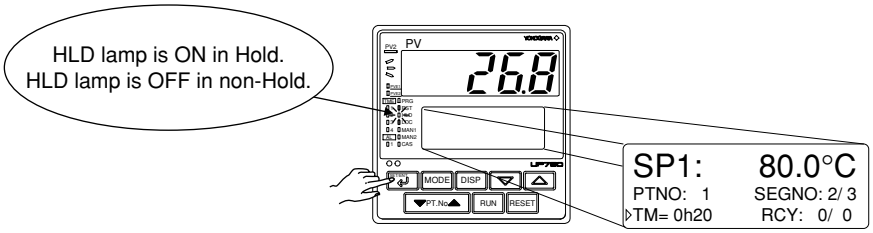

**2. [To enable the hold mode of program operation]**
**Press the MODE key once to display the HOLD:ON mode parameter.**

**[To disable the hold mode of program operation]**
**Press the MODE key once to display the HOLD:OFF mode parameter.**

**The figure below is an example of enabling the hold mode of program operation.**




**3. Press the SET/ENT key once. The controller switches to either the non-hold mode or the hold mode.**




* Other operating procedures for disabling the hold mode:

[1] Press the RUN key for two seconds during hold-mode operation. In this case, the controller resumes program operation.

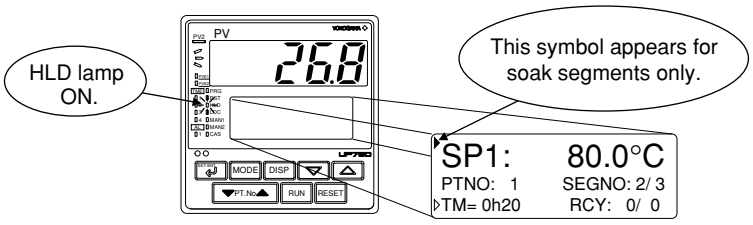
[2] Execute the “advance” function during hold-mode operation. In this case, the segment is advanced.

# 4.12 Changing Program Setpoints when in Hold Mode

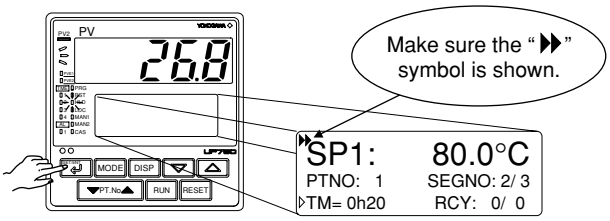
The following operating procedure changes program setpoints when program operation in soak segment is put in hold mode.

When you have finished changing the setpoints, disable the hold mode of program operation as instructed in, “4.11 Enabling/Disabling the Hold Mode of Program Operation.” The controller resumes program operation when the hold mode is disabled.

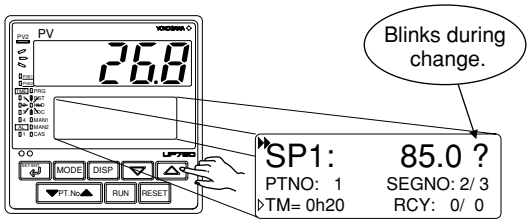
**1. Set program operation in the hold mode. To do this, see “4.11 Enabling/Disabling the Hold Mode of Program Operation.”**



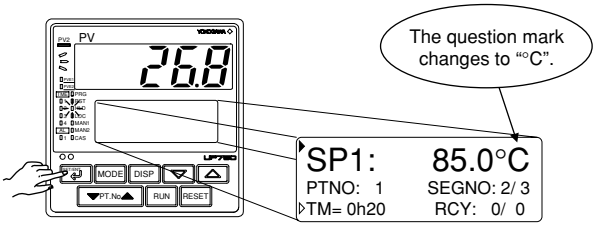

**2. Press the SET/ENT key once to display the symbol “ ⏩ ”.**




**3. Press the ▲ or ▼ key to change the setpoint.**



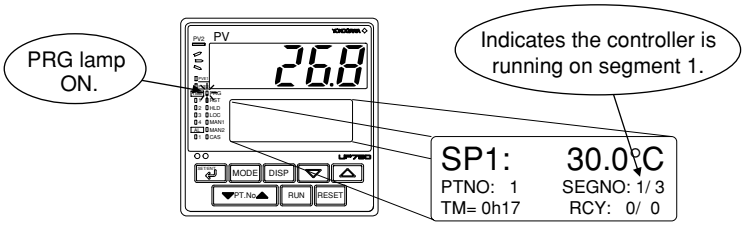

**4. Press the SET/ENT key once to register the setpoint.**



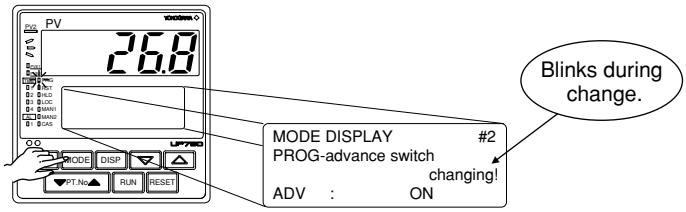
# 4.13 Executing the "Advance" Function

The following operating procedure advances the controller from segment 1 to segment 2. If you execute the "advance" function during hold-mode operation, the hold mode is disabled.

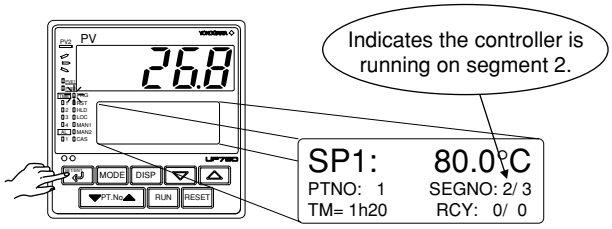
**1. Bring the current operating display for program operation into view.**




**2. Press the MODE key twice to display the ADV:ON mode parameter.**




**3. Press the SET/ENT key once. The controller resumes operation from the target setpoint of segment 1.**

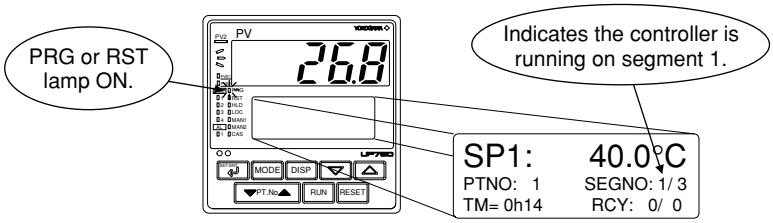


# 4.14 Switching to Local-mode (LOCAL) of Primary-loop Operation

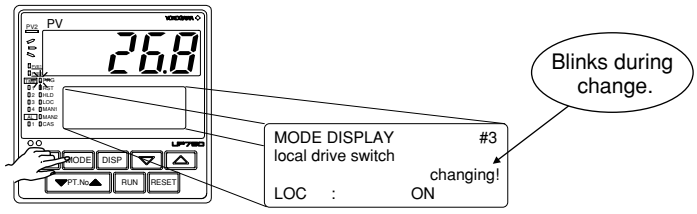
The controller can be switched to local-mode of the primary-loop operation when it is in program operation or in a RESET mode.

The following operating procedure switches the controller to local-mode operation during program operation.

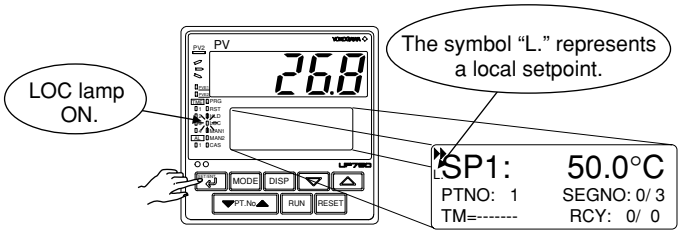
**1. Bring the current display for program operation into view.**




**2. Press the MODE key several times to display the LOC:ON mode parameter.**



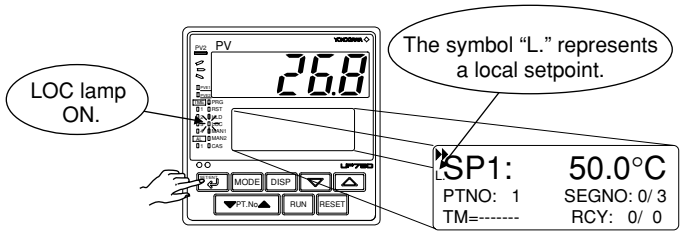

**3. Press the SET/ENT key once. The controller begins running with a local setpoint (L.SP). The figure below shows an example of setting the controller with the local setpoint of 50.0°C.**



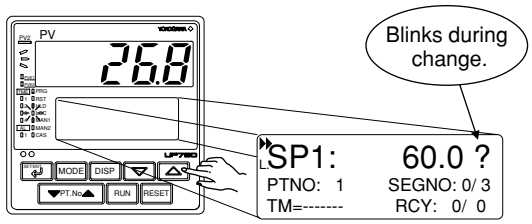
# 4.15 Changing Setpoints during Local-mode of Primary-loop Operation

The following operating procedure changes setpoints during local-mode operation.

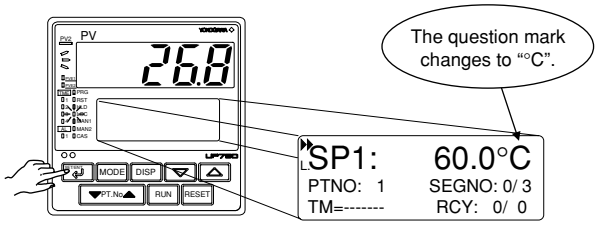
**1. Change the controller to local-mode operation. To do this, see "4.14 Switching to Local-mode (LOCAL) Operation."**




**2. Press the ▲ or ▼ key to change the local setpoint.**




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



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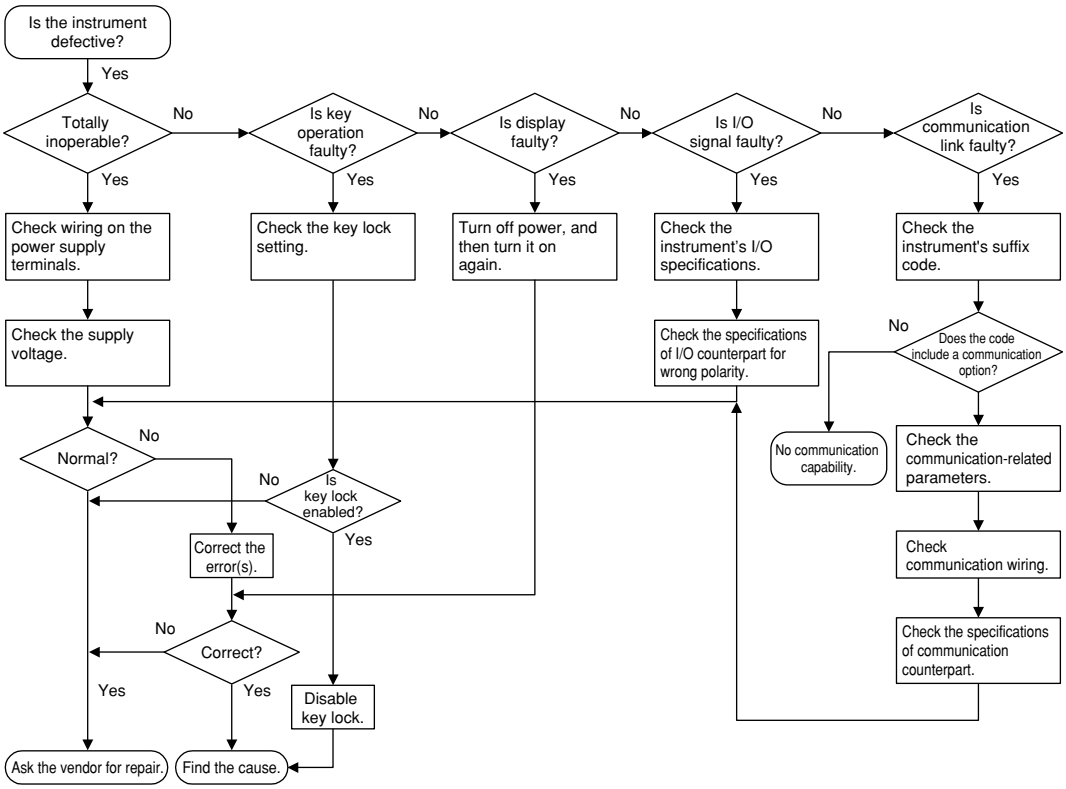
# 5. Troubleshooting and Maintenance

## 5.1 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.

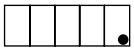



### IMPORTANT

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.

| Display position (Note) | Error indication | Description of error | PV | Control output | Alarm output | Retransmission output | Communication | Remedy |
|---|---|---|---|---|---|---|---|---|
| 1 | E000 | Faulty RAM | None | 0% or less or OFF | OFF | 0% or less | Stopped | Faulty Contact us for repair. |
| | E001 | Faulty ROM | | | | | | |
| | E002 | System data error | Undefined | | Undefined | Undefined | | |
| | PV decimal point blinks.  | Faulty calibration value | Normal action (out of accuracy) | Normal action (out of accuracy) | Normal action (out of accuracy) | Normal action (out of accuracy) | Normal action | |
| 2 | Error code (See description below.) | Parameter error | Normal action | 0% or less or OFF | Normal action | Normal action | | Check and set the initialized parameters. |

Note 1: PV display
2: Setpoint display

An error code is displayed in the event of an error, according to its type.

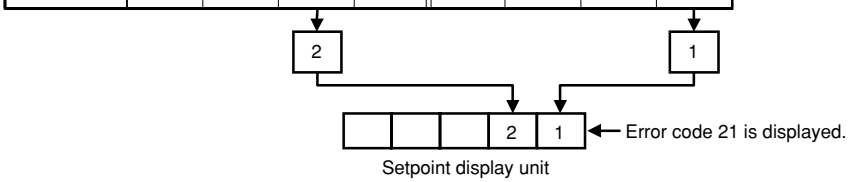
An error code is a two-digit figure in which a combination of 6 bits of on and off is converted into a decimal number.

The following shows the relationship between each bit and parameter to be checked for abnormality.

| Bit No. | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| Parameter to be checked | Operation mode/output | Operating parameters | Setup parameters | Range data | UP mode | Custom computing data | Calibration data |

For example, if an error occurs with the operating parameter and calibration data, the error code will be as follows:

| Bit No. | – | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Error Code | – | $2^2$ | $2^1$ | $2^0$ | $2^3$ | $2^2$ | $2^1$ | $2^0$ |



# ■ Possible Errors during Operation

The following shows possible errors occurring during operations.

| Display position (Note) | Error indication | Description of error | PV | Control output | Alarm output | Retransmis-sion output | Commu-nication | Remedy |
|---|---|---|---|---|---|---|---|---|
| 3 | Displays "RJC" and PV alternately | RJC error | Measured with RJC=0 | Normal action | Normal action | Normal action | Normal action | Faulty<br>Contact us for repair. |
| | E300 | ADC error | 105% | In AUTO:<br>Preset value output<br>In MAN:<br>Normal action | | | | |
| | B.OUT | PV burnout error | Dependent on the BSL parameter<br>Up-scale: 105%<br>Down-scale: -5% | | | | | Check wires and sensor. |
| | OVER or -OVER | Excessive PV<br>Out of -5 to 105% | -5% or 105% | Normal action | | | | Check process. |
| | E200 | Auto-tuning failure<br>(Time-out) | Normal action | Action with PID existing before auto-tuning | | | | Check process. Press any key to erase error indication. |
| 2 | - - - - - | Feedback resistor burnout | | Stopped | | Stopped | | Check the feedback resistor. |
| | Left end of Setpoint display unit blinks. | Faulty communication line | | Normal action | | Normal action | | Check wires and communication parameters, and make resetting. Recovery at normal receipt |
| 1 | Decimal point at right end lights. | Runaway (due to defective power or noise) | Undefined | 0% or less or OFF | OFF | 0% or less | Stopped | Faulty if power off/on does not reset start the unit. Contact us for repair. |
| No display | All indications off | Power off | None | | | | | Check for abnormal power. |

Note 1: PV display
2: Setpoint display
3: Display showing the PV of the corresponding loop

# ■ Remedies if Power Failure Occurs during Operations

The operation status and remedies after a power failure differ with the length of power failure time:

## ● Instantaneous Power Failure of 20 ms or less

A power failure is not detected. Normal operation continues.

