

# ThermoPLUS

## Smart Temperature Transmitter

### Model ATT61/71 (Integral Sensor type)

#### OVERVIEW

The models ATT61/71 Smart Transmitter are temperature transmitters for the model ATT90 integral temperature sensor and models ATT9□ protecting wells for the temperature sensor. It converts and transmits the input signal from a thermocouple or resistance thermometer into a 4~20mA DC or a digital signal.

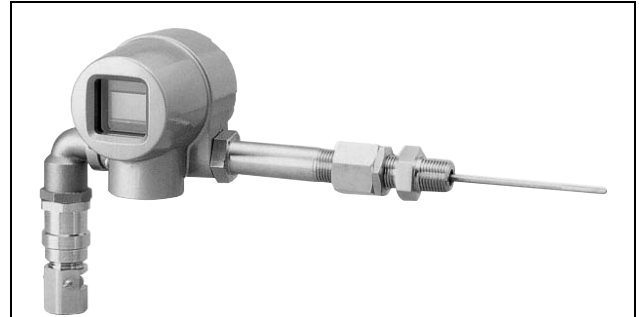
The SFC (Smart Field Communicator) facilitates remote setting of various parameters, calibration or self-diagnostics.

The models ATT61/71 Transmitter, consisting of a sensor and a transmitter have been certified to conform with the JIS Flameproof structure standard. For this reason, use of Yamatake's Model ATT sensor are highly recommended.

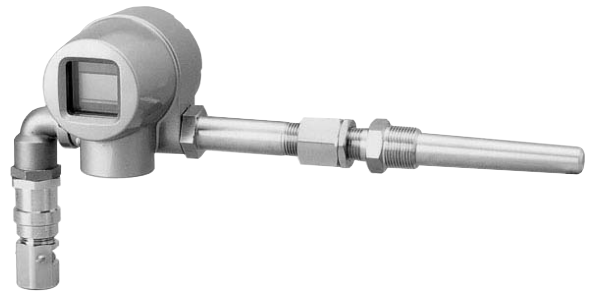
#### FEATURES

1. Vastly improves maintenance efficiency. The SFC facilitates setting, calibration and self-diagnostics of the transmitter from the control room
2. Reduces transmitter inventory  
Single model accepts wide range of sensor types.
3. Reduces installation costs.  
Two-wire system eliminates the need for compensating lead wire or three-core shield cable from site to control room.
4. Self-diagnostic functions facilitates simple operation:
  - Abnormal ambient temperature:
    - If deviates from the range of -40 ~ +85°C  
(Current ambient temperature can be monitored)
  - Abnormal cold junction: If platinum temperature sensor for cold junction becomes abnormal
  - Abnormal input:
    - If temperature sensor output shows irregularity
  - Open thermocouple wire:
    - If thermocouple wire becomes open
5. An optimal range for process operation can be selected.  
The maximum/minimum holding function allows read-out if the range is exceeded.
6. Useful integral indicator  
Integral digital indicator provides both field indication and signal transmission.
7. Explosion-proof model can be used in an acetylene or a hydrogen atmosphere  
The transmitter has been certified for JIS Flameproof, Exd IIC T6.

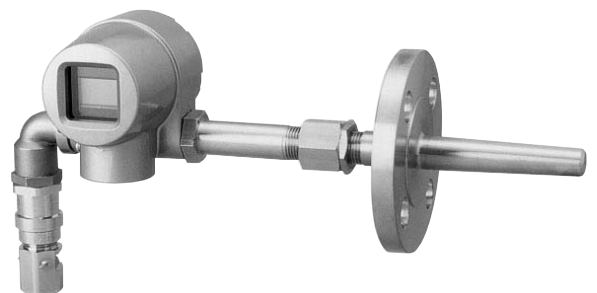
**Note) \*1 External appearance may differ from those shown in the photographs in this Specification Sheet depending on type of sensors used.**



