

# ST3000 Series 900 Smart Transmitter

## Absolute Pressure Transmitters

### Model STA923 / STA940

#### **OVERVIEW**

The ST3000 Smart Transmitter is a microprocessor-based smart transmitter that features high performance and excellent stability. Capable of measuring absolute pressure of gas, liquid, and vapor, it transmits 4 to 20 mA DC analog and digital signals according to the measured pressure. It can also execute two-way communications between the SFC (Smart Field Communicator) or HART 275 communicator, and, via DE protocol, with the TDCS3000 or 3000<sup>X</sup> and a database, thus facilitating self-diagnosis, range resetting, and automatic zero adjustment.



#### **FEATURES**

##### **Excellent stability and high performance**

- Long-term stability is proven in 500,000 installations worldwide.
- Unique characterization and composite semiconductor sensors realize excellent temperature and static pressure characteristics.

##### **Wide measuring range (rangeability)**

A wide measuring range is available from a single model. This feature is highly effective in taking measurements over a wide range and reducing the need for inventory.

\* Model STA940: 35 to 3500 kPa abs. (rangeability: 1 to 100)

##### **A diverse lineup**

- A wide range of models is available to meet user needs for low, standard, and high pressures.
- A wide variety of corrosion-resistant materials for wetted parts is also available.

##### **Remote communication**

- Either analog output (4 to 20 mA DC), or digital output (DE protocol) is possible.
- Two-way communication using digital output facilitates self-diagnosis, range resetting, automatic zero adjustment, and other operations.
- HART protocol communication is available. (Option)

**APPLICATION****Petroleum / Petrochemical / Chemical**

For measuring pressures and liquid levels in pipes and tanks.

**Electric power / City gas / Other utilities**

For measurement applications that require high degrees of stability and accuracy.

**Pulp and paper**

For lines that need transmitters resistant to chemical liquids, corrosive fluids and the like.

**Iron and steel / Nonferrous metal / Ceramics**

For lines that require stable measurement under strictly controlled (temperature, humidity, etc.) conditions.

**Machinery / Shipbuilding**

For lines that require stable measurement under strictly controlled (temperature, humidity, etc.) conditions.

**FUNCTIONAL SPECIFICATIONS****Type of protection**

JIS C0920 watertight: NEMA3 and 4X

JIS F8001 class 2 watertight: IEC IP67

**FM Explosionproof approval**

**Explosionproof** for Class I (Gas, steam), Division 1, Group A, B, C, D

**Dust-ignition** for Class II (Inflammable dust), Division 1, Group E, F, G

**Suitable** for Class III (inflammable fiber), Division 1

**Nonincendive** for Class I, Division 2, Group A, B, C, D

**FM Intrinsically safe approval**

**Intrinsically safe** for Class I, II, III, Division 1, Group A, B, C, D, E, F, G

**ATEX Flameproof approval**

Certificate number: INERIS99ATEX0010 X

$\text{Ex}$  II 2 GD EExd IIC T6 at  $-20 \leq T_{amb} \leq +60^{\circ}\text{C}$

**ATEX Intrinsic safety**

Certificate number: KEMA03ATEX1225 X

$\text{Ex}$  II 1 G EEx ia IIC T4 at  $-20 \leq T_{amb} \leq +60^{\circ}\text{C}$

Electrical data:  $U_i = 30\text{V}$

$I_i = 100\text{mA}$

$P_i = 1\text{W}$

$C_i = 3\text{nF}$

$L_i = 0.5\text{mH}$

**SPECIAL CONDITIONS FOR SAFE USE (X)**

Because the enclosure of the Smart Pressure Transmitter is made of aluminium, if it is mounted in an area where the use of category 1 G apparatus is required, it must be installed such that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

**NEPSI Flameproof approval**

Ex d IIC T6, with NEPSI Dust ignition DIP A20 T6

Approval No. GYJ 06204

**NEPSI Intrinsically safe approval**

NEPSI Intrinsically safe approval

Ex ia IIC T4 at  $-20 \leq T_{amb} \leq +60^{\circ}\text{C}$

The barriers should be NEPSI recognized types and comply with the following conditions as follows.

