

**Instruction
Manual**

**UT15/UT14
Digital Indicating Controller**

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1. WHEN YOU RECEIVE THIS INSTRUMENT...

Thank you for purchasing the UT15 or UT14 digital indicating controller.

Please read this "Instruction Manual" carefully, and use the instrument correctly.

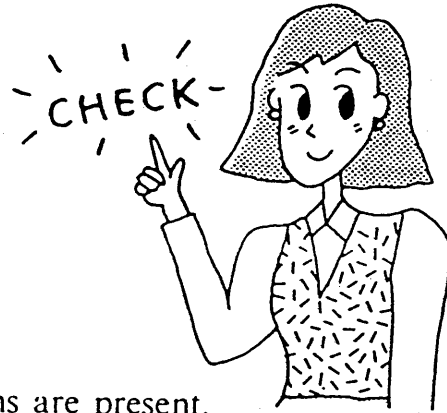
Diagrams in this "Instruction Manual" mainly show the UT15, but the handling of the UT14 is exactly the same.

Notes on Handling the UT15 and UT14

Cleaning of the front panel, key switches, etc., should be limited to wiping lightly with a dry cloth.

Do not use any solvents such as alcohol, benzene, etc.

1. 1 Checking Accessory Items



Check that all of the following items are present.

- UT15 main unit or UT14 main unit 1 unit
- Bracket (installation hardware) 2 pcs.
- Unit seals (labels) 1 sheet
- Instruction Manual (main text) 1 copy
- Instruction Manual (communications volume) 1 copy*

* Included only when option /RS422 is specified.

3. INSTALLATION

3.1 Installation Location

Install the instrument in a location that meets the following criteria.

- (1) Little or no mechanical vibration.
- (2) No corrosive gases.
- (3) Minimal temperature fluctuation, and near normal temperature (32 °F to 122°F)
- (4) Not directly subject to radiant heat.
- (5) Not subject to strong electromagnetic fields.
- (6) No direct exposure to water.

3.2 Installation Procedure

- (1) Insert the instrument from the front of the panel.
- (2) To fasten the instrument to the panel, use the accessory installation brackets provided. Take care not to overtighten the bracket screws when mounting.

CAUTION

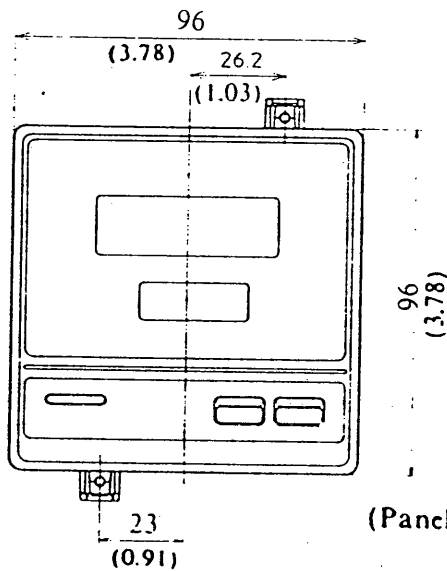
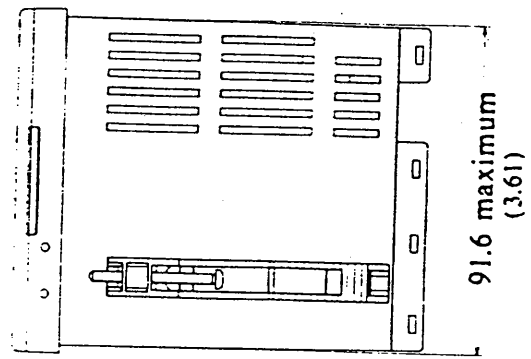
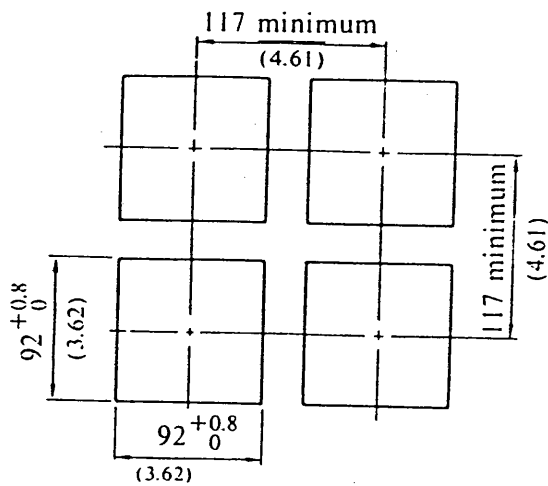
CAUTION: WHEN MOUNTING ON OR OVER A COMBUSTIBLE SURFACE. A PLATE OF AT LEAST 1.43mm GALVANIZED OR 1.6mm UNCOATED STEEL EXTENDED AT LEAST 150mm BEYOND THE EQUIPMENT ON ALL SIDES MUST BE INSTALLED and

AVERTISSEMENT: LORSQUE L'APPAREIL EST INSTALLÉ SUR OU AU-DESSUS D'UNE SURFACE COMBUSTIBLE, ON DOIT PRÉVOIR UNE PLAQUE D'ACIER GALVANISÉ D'AU MOINS 1.43mm OU UNE PLAQUE D'ACIER SANS REVÊTEMENT DE 1.6mm SE PROLONGEANT SUR AU MOINS 150mm TOUT AUTOUR DE L'APPAREIL.

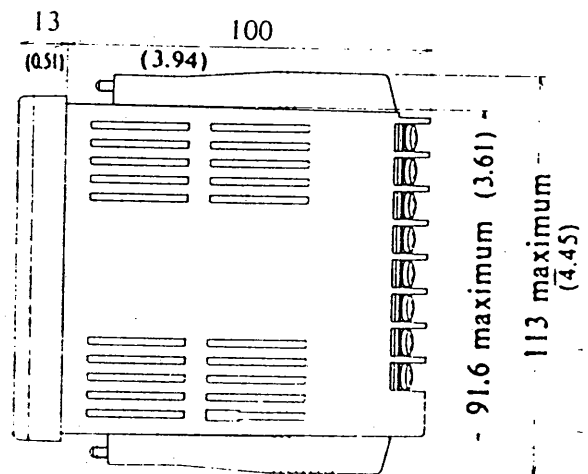
3. 3 Outside Dimensions and Panel Cutout Dimensions

UT15

Unit: mm
(approx. inch)



(Panel thickness)
1 to 10
(0.04 to 0.39)



91.6 maximum (3.61)
113 maximum (4.45)

1. 2 Verifying Product Specifications

Verify that the product delivered agrees with the model code ordered.

Model/Option Code Table

Model	Suffix code	Description
UT15	Digital indicating controller
Style code	* A	Style A
Option codes	/RET	Measured value retransmission output
	/RS422	RS-422A communication interface

Model	Suffix code	Description
UT14	Digital indicating controller
Style code	* A	Style A
Option codes	There are no option suffix codes for the UT14.	

1. 3 Verifying Measurement Input Type and Control Output Type

○ Unless otherwise specified, the UT15 and UT14 are shipped from the factory set up as follows:

Measurement input range code: 0 (thermocouple type K, -200 to 1200°C)

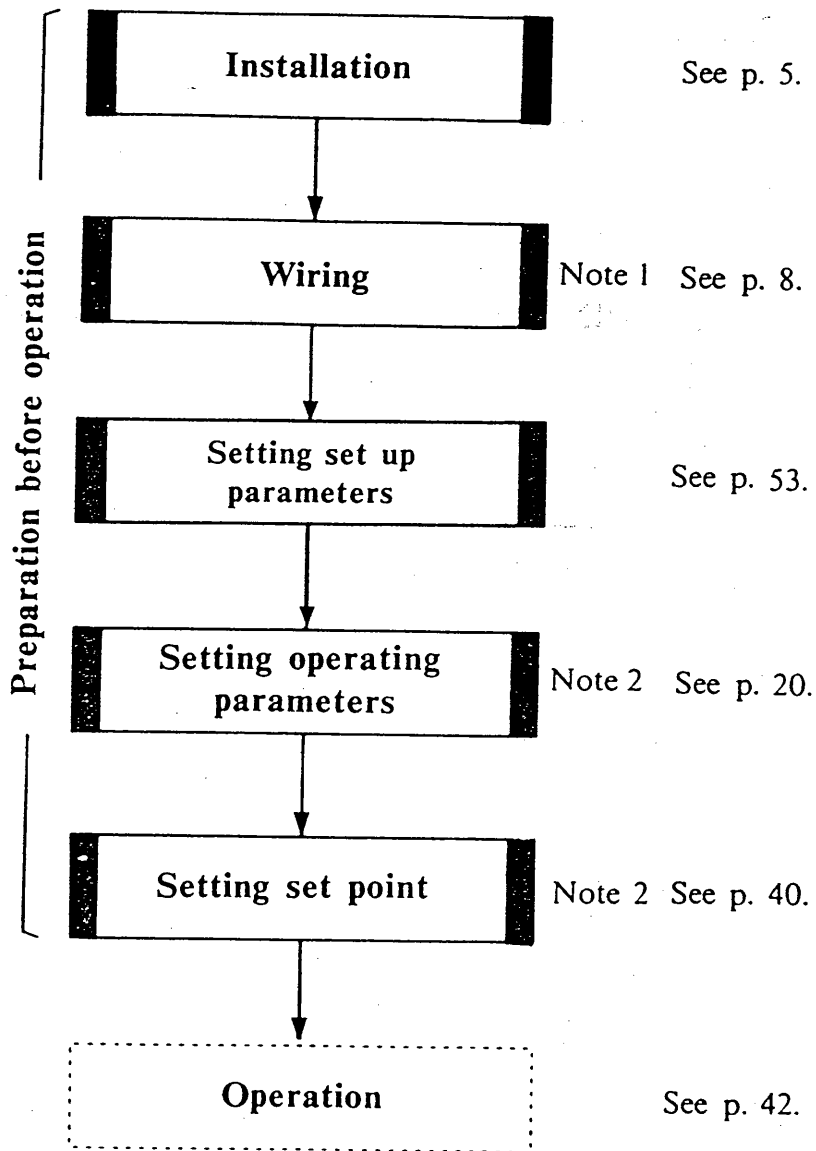
Control output type code: 0 (relay output)

○ The controllers are shipped from the factory with the control action set up for reverse action.

○ If you need to change any of these settings to use this instrument, see Appendix I, Input, Output, and Control Action Change Procedures (p.48).

2. BEFORE BEGINNING OPERATION

Prepare for use according to the flow chart below.

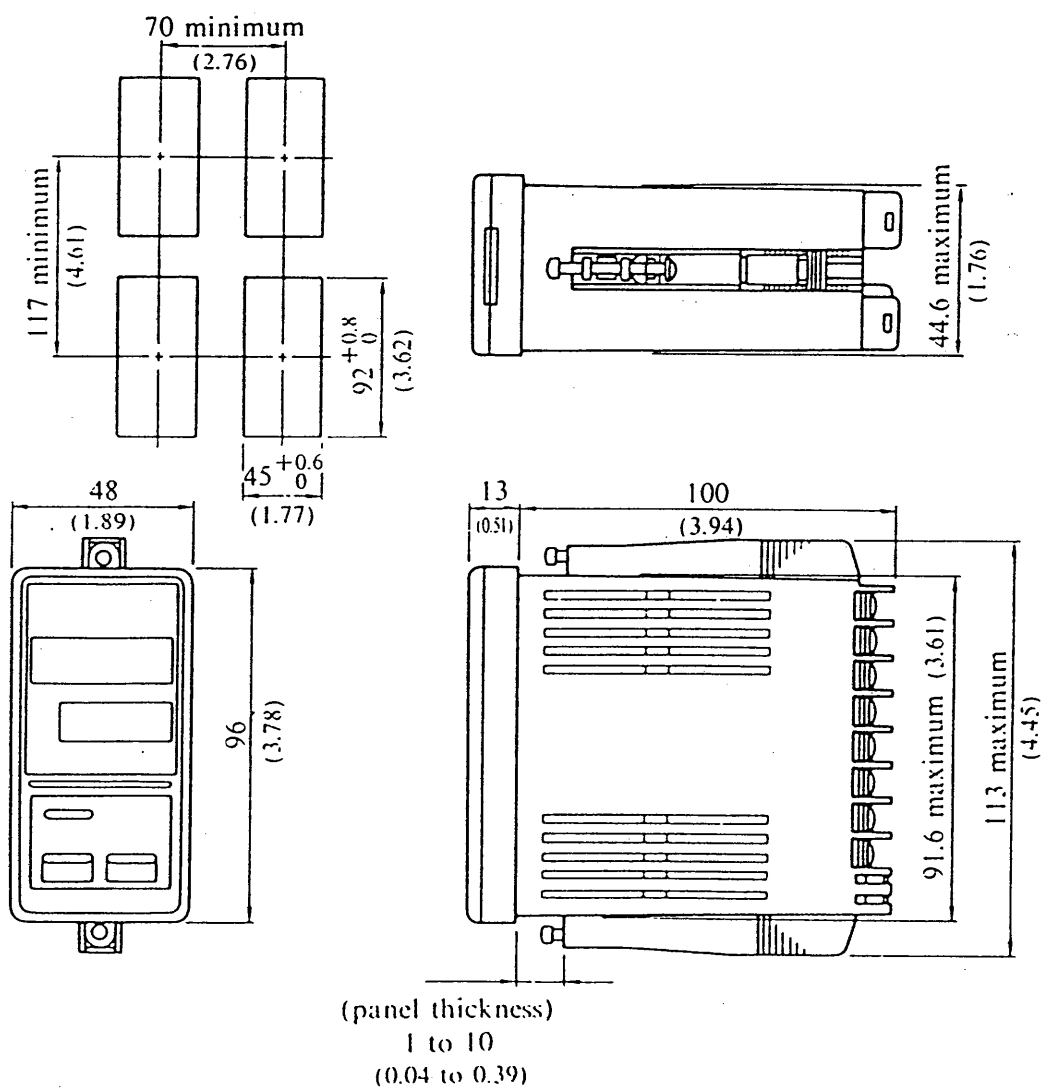


Note 1: This instrument itself has no power switch. It will begin to operate and generate a control output as soon as power is supplied to it. We recommend that the device to be controlled not be connected until immediately before operation is to begin.

Note 2: The parameters and setpoint (SP) for this instrument will be set when shipped from the factory as described in Appendix 3 and 4.

UT14

Unit: mm
(approx. inch)



4. WIRING

4.1 Wiring Procedure

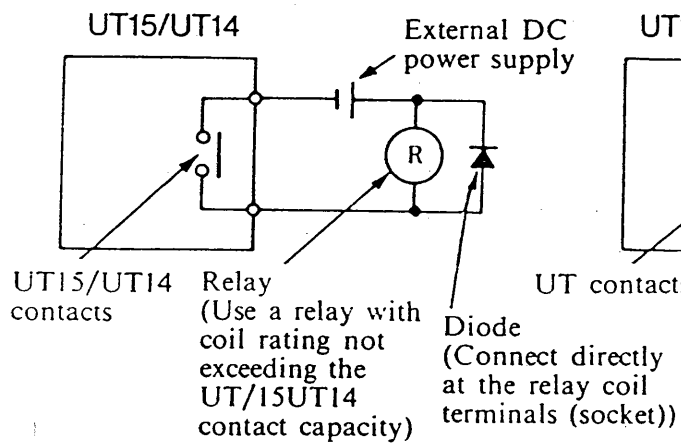
When wiring, see Section 4.3, "Terminal Wiring Diagrams," and observe the following precautions.

- (1) In the case of thermocouple input, use the proper thermocouple extension wire type (compensating leads).
- (2) For RTD input, use wiring having low conductor resistance, and no significant differences in resistance among the three conductors.
- (3) For power supply wiring, use a cable or wiring with characteristics equal to or better than 600 V vinyl insulated wire (JIS C3307). If necessary, insert a noise filter in the power supply circuit.
- (4) The ground conductor should have at least a 2 mm² crosssectional area, with resistance to ground not exceeding 100 Ω maximum.
- (5) Plan the input circuit wiring so as to avoid noise pickup.
 - (a) The input circuit wiring should be kept as far away as possible from power and ground circuits.
 - (b) Use of shielded wire is effective against noise due to electrostatic induction. If necessary, connect the shield to the ground terminal of the UT15/UT14. (Be careful that this does not result in a two-point ground.)
 - (c) Use of conductor pairs twisted with a short and constant spacing between twists is relatively effective against noise due to electromagnetic induction.
- (6) For connecting the wiring to the terminals, we recommend use of crimp terminal lugs (3.5 mm screw) with insulated sleeves.

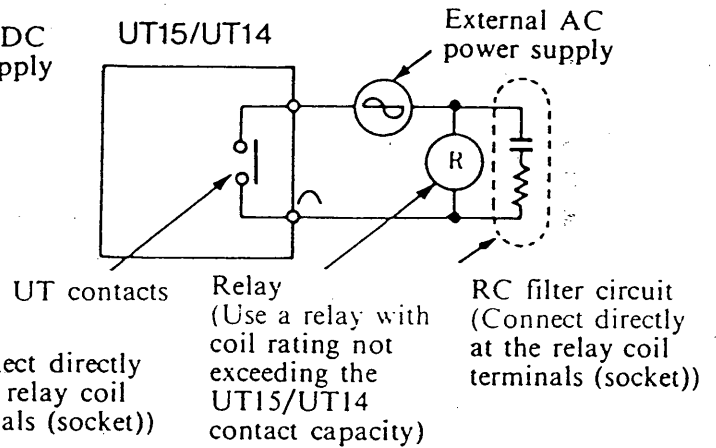
4. 2 Cautions When Wiring

- (1) There is no fuse or power supply switch in this instrument. If required, these must be provided separately.
For fusing, use time-lag fuses with a rated voltage of 250V, and a rated current of 1A.
- (2) If a load exceeds a relay output contact rating (control output: 250 V, 3 A AC resistive load; alarm output 250 V AC, 1A resistive load), use an auxiliary relay to turn the load on and off.
- (3) If using an inductive load such as an auxiliary relay on a relay contact output, connect a diode (for DC) or an RC filter (for AC) in parallel as a surge suppressor circuit to suppress sparking.

