

SITRANS P measuring instruments for pressure

Transmitters for pressure

MS series

Overview



SITRANS P pressure transmitters, MS series, with built-in analog indicator (as option)

SITRANS P pressure transmitters, MS series, measure the pressure of aggressive, non-aggressive and hazardous gases, vapors and liquids.

They are precise and robust pressure transmitters of compact design.

These pressure transmitters are available in numerous versions and with a wide range of accessories.

Benefits

- The span can be selected in a large range (0.03 ... 400 bar (0.435 ... 5802 psi))
- Small error in measurement
- Operation by keys or through HART communication
- Measuring aggressive media
- Long-term drift $\leq 0.1\%$ in 12 months
- Conformity error $\leq 0.25\%$
- Is easy to integrate in the SIMATIC PCS7 process control system
- Ex protection to ATEX and FM/CSA

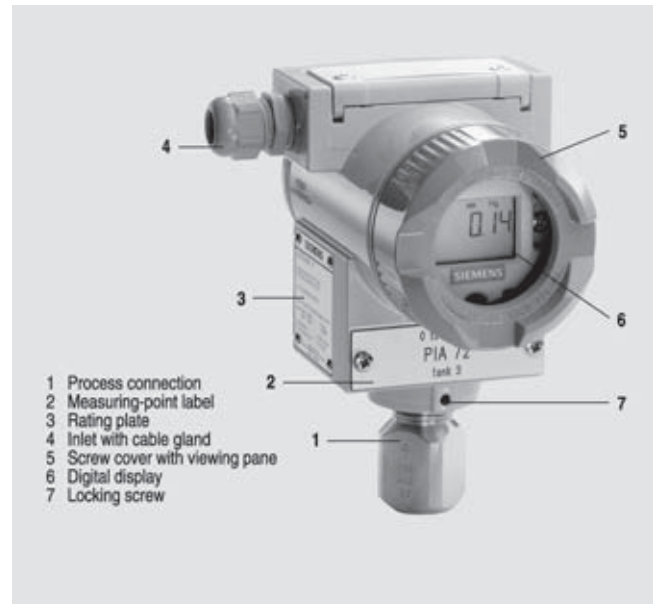
Application

SITRANS P pressure transmitters, MS series, measure the pressure of aggressive and non-aggressive gases, vapors and liquids. Spans are possible between 0.03 mbar (0.44 psi) and 400 bar (5802 psi).

Transmitters with the type of protection "Intrinsic safety" may be installed within potentially explosive atmospheres (zone 1). The conformity certificate corresponds to the European standard (ATEX).

The transmitters can be equipped with various designs of remote seals for special applications such as the measurement of highly viscous substances.

Design



SITRANS P pressure transmitters, MS series, front view

The transmitter consists of various components depending on the order. The possible versions are listed in the ordering information. The components described below are the same for all transmitters.

The rating plate (3, Figure "Front view") with the Order No. is located on the side of the housing. The specified number together with the ordering information provide details on the optional design details and on the possible measuring range (physical properties of built-in sensor element).

The approval label is located on the opposite side.

The housing is made of die-cast aluminium or stainless steel precision casting. A round cover (5) is screwed on at the front and rear of the housing. The front cover (6) can be fitted with a viewing pane so that the measured values can be read directly on the digital display. The inlet (4) for the electrical connection is located either on the left or right side. The unused opening on the opposite side is sealed by a blanking plug. The protective earth connection is located on the rear of the housing.

The electrical connections for the power supply and screen are accessible by unscrewing the rear cover. The bottom part of the housing contains the measuring cell with process connection (1). The measuring cell is protected from rotating by a locking screw.

