# High performance pressure transmitter
## Model: SMT2012-A

Spec. sheet no. SD02-05

### Service intended

The High Performance pressure transmitter SMT2012-A is suitable to measure liquid, gas, and steam flow as well as liquid level, density and pressure.
SMT2012-A outputs a 4~20 mADC signal corresponding to the measured pressure.
Its highly accurate and stable sensor can also measure the static pressure which can be shown on the integral indicator or remotely monitored via HART communications.
Other key features include quick response, remote set-up using communications, self-diagnostics and optional status output for pressure high/low alarm.

## Standard features

### Base accuracy
±0.05 % of calibrated span.

### Range limits
0 ~ 600 Pa to 0 ~ 40 MPa

### Turn down
Adjustable up to 100:1 range ability

### Temperature compensation
High sensitivity temperature sensor packaged in the sensor

### Isolating diaphragm
Stainless steel 316L / Hastelloy C

### Measurement medium
Gas, Steam and liquid

### Stability
10 years stability
0.15 % of URL

### Output
4 ~ 20 mA with HART protocol

## Principle of operation

The pressure transmitter includes two functional units:

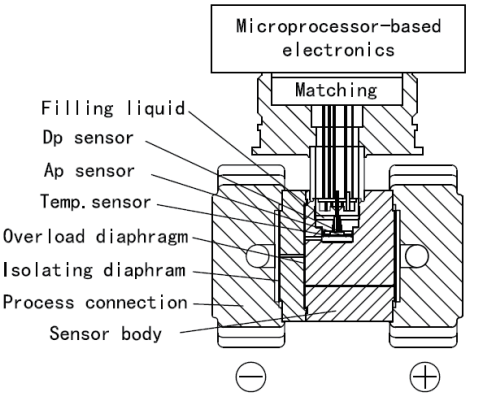
- Main unit
- Auxilary unit

The main unit includes a sensor and process connection.

The completely welded sensor module is a twin-chamber system with an integral overload diaphragm, an absolute pressure sensor, a temperature sensor and the silicon differential pressure sensor.

The absolute pressure sensor, which is only exposed to the pressure at the high pressure side, acts as a reference value to compensate for the static pressure.

The temperature sensor as a temperature compensated reference value to compensate for the temperature drift.




## Main specification

- The differential pressure transmitter utilize the world's leading high stability silicon sensor, the highest Reference Accuracy is ±0.05 %
- Micro-differential pressure transmitter utilize the world's leading dual overload diaphragm patented technology, the highest Reference Accuracy is ±0.075 %
- The differential pressure transmitter working pressure are 16, 25 and 40 MPa, the one-way overload pressure up to 40 MPa
- Micro-pressure / absolute pressure transmitter utilize the no pressure transmission loss overload diaphragm patented technology, the one-way overload pressure up to 7 MPa
- The absolute pressure sensor packaged in the differential pressure transmitter, can be used for static pressure measurement, display and the static pressure compensation. The minimum of the static error is ≤ ±0.05 % / 10 MPa
- High sensitivity temperature sensor packaged in the sensor. The minimum of the temperature error is ≤ ±0.04 % / 10 K
- Stainless steel 316L and silicone oil filling welded seal structure
- Long stability is ≤ ±0.1 % / 3 years, 10 years of maintenance-free
- Extremely wide measuring range 100 Pa ~ 60 MPa
- Adjustable up to 100:1 range ability
- The remote seal transmitter utilize ultra-high temperature(400 ℃) patented technology.

## Standard Specifications

### Performance Specifications

Reference Accuracy of Calibrated Span (includes terminal-based linearity, hysteresis, and repeatability) ± 0.05 %
If TD > 10(TD = URL / SPAN), ±(0.005 × TD)%

The square root accuracy is 1.5 times of reference accuracy of calibrated span.