## ● Power Failure of about 2 seconds or less

The following show effects caused in "settings" and "operation status."

| | |
|---|---|
| Alarm action | Continues. Alarm with standby function will enter standby status. |
| Settig parameter | Set contents of each parameter are retained. |
| Auto-tuning | Cancelled. |
| Control action | Action before power failure continues. |

### ● Power Failure of more than about 2 seconds

The following show effects caused in “settings” and “operation status.”

| | |
|---|---|
| Alarm action | Continues. Alarm with standby function will enter standby status. |
| Setting parameter | Set contents of each parameter are retained. |
| Auto-tuning | Cancelled. |
| Control action | Differs with setting of setup parameter “R.MD”(restart mode). |

| R.MD setting | Control action after recovery from power failure |
|---|---|
| CONT | Action before power failure continues. (factory-shipped setting) |
| MAN | Outputs preset output value (PO) (NOTE) as control output and continues action set before power failure in MAN mode. |
| RESET | Outputs preset output value (PO) (NOTE) as control output and continues action set before power failure in AUTO mode. Operation mode is set to RESET. |

NOTE : For heating/cooling control, the preset output value is 50% of PID computation.

## ■ 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 Correct Process Variable (PV).

- The UP750 controllers have a universal input.
  The type of PV input can be set/changed using the parameter “IN1”. 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 value. To do this, refer to “2. Initial Settings.”
  With the parameters “RH1”, “RL1”, “SDP1”, “SH1” and “SL1”, 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 UP750 controllers have a universal output.
  The type of control output can be set/changed using the parameter “OT2”.
  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 “MOD1”. In cases where fixed-point control is selected as the PID control mode (MOD1 = 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. Be especially careful when the controller is in the fixed-point control mode; the control output may fail to change and therefore result in a loss of control if you change the target setpoint SP too frequently.

# 5.2 Maintenance

This section describes the cleaning and maintenance of the UP750.

## 5.2.1 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.

## 5.2.2 Replacing Brackets

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

| Target Model | Part No. | Sales Unit |
|---|---|---|
| UP750 | T9115NL | A large bracket and small bracket in pair |

**SEE ALSO**

“1.2 How to Install,” for how to replace brackets.

## 5.2.3 Attaching Terminal Cover

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

| Target Model | Part No. | Sales Unit |
|---|---|---|
| UP750 | T9115YD | 1 |

## ■ Attaching Terminal Cover

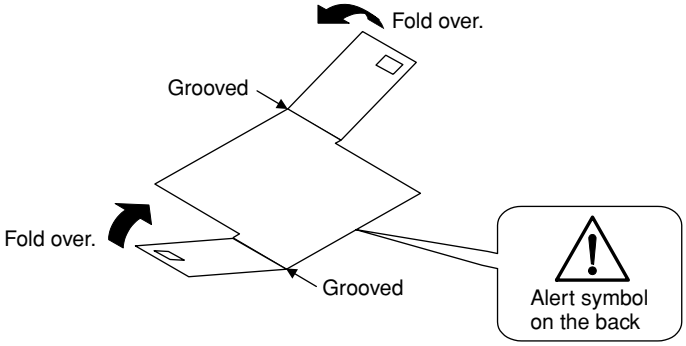
The procedure for attaching the terminal cover is as follows.

**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.**

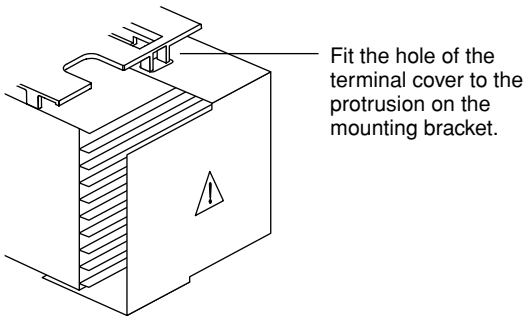



**Folding Direction of Terminal Cover**

**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.**




**Attaching Terminal Cover**

## 5.2.4 Replacing Parts with a Limited Service Life

The following UP750 parts have a limited service life.
The service life given in the table assume that the controller is used under normal operating conditions.

| Part | Service life |
|---|---|
| Aluminum electrolytic condenser | About 10 years (rated) |
| Lithium battery for backup | About 10 years (rated) |
| Alarm output relays | About 100,000 more ON-OFF operations or with resistance load |
| Control output relays | About 100,000 more ON-OFF operations or with resistance load |

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

### SEE ALSO

"5.2.5 Replacing Control Output Relays," for how to replace the control output relays.

## 5.2.5 Replacing Control Output Relays

This subsection describes how to replace the control output relays.

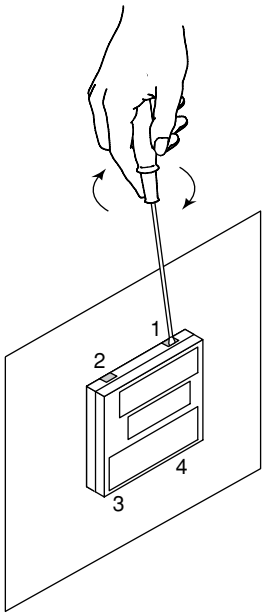
The replacement must be performed by an engineer qualified for the work.

**CAUTION**

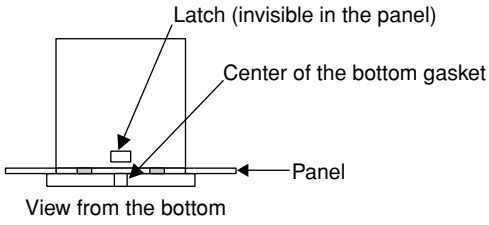
Always turn off the power before starting the work in order to avoid electric shock.

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.**

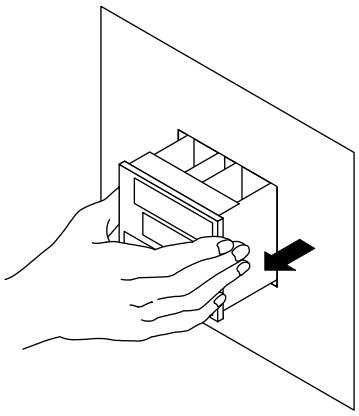



**2. Push up the center of the bottom gasket of bezel by a finger to release the latch.**

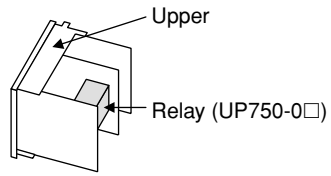


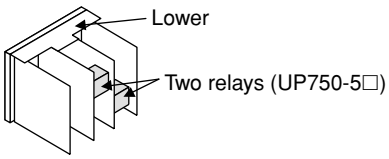
**3.** **Insert the flat-blade screwdriver into the four openings and flip the tip forward to move the bezel more forward.**

**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.**

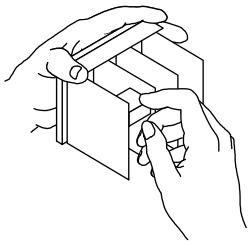


**5.** **The location and number of the relays differ depending on the model code of the UP750. Confirm the location of the control output relay to be replaced before pulling out the relay.**



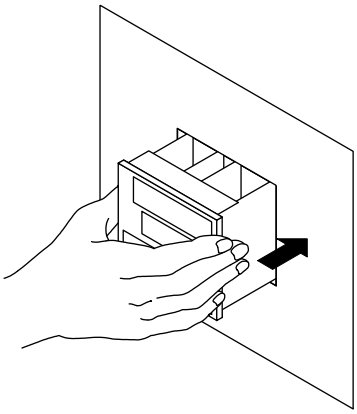

**6.** **Pull out the relay to be replaced.**
**The control output relays are easy to remove and mount, since they are connected via a socket onto the print boards.**



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

| | |
|---|---|
| Manufacturer | OMRON |
| Model | G6B-2114P-FD-US-P6B |
| Power supply | 12 V DC |

**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.

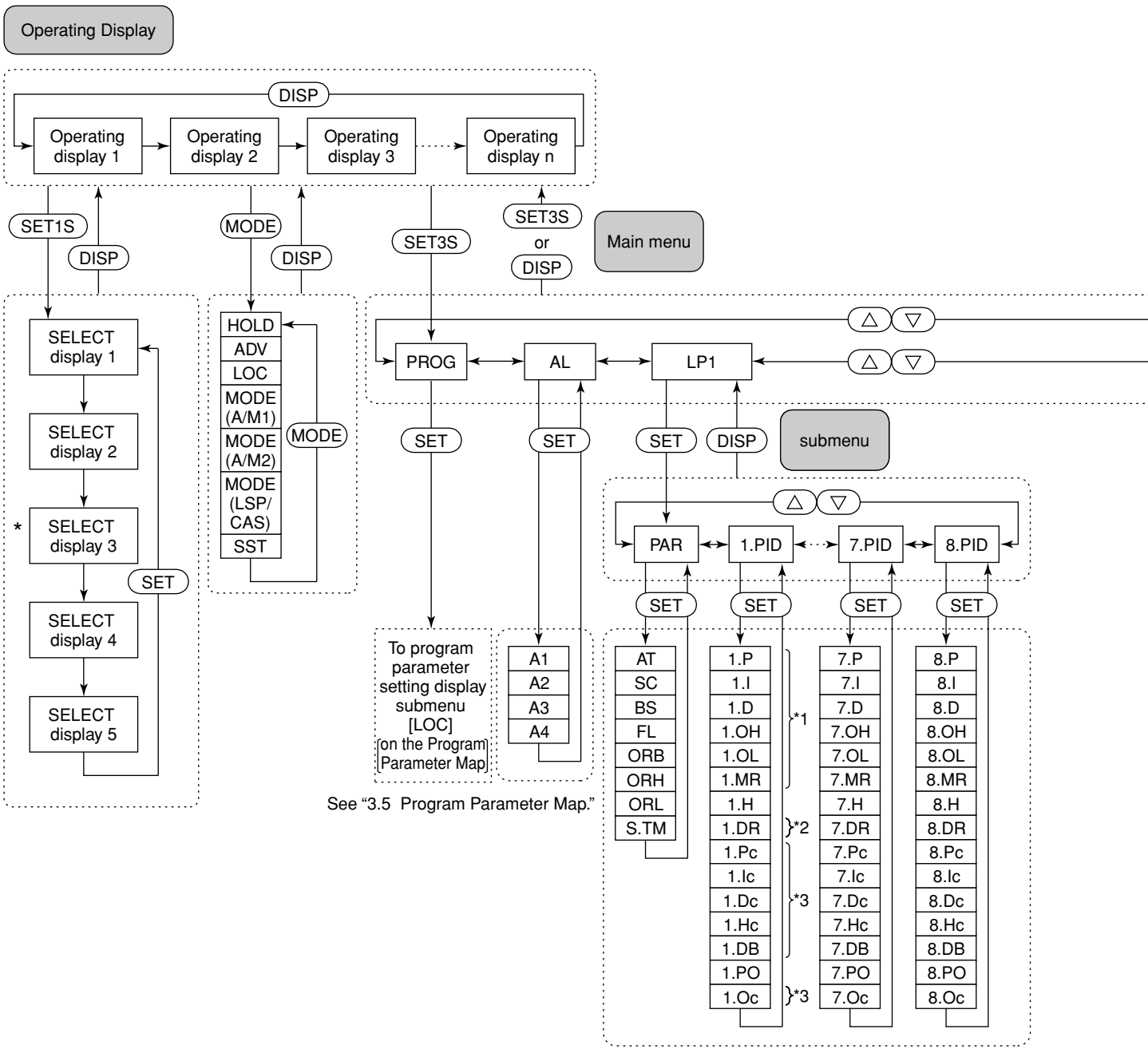
# 6. Parameters

## 6.1 Parameter Map

This section contains “Operating Parameter Map” and “Setup Parameter Map” for UP750 as a guideline for setting parameters.

These maps are helpful in finding the positions of the displays when setting the parameters, and should be used as a quick reference for the entire range of parameter displays.

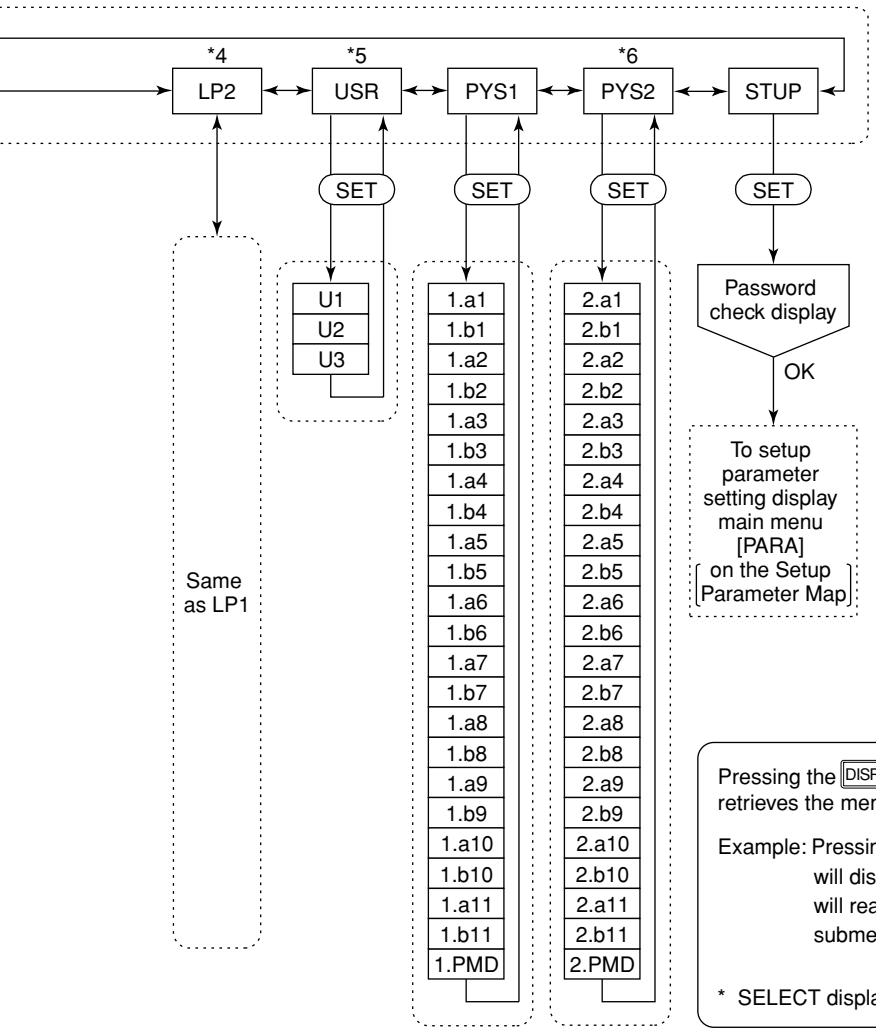
# UP750 Operating Parameter Map




See “3.5 Program Parameter Map.”

*1 Not displayed for ON/OFF control
*2 Not displayed for heating/cooling control
*3 Displayed for heating/cooling control

SET : Press the SET/ENT key once.
MODE : Press the MODE key once.
DISP : Press the DISP key once.
SET1S : Press the SET/ENT key for 1 second.
SET3S : Press the SET/ENT key for 3 seconds.
△ ▽ : Press the △ or ▽ key once.




Pressing the DISP key once when a parameter setting display is shown retrieves the menu of that parameter setting display.