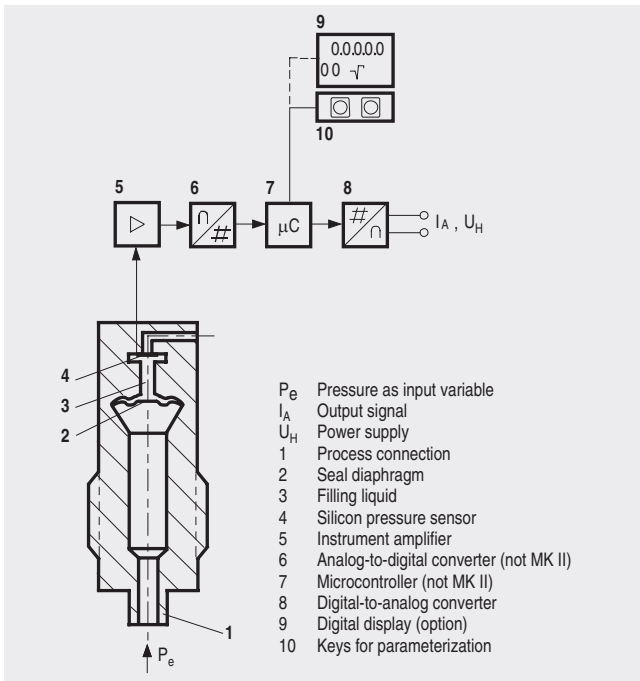
SITRANS P measuring instruments for pressure

Transmitters for pressure

MS series

2

Function



SITRANS P pressure transmitters, MS series, functional diagram

The pressure is applied through the seal diaphragm (2, Figure "Functional diagram") and the filling liquid (3) to the silicon pressure sensor (4) whose measuring diaphragm is then flexed. The resistance of the four piezo-resistors fitted in the diaphragm in a bridge circuit thus changes.

This change in resistance results in a bridge output voltage proportional to the input pressure, which is amplified in an instrument amplifier and converted in an analog-to-digital converter into a digital signal.

This signal is evaluated by a microcontroller (7), and its linearity and temperature response corrected. The signal processed in this manner is converted in a digital-to-analog converter (8) into an output current 4 ... 20 mA.

The data specific to the measuring cell as well as the data for parameterization of the pressure transmitter are stored in a non-volatile EEPROM.

Transmitters with spans ≤ 63 bar (≤ 914 psi) measure the input pressure compared to atmospheric, transmitters with spans of 160 bar (2320 psi) and 400 bar (5802 psi) compared to a vacuum.

Parameterization

Depending on the version, there are different possibilities for parameterizing the pressure transmitter and for setting or scanning the parameters.

Parameterization using the input keys (local operation)

The input keys can be used to set or adjust the start-of-scale and full-scale values with application of a pressure.

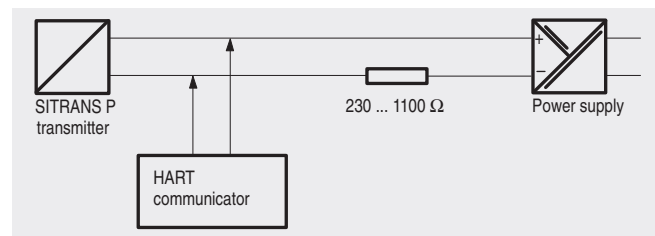
Parameterization using HART communication

The following parameters can be adjusted or can be scanned:

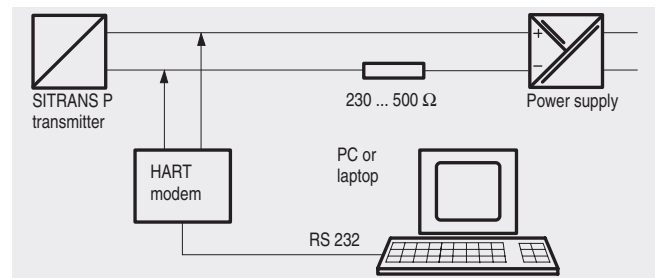
- Start-of-scale and full-scale values with application of a pressure
- Start-of-scale and full-scale values without application of a pressure ("Blind setting")
- Damping
- Current transmitter function

- Zero adjustment
- Output signal in event of fault
- Disabling of keys for operation
- Measured-value display in % or mA
- Measured-value display of physical dimension
- Measuring-point number (abbreviation, max. 16 characters)
- Measuring point description (max. 27 char.)
- Message
- Measuring range limits
- Pressure transmitter version (e.g. material)
- Slave pointer
- Further displays and parameters

When parameterizing with the HART communicator, the connection is made directly to the two-wire system. When parameterizing with a laptop or PC, the connection is made through a HART modem.