Combination of ATT71 temperature transmitter and ATT90 temperature sensor (Sold separately) \*1



Combination of ATT71 temperature transmitter and ATT90 temperature sensor with ATT92 sensor protecting well (Sold separately) \*1



Combination of Temperature Transmitter ATT71, Temperature Sensor ATT90 (Sold separately) with Sensor Protecting Well ATT95 (Sold separately) \*1



SFC Smart Communicator (Sold separately)

**STANDARD SPECIFICATIONS****Converter****Input type (Select by SFC)**

Thermocouple

SJ(J), SK(K), ST(T) SE(E) SN(N), SR(R), SS(S), SB(B)

Resistance temperature detector (RTD)

Pt100, Jpt100

mV

**Measurable range**

All temperature ranges listed in official JIS Table (For details, refer to Table 1)

-20~120mV

**Burn-out**

Up-scale (over 21.1mA DC) or down-scale (under 3.6mA DC)

**Cold joint compensation**

External/internal selectable from an SFC

**Cold joint compensation accuracy**

±0.5 °C

**Conversion accuracy**

Depends on the sensor type and measurement span. (For details refer to Table 2.)

**Output**

Analog (4~20mA DC), or digital (DE protocol) selectable by SFC

**Digital indication**

An optional LCD display is in 4.5-digit with an engineering unit (degree C) including 0-100% bar graph.

**Power supply/load resistance**

17.5~42V DC/250~1271 Ω (For details, refer to Table 2)

**Input/output insulation**

500V AC

**Ambient temperature range**

Waterproof model:

Without LCD display: -40~85°C

With LCD display: -20~70°C

JIS Flameproof model:

-20~60°C regardless of LCD display

**Ambient humidity**

5~100% RH (No condensation)

**Additional features****Influence of ambient temperature**

±0.5% F.S. (30°C)

**Influence of ambient humidity**

±0.01%F.S. (5~100% RH)

**Influence of power supply voltage**

±0.1%F.S. (@17~42V DC)

**Construction****Case**

Aluminum alloy

**Waterproof model**

JIS C0920 immersion-proof compatible

NEMA Type 4X, IEC IP6 equivalent

**JIS Flameproof model**

JIS Flameproof Ex d II T6 (Ambient temperature

-20~60°C, Flameproof range: -20~85 °C)

**Installation**

Horizontal or on 2 in. vertical pipe pedestal

**Painting**

Metallic green (Munsell 5G7/8)

**Weight**

Approx. 830g (w/integral LCD and sensor, w/o bracket)

**Setting at factory shipment (All settings can be modified with SFC (sold separately))****Sensor model**

Pt100 (by specifying 'C' of additional specifications)

**Temperature range**

0~100 °C (by specifying 'C' of additional specifications)

**TAG No.**

XXXXXXXX (up to 8 digits as specified)

**Output characteristics**

Linearized

**Damping constant**

0.0sec

**Cold junction compensation**

Internal cold junction

**Table 1 Measurable range**

Type of sensor	Guaranteed accuracy range *1	SFC's setting range *2	Applicable standards
SJ(J)	-50~1200°C	-200~1200°C	JIS C1605-1995
SK(K)	-170~1250°C	-200~1370°C	
ST(T)	-120~400°C	-250~400°C	
SE(E)	-100~1000°C	-200~1000°C	
SN(N)	0~1300°C	-200~1300°C	
SR(R)	0~1760°C	-50~1760°C	
SS(S)	0~1760°C	-50~1760°C	
SB(B)	400~1820°C	200~1820°C	
Pt100	-200~850°C	-200~850°C	JIS C1604-1997
JPt100	-200~640°C	-200~640°C	JIS C1604-1989
mV	-20~120mV	-10~120mV	--

Note) 1. Guaranteed accuracy means the range of signal conversion that is guaranteed. Measurable range is governed by sensor that is used.

Note) 2. SFC's setting range is the output range that can be set by SFC (sold separately).