● For DC relay



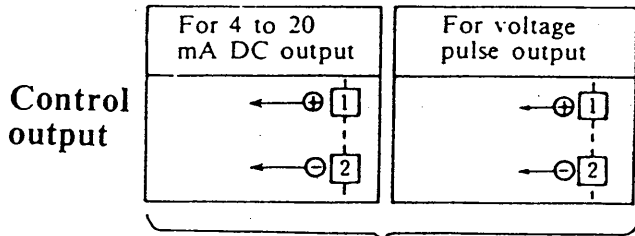
● For AC relay



4. 3 Terminal Wiring Diagram

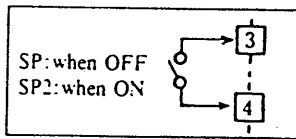
4. 3. 1 UT15 Terminal Wiring Diagram

(note)

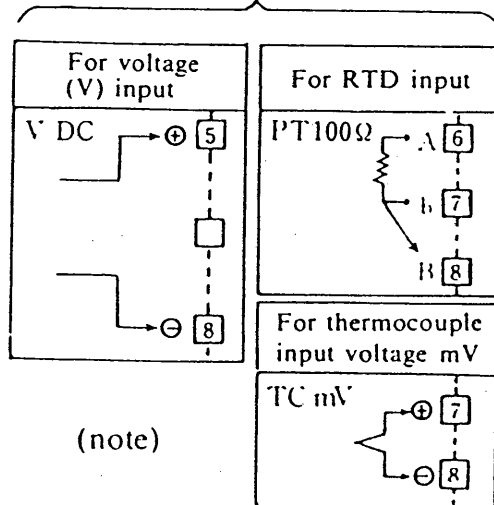
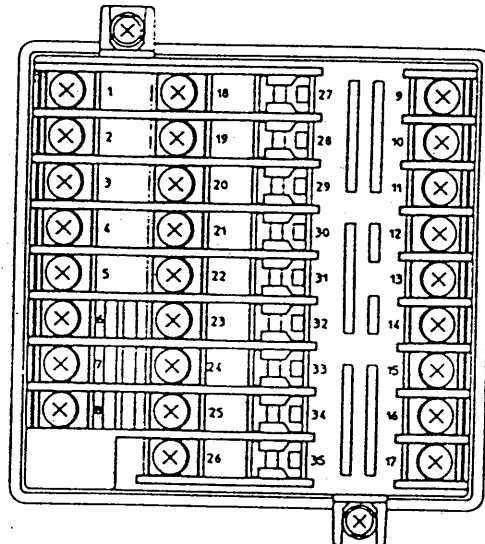


(Note) As the process input and control output types for the UT 15 can be freely changed, use the terminal connections matching the input and output types being used.

Set point selection



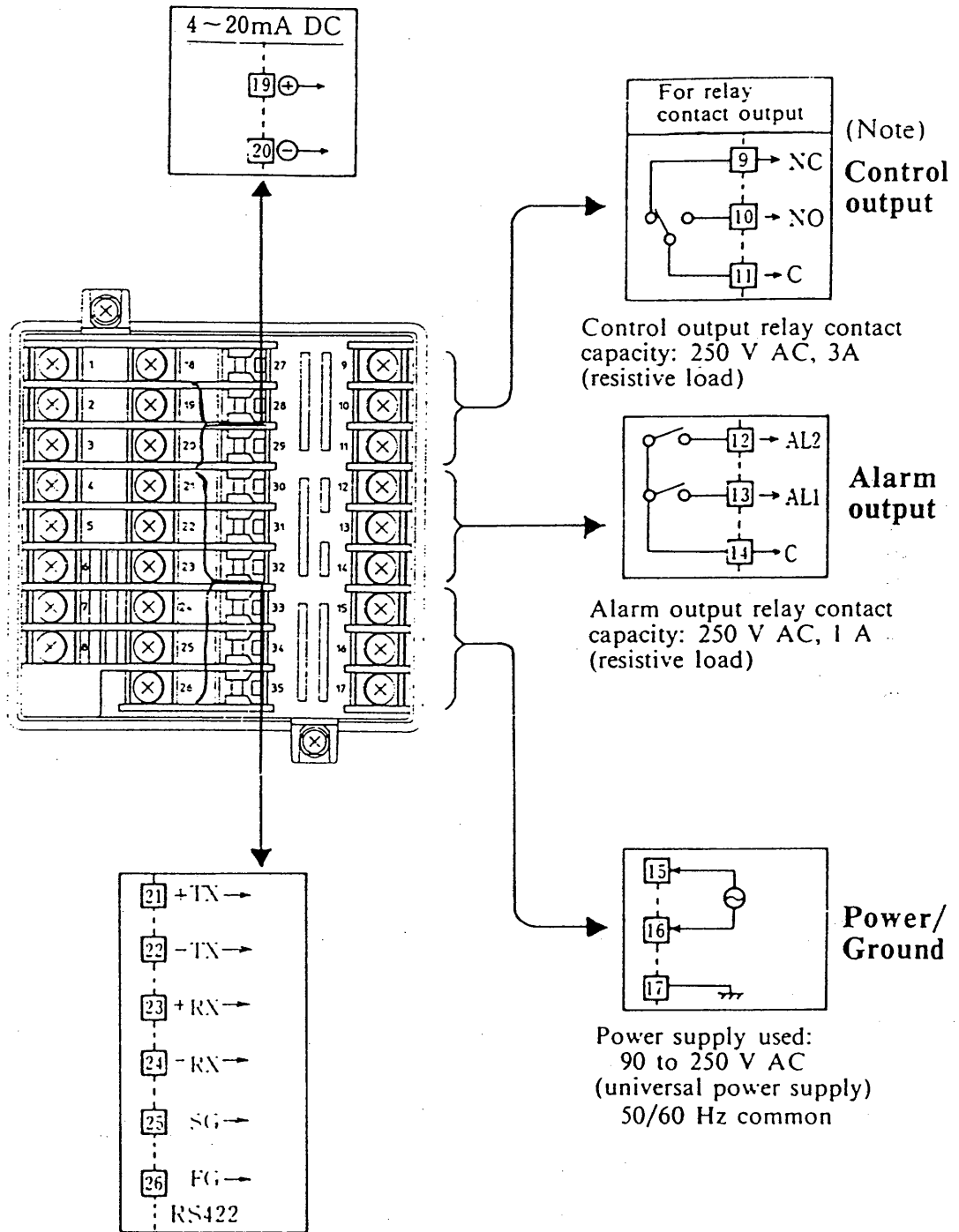
Selector contact capacity:
12V DC or more,
10mA or more



(note)

UT15

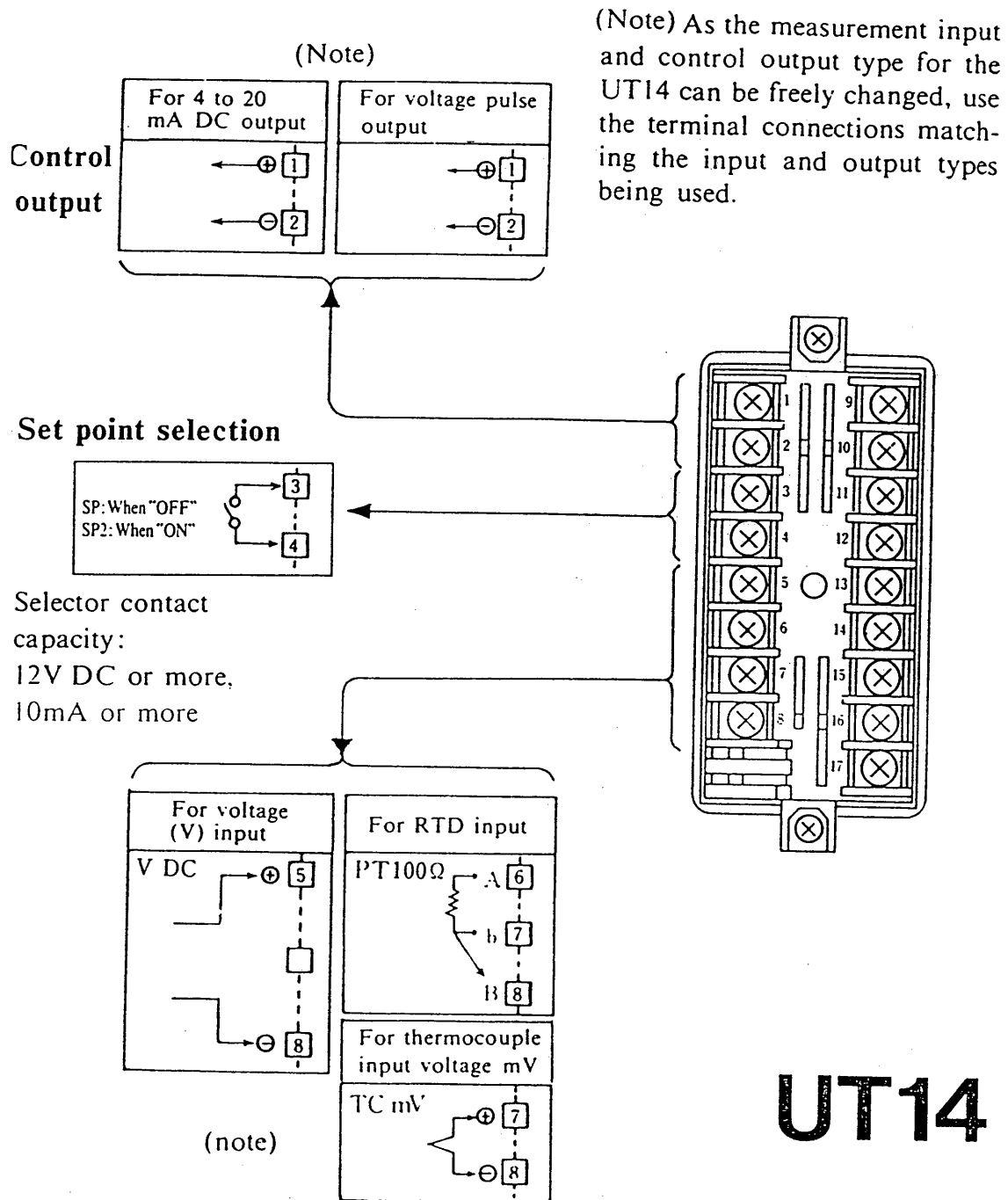
Retransmission output (option)

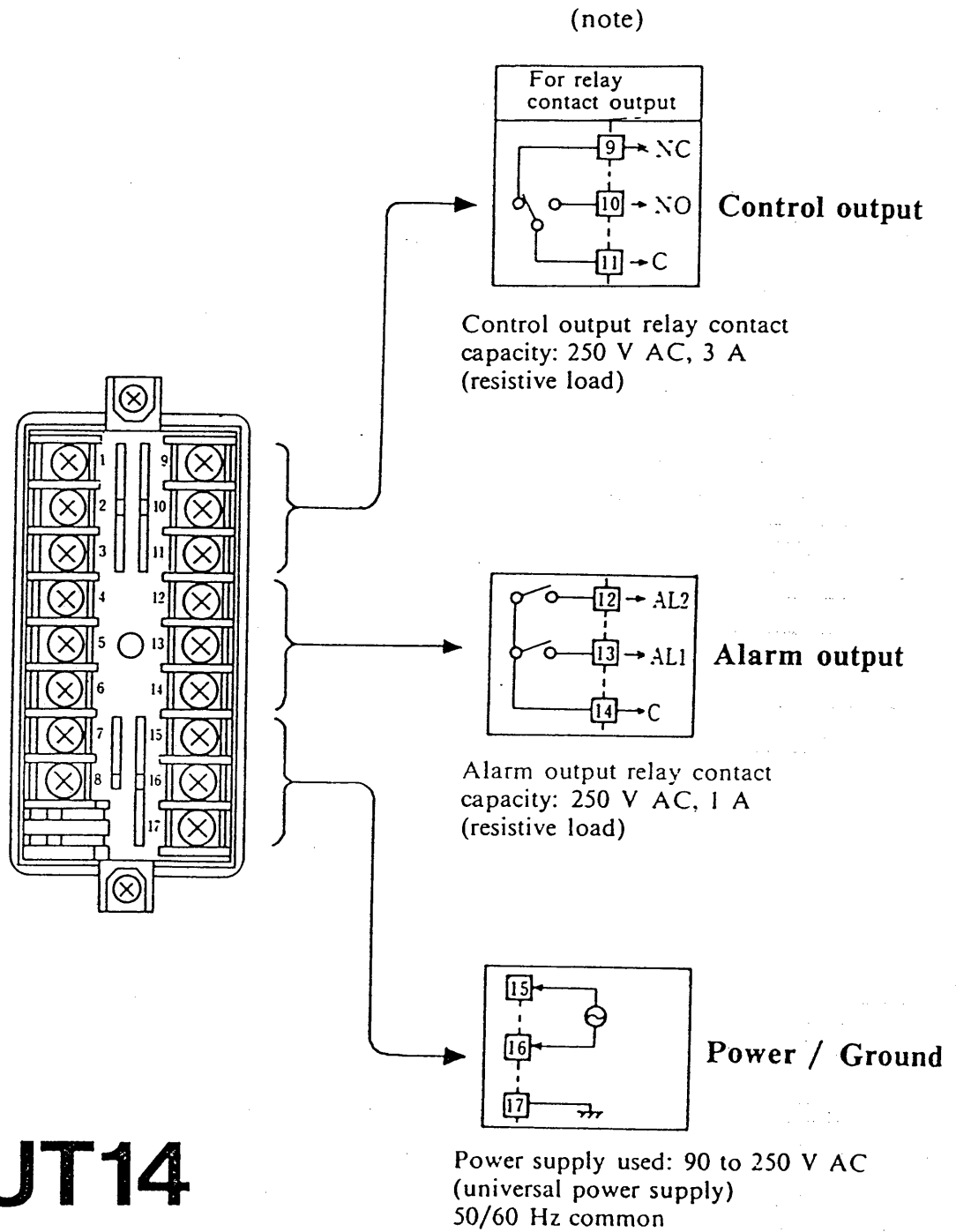


Communications (option)

UT15

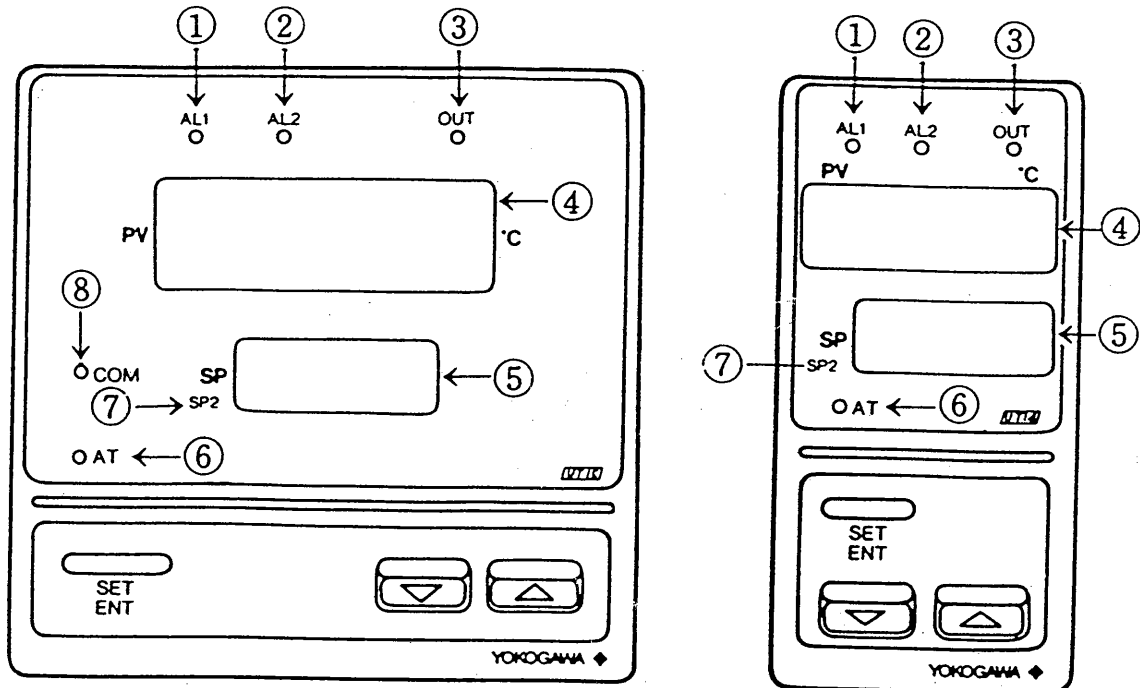
4. 3. 2 UT14 Terminal Wiring Diagram




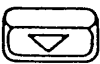







UT14

5. FRONT PANEL DISPLAY AND USE



Key	Function
 SET ENT (Set/entry key)	<ul style="list-style-type: none"> Used to switch between the normal display panel (measured variable display) and operating parameter setting display panel. (Pressing and holding this key for 3 seconds or more switches between the two displays.) Calls up the individual operating parameters one by one in sequence. Registers (enters) numeric values and changes.
  (Numeric value keys)	Used to change the displayed value of the set point or any operating parameter. The  (down) key decreases the value, and the  (up) key increases the value. Although when one of these keys is pressed the numeric value increments or decrements in units of one, holding the key continuously causes the rate of change to increase.

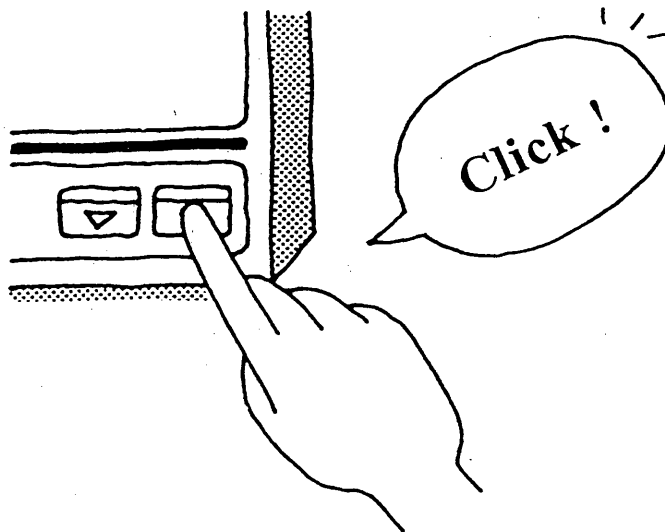
No.	Display	Function
①	AL1 ○ (Alarm 1 lamp)	Lights when alarm 1 is occurring.
②	AL2 ○ (Alarm 2 lamp)	Lights when alarm 2 is occurring.
③	OUT ○ (Control output monitor)	Monitors the control output. <ul style="list-style-type: none"> ● For relay or voltage pulse output, lights with output "ON". ● For 4 to 20 mA output, flash pattern changes according to percent output.
④	PV  °C (Measured-value display)	<ul style="list-style-type: none"> ● Displays the measured value (PV). ● During operating parameter setting, displays the parameter symbol.
⑤	SP  (Set-point value display)	<ul style="list-style-type: none"> ● Displays the set-point value (either main or 2nd) currently in use. (During operating parameter setting, displays the parameter numeric value.)
⑥	○ AT (Auto tuning execution indicator lamp)	Flashes while auto tuning is occurring.
⑦	SP2 2nd set point in use indicator lamp)	Lights during operations with the "2nd" set point.
⑧ *	○ COM (Communication indicator lamp)	<ul style="list-style-type: none"> ● Lights while communications (RS-422A) are in progress. ● Flashes when there is a communication error (parity error, framing error).

* The COM lamp is provided on the UT15 only.

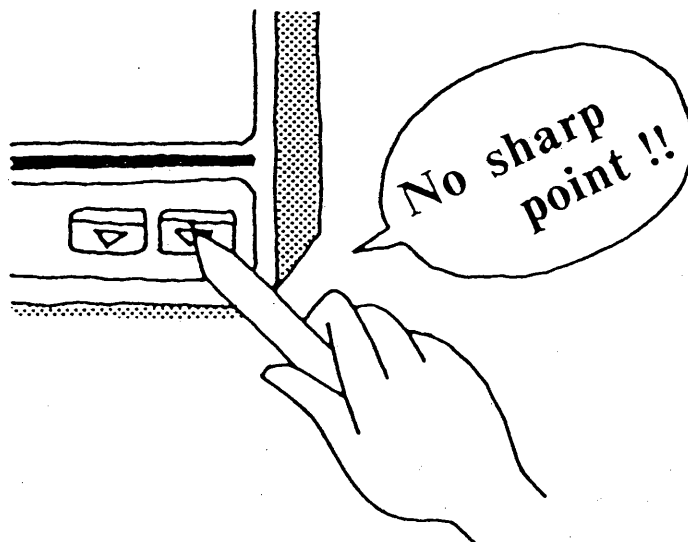
6. OPERATIONS

Notes on Key Operation


- ① The keys on this instrument have been designed with tactile feedback, and will click when pressed. Press firmly with your finger until you feel this click.

