

# General Specifications

## Model UT37 Digital Indicating Controller

### OUTLINE

The UT37 digital indicating controller features universal input, output and power, and high accuracy ( $\pm 0.1\%$ ). A single instrument can accept thermocouples, RTDs, or DC voltage. Its control output can be ON-OFF control, relay time proportional PID, voltage pulse time proportional PID, 4 to 20 mA continuous PID, selectable by the user using rotary switches.

UT37 allows 20 types of alarm functions to be independently set to alarms 1 and 2 and offers selection of a time-based relay output function (timer function: for alarm 1 only).

In addition, the instrument has an auto-tuning function and also an overshoot suppressing function "SUPER" as standard.

Available options include analog retransmission (4 to 20 mA) function of process variables, RS-422A communications function, remote setting input, an internal transmitter power supply, and additional two alarm outputs.



### DISPLAY

Process variable (PV) display ①	4-digit (red), 7-segment LED (Parameter symbol and error code are also displayed.)
Display range	For thermocouple and RTD input: -5 to 105% of instrument range (See Table 1 on p. 2.) For DC voltage: -5.0 to 105.0
Display content indicator ②	3-digit (red), 7-segment LED
Setpoint (SP) display ③	4-digit (red), 7-segment LED (Setpoints, output values, or parameters are displayed.)
Display resolution	Same as the instrument range resolution For 9999 type.....1 For 999.9 type.....0.1

● The process variable display shows the input range code and output type code for approx. 2 sec after turning the power ON.

● Numbers ①, ②, and ③ in the table indicate the locations in the display unit. (See Note 1 on p.6.)

#### Alarm indication lamps: 2 (red)

AL1: Lights if alarm 1 is generated.  
AL2: Lights if alarm 2 is generated.

#### Status indication lamps: 4 (green)

REM: Lights during remote operation.  
STP: Lights when operation stops.  
MAN: Lights during MAN (manual) operation.  
AT: Flashes during auto-tuning.

#### Deviation monitor: 1 set ( $\wedge$ and $\vee$ : orange, $\equiv$ : green)

- $\wedge$  or  $\vee$  (orange) lights if deviation display range (DVB)\* exceeds  $\pm 1.0\%$  of F.S.
  - $\equiv$  (green) lights when deviation display range (DVB)\* is within  $\pm 1.0$  of F.S.
- \* Settable by Setup parameter.

### SETTING

Setting keys (4)	Up key: Increases a set value. Each digit increases automatically. Down key: Decreases a set value. Each digit decreases automatically. A negative value can also be set. Set/Enter key: Used to select a parameter or change a set value. Selects AUTO (automatic) or MAN (manual) mode.
Setpoint resolution	Same as the Up or Down key increases (See Table 1 on p.2.)

- Holding down the Up or Down key increases the rate at which the numbers advance/reverse.
- Key-lock (function of preventing a parameter from change) is available by setting a set-up parameter. This disables key operation.

## INPUT

### Universal Measured Input

#### ● Input Type/Instrument Range Selection

Changing internal DIP switch Ⓑ (No.1), internal rotary switch A (Figure 1), and terminal connection allows the instrument to select the desired type and instrument range from among those listed in Table 1.

#### ● Measured input bias

Desired correction can be made on measured input.

Variable bias range	-100.0 to 100.0% of instrument range width
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#### ● Measured input filter

A first-order lag filter is available to eliminate noise contained in input.

Filter setting range	OFF or 1 to 120 sec (time constant) (OFF: non-filtering status)
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#### ● Burnout (action at thermocouple/RTD input break)

If burnout

- The process variable display shows b.o.u.t.
- Control output is less than 0% (or OFF).
- When the measured value upper limit alarm is set, alarm is generated (lamp: lit, relay output: ON).