Table 2 Conversion accuracy

Type of sensor	Digital accuracy	Internal cold junction compensation accuracy	Analog accuracy	Minimum span	
SJ(J)	±0.3 °C	±0.5°C	±0.05%F.S.	25°C	
SK(K)	±0.4 °C				
ST(T)	±0.4 °C				
SE(E)	±0.3 °C				
SN(N)	±0.5 °C				
SR(R)	±0.6 °C				
SS(S)	±0.6 °C				
SB(B)	±0.8 °C				
Pt100	±0.2 °C	Not required			10°C
JPt100	±0.2 °C				
mV	±0.05%rdg, or ±50µV, whichever is larger				

Note) \* Overall accuracy = Digital accuracy + analog accuracy (For digital output type, only digital accuracy applies.)

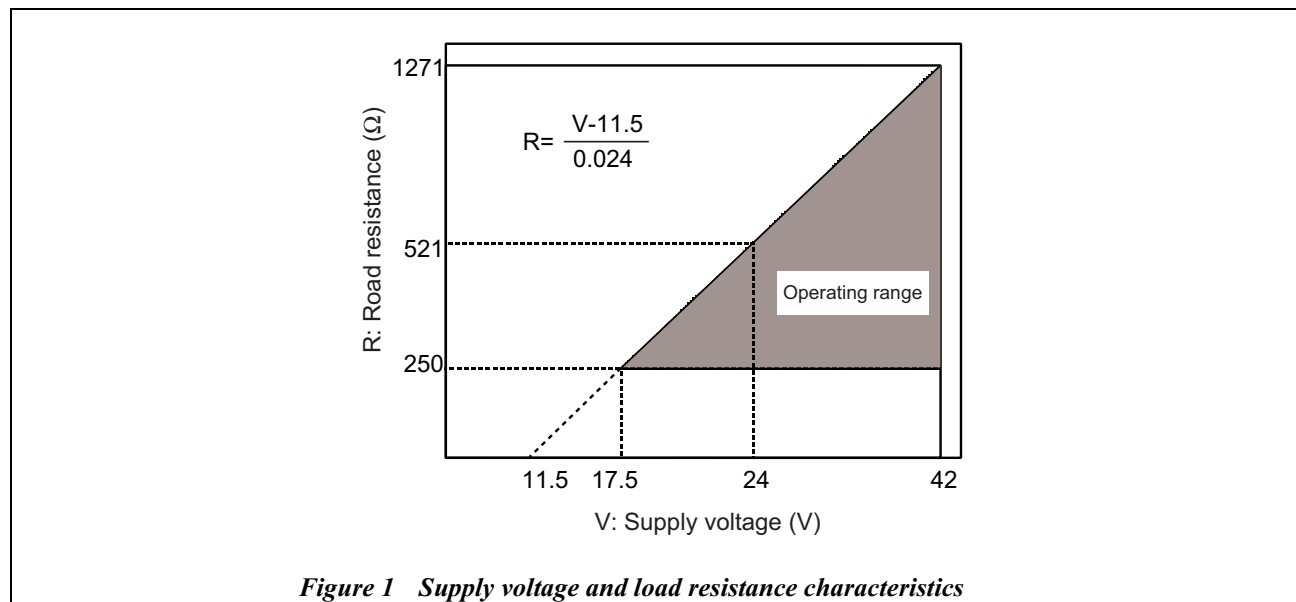


Figure 1 Supply voltage and load resistance characteristics

### Example of accuracy calculation

When the models ATT61/71 are used with an model ATT90 sensor (sold separately) the maximum error and accuracy can be calculated as follows:  
 Both models ATT61/71 and model ATT90 have their own integral errors. When they are integrated, the total sum of the errors must be taken into consideration.  
 Each temperature sensor's error differs one from the other, depending on type of sensor, measuring location and class. Refer to our model ATT90 Sensor's Specifications. If another manufacturer's sensor is used with the model ATT61, please inquire of the accuracy with that sensor's manufacturer.

