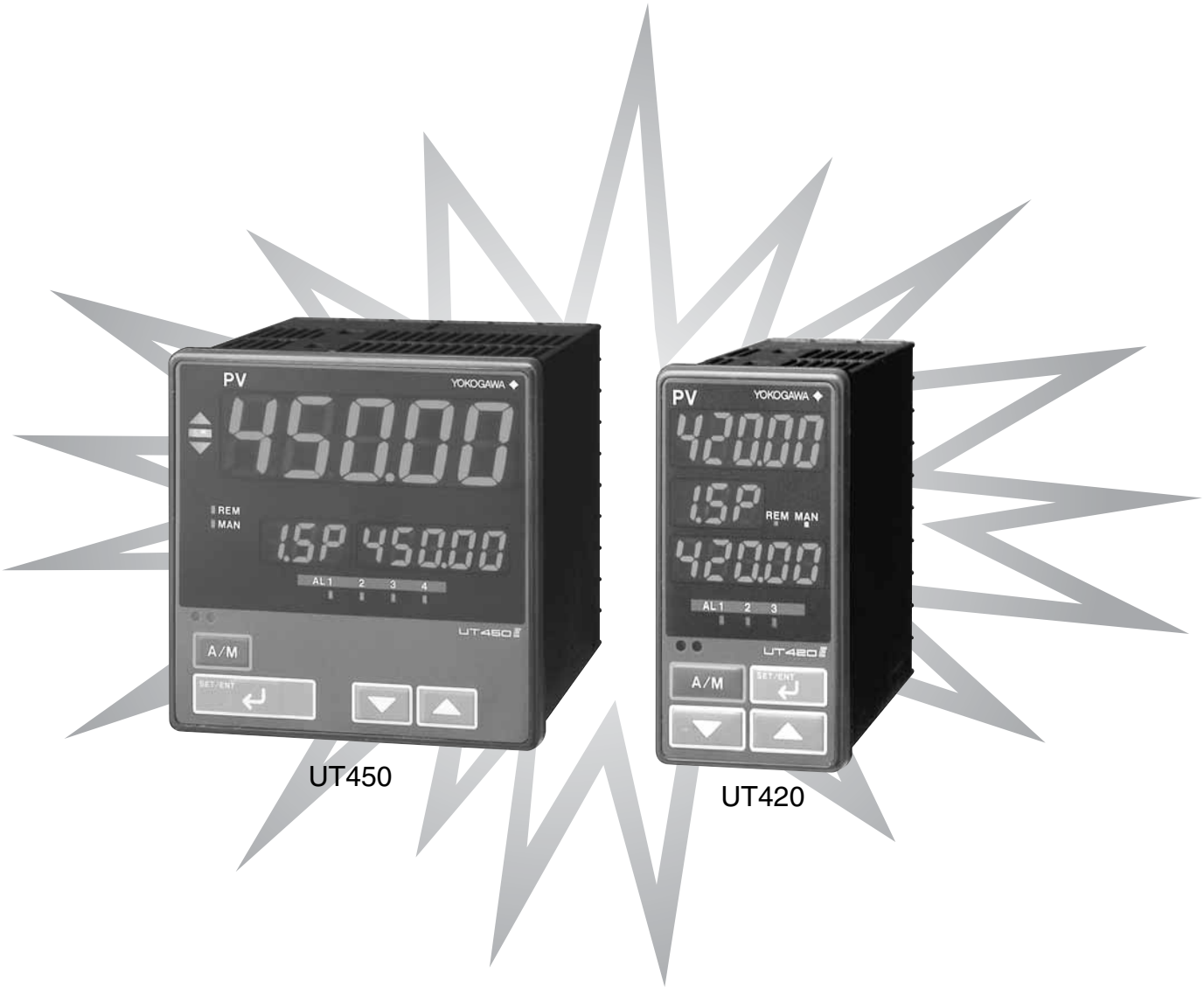
**Technical Information**

UT450/UT420
Digital Indicating Controller

TI 05D01C12-01E




UT450

UT420

# UT450/UT420

Combines the simplicity of the UT350/UT320
with the most popular features of the UT550/UT520.

YOKOGAWA ◆
Yokogawa M&C Corporation

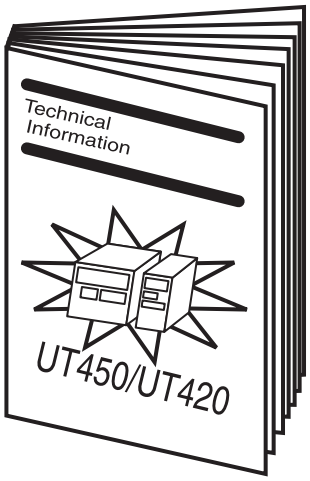
TI 05D01C12-01E

1st Edition: Mar. 2001

Blank Page

# Introduction

## This Book !
(TI 05D01C12-01E)

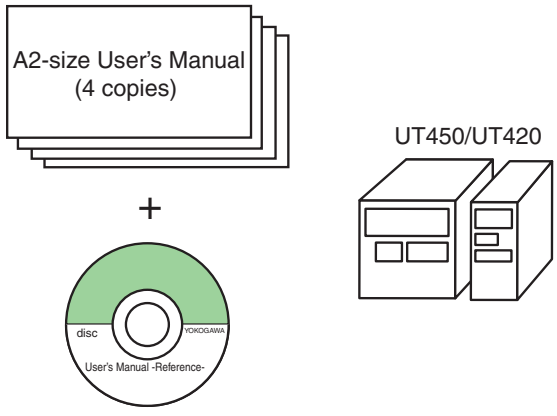



This technical information descibes the function of the UT450 and UT420 Digital Indicating Controllers.

Note : For operating procedures, be careful to refer to the corresponding User's Manual (those are descibed below.)

The following User's Manuals are attached when the UT450/UT420 controller is shipped from factory.

- A2-size User's Manual (4 copies) (IM 05D01C12-01E to 04E)




- CD-ROM type User's Manual (IM 05D01A02-01E)
  Including the manuals of "Reference" and "Communication."

- A4-size User's Manual of UT450/UT420 can be purchased separately if necessary. (Document No. : IM 05D01C12-41E)
  The contents are same as those of A2-size User's Manuals.
- The following User's Manuals also can be purchased if necessary.

| Type | Title | Doc No. |
|---|---|---|
| A4-size | GREEN Series Communication Functions | IM 05G01B02-01E |
| | GREEN Series Communication Reference | IM 05G01B02-02E |
| | GREEN Series User's Manual - Detailed Functions - | IM 05J01B02-01E |
| A2-size* | Digital Indicating Controller User's Manual (4 copies) | IM 05D01C12-00E |
| CD-ROM* | GREEN Series User's Manual - Reference - (CD-ROM Edition) | IM 05D01A02-01E |

* These are same User's Manuals those are attached to the controller.

Blank Page

# UT450/UT420
# Digital Indicating Controller

TI 05D01C12-01E 1st Edition

# CONTENTS

# 1. OVERVIEW

**Model UT450/420 Digital Indicating Controller is a simple, micro-processor based digital indicating controller with basic control capability and the user-friendly large numerical display. The UT450/420 features as standard many functions which are necessary for various control applications, and all of these functions such as control function, control computation function, signal computation function, etc. can be configured by using the keys on the front panel. The instrument has an Auto-tuning, an Overshoot-suppressing function "SUPER" and a hunting suppressing function "SUPER2" built in as standard. It is suitable for a diverse range of applications, with UT450 position-proportional control and heating/cooling control models also available.**

## ● UT450 Main Features


F1-01.EPS

- Extra-large digital display allows the indicated values to be read even from a long distance. LEDs of 20 mm height are used for the process variable (PV) display. This is a 5-digit display for higher resolution.
- Operator can start control operation immediately after completing the simple settings.
- Parameters can be easily set using a personal computer. ("Parameter setting tool (model LL100)" sold separately is required.)
- Universal input and output enables users to set or change freely the type of measured inputs, measurement range, type of control output, etc. from the front panel.
- In addition to general purpose models (universal output), the position-proportional model (relay output) or the heating/cooling control model (universal output) can be specified.
- Contact inputs (up to 7 points) can be employed and functions assigned to each contact (The maximum number of points varies depending on the specification code.)
- Various communication function are provided. Communication is possible with personal computer, programable logic controller, and other controllers.

## ● Model and Suffix Codes

| Model | Suffix Code | | Description | Contact input/output available | |
|---|---|---|---|---|---|
| UT450 | | | Digital indicating controller (1/4 DIN) | | |
| Type | -0 | | Standard type | Contact input | Contact output |
| | -1 | | Position-proportional type | | |
| | -2 | | Heating/cooling type | | |
| | -3 | | Standard type with 24V DC loop power supply | | |
| | -4 | | Position-proportional type with 24V DC loop power supply | | |
| Options | | 0 | None | DI1, DI2 | AL1, AL2, AL3 |
| | | 1 | Communication functions, remote input, 5 additional DIs, 1 additional Alarm | DI1 to DI6, R/L | AL1 to AL4 |
| | | 2 | Communication functions, remote input, 1 additional DI | DI1, DI2, R/L | AL1, AL2, AL3 |
| | | 3 | 4 additional DIs, 1 additional Alarm | DI1 to DI6 | AL1 to AL4 |
| | | 4 | Remote input, 1 additional DI | DI1, DI2, R/L | AL1, AL2, AL3 |

T1-01.EPS

## ● Items to be Specified When Ordering

Model and suffix codes, necessary/unnecessary of User's Manual or Quality Inspection Certificate (QIC).

## ● UT450 Main Features


F1-02.EPS

- High resolution display of 5 digits. Since LEDs of 12 mm height are used for displaying measured values, the display is clearly read.
- The front panel size is 48 mm (width) × 96 mm (height) and the depth is 100 mm, designed for saving space.
- Operator can start control operation immediately after completing the simple settings.
- Parameter can be easily set using a personal computer. (“Parameter setting tool (model LL100)” sold separately is required.)
- Universal input and output enables users to set or change freely the type of measured inputs, measurement range, type of control output, etc. from the front panel.
- Contact inputs (up to 4 points) can be employed and functions assigned to each contact (The maximum number of points varies depending on the specification code.)
- Various communication function are provided. Communication is possible with personal computer, programable logic controller, and other controllers.

## ● Model and Suffix Codes

| Model | Suffix Code | | Description | Contact input/output available | |
|---|---|---|---|---|---|
| UT420 | | | Digital indicating controller (1/8 DIN) | Contact input | Contact output |
| Type | -0 | | Standard type | | |
| Options | | 0 | None | DI1, DI2 | AL1, AL2, AL3 |
| | | 7 | Communication functions, remote input, 2 additional DIs | DI1, DI2,DI3, R/L | AL1, AL2, AL3 |
| | | 8 | Remote input, 2 additional DIs | DI1, DI2,DI3, R/L | AL1, AL2, AL3 |

T1-02.EPS

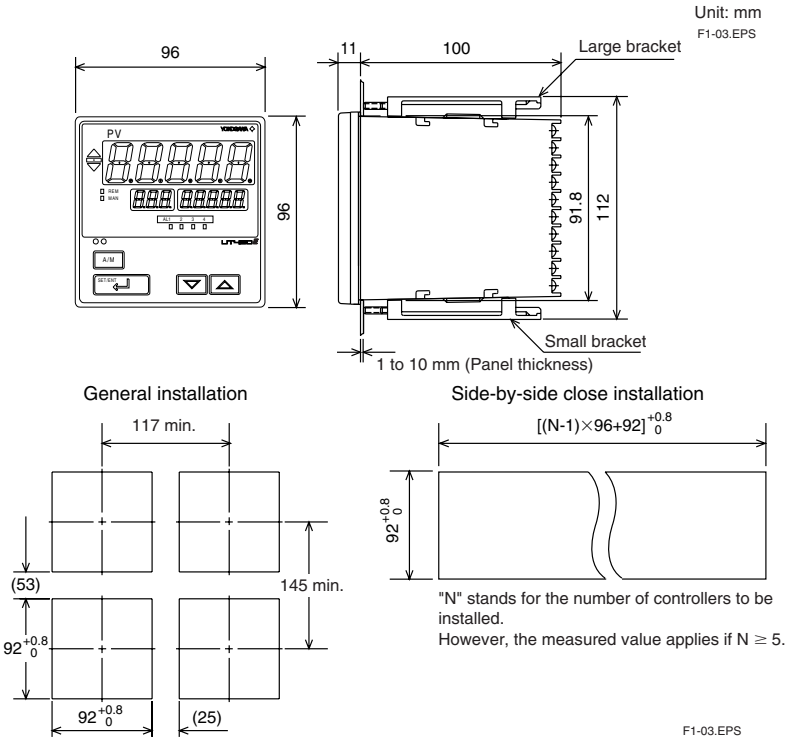
## ● Items to be Specified When Ordering

Model and suffix codes, necessary/unnecessary of User’s Manual or Quality Inspection Certificate (QIC).

# 1.1 External Dimensions and Panel Cutout Dimensions

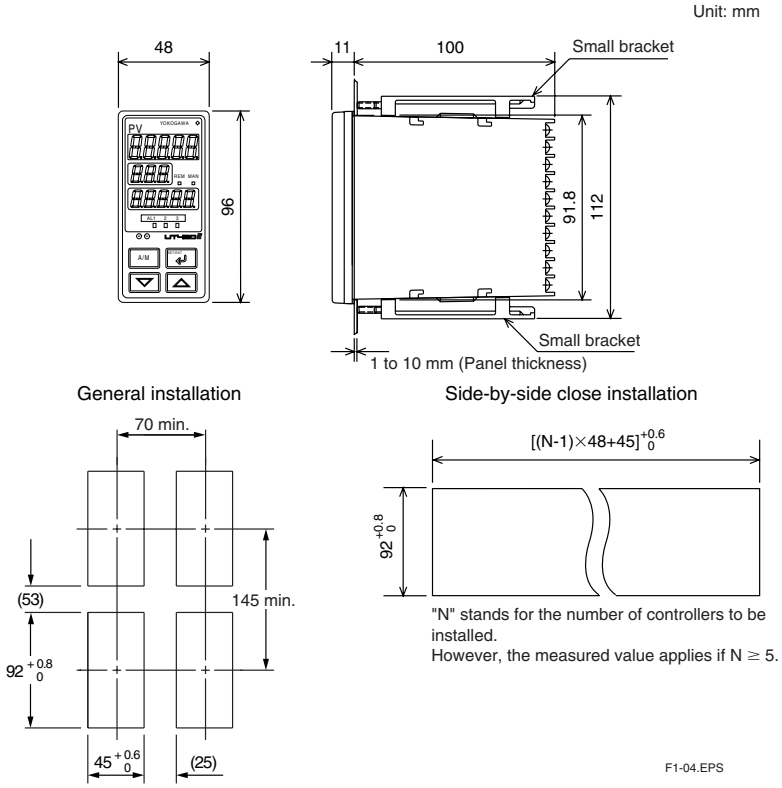
## ● UT450

Unit: mm

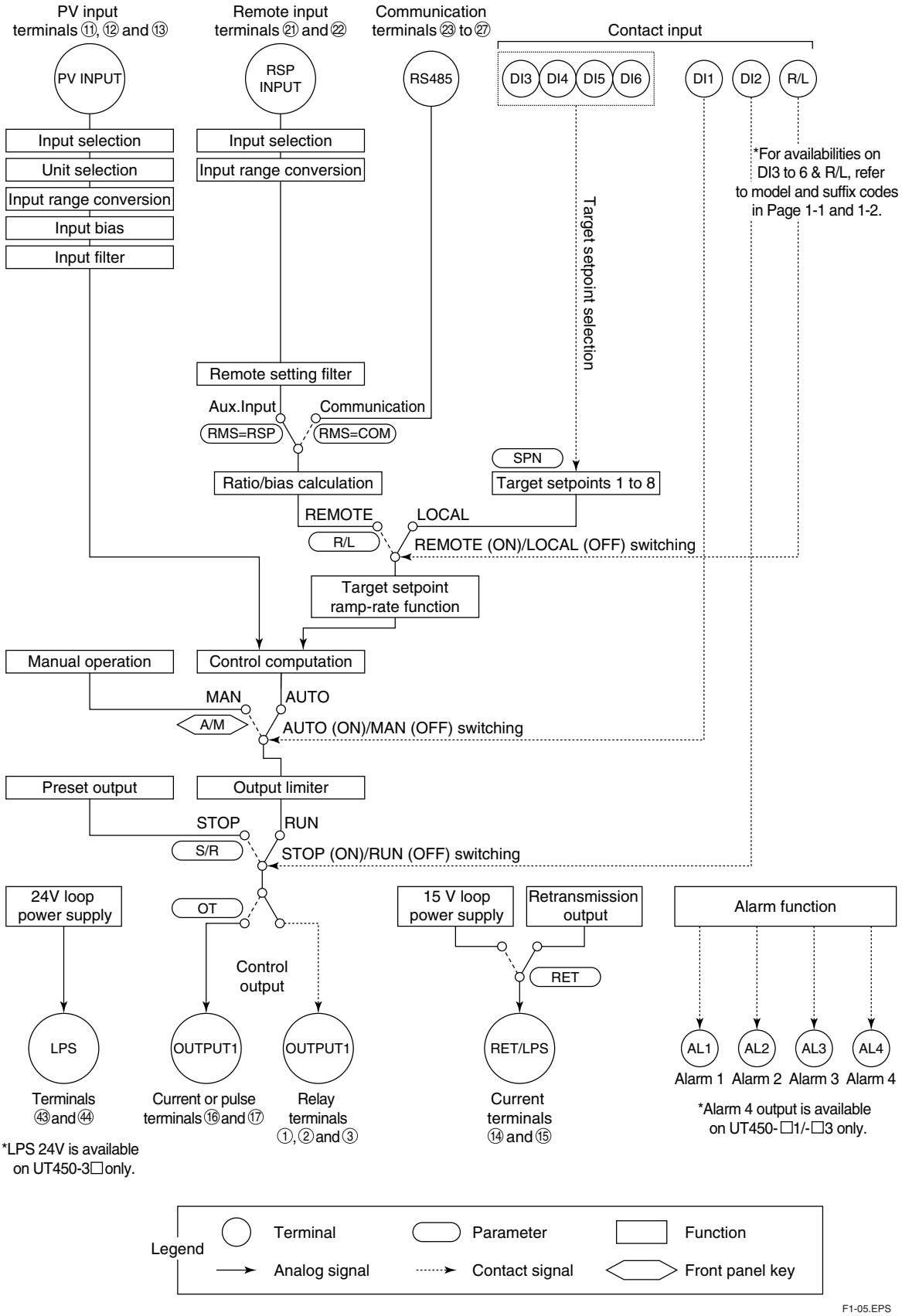



## ● UT420

Unit: mm

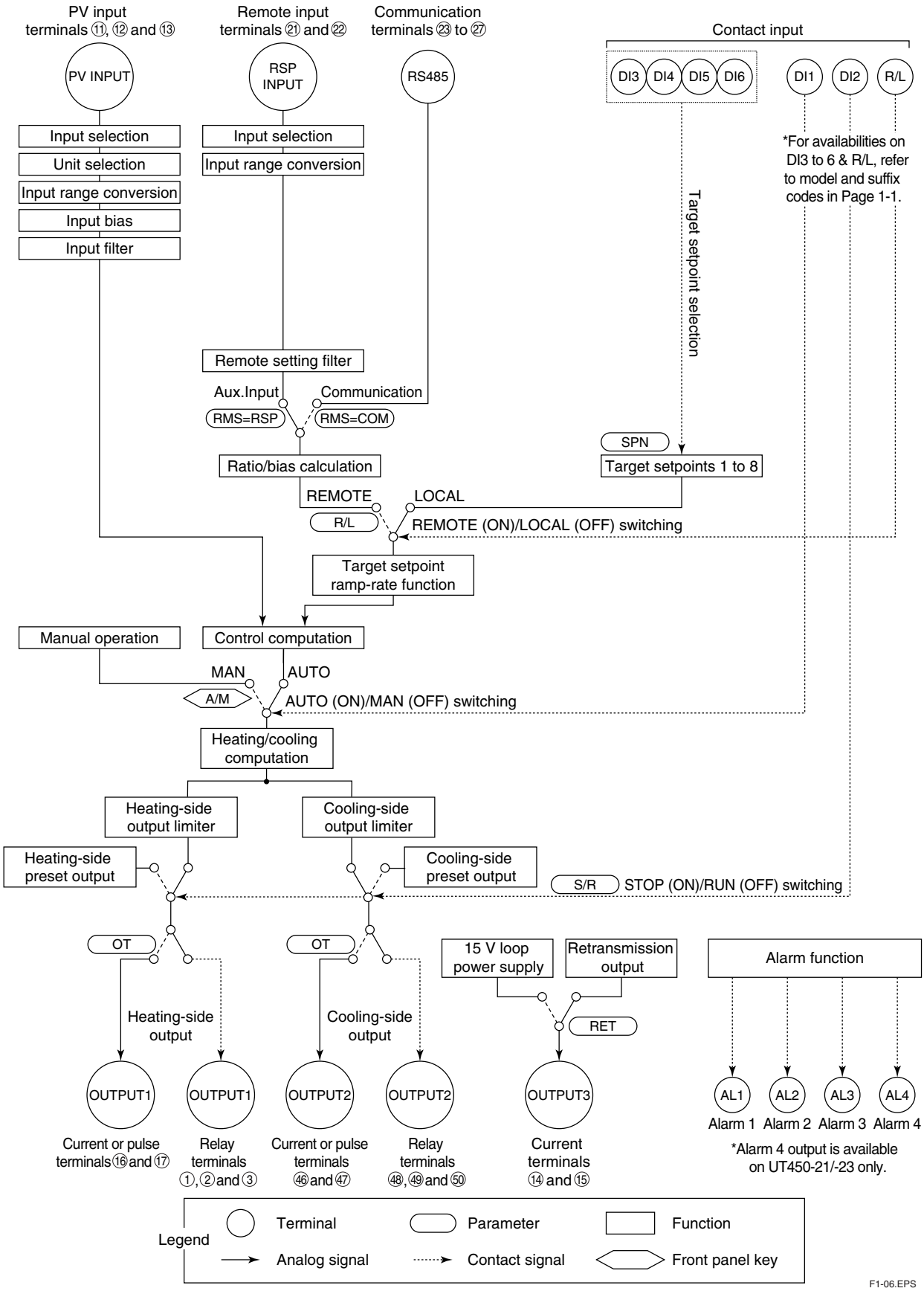


# 1.2 Function Block Diagram for Standard Type(UT450/420)

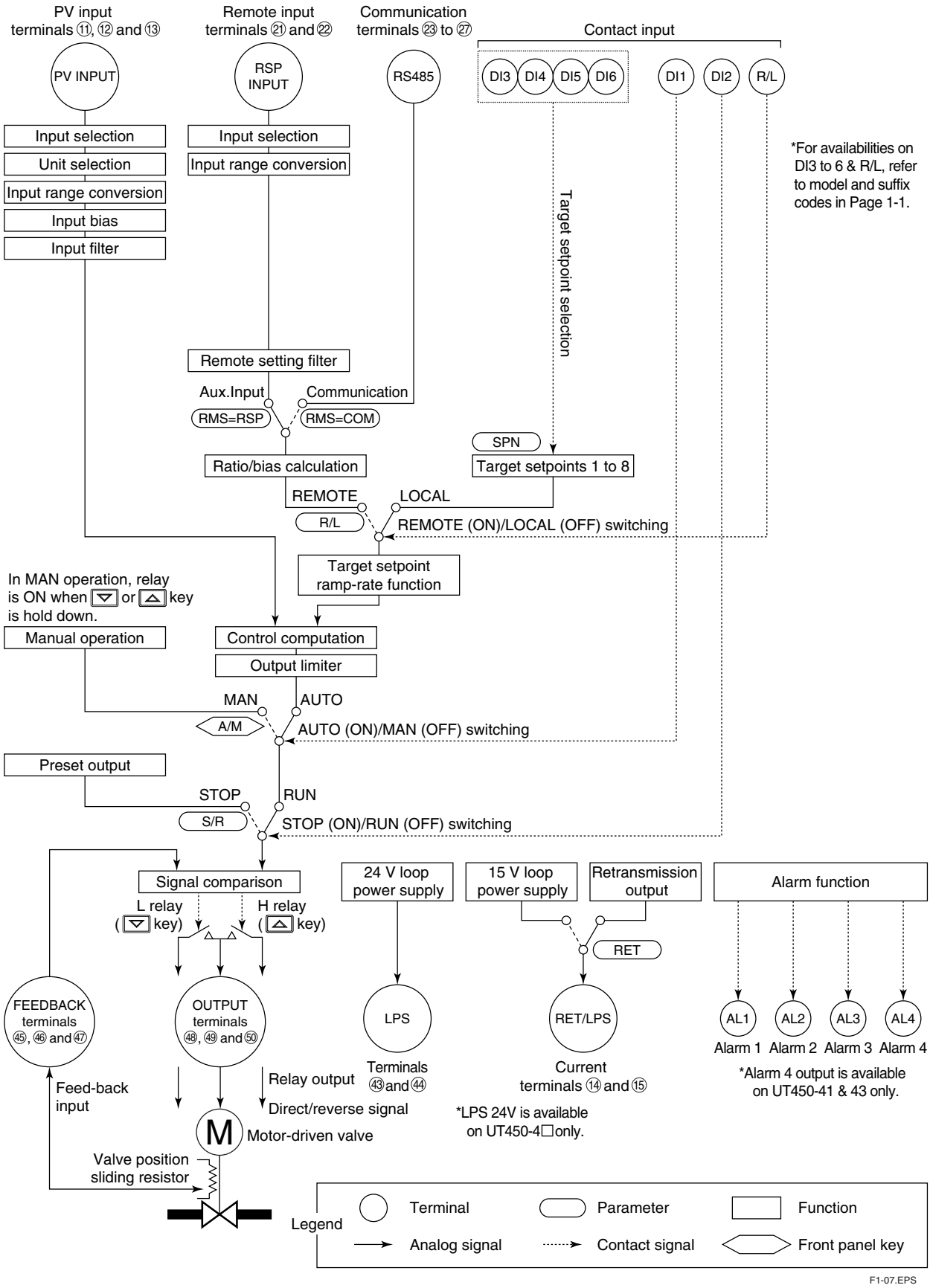



F1-05.EPS

# 1.3 Function Block Diagram for Heating/Cooling Type (UT450)

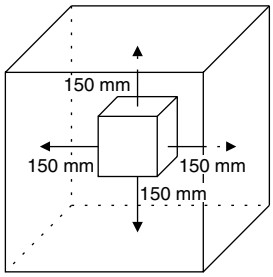


# 1.4 Function Block Diagram for Position Proportional Type (UT450)



# 2. INSTALLATION AND WIRING

## 2.1 Installation Location




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.

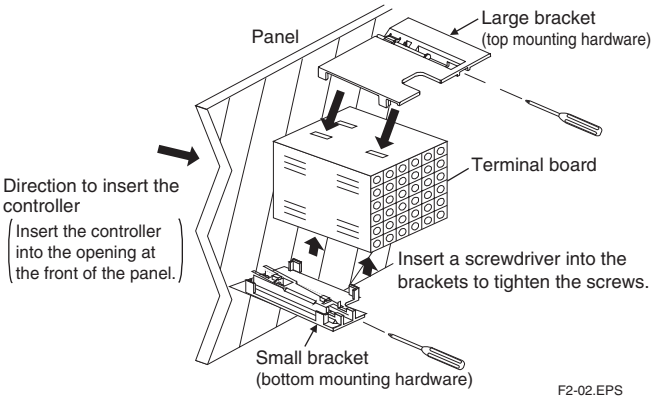
If the controller has to be installed close to flammable items or equipment, be sure to provide shielding panels all around the controller, at least 150 mm away from every side; the panels should be made of either 1.43 mm-thick metal-plated steel plates or 1.6 mm-thick uncoated steel plates.

## 2.2 How to Install

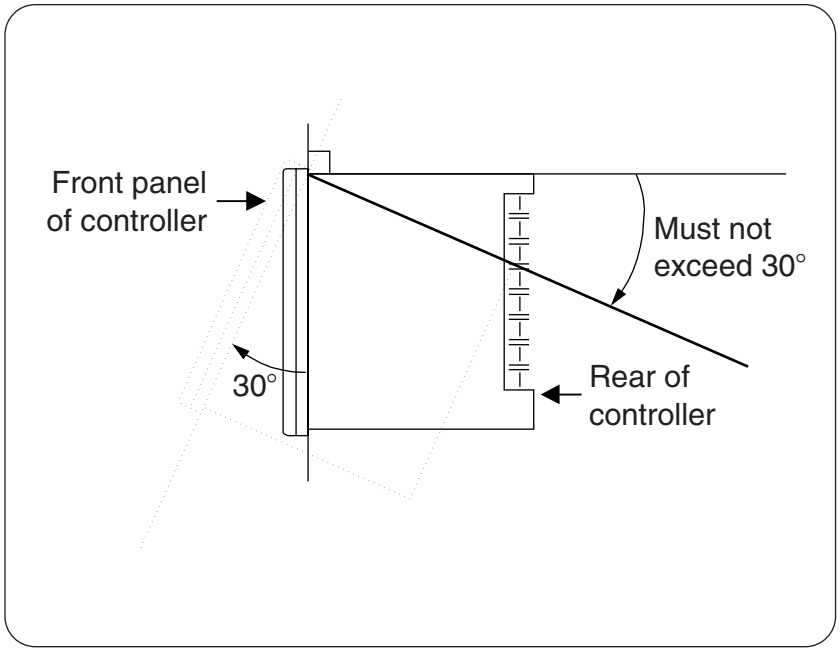
**CAUTION:** Turn off the power to the controller before installing it on the panel because there is a possibility of electric shock.

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.



## ● Installation Position




F2-03.EPS

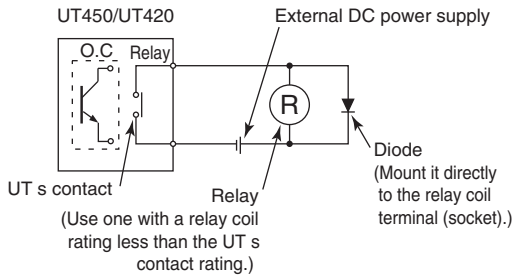
Install the controller at an angle within 30° from horizontal with the front panel facing upward. Do not install it facing downward. The position of right and left sides should be horizontal.

# 2.3 How to Connect Wires

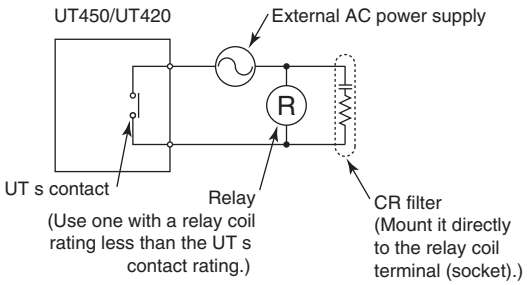
**CAUTION:** 1) Before carrying out wiring, turn off the power to the controller and check that the cables to be connected are not alive with a tester or the like because there is a possibility of electric shock.

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

## ■ For DC Relay Wiring




## ■ For AC Relay Wiring




F2-04.EPS

**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.

## 2.3.1 Cable Specifications and Recommended Cables

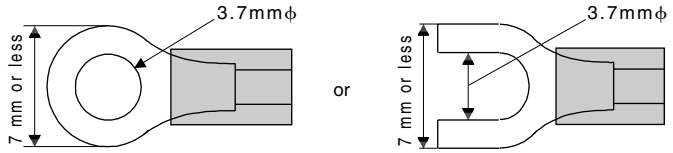
| Purpose | Name and Manufacturer |
|---|---|
| Power supply, grounding, relay contact outputs | 600 V PVC insulated wires, JIS C 3307, 0.9 to 2.0 $mm^2$ |
| Thermocouple | Shielded compensating lead wires, JIS C 1610, □X-□-□-□ (See Yokogawa Electric's GS 6B1U1-E.) |
| RTD | Shielded wires (three conductors),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

F2-05.EPS

- In the case of thermocouple input, use the proper compensating leadwire types.
- For RTD input, use wiring having low conductor resistance, and so significant differences in resistance among the three conductors.
- For power supply wiring, use a cable or wiring with the characteristics of 600V vinyl insulated wire (JIS C3307) or equivalent.

## 2.3.2 Recommended Terminal Lugs

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

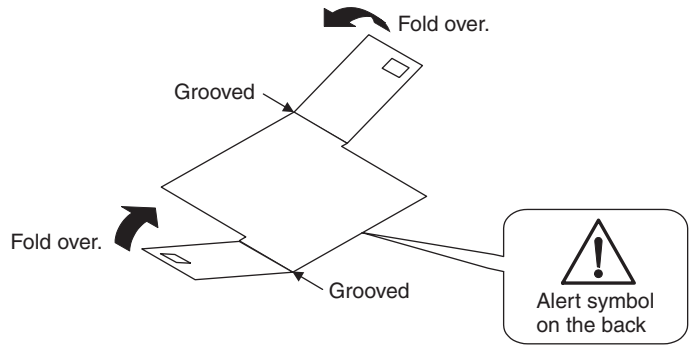



F2-06.EPS

- When connecting the wiring to the terminals, we recommend use of solderless crimp terminal lugs with insulated sleeves.

# 2.3.3 Terminal Covers

< Step-1 >




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.

F2-07.EPS

**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.

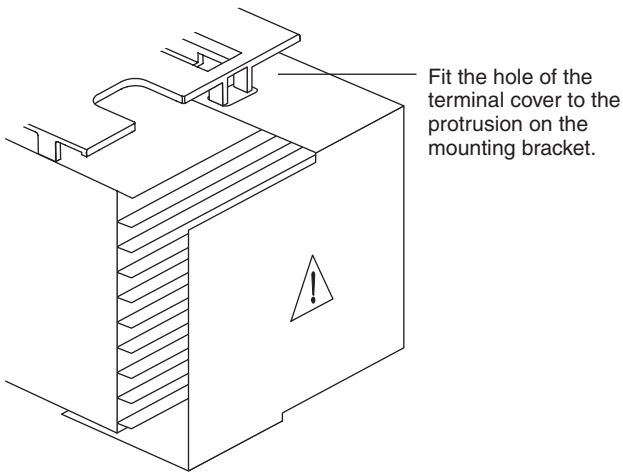
- An optional terminal cover, used to keep the terminals from accidentally being touched and to prevent electrics shocks, is also available.

| Target Model | Part Number | Sales Unit |
|---|---|---|
| For UT450 | T9115YD | 1 |
| For UT420 | T9115YE | 1 |

See the figure <step-1> and <step-2> on the left to attach the terminal cover.

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.

< Step-2 >



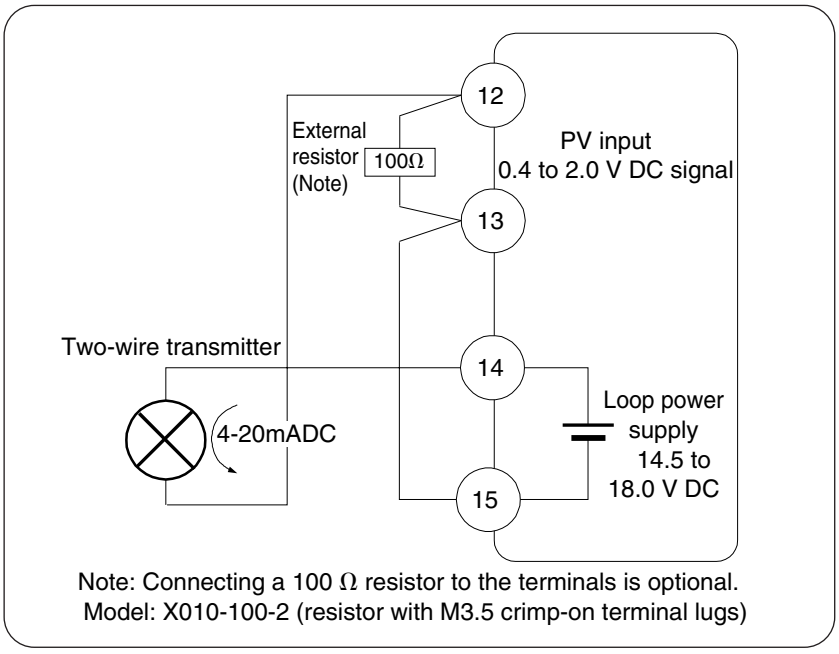

F2-07-01.EPS

2 With the cover properly folded, fit the top and bottom holes to the protrusion of the mounting brackets.

# 2.3.4 Wiring for 15V DC/24V DC Loop Power Supply

(See 10.7 Loop Power Supply on Page 10-19 for the outline of these function.)

## ● 15V DC Power Supply Wiring to Two-wire Sensor

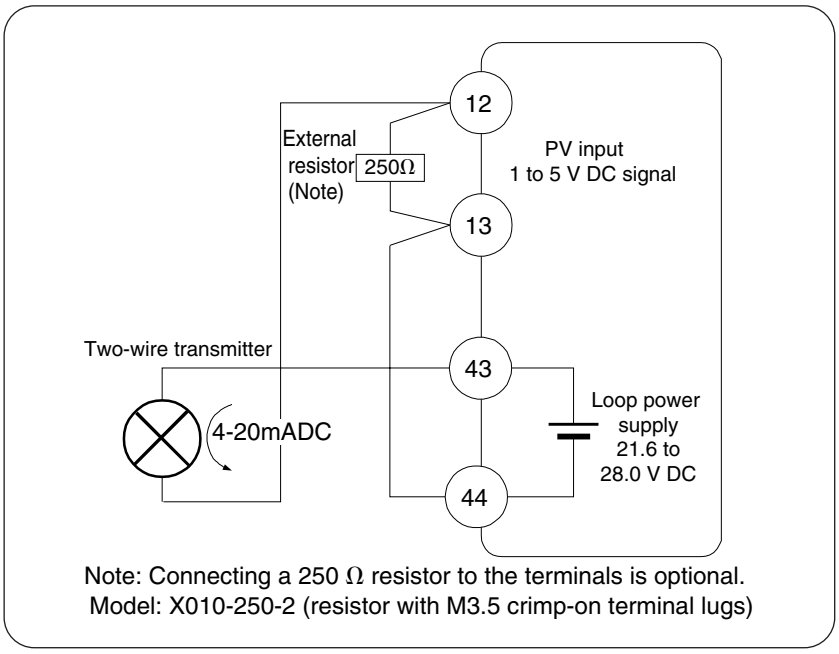



Note: Connecting a 100 Ω resistor to the terminals is optional.
Model: X010-100-2 (resistor with M3.5 crimp-on terminal lugs)

F2-07-02.EPS

- 15V DC Loop Power Supply for two-wire transmitter is available in all models of UT450/UT420 as standard function. If retransmission output is used, 15V DC loop power supply can not be used.

## ● 24V DC Power Supply Wiring to Two-wire Sensor

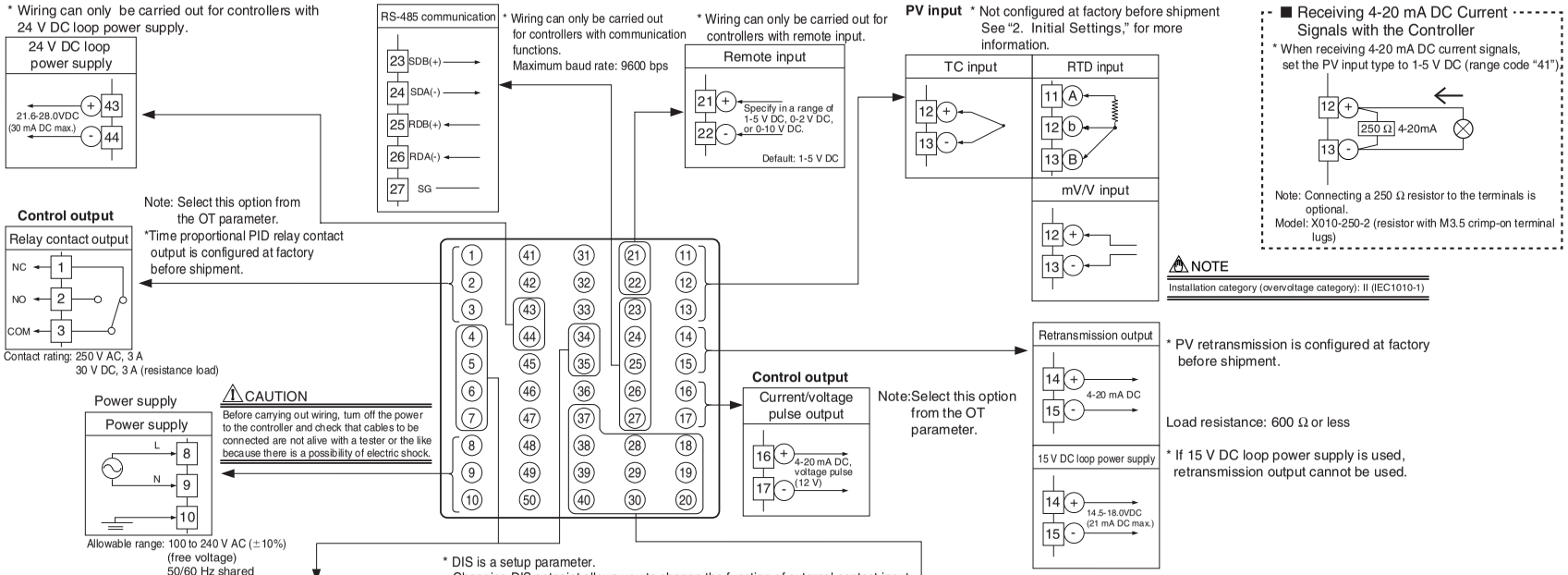



Note: Connecting a 250 Ω resistor to the terminals is optional.
Model: X010-250-2 (resistor with M3.5 crimp-on terminal lugs)

F2-07-03.EPS

- 24V DC Loop Power Supply for two-wire transmitter is available in UT450-3□ and 4□. In these models, this function can be used with retransmission output or 15V DC loop power supply simultaneously.