Communication between a HART communicator and a pressure transmitter



Communication between a PC communicator and a pressure transmitter

The signals needed for communication in conformity with HART protocol 5 are superimposed on the output current in accordance with the frequency shift keying (Frequency Shift Keying, FSK) method.

Technical specifications

SITRANS P pressure transmitters, MS series

Mode of operation

Measuring principle Piezo-resistive

Input

Measured variable Pressure

Measured range

- Measured span 0.03 ... 400 bar (0.43 ... 5802 psi) (continuously adjustable)

- Lower measuring limit

- Measuring cell with silicone oil filling 30 mbar (0.43 psi) absolute

- Upper measuring limit 100% of max. span

- Start-of-scale (continuously adjustable) Between the measuring limits table)

SITRANS P measuring instruments for pressure

Transmitters for pressure

MS series

Maximum working pressure

Measured span	Maximum working pressure
0.3 ... 1 bar (0.44 ... 14.5 psi)	6 bar (87 psi)
0.13 ... 4 bar (1.9 ... 58 psi)	10 bar (145 psi)
0.53 ... 16 bar (7.7 ... 232 psi)	32 bar (464 psi)
2.1 ... 63 bar (30.5 ... 914 psi)	100 bar (1450 psi)
5.3 ... 160 bar (77.3 ... 2320 psi)	250 bar (3625 psi)
13.33 ... 400 bar (193 ... 5802 psi)	500 bar (7252 psi)

Output

Output signal	4 ... 20 mA
Voltage measurement	Linear rising or falling

Measuring accuracy

Reference conditions	Increasing characteristic Start-of-scale value 0 bar Stainless steel seal diaphragm Silicone oil filling Limit setting r: Span ratio (r = max. span / set span)
----------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Error in measurement (with fixed-point setting, including hysteresis and repeatability)

- $r > 10$ $\leq 0.25\%$
- $10 < r \leq 30$ $\leq 0.5\%$

Long-term drift $\leq (0.1 \cdot r)\%$ in 12 months with max. span

Influence of ambient temperature

- $-10 \dots +60 \text{ }^\circ\text{C}$ ($14 \dots 140 \text{ }^\circ\text{F}$) $\leq (0.2 \cdot r + 0.4)\%$
- $-40 \dots -10 \text{ }^\circ\text{C}$ ($-40 \dots +14 \text{ }^\circ\text{F}$) and $60 \dots 85 \text{ }^\circ\text{C}$ ($140 \dots 185 \text{ }^\circ\text{F}$) $\leq (0.3 \cdot r + 0.35)\% / 10 \text{ K}$
($\leq (0.3 \cdot r + 0.35)\% / 18 \text{ }^\circ\text{F}$)

Rated conditions

Degree of protection (to EN 60529)	IP65
Process temperature	$-40 \dots 100 \text{ }^\circ\text{C}$ ($-40 \dots 212 \text{ }^\circ\text{F}$) $-20 \dots +60 \text{ }^\circ\text{C}$ ($-4 \dots +140 \text{ }^\circ\text{F}$) with dust explosion protection

Design

Weight (without options)	$\approx 1.5 \text{ kg}$ ($\approx 3.3 \text{ lb}$)
Wetted parts materials	
• Connection shank	Stainless steel, mat. No. 1.4404/316L
• Seal diaphragm.	Stainless steel, mat. No. 1.4404/316L
Measuring cell filling	Silicone oil
Process connection	Connection shank G $\frac{1}{2}$ A to DIN EN 837-1, female thread $\frac{1}{2}$ - 14 NPT
Electrical connection	Screw terminals, cable inlet through screwed gland Pg 13.5 (adapter), M20x 1.5 or $\frac{1}{2}$ -14 NPT, or Han 7D / Han 8U plug

Power supply U_H

Terminal voltage on pressure transmitter	10.5 ... 45 V DC 10.5 ... 30 V DC in intrinsically-safe mode
------------------------------------------	-----------------------------------------------------------------

