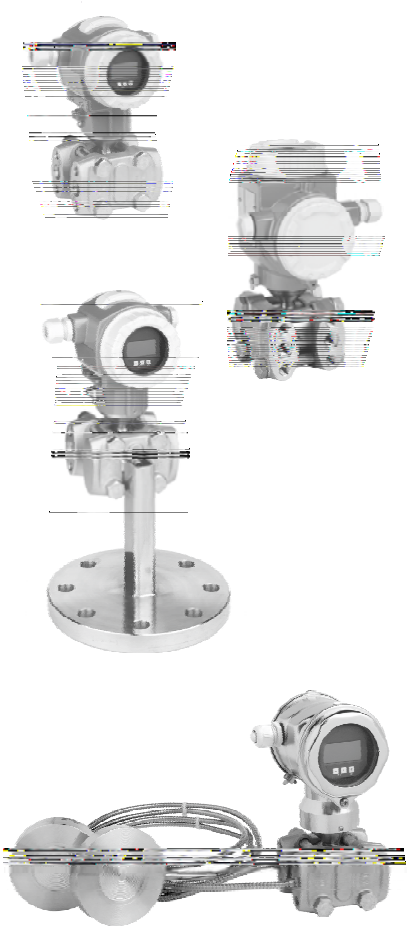
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No. 71260317

Technical Information
Deltabar S PMD75, FMD77, FMD78

Differential pressure measurement



Differential pressure transmitter with metal sensors

Application

The device is used for the following measuring tasks:
- Flow measurement (volume or mass flow) in conjunction with primary devices in gases, vapors and liquids
- Level, volume or mass measurement in liquids
- Differential pressure monitoring, e.g. of filters and pumps
- High process temperatures of up to 400 °C (752 °F) possible with diaphragm seal

Your benefits

- Very good reproducibility and long-term stability
- High reference accuracy down to 0.035%
- Turn down up to 100:1, higher on request
- Used for flow and differential pressure monitoring up to SIL 3, certified to IEC 61508 by TÜV SÜD
- High level of safety during operation thanks to function monitoring from the measuring cell to the electronics
- The patented TempC membrane for the diaphragm seal reduces measured errors caused by environmental and process temperature influences to a minimum
- Simple electronics exchange guaranteed with HistoROM®/M-DAT
- Standardized platform for differential pressure, hydrostatics, and pressure (Deltabar S – Deltapilot S – Cerabar S)
- Simple, fast commissioning through a user interface designed for real-world applications
- Extensive diagnostic functions

Endress+Hauser
People for Process Automation

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Document information

Symbols used

Warning symbols

Symbol	Meaning
 A0011189-EN	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 A0011190-EN	**WARNUNG!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 A0011191-EN	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or moderate injury.
 A0011192-EN	**NOTE!** This symbol contains information on procedures and other facts which do not result in personal injury.

Electrical symbols

Symbol	Meaning
A0018335	**Direct current** A terminal to which DC voltage is applied or through which direct current flows.
A0018336	**Alternating current** A terminal to which alternating voltage is applied or through which alternating current flows.
 A0018337	**Direct current and alternating current** ▪ A terminal to which alternating voltage or DC voltage is applied. ▪ A terminal through which alternating current or direct current flows.
 A0018338	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
 A0018339	**Protective ground connection** A terminal that must be connected to ground prior to establishing any other conections.
 A0011201	**Equipotential connection** A connection that must be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

Tool symbols

Symbol	Meaning
 A0011219	Phillips head screwdriver
 A0011220	Flat blade screwdriver
 A0013442	Torx screwdriver
 A0011222	Hexagon wrench
 A0011221	Allen key

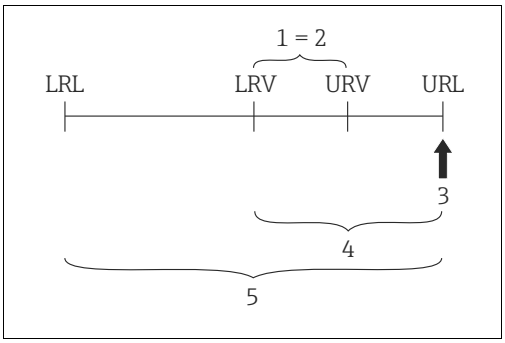
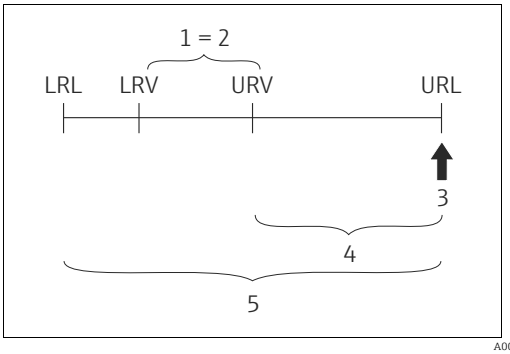
Symbols for certain types of information

Symbol	Meaning
 A0011182	**Allowed** Indicates procedures, processes or actions that are allowed.
 A0011183	**Preferred** Indicates procedures, processes or actions that are preferred.
 A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
 A0011193	**Tip** Indicates additional information.
 A0015483	**Reference to documentation** Refers to the corresponding device documentation.
 A0015484	**Reference to page** Refers to the corresponding page number.
 A0015486	**Reference to diagrams** Refers to the corresponding graphic number and page number.
1. , 2. , ...	Series of steps
 A0015488	**Help in the event of a problem**

Symbols in graphics

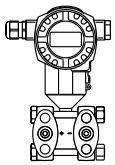
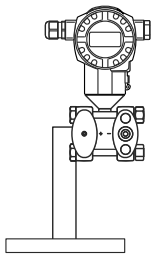
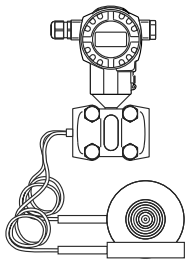
Symbol	Meaning
1, 2, 3, 4, ...	Numbering for main positions
1. , 2. , ...	Series of steps
A, **B**, **C**, **D**, ...	Views
A-A, **B-B**, ...	Sections
 A0011187	**Hazardous area** Indicates a hazardous area.
 A0011188	Safe area (non-hazardous area) Indicates a non-hazardous area.

Terms and abbreviations

Term/abbreviation	Explanation
MWP	The MWP (maximum working pressure; MWP = PN) depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection must be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "→ 35" section.
OPL	The OPL (over pressure limit) depends on the lowest-rated element, with regard to pressure, of the selected components i.e. the process connection must be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "→ 35" section.
LRL	Lower range limit
URL	Upper range limit
LRV	Lower range value
URV	Upper range value
TD	**Turn down**
Case 1: ▪ |Lower range value (LRV)| ≤ |Upper range value (URV)| *Example:* ▪ Lower range value (LRV) = 0 mbar ▪ Upper range value (URV) = 100 mbar (1.5 psi) ▪ Nominal value (URL) = 500 mbar (7.5 psi) *Turn down:* ▪ TD = URL / |URV| = 5:1 *Set span:* ▪ URV − LRV = 100 mbar (1.5 psi) This span is based on the zero point.	 *Example: 500 mbar (7.5 psi) measuring cell*
Case 2: ▪ |Lower range value (LRV)| ≥ |Upper range value (URV)| *Example:* ▪ Lower range value (LRV) = −300 mbar (4.5 psi) ▪ Upper range value (URV) = 0 bar ▪ Nominal value (URL) = 500 mbar (7.5 psi) *Turn down:* ▪ TD = URL / |(LRV)| = 1.67:1 *Set span:* ▪ URV − LRV = 300 mbar (4.5 psi) This span is based on the zero point.	 *Example: 500 mbar (7.5 psi) measuring cell* *1 Set span* *2 Zero-based span* *3 Nominal value i upper range limit (URL)* *4 Nominal measuring range* *5 Sensor measuring range*

Function and system design

Device selection

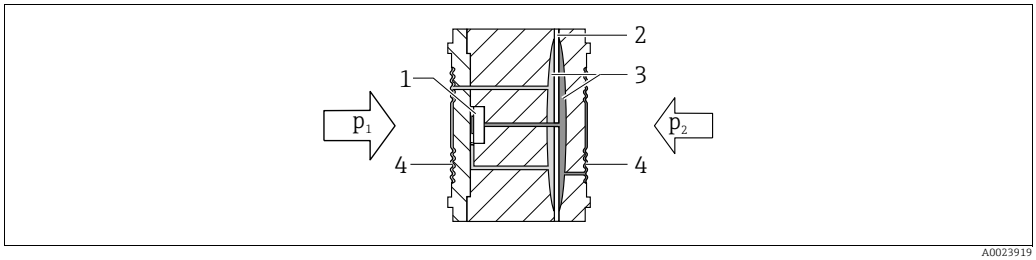
Deltabar S – product family	PMD75	FMD77	FMD78
	 A0023922	 A0023923 **with diaphragm seal installed on one side**	 A0023924 **with capillary diaphragm seals**
Field of application	– Flow – Level – Differential pressure	– Level	– Level – Differential pressure
Process connections	– 1/4 – 18 NPT – RC 1/4	Low-pressure side (–): – 1/4 – 18 NPT – RC 1/4 High-pressure side (+): – DN 50 – DN 100 – ASME 2" – 4" – JIS 80A – 100A	– Wide range of diaphragm seals
Measuring ranges	From –10 to +10 mbar (-0.15 to +0.15 psi) to –40 to +40 bar (-600 to +600 psi)	From –100 to +100 mbar (-1.5 to +1.5 psi) to –16 bar to +16 bar (-240 to +240 psi)	From –100 to +100 mbar (-1.5 to +1.5 psi) to –40 to +40 bar (-600 to +600 psi)
OPL	On one side: up to 420 bar (6300 psi) On both sides: up to 630 bar (9450 psi)	On one side: up to 160 bar (2400 psi) On both sides: up to 240 bar (3600 psi)	On one side: up to 160 bar (2400 psi) On both sides: up to 240 bar (3600 psi)
Process temperature range (temperature at process connection)	–40 to +85 °C (–40 to +185 °F)	Up to +400 °C (752 °F) (depending on the filling oil)	Up to +400 °C (752 °F) (depending on the filling oil)
Ambient temperature range	–40 to +85 °C (-40 to +185 °F)[1]	–40 to +85 °C (-40 to +185 °F) [2]	–40 to +85 °C (-40 to +185 °F) [2]
Ambient temperature range, separate housing	-20 to +60 °C (-4 to +122 °F)		
Reference accuracy	– up to ±0.05 % of the set span	– Up to ±0.075 % of the set span	
Supply voltage	– Version for non-hazardous areas: – 4...20 mA HART: 10.5 to 45 V DC – PROFIBUS PA and FOUNDATION Fieldbus: 9 to 32 V DC – Ex ia: 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 (10500 psi) – Gold-rhodium-coated process isolating diaphragm, NACE-compliant materials – Separate housing		
Specialties (options)	– p_{stat} to 420 bar (6300 psi) – Process isolating diaphragm: tantalum – Available with Deltatop as flow compact device	– For high media temperatures	– Wide range of diaphragm seals
	– HistoROM®/M-DAT memory module		

1) Lower temperatures on request

Measuring principle

Metal process isolating diaphragm

The process isolating diaphragms are deflected on both sides by the acting pressures. A filling oil transfers the pressure to a resistance bridge (semiconductor technology). The change in the bridge output voltage, which depends on the differential pressure, is measured and processed further.



A0023919

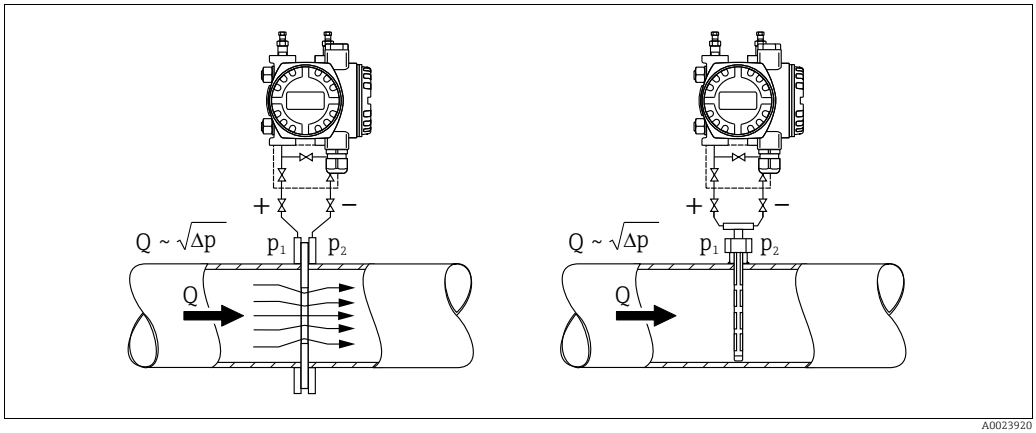
Metal sensor

1 Sensing element
2 Middle diaphragm
3 Filling oil
4 Process isolating diaphragm

Advantages:
- Standard system pressures: 160 bar (2400 psi) and 420 bar (6300 psi)
- High long-term stability
- Very high single-sided overload resistance

Flow measurement

Design and operation mode



A0023920

Flow measurement with Deltabar S and primary device, left: orifice plate and right: Pitot tube

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

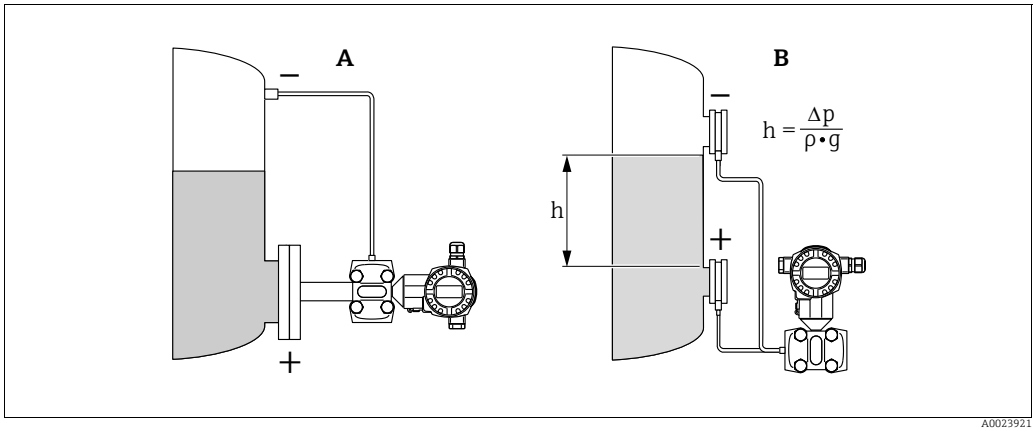
Your benefits

- Choice of four flow modes of operation: volume flow, corrected volume flow (European norm conditions), standard volume flow (American standard conditions) and mass flow.
- Choice of diverse flow units with automatic unit conversion.
- A customized 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 Deltatop product family, Endress+Hauser is offering universal and reliable solutions for flow measurement:
  – Deltatop, the compact, ready-to-use flow measuring unit including the Deltabar S differential pressure transmitter

For more information about flow measurement with the Deltabar S differential pressure transmitter
- Deltabar S with orifice plate (TI00422P, Deltatop DO6x)
- Deltabar S with Pitot tube (TI00425P, Deltatop DP6x)

Level measurement (level, volume and mass)

Design and operation mode



A0023921

Level measurement with Deltabar S

A Level measurement with FMD77
B Level measurement with FMD78
h Height (level)
Δp Differential pressure
ρ Density of the media
g Gravitation constant

Your benefits

- Choice of three level operating modes.
- Volume and mass measurements in any vessel shapes by means of a freely programmable characteristic curve.
- Choice of diverse level units with automatic unit conversion.
- A customized unit can be specified.
- Has a wide range of uses, e.g.
  - for level measurement in vessels with pressure overlay
  - in the event of foam formation
  - in vessels 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 of the FISCO model.
  - Due to the low current consumption of 13 mA ± 1 mA, the following number of devices can be operated on one bus segment if installing as per FISCO:
    - up to 7 Deltabar S for Ex ia, CSA IS and FM IS applications
    - up to 27 Deltabar S for all other applications, e.g. in non-hazardous areas, Ex nA, etc.

  Further information on PROFIBUS PA can be found in Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and in the PNO Guideline.
- FOUNDATION Fieldbus
  - The Endress+Hauser devices meet the requirements of the FISCO model.
  - Due to the low current consumption of 15.5 mA ± 1 mA, the following number of devices can be operated on one bus segment if installing as per FISCO:
    - up to 6 Deltabar S for Ex ia, CSA IS and FM IS applications
    - up to 24 Deltabar S for all other applications, e.g. in non-hazardous areas, Ex nA, etc.

  Further information on FOUNDATION Fieldbus, such as requirements for bus system components can be found in Operating Instructions BA00013S "FOUNDATION Fieldbus Overview".

Input

Measured variable

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

Measuring range

FMD77, FMD78, PMD75: Option PN 160 / 16 MPa / 2400 psi

Nominal value	Range limit		Smallest calibratable span [1]	MWP	OPL		Min. operating pressure [2]	Option [3]
	lower (LRL)	upper (URL)			on one side	on both sides		PN 160 [4]
[mbar (psi)]	[mbar (psi)]	[mbar (psi)]	[mbar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[$mbar_{abs}$ (psi_{abs})]	
10 (0.15) (PMD75 only)	−10 (-0.15)	+10 (+0.15)	0.25 (0.00375)	160 (2400)	160 (2400)	240 (3600)	0.1 (0.0015)	7B
30 (0.45) (PMD75 only)	−30 (-0.45)	+30 (+0.45)	0.3 (0.0045)					7C
100 (1.5)	−100 (-1.5)	+100 (+1.5)	1/5 (0.015/0.075) [5]	160 (2400) [6]	160 (2400)	240 (3600)		7D
500 (7.5)	−500 (-7.5)	+500 (+7.5)	5 (0.075)					7F
3000 (45)	−3000 (-45)	+3000 (+45)	30 (0.45)					7H
16000 (240)	−16000 (-240)	+16000 (+240)	160 (2.4)					7L
40000 (600)	−40000 (-600)	+40000 (+600)	400 (6)		"+" side [7]: 160 (2400)			7M

PMD75: Option PN 420 / 42 MPa / 6300 psi

Nominal value	Range limit		Smallest calibratable span [1]	MWP	OPL		Min. operating pressure [2]	Option [3]
	lower (LRL)	upper (URL)			on one side	on both sides		PN 420 [4]
[mbar (psi)]	[mbar (psi)]	[mbar (psi)]	[mbar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[$mbar_{abs}$ (psi_{abs})]	
100 (1.5)	−100 (-1.5)	+100 (+1.5)	1/5 (0.015/0.075) [5]	420 (6300) [6]	420 (6300)	630 (9450)	0.1 (0.0015)	8D
500 (7.5)	−500 (-7.5)	+500 (+7.5)	5 (0.075)					8F
3000 (45)	−3000 (-45)	+3000 (+45)	30 (0.45)					8H
16000 (240)	−16000 (-240)	+16000 (+240)	160 (2.4)					8L
40000 (600)	−40000 (-600)	+40000 (+600)	400 (6)		"+" side [7]: 420 (6300)			8M

1) Turn down > 100:1 on request

2) 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: up to 10 $mbar_{abs}$ (0.15 psi_{abs}).
FMD77 and FMD78: Min. operating pressure: 50 $mbar_{abs}$ (0.75 psi_{abs}); observe also the pressure and temperature application limits of the selected filling oil on → 73. For vacuum applications, please observe the installation instructions on → 75 ff.