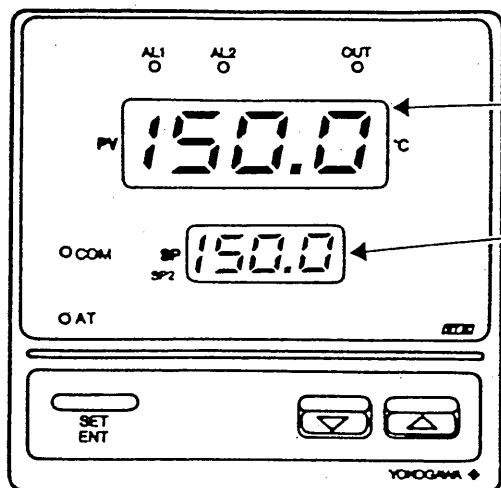


- ② Never use a sharp point to press the keys, as this can cause failure of the key.



6. 1 Normal Display Panel and Operating Parameter Setting Display Panel

The UT15 and UT14 has two major display modes. Switching between these display panels is done by holding the  key depressed for three or more seconds.



Normal display panel

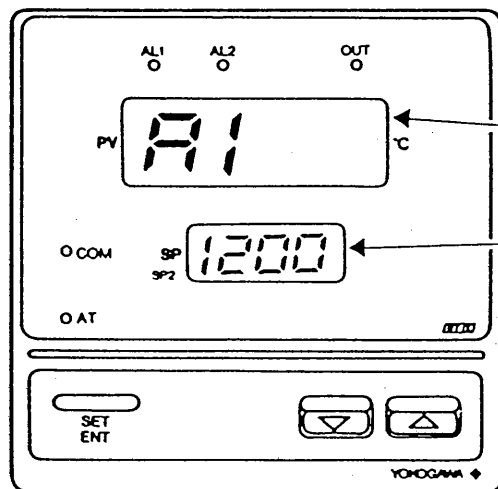
The measured value is displayed in the measured value display area.

The set point value is displayed in the set point display area.

When this display panel is presented the set-point can be changed.



Push this key and hold for three seconds or more to alternate between these displays



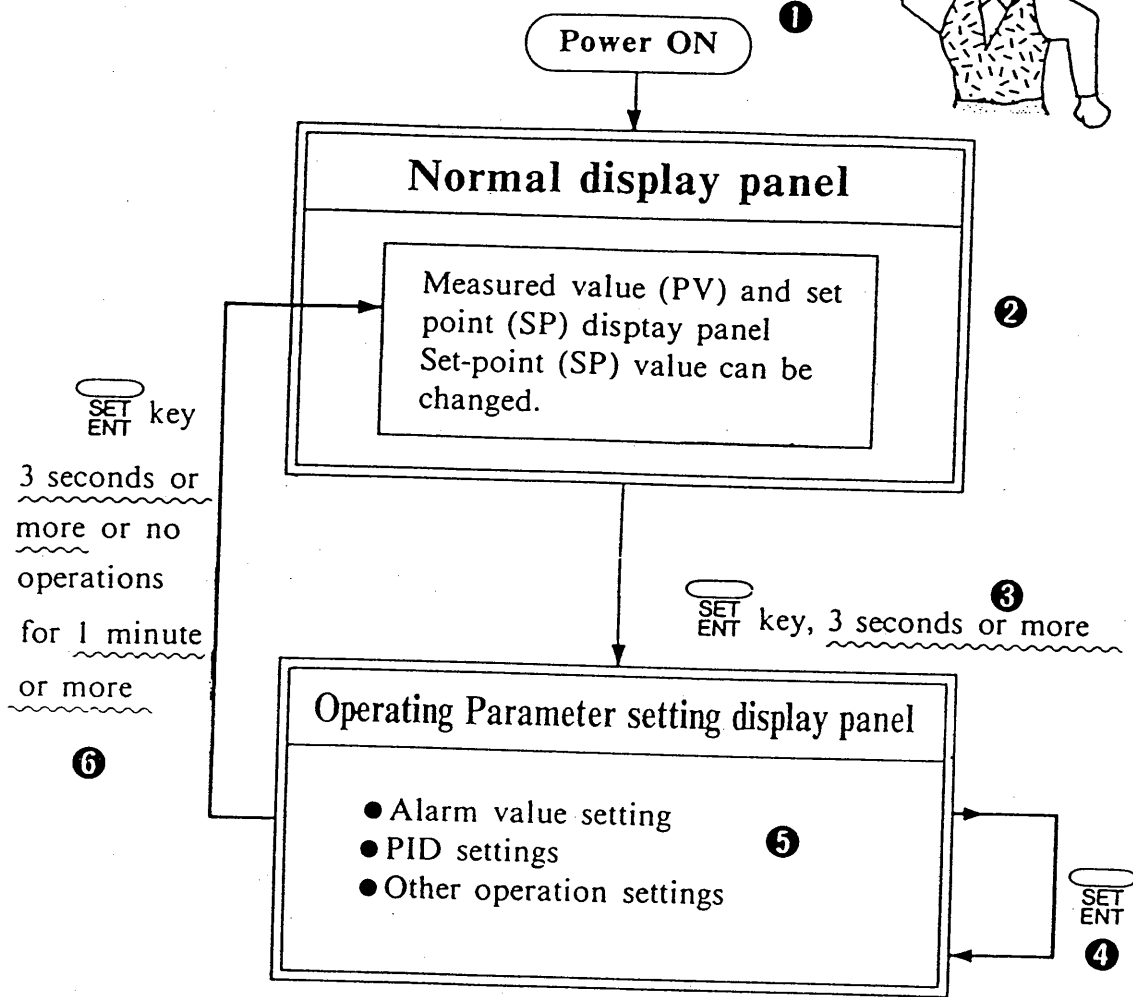
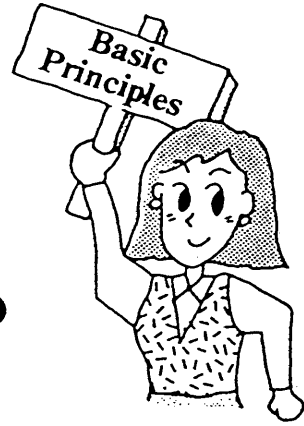
Operating Parameter setting display panel










The parameter symbol is displayed in the measured-value display area.

The parameter setting is displayed in the set-point value display area.

When this display panel is on display the operating parameters can be changed and entered.

6.2 Basic Principles of Key Operation



- ① When power is applied to the UT15 or UT14 it displays the normal display panel.
(After power is turned ON, the model, input range code, and output type code are displayed in the measured-value display area for approximately 2 seconds before the normal display panel appears.)
- ② The normal panel displays the measured value (PV) and the set-point value (SP).
The set point can be changed by pressing the  or  key; this will cause the decimal point to begin flashing.
The new value will take effect when entered by pressing the  key.
- ③ Pressing the  key continuously for 3 seconds or more while the normal display panel is shown switches the display to the parameter setting display.
- ④ Subsequent depressions of the  key (for less than 3 seconds) step the display sequentially through the individual operating parameters.
- ⑤ The  and  keys can be used to change the settings (displayed values) of the individual operating parameters.
(The decimal point will be flashing while a change to one of these numeric values is in progress.) After changing a setting, press the  key to enter it.
- ⑥ When either of the following is done while the operating parameter setting display is present the display returns to the operating display panel.
 -  key is pressed continuously for 3 seconds or more.
 - No operation is performed for 1 minute or more.

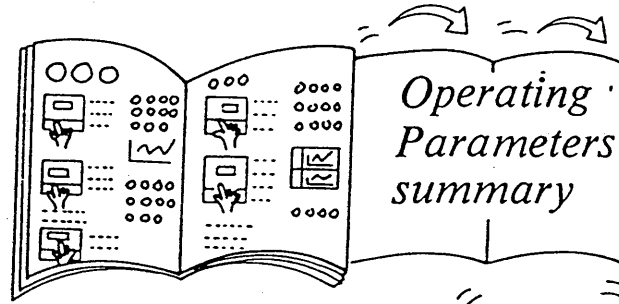
6.3 Key Lock

To protect important data, the UT15 and UT14 have a key lock function. No key operations can be performed when the key lock is engaged.




The procedure for placing the controller in the key lock state is described in Appendix 2 (p.52).

7. OPERATING PARAMETER SETTING

This section describes procedures for setting the operating parameters. When you are entering these settings you will find it convenient to open Appendix 4, "Operating Parameters (Including Set Points) Summary" (P. 64 and 65) as shown below.



Notes on Operating Parameter Setting

- Note 1: To enter these settings, press the  key for three seconds or more continuously from the normal display panel, as described in Section 6. 2, "Basic Principles of Key Operation", to call up the operating parameter setting display panel.
- Note 2: When on/off control is selected, the types of operating parameter setting selections (symbol displayed) that appear differ depending to the control output chosen (see Appendix 1). (See figure at right.)
- Note 3: • If the entry of one operating parameter has been completed and no additional operating parameter entries are required, press the  key for three seconds or more to return to the normal display panel. (If no key operations are performed for 1 minute or more, the display automatically returns to the operating display panel.)
- If other operating parameter entries are required, press the  key once for each parameter to step to the correct item display for the required parameter. When setting individual parameters see the detailed setting procedures (p. 22 through p. 39.).

Normal display panel

Set point entries may be done from the normal display panel.

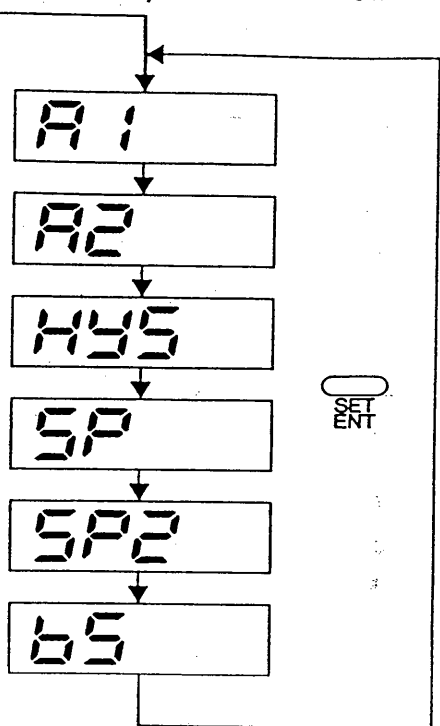
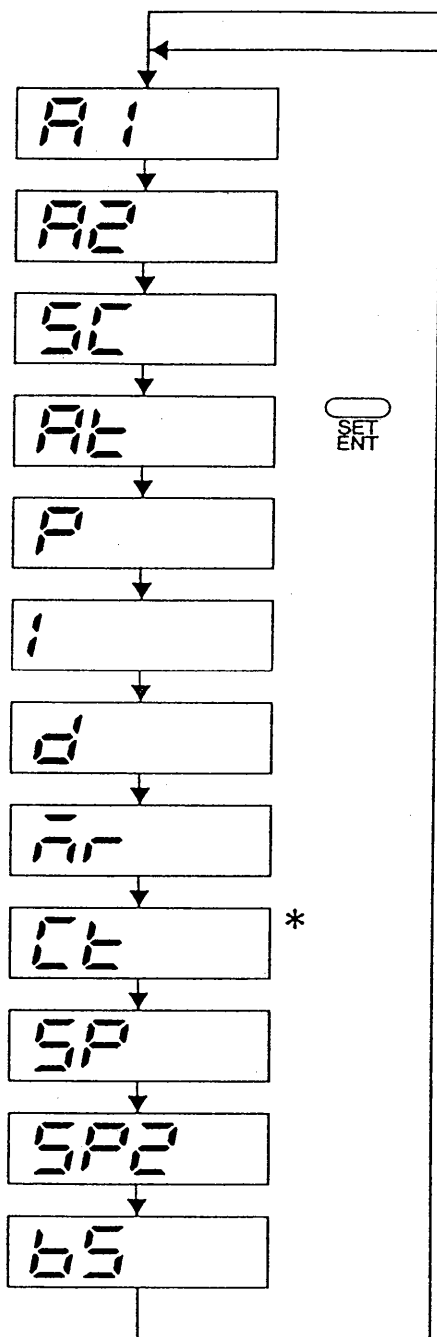
Press



key for 3 seconds or more.

For PID control

For on/off control

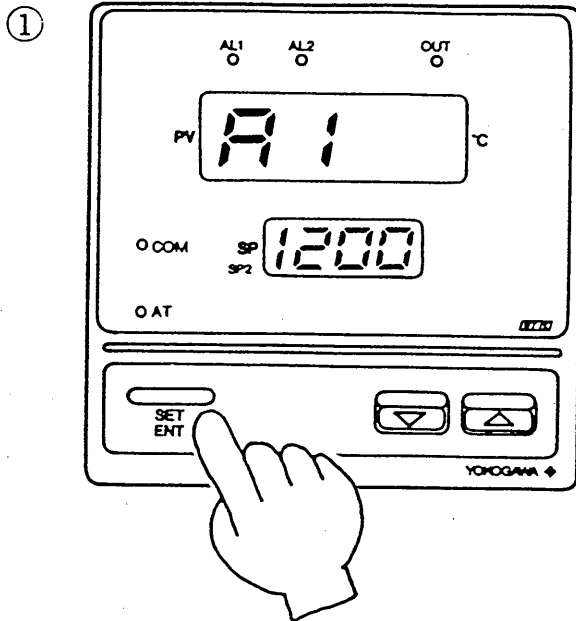


See Appendix 1 (p. 51) concerning the procedure for changing to on/off control.

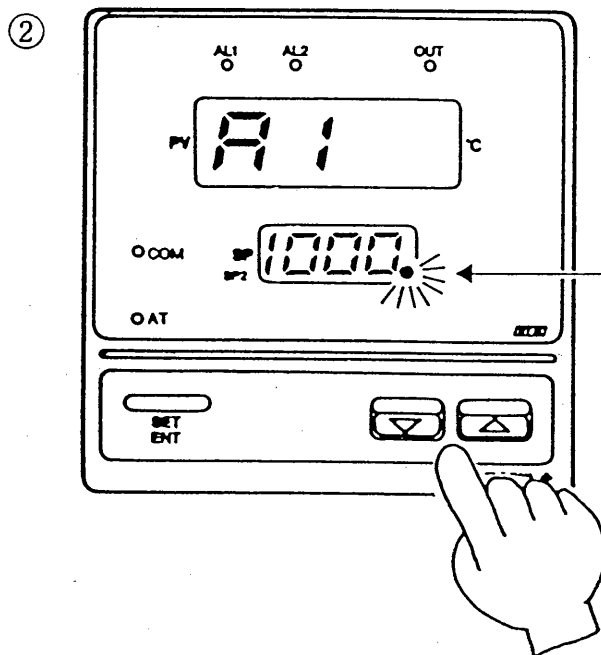
* **Ct** is displayed for time-proportioning PID output (relay, pulse) only.


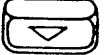
7. 1 Alarm Setting Procedure

7. 1. 1 Alarm 1 [A1] Setting Procedure (see appendix 3 for selecting Alarm type), comes from factory as High Limit Alarm.

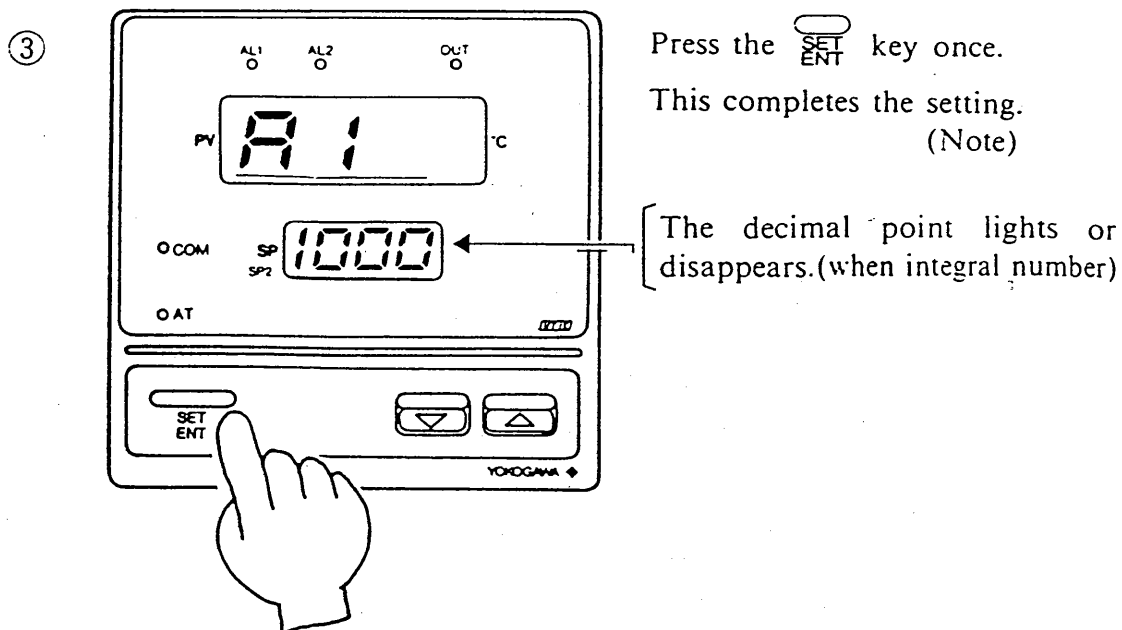


From the normal display panel (measured-value display), press the **SET ENT** key for 3 seconds or more continuously. (The display should appear as at left. Verify that **A1** is displayed.)



Using the  and  keys, set the alarm 1 setting to the required value.

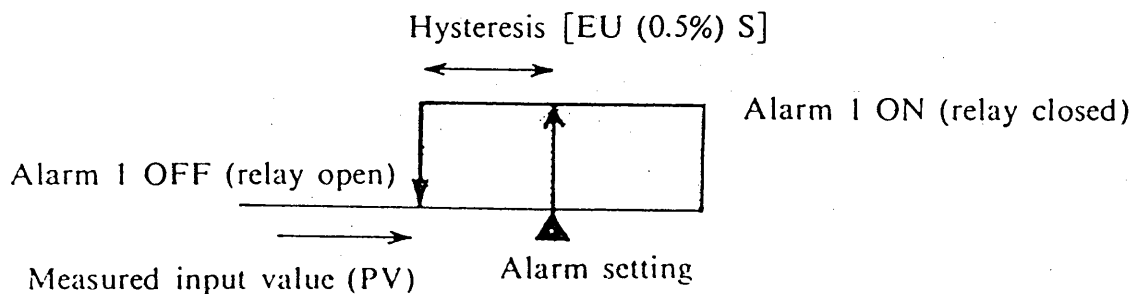
The decimal point will flash. If you return to the value in effect before changes were made, the decimal point will light or disappear. (when integral number)



Note: See "Note 3" of the "Notes on operating Parameter Setting" (p. 20).