Safety Parameters :  $U_i=28\text{V}$ ,  $I_i=93\text{mA}$ ,  $P_i=0.651\text{W}$ ,  $L_i=0$ ,  $C_i=0.0\mu\text{F}$

Approval No. GYJ 06176

**CSA Explosion-proof Approval**

**CSA Explosion-proof** for Class I, (Division 1), Groups A, B, C and D

**CSA Flameproof** for Class I, Zone 1, Ex d IIC T6 at ambient temp. =  $-20^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$

**CSA Dust-ignitionproof** for Class II and III, (Division 1), Groups E, F and G

**EMC Conformity**

89/336/EEC, 92/31/EEC, 93/68/EEC Electromagnetic Compatibility (EMC) Directive

**PED Conformity (97/23/EC)**

Comply with Module H (with "H1" option), or SEP (Sound Engineering Practice) for models of which maximum working pressure is 200 bar or lower.

**Measuring span / Setting range / Working pressure range**

	Measuring Span	Setting Range	Working Pressure Range	Overload Resistant Value
STA 923	4 to 104 kPa abs {30 to 780 mmHg abs}	0 to 104 kPa abs {0 to 780 mmHg abs}	0.01 to 104 kPa abs {0.1 to 780 mmHg abs} See Figure 1	300 kPa abs {3.0 kgf/cm <sup>2</sup> abs}
STA 940	35 to 3500 kPa abs {0.35 to 35 kgf/cm <sup>2</sup> abs}	0 to 3500kPa abs {0 to 35 kgf/cm <sup>2</sup> abs}	0.01 to 3500 kPa abs {0.1 mmHg abs to 35 kgf/cm <sup>2</sup> abs} See Figure 1	5250 kPa abs {52.5 kgf/cm <sup>2</sup> abs}

Note) With PVC wetted parts, the maximum working pressure is 1.5 MPa {15 kgf/cm<sup>2</sup>}.

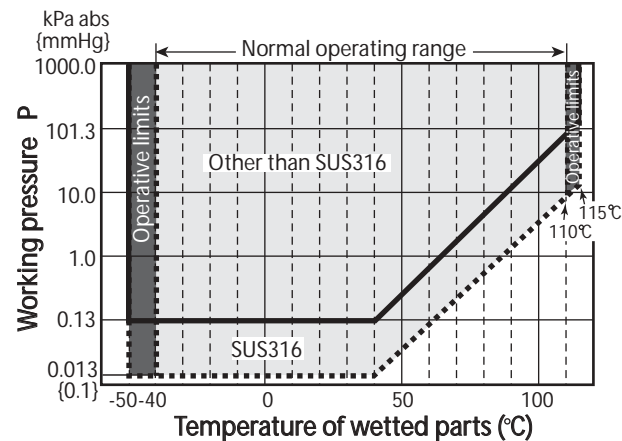


Figure 1 Working pressure and temperature of wetted parts section (for general purpose models)

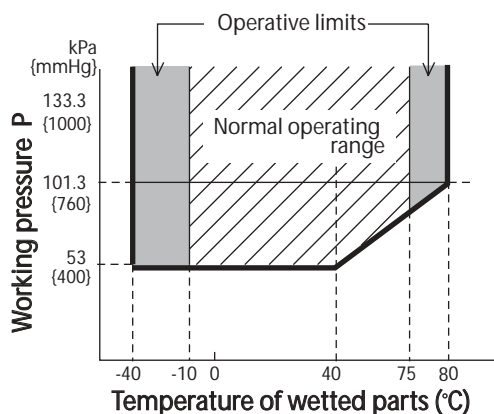


Figure 2 Working pressure and temperature of wetted parts section (for oxygen and chlorine service models)

**Supply voltage and load resistance**

10.8 to 45V DC. A load resistance of 250 Ω or more is necessary between loops. See Figure 3.

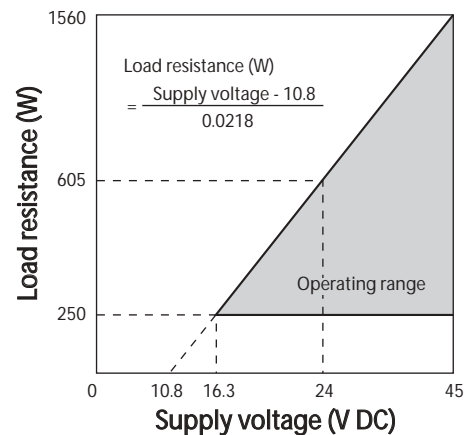


Figure 3 Supply voltage vs. load resistance characteristics

Note) For communication with SFC, a load resistance of 250 Ω or more is necessary.