### Ambient Temperature Effects

-20～65 ˚C：±(0.075×TD+0.025) % × Span
Every 10 ˚C is ±0.04 % × Span (TD=1)
-40～-20 ˚C and 65～85 ˚C：±(0.1 × TD + 0.025) % × Span

### Overpressure Effects

±0.05 % × Span / 10 MPa

### Stability

±0.1 % × Span / 3 years

### Power Supply Effects

±0.001 % /10 V (12～42 V DC)

### Reference Accuracy of Calibrated Span

(Includes terminal-based linearity, hysteresis, and repeatability)

| **Measurement span** | | **1C, 1L** |
|---|---|---|
| Reference accuracy | X ≤ Span | ± 0.05 % of span |
| | X ≥ Span | $\pm (0.05 + \frac{URL}{Span})$% of span |
| X | | 4 kPa |
| URL (Upper range limit) | | 40 kPa |
| **Measurement span** | | **1D, 1M** |
| Reference accuracy | X ≤ Span | ± 0.05 % of span |
| | X ≥ Span | $\pm (0.05 + \frac{URL}{Span})$% of span |
| X | | 25 kPa |
| URL (Upper range limit) | | 250 kPa |
| **Measurement span** | | **1O** |
| Reference accuracy | X ≤ Span | ± 0.05 % of span |
| | X ≥ Span | $\pm (0.05 + \frac{URL}{Span})$% of span |
| X | | 0.3 MPa |
| URL (Upper range limit) | | 3 MPa |
| **Measurement span** | | **1E** |
| Reference accuracy | X ≤ Span | ± 0.05 % of span |
| | X ≥ Span | $\pm (0.05 + \frac{URL}{Span})$% of span |
| X | | 2.1 MPa |
| URL (Upper range limit) | | 21 MPa |
| **Measurement span** | | **G** |
| Reference accuracy | X ≤ Span | ± 0.05 % of span |
| | X ≥ Span | $\pm (0.05 + \frac{URL}{Span})$% of span |
| X | | 1 MPa |
| URL (Upper range limit) | | 10 MPa |

## Standard Specifications

| Measurement span | | H |
|---|---|---|
| Reference accuracy | X ≤ Span | ± 0.05 % of span |
| | X ≥ Span | ± (0.05 + $\frac{URL}{Span}$)% of span |
| X | | 2.1 MPa |
| URL (Upper range limit) | | 21 MPa |
| **Measurement span** | | **I** |
| Reference accuracy | X ≤ Span | ± 0.05 % of span |
| | X ≥ Span | ± (0.05 + $\frac{URL}{Span}$)% of span |
| X | | 4 MPa |
| URL (Upper range limit) | | 40 MPa |

### Maximum total performance

For temperature change of 28 ºC, static pressure change of 5.1 Mpa, for model SMT2012-A.

| Sensor | Span | Maximum total performance |
|---|---|---|
| 1C | 0~2 kPa to 0~40 kPa, 0~2 to 0~400 mbar | ≤ ±0.125 % of calibrated span |
| 1D | 0~2.5 kPa to 0~250 kPa, 0~25 to 0~2.5 bar | |
| 1E | 0~20 kPa to 0~2 MPa, 0~0.2 to 0~20 bar | |
| 1G | 0~0.1 MPa to 0~10 MPa, 0~1 to 0~100 bar | |
| 1H | 0~0.21 MPa to 0~21 MPa, 0~2.1 to 0~210 bar | |
| 1I | 0~0.4 MPa to 0~40 MPa, 0~4 to 0~400 bar | |
| 1L | 0~2 kPa to 0~40 kPa, 0~0.02 to 0~0.4 bar | |
| 1M | 0~2.5 kPa to 0~250 kPa, 0~0.025 to 0~2.5 bar | |
| 1O | 0~30 kPa to 0~3 MPa, 0~0.3 to 0~30 bar | |

*Note : Sensor "1L" , "1M" , "1O" is Absolute pressure

$$E_{Mperf} = \sqrt{(E_{\Delta TZ} + E_{\Delta TS})^2 E_{\Delta PS}{}^2 + E_{lin}{}^2}$$

$E_{Mperf}$ = Maximum total performance

$E_{\Delta Tz}$ = Effect of the ambient temperature on zero

$E_{\Delta Ts}$ = Effect of the ambient temperature on span

$E_{\Delta Ps}$ = Effect of the static pressure on span

$E_{lin}$ = Accuracy rating (for terminal – based linearity 0.05 % as per model and sensor accuracy)