○ Alarm 1 (Shipped as high limit N.O. Alarm) [A1]

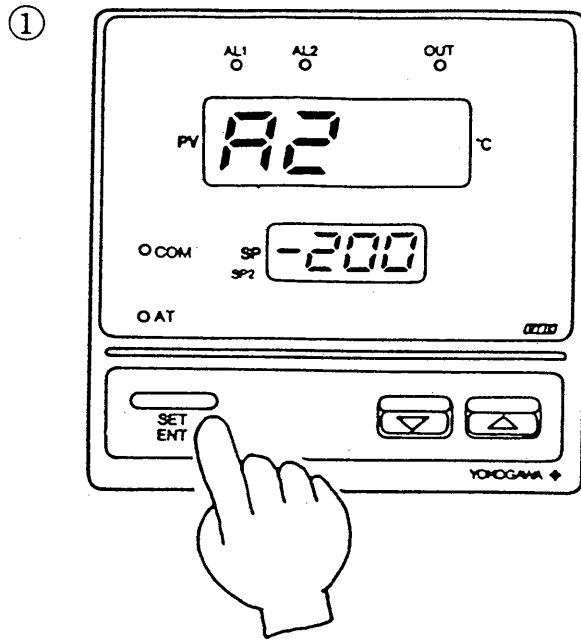
If the measured input value (PV) exceeds the alarm setting, the alarm turns ON, and the alarm relay closes. The alarm is cancelled when the PV drops below the alarm setting by the alarm hysteresis width.





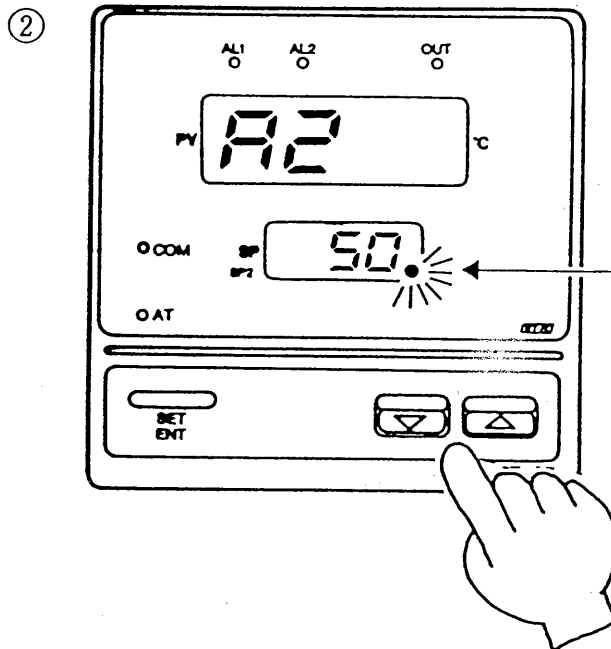
7. 1. 2 Alarm 2 (A2) Setting Procedure



See Appendix 3 for selecting alarm action.

Shipped from factory as low limit alarm.

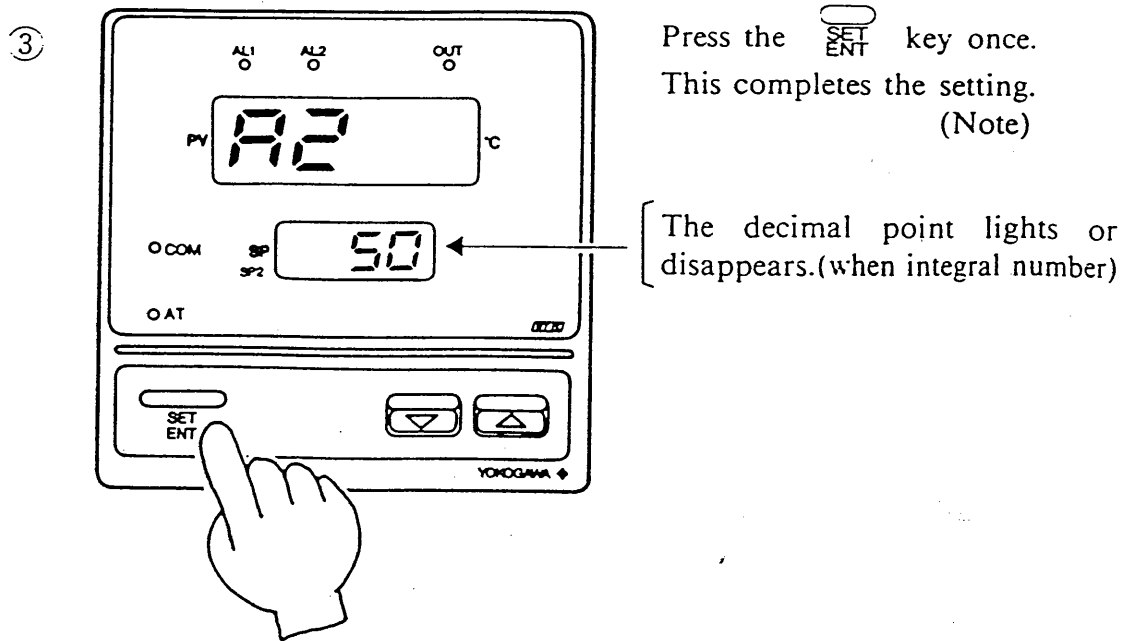


- From the normal display panel (measured-value display), press the  key continuously for three seconds or more to display the alarm 1 setting display panel.
- Then, press and release the  key once more. (The display should appear as at left. Verify that **A2** is displayed.)



Using the  and  keys, set the alarm 2 setting to the required value.

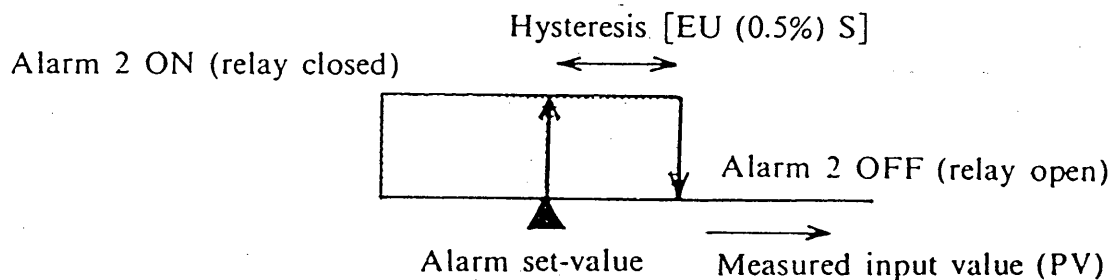
The decimal point will flash. If you return to the value in effect before changes were made, the decimal point will light or disappear. (when integral number)



Note: See "Note 3" of the "Notes on Operating Parameter Setting" (p.20).

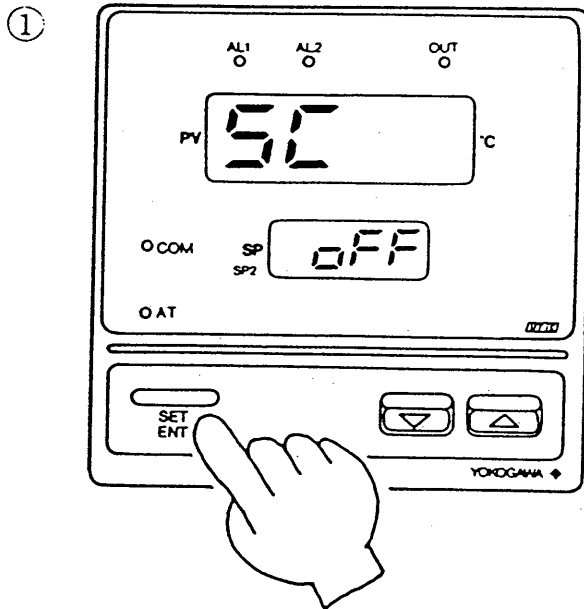
○ Alarm 2 (shipped as low limit N.O. Alarm) [A2]


If the measured input value (PV) falls below the alarm setpoint, the alarm is turned ON, and the alarm relay closes. The alarm is cancelled when the PV rises above the alarm set-value by the alarm hysteresis width.



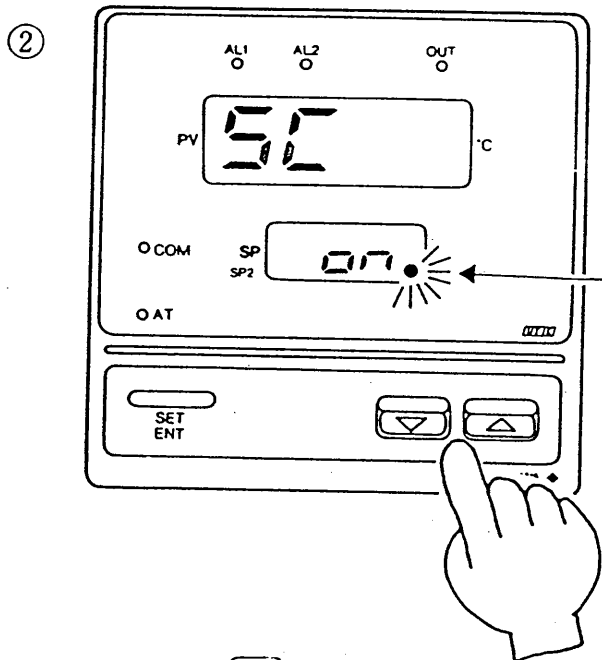
7. 2 "Super" Function ON/OFF Selection Procedure



- Note:
- Cannot be selected when on/off control is in effect.
 - "Super" takes effect only with PID control. It has no effect with P, PI, or PD control.




From the operating parameter setting display panel, press the  key several times to come to the display in the figure at left.

(Verify that 50 is displayed.)



Use the  and  keys to display either "ON" or "OFF" in the lower indicator.

The decimal point begins flashing. If you return to the value in effect before the change, it disappears.

- ③ Press the  key once. This completes the setting. (Note) The decimal point disappears.

Note: See "Note 3" of the "Notes on Parameter Setting" (p. 20)

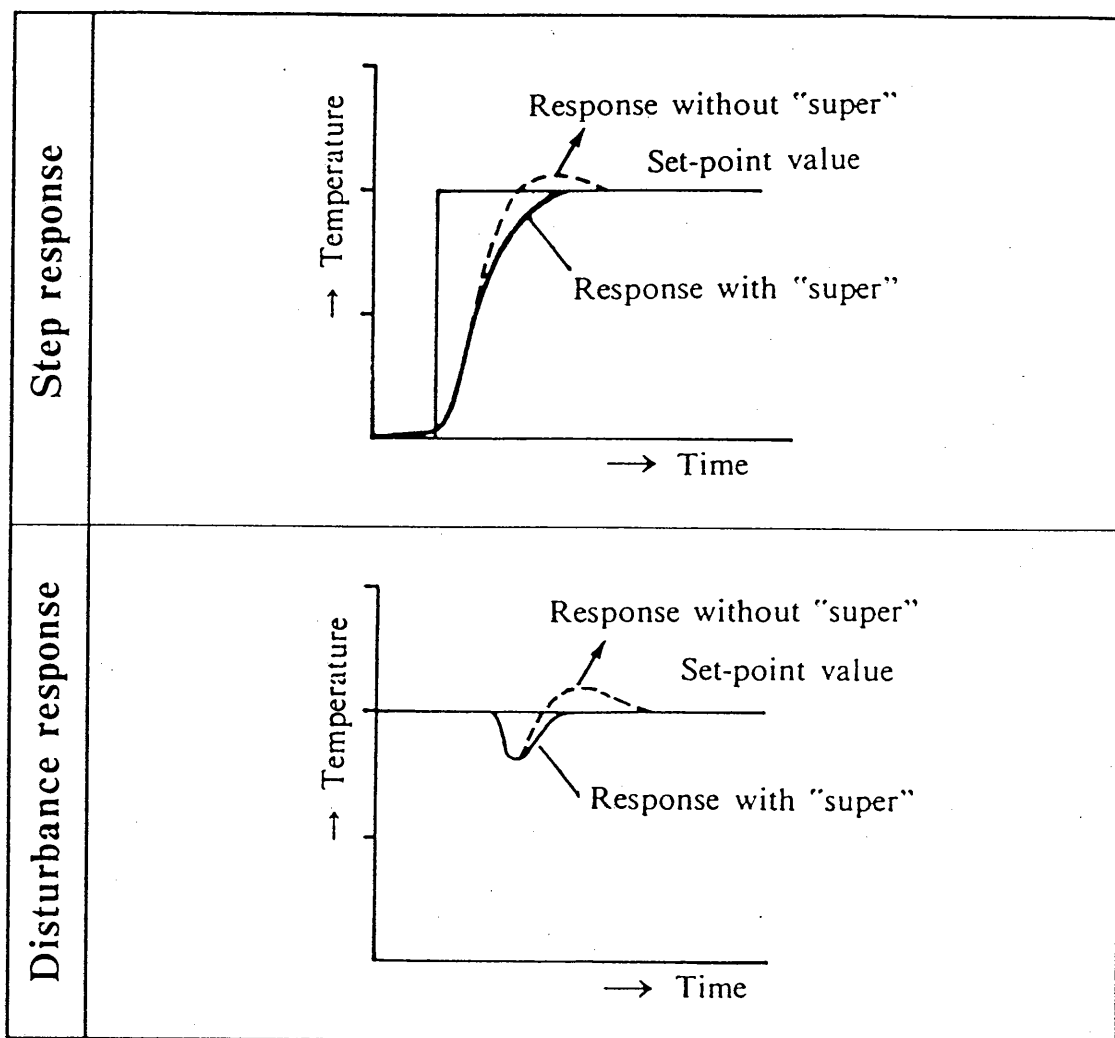
○ Effect of "Super"

This function suppress overshoot.

It is particularly effective.

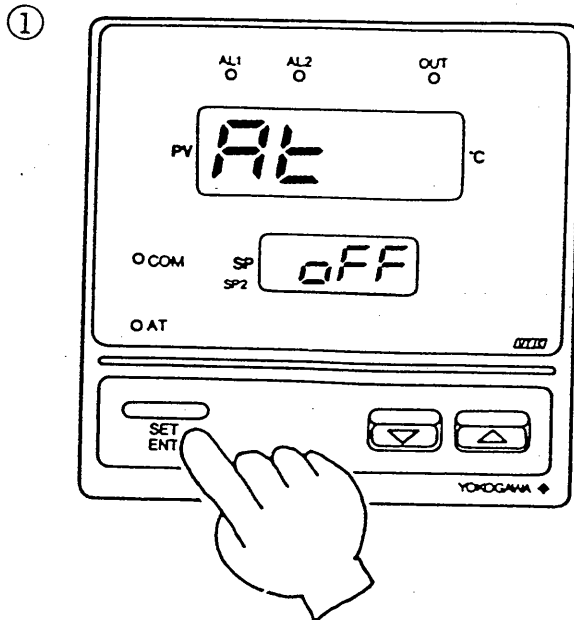
- To suppress overshoot.
- To shorten rise time.
- Where there are frequent load changes. (process upsets)
- During setpoint changes.

Super controls overshoot by using a fuzzy logic inference algorithm.



7.3 Auto Tuning Start (ON)/Stop (OFF) Procedure

Note: Auto tuning cannot be started when on/off control is in effect.

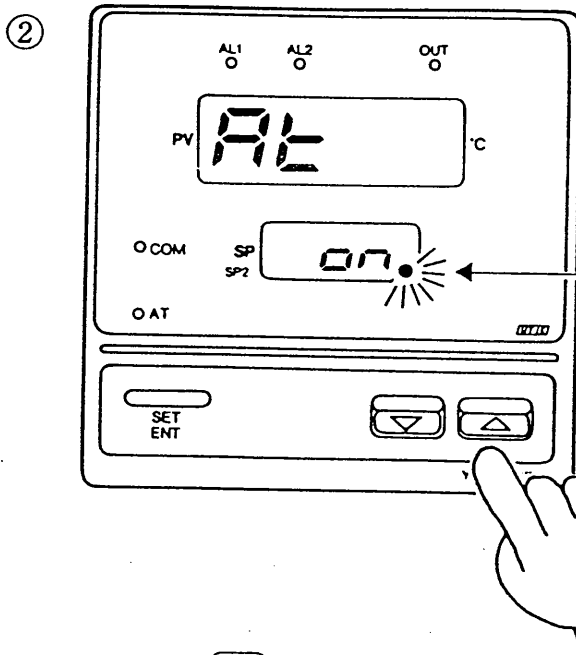




From the operating parameter setting display panel, press the




key several times to come to the display in the figure at left.

(Verify that **AL** is displayed.)



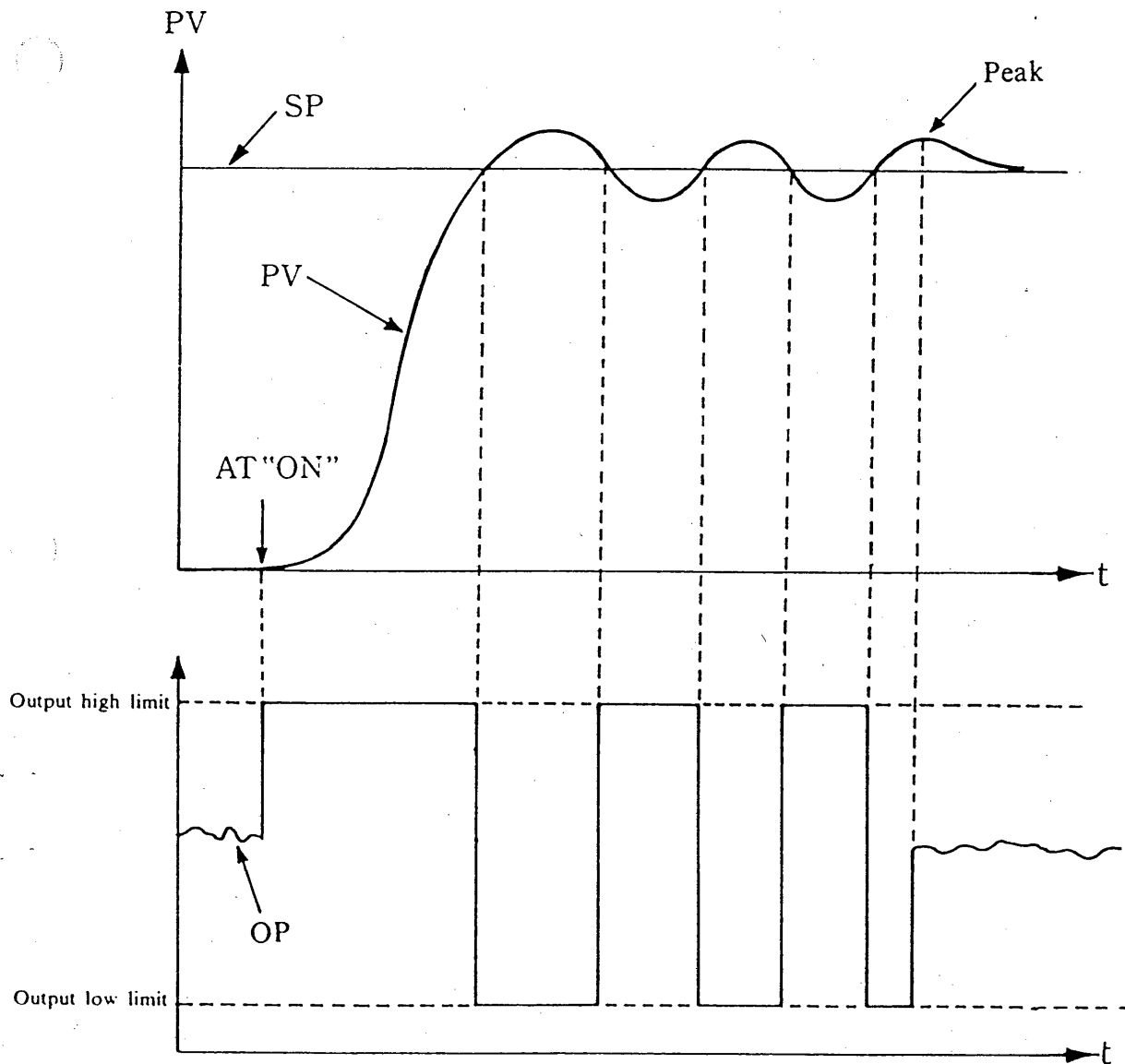
Use the  and  keys to display either "ON" or "OFF" in the lower indicator.

