Technical Information

Deltabar S PMD70/75, FMD76/77/78

Differential pressure transmitter with ceramic and monosilicon sensors for flow, level and differential measurement
High accuracy with excellent long-term stability
HART®, PROFIBUS® PA or FOUNDATION™ Fieldbus protocols



Application

The Deltabar S differential pressure transmitter are suitable for:
- Flow measurement (volume or mass flow) in conjunction with primary elements in gase, steam and liquids
- Level, volume or mass measurement in liquids
- Differential pressure monitoring, e.g. across filters and pumps
- Corrosive or abrasive applications using unique ceramic sensor technology (PMD70). For example, DP measurement across a filter with abrasive product
- High temperatures up to 662°F (350°C) with remote diaphragm seals (FMD78)

Your benefits

- Excellent reproducibility and long-term stability
- High accuracy: up to ±0.075%, (<15:1 turndown), with optional PLATINUM version: ±0.05% span
- Turn down 100:1, higher on request

Designed with safety in mind to keep your plant, equipment and personnel safe:
- Used for flow and differential pressure monitoring up to SIL3, certified to IEC 61508 by TÜV SÜD
- Meets PED (Pressure Equipment Directive)
- Secondary seals standard in every transmitter
- Built-in diagnostic software functionality (e.g. user-defined max. / min. operating window)
- Function-monitored from the measuring cell to the electronics
- Modularity for easy, cost-effective repair
  - replaceable display
  - universal electronics for pressure and differential pressure
- Easy setup with menu-driven interface, quick setup menu for standard application modes including pressure, level and flow

HistoROM®/M-DAT memory module enables:
- Quick commissioning thanks to quick setup menu
- Process monitoring via periodic recording of pressure and temaperature values
- Monitoring of events and configuration changes

Flexible commissioning via multiple modes:
- On-board push buttons (external or inside housing)
- Easy and safe menu-guided operation on-site, via 4 to 20 mA with HART, PROFIBUS PA or FOUNDATION Fieldbus
- Extensive diagnostic functions

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Endress+Hauser
People for Process Automation

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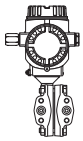
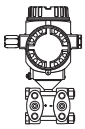
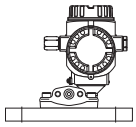
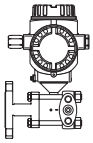
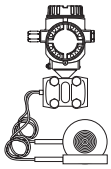
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Function and system design

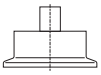
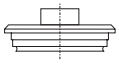
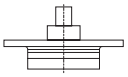
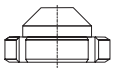
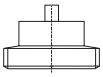
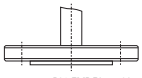
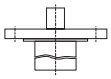
Device selection

Deltabar S – product family	**PMD70**  P01-PMD70xxx-16-xx-xx-xx-000 **With ceramic measuring diaphragms**	**PMD75**  P01-PMD75xxx-16-xx-xx-xx-000 **With metallic measuring diaphragms**	**FMD76**  P01-FMD76xxx-16-xx-xx-xx-000 **With ceramic measuring diaphragms**	**FMD77**  P01-FMD77xxx-16-xx-xx-xx-000 **With metallic measuring diaphragms and diaphragm seal mounted on one side**	**FMD78**  P01-FMD78xxx-16-xx-xx-xx-003 **With metallic measuring diaphragms and capillary diaphragm seals**
Field of application	– Flow – Level – Differential pressure	– Flow – Level – Differential pressure	– Level	– Level	– Level – Differential pressure
Process connections	– 1/4 – 18 NPT – RC 1/4	– 1/4 – 18 NPT – RC 1/4	Low-pressure side (–): – 1/4 – 18 NPT – RC 1/4 High-pressure side (+): – DN 80 – DN 100 – ANSI 3" – 4" – JIS 80A – 100A	Low-pressure side (–): – 1/4 – 18 NPT – RC 1/4 High-pressure side (+): – DN 50 – DN 100 – ANSI 2" – 4" – JIS 80A – 100A	– Wide range of diaphragm seals, → page 5, section "Overview of diaphragm seal FMD78"
Measuring ranges	from –25 to +25 mbar (–10 to +10 inH_2O) to –3 to +3 bar (-45 to +45 psi)	from –10 to +10 mbar (-4 to +4 inH_2O) to –40 to +40 bar (-600 to +600 psi)	from –100 to +100 mbar (-40 to +40 inH_2O) to –3 to +3 bar (-45 to +45 psi)	from –100 to +100 mbar (–40 to +40 inH_2O) to –16 bar to +16 bar (-230 to +230 psi)	from –100 to +100 mbar (–40 to +40 inH_2O) to –40 to +40 bar (-600 to +600 psi)
Overload [1]	on one side: max. 100 bar (1450 psi) on both sides: max. 150 bar (2175 psi)	on one side: max. 420 bar (6100 psi) on both sides: max. 630 bar (8700 psi)	on one side: max. 100 bar (1450 psi)	on one side: max. 160 bar (2320 psi)	on one side: max. 160 bar (2320 psi) on both sides: max. 240 bar (3480 psi)
Process temperature range	–20 to +85°C (–4 to +185°F)	–40 to +120°C (–40 to +248°F)	–20 to +85°C (–4 to +185°F)	up to + 400°C (+752°F)	up to +400°C (+752°F)
Ambient temperature range	–20 to +85°C (–4 to +185°F)	–40 to +85°C (–40 to +185°F) [2]	–20 to +85°C (–4 to +185°F)	–40 to +85°C (–40 to +185°F) [2]	–40 to +85°C (–40 to +185°F) [2]
Ambient temp. range separate housing	–40 to +60°C (–40 to +140°F)				
Reference Accuracy	– Up to ±0.075% of the set span – PLATINUM version: up to ±0.05% of the set span			– Up to ±0.075 % of the set span	
Supply voltage	– For non-hazardous areas: 10.5 to 45 V DC; EEx ia (intrinsically safe): 10.5 to 30 V DC				
Output	4 to 20 mA with superimposed HART protocol, PROFIBUS PA or FOUNDATION Fieldbus				
Options	– High-pressure version up to p_{stat} 700 bar (10,100 psi) – PMD75, FMD77, FMD78: Gold-Rhodium-coated diaphragm, NACE-compliant materials – Remote housing				
Specialities (options)	– Metal-free measurement with PVDF flange – Available with Deltatop as flow compact device	– p_{stat} up to 420 bar (6100 psi) – Diaphragm: tantalum – Available with Deltatop as flow compact device	– Abrasion-resistant and corrosion-resistant – No diaphragm-seal temperature effects – Metal-free measurement possible with ECTFE-coated process connection	– For high media temperatures	– Wide range of diaphragm seals
	– HistoROM®/M-DAT memory module				

1) dependent on the lowest-rated element, with regard to pressure, of the selected components

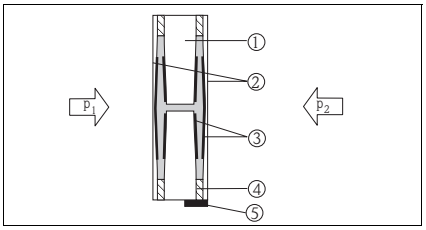
2) lower temperature on request

Overview of diaphragm seal
FMD78

Design	Diaphr. seal	Connection	Version	Standard	Nominal diameter	Nom. press./Class
Pancake	Membrane diaphragm seal	DIN cell	 P01-FMD78xxx-04-xx-xx-xx-000	DIN 2501	– DN 50 – DN 80 – DN 100	PN 16 – 400
		ANSI cell		ANSI B 16.5	– 2" – 3" – 4"	150 – 2500 lbs
Threaded connection with separator	Membrane diaphragm seal	G	 P01-FMD78xxx-03-xx-xx-xx-010	ISO 228	G 1/2 B	PN 40
		NPT	 P01-FMD78xxx-03-xx-xx-xx-011	ANSI	1/2 NPT	PN 40
Tri-Clamp	Membrane diaphragm seal	Clamp	 P01-FMD78xxx-03-xx-xx-xx-005	ISO 2852	– DN 25 (1") – DN 38 (1 1/2") – DN 51 (2") – DN 76.1 (3")	Dependent on the clamp used
	Pipe diaphragm seal	Clamp	 P01-FMD78xxx-03-xx-xx-xx-009	ISO 2852	– DN 25 (1") – DN 38 (1 1/2") – DN 51 (2")	Dependent on the clamp used
Hygienic connections	Membrane diaphragm seal	Varivent	 P01-FMD78xxx-03-xx-xx-xx-007		Type N for pipes DN 40 – DN 162	PN 40
		DRD	 P01-FMD78xxx-03-xx-xx-xx-006		DN50 (65 mm)	25 bar
		Sanitary tank spud with 2" extended diaphragm seal	 P01-FMD78xxx-03-xx-xx-xx-008		d = 100 mm	Dependent on the clamp used
		Taper adapter with coupling nut	 P01-FMD78xxx-03-xx-xx-xx-003	DIN 11851	– DN 50 – DN 65 – DN 80	PN 25
		Threaded adapter	 P01-FMD78xxx-03-xx-xx-xx-004	DIN 11851	– DN 50 – DN 65 – DN 80	PN 25
Flange	Membrane diaphragm seal	EN/DIN flange	 P01-FMD78xxx-03-xx-xx-xx-001	EN 1092-1/ DIN 2527	– DN 50 – DN 80 – DN 100	Up to 40 bar
		ANSI flange		ANSI B 16.5	– 2" – 3" – 4"	150 lbs and 300 lbs
		JIS flange		B 2220 BL	– 50 A – 80 A – 100 A	10 K
Flange with extended diaphragm seal	Membrane diaphragm seal	ANSI flange	 P01-FMD78xxx-03-xx-xx-xx-002	ANSI B 16.5	– 3" with 2"/4"/6"/ 8" extended diaphragm seal – 4" with 2"/4"/6"/ 8" ext. diaphr. seal	150 lbs

Measuring principle

Ceramic measuring diaphragms used for PMD70 and FMD76

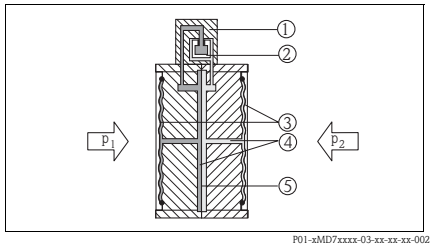


P01-xMD7xxxx-03-xx-xx-xx-000

Ceramic measuring cell PMD70 and FMD76

1 Meter body
2 Diaphragm
3 Electrodes
4 Glass frit fixes the diaphragm onto the meter body
5 Temperature sensor

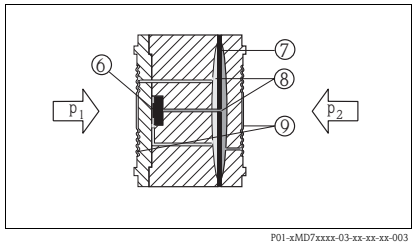
Metallic measuring diaphragms used for PMD75, FMD77 and FMD78



P01-xMD7xxxx-03-xx-xx-xx-002

Metal measuring cell 10 and 30 mbar (2 and 12 inH_2O)

1 Sensing element
2 Silicon diaphragm
3 Separating diaphragm
4 Filling oil
5 Integrated overload protection



P01-xMD7xxxx-03-xx-xx-xx-003

Metal measuring cell as of 100 mbar (40 inH_2O)

6 Sensing element
7 Overload diaphragm/Middle diaphragm
8 Filling oil
9 Separating diaphragm

Ceramic measuring diaphragms used for PMD70 and FMD76

The ceramic measuring cell is based on the principle of a plate capacitor with an electrode on (1) and a movable electrode on the interior of the diaphragm (3). Standard silicone oil or mineral oil filling oils for this measuring cell.
A differential pressure ($p_1 \neq p_2$) causes a corresponding deflection of both diaphragms. Both capacitance values are converted and are fed to the microprocessor of the transmitter as a digital signal.

Advantages:
- Self-monitoring for diaphragm break or oil loss (constant comparison of the measured temperature with a temperature calculated from the capacitance values)
- Extremely high resistance to aggressive media
- Suitable for vacuums up to 1 $mbar_{abs}$ (0.4 inH_2O)
- Metal-free versions available
- Second process barrier (Secondary Containment) for enhanced integrity

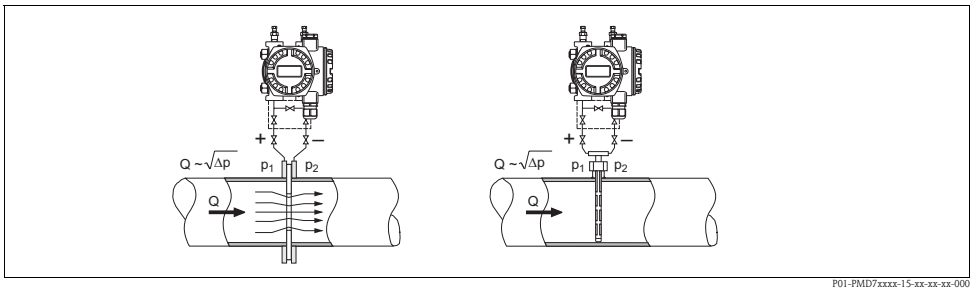
Metallic measuring diaphragms used for PMD75, FMD77 and FMD78

The separating diaphragms (3/9) are deflected on both sides by the acting pressures. A filling oil (4/8) transfers the pressure to a resistance circuit bridge (semi-conductor technology). The differential-pressure-dependent change of the bridge output voltage is measured and further processed.

Advantages:
- Standard operating pressures: 160 bar (2320 psi) and 420 bar (6090 psi)
- High long-term stability
- Very high single-sided overload resistance
- Second process barrier (Secondary Containment) for enhanced integrity

Flow measurement

Design and operation mode



P01-PMD7xxxx-15-xx-xx-xx-000

Flow measurement with Deltabar S and primary element, left: Orifice plate and right: Pitot tube

Q Flow
Δp Differential pressure, $\Delta p = p_1 - p_2$

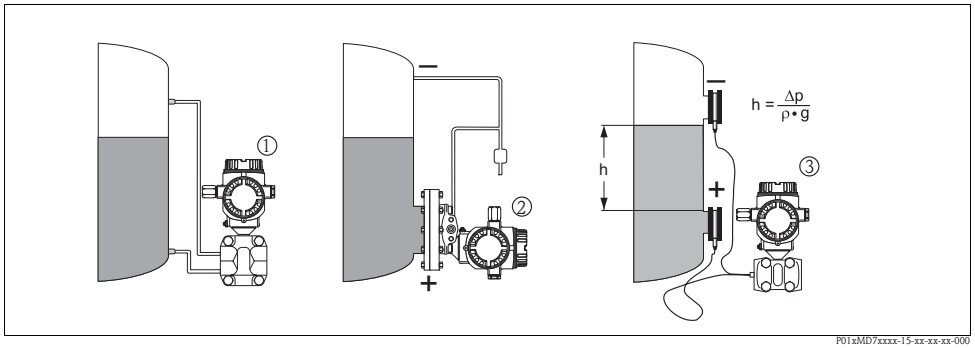
Your benefits

- Choice of four flow modes of operation: volume flow, norm volume flow (European norm conditions), standard volume flow (American standard conditions) and mass flow.
- Choice of diverse flow units with automatic unit conversion.
- A customised unit can be specified
- Low flow cut off: when activated, this function suppresses small flows which can lead to large fluctuations in the measured value.
- Contains two totalizers as standard. One totalizer can be reset to zero.
- The totalizing mode and unit can be individually set for each totalizer. This allows independent daily and annual quantity totalizing.
- With the product family Deltatop, Endress+Hauser is offering a universal and reliable solutions for flow measurement:
  – Deltatop, the compact, ready-to-use flow measuring unit including differential pressure transmitter Deltabar S

Note!
For more information about flow measurement with the Deltabar S differential pressure transmitter
- Deltabar S with orifice plate (TI422P, Deltatop DO6x)
- Deltabar S with pitot tube (TI425P, Deltatop DP6x)

Level measurement (level, volume and mass)

Design and operation mode



Level measurement with Deltabar S

1 Level measurement via impulse piping and PMD70
2 Level measurement with FMD76
3 Level measurement with FMD78
h Height (level)
Δp Differential pressure
ρ Density of the medium
g Gravitation constant

Your benefits

- Choice of three level operating modes
- Volume and mass measurements in any tank shapes by means of a freely programmable characteristic curve
- Choice of diverse level units with automatic unit conversion
- A customised unit can be specified
- Has a wide range of uses, e.g.
  – for level measurement in tanks with superimposed pressure
  – in the event of foam formation
  – in tanks with agitators of screen fittings
  – in the event of liquid gases
  – for standard level measurement

Communication protocol

- 4 to 20 mA with HART communication protocol
- PROFIBUS PA
  – The Endress+Hauser devices meet the requirements as per the FISCO model.
  – Due to the low current consumption of 13 mA ± 1 mA
    – up to 7 Deltabar S for EEx ia, CSA IS and FM IS applications
    – up to 27 Deltabar S for all other applications, e.g. in non-hazardous areas, EEx nA, etc.
    can be operated at one bus segment with installation as per FISCO.

Further information on PROFIBUS PA, such as requirements for bus system components, can be found in the Operating Instructions BA034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and in the PNO guideline.

- FOUNDATION Fieldbus
  - The Endress+Hauser devices meet the requirements as per the FISCO model.
  - Due to the low current consumption of 15 mA ± 1 mA
    - up to 6 Deltabar S for EEx ia, CSA IS and FM IS applications
    - up to 24 Deltabar S for all other applications, e.g. in non-hazardous areas, EEx nA, etc.

    can be operated at one bus segment with installation as per FISCO.

  Further information on FOUNDATION Fieldbus, such as requirements for bus system components can be found in the Operating Instructions BA013S "FOUNDATION Fieldbus Overview".

Input

Measured variable

Differential pressure, from which flow (volume or mass current) and level (level, volume or mass) are derived

Measuring range

PMD75, FMD77, FMD78 (with metallic measuring diaphragms)

Nominal value	Measurement limit		Smallest calibratable span [5]	MWP [1]	Overload [2]		Min. operating pressure [3]	Order code version [4]	
	lower (LRL)	upper (URL)			on one side	on both sides		PN 160 [6] (2320 psi)	PN 420 [6] (6100 psi)
mbar	mbar	mbar	mbar (inH_20)	mbar (inH_20)	mbar (inH_20)	mbar (inH_20)	$mbar_{abs}$ (psia)		
10 (4 inH_20) [7]	–10 (-4 inH_20)	+10 (+4 inH_20)	0.25 (0.10)	160 (2320)	160 (2320)	240 (3480)	0.1 (0.001)	7B	–
30 (12 inH_20) [7]	–30 (-12 inH_20)	+30 (+12 inH_20)	0.3 (0.12)	160 (2320)	160 (2320)	240 (3480)	0.1 (0.001)	7C	–
100 (40 inH_20)	–100 (-40 inH_20)	+100 (+40 inH_20)	1/5 (0.4/2) [8]	160 (2320)	160 (2320)	240 (3480)	0.1 (0.001)	7D	–
500 (200 inH_20)	–500 (-200 inH_20)	+500 (+200 inH_20)	5 (2)	160/420 [9] (2320/6100)	160/420 (2320/6100)	240/630 (3480/9140)	0.1 (0.001)	7F	8F
3000 (45 psi)	–3000 (-45 psi)	+3000 (+45 psi)	30 (12)	160/420 [9] (2320/6100)	160/420 (2320/6100)	240/630 (3480/9140)	0.1 (0.001)	7H	8H
16000 (240 psi)	–16000 _240 psi)	+16000 (+240 psi)	160 (65)	160/420 [9] (2320/6100)	160/420 (2320/6100)	240/630 (3480/9140)	0.1 (0.001)	7L	8L
40000 (600 psi)	–40000 (-600 psi)	+40000 (+600 psi)	400 (160)	160/420 [9] (2320/6100)	"+"side: 160/420 [10] (2320/6100)	240/630 (3480/9140)	0.1 (0.001)	7M	8M

PMD70, FMD76 (with ceramic measuring diaphragms)

Nominal value	Measurement limit		Smallest calibratable span [5]	MWP [1]	Overload [2]		Min. operating pressure [3]	Order code version [4]
	lower (LRL)	upper (URL)			on one side	on both sides		
mbar (inH_2O)	mbar (inH_2O)	mbar (inH_2O)	mbar (inH_2O)	bar (psi)	bar (psi)	bar (psi)	$mbar_{abs}$ (psia)	
25 (10)	–25 (-10)	+25 (+10)	0.25 (0.10)	10 (145)	10 (145)	15 (217)	1 (0.015)	7B
100 (40)	–100 (-40)	+100 (+40)	1 (0.4)	16 (240)	16 (240)	24 (348)	1 (0.015)	7D
500 (200)	–500 (-200)	+500 (+200)	5 (2)	100 (1450)	100 (1450)	150 (2175)	1 (0.015)	7F
3000 (1200)	–3000 (-1200)	+3000 (+1200)	30 (12)	100 (1450)	100 (1450)	150 (2175)	1 (0.015)	7H

1) The MWP (maximum working pressure; MWP = PN) for the measuring device depends on the weakest element of the components selected with regard to pressure, i.e. the process connection (see page 30 ff) has to be taken into consideration in addition to the measuring cell (see table above). Also observe pressure-temperature dependency. For the appropriate standards and further information, see page 29, "Pressure specifications" section.
2) The maximum pressure for the measuring device is dependent on the lowest-rated element, with regard to pressure, of the selected components. See also page 29, section "Pressure specifications".
3) The minimum operating pressure indicated in the table applies to silicone oil under reference operating conditions.
Min. operating pressure at 85°C (185°F) for silicone oil: 10 $mbar_{abs}$ (4 inH_2O).
FMD77 and FMD78: Min. operating pressure: 50 $mbar_{abs}$ (20 inH_2O); observe also the pressure and temperature application limits of the selected filling oil on page 56.
For vacuum applications, please observe the installation instructions on page 62 ff.
4) Versions in the order code Page 65 ff, feature 40 "Nominal range; PN"
5) Turn down > 100:1 on request
6) PN 160 versions with stainless steel A2 screws, PN 420 versions with stainless steel A4 M12 screws. PN 420 versions for PMD75 only.
7) PMD75 only
8) Minimum span that can be calibrated for PMD75: 1 mbar (0.015 psi); minimum span that can be calibrated for FMD77 and FMD78: 5 mbar (0.07 psi)
9) For PMD75 with CRN-approved process connections, the MWP is 315 bar (4570 psi).
10) "–" side: 100 bar (1450 psi)

Explanation of terms

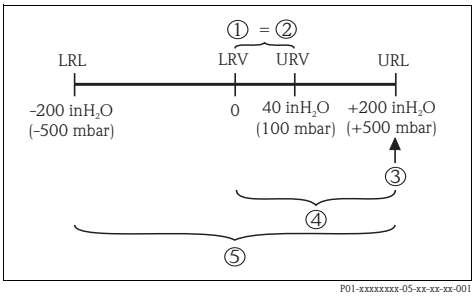
Explanation of the terms: Turn down (TD), set span and zero based span

Case 1:
- |Lower range value| ≤ |Upper range value|

Example:
- Lower range value (LRV) = 0 mbar
- Upper range value (URV) = 100 mbar (40 inH_2O)
- Nominal value (URL) = 500 mbar (200 inH_2O)

Turn down:
- TD = URL / |URV| = 5:1

set span:
- URV – LRV = 100 mbar (40 inH_2O)
  This span is based on the zero point.



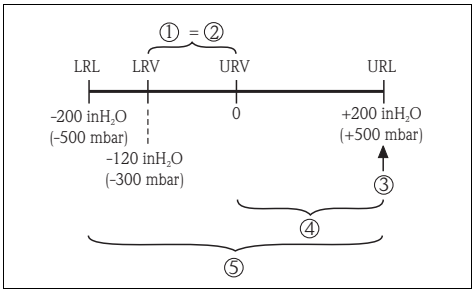
Example: 500 mbar sensor

Case 2:
- |Lower range value| ≥ |Upper range value|

Example:
- Lower range value (LRV) = –300 mbar (-120 inH_2O)
- Upper range value (URV) = 0 bar
- Nominal value (URL) = 500 mbar (200 inH_2O)

Turn down:
- TD = URL / |(LRV)| = 1,67:1

set span:
- URV – LRV = 300 mbar (120 inH_2O)
  This span is based on the zero point.



Example: 500 mbar (200 inH_2O) sensor

1 Set span
2 Zero based span
3 Nominal value ≙ Upper range limit (URL)
4 Nominal measuring range
5 Sensor measuring range
LRL Lower range limit
URL Upper range limit
LRV Lower range value
URV Upper range value

Output

Output signal

- 4 to 20 mA with superimposed digital communication protocol HART 5.0, 2-wire
- Digital communication signal PROFIBUS PA (Profile 3.0)
  – signal coding: Manchester Bus Powered (MBP); Manchester II
  – data transmission rate: 31.25 KBit/s, voltage mode
- Digital communication signal FOUNDATION Fieldbus
  – signal coding: Manchester Bus Powered (MBP); Manchester II
  – data transmission rate: 31.25 KBit/s, voltage mode

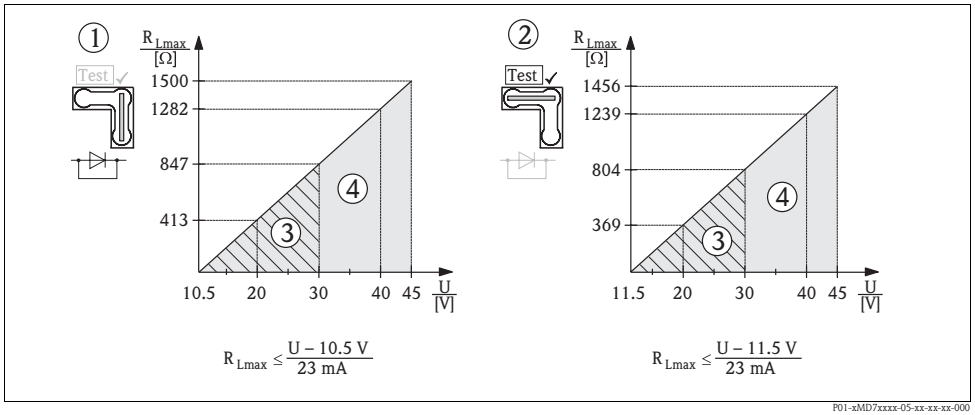
Signal range – 4 to 20 mA HART

3.8 mA to 20.5 mA

Signal on alarm

- 4 to 20 mA HART
  Options:
  – Max. alarm*: can be set from 21 to 23 mA
  – Keep measured value: last measured value is kept
  – Min. alarm: 3.6 mA
  * Factory setting: 22 mA
- PROFIBUS PA: can be set in the Analog Input block,
  options: Last Valid Out Value, Fsafe Value (factory setting), Status bad
- FOUNDATION Fieldbus: can be set in the Analog Input Block,
  options: Last Good Value, Fail Safe Value (factory setting), Wrong Value

Load – 4 to 20 mA HART



Load diagram, observe the position of the jumper and the explosion protection (page 18, section "Measuring the 4 to 20 mA test signal".)

1 Jumper for 4 to 20 mA test signal inserted in "Non-test" position
2 Jumper for 4 to 20 mA test signal inserted in "Test" position
3 Supply voltage 10.5 (11.5) to 30 V DC for 1/2 D, 1 GD, 1/2 GD, FM IS, CSA IS, IECEx ia, NEPSI Ex ia
4 Supply voltage 10.5 (11.5) to 45 V DC for device for non-hazardous areas, 1/2 D, 1/3 D, 2 G EEx d, 3 G EEx nA, FM XP, FM DIP, FM NI, CSA XP, CSA Dust-Ex, NEPSI Ex d
R_{Lmax} Maximum load resistance
U Supply voltage

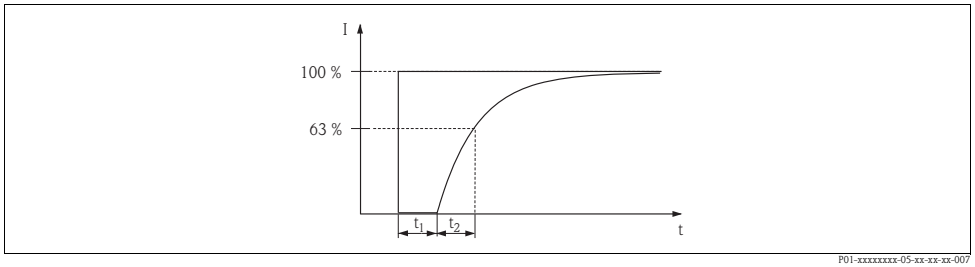
Note!
When operating via a handheld terminal or via PC with an operating program, a minimum communication resistance of 250 Ω must exist within the loop.

Resolution

- Current output: 1 μA
- Display: can be set (setting at the factory: presentation of the maximum accuracy of the transmitter)

Dynamic behavior current output

Dead time, Time constant (T63)



Presentation of the dead time and the time constant

Type	Dead time t_1	Time constant (T63), t_2
PMD75	45 ms	■ 10 and 30 mbar (2 and 12 inH_2O) measuring cell: 200 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 60 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 45 ms ■ 3 bar (43 psi) measuring cell: 40 ms ■ 16 and 40 bar (232 and 600 psi) measuring cell: 60 ms
FMD77, FMD78	dependent on the diaphragm seal	
PMD70, FMD76	90 ms	■ 25 mbar (10 12 inH_2O) measuring cell: 4700 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 280 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 210 ms ■ 3 bar (43 psi) measuring cell: 110 ms

Dynamic behavior HART

Dead time, Time constant (T63)

A typical parametrization for the PLC of 3 to 4 values per second results in the following total dead time:

Type	Dead time t_1	Time constant (T63), t_2
PMD75	295 ms	■ 10 and 30 mbar (2 and 12 inH_2O) measuring cell: 200 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 60 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 45 ms ■ 3 bar (43 psi) measuring cell: 40 ms ■ 16 and 40 bar (232 and 600 psi) measuring cell: 60 ms
FMD77, FMD78	dependent on the diaphragm seal	
PMD70, FMD76	340 ms	■ 25 mbar (10 12 inH_2O) measuring cell: 4700 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 280 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 210 ms ■ 3 bar (43 psi) measuring cell: 110 ms

Reading cycle

■ HART commands: on average 3 to 4 per second.
The Deltabar S commands the BURST MODE function for cyclic value transmission via the HART communication protocol.

Response time

≤ 250 ms

Cycle time (Update time)

On average 250 to 330 ms.

Dynamic behavior PROFIBUS PA

Dead time, Time constant (T63)

A typical cyclic parametrization for the PLC of 20 values per second results in the following total dead time:

Type	Dead time t_1	Time constant (T63), t_2
PMD75	295 ms	■ 10 and 30 mbar (2 and 12 inH_2O) measuring cell: 200 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 60 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 45 ms ■ 3 bar (43 psi) measuring cell: 40 ms ■ 16 and 40 bar (232 and 600 psi) measuring cell: 60 ms
FMD77, FMD78	dependent on the diaphragm seal	
PMD70, FMD76	340 ms	■ 25 mbar (10 12 inH_2O) measuring cell: 4700 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 280 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 210 ms ■ 3 bar (43 psi) measuring cell: 110 ms

Response time

■ cyclic: approx. 10 ms per request
■ acyclic: < 50 ms

All values are typical values.

Cycle time (Update time)

The cycle time in a bus segment in cyclic data communication depends on the number of devices, on the segment coupler used and on the internal PLC cycle time.

Dynamic behavior FOUNDATION Fieldbus

Dead time, Time constant (T63)

If the macro cycle time (Hostsystem) is set to a typical value of 250 ms, the following total dead time results:

Type	Dead time t_1	Time constant (T63), t_2
PMD75	295 ms	■ 10 and 30 mbar (2 and 12 inH_2O) measuring cell: 200 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 60 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 45 ms ■ 3 bar (43 psi) measuring cell: 40 ms ■ 16 and 40 bar (232 and 600 psi) measuring cell: 60 ms
FMD77, FMD78	dependent on the diaphragm seal	
PMD70, FMD76	340 ms	■ 25 mbar (10 12 inH_2O) measuring cell: 4700 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 280 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 210 ms ■ 3 bar (43 psi) measuring cell: 110 ms

Reading cycle

- cyclic: up to 5/s, dependent on the number and type of function blocks used in a closed-control loop
- acyclic: 10/s

Response time

- cyclic: < 80 ms
- acyclic: < 40 ms

All values are typical values.

Cycle time (Update time)

250 ms

Damping

A damping affects all outputs (output signal, display).