#### ● Other input specifications

Input sampling period	200 ms
Input resistance	TC.....1 MΩ or more DC voltage.....Approx. 1 MΩ
Allowable signal source resistance	TC.....250 Ω or less DC voltage.....2 kΩ or less
Allowable wiring resistance	RTD.....10 Ω or less/wire (Provided that there are no variations between three wires.)
Allowable input voltage	TC.....Within ±10V DC voltage.....Within ±10V
Noise rejection ratio	Normal mode.....40 dB (50/60 Hz) or more Common mode.....120 dB (50/60 Hz) or more
Applicable standard	TC.....IEC/DIN (L and U)/JIS RTD.....IEC/DIN/JIS '89 JPt100, Pt100

Table 1 Input Range Code

Input type and instrument range				DIP switch No. 1 (Note 1)	Input range code (Note 2)
TC	JIS	K	-200~1200°C	-300~2300°F	0
		K	-199.9~999.9°C	0~2300°F	1
		K	-199.9~500.0°C	-199.9~999.9°F	2
		J	-199.9~800.0°C	-300~1500°F	3
		T	-199.9~400.0°C	-199.9~750.0°F	4
		T	0.0~400.0°C	-300~750°F	5
		T	-199.9~200.0°C	-199.9~400.0°F	6
		B	0~1800°C	32~3300°F	7
		S	0~1700°C	32~3100°F	8
		R	0~1700°C	32~3100°F	9
		N	0~1300°C	32~2400°F	A
		W	0~2300°C	32~4200°F	B
		E	-199.9~800.0°C	-300~1500°F	C
		L	-199.9~800.0°C	-300~1500°F	D
		U	-199.9~400.0°C	-300~750°F	E
		U	0.0~400.0°C	-199.9~750.0°F	F
RTD (Note 3)	JPt100		-199.9~500.0°C	-199.9~999.9°F	0
			0.0~200.0°C	32.0~400.0°F	1
			0.0~100.0°C	32.0~200.0°F	2
			-100.0~100.0°C	-199.9~200.0°F	3
	Pt100		-199.9~640.0°C	-300~1180°F	4
			-199.9~500.0°C	-199.9~999.9°F	5
			0.0~200.0°C	32.0~400.0°F	6
			0.0~100.0°C	32.0~200.0°F	7
			-100.0~100.0°C	-199.9~200.0°F	8
					9
DC Voltage		-10~10mV	Scaling is available within the following four ranges. -1999~9999 -199.9~999.9 -19.99~99.99 -1.999~9.999		A
		0~10mV			B
		0~100mV			C
		0~1V			D
		0~5V			E
		1~5V			F
		0~10V			

Note 1: Set the bits of DIP switch Ⓑ (No.1) to either ON or OFF.

Note 2: Same as rotary switch A setting position number.

Note 3: JIS '89 JPt100, JIS '89 Pt100/DIN

## REMOTE SETPOINT INPUT

(Option: /RSP is added to the model.)

Input Signal	1 ~ 5 VDC
Receiving Resistance	approx. 1 MΩ
Indicating Accuracy	±0.3% of F.S. ±1 digit

- The Remote setpoint circuit and measuring input circuit are isolated in the controller.
- Remote to Local mode transfer:  
Bumpless tracking (remote setpoint unchanged) or without tracking (transfer to preset local setpoint).

- This "Remote Setpoint Input (/RSP)" has functions of "Setting Ratio and Bias".  
Ratio setting range: 0.000 to 9.999  
Bias setting range: EU (-100%)S~EU(100%)S
- This "Remote Setpoint Input (/RSP)" has function of external switching of Remote/Local mode.  
Remote contact capacity:  
12V DC or more, 10 mA DC or more.

## OUTPUT

### Universal Control Output

#### ● Output selection

Use of internal dip switch (Figure 1) and changing terminal connection allows selection of any desired output in Table 2.

### Retransmission Output

(Option:  $\overline{\text{RET}}$  is added to the model.)

- One of measured value, setpoint, and control output is output as analog current signal. (Measured values and setpoints can be scaled.)