For ATEX Intrinsic safety model, minimum voltage of 18.0V is required.

**Output**

- Analog output (4 to 20 mA DC) with DE protocol
- Analog output (4 to 20 mA DC) with HART protocol
- Digital output (DE protocol)

**Ambient temperature limits**

**Normal operating range**

- 40 to 85°C for general purpose models
- 10 to 75°C for oxygen and chlorine models
- 20 to 70°C for models with digital indicators

**Operative limits**

- 50 to 93°C for general purpose models
- 40 to 80°C for oxygen and chlorine models
- 30 to 80°C for models with digital indicators

**Transportation and storage conditions**

- 50 to 85°C

**Temperature ranges of wetted parts**

**Normal operating range**

- 40 to 110°C for general purpose models
- 10 to 75°C for oxygen and chlorine models

**Operative limits**

- 50 to 115°C for general purpose models
- 40 to 80°C for oxygen and chlorine models

**Ambient humidity limits**

- 5 to 100% RH

**Stability against supply voltage change**

- ±0.005% FS/V

**Dead time**

- Approximately 0.4 sec.

**Damping time**

- Selectable from 0 to 32 sec. in ten stages

**OPTIONAL SPECIFICATIONS****Lightning protection**

Peak value of voltage surge: 200 kV

Peak value of current surge: 2000A

**Built-in indicating meter**

The digital LCD indicator (optional) indicates engineering units and can be set freely between -19999 and 19999 (4.5 digits). For meter calibration, specify the following items when placing your order

- Meter calibration range
  - Meter calibration unit
  - Linear / Square-root for meter indication
- Various kinds of data can be set using the SFC smart communicator (Ver. 7.1 or later) or HART275 communicator.

**Bolts and nuts materials (for fastening meter body cover)**

Carbon steel (SNB7), SUS304, SUS630

**Corrosion-resistant finish****Corrosion-resistant finish**

Corrosion-resistant paint (Baked acrylic paint), fungus-proof finish

**Corrosion-proof finish**

Corrosion-proof paint (Baked epoxy paint), fungus-proof finish

**Corrosion-resistant finish (silver paint)**

Transmitter case is coated with silver paint in addition to the above corrosion-resistant finish.

**Oil free finish**

The transmitter is shipped with oil-free wetted parts.

**External zero/span adjustment function**

The transmitter can be easily zero/span adjusted in the field.

**Burnout feature**

Choice of three states at abnormal condition

Burnout of output values: None, upper limit, lower limit

**Elbow**

This is an adaptor for changing the electrical conduit connection port from the horizontal to the vertical direction, if required by wiring conditions in the field. One or two elbows may be used as needed.

**Conformance to SI units**

We deliver transmitters set to any SI units as specified.

**PHYSICAL SPECIFICATIONS****Materials****Fill fluid**

Silicone oil for general purpose and high-temperature vacuum models

Fluorine oil for oxygen and chlorine models

**Center body**

SUS316

**Transmitter case**

Aluminum alloy

**Meter body cover**

SCS14A (equivalent to SUS316) or SUSF316, PVC

**For Wetted parts****Adapter flange (option)**

SCS14A (equivalent to SUS316), PVC

**Center body**

SUS316 (Diaphragm SUS316L)

ASTM B574 (Hastelloy C-276 equivalent),

Tantalum, SUS316L

**Vents and plugs**

SUS316, PVC

**Gaskets**

FEP

**Finish**

Baked acrylic paint

Housing light beige (Munsell 4Y7.2/1.3)

Cap dark beige (Munsell 10YR4.7/0.5)

**Weight**

Approx. 6.8 kg

**INSTALLATION****Electrical connection**

1/2NPT internal thread

**Grounding**

Resistance 100 Ω max.

**Mounting**

Can be installed on a 2-inch horizontal or vertical pipe (can be directly mounted on a process pipe)

**Process connection**

Rc1/2, 1/2NPT internal thread and Rc1/4, 1/4NPT internal thread

**PERFORMANCE SPECIFICATIONS****Accuracy**

Shown for each item are the percentage ratio for  $\chi$  (kPa), which is the greatest value of either the upper range value (URV)\*<sup>1</sup>, the lower range value (LRV)\*<sup>2</sup> or the span.

