

Gauge / Absolute Pressure Transmitter

Model: SMT2002-B

Spec. sheet no. SD02-04

Service intended

The pressure transmitter SMT2002-B is suitable to measure liquid, gas, and steam flow as well as liquid level, density and pressure.

SMT2002-B outputs a 4~20 mA DC signal corresponding to the measured pressure.

The key features include quick response, remote set-up using communications, self-diagnostics and optional status output for pressure high/low alarm.

The high performance pressure transmitter SMT2002-B is suitable to measure liquid, gas, or steam flow as well as liquid level, density and pressure.

SMT2002-B outputs a 4~20 mADC signal corresponding to the measured pressure.



Standard features

Base accuracy

±0.075 % of calibrated span.

Isolating diaphragm

Stainless steel 316L / Hastelloy C

Range limits

0 ~ 600 Pa to 0 ~ 60 MPa

Measurement medium

Gas, Steam and liquid

Turn down

Adjustable up to 100:1 range ability

Stability

10 years stability
0.15 % of URL

Temperature compensation

High sensitivity temperature sensor packaged in the sensor

Output

4 ~ 20 mA with HART protocol

Principle of operation

The differential pressure transmitter includes two functional units:

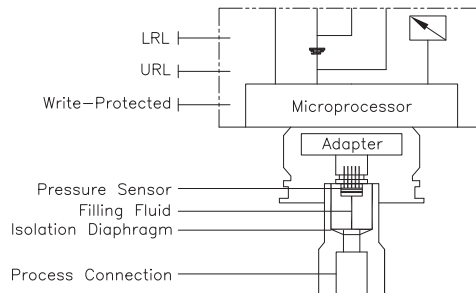
- Main unit
- Auxiliary unit

Main unit includes sensor and Process connection, Works as follows.

The process medium through a flexible, corrosion resistance of the isolation diaphragm and the fill fluid pressure is applied on the measuring silicon pressure chip.

A termination of the chip connected at the atmosphere (for a gauge pressure measurement) or vacuum (for absolute pressure measurement).

When the measured pressure through the measuring diaphragm and the filling liquid is transmitted to the sensor silicon chip, so that the silicon chip of the sensor resistance changes, resulting in change in output voltage of the detection system. this output voltage is proportional to the pressure change. The output is transfer into a standardized signal output by adapter unit and amplifier.



Main specification

- The gauge pressure transmitter utilize the world's leading high stability silicon sensor, the highest Reference Accuracy is $\pm 0.075\%$
- Micro-gauge pressure transmitter utilize the world's leading dual overload diaphragm patented technology, the highest Reference Accuracy is $\pm 0.075\%$
- The gauge 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
- High sensitivity temperature sensor packaged in the sensor. The minimum of the temperature error is $\leq \pm 0.075\% / 10\text{ K}$
- Stainless steel 316L and silicone oil filling welded seal structure
- Long stability is $\leq \pm 0.1\% / 3\text{ years}$, 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 °C) patented technology.

Standard Specifications

Performance Specifications

Reference Accuracy of Calibrated Span (includes terminal-based linearity, hysteresis, and repeatability) $\pm 0.075\%$
If $TD > 10(TD = URL / SPAN)$, $\pm(0.0075 \times TD)\%$

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

Ambient Temperature Effects

$-20 \sim 65\text{ }^{\circ}\text{C} : \pm(0.2 \times TD + 0.05)\% \times \text{Span}$

Every $10\text{ }^{\circ}\text{C}$ is $\pm 0.08\% \times \text{Span}$ ($TD=1$)

$-40 \sim 20\text{ }^{\circ}\text{C}$ and $65 \sim 85\text{ }^{\circ}\text{C} : \pm(0.3 \times TD + 0.1)\% \times \text{Span}$

Overpressure Effects

$\pm 0.075\% \times \text{Span}$

Stability

$\pm 0.1\% \times \text{Span} / 3\text{ years}$

Power Supply Effects

$\pm 0.001\% / 10\text{ V}$ ($12 \sim 42\text{ V DC}$)