3) Product Configurator, order code for "Nominal range; PN"

4) Screws → 60 ff.

5) 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 (0.075 psi)

6) For PMD75 devices with CRN-approved process connection, the MWP when using O-rings is 315 bar (4725 psi) and when using PTFE and CU seals is 120 bar (1800 psi)

7) "–" side: 100 bar (1500 psi)

Output

Output signal

- 4 to 20 mA with superimposed digital communication protocol HART, 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

Output	Operation (→ 66 ff)		
	External + LCD	Internal + LCD	Internal
	Option [1]		
4 to 20mA HART	A	B	C
4 to 20mA HART, Li=0	D	E	F
PROFIBUS PA	M	N	O
FOUNDATION Fieldbus	P	Q	R

1) Product Configurator, order code for "Output; Operation"

Signal range – 4 to 20 mA HART

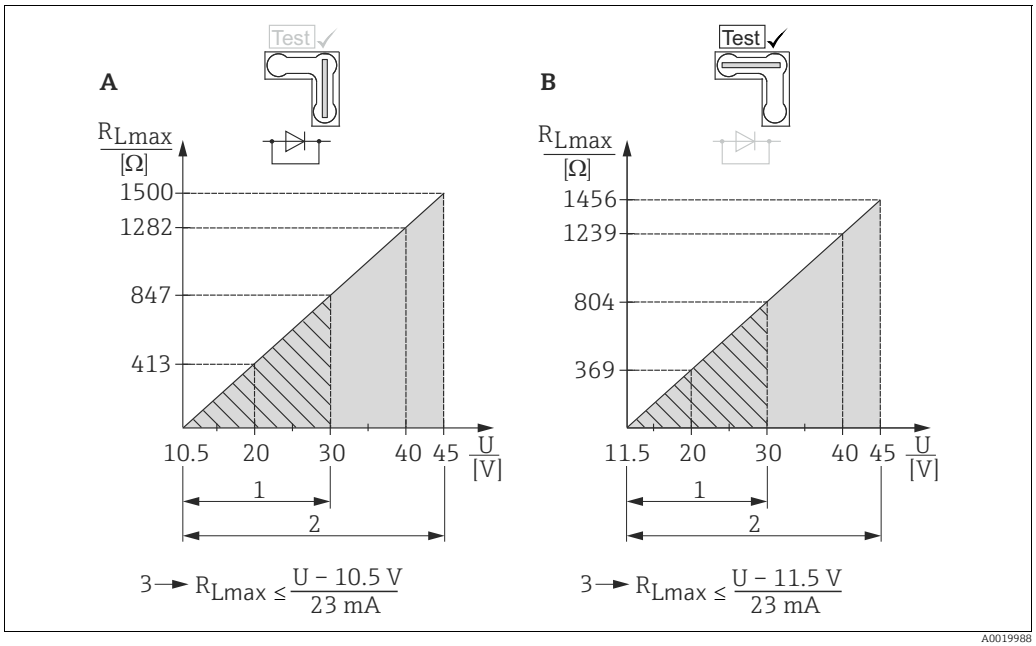
3.8 mA to 20.5 mA

Signal on alarm

As per NAMUR NE 43

- 4 to 20 mA HART
  Options:
  - Max. alarm: can be set from 21 to 23 mA (Factory setting: 22 mA)
  - Hold measured value: last measured value is held
  - Min. alarm: 3.6 mA
- PROFIBUS PA: can be set in the Analog Input block,
  Options: Last Valid Out Value (factory setting), Fail Safe Value, 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



A0019988

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

A Jumper for 4 to 20 mA test signal set to "Non-test" position

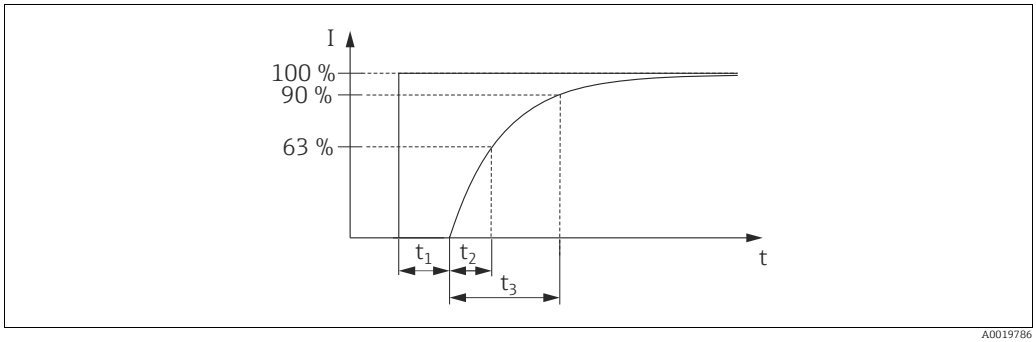
B Jumper for 4 to 20 mA test signal set to "Test" position
1 Power supply 10.5 (11.5) to 30 V DC for 1/2 G Ex ia, 1 GD Ex ia, 1/2 GD Ex ia, FM IS, CSA IS, IECEx ia, NEPSI Ex ia
2 Power supply 10.5 (11.5) to 45 V DC for devices for non-hazardous areas, 1/2 D, 1/3 D, 2 G Ex d, 3 G Ex nA, FM XP, FM DIP, FM NI, CSA XP, CSA dust ignition proof, NEPSI Ex d
3 R_{Lmax} = maximum load resistance
U Supply voltage

When operating via a handheld terminal or via a 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 (factory setting: presentation of the maximum accuracy of the transmitter)

Dead time, time constant



Presentation of the dead time and the time constant

Dynamic behavior: current output

Type		Measuring cell	Dead time (t_1) [ms]	Time constant T63 (t_2) [ms]	Time constant T90 (t_3) [ms]
PMD75	Max.	▪ 10 mbar (0.15 psi) and 30 mbar (0.45 psi) ▪ 100 mbar (1.5 psi) ▪ 500 mbar (7.5 psi) ▪ 3 bar (45 psi) ▪ 16 bar (240 psi)	45	▪ 450 ▪ 60 ▪ 45 ▪ 40 ▪ 60	▪ 1040 ▪ 138 ▪ 104 ▪ 92 ▪ 138
FMD77, FMD78	Max.	Dependent on the diaphragm seal			

Dynamic behavior: digital output (HART electronics)

A typical burst rate of 300 ms results in the following behavior:

Type		Measuring cell	Dead time (t_1) [ms]	Dead time (t1) + Time constant T63 (=t_2) [ms]	Dead time (t1) + Time constant T90 (=t_3) [ms]
PMD75	Min.	▪ 10 mbar (0.15 psi) and 30 mbar (0.45 psi) ▪ 100 mbar (1.5 psi) ▪ 500 mbar (7.5 psi) ▪ 3 bar (45 psi) ▪ 16 bar (240 psi)	205	▪ 655 ▪ 265 ▪ 250 ▪ 245 ▪ 265	▪ 1200 ▪ 298 ▪ 264 ▪ 252 ▪ 298
	Max.	▪ 10 mbar (0.15 psi) and 30 mbar (0.45 psi) ▪ 100 mbar (1.5 psi) ▪ 500 mbar (7.5 psi) ▪ 3 bar (45 psi) ▪ 16 bar (240 psi)	1005	▪ 1455 ▪ 1065 ▪ 1050 ▪ 1045 ▪ 1065	▪ 2000 ▪ 1098 ▪ 1064 ▪ 1052 ▪ 1098
FMD77, FMD78	Max.	Dependent on the diaphragm seal			

Reading cycle

- Acyclic: max. 3/s, typical 1/s (depends on command # and number of preambles)
- Cyclic (Burst): max. 3/s, typical 2/s

The Device commands the BURST MODE function for cyclic value transmission via the HART communication protocol.

Cycle time (update time)

Cyclic (Burst): min. 300 ms

Response time

- Acyclic: min. 330 ms, typical 590 ms (depends on command # and number of preambles)
- Cyclic (Burst): min. 160 ms, typical 350 ms (depends on command # and number of preambles)

Dynamic behavior: PROFIBUS PA

A typical PLC cycle time of 1 s results in the following behavior:

Type		Measuring cell	Dead time (t_1) [ms]	Dead time (t1) + Time constant T63 (=t_2) [ms]	Dead time (t1) + Time constant T90 (=t_3) [ms]
PMD75	Min.	▪ 10 mbar (0.15 psi) and 30 mbar (0.45 psi) ▪ 100 mbar (1.5 psi) ▪ 500 mbar (7.5 psi) ▪ 3 bar (45 psi) ▪ 16 bar (240 psi)	80	▪ 530 ▪ 140 ▪ 125 ▪ 120 ▪ 140	▪ 1075 ▪ 173 ▪ 139 ▪ 127 ▪ 173
	Max.	▪ 10 mbar (0.15 psi) and 30 mbar (0.45 psi) ▪ 100 mbar (1.5 psi) ▪ 500 mbar (7.5 psi) ▪ 3 bar (45 psi) ▪ 16 bar (240 psi)	1280	▪ 1730 ▪ 1340 ▪ 1325 ▪ 1320 ▪ 1340	▪ 2275 ▪ 1373 ▪ 1339 ▪ 1327 ▪ 1373
FMD77, FMD78	Max.	Dependent on the diaphragm seal			

Reading cycle (PLC)

- Cyclic: max. 30/s (dependent on the number and type of function blocks used in a closed-control loop)
- Acyclic: typical 25/s

Cycle time (update time)

min. 200 ms
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. A new value can be determined up to 5 times per second.

Response time

- Cyclic: approx. 10 to 13 ms (depends on Min. Slave Interval)
- Acyclic: approx. 60 to 70 ms (depends on Min. Slave Interval)

Dynamic behavior: FOUNDATION Fieldbus

A typical configuration for the macro cycle time (host system) of 1 s results in the following behavior:

Type		Measuring cell	Dead time (t_1) [ms]	Dead time (t1) + Time constant T63 (=t_2) [ms]	Dead time (t1) + Time constant T90 (=t_3) [ms]
PMD75	Min.	▪ 10 mbar (0.15 psi) and 30 mbar (0.45 psi) ▪ 100 mbar (1.5 psi) ▪ 500 mbar (7.5 psi) ▪ 3 bar (45 psi) ▪ 16 bar (240 psi)	90	▪ 540 ▪ 150 ▪ 135 ▪ 130 ▪ 150	▪ 1085 ▪ 183 ▪ 149 ▪ 137 ▪ 183
	Max.	▪ 10 mbar (0.15 psi) and 30 mbar (0.45 psi) ▪ 100 mbar (1.5 psi) ▪ 500 mbar (7.5 psi) ▪ 3 bar (45 psi) ▪ 16 bar (240 psi)	1090	▪ 1540 ▪ 1150 ▪ 1135 ▪ 1130 ▪ 1150	▪ 2085 ▪ 1183 ▪ 1149 ▪ 1137 ▪ 1183
FMD77, FMD78	Max.	Dependent on the diaphragm seal			

Reading cycle

- Cyclic: max. 10/s (dependent on the number and type of function blocks used in a closed-control loop)
- Acyclic: typical 10/s

Cycle time (update time)

Cyclic: min. 100 ms

Response time

- Cyclic: max. 20 ms (for standard bus parameter settings)
- Acyclic: typical 100 ms (for standard bus parameter settings)

Damping

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

- Via onsite 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

Alarm current

Description	Option [1]
Min alarm current	J
HART burst mode PV	
Min alarm current + HART burst mode PV	

1) Product Configurator, order code for "Additional options 1" and "Additional options 2"

Firmware version

Description	Option [1]
02.20.zz, HART, DevRev22	72
02.11.zz, HART, DevRev21	73
04.00.zz, FF, DevRev07	74
04.01.zz, PROFIBUS PA, DevRev03	75
02.10.zz, HART, DevRev21	76
03.00.zz, FF, DevRev06	77
04.00.zz, PROFIBUS PA	78

1) Product Configurator, order code for "Firmware version"

Protocol-specific data

HART

Manufacturer ID	17 (11 hex)
Device Type Code	23 (17 hex)
Device Revision	▪ 21 (15 hex) - SW version 02.1y.zz - HART specification 5 ▪ 22 (16 hex) - SW version 02.2y.zz - HART specification 7
HART specification	▪ 5 ▪ 7
DD Revision	▪ 4 (Russian in language selection) for device revision 21 ▪ 3 (Dutch in language selection) for device revision 21 ▪ 1 for device revision 22
Device description files (DTM, DD)	Information and files can be found: ▪ www.endress.com ▪ www.hartcomm.org
HART load	Min. 250 Ω
HART device variables	The measured values can be freely assigned to the device variables: **Measured values for PV (primary variable)** ▪ Pressure ▪ Flow ▪ Level ▪ Tank content **Measured values for SV, TV (second and third variable)** ▪ Pressure ▪ Totalizer **Measured values for QV (fourth variable)** ▪ Temperature
Supported functions	▪ Burst mode ▪ Additional Transmitter Status ▪ Device Locking ▪ Alternative operating modes

PROFIBUS PA

Manufacturer ID	17 (11 hex)
Ident number	1542 hex
Profile Version	3.0 ▪ SW Version 03.00.zz ▪ SW Version 04.00.zz 3.02 ▪ SW Version 04.01.zz (Device Revision 3) Compartibility SW version 03.00.zz and higher.
GSD Revision	▪ 4 (SW Version 3.00.zz and 4.00.zz) ▪ 5 (Device Revision 3)
DD Revision	▪ 1 (SW Version 3.00.zz and 4.00.zz) ▪ 1 (Device Revision 3)
GSD File DD Files	Information and files can be found: ▪ www.endress.com ▪ www.profibus.org
Output values	**Measured values for PV (via Analog Input Function Block)** ▪ Pressure ▪ Flow ▪ Level ▪ Tank content **Measured values for SV** ▪ Pressure ▪ Temperature **Measured values for QV** ▪ Totalizer

Input values	Input value sent from PLC, can be shown on display
Supported functions	▪ Identification & Maintenance Simple device identification via control system and nameplate ▪ Condensed status[1)] ▪ Automatic ident number adaptation and switchable to following ident numbers[1)]: – 9700: Profile-specific transmitter identification number with the "Classic" or "Condensed" status". – 1504: Compatibility mode for the old Deltabar S generation (FMD230, FMD630, FMD633, PMD230, PMD235). – 1542: Identification number for the new Deltabar S device generation (FMD77, FMD78, PMD75). ▪ Device locking: The device can be locked by hardware or software.

1) Only with Profile Version 3.02

FOUNDATION Fieldbus

Manufacturer ID	452B48 hex
Device type	1009 hex
Device Revision	▪ 6 - SW Version 03.00.zz ▪ 7 - SW Version 04.00.zz (FF-912)
DD Revision	▪ 3 (Device Revision 6) ▪ 2 (Device Revision 7)
CFF Revision	▪ 4 (Device Revision 6) ▪ 1 (Device Revision 7)
DD Files CFF Files	Information and files can be found: ▪ www.endress.com ▪ www.fieldbus.org
Device Tester Version (ITK Version)	▪ 5.0 (Device Revision 6) ▪ 6.01 (Device Revision 7)
ITK Test Campaign Number	▪ IT054700 (Device Revision 6) ▪ IT085400 (Device Revision 7)
Link Master (LAS) capable	yes
Choose from "Link Master" and "Basic Device"	Yes, default is Basic Device
Node Address	Default: 247 (F7 hex)
Supported functions	Field Diagnostics Profile [1)] Following methods are supported: ▪ Restart ▪ Configure error as warning or alarm ▪ HistoROM ▪ Peakhold ▪ AlarmInfo ▪ SensorTrimm
Number of VCRs	▪ 44 (Device Revision 6) ▪ 24 (Device Revision 7)
Number of Link Objects in VFD	50

1) Only with FF912

Virtual communication references (VCRs)

	Device Revision 6	Device Revision 7
Permanent Entries	44	1
Client VCRs	0	0
Server VCRs	5	10

	Device Revision 6	Device Revision 7
Source VCRs	8	43
Sink VCRs	0	0
Subscriber VCRs	12	43
Publisher VCRs	19	43

Link settings

	Device Revision 6	Device Revision 7
Slot time	4	4
Min. inter PDU delay	12	10
Max. response delay	10	10

Transducer Blocks

Block	Content	Output values
TRD1 Block	Contains all parameters related to the measurement	▪ Pressure, flow or level (channel 1) ▪ Process temperature (channel 2)
Service Block	Contains service information	▪ Pressure after damping (channel 3) ▪ Pressure peakhold indicator (channel 4) ▪ Counter for max. pressure transgressions (channel 5)
Dp Flow Block	Contains flow and totalizer parameter	Totalizer 1 (channel 6)
Diagnostic Block	Contains diagnostic information	Error code via DI channels (channel 0 to 16)
Display Block	Contains parameters to configure the onsite display	No output values

Function blocks

Block	Content	Number of blocks	Execution time		Functionality	
			Device Revision 6	Device Revision 7	Device Revision 6	Device Revision 7
Resource Block	The Resource Block contains all the data that uniquely identify the device. It is an electronic version of a nameplate of the device.	1			enhanced	enhanced
Analog Input Block 1 Analog Input Block 2 Analog Input Block 3	The AI Block receives the measuring data from the Sensor Block, (selectable via a channel number) and makes the data available to other function blocks at its output. Enhancement: digital outputs for process alarms, fail safe mode.	3	45 ms	45 ms [1]	enhanced	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 other blocks at the output.	1	40 ms	30 ms	standard	enhanced
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..	1	60 ms	40 ms	standard	enhanced
PID Block	The PID Block serves as a proportional-integral-derivative controller and is used almost universally for 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).	1	120 ms	70 ms	standard	enhanced
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 performed.	1	50 ms	40 ms	standard	enhanced
Input Selector Block	The Input Selector Block facilitates the 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, average and 'first good' signal selection. Inputs IN1 to IN4 can be indicated on the display. The selection is performed in the Display Block (DISPLAY_MAIN_LINE_CONTENT).	1	35 ms	35 ms	standard	enhanced
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 generated by a single look-up table with 21 arbitrary x-y pairs.	1	30 ms	40 ms	standard	enhanced
Integrator Block	The Integrator 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 a binary signal when the setpoint is reached.	1	35 ms	40 ms	standard	enhanced
Analog Alarm Block	This block contains all process alarm conditions (working like a comparator) and represents them at the output.	1	35 ms	35 ms	standard	enhanced

Additional function block information:

Instantiate Function Block	YES	YES
Number of additional instantiate blocks	9	4

1) Without trend and alarm reports

Power supply

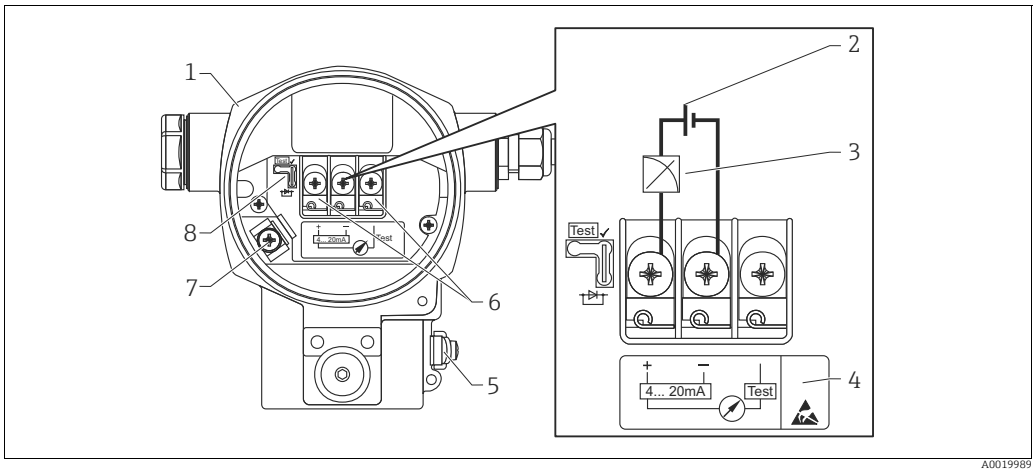
⚠ WARNING

Electrical safety is compromised by an incorrect connection!