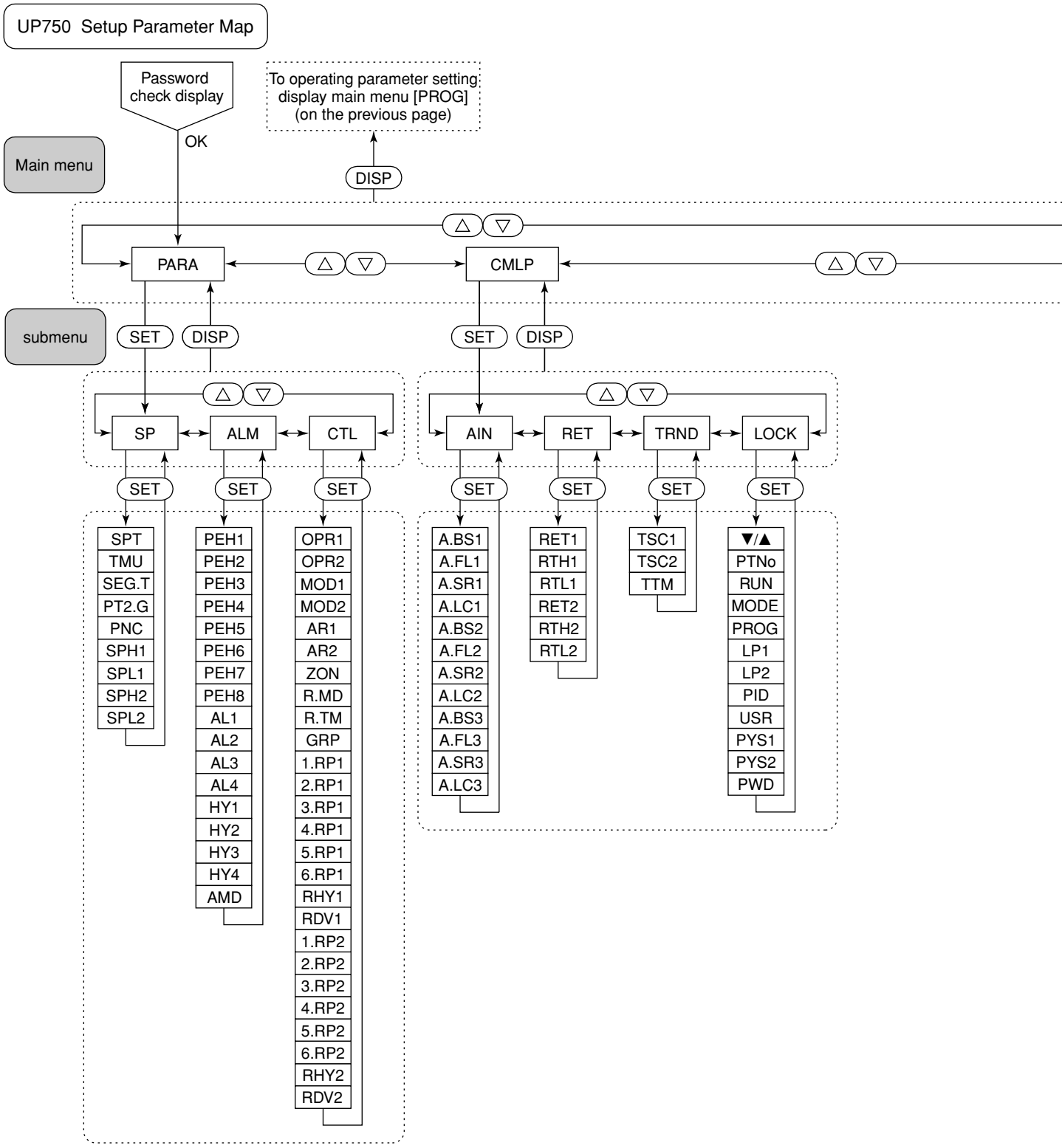
Example: Pressing the DISP key once when the [PAR] submenu is displayed, will display the [LP1] main menu. Conversely, the [PAR] submenu will reappear by pressing the DISP key once when the [PAR] submenu's "FL" parameter display is shown.

* SELECT displays 1 to 5 are shown only when they are registered.

*4 Main menu LP2 is displayed when UP mode is "Cascade control," "Dual-loop control," "Temperature and humidity control," "Cascade control with two universal inputs."

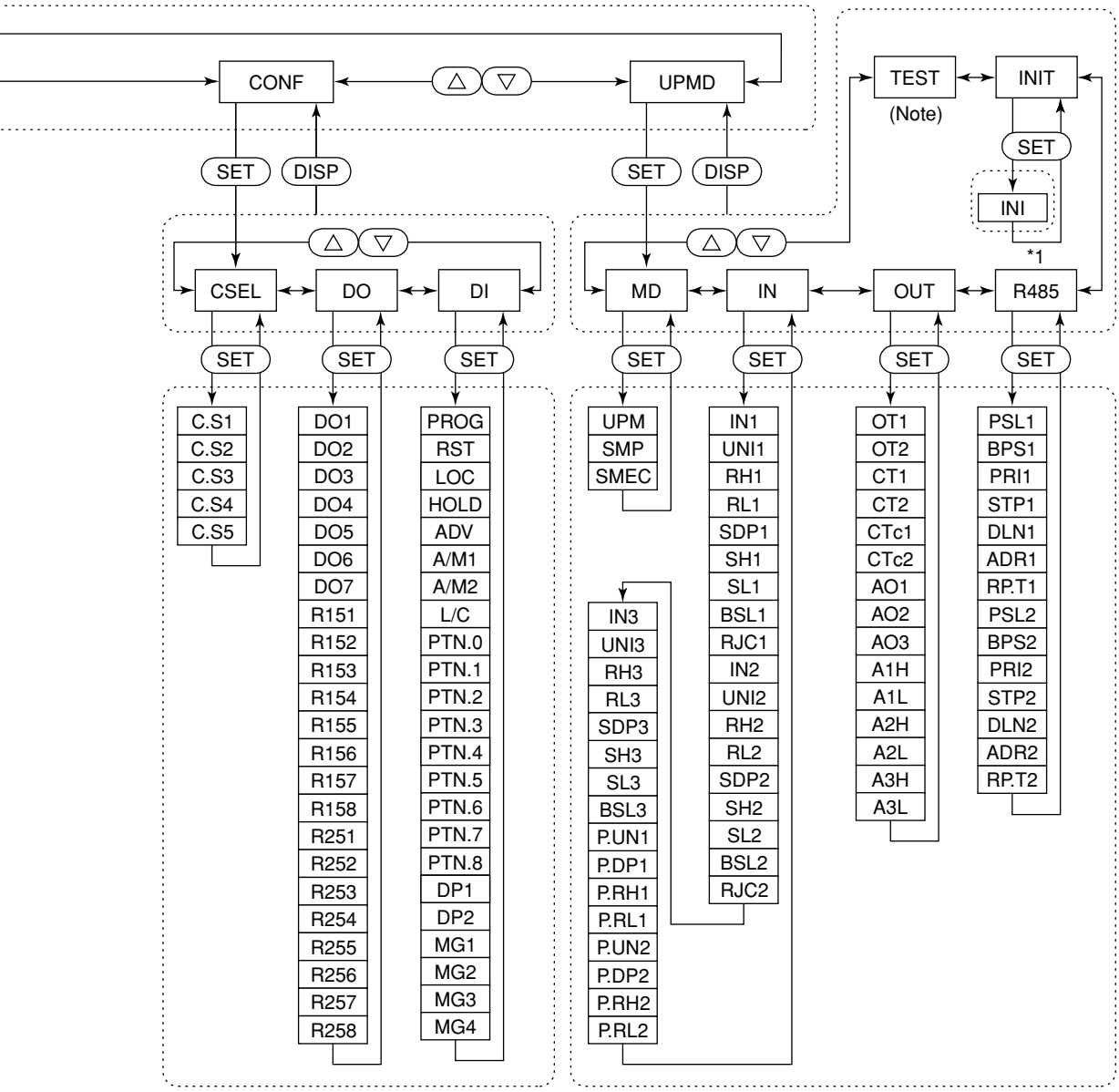
*5 Main menu USR is displayed when UP mode is "Loop control with PV switching," "Loop control with PV auto-selector," "Loop control with PV switching and two universal inputs," "Loop control with PV auto-selector and two universal inputs."

*6 Main menu PYS2 is displayed when UP mode is "Cascade control," "Loop control with PV switching," "Dual-loop control," "Temperature and humidity control," "Cascade control with two universal inputs," "Loop control with PV switching and two universal inputs," "Loop control with PV auto-selector and two universal inputs."




Pressing the DISP key once when a parameter setting display is shown retrieves the submenu of that parameter setting display.

SET : Press the SET/ENT key once.
DISP : Press the DISP key once.
△ ▽ : Press the △ or ▽ key once.




*1 Submenu R485 is displayed only for the controller with communication function.

Note: The parameter items shown on the [TEST] submenu of the setup parameter setting display are to be used by Yokogawa service personnel to check the controller functions. User cannot set or change these parameters.

# 6.2 Lists of Parameters

This section describes the functions of parameters briefly. In addition, each parameter table has a “User Setting” column, where you can record your setpoints when setting them in the controller.

* Parameters relating to PV or program setpoints should all be set in real numbers. For example, use temperature values to define program setpoints and PV event setpoints for temperature input.
* The “User Setting” column in the table is provided for the customer to record setpoints.
* Numbers in ( ) are the parameter setpoints that apply when the communication function is used. ex. AUTO2 (0), MAN2 (1).

## ■ Operation Mode Parameters

**Located in: MODE key (MODE key on the instrument’s front panel)**

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| HOLD | Pause of program operation | Set as “HOLD = ON” to enable the hold mode of program operation. | | |
| ADV | Advance of segment | Set as “ADV = ON” to advance from the current segment to the next segment. | | |
| LOC | Local-mode operation | Set as “LOC = ON” to switch from program operation or RESET mode to local-mode operation. | | |
| A/M2 | AUTO/MAN switching (secondary-loop) | To switch between AUTO and MAN:<br>To switch to AUTO mode, set as “MODE: AUTO2 (0).”<br>To switch to MAN mode, set as “MODE: MAN2 (1).” | | |
| LSP/ CAS | Local/Cascade switching | To switch between Local and Cascade:<br>To switch to Local mode, set as “MODE: LSP (0).”<br>To switch to Cascade mode, set as “MODE: CAS (1).” | | |
| SST | Start-of-program segment number | 1 to 99<br>Program operation begins with the segment whose number is specified by this parameter. | 1 | |

# ■ Operating Parameters

## ● Instrument Alarm Setting Parameters

### Located in: Main menu = AL

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| A1 | Instrument alarm-1 setpoint | Allows alarm action to be set irrespective of the program.<br>PV alarm / SP alarm: -100.0 to 100.0% of PV input range<br>Deviation alarm: -100.0 to 100.0% of PV input range span<br>Output alarm: -5.0 to 105.0% | PV high limit/SP high limit alarm: 100.0% of PV input range<br>Deviation alarm: 0.0% of PV input range span<br>Other PV/SP low limit alarm: 0.0% of PV input range<br>Output high limit alarm: 100.0%<br>Output low limit alarm: 0.0% | |
| A2 | Instrument alarm-2 setpoint | | | |
| A3 | Instrument alarm-3 setpoint | | | |
| A4 | Instrument alarm-4 setpoint | | | |

The following parameter is for cascade primary-loop.

## ● Operation-related Parameters

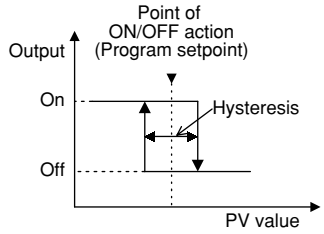
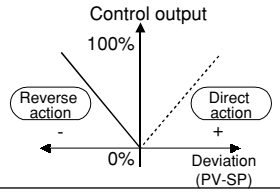
### Located in: Main menu = LP1 ; Submenu = PAR

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| AT | Auto-tuning | OFF (0): No auto-tuning<br>1: Auto-tuning for 1st group of PID 2: Auto-tuning for 2nd group of PID<br>3: Auto-tuning for 3rd group of PID 4: Auto-tuning for 4th group of PID<br>5 to 8: Perform auto-tuning on a group basis in the same way as 1 to 4<br>9: Performs auto-tuning to all groups 1 to 8. | OFF (0) | |
| SC | "SUPER" function | OFF (0): Disable<br>1: Overshoot suppressing function<br>Suppresses overshoots generated by abrupt changes in the target setpoint or by disturbances.<br>2: Hunting suppressing function (Stable mode)<br>Suitable to stabilize the state of control when the load varies greatly, or the target setpoint is changed.<br>Enables to answer the wider characteristic changes compared with Response mode.<br>3: Hunting suppressing function (Response mode)<br>Enables quick follow-up and short converging time of PV for the changed target setpoint.<br><br>Note: Use "SUPER" function (SC) 2 or 3 in PID control or PI control.<br>"SUPER" function 2 or 3 is not available in the following controls:<br>1) ON/OFF control<br>2) P control (control for proportional band only)<br>3) PD control (control for proportional band and derivative item only)<br>4) Heating/cooling control<br>Do not use hunting suppressing function when control processes with response such as flow or pressure control. | OFF (0) | |
| BS | PV input bias | -100.0% to 100.0% of primary PV input range span<br>Used to correct the PV input value. | 0.0% of primary PV input range span | |
| FL | PV input filter | OFF (0), 1 to 120 sec.<br>Used when the PV input value fluctuates. | OFF (0) | |
| ORB | ON/OFF rate detection band | 0.0 to 100.0% of primary PV input range span | 1.0% of primary PV input range span | |
| ORH | ON/OFF rate high limit | ORL + 1 digit to 105.0% | 100.0% | |
| ORL | ON/OFF rate low limit | -5.0% to ORH - 1 digit | 0.0% | |
| S.TM | Starting time of program pattern operation | 0.00 to 99.59 ("hour, minute" or "minute, second")<br>The controller begins control when the specified time has passed after power-on. | 0.00 | |

The following parameter is for cascade primary-loop.

## ● PID-related Parameters

### Located in: Main menu = LP1 ; Submenu = 1.PID

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| 1.P | Proportional band | 0.1 to 999.9% of PV input range | 5.0% | |
| 1.I | Integral time | OFF (0), 1 to 6000 sec. | 240 sec. | |
| 1.D | Derivative time | OFF (0), 1 to 6000 sec. | 60 sec. | |
| 1.OH | Output high limit | -5.0 to 105.0% (1.OL < 1.OH) | 100% | |
| 1.OL | Output low limit | -5.0 to 105.0%<br>(1.OL < 1.OH)<br>SD (shutdown): Set in manual operation in 4-20 mA control output. Output is 0 mA. | 0.0% | |
| 1.MR | Manual reset | -5.0 to 105.0%<br>(enabled when integral time "1.I" is OFF)<br>The manual reset value equals the output value when PV = SP is true. For example, if the manual reset value is 50%, the output value is 50% when PV = SP becomes true. | 50.0% | |
| 1.H | ON/OFF control hysteresis | In ON/OFF control: 0.0 to 100.0% of PV input range span<br><br>Hysteresis can be set in the program setpoint when the controller is performing ON/OFF control.<br>  <br> | ON/OFF control: 0.5% of PV input range span | |
| 1.DR | Direct/reverse action switching | REVERSE (0): reverse action, DIRECT (1): direct action<br>  <br> | REVERSE (0) | |
| 1.PO | Preset output | -5.0 to 105.0%<br>In RESET mode, fixed control output can be generated. | 0.0% | |

If you are using two or more groups of PID parameters, use the following table to record their values.

| Parameter | n=2 | n=3 | n=4 | n=5 | n=6 | n=7 | n=8 |
|---|---|---|---|---|---|---|---|
| n.P | | | | | | | |
| n.I | | | | | | | |
| n.D | | | | | | | |
| n.OH | | | | | | | |
| n.OL | | | | | | | |
| n.MR | | | | | | | |
| n.H | | | | | | | |
| n.DR | | | | | | | |
| n.PO | | | | | | | |

The following parameter is for cascade secondary-loop.

## ● Operation-related Parameters

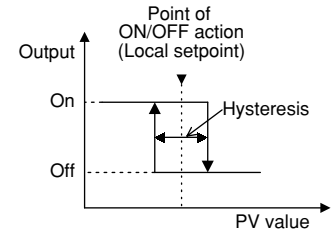
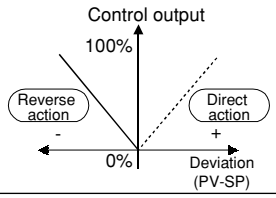
### Located in: Main menu = LP2 ; Submenu = PAR

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| AT | Auto-tuning | OFF (0): No auto-tuning<br>1: Auto-tuning for 1st group of PID 2: Auto-tuning for 2nd group of PID<br>3: Auto-tuning for 3rd group of PID 4: Auto-tuning for 4th group of PID<br>5 to 8: Perform auto-tuning on a group basis in the same way as 1 to 4<br>9: Performs auto-tuning to all groups 1 to 8. | OFF (0) | |
| SC | "SUPER" function | OFF (0): Disable<br>1: Overshoot suppressing function<br>Suppresses overshoots generated by abrupt changes in the target setpoint or by disturbances.<br>2: Hunting suppressing function (Stable mode)<br>Suitable to stabilize the state of control when the load varies greatly, or the target setpoint is changed.<br>Enables to answer the wider characteristic changes compared with Response mode.<br>3: Hunting suppressing function (Response mode)<br>Enables quick follow-up and short converging time of PV for the changed target setpoint.<br><br>Note: Use "SUPER" function (SC) 2 or 3 in PID control or PI control.<br>"SUPER" function 2 or 3 is not available in the following controls:<br>1) ON/OFF control<br>2) P control (control for proportional band only)<br>3) PD control (control for proportional band and derivative item only)<br>4) Heating/cooling control<br>Do not use hunting suppressing function when control processes with response such as flow or pressure control. | OFF (0) | |
| BS | PV input bias | -100.0% to 100.0% of secondary PV input range span<br>Used to correct the PV input value. | 0.0% of secondary PV input range span | |
| FL | PV input filter | OFF (0), 1 to 120 sec.<br>Used when the PV input value fluctuates. | OFF (0) | |
| ORB | ON/OFF rate detection band | 0.0 to 100.0% of secondary PV input range span | 1.0% of secondary PV input range span | |
| ORH | ON/OFF rate high limit | ORL + 1 digit to 105.0% | 100.0% | |
| ORL | ON/OFF rate low limit | -5.0% to (ORH - 1 digit) | 0.0% | |
| S.TM | Starting time of program pattern operation | 0.00 to 99.59 ("hour, minute" or "minute, second")<br>The controller begins control when the specified time has passed after power-on. | 0.00 | |

The following parameter is for cascade secondary-loop.