• **Calculation of maximum error when SN (N) thermocouple range is set at 0~1000°C analog output**

[Converter error]

$$\begin{aligned} \text{Converter accuracy} &= \text{digital accuracy} + \text{analog accuracy} \\ &\quad + \text{internal cold junction compensator accuracy} \\ &= 0.5 + 1000 \times 0.05\% \text{ F.S.} + 0.5 \\ &= 0.5 + 0.5 + 0.5 \\ &= 1.5 \text{ (}^\circ\text{C)} \end{aligned}$$

Hence the maximum converter error is within +1.5 °C.  
 (Accuracy is  $1.5/1000 \times 100 = 0.15\%$  F.S.)

[Temperature sensor error]

<ul style="list-style-type: none"> <li>• Type of thermocouple: SN(N)</li> <li>• Class:2</li> <li>• Operating temperature range: 1000 °C</li> </ul>	From model ATT90 Specifications $\Rightarrow + 0.0075   t  $ $+ 0.0075 \times 1000$ $= +7.5 \text{ (}^\circ\text{C)}$
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[Overall error]

$$\begin{aligned} \text{Overall error} &= \text{Converter error} + \text{temperature sensor error} \\ &= 1.5 + 7.5 \\ &= 9.0 \text{ (}^\circ\text{C)} \end{aligned}$$

The overall maximum error for a combination of a converter and sensor is approximately +9°C.  
 (Overall accuracy is  $+ 9.0/1000 \times 100 = 0.9\%$  F.S.)

• **Calculation of maximum analog output error when Pt100 resistance temperature sensor range is set at -20~80°C analog output**

[Converter error]

$$\begin{aligned} \text{Converter accuracy} &= \text{digital accuracy} + \text{analog accuracy} + \text{internal cold junction compensator accuracy} \\ &= 0.2 + 100 \times 0.05\% \text{ F.S.} + 0 \\ &= 0.2 + 0.05 + 0 \\ &= 0.25 \text{ (}^\circ\text{C)} \end{aligned}$$

Hence, the maximum converter error is  $\pm 0.25^\circ\text{C}$   
 (Overall accuracy is  $0.25/100 \times 100 = 0.25\%$  F.S.)

[Temperature sensor error]

<ul style="list-style-type: none"> <li>• Resistance temperature detector: Pt100</li> <li>• Class: A</li> <li>• Temperature range 100°C</li> </ul>	From model ATT90 Specifications, $\Rightarrow \pm 0.15 + 0.002   t  $ ; $\pm 0.15 + 0.002 \times 100$ $= \pm 0.35 \text{ (}^\circ\text{C)}$
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[Overall accuracy]

$$\begin{aligned} \text{Overall accuracy} &= \text{Converter error} + \text{temperature sensor error} \\ &= 0.25 + 0.35 \\ &= 0.6 \text{ (}^\circ\text{C)} \end{aligned}$$

Hence, the maximum converter and sensor combination error is under  $\pm 0.6^\circ\text{C}$ .  
 (Overall accuracy is  $0.6/100 \times 100 = 0.6\%$  F.S.)

• **Calculation of maximum digital output error when Pt100 resistance temperature sensor range is set at 0~200 °C analog output**

[Converter error]

$$\begin{aligned} \text{Converter accuracy} &= \text{digital accuracy} + \text{analog accuracy} + \text{internal cold junction compensator accuracy} \\ &(\rightarrow \text{No analog error because output is digital}) \\ &= 0.2 + 0 + 0 \\ &= 0.2 \end{aligned}$$

The maximum error is under  $\pm 2^\circ\text{C}$   
 (Accuracy is  $0.2/100 \times 100 = 0.2\%$  F.S.)