- When using the measuring device in hazardous areas, installation must comply with the relevant national standards and regulations and the Safety Instructions or Installation or Control Drawings → 84. 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 → 84.
- Devices with integrated overvoltage protection must be grounded → 23.
- Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.

Terminal assignment

4 to 20 mA HART

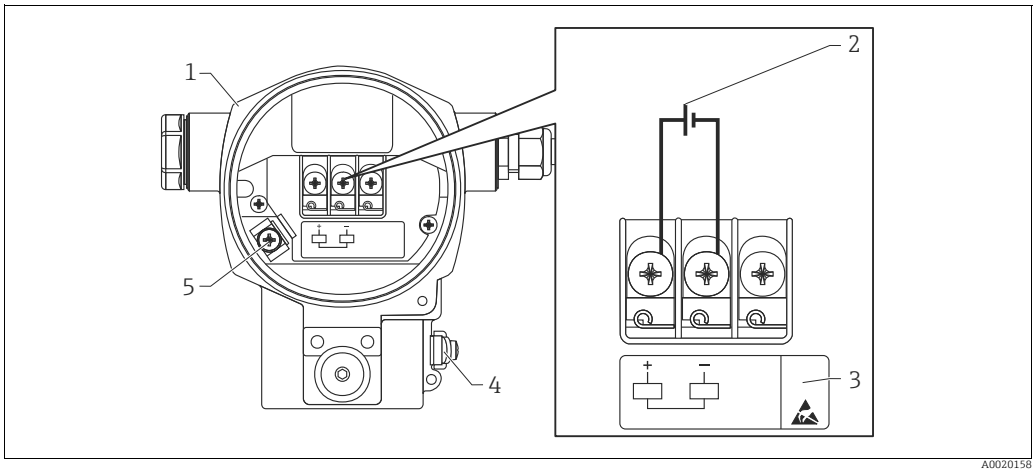


A0019989

Terminal assignment, shown here with aluminum housing (T14)

1 Housing
2 Supply voltage
3 4 to 20 mA
4 Devices with integrated overvoltage protection are labeled "OVP" (overvoltage protection) here.
5 External ground terminal
6 4 to 20 mA test signal between positive and test terminal
7 Internal ground terminal
8 Jumper for 4 to 20 mA test signal → 20, "Measuring a 4 to 20 mA test signal" section.

PROFIBUS PA and FOUNDATION Fieldbus



A0020158

Terminal assignment, shown here with aluminum housing (T14)

1 Housing
3 Supply voltage
3 Devices with integrated overvoltage protection are labeled OVP (overvoltage protection) here.
4 External ground terminal
5 Internal ground terminal

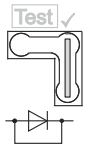
Supply voltage

4 to 20 mA HART

Version	Jumper for 4 to 20 mA test signal	Supply voltage
Non-hazardous area	in "Test" position	11.5 to 45 V DC
	in "Non-test" position	10.5 to 45 V DC
Intrinsically safe	in "Test" position	11.5 to 30 V DC
	in "Non-test" position	10.5 to 30 V DC
▪ Other types of protection ▪ Devices without certificate	in "Test" position	11.5 to 45 V DC (versions with 35 V DC plug-in connection)
	in "Non-test" position	10.5 to 45 V DC (versions with 35 V DC plug-in connection)

Measuring a 4 to 20 mA test signal

A 4 to 20 mA test 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
 A0019992	– Measuring 4 to 20 mA test signal via the 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
 A0019993	– Measuring 4 to 20 mA test signal via the plus and test terminal: not possible. – Minimum supply voltage: 10.5 V DC

PROFIBUS PA

- Version for non-hazardous areas: 9 to 32 V DC
- Ex ia: 10.5 to 30 V DC

FOUNDATION Fieldbus

- Version for non-hazardous areas: 9 to 32 V DC
- Ex ia: 10.5 to 30 V DC

Current consumption

- PROFIBUS PA: 13 mA ± 1 mA, switch-on current corresponds to IEC 61158-2, Clause 21
- FOUNDATION Fieldbus: 15,5 mA ± 1 mA, switch-on current corresponds to IEC 61158-2, Clause 21

Electrical connection

PROFIBUS PA

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the power supply. 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 BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and the PNO Guideline.

FOUNDATION Fieldbus

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the power supply. 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 BA00013S "FOUNDATION Fieldbus Overview" and the FOUNDATION Fieldbus Guideline.

Terminals

For wire cross-sections of 0.5 to 2.5 mm² (20 to 14 AWG)

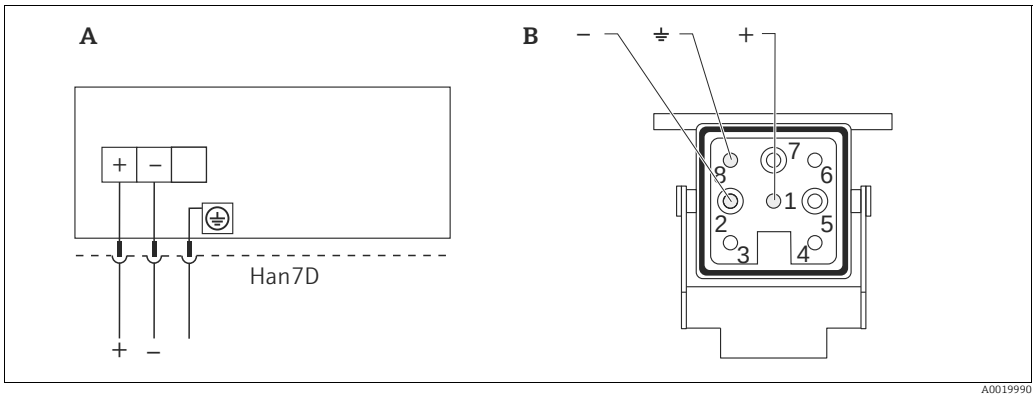
Cable entry

Approval	Type	Clamping area
Standard, II1/2G Exia, IS	Plastic M20x1.5	5 to 10 mm (0.2 to 0.39 in)
ATEX II1/2D, II1/3D, II1/2GD Exia, II1GD Exia II3G Ex nA	Metal M20x1.5 (Ex e)	7 to 10.5 mm (0.28 to 0.41 in)

For additional technical data, see section on housing → 37 ff".

Device plug connectors

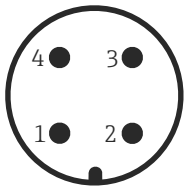
Devices with Harting plug Han7D



A Electrical connection for devices with Harting plug Han7D
B View of the plug-in connection at the device

Material: CuZn, gold-plated plug-in jack and plug

Devices with M12 plug

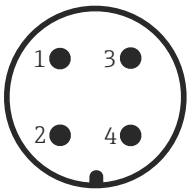
PIN assignment for M12 connector	PIN	Meaning
 A0011175	1	Signal +
	2	Not assigned
	3	Signal –
	4	Earth

Endress+Hauser offers the following accessories for devices with an M12 plug:
Plug-in jack M 12x1, straight
- Material: body PA; coupling nut CuZn, nickel-plated
- Degree of protection (fully locked): IP67
- 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
- Order number: 71114212

Cable 4x0.34 mm² (20 AWG) with M12 socket, elbowed, screw plug, length 5 m (16 ft)
- Material: body PUR; coupling nut CuSn/Ni; cable PVC
- Degree of protection (fully locked): IP67
- Order number: 52010285

Devices with 7/8" plug

PIN assignment for 7/8" connector	PIN	Meaning
 A0011176	1	Signal –
	2	Signal +
	3	Not assigned
	4	Shield

External thread: 7/8 - 16 UNC
- Material: 316L (1.4401)
- Degree of protection: IP68

Cable specification

HART

- Endress+Hauser recommends using shielded, twisted-pair two-wire cables.
- Cable outer diameter: 5 to 9 mm (0.2 to 0.35 in) depending on the cable entry used (→ 21).

PROFIBUS PA

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

For further information on the cable specifications, see Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning", the PNO Guideline 2.092 "PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

FOUNDATION Fieldbus

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

For further information on the cable specifications, see Operating Instructions BA00013S "FOUNDATION Fieldbus Overview", FOUNDATION Fieldbus Guideline and IEC 61158-2 (MBP).

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)]

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

Ordering information:
Product Configurator, order code for "Additional options 1" or "Additional options 2" option "M"

NOTICE

Device could be destroyed!

- ▸ Devices with integrated overvoltage protection must be grounded.

Influence of power supply

≤ 0.0006% of URL/1 V

Performance characteristics

Reference operating conditions

- As per IEC 60770
- Ambient temperature T_A = constant, in the range of: +21 to +33 °C (+70 to 91 °F)
- Humidity φ = constant, in the range of: 5 to 80 % rH
- Ambient pressure p_A = constant, in the range of: 860 to 1060 mbar (12.47 to 15.37 psi)
- Position of the measuring cell = constant, in range: horizontally ±1°
- Input of LOW SENSOR TRIM and HIGH SENSOR TRIM for lower range value and upper range value
- Zero based span
- Process isolating diaphragm material:
  - PMD75: AISI 316L/1.4435, Alloy C276, gold-rhodium-coated, Monel
  - FMD77, FMD78: AISI 316L/1.4435
- Filling oil: silicone oil
- Side flange material PMD75: AISI 316L/1.4435
- Supply voltage: 24 V DC ± 3 V DC
- Load with HART: 250 Ω

Influence of the installation position

- PMD75: ≤ 4 mbar (0.06 psi) [1, 3]
- FMD77: ≤ 32 mbar (0.48 psi) [2, 3]

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

Position-dependent zero shift can be corrected. → 28, "General installation instructions" section and → 75 ff, "Installation instructions, diaphragm seal systems" section

Resolution

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

Vibration effects

Device	Measuring cell	Housing	Test standard	Vibration effects
PMD75	10 mbar (0.15 psi) 30 mbar (0.45 psi)	Optional onsite display on the side (T14)	IEC 61298-3	≤ 0.15% URL to 10 to 38 Hz: ±0.35 mm (0.01 in); 38 to 2000 Hz: 2 g
		Optional onsite display on the top (T15)		≤ 0.15% URL to 10 to 60 Hz: ±0.35 mm (0.01 in); 60 to 2000 Hz: 5 g
PMD75	▪ 100 mbar (1.5 psi) ▪ 500 mbar (7.5 psi) ▪ 3 bar (45 psi) ▪ 16 bar (240 psi) ▪ 40 bar (600 psi)	Optional onsite display on the side (T14)	IEC 61298-3	≤ reference accuracy to 10 to 38 Hz: ±0.35 mm (0.01 in); 38 to 2000 Hz: 2 g
		Optional onsite display on the top (T15)		≤ reference accuracy to 10 to 60 Hz: ±0.35 mm (0.01 in); 60 to 2000 Hz: 5 g

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 data refer to the calibrated span.

The following applies for the root-extracting characteristic curve:
The accuracy data of the Deltabar S are taken into the accuracy calculation of the flow rate with a factor of 0.5.

PMD75

Measuring cell	% of the set span	
10 mbar (0.15 psi), 30 mbar (0.45 psi)	▪ TD 1:1 ▪ TD > 1:1	= ±0.09 = ±0.09 x TD
100 mbar (1.5 psi)	▪ TD 1:1 to TD 4:1 ▪ TD > 4:1	= ±0.075 = ±(0.012 x TD + 0.027)

Measuring cell	% of the set span
500 mbar (7.5 psi)	▪ TD 1:1 to TD 15:1 = ±0.075 ▪ TD > 15:1 = ±(0.0015 x TD + 0.053)
≥ 3 bar (45 psi)	▪ TD 1:1 to TD 15:1 = ±0.05 ▪ TD > 15:1 = ±(0.0015 x TD + 0.0275)
Platinum version: 100 mbar (1.5 psi), 500 mbar (7.5 psi)	▪ TD 1:1 = ±0.05
Platinum version: ≥3 bar (45 psi)	▪ TD 1:1 = ±0.035

FMD77, FMD78

Measuring cell	FMD77	FMD78
	% of the set span (influence of the diaphragm seal included)	
100 mbar (1.5 psi)	▪ 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 (7.5 psi), 3 bar (45 psi), 16 bar (240 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)

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

Measuring cell	−10 to +60 °C (14 to 140 °F)			
	AISI 316L/1.4435 or Alloy C Process isolating diaphragm	Gold-rhodium Process isolating diaphragm	Monel Process isolating diaphragm	Tantalum Process isolating diaphragm
	% of the set span			
10 mbar (0.15 psi), 30 mbar (0.45 psi)	±(0.30 x TD + 0.06)	±(0.60 x TD + 0.1)	±(0.60 x TD + 0.2)	±(0.5 x TD + 0.15)
100 mbar (1.5 psi)	±(0.18 x TD + 0.02)	±(0.18 x TD + 0.02)	±(0.18 x TD + 0.02)	±(0.23 x TD + 0.07)
500 mbar (7.5 psi), 3 bar (45 psi)	±(0.08 x TD + 0.05)			
16 bar (240 psi)	±(0.1 x TD + 0.10)			
40 bar (600 psi)	±(0.08 x TD + 0.05)			

Measuring cell	−40 to -10 °C (-40 to 14 °F), +60 to +85 °C (140 to 185 °F)
	all process isolating diaphragm materials
	% of the set span
10 mbar (0.15 psi), 30 mbar (0.45 psi)	±(0.45 x TD + 0.10)
100 mbar (1.5 psi)	±(0.30 x TD + 0.15)
500 mbar (7.5 psi), 3 bar (45 psi)	±(0.12 x TD + 0.10)
16 bar (240 psi)	±(0.15 x TD + 0.20)
40 bar (600 psi)	±(0.37 x TD + 0.10)

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

The influence of the operating pressure on the zero point can be corrected.

Material of the Process isolating diaphragm	AISI 316L (1.4435), Alloy C		Gold-rhodium[1)]	
	Influence of the operating pressure		Influence of the operating pressure	
Measuring cell	on the zero point	on the span	on the zero point	on the span
10 mbar (0.15 psi)	±0.15 % v. URL/ 7 bar (105 psi)	±0.035 % v. URL/ 7 bar (105 psi)	±0.15 % v. URL/ 7 bar (105 psi)	±0.035 % v. URL/ 7 bar (105 psi)
30 mbar (0.45 psi)	±0.50 % v. URL/ 70 bar (1050 psi)	±0.14 % v. URL/ 70 bar (1050 psi)	±0.77 % v. URL/ 70 bar (1050 psi)	±0.14 % v. URL/ 70 bar (1050 psi)
100 mbar (1.5 psi)	±0.15 % v. URL/ 70 bar (1050 psi)	±0.14 % v. URL/ 70 bar (1050 psi)	±0.42 % v. URL/ 70 bar (1050 psi)	±0.42 % v. URL/ 70 bar (1050 psi)
500 mbar (7.5 psi)	±0.075 % v. URL/ 70 bar (1050 psi)	±0.14 % v. URL/ 70 bar (1050 psi)	±0.075 % v. URL/ 70 bar (1050 psi)	±0.14 % v. URL/ 70 bar (1050 psi)
3 bar (45 psi)				
16 bar (240 psi)				
40 bar (600 psi)				

1) The material of the process isolating diaphragm is Alloy C276 for PMD75 and 316L for FMD77/FMD78. The coating of the process isolating diaphragm is gold-rhodium.

Material of the Process isolating diaphragm	Monel		Tantalum	
	Influence of the operating pressure		Influence of the operating pressure	
Measuring cell	on the zero point	on the span	on the zero point	on the span
10 mbar (0.15 psi)	±0.21 % v. URL/ 7 bar (105 psi)	±0.05 % v. URL/ 7 bar (105 psi)	±0.32 % v. URL/ 7 bar (105 psi)	±0.07 % v. URL/ 7 bar (105 psi)
30 mbar (0.45 psi)	±1.05 % v. URL/ 70 bar (1050 psi)	±0.21 % v. URL/ 70 bar (1050 psi)	±1.60 % v. URL/ 70 bar (1050 psi)	±0.32 % v. URL/ 70 bar (1050 psi)
100 mbar (1.5 psi)	±0.42 % v. URL/ 70 bar (1050 psi)	±0.42 % v. URL/ 70 bar (1050 psi)	±0.42 % v. URL/ 70 bar (1050 psi)	±0.42 % v. URL/ 70 bar (1050 psi)
500 mbar (7.5 psi)	±0.075 % v. URL/ 70 bar (1050 psi)	±0.14 % v. URL/ 70 bar (1050 psi)	±0.14 % v. URL/ 70 bar (1050 psi)	±0.14 % v. URL/ 70 bar (1050 psi)
3 bar (45 psi)				
16 bar (240 psi)				
40 bar (600 psi)				

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 static pressure (p_{st} = 70 bar (1050 psi)).
All specifications apply to the temperature range −10 to +60 °C (+14 to +140 °F).

Measuring cell	AISI 316L/1.4435 or Alloy C Process isolating diaphragm	Gold-rhodium Process isolating diaphragm	Monel Process isolating diaphragm	Tantalum Process isolating diaphragm
	% of the set span [1]			
10 mbar (0.15 psi)	±0.35	±0.64	±0.66	±0.61
30 mbar (0.45 psi)	±0.77	±0.99	±1.22	±1.66
100 mbar (1.5 psi)	±0.27	±0.50	±0.50	±0.30
≥ 500 mbar (7.5 psi) to TD 2:1	±0.15	±0.15	±0.15	±0.30

1) for measuring cells ≤ 30 mbar (0.45 psi) TD 1:1, for measuring cells ≥ 100 mbar (1.5 psi) TD 2:1

Long-term stability

	1 year	5 years	10 year
Measuring ranges	% of URL		
10 mbar (0.15 psi)	±0.100	±0.150	--
100 mbar (1.5 psi)	±0.180	--	--
500 mbar (7.5 psi)	±0.025	±0.050	±0.075
3 bar (45 psi)	±0.038	±0.075	±0.150
16 bar (240 psi)	±0.025	±0.110	±0.210

Total error

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

Measuring cell	AISI 316L/1.4435 or Alloy C Process isolating diaphragm	Gold-rhodium Process isolating diaphragm	Monel Process isolating diaphragm	Tantalum Process isolating diaphragm
	% of URL/year			
10 mbar (0.15 psi)	±0.36	±0.64	±0.67	±0.62
30 mbar (0.45 psi)	±0.77	±0.99	±1.23	±1.66
100 mbar (1.5 psi)	±0.33	±0.50	±0.50	±0.48
≥500 mbar (7.5 psi)	±0.20	±0.20	±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

Installation

General installation instructions

- The position-dependent zero point shift can be corrected directly at the device via operating keys, and also in hazardous areas in the case of devices with external operation. Diaphragm seals also shift the zero point, depending on the installation position (→ 📄 75 ff, "Installation instructions, diaphragm seal systems" section).
- The housing of the Deltabar S can be rotated up to 380° → 📄 31.
- Endress+Hauser offers a mounting bracket for installing the device on pipes or walls. See → 📄 29, "Wall and pipe-mounting" section.
- When measuring in media containing solids, 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 pressure 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 pressure piping with a continuous gradient of at least 10%.
- When routing the pressure piping outdoors, ensure sufficient anti-freeze protection, e.g. by using pipe heat tracing.
- For FMD77 and FMD78: → 📄 75 ff, "Installation instructions, diaphragm seal system" section.
- Use flushing rings for flange and cell diaphragm seals if buildup or clogging can be expected at the diaphragm seal connection. The flushing ring can be fitted between the process connection and diaphragm seal. Material buildup in front of the process isolating diaphragm can be flushed away, and the pressure chamber vented, via the two lateral flushing holes.