## ● PID-related Parameters

### Located in: Main menu = LP2 ; Submenu = 1.PID

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| 1.P | Proportional band/Heating-side proportional band (in heating/cooling control) | 0.1 to 999.9% of secondary PV input range<br>In heating/cooling control: 0.0 to 999.9%<br>(heating-side on/off control applies when 0.0) | 5.0% | |
| 1.I | Integral time<br>Heating-side integral time<br>(in heating/cooling control) | OFF (0), 1 to 6000 sec. | 240 sec. | |
| 1.D | Derivative time<br>Heating-side derivative time<br>(in heating/cooling control) | OFF (0), 1 to 6000 sec. | 60 sec. | |
| 1.OH | Output high limit<br>Heating-side output high limit<br>(in heating/cooling control) | -5.0 to 105.0%<br>Heating-side limiter in heating/cooling control:<br>0.0 to 105.0% (1.OL < 1.OH) | 100%<br>Heating/cooling control: 100.0% | |
| 1.OL | Output low limit<br>Cooling-side output high limit (in heating/cooling control) | -5.0 to 105.0%<br>Cooling-side limiter in heating/cooling control:<br>0.0 to 105.0% (1.OL < 1.OH)<br>SD (shutdown): Set in manual operation in 4-20 mA control output. Output is 0 mA. | 0.0%<br>Heating/cooling control: 100.0% | |
| 1.MR | Manual reset | -5.0 to 105.0%<br>(enabled when integral time "1.I" is OFF)<br>The manual reset value equals the output value when PV = SP is true. For example, if the manual reset value is 50%, the output value is 50% when PV = SP becomes true. | 50.0% | |
| 1.H | ON/OFF control hysteresis<br>Heating-side ON/OFF control hysteresis<br>(in heating/cooling control) | In ON/OFF control: 0.0 to 100.0% of secondary PV input range span<br>In heating/cooling control: 0.0 to 100.0%<br><br>Hysteresis can be set in the local setpoint when the controller is performing ON/OFF control.<br>  <br> | ON/OFF control: 0.5% of secondary PV input range span<br>Heating/cooling control: 0.5% | |
| 1.DR | Direct/reverse action switching | REVERSE (0): reverse action, DIRECT (1): direct action<br>  <br> | REVERSE (0) | |
| 1.Pc | Cooling-side proportional band | 0.0 to 999.9% of secondary PV input range<br>(Cooling-side ON/OFF control applies when 0.0) | 5.0% | |
| 1.Ic | Cooling-side integral time | OFF, 1 to 6000 sec. | 240 sec. | |
| 1.Dc | Cooling-side derivative time | OFF, 1 to 6000 sec. | 60 sec. | |
| 1.Hc | Cooling-side ON/OFF control hysteresis | 0.0 to 100.0% | 0.5% | |

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| 1.DB | Dead band | In heating/cooling control: -100.0 to 50.0%<br>• When performing heating/cooling control: setting any positive value prohibits both the heating and cooling outputs from turning on; setting any negative value allows both the heating and cooling outputs to turn on; and setting a value of zero either the heating or cooling output to turn on. | 3.0% | |
| 1.PO | Preset output/Heating-side preset output (in heating/cooling control) | -5.0 to 105.0%<br>In RESET mode, fixed control output can be generated.<br>In heating/cooling control: Heating-side 0.0 to 105.0% | 0.0% | |
| 1.Oc | Cooling-side preset output | 0.0 to 105.0%<br>In RESET mode, cooling-side fixed control output can be generated. | 0.0% | |

If you are using two or more groups of PID parameters, use the following table to record their values.

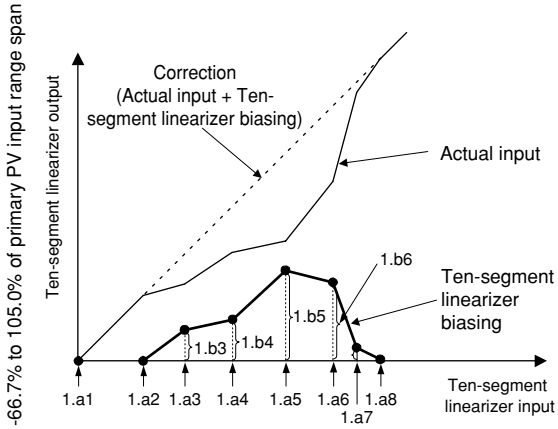
| Parameter | n=2 | n=3 | n=4 | n=5 | n=6 | n=7 | n=8 |
|---|---|---|---|---|---|---|---|
| n.P | | | | | | | |
| n.I | | | | | | | |
| n.D | | | | | | | |
| n.OH | | | | | | | |
| n.OL | | | | | | | |
| n.MR | | | | | | | |
| n.H | | | | | | | |
| n.DR | | | | | | | |
| n.Pc | | | | | | | |
| n.Ic | | | | | | | |
| n.Dc | | | | | | | |
| n.Hc | | | | | | | |
| n.DB | | | | | | | |
| n.PO | | | | | | | |
| n.Oc | | | | | | | |

The following parameter is for cascade primary-loop.

## ● Ten-segment Linearizer 1 Parameters

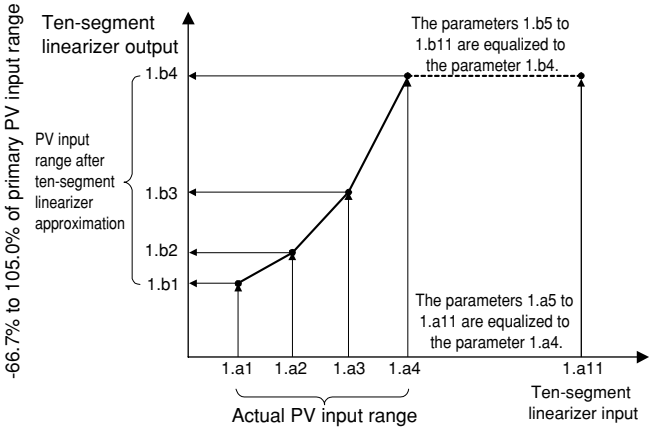
### Located in: Main menu = PYS1

- Ten-segment linearizer biasing (factory-set default)




-66.7% to 105.0% of primary PV input range

- Ten-segment linearizer approximation




-66.7% to 105.0% of primary PV input range

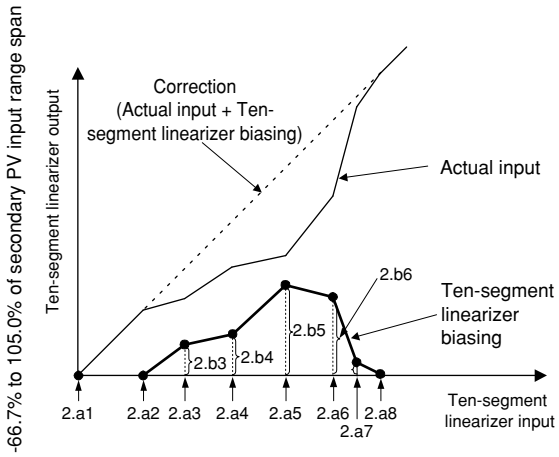
| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| 1.a1 | Ten-segment linearizer 1 input-1 | -66.7% to 105.0% of primary PV input range | 0.0% of primary PV input range | |
| 1.b1 | Ten-segment linearizer 1 output-1 | -66.7% to 105.0% of primary PV input range span<br>-66.7% to 105.0% of primary PV input range when in ten-segment linearizer approximation | 0.0% of primary PV input range span<br>0.0% of primary PV input range when in ten-segment linearizer approximation | |
| 1.a2 | Ten-segment linearizer 1 input-2 | -66.7% to 105.0% of primary PV input range | 0.0% of primary PV input range | |
| 1.b2 | Ten-segment linearizer 1 output-2 | -66.7% to 105.0% of primary PV input range span<br>-66.7% to 105.0% of primary PV input range when in ten-segment linearizer approximation | 0.0% of primary PV input range span<br>0.0% of primary PV input range when in ten-segment linearizer approximation | |
| 1.a3 | Ten-segment linearizer 1 input-3 | -66.7% to 105.0% of primary PV input range | 0.0% of primary PV input range | |
| 1.b3 | Ten-segment linearizer 1 output-3 | -66.7% to 105.0% of primary PV input range span<br>-66.7% to 105.0% of primary PV input range when in ten-segment linearizer approximation | 0.0% of primary PV input range span<br>0.0% of primary PV input range when in ten-segment linearizer approximation | |
| 1.a4 | Ten-segment linearizer 1 input-4 | -66.7% to 105.0% of primary PV input range | 0.0% of primary PV input range | |
| 1.b4 | Ten-segment linearizer 1 output-4 | -66.7% to 105.0% of primary PV input range span<br>-66.7% to 105.0% of primary PV input range when in ten-segment linearizer approximation | 0.0% of primary PV input range span<br>0.0% of primary PV input range when in ten-segment linearizer approximation | |
| 1.a5 | Ten-segment linearizer 1 input-5 | -66.7% to 105.0% of primary PV input range | 0.0% of primary PV input range | |
| 1.b5 | Ten-segment linearizer 1 output-5 | -66.7% to 105.0% of primary PV input range span<br>-66.7% to 105.0% of primary PV input range when in ten-segment linearizer approximation | 0.0% of primary PV input range span<br>0.0% of primary PV input range when in ten-segment linearizer approximation | |
| 1.a6 | Ten-segment linearizer 1 input-6 | -66.7% to 105.0% of primary PV input range | 0.0% of primary PV input range | |
| 1.b6 | Ten-segment linearizer 1 output-6 | -66.7% to 105.0% of primary PV input range span<br>-66.7% to 105.0% of primary PV input range when in ten-segment linearizer approximation | 0.0% of primary PV input range span<br>0.0% of primary PV input range when in ten-segment linearizer approximation | |
| 1.a7 | Ten-segment linearizer 1 input-7 | -66.7% to 105.0% of primary PV input range | 0.0% of primary PV input range | |
| 1.b7 | Ten-segment linearizer 1 output-7 | -66.7% to 105.0% of primary PV input range span<br>-66.7% to 105.0% of primary PV input range when in ten-segment linearizer approximation | 0.0% of primary PV input range span<br>0.0% of primary PV input range when in ten-segment linearizer approximation | |
| 1.a8 | Ten-segment linearizer 1 input-8 | -66.7% to 105.0% of primary PV input range | 0.0% of primary PV input range | |
| 1.b8 | Ten-segment linearizer 1 output-8 | -66.7% to 105.0% of primary PV input range span<br>-66.7% to 105.0% of primary PV input range when in ten-segment linearizer approximation | 0.0% of primary PV input range span<br>0.0% of primary PV input range when in ten-segment linearizer approximation | |
| 1.a9 | Ten-segment linearizer 1 input-9 | -66.7% to 105.0% of primary PV input range | 0.0% of primary PV input range | |
| 1.b9 | Ten-segment linearizer 1 output-9 | -66.7% to 105.0% of primary PV input range span<br>-66.7% to 105.0% of primary PV input range when in ten-segment linearizer approximation | 0.0% of primary PV input range span<br>0.0% of primary PV input range when in ten-segment linearizer approximation | |
| 1.a10 | Ten-segment linearizer 1 input-10 | -66.7% to 105.0% of primary PV input range | 0.0% of primary PV input range | |
| 1.b10 | Ten-segment linearizer 1 output-10 | -66.7% to 105.0% of primary PV input range span<br>-66.7% to 105.0% of primary PV input range when in ten-segment linearizer approximation | 0.0% of primary PV input range span<br>0.0% of primary PV input range when in ten-segment linearizer approximation | |
| 1.a11 | Ten-segment linearizer 1 input-11 | -66.7% to 105.0% of primary PV input range | 0.0% of primary PV input range | |
| 1.b11 | Ten-segment linearizer 1 output-11 | -66.7% to 105.0% of primary PV input range span<br>-66.7% to 105.0% of primary PV input range when in ten-segment linearizer approximation | 0.0% of primary PV input range span<br>0.0% of primary PV input range when in ten-segment linearizer approximation | |
| 1.PMD | Ten-segment linearizer 1 mode | 0: Ten-segment linearizer biasing<br>1: Ten-segment linearizer approximation | 0 | |

The following parameter is for cascade secondary-loop.

## ● Ten-segment Linearizer 2 Parameters

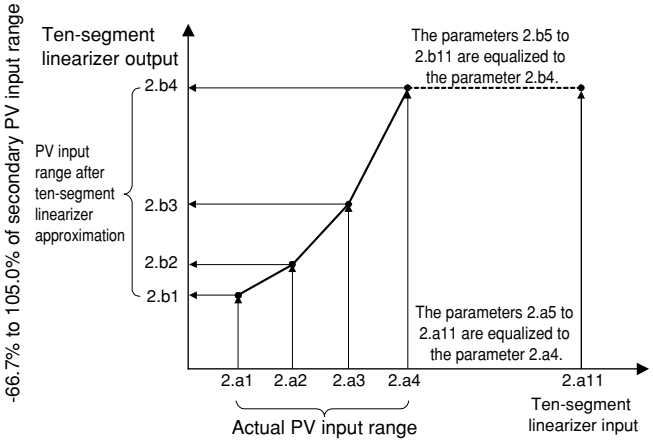
### Located in: Main menu = PYS2

- Ten-segment linearizer biasing (factory-set default)




-66.7% to 105.0% of secondary PV input range

- Ten-segment linearizer approximation




-66.7% to 105.0% of secondary PV input range

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| 2.a1 | Ten-segment linearizer 2 input-1 | -66.7% to 105.0% of secondary PV input range | 0.0% of secondary PV input range | |
| 2.b1 | Ten-segment linearizer 2 output-1 | -66.7% to 105.0% of secondary PV input range span<br>-66.7% to 105.0% of secondary PV input range when in ten-segment linearizer approximation | 0.0% of secondary PV input range span<br>0.0% of secondary PV input range when in ten-segment linearizer approximation | |
| 2.a2 | Ten-segment linearizer 2 input-2 | -66.7% to 105.0% of secondary PV input range | 0.0% of secondary PV input range | |
| 2.b2 | Ten-segment linearizer 2 output-2 | -66.7% to 105.0% of secondary PV input range span<br>-66.7% to 105.0% of secondary PV input range when in ten-segment linearizer approximation | 0.0% of secondary PV input range span<br>0.0% of secondary PV input range when in ten-segment linearizer approximation | |
| 2.a3 | Ten-segment linearizer 2 input-3 | -66.7% to 105.0% of secondary PV input range | 0.0% of secondary PV input range | |
| 2.b3 | Ten-segment linearizer 2 output-3 | -66.7% to 105.0% of secondary PV input range span<br>-66.7% to 105.0% of secondary PV input range when in ten-segment linearizer approximation | 0.0% of secondary PV input range span<br>0.0% of secondary PV input range when in ten-segment linearizer approximation | |
| 2.a4 | Ten-segment linearizer 2 input-4 | -66.7% to 105.0% of secondary PV input range | 0.0% of secondary PV input range | |
| 2.b4 | Ten-segment linearizer 2 output-4 | -66.7% to 105.0% of secondary PV input range span<br>-66.7% to 105.0% of secondary PV input range when in ten-segment linearizer approximation | 0.0% of secondary PV input range span<br>0.0% of secondary PV input range when in ten-segment linearizer approximation | |
| 2.a5 | Ten-segment linearizer 2 input-5 | -66.7% to 105.0% of secondary PV input range | 0.0% of secondary PV input range | |
| 2.b5 | Ten-segment linearizer 2 output-5 | -66.7% to 105.0% of secondary PV input range span<br>-66.7% to 105.0% of secondary PV input range when in ten-segment linearizer approximation | 0.0% of secondary PV input range span<br>0.0% of secondary PV input range when in ten-segment linearizer approximation | |
| 2.a6 | Ten-segment linearizer 2 input-6 | -66.7% to 105.0% of secondary PV input range | 0.0% of secondary PV input range | |
| 2.b6 | Ten-segment linearizer 2 output-6 | -66.7% to 105.0% of secondary PV input range span<br>-66.7% to 105.0% of secondary PV input range when in ten-segment linearizer approximation | 0.0% of secondary PV input range span<br>0.0% of secondary PV input range when in ten-segment linearizer approximation | |
| 2.a7 | Ten-segment linearizer 2 input-7 | -66.7% to 105.0% of secondary PV input range | 0.0% of secondary PV input range | |
| 2.b7 | Ten-segment linearizer 2 output-7 | -66.7% to 105.0% of secondary PV input range span<br>-66.7% to 105.0% of secondary PV input range when in ten-segment linearizer approximation | 0.0% of secondary PV input range span<br>0.0% of secondary PV input range when in ten-segment linearizer approximation | |
| 2.a8 | Ten-segment linearizer 2 input-8 | -66.7% to 105.0% of secondary PV input range | 0.0% of secondary PV input range | |
| 2.b8 | Ten-segment linearizer 2 output-8 | -66.7% to 105.0% of secondary PV input range span<br>-66.7% to 105.0% of secondary PV input range when in ten-segment linearizer approximation | 0.0% of secondary PV input range span<br>0.0% of secondary PV input range when in ten-segment linearizer approximation | |
| 2.a9 | Ten-segment linearizer 2 input-9 | -66.7% to 105.0% of secondary PV input range | 0.0% of secondary PV input range | |
| 2.b9 | Ten-segment linearizer 2 output-9 | -66.7% to 105.0% of secondary PV input range span<br>-66.7% to 105.0% of secondary PV input range when in ten-segment linearizer approximation | 0.0% of secondary PV input range span<br>0.0% of secondary PV input range when in ten-segment linearizer approximation | |
| 2.a10 | Ten-segment linearizer 2 input-10 | -66.7% to 105.0% of secondary PV input range | 0.0% of secondary PV input range | |
| 2.b10 | Ten-segment linearizer 2 output-10 | -66.7% to 105.0% of secondary PV input range span<br>-66.7% to 105.0% of secondary PV input range when in ten-segment linearizer approximation | 0.0% of secondary PV input range span<br>0.0% of secondary PV input range when in ten-segment linearizer approximation | |
| 2.a11 | Ten-segment linearizer 2 input-11 | -66.7% to 105.0% of secondary PV input range | 0.0% of secondary PV input range | |
| 2.b11 | Ten-segment linearizer 2 output-11 | -66.7% to 105.0% of secondary PV input range span<br>-66.7% to 105.0% of secondary PV input range when in ten-segment linearizer approximation | 0.0% of secondary PV input range span<br>0.0% of secondary PV input range when in ten-segment linearizer approximation | |
| 2.PMD | Ten-segment linearizer 2 mode | 0: Ten-segment linearizer biasing<br>1: Ten-segment linearizer approximation | 0 | |