[Temperature sensor error]

<ul style="list-style-type: none"> <li>• Resistance temperature detector: Pt100</li> <li>• Class: B</li> <li>• Temperature range 200°C</li> </ul>	From model ATT90 Specifications, $\Rightarrow + 0.3 + 0.005   t  $ ; $0.3 + 0.005 \times 200$ $= 1.3 \text{ (}^\circ\text{C)}$
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[Overall error]

$$\begin{aligned} \text{Overall error} &= \text{converter error} + \text{temperature sensor error} \\ &= 0.2 + 1.3 \\ &= 1.5 \text{ (}^\circ\text{C)} \end{aligned}$$

The maximum overall error for a combination of a converter and temperature sensor is under +1.5°C.  
 (Overall accuracy is  $1.5/200 \times 100 = 0.75\%$  F.S.)

## Explanation of converter model number symbols

### Standard model number

Model ATT61 Waterproof temperature transmitter (integral type)

Model ATT71 Flameproof models (integral type)

### Selectable specifications

#### Output type

- A 4~20 mA DC analog
- D DE protocol

#### Construction

Case: Aluminum alloy

- 1 Waterproof: JISC0920 immersion-proof equivalent NEMA3 and 4X, IEC IP67 equivalent
- 2 JIS Flameproof: Ex d IIC T6 (Ambient temperature -20~60°C)

#### Electric conduit

- 1 G1/2 thread
- 2 NPT1/2 thread
- 3 M20\*1.5 thread (for adaptor)
- 4 Pg13.5 thread (for adaptor)

*Note) Only G1/2 thread of "1" is available for JIS Flameproof construction.*

### Additional specification selection

#### Integral indicator

- X No indicator
- M Digital indicator (°C)  
Digital indication: 4.5 digits -1999.9 ~ 1999.9°C  
Plus 4~20mADC level bar graph indication  
Self-diagnostic status

#### Painting

- S Standard finish  
Baked acrylic resin
- A Corrosion-proof paint  
Baked acrylic resin, fungus proof finish
- B Corrosion-proof paint  
Baked epoxy resin, fungus proof finish

#### Direction of burn-out

- U Upscale on failure
- D Downscale on failure

### Additional specifications

- A Traceability certificate  
This certificate consists of three copies of the measurement management system's block diagram, calibration certificate, and test report.
- B 2-inch pipe mounting bracket  
Can be mounted either horizontally or vertically
- C Internal data setting  
Type of sensor, range setting, Tag. No. (Engraved on name plate and written into EEPROM in eight alpha numerical characters) before shipment. Please specify setting when ordering.

- E One electric conduit elbow  
One elbow is provided to direct the explosion-proof cable gland and cable downward. This must be selected for JIS Flameproof specifications.  
Material: brass, Wire diameter: Ø8~13
- H Tropicalization treatment  
Fungus proof spray is sprayed on terminal bracket on up to improve tropical climate resistance.
- T Test report treatment  
This test report covers testing such as for external appearance, insulation resistance, and voltage withstanding, input/output characteristics. Since input/output test of thermocouple input model and mV input model are identical, the test is conducted with mV input. Note that this test is for the temperature transmitter itself and not for the integrated temperature transmitter-sensor test.

## Other common specifications

### Lightning guard specifications

Voltage surge peak amplitude: 100kV

Current surge peak amplitude: 1000A

### Anti-vibration specifications

5~9Hz 0~7.5 mmp-p

9~2000Hz 0~29.4 m/S<sup>2</sup>

*Note) Product specifications except sensor and bracket*

### Finish

Metallic green (Munsell 5G7/8)

## Cautions regarding product selection

- JIS Flameproof construction consists of temperature transmitter itself and temperature sensor. When specifying a JIS Flameproof model, please order a Yamatake Temperature sensor model ATT90. Also, please use a protecting well to protect temperature sheath.
- According to the 'JIS Flameproof Technical Standard (February 1997)' the ambient temperature should be -20~60°C, and applicable range for explosion-proof is -20~85°C. Also, explosion-proof standards can be ensured of by using an explosion-proof packing type cable gland. If cable glands of other makes are incorporated, Yamatake cannot guarantee that the unit will comply to explosion-proof standards.
- Even though ambient temperature is within the specified range, heat may accumulate in converter. If this occurs, provide a shield to keep the converter temperature within the specified range.