Reference Accuracy of Calibrated Span

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

Measurement span		B
Reference accuracy	$X \leq \text{Span}$	$\pm 0.075\%$ of span
	$X \geq \text{Span}$	$\pm (0.075 + \frac{URL}{Span})\%$ of span
X		3.3 kPa
URL (Upper range limit)		6 kPa
Measurement span		C, L
Reference accuracy	$X \leq \text{Span}$	$\pm 0.075\%$ of span
	$X \geq \text{Span}$	$\pm (0.075 + \frac{URL}{Span})\%$ of span
X		21 kPa
URL (Upper range limit)		40 kPa
Measurement span		D, M
Reference accuracy	$X \leq \text{Span}$	$\pm 0.075\%$ of span
	$X \geq \text{Span}$	$\pm (0.075 + \frac{URL}{Span})\%$ of span
X		126 kPa
URL (Upper range limit)		250 kPa
Measurement span		F, O
Reference accuracy	$X \leq \text{Span}$	$\pm 0.075\%$ of span
	$X \geq \text{Span}$	$\pm (0.075 + \frac{URL}{Span})\%$ of span
X		1.5 MPa
URL (Upper range limit)		3 MPa
Measurement span		G
Reference accuracy	$X \leq \text{Span}$	$\pm 0.075\%$ of span
	$X \geq \text{Span}$	$\pm (0.075 + \frac{URL}{Span})\%$ of span
X		5 MPa
URL (Upper range limit)		10 MPa

Standard Specifications

Measurement span		H
Reference accuracy	$X \leq \text{Span}$	$\pm 0.075 \% \text{ of span}$
	$X \geq \text{Span}$	$\pm (0.075 + \frac{\text{URL}}{\text{Span}}) \% \text{ of span}$
X		10.6 MPa
URL (Upper range limit)		21 MPa
Measurement span		I
Reference accuracy	$X \leq \text{Span}$	$\pm 0.075 \% \text{ of span}$
	$X \geq \text{Span}$	$\pm (0.075 + \frac{\text{URL}}{\text{Span}}) \% \text{ of span}$
X		20.2 MPa
URL (Upper range limit)		40 MPa
Measurement span		J
Reference accuracy	$X \leq \text{Span}$	$\pm 0.075 \% \text{ of span}$
	$X \geq \text{Span}$	$\pm (0.075 + \frac{\text{URL}}{\text{Span}}) \% \text{ of span}$
X		30.3 MPa
URL (Upper range limit)		60 MPa

Maximum total performance

For temperature change of 28 °C, static pressure change of 5.1 Mpa, for model SMT2002-B.

Sensor	Span	Maximum total performance
B	0~0.6 kPa to 0~6 kPa, 0~0.06 to 0~60 mbar	$\leq \pm 0.188 \% \text{ of calibrated span}$
C	0~2 kPa to 0~40 kPa, 0~2 to 0~400 mbar	
D	0~2.5 kPa to 0~250 kPa, 0~25 to 0~2.5 bar	
F	0~30 kPa to 0~3 MPa, 0~0.3 to 0~30 bar	
G	0~0.1 MPa to 0~10 MPa, 0~1 to 0~100 bar	
H	0~0.21 MPa to 0~21 MPa, 0~2.1 to 0~210 bar	
I	0~0.4 MPa to 0~40 MPa, 0~4 to 0~400 bar	
J	0~0.6 MPa to 0~60 MPa, 0~6 to 0~600 bar	
L	0~2 kPa to 0~40 kPa, 0~0.02 to 0~0.4 bar	
M	0~2.5 kPa to 0~250 kPa, 0~0.025 to 0~2.5 bar	
O	0~30 kPa to 0~3 MPa, 0~0.3 to 0~30 bar	