The decimal point begins flashing. If you return to the value in effect before the change, it disappears.

- ③ Press the  key once. This completes the setting. (Note) The decimal point disappears. The \circ AT lamp will be flashing while auto tuning is being executed. Note: See "Note 3" of the "Notes on Operating Parameter Setting" (p. 20).

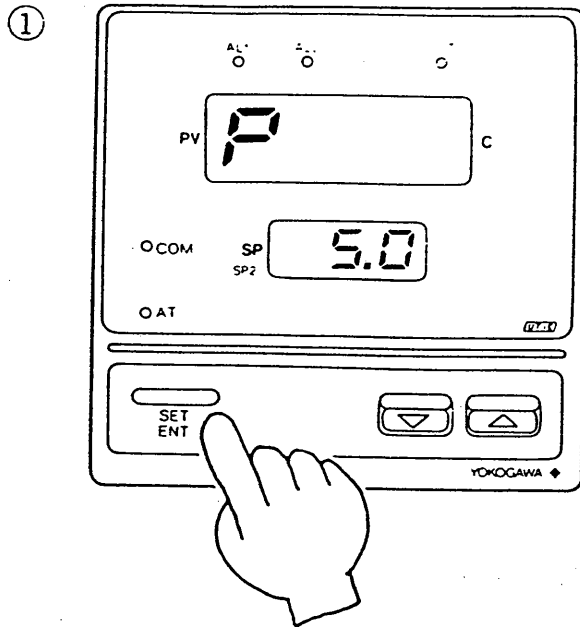
UT15/UT14 Auto Tuning Procedure


At the time that auto tuning is started (AT="ON"), the control output for the UT15 or UT14 will go to output high limit. The condition output (OP) output high limit is then maintained until the measured value (PV) reaches the set point (SP). Subsequently, whenever $PV > SP$, the OP is sent to output low limit. As shown in the figure below, the OP is sent to output low limit. As shown in the figure below, the OP value is then caused to repeat this alternation between output high and output low according to the relative magnitude of PV and SP three times, and the PID constants are determined automatically by the response of the control object. Consider the product and possible implications before initiating the autotuning sequence.




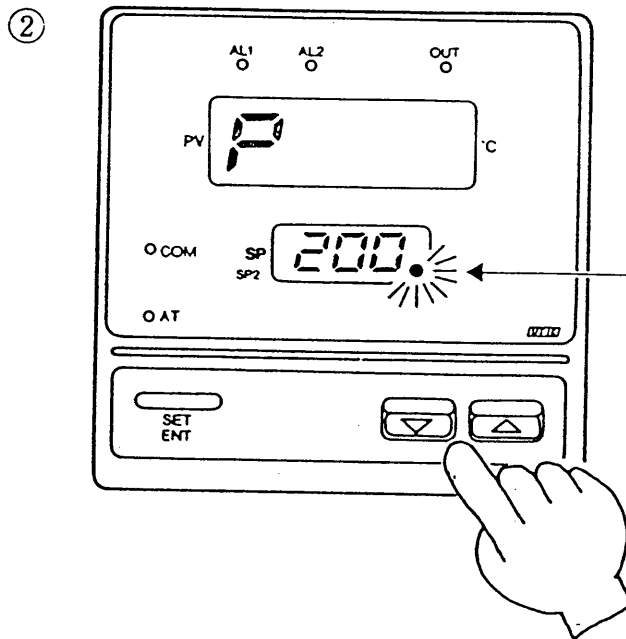
7. 4 Proportional Band (P) Setting Procedure


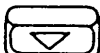
Note: The proportional band setting display is not available when on/off control is in effect.




From the operating parameter setting display panel, press the  key several times to come to the display in the figure at left.

(Verify that  is displayed.)



Use the  and  keys to set the proportional band to the required value.

The decimal point begins flashing. If you return to the value in effect before the change, it remains lit continuously.

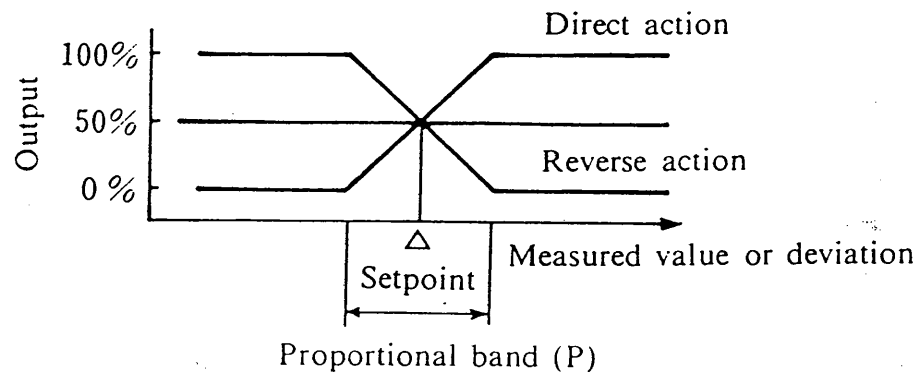
- ③ Press the  key once. This completes the setting. (Note) The decimal point remains lit continuously.

Note: See "Note 3" of the "Notes on Operating Parameter Setting" (p. 20).

○ **What is Proportional Band (P)?**

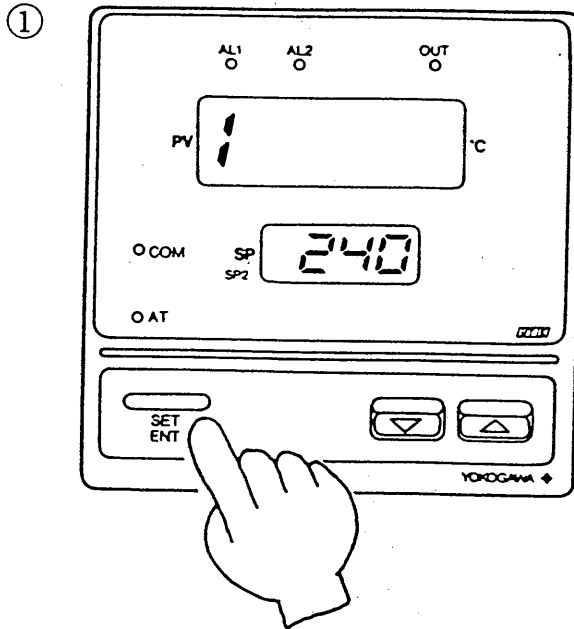
The control algorithm that generates a linear control output proportional to the deviation is called "proportional action" (or, "P" action). In proportional action the amount of change in the measured value (or deviation) is expressed in percent of span that is required to cause the control output to change from 0 to 100% is called the proportional band.



In general the output will be 50% when the measured value and set point are exactly the same. But this may be adjusted using manual reset. Proportional action makes it possible to eliminate the output and PV fluctuations that are a shortcoming of on/off control.

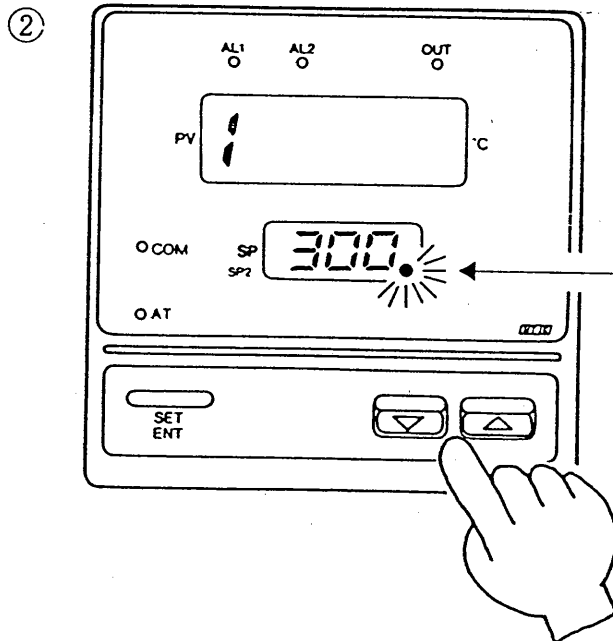



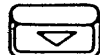
7.5 Integral Time (I) Setting Procedure

Note: The integral time setting display is not shown when on/off control is selected.




From the operating parameter setting display, press the  key several times to come to the display in the figure at left. (Verify that  is displayed.)



Use the  and  keys to set the integral time to the required value.

The decimal point begins flashing. If you return to the value in effect before the change, it disappears.

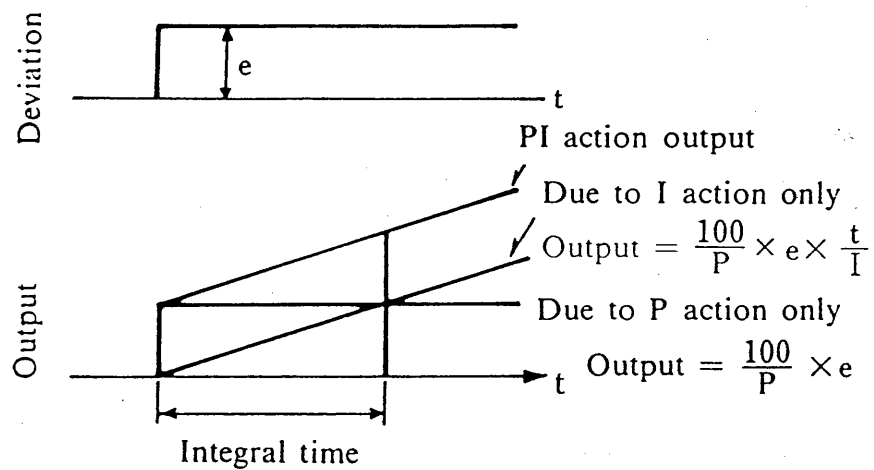
- ③ Press the  key once. This completes the setting. (Note) The decimal point disappears.

Note: See "Note 3" of the "Notes on Operating Parameter Setting" (p.20).

○ What is Integral Time [I]?

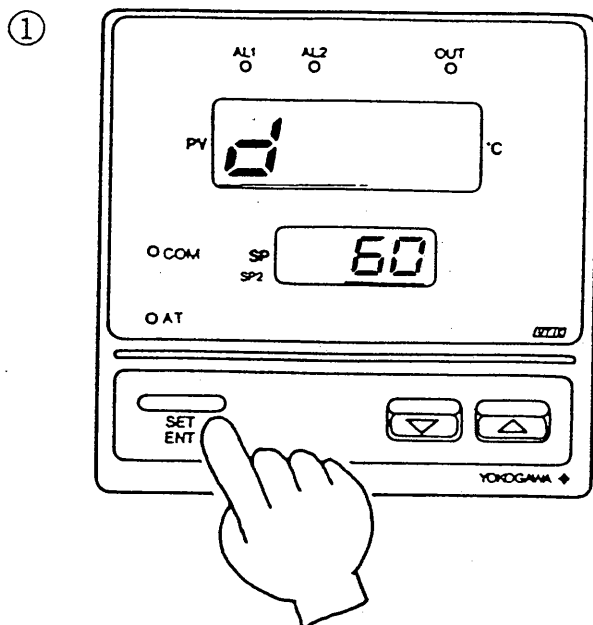
With P action the measured value will not necessarily become equal to the set point, and a deviation will usually be present. The control algorithm that applies changes in output as long as a deviation exists, so as to bring the deviation to zero, is called "integral action" ("I" action).


When integral action is used, the parameter that determines how fast the output will change in correspondence to some amount of deviation is referred to as the integral time, and the shorter the integral time, the stronger the integral action (the greater the output rate-of-change). I action is usually used together with P action as PI action, and the integral time [I] is the time required, after application of a step input, for the output change due only to I action to become equal to that due only to P action.




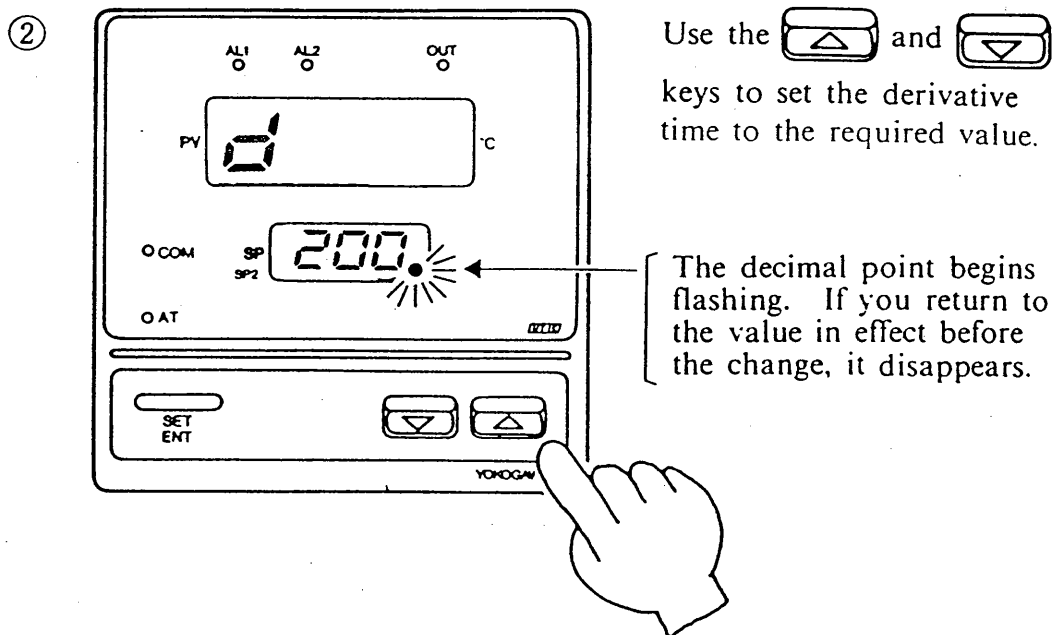
7. 6 Derivative Time (D) Setting Procedure



Note: The derivative time setting display is not shown when on/off control is in effect.




From the operating parameter setting panel, press the  key several times to come to the display in the figure at left.

(Verify that  is displayed.)



Use the  and  keys to set the derivative time to the required value.

The decimal point begins flashing. If you return to the value in effect before the change, it disappears.

- ③ Press the  key once. This completes the setting. (Note) The decimal point disappears.

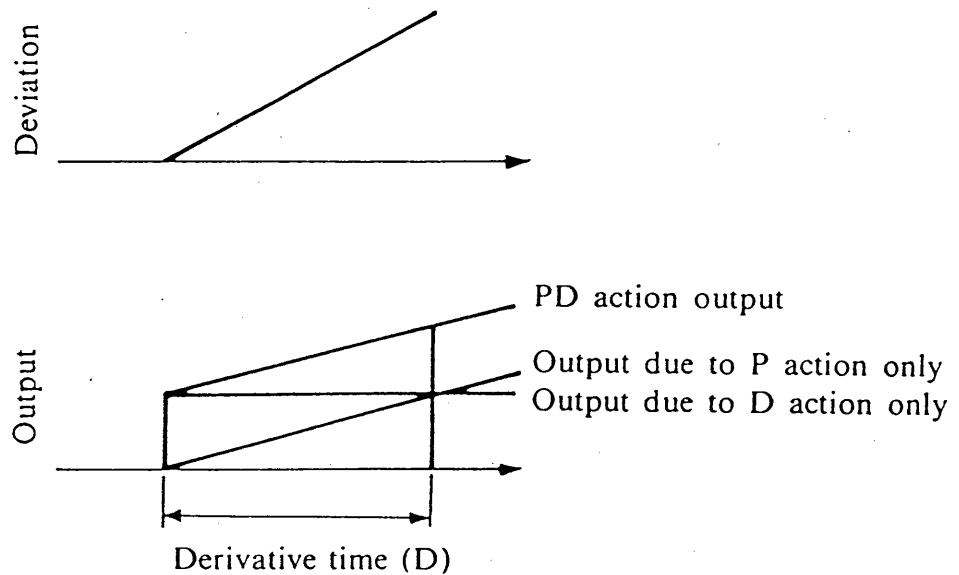
Note: See "Note 3" of the "Notes on Parameter Setting" (p. 20).

○ What is Derivative Time (D)?


If the controlled object has a large time constant or dead time, with P or PI action alone there will be cases where the response will be slow, overshoot will occur, and the control system will be unstable. In order to achieve faster response and more stable operation in these cases one uses derivative action ("D" action) to apply an output component proportional to the input (deviation) rate-of-change.

D action must always be used with P action or PI action as PD or PID action.

What we call the derivative time (D) will be that time required with PD action, if a ramp input (constant rate-of-change input) is applied, for the output due to P action alone to become equal to that due to D action alone. The longer the derivative time, the stronger the derivative action.

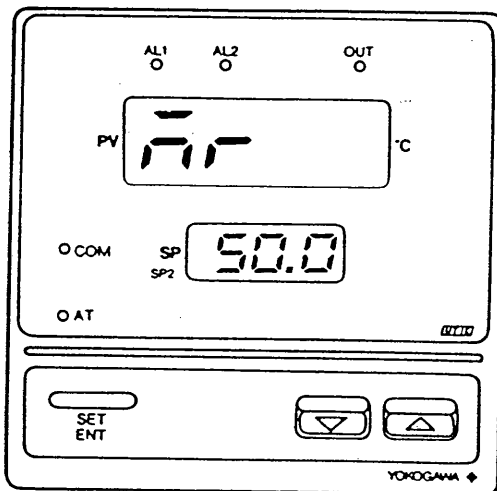


7. 7 Other Operating Parameter Setting Procedures

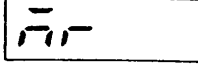
- The other operating parameters are as follows:
 - Manual reset value {MR}
 - Cycle time {CT}
 - On/Off control hysteresis {HYS}
 - Main set point {SP}
 - Sub set point {SP2}
 - Measurement input bias {BS}
- These parameters should be entered after displaying the setting display panel for the individual parameter as shown below. (Use the  key.)

The setting procedure is the same as steps ② and ③ in Section. 7. 1, "Alarm Value Setting Procedure" (p.22 and 23).

7. 7. 1 Manual Reset Value {MR}



Enter this parameter from the setting display panel at left.

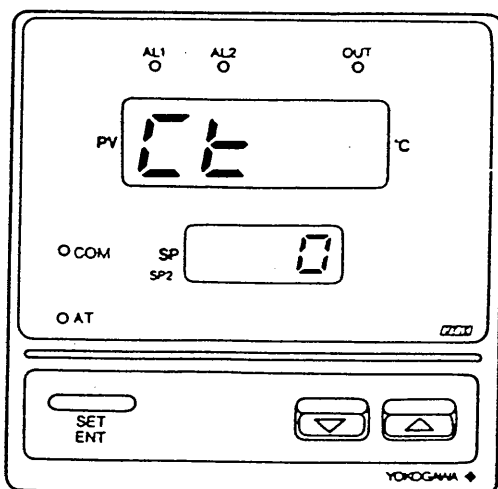
Verify that  (MR) is displayed.