## ■ UT450 Standard Type (Model UT450-0□ or UT450-3□)



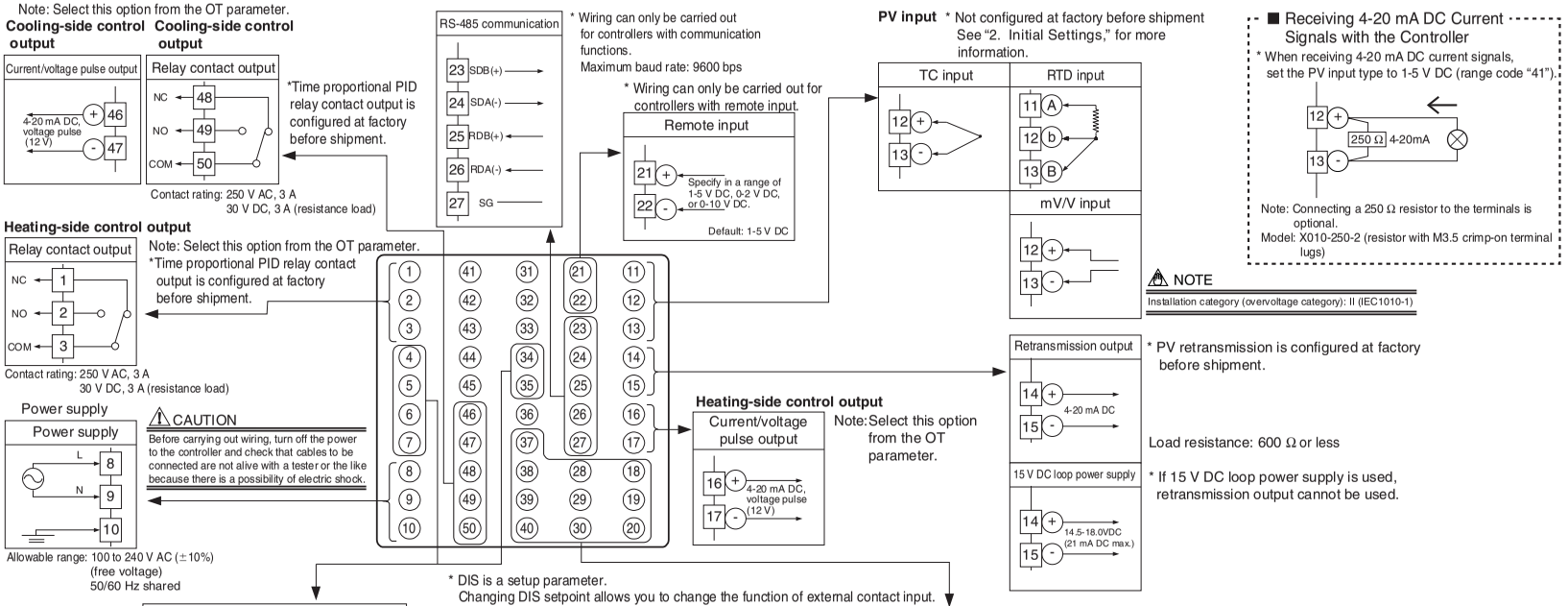

* OT is a setup parameter.
You can change the settings of the parameter OT to change the control output type.
See "2. Initial Settings," for more information.

| Correspondence between parameter OT and control output types | | | |
|---|---|---|---|
| OT=0 (factory-set default) | OT=1 | OT=2 | OT=3 |
| Time proportional control Relay output (terminals①, ②and③) | Time proportional control Voltage pulse output (terminals⑯and⑰) | Current output (terminals⑯and⑰) | On-off control Relay output (terminals①, ②and③) |

Note: External Contact Input
If the power is turned on when the external contact input is OFF, the mode (SPN, R/L, or A/M) existing before the power is turned off will be continued. (except for RUN/STOP)

F2-08.EPS

# ■ UT450 Heating/Cooling Type (Model UT450-2□)




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

| When DIS=0 | When DIS=1 (Factory-set default) | When DIS=2 | When DIS=3 | When DIS=4 |
|---|---|---|---|---|
| No function | AUTO when DI1=ON<br>MAN when DI1=OFF | AUTO when DI1=ON<br>MAN when DI1=OFF | STOP when DI1=ON<br>RUN when DI1=OFF | When switching target SP 1 to 4:<br>1.SP 2.SP 3.SP 4.SP<br>DI1 OFF ON OFF ON<br>DI2 OFF OFF ON ON |
| No function | STOP when DI2=ON<br>RUN when DI2=OFF | 2.SP when DI2=ON<br>1.SP when DI2=OFF | 2.SP when DI2=ON<br>1.SP when DI2=OFF | |
| No function | When switching target SP 1 to 8:<br>1.SP 2.SP 3.SP 4.SP 5.SP 6.SP 7.SP 8.SP<br>DI3 ON OFF ON OFF ON OFF ON OFF<br>DI4 OFF ON ON OFF OFF ON ON OFF<br>DI5 OFF OFF OFF ON ON ON ON OFF<br>DI6 OFF OFF OFF OFF OFF OFF OFF ON | STOP when DI3=ON<br>RUN when DI3=OFF | AUTO when DI3=ON<br>MAN when DI3=OFF | STOP when DI3=ON<br>RUN when DI3=OFF |
| No function | | No function | No function | AUTO when DI4=ON<br>MAN when DI4=OFF |
| No function | | No function | No function | No function |
| No function | * If all of the contact inputs are set to OFF, the controller uses the immediately preceding target setpoint. | No function | No function | No function |
| No function | Common | Common | Common | Common |
| Remote when R/L=ON<br>Local when R/L=OFF | Remote when R/L=ON<br>Local when R/L=OFF | Remote when R/L=ON<br>Local when R/L=OFF | Remote when R/L=ON<br>Local when R/L=OFF | Remote when R/L=ON<br>Local when R/L=OFF |
| Common | Common | Common | Common | Common |

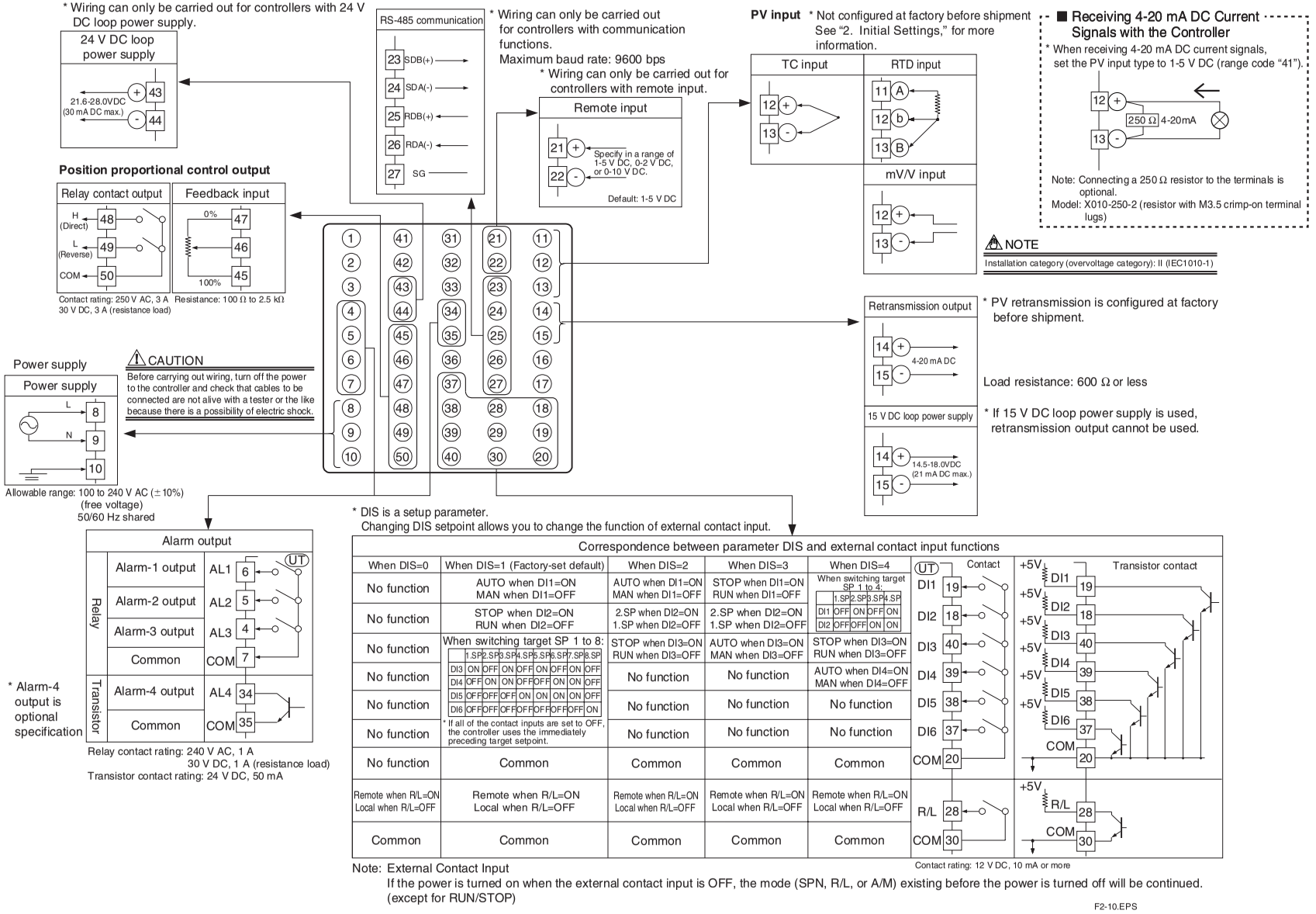
**Correspondence between parameter OT and heating-side/cooling-side output types**

| OT=4 (factory-set default) | OT=5 | OT=6 | OT=7 | OT=8 | OT=9 | OT=10 | OT=11 | OT=12 |
|---|---|---|---|---|---|---|---|---|
| Heating side: Relay output (terminals ①, ② and ③)<br>Cooling side: Relay output (terminals ㊽, ㊾ and ㊿) | Heating side: Voltage pulse output (terminals ⑯ and ⑰)<br>Cooling side: Relay output (terminals ㊽, ㊾ and ㊿) | Heating side: Current output (terminals ⑯ and ⑰)<br>Cooling side: Relay output (terminals ㊽, ㊾ and ㊿) | Heating side: Relay output (terminals ①, ② and ③)<br>Cooling side: Voltage pulse output (terminals ㊻ and ㊼) | Heating side: Voltage pulse output (terminals ⑯ and ⑰)<br>Cooling side: Voltage pulse output (terminals ㊻ and ㊼) | Heating side: Current output (terminals ⑯ and ⑰)<br>Cooling side: Voltage pulse output (terminals ㊻ and ㊼) | Heating side: Relay output (terminals ①, ② and ③)<br>Cooling side: Current output (terminals ㊽ and ㊼) | Heating side: Voltage pulse output (terminals ⑯ and ⑰)<br>Cooling side: Current output (terminals ㊻ and ㊼) | Heating side: Current output (terminals ⑯ and ⑰)<br>Cooling side: Current output (terminals ㊻ and ㊼) |

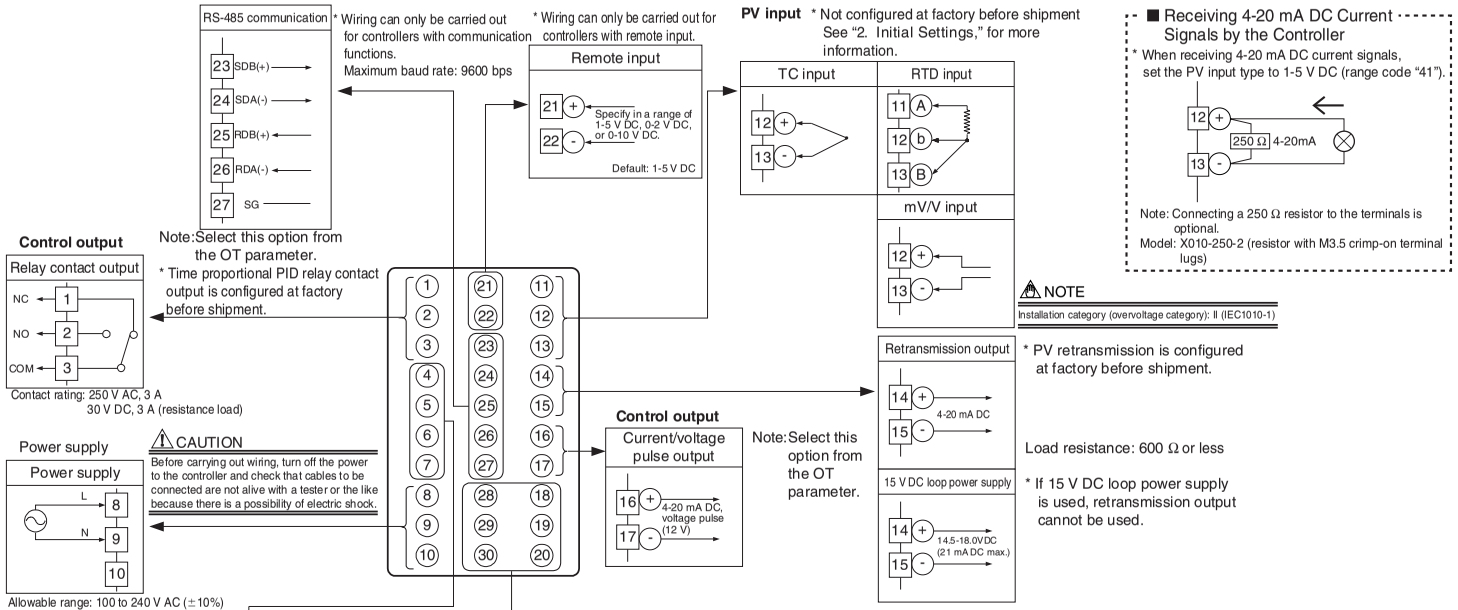
The control output types, "relay output" and "voltage pulse output" shown in the table above refer to those of time proportional control.
To change the type to a relay output for on-off control, select "Relay Terminals" and change the setpoint of the proportional band to "0."

F2-09.EPS

# ■ UT450 Position Proportional Type (Model UT450-1□ or UT450-4□)



# ■ UT420 Standard Type (Model UT420-0□)



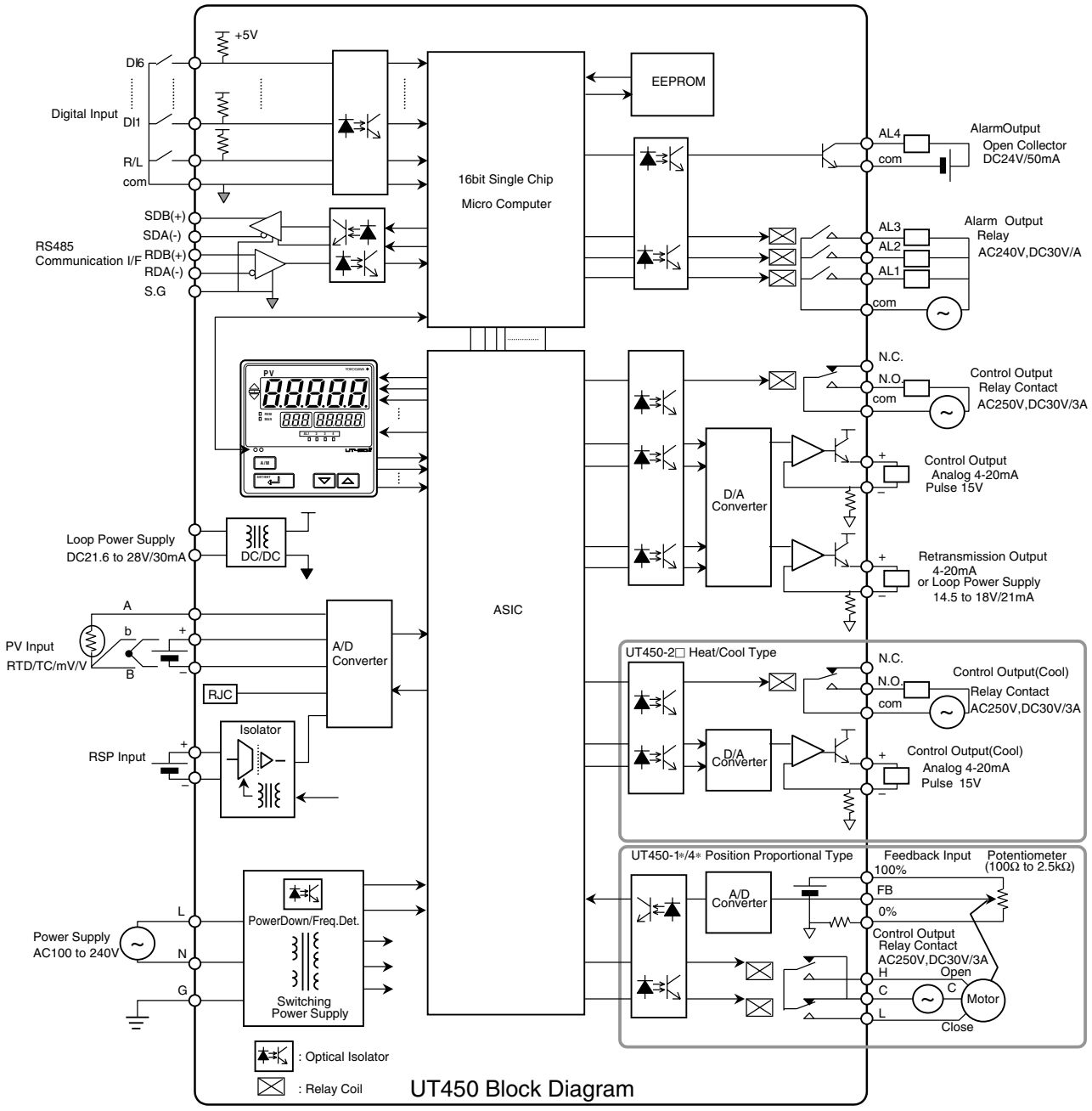

Note: External Contact Input
If the power is turned on when the external contact input is OFF, the mode (SPN, R/L, or A/M) existing before the power is turned off will be continued. (except for RUN/STOP)

* OT is a setup parameter.
You can change the settings of the parameter OT to change the control output type.
See "2. Initial Settings," for more information.

| Correspondence between parameter OT and control output types | | | |
|---|---|---|---|
| OT=0 (factory-set default) | OT=1 | OT=2 | OT=3 |
| Time proportional control<br>Relay output (terminals①, ②and③) | Time proportional control<br>Voltage pulse output (terminals⑯ and ⑰) | Current output<br>(terminals⑯ and ⑰) | On-off control<br>Relay output (terminals①, ②and③) |

F2-11.EPS

# 2.5 Input/Output Circuit Block Diagrams

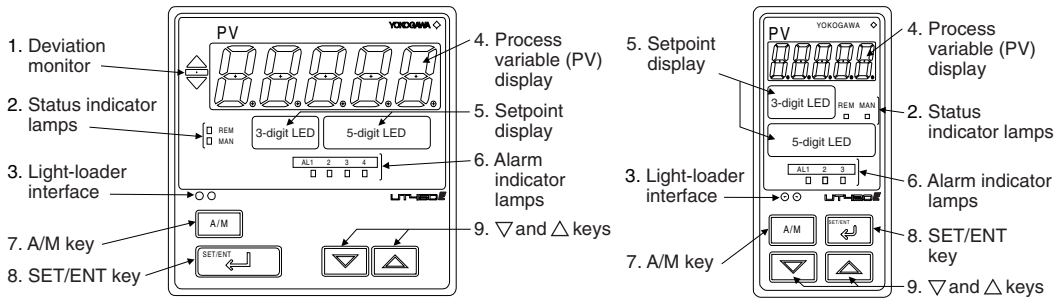



F2-12.EPS

Blank Page

# 3. OPERATIONS

## 3.1 Names and Functions of Front Panel Parts




F3-01.EPS

| | Name of Part | Function |
|---|---|---|
| 1. | Deviation monitor (for UT450 only) | When lit, indicates the status of a deviation (PV - SP).<br>△ : Is lit (in orange) if a deviation exceeds the deviation display range.<br>▭ : Is lit (in green) when a deviation is within the deviation display range.<br>▽ : Is lit (in orange) if a deviation falls below the deviation display range.<br>(The deviation display range can be changed using the setup parameter DVB .)<br>The deviation monitor goes off if any display other than the operating display or SELECT display is shown. |
| 2. | Status indicator lamps | Is lit (in green) to indicate the status of operation or control.<br>REM: Is lit when in remote mode.<br>MAN: Is lit when in manual mode. The lamp blinks when the controller is being auto-tuned. |
| 3. | 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. |
| 4. | Process variable (PV) display | Displays PV.<br>Displays a menu symbol when you set a parameter.<br>Displays an error code (in red) if an error occurs. |
| 5. | Setpoint display | Displays a parameter symbol in 3-digit LED.<br>Displays the setpoint of a parameter in 5-digit LED. |
| 6. | Alarm indicator lamps | UT450: If any of alarms 1 to 4 occurs, the respective alarm indicator lamp (AL1 to AL4) is lit (in orange).<br>UT420: If any of alarms 1 to 3 occurs, the respective alarm indicator lamp (AL1 to AL3) is lit (in orange). |
| 7. | A/M key (A/M) | Used to switch between the AUTO and MAN modes. Each time you press the key, it switches to the AUTO or MAN mode alternately. |
| 8. | 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. |
| 9. | ▽and △ keys | 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. To change from the parameter setting (operating or setup) display to the menu or from the setup parameter setting display menu to operating parameter setting display menu, press the ▽ and △ keys simultaneously. |

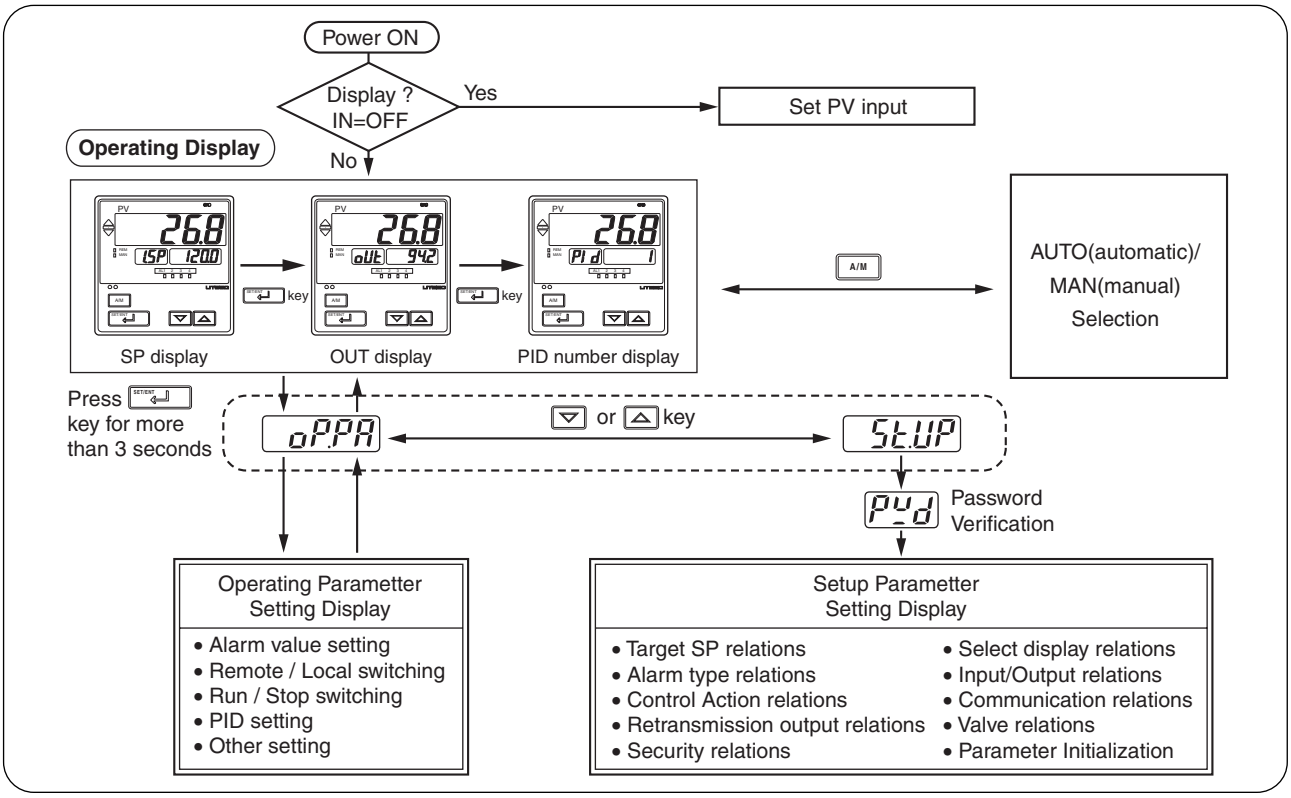
T3-01.EPS

## ■ Setting of Main Parameters at the Shipment from Factory

| Item | Initial values for standard type controllers | Initial values for heating/cooling type controllers | Initial values for position proportional type controllers |
|---|---|---|---|
| Remote input signal (only for controllers with remote inputs) | 1 to 5 V DC (variable) | | |
| Control output | Time proportional PID relay output (variable) | Heating side: Time proportional PID relay output (variable)<br>Cooling side: Time proportional PID relay output (variable) | Relay output (fixed) |
| Control action | Reverse action (variable) | Not specified | |
| PID parameter | P = 5.0%, I = 240 seconds, D = 60 seconds. | | |
| Alarm output | Alarm-1: PV high limit, Alarm-2: PV low limit, Alarm-3: PV high limit, Alarm-4: PV low limit | | |

T3-02.EPS

# 3.2 Key Operation Principles




F3-02.EPS

**Transferring to the Operating Display / Operating Parameter Setting Display requires pressing of the SET/ENT Key for more than 3 sec.**

Pressing the SET/ENT key for more than 3 sec allows the operating display or the operating parameter setting display to be alternately selected.

**A/M Key for switching between AUTO (Automatic) and MAN (Manual)**

Press the A/M key to switch between AUTO and MAN. Successive keystrokes toggle the mode back and forth between automatic and manual.

**SET/ENT Key for selecting a Parameter**

With the operating parameter setting display or the setup parameter setting display shown, each press of the SET/ENT key changes a parameter item.

**▽ and △ Keys for increasing / decreasing a value**

Press the ▽ key to decrease a numeric or the △ key to increase a numeric.

**SET/ENT Key for execution**

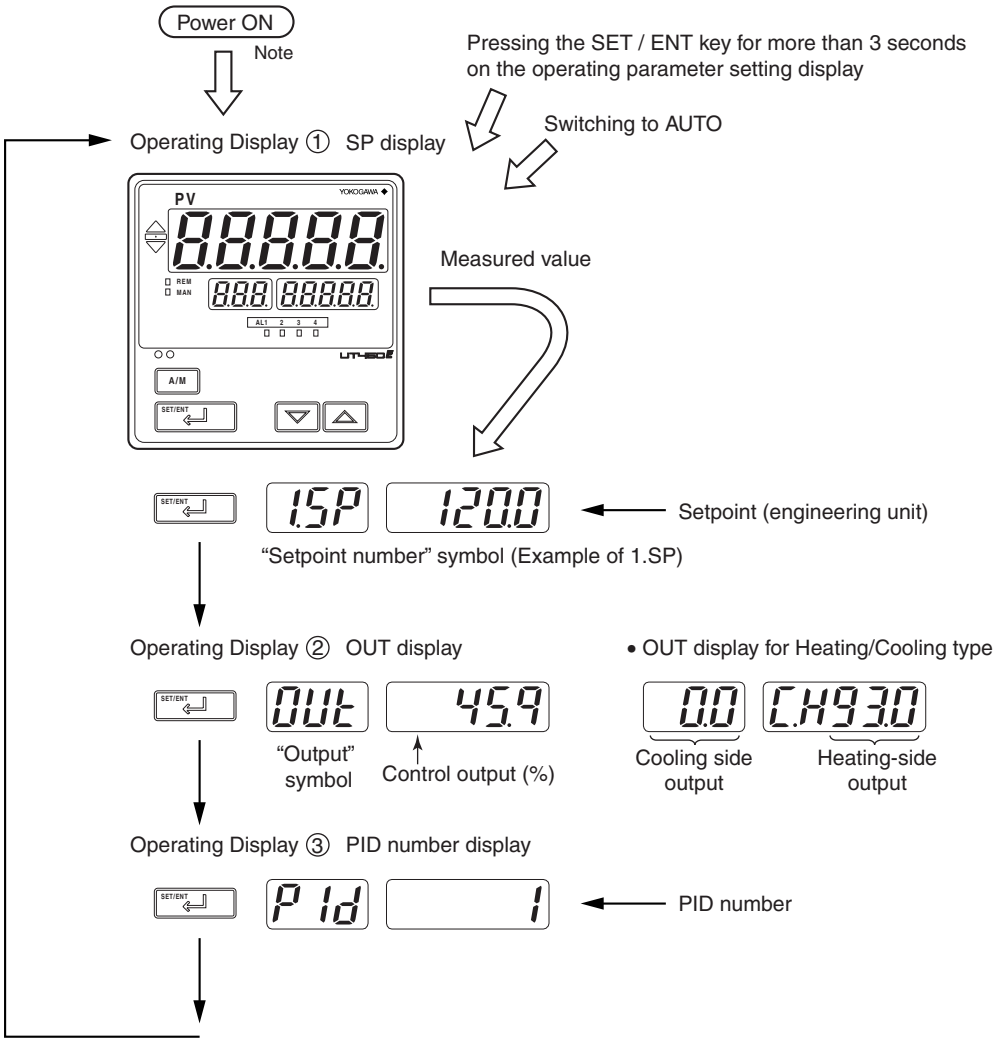
To execute numeric setting, mode change, or SP number selection, always press the SET/ENT key. This changes the existing numeric or mode to the newly set numeric or mode.

By setting a password, you can prevent changes to setup parameters. (See 10.4 Security Function for details.)

The password is verified when you switch from the operating parameter setting display to the setup parameter setting display.

# 3.3 Operating Display

- Pressing the SET/ENT key for more than 3 seconds on the operating display to move to the operating parameter setting display.
- Pressing the SET/ENT key for more than 3 seconds on the operating parameter setting display causes the operating display ① to appear.
- Switching from the MAN mode to AUTO causes the operating display ① to appear.
- Switching from the AUTO mode to MAN causes the operating display ② to appear.
- Each time the SET/ENT key is pressed, the operating display changes in the order of ①, ②, ③, ①, .....
- The upper large display area always displays process variables.
- The lower right and left display areas change as follows and can be suitably used as needed.

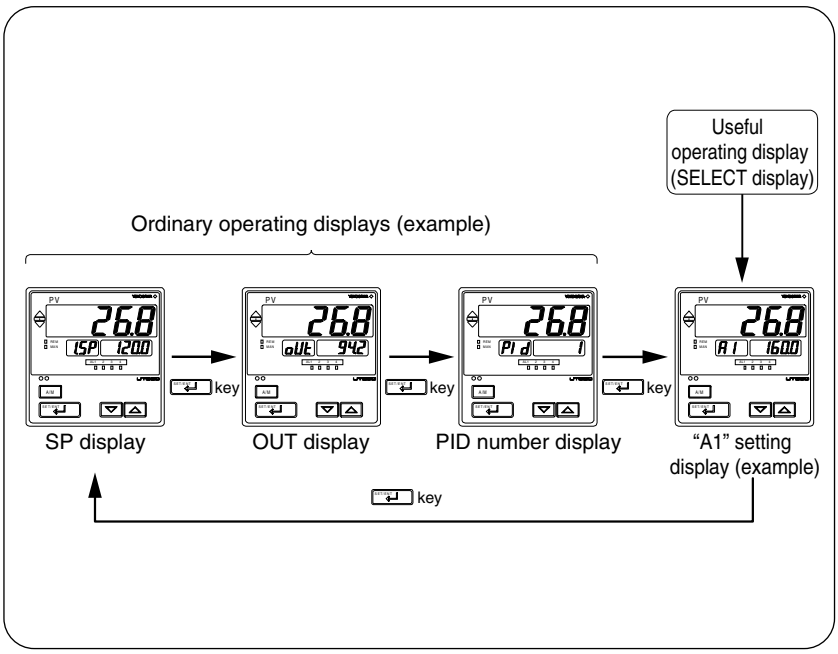



Note: Set PV input type first, when the "IN = OFF" display is appeared.

F3-03.EPS

# 3.3.1 SELECT Display

## ● Useful Operating Displays




F3-03-01.EPS

- Registering frequently changed parameters in the SELECT display after ordinary operating displays will allows you to change settings easily. A maximum of five SELECT displays can be registered.
- For example, if you want to change the Alarm-1 setting value often, select the operating parameter "A1" setting display as a SELECT display.

## ● Seting

**UT450, UT420 D-register Map**

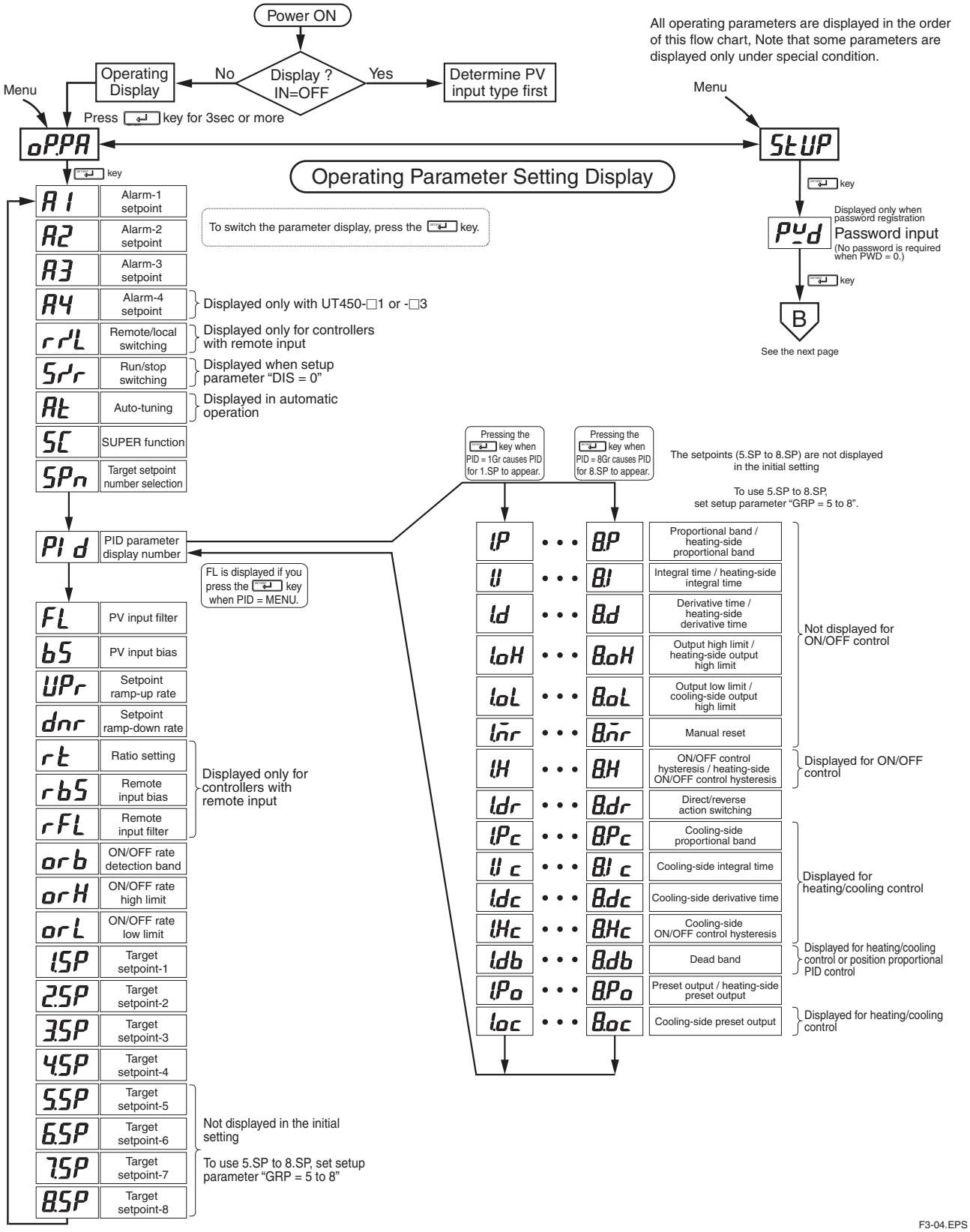
| PROCESS | | | PROGRAM | | MODE/PAR | | | |
|---|---|---|---|---|---|---|---|---|
| No. | 1~ | No. 51~ | No. 101~ | No. 151~ | No. | 201~ | No. | 251~ |
| 1 | ADERROR | 51 | 101 | 151 | 201 | A/M | 251 | ORH |
| 2 | ERROR | 52 | 102 | 152 | 202 | | 252 | ORL |
| 3 | PV | 53 | 103 | 153 | 203 | R/L | 253 | |
| 4 | CSP | 54 | 104 | 154 | 204 | | 254 | |
| 5 | OUT | 55 | 105 | 155 | 205 | S/R | 255 | |
| 6 | HOUT | 56 | 106 | 156 | 206 | | 256 | |
| 7 | COUT | 57 | 107 | 157 | 207 | SPN | 257 | |
| 8 | MOD | 58 | 108 | 158 | 208 | | 258 | |
| 9 | PIDNO | 59 | 109 | 159 | | | | |
| | CSPNO | 60 | 110 | | | | | |
| | | | | 178 | 228 | | 278 | |
| 29 | | | 129 | 179 | 229 | | 279 | |
| 30 | | 80 | 130 | 180 | 230 | | 280 | |
| 31 | | 81 | 131 | 181 | 231 | A1 | 281 | |
| 32 | | 82 | 132 | 182 | 232 | A2 | 282 | |
| 33 | DISTS | 83 | 133 | 183 | 233 | A3 | 283 | |
| 34 | | 84 | 134 | 184 | | | | |
| | PARAERR | 85 | 135 | | | | | |

F3-03-02.EPS

- Setup parameters "C.S1", "C.S2", "C.S3", "C.S4" and "C.S5" are used to set the SELECT displays.
- For parameters "C.S1" to "C.S5", set a number on the D-register map to specify the parameter you want to register.
- For example, if you want to make a SELECT display-1 for setting the Alarm-1 setpoint, set "231" (D-register number of parameter "A1") to the setup parameter "C.S1".
- For any D register number other than those on the left, see the User's Manual (IM 05J01B02-01E in the CD-ROM).

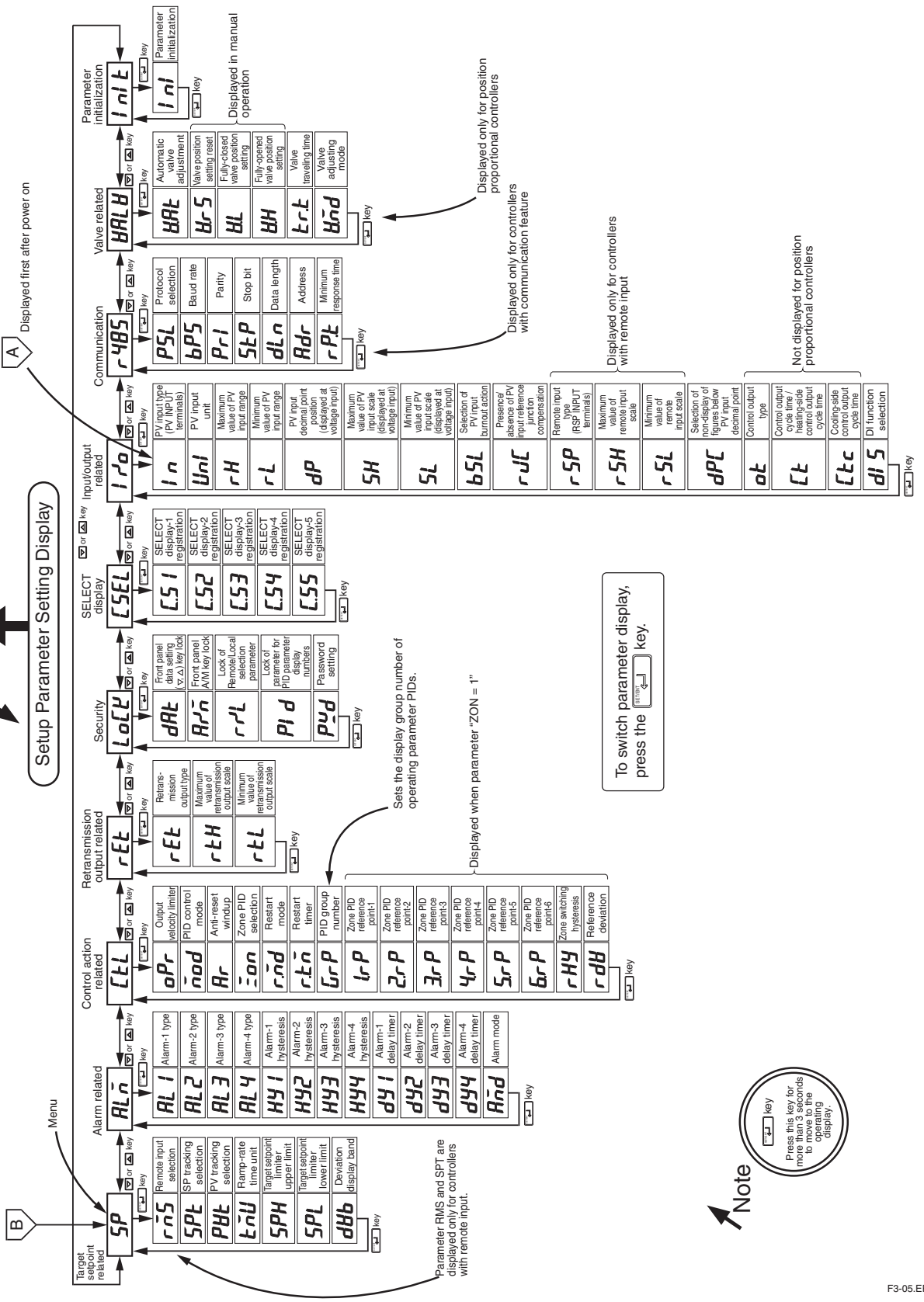
# 3.4 PARAMETERS

## 3.4.1 Parameter Setting Flow




F3-04.EPS

# 3.4.2 Setup Parameter Setting Flow



# 3.4.3 Parameter List

**Operating Parameter (1/2)**

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting | Reference Page |
|---|---|---|---|---|---|
| A1 (A1) | Alarm 1-setpoint | 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%<br>Timer alarm (for alarm 1 only): 0.00 to 99.59 (hour. min) or (min. sec)<br>These Alarm setpoint parameters are common to the parameters 1.SP to 8.SP. | 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% | | P.10-10 |
| A2 (A2) | Alarm 2-setpoint | | | | |
| A3 (A3) | Alarm 3-setpoint | | | | |
| A4 (A4) | Alarm 4-setpoint | | | | |
| rrL (R/L) | Remote/local switching | REM: remote operation<br>LCL: local operation | LCL | | P.10-2 |
| SrR (S/R) | Run/stop switching | Stop: operation stopped<br>Run: operation started | RUN | | P.10-6 |
| AT (AT) | Auto-tuning | OFF: No auto-tuning<br>1 to 8: Auto-tuning for 1.SP to 8.SP<br>9: Performs auto-tuning to all groups 1 to 8. | OFF | | P.6-1 |
| SC (SC) | "Super" function | OFF: Disable<br>1: Overshoot suppressing function<br>2: Hunting suppressing function (Stable mode)<br>3: Hunting suppressing function (Response mode) | OFF | | P.7-1 to P.7-2 |
| SPn (SPN) | Target setpoint number selection | 1 to 8:<br>Select target setpoint 1 (1.SP) to 8 (8.SP) | 1 | | P.9-1 |
| PId (PID) | PID parameter display number | MENU: Move to FL parameter display<br>1Gr to 8Gr: Display of each PID parameter (factory-set to 1Gr to 4Gr) | MENU | | P.8-1 |
| FL (FL) | PV input filter | OFF, 1 to 120 sec<br>Used when the PV input fluctuates. | OFF | | P.4-7 |
| bS (BS) | PV input bias | -100.0% to 100.0% of PV input range span<br>Used to adjust the PV input value. | 0.0% of PV input range span | | P.4-6 |
| UPr (UPR) | Setpoint ramp-up-rate | OFF<br>0.0% + 1 digit of PV input range span to 100.0% of PV input range span<br>Set ramp-up-rate or ramp-down-rate per hour or minute.<br>Sets unit in ramp-rate-time unit (TMU). | OFF | | P.9-2 |
| dnr (DNR) | Setpoint ramp-down-rate | | OFF | | |
| rt (RT) | Ratio setting | 0.001 to 9.999<br>Target setpoint = Remote input × Ratio setpoint + Remote bias | 1.000 | | P.4-7<br>P.10-17 |
| rbS (RBS) | Remote input bias | -100.0 to 100.0% of PV input range span | 0.0% of PV input range span | | |
| rFL (RFL) | Remote input filter | OFF, 1 to 120 sec. | OFF | | P.10-16 |
| orb (ORB) | ON/OFF rate detection band | 0.0 to 100.0% of PV input range span | 1.0% of PV input range span | | P.10-12 |
| orH (ORH) | ON/OFF rate high limit | [ORL + 1 digit] to 105.0% | 100.0% | | |
| orL (ORL) | ON/OFF rate low limit | -5.0% to [ORH - 1 digit] | 0.0% | | |

T3-03-1.EPS

## Operating Parameter (2/2)

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting | Reference Page |
|---|---|---|---|---|---|
| 1.SP (1.SP) | Target setpoint-1 | 0.0 to 100.0% of PV input range<br>However, between target setpoint limiter lower limit (SPL) and upper limit (SPH).<br>Note: The 5.SP to 8.SP are not displayed in the initial setting.<br>To display them, set setup parameter GRP (PID set number) to the number you wish to display. | 0.0% of PV input range | | P.9-1 |
| • • • | | | | | |
| 8.SP (8.SP) | Target setpoint-8 | | | | |
| 1.P (1.P) | •Proportional band<br>•Heating-side proportional band (in heating/cooling control) | 0.1 to 999.9%<br>In heating/cooling control: 0.0 to 999.9% (heating-side ON/OFF control applies when 0.0) | 5.0% | | P.8-1 |
| 1.I (1.I) | Integral time<br>Heating-side integral time (in heating/cooling control) | OFF, 1 to 6000 sec. | 240 sec. | | P.8-2 |
| 1.d (1.D) | Derivative time<br>Heating-side derivative time (in heating/cooling control) | OFF, 1 to 6000 sec. | 60 sec. | | P.8-3 |
| 1.oH (1.OH) | Output high limit<br>Heating-side output high limit (in heating/cooling control) | -5.0 to 105.0%<br>Heating-side limiter in heating/cooling control: 0.0 to 105.0% (1.OL < 1.OH) | 100%<br>Heating/cooling control: 100.0% | | P.5-11 |
| 1.oL (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: 0.0 to 105.0% (1.OL < 1.OH)<br>SD (shutdown): Set in manual operation in 4-20 mA control output. The control output is set at 0 mA. | 0.0%<br>Heating/cooling control: 100.0% | | |
| 1.MR (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. | 50.0% | | P.8-2 |
| 1.H (1.H) | ON/OFF control hysteresis<br>Heating-side ON/OFF control hysteresis | In ON/OFF control: 0.0 to 100.0% of PV input range span<br>Position proportional PID control or heating/cooling control: 0.0 to 100.0% | ON/OFF control: 0.5% of PV input range span<br>Position proportional PID control and heating/cooling control: 0.5% | | P.5-7 |
| 1.dr (1.DR) | Direct/reverse action switching | RVS: reverse action, DIR: direct action | RVS | | P.5-10 |
| 1.Pc (1.Pc) | Cooling-side proportional band | 0.0 to 999.9%<br>(Cooling-side ON/OFF control applies when 0.0) | 5.0% | | P.5-8<br>P.8-1 |
| 1.Ic (1.Ic) | Cooling-side integral time | OFF, 1 to 6000 sec | 240 sec. | | P.8-2 |
| 1.dc (1.Dc) | Cooling-side derivative time | OFF, 1 to 6000 sec | 60 sec. | | P.8-3 |
| 1.Hc (1.Hc) | Cooling-side ON/OFF control hysteresis | 0.0 to 100.0% | 0.5% | | P.5-7 |
| 1.db (1.DB) | Dead band | In heating/cooling control: -100.0 to 50.0%<br>In position proportional PID control: 1.0 to 10.0% (*See P.5-6) | 3.0% | | P.5-6<br>P.5-8 |
| 1.Po (1.PO) | Preset output/Heating-side preset output (in heating/cooling control) | -5.0 to 105.0%<br>In heating/cooling control:<br>Heating side 0.0 to 105.0%<br>In Stop mode, fixed control output can be generated. | 0.0% | | P.5-12<br>P.11-4 |
| 1.oc (1.Oc) | Cooling-side preset output | 0.0 to 105.0%<br>In Stop mode, cooling-side fixed control output can be generated. | 0.0% | | |

The PID-related parameters in the above chart are displayed when "1Gr" is set to PID parameter display number (PID). In this case, the corresponding target setpoint is 1.SP (target setpoint-1).
To set PID corresponding to target setpoint 2 to 4, set "2Gr", "3Gr", or "4Gr" to PID. The relevant parameters will then be displayed.