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

$$E_{\text{Mperf}} = \sqrt{(E_{\Delta\text{Tz}} + E_{\Delta\text{T}s})^2 + E_{\Delta\text{Ps}}^2 + E_{\text{lin}}^2}$$

E_{Mperf} = Maximum total performance

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

$E_{\Delta\text{T}s}$ = Effect of the ambient temperature on span

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

E_{lin} = Accuracy rating (for terminal – based linearity 0.05%)

Standard Specifications

Total performance

Similar to DIN 16086

Temperature change in the range from -10 to 60 °C, static pressure change. (SMT2002-B) 10 Mpa

$$E_{\text{perf}} = \sqrt{(E_{\Delta Tz} + E_{\Delta Ts})^2 E_{\Delta Ps}^2 + E_{\text{lin}}^2}$$

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 0.075 % 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
B	Span	0.6 ~ 6	6 ~ 60 mbar
	Range Limits	-6 ~ 6	-60 ~ 60 mbar
C/L	Span	2 ~ 40	0.02 ~ 0.4
	Range Limits	-40 ~ 40	-0.4 ~ 0.4
D/M	Span	2.5 ~ 250	0.0025 ~ 2.5
	Range Limits	-100 ~ 250	-1 ~ 2.5
F/O	Span	30 ~ 3000	0.3 ~ 30
	Range Limits	-100 ~ 3000	-1 ~ 30
G	Span	0.1 ~ 10 MPa	1 ~ 100
	Range Limits	-0.1 ~ 10 MPa	-1 ~ 100
H	Span	0.21 ~ 21 MPa	2.1 ~ 210
	Range Limits	-0.1 ~ 21 MPa	-1 ~ 210
I	Span	0.4 ~ 40 MPa	4 ~ 400
	Range Limits	-0.1 ~ 40 MPa	-1 ~ 400
J	Span	0.6 ~ 60 MPa	6 ~ 600
	Range Limits	-0.1 ~ 60 MPa	-1 ~ 600

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		250 MPa [D/M]	3 MPa [F/O]
	[C]			
OPL	1 MPa		4 MPa	15 MPa
Span	10 MPa (G)		21 MPa (H)	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

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

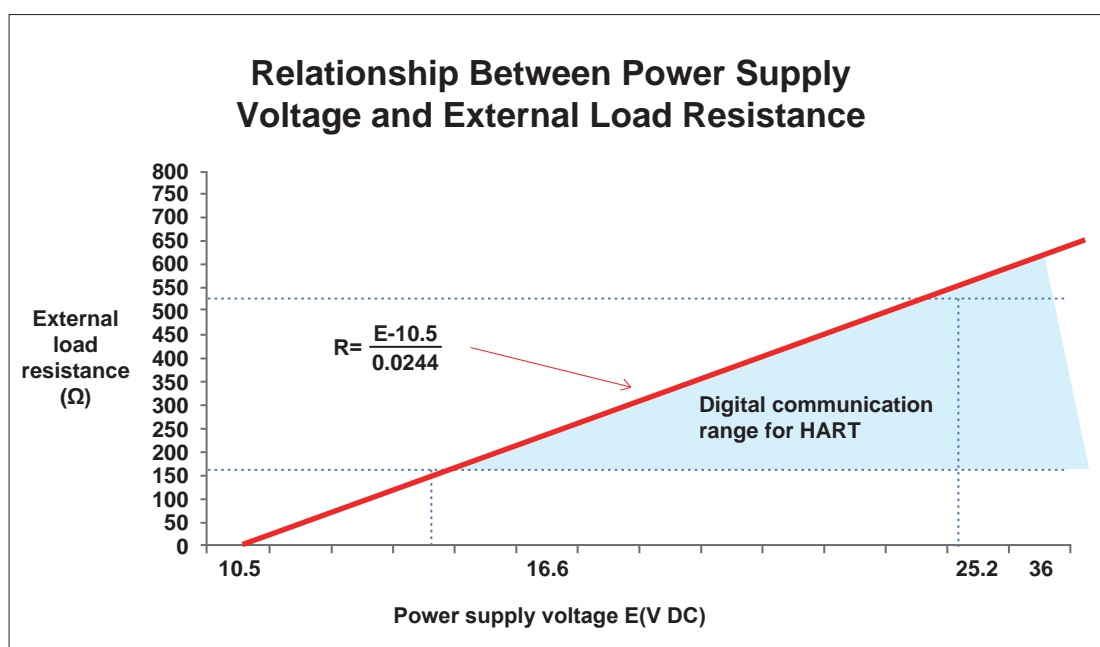
20 mV max on a 250 Ω load as per HART specifications.