## Standard Specifications

### Total performance

Similar to DIN 16086
Temperature change in the range from -10 to 60 °C, static pressure change. (SMT2012-A) 10 Mpa

$$E_{perf} = \sqrt{(E_{\Delta TZ} + E_{\Delta TS})^2 E_{\Delta PS}{}^2 + E_{lin}{}^2}$$

$E_{perf}$ = Total performance

$E_{\Delta Tz}$ = Effect of the ambient temperature on zero

$E_{\Delta Ts}$ = Effect of the ambient temperature on span

$E_{\Delta Ps}$ = Effect of the static pressure on span

$E_{lin}$ = Accuracy rating (for terminal – based linearity 0.05 % as per model and sensor accuracy)

Maximum total performance and Total performance includes the measuring errors of
- Non-linearity including hysteresis and non-reproducibility,
- Thermal change of the ambient temperature as regards the zero signal and the calibrated span,
- Effect of static pressure change on the calibrated span, with transmitter re-zeroed at line pressure

## Functional Specifications

### Span and Range Limits

| Span / Range Limits | | kPa | bar |
|---|---|---|---|
| 1C / 1L | Span | 2 ~ 40 | 0.02 ~ 0.4 |
| | Range Limits | -40 ~ 40 | -0.4 ~ 0.4 |
| 1D / 1M | Span | 2.5 ~ 250 | 0.025 ~ 2.5 |
| | Range Limits | -100 ~ 250 | -1 ~ 2.5 |
| 1E | Span | 20 ~ 2000 | 0.2 ~ 20 |
| | Range Limits | -100 ~ 2000 | -1 ~ 2.5 |
| 1G | Span | 0.1 ~ 10 MPa | 1 ~ 100 |
| | Range Limits | -0.1 ~ 10 MPa | -1 ~ 100 |
| 1H | Span | 0.21 ~ 21 MPa | 2.1 ~ 210 |
| | Range Limits | -0.1 ~ 21 MPa | -1 ~ 210 |
| 1I | Span | 0.4 ~ 40 MPa | 4 ~ 400 |
| | Range Limits | -0.1 ~ 40 MPa | -1 ~ 400 |
| 1O | Span | 0.4 ~ 40 MPa | 4 ~ 400 |
| | Range Limits | -0.1 ~ 40 MPa | -1 ~ 400 |

### Zero Adjustment Limits

Zero can be fully elevated or suppressed, within the lower and upper range limits of the capsule.

## Standard Specifications

### Overload Pressure Limits

| Span | | 40 kPa [1C] | 250 kPa [1D] | 3 MPa [1E] |
|---|---|---|---|---|
| **OPL** | | 16 MPa | 16 MPa | 16 MPa |
| **Span** | 10 MPa (1G) | 21 MPa (1H) | 40 MPa (I) | |
| **OPL** | 20 MPa | 50 MPa | 50 MPa | |

### External Zero Adjustment
External zero is continuously adjustable with 0.01 % incremental resolution of span. Re-range can be done locally using the range setting switch.

### Mounting Position Effects
Rotation in diaphragm plane has no effect. Tilting up to 90° will cause zero shift up to 0.25 kPa which can be corrected by the zero adjustment.

### Output
Two wire 4~20 mADC output with digital communications, linear or square root programmable.
HART FSK protocol are superimposed on the 4~20 mADC signal.
Output range : 3.9 mA to 20.5 mA.

### Failure Alarm (the mode can be selected)
Low Mode (min) : 3.7 mA
High Mode (max) : 21 mA
No Mode (hold) : Keep the effective value before the fault.

* Note : The standard setting of failure alarm is High Mode.

### Response Time
The amplifier damping constant is 0.1 sec.
The sensor damping constant is 0.1~1.6 sec, it depends on the range and range compression ratio.
Amplifier damping time constant is adjustable from 0.1 to 60 sec by software and added to response time.