# ■ Setup Parameters

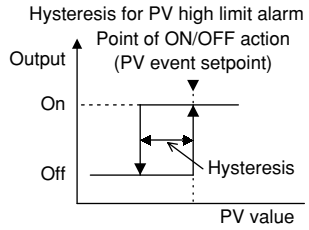
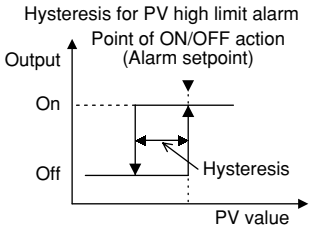
## ● Program Setpoint-related Parameters

### Located in: Main menu = PARA ; Submenu = SP

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| SPT | SP tracking selection | OFF (0), ON (1)<br>Tracking is performed when the mode changes from program to Local (The local setpoint keeps track of the program setpoint.) | OFF (0) | |
| TMU | Program time unit | Sets the time unit of a program.<br>hh:mm (0): “hour, minute”<br>mm:ss (1): “minute, second” | hh:mm (0) | |
| SEG.T | Segment setting method | Defines the method of programming. Note that changing the setpoint of this parameter deletes the program in question.<br>0: Programming by setting segment times<br>1: Programming by setting segment ramps | 0 | |
| PNC | Program pattern number clearance | The controller resets (clears) the program pattern number on the operating display to “0” at the end of program operation.<br>OFF (0): Not cleared.<br>ON (1): Cleared. | OFF (0) | |
| SPH1 | Program setpoint-1 limiter upper limit | Place limits on the program setpoints when the controller is in program operation.<br>0.0% to 100.0% of primary PV input range.<br>Note that SPL1 < SPH1 | 100.0% of primary PV input range | |
| SPL1 | Program setpoint-1 limiter lower limit | | 0.0% of primary PV input range | |
| SPH2 | Program setpoint-2 limiter upper limit | Place limits on the local setpoints when the controller is in local operation.<br>0.0% to 100.0% of secondary PV input range.<br>Note that SPL2 < SPH2 | 100.0% of secondary PV input range | |
| SPL2 | Program setpoint-2 limiter lower limit | | 0.0% of secondary PV input range | |

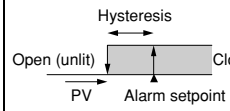
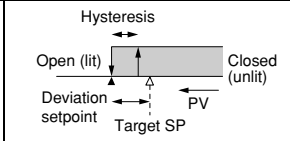
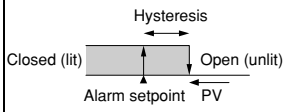
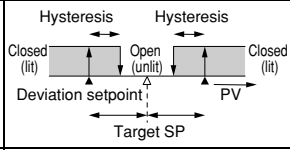
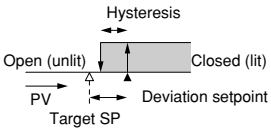
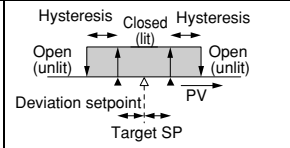
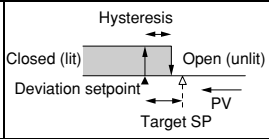
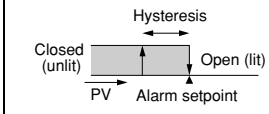
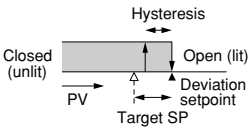
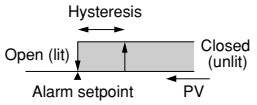
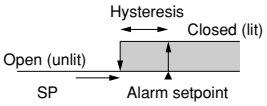
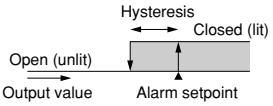
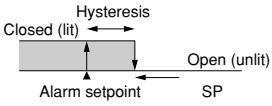
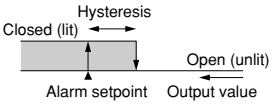
## ● Alarm-related Parameters

### Located in: Main menu = PARA ; Submenu = ALM

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| PEH1 | PV event 1 hysteresis | Allows margins to be set for a PV event setpoint.<br>With the hysteresis settings, it is possible to prevent relays from chattering.<br>  <br><br>0.0 to 100.0% | 0.5% | |
| PEH2 | PV event 2 hysteresis | | | |
| PEH3 | PV event 3 hysteresis | | | |
| PEH4 | PV event 4 hysteresis | | | |
| PEH5 | PV event 5 hysteresis | | | |
| PEH6 | PV event 6 hysteresis | | | |
| PEH7 | PV event 7 hysteresis | | | |
| PEH8 | PV event 8 hysteresis | | | |
| AL1 | Instrument alarm-1 type | OFF (0), primary-loop: 1 to 20, 25 to 31<br>secondary-loop: 41 to 60, 65 to 71<br>1: PV high limit (energized, no stand-by action)<br>2: PV low limit (energized, no stand-by action)<br>3: Deviation high limit (energized, no stand-by action)<br>4: Deviation low limit (energized, no stand-by action)<br>5: Deviation high limit (de-energized, no stand-by action)<br>6: Deviation low limit (de-energized, no stand-by action)<br>For other alarm types, see the next page. | 1 | |
| AL2 | Instrument alarm-2 type | | 2 | |
| AL3 | Instrument alarm-3 type | | 1 | |
| AL4 | Instrument alarm-4 type | | 2 | |
| HY1 | Instrument alarm-1 hysteresis | 0.0 to 100.0% of PV input range span<br>Output alarm: 0.0 to 100.0%<br><br>Allows margins to be set for an alarm setpoint.<br>With the hysteresis settings, it is possible to prevent relays from chattering.<br>  <br> | 0.5% of PV input range span<br>Output alarm: 0.5% | |
| HY2 | Instrument alarm-2 hysteresis | | | |
| HY3 | Instrument alarm-3 hysteresis | | | |
| HY4 | Instrument alarm-4 hysteresis | | | |
| AMD | Alarm mode | Allows the instrument alarm function to be enabled or disabled according to the operating condition.<br>0: Always active<br>1: Not active when in RESET mode<br>2: Not active when in RESET mode or manual operation | 0 | |

## List of Instrument Alarm Types

The table below shows the types and actions of instrument alarm. In the table, codes 1 to 20 and 28 to 31 are for the primary-loop, codes 41 to 60 and 68 to 71 are for the secondary-loop. Codes 1 to 10 and 41 to 50 are not provided with stand-by actions, while codes 11 to 20 and 51 to 60 are provided with stand-by actions.

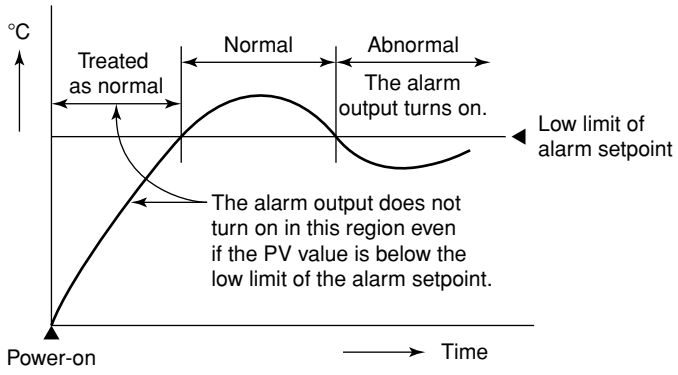
| Alarm type | Alarm action<br>"Open/close" shows status of relay contact, and "lit" and "unlit" shows status of lamp | Alarm type code<br>Contact closes if alarm occurs | Alarm type code<br>Contact opens if alarm occurs | Alarm type | Alarm action<br>"Open/close" shows status of relay contact, and "lit" and "unlit" shows status of lamp | Alarm type code<br>Contact closes if alarm occurs | Alarm type code<br>Contact opens if alarm occurs |
|---|---|---|---|---|---|---|---|
| No alarm | | OFF | | | | | |
| PV high limit |  | 1<br>11<br>41<br>51 | | De-energized on deviation low limit alarm |  | | 6<br>16<br>46<br>56 |
| PV low limit |  | 2<br>12<br>42<br>52 | | Deviation high and low limits |  | 7<br>17<br>47<br>57 | |
| Deviation high limit |  | 3<br>13<br>43<br>53 | | Deviation within high and low limits |  | 8<br>18<br>48<br>58 | |
| Deviation low limit |  | 4<br>14<br>44<br>54 | | De-energized on PV high limit |  | | 9<br>19<br>49<br>59 |
| De-energized on deviation high limit alarm |  | | 5<br>15<br>45<br>55 | De-energized on PV low limit |  | | 10<br>20<br>50<br>60 |
| SP high limit |  | 28<br>68 | | Output high limit |  | 30<br>70 | |
| SP low limit |  | 29<br>69 | | Output low limit |  | 31<br>71 | |

The following alarm types are used only for "Instrument Alarm."

25, 65: Sensor grounding alarm
26, 66: Fault diagnosis output (Note 1)
27, 67: FAIL output (Note 2)

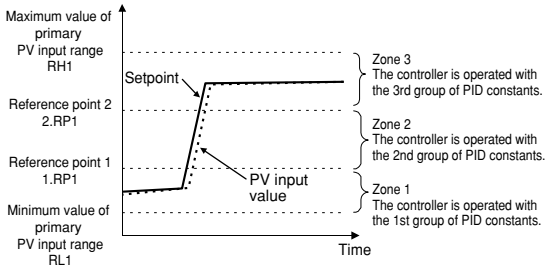
Note 1: The fault diagnosis output turns on in case of input burnout, A/D converter failure, or reference junction compensation (RJC) failure. For input burnout or A/D converter failure, the control output is set to the setpoint of the Preset Output Value operating parameter (PO).
Note 2: The FAIL output is on during normal operation and turns off case failure.

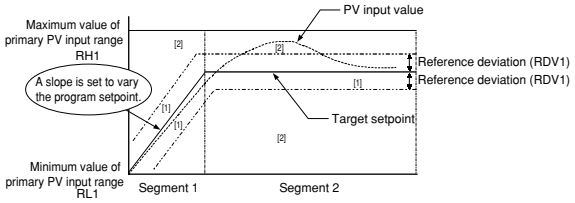
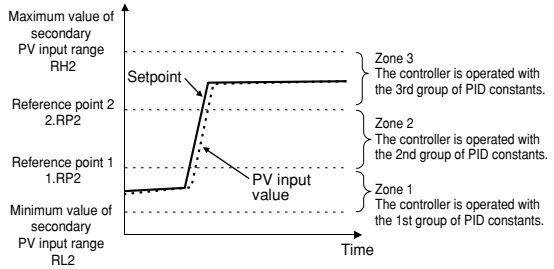
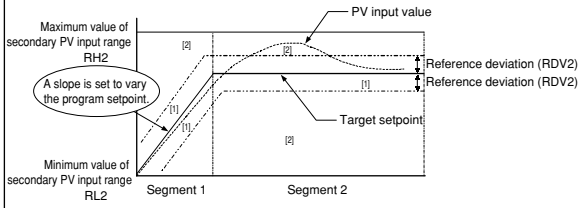
### Stand-by Action



## ● Control Action-related Parameters

### Located in: Main menu = PARA ; Submenu = CTL

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| OPR1 | Output velocity limiter (primary-loop) | OFF (0)<br>0.1 to 100.0%/sec.<br>can limit control output velocity | OFF (0) | |
| OPR2 | Output velocity limiter (secondary-loop) | OFF (0)<br>0.1 to 100.0%/sec.<br>can limit control output velocity | OFF (0) | |
| MOD1 | PID control mode (primary-loop) | 0: Standard PID control (with output bump at SP change)<br>1: Fixed Point control (without output bump at SP change)<br>Choose “Fixed Point Control” when controlling pressure or flow rate. | 0 | |
| MOD2 | PID control mode (secondary-loop) | 0: Standard PID control (with output bump at SP change)<br>1: Fixed Point control (without output bump at SP change)<br>Choose “Fixed Point Control” when controlling pressure or flow rate. | 0 | |
| AR1 | Anti-reset windup (Excess integration prevention) (primary-loop) | AUTO (0), 50.0 to 200.0%<br>The larger Setting, the sooner PID computation (integral computation) stops. Used when the control output travels up to 100% or down to 0% and stays at this point. | AUTO (0) | |
| AR2 | Anti-reset windup (Excess integration prevention) (secondary-loop) | AUTO (0), 50.0 to 200.0%<br>The larger Setting, the sooner PID computation (integral computation) stops. Used when the control output travels up to 100% or down to 0% and stays at this point. | AUTO (0) | |
| ZON | Zone PID selection | 0: Segment PID<br>1: Zone PID<br>If set to “Segment PID,” allows PID constants to be selected for each segment.<br>If set to “Zone PID,” automatically selects PID constants according to the temperature range set in the given Reference Point parameter. | 1 | |
| R.MD | Restart mode | CONT (0): Continues action set before power failure.<br>MAN (1): Starts from manual operation status<br>RESET (2): Continues action set before power failure and starts computation from the preset output value. | CONT (0) | |
| R.TM | Restart timer | 0 to 10 sec.<br>Sets time between power on and the instant where controller starts computation. | 0 sec. | |
| GRP | PID group number | Allows you to determine how many groups of setpoint, alarm and PID parameters the controller should show.<br>1: Show one set. 2: Show two sets.<br>3: Show three sets. 4: Show four sets.<br>5 to 8: Show as many groups of parameters as have been set. | 8 | |
| 1.RP1 | Zone PID reference point-1 (primary-loop) | 0.0 to 100.0% of primary PV input range.<br>Note that 1.RP1 ≦ 2.RP1 ≦ 3.RP1 ≦ 4.RP1 ≦ 5.RP1 ≦ 6.RP1.<br>Sets reference points at which switching is carried out between groups of PID constants according to the given temperature zone. You can set a maximum of six reference points and therefore a maximum of seven temperature zones.<br><br>The example below sets reference points 1 and 2 to provide 3 zones to switch PID constants automatically.<br>  <br> | 100.0% of primary PV input range | |
| 2.RP1 | Zone PID reference point-2 (primary-loop) | | | |
| 3.RP1 | Zone PID reference point-3 (primary-loop) | | | |
| 4.RP1 | Zone PID reference point-4 (primary-loop) | | | |
| 5.RP1 | Zone PID reference point-5 (primary-loop) | | | |
| 6.RP1 | Zone PID reference point-6 (primary-loop) | | | |