**Model STA923**

(Material of wetted parts: Diaphragm; SUS316L, Others; SUS316)

Accuracy (*3)		$\pm 0.15\%$	(For $\chi \geq 12kPa$ abs{90 mmHg abs})
		$\pm\left(0.05 + 0.1 \times \frac{12}{\chi}\right)\%$	(For $\chi < 12kPa$ abs{90 mmHg abs})
Temperature characteristics (Shift from the set range) Change of 55°C (*3)	Zero shift:	$\pm\left(0.35 + 0.75 \times \frac{12}{\chi}\right)\%$	
	Combined shift: (including zero and span shifts)	$\pm 1.2\%$	(For $\chi \geq 12kPa$ abs{90 mmHg abs})
		$\pm\left(0.35 + 0.85 \times \frac{12}{\chi}\right)\%$	(For $\chi < 12kPa$ abs{90 mmHg abs})

**Model STA940**

(Material of wetted parts: Diaphragm; SUS316L, Others; SUS316)

Accuracy (*3)		$\pm 0.15\%$	(For $\chi \geq 350kPa$ abs{3.5 kgf/cm <sup>2</sup> abs})
		$\pm\left(0.05 + 0.1 \times \frac{350}{\chi}\right)\%$	(For $\chi < 350kPa$ abs{3.5 kgf/cm <sup>2</sup> abs})
Temperature characteristics (Shift from the set range) Change of 55°C (*3)	Zero shift:	$\pm\left(0.25 + 0.75 \times \frac{350}{\chi}\right)\%$	
	Combined shift: (including zero and span shifts)	$\pm 1.2\%$	(For $\chi \geq 350kPa$ abs{3.5 kgf/cm <sup>2</sup> abs})
		$\pm\left(0.35 + 0.85 \times \frac{12}{\chi}\right)\%$	(For $\chi < 350kPa$ abs{3.5 kgf/cm <sup>2</sup> abs})

**Model STA923**

(Material of wetted parts: Diaphragm; ASTM B574 (Hastelloy C-276 equivalent), Tantalum, SUS316L  
Others; ASTM B574 (Hastelloy C-276 equivalent), Tantalum, SUS316L)

Accuracy (*3)		$\pm 0.35\%$	(For $\chi \geq 12kPa$ abs{90 mmHg abs})
		$\pm\left(0.25 + 0.1 \times \frac{12}{\chi}\right)\%$	(For $\chi < 12kPa$ abs{90 mmHg abs})
Temperature characteristics (Shift from the set range) Change of 30°C (*3) (Range from -5 to 55°C)	Zero shift:	$\pm\left(0.15 + 1.85 \times \frac{24}{\chi}\right)\%$	
	Combined shift: (including zero and span shifts)	$\pm\left(0.55 + 1.85 \times \frac{24}{\chi}\right)\%$	

**Model STA940**

(Material of wetted parts: Diaphragm; ASTM B574 (Hastelloy C-276 equivalent), Tantalum, SUS316L  
Others; ASTM B574 (Hastelloy C-276 equivalent), Tantalum, SUS316L)

Accuracy (*3)		$\pm 0.35\%$	(For $\chi \geq 350kPa$ abs{3.5 kgf/cm <sup>2</sup> abs})
		$\pm\left(0.25 + 0.1 \times \frac{350}{\chi}\right)\%$	(For $\chi < 350kPa$ abs{3.5 kgf/cm <sup>2</sup> abs})
Temperature characteristics (Shift from the set range) Change of 30°C (*3) (Range from -5 to 55°C)	Zero shift:	$\pm\left(0.25 + 0.75 \times \frac{350}{\chi}\right)\%$	
	Combined shift: (including zero and span shifts)	$\pm 1.5\%$	(For $\chi \geq 350kPa$ abs{3.5 kgf/cm <sup>2</sup> abs})
		$\pm\left(0.35 + 1.15 \times \frac{350}{\chi}\right)\%$	(For $\chi < 350kPa$ abs{3.5 kgf/cm <sup>2</sup> abs})

Note) \*1: URV denotes the process value for 100% (20 mA DC) output

\*2: LRV denotes the process value for 0% (4 mA DC) output.