- Via on-site display, handheld terminal or PC with operating program, continuous from 0 to 999 s
- Additionally for HART and PROFIBUS PA: via DIP-switch on the electronic insert, switch position "on" = set value and "off"
- Factory setting: 2 s

Data of the FOUNDATION Fieldbus interface

Basic Data

Device Type	1009F (hex)
Device Revision	06 (hex)
DD Revision	01 (hex)
CFF Revision	01 (hex)
ITK Version	5.0
ITK-Certification Driver-No.	IT054700
Link-Master (LAS) cabable	yes
Link Master / Basic Device selectable	yes; Default: Basic Devce
Number VCRs	44
Number of Link-Objects in VFD	50

Virtual communication references (VCRs)

Permanent Entries	44
Client VCRs	0
Server VCRs	5
Source VCRs	8
Sink VCRs	0
Subscriber VCRs	12
Publisher VCRs	19

Link Settings

Slot time	4
Min. Inter PDU delay	12
Max. response delay	10

Transducer Blocks

Block	Content	Output values
TRD1 Block	contains all parameters related to the measurement	■ Pressure, Flow or Level (Channel 1) ■ Process temperatur (Channel 2)
Service Block	contains service information	■ Pressure after damping (Channel 3) ■ Pressure drag indicator (Channel 4) ■ Counter for max. pressure transgressions (Channel 5)
Dp Flow Block	contains flow and totalizer parameter	Totalizer 1 (Channel 6)
Diagnsotic Block	contains diagnostic information	Error code via DI channels (channel 0 to 6)
Display Block	contains parameters to configure the local display	No output values

Function Blocks

Block	Content	Number of Function Blocks	Execution time	Functionality
Resource Block	The Resource Block contains all the data that uniquely identifies the field device. It is an electronic version of a nameplate of the device.			enhanced
Analog Input Block 1 Analog Input Block 2	The AI block takes the manufacturer's input data, selected by channel number, and makes it available to other function blocks at its output. Enhancement: digital outputs for process alarms, fail safe mode		45 ms	enhanced
Digital Input Block	This block contains the discrete data of the diagnose block (selectable via a channel number 0 to 16) and provides them for the blocks at the output.		40 ms	standard
Digital Output Block	This block converts the discrete input and thus initiates an action (selectable via a channel number) in the dp flow block or in the service block. Channel 1 resets the counter for max. pressure transgressions..		60 ms	standard
PID Block	The PID block serves as proportional-integral-derivative controller and is used almost universally to do closed-loop-control in the field including cascade and feedforward. Input IN can be indicated on the display. The selection is performed in the display block (DISPLAY_MAIN_LINE_CONTENT).		120 ms	standard
Arithmetic Block	This block is designed to permit simple use of popular measurement math functions. The user does not have to know how to write equations. The math algorithm is selected by name, chosen by the user for the function to be done.		50 ms	standard
Input Selector Block	The input selector block provides selection of up to four inputs and generates an output based on the configured action. This block normally receives its inputs from AI blocks. The block performs maximum, minimum, middle, average and 'first good' signal selection. INPUT IN1 to IN4 can be indicated on the display. The selection is performed in the display block (DISPLAY_MAIN_LINE_CONTENT).		35 ms	standard
Signal Characterizer Block	The signal characterizer block has two sections, each with an output that is a non-linear function of the respective input. The non-linear function is determined by a single look-up table with 21 arbitrary x-y pairs.		30 ms	standard
Integrator Block	The Integrator Function Block integrates a variable as a function of the time or accumulates the counts from a Pulse Input block. The block may be used as a totalizer that counts up until reset or as a batch totalizer that has a setpoint, where the integrated or accumulated value is compared to pre-trip and trip settings, generating discrete signals when these settings are reached.		35 ms	standard
Analog Alarm Block	This block contains all process alarm conditions (working like a comparator) and represents them at the output.		35 ms	standard

Additional Function Block Information:

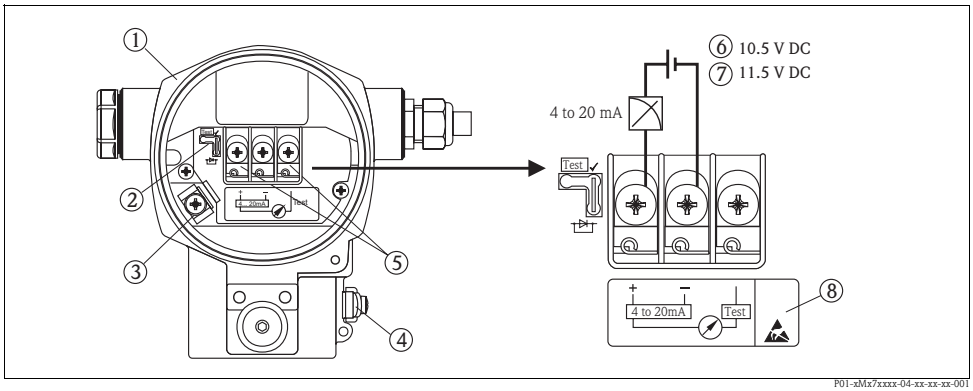
Segmented Function Block	YES
Number of segmented blocks	15

Power supply

Electrical connection

Note!
- When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings. See page 79, section "Safety Instructions" and "Installation/Control Drawings".
- Devices with integrated overvoltage protection must be grounded. See page 28.
- Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.

4 to 20 mA HART



Electrical connection 4 to 20 mA HART

1 Housing
2 Jumper for 4 to 20 mA test signal. See page 18, section "Measuring the 4 to 20 mA test signal" .
3 Internal earth terminal
4 External earth terminal
5 4 to 20 mA test signal between positive and test terminal
6 minimum supply voltage = 10.5 V DC, jumper is inserted in accordance with the illustration.
7 minimum supply voltage = 11.5 V DC, jumper is inserted in "Test" position.
8 Devices with integrated overvoltage protection are labled OVP (overvoltage protection) here (See page 28).

PROFIBUS PA

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the auxiliary energy. For further information on the network structure and grounding and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA034S "Guidelines for planning and commissioning PROFIBUS DP/PA" and the PNO Guideline.

Cable specifications:
- Use a twisted, shielded two-wire cable, preferably cable type A

Note!
For further information on the cable specifications, see Operating Instructions BA034S Guidelines for planning and commissioning PROFIBUS DP/PA", PNO Guideline 2.092" PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

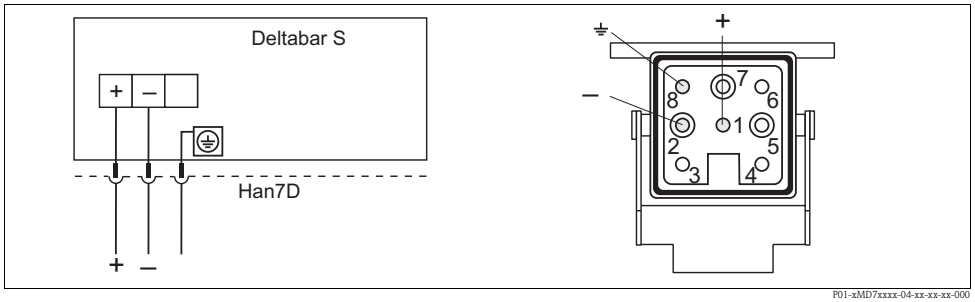
FOUNDATION Fieldbus

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the auxiliary energy. For further information on the network structure and grounding and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA013S "FOUNDATION Fieldbus Overview" and the FOUNDATION Fieldbus Guideline.

Cable specifications:
- Use a twisted, shielded two-wire cable, preferably cable type A

Note!
For further information on the cable specifications, see Operating Instructions BA013S "FOUNDATION Fieldbus Overview", FOUNDATION Fieldbus Guideline and IEC 61158-2 (MBP).

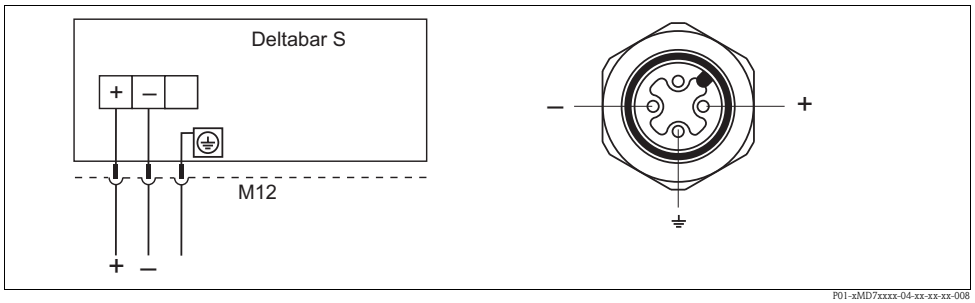
Devices with Harting plug Han7D



P01-xMD7xxxx-04-xx-xx-xx-000

Left: electrical connection for devices with Harting plug Han7D
Right: view of the plug connector at the device

Devices with M12 plug



P01-xMD7xxxx-04-xx-xx-xx-008

Left: electrical connection for devices with M12 plug
Right: view of the plug at the device

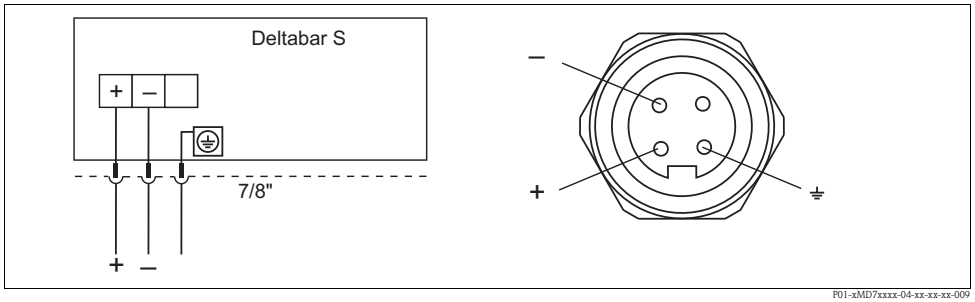
Endress+Hauser offers for devices with M12 plug the following accessories:

Plug-in jack M 12x1, straight
- Material: Body PA; coupling nut CuZn, nickel-plated
- Degree of protection (fully locked): IP67 (NEMA 4X)
- Order number: 52006263

Plug-in jack M 12x1, elbowed
- Material: Body PBT/PA; coupling nut GD-Zn, nickel-plated
- Degree of protection (fully locked): IP67 (NEMA 4X)
- Order number: 51006327

Cable 4x0.34 mm^2 with M12 socket, elbowed, screw plug, 5 m length
- Material: Body PUR; coupling nut CuSn/Ni; cable PVC
- Degree of protection (fully locked): IP67 (NEMA 4X)
- Order number: 52010285

Devices with 7/8" plug



P01-xMD7xxxx-04-xx-xx-xx-009

Left: electrical connection for devices with 7/8" plug
Right: view of the plug at the device

Cable gland

Approval	Typ	Clamping range
Standard, II1/2G Exia, IS	Plastic M20x1.5	5 to 10 mm
ATEX II1/2D, II1/3D, II1/2GD Exia, II1GD Exia II3G Ex nA	Metal M20x1.5 (Ex e)	7 to 10.5 mm

Terminals

For wire cross-sections of 0.5 to 2.5 mm^2 (18 AWG max.)

Measuring the 4 to 20 mA test signal

A 4 to 20 mA signal may be measured via the positive and test terminal without interrupting the measurement. The minimum supply voltage of the device can be reduced by simply changing the position of the jumper. As a result, operation is also possible with lower voltage sources. Observe the position of the jumper in accordance with the following table.

Jumper position for test signal	Description
	– Measuring the 4 to 0 mA test signal via plus and test terminal: possible. (Thus, the output current can be measured without interruption via the diode.) – Delivery status – minimum supply voltage: 11.5 V DC
	– Measuring the 4 to 20 mA test signal via plus and test terminal: not possible. – minimum supply voltage: 10.5 V DC

Supply voltage

Note!
- When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.
- All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas. Page 79, sections "Safety Instructions" and "Installation/Control Drawings".

4 to 20 mA HART

- Version for non-hazardous areas, jumper for 4 to 20 mA test signal in "Test" position (delivery status): 11.5 to 45 VDC
- Version for non-hazardous areas, jumper for 4 to 20 mA test signal in "Non-test" position: 10.5 to 45 VDC

PROFIBUS PA

- Version for non-hazardous areas: 9 to 32 VDC

FOUNDATION Fieldbus

- Version for non-hazardous areas: 9 to 32 V DC

Current consumption

- PROFIBUS PA: 13 mA ± 1 mA, switch-on current corresponds to IEC 61158-2, Clause 21
- FOUNDATION Fieldbus: 15 mA ± 1 mA, switch-on current corresponds to IEC 61158-2, Clause 21

Cable entry

Page 65 ff, feature 30 "Housing, Cable entry, Protection".

Cable specification

- Endress+Hauser recommends using shielded, twisted-pair two-wire cables.
- Terminals for wire cross-sections 0.5 to 2.5 mm^2 (40 to 18 AWG)
- Cable external diameter: 5 to 9 mm (0.2 to 0.4")

Residual ripple

Without influence on 4 to 20 mA signal up to ± 5 % residual ripple within the permitted voltage range [according to HART hardware specification HCF_SPEC-54 (DIN IEC 60381-1)]

Influence of power supply

≤ 0.0006% of URL/1 V

Performance characteristics – general

Reference operating conditions

- As per IEC 60770
- Ambient temperature T_U = constant, in the range of: +21 to +33°C (+69.8 to +91.4°F)
- Humidity φ = constant, in the range of: 5 to .80 % r.H
- Ambient pressure p_U = constant, in the range of: 860 to 1060 mbar (12 to 15 psi)
- Position of the measuring cell: constant, in the range of: ±1°
- Input of LOW SENSOR TRIM and HIGH SENSOR TRIM for lower range value and upper range value
- Zero based span
- Membrane material
  - PMD75: AISI 316L/1.4435, Alloy C276, Gold-Rhodium coated, Monel
  - FMD77, FMD78: AISI 316L/1.4435
  - PMD70, FMD76: Al_2O_3 (Aluminum-oxide-ceramic)
- Filling oil: silicone oil
- Side flanges material PMD75: AISI 316L SS/1.4435
- Supply voltage: 24 V DC ± 3 V DC
- Load with HART: 250 Ω

Long-term stability

Measuring cells ≥ 500 mbar (200 inH_2O):
- ±0.05% of URL/year
- ±0.125% of URL/5 years

Measuring cells ≤ 100 mbar (40 inH_2O):
- ±0.18% of URL/year

Influence of the installation position

- PMD70, FMD76: ≤ 3 mbar (1.2 inH_2O) [1, 3]
- PMD75: ≤ 4 mbar (1.6 inH_2O) [1, 3]
- FMD77: ≤ 32 mbar (12.8 inH_2O) [2, 3]

1) Device is rotated vertically to the membrane axis.
2) Device rotated vertically to the flange membrane.
3) The value is doubled for devices with inert oil.

Note!
Position-dependent zero shift can be corrected. Page 23, section "General installation instructions" and Page 60 ff, section "Response time".

Vibration effects

Device	Housing	Test standard	Vibration effects
PMD70/ FMD76	optional local display on the side (T14)	GL	≤ reference accuracy to 10 to 18 Hz: ±4 mm (0.16"); 18 to 500 Hz: 5 g
PMD75	optional local display on the side (T14)	IEC 61298-3	≤ reference accuracy to 10 to 60 Hz: ±0.35 mm (0.01"); 60 to 2000 Hz: 5 g
PMD75	optional local display on the top (T15)		

Performance characteristics – metallic diaphragms

Reference accuracy – PMD75, FMD77, FMD78

The reference accuracy comprises the non-linearity according to limit point setting, hysteresis and non-reproducibility as per IEC 60770.
The following applies for the root-extracting characteristic curve:
The accuracy data of the Deltabar S is taken into the accuracy calculation of the flow rate with a factor of 0.5.

PMD75

Measuring cell	% of the set span
10 mbar, 30 mbar (4, 12 inH_2O)	■ TD 1:1 = ±0.15 ■ TD > 1:1 = ±0.15 x TD
100 mbar (40 inH_2O)	■ TD 1:1 to TD 4:1 = ±0.075 ■ TD > 4:1 = ±(0.012 x TD + 0.027)
≥ 500 mbar (200 inH_2O)	■ TD 1:1 to TD 15:1 = ±0.075 ■ TD > 15:1 = ±(0.0015 x TD + 0.053)
Platinum version: ≥ 100 mbar (40 inH_2O)	■ TD 1:1 = ±0.05

FMD77, FMD78

Measuring cell	FMD77	FMD78
	% of the set span (influence of the diaphragm seal included)	
100 mbar (40 inH_2O)	■ TD 1:1 to TD 4:1 = ±0.15 ■ TD > 4:1 = ±(0.03 x TD + 0.03)	■ TD 1:1 to TD 4:1 = ±0.15 ■ TD > 4:1 = ±(0.03 x TD + 0.03)
≥ 500 mbar (200 inH_2O), 3 bar, 16 bar (43, 232 psi)	■ TD 1:1 to TD 15:1 = ±0.075 ■ TD > 15:1 = ±(0.0015 x TD + 0.053)	■ TD 1:1 to TD 4:1 = ±0.15 ■ TD > 4:1 = ±(0.02 x TD + 0.07)
40 bar (600 psi)	—	■ TD 1:1 to TD 4:1 = ±0.15 ■ TD > 4:1 = ±(0.02 x TD + 0.07)

Total performance – PMD75

The "Total performance" specification comprises the non-linearity including hysteresis, non-reproducibility, the thermal change of the zero point as well as the influence of the line pressure (p_{st} = 70 bar / 1015 psi).

Measuring cell	AISI 316L SS/1.4435, Alloy, Gold-Rhodium or Monel membrane	Tantalum membrane
	% of the set span	
≥ 500 mbar (200 inH_2O) to TD 2:1	±0.15	±0.30
All specifications apply to the temperature range –10 to +60°C (+14 to +140°F).		

Total Error

The total error comprises the long-term stability and the total performance:

Measuring cell	AISI 316L SS/1.4435, Alloy, Gold-Rhodium or Monel membrane	Tantalum membrane
	% of URL/year	
10 mbar, 30 mbar, 100 mbar (4, 12, 40 inH_2O)	±0.33	±0.48
≥ 500 mbar (200 inH_2O)	±0.20	±0.35

Warm-up period – PMD75, FMD77, FMD78

- 4 to 20 mA HART : < 10 s
- PROFIBUS PA: 6 s
- FOUNDATION Fieldbus: 50 s

Influence of the operating pressure on zero point and span – PMD75, FMD77, FMD78

Measuring cell	AISI 316L SS/1.4435, Alloy, Gold-Rhodium coated or Monel membrane		Tantalum membrane	
	Influence of the operating pressure on the zero point	Influence of the operating pressure on the span	Influence of the operating pressure on the zero point	Influence of the operating pressure on the span
10 mbar (4 inH_2O)	±0.15 % of URL/7 bar (100 psi)	±0.035 % of URL/7 bar (100 psi)	±0.28 % of URL/7 bar (100 psi)	±0.28 % of URL/7 bar (100 psi)
30 mbar (12 inH_2O)	±0.35 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)	±0.70 % of URL/70 bar (1015 psi)	±0.70 % of URL/70 bar (1015 psi)
100 mbar (40 inH_2O)	±0.15 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)	±0.42 % of URL/70 bar (1015 psi)	±0.42 % of URL/70 bar (1015 psi)
500 mbar (200 inH_2O)	±0.075 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)
3 bar (43 psi)	±0.075 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)
16 bar (232 psi)	±0.075 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)
40 bar (600 psi)	±0.075 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)

Note!
The influence of the operating pressure on the zero point can be calibrated out.

Thermal change of the zero output and the output span – PMD75

Measuring cell	–10 to +60 °C (+14 to +140°F)	
	AISI 316L SS/1.4435, Alloy, Gold-Rhodium coated or Monel membrane	Tantalum membrane
	% of the set span	
10 mbar, 30 mbar (4, 12 inH_2O)	±(0.31 x TD + 0.06)	
100 mbar (40 inH_2O)	±(0.18 x TD + 0.02)	±(0.24 x TD + 0.06)
500 mbar, 3 bar (200 inH_2O, 43 psi)	±(0.08 x TD + 0.05)	
16 bar (232 psi)	±(0.1 x TD + 0.1)	
40 bar (600 psi)	±(0.08 x TD + 0.05)	

Measuring cell	–40 to -10 °C, +60 to +85 °C (–40 to +14°F, +140 to +185°F)
	all membrane materials
	% of the set span
10 mbar, 30 mbar (4, 12 inH_2O)	±(0.45 x TD + 0.1)
100 mbar (40 inH_2O)	±(0.3 x TD + 0.15)
500 mbar, 3 bar (200 inH_2O, 43 psi)	±(0.12 x TD + 0.1)
16 bar (232 psi)	±(0.15 x TD + 0.2)
40 bar	±(0.37 x TD + 0.1)

Performance characteristics – ceramic diaphragms

Reference accuracy – PMD70, FMD76

The reference accuracy comprises the non-linearity including hysteresis and non-reproducibility in accordance with the limit point method as per IEC 60770.
The following applies for the root-extracting characteristic curve:
The accuracy data of the Deltabar S is taken into the accuracy calculation of the flow rate with a factor of 0.5.

Measuring cell	% of the set span
25 mbar (10 inH_2O)	■ TD 1:1 = ±0.15 ■ TD > 1:1 = ±0.15 x TD
100 mbar (40 inH_2O)	■ TD 1:1 to TD 4:1 = ±0.075 ■ TD > 4:1 = ±(0.012 x TD + 0,027)
500 mbar (200 inH_2O), 3 bar (43 psi)	■ TD 1:1 to TD 15:1 = ±0.075 ■ TD > 15:1 = ±(0.0015 x TD + 0.05252)
Platinum version: 100 mbar, 500 mbar, 3 bar (40 inH_2O, 200 inH_2O, 43 psi)	■ TD 1:1 = ±0.05

Total performance – PMD70, FMD76

The "Total performance" specification comprises the non-linearity including hysteresis, non-reproducibility, the thermal change of the zero point as well as the influence of the line pressure (p_{st} = 70 bar/1015 psi).

Measuring cell	% of the set span
≥ 500 mbar (200 inH_2O) to TD 1:1	■ ±0.15
All specifications apply to the temperature range –10 to +60°C (+14 to +140°F).	

Total Error

The total error comprises the long-term stability and the total performance:

Measuring cell	% of URL/year
25 mbar, 100 mbar (10 inH_2O, 40 inH_2O)	■ ±0.33
500 mbar, 3 bar (200 inH_2O, 43 psi)	■ ±0.20

Warm-up period – PMD70, FMD76

- 4 to 20 mA HART : < 10 s
- PROFIBUS PA: 6 s
- FOUNDATION Fieldbus: 50 s

Influence of the operating pressure on zero point and span – PMD70, FMD76

Measuring cell	Influence of the operating pressure on the zero point	Influence of the operating pressure on the span
25 mbar (10 inH_2O)	±0.7 % of URL/7 bar (100 psi)	±0.14 % of URL/7 bar (100 psi)
100 mbar (40 inH_2O)	±0.175 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)
500 mbar (200 inH_2O)	±0.075 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)
3 bar (43 psi)	±0.075 % of URL/70 bar (1015 psi)	±0.14 % of URL/70 bar (1015 psi)

Note!
The influence of the operating pressure on the zero point can be calibrated out.

Thermal change of the zero output and the output span – PMD70, FMD76

Measuring cell	–10 to +60 °C (+14 to +140°F)	–20 to –10 °C, +60 to +85 °C (–4 to +14°F, +140 to +185°F)
	% of the set span	
25 mbar (10 inH_2O)	±(0.35 x TD + 0.05)	±(0.3 x TD + 0.15)
≥ 100 mbar (40 inH_2O)	±(0.05 x TD + 0.05)	±(0.08 x TD + 0.07)

Operating conditions (Installation)

General installation instructions

- The position-dependent zero shift can be corrected directly at the device via operating key, for devices with external operation even in hazardous areas. Diaphragm seals also shift the zero point, depending on the installation position (page 62 ff, "Installation instructions").
- The housing of the Deltabar S can be rotated up to 380°. Page 26, section "Rotating the housing".
- Endress+Hauser offers a mounting bracket for installing the device on pipes or walls. Page 24, section "Wall- and pipe-mounting".
- When measuring in media with solid proportions, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment.
- Using a three-valve or five-valve manifold allows for easy commissioning, installation and maintenance without interrupting the process.
- General recommendations for the impulse piping can be found in DIN 19210 "Methods for measurement of fluid flow; differential piping for flow measurement devices" or the corresponding national or international standards.
- Install the impulse piping with a continuous gradient of at least 10%.
- When routing the impulse piping outdoors, ensure that sufficient anti-freeze protection is used, e.g. by using pipe heat tracing.
- For FMD77 and FMD78: See page 62 ff, "Installation instructions, Diaphragm seal systems" section.

Measuring arrangement

Flow measurement

- The PMD70 and PMD75 are best suited to flow measurement.
- Measuring arrangement for gases: Mount device above the measuring point.
- Measuring arrangement for liquids and steam: Mount device below tapping point.
- For flow measurement in steam, mount the condensate traps at the same level as the tapping point and at the same distance from Deltabar S.

Level measurement

- PMD70, PMD75, FMD76 and FMD77 are best suited to level measurement in open tanks. All Deltabar S devices are suitable for level measurement in closed tanks.

Measuring arrangement level measurement in open tanks

- PMD70, PMD75: Mount device below the lower measuring connection. The negative side is open to atmosphere pressure.
- FMD76, FMD77: Mount device direct on the tank. The negative side is open to atmosphere pressure.

Measuring arrangement level measurement in closed tanks and closed tanks with superimposed steam

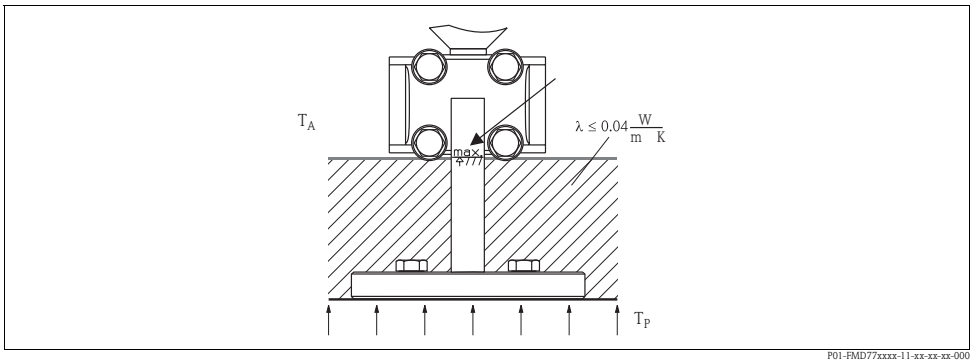
- PMD70, PMD75: Mount device below the lower measuring connection. Always connect the negative side above the maximum level.
- FMD76, FMD77: Mount device direct on the tank. Always connect the negative side above the maximum level.
- In the case of level measurement in closed tanks with superimposed steam, a condensate trap ensures pressure which remains constant on the minus side.

Pressure measurement

- The PMD70 and PMD75 are best suited to differential pressure measurement.
- Measuring arrangement for gases: Mount device above the measuring point.
- Measuring arrangement for liquids and steam: Mount device below tapping point.
- For differential pressure measurement in steam, mount the condensate traps at the same level as the tapping point and at the same distance from Deltabar S.

Heat insulation – FMD77

The FMD77 must only be insulated up to a certain height. The maximum permitted insulation height is labled on the devices and applies to an insulation material with a heat conductivity ≤ 0.04 W/(m x K) and to the maximum permitted ambient and process temperature (page see table below). The data were determined under the most critical application "quiescent air".



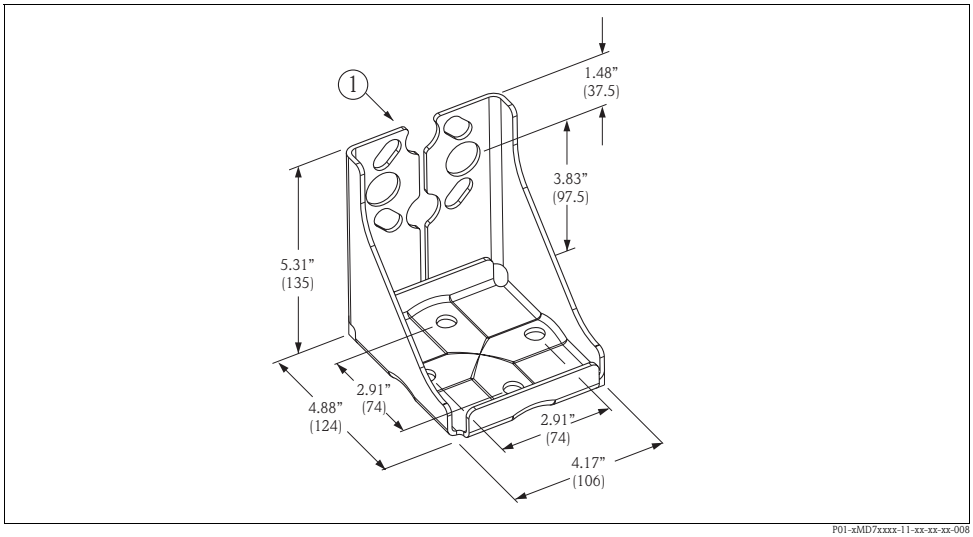
Maximum permitted insulation height

	FMD77
Ambient temperature (T_A)	≤ 70°C (158°F)
Process temperature (T_P)	max. 400°C (752°F), depending on the diaphragm seal filling oil used (see page 62)

Wall- and pipe-mounting

Endress+Hauser offers a mounting bracket for installing the device on pipes or walls. Page 66 ff, feature 110, "Additional options 2".

Note!
If a valve block is used, its dimensions should also be taken into consideration.



Mounting bracket for wall and pipe-mounting

A bracket including mounting accessories for pipe mounting is included with the device.

1 Device mounting

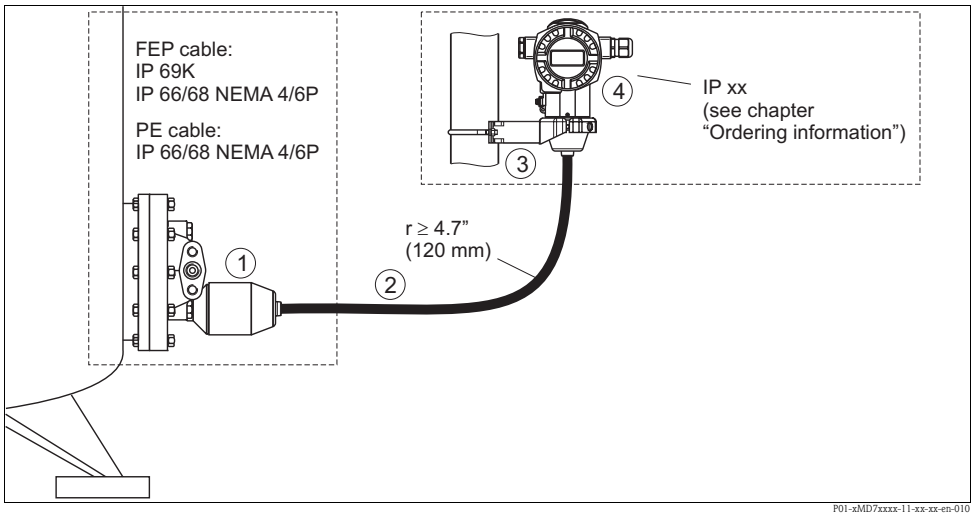
Remote housing version

With the remote housing version, you are able to mount the housing with the electronics insert at a distance from the measuring point. This facilitates trouble-free measurement:
- Under particularly difficult measuring conditions (at installation locations that are cramped or difficult to access)
- If rapid cleaning of the measuring point is required
- If the measuring point is exposed to vibrations.

You can choose between different cable versions:
- PE (2 m, 5 m and 10 m / 6, 16 and 33 ft)
- FEP (5 m / 16 ft).

Page 66 ff, Feature 110, "Additional options 2", Version "G".

For the dimensions, see page 48.



In the case of the remote housing version, the sensor is delivered with the process connection and cable ready mounted. The housing and a mounting bracket are enclosed as separate units. The cable is provided with a socket at both ends. These sockets are simply connected to the housing and the sensor.

1 Process connection with sensor
2 Cable, both ends are fitted with a socket
3 Mounting bracket provided, suitable for pipe and wall mounting
4 Housing with electronic insert

Degree of protection for the process connection with sensor with the use of
- FEP cable:
  - IP 69K
  - IP 66/68 NEMA 4/6P
- PE cable:
  - IP 66/68 NEMA 4/6P

Technical data of the PE and FEP cable:
- Minimum bending radius: 120 mm (4.72 inch)
- Cable extraction force: max. 450 N (101 lbf)
- Resistance to UV light

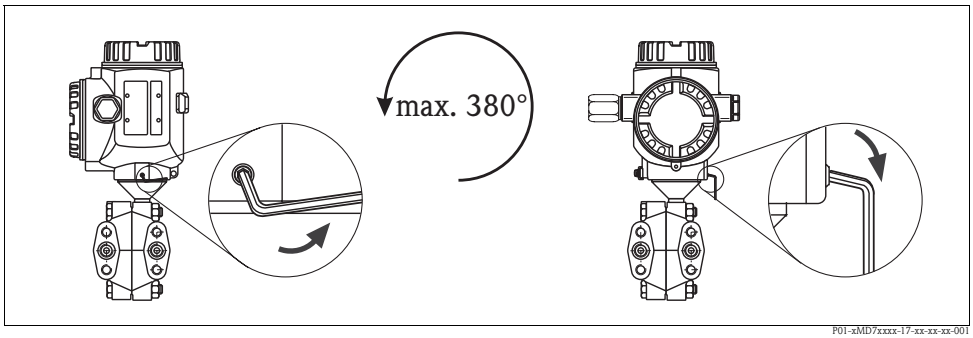
Use in hazardous area:
- Intrinsically safe installations (Ex ia/IS)
- FM/CSA IS: for Div.1 installatin only

Rotating the housing

The housing can be rotated up to 380° by loosening the Allen screw.