### UpTime
< 15s

### Static Pressure Limits
3.5 kPa absolute to maximum working pressure

### One-way Overload Pressure Limit
The maximum one-way overload pressure is maximum working pressure

## Standard Specifications

### HART digital communication and 4 to 20 mA output Power Supply

The transmitter operates from 12 to 36 V DC with no load and is protected against reverse polarity connection
Minimum operating voltage increase to 12 V DC with surge protector

### Ripple

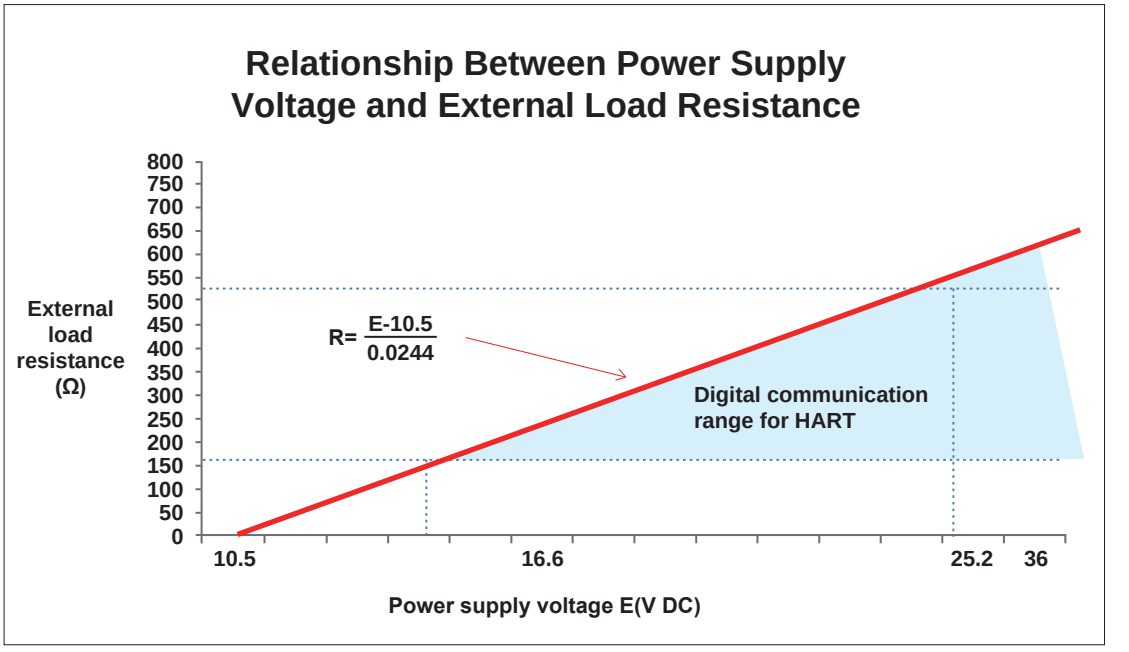
20 mV max on a 250 Ω load as per HART specifications.

### Load limitations

4 to 20 mA and HART total loop resistance :

$$R\ (k\Omega) = \frac{\text{Supply voltage} - \text{min. operating voltage (V DC)}}{22\ mA}$$

A minimum of 250 Ω is required for HART communication.




### Supply and Load Requirements

24 VDC supply, R≤(Us-12 V) / Imax kΩ, Imax = 23 mA.
Maximum voltage limited: 42 VDC, Minimum voltage limited: 12 VDC, 15 VDC（with LCD display）
230Ω to 600Ω for digital communication

### Electrical Connection

The electrical connection is made via cable entry M20x1.5.
The screw terminals are suitable for wire cross-sections up to 2.5 mm².

## Standard Specifications

### Process Connection
Flange with fixing thread 7/16-20 UNF and 1/4-18 NPT female thread on both sides.

### Electromagnetic field
Meets all the requirements of EN 61326 and NAMUR NE-21.

### Load
Within load/voltage specified limits the total effect is negligible

## Install

The transmitter housing can be rotated about 360 degrees relative to the transmitter module without affecting the performance and internal wiring.

Transmitter can be operated Through the PC machine or notebook computer via HART modem.
HART modem can be connected in parallel to the signal circuit at arbitrary point.
The HART modem communicates with the transmitter through an AC signal superimposed on the 4~20 mA output signals. This modulation does not change in the mean values, so does not affect the measurement signal.