Certificate and approvals

Classification according to pressure equipment directive (DRGL 97/23/EC)	For gases of fluid group 1 and liquids of fluid group 1; complies with requirements of article 3, paragraph 3 (sound engineering practice)
--------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------

Explosion protection

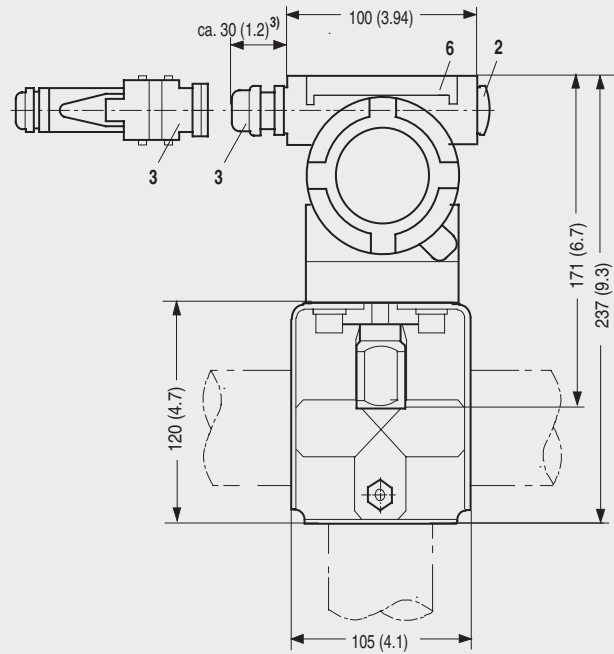
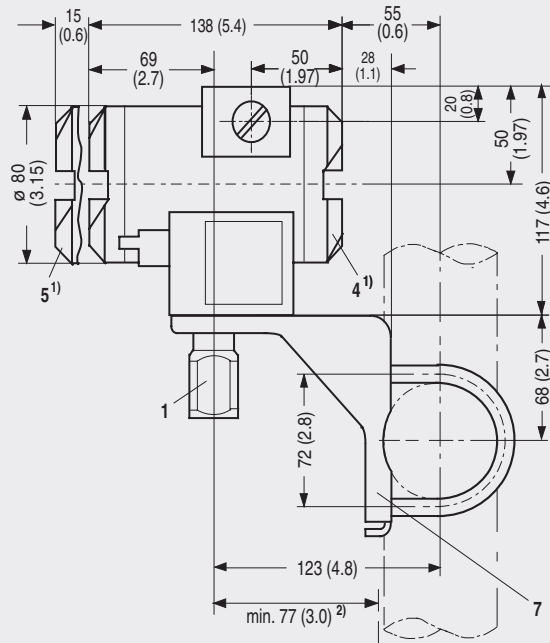
• Intrinsic safety "i"	PTB 99 ATEX 2122
- Identification	Ex II 1/2 G EEx ia/ib IIB/IIC T6
- Permissible ambient temperature	$-40 \dots +85 \text{ }^\circ\text{C}$ ($-40 \dots +185 \text{ }^\circ\text{F}$) temperature class T4; $-40 \dots +70 \text{ }^\circ\text{C}$ ($-40 \dots +158 \text{ }^\circ\text{F}$) temperature class T5; $-40 \dots +60 \text{ }^\circ\text{C}$ ($-40 \dots +140 \text{ }^\circ\text{F}$) temperature class T6
- Connection	To certified intrinsically-safe circuits with maximum values: $U_i = 30 \text{ V}$, $I_i = 100 \text{ mA}$, $P_i = 750 \text{ mW}$; $R_i = 300 \text{ }^\circ\Omega$
- Effective internal inductance/capacitance	$L_i = 0.4 \text{ mH}$, $C_i = 6 \text{ nF}$
• Explosion-proof "d"	PTB 99 ATEX 1160
- Identification	Ex II 1/2 G EEx d IIC T4/T6
- Permissible ambient temperature	$-40 \dots +85 \text{ }^\circ\text{C}$ ($-40 \dots +185 \text{ }^\circ\text{F}$) temperature class T4; $-40 \dots +60 \text{ }^\circ\text{C}$ ($-40 \dots +140 \text{ }^\circ\text{F}$) temperature class T6