Your benefits

- Simple mounting by optimally aligning the housing
- Good, accessible device operation
- Optimum readability of the local display (optional).



Align the housing by loosening the Allen screw.
T14 and T15 housing: 2 mm Allen key; T17 housing: 3 mm Allen key

Oxygen applications

Oxygen and other gases can react explosively to oils, grease and plastics, such that, among other things, the following precautions must be taken:

– All components of the system, such as measuring devices, must be cleaned in accordance with the BAM (DIN 19247) requirements.
– Dependent on the materials used, a certain maximum temperature and a maximum pressure for oxygen applications must not be exceeded.

The devices suitable for gaseous oxygen applications are listed in the following table with the specification p_{max}.

Order code for devices cleaned for oxygen applications	p_{max} for oxygen applications	T_{max} for oxygen applications
PMD70 – * * * ** * * * 2 * *, Devices with 500 mbar or 3000 mbar measuring cell (200 or 1200 inH_2O)	30 bar (435 psi)	60°C (140°F)
PMD70 – * * * ** * * * 2 * *, Devices with 25 mbar or 100 mbar measuring cell (10 or 40 inH_2O)	PN of the flange (pressure rating)	60°C (140°F)
PMD75 – * * * ** * * * K * *	160 bar (2320 psi)	85°C (185°F)
PMD75 – * * * ** * * * 2 * *	160 bar (2320 psi)	60°C (140°F)
PMD75 – * * * ** * * * 3 * *	160 bar (2320 psi)	60°C (140°F)
FMD76 – * * * ** * T * * *, Devices with 500 mbar or 3000 mbar measuring cell (200 or 1200 inH_2O)	30 bar (435 psi)	60°C (140°F)
FMD76 – * * * ** * T * * *, Devices with 25 mbar or 100 mbar measuring cell (10 or 40 inH_2O)	PN of the measuring cell (pressure rating)	60°C (140°F)
FMD77 – * * * ** T * F * *	PN of the flange (pressure rating)	60°C (140°F)
FMD78 – * * * ** * ** 4 * * FMD78 – * * * ** * ** D * *	90 bar (1300 psi)	85°C (185°F)

Ultra pure gas applications

Endress+Hauser also offers devices for special applications, such as ultra pure gas, cleaned from oil and grease. No special restrictions regarding the process conditions apply to these devices.

Page 66 ff, PMD70 and PMD75: feature 80 "Seal", FMD76 and FMD77: feature 70 "Process connection low-pressure side, material, seal".

Diaphragms for materials with hydrogen build-up (Gold-Rhodium coating)

With regard to materials in which hydrogen build-up takes place, hydrogen atoms can diffuse through the metal diaphragms. This can result in incorrect measurement results.
Endress+Hauser offers diaphragms with Gold-Rhodium coating for this application.

Page 67 ff "Ordering information PMD75", Page 73 "Ordering information FMD77" or Page 76 "Ordering information FMD78", feature 60 "Membrane material".

Operating conditions (Environment)

Ambient temperature range

- PMD75, FMD77, FMD78: –40 to +85°C (–40 to +185°F), devices for lower temperatures on request
- PMD70, FMD76: –20 to +85°C (–4 to +185°F)
- On-site display: –20 to +70°C (–4 to +158°F)
  Extended temperature application range with restrictions in optical properties such as display speed and contrast: –40 to +85°C (–40 to +185°F)
- Separate housing: –40 to +60°C (–40 to +140°F)

For devices for use in hazardous areas, see Safety instructions, Installation or Control Drawing (Page 85, sections "Safety Instructions" and "Installation/Control Drawings").

The device can be used in this temperature range. The values of the specification, such as thermal change, may be exceeded. See also DIN 16086.

Storage temperature range

- –40 to + 90°C (–40 to +194°F)
- On-site display: –40 to +85°C (–40 to +185°F)
- Separate housing: –40 to +60°C (–40 to +140°F)

Degree of protection

- Page 65 ff, feature 30 "Housing, Cable entry, Protection".
- Degree of protection IP 68 for T17 housing: 1.83 mH_2O (6 ftH_2O) for 24 h
- Remote housing Page 25

Climate class

Class 4K4H (air temperature: –20 to 55°C/–4 to +131F, relative humidity: 4 to 100%) fulfilled as per DIN EN 60721-3-4 (condensation possible)

Vibration resistance

Device/Additional option	Housing	Test standard	Vibration resistance
PMD70/ FMD76	optional local display on the side (T14)	GL	guaranteed for: 2 to 18 Hz: ±4 mm; 18 to 500 Hz: 5 g in all 3 planes
PMD75	optional local display on the side (T14)	IEC 61298-3	guaranteed for: 10 to 60 Hz: ±0.35 mm (0.01"); 60 to 2000 Hz: 5 g in all 3 planes
PMD75	optional local display on the top (T15)		
with mounting bracket		IEC 61298-3	guaranteed for: 10 to 60 Hz: ±0.15 mm (0.006"); 60 to 500 Hz: 2 g in all 3 planes

Electromagnetic compatibility

- Electromagnetic compatibility to EN 61326 and NAMUR recommendation EMC (NE21). For details refer to the declaration of conformity.
- With enhanced immunity against electromagnetic fields as per EN 61000-4-3: 30 V/m with closed cover (for devices with T14 or T15 housing)
- Maximum deviation: < 0.5% of span [1]
- All EMC measurements were performed with a turn down (TD) = 2:1.

1) Larger deviations possible with PMD70 with 25 mbar or 100 mbar (10 or 40 inH_2O) sensor

Overvoltage protection (optional)

- Overvoltage protection:
  - Nominal functioning DC voltage: 600 V
  - Nominal discharge current: 10 kA
- Surge current check î = 20 kA as per DIN EN 60079-14: 8/20 µs satisfied
- Arrester AC current check I = 10 A satisfied

Page 66 ff, feature 100 "Additional options 1" and feature 110 "Additional options 2", version "M Overvoltage protection".

Note!
Devices with integrated overvoltage protection must be grounded.

Operating conditions (Process)

Process temperature limits

- PMD70: –20 to +85°C (–4 to +185°F)
- FMD76: –20 to +85 °C (–4 to +185°F)
- PMD75 with impulse piping longer than 100 mm: –40 to +120°C (–40 to +248°F), with side flanges C22.8 and impulse piping longer than 100 mm: –10 to +120°C (14 to +248°F)
- FMD77 and FMD78, depending on the diaphragm seal and filling oil: up to + 400°C (+752°F)

Note!
- For oxygen applications, observe page 26 "Oxygen applications" section.
- PMD70, FMD76, PMD75 and FMD78: Observe the Process temperature range of the seal. See also the following section "Process temperature range, seals".
- FMD77 and FMD78: Observe the temperature application limits of the diaphragm seal oil. Page 56, sections "Diaphragm seal filling oils".
- FMD77 and FMD78: Do not use diaphragm seals with 0.09 mm PTFE foil on AISI 316L SS (1.4435/1.4405) for vacuum applications, upper temperature limit +204°C (+400°F).

Process temperature range, seals

PMD70 (with ceramic measuring diaphragms)

Versions for feature 80 in the order code	Seal	Process temperature range
A	FKM Viton	–20 to +85°C (–4 to +185°F)
B	EPDM	–20 to +85°C (–4 to +185°F)
D	Kalrez, Compound 4079	+5 to +85°C (+41 to +185°F)
E	Chemraz, Compound 505	–20 to +85°C (–4 to +185°F)
1	FKM Viton, cleaned from oil and greace	–10 to +85°C (+14 to +185°F)
2	FKM Viton, cleaned for oxygen service	–10 to +60°C (+14 to +140°F)

FMD76 (with ceramic measuring diaphragms)

Versions for feature 70 in the order code	Seal	Temperature operating range
B, D, F, G, U	FKM Viton	–20 to +85°C (–4 to +185°F)
K, L	EPDM FDA 21 CFR 177.2600	–20 to +85°C (–4 to +185°F)
M, N	Kalrez, Compound 4079	+5 to +85°C (+41 to +185°F)
P, Q	Chemraz, Compound 505	–20 to +85°C (–4 to +185°F)
S	FKM Viton, cleaned from oil and greace	–10 to +85°C (+14 to +185°F)
T	FKM Viton, cleaned for oxygen service	–10 to +60°C (+14 to +140°F)

PMD75 (with metallic measuring diaphragms)

Versions for feature 80 in the order code	Seal	Process temperature range [1]
A	FKM Viton	–20 to +85°C (–4 to +185°F)
C	PTFE	–40 to +85°C (–40 to +185°F)
F	NBR	–20 to +85°C (–4 to +185°F)
H	Copper	–40 to +85°C (–40 to +185°F)
K	Copper, cleaned for oxygen service	–20 to +85°C (–4 to +185°F)
1	FKM Viton, cleaned from oil and greace	–10 to +85°C (+14 to +185°F)
2	FKM Viton, cleaned for oxygen service	–10 to +60°C (+14 to +140°F)
3	PTFE, cleaned for oxygen service *	–20 to +60°C (–4 to +140°F)

1) lower temperature on request

* PTFE seal is 25% glass filled. Kalrez compound 4079 is standard replacement, other Kalrez compounds are available on request which prevent corrosive breakdown of seal (such as hydrochloric acid), please consult factory.

FMD77 (with metallic measuring diaphragms)

Versions for feature 70 in the order code	Seal on the LP side (–)	Process temperature range [1]
B, D, F, G	FKM Viton	–20 to +85°C (–4 to +185°F)
H, J	PTFE	–40 to +85°C (–40 to +185°F)
K, L	EPDM	–40 to +85°C (–40 to +185°F)
M, N	Kalrez, Compound 6375	+5 to +85°C (+41 to +185°F)
P, Q	Chemraz, Compound 505	–20 to +85°C (–4 to +185°F)
S	FKM Viton, cleaned from oil and greace	–10 to +85°C (+14 to +185°F)
T	FKM Viton, cleaned for oxygen service	–10 to +60°C (+14 to +140°F)

1) lower temperature on request

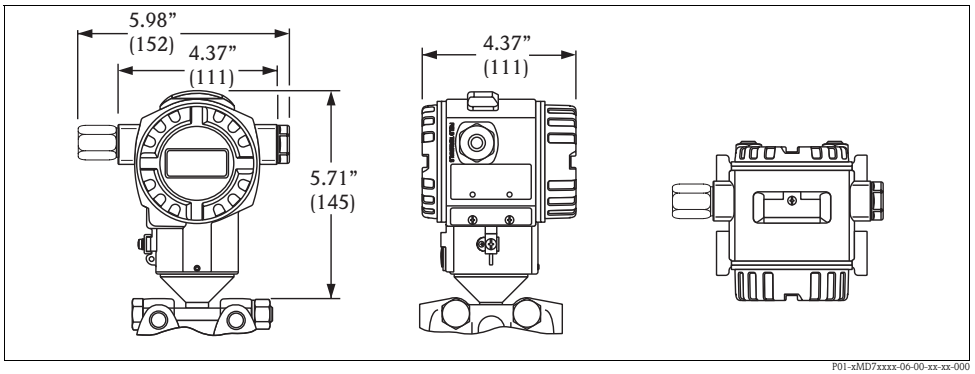
Pressure specifications

- The maximum pressure for the measuring device is dependent on the lowest-rated element with regard to pressure, see the following sections for this:
  – Page 9 ff, section "Measuring range" and chapter "Mechanical construction".
  The MWP (maximum working pressure) is specified on the nameplate. This value refers to a reference temperature of 20°C (68°F) or 100°F for ANSI flanges and may be applied to the device for an unlimited time. Observe pressure-temperature dependency.
- The pressure values permitted at higher temperatures can be found in the following standards:
  – EN 1092-1: 2001 Tab. 18 [1]
  – ASME B 16.5a – 1998 Tab. 2-2.2 F316 and ASME B 16.5a – 1998 Tab. 2.3.8 N10276
  – JIS B 2220
- For PMD70 and PMD75, the MWP applies for the temperature ranges specified in the "Ambient temperature range" (Page 27) and "Process temperature limits" (Page 28) sections.
- The test pressure corresponds to the over pressure limit of the measuring instrument (Over pressure limits OPL = 1.5 x MWP) and may fit only temporally limited, so that no permanent damage develops.
- The Pressure Equipment Directive (EC Directive 97/23/EC) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.
- In the case of sensor range and process connections where the OPL (Over Pressure Limit) of the pressure connection is smaller than the nominal value of the sensor, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If you want to use the entire sensor range, select a process connection with a higher OPL value (1.5 x PN; PN = MWP).
- In oxygen applications, the values for "p_{max} and T_{max} for oxygen applications" as per Page 26, "Oxygen applications" may not be exceeded.

1) With regard to their stability-temperature property, the materials 1.4435 and 1.4404 (stainless steel) are grouped together under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.

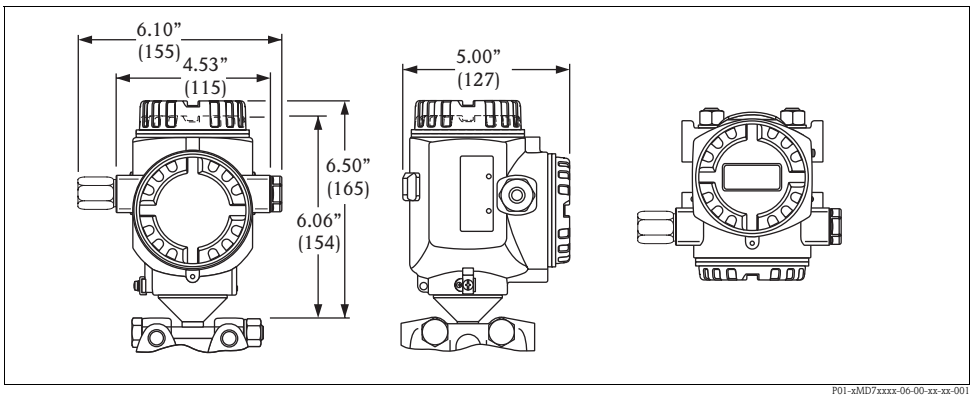
Mechanical construction

Housing dimensions T14, optional display on the side



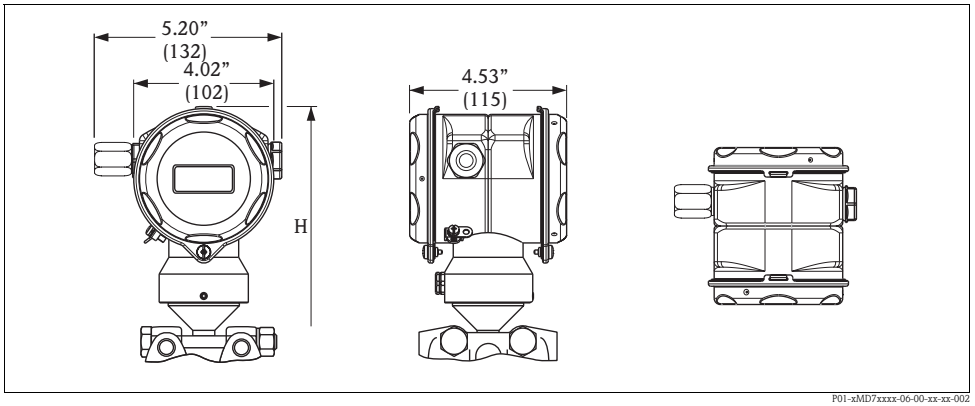
Front view, left-hand side view, top view
See the process connection in question for installation height. Housing weight see Page 49.

Housing dimensions T15, optional display on the top



Front view, left-hand side view, top view
See the process connection in question for installation height. Housing weight see Page 49.

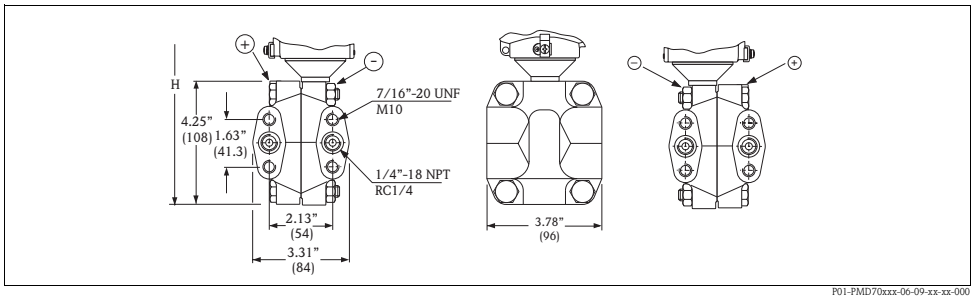
Housing dimensions T17, optional display on the top



Front view, left-hand side view, top view
See the process connection in question for installation height. Housing weight see Page 49.

Process connections PMD70 with ceramic measuring diaphragms

Note! Some device versions have CRN approval. For a CRN-approved device, a CRN-approved process connection (Page 66, feature 70 "Process connection") has to be ordered with a CSA approval (Page 65, feature 10 "Approval"). These devices are fitted with a separate plate bearing the registration number 0F10524.5C.



Process connection PMD70, oval flange

H Device height, see Page 32, section "Device height H"

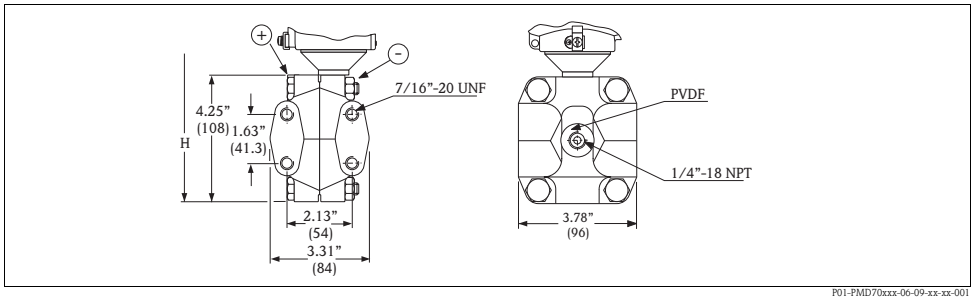
Version	Connection	Mounting	Material	Accessories	Weight [1] kg (lbs)
B	1/4-18 NPT IEC 61518	7/16-20 UNF	Steel C 22.8	2 vent valves (AISI 316L/1.4404) included	4.0 (8.8)
D	1/4-18 NPT IEC 61518	7/16-20 UNF	AISI 316L [2]		4.0 (8.8)
F	1/4-18 NPT IEC 61518	7/16-20 UNF	Alloy C276 [3]	Vent valves (Alloy C276/2.4819), see Page 72 feature 110 "Additional options 2".	4.2 (9.3)
U	RC 1/4	7/16-20 UNF	AISI 316L [2]	2 vent valves (AISI 316L/1.4404) included	4.0 (8.8)
1	1/4-18 NPT IEC 61518	PN 160: M10	Steel C 22.8		4.0 (8.8)
2	1/4-18 NPT IEC 61518	PN 160: M10	AISI 316L [2]		4.0 (8.8)
3	1/4-18 NPT IEC 61518	PN 160: M10	Alloy C276 [3]	Vent valves (Alloy C276/2.4819), see Page 72, feature 110 "Additional options 2".	4.2 (9.3)

1) Process connection weight, for housing weight see Page 49

2) AISI 316L SS/1.4435

3) Alloy C276/2.4819

Process connections PMD70 with ceramic measuring diaphragms (continued)



Process connection PMD70, version G, PVDF inlay, PN = 10 bar, process temperature T = –10 to +60°C (14 to +140°F)

H Device height see Page 32, section "Device height H"

Version	Connection	Mounting	Material	Weight [1]
G	1/4-18 NPT IEC 61518	7/16-20 UNF	PVDF	3.8 kg (8.4 lbs)

1) Process connection weight, for housing weight see Page 49

Device height H

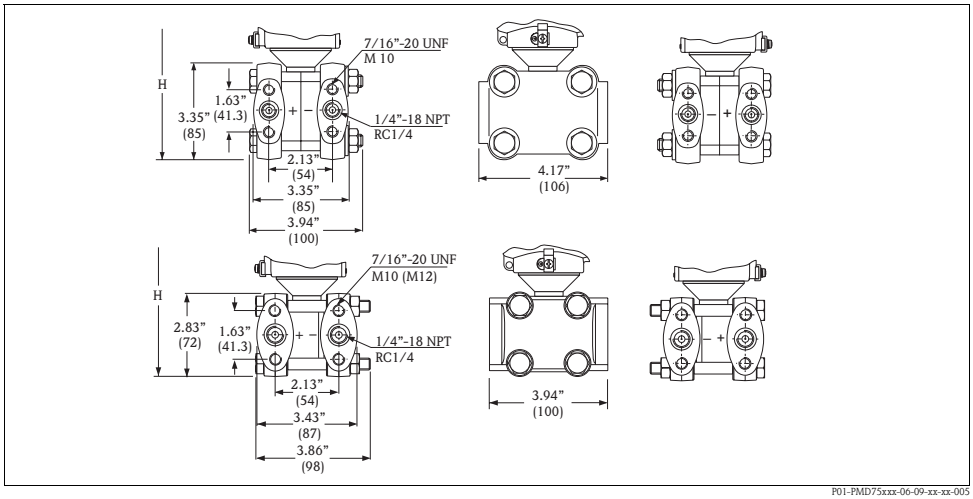
Description	Device height H
T14 housing, optional display on the side	253 mm (9.96")
T15 housing without display, flat cover	259 mm (10.2")
T15 housing with display, high cover	271.5 mm (10.7")
T17 housing, optional display on the side	269 mm (10.5")

Process connections PMD75 with metallic measuring diaphragms

Note! Some device versions have CRN approval. For a CRN-approved device, a CRN-approved process connection (Page 68, feature 70 "Process connection") has to be ordered with a CSA approval (Page 67, feature 10 "Approval"). These devices are fitted with a separate plate bearing the registration number 0F10524.5C.

NOTE: Metallic diaphragm is 3 mil thick. Optional 6 mil thickness is available.

Oval flange, connection 1/4-18 NPT or RC 1/4



P01-PMD75xxx-06-09-xx-xx-005

Process connection PMD75, above 10 and 30 mbar (4 and 12 inH_2O) measuring cell; below: Measuring cell ≥ 100 mbar (40 inH_2O)

H Device height see Page 34, section "Device height H"

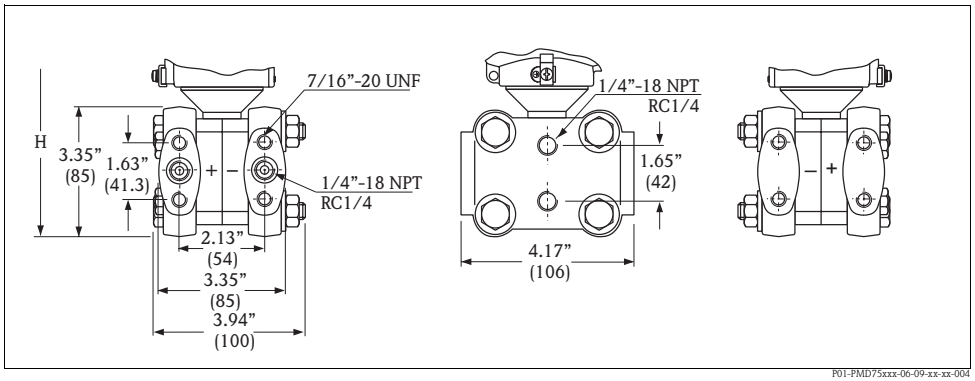
Version	Connection	Mounting	Material	Accessories	Weight [1] kg (lb)
B	1/4-18 NPT IEC 61518	7/16-20 UNF	Steel C 22.8	2 vent valves (AISI 316L/1.4404) included	4.2 (9.3)
D	1/4-18 NPT IEC 61518	7/16-20 UNF	AISI 316L [2]		4.2 (9.3)
F	1/4-18 NPT IEC 61518	7/16-20 UNF	Alloy C276 2.4819	Vent valves (Alloy C276/2.4819), see Page 5, feature 110 "Additional options 2".	4.5 (9.3)
U	RC 1/4	7/16-20 UNF	AISI 316L [2]	2 vent valves (AISI 316L/1.4404) included	4.2 (9.3)
1	1/4-18 NPT IEC 61518	– PN 160: M10 – PN 420: M12	Steel C 22.8		4.2 (9.3)
2	1/4-18 NPT IEC 61518	– PN 160: M10 – PN 420: M12	AISI 316L [2]		4.2 (9.3)
3	1/4-18 NPT IEC 61518	– PN 160: M10 – PN 420: M12	Alloy C276 2.4819	Vent valves (Alloy C276/2.4819), see Page 75 ff, feature 110 "Additional options 2".	4.5 (9.3)

1) Weight of process connections without vent valves with 10 or 30 mbar (4 and 12 inH_2O) sensors, process connections without vent valves with sensors ≥ 100 mbar (40 inH_2O)weght approx. 800 g (1.7 lbs) less. Housing weight see Page 49.

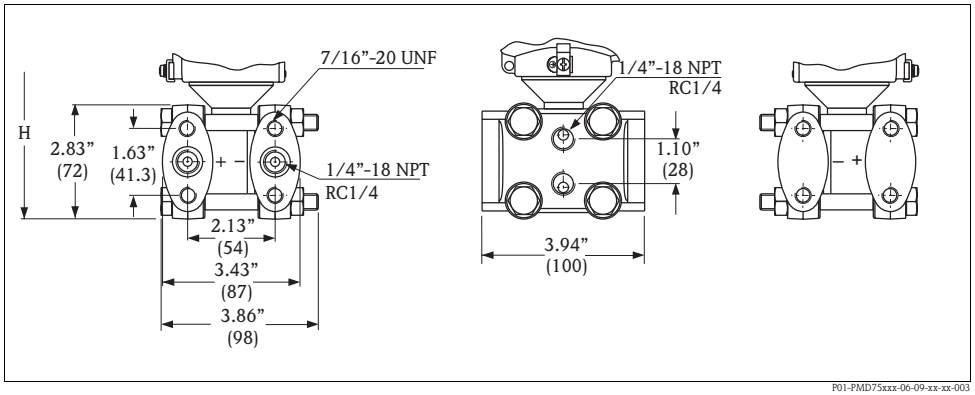
2) AISI 316L/1.4435 or 1.4404

Process connections PMD75 with metallic measuring diaphragms (continued)

Oval flange, connection 1/4-18 NPT or RC 1/4, with side vent



Process connection PMD75, 10 and 30 mbar (4 and 12 inH_2O) measuring cell



Process connection PMD75, nominal value ≥ 100 mbar (40 inH_2O)

H Device height see Page 34, section "Device height H"

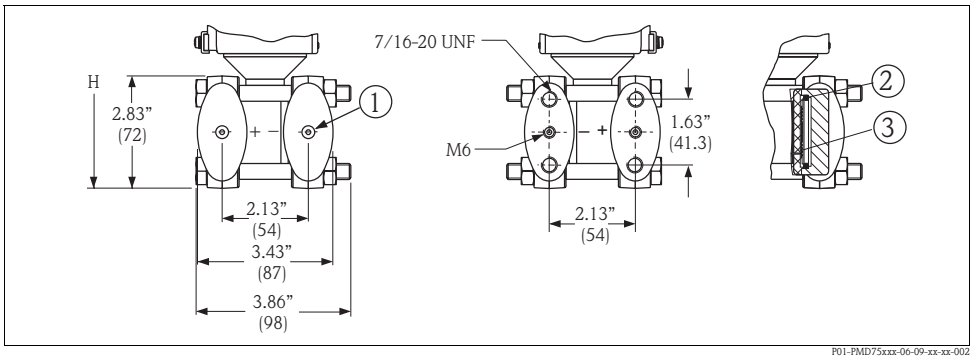
Version	Connection	Mounting	Material	Accessories	Weight [1] kg (lbs)
C	1/4-18 NPT IEC 61518	7/16-20 UNF	Steel C 22.8	4 locking screws and 2 vent valves included (AISI 316L/1.4404)	4.2 (9.3)
E	1/4-18 NPT IEC 61518	7/16-20 UNF	AISI 316L [2]		4.2 (9.3)
H	1/4-18 NPT IEC 61518	7/16-20 UNF	Alloy C276 2.4819	Vent valves (Alloy C276/2.4819), see Page 75, feature 110 "Additional options 2".	4.5 (9.9)
V	RC 1/4	7/16-20 UNF	AISI 316L [2]	4 looking screws and 2 vent valves included (AISI 316L/1.4404)	4.2 (9.3)

1) Weight of process connections without vent valves with 10 or 30 mbar **(4 or 12 inH_2O)** sensors, process connections without vent valves with sensors ≥ 100 mbar (40 inH_2O) weght approx. 800 g (1.7 lbs)less. Housing weight see Page 49

2) PN 160 bar (2320 psi) measuring cells: AISI 316L/1.4435, PN 420 bar measuring cells: AISI 316L/1.4435 or 1.4404

Process connections PMD75 with metallic measuring diaphragms (continued)

Oval flange, prepared for diaphragm seal mount



Left: Process connection PMD75, version W, prepared for diaphragm seal mount
Right: Position of the copper ring seal

H Device height, see the following section "Device height H"
1 Diaphragm seal attachment
2 Copper ring seal
3 Cup diaphragm

Device height H

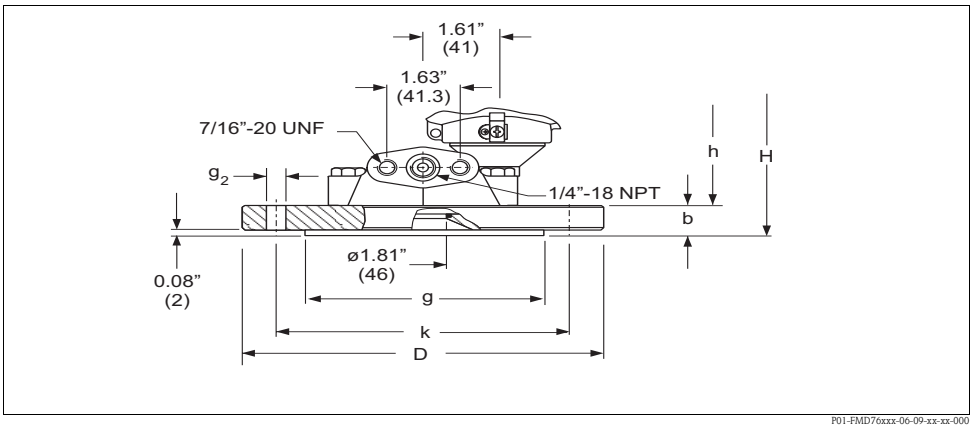
Description	Device height H [1]
T14 housing, optional display on the side	217 mm / 8.54" (230 mm / 9.05")
T15 housing without display, flat cover	223 mm / 8.78" (236 mm / 9.29")
T15 housing with display, high cover	235.5 mm / 9.27" (248.5 mm / 9.78")
T17 housing, optional display on the side	233 mm / 9.17" (246 mm 9.69")

1) Values for devices with 10 mbar and 30 mbar (4 and 12 inH_2O) measuring cell in brackets

Process connection FMD76 with ceramic measuring diaphragms

Note!
- Some device versions have CRN approval. For a CRN-approved device, a CRN-approved process connection (Page 71, feature 70 "Process connection") has to be ordered with a CSA approval (Page 70, feature 10 "Approval"). These devices are fitted with a separate plate bearing the registration number 0F10524.5C.
- FMD76 devices with an EN/DIN flange DN 80 PN 40, an ANSI flange 3" 150 lbs or a JIS flange 80 A 10 K can only be mounted with an open-ended wrench.

EN/DIN flanges, connection dimensions as per EN 1092-1/DIN 2527



Process connection FMD76, high-pressure side: EN/DIN flange,
low-pressure side: connection 1/4-18 NPT
Application limits for version "G" in feature 70 "Process connection low-pressure side" with PVDF inlay:
PN = 10 bar, process temperature T = –10 to +60°C (14 to +140°F)

H Device height see Page 37, section "Device height H, devices with flange"
h Height of the device without flange thickness b

	Flange [1]							Bolt holes			
Version	**Material**	**Nominal diameter**	**Shape [2]**	**Nominal pressure**	**Diameter D** [mm]	**Thickness b** [mm]	**Raised face g** [mm]	**Quantity**	**Diameter g_2** [mm]	**Bolt circle k** [mm]	**Flange weight [3]** [kg]
B	AISI 316L	DN 80	B1 (D)	PN 10-40	200	24	138	8	18	160	5.3
D	ECTFE [4]	DN 80	–	PN 10-40	200	24	–	8	18	160	5.3
E	Alloy C276 [5]	DN 80	B1 (D)	PN 10-40	200	24	138	8	18	160	6
F	AISI 316L	DN 100	B1 (C)	PN 10-16	220	22	–	8	18	180	6
G	AISI 316L	DN 100	B1 (D)	PN 25-40	235	26	162	8	22	190	8
H	ECTFE [4]	DN 100	–	PN 25-40	235	26	–	8	22	190	8
J	Alloy C276 [5]	DN 100	B1 (D)	PN 25-40	235	26	162	8	22	190	9
L	ECTFE [4]	DN 100	–	PN 10-16	220	22	–	8	18	180	6
M	Alloy C276 [5]	DN 100	B1 (C)	PN 10-16	220	22	–	8	18	180	6.8

1) The roughness of the surface in contact with the medium, including the sealing surface of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 µm. Lower surface roughness on request.