**MODEL SELECTION**

**Model ATT61 Waterproof model**

Basic Model No.		Selection1			Selection2			Option			
ATT61											
Output	Analog (4 -20mA)	A									
	Digital (DE -protocol)	D									
Housing	Waterproof and dust -proof structure		1								
Electrical connection	G1 / 2			1							
	1/2NPT			2							
	M20 × 1.5 (with adaptor)			3							
	Pg13.5 (with adaptor)			4							
Integral digital meter	Without				X						
	LCD meter for Deg. C				M						
Finish	Standard finish					S					
	Corrosion -resistant finish					A					
	Corrosion -proof finish					B					
Burnout feature	Upscale						U				
	Downscale						D				
Options *1	No selection									X	
	Certificate of traceability									A	
	Mounting bracket									B	
	Customer configurations (sensor type and measuring range) *2									C	
	Tropicalization treatment									H	
	Calibration test report									T	

Note) \*1. Up to five options may be selected simultaneously.

\*2. If it is required to configure sensor type, range and tag No. at the ex factory, please select "C" and specified specifications separately. If there is no specified specification, the unit will be configured with the default value based on Table 1.

## Model ATT71 Explosion-proof model

Basic Model No.

ATT71 -

Selection1

Selection2

Option

		Selection1	Selection2	Option
Output	Analog (4 -20mA)	A		
	Digital (DE -protocol)	D		
Housing	JIS Flameproof *5	2		
Electrical connection	G1 / 2 only for JIS Flameproof	1		
Integral digital meter	Without		X	
	LCD meter for deg. C		M	
Finish	Standard finish		S	
	Corrosion -resistant finish		A	
	Corrosion -proof finish		B	
Burnout feature	Upscale		U	
	Downscale		D	
Options *1	No selection			X
	Certificate of conformance and origin			A
	Mounting bracket			B
	Customer configurations (sensor type and measuring range) *2			C
	With an elbow for electrical conduit *3			E
	Tropical finish			H
	Calibration test report			T

Note) \*1. Up to five options may be selected simultaneously.