\*3: Within a range of  $URV \geq 0$  and  $LRV \geq 0$ .

**MODEL SELECTION**

**ST3000 series 900 electric absolute pressure transmitter**

**Model STA923 (low absolute pressure), Model STA940 (high absolute pressure)**

Model No.: STA923 - **I II III** - 00000 - Option I - Option II

Model No.: STA940 - **I II III** - 00000 - Option I - Option II

Basic Model No.

Measuring span	4.0 to 104 kPa abs (30 to 780 mmHg abs.)	STA923
	35 to 3500 kPa abs (0.35 to 35 kgf/cm <sup>2</sup> abs.)	STA940

Selection I				Code	Material code						
I	Material	Meter body cover	Adapter flange	vent/drain plugs	Wetted parts of center body	E	F	H	U	M	P
		SCS14A*1	SCS14A*1	SUS316	Diaphragm: SUS316L Others: SUS316	E					
		SCS14A*1	SCS14A*1	SUS316	Diaphragm: ASTM B574 *2 Others: ASTM B574 *2	F					
		SCS14A*1	SCS14A*1	SUS316	Diaphragm: Tantalum Others: Tantalum	H					
		SCS14A*1	SCS14A*1	SUS316	Diaphragm: SUS316L Others: SUS316L	U					
		PVC	PVC	PVC	Diaphragm: ASTM B574 *2 Others: ASTM B574 *2*3	M					
		PVC	PVC	PVC	Diaphragm: Tantalum Others: Tantalum *3	P					
II	Fill fluid	Regular type (Silicone oil)			1	✓	✓	✓	✓	✓	✓
		For oxygen service (Fluorine oil) *4			2	✓	✓	✓	✓	✓	✓
		For chlorine service (Fluorine oil) *4			5			✓			✓
III	Process connection	Front Connection	Rc1/2 with adapter flange		L	✓					
			1/2NPT internal thread with adapter flange		G	✓					
			Rc1/4 with adapter flange		D	✓					
			1/4NPT internal thread with adapter flange		A	✓					
			1/4NPT internal thread on head		B	✓					
	Top or bottom Connection	Rc1/2 with adapter flange *5		Q		✓	✓	✓	✓	✓	✓
		1/2NPT internal thread with adapter flange *5		R		✓	✓	✓	✓	✓	
		Rc1/4 with adapter flange *5		S		✓	✓	✓			
		1/4NPT internal thread with adapter flange *5		T		✓	✓	✓			
		1/4NPT internal thread on head *5		U		✓	✓	✓			

(Continued)

Note) \*1 SCS14A (Equivalent SUS316) or SUSF316

\*2 ASTM B574: Hastelloy C-276 equivalent

\*3 SUS304 bolts and nuts material (-w) must be selected when PVC meterbody cover is selected (-M or -P). The maximum working pressure is 1.5 MPa.

\*4 In case “for oxygen or chlorine (fluorine oil) service” is used, “oil free finish - code K” must be selected.

\*5 Applicable for wetted parts of center body material; ASTM B574 (Hastelloy C-276 equivalent) or Tantalum

(Continued from previous page)

Model No.: STA923 - I II III - 00000 - **Option I - Option II**Model No.: STA940 - I II III - 00000 - **Option I - Option II**