2) Designation as per DIN 2527 in brackets

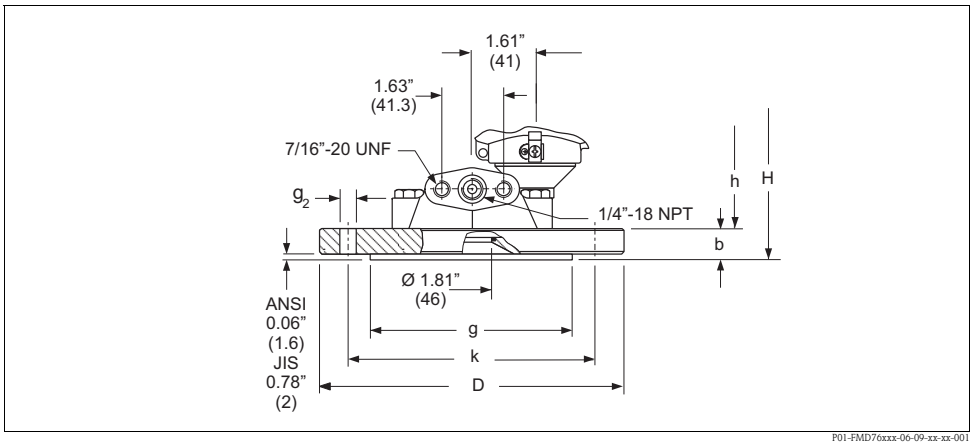
3) Housing weight see Page 49

4) ECTFE coating on AISI 316L SS/1.4435,
When operating in hazardous area, avoid electrostatic charge of the plastic surfaces.

5) Alloy C276/2.4819

Process connection FMD76 with ceramic measuring diaphragms (continued)

ANSI flanges, connection dimensions as per ANSI B 16.5, raised face RF and JIS flanges, connection dimensions as per JIS B 2220 BL, raised face RF



Process connection FMD76, high-pressure side: ANSI or JIS flange (see table below), low-pressure side: connection 1/4-18 NPT

H Device height see in Page 37, section "Device height H, devices with flange"
h Height of the device without flange thickness b

	Flange [1]						Bolt holes			
Version	**Material**	**Nominal diameter**	**Class/ Nominal pressure**	**Diameter** **D** in (mm)	**Thickness** **b** in (mm)	**Raised face** **g** in (mm)	**Quantity**	**Diameter** **g_2** in (mm)	**Bolt circle** **k** in (mm)	**Flange weight [2]** lbs (kg)
ANSI flanges										
P	AISI 316/316L [3]	3 in	150 lb./sq.in	7.5 (190.5)	0.94 (23.9)	5 (127)	4	0.75 (19.1)	6 (152.4)	10.8 (4.9)
R	ECTFE [4]									10.8 (4.9)
S	Alloy C276									12.1 (5.5)
T	AISI 316/316L [3]	4 in	150 lb./sq.in	9 (228.5)	0.94 (23.9)	6.19 (157.2)	8	0.75 (19.1)	7.5 (190.5)	15.7 (7.1)
U	ECTFE [4]									15.7 (7.1)
V	Alloy C276									17.6 (8)
W	AISI 316/316L [3]	4 in	300 lb./sq.in	10 (254)	1.25 (31.8)	6.19 (157.2)	8	0.88 (22.4)	7.88 (200.2)	26 (11.7)
JIS flanges										
1	AISI 316L	80 A	10 K	7.32 (185)	0.71 (18)	5 (127)	8	0.75 (19.1)	5.9 (150)	7.3 (3.3)
3	Alloy C276									8.2 (3.7)
4	AISI 316L	100 A	10 K	8.27 (210)	0.71 (18)	5.95 (151)	8	0.75 (19.1)	6.89 (175)	9.7 (4.4)

1) The roughness of the surface in contact with the medium, including the sealing surface of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 µm. Lower surface roughness on request.

2) Housing weight see Page 49

3) Combination of AISI 316 SS for required pressure resistance and AISI 316L SS for required chemical resistance (dual rated)

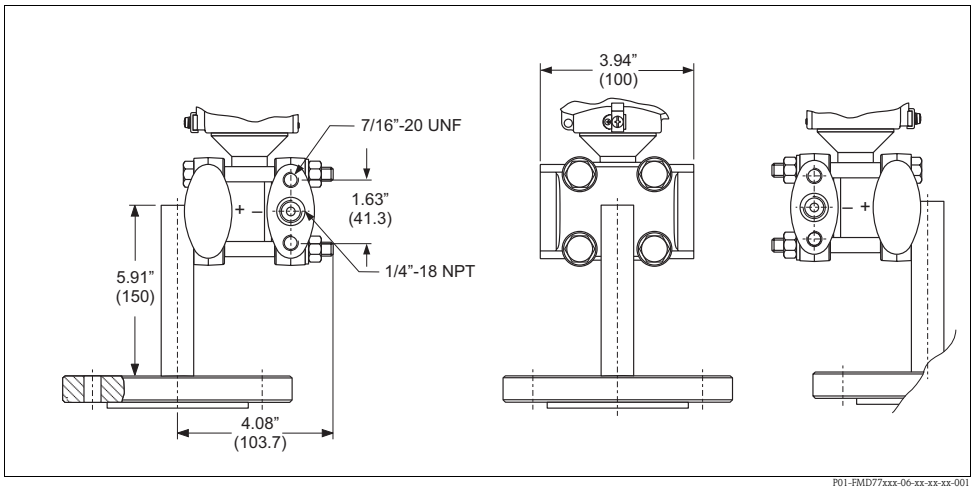
4) ECTFE coating on AISI 316L SS.
When operating in hazardous area, avoid electrostatic charge of the plastic surfaces.

Process connection FMD76 with ceramic measuring diaphragms (continued)

Device height H, devices with flange

Description	Device height H (h + b)
T14 housing, optional display on the side	175 mm (6.89") + flange thickness b (see tables)
T15 housing without display, flat cover	181 mm (7.12") + flange thickness b (see tables)
T15 housing with display, high cover	193.5 mm (7.62") + flange thickness b (see tables)
T17 housing, optional display on the side	191 mm (7.52") + flange thickness b (see tables)

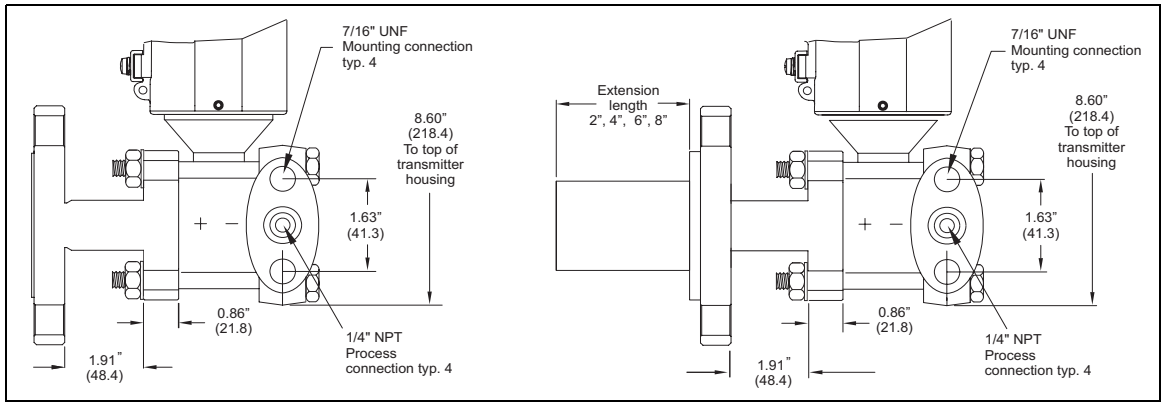
Process connections FMD77 with metallic measuring diaphragms, low-pressure side



Low-pressure side: connection 1/4-18 NPT, mounting optionally 7/16-20 UNF,
Side flanges material of the basic device: AISI 316L/1.4435 or 1.4404
high-pressure side, see the following section "Process connections, high-pressure side FMD77"

Compact flange design

- ANSI flange (FMD77 versions 5, 6, 7 and 8 only) – see page 74 "Process Connection" ordering information.

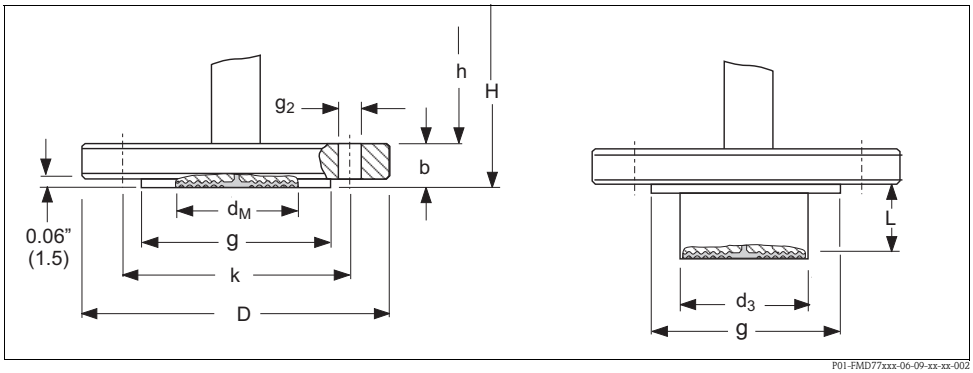


Process connections FMD77 with metallic measuring diaphragms, high-pressure side

Note!

- Some device versions have CRN approval. For a CRN-approved device, a CRN-approved process connection (Page 74, feature 70 "Process connection") has to be ordered with a CSA approval (Page 73, feature 10 "Approval"). These devices are fitted with a separate plate bearing the registration number 0F10524.5C.
- Specifications for the "T_K Ambient" and "T_K Process" are listed in the following tables. These are typical values. These temperature coefficients apply to silicone oil and the membrane material AISI 316L/1.4435. For other filling oils, this temperature coefficient must be multiplied by the T_K correction factor of the corresponding filling oil. For the T_K correction factors, see also page 62, section "Diaphragm seal filling oils".

EN/DIN flanges, connections as per EN 1092-1/DIN 2527



Process connection FMD77, high-pressure side EN/DIN flange with and without extended diaphragm seal, material AISI 316L

H Device height see Page 40, section "Device height H"
h Height of the device without flange thickness b

	Flange [1]								Bolt holes			Diaphragm seal			
Version	Nominal diameter	Nominal pressure	Shape [2]	Diameter D [mm]	Thickness b [mm]	Raised face g [mm]	Extension length L [mm]	Extension diameter d_3	Quantity	Diameter g_2 [mm]	Bolt circle k [mm]	max. Diaphragm diameter d_M [mm]	T_K Ambient [mbar/10 K]	T_K Process [mbar/10 K]	Flange weight [3] [kg]
A	DN 50	PN 10-40	B1 (D)	165	20	102	–	–	4	18	125	59	+3.02	+1.25	3.0
B	DN 80	PN 10-40	B1 (D)	200	24	138	–	–	8	18	160	89	+0.23	+0.18	5.2
C	DN 80	PN 10-40	B1 (D)	200	24	–	50	76	8	18	160	72	+0.23	+0.11	6.2
							100								6.7
							200								7.8
F	DN 100	PN 10-16	B1 (C)	220	20	–	–	–	8	18	180	89	+0.23	+0.28	4.8
G	DN 100	PN 25-40	B1 (D)	235	24	162	–	–	8	22	190	89	+0.23	+0.11	6.7

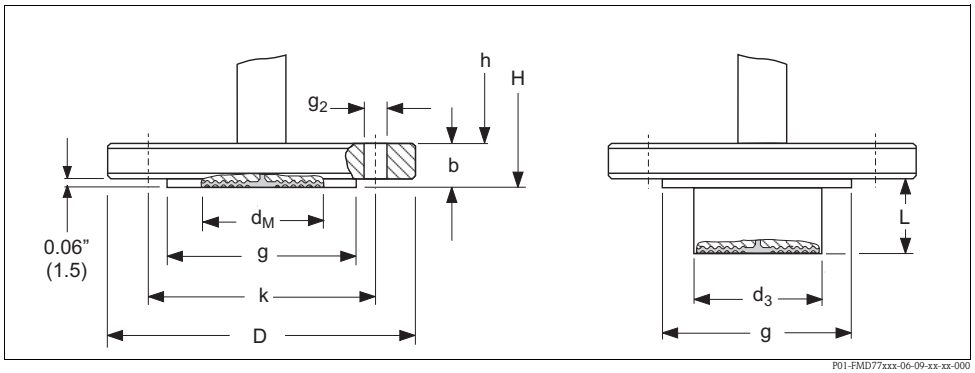
1) The roughness of the surface in contact with the medium, including the sealing surface of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 µm. Lower surface roughness on request.

2) Designation as per DIN 2527 in brackets

3) Housing weight see Page 49

Process connections FMD77 with metallic measuring diaphragms, high-pressure side (continued)

ANSI flanges, connection dimensions as per B 16.5, raised face RF



Process connection FMD77, high-pressure side ANSI flange with and without extended diaphragm seal, material AISI 316/316L

H Device height see Page 40, section "Device height H"
h Height of the device without flange thickness b

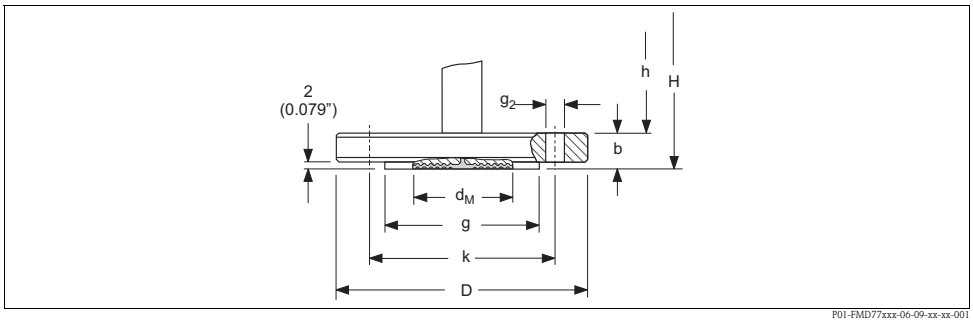
	Flange [1]							Bolt holes			Diaphragm seal			
Version	Nominal diameter	Class	Diameter D	Thickness b	Raised face g	Extension length L	Extension diameter d_3	Quantity	Diameter g_2	Bolt circle k	max. Diaphragm diameter d_M	T_K Ambient	T_K Process	Flange weight [2]
		[lb./sq.in]	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)		in (mm)	in (mm)	in (mm)	[mbar/10 K]		lbs [kg]
N	2	150	6 (152.4)	0.75 (19.1)	3.62 (91.9)	–	–	4	0.75 (19.1)	4.75 (120.7)	2.32 (59)	+3.02	+0.90	5.7 (2.6)
P	3	150	7.5 (190.5)	0.94 (23.9)	5 (127)	–	–	4	0.75 (19.1)	6 (152.4)	3.50 (89)	+0.23	+0.18	11.2 (5.1)
Q	3	150	7.5 (190.5)	0.94 (23.9)	5 (127)	2 (50.8)	3 (76.2)	4	0.75 (19.1)	6 (152.4)	2.83 (72)	+0.23	+0.11	13.2 (6)
						4 (101.6)								14.6 (6.6)
						6 (152.4)								15.7 (7.1)
						8 (203.8)								17.0 (7.7)
T	4	150	9 (228.6)	0.94 (23.9)	6.19 (157.2)	–	–	8	0.75 (19.1)	7.5 (190.5)	3.50 (89)	+0.23	+0.11	16 (7.2)
W	4	300	10 (254)	1.25 (31.8)	6.19 (157.2)	–	–	8	0.88 (22.4)	7.88 (200.2)	3.50 (89)	+0.23	+0.11	26 (11.7)

1) The roughness of the surface in contact with the medium, including the sealing surface of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 µm. Lower surface roughness on request.

2) Housing weight see Page 49

Process connections FMD77 with metallic measuring diaphragms, high-pressure side (continued)

JIS flanges, connection dimensions as per JIS B 2220 BL , raised face RF



Process connection FMD77, high-pressure side, JIS flange, material AISI 316L/1.4435

H Device height, see the following section "Device height H"
h Height of the device without flange thickness b

	Flange [1]					Bolt holes			Diaphragm seal			
Version	Nominal diameter	Nominal pressure	Diameter D mm [in]	Thickness b [mm [in]	Raised face g mm [in]	Quantity	Diameter g_2 mm [in]	Bolt circle k mm [in]	max. Diaphragm diameter d_M mm [in]	T_K Ambient [mbar/10 K]	T_K Process	Flange weight [2] [kg]
X	50 A	10 K	155 (6.1)	16 (0.63)	96 (3.78)	4	19 (0.75)	120 (4.72)	59 (2.32)	+3.02	+0.60	2.3
1	80 A	10 K	185 (7.28)	18 (0.71)	126 (4.96)	8	19 (0.75)	150 (5.91)	89 (3.50)	+0.23	+0.31	3.5
4	100 A	10 K	210 (8.27)	18 (0.71)	151 (5.94)	8	19 (0.75)	175 (6.89)	89 (3.50)	+0.23	+0.11	4.7

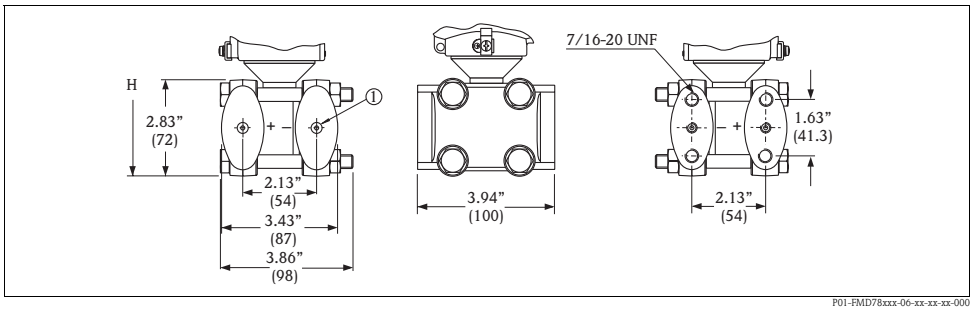
1) The roughness of the surface in contact with the medium, including the sealing surface of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 µm. Lower surface roughness on request.

2) Housing weight see Page 49

Device height H

Description	Device height H (h + b)
T14 housing, optional display on the side	325 mm (12.8") + flange thickness b (see tables)
T15 housing without display, flat cover	331 mm (13.0") + flange thickness b (see tables)
T15 housing with display, high cover	343.5 mm (13.5") + flange thickness b (see tables)
T17 housing, optional display on the side	341 mm (13.4") + flange thickness b (see tables)

FMD78 Basic unit



FMD78 Basic unit

H Device height, see the following section "Device height H"
1 Diaphragm seal attachment

Device height H

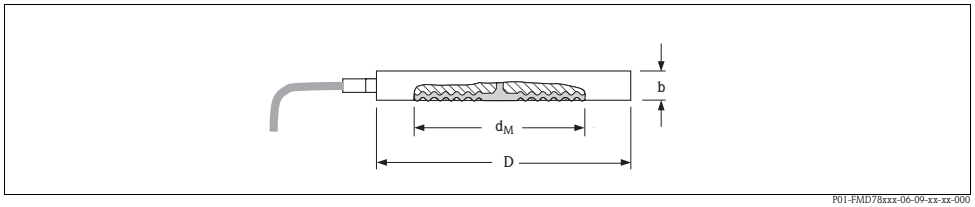
Description	Device height
T14 housing, optional display on the side	217 mm (8.54")
T15 housing without display, flat cover	223 mm (8.78")
T15 housing with display, high cover	235.5 mm (9.27")
T17 housing, optional display on the side	233 mm (9.17")

Process connection FMD78 with metallic measuring diaphragms

Note!

- Specifications for the "T_K Process" are listed in the following tables. These are typically values. These temperature coefficients apply to silicone oil and the membrane material AISI 316L SS/1.4435. For other filling oils, this temperature coefficient must be multiplied by the T_K correction factor of the corresponding filling oil. For the T_K correction factors, see also Page 56 ff, section "Diaphragm seal filling oils".
- The temperature coefficient "T_K Ambient" is listed in relation to the capillary length on Page 63 in the "Influence of the temperature on the zero point" section.
- The weights of the diaphragm seals are given in the tables. See Page 49 for the weight of the housing.
- The following drawings are drawings that illustrate how the system works in principle. In other words, the dimensions of a diaphragm seal supplied can deviate from the dimensions given in this document.

Diaphragm seal cell structure



Process connection FMD78, material AISI 316L SS

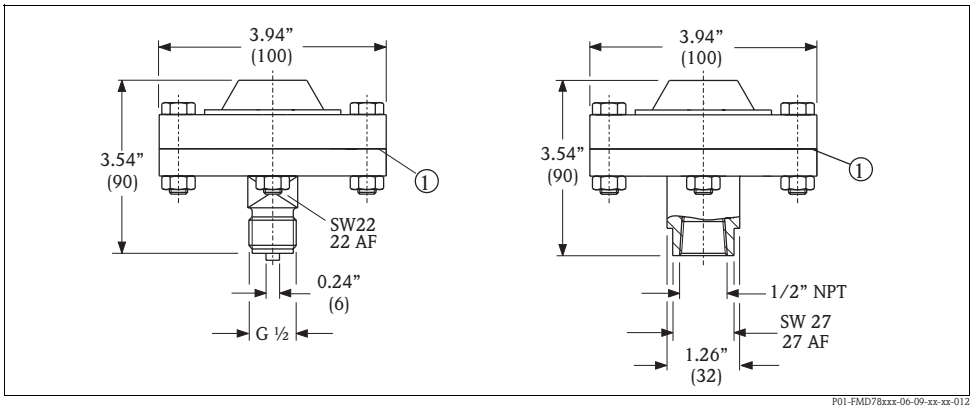
	Flange				Diaphragm seal		
Version	**Nominal diameter**	**Nominal pressure** [1]	**Diameter** **D**	**Thickness** **b**	**max. Diaphragm diameter** **d_M**	**T_K Process**	**Weight of two diaphragm seals**
			mm	mm	mm	mbar/10K	kg
UF	DN 50	PN 16-400	102	20	59	+2.00	2.6
UH	DN 80	PN 16-400	138	20	89	+0.20	4.6
UJ	DN 100	PN 16-400	162	20	89	+0.30	6.2

	Flange				Diaphragm seal		
Version	**Nominal diameter**	**Nominal pressure** [1]	**Diameter** **D**	**Thickness** **b**	**max. Diaphragm diameter** **d_M**	**T_K Process**	**Weight of two diaphragm seals**
	inches	lb/sq.in	in (mm)	in (mm)	in (mm)	[mbar/10K]	lbs (kg)
VF	2	150-2500	4.01 (102)	0.79 (20)	2.32 (59)	+1.25	5.7 (2.6)
VH	3	150-2500	5.35 (136)	0.79 (20)	3.50 (89)	+0.25	10.1 (4.6)
VJ	4	150-2500	6.22 (158)	0.79 (20)	3.50 (89)	+0.19	13.7 (6.2)

1) The specified nominal pressure applies to the diaphragm seal. The maximum pressure for the measuring device is dependent on the lowest-rated element, with regard to pressure, of the selected components. See also Page 29, section "Pressure specifications".

Process connection FMD78 with metallic measuring diaphragms (continued)

Threaded ISO 228 G 1/2 B and ANSI 1/2 MNPT, separator with PTFE seal

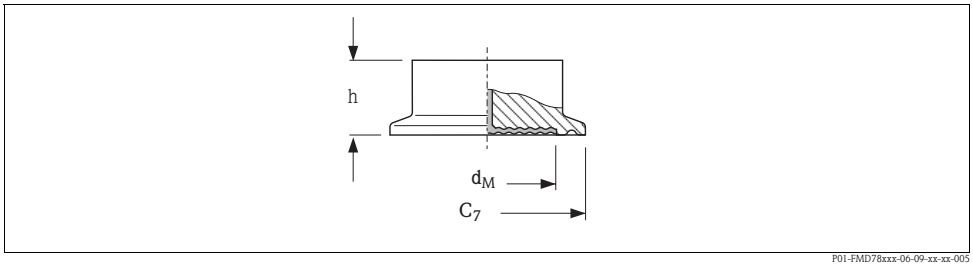


Process connection FMD78, left: with threaded connection ISO 228 G 1/2 B, right: with threaded connection ANSI 1/2 MNPT

1 PTFE seal as standard max. 260°C / 500°F (higher temperatures on request)

Version	Material	Nominal pressure	T_K Process [mbar/10 K]	Weight of two diaphragm seals lbs (kg)
GA	AISI 316L	PN 40 (600 psi)	+0.75	6.4 (2.9)
RL	AISI 316L	PN 40 (600 psi)	+0.55	6.4 (2.9)

Tri-Clamp ISO 2852

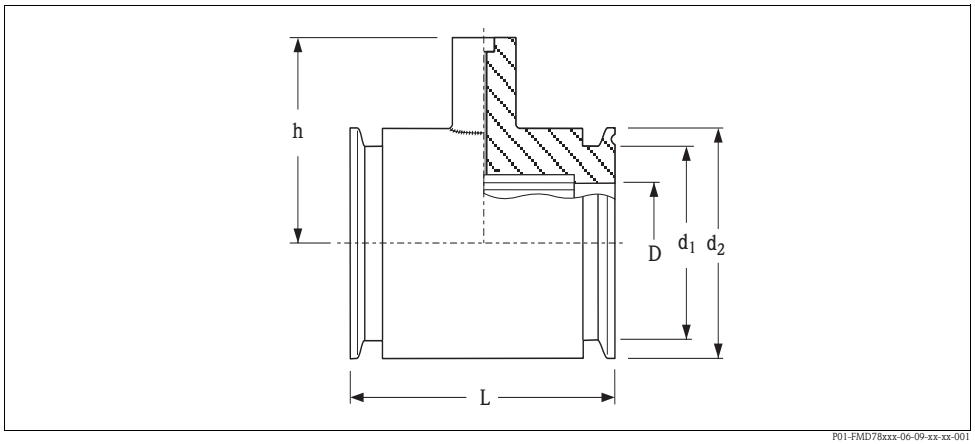


Process connection FMD78, Material: AISI 316L, surface roughness of the wetted surfaces ≤ 0.8 µm as standard. Lower surface roughness on request.

Version	Nominal diameter ISO 2852	Nominal diameter DIN 32676	Nominal diameter inch	Diameter C_7 in (mm)	max. Diaphragm diameter d_M in (mm)	Height h in (mm)	T_K Process [mbar/10 K]	Weight of two diaphragm seals lbs (kg)
TB	DN 25	DN 25	1	1.99 (50.5)	0.94 (24)	1.46 (37)	+10.45	1.4 (0.64)
TC	DN 38	DN 40	1 1/2	1.99 (50.5)	1.42 (36)	1.18 (30)	+2.40	4.4 (2.0)
TD	DN 51	DN 50	2	2.5 (64)	1.89 (48)	1.18 (30)	+1.00	4.8 (2.2)
TF	DN 76.1	–	3	3.6 (91)	2.87 (73)	1.18 (30)	+0.20	5.3 (2.4)

Process connection FMD78 with metallic measuring diaphragms (continued)

Tri-Clamp pipe diaphragm seal ISO 2852

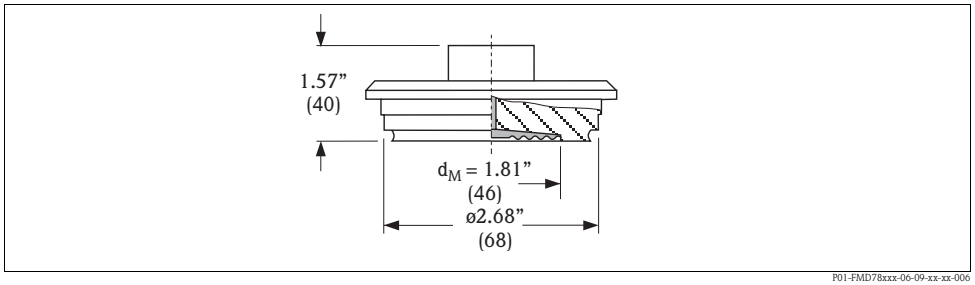


Process connection FMD78, Material: AISI 316L, surface roughness of the wetted surfaces ≤ 0.8 µm as standard. Lower surface roughness on request.

Version	Nominal diameter ISO 2852	Nominal diameter	Diameter D	Diameter d_1	Diameter d_2	Height h	Face-to-face length L	T_K Process	Weight of two diaphragm seals
		inch	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	[mbar/10 K]	lbs (kg)
SB	DN 25	1	0.89 (22.5)	1.71 (43.5)	1.99 (50.5)	2.64 (67)	4.96 (126)	+4.49	7.5 (3.4)
SC [1]	DN 38	1 1/2	1.40 (35.5)	1.71 (43.5)	1.99 (50.5)	2.64 (67)	4.96 (126)	+3.46	4.4 (2)
SD [1]	DN 51	2	1.91 (48.6)	2.22 (56.5)	2.52 (64)	3.11 (79)	3.94 (100)	+2.69	7.5 (3.4)

1) Including 3.1 and pressure test as per Pressure Equipment Directive, category II

Varivent N for pipes DN 40 – DN 162

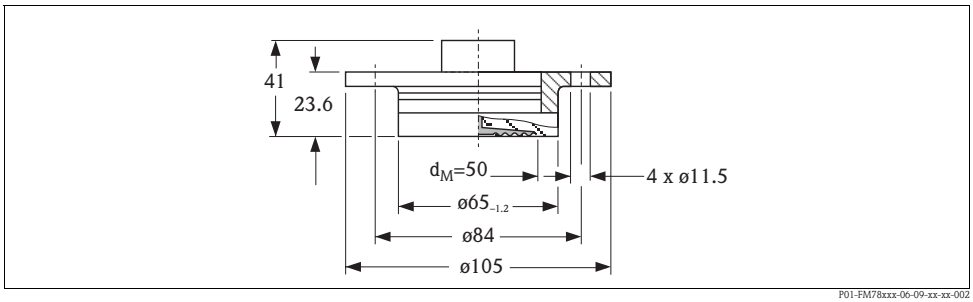


Process connection FMD78, surface roughness of the wetted surfaces ≤ 0.8 µm as standard. Lower surface roughness on request.

Version	Material	Nominal pressure	T_K Process	Weight of two diaphragm seals
			[mbar/10 K]	[kg]
TR	AISI 316L	PN 40 (600 psi)	+1.65	2.6 (5.7 lbs)

Process connection FMD78 with metallic measuring diaphragms (continued)

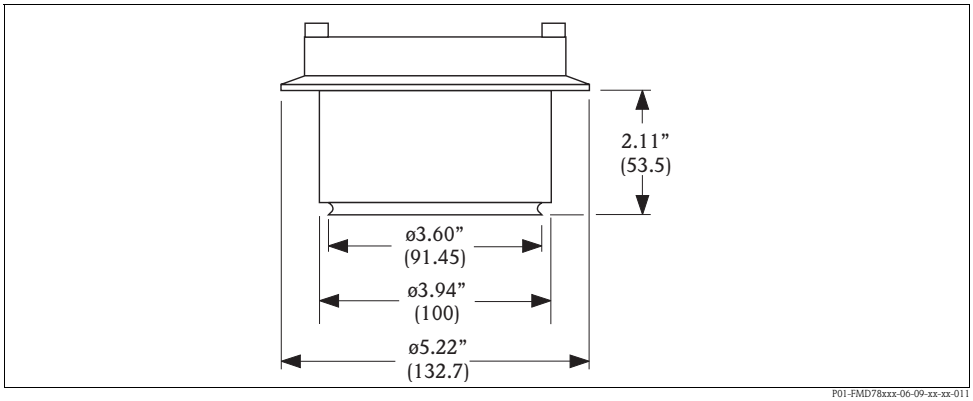
DRD DN50 (65 mm)



Process connection FMD78, surface roughness of the wetted surfaces ≤ 0.8 µm as standard. Lower surface roughness on request.

Version	Material	Nominal pressure	T_K Process [mbar/10 K]	Weight of two diaphragm seals [kg]
TK	AISI 316L	PN 25 (360 psi)	+1.25	1.5 (3.3 lb)

Hygienic connection, sanitary tank spud, extended diaphragm seal 2"

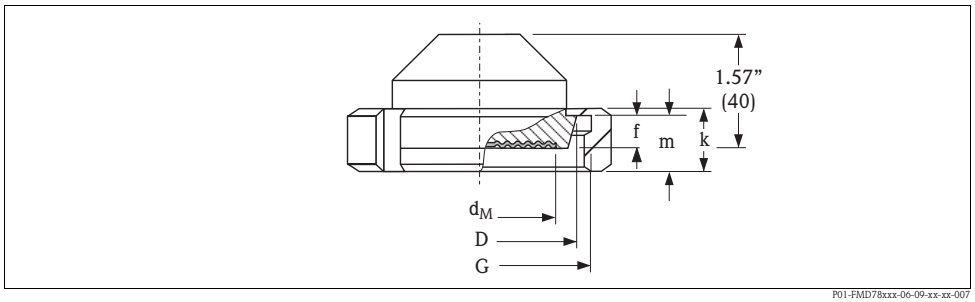


Process connection FMD78, surface roughness of the wetted surfaces ≤ 0.8 µm as standard. Lower surface roughness on request.