## Physical Specifications

### Wetted Parts Materials

**Sensor Body**
Stainless steel 316L

**Process Connector Gasket**
NBR / Viton / Teflon

**Isolating Diaphragm**
Stainless steel 316L / Hastelloy C

**Amplifier Housing**
Aluminium with epoxy resin coat

**Cover Flange**
Stainless steel 316

**Housing Gasket**
Perbunan（NBR）

**Nuts and Bolts**
Stainless steel 304

**Name plate and tag**
Stainless steel 304

**Process Connector**
Stainless steel 316

**Weight**
3.3 kg

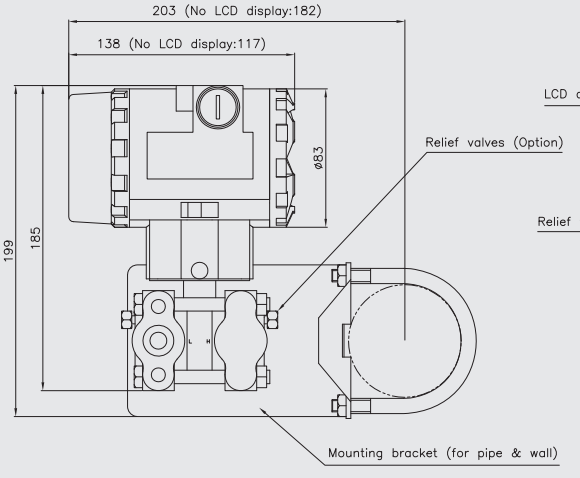
**Fill fluid**
Silicone oil / Fluorinated oil

**Degrees of Protection**
IP67

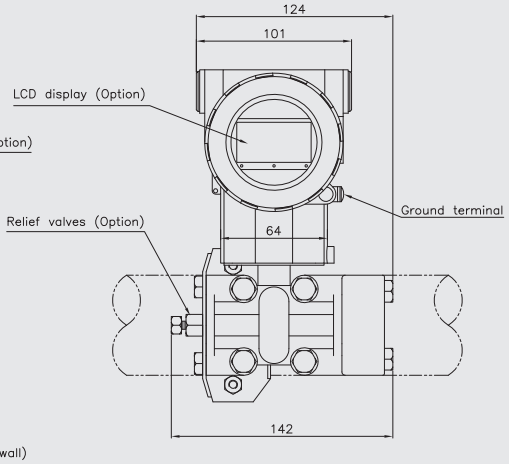
## SMT2012-A : Type of mounting

**Unit : mm**

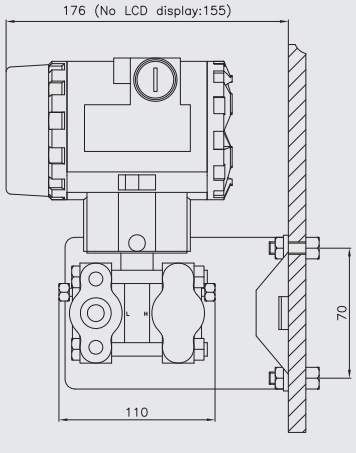
### Horizontal Impulse Piping Type (Side face)