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| RHY1 | Zone switching hysteresis (primary-loop) | 0.0 to10.0% of primary PV input range span<br>Allows hysteresis to be set for switching at a reference point. | 0.5% of primary PV input range span | |
| RDV1 | Reference deviation (primary-loop) | Used to select a group of PID parameters according to a deviation from the given program setpoint. The controller uses the PID parameters of the number selected in PID group number (GRP) if the PV input falls outside the given deviation range. The following example shows a case when only the reference deviation is set without setting any reference point.<br>The selected group of PID parameters is as follows.<br>Since region 1 is within the deviation range, the controller uses the 1st group of PID parameters.<br>Since region 2 is outside the deviation range, the controller uses the PID parameters of the number selected in PID group number (GRP).<br>  <br><br>OFF (0): Disable<br>0.0% to 100.0% of primary PV input range span | OFF (0) | |
| 1.RP2 | Zone PID reference point-1 (secondary-loop) | 0.0 to 100.0% of secondary PV input range.<br>Note that 1.RP2 ≦ 2.RP2 ≦ 3.RP2 ≦ 4.RP2 ≦ 5.RP2 ≦ 6.RP2.<br>Sets reference points at which switching is carried out between groups of PID constants according to the given temperature zone. You can set a maximum of six reference points and therefore a maximum of seven temperature zones.<br><br>The example below sets reference points 1 and 2 to provide 3 zones to switch PID constants automatically.<br>  <br> | 100.0% of secondary PV input range | |
| 2.RP2 | Zone PID reference point-2 (secondary-loop) | | | |
| 3.RP2 | Zone PID reference point-3 (secondary-loop) | | | |
| 4.RP2 | Zone PID reference point-4 (secondary-loop) | | | |
| 5.RP2 | Zone PID reference point-5 (secondary-loop) | | | |
| 6.RP2 | Zone PID reference point-6 (secondary-loop) | | | |
| RHY2 | Zone switching hysteresis (secondary-loop) | 0.0 to10.0% of secondary PV input range span<br>Allows hysteresis to be set for switching at a reference point. | 0.5% of secondary PV input range span | |
| RDV2 | Reference deviation (secondary-loop) | Used to select a group of PID parameters according to a deviation from the given program setpoint. The controller uses the PID parameters of the number selected in PID group number (GRP) if the PV input falls outside the given deviation range. The following example shows a case when only the reference deviation is set without setting any reference point.<br>The selected group of PID parameters is as follows.<br>Since region 1 is within the deviation range, the controller uses the 1st group of PID parameters.<br>Since region 2 is outside the deviation range, the controller uses the PID parameters of the number selected in PID group number (GRP).<br>  <br><br>OFF (0): Disable<br>0.0% to 100.0% of secondary PV input range span | OFF (0) | |

## ● Analog Input Computation Parameters

### Located in: Main menu = CMLP ; Submenu = AIN

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| A.BS1 | Analog input-1 bias | Used to correct the primary PV input value beforehand.<br>When in normal operation, use the PV Input Bias (BS) operating parameter.<br>-100.0% to 100.0% of primary PV input range span | 0.0% of primary PV input range span | |
| A.FL1 | Analog input-1 filter | OFF (0): Disable<br>1 to 120 sec. | OFF (0) | |
| A.SR1 | Analog input-1 square-root computation | Performs square-root computation for the primary PV input value.<br>OFF (0): Do not compute the square root<br>ON (1): Compute the square root | OFF (0) | |
| A.LC1 | Analog input-1 low signal cutoff | 0.0% to 5.0%<br>The slope equals “1” at levels below the low-signal cutoff point. | 1.0% | |
| A.BS2 | Analog input-2 bias | Used to correct the secondary PV input value beforehand.<br>When in normal operation, use the PV Input Bias (BS) operating parameter.<br>-100.0% to 100.0% of PV input range span | 0.0% of secondary PV input range span | |
| A.FL2 | Analog input-2 filter | OFF (0): Disable<br>1 to 120 sec. | OFF (0) | |
| A.SR2 | Analog input-2 square-root computation | Performs square-root computation for the secondary PV input value.<br>OFF (0): Do not compute the square root<br>ON (1): Compute the square root | OFF (0) | |
| A.LC2 | Analog input-2 low signal cutoff | 0.0% to 5.0%<br>The slope equals “1” at levels below the low-signal cutoff point. | 1.0% | |
| A.BS3 | Although not used in cascade control with two universal inputs, it is shown on the display. | | | |
| A.FL3 | Although not used in cascade control with two universal inputs, it is shown on the display. | | | |
| A.SR3 | Although not used in cascade control with two universal inputs, it is shown on the display. | | | |
| A.LC3 | Although not used in cascade control with two universal inputs, it is shown on the display. | | | |

## ● Retransmission Output Parameters

### Located in: Main menu = CMLP ; Submenu = RET

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| RET1 | Retransmission output-1 type | OFF (0): Disable<br>1: PV1, 2: SP1, 3: OUT1, 4: LPS loop power supply (15 V), 5: PV2, 6: SP2, 7: OUT2<br>Retransmission output 1 is always provided via terminals 14 and 15.<br><br>In heating/cooling control, an output value before allocation to heating/cooling control is transmitted if setpoint "7" is selected.<br>(0% to 50%: Cooling-side output; 50% to 100%: Heating-side output) | 1 | |
| RTH1 | Maximum value of retransmission output-1 scale | RET1=1, 2: RTL1 + 1 digit to 100.0% of PV input range<br>RET1=3: RTL1 + 1 digit to 100.0% | 100.0% of PV input range | |
| RTL1 | Minimum value of retransmission output-1 scale | RET1=1, 2: 0.0% of PV input range to RTH1 - 1 digit<br>RET1=3: 0.0% to RTH1 - 1 digit | 0.0% of PV input range | |
| RET2 | Retransmission output-2 type | Retransmission output-2 is available when the type of control output is not "current" or "voltage pulse." The output is provided via terminals 16 and 17.<br>OFF (0): Disable<br>1: PV1, 2: SP1, 3: OUT1, 4: LPS loop power supply (15 V), 5: PV2, 6: SP2, 7: OUT2<br><br>In heating/cooling control, an output value before allocation to heating/cooling control is transmitted if setpoint "7" is selected.<br>(0% to 50%: Cooling-side output; 50% to 100%: Heating-side output) | OFF (0) | |
| RTH2 | Maximum value of retransmission output-2 scale | RET2=1, 2: RTL2 + 1 digit to 100.0% of PV input range<br>RET2=3: RTL2 + 1 digit to 100.0% | 100.0% of PV input range | |
| RTL2 | Minimum value of retransmission output-2 scale | RET2=1, 2: 0.0% of PV input range to RTH2 - 1 digit<br>RET2=3: 0.0% to RTH2 - 1 digit | 0.0% of PV input range | |

## ● Deviation Trend Parameters

### Located in: Main menu = CMLP ; Submenu = TRND

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| TSC1 | Deviation trend scale (primary-loop) | Allows the deviation axis of the Deviation Trend operating display to be rescaled.<br>0.1 to 100.0% of primary PV input range span | 0.5% of primary PV input range span | |
| TSC2 | Deviation trend scale (secondary-loop) | Allows the deviation axis of the Deviation Trend operating display to be rescaled.<br>0.1 to 100.0% of secondary PV input range span | 0.5% of secondary PV input range span | |
| TTM | Deviation trend time | Allows the time axis of the Deviation Trend operating display to be rescaled.<br>1 to 600 sec. | 5 sec. | |

## ● Security-related Parameters

### Located in: Main menu = CMLP ; Submenu = LOCK

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| ▼/▲ | Locking of front panel up/down keys (▲and▼) | OFF (0): Unlock<br>ON (1): Lock | OFF (0) | |
| PTNo | Locking of front panel PT.No key | OFF (0): Unlock<br>ON (1): Lock | OFF (0) | |
| RUN | Locking of front panel RUN key | OFF (0): Unlock<br>ON (1): Lock | OFF (0) | |
| MODE | Locking of front panel MODE key | OFF (0): Unlock<br>ON (1): Lock | OFF (0) | |
| PROG | Locking of operating parameter main menu PROG display | OFF (0): Unlock<br>ON (1): Lock | OFF (0) | |
| LP1 | Operating parameter main menu [LP1] lock | OFF (0): Unlock<br>ON (1): Lock | OFF (0) | |
| LP2 | Operating parameter main menu [LP2] lock | OFF (0): Unlock<br>ON (1): Lock | OFF (0) | |
| PID | Operating parameter submenu [PID] lock | OFF (0): Unlock<br>ON (1): Lock | OFF (0) | |
| USR | Although not used in cascade control with two universal inputs, it is shown on the display. | | | |
| PYS1 | Operating parameter main menu [PYS1] lock | OFF (0): Unlock<br>ON (1): Lock | OFF (0) | |
| PYS2 | Operating parameter main menu [PYS2] lock | OFF (0): Unlock<br>ON (1): Lock | OFF (0) | |
| PWD | Password setting | 0: Password not set<br>1 to 30000<br>Note: If a password is set, the setup parameters cannot be displayed without entering the correct password. | 0 | |

## ● SELECT Display Parameters

### Located in: Main menu = CONF ; Submenu = CSEL

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| C.S1 | SELECT display-1 registration | OFF (0), 101 to 1023<br>Select the desired parameter from among the operating and setup parameters, then register the number (D register No.) accompanying that parameter.<br>For example, registering “231” for C.S1 allows you to change instrument alarm-1 setpoint in operating display.<br>Numbers for registering instrument alarm SP parameter for operating display:<br>Instrument alarm-1 setpoint: 231<br>Instrument alarm-2 setpoint: 232<br>Instrument alarm-3 setpoint: 233<br>Instrument alarm-4 setpoint: 234 | OFF (0) | |
| C.S2 | SELECT display-2 registration | | | |
| C.S3 | SELECT display-3 registration | | | |
| C.S4 | SELECT display-4 registration | | | |
| C.S5 | SELECT display-5 registration | | | |

## ● Contact Output Registration Parameters

### Located in: Main menu = CONF ; Submenu = DO

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| DO1 | Relay output flag registration for DO1 | The following setpoints are registration numbers for cascade control with two universal inputs only.<br>5705: PV event 1 output 0: No function<br>5706: PV event 2 output<br>5689: Instrument alarm 1 output<br>5129: Time event 1 output<br>5130: Time event 2 output<br>5131: Time event 3 output<br>5133: Time event 4 output<br><br>See “External contact output” in “1.5 Terminal Wiring Diagrams.” | 5705 | |
| DO2 | Relay output flag registration for DO2 | | 5706 | |
| DO3 | Relay output flag registration for DO3 | | 5689 | |
| DO4 | Open-collector transistor output flag registration for DO4 | | 5129 | |
| DO5 | Open-collector transistor output flag registration for DO5 | | 5130 | |
| DO6 | Open-collector transistor output flag registration for DO6 | | 5131 | |
| DO7 | Open-collector transistor output flag registration for DO7 | | 5133 | |

## ● Contact Input Registration Parameters

### Located in: Main menu = CONF ; Submenu = DI

<table>
<tr><th>Parameter Symbol</th><th>Name of Parameter</th><th>Setting Range and Description</th><th>Initial Value</th><th>User Setting</th></tr>
<tr><td>PROG</td><td>Start of program operation (When “DIn” changes from OFF to ON)</td><td rowspan="16">These parameters determine which contact input to use to make selections/switches listed on the left.<br>DI1: 5161 No function: 0<br>DI2: 5162<br>DI3: 5163<br>DI4: 5164<br>DI5: 5165<br>DI6: 5166<br>DI7: 5167<br>The contact inputs are factory-set as shown below.<br>Contact inputs 1 to 4 (DI1 to DI4): Program pattern number selection (see below)<br>Contact input 5 (DI5): Start of program operation<br>Contact input 6 (DI6): Stop of program operation<br>Contact input 7 (DI7): LSP/CAS switching<br><br>Program pattern number selection<br><table><tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr><tr><td>DI1</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td></tr><tr><td>DI2</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td></tr><tr><td>DI3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>OFF</td></tr><tr><td>DI4</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td></tr></table><table><tr><th></th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th></tr><tr><td>DI1</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr><tr><td>DI2</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr><tr><td>DI3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>DI4</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr></table>See “External contact input” in “1.5 Terminal Wiring Diagrams.”</td><td>5165</td><td></td></tr>
<tr><td>RST</td><td>Stop of program operation (When “DIn” changes from OFF to ON)</td><td>5166</td><td></td></tr>
<tr><td>LOC</td><td>Start of local-mode operation (When “DIn” changes from OFF to ON)</td><td>0</td><td></td></tr>
<tr><td>HOLD</td><td>Start of hold-mode operation (When “DIn” changes from OFF to ON)</td><td>0</td><td></td></tr>
<tr><td>ADV</td><td>Advance of segment (When “DIn” changes from OFF to ON)</td><td>0</td><td></td></tr>
<tr><td>A/M1</td><td>Loop-1 AUTO/MAN switching (AUTO when contact input is ON; MAN when contact input is OFF)</td><td>0</td><td></td></tr>
<tr><td>A/M2</td><td>Loop-2 AUTO/MAN switching</td><td>0</td><td></td></tr>
<tr><td>L/C</td><td>LOCAL/CASCADE switching</td><td>5167</td><td></td></tr>
<tr><td>PTN.0</td><td>Bit 0 of program pattern number</td><td>5161</td><td></td></tr>
<tr><td>PTN.1</td><td>Bit 1 of program pattern number</td><td>5162</td><td></td></tr>
<tr><td>PTN.2</td><td>Bit 2 of program pattern number</td><td>5163</td><td></td></tr>
<tr><td>PTN.3</td><td>Bit 3 of program pattern number</td><td>5164</td><td></td></tr>
<tr><td>PTN.4</td><td>Bit 4 of program pattern number</td><td>0</td><td></td></tr>
<tr><td>MG1</td><td>Interruptive message display 1</td><td>0</td><td></td></tr>
<tr><td>MG2</td><td>Interruptive message display 2</td><td>0</td><td></td></tr>
<tr><td>MG3</td><td>Interruptive message display 3</td><td>0</td><td></td></tr>
<tr><td>MG4</td><td>Interruptive message display 4</td><td>0</td><td></td></tr>
</table>

## ● UP Mode Parameters

### Located in: Main menu = UPMD ; Submenu = MD

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| UPM | Controller mode (UP mode) | 13: Cascade control with two universal inputs<br>For another Controller mode, see User’s Manual (Reference) (CD-ROM version). | 1 | |
| SMP | PV sampling period setting | 100, 200 and 500 ms<br>The controller restarts if any change is made to the PV sampling period; this does not affect other parameter settings at all, however. | 200 ms | |
| SMEC | Sampling period error counter (reading only) | 0 to 30000 | Shows 0 at power-on. | |

## ● Input-related Parameters

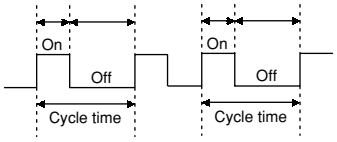
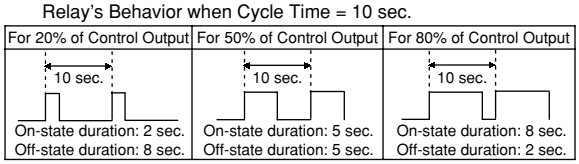
### Located in: Main menu = UPMD ; Submenu = IN