Measuring arrangement

Flow measurement

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

Level measurement

- The PMD75 and FMD77 are best suited to level measurement in open vessels. All Deltabar S devices are suitable for level measurement in closed vessels.

Measuring arrangement for level measurement in open vessels

- PMD75: Mount device below the lower measuring connection. The negative side is open to atmospheric pressure.
- FMD77: Mount device directly on the vessel. The negative side is open to atmospheric pressure.

Measuring arrangement for level measurement in closed vessels and closed vessels with superimposed vapor

- PMD75: Mount device below the lower measuring connection. Always connect the negative side above the maximum level via pressure piping.
- FMD77: Mount device directly on the vessel. Always connect the negative side above the maximum level via pressure piping.
- In the case of level measurement in closed vessels with superimposed vapor, a condensate trap ensures the pressure remains constant on the minus side.

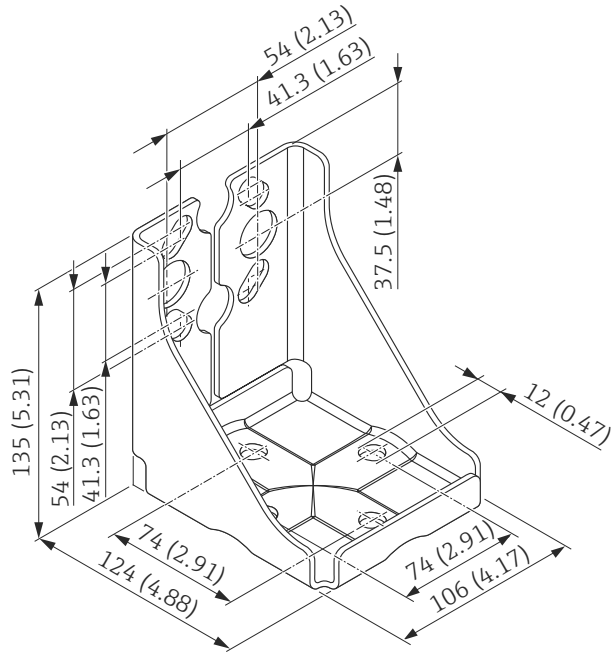
Pressure measurement

- The PMD75 and FMD78 are best suited to differential pressure measurement.
- Measuring arrangement for gases: Mount device above the measuring point.
- Measuring arrangement for liquids and vapors: Mount device below the measuring point.
- For differential pressure measurement in vapor, mount the condensate traps at the same level as the tapping point and at the same distance from Deltabar S.

Wall and pipe-mounting

Endress+Hauser offers a mounting bracket for installing the device on pipes or walls.

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



Engineering unit mm (in)

Bracket for wall- and pipe-mounting including retainer for pipe-mounting and two nuts
Materials: Screws and washers A2-70 or A4, bracket and retainer AISI 304 (1.4301).
The material of the screws used to secure the device depend on the order code.

Please note the following when mounting:
- To prevent the mounting screws from scoring, lubricate them with a multipurpose grease prior to mounting.
- For pipe-mounting, the nuts on the retainer must be tightened uniformly with a torque of at least 30 Nm (22.13 lbf ft).

Ordering information:

- Product Configurator, order code for "Additional options 2" option "U"
- Product Configurator, order code for "Enclosed accessories" option PB
- Order number for 7/16 UNF: 52024609
- Order number for M10: 52024611
- Order number for M12: 52024610

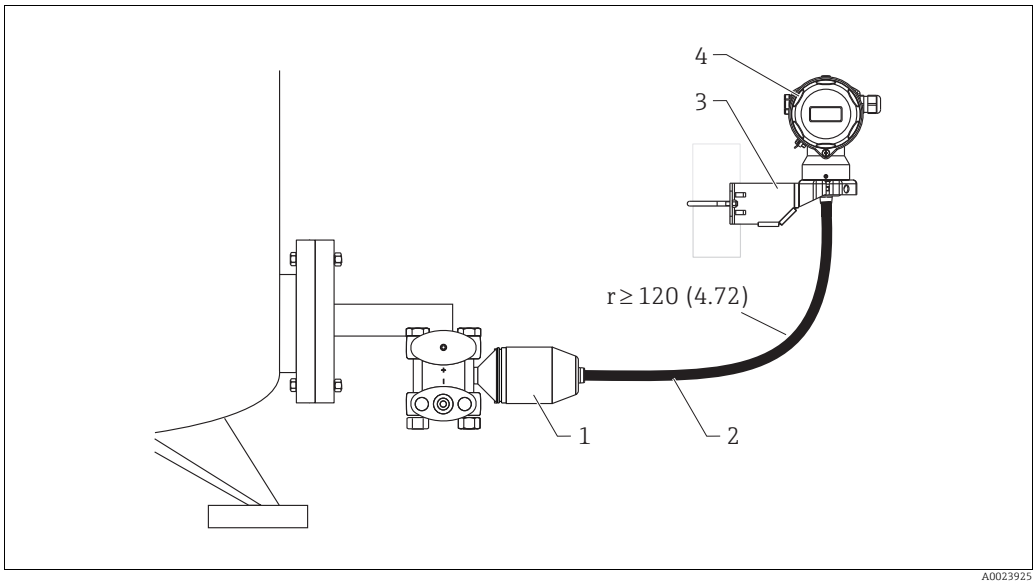
"Separate housing" version

With the "separate housing" version, you are able to mount the housing with the electronics insert at a distance from the measuring point. This version 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 (6.6 ft), 5 m (16 ft) and 10 m (33 ft))
- FEP (5 m (16 ft)).

Product Configurator, order code for "Additional options 2", option "G".

For the dimensions, see → 59.



Dimensions in mm (inch)

In the case of the "separate 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 - For degrees of protection, see the following section
2 Cable, both ends are fitted with a socket
3 Mounting bracket provided, suitable for pipe and wall mounting
4 Housing with electronic insert - Degrees of protection → 37 ff

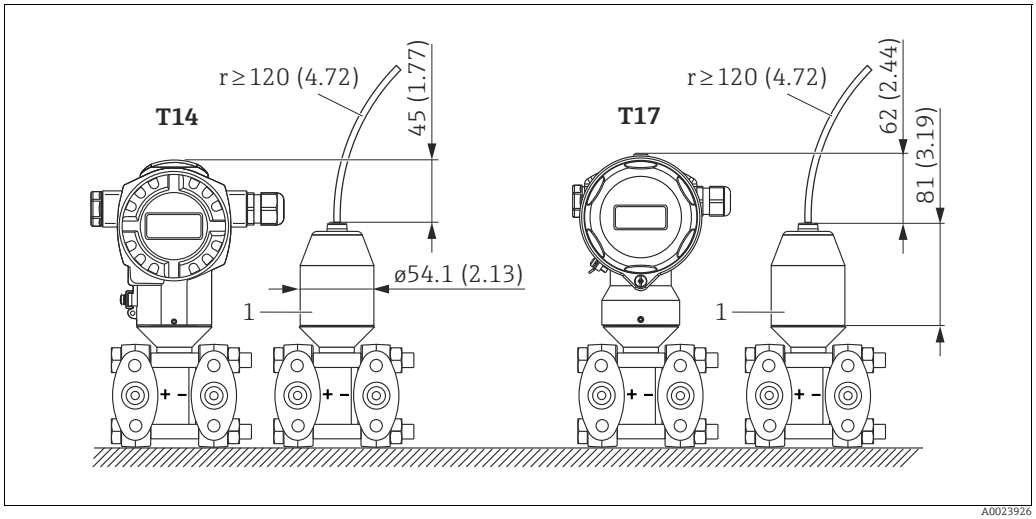
Degree of protection for the process connection and sensor with the use of
- FEP cable:
  - IP 69K
  - IP 66 NEMA 4/6P
  - IP 68 (1.83 mH_2O for 24 h) NEMA 4/6P
- PE cable:
  - IP 66 NEMA 4/6P
  - IP 68 (1.83 mH_2O for 24 h) NEMA 4/6P

Technical data of the PE and FEP cable:
- Minimum bending radius: 120 mm (4.72 in)
- 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 installation only

Reduction of the installation height

If the separate housing is used, the installation height of the process connection is reduced compared to the dimensions of the standard version.



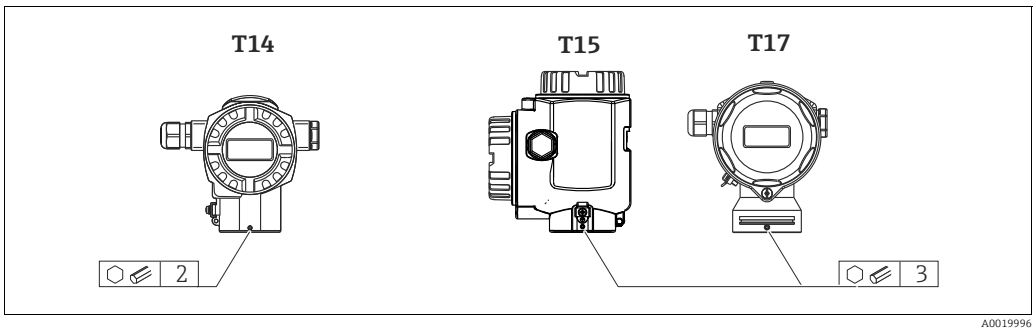
Dimensions in mm (inch)
1 Process connection adapter.

Turning 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 onsite display (optional).



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 [1] cleaned for oxygen applications	p_{max} for oxygen applications	T_{max} for oxygen applications
PMD75 – * * * ** * * * K * *	160 bar (2400 psi)	85 °C (185 °F)
PMD75 – * * * ** * * * 2 * *	160 bar (2400 psi)	60 °C (140 °F)
PMD75 – * * * ** * * * 3 * *	160 bar (2400 psi)	60 °C (140 °F)
FMD77 – * * * ** T * F * *	PN of the flange	60 °C (140 °F)
FMD78 – * * * ** * ** 4 * * FMD78 – * * * ** * ** D * *	depends on filling oil: max. 160 bar (2400 psi)	85 °C (185 °F)

1) Only devices, not accessories or enclosed accessories.

Ultrapure gas applications

Endress+Hauser also offers devices for special applications, such as ultrapure gas, cleaned from oil and grease.
No special restrictions regarding the process conditions apply to these devices.
Ordering information:
PMD75: Product Configurator, order code for "Seal"
FMD77: Product Configurator, order code for "Process connection low-pressure side; Material; Seal".

Applications with hydrogen

The following distinction is made for applications or media with hydrogen content:

a. Liquid applications with hydrogen separation from an electrolyte:
The gold-rhodium coating, which can be ordered in the order code, offers protection only against hydrogen diffusion through the process isolating diaphragm in liquids (e.g. electrolytes or aqueous solutions). In gas applications, the gold-rhodium coating does **not** provide effective protection against hydrogen diffusion through the process isolating diaphragm.

b. Gas applications with hydrogen content:
If the application is a gas application with hydrogen content, the membrane requires a **pure** gold coating. Endress+Hauser offers this product version with a gold coating of ≥25 µm as a **T**echnical **S**pecial **P**roduct.

Ordering information:
Product Configurator, order code for "Material of process isolating diaphragm".

Environment

Ambient temperature range

- PMD75, FMD77, FMD78: −40 to +85 °C (-40 to +185 °F), devices for lower temperatures on request
- Onsite 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: -20 to +60 °C (-4 to +140 °F) (installation without insulation)

For devices for use in hazardous areas, see Safety instructions, Installation or Control Drawing (→ 🖹 84, "Safety Instructions" and "Installation/Control Drawings" sections).

Hazardous area

- Pressure measuring devices that have the usual explosion protection certificates (e.g. ATEX/FM/CSA/ IEC Ex etc.) can be used in hazardous areas with ambient temperatures down to -50 °C (-58 °F). The functionality of the explosion protection is also guaranteed for ambient temperatures down to -50 °C (-58 °F).
- The nameplate specification is limited to an ambient temperature of -40 °C (-40 °F), as all metrological device tests are performed only down to temperatures of -40 °C (-40 °F). If the device is operated at an ambient temperature below -40 °C (-40 °F), the technical specifications in this document no longer apply. Restrictions to measurement functionality can be expected.

Storage temperature range

- −40 to +90 °C (-40 to +194 °F)
- Onsite display: −40 to +85 °C (-40 to +185 °F)
- Separate housing: -40 to +60 °C (-40 to +140 °F)

Degree of protection

- Product Configurator, order code for "Housing; Cable entry; Protection".
- Degree of protection IP 68 for T17 housing: 1.83 mH_2O for 24 h
- Separate housing → 🖹 30

Climate class

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

Vibration resistance

Device/accessory	Housing	Test standard	Vibration resistance
PMD75	Optional onsite display on the side (T14)	IEC 61298-3	Guaranteed for: 10 to 60 Hz: ±0.35 mm (0.0138 in); 60 to 2000 Hz: 5 g in all 3 planes
PMD75	Optional onsite display on the top (T15)		
With mounting bracket		IEC 61298-3	Guaranteed for: 10 to 60 Hz: ±0.15 mm (0.0059 in); 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
- All EMC measurements were performed with a turn down (TD) = 2:1.

Process

Process temperature limits (temperature at transmitter)

	Process connection material		
Device	**316L / Alloy C**	**C22.8**	**PVDF**
PMD75	-40 to +85 °C (-40 to 185 °F)	-10 to +85 °C (+14 to 185 °F)	-
FMD77 / FMD78	Dependent on the diaphragm seal and filling oil: up to + 400 °C (752 °F)		

- For oxygen applications, observe → 32, "Oxygen applications" section.
- 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.
  See → 73, "Diaphragm seal filling oils" section.
- FMD77 and FMD78: Do not use diaphragm seals with 0.09 mm (0.0035 in) PTFE foil on AISI 316L (1.4435/1.4405) for vacuum applications, upper temperature limit +204 °C (+399 °F).

Process temperature range, seals

PMD75

Seal	Process temperature range [1]	Option [2]
FKM Viton	−20 to +85 °C (-4 to +185 °F)	A
PTFE	−40 to +85 °C (-40 to +185 °F)	C
NBR	−20 to +85 °C (-4 to +185 °F)	F
Copper	−40 to +85 °C (-40 to +185 °F)	H
Copper, cleaned for oxygen service	−20 to +85 °C (-4 to +185 °F)	K
FKM Viton, cleaned from oil and grease	−10 to +85 °C (+14 to +185 °F)	1
FKM Viton, cleaned for oxygen service	−10 to +60 °C (+14 to +140 °F)	2
PTFE, cleaned for oxygen applications	−20 to +60 °C (-4 to +140 °F)	3

1) Lower temperatures on request

2) Product Configurator, order code for "Seal"

FMD77 (with diaphragm seal)

Seal on the LP side (−)	Process temperature range [1]	OPL bar (psi)	PN bar (psi)	Option [2]
FKM Viton	−20 to +85 °C (-4 to +185 °F)	See chapter "Measuring range (FMD77, FMD78, PMD75: Option PN 160 / 16 MPa / 2400 psi" → 10.		B, D, F, U
PTFE	−40 to +85 °C (-40 to +185 °F)			H, J
EPDM	−40 to +85 °C (-40 to +185 °F)			K, L
FKM Viton, cleaned from oil and grease	−10 to +85 °C (+14 to +185 °F)			S
FKM Viton, cleaned for oxygen service	−10 to +60 °C (+14 to +140 °F)			T
Kalrez, Compound 6375	0 to +5 °C (+32 to +41 °F)	44...49 (660...735)	29...33 (435...495)	M, N
	+5 to +10 °C (+41 to +50 °F)	49...160 (735...2400)	33...107 (495...1605)	
	+10 to +85 °C (+50 to +185 °F)	160 (2400)	107 (1605)	
Chemraz, Compound 505	−10 to +25 °C (14 to +77 °F)	130...160 (1950...2400)	87...107 (1305...1605)	P, Q
	+25 to +85 °C (77 to +185 °F)	160 (2400)	107 (1605)	

1) Lower temperatures on request

2) Product Configurator, order code for "Process connection, LP side; Seal:"

Pressure specifications

⚠ WARNING

The maximum pressure for the measuring device depends on the lowest rated element with regard to pressure → 🗎 10 ff, "Measuring range" and → 🗎 36 ff "Mechanical construction" section.

- The measuring device must be operated only within the specified limits!
- The MWP (maximum working pressure) is specified on the nameplate. This value is based on a reference temperature of +20 °C (68 °F), or 100 °F (38 °C) for ANSI flanges, and may be applied to the device for an unlimited time. Observe the pressure-temperature dependency of the MWP.
- The pressure values permitted at higher temperatures can be found in the standards
  EN 1092-1: 2001 Tab. 18 [1)]
  ASME B 16.5a – 1998 Tab. 2-2.2 F316
  ASME B 16.5a – 1998 Tab. 2.3.8 N10276
  JIS B 2220.
- The test pressure corresponds to the over pressure limit of the measuring device (OPL = 1.5 x MWP) and may only be applied temporarily 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 over pressure limit (OPL) of the process 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; MWP = PN).
- In oxygen applications, the values for "p_{max} and T_{max} for oxygen applications" as per → 🗎 32, "Oxygen applications" may not be exceeded.
- For the PMD75, the MWP applies to the temperature ranges specified in the "Ambient temperature range" (→ 🗎 33) and "Process temperature limits" (→ 🗎 34) sections.

1) With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13EO in EN 1092-1: 2001 Tab. 18. The chemical composition of the two materials can be identical.

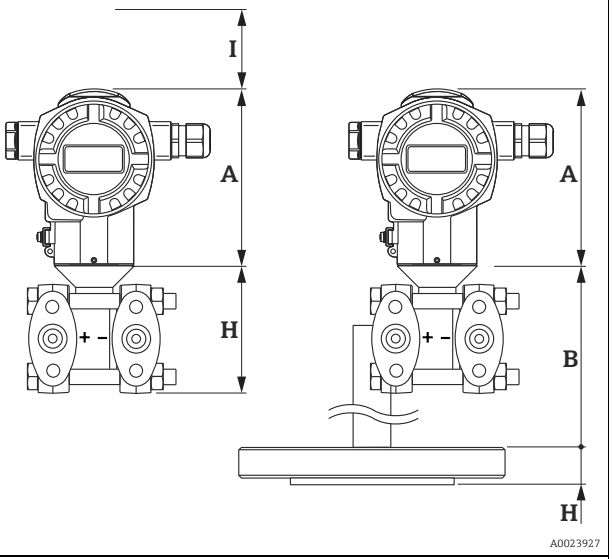
Mechanical construction

Device height

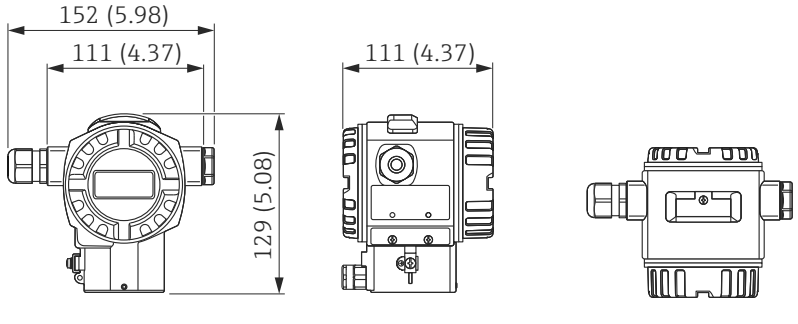
The device height is based on

- the height of the housing
- the height of optional mounted parts such as temperature isolators or capillaries
- the height of the relevant process connection.