Output signal	4 to 20 mA DC
Allowable load resistance	600 $\Omega$ or less
Accuracy	$\pm 0.3\%$ (of output span)

Table 2 Output Type Code

Control output type	Specifications	DIP switch
Time-proportional PID (relay) output	Contact rating: 250V AC, 3A (resistive load) Cycle time: 1 to 240 sec (selectable)	ON 1 OFF 2 3 4 5 6
Time-proportional PID (voltage pulse) output	ON voltage: Approx. 12V DC or more OFF voltage: 0.1V DC or less (load resistance: 600 $\Omega$ or more) Cycle time: 1 to 240 sec (selectable)	ON 1 OFF 2 3 4 5 6
Continuous PID output	Output current: 4 to 20mA DC (Load resistance: 600 $\Omega$ or less) Accuracy: $\pm 0.3\%$ (of output span) Output update period: 200ms	ON 1 OFF 2 3 4 5 6
ON/OFF relay output	Contact rating: 250V AC, 3A (resistive load) Output update period: 200ms	ON 1 OFF 2 3 4 5 6

## CONTROL

### Setpoints

- Four setpoints (max.) are available.
- SP, 2. SP, 3. SP or 4. SP is selected using an external volt-free contact.

External contact	EX1 [10-11], EX2 [9-11]
Contact capacity	12 V DC or more, 10 mA or more

#### ● Setting

Variable setpoint range	EU (0%) to EU (100%) (Minimum value to maximum value of instrument range)
Setting resolution	Same as the instrument range resolution

### Automatic Tuning

Provided as standard. When activated, auto-tuning automatically sets PID constants (limit cycle method).

### Overshoot Suppressing Function "SUPER"

Provided as standard. SUPER ON/OFF is available by setting parameter.

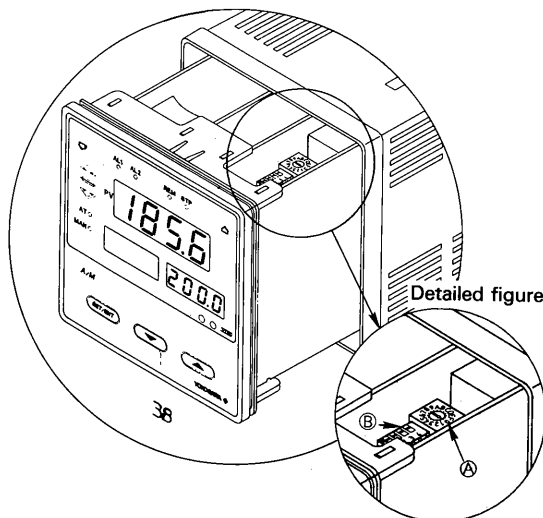
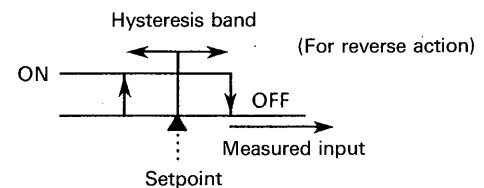


Figure 1 Rotary Switches A and DIP Switch B

### PID constants

Proportional band (P)	0.1 to 999.9%
Integral time (I)	OFF, 1 to 6000 sec
Derivative time (D)	OFF, 1 to 6000 sec

- Change to ON/OFF control is available using internal rotary switch B. In ON/OFF control, the ON/OFF control hysteresis band is settable.



ON/OFF control hysteresis band	EU (0.0%) S to EU (100.0%) S 0 to 100% of instrument range width
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- If integral time is set to OFF, manual reset is also available as a control parameter.

Manual reset	-5.0 to 105.0% (of output)
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#### ● Direct/reverse action change

Change to direct/reverse action can be accomplished using setup parameters. At factory shipment, reverse action is selected.

#### ● AUTO/MAN selection

Balance-less, bump-less switching is available.