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| IN1 | Primary PV input type (INPUT 1 terminals) Terminals ⑪, ⑫ and ⑬ | Specify the type of primary PV input as a range code. See “Instrument Input Range Codes” in “2. Initial Settings.” | OFF (0) | |
| UNI1 | Primary PV input unit | Select the unit of primary PV input.<br>% (0): Percent - (2): No unit<br>°C (1): Degree Celsius °F (5): Fahrenheit | Depends on the primary PV input type. | |
| RH1 | Max. value of primary PV input range | Set the instrument input range (RL1 < RH1).<br><br>- For temperature input -<br>Set the range of temperature that is actually controlled.<br>- For voltage input -<br>Set the range of a voltage signal that is applied.<br>The scale across which the voltage signal is actually controlled should be set using the parameters Maximum Value of primary PV Input Scale (SH1) and Minimum Value of primary PV Input Scale (SL1). | Depends on the primary PV input type. | |
| RL1 | Min. value of primary PV input range | | | |
| SDP1 | Primary PV input decimal point position (shown when in voltage-input mode) | Set the position of the decimal point of voltage-mode primary PV input.<br>0 to 4<br>0: No decimal place<br>1: One decimal place, 2 to 4: Two, three, four decimal places | Depends on the primary PV input type. | |
| SH1 | Max. value of primary PV input scale (shown when in voltage-input mode) | Set the read-out scale of voltage-mode primary PV input.<br>-19999 to 30000, where SL1 < SH1 | Depends on the primary PV input type. | |
| SL1 | Min. value of primary PV input scale (shown when in voltage-input mode) | | | |
| BSL1 | Selection of primary PV input burnout action | Allows the primary PV input value to be determined as shown below in case of primary PV input burnout.<br>• 105% of PV input range if set to “Upscale”<br>• -5.0% of PV input range if set to “Downscale”<br>OFF (0): Disable<br>UP (1): Upscale<br>DOWN (2): Downscale | Depends on the primary PV input type. | |
| RJC1 | Presence/absence of primary PV input reference junction compensation | Allows input compensation to be applied to thermocouple input.<br>OFF (0): Absent<br>ON (1): Present | ON (1) | |
| IN2 | Secondary PV input type (INPUT 1 terminals) Terminals ㊶, ㊷ and ㊸ | Specify the type of secondary PV input as a range code. See “Instrument Input Range Codes” in “2. Initial Settings.” | typeK1 | |
| UNI2 | Secondary PV input unit | Select the unit of secondary PV input.<br>% (0): Percent - (2): No unit<br>°C (1): Degree Celsius °F (5): Fahrenheit | Depends on the secondary PV input type. | |
| RH2 | Max. value of secondary PV input range | Set the instrument input range (RL2 < RH2).<br><br>- For temperature input -<br>Set the range of temperature that is actually controlled.<br>- For voltage input -<br>Set the range of a voltage signal that is applied.<br>The scale across which the voltage signal is actually controlled should be set using the parameters Maximum Value of secondary PV Input Scale (SH1) and Minimum Value of secondary PV Input Scale (SL1). | Depends on the secondary PV input type. | |
| RL2 | Min. value of secondary PV input range | | | |
| SDP2 | Ssecondary PV input decimal point position (shown when in voltage-input mode) | Set the position of the decimal point of voltage-mode secondary PV input.<br>0 to 4<br>0: No decimal place<br>1: One decimal place, 2 to 4: Two, three, four decimal places | Depends on the secondary PV input type. | |

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| SH2 | Max. value of secondary PV input scale (shown when in voltage-input mode) | Set the read-out scale of voltage-mode secondary PV input.<br>-19999 to 30000, where SL1 < SH1 | Depends on the secondary PV input type. | |
| SL2 | Min. value of secondary PV input scale (shown when in voltage-input mode) | | | |
| BSL2 | Selection of secondary PV input burnout action | Allows the secondary PV input value to be determined as shown below in case of secondary PV input burnout.<br>• 105% of PV input range if set to “Upscale”<br>• -5.0% of PV input range if set to “Downscale”<br>OFF (0): Disable<br>UP (1): Upscale<br>DOWN (2): Downscale | Depends on the secondary PV input type. | |
| RJC2 | Presence/absence of secondary PV input reference junction compensation | Allows input compensation to be applied to thermocouple input.<br>OFF (0): Absent<br>ON (1): Present | ON (1) | |
| IN3 | Although not used in cascade control with two universal inputs, it is shown on the display. | | | |
| UNI3 | Although not used in cascade control with two universal inputs, it is shown on the display. | | | |
| RH3 | Although not used in cascade control with two universal inputs, it is shown on the display. | | | |
| RL3 | Although not used in cascade control with two universal inputs, it is shown on the display. | | | |
| SDP3 | Although not used in cascade control with two universal inputs, it is shown on the display. | | | |
| SH3 | Although not used in cascade control with two universal inputs, it is shown on the display. | | | |
| SL3 | Although not used in cascade control with two universal inputs, it is shown on the display. | | | |
| BSL3 | Although not used in cascade control with two universal inputs, it is shown on the display. | | | |
| P.UN1 | PV1 unit (primary) | Set the unit of PV1.<br>% (0): Percent - (2): No unit<br>°C (1): Degree Celsius °F (5): Fahrenheit | Same as the unit of primary PV input | |
| P.DP1 | PV1 decimal point position (primary) | Under normal operation, set the same value as in the primary PV Input Decimal Point Position (SDP1) parameter.<br>To shift the decimal point for temperature input, use this parameter. For example, set as “P.DP1 = 0” to change a temperature reading of one decimal place to that of no decimal places. This involves reconfiguring the P.RH1 and P.RL1 parameters.<br>0 to 4 | - | |
| P.RH1 | Maximum value of PV1 range (primary) | Under normal operation, keep the values of these parameters between the maximum and minimum values of the primary PV input range.<br>-19999 to 30000<br>P.RL1 < P.RH1, where P.RH1-P.RL1 ≤ 30000 | Maximum value of primary PV input range or scale | |
| P.RL1 | Minimum value of PV1 range (primary) | | Minimum value of primary PV input range or scale | |
| P.UN2 | PV2 unit (secondary) | Set the unit of PV2.<br>% (0): Percent - (2): No unit<br>°C (1): Degree Celsius °F (5): Fahrenheit | Same as the unit of secondary PV input | |
| P.DP2 | PV2 decimal point position (secondary) | Under normal operation, set the same value as in the secondary PV Input Decimal Point Position (SDP3) parameter.<br>To shift the decimal point for temperature input, use this parameter. For example, set as “P.DP2 = 0” to change a temperature reading of one decimal place to that of no decimal places. This involves reconfiguring the P.RH2 and P.RL2 parameters.<br>0 to 4 | - | |
| P.RH2 | Maximum value of PV2 range (secondary) | Under normal operation, keep the values of these parameters between the maximum and minimum values of the secondary PV input range.<br>-19999 to 30000<br>P.RL2 < P.RH2, where P.RH2-P.RL2 ≤ 30000 | Maximum value of secondary PV input range or scale | |
| P.RL2 | Minimum value of PV2 range (secondary) | | Minimum value of secondary PV input range or scale | |

## ● Output-related Parameters

### Located in: Main menu = UPMD ; Submenu = OUT

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| OT2 | Control output type | 0 Time proportional PID relay contact output (terminals ① - ② - ③)<br>1 Time proportional PID voltage pulse output (terminals ⑯ - ⑰)<br>2 Current output (terminals ⑯ - ⑰)<br>3 ON/OFF control relay contact output (terminals ① - ② - ③)<br>4 Heating-side relay output (terminals ① - ② - ③), cooling-side relay output (terminals ④ - ⑦)<br>5 Heating-side pulse output (terminals ⑯ - ⑰), cooling-side relay output (terminals ④ - ⑦)<br>6 Heating-side current output (terminals ⑯ - ⑰), cooling-side relay output (terminals ④ - ⑦)<br>7 Heating-side relay output (terminals ① - ② - ③), cooling-side transistor output (terminals ㉞ - ㉟)<br>8 Heating-side pulse output (terminals ⑯ - ⑰), cooling-side transistor output (terminals ㉞ - ㉟)<br>9 Heating-side current output (terminals ⑯ - ⑰), cooling-side transistor output (terminals ㉞ - ㉟)<br>10 Heating-side relay output (terminals ① - ② - ③), cooling-side current output (terminals ⑭ - ⑮)<br>11 Heating-side pulse output (terminals ⑯ - ⑰), cooling-side current output (terminals ⑭ - ⑮)<br>12 Heating-side current output (terminals ⑯ - ⑰), cooling-side current output (terminals ⑭ - ⑮) | 0 | |
| CT1 | Control output cycle time<br>Heating-side control output cycle time (in heating/cooling control) | 1 to 1000 sec.<br>  <br>Relay's Behavior when Cycle Time = 10 sec.<br>  | 30 sec. | |
| CTc1 | Cooling-side control output cycle time | 1 to 1000 sec. | 30 sec. | |
| AO1 | Analog output-1 type (OUTPUT 1: Terminals ⑯ and ⑰) | Allows control output or retransmission output to be presented as one of the following current signals.<br>0: 4 to 20 mA<br>1: 0 to 20 mA<br>2: 20 to 4 mA<br>3: 20 to 0 mA | 0 | |
| AO2 | Analog output-2 type (OUTPUT 2: Terminals ㊻ and ㊼) | | 0 | |
| AO3 | Analog output-3 type (OUTPUT 3: Terminals ⑭ and ⑮) | | 0 | |
| A1H | Analog output-1 100% segmental point | Set the values of segmental points for the 0% and 100% output levels at which the values are presented via OUTPUT-1 (terminals ⑯ and ⑰). See "■ Performing Split Computations" below.<br>-5.0% to 105.0% | 100.0% | |
| A1L | Analog output-1 0% segmental point | | 0.0% | |
| A2H | Analog output-2 100% segmental point | Set the values of segmental points for the 0% and 100% output levels at which the values are presented via OUTPUT-2 (terminals ㊻ and ㊼). See "■ Performing Split Computations" below.<br>-5.0% to 105.0% | 100.0% | |
| A2L | Analog output-2 0% segmental point | | 0.0% | |
| A3H | Analog output-3 100% segmental point | Set the values of segmental points for the 0% and 100% output levels at which the values are presented via OUTPUT-3 (terminals ⑭ and ⑮). See "■ Performing Split Computations" below.<br>-5.0% to 105.0% | 100.0% | |
| A3L | Analog output-3 0% segmental point | | 0.0% | |

# ■ Performing Split Computations

**[V-mode Output]**

The following explains an example of letting “Analog OUTPUT-1 (terminals ⑯ and ⑰)” and “Analog OUTPUT-3 (terminals ⑭ and ⑮)” present the V-mode characteristics of split computations.

[1] Set the Control Output Type (OT2) parameter to “2”.
This sets the control output to “current output.”

[2] Set the Retransmission Output 1 (RET1) parameter to “7”.
This sets the retransmission output to “control output retransmission.”

[3] Set the Analog Output-1 100% Segmental Point (A1H) parameter to “100%”.

[4] Set the Analog Output-1 0% Segmental Point (A1L) parameter to “25%”.

[5] Set the Analog Output-3 100% Segmental Point (A3H) parameter to “0%”.

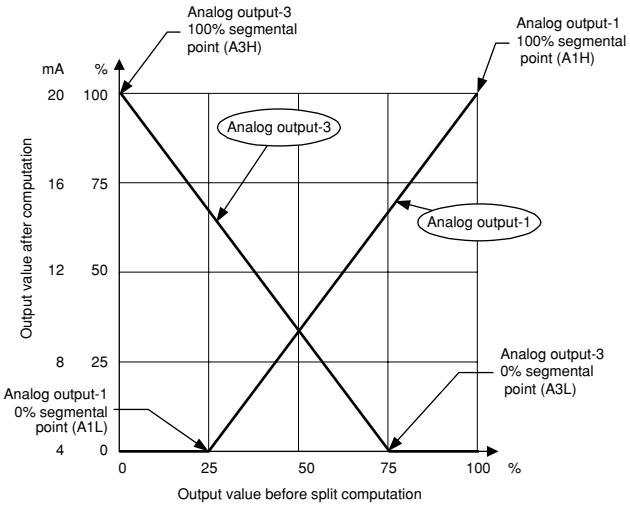
[6] Set the Analog Output-3 0% Segmental Point (A3L) parameter to “75%”.

The figure below shows an example where both analog outputs-1 and 3 are set to the current signal of 4 to 20 mA DC. The type of output signal can be determined separately for each of the analog outputs listed above, using the following three parameters.

Analog output-1: Analog output-1 type (AO1)

Analog output-2: Analog output-2 type (AO2)

Analog output-3: Analog output-3 type (AO3)



**[Parallel-mode Output]**

The following explains an example of letting “Analog OUTPUT-1 (terminals ⑯ and ⑰)” and “Analog OUTPUT-3 (terminals ⑭ and ⑮)” present the parallel-mode characteristics of split computations.

[1] Set the Control Output Type (OT2) parameter to “2”.
This sets the control output to “current output.”

[2] Set the Retransmission Output 1 (RET1) parameter to “7”.
This sets the retransmission output to “control output retransmission.”

[3] Set the Analog Output-1 100% Segmental Point (A1H) parameter to “100%”.

[4] Set the Analog Output-1 0% Segmental Point (A1L) parameter to “25%”.

[5] Set the Analog Output-3 100% Segmental Point (A3H) parameter to “75%”.

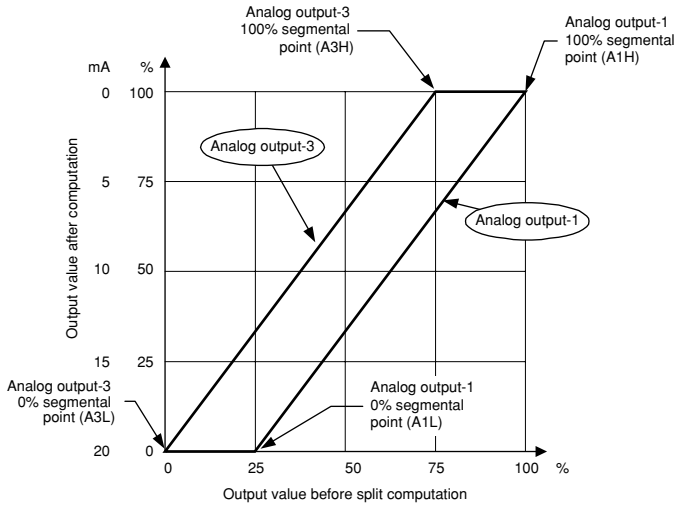
[6] Set the Analog Output-3 0% Segmental Point (A3L) parameter to “0%”.

The figure below shows an example where both analog outputs-1 and 3 are set to the current signal of 20 to 0 mA DC. The type of output signal can be determined separately for each of the analog outputs listed above, using the following three parameters.

Analog output-1: Analog output-1 type (AO1)

Analog output-2: Analog output-2 type (AO2)

Analog output-3: Analog output-3 type (AO3)



## ● Communication Parameters

### Located in: Main menu = UPMD ; Submenu = R485

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| PSL1 | Protocol selection-1 | 0: PC link communication<br>1: PC link communication (with sum check)<br>2: Ladder communication<br>3: Coordinated master station<br>7: MODBUS (ASCII)<br>8: MODBUS (RTU)<br>9: Coordinated master station (2 loop mode) | 0 | |
| BPS1 | Baud rate-1 | 600 (0), 1200 (1), 2400 (2), 4800 (3),<br>9600 (4) (bps) | 9600 (4) | |
| PRI1 | Parity-1 | NONE (0): None<br>EVEN (1): Even<br>ODD (2): Odd | EVEN (1) | |
| STP1 | Stop bit-1 | 1, 2 | 1 | |
| DLN1 | Data length-1 | 7, 8;<br>7 is fixed for MODBUS (ASCII)<br>8 is fixed for MODBUS (RTU), Ladder | 8 | |
| ADR1 | Address-1 | 1 to 99<br>However, the maximum number of stations connectable is 31. | 1 | |
| RP.T1 | Minimum response time-1 | 0 to 10 (× 10 ms) | 0 | |
| PSL2 | Protocol selection-2 | 0: PC link communication<br>1: PC link communication (with sum check)<br>2: Ladder communication<br>3: Coordinated master station<br>5: I/O expansion (for single-controller applications)<br>6: I/O expansion (for dual-controller applications)<br>9: Coordinated master station (2 loop mode) | 0 | |
| BPS2 | Baud rate-2 | 600 (0), 1200 (1), 2400 (2), 4800 (3), 9600 (4),<br>19200 (5), 38400 (6) (bps) | 9600 (4) | |
| PRI2 | Parity-2 | NONE (0): None<br>EVEN (1): Even<br>ODD (2): Odd | EVEN (1) | |
| STP2 | Stop bit-2 | 1, 2 | 1 | |
| DLN2 | Data length-2 | 7, 8<br>8 is fixed for Ladder | 8 | |
| ADR2 | Address-2 | 1 to 99<br>However, the maximum number of stations connectable is 31. | 1 | |
| RP.T2 | Minimum response time-2 | 0 to 10 (× 10 ms) | 0 | |

## ● Parameter-initializing Parameters

### Located in: Main menu = UPMD ; Submenu = INIT

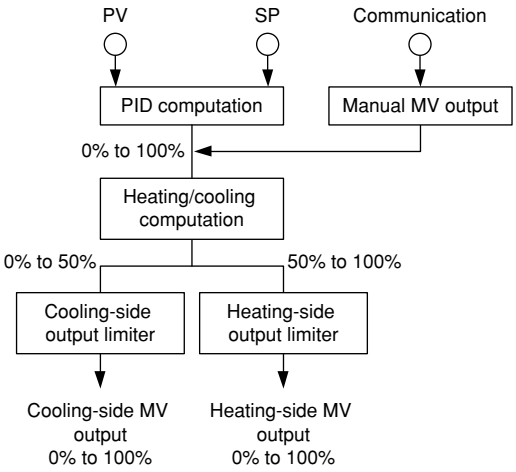
| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting |
|---|---|---|---|---|
| INI | Parameter initialization | OFF (0): -<br>ON (1): Initialize parameters | OFF (0) | |

# ■ Tips about Heating/Cooling Control

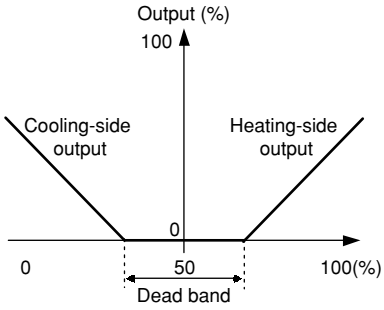
In heating/cooling control, the controller outputs the result of computation after splitting it into heating-purpose and cooling-purpose signals. In addition, the controller can perform PID control or ON/OFF control on the heating and cooling sides separately. When performing ON/OFF control, set the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

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

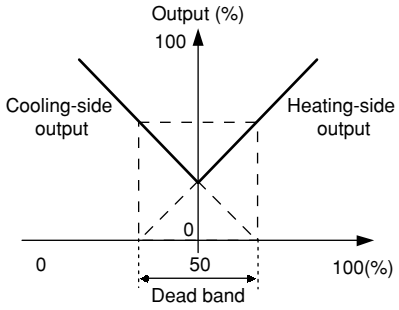
- 0% to 50% of the computation result is presented as a 0% to 100% cooling-side output.
- 50% to 100% of the computation result is presented as a 0% to 100% heating-side output.