Load limitations

4 to 20 mA and HART total loop resistance :

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

A minimum of 250 Ω is required for HART communication.



Supply voltage

Within voltage/load specified limits the total effect is less than 0.005 % of URL per volt.

Supply and Load Requirements

24 VDC supply, $R \leq (U_s - 12 \text{ V}) / I_{\text{max}}$ k Ω , $I_{\text{max}} = 23 \text{ mA}$.

Maximum voltage limited: 42 VDC, Minimum voltage limited: 12 VDC, 15 VDC (with LCD display)

230 Ω to 600 Ω 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

Ambient Temperature Limits

-40 to 85 °C

-20 to 65 °C with LCD display or fluorine rubber sealing

Storage and Transportation Temperature Limits

-50 to 85 °C

-40 to 85 °C with LCD display

Working Pressure Limits (Silicone oil)

From vacuum to upper range limits

Process Connection

Default Process Connection : ½ NPT female thread

Electromagnetic field

Meets all the requirements of EN 61326 and NAMUR NE-21. it can be changed to ½ NPT, G½, M20x1.5 male thread and KF16 vacuum Connection

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 modem.

Modem can be connected in parallel to the signal circuit at arbitrary point.

The 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

Isolating Diaphragm

Stainless steel 316L / Hastelloy C /

Gold plated on 316L / FEP Plated on 316L /

Tantalum

Amplifier Housing

Aluminium with epoxy resin coat

Housing Gasket

Perbunan (NBR)

Process Connector

Stainless steel 316

Name plate and tag

Stainless steel 304

Fill fluid

Silicone oil / Fluorinated oil

Weight

1.6 kg

Process Connector Gasket

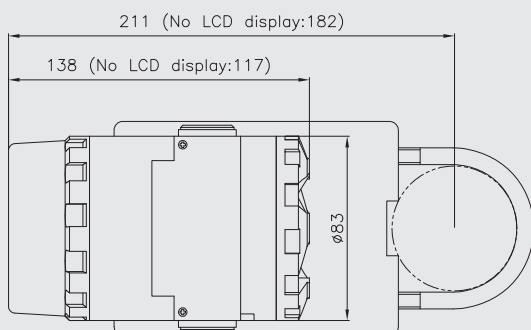
Perbunan (NBR) / Viton (FKM) / Teflon (PTFE)

Degrees of Protection

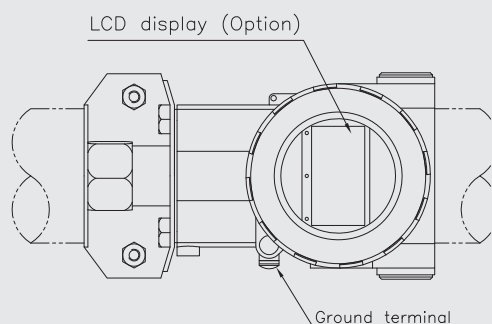
IP67

Unit : mm

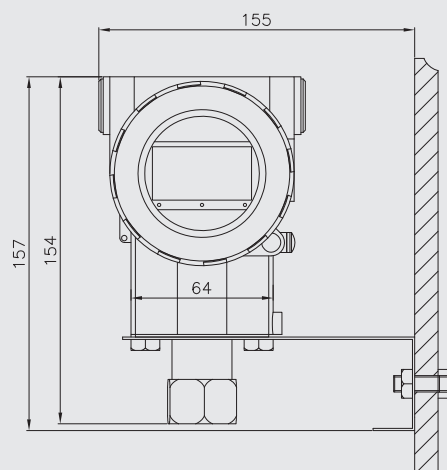
**Horizontal Impulse Piping Type
(Side face)**