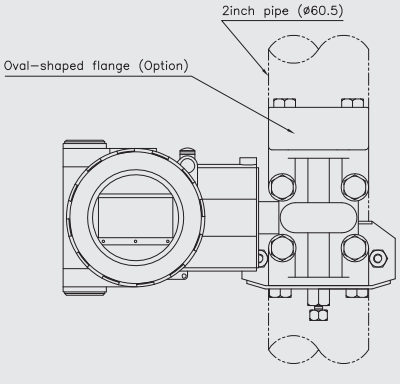

### Horizontal Impulse Piping Type (Front side)




### Horizontal Impulse Wall Mounting Type

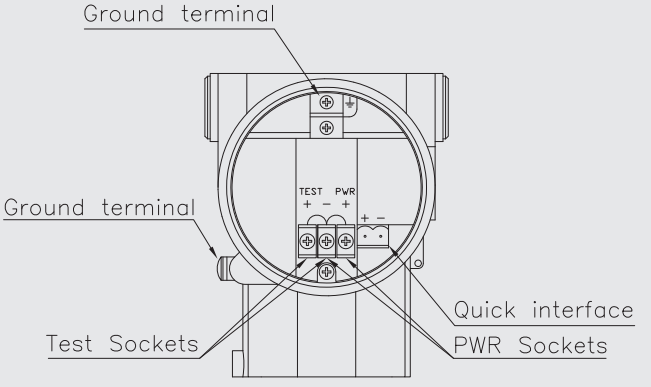



### Vertical Impulse Piping Type

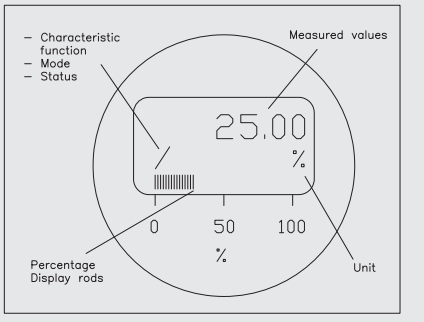


# SMT2012-A : Type of mounting

## Terminal Configuration

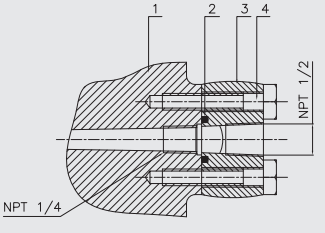



## LCD Display



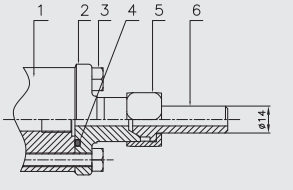

## Process Connection Description

**Oval-shaped flange with ¼-18 NPT female thread (Code 1)**




1. Flange
2. O−ring
3. Oval−shaped flange
4. Bolt

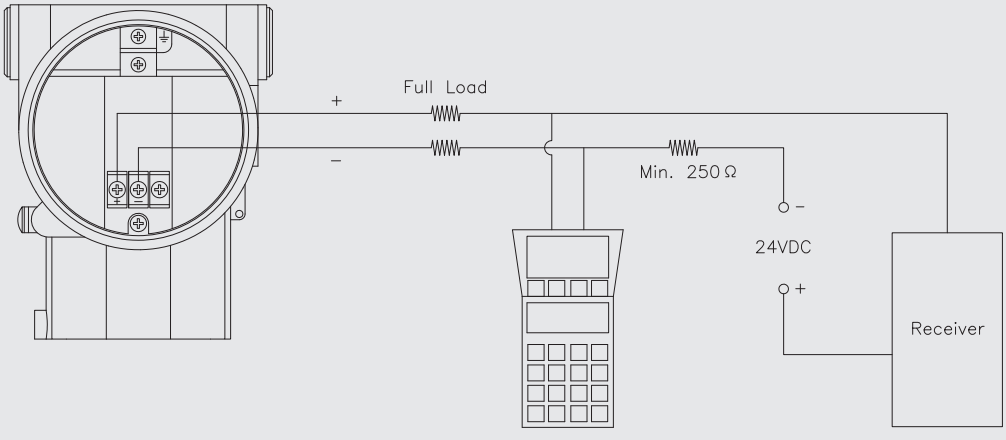
**D-shaped connector with M20X1.5 male thread (Code 2)**