### Control Auxiliary Constant

Cycle time	1 to 240 sec
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### Output Update Cycle

Update cycle	200 ms	
Resolution	Relay output time proportional PID	10 ms
	Voltage pulse output time proportional PID	
	Continuous output PID	0.05% (of output)

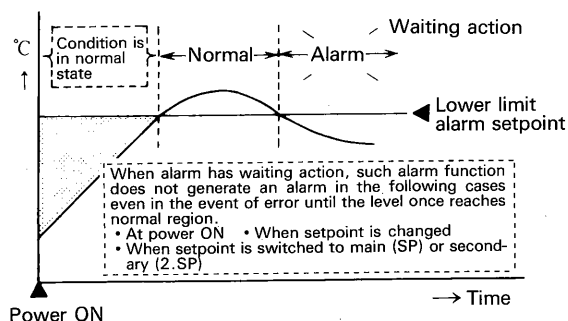
## ALARM

- **Number of alarms:** 2 (standard) + 2 (option: /ALM4)
- **Indication lamp:** LED (red)  
No LED for AL3 and AL4
- **Output type:** Relay output (AL1, AL2)  
Open Collector output (AL3, AL4)

Relay contact capacity	250 V DC, 1 A (resistive load)
Open collector contact capacity	250 V DC or less, 50 mA or less

- Alarms 1 and 2 can be independently set using an alarm type code in Table 3 to determine their alarm type. When OFF is set, the relevant alarm does not function.
- Alarms with alarm type codes 1 to 10 in Table 3 have no waiting action; alarms with alarm type code 11 to 20 have waiting action.
- Alarm operation with waiting action is as shown below.

(Example of measured-value lower limit with waiting action)



- Alarm 3 can be used as Self-diagnostics output (Input burn-out, A/D converter error and RJC error).
- Alarm 4 can be used as Fail output (Program over-run, ROM error and RAM error).
- Both Alarm 3 and Alarm 4 cannot be set to "OFF".

Table 3

Alarm type	Alarm action ("Open/Closed" shows relay contact state; (Light)/(Flash) indicates lamp state.)	Alarm type code	
No alarm		OFF	
Measured value upper limit		1	11
Measured value lower limit		2	
Deviation upper limit		3	13
Deviation lower limit		4	
De-energizing if deviation upper limit alarm occurs		5	15
De-energizing if deviation lower limit alarm occurs		6	
Deviation upper and lower limits		7	17
Within upper or lower limit deviation		8	
Measured value upper limit de-energizing		9	19
Measured value lower limit de-energizing		10	

## Timer Function

[The timer function sets alarm-1 relay output to ON when preset time (timer set time) is elapsed after a measured value has reached to the setpoint and its hysteresis band.]

- The timer function is available only on alarm 1.
- The relationship between codes and timer type functions are as follows:

Code	Detecting direction	Time unit
21	Upward	Hours and minutes
22	Upward	Minutes and seconds
23	Downward	Hours and minutes
24	Downward	Minutes and seconds

Alarm 1 allows setting of codes 21 to 24 in addition to alarm type codes 1 to 20 in Table 3.

- The action of upward detecting direction is as shown in Figure 2; that of downward detecting direction is as shown in Figure 3.

**Note:** Timer function is not available for 2.SP.

Note: Timer start counting when PV (measured value) reach the final target setpoint in case "SP up/down-ramp slope" function is used.