		Code	Material code					
			E	F	H	U	M	P
Options I	No options	X	✓	✓	✓	✓	✓	✓
	Lightning arrester	L	✓	✓	✓	✓	✓	✓
	Built-in indicating smart meter (0 to 100% liner scales)	P	✓	✓	✓	✓	✓	✓
	Built-in indicating smart meter (engineering unit scales)	R	✓	✓	✓	✓	✓	✓
	SUS304 bolt and nuts material	W	✓	✓	✓	✓	✓	✓
	SUS630 bolt and nuts material	U	✓	✓	✓	✓		
	Corrosion-resistant finish	A	✓	✓	✓	✓	✓	✓
	Corrosion-proof finish	B	✓	✓	✓	✓	✓	✓
	Corrosion-resistant finish, silver paint	D	✓	✓	✓	✓	✓	✓
	Oil free finish	K	✓	✓	✓	✓	✓	✓
	Long vent/drain plugs	J	✓	✓	✓	✓		
	FM Explosionproof	3	✓	✓	✓	✓	✓	✓
	FM Intrinsically safe	4	✓	✓	✓	✓	✓	✓
	Combination of FM Explosionproof and Intrinsically safe	5	✓	✓	✓	✓	✓	✓
	ATEX Flameproof	6	✓	✓	✓	✓	✓	✓
ATEX Intrinsic safety	7	✓	✓	✓	✓	✓	✓	
CSA Explosion-proof	8	✓	✓	✓	✓	✓	✓	
Options II	No option	XX	✓	✓	✓	✓	✓	✓
	Burn-out feature (Lower limit of value at abnormal condition) *6	A4	✓	✓	✓	✓	✓	✓
	Burn-out feature (Upper limit of value at abnormal condition) *6	A5	✓	✓	✓	✓	✓	✓
	Water free finish (with oil free finish)	A7	✓	✓	✓	✓	✓	✓
	NEPSI Flameproof	C1	✓	✓	✓	✓	✓	✓
	NEPSI Intrinsically safe	C2	✓	✓	✓	✓	✓	✓
	Custom calibration	C7	✓	✓	✓	✓	✓	✓
	Digital output *7	D5	✓	✓	✓	✓	✓	✓
	HART communication *7 *8	D7	✓	✓	✓	✓	✓	✓
	One elbow	E1	✓	✓	✓	✓	✓	✓
	Two elbows	E2	✓	✓	✓	✓	✓	✓
	External zero/span adjustment	E5	✓	✓	✓	✓	✓	✓
	Mounting bracket	E9	✓	✓	✓	✓	✓	✓
	Side vent/drain top	F1	✓					
	Side vent/drain bottom	F2	✓					
SI unit	U1	✓	✓	✓	✓	✓	✓	

Note) \*6 The output current value ranges from 3.0 to 3.8 mA for the lower limit and from 20.8 to 21.8 mA for the upper limit.

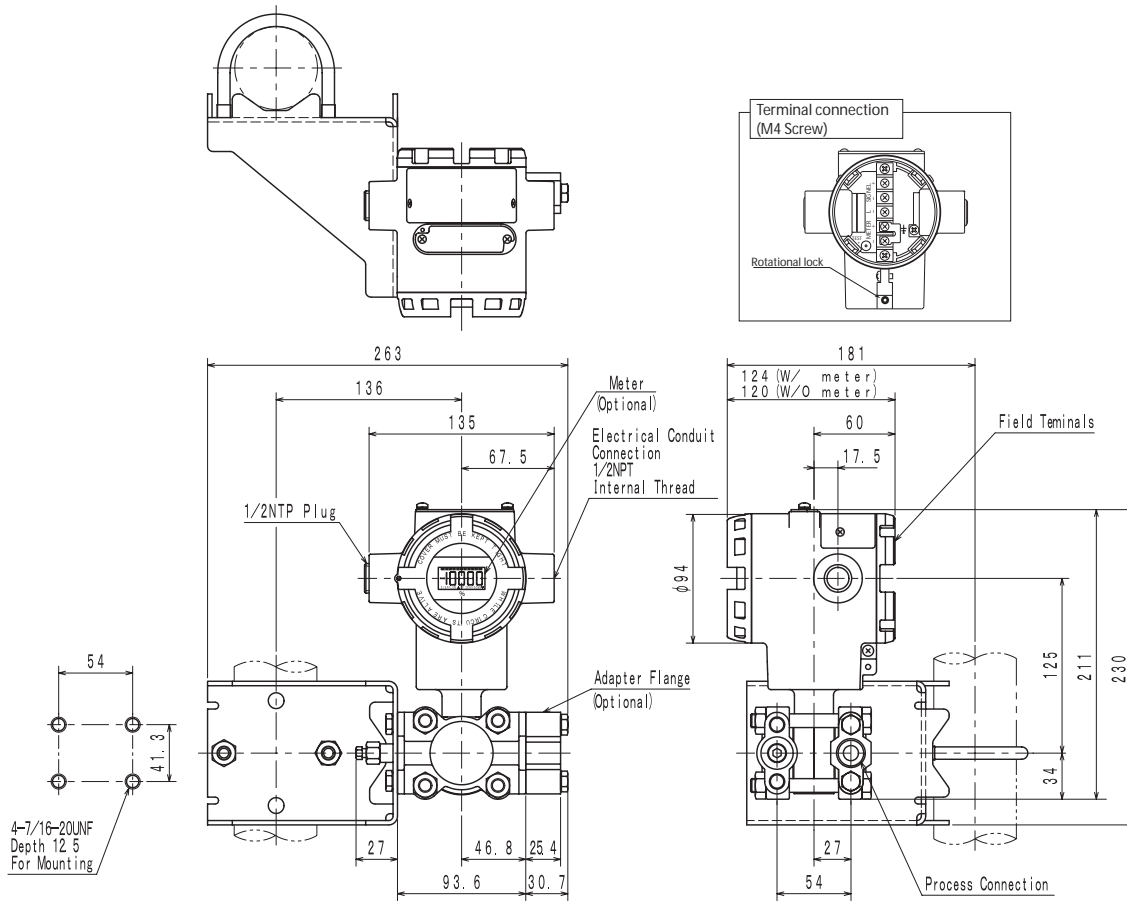
\*7 Either one of "digital output - code D5" or "HART communication - code D7" can be selected at a time.