Version	Material	T_K Process [mbar/10 K]	Weight of two diaphragm seals [kg]
WH	AISI 316L	+1.64	5 (11 lb)

Process connection FMD78 with metallic measuring diaphragms (continued)

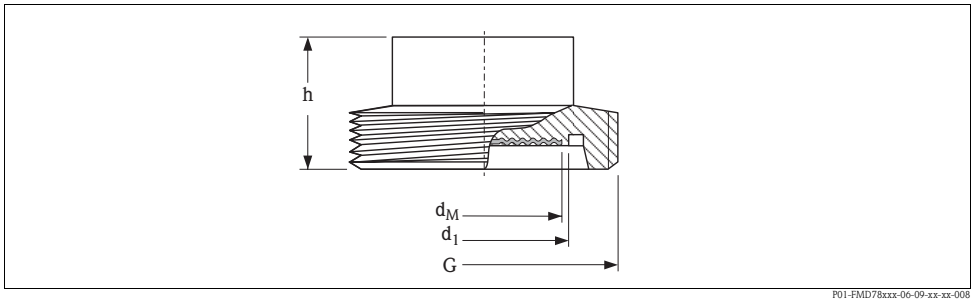
Taper adapter with coupling nut, DIN 11851 (dairy fitting)



Process connection FMD78, material AISI 316L, surface roughness of the wetted surfaces ≤ 0.8 µm as standard. Lower surface roughness on request.

	Taper adapter				Slotted nut			Diaphragm seal		
Version	**Nominal diameter**	**Nominal pressure**	**Diameter** **D** [mm]	**Adapter height** **f** [mm]	**Thread** **G**	**Height** **k** [mm]	**Height** **m** [mm]	**max. Diaphragm diameter** **d_M** [mm]	**T_K Process** [mbar/10 K]	**Weight of two diaphragm seals** [kg]
MR	DN 50	PN 25	68.5	11	Rd 78 x 1/6"	22	19	52	+0.90	2.2
MS	DN 65	PN 25	86	12	Rd 95 x 1/6"	25	21	66	+0.29	4.0
MT	DN 80	PN 25	100	12	Rd 110 x 1/4"	30	26	81	+0.30	5.1

Threaded adapter, DIN 11851 (dairy fitting)

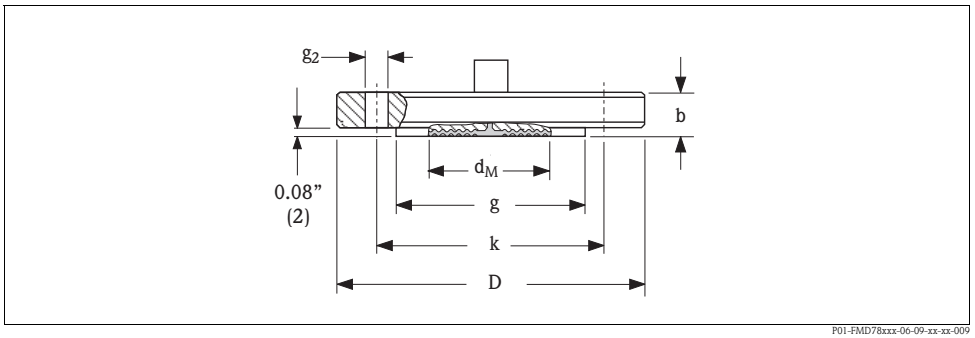


Process connection FMD78, material AISI 316L, surface roughness of the wetted surfaces ≤ 0.8 µm as standard. Lower surface roughness on request.

	Threaded adapter					Diaphragm seal		
Version	**Nominal diameter**	**Nominal pressure**	**Diameter** **d_1** [mm]	**Height** **h** [mm]	**Thread** **G**	**max. Diaphragm diameter** **d_M** [mm]	**T_K Process** [mbar/10 K]	**Weight of two diaphragm seals** [kg]
M3	DN 50	PN 25	54	35	Rd 78 x 1/6"	52	+0.95	1.8
M4	DN 65	PN 25	71	40	Rd 95 x 1/6"	66	+0.29	3.4
M5	DN 80	PN 25	85	40	Rd 110 x 1/4"	81	+0.19	4.0

Process connection FMD78 with metallic measuring diaphragms (continued)

EN/DIN flanges, connection dimensions as per EN 1092-1/DIN 2527
JIS flanges, connection dimensions as per JIS B 2220 BL



Process connection FMD78, EN/DIN flange, Material AISI 316L

	EN/DIN flange [1]						Bolt holes			Diaphragm seal		
Version	Nominal diameter	Nominal pressure	Shape [2]	Diameter D mm	Thickness b mm	Raised face g mm	Quantity	Diameter g_2 mm	Bolt circle k mm	max. Diaphragm diameter d_M mm	T_K Process [mbar/10 K]	Weight of two diaphragm seals kg
B3	DN 50	PN 10-40	B1 (D)	165	20	102	4	18	125	59	+1.50	6.0
B5	DN 80	PN 10-40	B1 (D)	200	24	138	8	18	160	89	+0.20	10.5
BT	DN 100	PN 10-16	B1 (C)	220	20	–	8	18	180	89	+0.35	9.5
B6	DN 100	PN 25-40	B1 (D)	235	24	162	8	22	190	89	+0.19	13.3

1) The roughness of the surface in contact with the medium, including the sealing surface of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 µm. Lower surface roughness on request.

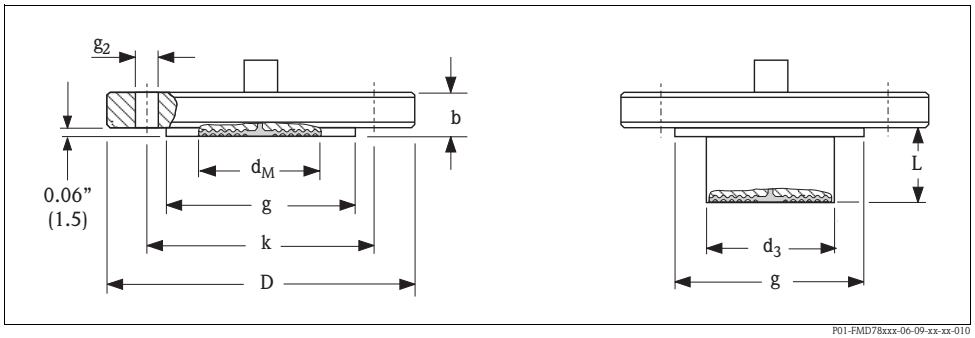
2) Designation as per DIN 2527 in brackets

	JIS flange [1]					Bolt holes			Diaphragm seal		
Version	Nominal diameter	Nominal pressure	Diameter D mm	Thickness b mm	Raised face g mm	Quantity	Diameter g_2 mm	Bolt circle k mm	max. Diaphragm diameter d_M mm	T_K Process [mbar/10 K]	Weight of two diaphragm seals kg
KF	50 A	10 K	155	16	96	4	19	120	59	+0.81	4.6
KL	80 A	10 K	185	18	127	8	19	150	89	+0.19	7.0
KH	100 A	10 K	210	18	151	8	19	175	89	+0.25	9.4

1) The roughness of the surface in contact with the medium, including the sealing surface of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 µm. Lower surface roughness on request.

Process connection FMD78 with metallic measuring diaphragms (continued)

ANSI flanges, connection dimensions as per ANSI B 16.5, raised face RF

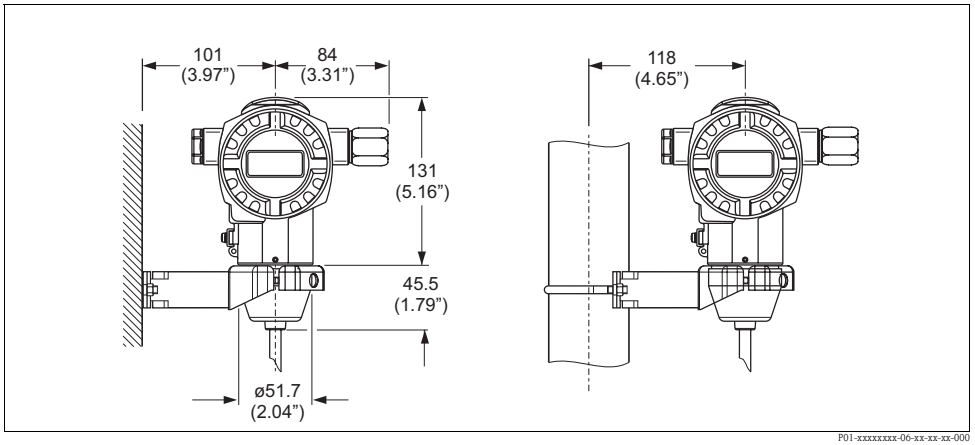


Process connection FMD78, ANSI flange with and without extended diaphragm seal, material AISI 316/AISI 316L

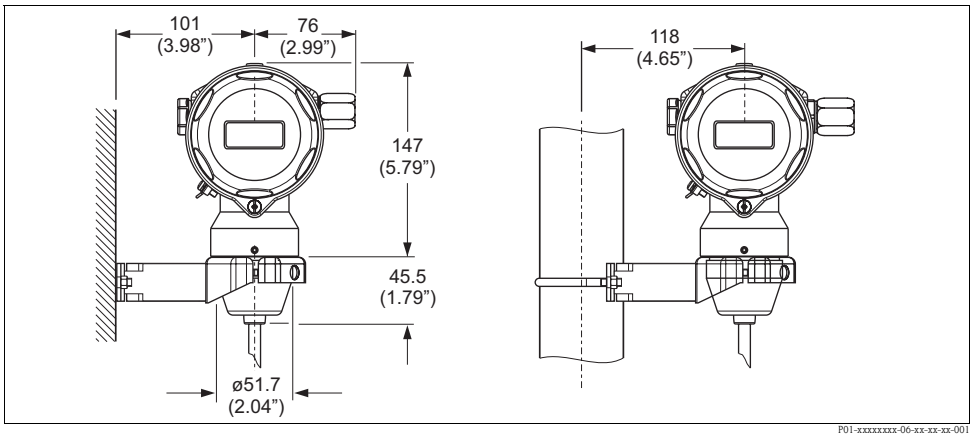
	Flange [1]							Bolt holes			Diaphragm seal		
Version	Nominal diameter	Class	Diameter D	Thickness b	Raised face g	Extension length L	Extension diameter d_3	Quantity	Diameter g_2	Bolt circle k	max. Diaphragm diameter d_M	T_K Process	Weight of two diaphragm seals
		lb/sq.in	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)		in (mm)	in (mm)	in (mm)	[mbar/ 10 K]	lbs (kg)
AF	2	150	6 (152.4)	0.75 (19.1)	3.62 (91.9)	–	–	4	0.75 (19.1)	4.75 (120.7)	2.32 (59)	+1.10	11 (5.2)
AR	2	300	6.5 (165.1)	0.88 (22.5)	3.62 (91.9)	–	–	8	0.75 (19.1)	5 (127)	2.32 (59)	+0.75	15 (6.8)
AG	3	150	7.5 (190.5)	0.94 (23.9)	5 (127)	–	–	4	0.75 (19.1)	6 (152.4)	3.50 (89)	+0.40	22 (10.2)
AS	3	300	8.25 (209.5)	1.12 (28.4)	5 (127)	–	–	8	0.88 (22.4)	6.62 (168.1)	3.50 (89)	+0.35	31 (14)
J4	3	150	7.5 (190.5)	0.94 (23.9)	5 (127)	2 (50.8)	3 (76)	4	0.75 (19.1)	6 (152.4)	2.83 (72)	+0.29	26 (12)
						4 (101.6)							29 (13.2)
						6 (152.4)							31 (14.2)
						8 (203.6)							34 (15.4)
AH	4	150	9 (228.6)	0.94 (23.9)	6.19 (157.2)	–	–	8	0.75 (19.1)	7.5 (190.5)	3.50 (89)	+0.25	32 (14.4)
AT	4	300	10 (254)	1.25 (31.8)	6.19 (157.2)	–	–	8	0.88 (22.4)	7.88 (200.1)	3.50 (89)	+0.19	52 (23.4)
J5	4	150	9 (228.6)	0.94 (23.9)	6.19 (157.2)	2 (50.8)	3.7 (94)	8	0.75 (19.1)	7.5 (190.5)	3.50 (89)	+0.19	38 (17.3)
						4 (101.6)							44 (19.8)
						6 (152.4)							49 (22.3)
						8 (203.6)							55 (24.8)

1) The roughness of the surface in contact with the medium, including the sealing surface of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 µm. Lower surface roughness on request.

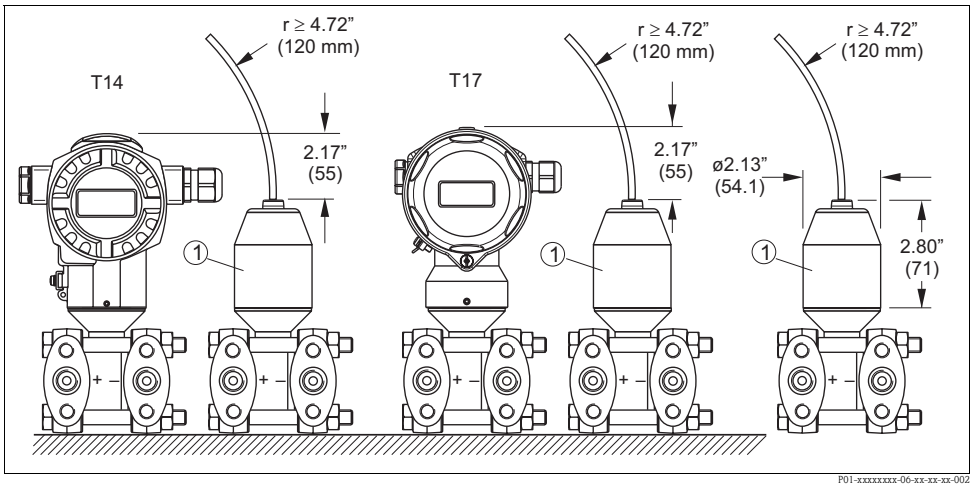
Remote housing version



Dimensions T14 housing, optional display on the side. Housing weight see Page 49.



Dimensions T17 housing, optional display on the side. Housing weight see Page 49.



Reduction of the mounting height of the process connection, for application of the separate housing.
1 Process connection adapter.

If the separate housing is used, the mounting height of the process connection is reduced by approx. 55 mm (2.16") as compared to the dimensions of the standard version.
The minimum bending radius (r) for the cable is 120 mm (4.7").

Weight **Housing**

	T14		T15	T17	Remote housing
	Aluminum	**AISI 316L**	**Aluminum**	**AISI 316L**	
With electronic insert and display	2.6 lbs (1.2 kg)	4.6 lbs (2.1 kg)	4 lbs (1.8 kg)	2.6 lbs (1.2 kg)	Weight of housing T14, T15 or T17 + 1.1 lbs (0.5 kg). Weight of sensor + 1.1 lbs (0.5 kg).
With electronic insert without display	2.4 lbs (1.1 kg)	4.4 lbs (2.0 kg)	3.7 lbs (1.7 kg)	2.4 lbs (1.1 kg)	

Process connections

- Process connections PMD70 with ceramic measuring diaphragms: Page 31 ff
- Process connections PMD75 with metallic measuring diaphragms: Page 32 ff
- Process connection FMD76 with ceramic measuring diaphragms: Page 35 ff
- Process connections FMD77 with metallic measuring diaphragms, low-pressure side: Page 37 ff
- Process connection FMD78 with metallic measuring diaphragms: Page 41 ff

Material

T14/T15 housing:
- T14 housing, selectable:
  - Die-cast aluminum with protective powder-coating on polyester basis: RAL 5012 (blue), cover: RAL 7035 (grey)
  - Precision cast stainless steel AISI 316L SS (1.4435)
- T15 housing: Die-cast aluminum with protective powder-coating on polyester basis: RAL 5012 (blue), cover: RAL 7035 (grey)
- External operation (keys and key covering): Polycarbonate PC-FR, RAL 7035 (grey)
- Sight glass: Mineral glass
- Cable gland: Polyamid (PA)
- Pressure compensation filter: PA6 GF10
- Bind plug: PBT-GF30 FR, for Dust Ex, EEx d, FM XP and CSA XP: AISI 316L SS (1.4435)
- Seals:
  - Cable and blind plug seal: Silicone (VMQ)
  - Pressure compensation filter o-ring: Silicone (VMQ)
  - Cover: EPDM
  - Sight glass: Silicone (VMQ)
- Nameplates: AISI 304 SS (1.4301)

T17 housing:
- Housing: Stainless steel AISI 316L SS (1.4404)
- Sight glass:
  - Version for non-hazardous area, ATEX EEx ia, NEPSI Zone 0/1 Ex ia, IECEx Zone 0/1 Ex ia, FM NI, FM IS, CSA IS: Polycarbonate (PC)
  - ATEX 1/2 D, ATEX 1/3 D, ATEX 1 GD, ATEX 1/2 GD, ATEX 3 G, FM DIP, CSA Dust Ex: Mineral glass
- Cable gland: Polyamid (PA), for Dust-Ex: CuZn nickel-plated
- Blind plug: PBT-GF30 FR, for Dust-Ex: AISI 316L (1.4435)
- Pressure compensation filter: PA6 GF10
- Seals:
  - Cable and blind plug seal: Silicone (VMQ)
  - Pressure compensation filter o-ring: Silicone (VMQ)
  - Cover: EPDM
  - Sight glass: EPDM
- Nameplates: lasered

Process connections

- "Clamp connections" and "Hygienic connections" (see also Chapter "Ordering information"): AISI 316L SS/ 1.4435
- "Threaded connection" and "DIN/EN flanges" (see also Chapter "Ordering information"): stainless steel AISI 316L SS with the material number 1.4435 or 1.4404
- With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13E0 in EN 1092-1 Tab.18. The chemical composition of the two materials can be identical.

Cable for separate housing:

- PE cable:
  Slip-resistant cable with strain-relief members made of Dynemo; shielded using aluminum-coated film; insulated with polyethylene (PE-LD), black; copper wires, twisted, UV resistant
- FEP cable:
  Slip-resistant cable; shielded using galvanized steel wire netting; insulated with fluorinated ethylene propylene (FEP), black; copper wires, twisted, UV resistant

TSE Certificate of Suitability

The following applies to wetted device components:
- They do not contain any materials derived from animals.
- No auxiliaries or operating materials derived from animals are used in production or processing.



Note!
Process wetted device components are listed in the "Mechanical construction" (Page 30) and "Ordering information" (Page 65) sections.

Miscellaneous:

- Measuring cell PMD70/FMD76, filling oil
  - 25 mbar and 100 mbar (10 and 40 inH_2O) measuring cell: Silicone oil
  - 500 mbar and 3000 mbar (200 and 1200 inH_2O) measuring cell: Mineral oil
  - for oxygen and ultra pure gas applications: Inert oil (Voltalef 1A)
- Measuring cell PMD75/FMD77 and FMD78, filling oil (Silicone oil)
  - for oxygen and ultra pure gas applications: Inert oil (Halocarbon 6.3)
- Membrane material:
  - PMD70/FMD76: Al_2O_3 (Aluminum-oxide-ceramic)
  - PMD75, FMD77, FMD78:
    - AISI 316L SS (1.4435)
    - Alloy C276 (2.4819)
    - Monel 400 (2.4360)
    - Tantal
    - AISI 316L SS (1.4435) with Gold-Rhodium coating (FMD77/FMD78 only)
    - AISI 316L SS (1.4435) with 0.09 mm PTFE foil (FMD77/FMD78 only)
- Process diaphragm PMD70/FMD76: Al_2O_3 (Aluminum-oxide-ceramic)
- Mounting accessories: mounting bracket with screws AISI 304 SS (1.4301)
- Capillary: AISI 316 Ti SS (1.4571)
- Protective hose for capillary: AISI 304 SS (1.4301)
- External earth terminal: AISI 304 SS (1.4301)
- Screws and nuts for side flanges:
  - PMD70: hex.-headed bolt DIN 931-M10x50-A2-70, hex.-headed nut: DIN 934-M10-A4-70
  - PMD75 PN 160: hex.-headed bolt ISO 4014-M12x90-A4
  - PMD75 PN 420: hex.-headed nut ISO 4032-M12-A4-bs

→ For process connections, seals and filling oils see ordering information, Page 65 ff.

Human interface

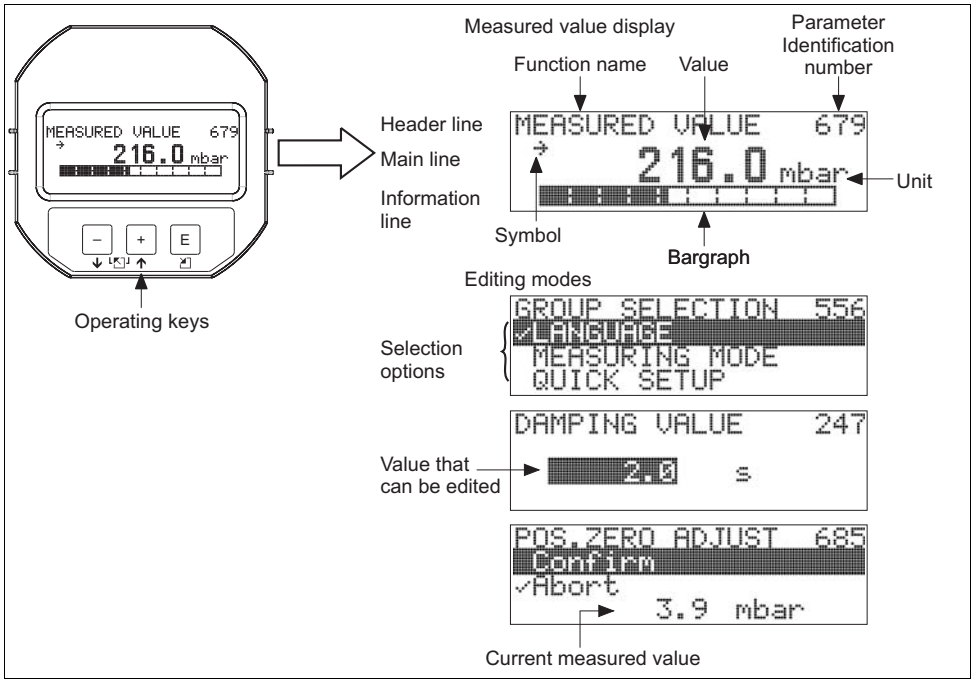
Operating elements

Local display (optional)

A 4-line liquid crystal display (LCD) is used for display and operation. The local display shows measured values, dialog text as well as fault and notice messages in plain text, thereby supporting the user in every stage of operation. The liquid crystal display of the device can be turned in 90° steps.
Depending on the installation position of the device, this makes it easy to operate the device and read the measured value.

Functions:

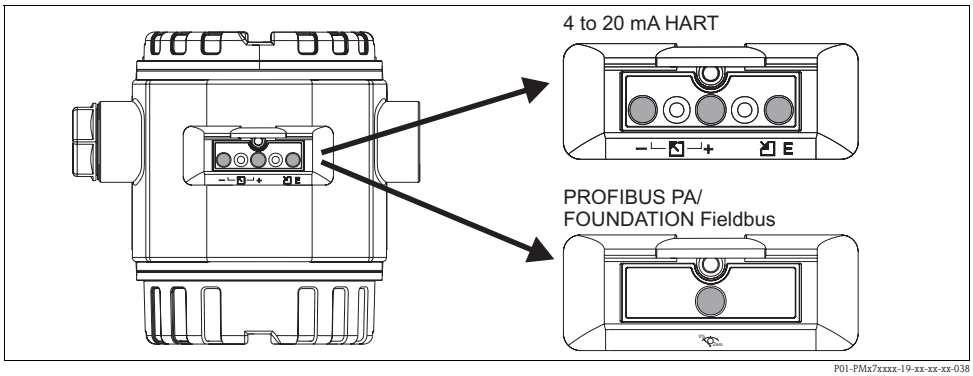
- 8-digit measured value display including sign and decimal point, bar graph for 4 to 20 mA HART as current display or for PROFIBUS PA as graphical display of the scaled value of the AI Block
- Simple and complete menu guidance thanks to seperation of the parameters into three levels
- Ech parameter is given as 3-digit ID number for easy navigation
- Option for configuring the display according to individual requirements and desires, such as language, alternating display, display of other measured values such as sensor temperature, contrast setting
- Comprehensive diagnostic functions (fault and warning message, peak-hold indicators, etc.)
- Rapid and safe commissioning with the Quick Setup menus



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Operating keys on the exterior of the device

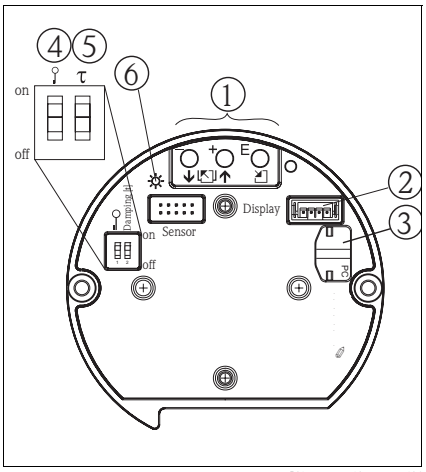
The operating keys of the housing T14 (aluminum or stainless steel) are located either outside of the housing, under the protection cap or upon the electronic insert. The operating keys of the housing T17 (ironing stainless steel) are located inside the housing upon the electronic insert. In addition, devices with a local display and a 4 to 20 mA HART- or PROFIBUS PA electronic insert have operating keys on the local display.



P01-PMx7xxxx-19-xx-xx-xx-038

The operating keys located externally on the device work on the Hall sensor principle. As a result, no additional openings are required in the device. This guarantees:
- Complete protection against environmental influences such as moisture and contamination
- Simple operation without any tools
- No wear.

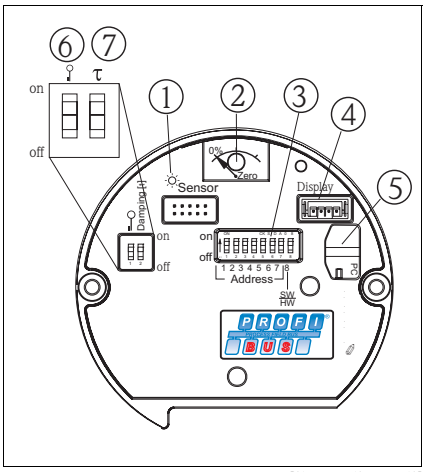
Operating keys and elements located internally on the electronic insert



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Electronic insert HART

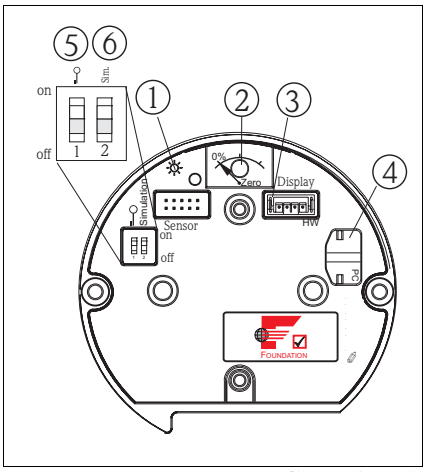
1 Operating keys
2 Slot for optional display
3 Slot for optional HistoROM®/M-DAT
4 DIP-switch for locking/unlocking measured-value-relevant parameters
5 DIP-switch for damping on/off
6 Green LED to indicate value being accepted



P01-xxxxxxxx-19-xx-xx-xx-105

Electronic insert PROFIBUS PA

1 Green LED to indicate value being accepted
2 Key for position calibration and device reset
3 DIP-switch for bus address
4 Slot for optional display
5 Slot for optional HistoROM®/M-DAT
6 DIP-switch for locking/unlocking measured-value-relevant parameters
7 DIP-switch for damping on/off



P01-xxxxxxxx-19-xx-xx-xx-106

Electronic insert FOUNDATION Fieldbus

1 Green LED to indicate value being accepted
2 Key for position calibration and device reset
3 Slot for optional display
4 Slot for optional HistoROM®/M-DAT
5 DIP-switch for locking/unlocking measured-value-relevant parameters
6 DIP-switch for simulation mode on/off

Local operation

Function	External operation (operation keys, optional, not T17 housing)	Internal operation (electronic insert)	Display (optional)
Position calibration (zero point correction)	X	X	X
Setting lower-range value and upper-range value - reference pressure present at the device	X (HART only)	X (HART only)	X
Device Reset	X	X	X
Locking and unlocking measured-value-relevant parameters	—	X	X
Value acceptance indicated by green LED	X	X	X
Switching damping on and off	—	X (HART and PA only)	X
Setting bus address (PA)	—	X	X
Switching simulation mode on and off (FOUNDATION Fieldbus)	—	X	X

Remote operation

Depending on the position of the write protection switch at the device, all software parameters are accessible.

HART

Remote operation via:
- Handheld terminal Field Communicator 375 (see Chapter "Hard- and Software for local and remote operation" Page 54)
- FieldCare (see Chapter "Hard- and Software for local and remote operation" Page 54 ff) mit
  - Commubox FXA191 (see Chapter "Hard- and Software for local and remote operation" Page 54 ff)
  - Commubox FXA195 (see Chapter "Hard- and Software for local and remote operation" Page 54 ff)

PROFIBUS PA

Remote operation via:
- FieldCare (see Chapter "Hard- and Software for local and remote operation" Page 54 ff)
  - Profiboard: For the Connection of a Personal Computer to PROFIBUS
  - Proficard: For the Connection of a Laptop to PROFIBUS

FOUNDATION Fieldbus

Remote operation via:
- Handheld terminal Field Communicator 375 (see Chapter "Hard- and Software for local and remote operation" Page 54 ff)
- Use an FF-configuration program for e.g. NI-FBUS configurator, to
  - connect devices with "FOUNDATION Fieldbus signal" into an FF-network
  - set FF-specific parameter

  Operation with NI-FBUS Configurator:
  The NI-FBUS Configurator is an easy-to-use graphical environment for creating linkages, loops and a schedule based on the fieldbus concept. You can use the NI-FBUS Configurator to configure a fieldbus network as follows:
  - Set block and device tags
  - Set device addresses
  - Create and edit function block control strategies (function block applications)
  - Configure vendor -defined function and transducer blocks
  - Create and edit schedules
  - Read and write to function block control strategies (function block applications)
  - Invoke Device Description (DD) methods
  - Display DD menus
  - Download a configuration
  - Verify a configuration and compare it to a saved configuration
  - Monitor a downloaded configuration
  - Replace a virtual device by a real device
  - Save and print a configuration

Note! For further information please contact your local Endress+Hauser Sales Center.

Hard- and Software for local and remote operation

Commubox FXA191

For intrinsically safe communication with FieldCare via the RS232C interface. For details refer to TI237F700/en.

Commubox FXA195

For intrinsically safe communication with FieldCare via the USB interface. For details refer to TI404F/00/en.

Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field instruent with CDI interface (=Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook. For details refer to TI405C/07/en.

Note!
For the following Endress+Hauser instruments you need the "ToF Adapter FXA291" as an additional accessory:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70

ToF Adapter FXA291

The ToF Adapter FXA291 connects the Commubox FXA291 with instruments of the ToF platform, pressure instruments and Gammapilot via the USB interface of a personal computer or a notebook. For details refer to KA271F.

Field Communicator 375

With a handheld terminal, all the parameters can be configured anywhere along the 4 to 20 mA line via menu operation.

HistoROM®/M-DAT (optional)

HistoROM®/M-DAT is a memory module, which is attached to the electronic insert. The HistoROM®/M-DAT can be retrofitted at any stage (Order number: 52027785).

Your benefits

- Quick and safe commissioning of the same measuring points by copying the configuration data of one transmitter to another transmitter
- Reliable process monitoring thanks to cyclical recording of pressure and sensor temperature measured values
- Simple dagnosis by recording diverse events such as alarms, configuration changes, counters for measuring range undershoot and overshoot for pressure and temperature as well as user limit overshoot and undershoot for pressure and temperature etc.
- Analysis and graphic evaluation of the events and process parameters via software (contained in scope of supply).

HistoROM®/M-DAT can be ordered via feature 100 "Additional options 1" or feature 110 "Additional options 2" or as spare parts. Page 66 ff. A CD with Endress+Hauser operating program is also included in the scope of delivery.
You can copy data from one transmitter to another transmitter when operating a FOUNDATION Fieldbus device via an FF configuration program. You need the Endress+Hauser FieldCare operating program and the Commubox FXA291 service interface and the ToF Adapter FXA291 to be able to access the data and events saved in the HistoROM®/M-DAT.

FieldCare

FieldCare is an Endress+Hauser asset management tool based on FDT technology. With FieldCare, you can configure all Endress+Hauser devices as wella s devices from other manufacturers that support the FDT standard.