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.




Value of control output before split into heating- and cooling-side outputs




Value of control output before split into heating- and cooling-side outputs

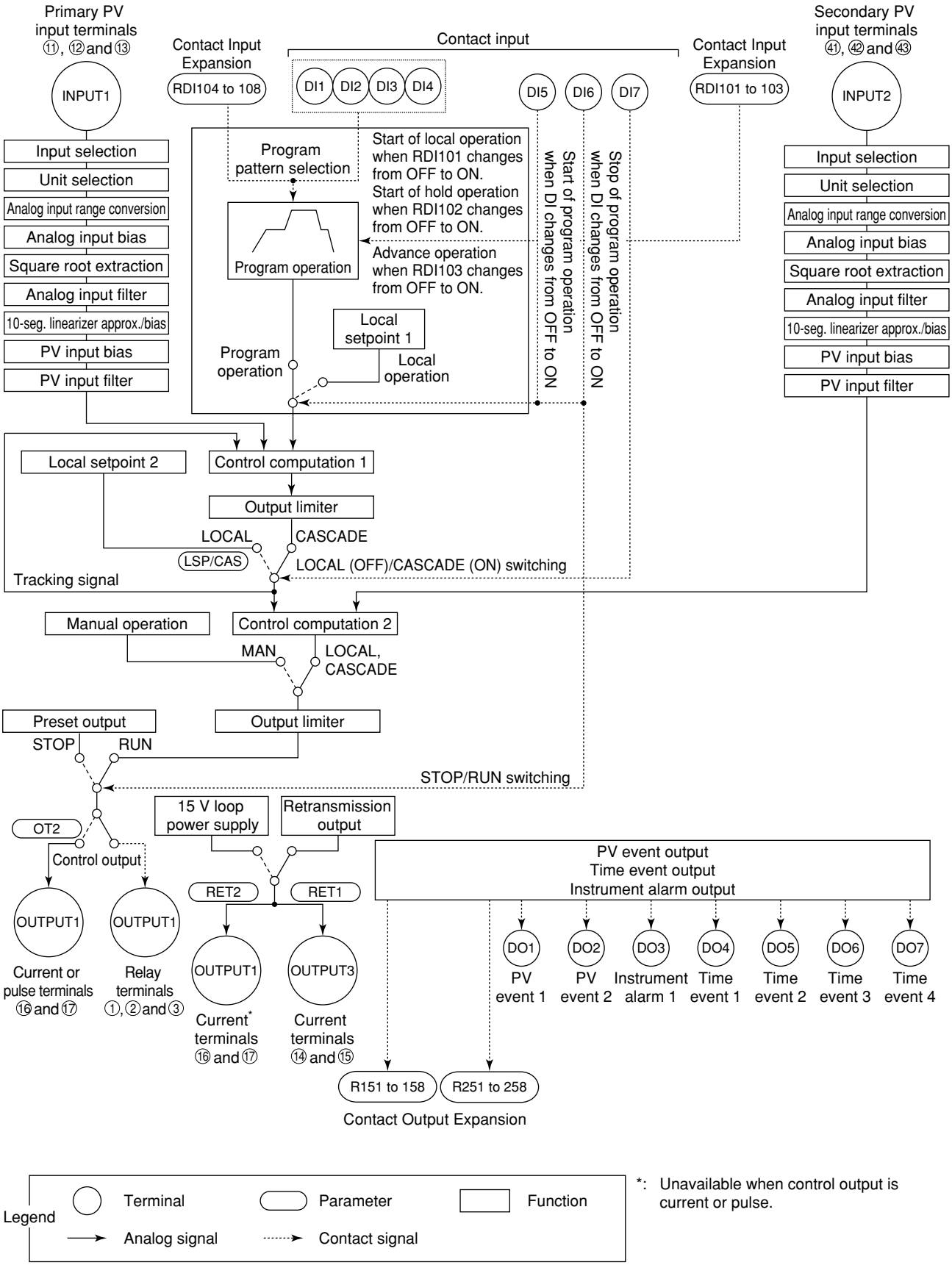
## Precautions in Heating/Cooling Control

- 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.

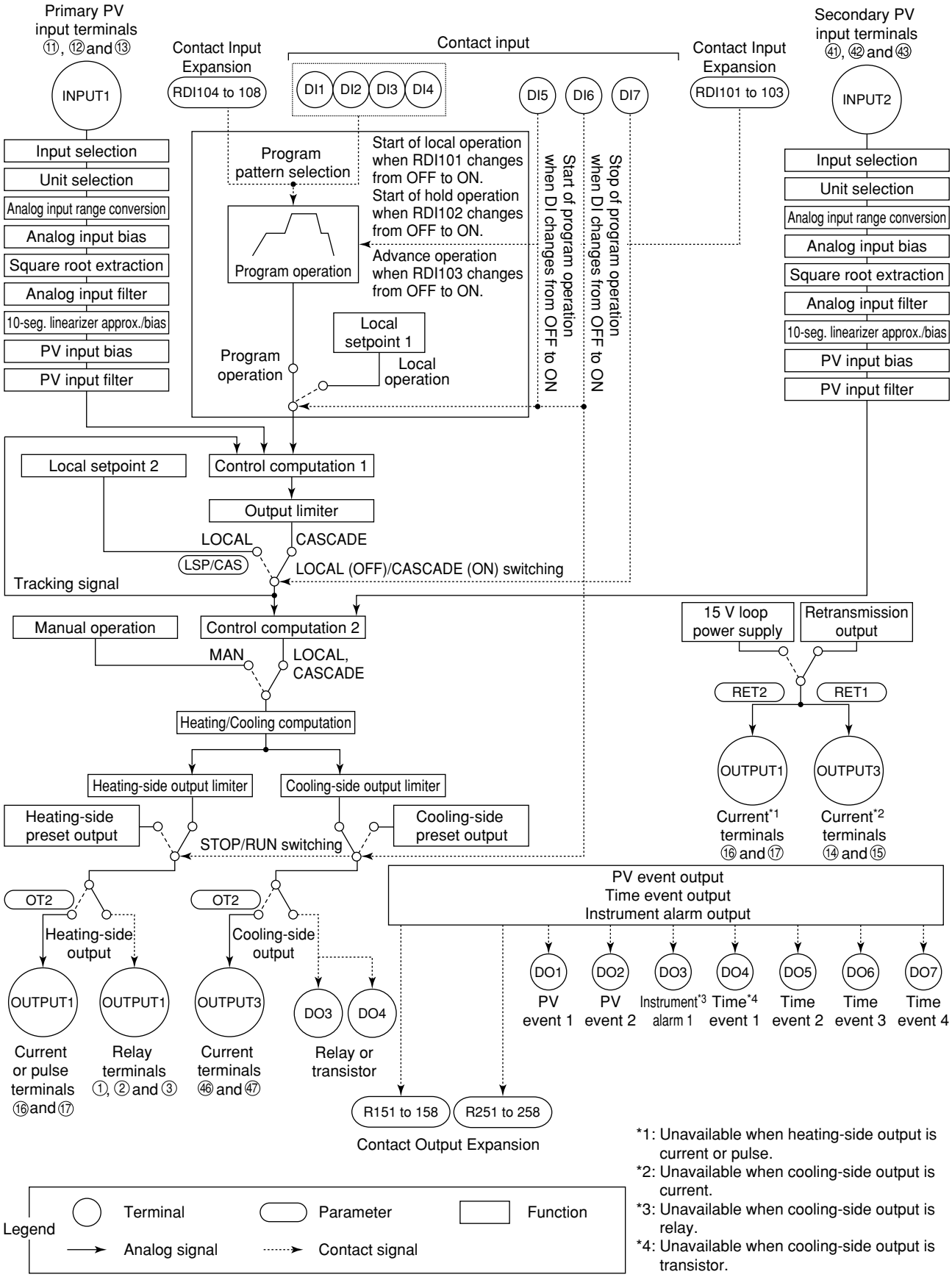
# 7. Function Block Diagram and Descriptions

**This chapter contains the function block diagrams for “Cascade control with two universal inputs,” “Cascade heating/cooling control with two universal inputs.” For details on these function block diagrams, refer to the descriptions mentioned later.**

# ■ Function Block Diagram for Cascade Control with Two Universal Inputs



# ■ Function Block Diagram for Cascade Heating/Cooling Control with Two Universal Inputs




*1: Unavailable when heating-side output is current or pulse.
*2: Unavailable when cooling-side output is current.
*3: Unavailable when cooling-side output is relay.
*4: Unavailable when cooling-side output is transistor.

# Functions and Parameters for "Cascade Control with Two Universal Inputs" in Initial State

Functions and parameters in initial state are given in the tables below. For details on each parameter, refer to "6.2 Lists of Parameters."

## ■ Primary-loop PV Input

PV input of the primary-loop (INPUT1) is a universal input, which can receive signals from thermocouple, RTD, or DC voltage signals. The controller is capable of biasing, square root extraction, first-order lag computation (filtering), ten-segment linearizer approximation, and ten-segment linearizer biasing on input signals.

Each function can be set by the following parameters.

### Setup Parameters

| Function | Parameter | Main menu | Submenu |
|---|---|---|---|
| Input selection | IN1 | UPMD | IN |
| Unit selection | UNI1 | UPMD | IN |
| Analog input range conversion | RH1, RL1 (SDP1, SH1, SL1) | UPMD | IN |
| Analog input bias | A.BS1 | CMLP | AIN |
| Square root extraction | A.SR1, A.LC1 | CMLP | AIN |
| Analog input filter | A.FL1 | CMLP | AIN |

Note: PV input bias (BS) and PV input filter (FL) among the operating parameters are used as bias and filter when normal operation. Analog input bias (A.BS1) and analog input filter (A.FL1) among the setup parameters are used when PV correction value is decided in advance.

### Operating Parameters

| Function | Parameter | Main menu | Submenu |
|---|---|---|---|
| Ten-segment linearizer mode | 1.PMD | PYS1 | None |
| Ten-segment linearizer approximation/biasing | 1.a1 to 1.a11, 1.b1 to 1.b11 | PYS1 | None |

## ■ Secondary-loop PV Input

PV input (INPUT2) is a universal input, which can receive signals from thermocouple, RTD, or DC voltage signals. The controller is capable of biasing, square root extraction, first-order lag computation (filtering), ten-segment linearizer approximation, and ten-segment linearizer biasing on input signals.

Each function can be set by the following parameters.

### Setup Parameters

| Function | Parameter | Main menu | Submenu |
|---|---|---|---|
| Input selection | IN2 | UPMD | IN |
| Unit selection | UNI2 | UPMD | IN |
| Analog input range conversion | RH2, RL2 (SDP2, SH2, SL2) | UPMD | IN |
| Analog input bias | A.BS2 | CMLP | AIN |
| Square root extraction | A.SR2, A.LC2 | CMLP | AIN |
| Analog input filter | A.FL2 | CMLP | AIN |

Note: PV input bias (BS) and PV input filter (FL) among the operating parameters are used as bias and filter when normal operation. Analog input bias (A.BS2) and analog input filter (A.FL2) among the setup parameters are used when PV correction value is decided in advance.

### Operating Parameters

| Function | Parameter | Main menu | Submenu |
|---|---|---|---|
| Ten-segment linearizer mode | 2.PMD | PYS2 | None |
| Ten-segment linearizer approximation/biasing | 2.a1 to 2.a11, 2.b1 to 2.b11 | PYS2 | None |

## ■ Selecting Program Pattern Using Contact Input

It is possible to select the program pattern by turning the four contact input signals ON or OFF. This function is assigned to DI1 (contact input 1) to DI4 (contact input 4). Note that the program pattern can be selected during RESET mode, can not during operation.

| Contact input | Program pattern number to be selected (PT.No) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| DI1 | ON | OFF | ON | OFF | ON | OFF | ON | OFF | ON | OFF | ON | OFF | ON | OFF | ON |
| DI2 | OFF | ON | ON | OFF | OFF | ON | ON | OFF | OFF | ON | ON | OFF | OFF | ON | ON |
| DI3 | OFF | OFF | OFF | ON | ON | ON | ON | OFF | OFF | OFF | OFF | ON | ON | ON | ON |
| DI4 | OFF | OFF | OFF | OFF | OFF | OFF | OFF | ON | ON | ON | ON | ON | ON | ON | ON |

For example, set contact input 2 (DI2) only to “ON” to change the program pattern 1 to the program pattern 2.
Set contact input 1 (DI1) and contact input 2 (DI2) to “ON” to select the program pattern 3.

## ■ Switching Operation Mode Using Contact Input

Program operation for the selected program pattern starts when DI5 (contact input 5) changes from OFF to ON.

Program operation stops when DI6 (contact input 6) changes from OFF to ON. Preset output value is output when the operation stops.

Cascade (ON)/Local (OFF) switching function is assigned to DI7 (contact input 7).

## ■ PID (Primary-loop)

It is possible to use a maximum of eight groups of PID parameters in Cascade operation.

### Operating Parameters

| Function | Parameter | Main menu | Submenu |
|---|---|---|---|
| Proportional band (P) | n.P | LP1 | n.PID |
| Integral time (I) | n.I | LP1 | n.PID |
| Derivative time (D) | n.D | LP1 | n.PID |

## ■ PID (Secondary-loop)

It is possible to use a maximum of eight groups of PID parameters in AUTO or MAN operation.

### Operating Parameters

| Function | Parameter | Main menu | Submenu |
|---|---|---|---|
| Proportional band (P) | n.P | LP2 | n.PID |
| Integral time (I) | n.I | LP2 | n.PID |
| Derivative time (D) | n.D | LP2 | n.PID |

# ■ Control Output

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

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

| Function | Parameter | Main menu | Submenu |
|---|---|---|---|
| Control output type selection | OT2 | UPMD | OUT |
| Control output cycle time | CT1 | UPMD | OUT |
| Analog output-1 type | AO1 | UPMD | OUT |

## Operating Parameters

| Function | Parameter | Main menu | Submenu |
|---|---|---|---|
| Preset output | n.PO | LP1 | n.PID |
| Output limiter | n.OL, n.OH | LP1 | n.PID |

# ■ Contact Output

PV event 1 is output via DO1 (contact output 1).

PV event 2 is output via DO2 (contact output 2).

Instrument alarm 1 is output via DO3 (contact output 3).

Time event 1 is output via DO4 (contact output 4).

Time event 2 is output via DO5 (contact output 5).

Time event 3 is output via DO6 (contact output 6).

Time event 4 is output via DO7 (contact output 7).

## ■ Retransmission Output

PV, program setpoint, or control output can be output to retransmission output 1 (OUTPUT3).

Retransmission output 2 (OUTPUT1) can be used when the control output is relay.

Each function can be set by the following parameters.

### Setup Parameters

| Function | Parameter | Main menu | Submenu |
|---|---|---|---|
| Retransmission output 1 type | RET1 | CMLP | RET |
| Retransmission output 1 scale | RTH1, RTL1 | CMLP | RET |
| Retransmission output 2 type | RET2 | CMLP | RET |
| Retransmission output 2 scale | RTH2, RTL2 | CMLP | RET |

## ■ 15 V DC Loop Power Supply

The 15 V DC loop power supply (OUTPUT3) uses the same terminal of retransmission output 1 or 2. The 15 V DC loop power supply can not be used when retransmission output 1 or 2 is used. To use the 15 V DC loop power supply, set “4” in retransmission output type 1 (RET1) or 2 (RET2) selection parameter.

Each function can be set by the following parameters.

### Setup Parameters

| Function | Parameter | Main menu | Submenu |
|---|---|---|---|
| Retransmission output 1 type | RET1 | CMLP | RET |
| Retransmission output 2 type | RET2 | CMLP | RET |

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