The individual heights of the components can be found in the following sections. You can calculate the device height easily by adding the individual heights together. If necessary, the installation space (the space used to install the device) must also be taken into account.
You can use the following table for this:

Section	Page	Height	Examples
Height of housing	→ 37 ff	(A)	
Optional mounted parts	→ 39 ff	(B)	
Process connections	→ 39 ff	(H)	
Installation space	-	(I)	
Device height			

T14 housing, optional display on the side



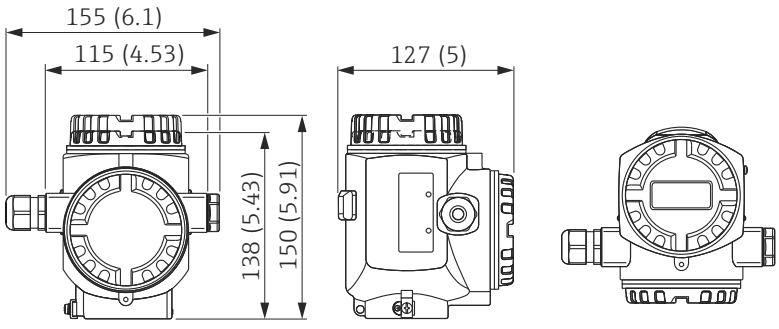
Engineering unit mm (in)

Front view, left-hand side view, top view

Material		Degree of protection	Cable entry	Weight kg (lbs)		Option [1]
Housing	Cover seal			with display	without display	
Aluminum	EPDM	IP66/67 NEMA 6P	M20 gland	1.2 (2.65)	1.1 (2.43)	A
		IP66/67 NEMA 6P	G ½" thread			B
		IP66/67 NEMA 6P	NPT ½" thread			C
		IP66/67 NEMA 6P	M12 plug			D
		IP66/67 NEMA 6P	7/8" plug			E
		IP65 NEMA 4	HAN7D plug 90 degrees			F
316L	EPDM	IP66/67 NEMA 6P	M20 gland	2.1 (4.63)	2.0 (4.41)	1
		IP66/67 NEMA 6P	G ½" thread			2
		IP66/67 NEMA 6P	NPT ½" thread			3
		IP66/67 NEMA 6P	M12 plug			4
		IP66/67 NEMA 6P	7/8" plug			5
		IP65 NEMA 4	HAN7D plug 90 degrees			6
	FVMQ	IP66/67 NEMA 6P	M20 gland			7
	FVMQ	IP66/67 NEMA 6P	NPT ½" thread			8

1) Product Configurator, order code for "Housing, cover seal, cable entry"

T15 housing, optional display on the top



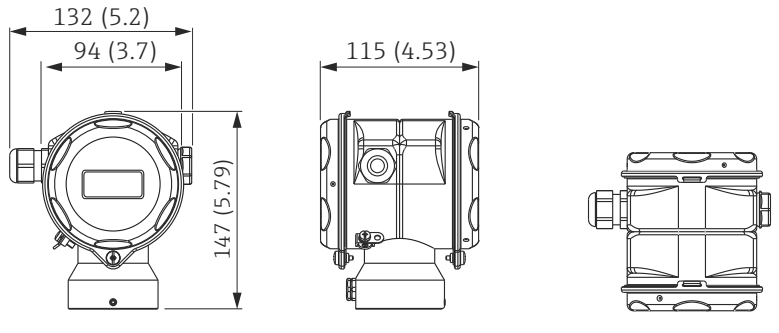
Engineering unit mm (in)

Front view, left-hand side view, top view

Material		Degree of protection	Cable entry	Weight kg (lbs)		Option [1]
Housing	Cover seal			with display	without display	
Aluminum	EPDM	IP66/67 NEMA 6P	M20 gland	1.8 (3.97)	1.7 (3.75)	J
		IP66/67 NEMA 6P	G ½" thread			K
		IP66/67 NEMA 6P	NPT ½" thread			L
		IP66/67 NEMA 6P	M12 plug			M
		IP66/67 NEMA 6P	7/8" plug			N
		IP65 NEMA 4	HAN7D plug 90 degrees			P

1) Product Configurator, order code for "Housing, cover seal, cable entry"

T17 housing (hygienic), optional display on the side



Engineering unit mm (in)

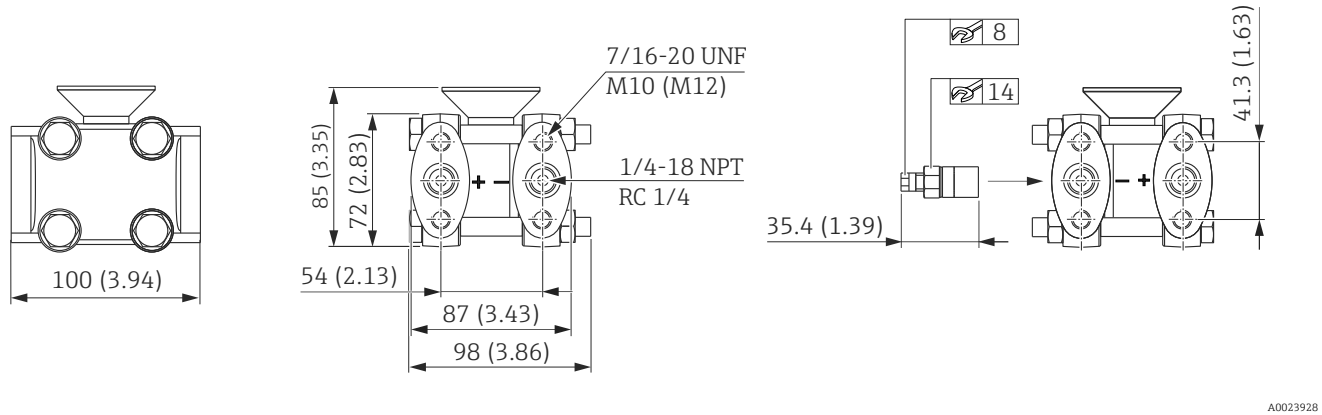
Front view, left-hand side view, top view

Material		Degree of protection[1]	Cable entry	Weight kg (lbs)		Option [2]
Housing	Cover seal			with display	without display	
316L	EPDM	IP66/68 NEMA 6P	M20 gland	1.2 (2.65)	1.1 (2.43)	R
		IP66/68 NEMA 6P	G ½" thread			S
		IP66/68 NEMA 6P	NPT ½" thread			T
		IP66/68 NEMA 6P	M12 plug			U
		IP66/68 NEMA 6P	7/8" plug			V

1) Degree of protection IP 68: 1.83 mH_2O for 24 h

2) Product Configurator, order code for "Housing, cover seal, cable entry"

Process connections PMD75 Oval flange, connection 1/4-18 NPT or RC 1/4



Engineering unit mm (in)

Front view, left-hand side view, right-hand side view. Nuts are always located on the minus side.

Connection	Mounting	Material	Accessories	Weight[1] kg (lbs)	Approval[2]	Option [3]
1/4-18 NPT IEC 61518	7/16-20 UNF	Steel C 22.8 [4]	2 vent valves included AISI 316L (1.4404)	4.2 (9.26)	CRN	B
1/4-18 NPT IEC 61518	7/16-20 UNF	AISI 316L (1.4435 or 1.4404)			CRN	D
1/4-18 NPT IEC 61518	7/16-20 UNF	CW12MW [5]	Vent valves Alloy C276 (2.4819)[6]	4.5 (9.92)	CRN	F
RC 1/4	7/16-20 UNF	AISI 316L (1.4435 or 1.4404)	2 vent valves included AISI 316L (1.4404)	4.2 (9.26)	CRN	U
1/4-18 NPT IEC 61518	– PN 160: M10 – PN 420: M12	Steel C 22.8 [4]			CRN	1
1/4-18 NPT IEC 61518	– PN 160: M10 – PN 420: M12	AISI 316L (1.4435 or 1.4404)			CRN	2
1/4-18 NPT IEC 61518	– PN 160: M10 – PN 420: M12	CW12MW [5]	Vent valves Alloy C276 (2.4819) [6]	4.5 (9.92)	CRN	3

1) Weight of process connections without vent valves with 10 mbar (0.15 psi) or 30 mbar (0.45 psi) measuring cell, process connections without vent valves with measuring cells ≥100 mbar (1.5 psi) weigh approx. 800 g (28.22 oz) less.

2) CSA approval: Product Configurator, order code for "Approval"

3) Product Configurator, order code for "Process connection"

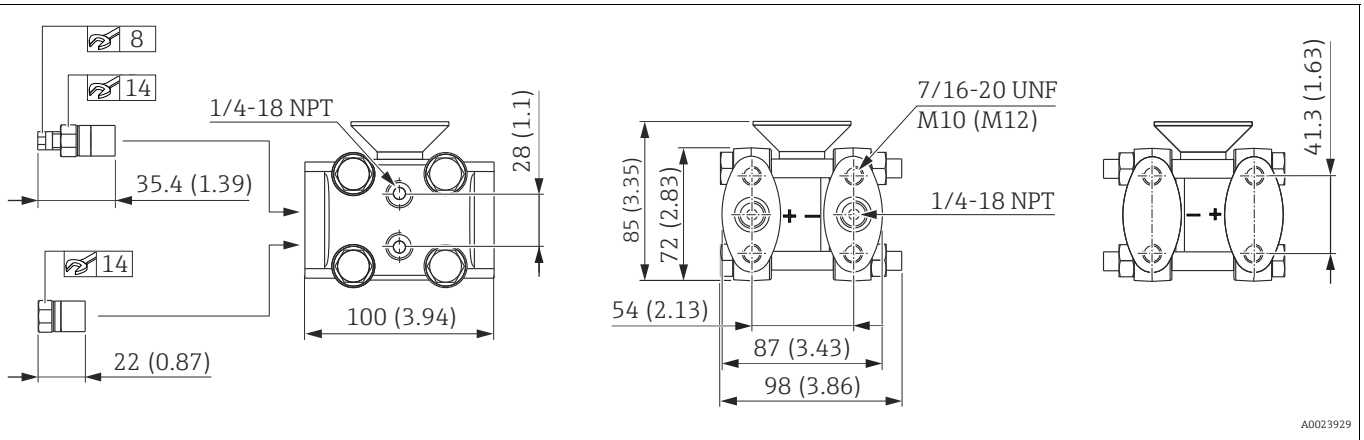
4) Side flanges made out of C22.8 are zinc-plated. Endress+Hauser recommends to use side flanges made out of 316L for applications with water.

5) Listed material is equivalent to Alloy C276.

6) Product Configurator, order code for "Additional options 2"

Some device versions have CRN approval. A CRN-approved process connection (Product Configurator, order code for "Process connection") must be ordered with a CSA approval (Product Configurator, order code for "Approval") for a CRN-approved device. These devices are fitted with a separate plate bearing the registration number 0F10524.5C.

Process connections PMD75 (continued) **Oval flange, connection 1/4-18 NPT or RC 1/4, with side vent**



Engineering unit mm (in)

Front view, left-hand side view, right-hand side view. Nuts are always located on the minus side.

Connection	Mounting	Material	Accessories	Weight[1] kg (lbs)	Option [2]
1/4-18 NPT IEC 61518	7/16-20 UNF	Steel C 22.8 [3]	4 locking screws and 2 vent valves AISI 316L (1.4404)	4.2 (9.26)	C
1/4-18 NPT IEC 61518	7/16-20 UNF	AISI 316L [4]			E
1/4-18 NPT IEC 61518	7/16-20 UNF	Alloy C276 (2.4819)	Vent valves Alloy C276 (2.4819) [5]	4.5 (9.92)	H
RC 1/4	7/16-20 UNF	AISI 316L [3]	4 locking screws and 2 vent valves AISI 316L (1.4404)	4.2 (9.26)	V

1) Weight of process connections without vent valves with 10 mbar (0.15 psi) or 30 mbar (0.45 psi) measuring cell, process connections without vent valves with measuring cells ≥100 mbar (1.5 psi) weigh approx. 800 g (28.22 oz) less.

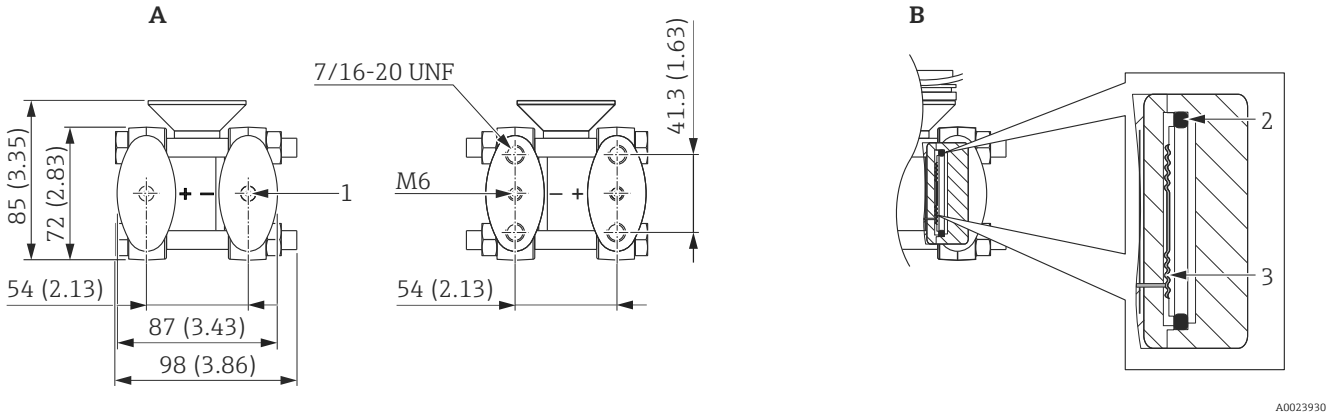
2) Product Configurator, order code for "Process connection"

3) Side flanges made out of C22.8 are zinc-plated. Endress+Hauser recommends to use side flanges made out of 316L for applications with water.

4) PN 160 bar (2400 psi) measuring cells: AISI 316L/1.4435, PN 420 bar (6300 psi) measuring cells: AISI 316L (1.4435 or 1.4404)

5) Product Configurator, order code for "Additional options 2"

Process connections PMD75 (continued) **Oval flange, prepared for diaphragm seal mount**



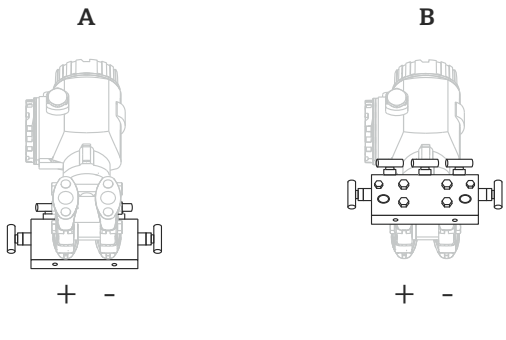
Engineering unit mm (in)

Left-hand side view, right-hand side view. Nuts are always located on the minus side.

Position	Description	Option [1]
A	Prepared for diaphragm seal mount 1 Diaphragm seal attachment	W
B	Position of copper seal: 2 Copper ring seal 3 Process isolating diaphragm	

1) Product Configurator, order code for "Process connection"

Mounting on valve manifold



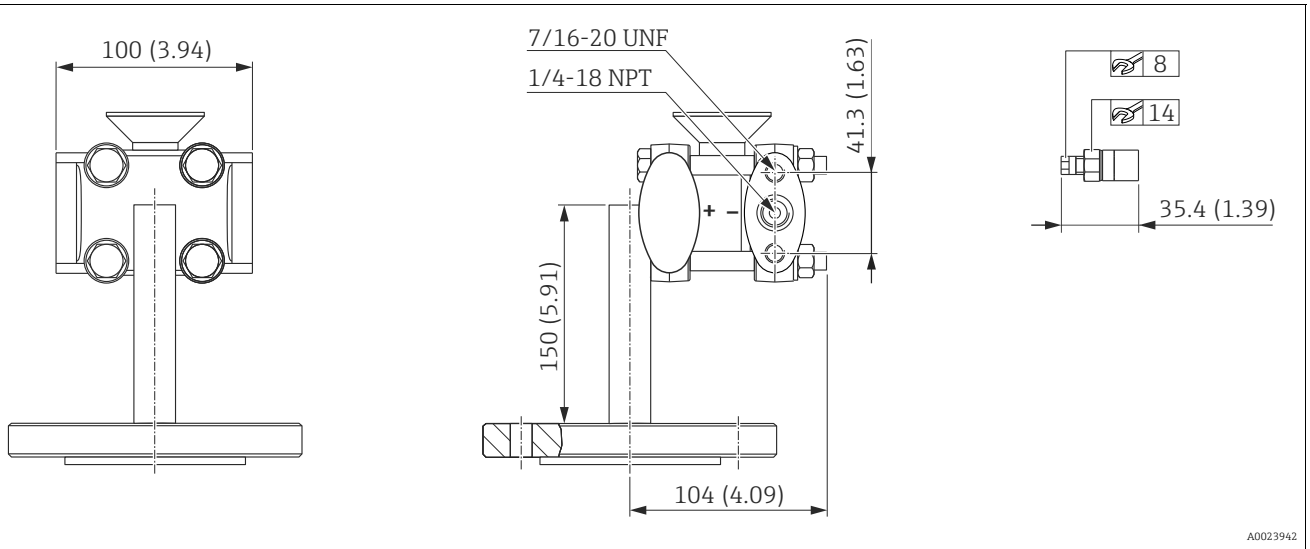
Plus side left, minus side right.

Position	Description	Option [1] [2]
A	Mounting from above	V
B	Mounting from below	W

1) Product Configurator, order code for "Additional options 1"

2) Product Configurator, order code for "Accessory mounted"

Process connections FMD77 with diaphragm seal, low-pressure side



Engineering unit mm (in)

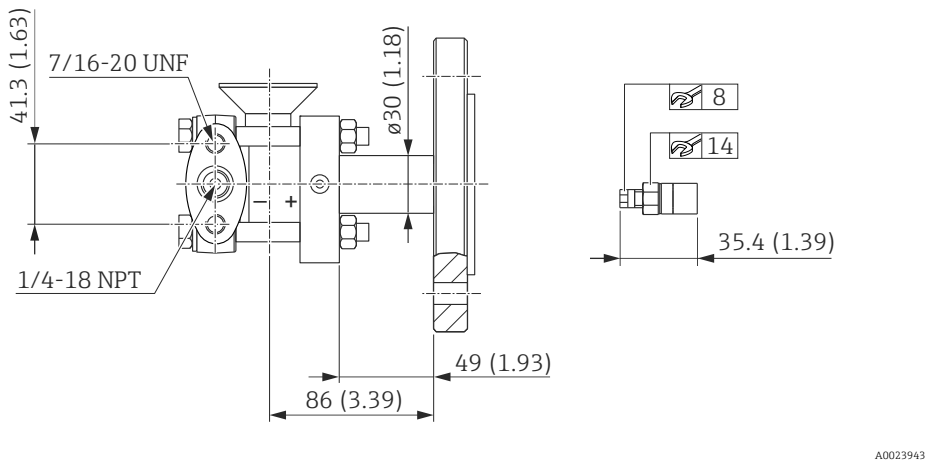
Front view, right-hand side view. Nuts are always located on the minus side.