## ALARM

Figure 2 Upward Action

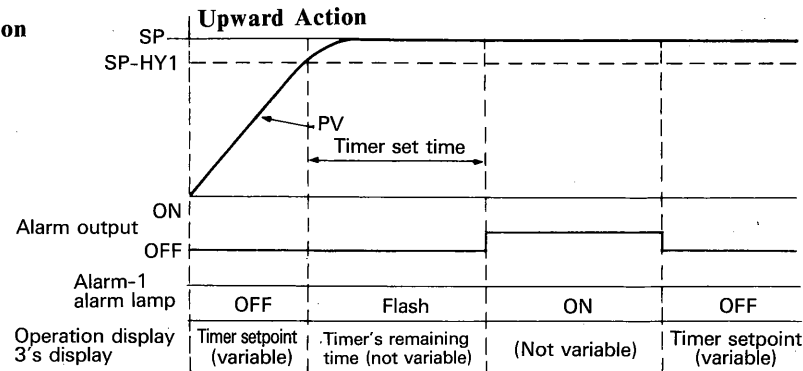
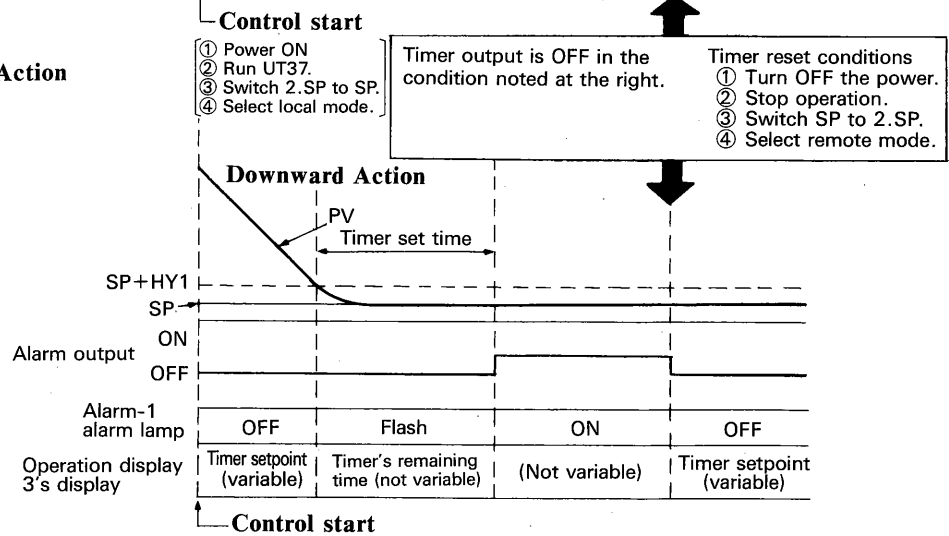


Figure 3 Downward Action



## GENERAL SPECIFICATIONS

### Measuring Accuracy

Input type	Input	Accuracy
TC (ANSI, DIN, JIS)	B *1 S R	±0.15% of F.S. ±1 digit
	K *2 J *2 T *3 N	±0.10% of F.S. ±1 digit
	W	±0.20% of F.S. ±1 digit
	E *2 L (DIN) *2 U (DIN) *2	±0.10% of F.S. ±1 digit
	Pt100 *4 JPt100 *4	±0.10% of F.S. ±1 digit
	DCV *5 mVDC *5	±0.10% of F.S. ±1 digit

"digit" means minimum display unit.

- \*1 Range of 0 to 400°C : ±5% of F.S. ±1 digit  
Range of 400 to 600°C : ±0.20% of F.S. ±1 digit
- \*2 0°C or below : ±0.20% of F.S. ±1 digit
- \*3 Range of 0 to 200°C : ±0.15% of F.S. ±1 digit
- \*4 Range of 0 to 100°C : ±0.30% of F.S. ±1 digit  
Range of 0 to 200°C : ±0.20% of F.S. ±1 digit  
Range of -100 to 100°C : ±0.20% of F.S. ±1 digit
- \*5 Range of 0 to 10mV : ±0.20% of F.S. ±1 digit  
Range of 0 to 1V : ±0.20% of F.S. ±1 digit

For thermocouple input, the value given includes no reference junction compensation error.

### Power Supply, Withstand Voltage, Insulation Resistance, and Ground

Power supply	Voltage	100 to 240 V AC (universal power supply) *1
	Frequency	50/60 Hz common
Power consumption		Approx. 12 VA (100 V) Approx. 16 VA (200 V) (1 A time lag fuse is recommendable if an external fuse is required.)
Memory hold		Non-volatile memory
Withstand voltage		Power terminal to ground: 1500 V AC for 1 min Input terminal to ground: 1000 V AC for 1 min Output terminal to ground: 1500 V AC for 1 min
Insulation resistance		Each terminal to ground: 500 V DC at 20 MΩ or more
Grounding		Through resistance of 100 Ω or less

\*1 Allowable supply voltage range: 90 to 250 V AC

### • Relation between Input and Output Isolation

Isolation is accomplished between measured input and control output, measured input and transmission output, and measured input and remote setting input. However, control output to transmission output is not isolated.