The manual reset value setting panel is not displayed when on/off control is in effect.

○ What is Manual Reset Value {MR}?

With P action or PD action alone the deviation can never be made to be zero at all times. The residual deviation is called offset. Manual reset is the output when PV=SP in steady state. (Integral action is a function that performs this reset action automatically, it is referred to as automatic reset.)

7. 7. 2 Cycle Time [CT]



Enter this parameter from the setting display panel at left.

Verify that **CT** (CT) is displayed.

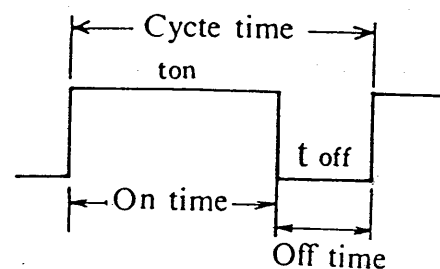
(The cycle time setting panel is displayed only for time-proportioning PID output.)

○ What is cycle Time [CT] ?

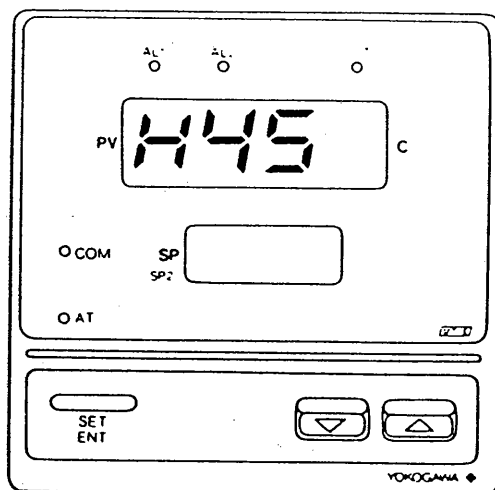
When time-proportioning PID output (relay output or voltage pulse output) is used, the PID computation result is output as the pulse width of an on/off signal.

The time proportion of this output in percent corresponds to the ratio of the ON time to the cycle time.

On time + Off time = Cycle time



7. 7. 3 On/Off Control Hysteresis [HYS]



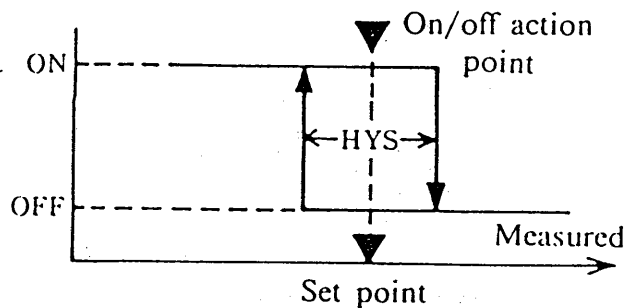
Enter this parameter from the setting display panel at left.

Verify that **HYS** (HYS) is displayed.

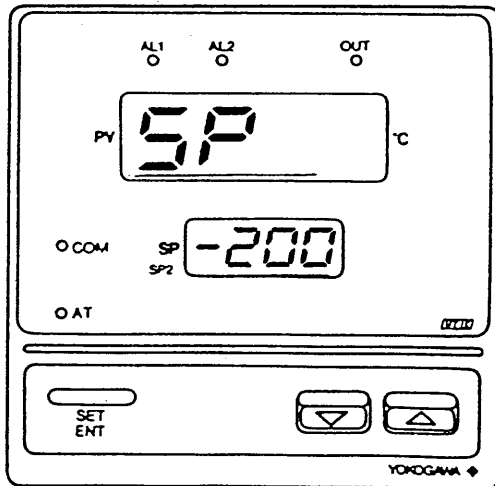
(The on/off control hysteresis setting panel is displayed only when on/off control is in effect.)

○ What is On/Off Control Hysteresis [HYS] ?

The on/off control hysteresis is a "gap" set as necessary around the on/off action point in order to prevent control output chattering.



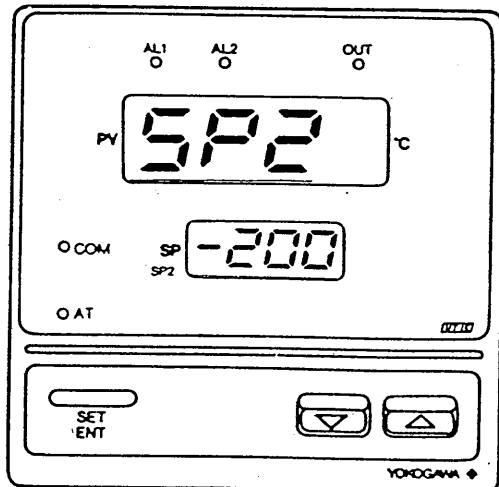
7. 7. 4 Main Set Point [SP]



Enter this parameter from the setting display panel at left.

Verify that SP (SP) is displayed.

7. 7. 5 Second Set Point [SP2]

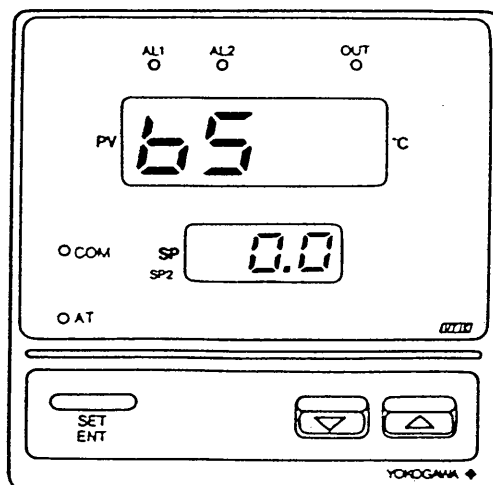


Enter this parameter from the setting panel at left. Verify that SP2 (SP2) is displayed.

Note 1: The SP and SP2 values set here can also be changed by the operating display panel operations described in Section 8, "Set Point Setting" (p.40).

Note 2: The UT15 and UT14 operate with the same PID constants regardless of whether SP or SP2 is being used as the set point. It can be expected that there will be cases where the PID constants obtained when auto tuning is performed using SP as the set point will not be optimum when operating with SP2 as the set point. In such cases we recommend that SP2 be used during preparatory operations (furnace dryout, etc.) prior to beginning main operation. Note that if the PID constants are obtained by auto tuning with respect to the SP2 (2nd set point value), the relationships between SP and SP2 will become the opposite of the above.

7. 7. 6 Measurement Input Bias (BS)



Enter this parameter from the setting display panel at left.

Verify that 65 (BS) is displayed.

○ What is Measurement Input Bias (BS)?

In cases such as where a difference has been observed between the temperature at the sensor location and the furnace internal temperature being controlled, that difference can be entered into the measurement input bias as a compensating value. This allows control and display to be performed using, as the measured input value, the actual measured-input value plus the measured-input bias.

$PV \text{ actual} + \text{Bias} = PV \text{ utilized}$

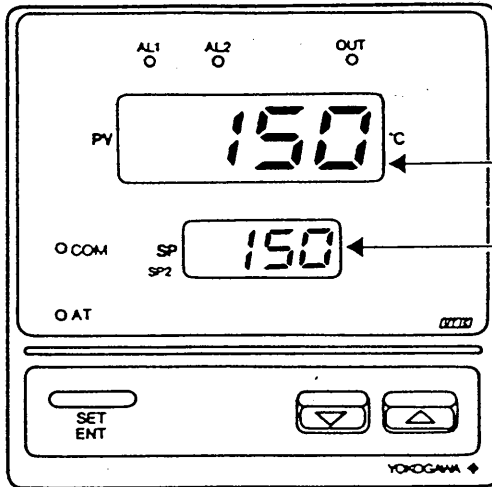
For example, in the following case we would set $BS = \underline{7}^{\circ}\text{C}$

- Furnace internal temperature (T1): 1000°C
- Measured temperature (T2) at sensor location: 993°C
- Range (full scale): -200 to 1200°C

(As this indicates, the entry can be input in the units in use at that time.)

8. SET POINT SETTING

①

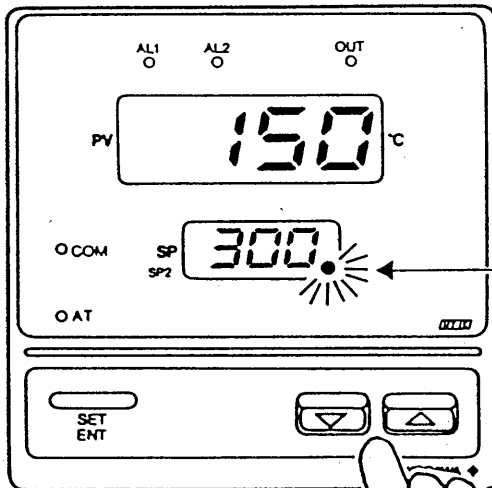




Verify that the instrument is in the operating display mode (measured-value display panel).

Measured-value display

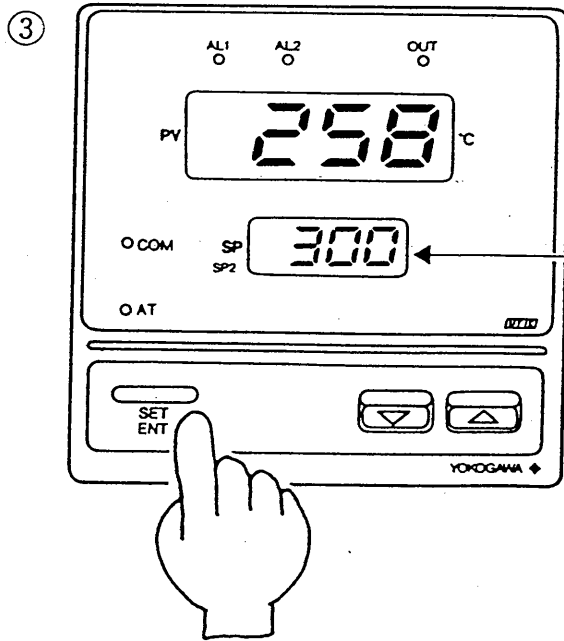
Set point display


②



Using the  and  keys, set the set point to the required value.

The decimal point in the setting value display area will begin flashing. If you return to the value in effect before changes were made, the decimal point will either light continuously or disappear (when integral number).





Press the  key.

Entry of the new set point is completed.

The decimal point either lights continuously or disappears. (when integral number)

Notes:

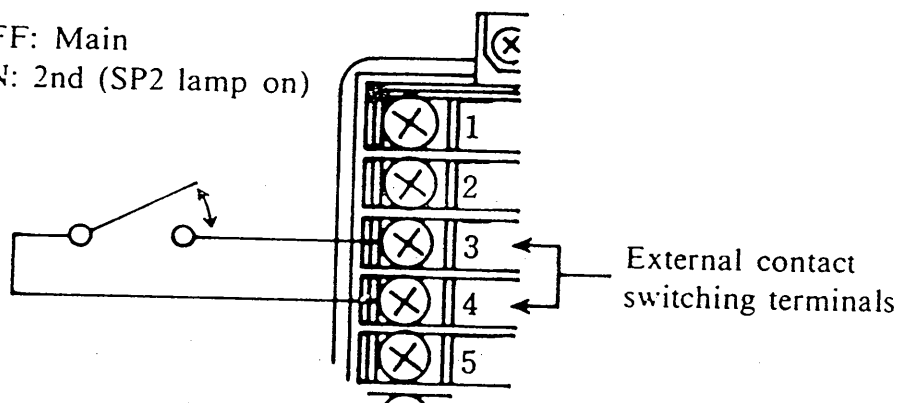
- 1) If at step ① the SP2 lamp is on, the set point setting will be for the second set point.
- 2) In step ③ be careful not to press the  key continuously for three seconds or more. (See Section 6.2, "Principles of Key Operations" (p. 18)).
- 3) If at step ③ the  key is not pressed and no key operations are performed for one minute or more, the instrument automatically returns to its state at step ① (and the instrument operates as it would if step ② had never been performed). Thus the set point is not changed.

9. OPERATION

- When you have completed the preparations described in Section 2, "Before Beginning Operations" (p.4) you can begin actual operation.
- The UT15 or UT14 will begin operating as soon as power is supplied. The instrument should be set so that the operating display is shown during actual operation. (See p.17).
- To change the set point during operation, follow the instructions on p. 40.
- To change operating parameters during operation, follow the instructions on p.20 through 39.
- Switching between the two set points "main" and "second" can be performed by opening and closing an external contact. (This switching cannot be done using the keys.)

External contact OFF: Main

External contact ON: 2nd (SP2 lamp on)



- If an "error display" should appear during operation, see p.46 for the action that should be taken.

□ When Power Is Lost During Operation

- i) Momentary power outages in which power is lost for less than 20 ms have no effect on UT15/UT14 operation (operation continues normally).
- ii)
 - When power is restored (after a power outage longer than 20 ms), the operation in effect immediately before power was lost is continued.
 - The control output value will restart from 0% (for a 4 to 20 mA output) or OFF (for a relay or voltage pulse output).
 - If a power outage occurs while auto tuning is in progress, auto tuning is cancelled.
 - For about two seconds after power is restored, the input range code and output type code are displayed in the measured value display area.
 - Even when power is lost, values such as set points, alarm values, PID constants, etc. that have already been entered are maintained.

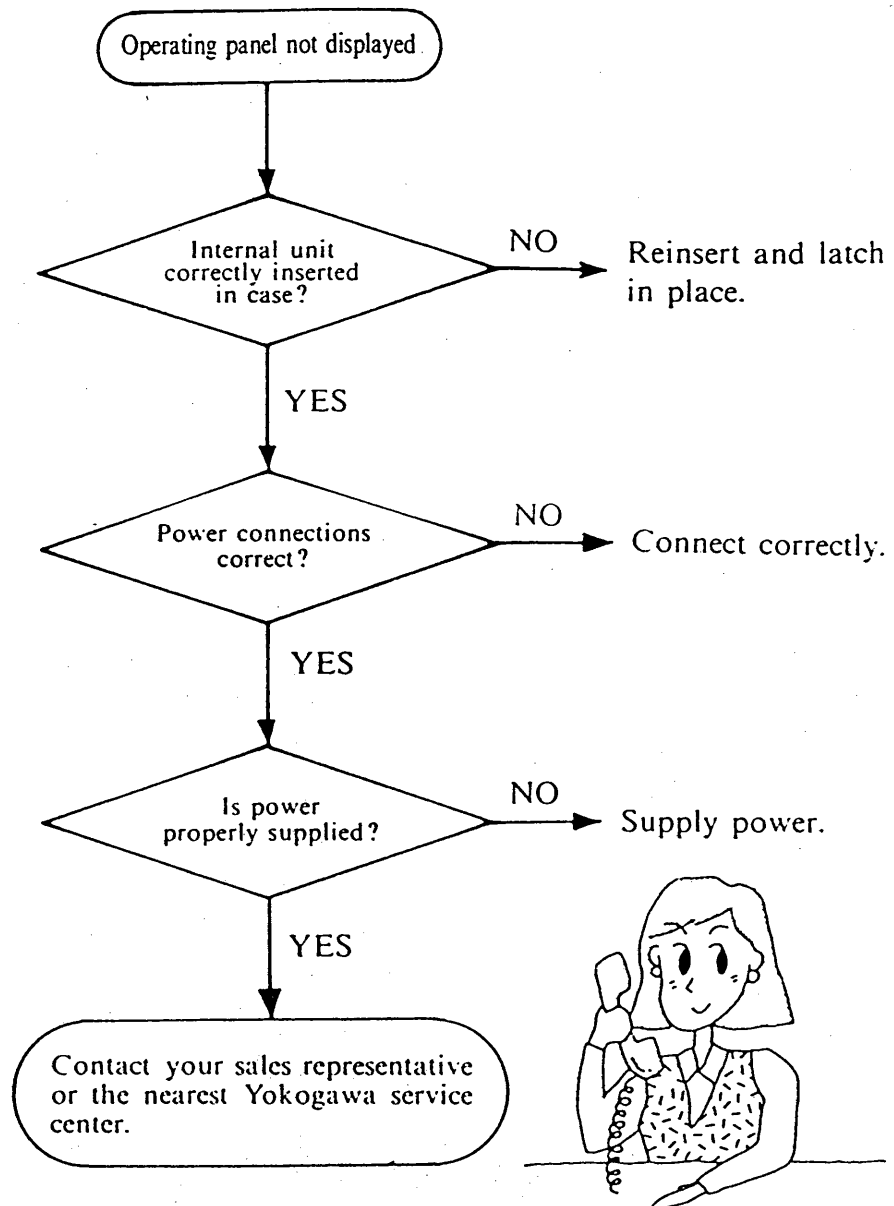
Note: However, if power is lost while a numeric value is being set using the keys, error code **E400** may be displayed in some cases. (See Section 10.3, "Error Display" (p.46))



10. MAINTENANCE

If the operating display panel is not displayed on the UT15 or UT14 when power is applied, take action according to the following flowchart. If you suspect a serious problem, contact your sales representative or the nearest Yokogawa service center.

Troubleshooting flowchart



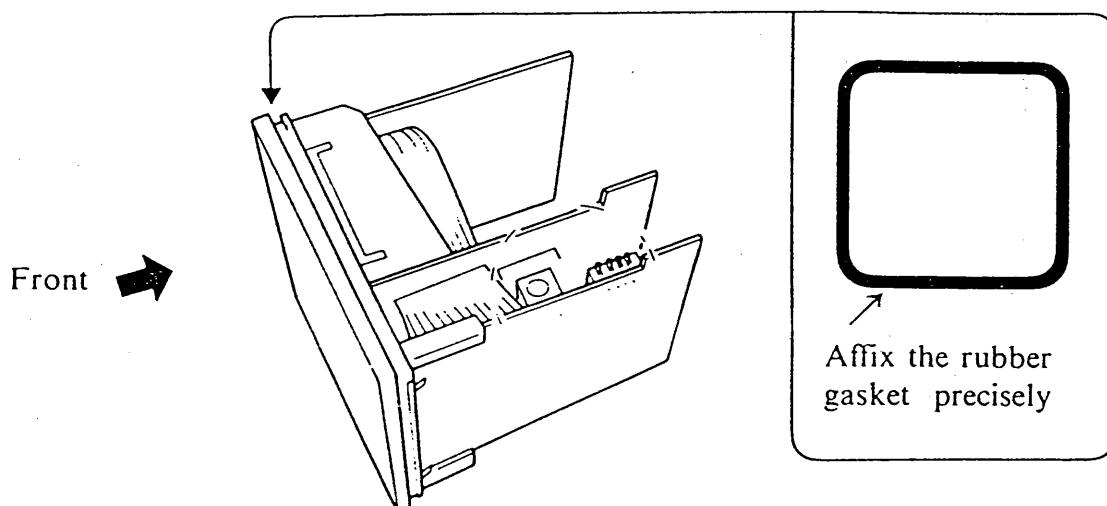
10. 1 Replacement of Rubber Gasket for Dustproofing

Although the life of the rubber gasket for dustproofing is at least five or six years under normal operating conditions, when it deteriorates it should be replaced.

The part number and sales unit of the rubber gasket are as follows. (Order from your UM05/UM04 sales representative.)

Type	Part number	Sales unit
UT15	B9877AJ	1 peace
UT14	B9877FJ	

Note: Turn the power OFF when removing the internal unit.



10. 2 Control Output Relay Replacement

If the control output relay deteriorates it should be replaced.