T3-03-2.EPS

## Setup Parameter (1/4)

| Related Function | Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting | Reference Page |
|---|---|---|---|---|---|---|
| Target Setpoint | rmS (RMS) | Remote input selection | RSP: Remote setpoints are used via remote input (terminals).<br>COM: Remote setpoints are used via communication. | RSP | | P.10-16 |
| | SPt (SPT) | SP tracking selection | OFF, ON<br>Tracking is performed when the mode changes from Remote to Local (the local setpoint keeps track of the remote setpoint). | ON | | P.10-1 |
| | PVt (PVT) | PV tracking selection | OFF, ON<br>Uses a combination of the setpoint ramp-up (UPR) and setpoint ramp-down (DNR) parameters. | OFF | | |
| | tmU (TMU) | Ramp-rate time unit setting | HOUR, MIN<br>Time unit of setpoint ramp-up (UPR) and setpoint ramp-down (DNR) | HOUR | | P.9-2 |
| | SPH (SPH) | Target setpoint limiter upper limit | 0.0 to 100.0% of PV input range<br>where, SPL < SPH<br>Places a limit on the range within which the target setpoint is changed. | 100.0% of PV input range | | P.9-1 |
| | SPL (SPL) | Target setpoint limiter lower limit | | 0.0% of PV input range | | |
| | dvb (DVB) | Deviation display band (UT450 only) | 0.0 to 100.0% of PV input range span | 1.0% of PV input range span | | — |
| Alarms | AL 1 (AL1) | Alarm-1 type | OFF, 1 to 31<br>See page for timer function. | 1 | | P.10-9 |
| | AL2 (AL2) | Alarm-2 type | OFF, 1 to 20, 25 to 31<br>These Alarm Type parameters are common to the parameters 1.SP to 8.SP. | 2 | | |
| | AL3 (AL3) | Alarm-3 type | | 1 | | |
| | AL4 (AL4) | Alarm-4 type | | 2 | | |
| | HY1 (HY1) | Alarm-1 hysteresis | 0.0 to 100.0% of PV input range span<br>Output alarm: 0.0 to 100.0% | 0.5% of PV input range span<br>Output alarm: 0.5% | | P.10-10 |
| | HY2 (HY2) | Alarm-2 hysteresis | | | | |
| | HY3 (HY3) | Alarm-3 hysteresis | | | | |
| | HY4 (HY4) | Alarm-4 hysteresis | | | | |
| | dY1 (DY1) | Alarm-1 delay timer | 0.00 to 99.59 (min, sec.) (enabled when alarm-n type “ALn” is 1 to 20 or 28 to 31)<br>(n=1 to 4)<br>An alarm is output when the delay timer expires after the alarm setpoint is reached. | 0.00 | | — |
| | dY2 (DY2) | Alarm-2 delay timer | | | | |
| | dY3 (DY3) | Alarm-3 delay timer | | | | |
| | dY4 (DY4) | Alarm-4 delay timer | | | | |
| | Amd (AMD) | Alarm mode | Allows the alarm function to be enabled or disabled according to the operating condition.<br>0: Always active<br>1: Not active when in Stop mode<br>2: Not active when in Stop mode or manual operation | 0 | | — |

T3-04-1.EPS

## Setup Parameter (2/4)

| Related Function | Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting | Reference Page |
|---|---|---|---|---|---|---|
| Control Action | oPr (OPR) | Output velocity limiter | OFF (0)<br>0.1 to 100.0%/sec<br>can limit control output velocity | OFF | | P.5-11 |
| | mod (MOD) | PID control mode | 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 | | P.10-3 |
| | Ar (AR) | Anti-reset windup (Excess integration prevention) | AUTO (0), 50.0 to 200.0%<br>Used when the control output travels up to 100% or down to 0% and remains there.<br>The larger SP, the sooner PID computation (integral computation) stops. | AUTO | | P.8-5 |
| | zon (ZON) | Zone PID selection | 0: SP selection<br>1: Zone PID | 0 | | P.8-6 |
| | r.md (R.MD) | Restart mode | CONT: Continues action set before power failure.<br>MAN: Starts from manual operation status<br>AUTO: Continues action set before power failure in automatic operation. | CONT | | P.11-3 |
| | r.tm (R.TM) | Restart timer | 0 to 10 sec.<br>Sets time between power on and the instant where controller starts computation. | 0 sec. | | — |
| | GrP (GRP) | PID group number | 1 to 8<br>Determines operating parameter PID display group number. | 4 | | P.8-1 |
| | 1.rP (1.RP) | Zone PID reference point-1 | 0.0 to 100.0% of PV input range.<br>Note that 1.RP ≦ 2.RP ≦ 3.RP ≦ 4.RP ≦ 5.RP ≦ 6.RP.<br>Set Zone PID selection (ZON) parameter to “1”. | 100% value of PV input range | | P.8-6 |
| | UT450/420 has six reference point-1 to -6. ⋮ | | | | | |
| | 6.rP (6.RP) | Zone PID reference point-6 | | | | |
| | rHy (RHY) | Zone switching hysteresis | 0.0 to10.0% of PV input range span<br>Allows a hysteresis to be set for switching at a reference point. | 0.5% of PV input range span | | |
| | rdV (RDV) | Reference deviation | OFF, 0.0 to100.0% of PV input range span<br>Used to select PID constants according to a deviation from the setpoint. The maximum group of PID constants is used when the controller fails to keep track of the deviation. | OFF | | |
| Retransmission Output | rEt (RET) | Retransmission output type | OFF: Disable<br>1: PV, 2: SP , 3: OUT<br>4: Loop power supply for sensor (15 V) | 1 | | P.10-18 |
| | rtH (RTH) | Max. value of retransmission output scale | RET=1, 2: [RTL + 1 digit] to 100.0% of PV input range<br>RET=3: [RTL + 1 digit] to 100.0% | 100.0% of PV input range | | |
| | rtL (RTL) | Min. value of retransmission output scale | RET=1, 2: 0.0% of PV input range to [RTH - 1 digit]<br>RET=3: 0.0% to [RTH - 1 digit] | 0.0% of PV input range | | |
| Security | dAt (DAT) | Front panel data setting (△,▽) key lock | OFF, ON | OFF | | P.10-15 |
| | A/M (A/M) | Front panel A/M key lock | OFF, ON | OFF | | |
| | r/L (R/L) | Lock of Remote/Local selection parameter | OFF, ON | OFF | | |
| | PId (PID) | Lock of parameter for PID parameter display number | OFF, ON | OFF | | |
| | Pwd (PWD) | Password setting | 0: Password not set<br>1 to 30000 | 0 | | P.10-14 |

T3-04-2.EPS

## Setup Parameter (3/4)

| Related Function | Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting | Reference Page |
|---|---|---|---|---|---|---|
| SELECT Display | C.S1 | SELECT display-1 registration | OFF, 201 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 alarm-1 setpoint in operating display.<br>Numbers for registering alarm SP parameter for operating display:<br>Alarm-1 setpoint: 231 Alarm-2 setpoint: 232<br>Alarm-3 setpoint: 233 Alarm-4 setpoint: 234<br>Above numbers are alarm setpoint parameters for target setpoint-1 (1.SP). | OFF | | P.3-4 |
| | C.S2 | SELECT display-2 registration | | | | |
| | C.S3 | SELECT display-3 registration | | | | |
| | C.S4 | SELECT display-4 registration | | | | |
| | C.S5 | SELECT display-5 registration | | | | |
| Input / Output | IN | PV input type | OFF, 1 to 18, 30, 31, 35 to 37, 40, 41, 50, 51, 55, 56<br>(See Instrument Input Range Codes) | OFF | | P.4-2 |
| | UNI | PV input unit | %: Percent °F: Fahrenheit<br>°C: degree Celsius<br>-: No unit | °C | | P.4-3 |
| | RH | Max. value of PV input range | Instrument input range, however RL < RH<br>-Temperature input<br>Set the range of temperature that is actually controlled.<br>- 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 PV Input Scale (SH) and Minimum Value of PV Input Scale (SL). | Max. value of instrument input range | | P.4-4 |
| | RL | Min. value of PV input range | | Min. value of instrument input range | | |
| | DP | PV input decimal point position (displayed at voltage input) | 0 to 4<br>Set the position of the decimal point of voltage-mode PV input. | 2 | | P.4-5 |
| | SH | Max. value of PV input scale (displayed at voltage input) | -19999 to 30000, however SL < SH<br>Set the read-out scale of voltage-mode PV input. | 100.00 | | |
| | SL | Min. value of PV input scale (displayed at voltage input) | | 0.00 | | |
| | BSL | Selection of PV input burnout action | OFF<br>UP: Up scale<br>DOWN: Down scale | - | | |
| | RJC | Presence/absence of PV input reference junction compensation | OFF, ON | - | | P.4-6 |
| | RSP | Remote input type | 40, 41, 50, 51 | 41 | | P.10-16 |
| | RSH | Max. value of remote setting input scale | -19999 to 30000<br>However, RSL < RSH<br>Set RSL and RSH in a range of RL to RH or SL to SH. | Max. value of PV input range or that of PV input scale | | |
| | RSL | Min. value of remote setting input scale | | Min. value of PV input range or that of PV input scale | | |
| | DPC | Selection of non-display of figures below PV input decimal point | OFF, ON<br>For second decimal place, figures up to the first decimal place are shown. | OFF | | — |
| | OT | Control output type | 0 to 12<br>Note:The setting ralue 4 to 12 are displayed only for heating/ cooling type controllers. | 0<br>Heating/cooling type: 4 | | P.5-1 |
| | CT | Control output cycle time Heating-side control output cycle time in heating/cooling control | 1 to 1000 sec. | 30 sec. | | P.5-2 |
| | CTc | Cooling-side control output cycle time | 1 to 1000 sec. | 30 sec. | | |
| | DIS | DI function selection | 0,1,2,3 or 4 | | | P.10-4 |

T3-04-3.EPS

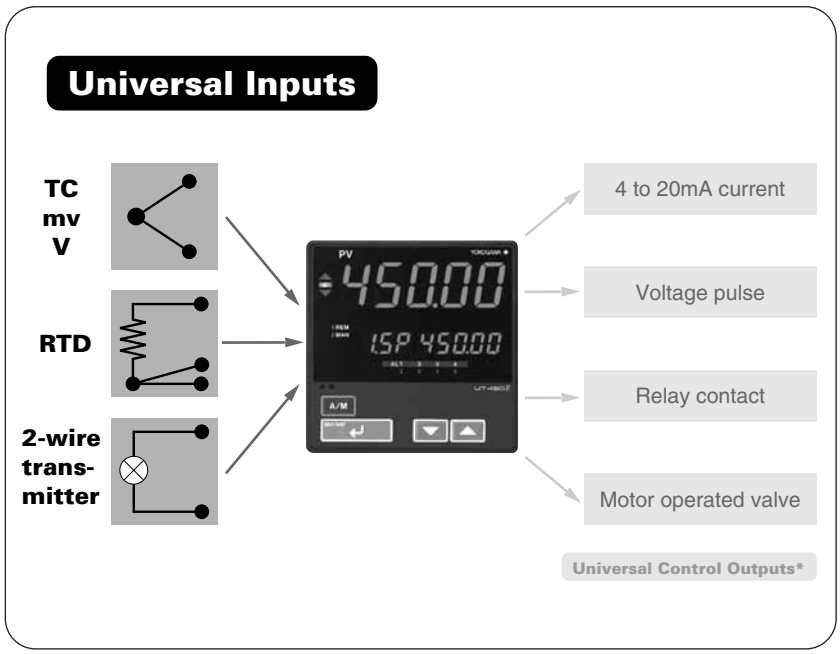
## Setup Parameter (4/4)

| Related Function | Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value | User Setting | Reference Page |
|---|---|---|---|---|---|---|
| Communication | PSL (PSL) | Protocol selection | 0: PC link communication<br>1: PC link communication (with sum check)<br>2: Ladder communication<br>3: Coordinated master station<br>4: Coordinated slave station<br>7: MODBUS (ASCII)<br>8: MODBUS (RTU)<br>10: Coordinated slave station (loop-1 mode)<br>11: Coordinated slave station (loop-2 mode) | 0 | | P.10-20 to P.10-44 |
| | bPS (BPS) | Baud rate | 600, 1200, 2400, 4800, 9600 (bps) | 9600 | | |
| | PrI (PRI) | Parity | NONE: None<br>EVEN: Even<br>ODD: Odd | EVEN | | |
| | StP (STP) | Stop bit | 1, 2 | 1 | | |
| | dLn (DLN) | Data length | 7, 8:<br>Fixed at 7, in MODBUS (ASCII) communication.<br>Fixed at 8, in MODBUS (RTU) and Ladder communication. | 8 | | |
| | Adr (ADR) | Address | 1 to 99<br>However, the maximum number of stations connectable is 31. | 1 | | |
| | rPt (RP.T) | Minimum response time | 0 to 10 (× 10 ms) | 0 | | |
| Valve Calibration (Position Proportional Controllers only) | V.AT (V.AT) | Automatic valve adjustment | Automatically adjusts the fully-shut and fully-open positions of a valve. When this function is used, there is no need for adjustment using the parameters V.RS, V.L and V.H.<br>OFF: -<br>ON: Start automatic adjustment | OFF | | P.5-5 |
| | V.rS (V.RS) | Valve position setting reset | The parameters V.RS, V.L and V.H are designed for manual adjustment of valve positions.<br>Setting V.RS to 1 resets the valve adjustment settings and causes the indication “V.RS” to blink. | 0 | | |
| | V.L (V.L) | Fully-closed valve position setting | Pressing the SET/ENT key with valve position set to the fully-closed position causes the adjusted value to be stored. When V.L adjustment is complete, V.L stops blinking. | Undefined | | |
| | V.H (V.H) | Fully-opened valve position setting | Pressing the SET/ENT key with valve position set to the fully-opened position causes the adjusted value to be stored. When V.H adjustment is complete, V.H stops blinking. | Undefined | | |
| | tr.t (TR.T) | Valve traveling time | 5 to 300 sec<br>Used to operate a valve according to the estimated valve position. Set the time required for the valve to open fully from a state of being fully shut. Confirm the valve traveling time by consulting the datasheet of the valve’s specifications.<br>The valve traveling time is only effective when Valve Adjustment Mode (V.MD) is set to 1 or 2. | 60 sec. | | |
| | V.Md (V.MD) | Valve adjusting mode | 0: Valve position feedback type<br>1: Valve position feedback type (moves to the estimating type if a valve input error or burnout occurs.)<br>2: Valve position estimating type | 0 | | |

T3-04-4.EPS

# 4. MEASURED INPUT

## 4.1 Universal Input




F4-01.EPS

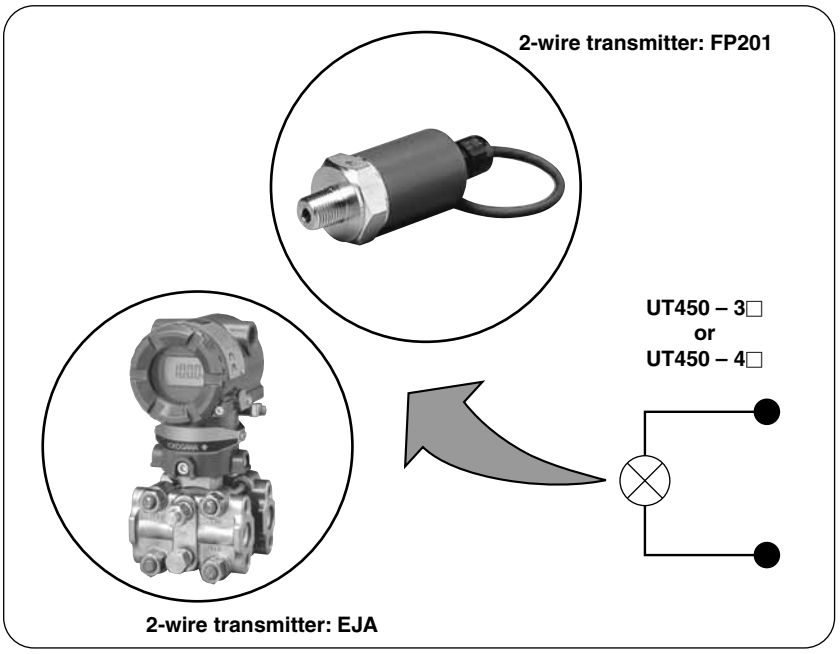
* See Page 5-1 for the information of Universal Output.

- **Selectable among TC, RTD, mV and DC voltage.**

  The type of input signal and input range can be changed at the customer side by some key operation or by using LL100 parameter setting tool.

- **0.1% Indication Accuracy.***

* Refer to the chart on the next page.




F4-02.EPS

- **Connectable up to two 2-wire trans mitters simultaneously.**

  UT450/420 has a 15V loop Supply (15V LPS) for a transmitter.

  Moreover, 24V LPS is also available simultaneously as optional function.

  Applicable models for 24V LPS:

  UT450 -3□

  and

  UT450 -4□

  *UT420 has no 24V LPS function.

# ■ Instrument Input Range Codes

| Input | Type | Instrument Input Range Code | Instrument Input Range | Measurement Accuracy |
|---|---|---|---|---|
| Unspecified | | OFF | Set the data item PV Input Type "IN" to the OFF option to leave the PV input type undefined. | |
| Thermocouple | K | 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. |
| | | 2 | -270.0 to 1000.0°C<br>-450.0 to 2300.0°F | |
| | | 3 | -200.0 to 500.0°C<br>-200.0 to 1000.0°F | |
| | J | 4 | -200.0 to 1200.0°C<br>-300.0 to 2300.0°F | |
| | T | 5 | -270.0 to 400.0°C<br>-450.0 to 750.0°F | |
| | | 6 | 0.0 to 400.0°C<br>-200.0 to 750.0°F | |
| | B | 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 | 8 | 0.0 to 1700.0°C<br>32 to 3100°F | ±0.15% of instrument range ±1 digit |
| | R | 9 | 0.0 to 1700.0°C<br>32 to 3100°F | |
| | N | 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 | 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) | 12 | -200.0 to 900.0°C<br>-300.0 to 1600.0°F | |
| | U(DIN) | 13 | -200.0 to 400.0°C<br>-300.0 to 750.0°F | |
| | | 14 | 0.0 to 400.0°C<br>-200.0 to 1000.0°F | |
| | W | 15 | 0.0 to 2300.0°C<br>32 to 4200°F | ±0.2% of instrument range ±1 digit |
| | Platinel 2 | 16 | 0.0 to 1390.0°C<br>32.0 to 2500.0°F | ±0.1% of instrument range ±1 digit |
| | PR20-40 | 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 | 18 | 0.0 to 2000.0°C<br>32 to 3600°F | ±0.2% of instrument range ±1 digit |
| RTD | JPt100 | 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) |
| | | 31 | -150.00 to 150.00°C<br>-200.0 to 300.0°F | ±0.2% of instrument range ±1 digit (Note 1) |
| | Pt100 | 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) |
| | | 36 | -200.0 to 500.0°C<br>-300.0 to 1000.0°F | |
| | | 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 | 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 | 41 | 1.000 to 5.000 V | |
| DC voltage | 0 to 2 V | 50 | 0.000 to 2.000 V | |
| | 0 to 10 V | 51 | 0.00 to 10.00 V | |
| | -10 to 20 mV | 55 | -10.00 to 20.00 mV | |
| | 0 to 100 mV | 56 | 0.0 to 100.0 mV | |

T4-01.EPS

* Performance in the standard operating condition (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.

* 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)

# 4.2 Measured Input Related Parameters

| PV input type (PV INPUT terminals) | PV input unit | Maximum value of PV input range | Minimum value of PV input range | PV input decimal point position (displayed at voltage input) | Maximum value of PV input scale (displayed at voltage input) | Minimum value of PV input scale (displayed at voltage input) | Selection of PV input burnout action | Presence/ absence of PV input reference junction compensation |
|---|---|---|---|---|---|---|---|---|
| In | Unl | rH | rL | dP | SH | SL | bSL | rJC |
| (IN) | (UNI) | (RH) | (RL) | (DP) | (SH) | (SL) | (BSL) | (RJC) |

F4-03.EPS

- The setup parameters (measured input relations) include the parameters shown at the left.

# 4.3 PV Input Unit

**%:** Percent

**°C:** Degree Celsius (Initial Value)

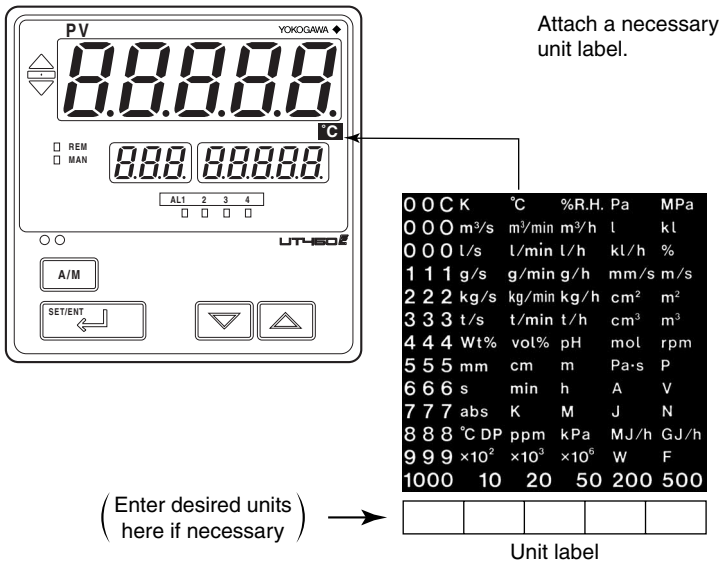
**°F:** Fahrenheit

**–:** No unit

F4-04.EPS

- The PV input unit can be set using the setup parameter “UNIT”.

## ● Unit Label




| | | | | | | |
|---|---|---|---|---|---|---|
| 0 0 C K | °C | %R.H. | Pa | MPa | | |
| 0 0 0 m³/s | m³/min | m³/h | l | kl | | |
| 0 0 0 l/s | l/min | l/h | kl/h | % | | |
| 1 1 1 g/s | g/min | g/h | mm/s | m/s | | |
| 2 2 2 kg/s | kg/min | kg/h | cm² | m² | | |
| 3 3 3 t/s | t/min | t/h | cm³ | m³ | | |
| 4 4 4 Wt% | vol% | pH | mol | rpm | | |
| 5 5 5 mm | cm | m | Pa·s | P | | |
| 6 6 6 s | min | h | A | V | | |
| 7 7 7 abs | K | M | J | N | | |
| 8 8 8 °C DP | ppm | kPa | MJ/h | GJ/h | | |
| 9 9 9 ×10² | ×10³ | ×10⁶ | W | F | | |
| 1000 | 10 | 20 | 50 | 200 | 500 | |

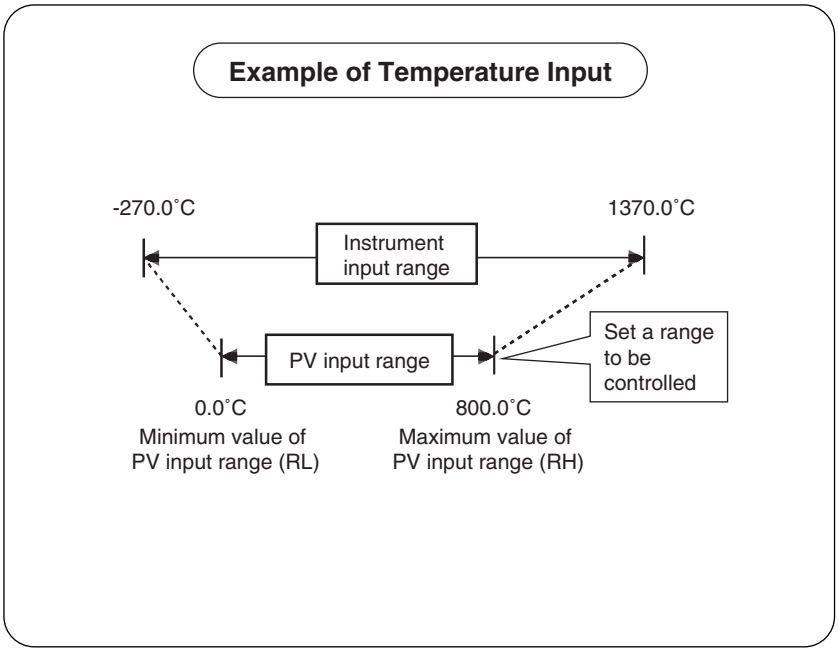
F4-05.EPS

- The UT450/420 is provided with unit labels. Attach a desired unit label at the display unit. If there is no relevant unit label, enter the desired unit in a blank label for use.

# 4.4 Changing the Measurement Range (Scaling)

The maximum value (RH) and minimum value (RL) of the PV range can be set {for voltage input, the maximum value (SH) and minimum value (SL) of the PV input scale can be set}.

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




F4-06.EPS

Parameters to be set for temperature input

1. PV input type (IN):

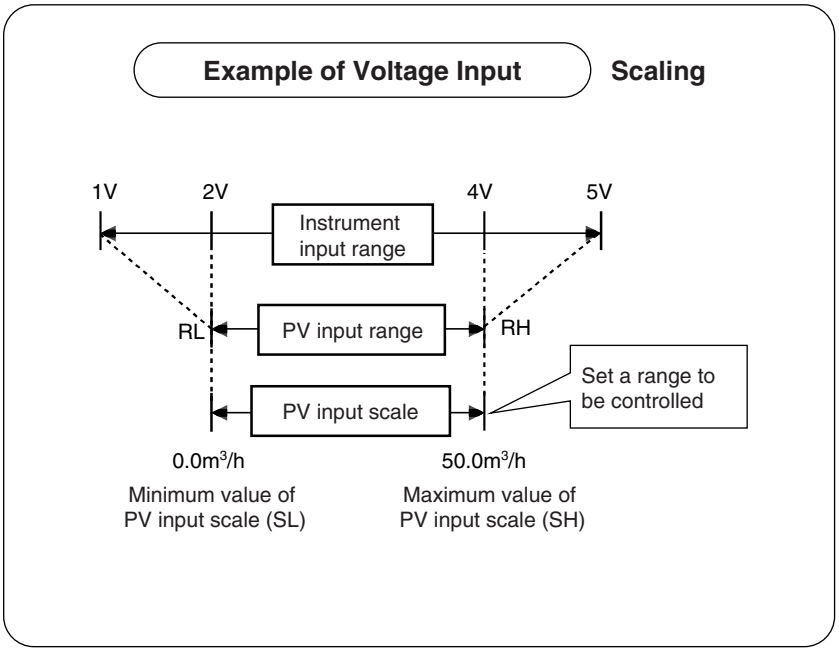
   Set according to a sensor.

2. Maximum value of PV input range (RH):

   Set the maximum value of the range to be controlled.

3. Minimum value of PV input range (RL):

   Set the minimum value of the range to be controlled.




F4-07.EPS

Parameters to be set for voltage input

1. PV input type (IN): Set according to an input signal
2. Maximum Value of PV input range (RH): Set the maximum value of an input signal.
3. Minimum value of PV input range (RL): Set the minimum value of an input signal.
4. Position of PV input decimal point (DP): Set the position of the decimal point for PV input display.
5. Maximum value of PV input scale (SH): Set the maximum value of the scale to be controlled.
6. Minimum value of PV input scale (SL): Set the minimum value of the scale to be controlled.

- For voltage input of 1 to 5 V DC, the initial range after input change always becomes 0.0 to 100.0 (with no units). To scale these figures into the actual equivalent engineering unit reading (for example, 0 to 600 (t/h) or 4 to 12 (pH)), the position of the decimal point (DP) is set using a code.

| Range After Scaling | DP's Code |
|---|---|
| -19999 to 99999 | 0 |
| -1999.9 to 9999.9 | 1 |
| -199.99 to 999.99 | 2 |
| -19.999 to 99.999 | 3 |
| -1.9999 to 9.9999 | 4 |

F4-07-01.EPS

# 4.5 Selection of PV input burnout action

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value |
|---|---|---|---|
| bSL (BSL) | Selection of PV input burnout action | OFF<br>UP: Up scale<br>DOWN: Down scale | — |

Possible to specify a travel of

- Up scale
- Down scale

or

- Off

F4-08.EPS

- Burnout Detection Activated for
  - Thermocouple (TC) input
  - RTD input
  - Standard signal of 0.4 to 2V DC or 1 to 5V DC.

Note: For standard signal input, burnout is determined to have occured if it is 0.1V or less.

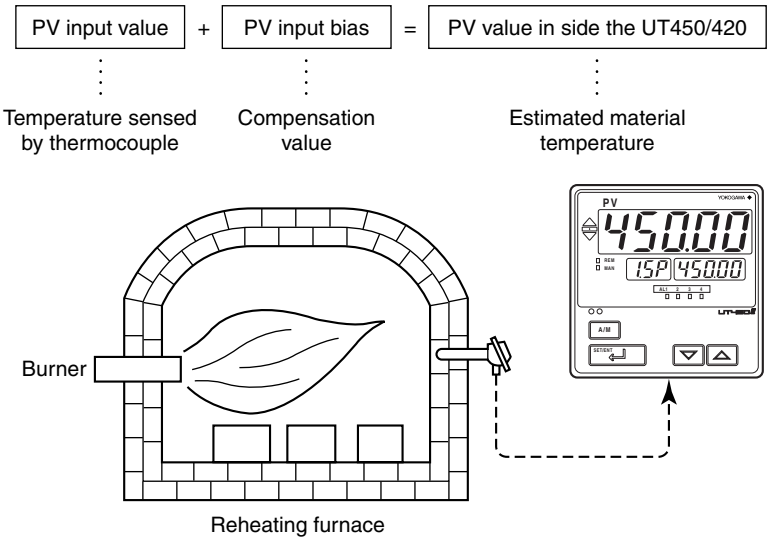
# 4.6 Reference Junction Compensation

| Parameter Symbol | Name of Parameter | Setting Range and Description | Initial Value |
|---|---|---|---|
| rJC (RJC) | Presence/absence of PV input reference junction compensation | OFF, ON | — |

- Usually input values are compensated with the RJC function provided for the controller. However, if it is necessary to rigorously compensate the values with a device other than the function of the controller, for example with a zero-compensator, the RJC function of the controller can be suspended by turning off the RJC parameter.

F4-09.EPS

# 4.7 PV Input Bias




F4-10.EPS

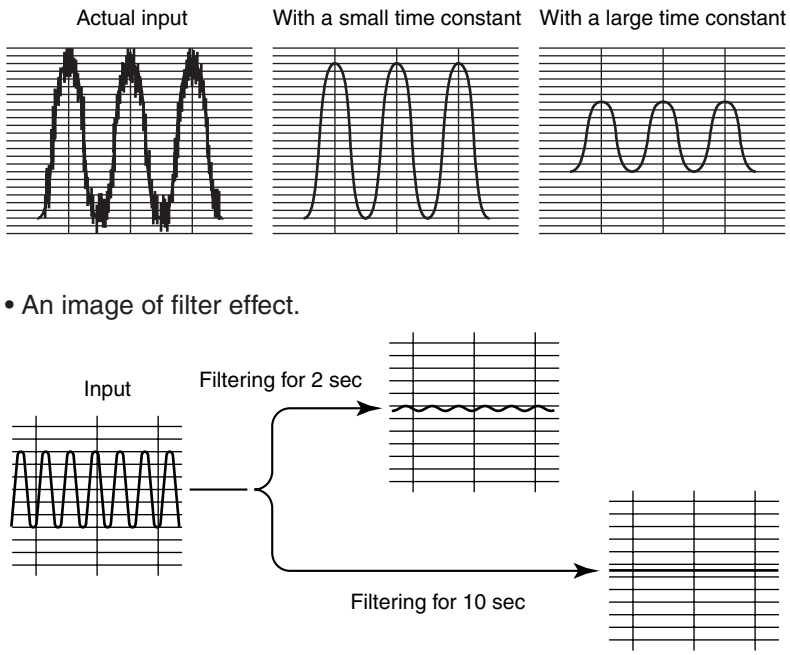
- This function allows bias to be summed with input to develop a measured-value for display and control use inside the controller.
- An application example for this function would be to measure furnace atmospheric temperature or furnace wall temperature, and add a correction for use as a substitute for the heated material temperature.
- This function can also be used for fine adjustment to compensate for small inter-instrument differences in measurement reading that can occur even if all are within the specified instrument accuracies.
- Bias is set using the PV input bias (BS) operation parameter.

Parameter Range

| | |
|---|---|
| BS | -100.0 to 100.0% of PV input range span |

- Note that the actual bias setpoint is in engineering units, not percent of span.

# 4.8 Filter



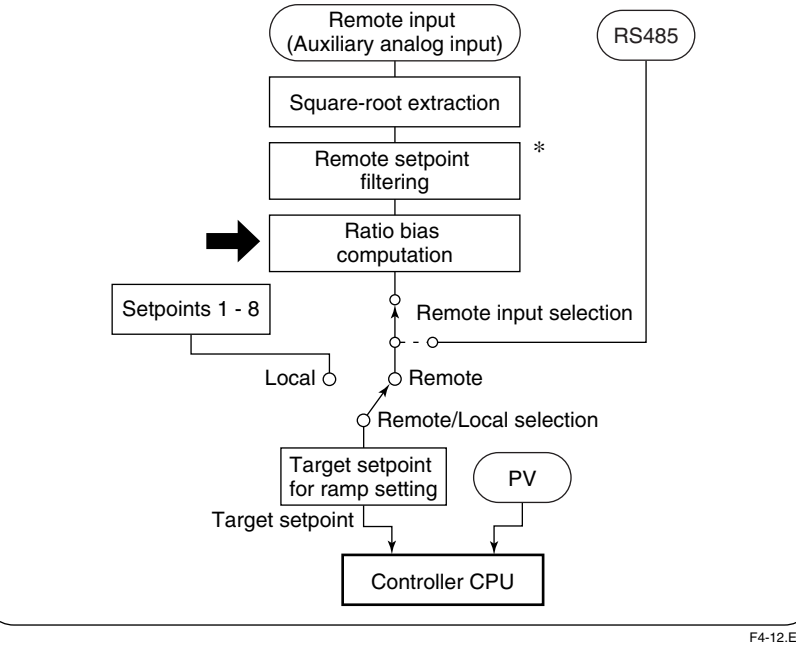

F4-11.EPS

- If input noise or variations cause the low-order display digits to fluctuate so that the displayed value is difficult to read, filtering of inputs will reduce the variations.
- Filtering is used by setting a 1st-order lag time constant; for measured input, this is set using the measured input filter (FL) setup parameter or, for remote setpoint input, it is set using the remote setpoint input filter (RFL) Setup paremeter.

Parameter Range

| | |
|---|---|
| FL<br>RFL | OFF, 1 to 120 sec |

# 4.9 Ratio bias computing




F4-12.EPS

- For this function, use the operating parameter RT and RBS.
- Ratio bias computing performs ratio computation and bias addition for remote setpoints. This enables load distribution by zone, air-heat ratio control, 2-flow ratio control, etc.

  This function acts on setpoints of substations used in coordinated operation.

*: Refer to “4.8 Filter” for the remote setpoint filtering.

## ● Computation

$$SP = (RSP \times RT) + RBS$$

SP : Setpoint

RSP : Remote setpoint input

RT : Ratio

RBS : Remote input bias

F4-13.EPS

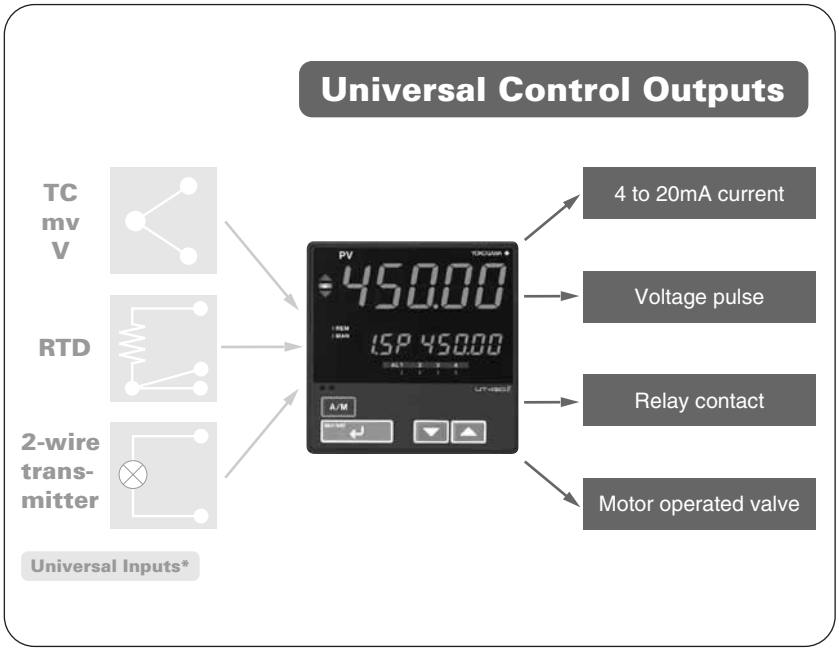
Parameter Range

| | |
|---|---|
| RT | 0.001 to 9.999 |
| RBS | -100.0 to 100.0% of PV input range span |

# 5. CONTROL OUTPUT

## 5.1 Universal Output

### ● Universal Output




F5-01.EPS

* See Page 4-1 for the information of Universal Inputs.

- **Selectable among Relay, Voltage Pulse and Current outputs.**

  Relay output:
  ON/OFF control, Time-proportional PID control

  Voltage Pulse output:
  Time-proportional PID control

  Current output:
  Continuous PID control

- **Heating/Cooling Control has two sets of universal outputs.**

  Any combinations with Relay, Pulse and Current outputs are available.

- **Drive the Motorized Control Valve by using Position-Proportional PID.**

  The position-proportional PID control function has two sets of relay outputs for direct / reverse rotation of motorized control valve.

  The side wire input to feed back the valve position is also available.

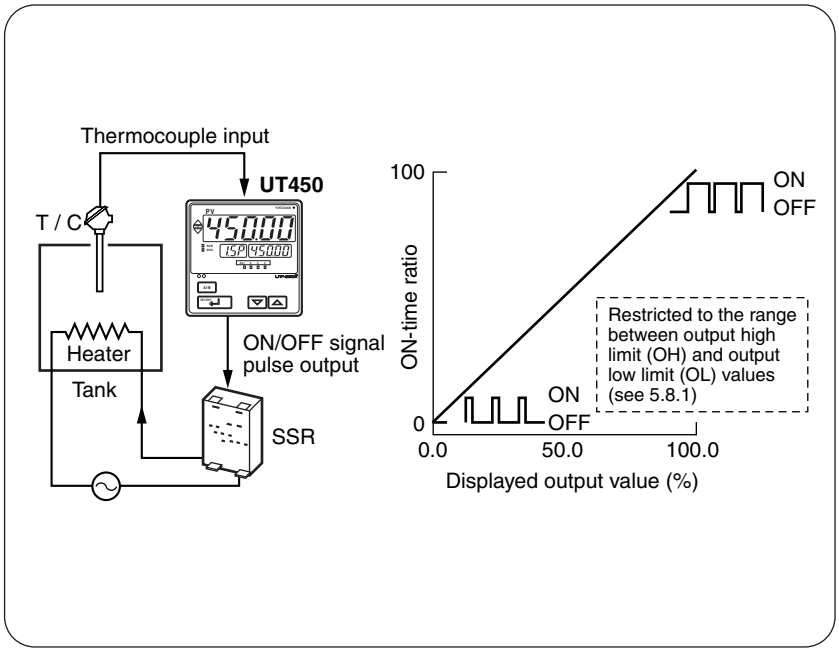
### ● Control Output Type

| | | | |
|---|---|---|---|
| ot (OT) | 0 | Time proportional PID relay contact output (terminals ①-②-③) | Initial setting value: 0<br><br>When Heating/cooling type: 4 |
| | 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) | |
| | The following 4 to 12 are displayed only for heating/ cooling type controllers. | | |
| | 4 | Heating-side relay output (terminals ①-②-③), cooling-side relay output (terminals ㊽-㊾-㊿) | |
| | 5 | Heating-side pulse output (terminals ⑯-⑰), cooling-side relay output (terminals ㊽-㊾-㊿) | |
| | 6 | Heating-side current output (terminals ⑯-⑰), cooling-side relay output (terminals ㊽-㊾-㊿) | |
| | 7 | Heating-side relay output (terminals ①-②-③), cooling-side pulse output (terminals ㊻-㊼) | |
| | 8 | Heating-side pulse output (terminals ⑯-⑰), cooling-side pulse output (terminals ㊻-㊼) | |
| | 9 | Heating-side current output (terminals ⑯-⑰), cooling-side pulse output (terminals ㊻-㊼) | |
| | 10 | Heating-side relay output (terminals ①-②-③), cooling-side current output (terminals ㊻-㊼) | |
| | 11 | Heating-side pulse output (terminals ⑯-⑰), cooling-side current output (terminals ㊻-㊼) | |
| | 12 | Heating-side current output (terminals ⑯-⑰), cooling-side current output (terminals ㊻-㊼) | |

F5-01-1.EPS

- **Control output type can be set using the OT setup parameters.**
- **See the table on the left for OT parameter's setting codes and function.**

# 5.2 Time Proportional PID Output (Relay Output / Voltage Pulse Output)

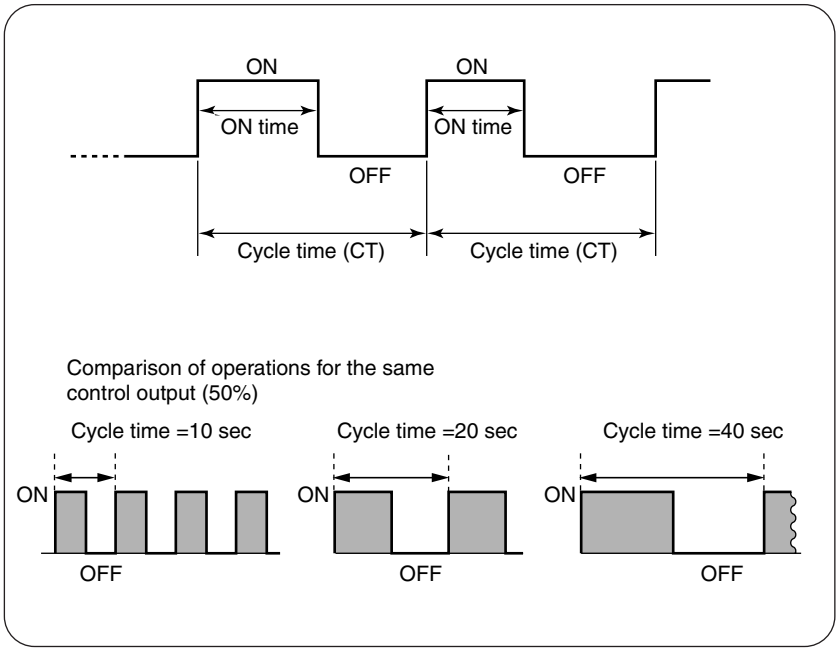



F5-02.EPS

- In time proportional PID, the PID computation result is output in the form of an on / off signal whose pulse width is proportional to the output value.
- The fraction of the cycle time (shown below) during which output is ON (ON-time ratio) is proportional to the displayed output value (PID computation value).
- This function is primarily used in electrical heating control.

| | |
|---|---|
| Relay output | • Contact rating: 250 V AC or 30 V DC, 3 A (resistance load) |
| Voltage pulse output | • ON voltage:12V or more (load resistance: 600 Ω or more)<br>• OFF voltage: 0.1V DC or less |

## 5.2.1 Cycle Time




F5-03.EPS

- Cycle time is the basic cycle period for a signal full cycle of ON-OFF operation for a relay or voltage pulse output.
- Reducing cycle time results in faster cycling and finer control. In contrast, reducing the ON-OFF period also reduces relay life. Generally, this is set to 10 to 30 sec for relay output.
- Cycle time can be set using the CT setup parameter.
- Cooling-side control output cycle time can be set using the CTc setup parameter.