## GENERAL SPECIFICATIONS

### Environmental Conditions

Normal operating conditions (design conditions where instrument continuously operates correctly)	Ambient temperature	0 to 50°C
	Ambient humidity	20 to 90% R.H. (non-condensing)
	Reference junction temperature compensation error	0 to 50°C: $\pm 1^\circ\text{C}$
	Magnetic field	400 AT/m or less
Effects on operating conditions	Warm-up time	30 min or more
	Ambient temperature effect	Input stability Within ( $\pm 1\mu\text{V}/^\circ\text{C}$ or $\pm 0.01\%/^\circ\text{C}$ , whichever is greater) Output stability Within (4 to 20 mA DC) $\pm 0.05\%/^\circ\text{C}$
	Power supply variation	Input stability Within ( $\pm 1\mu\text{V}/10\text{V}$ or $\pm 0.01\%/10\text{V}$ , whichever is greater) Output stability Within (4 to 20 mA DC) $\pm 0.05\%/10\text{V}$
	Transit/storage conditions	Temperature -25 to 70°C Humidity 5 to 95% R.H. (non-condensing)

### Construction, Dimensions, and Weight

Construction	Dustproof, drip-proof construction (front panel)
Mounting	Flash mounting (See DIMENSIONS on p. 7.)
Case	Plastic molding (ABS resin)
Dimensions	96W×96H×100D mm
Weight	Approx. 1 kg

### Power Failure Recovery Operation

Operation in the event of power failure is classified as given below depending on whether power failure time is 2 sec or less.

Power failure of 2 sec or less	Instrument continues normal operation as if there were no power failure. However, alarm with waiting action enters waiting status.	
Power failure of more than 2 sec	Alarm action	Alarm with waiting action restarts from waiting state.
	Setting parameters	Set parameters are kept secured
	Auto-tuning	Auto-tuning is canceled.
	Control operation	One of the following occurs in accordance with specified restart code (by setting RST: setup parameter). For code "0" Controller continues the operation before power failure. For code "1" Controller enters MAN (manual) mode. However, output applies the preset output value. For code "2" Controller continues the operation before power failure. However, output applies the preset output value.

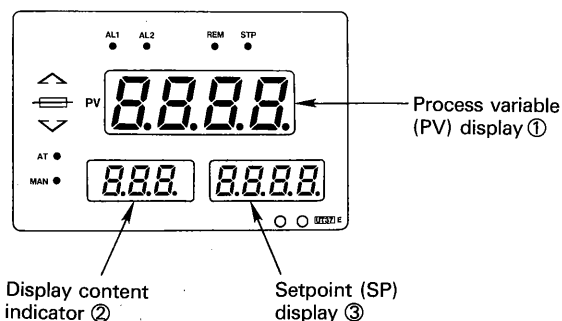
- If power failure occurs during setting using a key, error code [XX04] may appear.

### Self-Diagnosis

UT37 performs the following self-check and on detecting error, displays the relevant error code.

Error content	Error code	Display position (Note 1)
Input burnout	bOUT	①
Over-scale (105% or more of measurement range)	oDr	①
Under-scale (-5% or less of measurement range)	-oDr	①
RAM error	FAIL	①
ROM error	FAIL	①
Program overrun	FAIL	①
System data error	E002	①
Output type selection error (if any code other than 0 to 3 is selected)	E003	①
EEPROM protect error	XX01 <sup>(Note2)</sup>	③
Input range data error	XX02	③
Set parameter error	XX04	③
Backup data error	XX10	③
Reference junction compensation failure	rJc <sup>(Note3)</sup>	①
EEPROM error	Display content indicator flashes.	②
Sub-CPU error	All OFF	—
Auto-tuning time-out	E200	①
A/D converter error	E300	①
Exceeding of remote setpoint limit	Limit value is displayed.	③

Note 1: The arrangement of the display unit is as follows:



Note 2: ×× stands for symbol (value) of the operating power frequency and option designation status.