FieldCare supports the following functions:
- Configuration of transmitter in offline and online operation
- Loading and saving device data (upload/download)
- HistoROM®/M-DAT analysis
- Documentation of the measuring point

Connection options:
- HART via Commubox FXA191 and the RS232C serial interface of a computer
- HART via Commubox FXA195 and the USB port on a computer
- PROFIBUS PA via segment coupler and PROFIBUS interface card
- FOUNDATION Fieldbus via Commubox FXA193 and the RS232C serial interface of a computer
- Service interface with adapter Commubox FXA291 and ToF Adapter FXA291 (USB).

For further information see www.endress.com

Planning instructions, diaphragm seal systems

Applications

Diaphragm seal systems should be used if the process media and the device should be separated. Diaphragm seal systems offer clear advantages in the following instances:
- In the case of high process temperatures (Page 28, section "Process temperature limits".)
- In the case of process media that crystallize
- In the case of corrosive or highly various process media or process media with solids content
- In the case of heterogeneous and fibrous process media
- If good and rapid measuring point cleaning is necessary
- If the measuring point is exposed to vibrations
- For mounting locations that are difficult to access

Design and operation mode

Diaphragm seals are separating equipment between the measuring system and the process medium.

A diaphragm seal system consists of:
- A diaphragm seal in a one-sided system, e.g. FMD77 or two diaphragm seals, in a two-sided system, e.g. FMD78
- One capillary tube or two capillary tubes
- Fill fluid and
- A differential pressure transmitter.

The process pressure acts via the diaphragm seal membrane on the liquid-filled system, which transfers the process pressure via the capillary tube onto the sensor of the differential pressure transmitter.
Endress+Hauser delivers all diaphragm seal systems as welded versions. The system is hermetically sealed, which ensures the highest reliability.

Note!
The correlations between the individual diaphragm seal components are presented in the following section. For further information and comprehensive diaphragm seal system designs, please contact your local Endress+Hauser Sales Center.

Diaphragm seal

The diaphragm seal determines the application range of the system by
- the diaphragm diameter
- the diaphragms: stiffness and material
- the design (oil volume).

Diaphragm diameter

The larger the diaphragm diameter (less stiffness), the smaller the temperature effect on the measurement result.
Note: To keep the temperature effect in practice-oriented limits, you should select diaphragm seals with a nominal diameter of ≥ DN 80 (3"), in as far as the process connection allows for it.

Diaphragm stiffness

The stiffness is dependent on the diaphragm diameter, the material, any available coating and on the diaphragm thickness and shape. The diaphragm thickness and the shape are defined constructively. The stiffness of a diaphragm seal membrane influences the temperature operating range and the measuring error caused by temperature effects.

Capillary

Diaphragm seals are used with the following capillary internal diameters as standard:

- ≤ DN 50 (2"): 1 mm (0.04")
- > DN 50 (2"): 2 mm (0.08")

The capillary tube influences the T_K zero point, the ambient temperature operating range and the response time of a diaphragm seal system as a result of its length and internal diameter.
Page 57 ff, sections "Influence of the temperature on the zero point", "Ambient temperature range" and "Response time".
Observe the installation instructions regarding capillary tubes. See Page 62 ff, section "Installation instructions".

Filling oil

When selecting the filling oil, fluid and ambient temperature as well as the operating pressure are of crucial importance. Observe the temperatures and pressures during commissioning and cleaning. A further selection criterion is the compatibility of the filling oil with the requirements of the process medium. For this reason, only filling oils that are harmless to health are used in the food industry, such as vegetable oil or silicone oil. See also the following section "Diaphragm seal filling oils".
The filling oil used influences the T_K zero point and the temperature operating range of a diaphragm seal system and the response time. Page 57 ff, sections "Influence of the temperature on the zero point" and "Response time".

Differential pressure transmitter

The differential pressure transmitter influences the temperature operating range, the T_K zero point and the response time as a result of the volume of its side flange and as a result of its volume change. The volume change is the volume that has to be shifted to pass through the complete measuring range.
Differential pressure transmitters from Endress+Hauser are optimised with regard to minimum volume change and side flange.

Diaphragm seal filling oils

Version [1]	**Filling oil**	**Permissible temperature range at 0.05 ≤ p_{abs} ≤ 1 bar (0.7 ≤ p_{abs} ≤ 14.5 psi)**	**Permissible temperature range at p_{abs} ≥ 1 bar (14.5 psia)**	**Density [g/cm³]**	**Viscosity [cSt at 25°C (77°F)]**	**Coefficient of thermal expansion [1/K]**	**T_K correction factor**	**Notes**
FMD77: A FMD78: A, 1	Silicone oil	–40 to +180°C (–40 to +356°F)	–40 to +250°C (–40 to +482°F)	0.96	100	0.00096	1	suitable for foods FDA 21 CFR 175.105
FMD77: V FMD78: C, 3	High-temperature oil	–10 to +200°C (+14 to +392°F)	–10 to +400°C (+14 to +752°F)	1.07	37	0.0007	0.72	high temperatures
FMD77: F FMD78: D, 4	Inert oil	–40 to +80°C (–40 to +176°F)	–40 to +175°C (–40 to +347°F)	1.87	27	0.000876	0.91	Oil for ultra pure gas and oxygen applications
FMD77: D FMD78: B, 2	Vegetable oil	–10 to +120°C (+14 to +248°F)	–10 to +200°C (+14 to +392°F)	0.94	9.5	0.00101	1.05	suitable for foods FDA 21 CFR 172.856
FMD77: L FMD78: E, 5	Low temperature oil	–70 to +80°C[2] (–94 to 176°F)	–70...+180°C[2] (–94 to +356°F)	0.92	4.4	0,00108	1,12	low temperatures

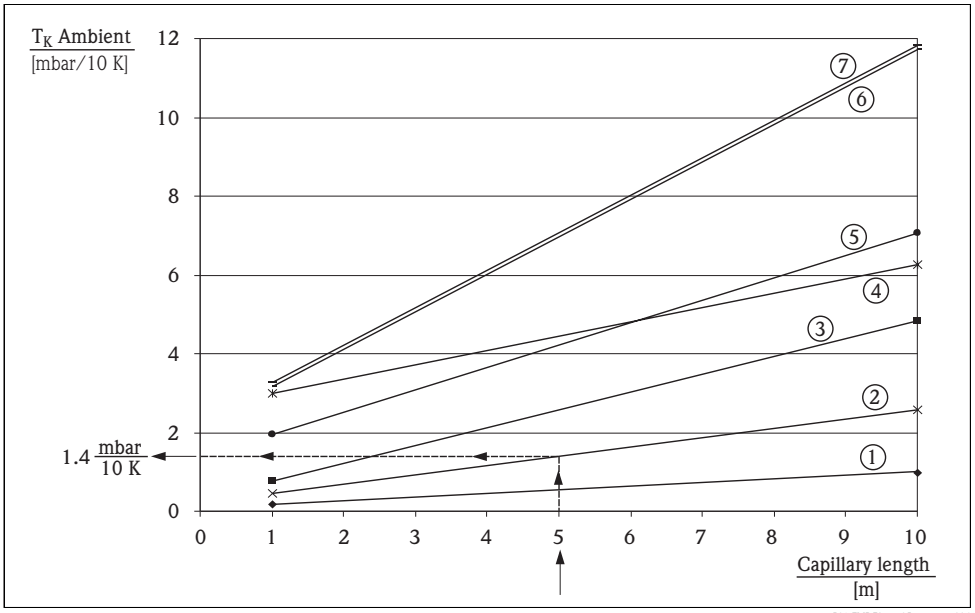
1) Version for feature 90 in the order code

2) Observe temperature limits of the device (Page 28 and Page 29)

Influence of the temperature on the zero point

A temperature change results in a volume change of the filling oil. The volume change is dependent on the coefficient of thermal expansion of the filling oil and on the volume of the filling oil at calibration temperature (constant in the range: +21 to +33°C (+69.8 to 91.4°F)). Page 56, section "Diaphragm seal filling oils".
For example, the filling oil expands in the event of a temperature increase. The additional volume presses against the diaphragm seal membrane. The stiffer a diaphragm is, the greater its return force, which counteracts a volume change and acts on the measuring cell together with the operating pressure, thus shifting the zero point. For the "T_K Process", see Page 41 ff, section "Process connections FMD78".

The following diagrams display the temperature coefficient "T_K Ambient" dependent on the capillary length. The following application is displayed: capillary temperature and transmitter temperature (ambient temperature) change, the process temperature corresponds to the calibration temperature.
The temperature coefficients obtained from the diagrams apply to silicone oil and the membrane material AISI 316L SS/1.4435. For other filling oils, these temperature coefficients must be multiplied by the T_K correction factor of the corresponding filling oil. For the T_K correction factors, see Page 56, section "Diaphragm seal filling oils".



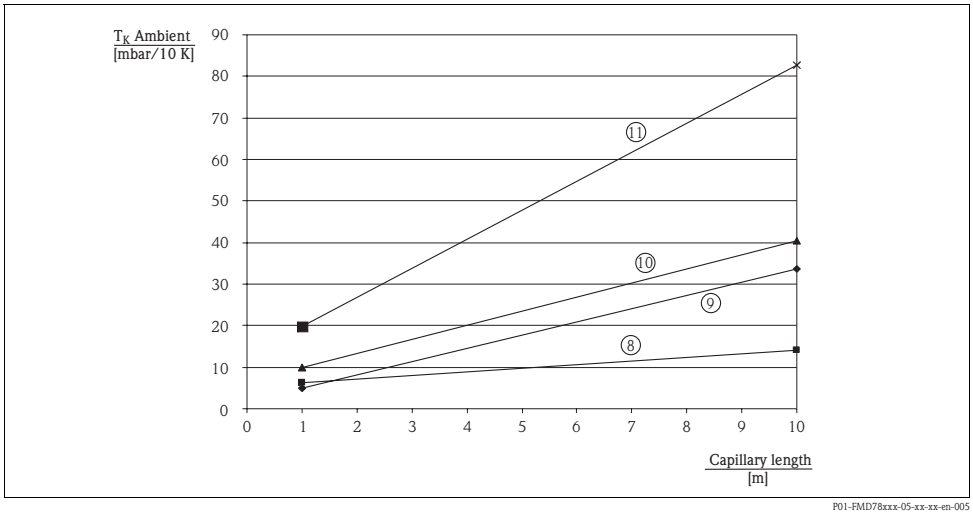
Example for:
– Diaphragm seal versions "B5, EN/DIN Flange DN 80 PN 10-40 B1, AISI 316L SS"
– Capillary length: 5 m
– Ambient temperature, capillary/transmitter: 45°C (113 °F)
– Filling oil: silicone oil

1. Select characteristic curve type for the diaphragm seal versions "B5" in accordance with the following table.
   Result: characteristic curve type 2
2. Obtain value for T_K Ambient from the diagram.
   Result: 1.4 mbar/10 K
3. $T_{Ambient} - T_{Calibration} = 45°C - 25°C = 20°C \Rightarrow 1.4$ mbar/10 K x 20 K = 2.8 mbar

Result: In this application, the zero point is shifted by 2.8 mbar.

Note!
- The influence of temperature on the zero point can be corrected with position calibration.
- The temperature influence can be minimised by using a filling oil with a smaller coefficient of thermal expansion, shorter capillaries, diaphragm seals with larger diaphragm diameter or by using a smaller capillary internal diameter.
- With the Endress Hauser selection tool "Applicator" you will find the optimum diaphragm seal for your application. Online on "www.endress.com/applicator" or offline (on CD)
  For further information please contact your local Endress+Hauser Sales Center.

Characteristic type	Version	Diaphragm seal
1	TF	Tri-Clamp, ISO 2852 DN 76.1 (3"), AISI 316L/1.4435
2	GA	Thread ISO 228 G 1/2 B, PN 40, AISI 316L, Separator, PTFE seal
	RL	Thread ANSI 1/2 FNPT, PN 40, AISI 316L, Separator, PTFE seal
	UH	Pancake DN 80 PN 16-400, AISI 316L
	UJ	Pancake DN 100 PN 16-400, AISI 316L
	VH	Pancake 3" 150-2500 lbs, AISI 316L
	VJ	Pancake 4" 150-2500 lbs, AISI 316L
	B5	EN/DIN flange DN 80 PN 10-40 B1, AISI 316L
	BT	EN/DIN flange DN 100 PN 10-16 B1, AISI 316L
	B6	EN/DIN flange DN 100 PN 25-40 B1, AISI 316L
	AG	ANSI flange 3" 150 lbs RF, AISI 316/316L
	AS	ANSI flange 3" 300 lbs RF, AISI 316/316L
	AH	ANSI flange 4" 150 lbs RF, AISI 316/316L
	J5	ANSI flange 4" 150 lbs RF, AISI 316/316L, Extensions: 2"/4"/6"/8"
	AT	ANSI flange 4" 300 lbs RF, AISI 316/316L
	KL	JIS flange 80 A 10 K RF, AISI 316L
	KH	JIS flange 100 A 10 K RF, AISI 316L
	MT	DIN 11851 DN 80 PN 25, AISI 316L
	M5	DIN 11851 DN 80 PN 25 socket, AISI 316L
3	MS	DIN 11851 DN 65 PN 25, AISI 316L
	M4	DIN 11851 DN 65 PN 25 socket, AISI 316L
	J4	ANSI flange 3" 150 lbs RF, AISI 316/316L, Extensions: 2"/4"/6"/8"
4	SC	Pipe seal diaphragm Tri Clamp, ISO 2852 DN 38 (1 1/2"), AISI 316L/1.4435
	SD	Pipe seal diaphragm Tri Clamp, ISO 2852 DN 51 (2"), AISI 316L/1.4435
5	UF	Pancake DN 50 PN 16-400, AISI 316L
	VF	Pancake 2" 150-2500 lbs, AISI 316L
	B3	EN/DIN flange DN 50 PN 10-40 B1, AISI 316L
	AF	ANSI flange 2" 150 lbs RF, AISI 316/316L
	AR	ANSI flange 2" 300 lbs RF, AISI 316/316L
	KF	JIS flange 50 A 10 K RF, AISI 316L
	MR	DIN 11851 DN 50 PN 25, AISI 316L
	M3	DIN 11851 DN 50 PN 25 socket, AISI 316L
6	TD	Tri-Clamp, ISO 2852 DN 51 (2"), DIN 32676 DN 50, AISI 316L/1.4435
7	TK	DRD DN50 (65 mm), PN 25, AISI 316L/1.4435
	TR	Varivent Type N for tubes DN 40 – DN 162, PN 40, AISI 316L/1.4435



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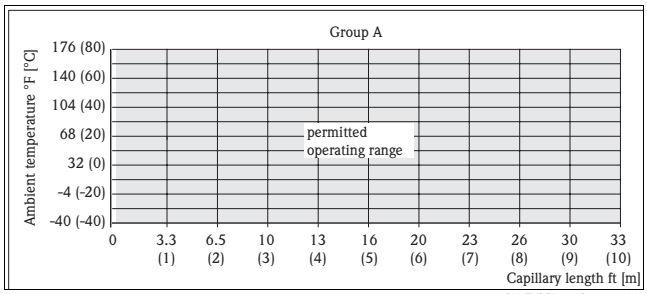
Characteristic type	Version	Diaphragm seal
8	SB	Pipe seal diaphragm Tri-Clamp, ISO 2852 DN 25 (1"), AISI 316L/1.4435
9	WH	Sanitary tank spud, AISI 316L/1.4435, Extensions 2"
10	TC	Tri-Clamp, ISO 2852 DN 38 (1 – 1 1/2"), DIN 32676 DN 40, AISI 316L/1.4435
11	TB	Tri-Clamp, ISO 2852 DN 25 (1"). DIN 32676 DN 25, AISI 316L/1.4435

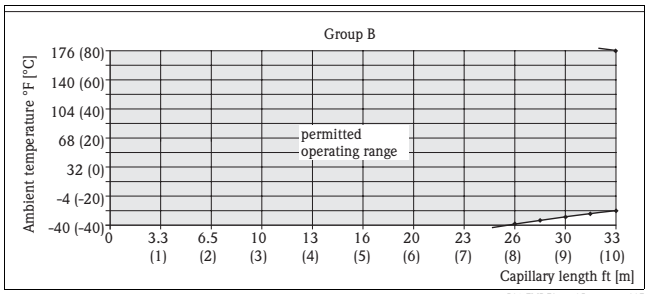
Ambient temperature range

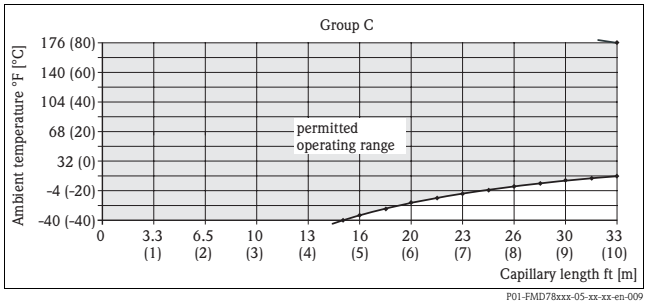
The filling oil, capillary length, capillary internal diameter, process temperature and the oil volume of the diaphragm seal determine the ambient temperature operating range of the diaphragm seal system.
The following diagrams display the permitted ambient temperature operating range in relation to the capillary length. The diagrams apply to a process temperature of +25°C (+77°F) and to silicone oil.
The operating range can be extended by using a filling oil with a smaller coefficient of expansion and by using shorter capillaries.

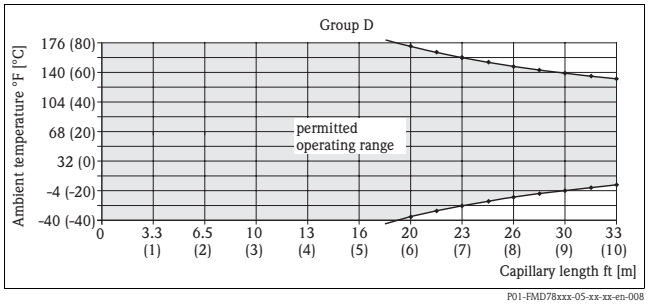
Note!

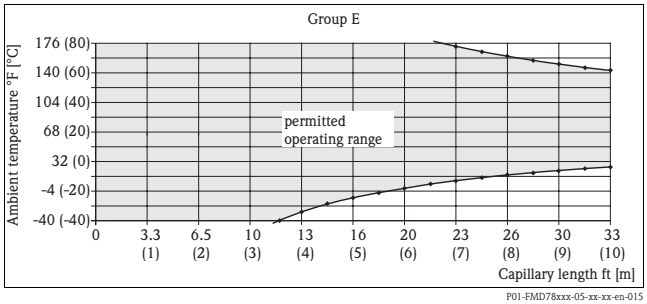
- Endress+Hauser recommends using low temperature oil for applications that require short response times or that are near the lower temperature limit. Page 56, "Diaphragm seal filling oils" section.
- For further information, comprehensive diaphragm seal system designs and measuring technology solutions acting close to the operating limits, please contact your local Endress+Hauser Sales Center.

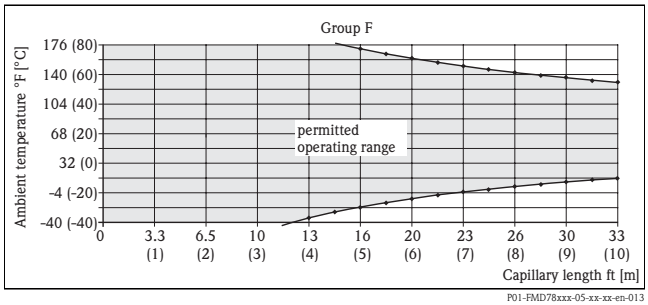


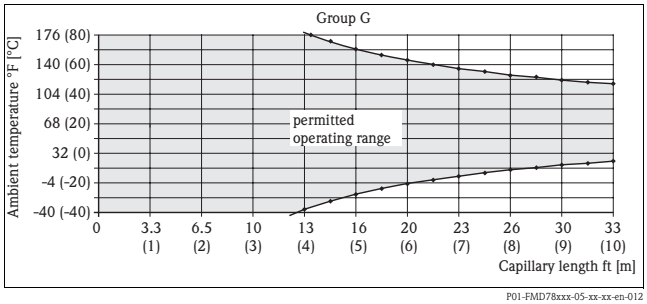


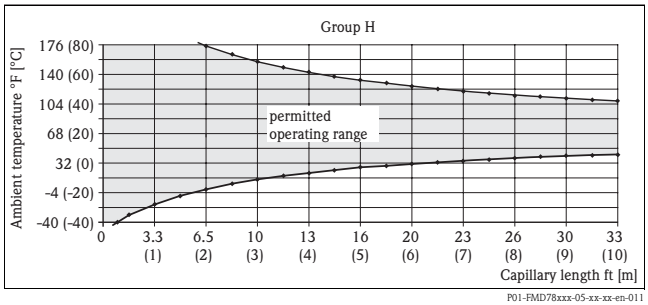


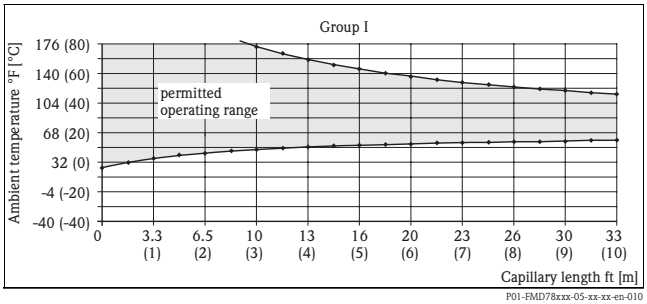


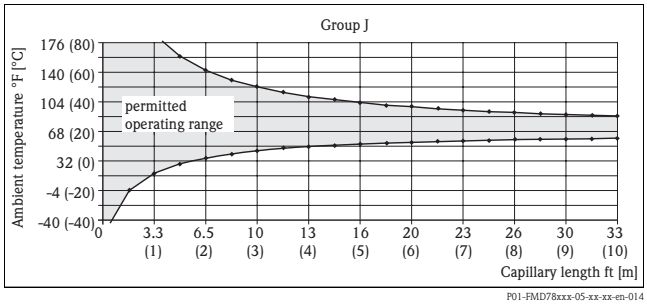










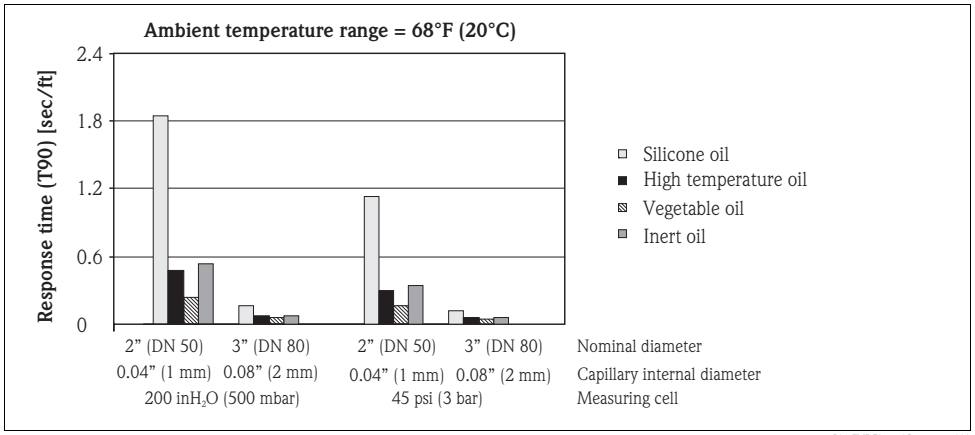


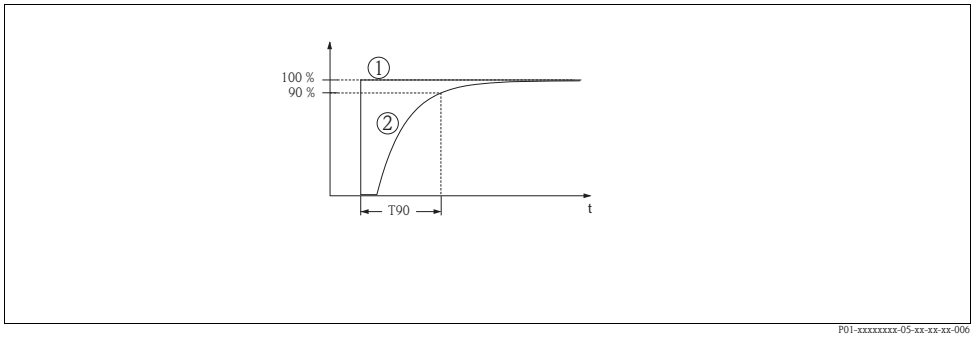
Group	**Version**	**Diaphragm seal**
A	SB	Pipe seal diaphragm Tri-Clamp, ISO 2852 DN 25 (1"), AISI 316L/1.4435
	SC	Pipe seal diaphragm Tri Clamp, ISO 2852 DN 38 (1 1/2"), AISI 316L/1.4435
	SD	Pipe seal diaphragm Tri Clamp, ISO 2852 DN 51 (2"), AISI 316L/1.4435
	GA	Thread ISO 228 G 1/2 B, PN 40, AISI 316L, Separator, PTFE seal
	RL	Thread ANSI 1/2 FNPT, PN 40, AISI 316L, Separator, PTFE seal
B	UF	Pancake DN 50 PN 16-400, AISI 316L
	VF	Pancake 2" 150-2500 lbs, AISI 316L
	B3	EN/DIN flange DN 50 PN 10-40 B1, AISI 316L
	AF	ANSI flange 2" 150 lbs RF, AISI 316/316L
	AR	ANSI flange 2" 300 lbs RF, AISI 316/316L
	KF	JIS flange 50 A 10 K RF, AISI 316L
	MR	DIN 11851 DN 50 PN 25, AISI 316L
	M3	DIN 11851 DN 50 PN 25 socket, AISI 316L
C	UH	Pancake DN 80 PN 16-400, AISI 316L
	UJ	Pancake DN 100 PN 16-400, AISI 316L
	VJ	Pancake 4" 150-2500 lbs, AISI 316L
	B5	EN/DIN flange DN 80 PN 10-40 B1, AISI 316L
	BT	EN/DIN flange DN 100 PN 10-16 B1, AISI 316L
	B6	EN/DIN flange DN 100 PN 25-40 B1, AISI 316L
	AH	ANSI flange 4" 150 lbs RF, AISI 316/316L
	J5	ANSI flange 4" 150 lbs RF, AISI 316/316L, Extensions: 2"/4"/6"/8"
	AT	ANSI flange 4" 300 lbs RF, AISI 316/316L
	KH	JIS flange 100 A 10 K RF, AISI 316L
	MT	DIN 11851 DN 80 PN 25, AISI 316L
	M5	DIN 11851 DN 80 PN 25 socket, AISI 316L
D	VH	Pancake 3" 150-2500 lbs, AISI 316L
	AG	ANSI flange 3" 150 lbs RF, AISI 316/316L
	AS	ANSI flange 3" 300 lbs RF, AISI 316/316L
	KL	JIS flange 80 A 10 K RF, AISI 316L
	TD	Tri-Clamp, ISO 2852 DN 51 (2"), DIN 32676 DN 50, AISI 316L/1.4435
	TF	Tri-Clamp, ISO 2852 DN 76.1 (3"), AISI 316L/1.4435
E	J4	ANSI flange 3" 150 lbs RF, AISI 316/316L, Extensions: 2"/4"/6"/8"
F	TK	DRD DN50 (65 mm), PN 25, AISI 316L/1.4435
	TR	Varivent Type N for tubes DN 40 – DN 162, PN 40, AISI 316L/1.4435
G	MS	DIN 11851 DN 65 PN 25, AISI 316L
	M4	DIN 11851 DN 65 PN 25 socket, AISI 316L
H	TC	Tri-Clamp, ISO 2852 DN 38 (1 – 1 1/2"), DIN 32676 DN 40, AISI 316L/1.4435
I	TB	Tri-Clamp, ISO 2852 DN 25 (1"). DIN 32676 DN 25, AISI 316L/1.4435
J	WH	Sanitary tank spud, AISI 316L/1.4435, Extensions 2"

Response time

The viscosity of the filling oil, the capillary length and the capillary internal diameter influence the frictional resistance. The greater the frictional resistance, the longer the response time.
Furthermore, the volume change of the measuring cell influences the response time. The lower the volume change of the measuring cell is, the less filling oil has to be shifted in the diaphragm seal system.

The following diagram shows typical response times (T90) for the various filling oils dependent on the measuring cell and the capillary internal diameter. The values given are in seconds per metre of capillary length and must be multiplied by the actual length of the capillary. The response time of the transmitter must also be taken into consideration.





Presentation of the response time (T90%)

1 Pressure step
2 Output signal

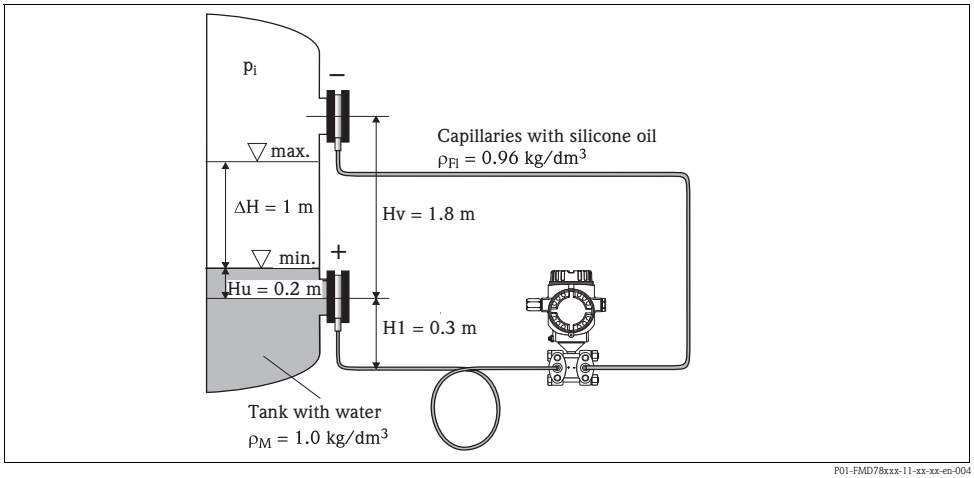
Minimize response time by	Comments
Larger capillary internal diameter	The temperature effect increases with increasing diameter.
Shorter capillaries	–
Filling oil with lower viscosity	– Observe compatibility of the filling oil with the process fluid. – Observe the filling oil operating limits.

Installation instructions

Instructions for diaphragm seal systems

- The diaphragm seal together with the transmitter form a closed, calibrated system, which is filled through ports in the diaphragm seal and in the measuring system of the transmitter. These ports are sealed and must not be opened.
- In the case of devices with diaphragm seals and capillaries, the zero point shift caused by the hydrostatic pressure of the filling liquid column in the capillaries must be taken into account when selecting the measuring cell. If a measuring cell with a small measuring range is selected, the sensor nominal range can be overdriven as a result of position adjustment. See the following diagram and the following example.
- For devices with capillary a suitable fastening device (mounting bracket) is recommended.
- When using a mounting bracket, sufficient strain relief must be allowed for in order to prevent the capillary bending down (bending radius ≥ 100 mm / 4").
- The temperature and length of both capillaries should be the same when using two-sided diaphragm seal systems.

Selecting the measuring cell (observe the hydrostatic pressure of the filling fluid column in the capillaries!)



Pressure on the negative side of the differential pressure transmitter (p_-) when the tank is empty (min. level)

$$p_- = p_{Hv} + p_{H1} = Hv \cdot \rho_{Fl} \cdot g + H1 \cdot \rho_{Fl} \cdot g + p_i$$

$$= 1.8\ m \cdot 0.96 \frac{kg}{dm^3} \cdot 9.81 \frac{m}{s} + 0.3\ m \cdot 0.96 \frac{kg}{dm^3} \cdot 9.81 \frac{m}{s} + p_i$$

$$= 197.77\ mbar + p_i$$

Pressure on the positive side of the differential pressure transmitter (p_+) when the tank is empty (min. level)

$$p_+ = p_{Hu} + p_{H1} = Hu \cdot \rho_M \cdot g + H1 \cdot \rho_{Fl} \cdot g + p_i$$

$$= 0.2\ m \cdot 1 \frac{kg}{dm^3} \cdot 9.81 \frac{m}{s} + 0.3\ m \cdot 0.96 \frac{kg}{dm^3} \cdot 9.81 \frac{m}{s} + p_i$$

$$= 47.87\ mbar + p_i$$

Differential pressure at the transmitter ($\Delta p_{Transmitter}$) when the tank is empty

$$\Delta p_{Transmitter} = p_+ - p_-$$

$$= 47.87\ mbar - 197.77\ mbar$$

$$= -149.90\ mbar$$

Result:
If the tank were full, a differential pressure of –51.80 mbar would be present at the differential pressure transmitter. When the tank is empty, a differential pressure of –149.90 mbar is present. Therefore, a 500 mbar measuring cell is required for this application.