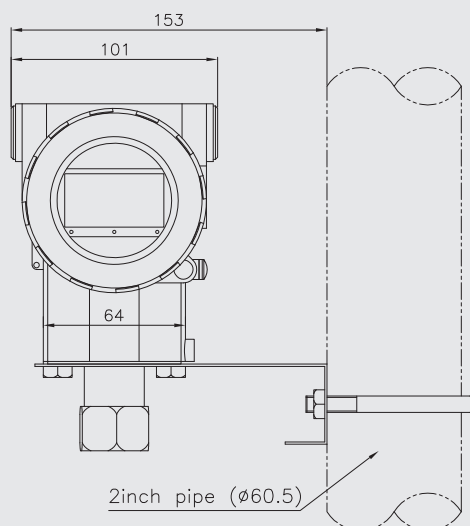
**Horizontal Impulse Piping Type
(Front side)**



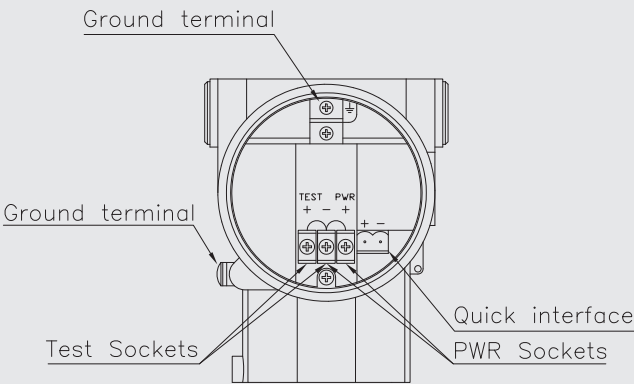
Horizontal Impulse Wall mounting Type



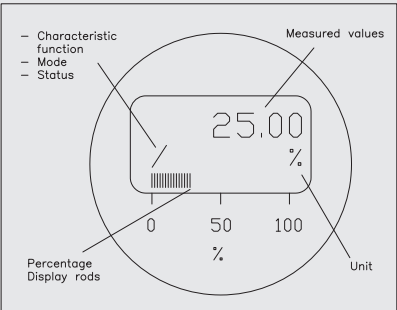
Vertical Impulse Piping Type



Terminal Configuration

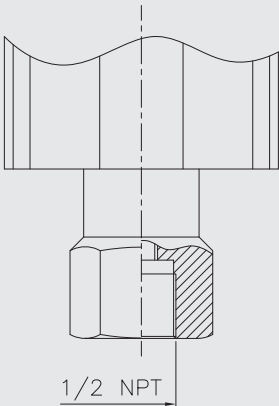


LCD Display

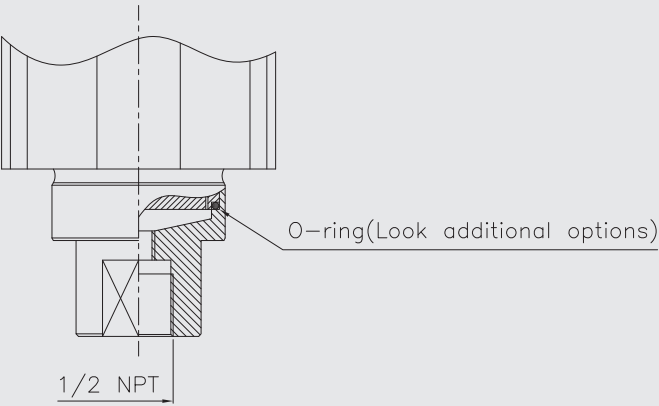


Process Connections Description Default Process Connection