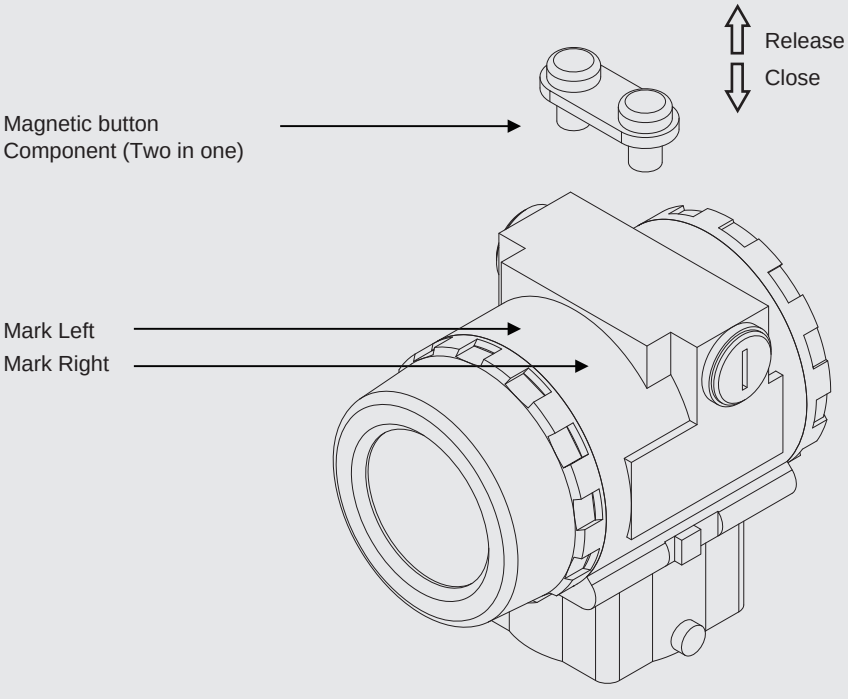

1. Flange
2. D−shaped connector
3. Bolt
4. O−ring
5. M20x1.5 Nut
6. Joining pipe

## SMT2012-A : Type of mounting

### Electrical Connection Diagram




### Control Button



## Main order Ordering information

### 1. Base model

**SMT2012-A** High Performance Pressure Transmitter

### 2. Accuracy

| | |
|---|---|
| **S** | 0.04 % |
| **A** | 0.05 % |

### 3. Span (kPa / bar)

| | |
|---|---|
| **1C** | 0-2 ~ 40 / 0-0.02 ~ 0.4 |
| **1D** | 0-2.5 ~ 250 / 0-0.025 ~ 2.5 |
| **1E** | 0-20 kPa ~ 2 MPa / 0-0.2 ~ 20 |
| **1G** | 0-0.1 ~ 10 MPa / 1 ~ 100 |
| **1H** | 0-0.21 ~ 21 MPa / 2.1 ~ 210 |
| **1I** | 0-0.4 ~ 40 MPa / 4 ~ 400 |
| **1L** | 0-2 to 40 / 0-0.02 ~ 0.4 (Absolute) |
| **1M** | 0-2.5 ~ 250 / 0-0.025 ~ 2.5 (Absolute) |
| **1O** | 0-30 kPa ~ 3 MPa / 0-0.3 ~ 30 (Absolute) |

### 4. Diaphragm fill fluid

| | |
|---|---|
| **A** | Stainless steel 316L / Silicone oil |
| **C** | Hastelloy-C / Silicone oil |

### 5. Maximum working pressure (MPa)

| | |
|---|---|
| **1** | 16 |
| **2** | 25 |
| **3** | 40 |

### 6. Process connections

| | |
|---|---|
| **N** | 7/16-20 UNF and 1/4-18 NPT female thread, No relief valve |
| **B** | 7/16-20 UNF and 1/4-18 NPT female thread, Relief valves at end of flanges |
| **U** | 7/16-20 UNF and 1/4-18 NPT female thread, Relief valves at the upper part of the flange side |
| **D** | 7/16-20 UNF and 1/4-18 NPT female thread, Relief valve at the lower part of the flange side |

### 7. Special Function

| | |
|---|---|
| **N** | None |
| **O** | Degrease cleansing treatment（Oxygen measurement must be with fluorinated oil filled capsule, Viton (FKM) gasket, < 6 MPa ,< 60 °C) |

### 8. Mounting bracket

| | |
|---|---|
| **N** | None |
| **1** | Stainless steel 304 |
| **2** | Carbon steel galvanized |

### 9. Process connector accessory

| | |
|---|---|
| **N** | None |
| **1** | Stainless steel oval-shaped flange with 1/2 NPT famale thread |
| **2** | Stainless steel D-shaped connector with M20X1.5 male thread |

### 10. Explosion-proof option

| | |
|---|---|
| **N** | None |
| **I** | Intrinsic safety Ex ia |
| **D** | Isolated explosion Ex d |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|
| SMT2012-A | **S** | **1D** | **A** | **1** | **N** | **N** | **2** | **2** | **N** | **Sample ordering code** |