Note 3: Measured value and rJc are displayed alternately.

## COMMUNICATION

(Option: /RS422 is added to the model.)

### ● NOTICE

When the UT37 receives a set command, data are stored in the EEP ROM. The EEP ROM's life expectancy (memory cell life) is about 100,000 writes. So, use the set command only when stored data must be changed; do not write data unnecessarily.

Applicable standard	Conforms to EIA RS-422A	Max. no. of units connected	16 (available addresses: 01 to 16 Address 99: For coordinated operation)
Communication method	4-Wire, half-duplex multi-drop connection Start-stop Non-procedural transmission	Communication distance	500 m (max.)
Communication speed	The following are selectable using a parameter. 150, 300, 600, 1200, 2400, 4800, and 9600 bps.	Bit configuration	Start bit: 1 bit Data bit: 7 or 8 bits Stop bit: 1 or 2 bits Parity bit: None, odd number, or even number

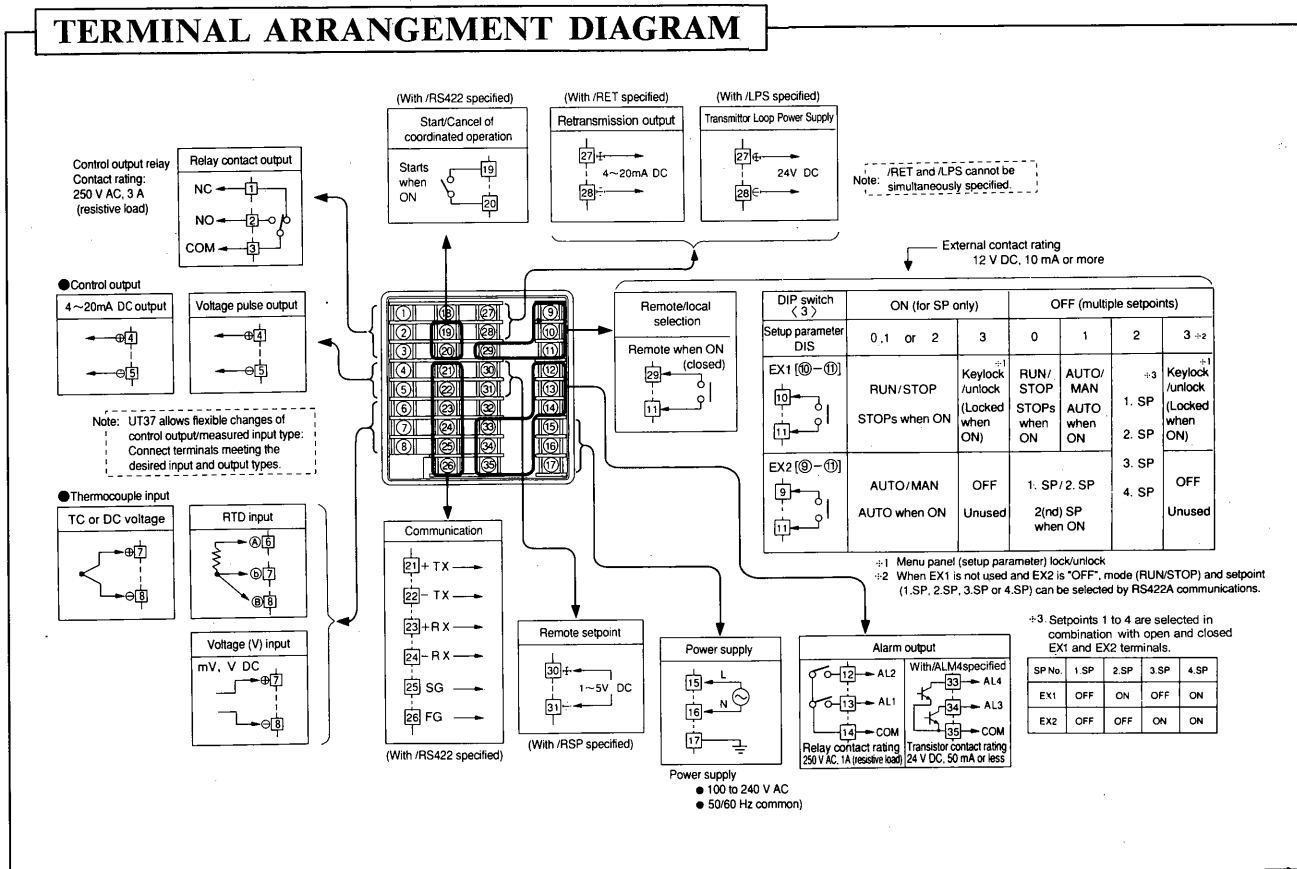
## TRANSMITTER LOOP POWER SUPPLY

(Option: /LPS is added to the model.)

Max. output current	30 mA
Output voltage	21.6 to 28.0 V DC

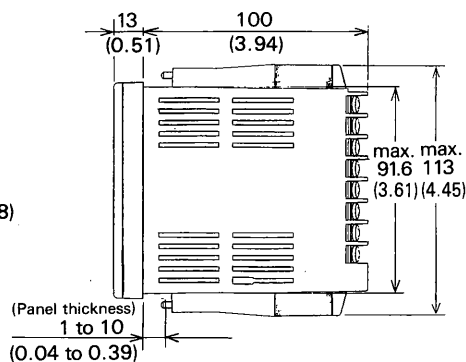
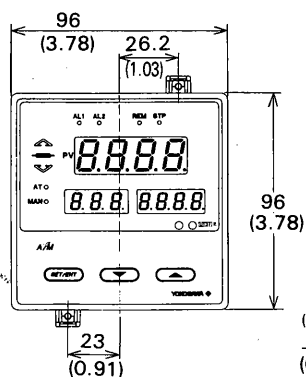
Note: /LPS is not available if digital communication is simultaneously performed, overlaying the signal line.