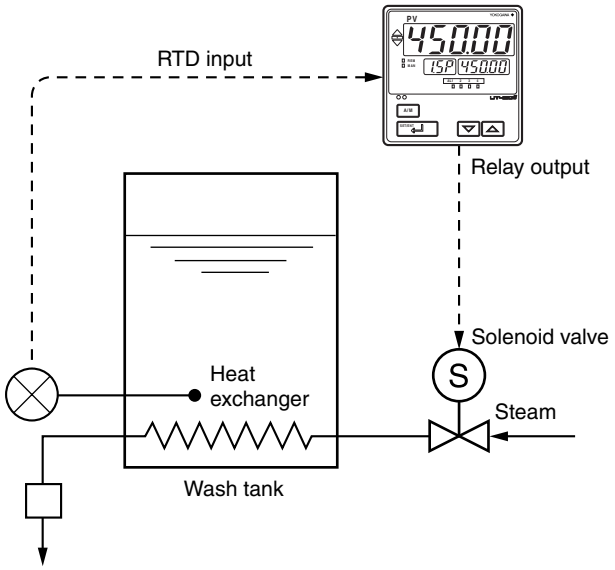
Parameter range

| | |
|---|---|
| CT | 1 to 1000 sec |
| CTc (Note) | |

(Note): Heating/cooling control type only

## 5.2.2 Time Proportional PID Control Application Examples

• **Water Temperature Control Example**

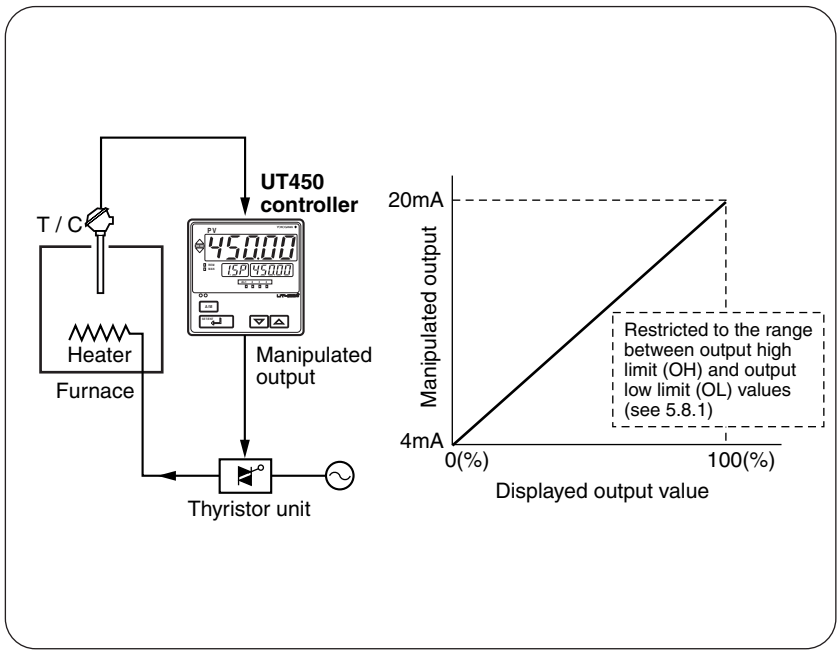



F5-04.EPS

Dye washing and food heating use steam and heat exchangers to control wash-tank water temperature or heating-chamber temperature.
Steam flow is controlled by ON / OFF operation of the solenoid valve.
Cycle time should be approx. 10 to 30 sec for relay output. However, for voltage pulse output, cycle time can be reduced to a minimum value of 1 sec without concerning about relay life. This allows further improvements in controllability (Note).

Note : The cycle time parameter range is 1 to 1000 sec, for both relay output and voltage pulse output.

# 5.3 Continuous PID Output (4 to 20 mA DC)



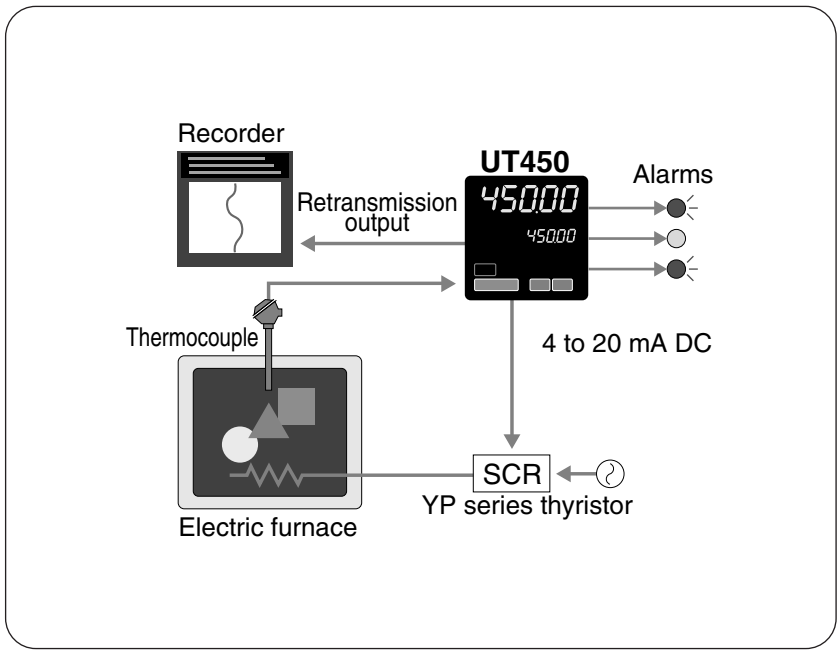

F5-05.EPS

- In continuous PID output, the PID computation result is output as a continuous analog signal. The analog signal that serves as manipulated output (4 to 20 mA DC or 1 to 5 V DC) is proportional to displayed output value (PID computation value).
- This output type is used to drive final control elements such as thyristors, electro-pneumatic converter + pneumatic control valve combinations, and electrical positioner + motor-operated valve (or control motors) combinations.

| | |
|---|---|
| 4 to 20 mA DC output | • Load resistance: 600Ω or less<br>• Output accuracy: ±0.1% of span<br>Under standard operation conditions (23 ±2°C, 55 ±10% RH, power frequency of 50/60 Hz.) |

- 4-20 mA analog output terminals (for control output and retransmission): Not isolated between 4-20 mA outputs nor from 15 V DC loop power supply and voltage pulse control output. Isolated from other input/output terminals and internal circuit.

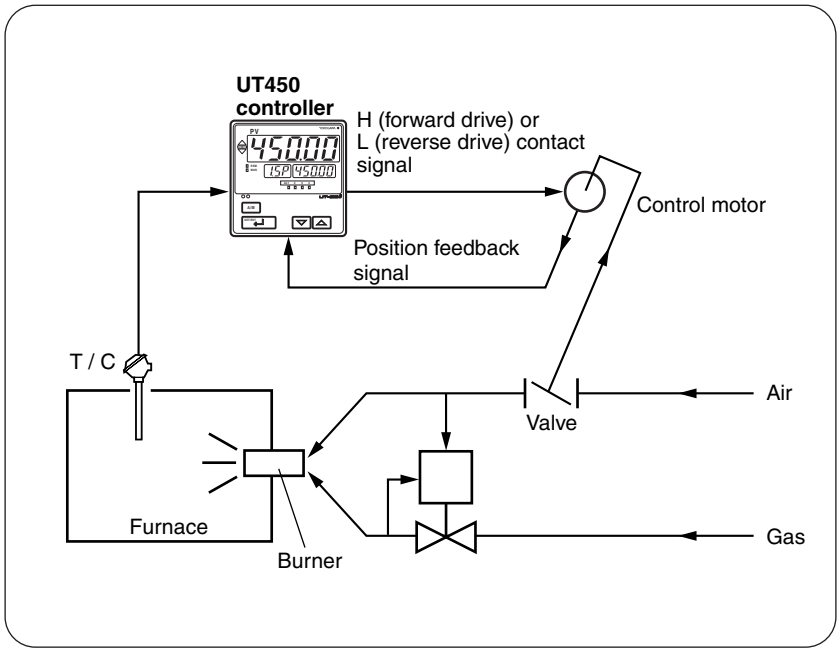
## 5.3.1 Continuous PID Output Application Example




F5-06.EPS

- The figure at the left shows as example of application in Electric Furnace control.
- The controller measures the internal temperature of the furnace by thermocouple, and operate SCR to equalize the temperature to SP value by PID control.
- Using the retransmission output, controller can transmit PV or SP value to the recorder.
- SUPER (Suppressing overshoot) or SUPER 2 (Suppressing hunting) function provide more stable control. (See Chapter 7)

# 5.4 Position Proportional PID Output (for UT450 Only)

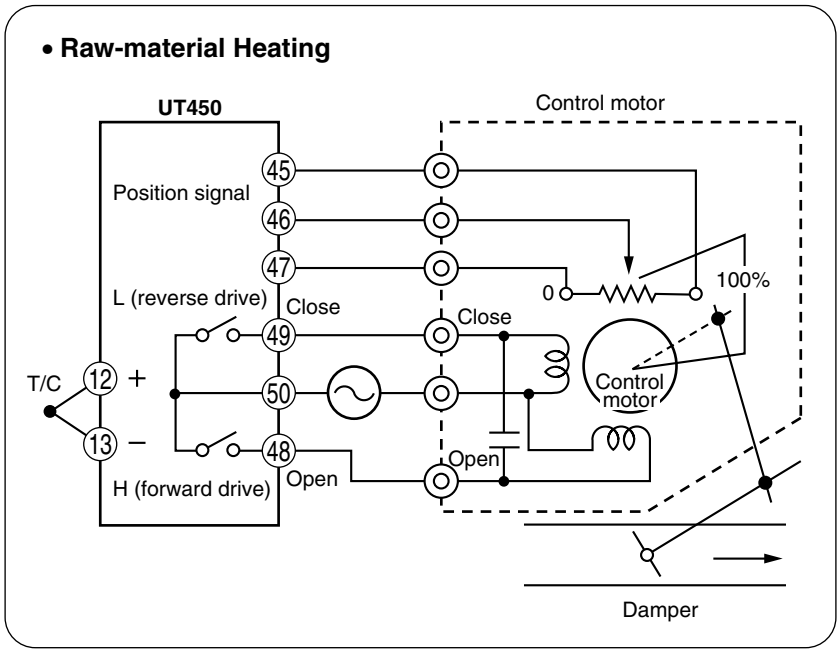



F5-07.EPS

- For position proportional PID output, valve opening (position feedback signal) is made proportional to the PID computation results. The controller outputs H (forward drive) and L (reverse drive) relay contact signals to control motor movement and valve opening.

| | |
|---|---|
| Relay Output | Contact reting:<br>250 V AC or 30 V DC,<br>3 A (resistance load) |
| Postion Signal<br>Resistance Value | 100Ω to 2.5 KΩ |

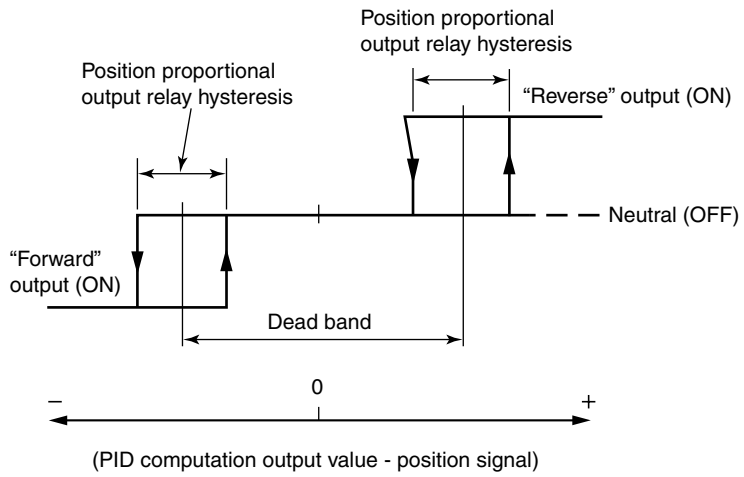
## 5.4.1 Position Proportional PID Operating Principles




F5-08.EPS

- The figure at the left shows the operating principle when UT450 is combined with a control motor.
- A potentiometer is coupled to the motor shaft to convert the angle of motor rotation to a resistance value (position signal). The UT450 uses this position signal to monitor valve opening.
- The UT450 controls the control motor using two manipulated output relays (L: reverse drive, H: forward drive) so that the valve opening (position feedback signal) agrees with the PID computation value in the UT450.
- If control motor drive current is greater than UT450 contact rating, an auxiliary relay should be used.

• **Deadband and Hysteresis**




F5-09.EPS

- To prevent excessively frequent operation of the motor and relays, a dead band (operating parameter n.DB) is provided between two relay output operating points, and hysteresis (operating parameter n.H) is provided for each relay output.

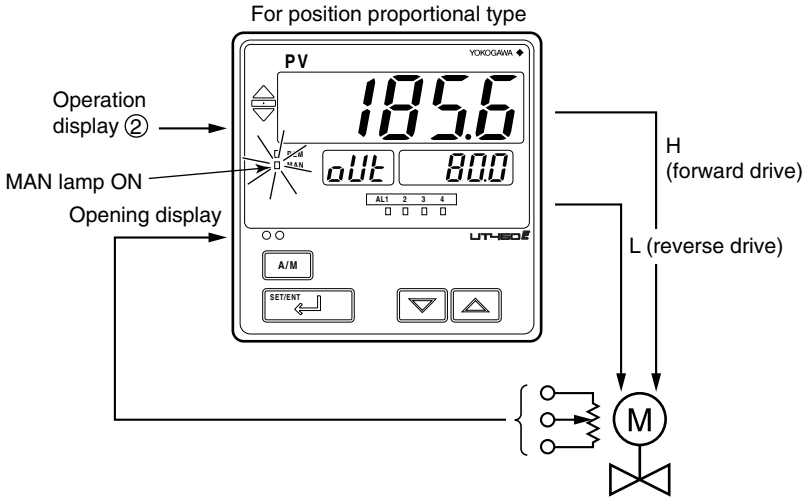
Parameter Range

| | |
|---|---|
| Dead band (n.DB) | 1.0 to 10.0% of output span |
| ON / OFF control Hysteresis (n.H) (n=1 to 8) | 0.0 to 100.0% of output span |

- If position signal differs from the PID computation output by less than the dead band value, neither the "forward drive" nor "reverse drive" relay turns ON. If the difference is large enough on the plus side, the forward drive relay turns ON; if on the minus side, the reverse drive relay turns ON (in reverse-action).

## 5.4.2 Manual Operation for Position Proportional PID Output

• **MAN (manual) Operation**

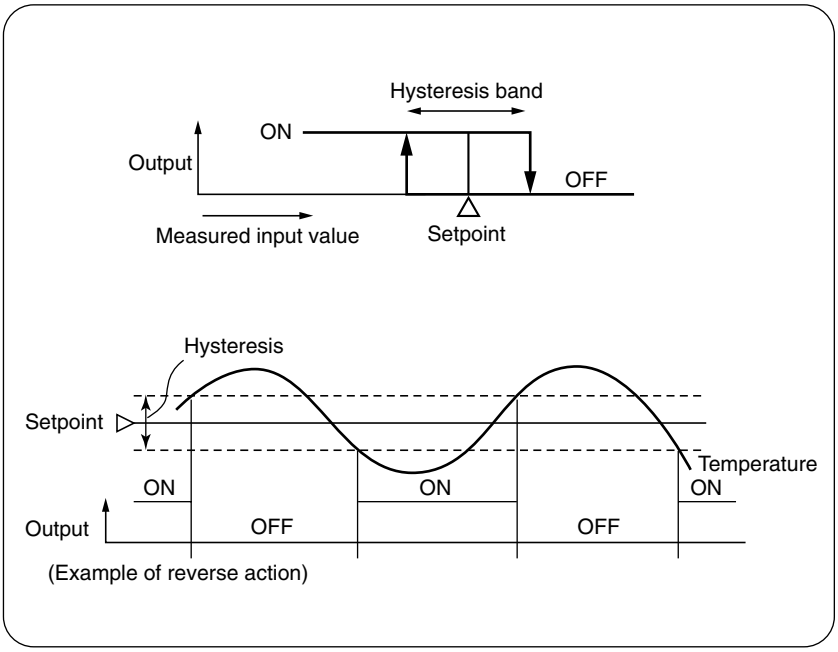



F5-10.EPS

- Pressing the ⏶ key causes the H (forward or open) contact to close and remain closed as long as the key is held down.
- Pressing a numeric key with the ⏷ key held down causes the L (reverse or close) contact to close and remain closed as long as both keys are held down.
- If the output high limit and low limit values have been set, manual output is restricted by those limit values.

# 5.5 ON/OFF Control

## 5.5.1 ON/OFF Control and Hysteresis



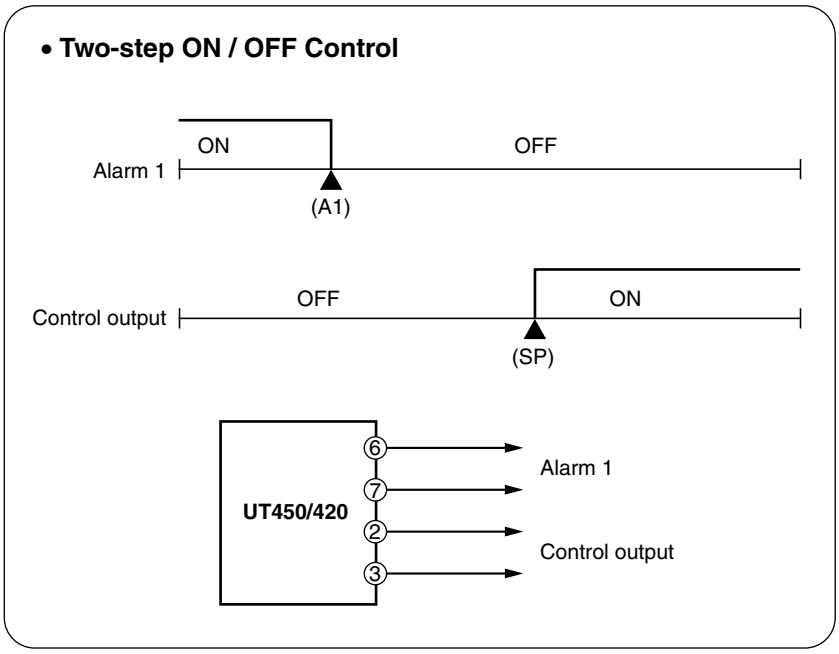

F5-11.EPS

- In ON / OFF operation, since the only two possible output states are ON and OFF, the control output cycles are as shown in the accompanying figure. ON / OFF becomes quite violent if the hysteresis is set too narrow, so that if relay output is used, chattering occurs, the hysteresis should be set wider to prevent relay chattering.
- Hysteresis is set using operating parameter n.H.

Parameter Range

| | |
|---|---|
| ON / OFF Control Hysteresis (n.H) (n=1 to 8) | 0.0 to 100.0% of PV input range span |

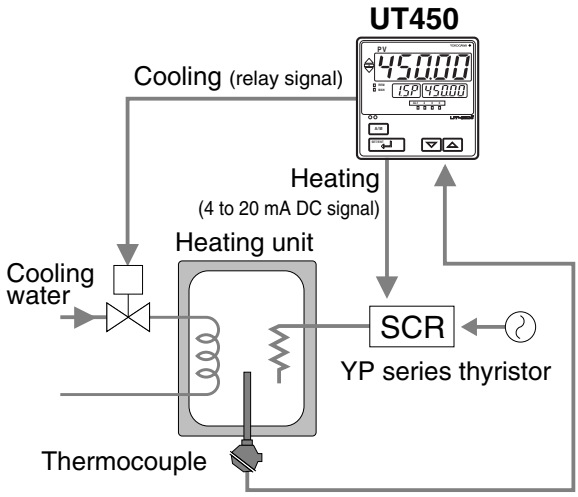
## 5.5.2 ON/OFF Control Application Example




F5-12.EPS

- An example at the left figure shows two-step ON / OFF control using ON / OFF control output and alarm output.
- Alarm 1 is set to low-limit alarm for measurement.

# 5.6 Heating/Cooling Control

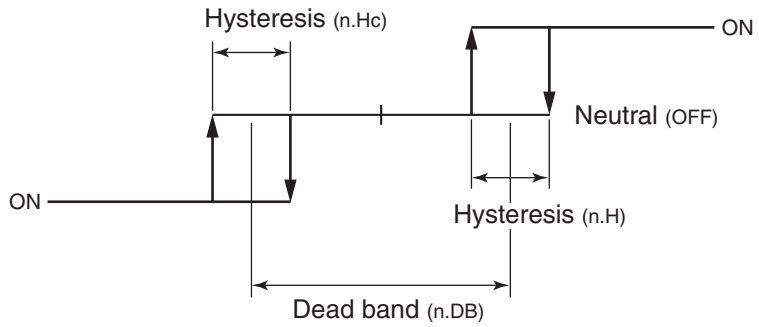



F5-13.EPS

The heating and cooling control function outputs the PID computation results in two lines of signals: heating signals, and cooling signals. PID control or ON/OFF control is selectable on either side. When the heating-side proportional band “n.P” is set to 0.0, ON/OFF control is executed on the heating side. When the cooling-side proportional band “n.Pc” is set to 0.0, ON/OFF control is executed on the cooling side.

Relay output, pulse voltage output, current output, or open collector output can be selected for the heating and cooling output.

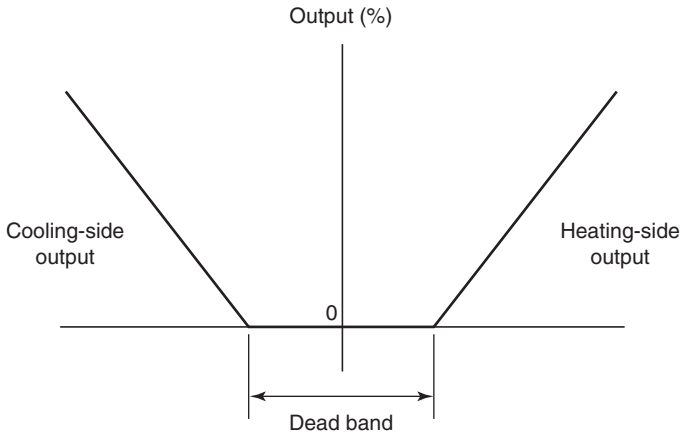
- **Positive Dead band (ON/OFF Control on Heating and Cooling Sides)**




F5-14.EPS

In heating and cooling control, the positive dead band denotes the zone where neither the heating-side nor cooling-side control signal is output. The figure on the left shows the dead band (n.DB) in the case where on/off control is selected on both the heating and cooling sides.

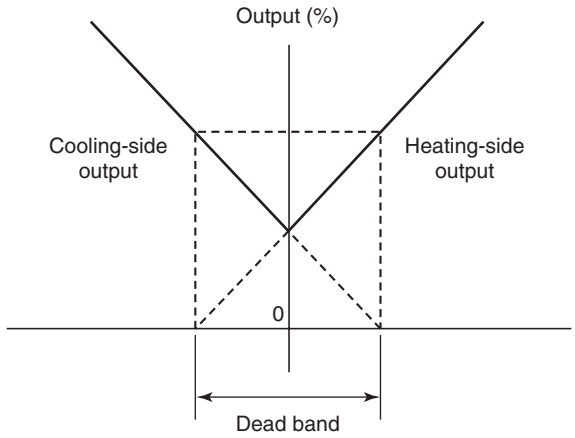
**• Positive Dead band**
**(PID Control on Heating and Cooling Sides)**




F5-15.EPS

The figure on the left shows the dead band in the case where PID control is selected on both the heating and cooling sides.

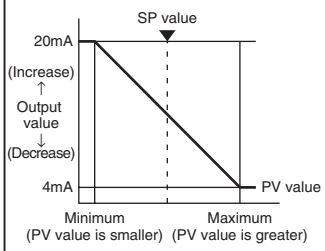
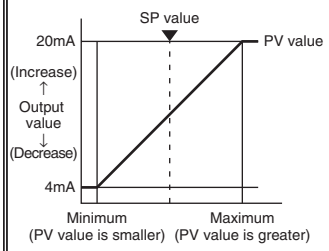
**• Negative Dead band**
**(PID Control on Heating and Cooling Sides)**




F5-16.EPS

The negative dead band denotes the zone where the heating-side and cooling-side control signals overlap each other. The figure on the left shows the negative dead band in the case where PID control is selected on both the heating and cooling sides.

# 5.7 Direct Actin / Reverse Action Selection

| | Reverse Action | | Direct Action | |
|---|---|---|---|---|
| Condition | PV>SP | PV<SP | PV>SP | PV<SP |
| ON/OFF output status | OFF | ON | ON | OFF |
| Current output | Decreases. | Increases. | Increases. | Decreases. |
| Time proportional output | The ON-state time decreases. | The ON-state time increases. | The ON-state time increases. | The ON-state time decreases. |
| Direction of change in control output | Reverse Action   | | Direct Action   | |

F5-17.EPS

- Direct and reverse action define the direction in which output increase or decrease, according to whether deviation is positive or negative.

  The accompanying figure shows the relationship between these two variables.
- The instrument is set to reverse action at shipment from the factory.
- Direct or reverse action is selected using the n.DR setup parameter.

| | |
|---|---|
| n.DR (n=1 to 8) | RVS : Reverse action<br>DIR : Direct action |

## 5.7.1 Direct / Reverse Action Selection, Using External Contact Input

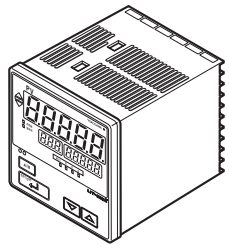
Example : Selection of 1.SP or 2.SP with an external contact to transfer from the direct to the reverse acting controller or vice versa.

| | |
|---|---|
| 1.SP | 1.DR = RVS (reverse action) |
| | 1.P, 1.I, 1.D, ····· ,1.OL |

| | |
|---|---|
| 2.SP | 2.DR = DIR (direct action) |
| | 2.P, 2.I, 2.D, ····· ,2.OL |

1.SP / 2.SP selection terminal (direct / reverse action selection)

* Set 1.SP = 2.SP



⑱ ⑳ 1.SP/2.SP selection (DI2)

OFF (open) : First setpoint (1.SP)
ON (close) : Second setpoint (2.SP)
Non-voltage contact (contact rating of 12V DC at 10mA or more)

F5-18.EPS

① Setting the setup parameter (DIS)
DIS = 3

② Setting the setup parameter (1. DR or 2.DR)

The relationship of external contact ON/OFF and direct/reverse action differs as shown in the left table depending on setting of 1.DR or 2.DR.

③ Operating parameter

To obtain the same setpoint and PID parameters before and after switching to direct or reverse action, the same value must be set for each as follows:

1.SP = 2.SP, 1.P = 2.P, ...

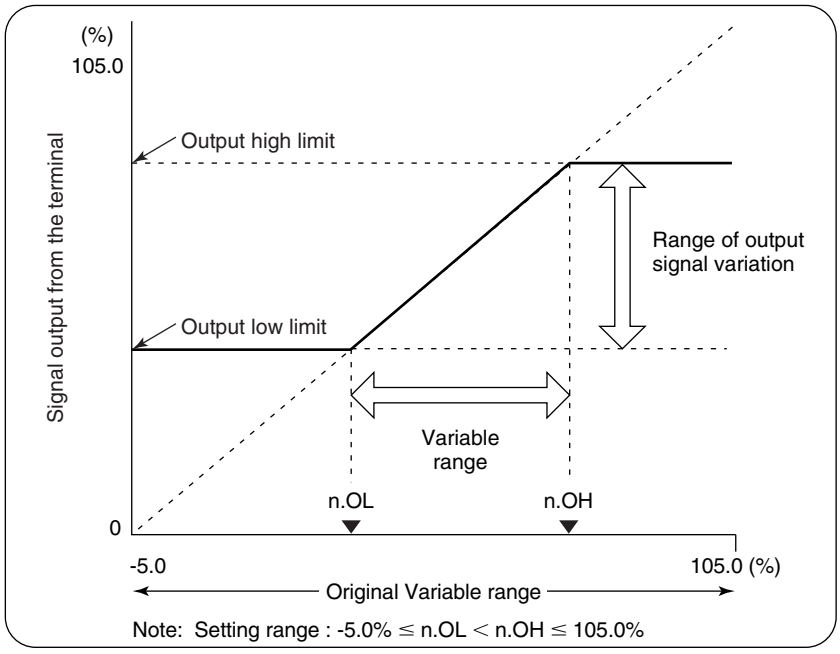
A different value can also be set to each.

| | DI2:Contact ON (2.SP) | DI2:Contact OFF (1.SP) |
|---|---|---|
| 1. DR=PVS<br>2. DR=PVS | Reverse action | Reverse action |
| 1. DR=PVS<br>2. DR=DIR | Direct action | Reverse action |
| 1. DR=DIR<br>2. DR=RVS | Reverse action | Direct ation |
| 1. DR=DIR<br>2. DR=DIR | Direct ation | Direct ationct |

F5-18_01.EPS

# 5.8 Control Output Limits

## 5.8.1 Output High and Low Limits



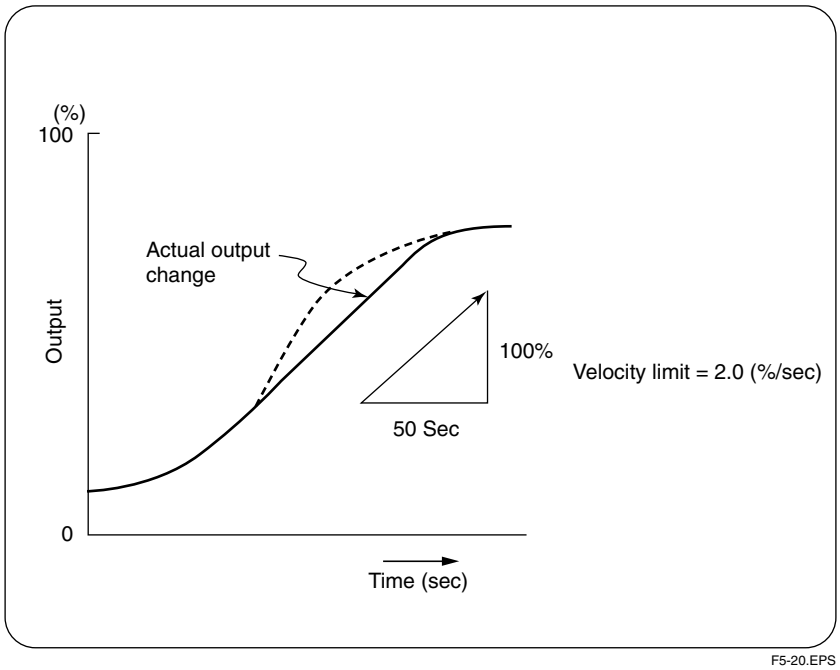

F5-19.EPS

- Output limits can be set for purposes such as to maintain heating to a minimum level at all times or to absolutely prevent a valve from opening beyond a certain fixed amount.
- Separate output limits can be set for setpoint numbers, using the output high limit (n. OH) and output low limit (n. OL) operating parameters.

Parameter Range

| | |
|---|---|
| n.OH and n.OL (n=1 to 8) | -5.0 to 105.0% of output range<br>Provided that n. OL ≦ n. OH |
| | In Heating/cooling control: 0.0 to 105.0% of output range<br>Provided that n.O ≦ n.OH |

## 5.8.2 Output Velocity Limit




F5-20.EPS

- If there is a need to avoid subjecting the process or final control element to abrupt changes, setting an output velocity (rate-of change) limit allows limitation on the rate at which output changes.
- Output velocity limit is set using the OPR setup parameter.

Parameter Range

| | |
|---|---|
| OPR | 0 : OFF<br>0.1 to 100.0% / sec |

- Note that setting an output velocity limit may cancel the effects of derivative action.

# 5.9 Preset Output Value

| | | | |
|---|---|---|---|
| Mode | **RUN (operation)** | | **STOP** |
| | Control program is running. | | Control program is stopped. |
| | AUTO | MAN | —— |
| Output | Output value based on computed control results | Output value entered by manual key operation | Preset output value |

F5-21.EPS

- If the UT420/450 operation mode is switched from RUN to STOP, the output value is neither the automatic output value nor the manual output value at that time, but rather a third value, the “preset output” value.
- The output under these conditions is free from the output high and low limits and from the output velocity limit.
- A preset output value is set using the n.PO operating parameter. (This value is not restricted by output limits n. OL or n. OH.)

Parameter Range

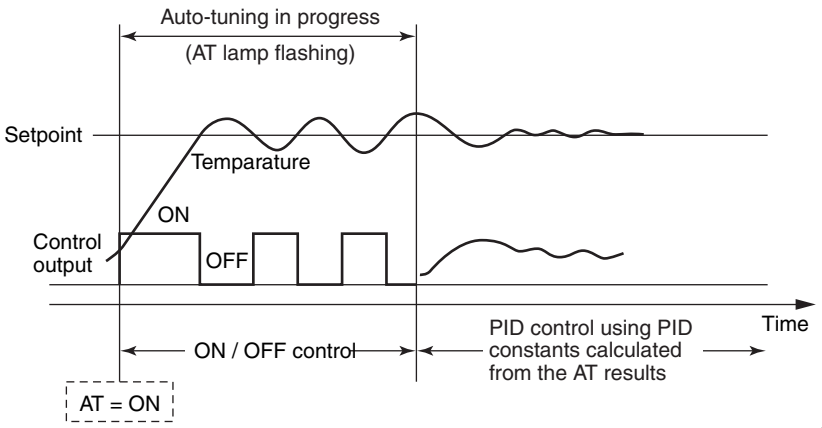
| | |
|---|---|
| n. PO (n=1 to 8) | -5.0 to 105.0% In heating/ cooling control: Heating side 0.0 to 105.0% In stop state, fixed control output can be generated. |
| n. OC (n=1 to 8) | In heating/cooling control: Cooling side 0.0 to 105.0% In stop state, fixed control output can be generated. |

- When the controller is switched from STOP to RUN, balanceless and bumpless transition is accomplished.

Note: See section 11.3 for the preset output value in Event of controller problem.

# 6. AUTO-TUNING

- **Auto-tuning (AT)**
  - Automatic PID constant setting function
  - UT420/450 uses a limit cycle method.
    The auto-tuning temporarily executes ON / OFF control, calculates appropriate PID constants from response data obtained, and sets these constants.




F6-01.EPS

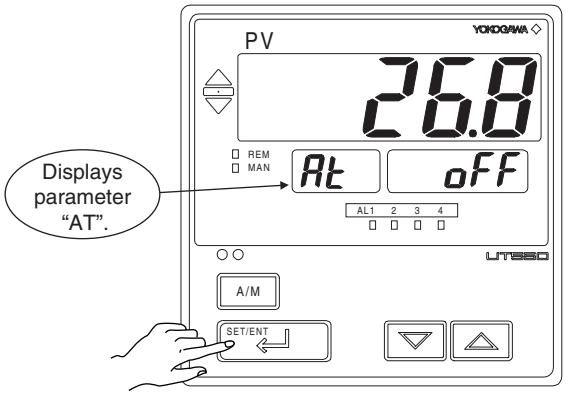
- The UT450/420 automatically measures the process characteristics and sets PID constants, which are control parameters, to optimum values for the setpoint.
- Auto-tuning can be executed using simple key operations.
- When auto-tuning starts, the UT450/420 becomes an ON / OFF controller, with its output alternating between 100% (or high output limit (OH)) and 0% (or low output limit (OL)).

Do not use auto-tuning in the following processes:

- Fast-response processes such as pressure and flow
- Processes in which control output ON / OFF switching is in-appropriate (regardless of variable type)

## 6.1 How to Start / Cancel Auto-Tuning

① With the operation display shown in the AUTO (automatic) and RUN (operating), press the [SET/ENT] key for more than 3 sec. Then, repress the [SET/ENT] key several more times to call the auto-tuning startup display (AT).




F6-02.EPS

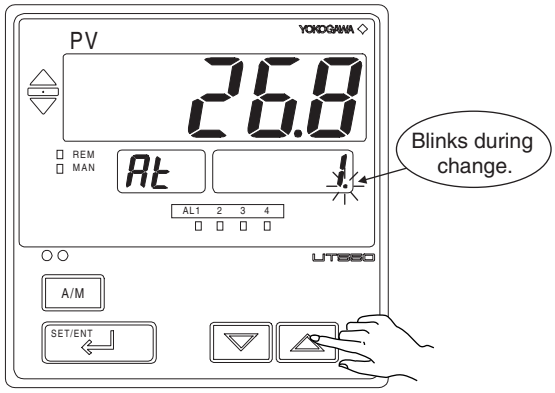
- The auto-tuning start procedure is as described at the left (① to ④).
- If the results of aut-tuning are Time-out (About 20 hours), the measured value display unit displays (E200).

E200

This indication can be erased by pressing any key.

In case of Time-out, examine for broken wires in external wiring to input path devices and at sensor terminals.

② Press the [▲] or [▼] key to display the required setpoint.
Tuning for 1.SP is AT = 1.

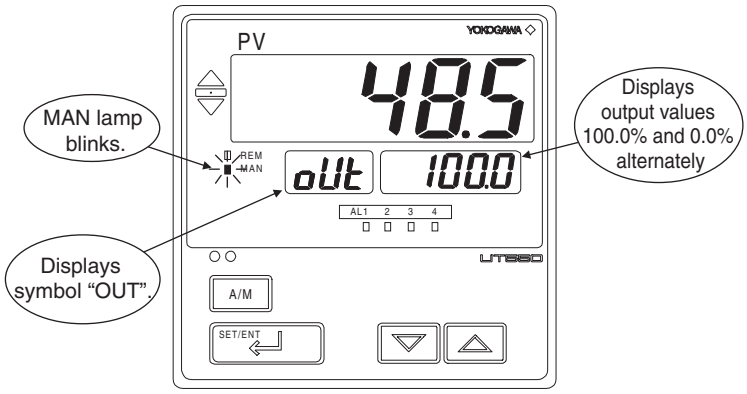



F6-03.EPS

To cancel auto-tuning, set AT = OFF.

③ Press the [SET/ENT] key once.

④
- This causes the display to return to operation display.
- During execution of the auto-tuning, the MAN lamp blinks.
- After auto-tuning completes, the MAN lamp goes off.
  The controllers resume operation using the new PID parameters obtained.




F6-04.EPS

# 7. “SUPER” AND “SUPER2” FUNCTIONS

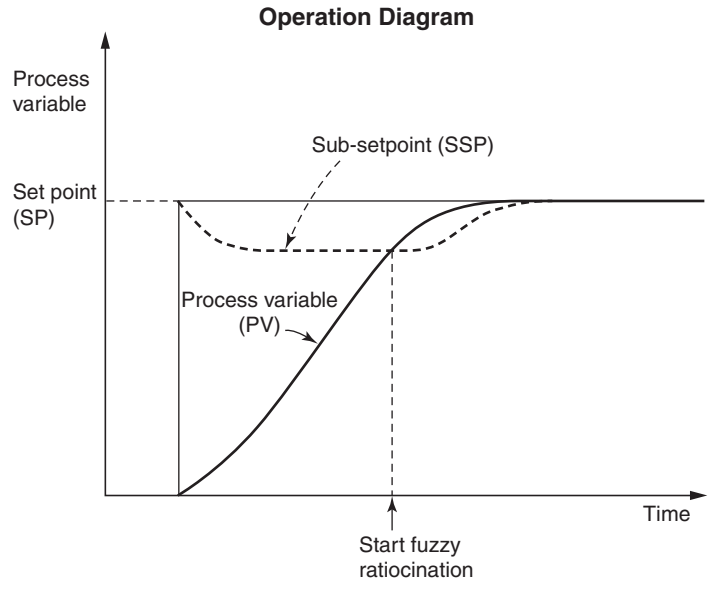
- **What is “SUPER” ?**
  - The field proven “SUPER” is overshoot-suppressing function that uses fuzzy inference.
  - “SUPER” is effective in the followings cases.
    - Overshoots must be suppressed.
    - Rise-up time needs to be shortened.
    - Setpoint (SP) is changed frequently.
- **What is “SUPER2” ?**
  - The new “SUPER2” is hunting-suppressing function, without re-tune the PID.
  - “SUPER2” effective in the followings cases.
    - Load Varies often.
    - There is various disturbance and takes time to settle to normal.
    - Hunting remains when setpoint (SP) value is changed.

F7-01.EPS

- The “SUPER” function is effective when used together with the Auto Tune (AT) function in the event of the left cases.
- To set the initial PID parameters by using Auto Tune (AT) function.
- No need to re-tune the PID parameters during operation if the process characteristics are changed.

## 7.1 “SUPER”

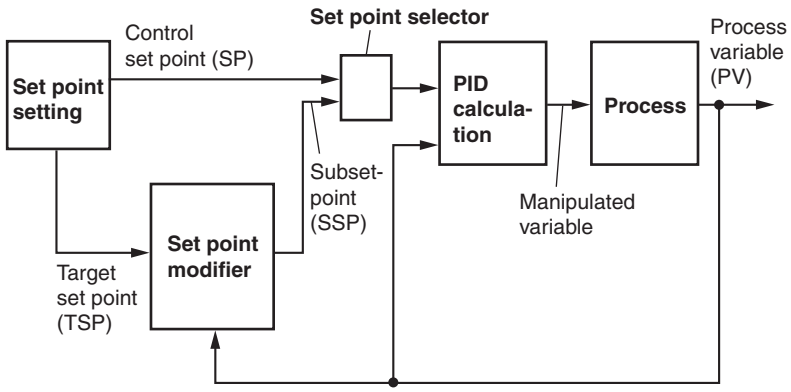
### 7.1.1 “SUPER” Operating Principles




F7-02.EPS

- The UT450/420 “SUPER” function monitors the deviation for evidence that there is a danger of overshoot, and on sensing such danger automatically changes the set point temporarily to a somewhat lower value (sub-setpoint “SSP”).
- Once the danger of overshoot appears diminished, the function returns the effective set point gradually to the true set point.
- “Fuzzy ratiocination” techniques are employed in the algorithms used to change the set point to the lower temporary value, and to return it gradually to the true set point.
- In addition to the UT450/420, the SUPER function is also available in GREEN series and UT100 series controllers as standard.

• **Control System Block Diagram**




F7-03.EPS

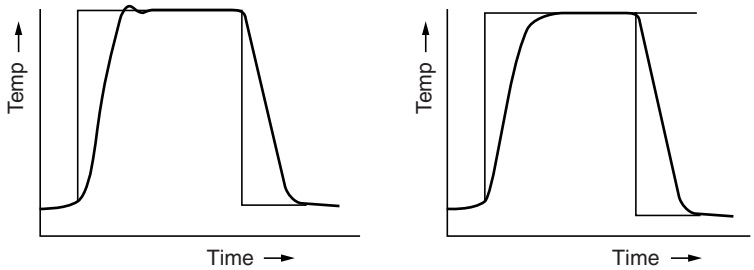
- The accompanying figure shows the operations described above using a block diagram of functions in the UT450/420.

## 7.1.2 Effects of “SUPER”

**SUPER Effects**

① Example of overshoot suppression control for set point changes

Process : Small electric furnace
P = 1.5% I = 128 sec D = 32 sec
(from auto-tuning)




UT450/420 without SUPER

UT450/420 with SUPER

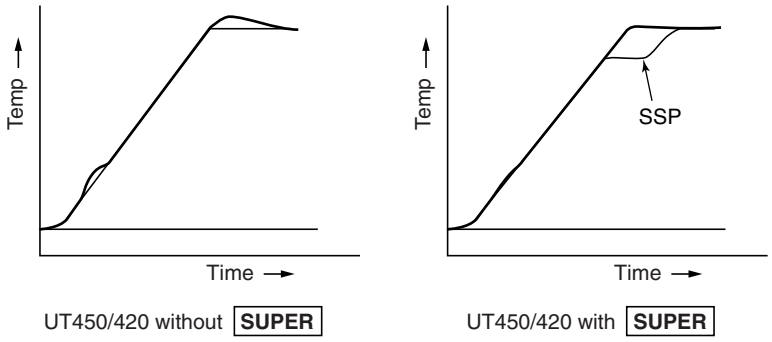
F7-04.EPS

- If the optimum PID values are being used, then use of the “Super” function yield stable control without overshoot even on set point changes.
- As a result, temperature up-ramps follow the programmed pattern more closely, giving more consistent product quality.
- “Overshoot” is not only a matter of temperature exceeding the set point, but also of prolonged instability and slow settling resulting from the undershoot that occurs in reaction to the overshoot.

**SUPER Effects**

② Example of ramp → soak transition overshoot suppression control

Process : Small electric furnace
P = 1.8% I = 317 sec D = 79 sec
(from auto-tuning)




UT450/420 without **SUPER**

UT450/420 with **SUPER**

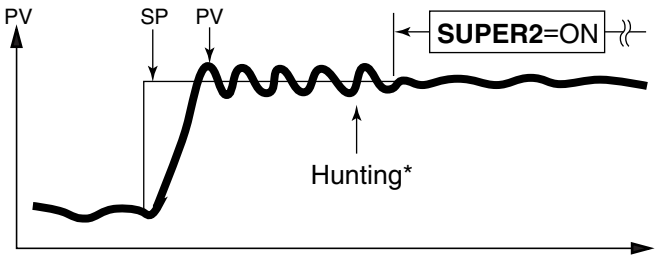
F7-05.EPS

- Due to the gain changes that occur at the transition from tamp to soak, conventional controls are inevitably prone to overshoot. Yet, if the PID constants are set so that the output stabilizes more quickly in order to avoid overshoot, the temperature ramp will lag behind the prescribed pattern.
- By using the “SUPER” function, the temperature up-ramp can be made to follow the pattern almost exactly, and significant savings can be achieved.

# 7.2 “SUPER2”

**What's "SUPER2" ?**

- SUPER2 function suppresses the hunting effect of the controller without re-tuning the PID parameters.




**SUPER2 is effective in following cases:**

- Auto Tune cannot be applied during operation due to a possible process upset.
- Eliminate a need to change PID parameters.