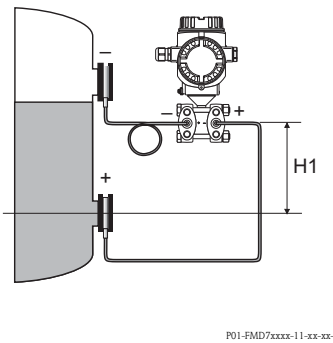
Installation instructions

In order to obtain more precise measurement results and to avoid a defect in the device, mount the capillaries as follows:
- vibration-free (in order to avoid additional pressure fluctuations)
- not in the vicinity of heating or cooling lines
- insulate if the ambient temperature is below ore above the reference temperature
- with a bending radius of ≥ 100 mm (4").

Vacuum applications

For applications under vacuum, Endress+Hauser recommends mounting the pressure transmitter underneath the lower diaphragm seal. A vacuum load of the diaphragm seal caused by the presence of filling oil in the capillaries is therefore prevented.

When the pressure transmitter is mounted above the lower diaphragm seal, the maximum height difference H1 in accordance with the following illustration on the left must not be exceeded. The maximum height difference is dependent on the density of the filling oil and the smallest ever pressure that is permitted to occur at the diaphragm seal on the positive side (empty tank), see the following illustration, on the right.



Installation above the lower diaphragm seal

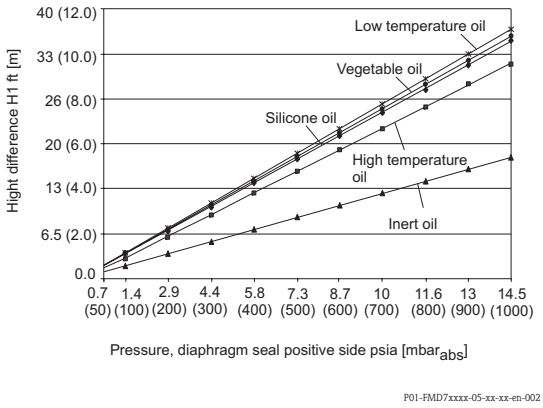


Diagram of maximum installation height above the lower diaphragm seal for vacuum applications dependent on the pressure at the diaphragm seal on the positive side

Certificates and approvals

CE mark

The device meets the legal requirements of the relevant EC directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

Ex approvals

- ATEX
- FM
- CSA
- NEPSI
- IECEx
- GOST on request
- also combinations of different approvals

All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas. Page 79 ff, sections "Safety Instructions" and "Installation/Control Drawings".

Marine certificate

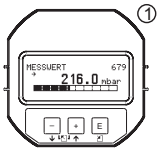
- GL: FMD76, FMD78, PMD70, PMD75
- ABS: FMD76, FMD78, PMD70, PMD75

Functional Safety SIL / IEC 61508 Declaration of conformity (optional)	The Deltabar S with 4 to 20 mA output signal have been developed to IEC 61508 standard. These devices can be used for flow, level and differential pressure monitoring up to SIL 3. For a detailed description of the safety functions with Deltabar S, settings and characteristic quantities for functional safety, please refer tot the "Manual for Functional Safety- Deltabar S" SD189. For devices with SIL / IEC 61508 declaration of conformity see Page 66 ff, Feature 100 "Additional option 1" and Feature 110 "Additional option 2" version E "SIL / IEC 61508, declaration of Conformity".
Overspill protection	WHG (German Water Resources Act). See "Ordering information" Page 65 (see also ZE259P/00/de).
CRN approvals	Some device versions have CRN approval. For a CRN-approved device, a CRN-approved process connection (Page 66, feature 70 "Process connection") has to be ordered with a CSA approval (Page 65, feature 10 "Approval"). These devices are fitted with a separate plate bearing the registration number 0F10524.5C.
Pressure Equipment Directive (PED)	The devices PMD70, PMD75, FMD76, FMD77 und FMD78 corresponds to Article 3 (3) of the EC directive 97/23/EC (Pressure Equipment Directive) and has been designed and manufactured according to good engineering practice. Additionally applies: – FMD78 with pipe diaphragm seal ≥ 1.5"/PN40: Suitable for stable gases in group 1, category II – PMD75, PN 420 Suitable for stable gases in group 1, category I
Standards and guidelines	DIN EN 60770 (IEC 60770): Transmitters for use in industrial-process control systems Part 1: Methods for inspection and routine testing DIN 16086: Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments, concepts, specifications in data sheets EN 61326-X: EMC product family standard for electrical equipment for measurement, control and laboratory use.

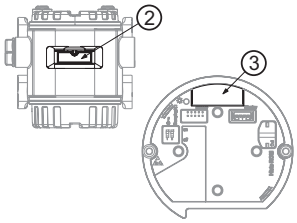
Ordering information

PMD70

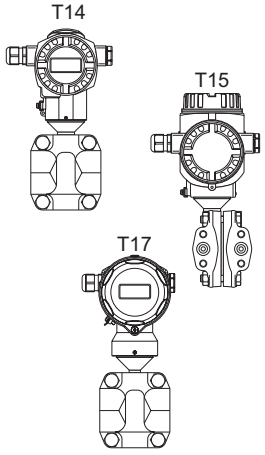
This overview does not mark options which are mutually exclusive.



10	Approval:
A	For non-hazardous areas
1	ATEX II 1/2 G EEx ia IIC T6
6	ATEX II 1/2 G EEx ia IIC T6, overspill protection WHG
2	ATEX II 1/2 D
4	ATEX II 1/3 D
8	ATEX II 1 GD EEx ia IIC T6
3	ATEX II 1/2 GD EEx ia IIC T6
7	ATEX II 3 G EEx nA II T6
S	FM IS, Class I, II, III Division 1, Groups A – G; NI Class I Division 2, Groups A – D; AEx ia
Q	FM DIP, Class II, III Division 1, Groups E – G
R	FM NI, Class I, Division 2, Groups A – D
U	CSA IS, Class I, II, III Division 1, Groups A – G; Class I Division 2, Groups A – D, Ex ia
W	CSA Class II, III Division 1, Groups E – G (Dust-Ex)
E	Combi-certification ATEX II EEx ia + FM IS + CSA IS ATEX II 1/2G EEx ia IIC T6 + FM/CSA IS Class I, II, III Division 1 Group A - G
H	NEPSI Ex ia IIC T6
I	IECEx Zone 0/1 Ex ia IIC T6



20	Output; Operation:
A	4...20 mA HART, SIL operation outside, LCD (→ see Fig. ① ②)
B	4...20 mA HART, SIL operation inside, LCD (→ see Fig. ① ③)
C	4...20 mA HART, SIL operation inside (→ see Fig. ③)
M	PROFIBUS PA, operation outside, LCD (→ see Fig.①, ②)
N	PROFIBUS PA, operation inside, LCD (→ see Fig. ①, ③)
O	PROFIBUS PA, operation inside (→ see Fig. ③)
P	FOUNDATION Fieldbus, operation outside, LCD (→ see Fig. ①, ②)
Q	FOUNDATION Fieldbus, operation inside, LCD (→ see Fig. ①, ③)
R	FOUNDATION Fieldbus, operation inside (→ see Fig. ③)



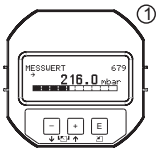
30	Housing; Cable entry; Protection:
A	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
B	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
C	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
D	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M12x1 PA plug
E	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
F	Aluminum T14 housing, optional display on the side, IP 65/NEMA 4X, Han7D plug, 90°
J	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
K	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
L	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
M	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, M12x1 PA plug
N	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
P	Aluminum T15 housing, optional display on the top, IP 65/NEMA 4X, Han7D plug, 90°
1	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
2	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
3	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
4	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug
5	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
6	AISI 316L T14 housing, optional display on the side, IP 65/NEMA 4X, Han7D plug, 90°
R	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Gland M 20x1.5
S	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Thread G 1/2
T	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Thread 1/2 NPT
U	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, M 12x1 PA plug
V	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, 7/8" FF plug
Z	Housing: see additional specifications

40	Nominal range; PN:		
		Nominal value	**PN**
7B	25 mbar/2500 Pa/0.375 psi	10 bar/1 MPa/150 psi
7D	100 mbar/10 kPa/1.5 psi	16 bar/1,6 MPa/240 psi
7F	500 mbar/50 kPa/7.5 psi	100 bar/10 MPa/1500 psi
7H	3 bar/300 kPa/45 psi	100 bar/10 MPa/1500 psi
78	Prepared mounting Deltatop	

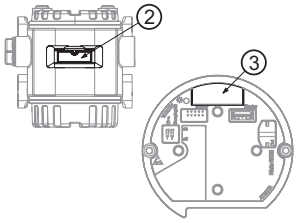
50										**Calibration; Unit:**
					1					Nominal range; mbar/bar
					2					Nominal range; kPa/MPa
					3					Nominal range; mmH_2O/mH_2O
					4					Nominal range; inH_2O/ftH_2O
					6					Nominal range; psi
					8					Adjusted for Deltatop; see additional specification
					B					Customised; see additional specification
					C					Factory certificate 5-point; see additional specification
					D					DKD certificate; see additional specification
					K					Platinum; see additional specification
					L					Platinum and factory certificate 5-point; see additional specification
					M					Platinum and DKD certificate; see additional specification
70										**Process connection; Material:**
						B				1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, C22.8 (CRN)
						D				1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L (CRN)
						F				1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, Alloy C (CRN)
						G				1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, PVDF
						U				RC 1/4 mounting: 7/16 – 20 UNF, AISI 316L (CRN)
						1				1/4 – 18 NPT, mounting: PN 160: M10, C22.8 (CRN)
						2				1/4 – 18 NPT, mounting: PN 160: M10, AISI 316L (CRN)
						3				1/4 – 18 NPT, mounting: PN 160: M10, Alloy C (CRN)
80								**Seal:**		
							A			FKM Viton
							B			EPDM
							D			Kalrez
							E			Chemraz
							1			FKM Viton, cleaned from oil and greace
							2			FKM Viton, cleaned for oxygen service Note application limits pressure/temp.
100									**Additional option 1:**	
								A		not selected
								E		SIL/IEC 61508 Declaration of conformity
								B		Material test certificate for wetted components, inspection certificate as per EN 10204 3.1 acc. to specification 52005759
								M		Overvoltage protection
								N		HistoROM/M-DAT
								S		GL/ABS marine certificate
								U		Mounting bracket, wall/pipe, 304
								V		Mounting on shut-off valve from above
								W		Mounting on shut-off valve from below
								2		Test report acc. to EN10204 2.2
								3		Routine test with certificate, inspection certificate as per EN 10204 3.1
								4		Overpressure test with certificate, inspection certificate as per EN 10204 3.1
110										**Additional option 2:**
									A	not selected
									E	SIL/IEC 61508 Declaration of conformity
									B	Material test certificate for wetted components, inspection certificate as per EN10204 3.1 acc. to specification 52005759
									G	Remote housing, cable length see additional spec. + mounting bracket, wall/pipe, 316L (FM /CSA IS: only for Div.1 Installation)
									K	Vent valves (2 pieces), Alloy C
									M	Overvoltage protection
									N	HistoROM/M-DAT
									R	Screws 7/16 UNF, length 1 1/2" (4 pieces) for oval flange adapter PZO
									S	GL/ABS marine certificate
									U	Mounting bracket for wall/pipe, AISI 304
									2	Test report acc. to EN10204 2.2
									3	Routine test with certificate, inspection certificate as per EN 10204 3.1
									4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1
									5	Helium leak test EN 1518 with test certificate, inspection certificate as per EN 10204 3.1
PMD70										order code

PMD75

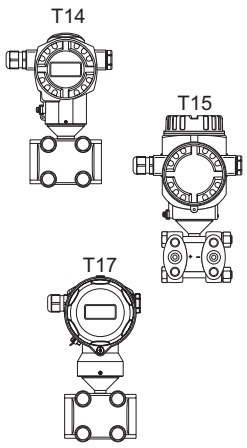
This overview does not mark options which are mutually exclusive.



10	Approval:
A	For non-hazardous areas
1	ATEX II 1/2 G EEx ia IIC T6
6	ATEX II 1/2 G EEx ia IIC T6, overspill protection WHG
2	ATEX II 1/2 D
4	ATEX II 1/3 D
8	ATEX II 1 GD EEx ia IIC T6
3	ATEX II 1/2 GD EEx ia IIC T6
5	ATEX II 2 G EEx d IIC T6
7	ATEX II 3 G EEx nA II T6
S	FM IS, Class I, II, III Division 1, Groups A – G; NI Class I Division 2, Groups A – D; AEx ia
T	FM XP, Class I Division 1, Groups A – D; AEx d
Q	FM DIP, Class II, III Division 1, Groups E – G
R	FM NI, Class I, Division 2, Groups A – D
U	CSA IS, Class I, II, III Division 1, Groups A – G; Class I Division 2, Groups A – D, Ex ia
V	CSA XP, Class I Division 1, Groups B – D; Ex d
W	CSA Class II, III Division 1, Groups E – G (Dust-Ex)
G	NEPSI Exd IIC T6
H	NEPSI Ex ia IIC T6
I	IECEx Zone 0/1 Ex ia IIC T6
B	Combined certificates: ATEX II 1/2 G EEx ia IIC T6 + II G EEx d IIC T6
C	Combined certificates: FM IS and XP Class I Division 1, Groups A – D
D	Combined certificates: CSA IS and XP Class I Division 1, Groups A – D
E	Combined certificates: FM/CSA IS and XP Class I Division 1, Groups A – D
F	Combined certificates: ATEX II EEx ia / EEx d + FM/CSA IS + XP; ATEX II 1/2G EEx ia IIC T6+; ATEX II 2G EEx d IIC T6+; FM/CSA IS + XP Cl.I Div.1 Gr.A-D



20	Output; Operation:
A	4...20 mA HART, SIL operation outside, LCD (→ see Fig. ①, ②)
B	4...20 mA HART, SIL operation inside, LCD (→ see Fig.①, ③)
C	4...20 mA HART, SIL operation inside (→ see Fig. ③)
M	PROFIBUS PA, operation outside, LCD (→ see Fig. ①, ②)
N	PROFIBUS PA, operation inside, LCD (→ see Fig. ①, ③)
O	PROFIBUS PA, operation inside (→ see Fig. ③)
P	FOUNDATION Fieldbus, operation outside, LCD (→ see Fig. ①, ②)
Q	FOUNDATION Fieldbus, operation inside, LCD (→ see Fig. ①, ③)
R	FOUNDATION Fieldbus, operation inside (→ see Fig. ③)



30	Housing; Cable entry, Protection:
A	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
B	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
C	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
D	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M12x1 PA plug
E	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
F	Aluminum T14 housing, optional display on the side, IP 65/NEMA 4X, Han7D plug, 90°
J	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
K	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
L	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
M	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug
N	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
P	Aluminum T15 housing, optional display on the top, IP 65/NEMA 4X, Han7D plug, 90°
1	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
2	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
3	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
4	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug
5	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
6	AISI 316L T14 housing, optional display on the side, IP 65/NEMA 4X, Han7D plug, 90°
R	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Gland M 20x1.5
S	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Thread G 1/2
T	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Thread 1/2 NPT
U	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, M 12x1 PA plug
V	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, 7/8" FF plug
Z	Housing: see additional specifications

40	Nominal range; PN:	
	Nominal value	**PN**
7B	10 mbar/1 kPa/0.15 psi	160 bar/16 MPa/2400 psi
7C	30 mbar/3 kPa/0.45 psi	160 bar/16 MPa/2400 psi

40	Nominal range; PN:		
	7D	100 mbar/10 kPa/1.5 psi	160 bar/16 MPa/2400 psi
	7F	500 mbar/50 kPa/7.5 psi	160 bar/16 MPa/2400 psi
	7H	3 bar/300 kPa/45 psi	160 bar/16 MPa/2400 psi
	7L	16 bar/1,6 MPa/240 psi	160 bar/16 MPa/2400 psi
	7M	40 bar/4 MPa/600 psi	160 bar/16 MPa/2400 psi
	8F	500 mbar/50 kPa/7.5 psi	420 bar/42 MPa/6300 psi
	8H	3 bar/300 kPa/45 psi	420 bar/42 MPa/6300 psi
	8L	16 bar/1.6 MPa/240 psi	420 bar/42 MPa/6300 psi
	8M	40 bar/4 MPa/600 psi	420 bar/42 MPa/6300 psi
	78	Prepared for Deltatop; PN = 160 bar	
	88	Prepared for Deltatop; PN = 420 bar	

50	Calibration; Unit:	
	1	Nominal range; mbar/bar
	2	Nominal range; kPa/MPa
	3	Nominal range; mmH_2O/mH_2O
	4	Nominal range; inH_2O/ftH_2O
	6	Nominal range; psi
	8	Adjusted for Deltatop; see additional specification
	B	Customised; see additional specification
	C	Factory certificate 5-point; see additional specification
	D	DKD certificate; see additional specification
	K	Platinum; see additional specification
	L	Platinum and factory certificate 5-point; see additional specification
	M	Platinum and DKD certificate; see additional specification

60	Membrane material:	
	1	AISI 316L
	2	Alloy C
	3	Monel
	5	Tantal
	6	AISI 316L with Gold-Rhodium coating

70	Process connection; Material:	
	B	1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, C22.8 (CRN), including 2 vent valves (AISI 316L)
	C	1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, C22.8, side vent, including 4 fastening bolt connections and 2 vent valves (AISI 316L)
	D	1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L (CRN), including 2 vent valves (AISI 316L)
	E	1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, AISI 316L, side vent, including 4 fastening bolt connections and 2 vent valves (AISI 316L)
	F	1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, Alloy C (CRN), without screws/vents
	H	1/4 – 18 NPT IEC 61518, mounting: 7/16 – 20 UNF, Alloy C, side vent, without screws/vents
	U	RC 1/4 mounting: 7/16 – 20 UNF, AISI 316L (CRN), including 2 vent valves (AISI 316L)
	V	RC 1/4 mounting: 7/16 – 20 UNF, AISI 316L, side vent, including 4 fastening bolt connections and 2 vent valves (AISI 316L)
	W	Prepared for diaphragm seal mount
	1	1/4 – 18 NPT, mounting: PN 160: M10, PN 420: M12, C22.8 (CRN), including 2 vent valves (AISI 316L)
	2	1/4 – 18 NPT, mounting: PN 160: M10, PN 420: M12, AISI 316L (CRN), including 2 vent valves (AISI 316L)
	3	1/4 – 18 NPT, mounting: PN 160: M10, PN 420: M12, Alloy C (CRN)

80	Seal:	
	A	FKM Viton
	C	PTFE
	F	NBR
	K	Copper seal ring, cleaned for oxygen service
	1	FKM Viton, cleaned from oil and greace
	2	FKM Viton, cleaned for oxygen service Note application limits pressure/temp.
	3	PTFE, cleaned for oxygen service (25% glass filled, see top of page 29)
	H	Copper seal ring

100	Additional option 1:	
	A	not selected
	E	SIL/IEC 61508 Declaration of conformity
	B	Material test certificate for wetted components, inspection certificate as per EN 10204 3.1 acc. to specification 52005759

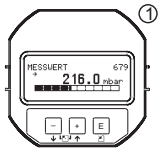
100									Additional option 1:	
									C	NACE MR0175 (wetted parts)
									D	Material test certificate for wetted components as per EN 10204 3.1 and NACE MR0175 material, inspection certificate as per EN 10204 acc. to specification 52010806
									M	Overvoltage protection
									N	HistoROM/M-DAT
									S	GL/ABS marine certificate
									U	Mounting bracket, wall/pipe, 304
									V	Mounting on shut-off valve from above
									W	Mounting on shut-off valve from below
									2	Test report acc. to EN10204 2.2
									3	Routine test with certificate, inspection certificate as per EN 10204 3.1
									4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1

110										Additional option 2:	
										A	not selected
										E	SIL/IEC 61508 Declaration of conformity
										B	Material test certificate for wetted components, inspection certificate as per EN 10204 3.1 acc. to specification 52005759
										G	Remote housing, cable length see additional spec. + mounting bracket, wall/pipe, 316L (FM/CSA IS: only for Div.1 Installation)
										K	Vent valves (2 pieces), Alloy C
										L	Vent valves (4 pieces), Alloy C
										M	Overvoltage protection
										N	HistoROM/M-DAT
										R	Screws 7/16 UNF, length 1 1/2" (4 pieces) for oval flange adapter PZO
										S	GL/ABS marine certificate
										U	Mounting bracket for wall/pipe, AISI 304
										2	Test report acc. to EN10204 2.2
										3	Routine test with certificate, inspection certificate as per EN 10204 3.1
										4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1
										5	Helium leak test EN 1518 with test certificate inspection certificate as per EN 10204 3.1

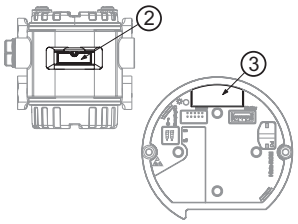
PMD75											complete order code

FMD76

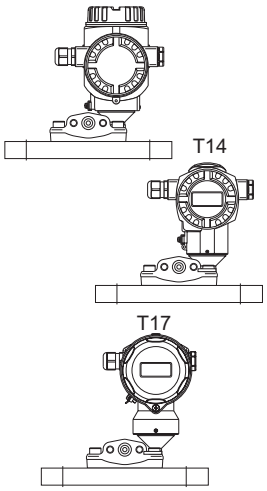
This overview does not mark options which are mutually exclusive.



10	Approval:
A	For non-hazardous areas
1	ATEX II 1/2 G EEx ia IIC T6
6	ATEX II 1/2 G EEx ia IIC T6, overspill protection WHG
2	ATEX II 1/2 D EEx ia IIC T6
8	ATEX II 1 GD EEx ia IIC T6
3	ATEX II 1/2 GD EEx ia IIC T6
7	ATEX II 3 G EEx nA II T6
S	FM IS, Class I, II, III Division 1, Groups A – G; NI Class I Division 2, Groups A – D; AEx ia
R	FM NI, Class I, Division 2, Groups A – D
U	CSA IS, Class I, II, III Division 1, Groups A – G; Class I Division 2, Groups A – D, Ex ia
E	Combi-certification ATEX II EEx ia + FM IS + CSA IS ATEX II 1/2G EEx ia IIC T6 + FM/CSA IS Class I, II, III Division 1 Group A - G
H	NEPSI Ex ia IIC T6
I	IECEx Zone 0/1 Ex ia IIC T6



20	Output; Operation:
A	4...20 mA HART, SIL operation outside, LCD (→ see Fig. ①, ②)
B	4...20 mA HART, SIL operation inside, LCD (→ see Fig. ①, ③)
C	4...20 mA HART, SIL operation inside (→ see Fig. ③)
M	PROFIBUS PA, operation outside, LCD (→ see Fig. ①, ②)
N	PROFIBUS PA, operation inside, LCD (→ see Fig. ①, ③)
O	PROFIBUS PA, operation inside (→ see Fig. ③)
P	FOUNDATION Fieldbus, operation outside, LCD (→ see Fig. ①, ②)
Q	FOUNDATION Fieldbus, operation inside, LCD (→ see Fig. ①, ③)
R	FOUNDATION Fieldbus, operation inside (→ see Fig. ③)



30	Housing; Cable entry, Protection:
A	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
B	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
C	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
D	Aluminum T14 housing, optional display on the side, IP66/67/NEMA 4X/ 6P, M12x1 PA plug
E	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
F	Aluminum T14 housing, optional display on the side, IP 65/NEMA 4X, Han7D plug, 90°
J	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
K	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
L	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
M	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug
N	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
P	Aluminum T15 housing, optional display on the top, IP 65/NEMA 4X, Han7D plug, 90°
1	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
2	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
3	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
4	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P,M 12x1 PA plug
5	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
6	AISI 316L T14 housing, optional display on the side, IP 65/NEMA 4X, Han7D plug, 90°
R	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Gland M 20x1.5
S	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Thread G 1/2
T	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Thread 1/2 NPT
U	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, , M 12x1 PA plug
V	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, 7/8" FF plug
Z	Housing: see additional specifications

40	Nominal range; PN:	
	Nominal value	**PN**
7D	100 mbar/10 kPa/1.5 psi	16 bar/1,6 MPa/240 psi
7F	500 mbar/50 kPa/7.5 psi	100 bar/10 MPa/1500 psi
7H	3 bar/300 kPa/45 psi	100 bar/10 MPa/1500 psi

50	Calibration; Unit:
1	Nominal range; mbar/bar
2	Nominal range; kPa/MPa
3	Nominal range; mmH_2O/mH_2O
4	Nominal range; inH_2O/ftH_2O
6	Nominal range; psi
B	Customized; see additional specification

50										**Calibration; Unit:**	
									C	Factory certificate 5-point; see additional specification	
									D	DKD certificate; see additional specification	
									K	Platinum; see additional specification	
									L	Platinum and factory certificate 5-point; see additional specification	
									M	Platinum and DKD certificate: see additional specification	

70										**Process connection low-pressure side; Material; Seal:**	
										Mounting: 7/16 – 20 UNF	
									B	1/4 – 18 NPT IEC 61518, C22.8, FKM Viton (CRN)	
									D	1/4 – 18 NPT IEC 61518, AISI 316L, FKM Viton (CRN)	
									F	1/4 – 18 NPT IEC 61518, Alloy C, FKM Viton (CRN)	
									G	1/4 – 18 NPT IEC 61518, PVDF, FKM Viton, Safety instructions, observe electrostatic charge.	
									K	1/4 – 18 NPT IEC 61518, AISI 316L, EPDM (CRN)	
									L	1/4 – 18 NPT IEC 61518, Alloy C, EPDM (CRN)	
									M	1/4 – 18 NPT IEC 61518, AISI 316L, Kalrez (CRN)	
									N	1/4 – 18 NPT IEC 61518, Alloy C, Kalrez (CRN)	
									P	1/4 – 18 NPT IEC 61518, AISI 316L, Chemraz (CRN)	
									Q	1/4 – 18 NPT IEC 61518, Alloy C, Chemraz (CRN)	
									S	1/4 – 18 NPT IEC 61518, AISI 316L, FKM Viton, cleaned from oil and greace (CRN)	
									T	1/4 – 18 NPT IEC 61518, AISI 316L, FKM Viton, cleaned for oxygen service (CRN)	
									U	RC 1/4, AISI 316L, FKM Viton (CRN)	

80										**Process connection high-pressure side; Material:**	
										EN/DIN flanges	
									B	DN 80 PN 10-40 B1, AISI 316L	
									D	DN 80 PN 10-40, AISI 316L with ECTFE coating Safety instructions, observe electrostatic charge!	
									E	DN 80 PN 10-40 B1, Alloy C276	
									F	DN 100 PN 10-16 B1, AISI 316L	
									G	DN 100 PN 25-40 B1, AISI 316L	
									H	DN 100 PN 25-40, AISI 316L with ECTFE coating Safety instructions, observe electrostatic charge!	
									J	DN 100 PN 25-40 B1, Alloy C276	
									L	DN 100 PN 10-16, AISI 316L with ECTFE coating Safety instructions, observe electrostatic charge!	
									M	DN 100 PN 10-16 B1, Alloy C276	
										ANSI flanges	
									P	3" 150 lbs RF, AISI 316/316L (CRN)	
									R	3" 150 lbs, AISI 316/316L with ECTFE coating Safety instructions, observe electrostatic charge!	
									S	3" 150 lbs RF, Alloy C276 (CRN)	
									T	4" 150 lbs RF, AISI 316/316L (CRN)	
									U	4" 150 lbs, AISI 316/316L with ECTFE coating Safety instructions, observe electrostatic charge!	
									V	4" 150 lbs RF, Alloy C276 (CRN)	
									W	4" 300 lbs RF, AISI 316/316L (CRN)	
										JIS flanges	
									1	10K 80A RF, AISI 316L	
									3	10K 80A RF, Alloy C276	
									4	10K 100A RF, AISI 316L	

100										**Additional option 1:**	
									A	not selected	
									E	SIL/IEC 61508 Declaration of conformity	
									B	Material test certificate for wetted components, inspection certificate as per EN 10204 3.1 acc. to specification 52005759	
									M	Overvoltage protection	
									N	HistoROM/M-DAT	
									S	GL/ABS marine certificate	
									2	Test report acc. to EN10204 2.2	
									3	Routine test with certificate, inspection certificate as per EN 10204 3.1	
									4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1	

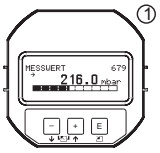
110										**Additional option 2:**	
									A	not selected	
									E	SIL/IEC 61508 Declaration of conformity	
									G	Remote housing, cable length see additional spec. + mounting bracket, wall/pipe, 316L (FM/CSA IS: only for Div.1 Installation)	
									K	Vent valves (2 pieces), Alloy C	
									M	Overvoltage protection	

110									**Additional option 2:**	
									N	HistoROM/M-DAT
									R	Screws 7/16 UNF, length 1 1/2" (4 pieces) for oval flange adapter PZO
									S	GL/ABS marine certificate
									U	Mounting bracket for wall/pipe, AISI 304
									2	Test report acc. to EN10204 2.2
									3	Routine test with certificate, inspection certificate as per EN 10204 3.1
									4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1
									5	Helium leak test EN 1518 with test certificate, inspection certificate as per EN 10204 3.1

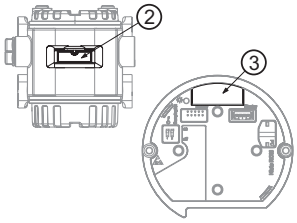
FMD76										order code

FMD77

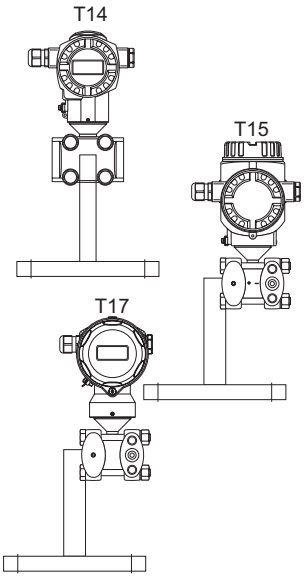
This overview does not mark options which are mutually exclusive.