## TERMINAL ARRANGEMENT DIAGRAM

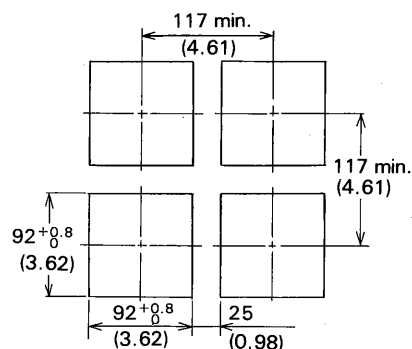


## DIMENSIONS

Units: mm (approx. inch)



### <Panel cut size>



## MODEL AND SUFFIX CODE

### Ordering Information

- (1) Model
- (2) Option code if required

**Note:** UT37 is factory shipped in the following condition.

**Measured input:** Thermocouple K (−200 to 1200°C)  
[DIP switch No.1: ON, Rotary switch A: Code 0]

**Control output:** Time proportional PID (relay output)  
[Dip switch B No.5, No.6: ON]

### Model and Suffix Code Table

Model	Suffix code	Description
UT37	.....	Digital indicating controller
Option code	/RET	Retransmission output (4 to 20 mA DC)
	/RSP	Remote setpoint input (1 to 5V DC)
	/RS422	RS-422A communication interface
	/LPS	Transmitter power supply
	/ALM4	Additional Alarms (Alarm 3 to Alarm 4)

**Note:** /RSP and /RET are not available when /LPS is specified.

## SAFETY STANDARD

### SAFETY STANDARD:

#### POWER SUPPLY:

#### CONTROL OUTPUT RELAY CONTACT:

#### ALARM OUTPUT RELAY CONTACT:

#### AMBIENT TEMPERATURE:

#### MOUNTING LOCATION:

CSA C22.2 No.142/UL 508

100-240 V AC, 50/60 Hz, 0.2 A Max.

Max. 250 V AC, 3A

Max. 250 V AC, 1A

0 to 50°C

Non-Hazardous Location, Indoor.

Mounting in an indoor (controlled environment) instrument panel.