The UT15 and UT14 use DSP1-DC12V relays (Matsushita Electric).

They may be ordered from your YOKOGAWA SALES REPRESENTATIVE or MATSUSHITA ELECTRIC OFFICES.

10.3 Error Display

If any of the following are displayed, an error has been detected. Respond to these errors as indicated in the individual "action" entries.

Error display	Description of error	Output status	Action
E000 (E000)	RAM error	0% max. or OFF (relay)	Request repair
E001 (E001)	ROM error		
E002 (E002)	System data error		
E003 (E003)	Output rotary switch setting error	0% max. or OFF (relay)	Set the output rotary switch to the number corresponding to the required code, either 0, 1, or 2.
E300 (E300)	A/D converter error	(Note) 0% max. or OFF (relay)	Request repair
E400 (E400)	Parameter entry error	(Note) 0% max. or OFF (relay)	Check whether any parameters are incorrect, and reenter
Undefined display	Program failure	0% max. or OFF (relay)	Request repair

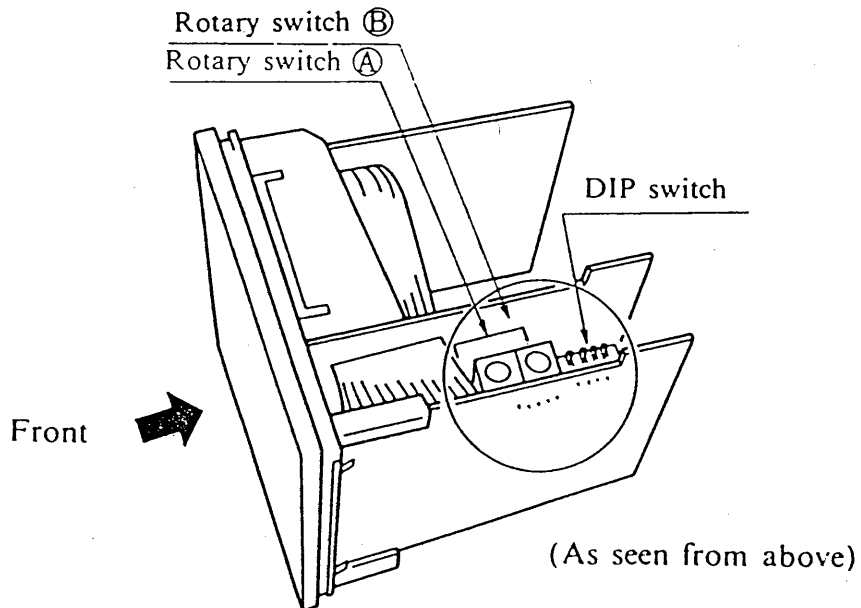
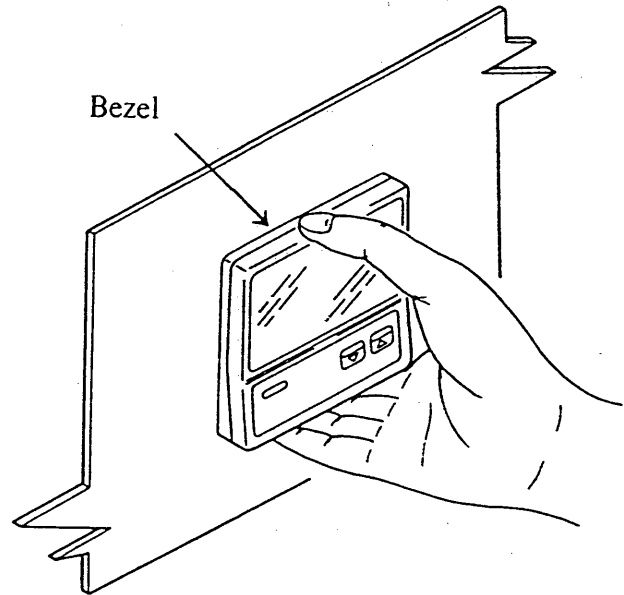
Error display	Description of error	Output status	Action
Measured-value (PV) decimal point flashing	Calibration data error	Operation continues with whatever inaccuracy has arisen	Request repair.
Measured value (PV) flashing	Non-volatile memory error		
\overline{RJC} (RJC) and measured value (PV) alternately displayed	Reference junction compensation error		
b.out (B. OUT)	Burnout (including RTD)	0% max. or OFF (relay)	Check thermocouple or RTD connections
obr (OVR)	Over-scale	Controller treats measured input value as 105% of input range, and continues control output	Check whether measurement input range is appropriate and whether sensor is Properly connected.
-obr (-OVR)	Under-scale	Controller treats measured input value as -5% of input range, and continues control output	

Appendix 1 Input/Output and Control Action Change Procedures

Follow the procedure below to remove and reinsert the internal unit.

- ① Remove power from the UT15/UT14 (turn power off).
- ② Pull out the internal unit.

While pressing up with your finger on the bezel stopper (latch), pull the entire bezel toward you, and remove the internal unit.



- ③ When changes to the input, output, and control actions have been completed, return the internal unit to the case, and apply power.

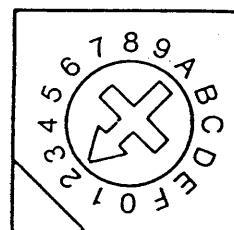
■ Measurement Input Range Code Change Procedure

The input range can be changed by setting the rotary switch **Ⓐ** arrow to the desired range code number using a screwdriver.
(Unless otherwise specified, the range code No. is "0" when shipped from the factory.)

Table 1. Input Range Codes

	Input type range / instrument range (note 1)		Input range code (note 2)	
Thermocouple	JIS	K	-200~1200°C	0
		K	-199.9~200.0°C	1
		S	0~1700°C	Note
		J	-199.9~800.0°C	2
		T	-199.9~400.0°C	3
		E	-199.9~800.0°C	4
		R	0~1700°C	5
		B	0~1800°C	6
		N	0~1300°C	7
		DIN	L	-199.9~800.0°C
U	-199.9~400.0°C		9	
RTD (note 3)	JPt100	-199.9~500.0°C	A	
	Pt100	-199.9~500.0°C	B	
mV, V, mA	0 to 10mV	Scaling is enabled in the following 4 ranges: -19999 to 9999 -199.9 to 999.9 -19.99 to 99.99 -1.999 to 9.999	C	
	0 to 100mV		D	
	0 to 5V		E	
	1 to 5V (Note 4)		F	

Note: Type of T.C. (K or S) can be selected when input range code is 1.
(See P.54)



Set the rotary switch **Ⓐ** arrow to the desired range code.
(Set for thermocouple type J in the example.)

Note 1: If instrument range "°F" is required.

See Appendix 3 **Set Up Parameters** (Page 58).

Note 2: Number is the same as that of the rotary switch setting position.

Note 3: JIS '89 JPt 100, JIS '89 Pt100/DIN

Note 4: 4 to 20 mA requires 250Ω 0.1% (accuracy) resistor between terminals **⑤** and **⑧**

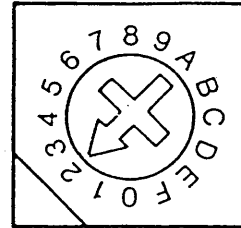
CAUTION: The parameters shown below are automatically initialized when input range code is changed.

Operating Parameters: A1, A2, HYS, SP, SP2, BS

Setup Parameters: HY1, HY2, PD, RH, RL, SP.UP, SP.DN

■ Control Output Type Code Change Procedures

The control output type code can be changed by using a screwdriver to set the rotary switch **Ⓑ** arrow to correspond with the desired control output type code No. (Unless otherwise specified, the control output type code No. is set at "0" when shipped from the factory.)



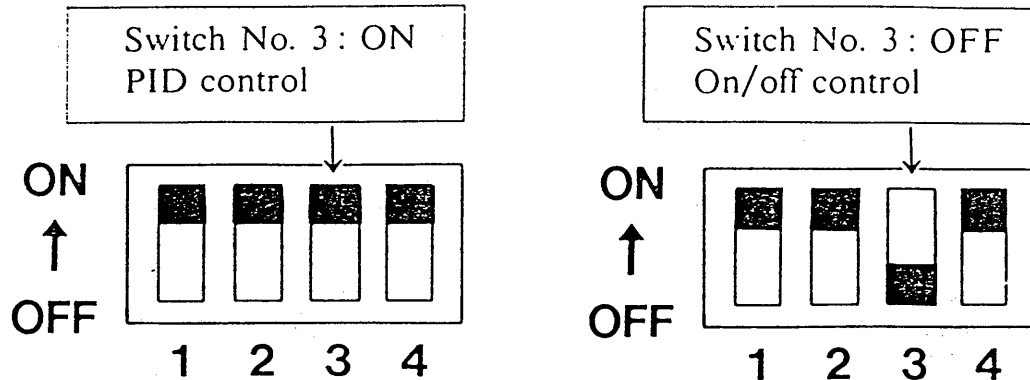
Set rotary switch **Ⓑ** to the desired control output type code No.
(In the example, the switch is set for continuous output PID.)

Control output type	Specifications	Control output type code
Relay output time-proportioning PID	Contact rating: 250 V AC, 3A (resistive load) Cycle time: 1 to 120 sec.	0
Voltage pulse output Time proportional PID	ON voltage: Approx. 15 V DC OFF voltage: 0.1 V DC max. Cycle time: 1 to 120 sec.	1
Continuous output PID	Output current 4 to 20 mA (resistive load 600 Ω max.) Accuracy $\pm 0.3\%$ (with respect to full scale) Output update interval: 500 ms	2

Note: There are only three control output type codes: 0, 1, 2 and If the rotary switch is not at position 0, 1, or 2, error "E003" is displayed.

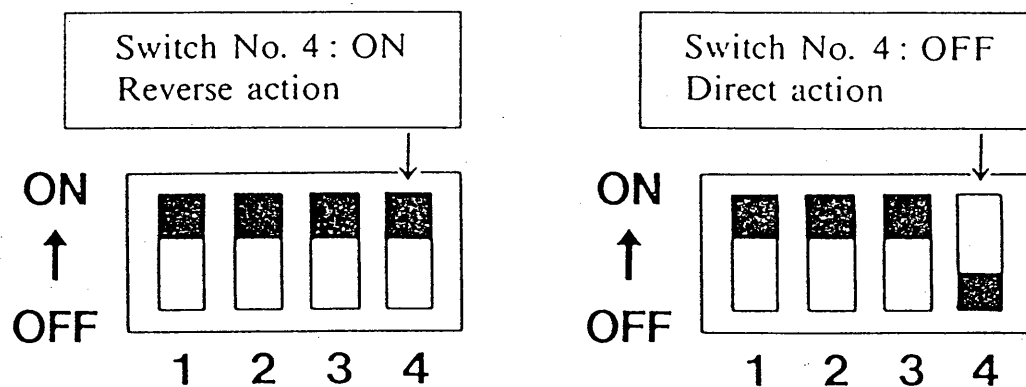
■ PID Control ↔ On/Off Control Change Procedure

UT15 or UT14 can be used as either a PID or an on/off controller, according to whether DIP switch No. 3 is ON or OFF. (DIP switch No. 3 is ON when shipped from the factory.)



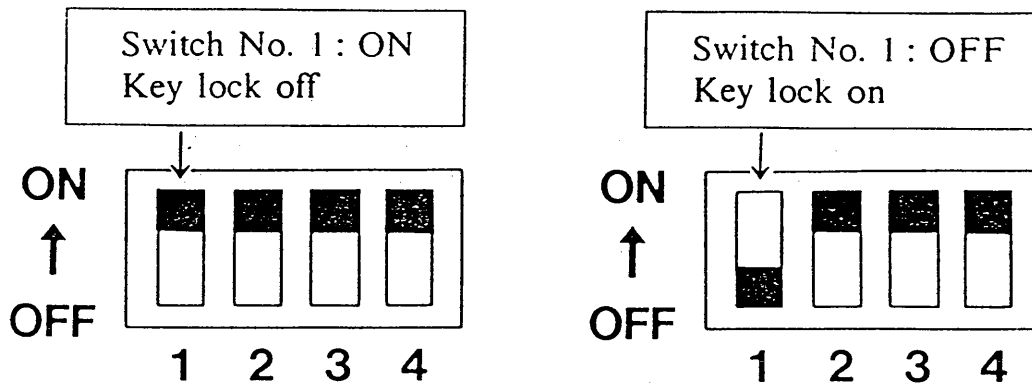
■ Direct Action ↔ Reverse Action Change Procedure

Either direct action or reverse action can be selected, according to whether DIP switch No. 4 is ON or OFF. (DIP switch No. 4 is ON when shipped from the factory.)



Appendix 2 Key Lock Setting Procedure

Setting DIP switch No. 1 to OFF turns on the key lock.
(The UT15/UT14 is shipped from the factory with the key lock disabled.)



Appendix 3 Set Up Parameters

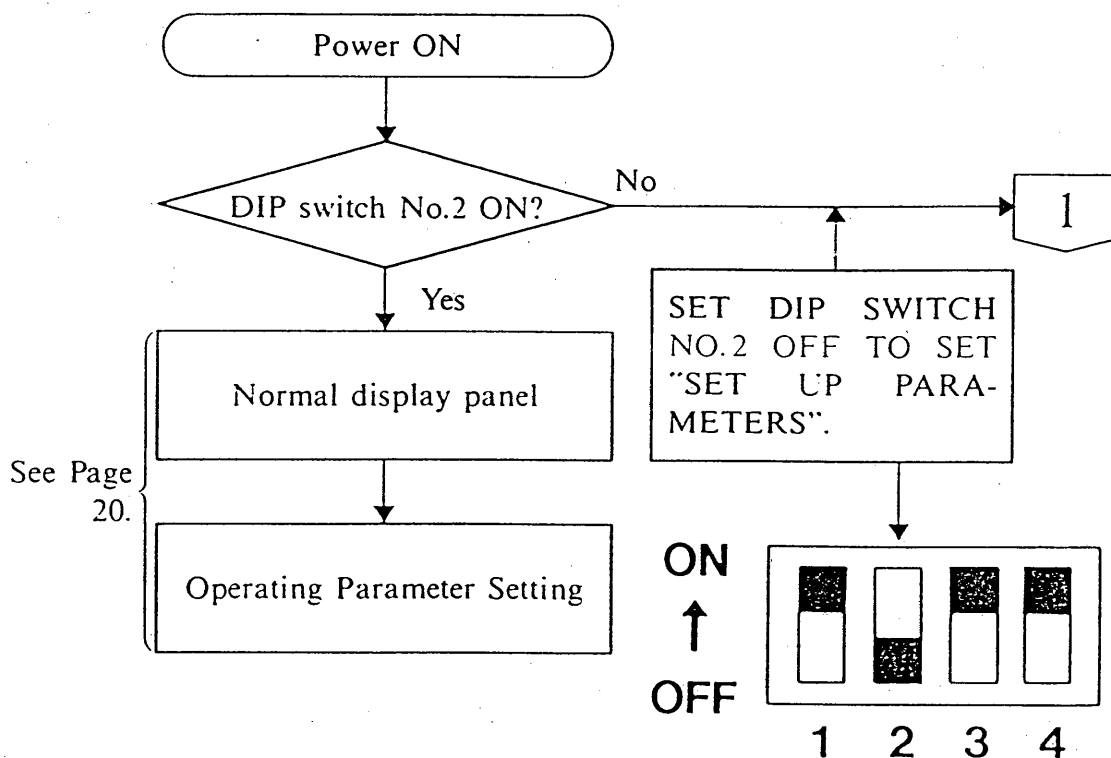
In addition to the operating parameters, the UT15/UT14 has various other parameters (these are referred to by the generic name "Set up parameters"). This appendix shows the way to set "Set up parameters".

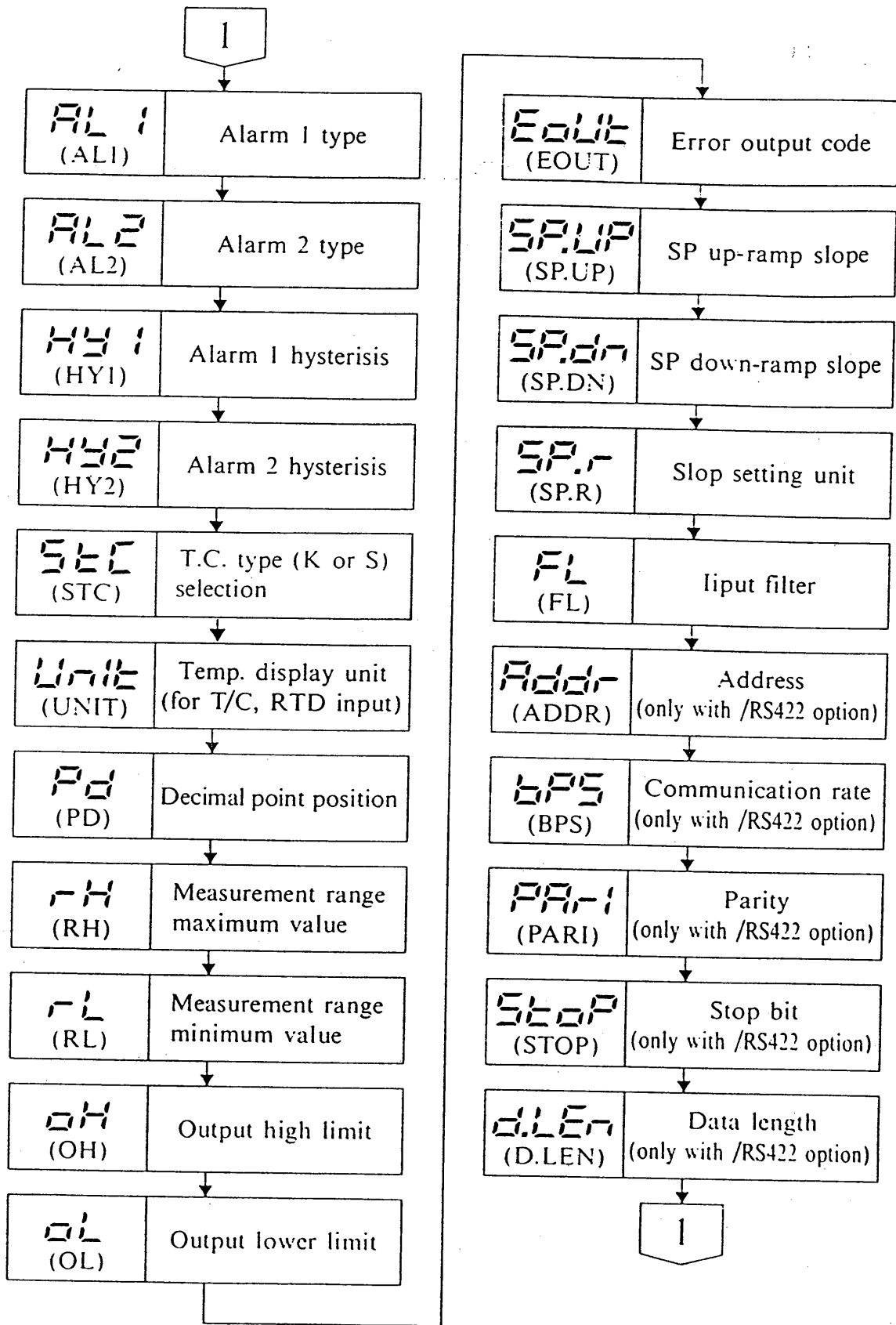
~~~~~ **Note** ~~~~~

Be careful, as the operation of the instrument may not conform exactly to the descriptions in this manual once these settings have been changed. (ex. °C → °F etc)

~~~~~

"Set up Parameter" Setting Flowchart





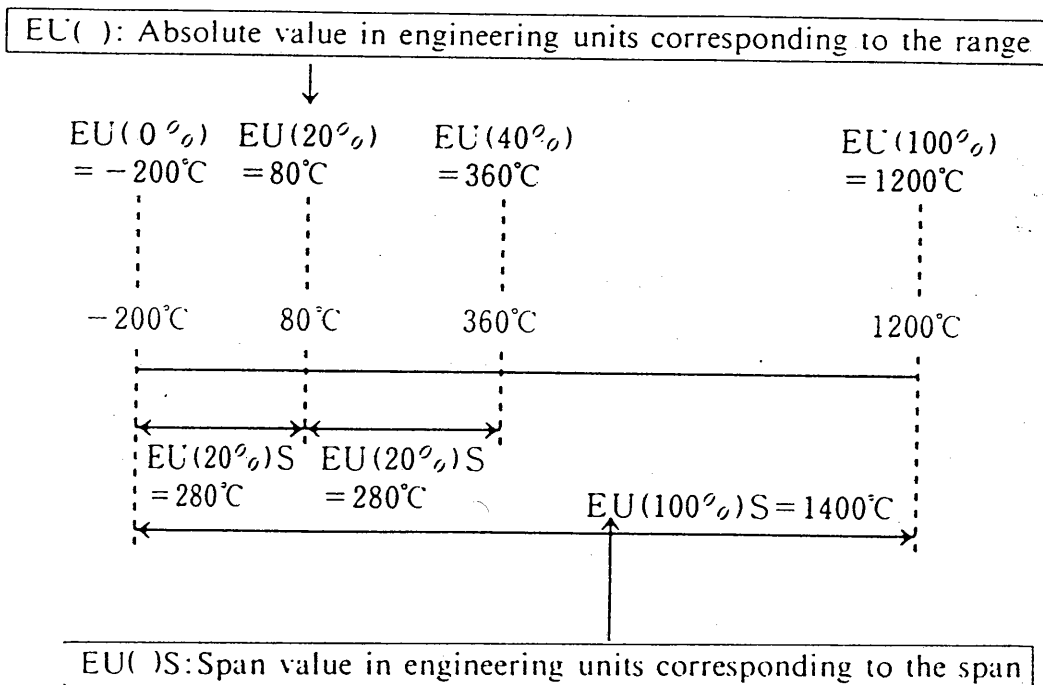
CAUTION: The parameters shown below are automatically initialized when the value of STC and/or UNIT is changed.