10	Approval:
A	For non-hazardous areas
1	ATEX II 1/2 G EEx ia IIC T6
6	ATEX II 1/2 G EEx ia IIC T6, overspill protection WHG
2	ATEX II 1/2 D
4	ATEX II 1/3 D
8	ATEX II 1 GD EEx ia IIC T6
3	ATEX II 1/2 GD EEx ia IIC T6
5	ATEX II 2 G EEx d IIC T6
7	ATEX II 3 G EEx nA II T6
S	FM IS, Class I, II, III Division 1, Groups A – G; NI Class I Division 2, Groups A – D; AEx ia
T	FM XP, Class I Division 1, Groups A – D; AEx ia
Q	FM DIP, Class II, III Division 1, Groups E – G
R	FM NI, Class I, Division 2, Groups A – D
U	CSA IS, Class I, II, III Division 1, Groups A – G; Class I Division 2, Groups A – D, Ex ia
V	CSA XP, Class I Division 1, Groups B – D; Ex d
W	CSA Class II, III Division 1, Groups E – G (Dust-Ex)
G	NEPSI Ex d IIC T6
H	NEPSI Ex ia IIC T6
I	IECEx Zone 0/1 Ex ia IIC T6
B	Combined certificates: ATEX II 1/2 G EEx ia IIC T6 + II G EEx d IIC T6
C	Combined certificates: FM IS and XP Class I Division 1, Groups A – D
D	Combined certificates: CSA IS and XP Class I Division 1, Groups A – D
E	Combined certificates: FM/CSA IS and XP Class I Division 1, Groups A – D
F	Combined certificates: ATEX II EEx ia / EEx d + FM/CSA IS + XP; ATEX II 1/2G EEx ia IIC T6+; ATEX II 2G EEx d IIC T6+; FM/CSA IS + XP Cl.I Div.1 Gr.A-D



20	Output; Operation:
A	4...20 mA HART, SIL operation outside, LCD (→ see Fig. ①, ②)
B	4...20 mA HART, SIL operation inside, LCD (→ see Fig. ①, ③)
C	4...20 mA HART, SIL operation inside (→ see Fig. ③)
M	PROFIBUS PA, operation outside, LCD (→ see Fig. ①, ②)
N	PROFIBUS PA, operation inside, LCD (→ see Fig. ①, ③)
O	PROFIBUS PA, operation inside (→ see Fig. ③)
P	FOUNDATION Fieldbus, operation outside, LCD (→ see Fig. ①, ②)
Q	FOUNDATION Fieldbus, operation inside, LCD (→ see Fig. ①, ③)
R	FOUNDATION Fieldbus, operation inside (→ see Fig. ③)



30	Housing; Cable entry, Protection:
A	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
B	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
C	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
D	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M12x1 PA plug
E	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
F	Aluminum T14 housing, optional display on the side, IP 65/NEMA 4X, Han7D plug, 90°
J	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
K	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
L	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
M	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug
N	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
P	Aluminum T15 housing, optional display on the top, IP 65/NEMA 4X, Han7D plug, 90°
1	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
2	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
3	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
4	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug
5	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
6	AISI 316L T14 housing, optional display on the side, IP 65/NEMA 4X, Han7D plug, 90°
R	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Gland M 20x1.5
S	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Thread G 1/2
T	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Thread 1/2 NPT
U	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, M 12x1 PA plug
V	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, 7/8" FF plug
Z	Housing: see additional specifications

40	Nominal range; PN:	
	Nominal value	**PN**
7D	100 mbar/10 kPa/1.5 psi	160 bar/16 MPa/2400 psi
7F	500 mbar/50 kPa/7.5 psi	160 bar/16 MPa/2400 psi

40				**Nominal range; PN:**							
				7H	3 bar/300 kPa/45 psi				160 bar/16 MPa/2400 psi		
				7L	16 bar/1.6 MPa/240 psi				160 bar/16 MPa/2400 psi		
50					**Calibration, Units:**						
					1	Calibration: nominal range, mbar/bar					
					2	Calibration: nominal range, kPa/MPa					
					3	Calibration: nominal range, mmH_2O/mH_2O					
					4	Calibration: nominal range, inH_2O/ftH_2O					
					6	Calibration: nominal range, psi					
					B	Custom calibration: see additional specification					
					C	Factory calibration: see additional specification, Factory calibration certificate, 5-point					
					D	DKD calibration: see additional specification					
60						**Membrane material (high-pressure side):**					
						1	AISI 316L				
						2	Alloy C				
						3	Monel				
						5	Tantalum				
						6	AISI 316L with Gold-Rhodium coating				
						7	AISI 316L with 0.09 mm PTFE foil (not for vacuum applications)				
70							**Process connection low-pressure side; Material; Seal:**				
								Mounting: 7/16 – 20 UNF			
							B	1/4 – 18 NPT IEC 61518, C22.8, FKM Viton (CRN)			
							D	1/4 – 18 NPT IEC 61518, AISI 316L, FKM Viton (CRN)			
							F	1/4 – 18 NPT IEC 61518, Alloy C276, FKM Viton (CRN)			
							H	1/4 – 18 NPT IEC 61518, AISI 316L, PTFE+C4-ring (CRN)			
							J	1/4 – 18 NPT IEC 61518, Alloy C, PTFE+C4-ring (CRN)			
							K	1/4 – 18 NPT IEC 61518, AISI 316L, EPDM (CRN)			
							L	1/4 – 18 NPT IEC 61518, Alloy C, EPDM (CRN)			
							M	1/4 – 18 NPT IEC 61518, AISI 316L, Kalrez (CRN)			
							N	1/4 – 18 NPT IEC 61518, Alloy C, Kalrez (CRN)			
							P	1/4 – 18 NPT IEC 61518, AISI 316L, Chemraz (CRN)			
							Q	1/4 – 18 NPT IEC 61518, Alloy C, Chemraz (CRN)			
							S	1/4 – 18 NPT IEC 61518, AISI 316L, cleaned from oil and greace (CRN)			
							T	1/4 – 18 NPT IEC 61518, AISI 316L, cleaned for oxygen service (CRN)			
							U	RC 1/4, AISI 316L, FKM Viton (CRN)			
80								**Process connection high-pressure side; Material:**			
									EN/DIN flanges		
								A	DN 50 PN 10-40 B1, AISI 316L		
								B	DN 80 PN 10-40 B1, AISI 316L		
								C	DN 80 PN 10-40 B1, extended diaphragm seal: 50 mm/100 mm/200 mm, extended diaphragm seal: see additional specification		
								F	DN 100 PN 10-16 B1, AISI 316L		
								G	DN 100 PN 25-40 B1, AISI 316L		
									ANSI flanges		
								N	2" 150 lbs, RF, AISI 316/316L (CRN)		
								P	3" 150 lbs, RF, AISI316/ 316L (CRN)		
								Q	3" 150 lbs RF, AISI 316/316L, extended diaphragm seal: 2"/4"/6"/8", extended diaphragm seal: see additional specification		
								5	3" 150 lbs, RF, compact, 316/316L, flange ANSI B16.5		
								7	3" 150 lbs, RF, compact, 316/316L, 2"/4"/6"/8" barrel, flange ANSI B16.5 see additional specification		
								6	3" 300 lbs, RF, compact, 316/316L, flange ANSI B16.5		
								T	4" 150 lbs, RF, AISI 316L (CRN)		
								8	4" 150 lbs, RF, compact, 316/316L, flange ANSI B16.5		
								W	4" 300 lbs, RF, AISI 316L (CRN)		
									JIS flanges		
								X	10K 50A RF, AISI 316L		
								1	10K 80A RF, AISI 316L		
								4	10K 100 A RF, AISI 316L		
90									**Fill fluid:**		
									A	Silicone oil	
									D	Vegetable oil	
									L	Low temperature oil	
									V	High-temperature oil	
									F	Inert oil	

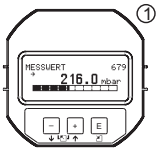
100	Additional options 1:
A	Additional options 1 not selected
B	Material test certificate for wetted components, inspection certificate as per EN 10204 3.1 acc. to specification 52005759
C	NACE MR0175 material
D	Material test certificate for wetted components as per EN 10204 3.1 and NACE MR0175 material, inspection certificate as per EN 10204 acc. to specification 52010806
M	Overvoltage protection
N	HistoROM module
2	Test report acc. to EN 10204 2.2
3	Routine test with certificate, inspection certificate as per EN 10204 3.1
4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1

110	Additional options 2:
A	Additional options 2 not selected
E	SIL/IEC 61508 declaration of conformity
G	Remote housing, cable length see additional spec. + mounting bracket, wall/pipe, 316L (FM/CSA IS: only for Div.1 Installation)
M	Overvoltage protection
N	HistoROM module
R	Screws 7/16 UNF, length 1 1/2" (4 pieces) for oval flange adapter PZO
2	Test report acc. to EN 10204 2.2
3	Routine test with certificate, inspection certificate as per EN 10204 3.1
4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1

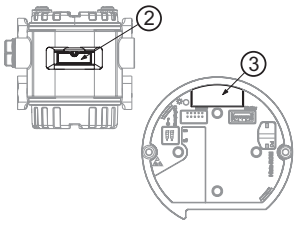
FMD77	order code

FMD78

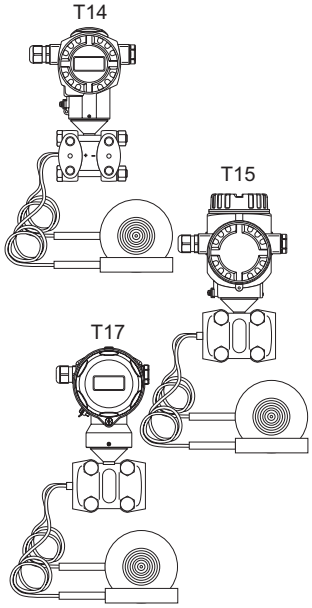
This overview does not mark options which are mutually exclusive.



10	Approval:
A	For non-hazardous areas
1	ATEX II 1/2 G EEx ia IIC T6
6	ATEX II 1/2 G EEx ia IIC T6, overspill protection WHG
2	ATEX II 1/2 D
4	ATEX II 1/3 D
8	ATEX II 1 GD EEx ia IIC T6
3	ATEX II 1/2 GD EEx ia IIC T6
5	ATEX II 2 G EEx d IIC T6
7	ATEX II 3 G EEx nA II T6
S	FM IS, Class I, II, III Division 1, Groups A – G; NI Class I Division 2, Groups A – D; AEx ia
T	FM XP, Class I Division 1, Groups A – D; AEx ia
Q	FM DIP, Class II, III Division 1, Groups E – G
R	FM NI, Class I, Division 2, Groups A – D
U	CSA IS, Class I, II, III Division 1, Groups A – G; Class I Division 2, Groups A – D, Ex ia
V	CSA XP, Class I Division 1, Groups B – D; Ex d
W	CSA Class II, III Division 1, Groups E – G (Dust-Ex)
G	NEPSI Ex d IIC T6
H	NEPSI Ex ia IIC T6
I	IECEx Zone 0/1 Ex ia IIC T6
B	Combined certificates: ATEX II 1/2 G EEx ia IIC T6 + II G EEx d IIC T6
C	Combined certificates: FM IS and XP Class I Division 1, Groups A – D
D	Combined certificates: CSA IS and XP Class I Division 1, Groups A – D
E	Combined certificates: FM/CSA IS and XP Class I Division 1, Groups A – D
F	Combined certificates: ATEX II EEx ia / EEx d + FM/CSA IS + XP; ATEX II 1/2G EEx ia IIC T6+; ATEX II 2G EEx d IIC T6+; FM/CSA IS + XP Cl.I Div.1 Gr.A-D



20	Output; Operation:
A	4...20 mA HART, SIL operation outside, LCD (→ see Fig. ①, ②)
B	4...20 mA HART, SIL operation inside, LCD (→ see Fig. ①, ③)
C	4...20 mA HART, SIL operation inside (→ see Fig. ③)
M	PROFIBUS PA, operation outside, LCD (→ see Fig. ①, ②)
N	PROFIBUS PA, operation inside, LCD (→ see Fig. ①, ③)
O	PROFIBUS PA, operation inside (→ see Fig. ③)
P	FOUNDATION Fieldbus, operation outside, LCD (→ see Fig. ①, ②)
Q	FOUNDATION Fieldbus, operation inside, LCD (→ see Fig. ①, ③)
R	FOUNDATION Fieldbus, operation inside (→ see Fig. ④)



30	Housing; Cable entry, Protection:
A	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
B	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
C	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
D	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M12x1 PA plug
E	Aluminum T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
F	Aluminum T14 housing, optional display on the side, IP 65/NEMA 4X, Han7D plug, 90°
J	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
K	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
L	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
M	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug
N	Aluminum T15 housing, optional display on the top, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
P	Aluminum T15 housing, optional display on the top, IP 65/NEMA 4X, Han7D plug, 90°
1	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
2	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
3	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
4	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug
5	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
6	AISI 316L T14 housing, optional display on the side, IP 65/NEMA 4X, Han7D plug, 90°
R	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Gland M 20x1.5
S	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Thread G 1/2
T	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, Thread 1/2 NPT
U	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, M 12x1 PA plug
V	AISI 316L T17 housing, optional display on the side, IP 66/68/NEMA 4X/ 6P, 7/8" FF plug
Z	Housing: see additional specifications

40	Nominal range; PN:	
	Nominal value	**PN**
7D	100 mbar/10 kPa/1.5 psi	160 bar/16 MPa/2400 psi

40	**Nominal range; PN:**		
	7F	500 mbar/50 kPa/7.5 psi	160 bar/16 MPa/2400 psi
	7H	3 bar/300 kPa/45 psi	160 bar/16 MPa/2400 psi
	7L	16 bar/1,6 MPa/240 psi	160 bar/16 MPa/2400 psi
	7M	40 bar/4 MPa/600 psi	160 bar/16 MPa/2400 psi

50	**Calibration, Units:**	
	1	Calibration: nominal range, mbar/bar
	2	Calibration: nominal range, kPa/MPa
	3	Calibration: nominal range, mmH_2O/mH_2O
	4	Calibration: nominal range, inH_2O/ftH_2O
	6	Calibration: nominal range, psi
	B	Custom calibration: see additional specification
	C	Factory calibration: see additional specification, Factory calibration certificate, 5-point
	D	DKD calibration: see additional specification, DKD-Certificate

60	**Membrane material:**	
	1	AISI 316L
	2	Alloy C
	3	Monel
	5	Tantalum
	6	AISI 316L with Gold-Rhodium coating
	7	AISI 316L with 0.09 mm PTFE foil (not for vacuum applications)

80	**Process connection, Material:**	
		Membrane diaphragm seal cell structure
	UF	Pancake DN 50 PN 16-400, AISI 316L
	UH	Pancake DN 80 PN 16-400, AISI 316L
	UJ	Pancake DN 100 PN 16-400, AISI 316L
	VF	Pancake 2" 150-2500 lbs, AISI 316L (CRN)
	VH	Pancake 3" 150-2500 lbs, AISI 316L (CRN)
	VJ	Pancake 4" 150-2500 lbs, AISI 316L (CRN)
		Threaded connections
	GA	Thread ISO 228 G 1/2 B, PN 40, AISI 316L, separator, PTFE seal
	RL	Thread ANSI 1/2 MNPT, PN 40, AISI 316L, separator, PTFE seal
		Clamp connections
	TB	Tri-Clamp, ISO 2852 DN 25 (1"), DIN 32676 DN 25, EHEDG, 3A, AISI 316L
	TC	Tri-Clamp, ISO 2852 DN 25 – DN 38 (1 – 1 1/2"), EHEDG, 3A, AISI 316L
	TD	Tri-Clamp, ISO 2852 DN 40 – DN 51 (2")/DN 50, EHEDG, 3A, AISI 316L
	TF	Tri-Clamp, ISO 2852 DN 70 – DN 76.1 (3"), EHEDG, 3A, AISI 316L
		Pipe diaphragm seal Clamp
	SB	Tri-Clamp, ISO 2852 DN 25 (1"), 3A, AISI 316L
	SC	Tri-Clamp, ISO 2852 DN 38 (1 1/2"), 3A, AISI 316L, 3.1 + P ressure test acc. to PED Cat. II
	SD	Tri-Clamp, ISO 2852 DN 51 (2"), 3A, AISI 316L, 3.1 + Pressure test acc. to PED Cat. II
		Hygienic connections
	TR	Varivent model N for pipes DN 40 – DN 162, PN 40, EHEDG, 3A, AISI 316L
	TK	DRD DN50 (65 mm), PN 25, 3A, AISI 316L
	WH	Sanitary tank spud, 3A, AISI 316L, extended diaphragm seal 2"
	MR	DIN 11851 DN 50 PN 25, EHEDG, 3A, AISI 316L
	MS	DIN 11851 DN 65 PN 25, EHEDG, 3A, AISI 316L
	MT	DIN 11851 DN 80 PN 25, EHEDG, 3A, AISI 316L
	M3	DIN 11851 DN 50 PN 25 socket, EHEDG, 3A, AISI 316L
	M4	DIN 11851 DN 65 PN 25 socket, EHEDG, 3A, AISI 316L
	M5	DIN 11851 DN 80 PN 25 socket, EHEDG, 3A, AISI 316L
		EN/DIN flanges
	B3	DN 50 PN 10-40 B1, AISI 316L
	B5	DN 80 PN 10-40 B1, AISI 316L
	BT	DN 100 PN 10-16 B1, AISI 316L
	B6	DN 100 PN 25-40 B1, AISI 316L
		ANSI flanges
	AF	2" 150 lbs RF, AISI 316/316L (CRN)
	AR	2" 300 lbs RF, AISI 316/316L (CRN)
	AG	3" 150 lbs RF, AISI 316/16L (CRN)
	AS	3" 300 lbs RF, AISI 316/316L (CRN)
	J4	3" 150 lbs RF, AISI 316/316L, extended diaphragm seal: 2"/4"/6"/8" (CRN), extended diaphragm seal: see additional specification
	AH	4" 150 lbs RF, AISI 316/316L (CRN)
	AT	4" 300 lbs RF, AISI 316/316L (CRN)
	J5	4" 150 lbs RF, AISI 316/316L, extended diaphragm seal: 2"/4"/6"/8" (CRN), extended diaphragm seal: see additional specification

80	**Process connection, Material:**	
	JIS flanges	
	KF	10K 50A RF, AISI 316L
	KL	10K 80A RF, AISI 316L
	KH	10K 100A RF, AISI 316L

90	**Capillary, Fill fluid:**	
	1	...m capillary, silicone oil
	2	...m capillary, vegetable oil
	3	...m capillary, high temperature oil
	4	...m capillary, oil for oxygen service
	5	...m capillary, low temperature oil
	A	...ft capillary, silicone oil
	B	...ft capillary, vegetable oil
	C	...ft capillary, high temperature oil
	D	...ft capillary, oil for oxygen service
	E	...ft capillary, low temperature oil

100	**Additional options 1:**	
	A	Additional options 1 not selected
	B	Material test certificate for wetted components, inspection certificate as per EN 10204 acc. to specification 52005759
	C	NACE MR0175 material
	D	Material test certificate for wetted components as per EN 10204 3.1 and NACE MR0175 material, inspection certificate as per EN 10204 acc. to specification 52010806
	M	Overvoltage protection
	N	HistoROM module
	S	GL/ABS marine certificate
	U	Mounting bracket, wall/pipe, 304
	2	Test report acc. to EN 10204 2.2
	3	Routine test with certificate, inspection certificate as per EN 10204 3.1
	4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1

110	**Additional options 2:**	
	A	Additional options 2 not selected
	E	SIL/IEC61508 Declaration of conformity
	G	Remote housing, cable length see additional spec. + mounting bracket, wall/pipe, 316L (FM/CSA IS: only for Div.1 Installation)
	M	Overvoltage protection
	N	HistoROM module
	R	4x srew UNF7/16, length 1-1/2"
	S	GL/ABS marine certificate
	U	Mounting bracket for wall and pipe, AISI 304
	2	Test report acc. to EN 10204 2.2
	3	Routine test with certificate, inspection certificate as per EN 10204 3.1
	4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1

FMD78	order code

Additional documentation

Innovation

- Cerabar S/Deltabar S/Deltapilot S,
  For process pressure, differential pressure, flow and level measurement: IN010P/00/en

Field of Activities

- Pressure measurement: Powerful instruments for process pressure, differential pressure, level and flow: FA004P/00/en

Technical Information

- Cerabar S: TI383P/24/ae
- Deltapilot S: TI416P/24/ae
- Deltatop:
  – orifice plate (TI422P/00/en)
  – pitot tube (TI425P/00/en)
- EMC test basic principles: TI241F/00/en

Operating Instructions

4 to 20 mA HART:
- Deltabar S: BA270P/00/en
- Description of device functions Cerabar S/Deltabar S/Deltapilot S: BA274P/00/en

PROFIBUS PA:
- Deltabar S: BA294P/00/en
- Description of device functions Cerabar S/Deltabar S/Deltapilot S: BA296P/00/en

FOUNDATION Fieldbus:
- Deltabar S: BA301P/00/en
- Description of device functions Cerabar S/Deltabar S: BA303P/00/en

Brief operating instructions

- 4 to 20 mA HART, Deltabar S: KA1018P/00/en
- PROFIBUS PA, Deltabar S: KA1021P/00/en
- FOUNDATION Fieldbus, Deltabar S: KA1024P/00/en

Manual for Functional Safety (SIL)

- Deltabar S (4 to 20 mA): SD189P/00/en

Safety Instructions

Certificate/Type of Protection	Device	Electronic insert	Documentation
ATEX II 1/2 G EEx ia IIC T6	PMD70, PMD75, FMD76, FMD77, FMD78	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA235P
ATEX II 1/2 D	PMD70, PMD75, FMD77, FMD78	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– XA237P – XA280P
ATEX II 1/2 D EEx ia IIC T6	FMD76	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– XA238P – XA281P
ATEX II 1/3 D	PMD70, PMD75, FMD77, FMD78	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– XA239P – XA282P
ATEX II 2 G EEx d IIC T6	PMD70, PMD75, FMD77, FMD78	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA240P
ATEX II 3 G EEx nA II T6	PMD70, PMD75, FMD76, FMD77, FMD78	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA241P
ATEX II 1/2 GD EEx ia IIC T6	PMD70, PMD75, FMD76, FMD77, FMD78	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA243P
ATEX II 1 GD EEx ia IIC T6	PMD70, PMD75, FMD76, FMD77, FMD78	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA275P

Certificate/Type of Protection	Device	Electronic insert	Documentation
ATEX II 1/2 G EEx ia IIC T6 + ATEX II 2 G EEx d IIC T6	PMD75, FMD77, FMD78	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA242P
ATEX II 1/2 G Ex ia IIC T6+ ATEX II 2 G EEx d IIC T6+ FM/CSA IS+XP Cl.I Div.1 Gp. A/B-D	PMD75, FMD77, FMD78	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– in preparation

Certificate/Type of Protection	Device	Electronic insert	Documentation
IECEx Zone 0/1 Ex ia IIC T6	PMD70, PMD75, FMD76, FMD77, FMD78	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XB004P

Certificate/Type of Protection	Device	Electronic insert	Documentation
NEPSI Ex ia IIC T6	PMD70, PMD75, FMD76, FMD77, FMD78	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XC004P
NEPSI Ex d IIC T6	PMD75, FMD77, FMD78	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XC006P

Installation/Control Drawings

Certificate/Type of Protection	Device	Electronic insert	Documentation
FM IS Class I, II, III, Division 1, Groups A – G; NI, Class I Division 2, Groups A – D; AEx ia	PMD70, PMD75, FMD76, FMD77, FMD78	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD141P – ZD188P
CSA IS Class I, II, III, Division 1, Groups A – G; Class I Division 2, Groups A – G	PMD70, PMD75, FMD76, FMD77, FMD78	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD142P – ZD189P
FM IS + XP Class I, Division 1, Groups A – D	PMD75, FMD77, FMD78	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD186P – ZD190P
CSA IS + XP Class I, Division 1, Groups A – D	PMD75, FMD77, FMD78	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD153P – ZD191P
FM/CSA IS + XP Class I, Division 1, Groups A – D	PMD75, FMD77, FMD78	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD153P + ZD186P – ZD190P + ZD191P
ATEX II EEx ia / EEx d + FM/CSA IS + XP ATEX II 1/2G EEx ia IIC T6+ ATEX II 2G EEx d IIC T6+ FM/CSA IS + XP Cl.I Div.1 Gr.A-D	PMD75, FMD77, FMD78	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– in preparation

Overspill protection

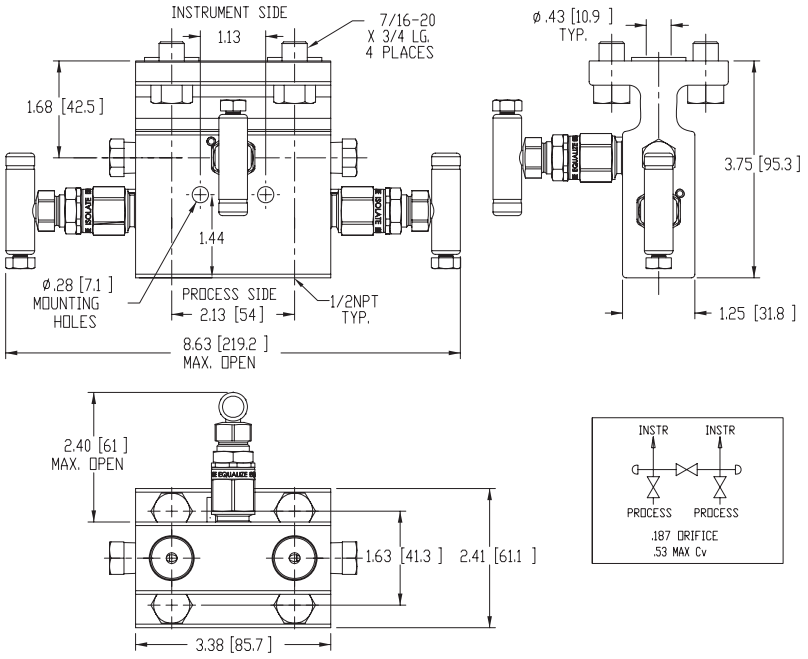
- WHG: ZE260P/00/de

Accessories

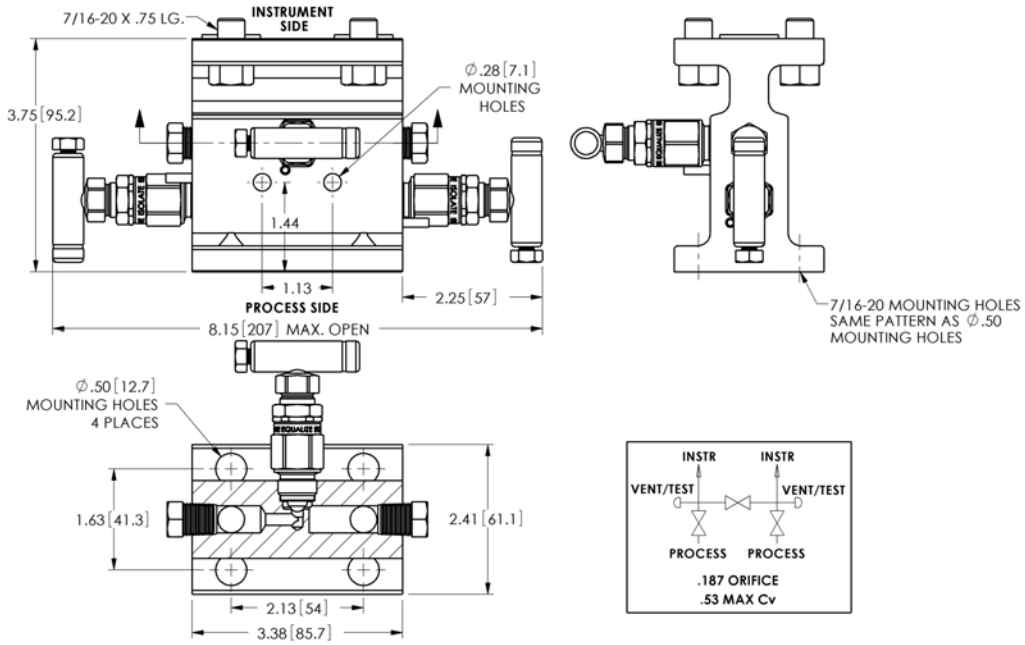
Manifold valves

Part No.	Type	Description	MWP
		3-Valve Manifolds	
71037612	316 SS 3-Valve Manifold with Teflon packing	3-Valve Manifold, hard seat configuration Direct Mount Inlet: 1/2" FNPT, Outlet:Flanged/Flanged Body: 316 Stainless, 3.1 Mat. Cert. Included Stem/tip: 316SS/Carbide Ball w/ Nickel Chrome Binder Seat Material: Integral, Packing: **PTFE** with 7/16" UNF, 3/4" 316SS bolts	6,000 psi at 200 F 4,000 psi at 450 F Max
71037613	316 SS 3-Valve Manifold with Grafoil packing	3-Valve Manifold, hard seat configuration Direct Mount Inlet: 1/2" FNPT, Outlet:Flanged/Flanged Body: 316 Stainless, 3.1 Mat. Cert. Included Stem/tip: 316SS/Carbide Ball w/ Nickel Chrome Binder Seat Material: Integral, Packing: **grafoil** with 7/16" UNF, 3/4" 316SS bolts	6,000 psi at 200 F 1,500 psi at 1,000 F Max
71037614	316 SS 3-Valve Manifold Double Flanged with Teflon packing	3-Valve Manifold, hard seat configuration Direct Mount, Double Flanged Inlet: F;anged/Flanged, Outlet:Flanged/Flanged Body: 316 Stainless, 3.1 Mat. Cert. Included Stem/tip: 316SS/Carbide Ball w/ Nickel Chrome Binder Seat Material: Integral, Packing: **PTFE** with 7/16" UNF, 3/4" 316SS bolts	6,000 psi at 200 F 1,500 psi at 1,000 F Max
		5-Valve Manifolds	
71037616	316 SS 5-Valve Manifold Gas Metering with Teflon packing	5-Valve Manifold, soft seat configuration Gas Metering Direct Mount Inlet: 1/2" FNPT, Outlet:Flanged/Flanged Body: 316 Stainless, 3.1 Mat. Cert. Included Stem/tip: 316/316SS NRT Seat Material: Delrin, Packing: **PTFE** with 7/16" UNF, 1" 316SS bolts	6,000 psi at 200 F Max
71037617	316 SS 5-Valve Manifold with Grafoil packing	5-Valve Manifold, hard seat configuration Standard Direct Mount Inlet: 1/2" FNPT, Outlet:Flanged/Flanged Body: 316 Stainless, 3.1 Mat. Cert. Included Stem/tip: 316SS/Carbide Ball w/ Nickel Chrome Binder Seat Material: Integral, Packing: **grafoil** with 7/16" UNF, 1" 316SS bolts	6,000 psi at 200 F 1,500 psi at 1,000 F Max
		Accessories & Spare Parts	
71037615	316 SS Mounting Bracket for manifold	Mounting Bracket (SS) for 3-Valve Manifold or 5-Valve Manifold	
71037618	Teflon Flange Seal	1 PTFE flange seal for 3-valve and 5-valve manifolds	
71037619	Grafoil Flange Seal	1 grafoil flange seal for 3-valve and 5-valve manifolds	
		Assembly to Transmitter	
71038037	Manifold Assembly	Assemble 3-Valve or 5-Valve Manifold to transmitter	

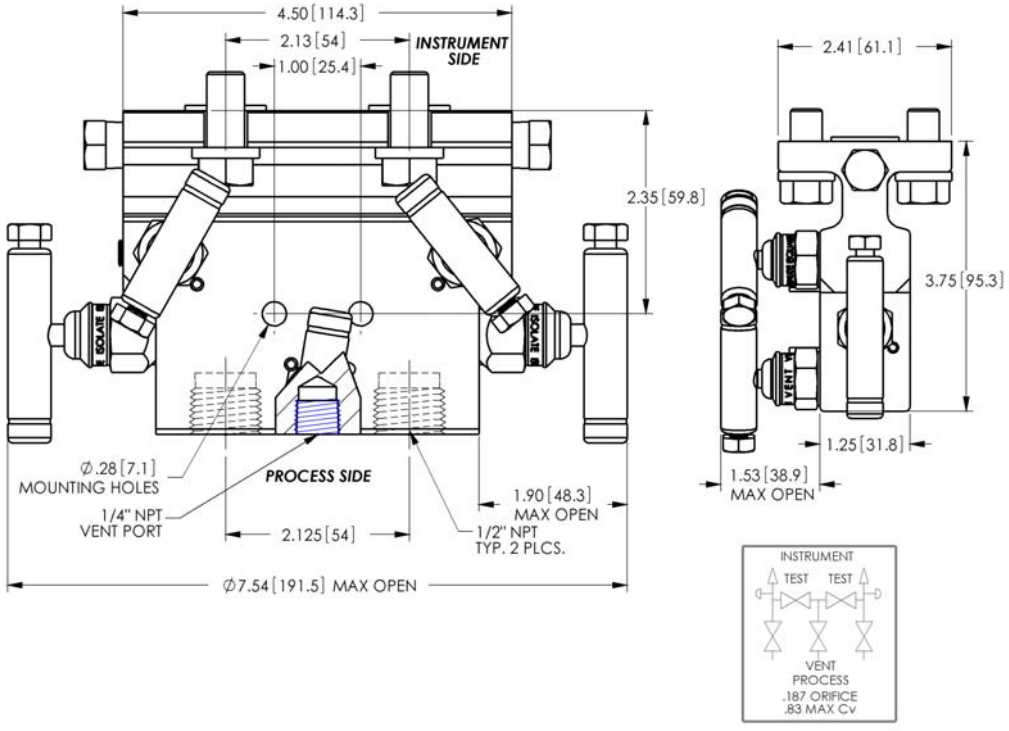




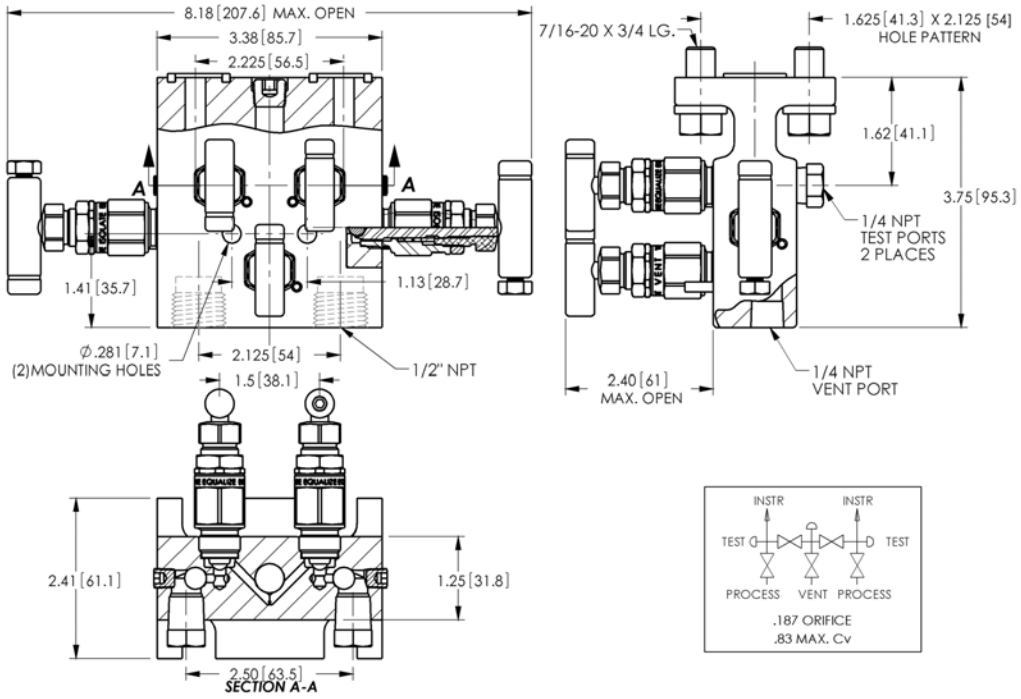
Three valve manifold, single flange:
71037612
71037613



Three valve manifold, double flange:
71037614



Five valve manifold, gas metering:
71037616



Five valve manifold
71037617

Futbol
Offset center mounting block, 1/2" FNPT adapter, 316 SS with PTFE seal (2 required per transmitter) with Teflon washers and 7/16" UNF mounting bolts.
Part No. PZO-RA112

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