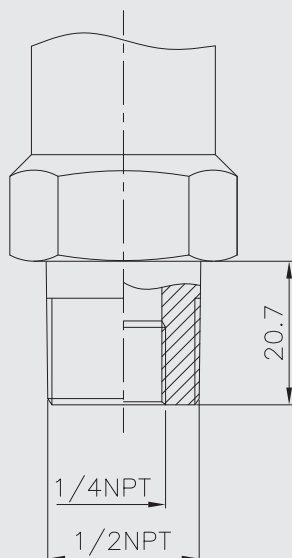
F/G/H/I Span



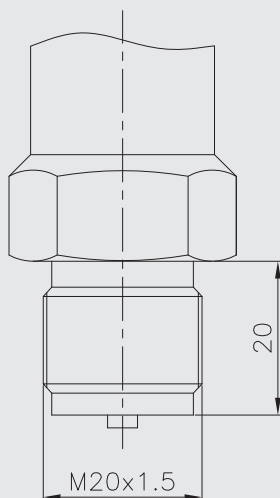
C/S/D Span



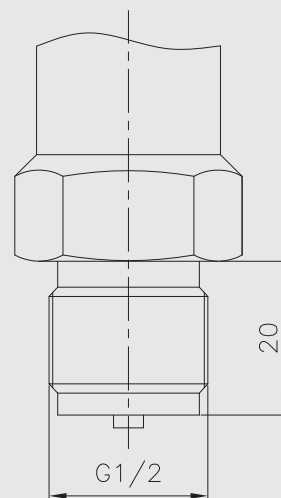
**Other forms of
Process connector
1/2"-NPT male thread**



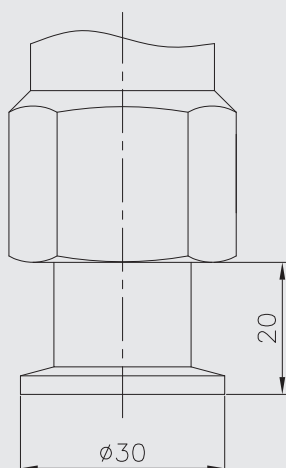
M20 x 1.5 male thread



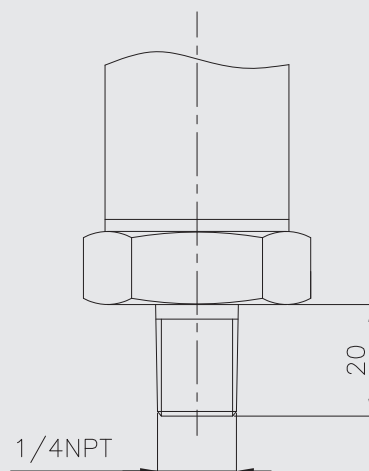
G1/2 male thread



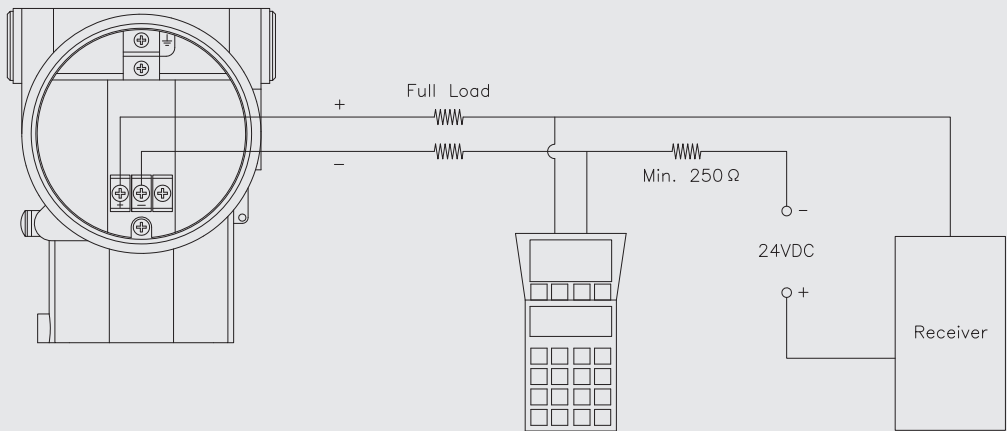
**Vacuum Connection
DIN 28403 KF16 / ISO 2861**