Operating Parameters: A1, A2, HYS, SP, SP2, BS

Setup Parameters: HY1, HY2, PD, RH, RL, SP.UP, SP.DN

- The UT15 and UT14 use certain symbols unique to these instruments to represent the parameter units. These symbols are described below.

The following illustrates EU() and EU()S (for a range of -200 to 1200°C)



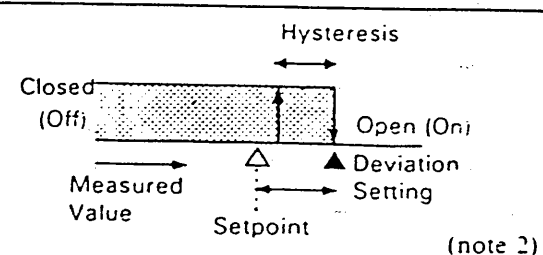
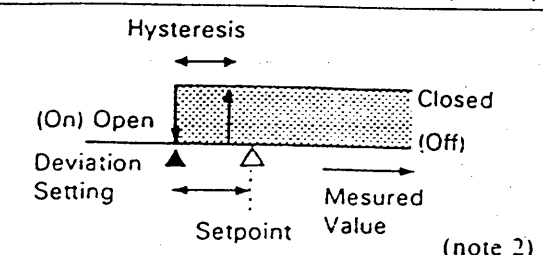
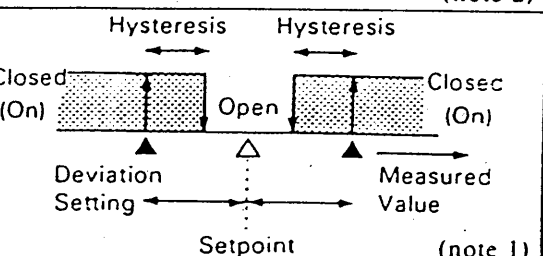
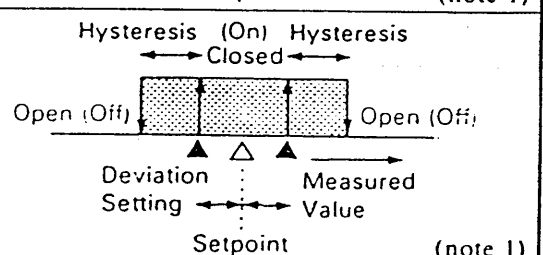
● SET UP PARAMETERS (AL1 and AL2)

Symbol	Description	Setting range	Value when shipped from factory	Customer's set value
AL1 (AL1)	Alarm 1 type	OFF, or 1~8, 11~18	1	
AL2 (AL2)	Alarm 2 type	OFF, or 1~8, 11~18	2	

See Table 1 for the relationship between alarm types and parameter codes.

Table 1

Code	Alarm type	Action
OFF	No alarm	No action
1	Measured value high limit alarm	<p>(note 1)</p>
11	Measured value high limit alarm with standby	
2	Measured value low limit alarm	<p>(note 1)</p>
12	Measured value low limit alarm with standby	
3	Deviation upper limit	<p>(note 1)</p>
13	Deviation upper limit with standby	
4	Deviation lower limit	<p>(note 1)</p>
14	Deviation lower limit with standby	

Code	Alarm type	Action
5	De-energized on deviation upper limit	
15	De-energized on deviation upper limit with standby	
6	De-energized on deviation lower limit	
16	De-energized on deviation lower limit with standby	
7	Deviation upper-lower limit	
17	Deviation upper-lower limit with standby	
8	Within upper-lower deviation limits	
18	Within upper-lower deviation limits with standby	

(Note 1) Contact closes when the alarm "ON".

(Note 2) Contact opens when the alarm "ON".

Note

When the standby operation is in effect, and any of the following conditions applies, no alarm is output even if a normal alarm condition is present, until the input (PV) has first entered into the normal condition.

- At power ON.
- Setpoint changed.
- Setpoint switched from "main" to "sub"

● SET UP PARAMETERS (HY1 and HY2)

See table 1 concerning the concept of hysteresis.

Symbol	Description	Setting range	Value when shipped from factory	Customer's set value
HY1 (HY1)	Alarm 1 hysteresis	EU(0.0%)S ~EU(100.0%)S	EU(0.5%)S	
HY2 (HY2)	Alarm 2 hysteresis	EU(0.0%)S ~EU(100.0%)S	EU(0.5%)S	

● SET UP PARAMETERS (STC)

Displays when input range code is "1"

Symbol	Description	Setting range	Value when shipped from factory	Customer's set value
STC (STC)	T.C. type (K or S) selection	0 or 1 (type K) (type S)	0	

CAUTION: Some parameters are automatically initialized when the value of STC is changed. (See Page 55)

● SET UP PARAMETERS (UNIT)


Symbol	Description	Setting range	Value when shipped from factory	Customer's set value
Unit (UNIT)	Temp. Display unit	°C or °F	°C	

The instrument range for thermocouple and RTD can be specified as °C or °F, according to the following table.

CAUTION: Some parameters are automatically initialized when the value of UNIT is changed. (See Page 55)



			°C	°F
Thermo couple	JIS	K	-200~1200°C	-300~2300°F
		K	-199.9~200.0°C	-300~400°F
		S	0~1700°C	0~3100°F
		J	-199.9~800.0°C	-300~1500°F
		T	-199.9~400.0°C	-300~750°F
		E	-199.9~800.0°C	-300~1500°F
		R	0~1700°C	0~3100°F
		B	0~1800°C	0~3300°F
		N	0~1300°C	32~2400°F
	DIN	L	-199.9~800.0°C	-300~1500°F
	U	-199.9~400.0°C	-300~750°F	
RTD	JPt100	-199.9~500.0°C	-199.9~999.9°F	
	Pt100	-199.9~500.0°C	-199.9~999.9°F	

● SET UP PARAMETERS (PD)

Symbol	Description	Setting range	Value when shipped from factory	Customer's set value
 (PD)	Decimal point position	0, 1, 2 or 3	1	

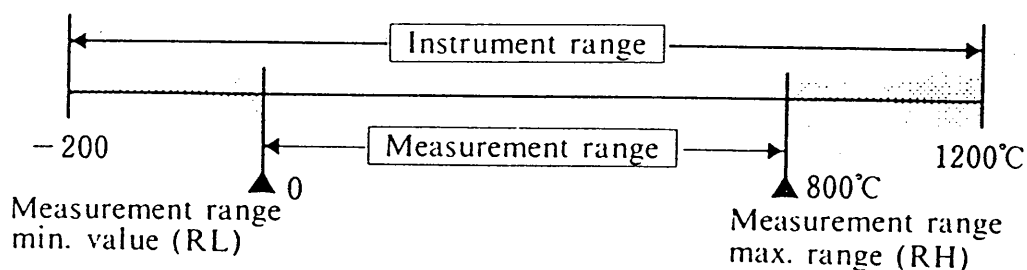
0: No digit below decimal point 3: 3 digit below decimal point
 1: 1 digit below decimal point (can be selected for DC voltage input)
 2: 2 digit below decimal point

● SET UP PARAMETERS (RH, RL)

Symbol	Description	Setting range	Value when shipped from factory	Customer's set value
 (RH)	Measurement range max. value	EU(0.0%) ~EU(100.0%)	EU(100.0%)	
 (RL)	Measurement range min. value	EU(0.0%) ~EU(100.0%)	EU(0.0%)	

Measurement Range Change (Using RH, RL)

The measurement range can be changed by entering a new measurement range max. value or min. value.



Scaling (Using PD, RH and RL)

In the case of DC voltage input, a conversion to actual scale and decimal point position can be specified. (In the following example, a 1 to 5 V DC input is scaled to 0.0 to 800.0.)

(Example)

Input voltage	1	2	3	4	5 VDC
Measurement range after scaling	0.0	200.0	400.0	600.0	800.0
Value before scaling	0.0	25.0	50.0	75.0	100.0

● SETUP PARAMETERS (OH, OL)

Symbol	Description	Setting range	Value when shipped from factory	Customer's set value
OH (OH)	Output high limit	-4.9 to 105.0% of output	100.0% of output	
OL (OL)	Output lower limit	-5.0 to 104.9% of output	0.0% of output	

Note : Can not be set for relay or voltage pulse output ON-OFF control.

Specify when restrictions are to be placed on the output value. The operating range of the restricted output is limited to the range between the output lower limit (OL) and the high limit (OH).

● SETUP PARAMETERS (EOUT)

Symbol	Description	Setting range	Value when shipped from factory	Customer's set value
EOUT (EOUT)	Error output code	0 or 1	0	

0 : Output on error → OFF or 0%

1 : Output on error → ON or 100%

Errors are followings

- T/C, RTD burnout
- A/D converter error
- Setting data error

● SET UP PARAMETERS (SP. UP, SP. DN and SP. R)

Symbol	Description	Setting range	Value when shipped from factory	Customer's set value
SP. UP (SP. UP)	SP up-ramp slope	OFF, or EU(0%)/min. or hr. ~ EU(100%)/min. or hr.	OFF	
SP. DN (SP. DN)	SP down-ramp slope	OFF, or EU(0%)/min. or hr. ~ EU(100%)/min. or hr.	OFF	
SP. R (SP. R)	Slop setting unit	0 : °C/hr. or 1 : °C/min.	0	

- When you do not want the setpoint (SP) to change suddenly, or when you want it to change with a constant slope, {SP. UP} and {SP. DN} set the slope values to increase or decrease.

This feature functions in the following three situations :

- When the setpoint is changed.
- When the setpoint is switched between (main) and (sub.:2nd).
- When power is turned ON (or when it is restored after a power outage).

When power is turned ON, or is restored, the value goes from the current measured-value to the setpoint, and the effective setpoint (SP) changes according to the slope that has been specified.

- The slope setting units for both up-ramp {SP. UP} and down-ramp {SP. DN} can be specified as either "/hr." or as "/min.". When shipped from the factory, "/hr." is selected.

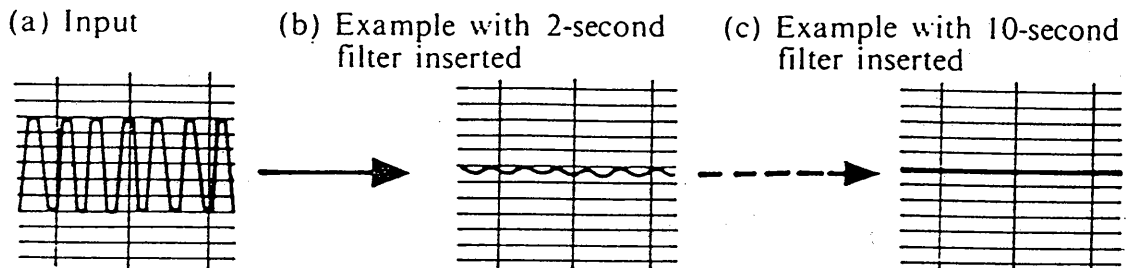
Note: The amount of increase or decrease in the setpoint for each output update period is truncated to a certain resolution. Therefore, if the range is broad and a very gradual slope has been specified, a slight disparity may arise in the setpoint {SP} after a long time has elapsed.

● SET UP PARAMETERS (FL)

Symbol	Description	Setting range	Value when shipped from factory	Customer's set value
<i>FL</i> (FL)	Input filter	OFF (no filter), or 1 to 120 seconds	OFF	

Use when there is a high level of noise in the measurement input, and the display value fluctuates.

The filter is a first-order lag type low-pass filter, the larger the time constant, the greater the noise rejection capability.



● SET UP PARAMETERS (ADDR to D.LEN)

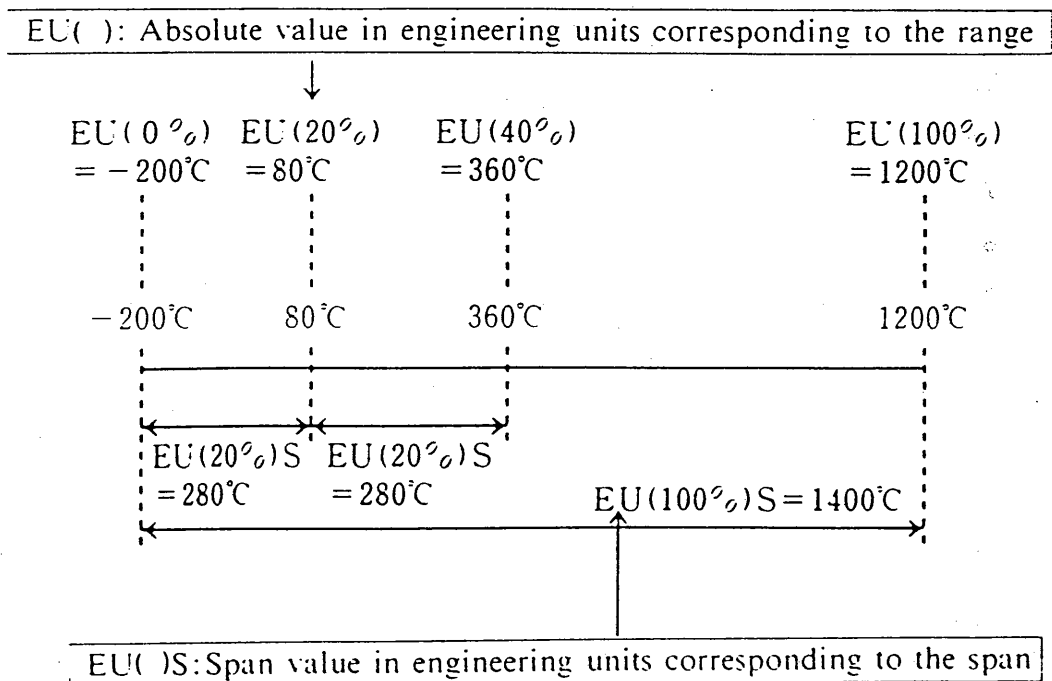
Displayed only if /RS422 is specified as an option suffix code.
See IM 5B4A7-50E concerning communications.

Symbol	Description	Setting range	Value when shipped from factory	Customer's set value
<i>Addr</i> (ADDR)	Communication address	1 to 16	1	
<i>bPS</i> (BPS)	Communication rate	0 to 6	6 (9600 BPS)	
<i>PAR-1</i> (PARI)	Parity bit	0, 1 or 2	0 (no parity)	
<i>STOP</i> (STOP)	Stop bit	1 or 2	1 (1 bit)	
<i>dLEn</i> (D.LEN)	Data length	7 or 8	8 (8 bit)	

Appendix 4 Parameters (Including Set Points) Summary

- Refer to the tables at right when performing individual settings according to Section 7. "Operating Parameter Setting", and Section 8. "Set point Setting".
- The UT15 and UT14 use certain symbols unique to these instruments to represent the parameter units. These symbols are described below.

The following illustrates EU() and EU()S (for a range of -200 to 1200°C)



Parameters (set points and operating parameters) summary

Set point value	Symbol	Description	Setting range	Value when shipped from factory	Customer's setting
	SP (SP)	Set point value *	EU (0%) ~EU (100%)	EU (0%)	

↑ Entered from operating display

Parameters	A1 (A1)	Alarm 1 (measurement high limit alarm setting)	Note EU (0%) ~EU (100%)	EU(100%)	
	A2 (A2)	Alarm 2 (measurement low limit alarm setting)	Note EU (0%) ~EU (100%)	EU (0%)	
	SC (SC)	"Super" function ON/OFF	ON or OFF	OFF	
	AT (AT)	Auto tuning ON/OFF	ON or OFF	OFF	
	P (P)	Proportional band	0.1% ~300.0%	5.0%	
	I (I)	Integral time	OFF, or 1 sec. to 3600 sec.	240 sec.	

* The set point entered (changed) from the operating panel may be either the main (SP) or 2nd (SP2) set point, whichever is display is accompanied by

Note: Setting range of "deviation alarm (See P.56. 57) is -100 to 100% of instrument range span.

Symbol	Description	Setting range	Value when shipped from factory	Customer's setting
\overline{d} (D)	Derivative time	OFF, or 1 sec. to 3600 sec.	60 sec.	
\overline{r} (MR)	Manual reset value	-5.0% ~105.0%	50.0%	
\overline{t} (CT)	Cycle time	1 sec. to 120 sec.	10 sec.	
↑ Can be set only for time-proportioning PID output.				
\overline{HYS} (HYS)	On/off control hysteresis	EU(0.0%)S ~EU(100.0%)S	EU(0.5%)S	
↑ Can be set only for on/off control.				
\overline{SP} (SP)	Main set point *	EU (0%) ~EU (100%)	EU(0%)	
$\overline{SP2}$ (SP2)	Second set point *	EU (0%) ~EU (100%)	EU(0%)	
\overline{BS} (BS)	Measurement input bias	EU(-100.0%)S ~EU(100.0%)S	EU(0.0%)S	

* a change in the value of SP or SP2 (whichever is in use at that time) in the operating.

MEMO

MEMO

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