F7-06.EPS

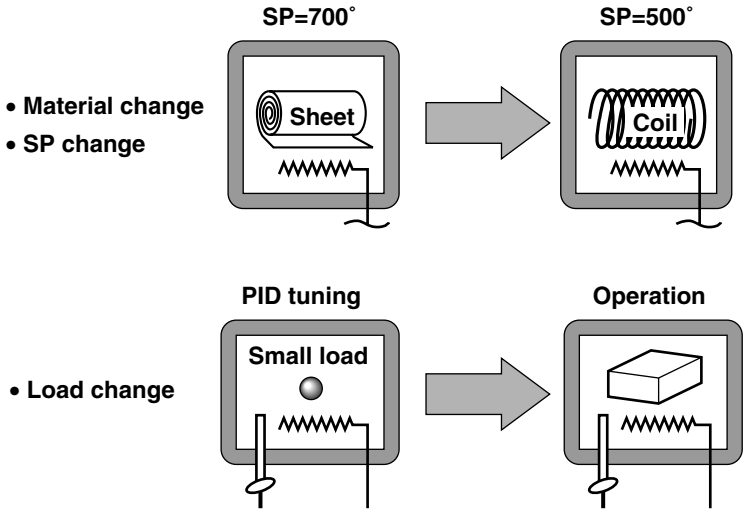
- When a recipe change is required in a batch process or a set point change is required in a heat treatment process, SUPER2 suppress hunting without change or re-tune of PID parameters.
- No need to change the initial PID parameters. SUPER2 suppresses hunting.

* HUNTING means the process variable becomes unstable and oscillates around set point.

## 7.2.1 “SUPER2” Operating Principles

### ● Operating Principle-1

**Hunting occurs when:**



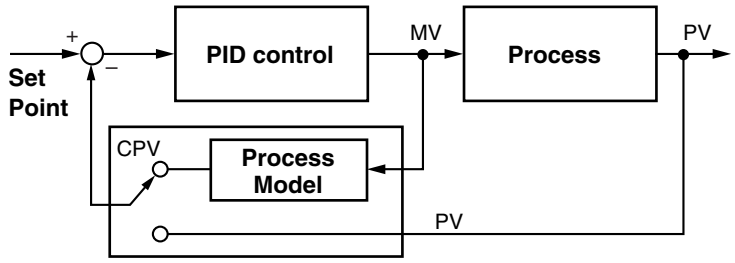

F7-07.EPS

- When the PID parameters are tuned based on the conditions as left side, hunting will occur at the following examples;
  - Setpoint (SP) change
  - Material change
  - Load change
- Hunting occurs under the following conditions:
  - The closed loop gain is larger than 1.00.
  - The deviation between the PV and output becomes 180° out of phase.

## ● Operating Principle-2

**Hunting Suppression**

- In hunting condition, SUPER2 selects the output from process model as PV signal.
- Process Model shall be to remove a factor of dead-time from the actual process.
- Real Process is under the open-loop condition.
- After hunting is suppressed, SUPER2 selects PV signal, and carry out the standard feedback control.



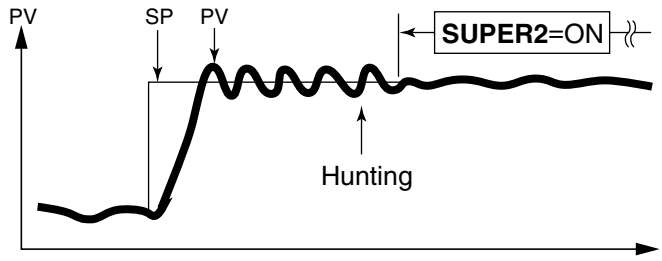

F7-08.EPS

- In the other word, PID controls the Process model in SUPER2.
- Hunting on PV will be converged to SP. Offset will remain on PV. SUPER2 adds the trimming signal on CPV for cancellation offset.

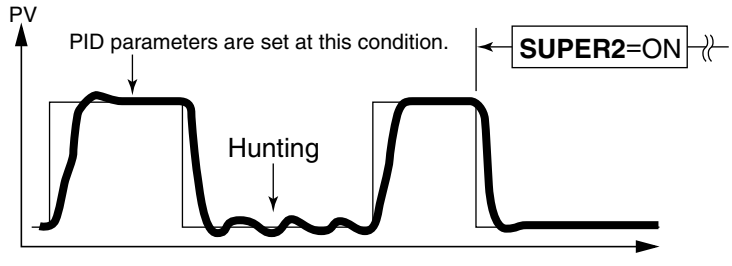
# 7.2.2 Effects of "SUPER2"

## ● Effect-1

**Load Change**




**Temperature Change**




F7-09.EPS

- SUPER2 is effective when used in the following cases.
  - There is a frequent change in the load.
  - The controller is exposed to a high degree of disturbance and takes time to settle to normal.
  - Even if the PID constants are correctly set, hunting remains when the SP value is changed.

## ● Effect-2

### (1) Step Response

If the process characteristics do not change, both responses are almost same.

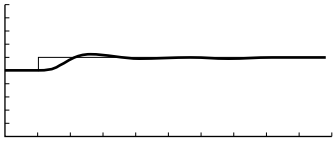


Fig. 1-1 SUPER2 = OFF

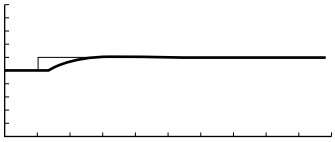


Fig. 1-2 SUPER2 =ON

### (2) Change Process Gain

Process gain is changed from Kp = 1 to Kp = 5.
SUPER2 suppresses the hunting, when the process gain is changed.

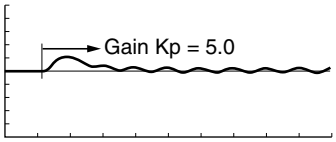



Fig. 2-1 SUPER2 = OFF

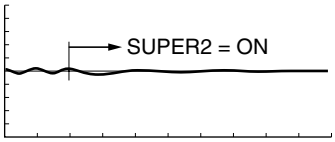



Fig. 2-2 SUPER2 =ON

### (3) Change Process Dead Time

Process Dead time is changed from 15sec to 45sec.
SUPER2 suppresses the hunting, when the process dead time is changed.

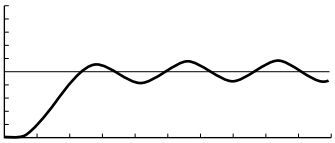


Fig. 3-1 SUPER2 = OFF

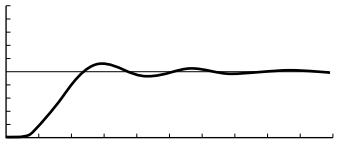


Fig. 3-2 SUPER2 =ON

F7-10.EPS

- These are results of the simulation test for:

  (1) Step Response

  (2) Change of Process Gain

  (3) Change of Process Dead Band

- Process is second order lag with dead time.

  Kp=1, T1=150sec, T2=80sec,

  L=15sec

- PID parameters in this simulation are computed by Auto tuning (Common for all simulation cases).

  P=12.7%, I=99sec, D=24sec.

# 7.2.3 How to Apply “SUPER2”

**How to apply SUPER2 ?**

- **Selection of the “SUPER2 mode”**

| | Stable Mode (SC=2) | Response Mode (SC=3) |
|---|---|---|
| Response speed | Good | Better |
| Stability | Fine | Better |

- **CAUTION:**
  - SUPER2 may not be effective for fast processes such as flow rate & pressure control.
  - SUPER2 can only be used with PID or PI control. The function does not work in On-Off control, P control, PD control and Heating/Cooling control.

F7-11.EPS

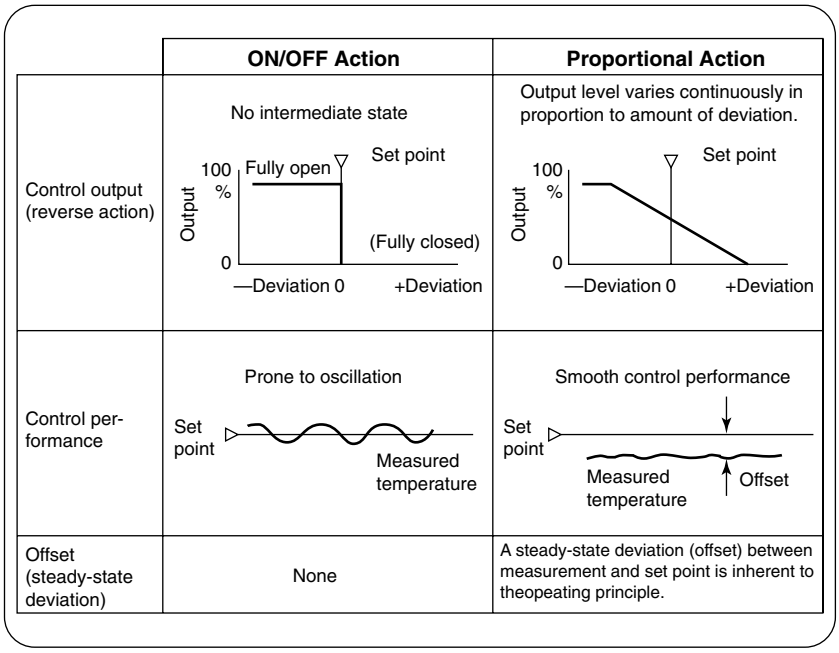
- Stable Mode (SC=2):
  High stability mode
  - Superior in control stability against a change in the load or SP value.
  - To support a wider range of characteristic change than SC=3.
- Response Mode (SC=3):
  Fast response mode
  - To provide shorter PV tracking time / setting time for a change in the SP value.
- Kp and T parameters for process model are different between SC=2 and SC=3

Blank Page

# 8. CONTROL PARAMETERS (PID CONSTANTS)

## 8.1 Proportional Band (P)

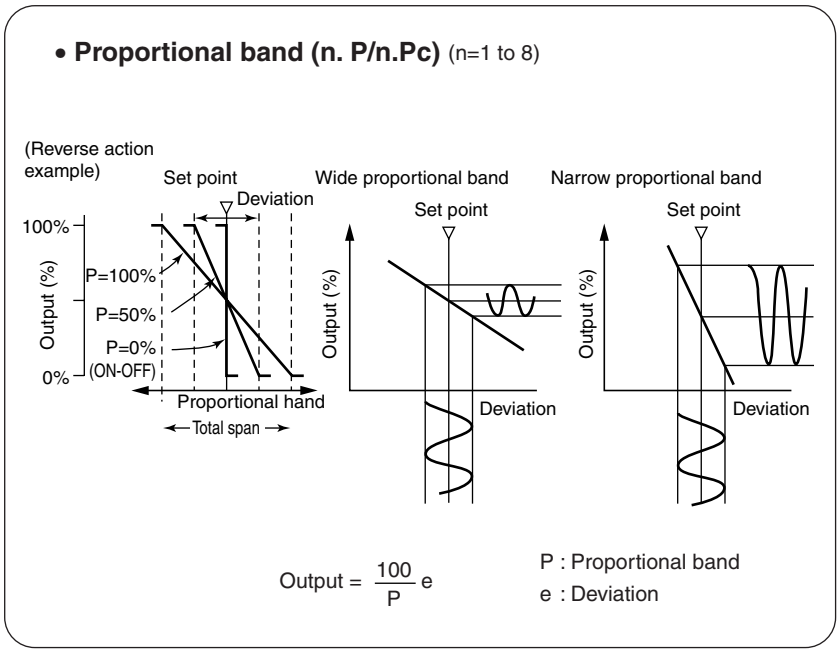
### 8.1.1 Differences between ON / OFF Action and Proportional Action




F8-01.EPS

- The proportional band is the parameter that determines the effectiveness of proportioning action.
- By using the “Super” function, the temperature up-ramp can be made to follow the k pattern almost exactly, and significant energy savings can be achieved.

### 8.1.2 Proportional Band (“1. P” to “8. P”) Details




F8-02.EPS

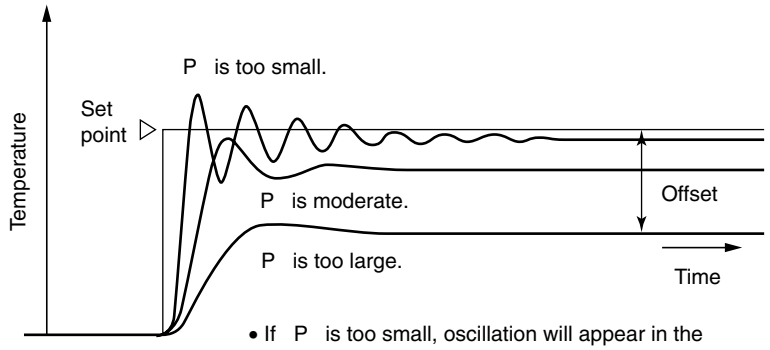
- “Proportional band” is defined as the amount of change in input (or deviation), as a percent of span, required to cause the control output to change from 0% to 100%.
- Because a narrower proportional band gives greater output change for any given deviation, it therefore also makes the control performance more susceptible to oscillation. At the same time, a narrower proportional band reduces the offset.
- Reducing the proportional band to its smallest limit (proportional band = 0%) results in ON-OFF control.

Note: The “5. P” to “8. P” can not be displayed in the initial setting. To use “5. SP” to “8. SP”, set setup parameter “GRP” = 5 to 8.

## 8.1.3 Tuning the Proportional Band

**• To fine-tune a proportional band obtained using auto-tuning, or to manually tune the proportional band :**

- Work from larger to smaller numbers (wider to narrower)
- If cycling appears, that means that the proportional band is too narrow.
- Proportional band tuning cannot cancel an offset.




• If P is too small, oscillation will appear in the measured temperature.

F8-03.EPS

- The proportional band (n. P) is adjusted as shown in the accompanying figure.

Parameter Range

| | |
|---|---|
| 1. P to 8. P | 0.1 to 999.9% |
| 1.Pc to 8.Pc (Note) | 0.0 to 999.9% |

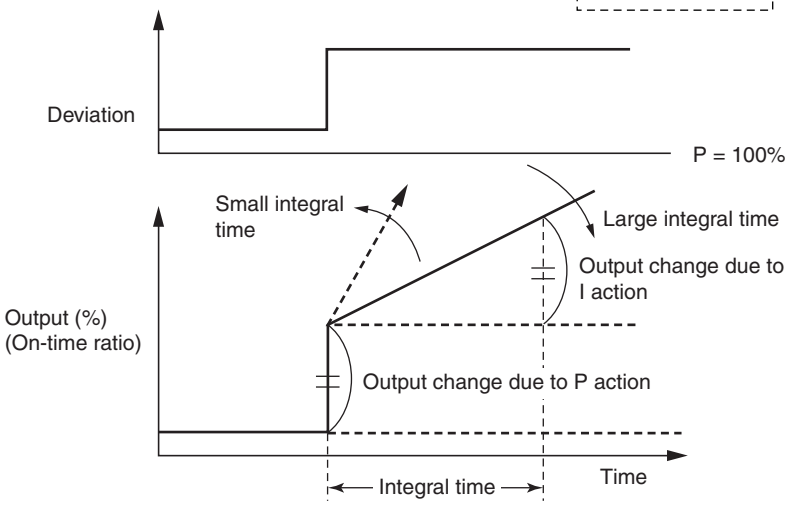
(Note): Heating/cooling control type only

# 8.2 Integral Time ("1.I" to "8.I")

**• Integral time (n.I/n.Ic)** (n=1 to 8)

$$\text{Output} = \frac{100}{P}e + \frac{1}{T_1}\int edt$$

e : Deviation
$T_1$ : Integral time




F8-04.EPS

- "Integral action" ("I "action) is a function that will automatically diminish the offset (steady-state deviation) that is inherently unavoidable with proportional action alone. The parameter that specifies how the integral action will be operate is the integral time (I). The integral action continuously increases or decreases the output in proportion to the time integral of the deviation (the product of the deviation and the time that the deviation continues.)
- Integral action is normally used together with proportional action as proportional-plus-integral action (PI action).

Parameter Range

| | |
|---|---|
| 1. I to 8. I | OFF, 1 to 6000 sec |
| 1.Ic to 8.Ic (Note) | |

(Note): Heating/cooling control type only

- If integral action is not to be used, the integral parameter is set to OFF.
- To cancel offset when I = OFF, change the manual reset value (MR) operation parameter.

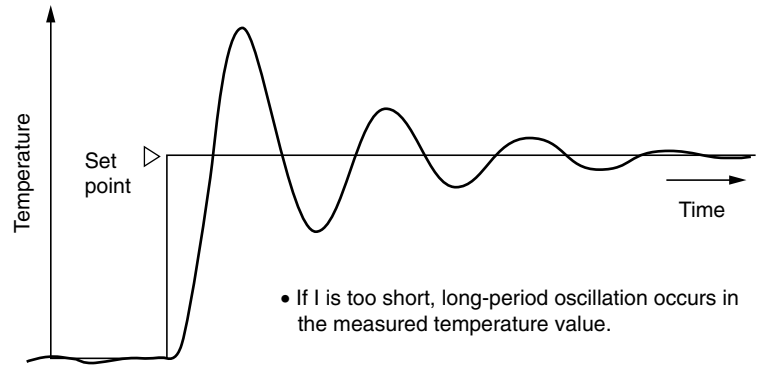
Parameter Range

| | |
|---|---|
| 1. MR to 8. MR | -5.0% to 105.0% of output |

- The integral time (I) is defined as the time required to develop, when a stepwise change in deviation is imposed, an output change due to integral action that is exactly equal to the change due to proportional action. The longer the integral time set, the slower the change in output; the smaller the time, the faster the output changes.

## 8.2.1 Tuning the Integral Time

- **To manually adjust integral time**
  - The main goal is to reduce the offset
  - Adjust from longer time to shorter time
  - If you see an oscillation at a longer period than that seen when proportional band is too narrow, then you have made the integral time too short




F8-05.EPS

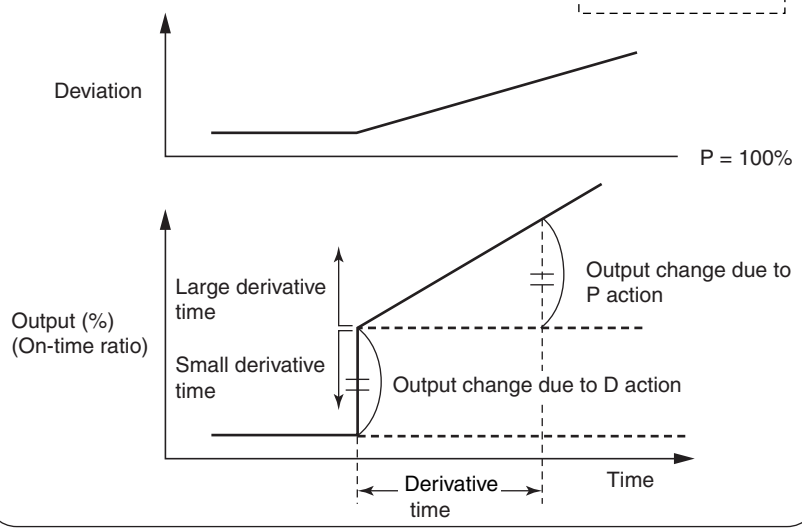
- Shortening the integral time, like narrowing the proportional band, will cause the measured temperature to begin oscillating. However, oscillation due to integral action is characterized by a longer period than that of oscillation due to narrow proportional band.

# 8.3 Derivative Time ("1.D" to "8.D")

- **Derivative time (n.D/n.Dc)** (n=1 to 8)

$$\text{Output} = \frac{100}{P} e + T_D \frac{d}{dt} e$$

e : Deviation
$T_D$ : Derivative time



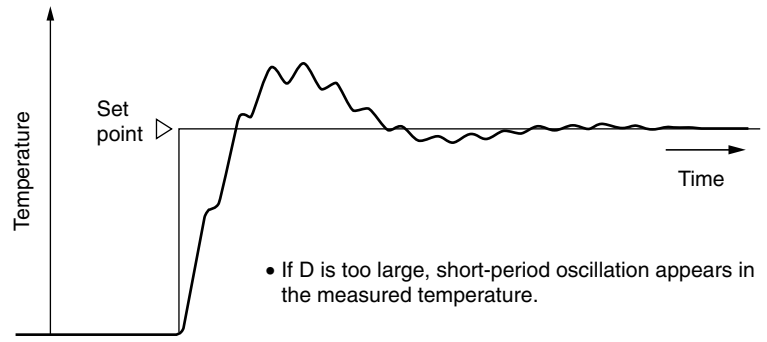

F8-06.EPS

- If the control object has a large time constant or dead time the corrective action will be too slow with proportional action or proportional-plus-integral action alone, causing overshoot. However, even just sensing whether the deviation is on an increasing or a decreasing trend and adding some early corrective action can improve the controllability. Thus the derivative action ("D" action) is action that changes the output in proportion to the deviation derivative value (rate-of-change). The parameter that sets how the derivative action will be operate is the derivative time (n. D).
- The derivative time (n. D) is defined as the time required with "PD" action to develop, when a constant-slope-change in deviation is imposed, an output change due to derivative action that is exactly equal to the change due to proportional action.

## 8.3.1 Tuning the Derivative Time

**• When manually adjusting the derivative time parameter**

- Adjust from shorter time to longer time.
- If you see a short-period oscillation, the time is too long.




- If D is too large, short-period oscillation appears in the measured temperature.

F8-07.EPS

- The longer the derivative time set, the stronger the corrective action, and the more likely the output will become oscillatory. Oscillations due to derivative action are characterized by a short period.
- When the derivation Time (n. D) is set to OFF, the derivative action does not function. D = OFF should always be used when controlling fast-responding inputs such as pressure and flow, or inputs characterized by rapid fluctuation, such as optical sensors.

Parameter Range

| | |
|---|---|
| 1.D to 8.D | OFF, 1 to 6000 sec |
| 1.Dc to 8.Dc (Note) | |

(Note): Heating/cooling control type only

# 8.4 Manual PID Tuning Procedure

**• Procedure for Manually Turning PID Constants**

$$\text{Output} = \frac{100}{P}e + \frac{1}{T_1}\int edt + T_D\frac{d}{dt}e$$

e : Deviation P : Proportional band
$T_1$ : Integral time $T_D$ : Derivative time

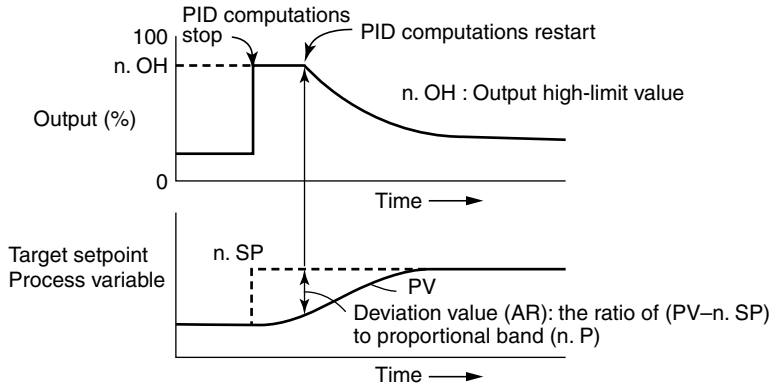
① (In principle, auto-tuning must be used.)
② Turn PID parameters in the order of P, I, and D. Adjust a numeric slowly by observing the result, and keep notes of what the progress is.
③ Gradually reduce P from a larger value. When the measured value begins to oscillate, stop tuning and increase the value somewhat.
④ Also gradually reduce I from a larger value. When the measured value begins to oscillate (with long period), stop tuning and increase the value somewhat.
⑤ Gradually increase D from a smaller value. When the measured value begins to oscillate (with short period), stop tuning and lower the value slightly.

F8-08.EPS

- PID based output can be obtained by the equation given at the left. Take this into account when tuning PID parameters. Manual PID tuning procedure is as described in ② to ⑤ at the left.

# 8.5 Anti-Reset Wind-up (AR)

## ● Function of AR




F8-09.EPS

- Where there is a large deviation at the start of the control operation, for example, integral outputs are accumulated and the process input exceeds the setpoint, thereby causing the output to overshoot. To avoid this, the controller provide an anti-reset wind-up function for suppressing an extreme integral output by stopping PID computations.

## ● Computation of AR

**• The deviation ratio (setting range of "AR") is obtained by the following.**

$$\text{Deviation ratio} = \frac{|\ PV - n.SP\ |}{\text{Proportional band (n.P)}} \times 100\ (\%)$$

F8-09-01.EPS

- Parameter AR sets the point (by specifying a deviation ratio (%) )at which to restart the PID computation that is suspended by the controller's anti-reset windup function. (PID computation restarts when the deviation ratio has decreased to the AR value.)
- The setting range for the deviation ratio set in parameter AR is 50.0 to 200.0%. However, when the parameter is set at AUTO. another setting option, the controller automatically determines the point at which to restart the PID computation.

Parameter Range

| | |
|---|---|
| AR | AUTO, 50.0 to 200.0% |

# 8.6 Zone PID

## 8.6.1 Reference Points

**• An Example of three Zone setting.**

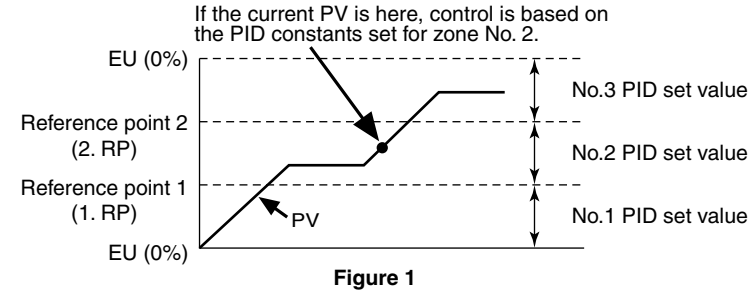



**Figure 1**

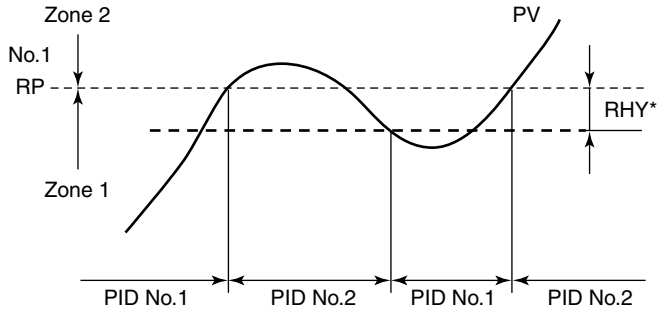



**Figure 2**

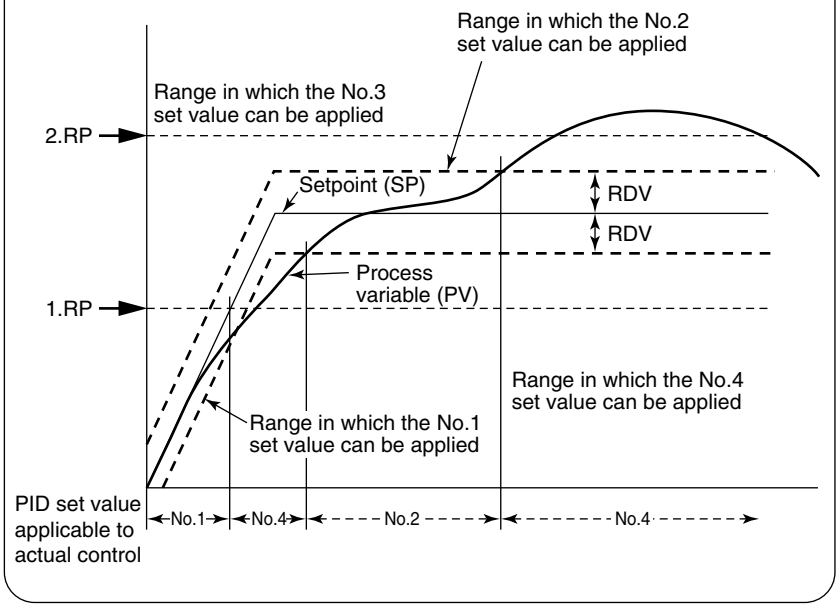
F8-10.EPS

- The zone PID control is selected, when the setup parameter “ZON” is set to 1.
- Zone PID control automatically switches PID settings according to PV. Regardless wheter the program is performing a ramp-up or ramp-down operation, control in the same PV zone is based on the same PID constants. Zone PID control is used with reactors that change chemical reaction gain according to temperature.
- As shown in the figure on the left, zones (Note) can be created using the maximum and minimum values of the PV range as reference points. PID constants can be assigned to each individual zone.
  In this way, even if PV changes from zone to zone, control within each individual zone is automatically based on the PID constants assigned to that zone.

Note: With UT450/420, up to 7 zones can be created by using reference points “1. RP” to “6.RP”.

| RHY: Zone switching hysteresis |
|---|
| 0.0 to 10.0% of PV input range span<br>Allows a hysteresis to be set for switching at a reference point. |

## 8.6.2 Reference Deviation (RDV)




F8-11.EPS

- If there is a larger deviation than the preset reference deviation (RDV) during regulatory control, a different PID set value (Note) will be selected. Selection of this set value has priority over the PID set values selected by reference points 1 and 2 described above. This can therefore be applied to reach the target deviation quickly, for example, by setting a narrower proportional band thus increasing the control sensitivity.
  If the RDV is set to OFF, the above features will not be attained.
  The figure to the left shows the applicable ranges for the nos. 1 through 3 PID set values as well as the No.4 PID set value selected by the reference deviation. (Note)
  A fixed hysteresis (deadband) is provided for reference deviation as well as reference points.

Note: The PID set values maximum number PID group are used when the controller fails to keep track of the deviation.
For example No.4 PID set values are used when the setup parameter “GPR” is set to 4 (initial setting). When the “GPP ” is set to 8, No.8 PID set values are used when a lager deviation than the “RDV” is occured.

# 9. SETPOINT

## 9.1 Setpoint Setting Type Overview

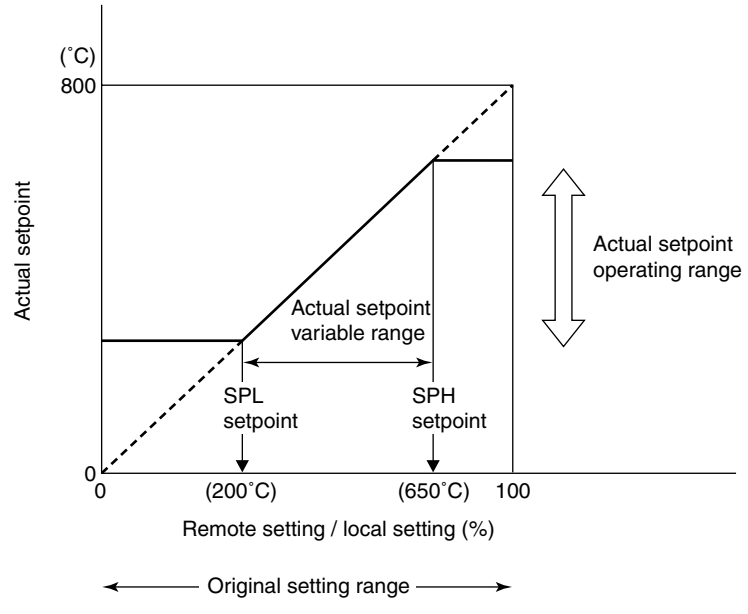
<table>
<tr><td colspan="2">Local setting (internal setting)</td><td>Local setting (internal setting) + remote setting (external setting)*</td></tr>
<tr><td>Single setpoint</td><td>Up to 8 multi-SPs</td><td rowspan="2">Same as left</td></tr>
<tr><td></td><td>Selection using external contact</td></tr>
<tr><td colspan="2"></td><td>• 1 to 5 V<br>• Scalling function<br>• Filtering function<br>• Ratio and ratio bias functions<br>• Remote / local external contact selection</td></tr>
<tr><td colspan="3">• Setpoint high and low limits<br>• Increase / decrease velocity (rate-of-change) limits</td></tr>
</table>

F9-01.EPS

The * mark indicates optional specifications.

- Setpoint setting can be broadly divided into local (internal) setting and local setting + remote (external) setting. Remote setting is available as an optional specification.
- The features of local setting are described in the next section; those of remote setting on the successive pages. The accompanying table shows the principle features of those settings.
- The functions below are available:
  If the setpoint high / low limits (set-up parameters (SPH, SPL)) are set, all setpoints are subject to those limits.
- If the setpoint up-ramp / down-ramp limits (UPR, DNR) are set, the setpoints are subject to those limits at start, when setpoint selection is changed, or when PV tracking is used.

## 9.2 Allowable Range for Setpoints (n. SP) Variation




F9-02.EPS

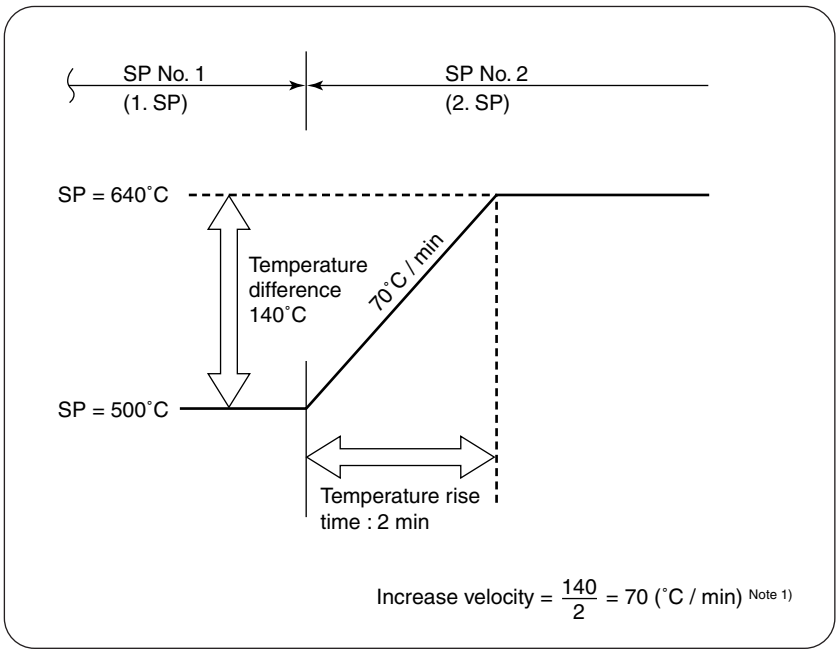
- To stabilize operation or protect equipment, it may be necessary not to allow use of the full setpoint operating range, but rather to some narrower range.
- In such cases, setpoint high and low limits can be set to restrict the setpoint to the range between those limits whether in local (internal) or remote (external) setting.
- The setpoint high and low limits are set using the SPL and SPH setup parameters.

Parameter Range

| | |
|---|---|
| SPH/ SPL | 0.0 to 100.0% of PV input range where, SPL < SPH. |

- Note that the setpoints are in engineering units, not in percent.

# 9.3 Setpoint (SP) Ramp-rate Setting




F9-03.EPS

- Velocity (rate-of-change) limits can be set for both increase and decrease of setpoint in order to prevent abrupt changes in setpoint or to create a ramp by forcing the setpoint to change at a fixed rate.
- Up-ramp and down-ramp settings can be accomplished using the UPR and DNR operating parameters.

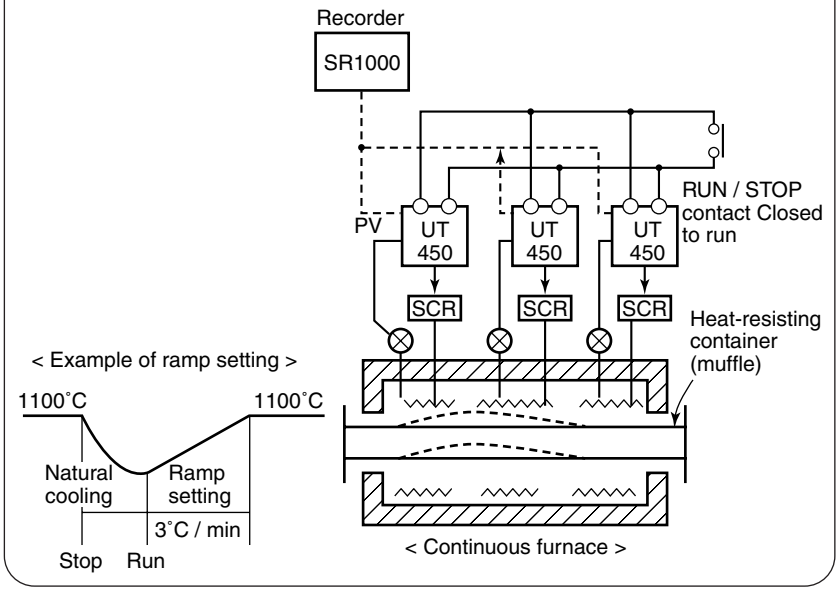
Parameter Range

| | |
|---|---|
| UPR/ DNR | OFF (0)<br>[0.0% + 1 digit] of PV input range span to 100.0% of PV input range span<br>Set ramp-up-rate or ramp-down-rate per hour or minutes.<br>Set unit in ramp-rate-time unit (TMU). |

Note1: Setting resolution is 1% / min or 1% / hr. “Min” or “hr” can be set using the TMU setup parameter.

## 9.3.1 Setpoint Ramp Application Example

- **Example : Continuous Furnace Control**




F9-04.EPS

Note: The external contact rating (current rating) requirement is multiplied by the number of controllers connected.

- The figure at the left shows an example of continuous furnace control. In an application such as a continuous furnace, thermal shock due to abrupt temperature changes pose a risk of deformation on the heat-resisting container.
  A setpoint ramp is therefore set to reduce thermal shock due to a sudden change in the setpoint (n.SP) immediately after operation startup (see the lower left of the figure).

Setting procedure is as follows:

- Set the setpoint up-ramp (UPR) to the desired value.
- Set the PV tracking selection (PVT) to ON (PV tracking ON).

Results

- Temperature never increases faster than the preset rate.
- Setting a moderate ramp can help to reduce time difference in heat transmission within the furnace.
- Deformation of heat-resistant materials inside the furnace due to thermal expansion and contraction can be reduced.
- The life of the heat-resistant material can be extended.

# 10. USE OF EACH FUNCTION

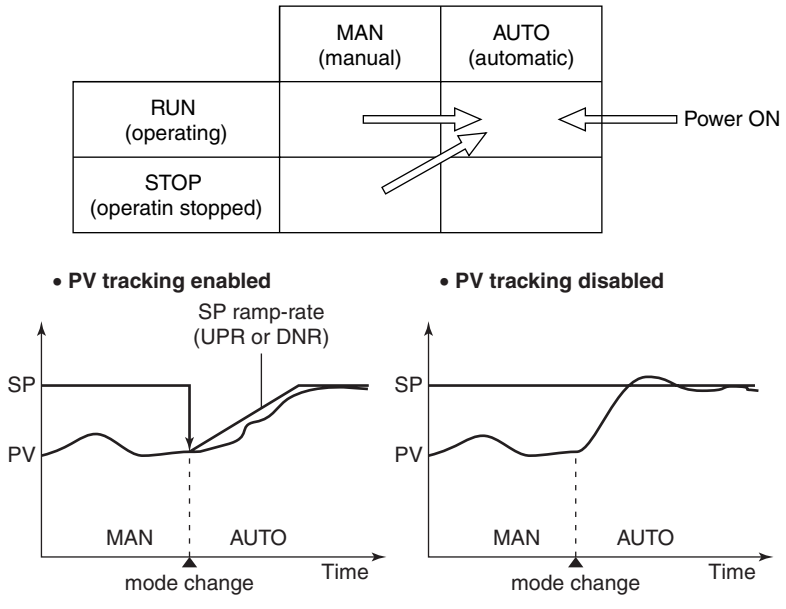
## 10.1 PV and SP Tracking

| | |
|---|---|
| **PV Tracking** | Forces the setpoint (SP) to track the measured value (PV) when in any mode combination other than AUTO RUN. This prevents output bumps at time of transfer to AUTO RUN which could otherwise occur due to deviation existing at the time of transfer. |
| **SP Tracking** | Forces the local setpoint to track the remote setpoint when in REM mode. This prevents output bumps at time of REM to LOCAL transfer which could otherwise occur due to sudden change in deviation. |

F10-01.EPS

- The balanceless and bumpless function is available to prevent abrupt control output changes at time of AUTO/MAN or STOP/RUN transfer (see pages P.10-5 and P.10-6).
- In contrast, the tracking function is based on the concept of eliminating deviation by manipulating the setpoint prior to the transfer.
- PV and SP tracking can be individually selected or canceled.

### 10.1.1 PV Tracking Selection




F10-02.EPS

When PV tracking is ON, the controller sets the SP equal to PV temporarily in the event of the following:

- Power-on to AUTO RUN
- Switching from MAN RUN to AUTO RUN mode
- Switching from AUTO STOP to AUTO RUN
- Switching the number of set point (SP No.)

- Use of PV tracking is set using the PVT setup parameter.

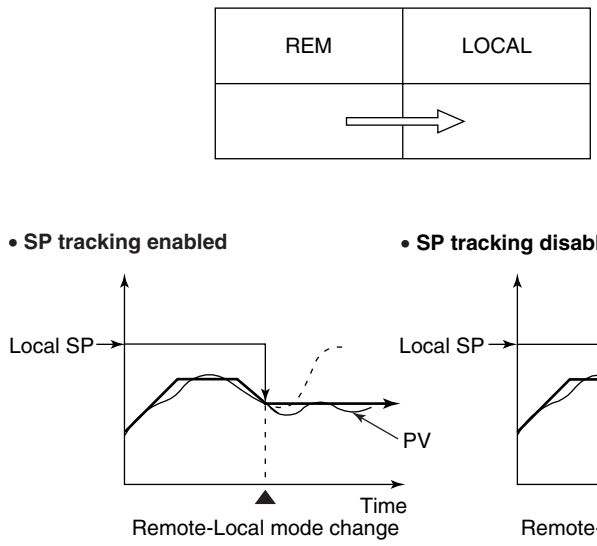
| | |
|---|---|
| PVT | ON : PV tracking enabled<br>OFF : PV tracking disabled |

- Transfer from AUTO to MAN desables PV tracking.

With PV tracking turned on, a transfer to AUTO causes the control setpoint to track to the present measured value PV and then return to the original SP at the rate of the SP ramp-rate (UPR or DNR).

This requires that setpoint ramp-up (UPR) and ramp-down (DNR) be set to a value other then 0.

## 10.1.2 SP Tracking Selection




F10-03.EPS

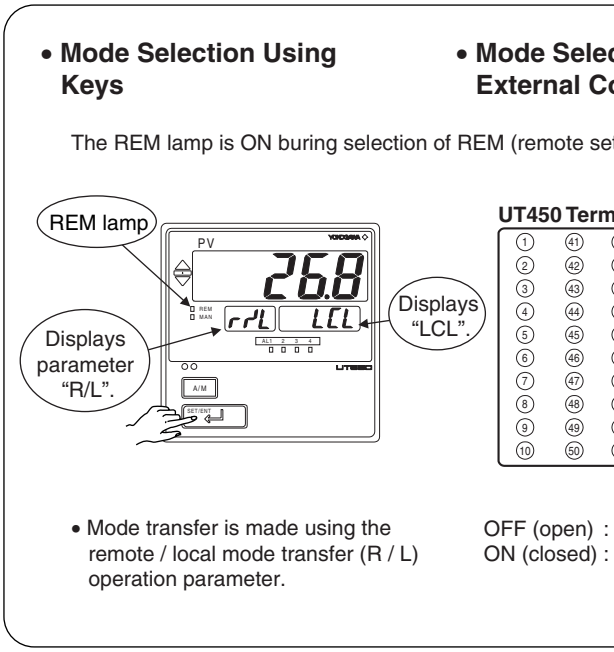
- SP tracking selection allows the user to select whether to force the local setpoint to track the remote setpoint when REM setting is transferred to LOCAL setting.
- SP tracking selection is set using the SPT set-up parameter.

| | |
|---|---|
| SP Tracking | ON : SP tracking enabled<br>OFF : SP tracking disabled |

- Transfer from LOCAL setting to REM setting disables SP tracking.

# 10.2 Mode Transfer Using External Contact

## 10.2.1 REM (Remote Setting) /LOCAL (Local Setting) Selection

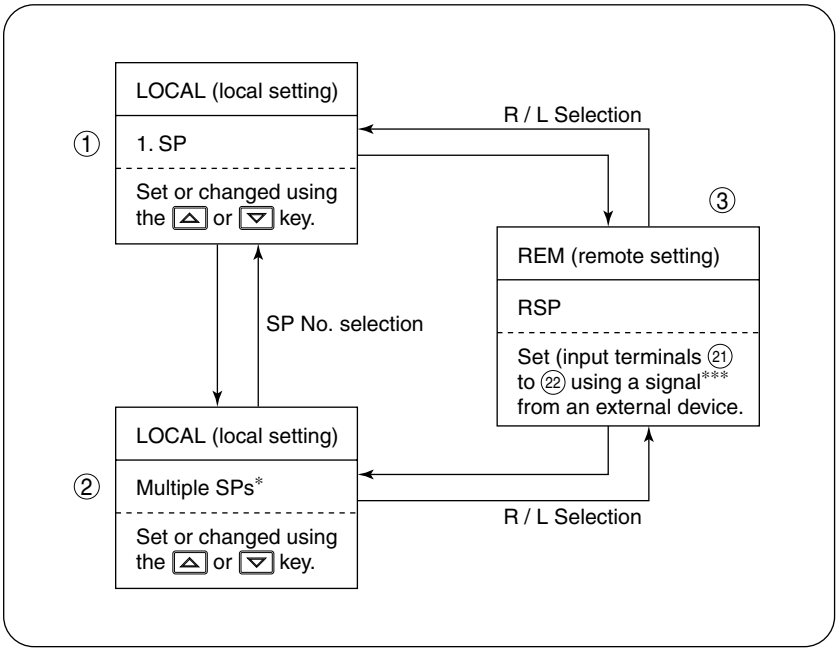



F10-04.EPS

- When the external contact is OFF (LOCAL mode), transfer to the REM mode is available by keystroke or through communication.
- When the external contact is ON (REM mode), transfer to the LOCAL mode is not available by keystroke or through communication. To select the LOCAL mode, set the external contact to OFF.
- REM/LOCAL Selection is available with the following models only.

| UT450 | UT420 |
|---|---|
| UT450-□ 1 | UT420-07 |
| UT450-□ 2 | UT420-08 |
| UT450-□ 4 | |

Note: Terminal No. (28) and (30) are commonly used for REM/LOCAL selection with UT450 and UT420.