- Connection	To circuits with values: $U_H = 10.5 \dots 45 \text{ V DC}$
• Dust explosion protection for zone 20	PTB 01 ATEX 2055
- Identification	Ex II 1 D IP65 T 120 $^\circ\text{C}$ Ex II 1/2 D IP65 T 120 $^\circ\text{C}$
- Permissible ambient temperature	$-40 \dots +85 \text{ }^\circ\text{C}$ ($-40 \dots +185 \text{ }^\circ\text{F}$)
- Max. surface temperature	120 $^\circ\text{C}$ (248 $^\circ\text{F}$)
- Connection	To certified intrinsically-safe circuits with maximum values: $U_i = 30 \text{ V}$, $I_i = 100 \text{ mA}$, $P_i = 750 \text{ mW}$, $R_i = 300 \text{ }^\circ\Omega$
- Effective internal inductance/capacitance	$L_i = 0.4 \text{ mH}$, $C_i = 6 \text{ nF}$
• Dust explosion protection for zone 21/22	PTB 01 ATEX 2055
- Identification	Ex II 2 D IP65 T 120 $^\circ\text{C}$
- Connection	To circuits with values: $U_H = 10.5 \dots 45 \text{ V DC}$; $P_{\text{max}} = 1.2 \text{ W}$
• Type of protection "n" (zone 2)	TÜV 01 ATEX 1696 X
- Identification	Ex II 3 G EEx nA L IIC T4/T5/T6
• Explosion protection to FM	Certificate of Compliance 3008490
- Identification (XP/DIP) or (IS); (NI)	CL I, DIV 1, GP ABCD T4 to T6; CL II, DIV 1, GP EFG; CL III; CL I, ZN 0/1 AEx ia IIC T4...T6; CL I, DIV 2, GP ABCD T4...T6; CL II, DIV 2, GP FG; CL III
• Explosion protection to CSA	Certificate of Compliance 2000.1153651
- Identification (XP/DIP) or (IS)	CL I, DIV 1, GP ABCD T4toT6; CL II, DIV 1, GP EFG; CL III; Ex ia IIC T4...T6; CL I, DIV 2, GP ABCD T4...T6; CL II, DIV 2, GP FG; CL III