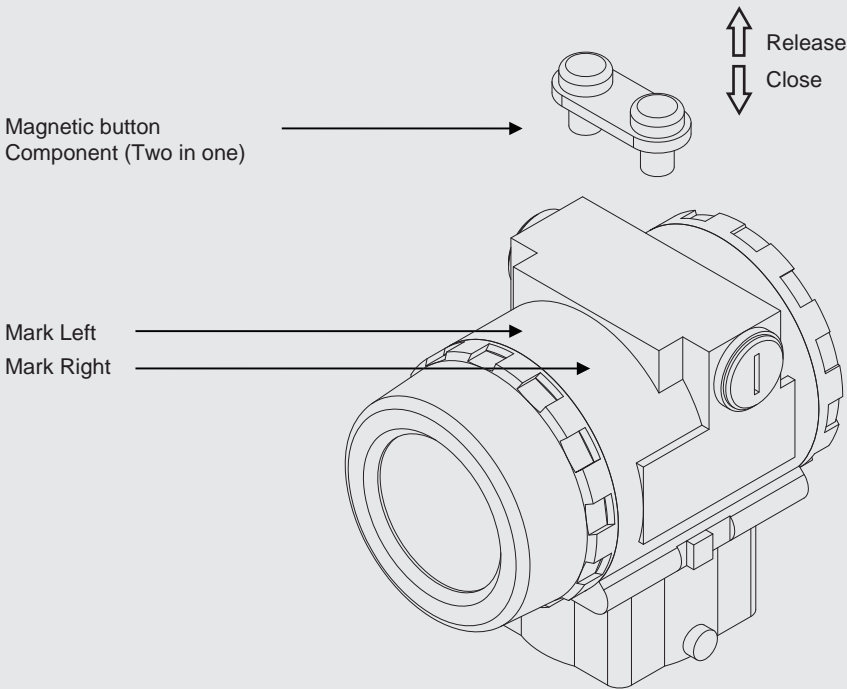
1/4-NPT male thread



Electrical Connection Diagram



Control Button



1. Base model**SMT2002-B** Gauge / Absolute Pressure Transmitter**2. Accuracy**

- S** 0.75 %
A 0.1 %

3. Span (kPa / bar)

- B** 0-0.6 ~ 6 / 6 ~ 60 mbar
C 0-2 ~ 40 / 0.02 ~ 4
D 0-2.5 ~ 250 / 0.025 ~ 2.5
F 0-30 ~ 3000 / 0.3 ~ 30
G 0-0.1 ~ 10 MPa / 1 ~ 100
H 0-0.21 ~ 21 MPa / 2.1 ~ 210
I 0-0.4 ~ 40 MPa / 4 ~ 400
J 0-0.6 ~ 60 MPa / 6 ~ 600
L 0-2 to 40 / 0.02 ~ 0.4 (Absolute)
M 0-2.5 ~ 250 / 0.025 ~ 2.5 (Absolute)
O 0-30 ~ 3000 / 0.3 ~ 30 (Absolute)

4. Diaphragm fill fluid

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

5. Process connections

- 1** ½ NPT female thread
2 ½ NPT male thread (Containing ¼ NPT female thread)
3 M20x1.5 female
4 G ½ female thread
5 Vacuum Connection DIN 28403 KF16 / ISO 2861
6 ¼ NPT male thread

6. Special Function

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

7. Mounting bracket

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

8. Explosion-proof option

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

1	2	3	4	5	6	7	8	Sample ordering code
SMT2002-B	A	C	A	2	N	N	N	