F10-05.EPS

① The setpoint is the first setpoint (1.SP). 1.SP can be set or changed using ▲ or ▼ on the front panel.

② The setpoints are the second setpoint (2.SP), third setpoint (3.SP), and foruth setpoint (4.SP)**. The value of those setpoints can be set or changed using ▲ or ▼ on the front panel.

③ The setpoint is in remote mode. The setpoint can be set or changed using a signal*** from an external device.

- ① and ② can be alternately selected using the external contacts.
- Transfer between REM and LOCAL (①, ②, and ③) can be accomplished using the external contact or keystroke.

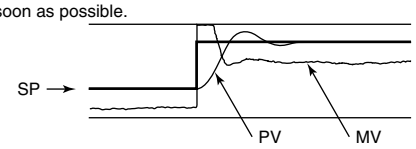
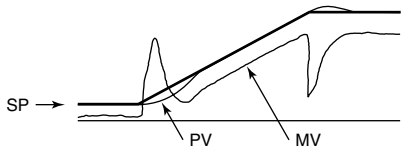
** : Up to eight setpoints (1.SP to 8.SP) can be set by using setup patameter GRP. {For example, set 6 to GRP to use 6 setpoints (1.SP to 6.SP).}

*** : Specify in a range of 1 to 5 VDC, 0 to 2 VDC or 0 to 10 VDC.

* : Selecting up to eight setpoints using setup parameter DIS and setting external contacts to on/off enable the setpoint to be switched. (See **Note:Selection of External Contact (DI) Terminal Function** on page10-4)

Note : UT420 can be set up to 8.SP as same as UT450.
However only 1 to 4.SP can be switched by external contacts (DIS). Use key to switch the numbers of SP (5 to 8.SP).

- Selecting PID control Mode According to the Operating Condition UT450/420 has two type of PID control modes. Those are the Standard PID control mode and the Fixed-point control mode.

| Type of PID Control Mode | Control Method | Description of Control Action | Mode |
|---|---|---|---|
| Standard PID control mode (MOD = 0)<br>Factory-set value<br>(Note) | PV derivative type PID control<br>Control output bump is allowed during change in SP value. | The PV derivative type PID control mode is adopted so that the controller can reach the new SP value without delay when the current SP value is changed.<br>In this control mode, the controller immediately outputs the value of the proportional term P which is proportional to the deviation resulting from a change in the SP value.<br>The controller thus attempts to reach the new SP value as soon as possible.<br>  | Local |
| | Deviation derivative type PID control | The deviation derivative type PID control mode is adopted in order to improve the follow-up capability of UP series program controllers for marginal variations in the SP value of a program pattern.<br>By allowing the derivative term D to positively act upon variations resulting from a marginal change in the program pattern, the controller keeps track of the pattern without delay.<br>  | Remote |

F10-06.EPS

- The figure on the left shows the control action when the Standard PID control mode is selected.
- UT450/420 selects either the PV derivation type PID control method or deviation derivative type PID control method to carry out control accroding to the operating mode (Local/ Remote).

Note: Set “MOD” to 1 to use “Fixed-point” control mode.
See the User’s Manual (IM05J01B02-01E) for more information of the “Fixed-point control mode.

| | |
|---|---|
| MOD | 0 : Standard PID control<br>1 : Fixed point control |

## Note :

## Selection of Extenal Contact (DI) Terminal Function

- The function of external contact terminals can be changed by using a setup parameter DIS.

  Especialy, when Multiple Setpoint is used, what function should be set on the DI terminals is selected by the parameter (DIS).

### UT450

| Terminal | Correspondence between parameter DIS and external contact input functions | | | | | |
|---|---|---|---|---|---|---|
| | When DIS=0 | When DIS=1 (Factory-shipped setting) | When DIS=2 | When DIS=3 | When DIS=4 | Contact |
| DI1 (No.19) | No function | AUTO when DI1=ON<br>MAN when DI1=OFF | AUTO when DI1=ON<br>MAN when DI1=OFF | STOP when DI1=ON<br>RUN when DI1=OFF | When switching target SP 1 to 4:<br>**See the below table [A]** | UT DI1 19 |
| DI2 (No.18) | No function | STOP when DI2=ON<br>RUN when DI2=OFF | 2.SP when DI2=ON<br>1.SP when DI2=OFF | 2.SP when DI2=ON<br>1.SP when DI2=OFF | | DI2 18 |
| DI3 (No.40) | No function | When switching target SP 1 to 8:<br>**See the below table [B]**<br>* If all of the contact inputs are set to OFF, the controller uses the immediately preceding target setpoint. | STOP when DI3=ON<br>RUN when DI3=OFF | AUTO when DI3=ON<br>MAN when DI3=OFF | STOP when DI3=ON<br>RUN when DI3=OFF | DI3 40 |
| DI4 (No.39) | No function | | No function | No function | AUTO when DI4=ON<br>MAN when DI4=OFF | DI4 39 |
| DI5 (No.38) | No function | | No function | No function | No function | DI5 38 |
| DI6 (No.37) | No function | | No function | No function | No function | DI6 37 |
| COM. (No.20) | No function | Common | Common | Common | Common | COM 20 |
| R/L (No.28) | Remote when R/L=ON<br>Local when R/L=OFF | Remote when R/L=ON<br>Local when R/L=OFF | Remote when R/L=ON<br>Local when R/L=OFF | Remote when R/L=ON<br>Local when R/L=OFF | Remote when R/L=ON<br>Local when R/L=OFF | R/L 28 |
| COM. (No.30) | Common | Common | Common | Common | Common | COM 30 |

Contact rating: 12 V DC, 10 mA or more

### UT420

| Terminal | Correspondence between parameter DIS and external contact input functions | | | | | |
|---|---|---|---|---|---|---|
| | When DIS=0 | When DIS=1 (Factory-shipped setting) | When DIS=2 | When DIS=3 | When DIS=4 | Contact |
| DI1 (No.19) | No function | AUTO when DI1=ON<br>MAN when DI1=OFF | AUTO when DI1=ON<br>MAN when DI1=OFF | STOP when DI1=ON<br>RUN when DI1=OFF | When switching target SP 1 to 4:<br>**See the below table [A]** | UT DI1 19 |
| DI2 (No.18) | No function | STOP when DI2=ON<br>RUN when DI2=OFF | 2.SP when DI2=ON<br>1.SP when DI2=OFF | 2.SP when DI2=ON<br>1.SP when DI2=OFF | | DI2 18 |
| COM. (No.20) | No function | Common | Common | Common | Common | COM 20 |
| DI3 (No.29) | No function | No function | STOP when DI3=ON<br>RUN when DI3=OFF | AUTO when DI3=ON<br>MAN when DI3=OFF | STOP when DI3=ON<br>RUN when DI3=OFF | DI3 29 |
| R/L (No.28) | Remote when R/L=ON<br>Local when R/L=OFF | Remote when R/L=ON<br>Local when R/L=OFF | Remote when R/L=ON<br>Local when R/L=OFF | Remote when R/L=ON<br>Local when R/L=OFF | Remote when R/L=ON<br>Local when R/L=OFF | R/L 28 |
| COM. (No.30) | Common | Common | Common | Common | Common | COM 30 |

Contact rating: 12 V DC, 10 mA or more

F10-07.EPS

### Table[A]

When switching target SP 1 to 4:

| | 1.SP | 2.SP | 3.SP | 4.SP |
|---|---|---|---|---|
| DI1 | OFF | ON | OFF | ON |
| DI2 | OFF | OFF | ON | ON |

F10-07-1.EPS

### Table[B]

When switching target SP 1 to 8:

| | 1.SP | 2.SP | 3.SP | 4.SP | 5.SP | 6.SP | 7.SP | 8.SP |
|---|---|---|---|---|---|---|---|---|
| DI3 | ON | OFF | ON | OFF | ON | OFF | ON | OFF |
| DI4 | OFF | ON | ON | OFF | OFF | ON | ON | OFF |
| DI5 | OFF | OFF | OFF | ON | ON | ON | ON | OFF |
| DI6 | OFF | OFF | OFF | OFF | OFF | OFF | OFF | ON |

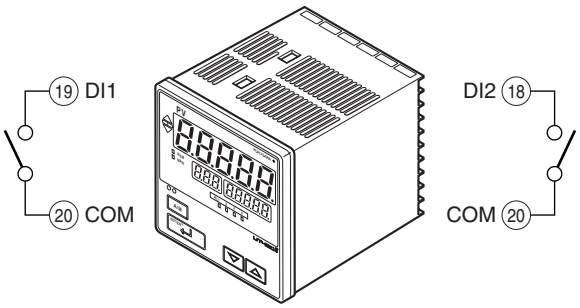
F10-07-2.EPS

Note : UT420 can be set up to 8.SP as same as UT450.

However only 1 to 4.SP can be switched by external contacts (DIS). Use key to switchi the numbers of SP (5 to 8.SP).

## 10.2.2 First/Second/Third/Fourth Setpoint Selection

**• Selection Using the External Contact**




Non-voltage contact (contact rating: 12 V DC at 10 mA or more)
For details on external contact terminal numbers, see **Note: Selection of External Contact (DI) Terminal Function.** (Page10-4)

F10-08.EPS

- Setting setup parameter GRP to 4, setup parameter DIS to 4, and external contacts (⑲-⑳, ⑱-⑳) to on/off enable the setpoint to be switched.

When switching target SP 1 to 4:

| | 1.SP | 2.SP | 3.SP | 4.SP |
|---|---|---|---|---|
| DI1 | OFF | ON | OFF | ON |
| DI2 | OFF | OFF | ON | ON |

F10-08-1.EPS

- Selection of the setpoint via communication is also available.

Note : UT420 can be set up to 8.SP as same as UT450.

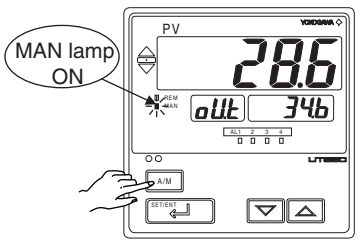
However only 1 to 4.SP can be switched by external contacts (DIS). Use key to switchi the numbers of SP (5 to 8.SP).

## 10.2.3 AUTO (Automatic)/MAN Selection

**• Selection Using Keys**

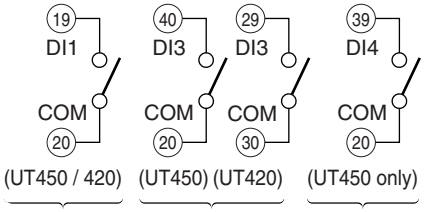
MAN lamp is ON during MAN (manual) operation

In manual operation




① Select the mode using the A/M key.
(SETENT keystroke is not required)

**• Selection Using External Contact**




(UT450 / 420) When setup parameter DIS is 1 or 2.
(UT450) (UT420) When DIS is 3.
(UT450 only) When DIS is 4.*

OFF: MAN (manual)
ON : AUTO (automatic)
Non-voltage contact
(contact rating: 12 V DC at 10 mA or more)

F10-09.EPS

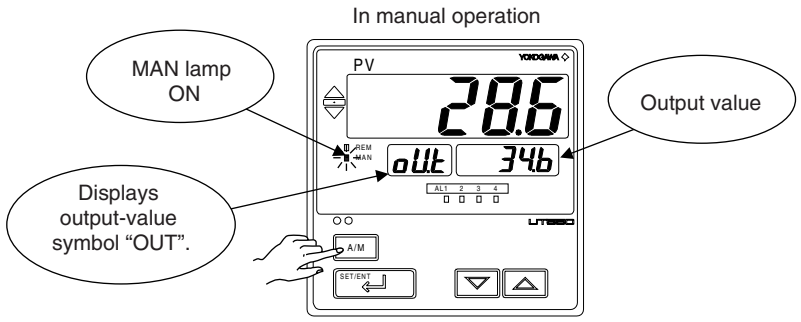
* : Only UT450 can switch AUTO/MAN when DIS is set to 4.

- Transfer between AUTO and MAN is accomplished using the A/M key or external contact terminal (see the figure at the left).

Note : Use of the external contact has priority over keystroke. Therefore, when the external contact is ON (closed), transfer to MAN operation using the A/M key is desabled.

- The mode transfer is balanceless and bumpless. In other words, when switching A→M, manual mode takes over using the existing auto mode output value as-is. (There is not abrupt change.) When switching M→A, the output will remain at the manual mode output level if there is no deviation, and will be taken over as-is as the auto mode output. If there is some deviation, auto mode operation begins with the output value taken over from manual mode, and the changes due to the PID computations begin to be applied starting from that value.

**• Controlling MAN (Manual) Output Value**



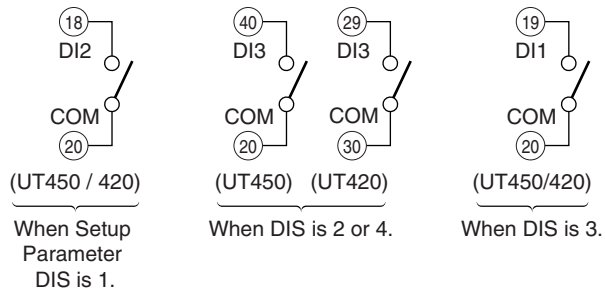

The control output value can be changed using the ▽ or △ key.
(The displayed value is a control output value.)

F10-10.EPS

- Press the A/M key to select MAN (manual) mode. Confirm that the MAN lamp is lit.

## 10.2.4 RUN (Oparating)/STOP (Oparation Stopping) Selection

**• Mode Selection Using External Contact**




OFF (open) : RUN
ON (closed): STOP
Non-voltage contact (contact rating: 12 V DC at 10 mA or more)
(See **Note: Selection of External Contact (DI) Terminal Function** on page10-4.)

F10-11.EPS

- RUN/STOP selection can be accomplished using the external contact.
- In the RUN mode, the automatic output is generated if AUTO/MAN selection is in the AUTO mode, or manual output is generated if in the MAN mode.
- During STOP status, the StoP (stop) is displayed and the preset value {operating parameter : n.PO n=1 to 8 (number of PID group)} is output.

n.PO’s setting range*

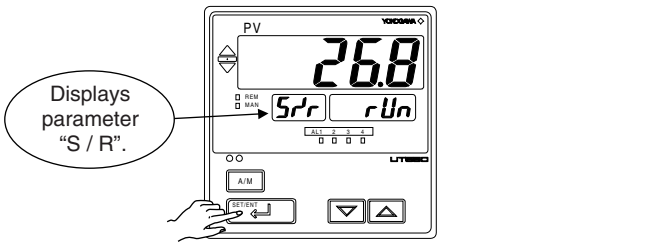
| | |
|---|---|
| n.PO | -5.0 to 105.0% of output |

(not subject to the OL and OH output limits)

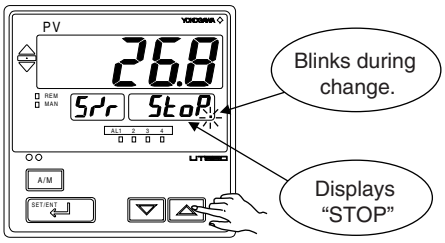
*: See section 5.9 and 11.3 for the preset output value for more information.

## • Mode Selection Using Keys

(1) Press the [SET/ENT] key several times to display the operating parameter "S / R".



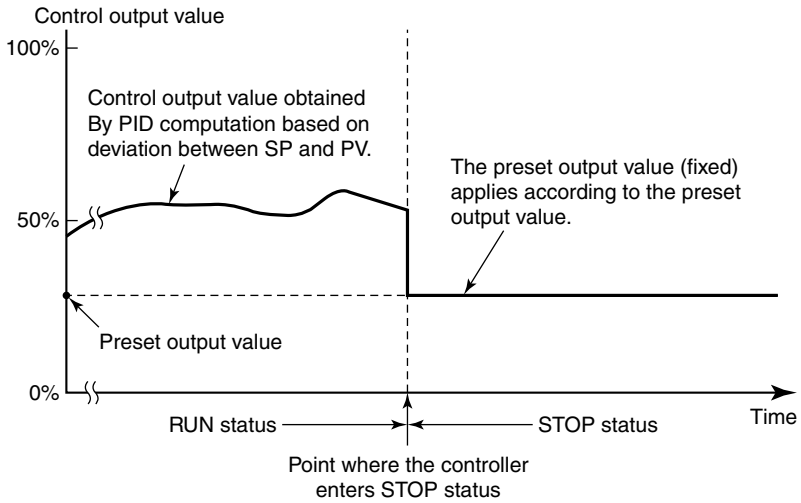

(2) Press the [▲] key to display "STOP".




F10-12.EPS

Note: The initial setting dose not allow switching between run and stop by keystroke. To perform switching by keystroke, configure setup parameter "DIS=0."

## • Control Output Value (Preset Output Value) During STOP (Operation Stopped)




F10-13.EPS

- When the mode is transferred from RUN to STOP, output is forced to the preset output value.

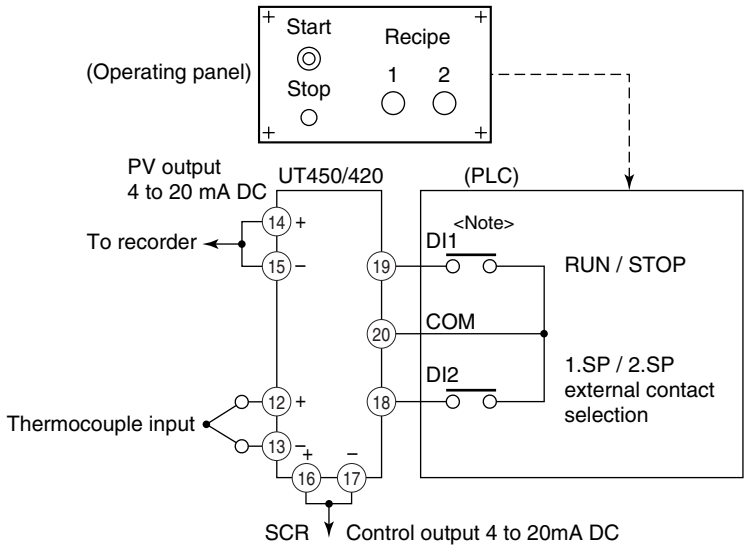
  If there is a defference between the output and the preset value, the output bumps.

- Transfer from STOP to RUN is balanceless and bumpless.

  When the mode is transferred from STOP to RUN (MAN), manual output takes over the preset value as is. If there is no deviation for transfer from STOP to RUN (AUTO), automatic output takes over the preset value as is. If there is a deviation, automatic output starts output updating based on PID computation, using the takenover preset value as the starting point.

- In any mode other than STOP, the preset value applies when the ADC error or PV burnout error is occured during AUTO mode operation, or the re-start mode (R.MD) after power failure (of more than 2 seconds) is set to MAN or AUTO.

## • Application of External Contact Selecting Function




F10-14.EPS

- The figure at the left shows an example of driving the UT450/420, using an equipment's RUN/STOP button and recipe setting switch only.

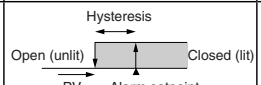
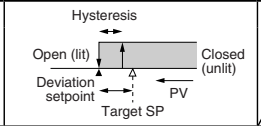
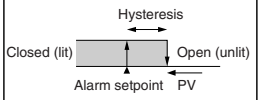
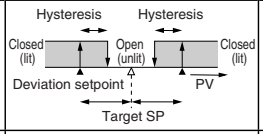
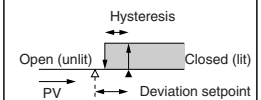
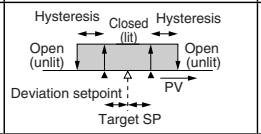
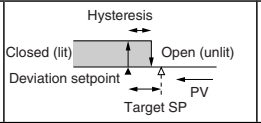
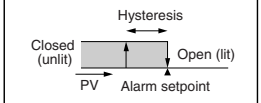
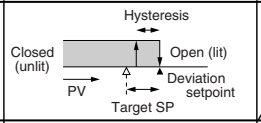
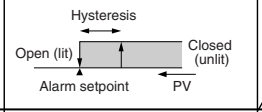
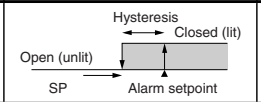
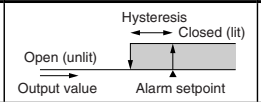
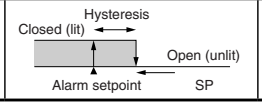
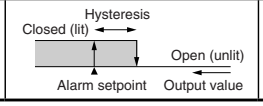
  In this case, the operator is not required to take into account UT450/420 operating method and can operate the equipment simply by controlling the operating panel.

Note: The DI terminal numbers in the figure on the left are an example of the case when the setup parameter DIS is set to 3.

# 10.3 Alarms

## 10.3.1 Alarm Type and Alarm Action

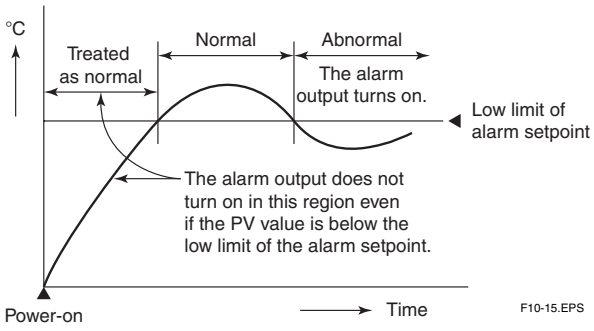
The table below shows the alarm types and alarm actions.
In the table, codes 1 to 10 are not provided with stand-by actions, while codes 11 to 20 are provided with stand-by actions.

| 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 | | De-energized on deviation low limit alarm |  | | 6<br>16 |
| PV low limit |  | 2<br>12 | | Deviation high and low limits |  | 7<br>17 | |
| Deviation high limit |  | 3<br>13 | | Deviation within high and low limits |  | 8<br>18 | |
| Deviation low limit |  | 4<br>14 | | De-energized on PV high limit |  | | 9<br>19 |
| De-energized on deviation high limit alarm |  | | 5<br>15 | De-energized on PV low limit |  | | 10<br>20 |
| Timer function (for Alarm-1 only) | Upward (hour/minute) | 21 | | Sensor grounding alarm | Sensor grounding alarm | 25 | |
| | Downward (hour/minute) | 22 | | Fault diagnosis output (Note 1) | Fault diagnosis output (Note 1) | 26 | |
| | Upward (minute/second) | 23 | | FAIL output (Note 2) | The controller stops when in a FAIL state (Note 2).<br>The control output is set to OFF or 0% and the alarm output is set to OFF . | 27 | |
| | Downward (minute/second) | 24 | | | | | |
| SP high limit |  | 28 | | Output high limit |  | 30 | |
| SP low limit |  | 29 | | Output low limit |  | 31 | |

T10-01.EPS

Note 1: The fault diagnosis output turns on if there is an 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 under normal operation and turns off if there is a failure.

Stand-by Action




F10-15.EPS

- There are alarms AL1, AL2 and AL3. The AL4 is included with UT450-□1 or UT450-□3 only.
  Note : UT420 does not have the alarm 4 (AL4).
- The user can set the characteristics for each of these alarms independently by setting the alarm type codes in the table for the alarm 1 (AL1), alarm 2 (AL2), alarm 3 (AL3), or alarm 4 (AL4) setup parameter.
  Note : UT420 does not have the alarm 4 (AL4).

- Output :
  - Relay Contact (AL1, AL2 and AL3)

    contact rating : 240V AC, 1A/30V DC, 1A (resistance load)
  - Transistor (AL4) <Optional>

    contact rating : 240V DC, 50 mA

- Alarm point setting

  The alarm setpoints are set using the A1, A2, A3 and A4 operating parameters.

Parameter Range

| | |
|---|---|
| A1<br>A2<br>A3<br>A4 | • For measured-value alarm<br>-100.0 to 100.0% of PV input range<br>• For deviation alarm<br>-100.0 to 100.0% of PV input range span<br>• For timer (AL1 only)<br>0.00 to 99.59 (min, sec or hr. min) |

- Alarm hysteresis

  If the instrument frequently goes in and out of an alarm condition, hysteresis band can be widened. Alarm hysteresis can be set using the HY1, HY2, HY3 or HY4 setup parameters.

Parameter Range

| | |
|---|---|
| HY1<br>HY2<br>HY3<br>HY4 | 0.0 to 100.0% of PV input range span |

## ● Hysteresis for PV High Limit Alaram

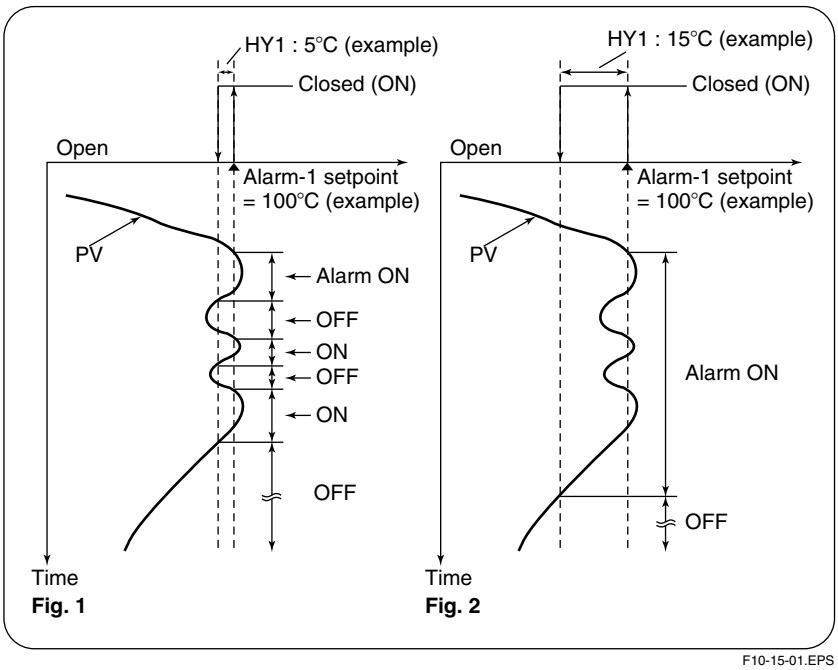
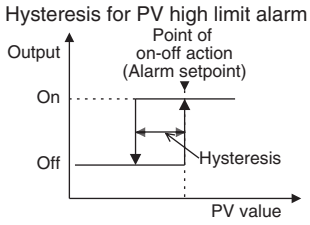



**Fig. 1** **Fig. 2**

F10-15-01.EPS

If the alarm turns on and off too often, set hysteresis band wider to reduce the excessive number of on/off actions.
In Fig. 2 (HY1:15°C), the ON/OFF action of the alarm is moderate compared to that in Fig. 1 (HY1: 5°C) because of the wider HY1 hysteresis band.




F10-15-02.EPS

# 10.3.2 Timer Function

### • To Use the Timer Function

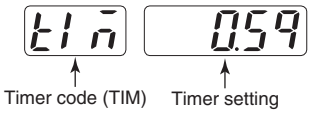
The code specified below is set using alarm 1 type (AL1) set-up parameter.

**Timer Type Code (for AL1 Only)**

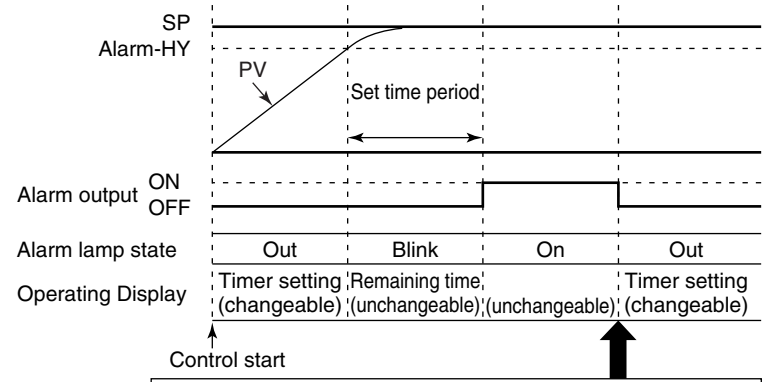
| Timer Function Details | Timer Type Code |
|---|---|
| Detecting direction: Upward<br>Time unit : hr, min | 21 |
| Detecting direction: Downward<br>Time unit : hr, min | 22 |
| Detecting direction: Upward<br>Time unit : min, sec | 23 |
| Detecting direction: Downward<br>Time unit : min, sec | 24 |

F10-16.EPS

- Timer function is avalable on alarm 1 (AL1) only.
- The alarm timer time can be set to operating parameter “AI” only when a timer type code shown in the table on the left is set to “AL1”.
- Timer time can be displayed and / or set in the Operating display.



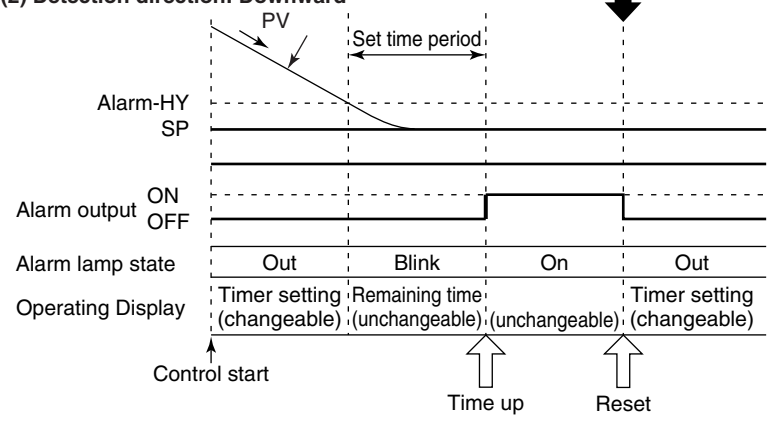

**(1) Detection direction: Upward**




Timer output is set to OFF under conditions listed at the right.

Timer reset conditions
① Power OFF
② Stop
③ Selection of 2.SP, 3.SP or 4.SP
④ Setting the remote mode
⑤ Set A1 to OFF

**(2) Detection direction: Downward**




F10-17.EPS

- The alarm timer notifies the operator when PV is stable.

  The timer starts counting the moment that PV attains the target setpoint (or is within that hysteresis range).

  Then, when the set time elapses, alarm 1 (relay) output turns ON. To use the alarm timer, the “AL1” setup parameter that determines the type of alarm is set to “21” to “24”. Timer time is set with the “1.A1” operating parameter.

  Timer output turns OFF in the following cases.

  - When power is turned OFF
  - When operation stops
  - When target setpoint No. is changed (to any number other than 1)
  - During remote control
  - When timer time is set to “OFF”

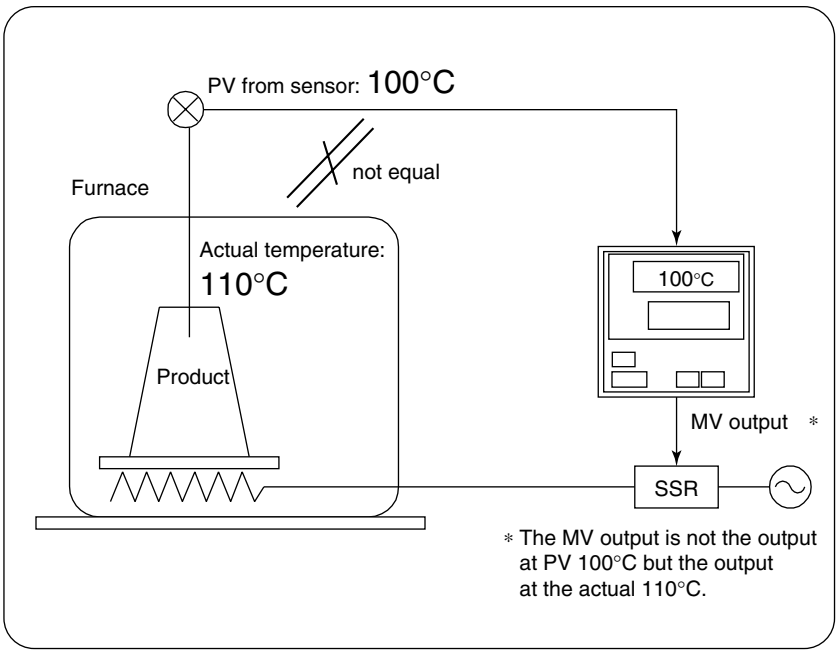
■ The alarm timer can only be set for alarm 1. It cannot be set for alarms 2 to 4.

Note: The timer function is not available for 2.SP to 8.SP.

- Timer starts counting when PV reach the final target SP in case “SP up / down-ramp slope” function is used.

# 10.3.3 Sensor Ground Alarm

## ● Application




F10-18.EPS

- When the controller-indicated PV and actual temperature of the furnace differ, sensor loss can be evaluated from the change in output.

  For example, when the temperature inseide the furnace is 110˚C despite the fact that the controller indicates as 100˚C. In this particular case, output is hifher than that at a 100˚C PV. This can be detected by the sensor ground alarm. In using this function, the user must keep data on the normal output range (i.e..how much output there is at a PV of 100˚C).

- Set the Alarm (AL1, AL2 or AL3) to 25, to use the sensor ground alarm function. (AL4 can not be used.)
- This function not active in the following case.
  - During manual operation mode.
  - When operation stops
  - During ON/OFF control mode
  - During auto-tuning

## ● Computation

$$\text{Moving average} = \frac{OUTn + OUTn\text{-}1 + OUTn\text{-}2 + OUTn\text{-}3 + OUTn\text{-}4}{5}$$

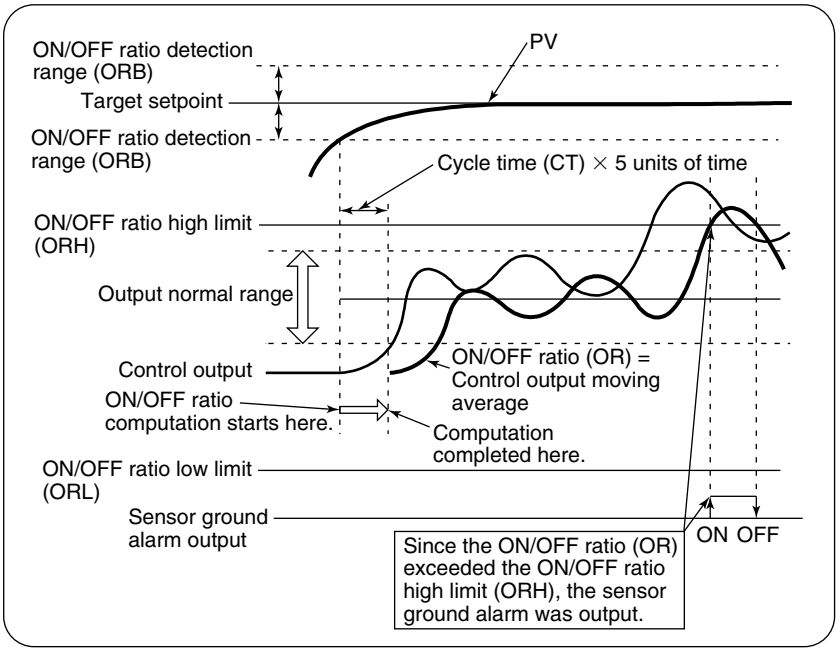
$$= \text{ON/OFF ratio (OR)}$$

OUTn is the current output.
The time width between each OUTn and OUTn-1, OUTn-1 and OUTn-2... OUTn-3 and OUTn-4 is the cycle time.

F10-19.EPS

- The moving average is computed as shown on the left. Computation starts after PV is within the ON/OFF ratio detection range.

Note: This moving average is the ON/OFF ratio (OR).




F10-20.EPS

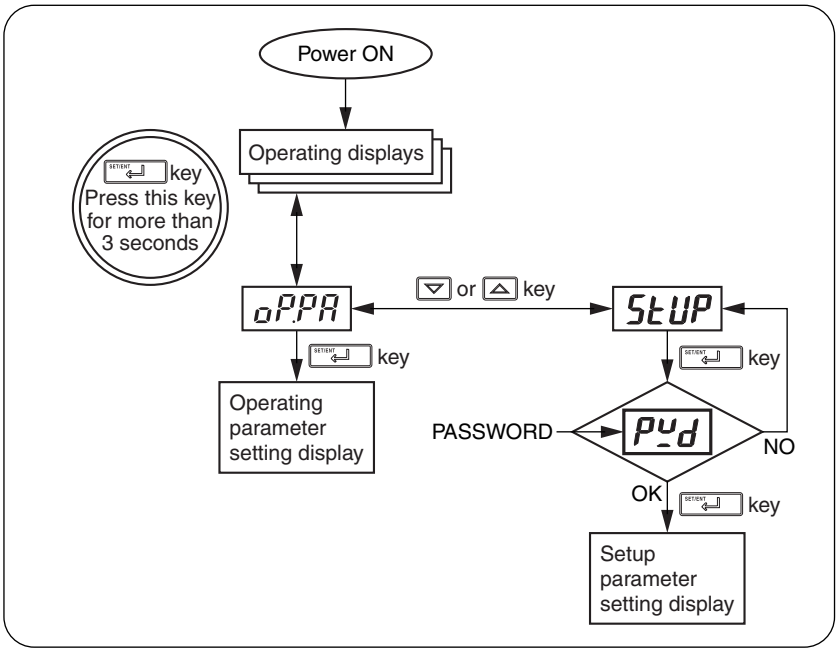
Sensor loss detection works as follows. Sensor loss is detected and an alarm is output when the moving average of the control output (ON/OFF ratil) drifts outside the set high limit (operation parameter “ORH’) and low limit (operation parameter “ORL”). This is done even if control is stable and PV stays within a constant range of the target setpoint. The sensor ground alarm trigger is shown in the figure on the left.

As shown in the figure, set the ON/OFF ratio high limit (ORH) and the ON/OFF ratio low limit (ORL) to a slightly wider range than the output normal range.

And, because ON/OFF ratio computation starts when PV is within the ON/OFF ratio detection range, set the ON/OFF detection range close to the target setpoint. If set too wide, the sensor ground alarm will trigger when output is unstable, hence it will be output frequently.

# 10.4 Security Function

## 10.4.1 Password




F10-21.EPS

By setting a password, you can prevent inadvertent changes to setup parameters. The password is verified when you switch from the operating parameter setting display to the setup parameter setting display.

*: "Password" is displayed only when password registration.

No password is required when PWD is set to 0.

Note: • Always remember your password. Once a password has been set, you cannot access the setup parameter setting display unless you enter the correct password. To cansel your password, the controller must be serviced (for a fee) at a Yokogawa service center.

• Cancelling a password reverts all parameters back to their factory-set defaults. For this reason, it is strongly recommended to keep a written record of all controller parameter settings.

## 10.4.2 Key Lock

| | | |
|---|---|---|
| dAt | ▲ / ▼ keylock | • Locks the ▲ / ▼ keys on the controller front panel to prohibit their operation. However, the password setting or the following security-related parameters setting operation is possible. |
| AMn | A/M key lock | • Locks the A/M key on the controller front panel to prohibit switching between auto and manual modes. |
| rAL | Remote/Local mode lock | • The R/L operating parameter, which is used to switch between remote and local modes, is not shown. This prohibits you from switching between the two modes by key operation. |
| PId | PID parameter number lock | • The PID operating parameter, which is used to select from the groups 1 to 8 of PID parameters, is not shown. This prohibits you from changing your choice of PID parameters by key operation. |

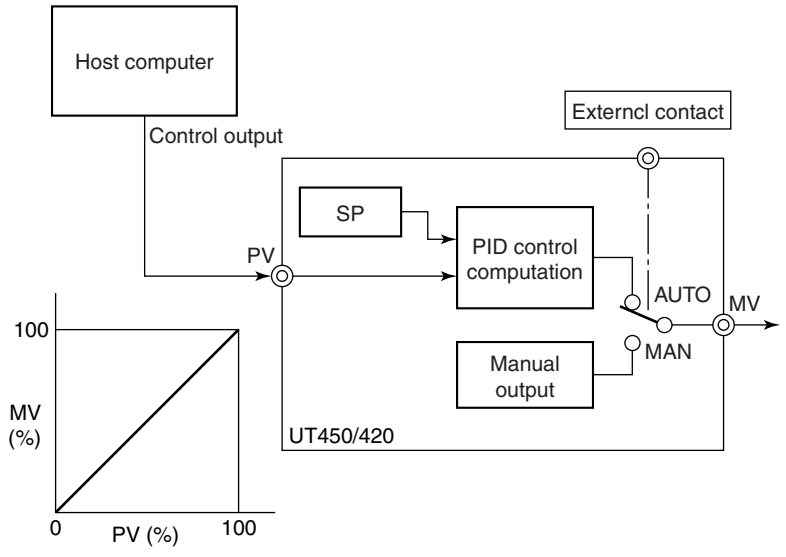
T10-02.EPS

- Problems could result if a person unaware of the UT450/420 functions inadvertally changing the operating conditions during operation.
- To prevent this, the UT450/420 offers the key lock-related parameters (noted at the left), which can be used so that the relevant keys will not function when pressed.
- Mode transfer using the external contact is available although key lock has been applied.

TIP

UT450/420 does not have the function of key lock and its release by external contacts.

**• Using UT450 / 420 as a Backup Manual Station**



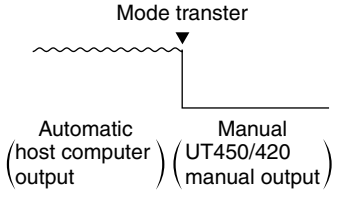

F10-22.EPS

- Generally, control output values from the host computer are passed through and are output as are. If the host computer goes down, an external contact signal is used to make a bumpless change to MAN (manual) mode.

  The UT450/420 then function as a manual station.
- In this case, the UT450/420 parameters must be set as shown at the lower left. Then the setup parameter "PID" must be set to ON to lock setting or change of the parameters.

| n. P | n. I | n. D | n. MR | n. DR | n. SP |
|---|---|---|---|---|---|
| 100.0 | 0 | 0 | 0 | DIR | 0 |

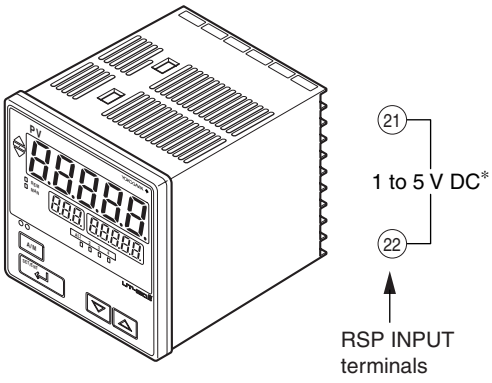
(Direct action)




T10-03.EPS

# 10.5 Remote Setpoint Input

- **This Function is Available when the Remote input Option is Added.**




F10-23.EPS

| | |
|---|---|
| Remote Input | Input resistance : about 1MΩ<br>Isolated from other input/ output terminals or the internal circuit. |

- Remote input is available with the following models only.

| UT450 | UT420 |
|---|---|
| UT450-□ 1 | UT420-07 |
| UT450-□ 2 | UT420-08 |
| UT450-□ 4 | |

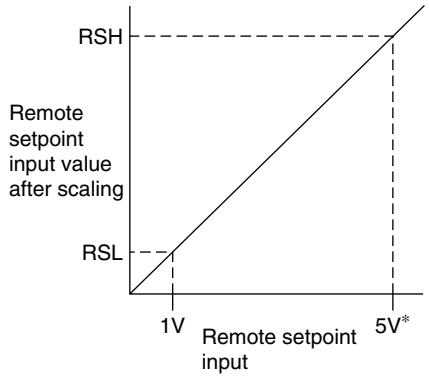
Parameter Range*

| | |
|---|---|
| RSP | 40: 0.4 to 2 V DC<br>41: 1 to 5 V DC<br>50: 0 to 2 V DC<br>51: 0 to 10 V DC |

* : Specify in a range of 1 to 5 VDC, 0 to 2 VDC, 0.4 to 2 VDC or 0 to 10 VDC (Default : 1 to 5 VDC, RSP=41)

## 10.5.1 Remote Setpoint Input Scaling and Filtering

- **Scaling Function**




RSH: Max. value of remote setting input range
RSL : Min. value of remote setting input range
(RSH, RSL: Set-up parameters)

- **Filtering**

Remote input → [1st-order lag filter] → Remote input for UT37/38 internal computation

F10-24.EPS

- Scaling for remote input is basically the same as for measured input side, or measurement range.

  However, to make small modification, it must be set using the remote setpoint input range maximum value (RSH) and minimum value (RSL).

Parameter Range

| | |
|---|---|
| RSH | -19999 to 30000 |
| RSL | However, RSL<RSH |

- Note that the setpoint is in engineering unit, not in percent.
- If remote input is noisy or oscillatory, a filter can be inserted to smooth operation.