\*8 Intrinsically safe for NEPSI cannot be selected with -D7.

**DIMENSIONS**

**Model STA923 / STA940**

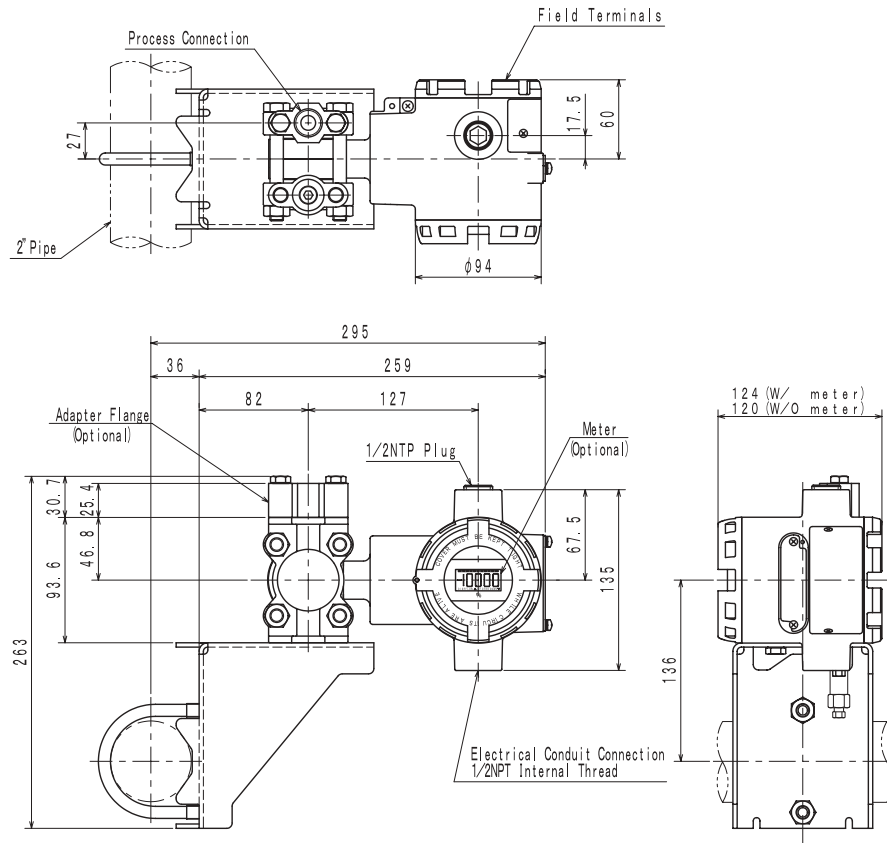
Process connection: Front side



**Model STA923 / STA940**

**Process connection: Top or bottom side**

\*Meter unit inside of transmitter can be rotated for the following installation





*Note*

**azbil**

---

**Yamatake Corporation**  
**Advanced Automation Company**

1-12-2 Kawana, Fujisawa  
Kanagawa 251-8522 Japan

**URL:**<http://www.azbil.com>