Low-pressure side: Connection 1/4-18 NPT, mounting optionally 7/16-20 UNF incl. 1 vent valve AISI 316L (1.4404), side flange material of the basic device: AISI 316L (1.4435 or 1.4404)
High-pressure side, see "Process connections FMD77 with diaphragm seal, high-pressure side" section

Process connection low-pressure side	Material	Seal	Approval	Option [1]
Mounting: 7/16 – 20 UNF, Process isolating diaphragm low-pressure side AISI 316L				
1/4 – 18 NPT IEC 61518	C22.8	FKM Viton	CRN	B
1/4 – 18 NPT IEC 61518,	AISI 316L	FKM Viton	CRN	D
1/4 – 18 NPT IEC 61518	Alloy C276	FKM Viton	CRN	F
1/4 – 18 NPT IEC 61518	AISI 316L	PTFE+C4-ring	CRN	H
1/4 – 18 NPT IEC 61518	Alloy C	PTFE+C4-ring	CRN	J
1/4 – 18 NPT IEC 61518	AISI 316L	EPDM	CRN	K
1/4 – 18 NPT IEC 61518	Alloy C	EPDM	CRN	L
1/4 – 18 NPT IEC 61518	AISI 316L	Kalrez	CRN	M
1/4 – 18 NPT IEC 61518	Alloy C	Kalrez	CRN	N
1/4 – 18 NPT IEC 61518	AISI 316L	Chemraz	CRN	P
1/4 – 18 NPT IEC 61518	Alloy C	Chemraz	CRN	Q
1/4 – 18 NPT IEC 61518	AISI 316L	FKM Viton, cleaned from oil and grease	CRN	S
1/4 – 18 NPT IEC 61518	AISI 316L	FKM Viton, cleaned for oxygen service	CRN	T
RC 1/4	AISI 316L	FKM Viton	CRN	U

1) Product Configurator, order code for "Process connection"

Compact version



Engineering unit mm (in)

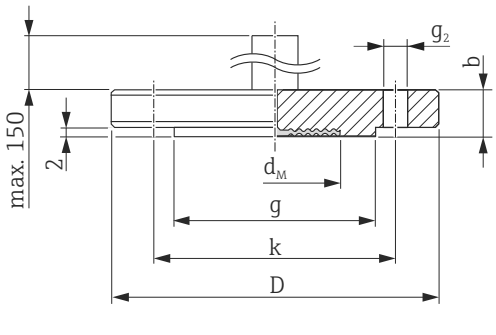
Front view, right-hand side view. Nuts are always located on the plus side.

Low-pressure side: Connection 1/4-18 NPT, mounting optionally 7/16-20 UNF incl. 1 vent valve AISI 316L (1.4404), side flange material of the basic device: AISI 316L (1.4435 or 1.4404)
High-pressure side, see "Process connections FMD77 with diaphragm seal, high-pressure side" section

Process connections FMD77 with diaphragm seal, high-pressure side

- 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.
- With the use of high-temperature oils the design can deviate strongly.
- Observe the information in the "Planning instructions, diaphragm seal systems" section → 71 ff.
- For further information please contact your local Endress+Hauser Sales Center.

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



Engineering unit mm (in)

Flange [1)2) 3)]						Boltholes			Diaphragm seal	Weight	Option [4)]
Nominal diameter	Nominal pressure	Shape[5)]	Diameter D	Thickness b	Raised face g	Quantity	Diameter g_2	Hole circle k	Max. diaphragm diameter d_M		
			[mm]	[mm]	[mm]		[mm]	[mm]	[mm]	[kg (lbs)]	
DN 50	PN 10-40	B1 (D)	165	20	102	4	18	125	59	3.0 (6.62)	A
DN 80	PN 10-40	B1 (D)	200	24	138	8	18	160	89	5.2 (11.47)	B
DN 100	PN 10-16	B1 (C)	220	20	–	8	18	180	89	4.8 (10.58)	F
DN 100	PN 25-40	B1 (D)	235	24	162	8	22	190	89	6.7 (14.77)	G

1) The roughness of the surface in contact with the media, including the sealing surface of the flanges (all standards) made of Hastelloy C, Monel or tantalum, is Ra <0.8 µm (31.5 µin). Lower surface roughness on request.

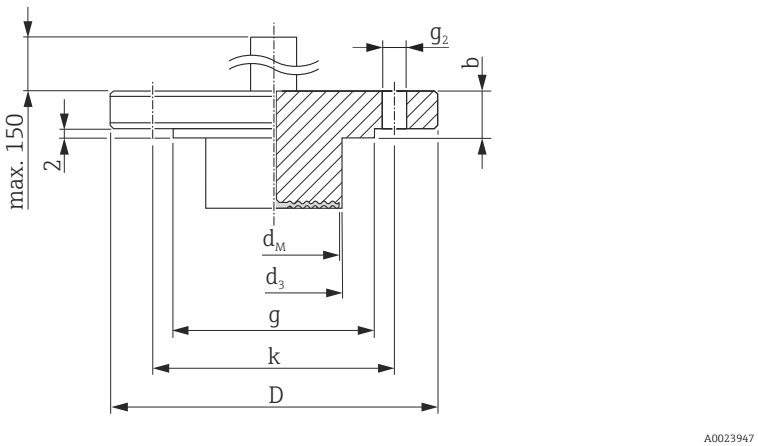
2) For process isolating diaphragms made of Alloy C, Monel oder tantalum, the raised face of the flange is made of the same material as the process isolating diaphragm.

3) Material: AISI 316L

4) Product Configurator, order code for "Process connection"

5) Designation as per DIN 2527 in brackets

EN/DIN flanges with extended diaphragm seal, connection dimensions as per EN 1092-1/ DIN 2527



Engineering unit mm (in)

Flange [1)2)]								Boltholes			Diaphragm seal	Weight	Option [3)]
Nominal diameter	Nominal pressure	Shape [4)]	Diameter D	Thickness b	Raised face g	Extended diaphragm seal length L	Extended diaphragm seal diameter d_3	Quantity	Diameter g_2	Hole circle k	Max. diaphragm diameter d_M		
			[mm]	[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	[mm]	[kg (lbs)]	
DN 80	PN 10-40	B1 (D)	200	24	–	50	76	8	18	160	72	6.2	C
						100						6.7	
						200						7.8	

1) The roughness of the surface in contact with the media, including the sealing surface of the flanges (all standards) made of Hastelloy C, Monel or tantalum, is Ra <0.8 µm (31.5 µin). Lower surface roughness on request.

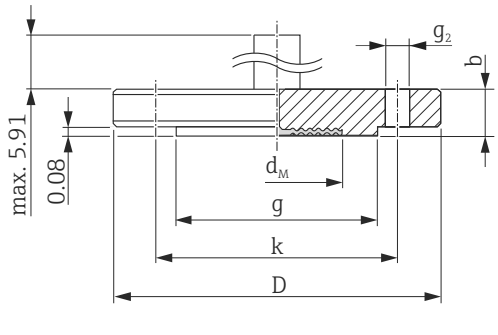
2) Material AISI 316L

3) Product Configurator, order code for "Process connection"

4) Designation as per DIN 2527 in brackets

Process connections FMD77 with diaphragm seal, high-pressure side (continued)

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



Engineering unit mm (in)

Flange [1)2) 3)]					Boltholes			Diaphragm seal	Weight	Approval[4)]	Option [5)]
Nominal diameter	Class	Diameter D	Thickness b	Raised face g	Quantity	Diameter g_2	Hole circle k	Max. diaphragm diameter d_M			
	[lb./sq.in]	[in]	[in]	[in]		[in]	[in]	[in]	[kg (lbs)]		
2	150	6	0.75	3.62	4	0.75	4.75	2.32	2.6 (5.73)	CRN	N
3	150	7.5	0.94	5	4	0.75	6	3.50	5.1 (11.25)	CRN	P
4	150	9	0.94	6.19	8	0.75	7.5	3.50	7.2 (15.88)	CRN	T
4	300	10	1.25	6.19	8	0.88	7.88	3.50	11.7 (25.8)	CRN	W
Compact version											
3	150	7.5	0.94	5	4	0.75	6	3.50	5.1 (11.25)	-	5
3	300	8.25	1.12	5	8	0.75	6	3.50	7 (15.44)	-	6
4	150	9	0.94	6.19	8	0.75	7.5	3.50	7.2 (15.88)	-	8

1) The roughness of the surface in contact with the media, including the sealing surface of the flanges (all standards) made of Hastelloy C, Monel or tantalum, is Ra <0.8 µm (31.5 µin). Lower surface roughness on request.

2) For process isolating diaphragms made of Alloy C, Monel oder tantalum, the raised face of the flange is made of the same material as the process isolating diaphragm.

3) Material AISI 316/316L

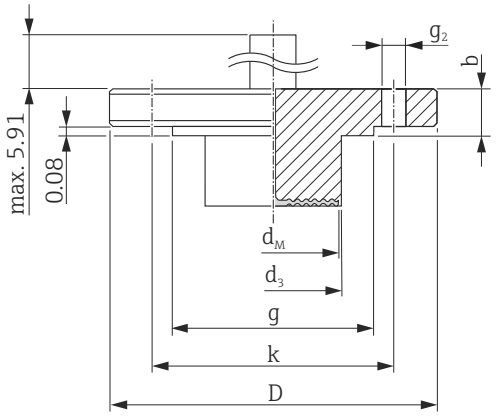
4) CSA approval: Product Configurator, order code for "Approval"

5) Product Configurator, order code for "Process connection"

Some device versions have CRN approval. A CRN-approved process connection (Product Configurator, order code for "Process connection") must be ordered with a CSA approval (Product Configurator, order code for "Approval") for a CRN-approved device. These devices are fitted with a separate plate bearing the registration number 0F10524.5C.

Process connections FMD77 with diaphragm seal, high-pressure side (continued)

ANSI flanges with extended diaphragm seal, connection dimensions as per B 16.5, raised face RF



Engineering unit mm (in)

Flange [1)2)]							Boltholes			Diaphragm seal	Weight	Option [3)]
Nominal diameter	Class	Diameter D	Thickness b	Raised face g	Extended diaphragm seal length L	Extended diaphragm seal diameter d_3	Quantity	Diameter g_2	Hole circle k	Max. diaphragm diameter d_M		
	[lb./sq.in]	[in]	[in]	[in]	[in]	[in]		[in]	[in]	[in]	[kg (lbs)]	
3	150	7.5	0.94	5	2	2.99	4	0.75	6	2.83	6 (13.23)	Q
					4						6.6 (14.55)	
					6						7.1 (15.66)	
					8						7.7 (16.98)	
Compact version												
3	150	7.5	0.94	5	2	2.99	4	0.75	6	2.83	6 (13.23)	7
					4						6.6 (14.55)	
					6						7.1 (15.66)	
					8						7.7 (16.98)	

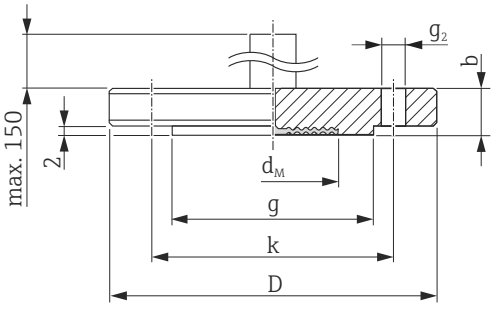
1) The roughness of the surface in contact with the media, including the sealing surface of the flanges (all standards) made of Hastelloy C, Monel or tantalum, is Ra <0.8 µm (31.5 µin). Lower surface roughness on request.

2) Material AISI 316/316L

3) Product Configurator, order code for "Process connection"

Process connections FMD77 with diaphragm seal, high-pressure side (continued)

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



Engineering unit mm (in)

Flange [1) 2)3)]					Boltholes			Diaphragm seal	Weight	Option [4)]
Nominal diameter	Nominal pressure	Diameter D	Thickness b	Raised face g	Quantity	Diameter g_2	Hole circle k	Max. diameter of the process isolating diaphragm d_M		
		[mm]	[mm]	[mm]		[mm]	[mm]	[mm]	[kg (lbs)]	
50 A	10 K	155	16	96	4	19	120	59	2.3 (5.07)	X
80 A	10 K	185	18	126	8	19	150	89	3.5 (7.72)	1
100 A	10 K	210	18	151	8	19	175	89	4.7 (10.36)	4

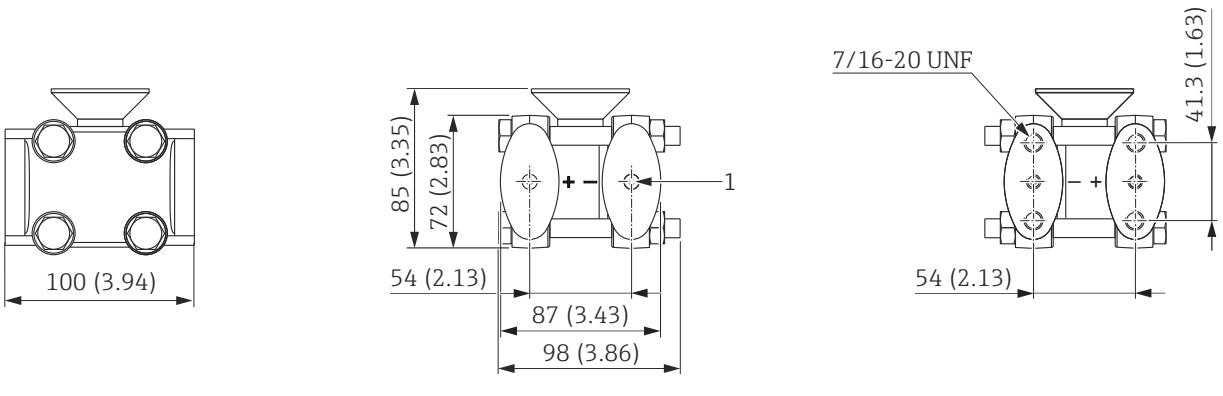
1) The roughness of the surface in contact with the media, including the sealing surface of the flanges (all standards) made of Hastelloy C, Monel or tantalum, is Ra <0.8 µm (31.5 µin). Lower surface roughness on request.

2) For process isolating diaphragms made of Alloy C, Monel oder tantalum, the raised face of the flange is made of the same material as the process isolating diaphragm.

3) Material AISI 316L (1.4435)

4) Product Configurator, order code for "Process connection"

FMD78 basic device



Engineering unit mm (in)

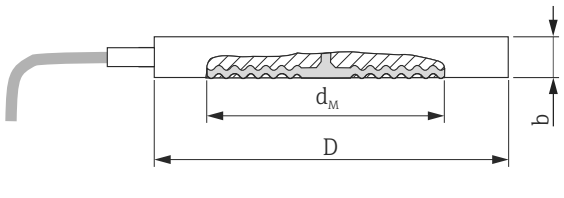
1 Diaphragm seal attachment

Front view, left-hand side view, right-hand side view. Nuts are always located on the minus side.

Process connections FMD78 with diaphragm seal

- 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.
- With the use of high-temperature oils the design can deviate strongly.
- Observe the information in the "Planning instructions, diaphragm seal systems" section → 71 ff.
- For further information please contact your local Endress+Hauser Sales Center.

Diaphragm seal cell structure



Engineering unit mm (in)

Flange					Diaphragm seal		Approval[1]	Option [2]
Material	Nominal diameter	Nominal pressure [3]	Max. diameter D	Thickness b	Max. diameter of the process isolating diaphragm d_M	Weight of two diaphragm seals		
			[mm]	[mm]	[mm]	[kg (lbs)]		
AISI 316L	DN 50	PN 16-400	102	20	59	2.6 (5.73)	-	UF
	DN 80	PN 16-400	138	20	89	4.6 (10.14)	-	UH
	DN 100	PN 16-400	162	20	89	6.2 (13.67)	-	UJ
	[in]	[lb/sq.in]	[in (mm)]	[in (mm)]	[in (mm)]	[kg]		
	2	150-2500	4.01 (102)	0.79 (20)	2.32 (59)	2.6 (5.73)	CRN	VF
	3	150-2500	5.35 (136)	0.79 (20)	3.50 (89)	4.6 (10.14)	CRN	VH
	4	150-2500	6.22 (158)	0.79 (20)	3.50 (89)	6.2 (13.67)	CRN	VJ

1) CSA approval: Product Configurator, order code for "Approval"

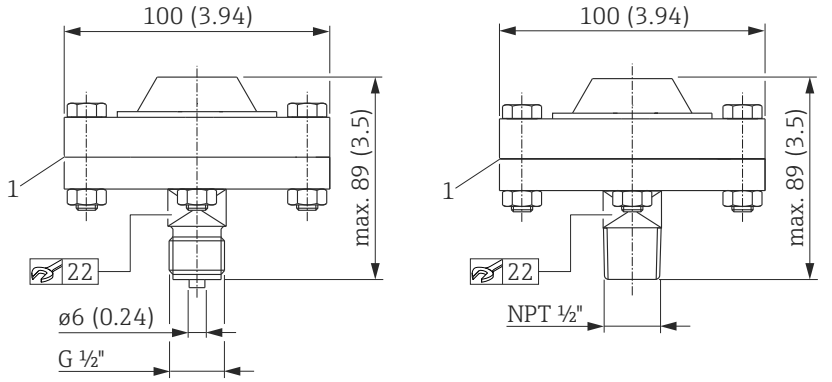
2) Product Configurator, order code for "Process connection"

3) 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 → 35, "Pressure specifications" section.

Some device versions have CRN approval. A CRN-approved process connection (Product Configurator, order code for "Process connection") must be ordered with a CSA approval (Product Configurator, order code for "Approval") for a CRN-approved device. These devices are fitted with a separate plate bearing the registration number 0F10524.5C.

Process connections FMD78 with diaphragm seal (continued)

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



Left: option "GA" with threaded connection ISO 228 G ½ B; Right: option "RL" with threaded connection ANSI ½ MNPT

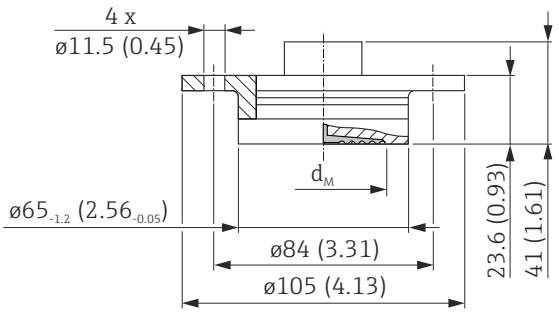
1 PTFE seal as standard max. 260 °C (500 °F) (higher temperatures on request)

Engineering unit mm (in)

Material	Description	Measuring range [bar (psi)]	Nominal pressure	Weight [kg (lbs)]	Option [1]
AISI 316L (1.4404), screws made of 1.4571	ISO 228 G ½ B EN837	≤ 40 (580)	PN 40	1.43 (3.15)	GA
	ANSI ½ MNPT	≤ 40 bar (580)	PN 40		RL

1) Product Configurator, order code for "Process connection"

DRD DN50 (65 mm)



Engineering unit mm (in)

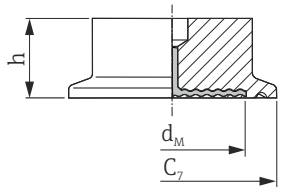
Material [1]	Nominal pressure	Max. diaphragm diameter		Weight	Option [2]
		standard	with TempC Process isolating diaphragm		
		d_M [mm]	d_M [mm]	[kg (lbs)]	
AISI 316L	PN 25	50	48	0.75 (1.65)	TK [3]

1) Surface roughness of the surfaces in contact with the medium $R_a \leq 0.76$ µm (29.9 µin) as standard.