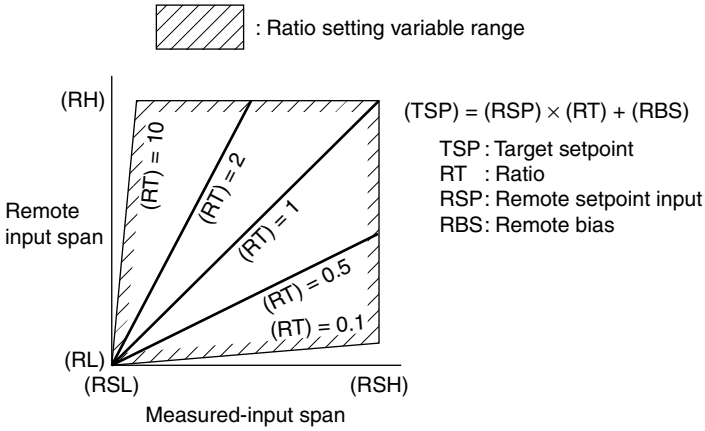
  The filtering function is the same as that of measured input (see page 26).

  Filtering is set as a 1st-order time constant using the RFL operating parameter.

Parameter Range

| | |
|---|---|
| RFL | OFF, 1 to 120 sec<br>When OFF, no filter is set. |

## 10.5.2 Ratio/Remote Bias Function



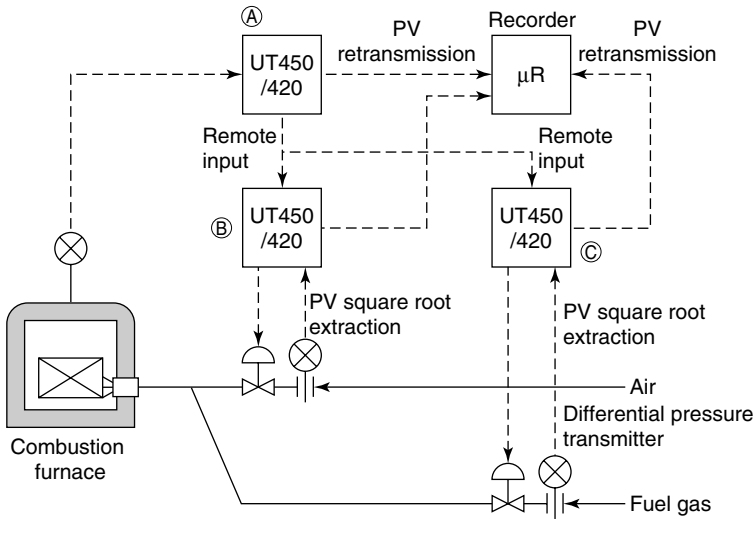

F10-25.EPS

- The UT450/420 also offers ratio and remote bias computation for applications like zone-baias load distribution or fuel-air ratio control.
- The computation expression is as shown on the left.
- Ratio is indicated as a multiplier to the reference which represents ratio = 1 when the remote setpoint input after filtering and scaling exactly corresponds to measured input span.
- Ratio is set using the RT operating parameter and ratio bias is set using the RBS operating parameter.

Parameter Range

| | |
|---|---|
| Ratio (RT) | 0.001 to 9.999 |
| Remote bias (RBS) | -100.0 to 100.0% of PV input range span |

## 10.5.3 Application of Ratio/Remote Bias Function




F10-26.EPS

- The figure at the left shows an example of combustion furnace fuel-air ratio. Temperature controller Ⓐ generates cascade output to set data to air-flow controller Ⓑ and fuel-flow controller Ⓒ.

  The measured values to air- and fuel-flow controller Ⓑ and Ⓒ are derived from defferential pressure transmitter signals.

  The remote bias computation function is used to control the ratio of air to fuel gas.

# 10.6 Retransmission Output

| Code | Retransmission Output Type | Retransmission Output Range |
|---|---|---|
| 1 | PV (Process variable) | The retransmission range can be represented with PV input range scaled with RTH (Max. value) and RTL (Min. value). See the table below for RTH and RTL |
| 2 | SP (Target setpoint) | |
| 3 | OUT Note 1 (Control output) | |
| 4 | Loop Power Supply | Note: For more informetion, see 10.7 Loop Power Supply. |
| OFF | Turns the function off (no retransmission output is used) | |

F10-27.EPS

| Parameter Symbol | Setting Range and Description | Initial Value |
|---|---|---|
| rtH (RTH) | RET=1, 2: [RTL + 1 digit] to 100.0% of PV input range<br>RET=3: [RTL + 1 digit] to 100.0% | 100.0% of PV input range |
| rtL (RTL) | RET=1, 2: 0.0% of PV input range to [RTH - 1 digit]<br>RET=3: 0.0% to [RTH - 1 digit] | 0.0% of PV input range |

F10-27-1.EPS

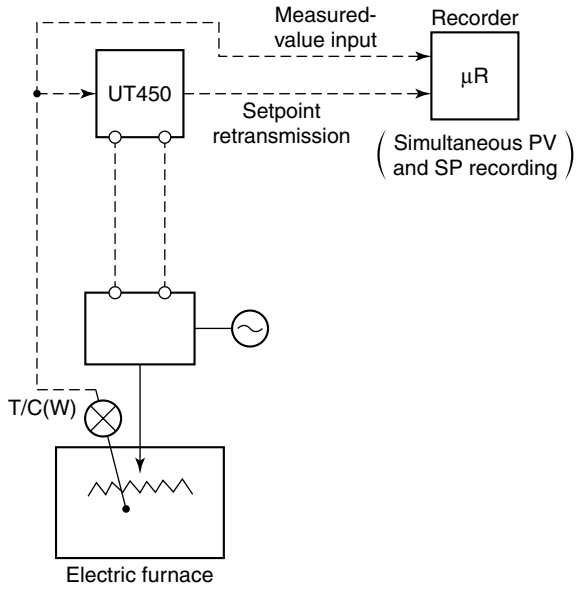
- Using the retransmission output function, any one of the following in the UT450/420 can be transmitted to an external instrument as a 4 to 20 mA DC continuous signal.
  - PV (Process variable)
  - SP (Target setpoint)
  - OUT (Control output)
- Retransmission content can be selected by setting a code shown in the accompanying table to the RET setup parameter.
- When code4 is selected, the instrument can generate an output for the loop power supply.

Note1: The following conditions apply if the parameter is set to “3”.

- In position proportional control, a valve opening (0 to 100%) is output.
- In heating/cooling control, the output value before allocation to the heating and cooling sides is output.

  (0 to 50%: Cooling-side output, 0 to 50%: Heating-side output)

## 10.6.1 Retransmission Output Application




F10-28.EPS

- Output

| Code | Output | Load Resistance |
|---|---|---|
| RET | 4 to 20 mA | 600Ω or less |

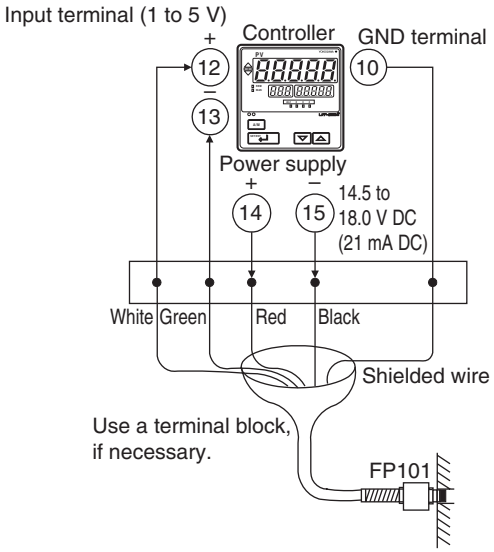
- The retransmission output terminals are (14)(+) and (15)(-).
- The retransmission output terminals isolation. Not isolated between 4-20mA outputs nor from 15 V DC loop power supply and voltage pulse control output. Isolated from other input/output terminals and internal circuit. (Isolated from the measured input and remote setpoint input.)

# 10.7 Loop Power Supply

(See 2.3.4 Wiring for 15V DC/24V DC Loop Power Supply on page 2-6 for wiring.)

## ● The Standard Loop Power Supply <14.5 to 18.0 V DC (21mA DC) voltage level>

**• Example of connection with FP100 series**



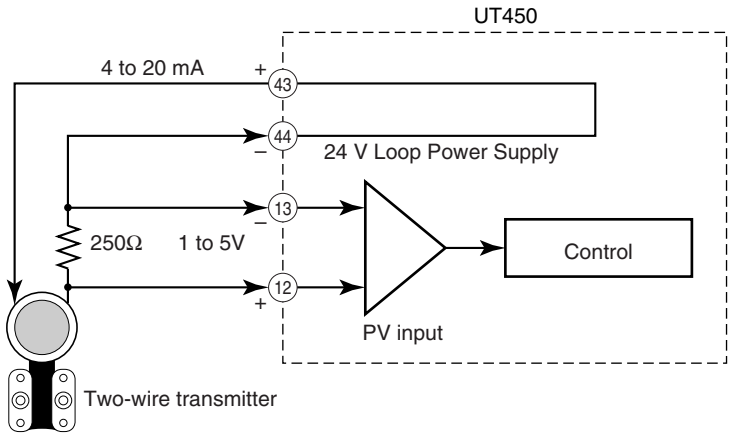

F10-29.EPS

- 15V* DC loop power supply is for all controller models. This standard feature becomes available when you specify the type of retransmission output. See the 10.6 Retransmission output.

  *: 14.5 to 18.0V DC (21mA DC) voltage level

## ● The Optional Loop Power Supply <21.6 to 28.0 V DC (30mA DC max) voltage level>

**• Example of connection to Two-wire Transmitter**




F10-30.EPS

- 24V* DC is added to your controller as an option if specified (by the option code) at the time of ordering. This optional feature is assigned to specific terminals prior todelivery. Therefore, you can use the feature directly without having to select a type of retransmission output like a standard Loop Power Supply.

  *: 21.6 to 28.0V DC (30mA max.) voltage level

- The UT420 and Heating/cooling type of UT450 can not be specified the optional 24V DC loop power supply.

# 10.8 Communications

## 10.8.1 Communications Overview

### ● Communication Protocols

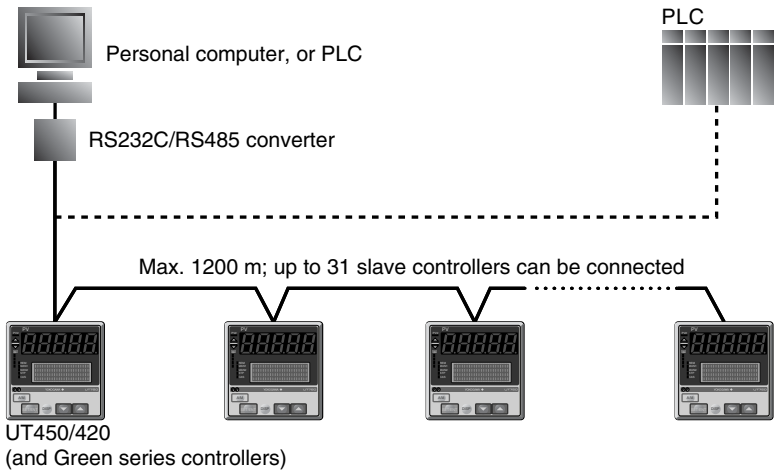
| Communication protocol | Protocol specification |
|---|---|
| MODBUS communication | RTU mode |
| | ASCII mode |
| PC link communication | Without sum check |
| | With sum check |
| Ladder communication | Handshaking |
| Coordinated operation | Specific to GREEN Series |

F10-31.EPS

The UT450/420 controller has an RS-485 serial communication interface, through which data exchange is performed with a device such as a personal computer, PLC (sequencer), and graphic panel.

The four communication protocols are supported.

### ● MODBUS Communication



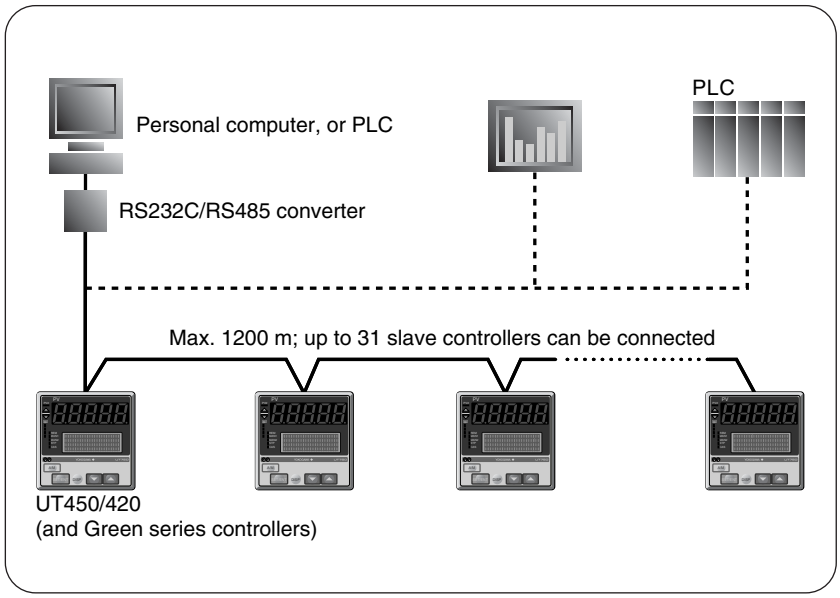

F10-32.EPS

A protocol used for communicating with a general-purpose personal computer and PLC.

Protocol: MODBUS RTU
MODBUS ASCII

Baud Rate: 600bps to 9,600bps

## ● Personal Computer Link Communication

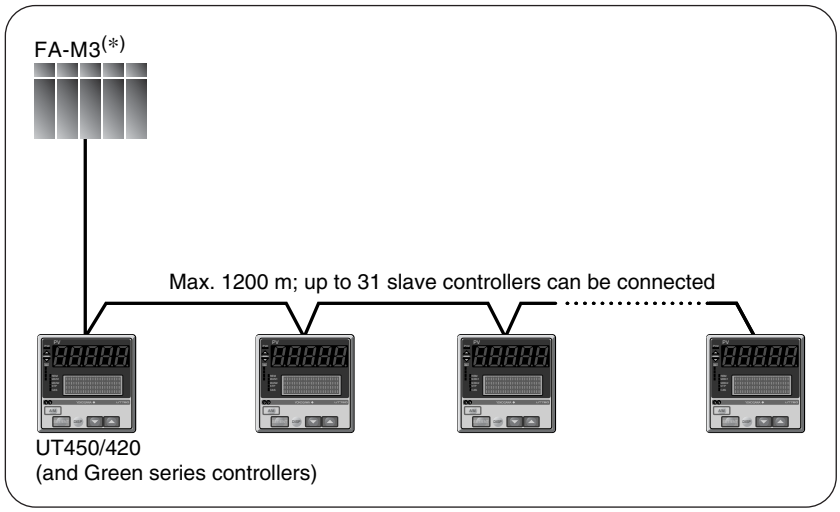



F10-33.EPS

A protocol used for communicating with a general-purpose personal computer, or UT link module and serial communication module of PLC (FA-M3 range-free controller).

FA-M3 and a recorder can be connected in the same line.

## ● Ladder Communication

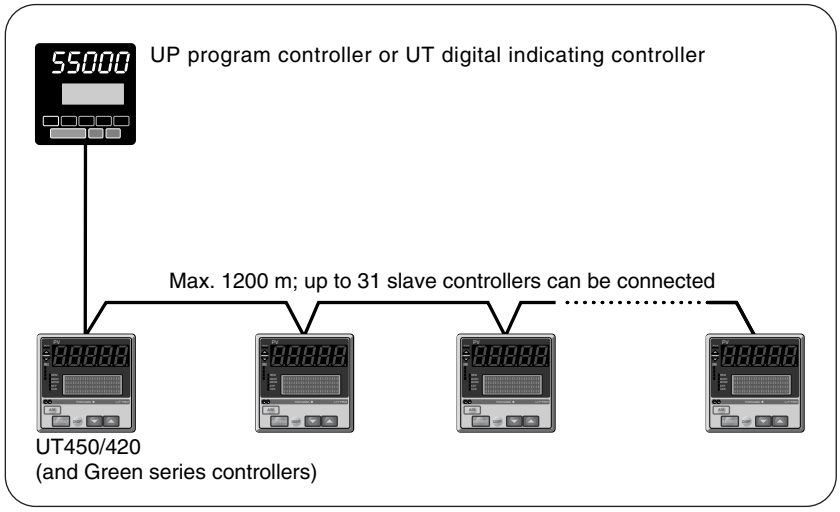



F10-34.EPS

A protocol used for communicating with a PLC.
Communication with a computer link unit of the MELSEC-A series (made by Mitsubishi Electric Corporation) is possible.

(*) FA-M3 is the PLC made by Yokogawa.

## ● Coordinated Operation

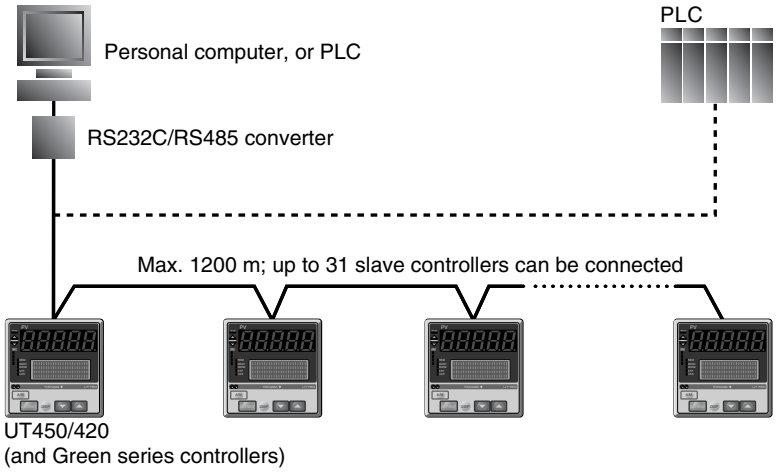



F10-35.EPS

In coordinated operation, a UP program controller or UT digital indicating controller is used as a master controller and multiple UT digital indicating controllers as slave controllers. The slave controllers are operated in accordance with the actions of the master controller.

# 10.8.2 MODBUS Communication

## ● Over View (MODBUS communication)




F10-36.EPS

A MODBUS communication protocol is one of the protocols used to communicate with devices such as PCs, PLCs (sequencers), and graphic panels. Via this communication protocol, these devices can exchange data with Green series controllers by reading/writing the internal registers (D registers) of a Green series controller.

Refer to the registers-Map (in the User's Manual: IM 05G01B02-02E) for more details about internal registers.

## ● ASCII Mode VS. RTU Mode (MODBUS communication)

| Item | ASCII mode | RTU mode |
|---|---|---|
| Number of data bits | 7 bits (ASCII) | 8 bits (binary) |
| Message start mark | : (colon) | Unnecessary |
| Message end mark | CR + LF | Unnecessary |
| Message length (Note 1) | 2N + 1 | N |
| Data time intervals | 1 second or less | 24-bit time or less (Note 2) |
| Error detection | Longitudinal redundancy check: LRC | Cyclic redundancy check: CRC-16 |

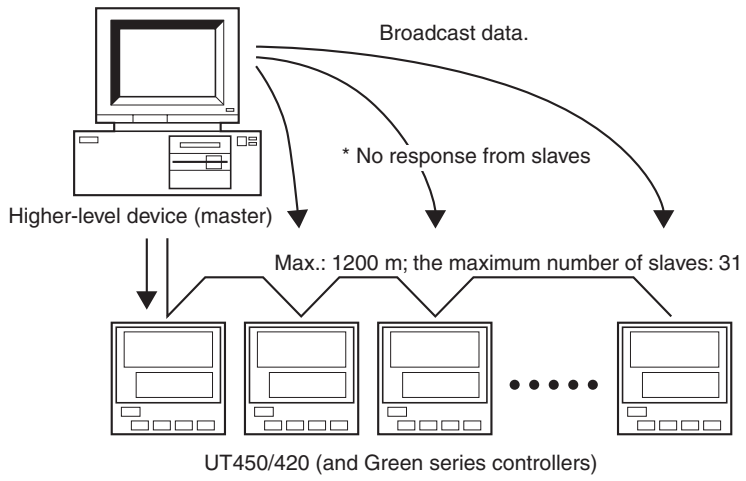
Note 1: When the message length in the RTU mode is assumed to be "N."
Note 2: When the communication rate is 9600 bps, 1÷ 9600 × 24 sec. or less.

F10-37.EPS

For the MODBUS communication of the UT450/420 (Green Series), two transmission modes are supported: ASCII mode (ASCII system) and RTU mode (binary system).

In MODBUS communication, a higher-level device identifies each Green series controller with a communication address, which ranges from 1 to 99. However, broadcasting, which requires no address number, is possible with some of the commands. For more information, see the next figure.

## ● Broadcasting (MODBUS communication)




F10-38.EPS

The broadcasting allows the corresponding multiple UT450/420 (and Green series) controllers to receive the command.

(1) In the command, specify the broadcast address “00” and execute it.

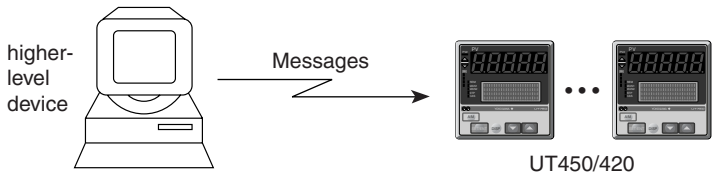
(2) The broadcasting works independently of the communication address of the controller.

(3) The broadcasting is applicable to write commands only.

*: No response is returned when the broadcasting is used.

## ● Messages (MODBUS communication)

| Element | Start of Message Mark | Address Number (ADR) | Function Code | Data | Error Check | End of Message Mark |
|---|---|---|---|---|---|---|
| Number of bytes in RTU mode | None | 1 | 1 | 2n | 2 | None |
| Number of bytes in ASCII mode | 1 | 2 | 2 | 4n | 2 | 2 |




F10-39.EPS

Messages sent from a higher-level device (Personal computer, etc.) to a UT450/420: Green series controller consist of the elements shown in the table on the left.

## ● The Description of Each Element of Message (MODBUS communication)

**(1) Start of Message Mark**
This mark indicates the start of a message. Note that only ASCII mode requires a " : " colon.

**(2) Address Number (1 to 99)**
An address number is used by a higher-level device to identify which Green series controller to communicate with. (ID number of UT450/420: Green series controller)

**(3) Function Code (See "List of Function Codes" on the next page.)**
The function code specifies a command (function code) from the higher-level device.

**(4) Data**
This element specifies D/B register numbers, the number of D/B registers, parameter values, and so on in accordance with the function code.

**(5) Error Check**
In RTU mode carried out by the cyclic redundancy check (CRC-16) system.

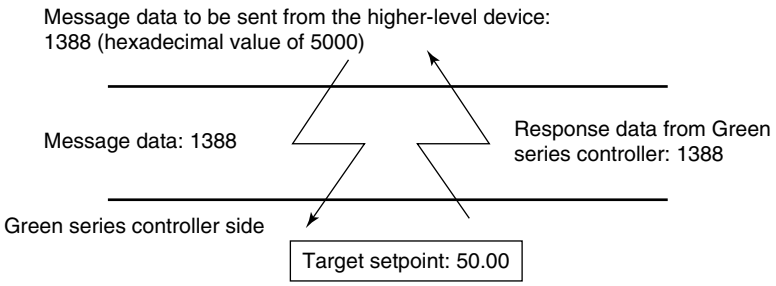
In ASCII mode carried out by the longitudinal redundancy check (LRC) system.

**(6) End of Message Mark**
This mark indicates the end of a message.

Note that only ASCII mode requires CR.

F10-40.EPS

## ● Message Format for Communication (MODBUS communication)




∗ The position of the decimal point for "5000" is determined by the DP (decimal point position) parameter of the Green series controller.

F10-41.EPS

**Example:**
When setting the target setpoint "50.00" to a UT450/420: Green series controller, the higher-level device sends the message data "1388," which is the hexadecimal value of "5000" - decimal point removed from "50.00" (this is also true for setting 5.000 or 500.0).

## ● List of Function Codes (MODBUS communication)

| Function Code | Function | Description |
|---|---|---|
| 03 | Reads data from multiple registers. | Capable of reading data from a maximum of 64 successive registers. |
| 06 | Writes data into a register. | Capable of writing data to one register. |
| 08 | Performs loop back test. | Used to check connection for communication |
| 16 | Writes data into multiple D/B registers. | Capable of writing data into a maximum of 32 successive registers. |

F10-42.EPS

Function codes are command words used by the higher-level device (Personal computer, etc.) to obtain the D register information of UT450/420.

- The write function codes will not write into read-only or disabled D registers.
- Broadcasting is possible with function codes 06 and 16 only. (Also in this case, read-only or disabled D registers will not be written.)

## ● Communication with Higher-level Devices (Personal computer, etc.)

When you use a commercially available SCADA or the like or a user-created communication program, you must be careful when specifying D register numbers contained in messages because in both cases, you cannot use the original D register numbers as they are.

(1) When using a commercially available SCADA or the like, specify D register numbers by changing them into reference numbers. To change them into a reference number, replace the D register number's leading character “D” with “4.” (When using a DDE server or others, specify these reference numbers.)

(2) In a user-created communication program, specify a D register using the hexadecimal number of the value obtained by subtracting “40001” from the D register's reference number. (Specify this hexadecimal number.)

**Example:** To specify target setpoint “D0301”

- For a message using commercially available SCADA or the like, specify reference number “40301.”
- For a message in a user-created communication program, specify “012C,” the hexadecimal number of “0300,” which is obtained by subtracting 40001 from the reference number.

F10-43.EPS

## ● Response Error Codes (MODBUS communication)

**• Message Format in the Event of an Error**

If there is any inconsistency other than communication errors in a message, the UT450/420 controller does nothing but return the following message.

| Element | Address Number (ADR) | Function Code* | Error Code | Error Check |
|---|---|---|---|---|
| Number of bytes in RTU mode | 1 | 1 | 1 | 2 |
| Number of bytes in ASCII mode | 2 | 2 | 2 | 2 |

* In this space, a value of [function code (hexadecimal number) + 80 (hexadecimal number)] is set.

**• Response Error Codes**

| Error Code | Meaning | Cause |
|---|---|---|
| 01 | Function code error | No such function code exists. |
| 02 | Register address error | Specified address is out of the range. |
| 03 | Register count error | Specified number of D/B registers is out of the range. |

F10-45.EPS

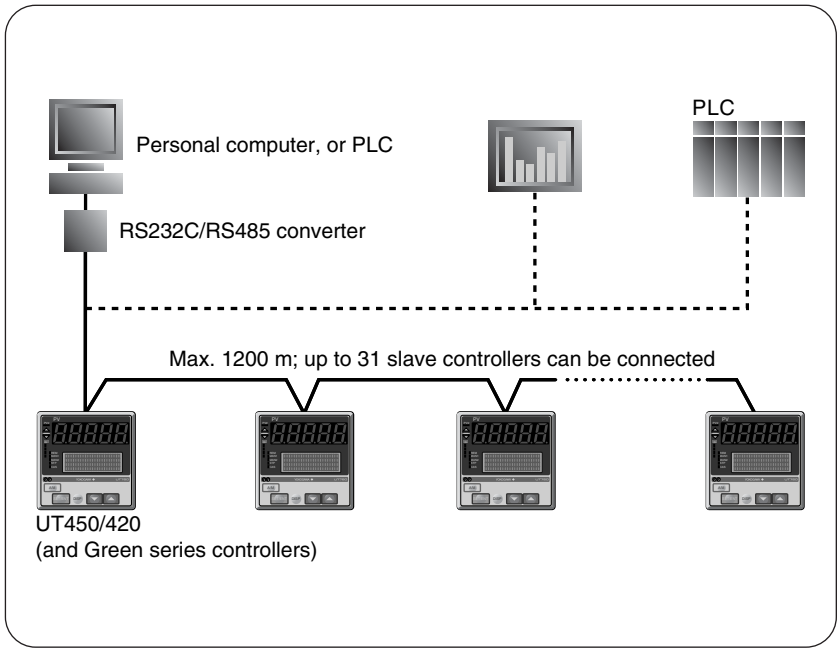
**● Even when a message is sent, no response is returned if:**

- Transmission error (overrun, framing, parity, LRC, or CRC-16 error) was detected.
- Address in a command message is incorrect.
- Time interval between the data composing a message was 1 second or more.
- Broadcast is specified (address number: 00).

As a measure against these situations, provide a timeout processing in the communication functions or communication programs of the higher-level device.

# 10.8.3 Personal Computer Link Communication

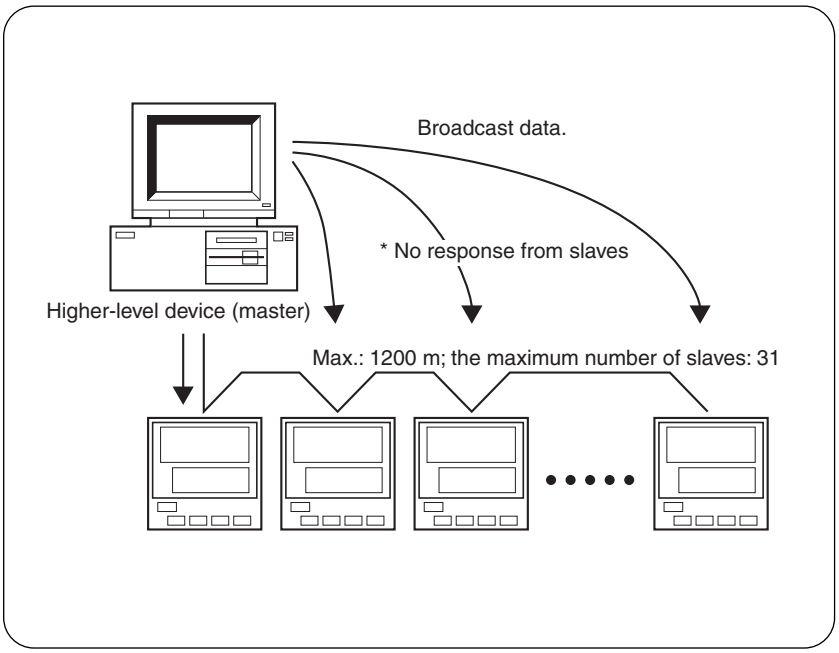
## ● Over View (PC Link communication)




F10-46.EPS

Personal Computer (hereinafter simply refferred to as PC) link communication protocol is one of the protocols used to communicate with devices such as Personal computers, PLCs (sequencers), and graphic panels. Via this communication protocol, these devices can exchange data with UT450/420 controller by reading/writing the controller's internal registers (D registers and I relays).

## ● Broadcasting (PC Link communication)




F10-47.EPS

The broadcasting allows the corresponding multiple UT450/420 (and Green series) controllers to receive the command.

(1) In the command, specify the broadcast address (B3) in the table below and execute it.

(2) The broadcasting works independently of the communication address of the controller.

(3) The broadcasting is only applicable to write commands.

(4) No response is returned when the broadcasting is used.

| Address No. | Corresponding devices |
|---|---|
| B1 | All UT750s |
| B2 | All UP750s |
| B3 | All UT550/520/450/420s |
| B4 | All UP550s |
| B5 | All UT350/320s |
| B6 | All UM350/330s |
| B7 | All UP350s |
| BA | All models of GREEN Series |
| BT | All UT controllers of GREEN Series |
| BP | All UP controllers of GREEN Series |
| 00 | All devices supporting PC link communication |
| 01 to 99 | Device with a corresponding address number |

F10-47-1.EPS

## ● Commands (PC Link communication)

| Number of bytes | 1 | 2 | 2 | 1 | 3 | Variable length | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|
| Element | STX | Address number (ADR) | CPU number 01 | Time to wait for response 0 | Command | Data corresponding to command | Checksum | ETX | CR |

F10-48.EPS

- Commands sent from a higher-lebel device (Personal computer, etc.) to a UT450/420: Green series controller consist of the elements shown in the table on the left.

Note: The control codes STX, ETX, and CR in commands are indispensable. Do not miss any of them when you create a communication program for PC link communication. A communication failure will result if any of them are omitted or if the order is incorrect.

## ● The Description of Each Element of Command (PC Link communication)

**(1) STX (Start of Text)**
This control code indicates the start of a command. The character code is CHR$(2).

**(2) Address Number (01 to 99)**
Address numbers are used by a higher-level device to identify which Green series controller to communicate with. (ID number of UT450/420: Green series)

**(3) CPU Number**
This number is fixed to 01.

**(4) Time to Wait for Response**
This is fixed to 0.

**(5) Command {See the List of Commands (P.10-32)}**
Specify a command to be issued from the higher-level device (Personal computer, etc.).

**(6) Data Corresponding to Command**
Specify an internal register (D register or I relay), number of data items, UT450/420: Green series' parameter values, or others.

**(7) Checksum**
In PC link communication with sum check, the ASCII codes of the text between STX and the checksum are converted into hexadecimal values and added on a byte basis. Then the lowermost byte of the added results is turned into ASCII code, and its lower byte is used as the checksum. This 2-byte space is unnecessary for PC link communication without sum check.

**(8) ETX (End of Text)**
This control code indicates the end of a command string. The character code is CHR$(3).

**(9) CR (Carriage Return)**
This control code marks the end of a command. The character code is CHR$(13).

F10-49.EPS

## ● Data Forms of Commands (PC Link communication)

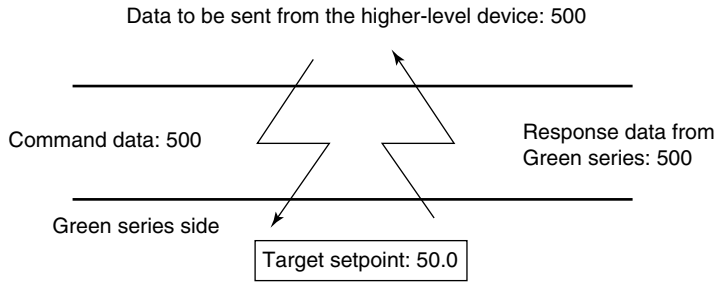
| Data type | Data content | Data form |
|---|---|---|
| PV high and low limits, target setpoints, and others | Measuring range (EU) data | Numeric data excluding the decimal point |
| Bias, deviation alarms, and others | Measuring range span (EUS) data | Numeric data excluding the decimal point |
| Proportional bands, upper and lower limits of output, and others | % data (0.0 to 100.0%) | 0 to 1000 |
| Various modes, alarm types, and others | Seconds, absolute values, and data without unit* | Absolute value excluding the decimal point |

*: Parameter list of Green series User's Manual (Reference) for information about data form.

F10-50.EPS

- The table on the left shows the data forms of D registers and I relays.

## ● Command Format for Communication (PC Link communication)




*: The position of the decimal point for "500" is determined by the DP (decimal point position) parameter of the Green series controller.

F10-51.EPS

**Example:**
When setting a target setpoint "50.0" to a UT450/420: Green series controller, the higher-level device sends the value "500" as command data without the decimal point (this is true for both settings 5.00 or 500).

## ● Configuration of Response (PC Link communication)

Responses from a UT450/420:Green series controller with respect to a command sent from the higher-level device consist of the elements shown below, which differ depending on the condition of communication – normal or failure.

(1) With normal Communication

| Number of bytes | 1 | 2 | 2 | 2 | Variable length | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|
| Element | STX | Address number (ADR) | CPU number: 01 | OK | Parameter data | Checksum | ETX | CR |

F10-52.EPS

When communication is carried out normally, the Green series controller returns the character string “OK” and, in response to read commands, also returns read-out (Parameter) data.

(2) In the Event of Failure

| Number of bytes | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Element | STX | Address number (ADR) | CPU number: 01 | ER | EC1 | EC2 | Command | Checksum | ETX | CR |

- No response is made in case of an error in address number specification or CPU number specification.
- If a Green series controller cannot receive an ETX contained in a command, a response may not be made.

∗: As a measure against these situations, provide a timeout processing in the communication functions or communication programs of the higher-level device.

F10-53.EPS

If communication is carried out abnormally, the UT450/420:Green series controller returns the character string “ER” and error codes (EC1 and EC2). (See the Response Error Codes on the next page.)

## ● Response Error Codes

UT450/420:Green series controller has two types of response error codes: the error code (EC1) and the detailed error code (EC2).

## ● Error Codes (EC1)

The error codes (EC1) are as follows.

| Error code | Meaning | Causes |
|---|---|---|
| **02** | Command error | • The command does not exist.<br>• Command not executable |
| **03** | Internal register specification error | • Specified register number does not exist.<br>• In handling bit registers (I relays) on a word-by-word basis, its specification is not correct. |
| **04** | Out of setting range | • A character other than 0 and 1 was used for bit setting.<br>• A value other than 0000 to FFFF was specified in the word specification.<br>• The start address specified for data loading/saving is out of the address range. |
| **05** | Number of data error | • Specified number of bits or words is too large.<br>• The number of data or registers specified and the number of parameters for them are inconsistent. |
| **06** | Monitor error | • An attempt was made to execute monitoring without specifying any device to be monitored (BRS or WRS). |
| **08** | Parameter error | • Wrong parameter. |
| **42** | Sum error | • The sum does not match. |
| **43** | Internal buffer overflow | • Too much data was received. |
| **44** | Timeout between received characters | • No terminal character or ETX is received. |

F10-54.EPS

## ● Detailed Error Codes (EC2)

• **Receiving Command**

When this parameter is the Internal register specification error (EC1 = 03)

STX 01 01 0 BRW 30 I003 , 1 , I004 , 0 , A0005 , ···
1 2 3 4 5 6

• **Error response from UT450/420: Green series**

STX 01 01 ER 03 06 BRW <checksum> ETX CR

In this case; EC1 = 03 and EC2 = 06

EC1 error code
- 03: Internal register specification error
- 04: Out of setting range
- 05: Number of data error
- 08: Parameter error

see the above table in the • Error codes (EC1)

For EC1 error codes other than those noted above, EC2 has no meaning.

F10-55.EPS

- The detailed error code (EC2) is the code to specify the error parameter indicating the cause of each error code (EC1).

  The detailed error codes (EC2) are provided for “03”, “04”, “05” and “08” among the error codes (EC1).

  For the receiving command, indicates the number of a parameter in sequence that first resulted in an error when counted from the leading parameter.

## ● List of Commands (PC Link communication)

### (1) Bit-basis Access Commands Dedicated to I Relays

| Command | Description | Number of bits handled |
|---|---|---|
| **BRD** | Bit-basis read | 1 to 256 bits |
| **BWR** | Bit-basis write | 1 to 256 bits |
| **BRR** | Bit-basis, random read | 1 to 32 bits |
| **BRW** | Bit-basis, random write | 1 to 32 bits |
| **BRS** | Specifies I relays to be monitored on a bit-by-bit basis. | 1 to 32 bits |
| **BRM** | Bit-basis monitoring | — |

### (2) Word-basis Access Commands

| Command | Description | Number of words handled |
|---|---|---|
| **WRD** | Word-basis read | 1 to 64 words |
| **WWR** | Word-basis write | 1 to 64 words |
| **WRR** | Word-basis, random read | 1 to 32 words |
| **WRW** | Word-basis, random write | 1 to 32 words |
| **WRS** | Specifies internal registers to be monitored on a word-by-word basis. | 1 to 32 words |
| **WRM** | Word-basis monitoring | — |

### (3) Information Commands

| Command | Description | Number of controllers handled |
|---|---|---|
| **INF** | Reads model, version, and revision. | 1 |

F10-56.EPS

- The tables are the lists of commands available in PC link communication. The details of them are explained in the description of each command on the User's Manual.

  See the User's Manual (IM05G01B02-01E) for more information about the Commands.

## ● Communication with Higher-level Devices (Personal computer, etc.)

Higher-level devices to be connected to a Green series controller are those capable of handling the PC link communication protocol.

In PC link communication, when specifying D register or I relays (internal registers of Green series), you can use the numbers as is. The numbers of these internal registers are in the following format:

- D register: D**** (****: numeric value)
- I relays: I**** (****: numeric value)

(1) Communication with the connectable graphic panels

| Product | Name | Name |
|---|---|---|
| Pro-face by Digital Electronics Corporation (Note) | GP70 series | Graphic control panel |
| | GP-J series | High-speed graphic control panel |
| | GP-230 series | Medium-size graphic control panel |
| | GP-430 series | Advanced, high-speed graphic control panels |
| | GP-530 series | |

Note: For more information about Digital's graphic panels, contact Digital Electronics Corporation.
(Be careful because the display device differs depending on the model.)

F10-57.EPS

Graphic panels that can be connected to a UT450/420:Green series controller are listed below. However, it may be possible to connect graphic panels other than the ones listed below.

(2) Communication with FA-M3 with UT-link module

**• 3 modes of the UT-link module**

| | |
|---|---|
| Non-user-specifiable mode | Always reads/writes the Predetermined devices* of the UT450/420: Green series controllers (User can not specify devices).<br>Predetermined devices of UT450/420 are D0001 to D0025. |
| User-specifiable mode | Always reads/writes the user-specified devices* of the UT450/420: Green series controller. |
| Command mode | Access the devices* of the UT450/420: Green series controller only when necessary. |

F10-58.EPS

No ladder communication program is required to communicate with FA-M3 with UT-link module (Yokogawa PLC). The UT-link module's function offers 3 modes, in which users can exchange data without paying attention to the communication procedure. (For more information, see the User's Manual of UT-link module "IM 34M6H25-01E.")

*: "Predetermined device" or "device" here denotes the internal registers of the UT450/420:Green series controller (D registers and I relays).

## ● Example of BASIC Program for Send and Receive

The following is an example of a command sending and response receiving program created with Microsoft Quick BASIC*2 for PC/AT*1 (or compatible machines).

The communication conditions of the UT450/420:Green series controller and those of the PC (e.g., communication rate) must agree with each other. Set the communication rate (baud rate) of the PC using the SWITCH command of MS-DOS*3 . For how to use the SWITCH command, refer to the User's Reference Manual of MS-DOS.

Set the parity, character bit length, stop bit length, and others in an OPEN statement.

*1: PC/AT is the product of IBM Corporation.

*2: Microsoft Quick BASIC is a registered trademark of Microsoft Corporation.

*3: MS-DOS is a registered trademark of Microsoft Corporation.

**Example of the Program Created Using Microsoft Quick BASIC Version 7.1**

```
1000 ' === Main routine ===
1010 STX$=CHR$(2)                                    ‘ Define
1020 ETX$=CHR$(3)                                    ‘ Define
1030  CR$=CHR$(13)                                   ‘ Define
1040 RCVCHR$= “”                                     ‘ Initialize receive character string
1050 fRCVEND=0                                       ‘ Initialize flag
1060  fTIMEOUT=0                                     ‘ Initialize flag
1070 '
1080 SEND$=STX$+“01010WRDD0003,03”+ETX$              ‘ Create character string for send
1090 '                                               ‘
1100 OPEN “COM1:9600,N,8,1,ASC” FOR RANDOM AS #1     ‘ Open a port
1110    ON COM(1) GOSUB receivechr                   ‘ Specify interruption processing during
                                                       receiving
1120    ON TIME(5) GOSUB timeout                     ‘ Specify interruption processing at timeout
1130 '
1140    PRINT #1,SEND$                               ‘ Send
1150    COM(1) ON                                    ‘ Permit interruption during receive
1160    TIMER ON                                     ‘ Start timer
1170 '
1180    DO                                           ‘ Wait for receive end or timeout
1190    LOOP WHILE fRCVEND=0 AND fTIMEOUT=0          ‘
1200 '
```

F10-59.EPS

<Continue to the next page>

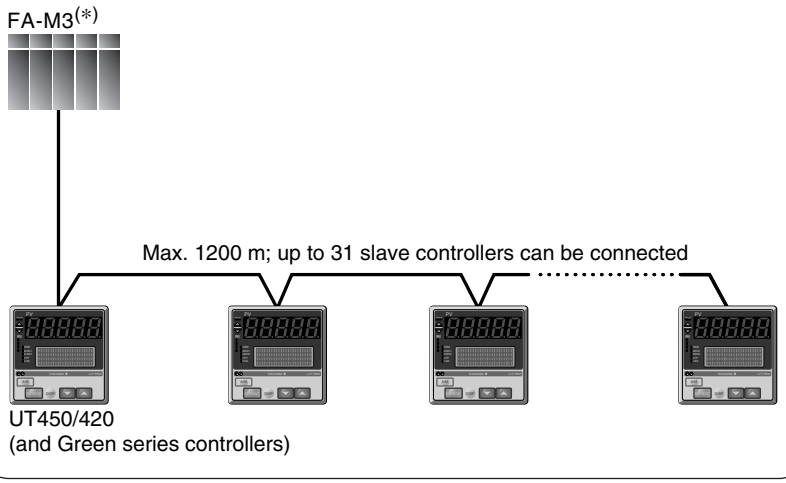
```
1210    TIMER OFF                                ‘ Stop timer
1220    COM(1) OFF                               ‘ Prohibit interruption during receiving
1230    CLOSE #1                                 ‘ Close the port
1240
1250    PRINT “>”+SEND$                          ‘ Display sent character string on screen
1260    PRINT “<”+RCVCHR$                        ‘ Display received character string on screen
1270  END                                        ‘ END
1280 '
1290 ' === subroutine ===
1300 receivechr:                                 ‘ Interruption processing during receiving
1310    CHR1$=INPUT\(1,#1)                       ‘ Fetch characters from receive buffer one by one
1320    IF CHR1$=CR$ THEN                        ‘ If received character string is “CR,”
1330      IF RCVCHR$=SEND$ THEN                  ‘ If received character string is the same
                                                   as sent command,
1340        RCVCHR$=“”                           ‘ received character string is initialized
                                                   (echo-back).
1350          fRCVEND=0                          ‘ receiving end flag remains initialized at 0.
1360    ELSE                                     ‘ If received character string is different
                                                   from sent command,
1370          fRCVEND=1                          ‘ receiving end flag is set.
1380      END IF                                 ‘
1390 ELSE                                        ‘ If it is a character other than CR,
1400          fRCVEND=0                          ‘ receiving end flag remains initialized at 0.
1410        RCVCHR$=RCVCHR$+CHR1$                ‘ Create received character string
1420      END IF
1430 RETURN
1440 '
1450 timeout:                                    ‘ Timeout processing
1460    fTIMEOUT=1                               ‘ Set timeout flag
1470    RCVCHR$=“Time out ! (5 sec)”+CR$         ‘ Character string for display on screen
                                                   “Time out! (5 sec)”
1480 RETURN
 ↑
```

∗ Line numbers are not required. (They are simply provided for checking the number of program steps.)