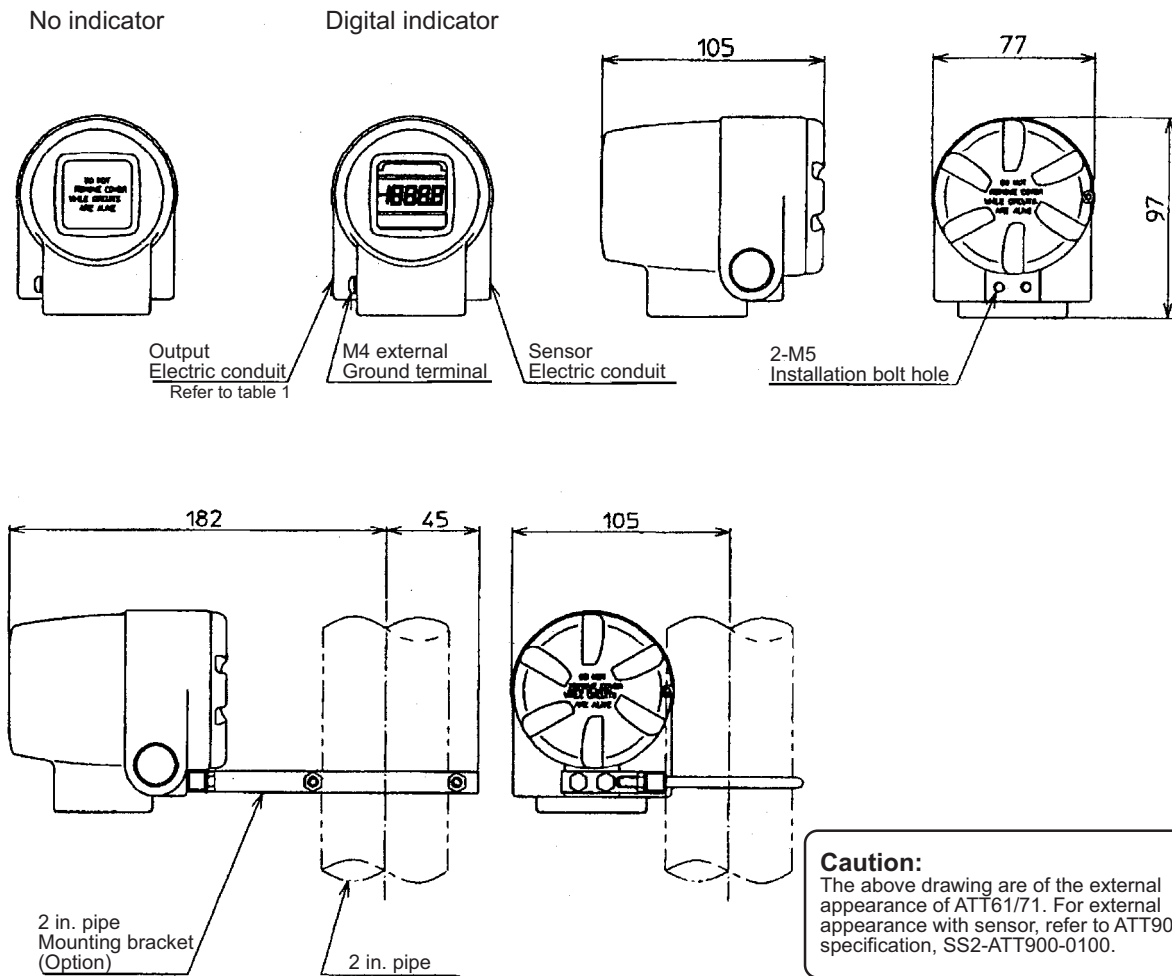
\*2. If it is required to configure the sensor type, range and tag No. at the ex factory, please select "C" and the specified specifications separately. If there is no specified specification, the unit will be configured with the default value based on Table 1 in the Specification sheets.

\*3. For options, "E: with an elbow for electrical conduit" must be selected.

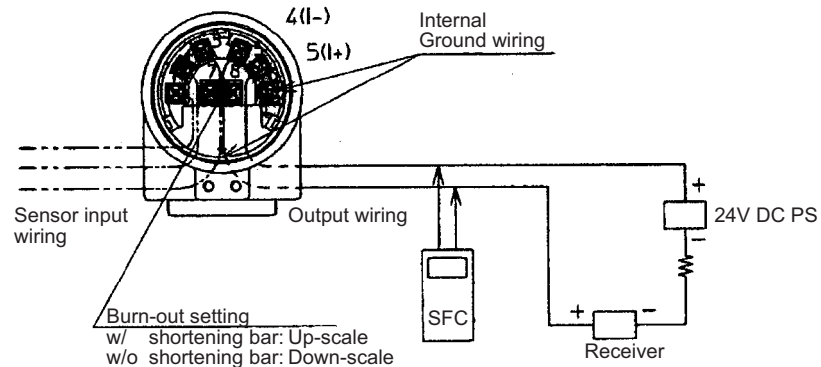
\*5. Use model ATT90 (sold separately) for the temperature sensor. JIS Flameproof construction consists of temperature transmitter itself and temperature sensor.

**DIMENSIONS**

**External dimensions**



**Output wiring**



Note) The size of the terminal screws are M4.



Saving through Automation

**Yamatake Corporation**

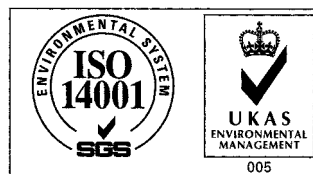
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Certificate No. Q17862



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