2) Product Configurator, order code for "Process connection"

3) Alternatively available with TempC diaphragm.

Tri-Clamp ISO 2852



A0021644

Engineering unit mm (in)

Material [1]	Nominal diameter ISO 2852	Nominal diameter DIN 32676	Nominal diameter	Diameter	Max. diaphragm diameter		Height	Weight	Approval [2]	Option [3]
					standard	with TempC Process isolating diaphragm				
			[in]	C_7 [mm]	d_M [mm]	d_M [mm]	h [mm]	[kg (lbs)]		
AISI 316L	ND 25 / 33.7	DN 25	1	50.5	24	-	37	0.32 (0.71)	EHEDG, 3A	TB
	ND 38	DN 40	1 ½	50.5	36	36	30	1 (2.21)	EHEDG, 3A	TC [4][5]
	ND 51 / 40	DN 50	2	64	48	41	30	1.1 (2.43)	EHEDG, 3A	TD [4] [5]
	ND 63.5	DN 50	2 ½	77.5	61	61	30	0.7 (1.54)	EHEDG, 3A	TE [6]
	ND 76.1	–	3	91	73	61	30	1.2 (2.65)	EHEDG, 3A	TF [5]

1) Surface roughness of the surfaces in contact with the medium $R_a \leq 0.76$ µm (29.9 µin) as standard. Lower surface roughness on request.

2) CSA approval: Product Configurator, order code for "Approval"

3) Product Configurator, order code for "Process connection"

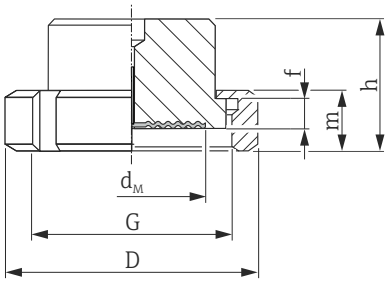
4) Diaphragm seal versions optionally in conformity with ASME-BPE for use in biochemical processes, wetted surfaces $R_a \leq 0{,}38$ µm (15 µin), electropolished. Ordering information: Product Configurator, order code for "Additional options 1" or "Additional options 2", option O in the order code.

5) Alternatively available with TempC diaphragm.

6) With TempC diaphragm

Process connections FMD78 with diaphragm seal (continued)

SMS nozzles with coupling nut



Engineering unit mm (in)

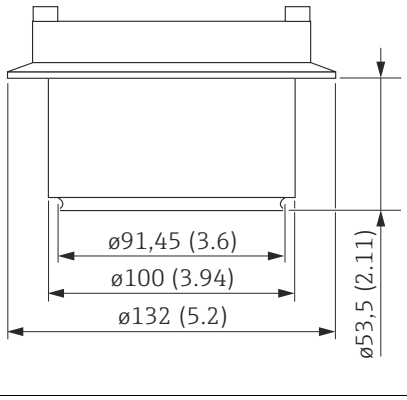
Material [1]	Nominal diameter	Nominal pressure	Diameter D	Adapter height f	Thread G	Height m	Height h	Max. diaphragm diameter d_M	Weight	Approval	Option [2]
	[in]	[bar]	[mm]	[mm]		[mm]	[mm]	[mm]	[kg (lbs)]		
AISI 316L	1 ½	PN 25	74	4	Rd 60 – 1/6	25	57	36	0.65 (1.43)	3A, EHEDG	TH [3]
	2	PN 25	84	4	Rd 70 – 1/6	26	62	48	1.05 (2.32)	3A, EHEDG	TI [3]

1) Surface roughness of the surfaces in contact with the medium $R_a \leq 0.76$ µm (29.9 µin) as standard.

2) Product Configurator, order code for "Process connection"

3) With TempC diaphragm

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

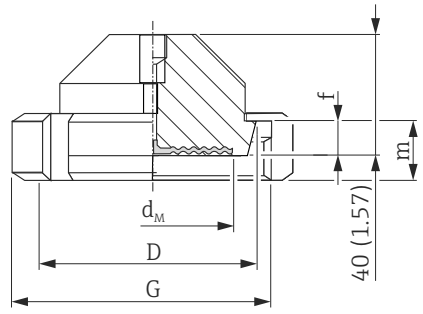


Engineering unit mm (in)

Material [1]	Weight kg (lbs)	Option
AISI 316L	2.5 (5.51)	WH

1) Surface roughness of the surfaces in contact with the medium $R_a \leq 0.8$ µm (31.5 µin) as standard. Lower surface roughness on request.

Taper adapter with slotted nut, DIN 11851



Engineering unit mm (in)

Material [1]	Taper adapter				Slotted nut		Diaphragm seal			Approval	Option [2]
	Nominal diameter	Nominal pressure	Diameter D	Adapter height f	Thread G	Height m	Max. diaphragm diameter standard	Max. diaphragm diameter with TempC Process isolating diaphragm	Weight		
			[mm]	[mm]		[mm]	d_M [mm]	d_M [mm]	[kg (lbs)]		
AISI 316L	DN 40	PN 40	56	10	Rd 65 x 1/6"	21	38	36	0.45 (0.99)	3A, EHEDG	MZ [3]
	DN 50	PN 25	68.5	11	Rd 78 x 1/6"	19	52	48	1.1 (2.43)	3A, EHEDG	MR [4]
	DN 65	PN 25	86	12	Rd 95 x 1/6"	21	66	61	2.0 (4.41)	3A, EHEDG	MS [4]
	DN 80	PN 25	100	12	Rd 110 x 1/4"	26	81	61	2.55 (5.62)	3A, EHEDG	MT[4]

1) Surface roughness of the surfaces in contact with the medium $R_a \leq 0.76$ µm (29.9 µin) as standard.

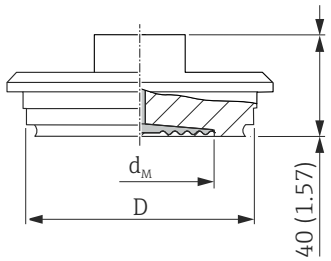
2) Product Configurator, order code for "Process connection"

3) With TempC diaphragm

4) Alternatively available with TempC diaphragm.

Process connections FMD78 with diaphragm seal (continued)

Varivent for pipes



A0021672

Engineering unit mm (in)

Material [1]	Description	Nominal pressure	Diameter	Max. diaphragm diameter		Weight	Approval	Option [2]
				standard	with TempC Process isolating diaphragm			
			D	d_M [mm]	d_M [mm]	[kg (lbs)]		
AISI 316L	Type F for pipes DN 25 - DN 32	PN 40	71	34	36	0.4 (0.88)	EHEDG, 3A	TU [3]
AISI 316L	Type N for pipes DN 40 - DN 162	PN 40	68	58	61	0.8 (1.76)	EHEDG, 3A	TR [4]

1) Surface roughness of the surfaces in contact with the medium $R_a \leq 0.76$ µm (29.9 µin) as standard.

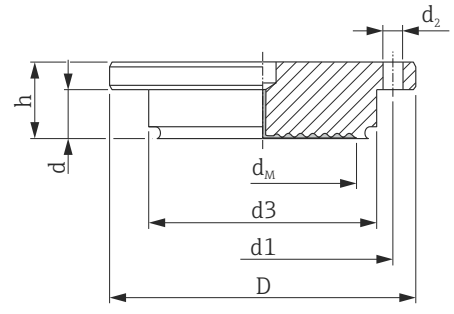
2) Product Configurator, order code for "Process connection"

3) With TempC diaphragm

4) Alternatively available with TempC diaphragm.

Process connections FMD78 with diaphragm seal (continued)

NEUMO BioControl



Engineering unit mm (in)

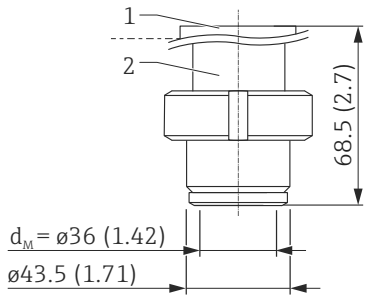
Material [1]	Threaded adapter							Diaphragm seal			Approval	Option [2]
	Nominal diameter	Nominal pressure	Diameter			Hole circle	Height	Max. diaphragm diameter		Weight		
			D	d_2	d_3	d_1	h	standard	with TempC Process isolating diaphragm			
			[mm]	[mm]	[mm]	[mm]	[mm]	d_M [mm]	d_M [mm]	[kg (lbs)]		
AISI 316L	DN 50	PN 16	90	4 x ∅ 9	50	70	27	40	36	1.1 (2.43)	3A	S4 [3]
	DN 80	PN 16	140	4 x ∅ 11	87.4	115	37	61	61	2.6 (5.73)	3A	S6 [3]

1) Surface roughness of the surfaces in contact with the medium is $R_a \leq 0.76$ µm (29.9 µin) as standard.

2) Product Configurator, order code for "Process connection"

3) With TempC diaphragm

Universal adapter



Engineering unit mm (in)

Description	Material [1]	Weight kg (lbs)	Approval	Option [2]
Universal adapter incl. silicone molded seal (Spare part no.: 52023572) FDA 21CFR177.2600/USP Class VI-70C	▪ b: top section AISI 316L (1.4404) ▪ a: bottom section AISI 316L (1.4435)	0.8 (1.76)	3A, EHEDG, CRN	0 [3] [4]

1) Surface roughness of the surfaces in contact with the medium $R_a \leq 0.76$ µm (29.9 µin) as standard.

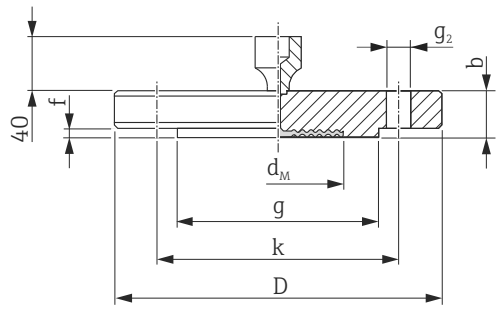
2) Product Configurator, order code for "Process connection"

3) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).

4) Alternatively available with TempC diaphragm.

Process connections FMD78 with diaphragm seal (continued)

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



Engineering unit mm

Material	Flange [1)2)]							Boltholes			Diaphragm seal		Option [3)]
	Nominal diameter	Nominal pressure	Shape [4)]	Diameter D	Thickness b	Raised face g	Raised face f	Quantity	Diameter g_2	Hole circle k	Max. diaphragm diameter d_M	Weight	
				[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	[mm]	[kg (lbs)]	
AISI 316L	DN 50	PN 10-40	B1 (D)	165	20	102	3	4	18	125	59	3.0 (6.62)	B3
AISI 316L	DN 80	PN 10-40	B1 (D)	200	24	138	3.5	8	18	160	89	5.3 (11.69)	B5
AISI 316L	DN 100	PN 10-16	B1 (C)	220	20	–	4	8	18	180	89	4.5 (9.92)	BT
AISI 316L	DN 100	PN 25-40	B1 (D)	235	24	162	5	8	22	190	89	7 (15.44)	B6

1) The roughness of the surface in contact with the media, including the raised face of the flanges (all standards) made of Alloy C, Monel or tantalum, is Ra <0.8 µm (31.5 µin). Lower surface roughness on request.

2) For process isolating diaphragms made of Alloy C, Monel oder tantalum, the raised face of the flange is made of the same material as the process isolating diaphragm.

3) Product Configurator, order code for "Process connection"

4) Designation as per DIN 2527 in brackets

Material	Flange [1)2)]						Boltholes			Diaphragm seal		Option [3)]
	Nominal diameter	Nominal pressure	Diameter D	Thickness b	Diameter of raised face g	Raised face height f	Quantity	Diameter g_2	Hole circle k	Max. diaphragm diameter d_M	Weight	
			[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	[mm]	[kg (lbs)]	
AISI 316L												
	50 A	10 K	155	16	96	2	4	19	120	59	2.3 (5.07)	KF
	80 A	10 K	185	18	127	2	8	19	150	89	3.3 (7.28)	KL
	100 A	10 K	210	18	151	2	8	19	175	89	4.4 (9.7)	KH

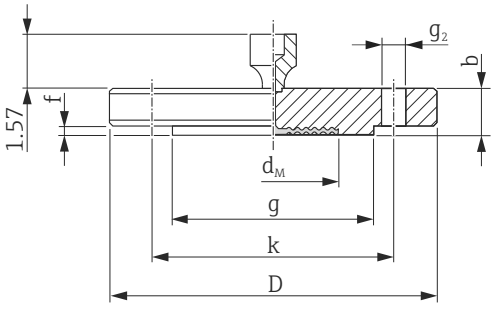
1) The roughness of the surface in contact with the media, including the raised face of the flanges (all standards) made of Alloy C, Monel or tantalum, is Ra 0.8 µm (31.5 µin). Lower surface roughness on request.

2) For process isolating diaphragms made of Alloy C, Monel oder tantalum, the raised face of the flange is made of the same material as the process isolating diaphragm.

3) Product Configurator, order code for "Process connection"

Process connections FMD78 with diaphragm seal (continued)

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



Engineering unit in

Flange [1)2) 3)]						Boltholes			Diaphragm seal		Approval[4)]	Option [5)]
Nominal diameter	Class	Diameter D	Thick-ness b	Raised face g	Raised face f	Quantity	Diameter g_2	Hole circle k	Max. diaphragm diameter d_M	Weight		
[in]	[lb./sq.in]	[in]	[in]	[in]	[in]		[in]	[in]	[in]	[kg (lbs)]		
2	150	6	0.75	3.62	0.06	4	0.75	4.75	2.32	2.2 (4.85)	CRN	AF
2	300	6.5	0.88	3.62	0.06	8	0.75	5	2.32	3.4 (7.5)	CRN	AR
3	150	7.5	0.94	5	0.06	4	0.75	6	3.50	5.1 (11.25)	CRN	AG
3	300	8.25	1.12	5	0.06	8	0.75	6	3.50	7.0 (15.44)	CRN	AS
4	150	9	0.94	6.19	0.06	8	0.75	7.5	3.50	7.2 (15.88)	CRN	AH
4	300	10	1.25	6.19	0.06	8	0.88	7.88	3.50	11.7 (25.8)	CRN	AT

1) Material AISI 316/316L

2) The roughness of the surface in contact with the media, including the raised face of the flanges (all standards) made of Alloy C, Monel or tantalum, is Ra <0.8 µm (31.5 µin). Lower surface roughness on request.

3) For process isolating diaphragms made of Alloy C, Monel oder tantalum, the raised face of the flange is made of the same material as the process isolating diaphragm.

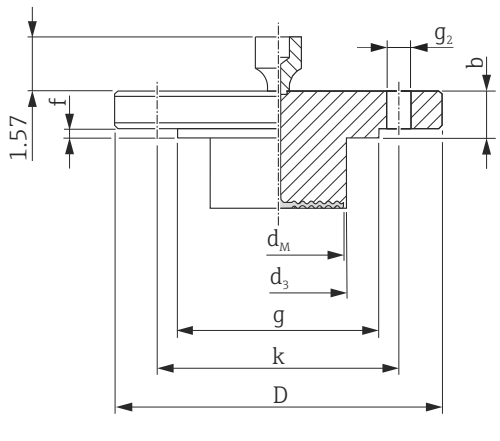
4) CSA approval: Product Configurator, order code for "Approval"

5) Product Configurator, order code for "Process connection"

Some device versions have CRN approval. A CRN-approved process connection with a CSA approval must be ordered for a CRN-approved device. These devices are fitted with a separate plate bearing the registration number 0F10525.5C.

Process connections FMD78 with diaphragm seal (continued)

ANSI flanges with extended diaphragm seal, as per connection dimensions ASME B 16.5, raised face RF



Engineering unit in

Material	Flange [1]						Boltholes			Diaphragm seal		Approval[2]	Option [3]
	Nominal diameter	Class	Diameter D	Thickness b	Raised face g	Raised face f	Quantity	Diameter g_2	Hole circle k	Max. diaphragm diameter d_M	Weight		
	[in]	[lb./sq.in]	[in]	[in]	[in]	[in]		[in]	[in]	[in]	[kg (lbs)]		
AISI 316/ 316L	3	150	7.5	0.94	5	0.06	4	0.75	6	2.83	[4]	CRN	J4 [4]
	4	150	9	0.94	6.19	0.06	8	0.75	7.5	3.50	[4]	CRN	J5 [4]

1) The roughness of the surface in contact with the media, including the raised face of the flanges (all standards) made of Alloy C, Monel or tantalum, is Ra 0.8 µm (31.5 µin). Lower surface roughness on request.

2) CSA approval: Product Configurator, order code for "Approval"

3) Product Configurator, order code for "Process connection"

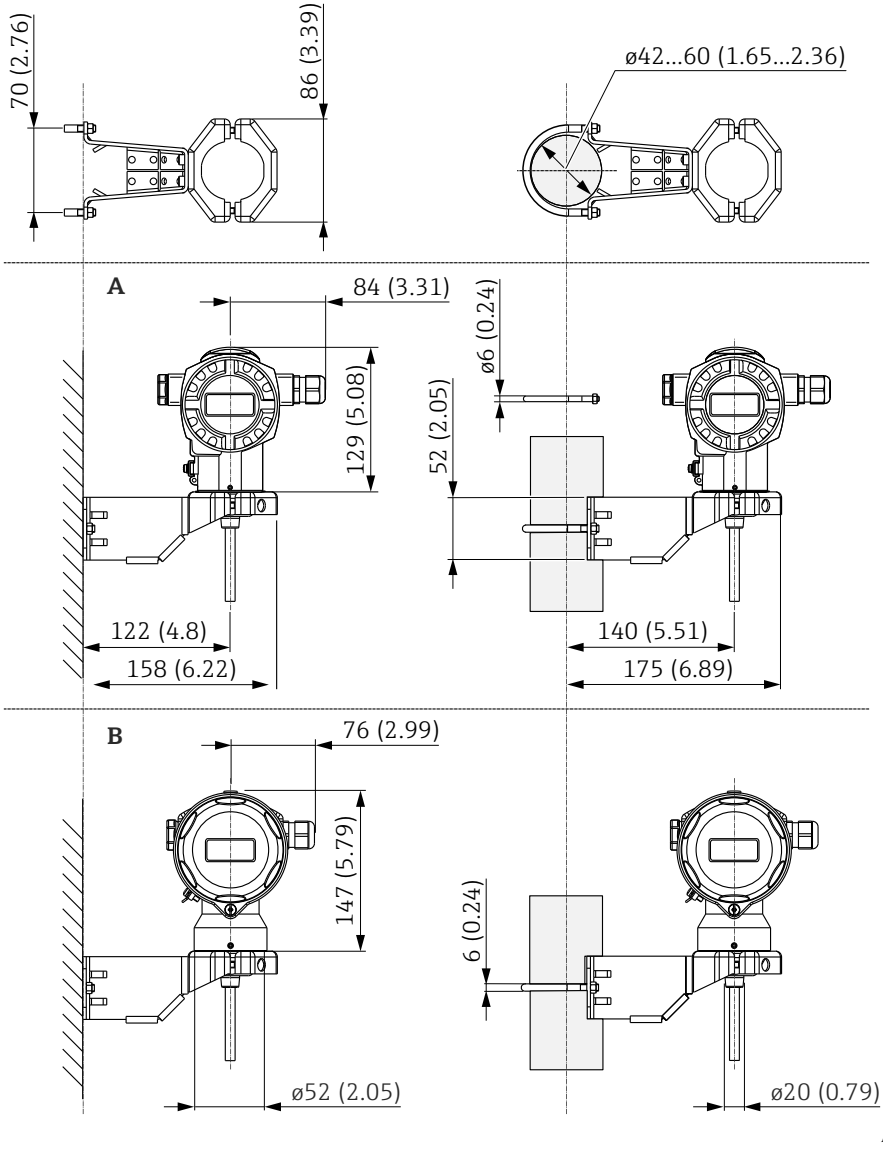
4) Available with 2", 4", 6" or 8" extended diaphragm seal, for extended diaphragm seal diameter and weight see the following table

Some device versions have CRN approval. A CRN-approved process connection with a CSA approval must be ordered for a CRN-approved device. These devices are fitted with a separate plate bearing the registration number 0F10525.5C.