SITRANS P measuring instruments for pressure Transmitters for pressure

MS series

2

Dimensional drawings



- 1 Process connection:
 - 1/2-14 NPT or
 - connection shank G1/2A
- 2 Blanking plug
- 3 Electrical connection:
 - screwed gland Pg 13,5 (adapter) ^{4) 5)},
 - screwed gland M20x1,5 ⁵⁾,
 - screwed gland 1/2-14 NPT or
 - Han 7D/Han 8U plug ^{4) 5)}
- 4 Terminal side
- 5 Electronics side, digital display
- 6 Protective cover over keys
- 7 Mounting bracket (option)

- 1) Allow approx. 20 mm (0.79 inch) thread length to permit unscrewing
- 2) Minimum distance for rotation
- 3) 45 mm (1.8 inch) for Pg 13,5 with adapter
- 4) Not with type of protection "explosion-proof enclosure"
- 5) Not with type of protection "FM + CSA [is + xp]"

SITRANS P pressure transmitters, MS series, dimensions in mm (inch)

SITRANS P measuring instruments for pressure

Transmitters for pressure

MS series

2

Selection and Ordering data		Order No.
SITRANS P pressure transmitters for pressure, MS series		7MF4013-
2-wire system, smart version Silicone oil as measuring cell filling Standard measuring cell cleaning		- 1
Measuring cell filling	Measuring cell cleaning	1
Silicone oil	Standard	
Measured span		B
0.03 ... 1 bar	(0.04 ... 14.5 psi)	C
0.13 ... 4 bar	(1.9 ... 58 psi)	D
0.53 ... 16 bar	(7.7 ... 232 psi)	E
2.1 ... 63 bar	(30.5 ... 914 psi)	F
5.3 ... 160 bar	(77.3 ... 2320 psi)	G
13.33 ... 400 bar	(193 ... 5802 psi)	
Wetted parts materials		A
Seal diaphragm	Parts of measuring cell	Y0
Stainless steel	Stainless steel	0
Version for diaphragm seal		1
Process connection		0
• Connection shank G½B to EN 837-1		1
• Female thread ½-14 NPT		0
Non-wetted parts materials		0
Housing made of die-cast aluminium		
Explosion protection		A
• without		B
• with ATEX, Type of protection:		D
- "Intrinsic safety (EEx ia)"		P
- "Explosion-proof (EEx d)" ¹⁾		E
- "Intrinsic safety and explosion-proof enclosure (EEx ia + EEx d)" ²⁾		R
- "n (zone 2)"		
- "Intrinsic safety, explosion-proof enclosure and dust explosion protection (EEx ia + EEx d + zone 1D/2D)" ²⁾		
• with FM + CSA, Type of protection:		N
- "Intrinsic safety and explosion-proof (is + xp)" ¹⁾		C
Electrical connection / cable inlet		A
• Screwed gland Pg 13.5 (adapter) ³⁾		B
• Screwed gland M20x1.5		C
• Screwed gland ½-14 NPT		D
• Han 7D plug (plastic housing) incl. mating connector ³⁾		
Display		1
• without		6
• Housing cover with window and digital indicator		7
• With indicator (setting as specified, Order code "Y21" required)		

Power supply units see "SITRANS I power supply units and input isolators".

Included in delivery of the device:

- Brief instructions (Leporello)
- CD-ROM with detailed documentation

- 1) Without cable gland, with blanking plug
- 2) With enclosed cable gland EEx ia and blanking plug
- 3) Not together with type of protection "Explosion-proof"

Further designs	Order code
Please add "-Z" to Order No. and specify Order code.	
Pressure transmitter with mounting bracket made of:	
• Steel	A01
• Stainless steel	A02
Plug	
• Han 7D (metal, gray)	A30
• Han 8U (instead of Han 7D)	A31
Rating plate inscription (instead of German)	
• English	B11
• French	B12
• Spanish	B13
• Italian	B14
English rating plate	B21
Pressure units in inH ₂ O or psi	
Manufacturer's test certificate M (calibration certificate)	C11
to DIN 55350, Part 18 and to ISO 8402	
Acceptance test certificate B	C12
to EN 10204-3.1.B	
Factory certificate	C14
to EN 10204-2.2	
Setting of upper limit of output signal to 22.0 mA	D05
Digital indicator along side the input keys (only together with the device 7MF4013-1...0-1A.6)	D27
Use in or at zone 1D/2D (only together with type of protection "Intrinsic safety (EEx ia)")	E01
Use at zone 0 (only together with type of protection "Intrinsic safety (EEx ia)")	E02
Additional data	
Please add "-Z" to Order No. and specify Order code.	
Measuring range to be set specify in plain text: Y01: ... to ... mbar, bar, kPa, MPa, psi	Y01
Measuring point number/identification max. 16 characters, specify in plain text: Y15:	Y15
Measuring point text max. 27 characters, specify in plain text: Y16:	Y16
Entry of HART address (TAG) max. 8 characters, specify in plain text: Y17:	Y17
Setting of pressure indicator in pressure units specify in plain text (standard setting: mA): Y21: mbar, bar, kPa, MPa, psi, ...	Y21
Note: The following pressure units can be selected: bar, mbar, mm H ₂ O ^{*)} , inH ₂ O ^{*)} , ftH ₂ O ^{*)} , mmHG, inHG, psi, Pa, kPa, MPa, g/cm ² , kg/cm ² , mA, Torr, ATM or %) Reference temperature 20 °C	

Only the settings for "Y01" and "D05" can be made in the factory

Ordering example

Item line: 7MF4013-1EA00-1AA6-Z
B line: A01 + Y01
C line: Y01: 10 ... 20 bar (145 ... 290 psi)