F10-60.EPS

# 10.8.4 Ladder Communication

## ● Overview (Ladder communication)




F10-61.EPS

By using ladder communication, you can easily perform communication between a PLC (sequencer) and a UT450/420:Green series controller. This kind of communication allows for the reading/writing of D registers* (internal registers of Green series).

In ladder communication, a PLC identifies each instrument by its station number, which ranges from 01 to 99.

*: See User's Manual (IM05G01B02-02E) for more information of D registers.

## ● Communications with PLC

**List of PLCs that can be connected**

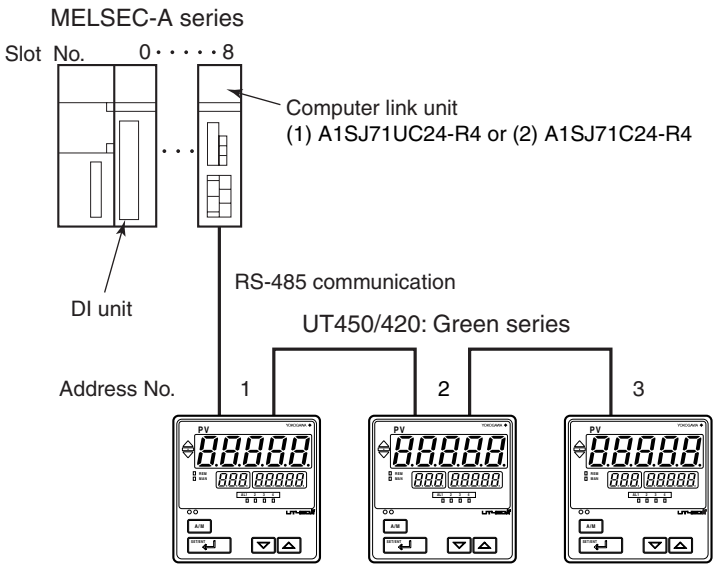
| Supplier | Product | Requirement |
|---|---|---|
| Yokogawa Electric Corporation | FA500 | With communication module (RZ91-ON) |
| | FA-M3 | With communication module (F3RZ91-ON) |
| Mitsubishi Electric Corporation, or others | MELSEC-A series and others | With computer link unit |
| | PLCs that can communicate in handshaking mode. | With computer link unit |

Note: For more information about the PLCs listed above, contact the supplier.

F10-62.EPS

- PLCs can communicate with UT450/420: Green series controllers capable of using the ladder communication protocol.

## ● Example (Communication with MELSEC)




F10-63.EPS

- The figure on the left shows an example of communication with MELSEC.
- Computer link unit is necessary.

  Use either (1) or (2)

  (1) AISJ71UC24-R4
  (2) AISJ71C24-R4
- See the User's Manual (IM05G01B02-01E) for more information about the Ladder Communication.

# 10.8.5 Coordinated Operation

- **Using the Coordinated-operation Function, the UP550 can**

① Select UT450/420 PID parameters on a zone (or segment) basis.

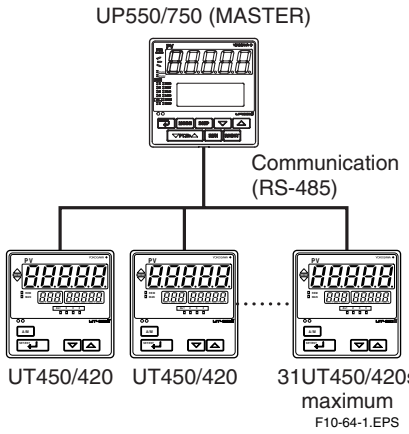
② Transfer the operation mode of a UT450/420.

③ Transmit setpoint data to a UT450/420, without error.

④ Cause a UT450/420 to use the SUPER function.

F10-64.EPS

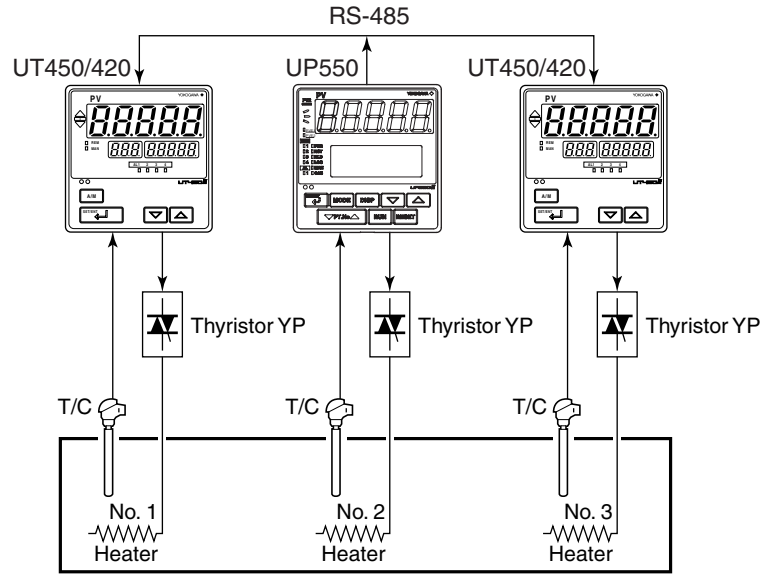
- A system of coordinated operation is configured with a master controller and some slave controllers, all of which are Green series controllers. The slave controllers are set to operate in the same way as the master controller. You do not have to create a communication program or to use specialized software for coordinated operation.
- Using an UP550/750 as the master station, a maximum of 31 UT450/420s can be connected using RS-485.




F10-64-1.EPS

- In this case, set the UP (MASTER)'s PSL parameter to "3" (coordinated master station) and UT (SLAVE)'s PSL parameter to "4" (coordinated slave station).
- For connection method, see the communication wiring.

## ● Coordinated-Operation Application Example




F10-64.EPS

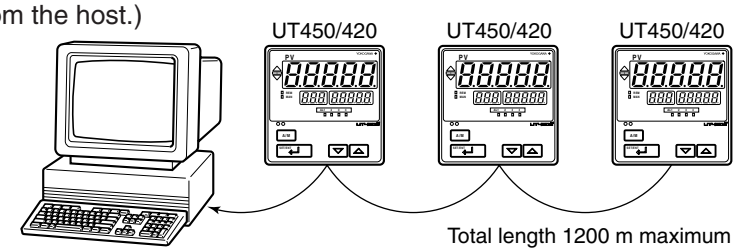
- The figure on the left represents an example of using coordinated operation in continuous furnace three zone control.
- In coordinated operation, UT450/420 performs program patern run in accordance with operation of key station UP550.
- See the User's Manual (IM05G01B02-01E) for more information

# 10.8.6 Wiring for Communication

- **Overview of Communications Terminal Connections**
  Using a recommended cable, connect the UT450/420: Green series controller in “daisy-chain” fashion.

  (a) Nunmber of units connected: Maximum 31 units, excluding the host.

  (b) Except for the host, each units has a communications address, and communications are done on a one-to-one basis with the UT450/420 specified by the host. (Only one unit at a time can be specified from the host.)




F10-66.EPS

## NOTE

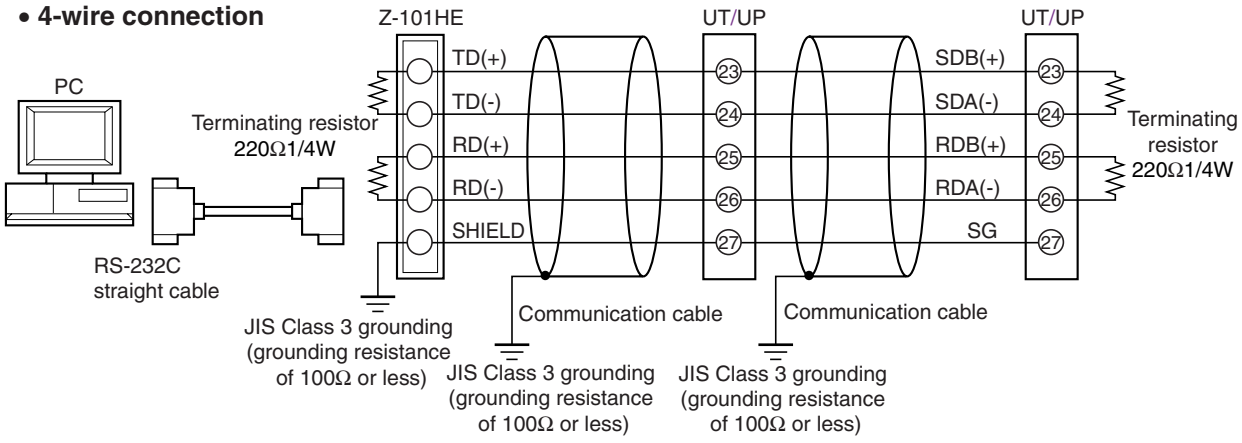
To avoid an electric shock, be sure to turn off the power supply source to the equipment involved before you start wiring. Use crimp terminals at cable ends.

Before you start wiring, read the user’s manual of each device.

## ● Wiring to a Personal Computer

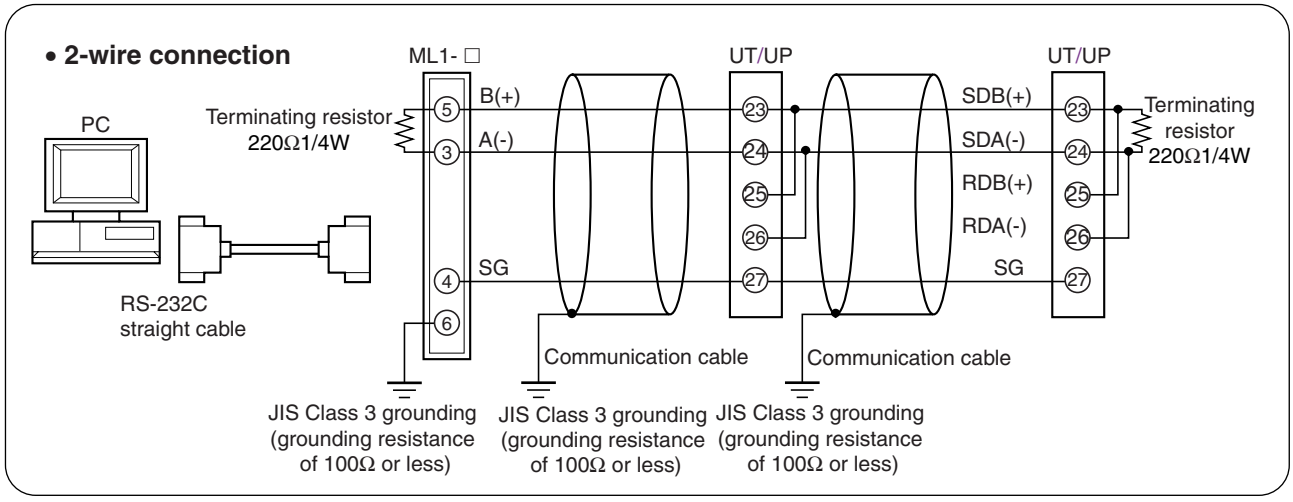
Since general personal computers cannot directly be connected to the RS-485 interface, wiring must be provided via an RS-232C/RS-485 converter. The following figures show the wiring for 4-wire connection and 2-wire connection.

- **4-wire connection**




F10-67.EPS

Note: Z-101HE and ML1-□ are the converters of Sharp Corporation and Yokogawa M&C Corporation, respectively. You can also use other RS-232C/RS-485 converters. Before you use another converter, check its electrical specifications.

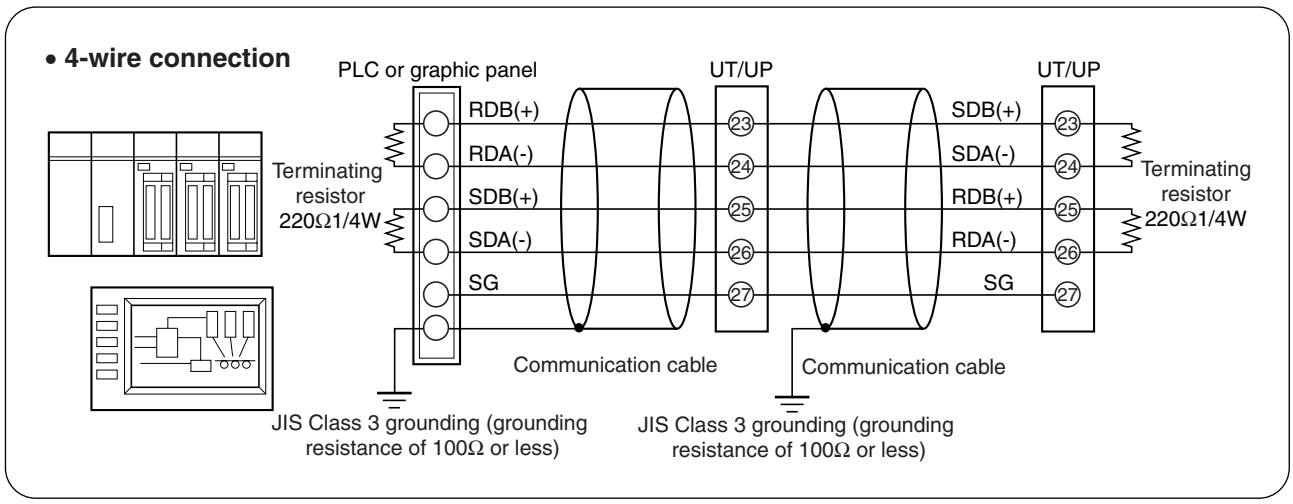



F10-68.EPS

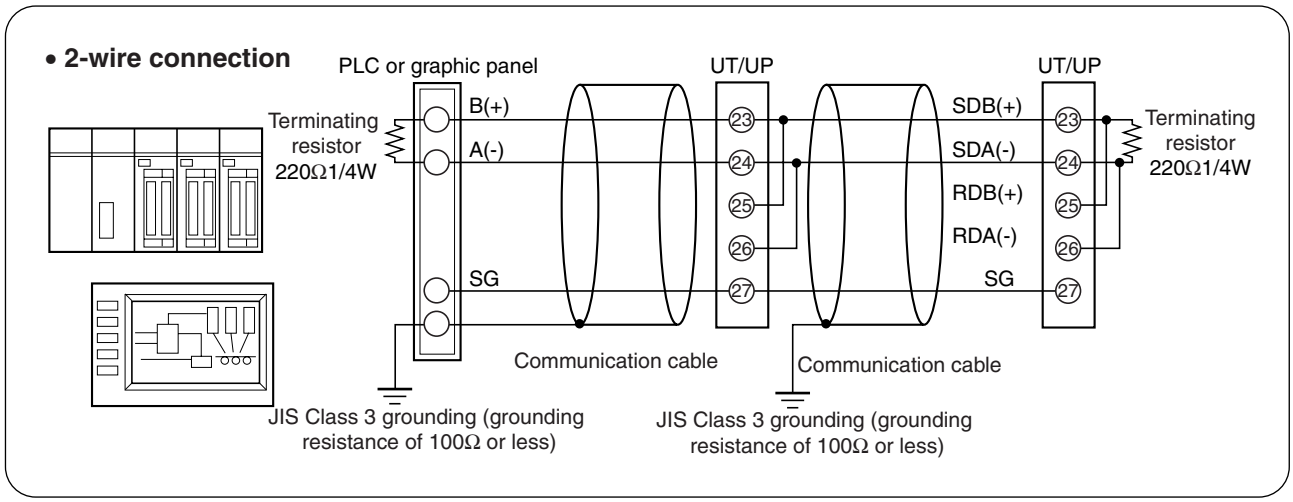
Note: Z-101HE and ML1-□ are the converters of Sharp Corporation and Yokogawa M&C Corporation, respectively. You can also use other RS-232C/RS-485 converters. Before you use another converter, check its electrical specifications.

## ● Wiring to a PLC or Graphic Panel

Since general PLCs (sequencers) and graphic panels have an RS-485 interface, they can be directly connected to a Green series controller. If your PLC (sequencer) or graphic panel has an RS-232C interface, see the previous ● Wiring to a Personal Computer.




F10-69.EPS

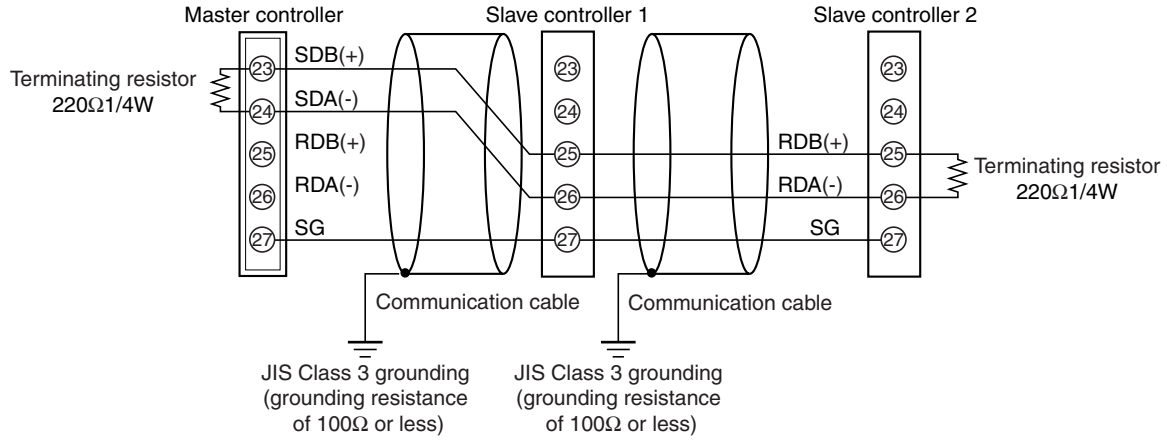



F10-70.EPS

## ● Wiring for Coordinated Operation

Coordinated operation can be configured by connecting a Green series controller as both a master and slave. There are some restrictions regarding the controller model (whether the model can be a master or slave) when setting the protocol selection parameter for coordinated operation. (See 10.8.5 Coordinated Operation)

**• Standard RS-485 interface connection**




F10-71.EPS

# 10.8.7 D register (of UT450/420)

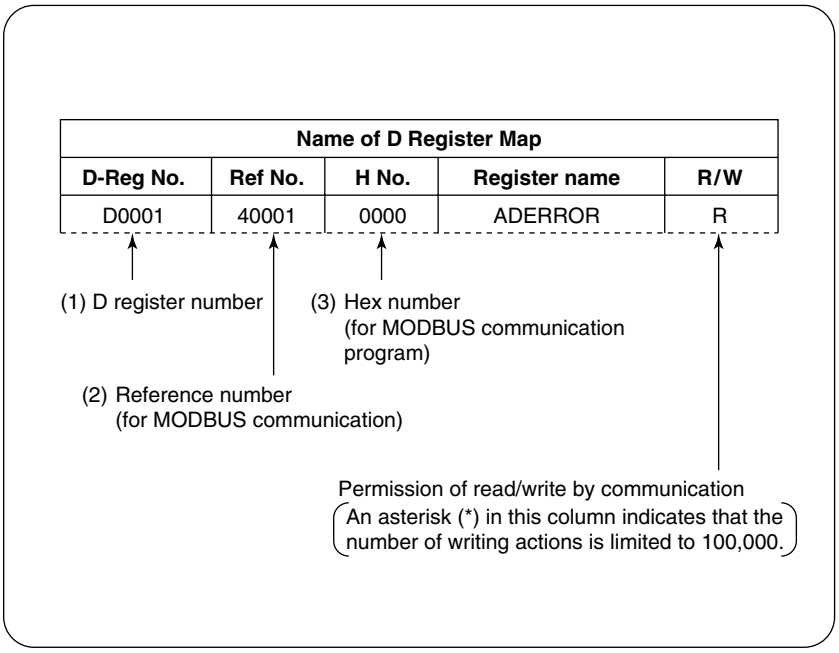
D registers store parameter data, flag data and process data of the UT450/420: Green series controller. You can readily use these internal data items by reading from or writing to the D registers.

You can use D registers to perform:

- Centralized control using a higher-level device
- Data exchange by reading/writing data from/to a higher-level device

Note: Refer to the User's Manual (IM05G01B02-02E) for more information about the function of D registers.

## ● Interpretation of D Register Tables




F10-72.EPS

This paragraph explains how to read the D Register Map tables (Note). The numbers listed in the leftmost column are D register numbers ((1) below). The five-digit numbers in the next column are reference numbers used for MODBUS communication ((2) below). The numbers in the column third from left are register numbers in hexadecimal notation used in MODBUS communication programs ((3) below).

Note: Refer to the User's Manual (IM05G01B02-02E) for the D Register Map.

Each register code name in the D Register Map tables represents a specific process data item, operating parameter, setup parameter or other data items such as a flag. For details on the operating parameters and setup parameters, See 3.4.3 Parameter List in this book.

## ● Classification of D Registers

The table below outlines how the D registers are classified by their numbers in the D Register Map tables.

| Register No. | Area and data categories | | Description |
|---|---|---|---|
| D0001 to D0049 | Process data area (Note 1) | Data displayed for operation | PV, SP, OUT, and others |
| D0050 to D0100 | User area (Note 2), represented by shaded cells in the table | — | If a graphic panel is used, this area is used for communication with the graphic panel. |
| D0101 to D0200 | Cannot be used. | | |
| D0201 to D0230 | Operating parameters (Note 1) | Operation mode parameters | A/M, MOUT, and others |
| D0231 to D0300 | | Computation parameters | AT, SC, BS, FL, and others |
| D0301 to D0500 | | PID parameters | P, I, D, and others |
| D0501 to D0900 | Cannot be used | | |
| D0901 to D1000 | Setup parameters (Note 1) | Control action parameters | OPR, MOD |
| D1001 to D1100 | | Common function parameters | RET, DVB |
| D1101 to D1200 | | SELECT display registration parameters | CS |
| D1201 to D1300 | | PV input, control output, and communication parameters | IN, OT, PSL |

Note 1: Data for process values, operating parameters and setup parameters are stored in the types (EU, EUS, %, or ABS without the decimal point) indicated in the Operating Parameter Lists and Setup Parameter Lists of the User's Manual of UT450/420. The OFF and ON states are represented by 0 and 1, respectively. D registers D0001 to D0049 are read-only.

Note 2: When communicating with a graphic panel, do not write to or read from this area (D0050 to D0100) because this area is reserved for 16-bit register data used by graphic panels.

F10-73.EPS

### NOTE

It is prohibited to read/write data by communication from/to the registers of blank cells in the register map tables. If you attempt to do so, the UT450/420 may not operate properly.

## 10.8.8 I Relays (of UT450/420)

I relays contain status information of errors, operation, and alarms. Contents of I relays can be read only by means of communication using a higher-level device. (Note that the I relays have the same information as the D registers but with I relays some of the information is read-only.)

You can use I relays to perform:

● Centralized monitoring through a display created with a higher-level device.

Note:
- Refer to the User's Manual (IM05G01B02-02E) for the detail of I relays Map.
- I relays are classified to five categories.

  Those are shown in the table on the next page.
- I relays 1 to 192 store on-off status information and are normally read for on-off status information.
- The "ON-status" I relays 193 to 384 are turned on for one control period only when the status changes from "OFF" to "ON".
- The "OFF-status" I relays 385 to 576 are turned on for one control period only when the status changes from "ON" to "OFF".
- When specifying an I relay number for communication, begin the number with the character "I." For example, set I0019 to specify the RJCERR.st relay (I relay No.: 0019).
- In the area for I relays 1 to 720, it is prohibited to write data to I relays with blank cells in I relay map tables. If you attempt to do so, the UT450/420 may not operate properly.
- You can read/write data from/to the area for I relays 721 to 2048 via communication.
  That is, you can use the area freely without affecting the control function of UT450/420.

## • UT450/420 I relay classification

| I relay | Classification | Description |
|---|---|---|
| 1 to 16 | Status | Input error (same as D0001). |
| 17 to 32 | | PV error (same as D0002). |
| 33 to 48 | | Use not permitted. |
| 49 to 64 | | Calibration, parameter error (same as D0035). |
| 65 to 80 | | Mode (same as D0008). |
| 81 to 96 | | Use not permitted. |
| 97 to 112 | | Alarm status (same as D0011). |
| 113 to 160 | | Use not permitted. |
| 161 to 176 | | |
| 177 to 192 | | |
| 193 to 208 | ON status | Input error (same as D0001). |
| 209 to 224 | | PV error (same as D0002). |
| 225 to 240 | | Use not permitted. |
| 241 to 256 | | Calibration, parameter error (same as D0035). |
| 257 to 272 | | Mode (same as D0008). |
| 273 to 288 | | Use not permitted. |
| 289 to 304 | | Alarm status (same as D0011). |
| 305 to 352 | | Use not permitted. |
| 353 to 368 | | |
| 369 to 384 | | |
| 385 to 400 | OFF status | Input error (same as D0001). |
| 401 to 416 | | PV error (same as D0002). |
| 417 to 432 | | Use not permitted. |
| 433 to 448 | | Calibration, parameter error (same as D0035). |
| 449 to 464 | | Mode (same as D0008). |
| 465 to 480 | | Use not permitted. |
| 481 to 496 | | Alarm status (same as D0011). |
| 497 to 544 | | Use not permitted. |
| 545 to 560 | | |
| 561 to 576 | | |
| 577 to 592 | Status | Actual cascade SP No (same as D0010). (Note1) |
| 593 to 608 | | Current PID number (same as D0009). (Note1) |
| 609 to 624 | | Use not permitted. |
| 625 to 656 | | Use not permitted. |
| 657 to 672 | | Power-on status. |
| 673 to 688 | | Deviation lamp status. (Note2) |
| 689 to 704 | | Alarm output status (same as D0036). |
| 705 to 720 | | Use not permitted. |
| 721 to 2048 | User area (Note3) | User write/read area. |

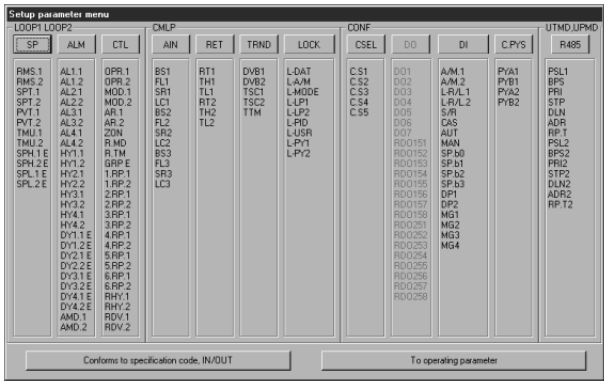
Note1: Four-bit information using hexadecimals:0000 for 0,0010 for 2, 0011 for 3, to 0111 for 7, and 1000 for 8. The least significant bit of four bits corresponds to the last digit in the relay number.
Note2: The status of the lamps on the front panel: lit when ON(1), unlit when OFF(0) .
Note3: The I relay numbers 769 through 2048 in the “user area” not shown in the I relay map are able to read operation with the communication function.

F10-74.EPS

# 10.9 LL100 (PC-Based Parameters Setting Tool)

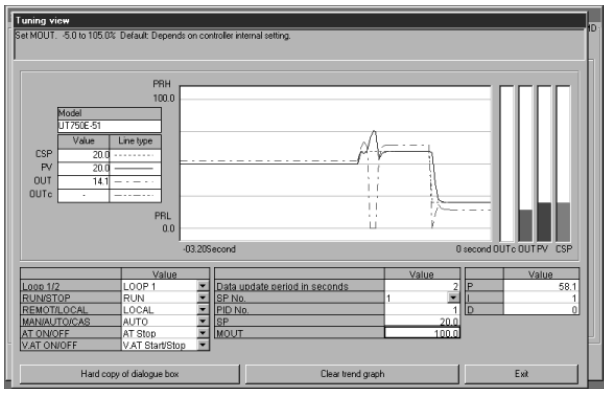
## 10.9.1 Functions

- **Parameter Setting Function**
  <Example of setup parameter extension diagram>




- Parameters that determine UT450/420 functions can easily be set:
  - Universal Input/Output type
  - Setup parameters
  - Operating parameters.

- **Tuning Function**
  <Example of Tuning display>



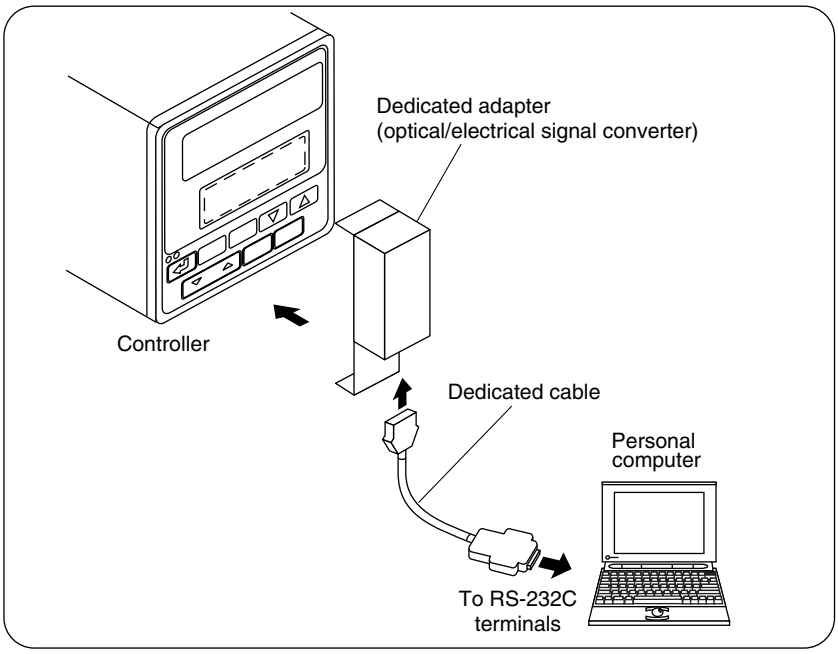

- Used to tune the PID parameters.
- Displays PV input value, target setpoint, and control output value as a trend graph on a personal computer screen, allowing PID parameter modification, AUTO/MAN switching, control output modification in manual operation, etc.

- **Downloading, Uploading and Comparing Parameters**
- **File Management Function**
- **Printout Function**

F10-75.EPS

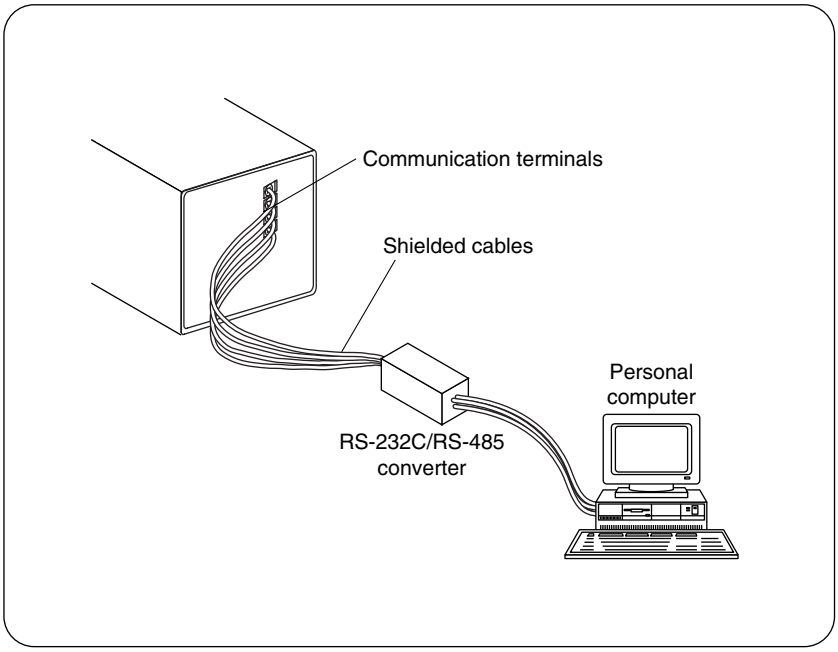
# 10.9.2 Connection Between the Controller and a Personal Computer

## ● Via Dedicated Adapter




F10-76.EPS

By attaching a dedicated adapter to the controller's front panel, users can upload and download parameter data to and from a personal computer.




F10-77.EPS

Users can also upload and download parameter data to and from a personal computer via the communication terminals in the back of the controller. This connection requires an RS-232C/ RS-485 converter.

# 11. SELF-DIAGNOSTICS AND POWER FAILURE COUNTERMEASURES

## 11.1 Self-Diagnostics

- The UT450/420 performs the self-diagnostics in the table below at power-ON and during normal operation.
- The table below shows the disposition of display, output, and communication function if error is detected, and action to be taken.

### 11.1.1 Errors at Power On

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

| Error indication (on PV display unit) | Description of error | PV | Control output | Alarm output | Retransmission output | Communi-cation | Remedy |
|---|---|---|---|---|---|---|---|
| E000 (E000) | Faulty RAM | None | 0% or less or OFF | OFF | 0% or less | Stopped | Faulty Contact us for repair. |
| E001 (E001) | Faulty ROM | | | | | | |
| E002 (E002) | System data error | Undefined | | Undefined | Undefined | Normal action | |
| 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) | | |
| Error code (Note) (See description below.) | Parameter error | Normal action | 0% or less or OFF | Normal action | Normal action | | Check and set the initialized parameters. |

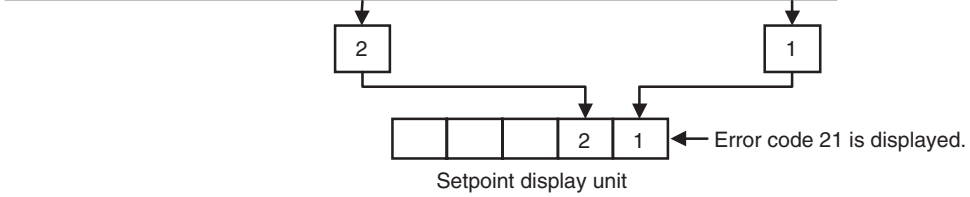
Note : An error code is displayed on the setpoint (S-digit) display unit.


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 | – | – | 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 | – | $2^2$ | $2^1$ | $2^0$ | $2^3$ | $2^2$ | $2^1$ | $2^0$ |




F11-01.EPS

## 11.1.2 Possible Errors During Operation

The following shows possible errors occurring during operations.

| Error indication (on PV display unit) | Description of error | PV | Control output | Alarm output | Retransmission output | Communication | Remedy |
|---|---|---|---|---|---|---|---|
| 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. |
| Decimal point of item part in SP display unit blinks. | EEPROM error | Normal action | | | | | |
| E300 (E300) | ADC error | 105% | In AUTO:<br>Preset value output<br>In MAN:<br>Normal action | | | | |
| bOUt (B.OUT) | PV burnout error | Dependent on the BSL parameter<br>Up-scale: 105%<br>Down-scale: -5% | | | | | Check wires and sensor. |
| oVEr (OVER) or -oVEr (-OVER) | Excessive PV<br>Out of -5 to 105% | -5% or 105% | Normal action | | | | Check process. |
| E200 (E200) | Auto-tuning failure (Time-out) | Normal action | Action with PID existing before auto-tuning | | | | Check process. Press any key to erase error indication. |
| Setpoint display unit - - - - - | Feedback resistor breakdown | | Stopped | | Stopped | | Check the feedback resistor. |
| Left end of SP display unit blinks. | Faulty communication line | | Normal action | | Normal action | | Check wires and communication parameters, and make resetting. Recovery at normal receipt |
| 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. |
| All indications off | Power off | None | | | | | Check for abnormal power. |

T11-01.EPS

# 11.2 Behavior on the Event of Power Failure or after Power Recovery

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

## ● Instantaneous power failure of 20ms or less

A power failure is not detected. Normal operation continues.

## ● Power failure of 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. |
| Setting parameter | Set contents of each parameter are retained. |
| Auto-tuning | Cancelled. |
| Control action | Action before power failure continues. |

F11-02.EPS

## ● Power failure of more than 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. |
| AUTO | Outputs preset output value (PO) (Note) as control output and continues action set before power failure in AUTO mode. |

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

T11-03.EPS

# 11.3 Preset Output Value (Output Value in Event of Controller Problem)

In the following situations, the UT450/420 outputs the preset output value.

- An input burnout has occurred during the AUTO mode operation.
- An abnormality in an analog/digital conversion circuit has occurred during the AUTO mode operation.
- After power failure (of more than 2 seconds) when the re-start mode (R.MD) is set to MAN or AUTO.
- The status of the controller changed from the operating mode to the stop mode.
  (This is not an event of controller problem.)

F11-02.EPS

- The preset output value is set with the setup parameter n.PO.
- The cooling-side preset output value is set with the setup parameter n.Oc.

| Code | Setting range |
|---|---|
| n.PO | -5.0 to 105.0 (%) (Note) |
| n.Oc | 0.0 to 105.0 (%) |

n=1 to 8 (PID Group number)

Note: The setting range in heating/coaling control mode is 0.0 to 105.0% of control output.

NOTE:
- The default value of the preset output values is set to 0.0% of control output.
  Change the setting value if necessary.
- The setting range of the preset output values is -5.0% to 105.0% of control output.
  However, the preset output value will not be limited even when the “n.OH” and “n.OL” limits of output have been set.

# 12. STANDARD SPECIFICATIONS

## PV Input Signals (Universal Input System)

- Number of inputs: 1 (terminals ⑪-⑫-⑬)
- Input type: Universal input system. The input type can be selected with the software.
- Sampling period: 200 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
- 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

## Remote Input Signals

Available only for controllers with remote input terminals

- Number of inputs: 1 (terminals ㉑-㉒)
- Input type: Settable in a range of 0 to 2, 0 to 10, 0.4 to 2.0, or 1 to 5 V DC
- Sampling period: 200 ms
- 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)

## Feedback Resistance Input

Provided for position proportional type only (terminals ㊺-㊻-㊼)

- Slide resistance value: 100 to 2.5 k Ω of overall resistance (burnout detection for sliding wire provided)
- Measuring resolution: ±0.1% of overall resistance

## Loop Power Supply

Power is supplied to a two-wire transmitter.
(15 V DC: terminals ⑭-⑮; 24 V DC: terminals ㊸-㊹)
A resistor (10 to 250 Ω) connected between the controller and transmitter converts a current signal into a voltage signal, which is then read via the PV input terminal.
Supply voltage: 14.5 to 18.0 V DC, max. 21 mA (provided with a protection circuit against a field short-circuit); 21.6 to 28.0 V DC, max. 30 mA (only for models with 24 V DC loop power supply)

## Retransmission Output

Either PV, target 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 (terminals ⑭-⑮)
- Output signal: 4-20 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)

## Control Output

Universal output system, The output type can be selected with the software.
Relay contact output(s) for the position proportional type

- Current output
  (Standard type: terminals ⑯-⑰; heating-side: terminals ⑯-⑰, cooling-side: terminals ㊻-㊼)

| | |
|---|---|
| Number of outputs | 1 or 2 (two for heating/cooling type), switched between a voltage pulse output and current output. |
| Output signal | 4-20 mA DC |
| Load resistance | 600 Ω or less |
| Output accuracy | ±0.1% of span under standard operating conditions (23 ± 2 °C, 55 ±10% RH, power frequency of 50/60 Hz) |

- Voltage pulse output
  (Standard type: terminals ⑯-⑰; heating-side: terminals ⑯-⑰, cooling-side: terminals ㊻-㊼)

| | |
|---|---|
| Number of outputs | 1 or 2 (two for heating/cooling type), switched between a voltage pulse output and current output. |
| Output signal | On-voltage = 12 V or more (load resistance: 600 Ω or more) Off-voltage = 0.1 V DC or less |
| Resolution | 10 ms or 0.1% of output, whichever is larger |

- Relay contact output
  (Standard type: terminals ①-②-③, heating-side: terminals ①-②-③, cooling-side: terminals ㊽-㊾-㊿, position proportional type: terminals ㊽-㊾-㊿)

| | |
|---|---|
| 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: Target setpoint selection, remote/local mode switching, and run/stop switching.
- Number of inputs: Differs with model and suffix codes as shown in the table below.

| Model and Suffix Codes | Number of Inputs | Contact input available ( ✓ : Present, Blank: Not preent) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | DI1 | DI2 | DI3 | DI4 | DI5 | DI6 | R/L |
| UT450- □0 | 2 | ✓ | ✓ | | | | | |
| UT450- □1 | 7 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| UT450- □2 | 3 | ✓ | ✓ | | | | | ✓ |
| UT450- □3 | 6 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| UT450- □4 | 3 | ✓ | ✓ | | | | | ✓ |
| UT420-00 | 2 | ✓ | ✓ | | | | | |
| UT420-07 | 4 | ✓ | ✓ | ✓ | | | | ✓ |
| UT420-08 | 4 | ✓ | ✓ | ✓ | | | | ✓ |

The function of external contact terminals can be chenged by a set up parameter DIS.
See “Note” on Page 10-4.

- 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: 0.6 second

## Contact Outputs

- Purpose: Alarm output, FAIL output, and others
- Number of outputs: Differs with the model and suffix code as shown in the table below.

| Model and Suffix Codes | Number of Inputs | Alarm output available ( ✓ : Present, Blank: Not preent) | | | |
|---|---|---|---|---|---|
| | | AL1 | AL2 | AL3 | AL4 |
| UT450- □0 | 3 | ✓ | ✓ | ✓ | |
| UT450- □1 | 4 | ✓ | ✓ | ✓ | ✓ |
| UT450- □2 | 3 | ✓ | ✓ | ✓ | |
| UT450- □3 | 4 | ✓ | ✓ | ✓ | ✓ |
| UT450- □4 | 3 | ✓ | ✓ | ✓ | |
| UT420-00 | 3 | ✓ | ✓ | ✓ | |
| UT420-07 | 3 | ✓ | ✓ | ✓ | |
| UT420-08 | 3 | ✓ | ✓ | ✓ | |

- 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: UT450 — 5-digit, 7-segment, red LEDs, character height of 20 mm
  UT420 — 5-digit, 7-segment, red LEDs, character height of 12 mm
- Setpoint display: 3-digit and 5-digit, 7-segment, red LEDs, character height of 9.3 mm (for both UT450 and UT420)
- 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: UT450 — 96 (W) × 96 (H) × 100 (depth from panel face) mm
  UT420 — 48 (W) × 96 (H) × 100 (depth from panel face) mm
- Installation: Panel-mounting type. With top and bottom mounting hardware (1 each)
- Panel cutout dimensions: UT450 — $92^{+0.8}_{0}$ (W) × $92^{+0.8}_{0}$ (H) mm
  UT420 — $45^{+0.6}_{0}$ (W) × $92^{+0.8}_{0}$ (H) mm
- Installation position: Up to 30° upward facing (See P.2-2)
  (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: Non-volatile memory (can be written to up to 100,000 times)
- Withstanding voltage
  - Between primary terminals* and secondary terminals**:
    At least 1500 V AC for 1 minute (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

- PV input terminals: Isolated from other input/output terminals. Not isolated from the internal circuit.
- Remote input terminals: Isolated from other input/output terminals or the internal circuit

- 15 V DC loop power supply terminals:
  Not isolated from 4-20 mA analog output nor voltage pulse control output. Isolated from other input/output terminals and internal circuit.
- 24 V DC loop power supply terminals:
  Isolated from 15 V DC loop power supply terminals, 4-20 mA analog output terminals, voltage pulse control output terminals, other I/O terminals and the internal circuit.
- 4-20 mA analog output terminals (for control output and retransmission):
  Not isolated between 4-20 mA outputs nor from 15 V DC loop power supply and voltage pulse control output. Isolated from other input/output terminals and internal circuit.
- Voltage pulse control output terminals:
  Not isolated from 4-20 mA outputs nor 15 V DC loop power supply. Isolated from other input/output terminals and internal circuit.
- Relay contact control output terminals:
  Isolated between contact output terminals and from other input/output terminals and internal circuit.
- Contact input terminals: Not isolated between contact input terminals and from communication terminals. Isolated from other input/output terminals and internal circuit.
- Relay contact alarm output terminals:
  Not isolated between relay contact alarm outputs. Isolated from other input/output terminals and internal circuit.
- Transistor contact alarm output terminals:
  Not isolated between transistor contact alarm outputs. Isolated from other input/output terminals and internal circuit.
- RS-485 communication terminals:
  Not isolated from contact input terminals. Isolated from other input/output terminals and internal circuit.
- Feedback slide resistance input terminals:
  Not isolated from 4-20 mA analog output terminals (control, retransmission), 15 V DC loop power supply, and voltage pulse control outputs. 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: 147 $m/s^2$ 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 remote 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 remote 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

Blank Page