Option [1]	Nominal diameter	Class	Extended diaphragm seal length (L)	Extended diaphragm seal diameter d_3	Weight
	[in]	[lb./sq.in]	in (mm)	in (mm)	[kg (lbs)]
J4	3	150	2 (50.8) / 4 (101.6) / 6 (152.4) / 8 (203.2)	2.99 (76)	6.0 (13.2) / 6.6 (14.5) / 7.1 (15.7) / 7.8 (17.2)
J5	4	150	2 (50.8) / 4 (101.6) / 6 (152.4) / 8 (203.2)	3.7 (94)	8.6 (19) / 9.9 (21.8) / 11.2 (24.7) / 12.4 (27.3)

1) Product Configurator, order code for "Process connection"

Separate housing:
wall and pipe mounting with mounting bracket



Engineering unit mm (in)

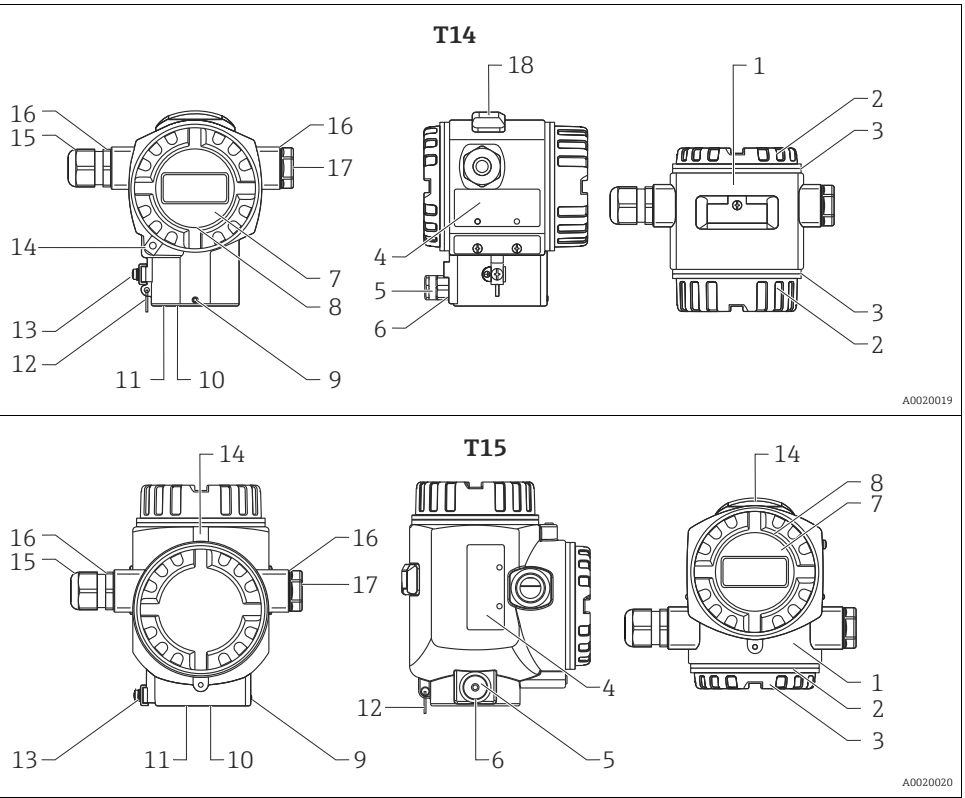
Position	Description	Weight (kg (lbs))		Option [1]
		Housing (T14 or T17)	Mounting bracket	
A	Dimensions with T14 housing, optional display on the side	→ 37 ff	0.5 (1.10)	U
B	Dimensions with T17 housing, optional display on the side			

1) Product Configurator, order code for "Additional options 2" option "U"

Can also be ordered as a separate accessory (part no.: 71102216).

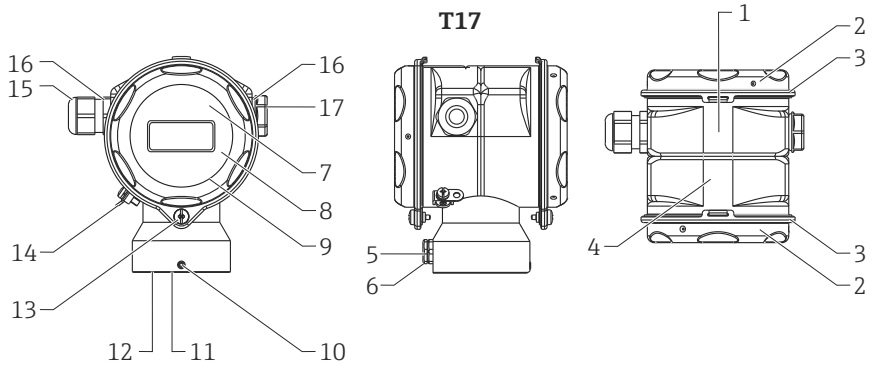
Materials not in contact with process

Housing



Front view, left-hand side view, top view

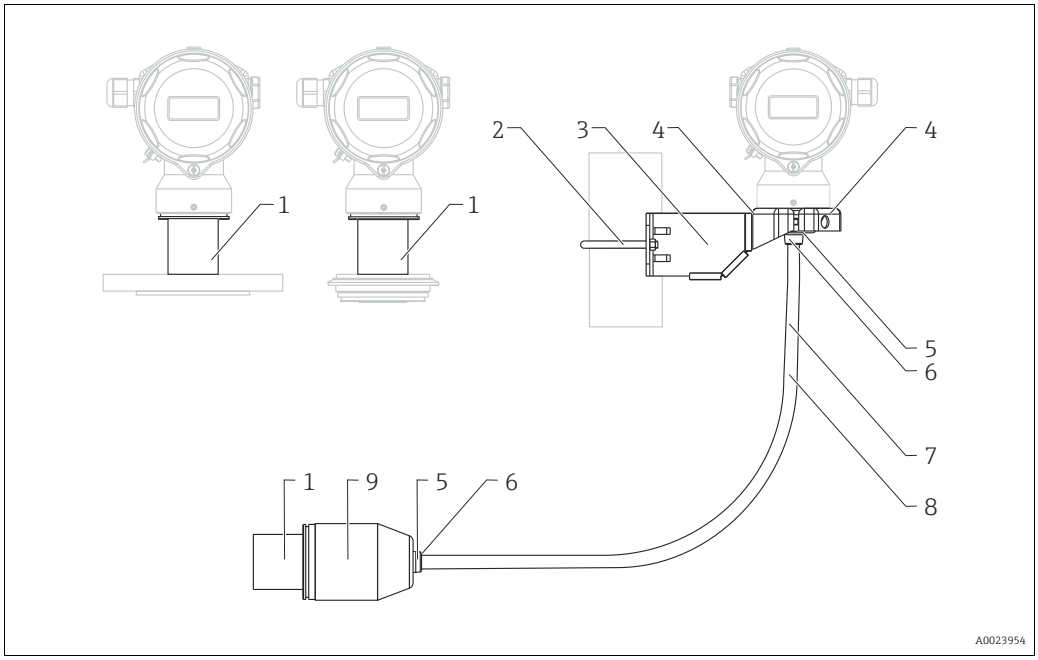
Item number	Component part	Material
1	T14 and T15 housing, RAL 5012 (blue)	▪ Die-cast aluminum with protective powder-coating on polyester base ▪ Thread coating: Heat-curing lubricant varnish
2	Cover, RAL 7035 (gray)	Die-cast aluminum with protective powder-coating on polyester base
3	Cover seal	EPDM
4	Nameplates	AISI 316L (1.4404)
5	Pressure compensation filter	AISI 316L (1.4404) and PBT-FR
6	Pressure compensation filter, O-ring	VMQ or EPDM
7	Sight glass	Mineral glass
8	Sight glass seal	Silicone (VMQ)
9	Screw	A4
10	Sealing ring	EPDM
11	Snap ring	PA66-GF25
12	Snap ring for nameplates	AISI 304 (1.4301)/ AISI 316 (1.4401
13	External ground terminal	AISI 304 (1.4301)
14	Cover clamp	Clamp AISI 316L (1.4435, screw A4
15	Cable entry	Polyamide (PA) or CuZn nickel-plated
16	Seal of cable entry and blind plug	Silicone (VMQ)
17	Blind plug	PBT-GF30 FR, for dust ignition-proof: AISI 316L (1.4435)
18	External operation (keys and key cover), RAL 7035 (gray)	Polycarbonate PC-FR, screw A4



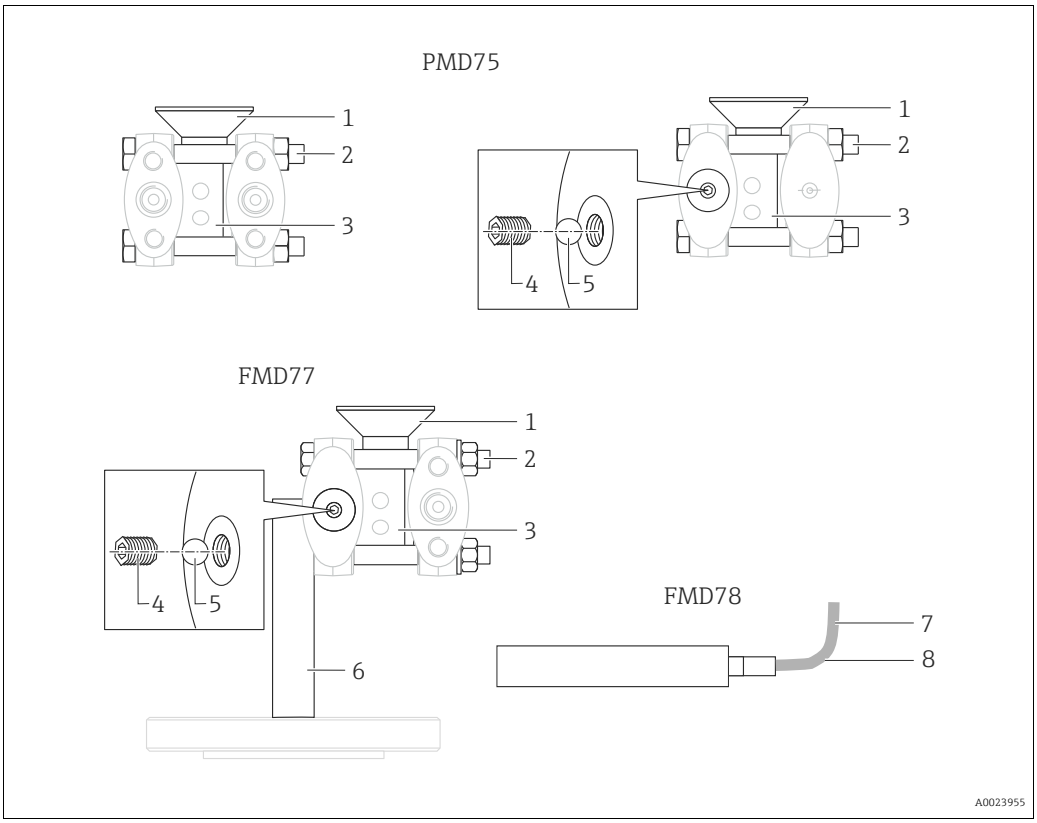
Front view, left-hand side view, top view

Item number	Component part	Material
1	T17 housing	AISI 316L (1.4404)
2	Cover	
3	Cover seal	EPDM
4	Nameplates	Lasered
5	Pressure compensation filter	AISI 316L (1.4404) and PBT-FR
6	Pressure compensation filter, O-ring	VMQ or EPDM
7	Sight glass for non-hazardous area, ATEX Ex ia, NEPSI Zone 0/1 Ex ia, IECEx Zone 0/1 Ex ia, FM NI, FM IS, CSA IS	Polycarbonate (PC)
8	Sight glass for ATEX 1/2 D, ATEX 1/3 D, ATEX 1 GD, ATEX 1/2 GD, ATEX 3 G, FM DIP, CSA dust ignition-proof	Mineral glass
9	Sight glass seal	EPDM
10	Screw	A2-70
11	Sealing ring	EPDM
12	Snap ring	PA6
13	Screw	A4-50
14	External ground terminal	AISI 304 (1.4301)
15	Cable entry	Polyamide PA, for dust ignition-proof: CuZn nickel-plated
16	Seal of cable entry and blind plug	Silicone (VMQ)
17	Blind plug	PBT-GF30 FR, for dust ignition-proof: AISI 316L (1.4435)

Connecting parts



Item number	Component part	Material
1	Connection between the housing and process connection	AISI 316L (1.4404)
2	Mounting bracket	Bracket AISI 316L (1.4404)
3		Screw and nuts A4-70
4		Half-shells: AISI 316L (1.4404)
5	Seal for cable from Separate housing	EPDM
6	Gland for cable from separate housing	AISI 316L (1.4404)
7	PE cable for separate housing	abrasion-proof cable with strain-relief Dynema members; shielded using aluminum-coated foil; insulated with polyethylene (PE-LD), black; copper wires, twisted, UV-resistant
8	FEP cable for separate housing	abrasion-proof cable; shielded using galvanized steel wire netting; insulated with fluorinated ethylene propylene (FEP), black; copper wires, twisted, UV-resistant
9	Process connection adapter for separate housing	AISI 316L (1.4404)



Item number	Component part	Material
1	Connection between the housing and process connection	AISI 316L (1.4404)
2	Screw and nuts	PMD75 PN 160: Hex.-headed bolt DIN 931-M12x90-A4-70/hex.-headed nut DIN 934-M12-A4-70 PMD75 PN 420: Hex.-headed bolt ISO 4014-M12x90-A4/ Hex.-headed nut ISO 4032-M12-A4-bs
		FMD77, FMD78: Hex.-headed bolt DIN 931-M12x 90-A4-70/ Hex.-headed nut DIN 934-M12 -A4-70
3	Cell body	AISI 316L (1.4404)
4	Setscrew	DIN 915 M 6x8 A2-70
5	Bearing	DIN 5401 (1.3505)
6	U-bracket	AISI 304 (1.4301)
7	Capillary	AISI 316 Ti (1.4571)
8	Protective hose for capillary	AISI 304 (1.4301)

Materials in contact with process

Process-wetted device components are listed in the "Mechanical construction" (→ 36) and "Ordering information" (→ 81) sections.

TSE Certificate of Suitability (Transmissible Spongiform Encephalopathy)

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

Process connections

- "Clamp connections" and "Hygienic connections" (see also "Ordering information" section): AISI 316L (DIN/EN material number 1.4435)
- Endress+Hauser supplies DIN/ EN process connections with threaded connections made of stainless steel as per AISI 316L (DIN/EN material number 1.4404 (AISI 316) or 14435). With regard to their stability-temperature property, the materials 1.4404 and 1.4435 are grouped together under 13E0 in EN 1092-1: 2001 Tab.18. The chemical composition of the two materials can be identical.
- Endress+Hauser supplies DIN/EN stainless steel flanges as per AISI 316L (DIN/ EN material number 1.4404 or 14435). With regard to their stability-temperature property, the materials 1.4404 and 1.4435 are grouped together under 13E0 in EN 1092-1: 2001 Tab.18. The chemical composition of the two materials can be identical.
- Side flanges: 316L, C 22.8 with zinc plating or Alloy C276
  Side flanges made out of C22.8 are zinc-plated. The zinc-plated carbon steel flange is not recommended for water application due to hydrogen diffusion. Endress+Hauser recommends the use of side flanges made of 316L.

Process isolating diaphragm

Device	Description	Option [1]
FMD77	AISI 316L	1
	Alloy C 276 [2]	2
	Monel [2]	3
	Tantalum [2]	5
	AISI 316L with gold-rhodium coating	6
	AISI 316L with 0.09 mm PTFE foil (not for vacuum applications)	7
FMD78	AISI 316L, TempC	E
	AISI 316L	1
	Alloy C 276 [2]	2
	Monel [2]	3
	Tantalum [2]	5
	AISI 316L with gold-rhodium coating	6
	AISI 316L with 0.09 mm PTFE foil (not for vacuum applications)	7
PMD75	AISI 316L	1
	Alloy C 276 (2.4819)	2
	Monel	3
	Tantalum	5
	Alloy C 276 with gold-rhodium coating	6

1) Product Configurator, order code for "Material of the process isolating diaphragm"

2) Raised face of flange is of same material as process isolating diaphragm.

Seals

Device	Description	Option [1]
PMD75	FKM Viton	A
	PTFE (PN160bar/16MPa/2400psi)	C
	PTFE (PN250bar/25MPa/3625psi)	D
	NBR	F
	Copper seal ring	H
	Copper seal ring, O2 application, note pressure and temperature application limits	K
	FKM Viton, cleaned from oil and grease	1
	FKM Viton, cleaned for oxygen service, note pressure and temperature application limits	2
	PTFE, cleaned for oxygen service, note pressure and temperature application limits	3

1) Product Configurator, order code for "Seal"

Filling oil

Fill fluid FMD77

Description	Option [1]
Silicone oil	A
Vegetable oil	D
Inert oil	F
Low-temperature oil	L
High-temperature oil	V

1) Product Configurator, order code for "Fill fluid"

Fill fluid FMD78

Description	Option [1]
... ft capillary; silicone oil	A
..... ft capillary; vegetable oil	B
..... ft capillary; high-temperature oil	C
..... ft capillary; inert oil, O2 application, observe pressure/temp. application limits	D
..... ft capillary; low-temperature oil	E
..... m capillary; silicone oil	1
..... m capillary; vegetable oil	2
..... m capillary; high-temperature oil	3
..... m capillary; inert oil, O2 application, observe pressure/temp. application limits	4
..... m capillary; low-temperature oil	5

1) Product Configurator, order code for "Transmitter mounting; Fill fluid"

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnosis

Quick and safe commissioning

Guided menus for applications

Reliable operation

- Local operation possible in several languages
- Standardized operation at the device and in the operating tools
- Parameters relating to measured values can be locked/unlocked using the device's write protection switch, using the device software or via remote control.

Efficient diagnostics increase measurement availability

- Remedial measures are integrated in plain text
- Diverse simulation options

Local operation

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

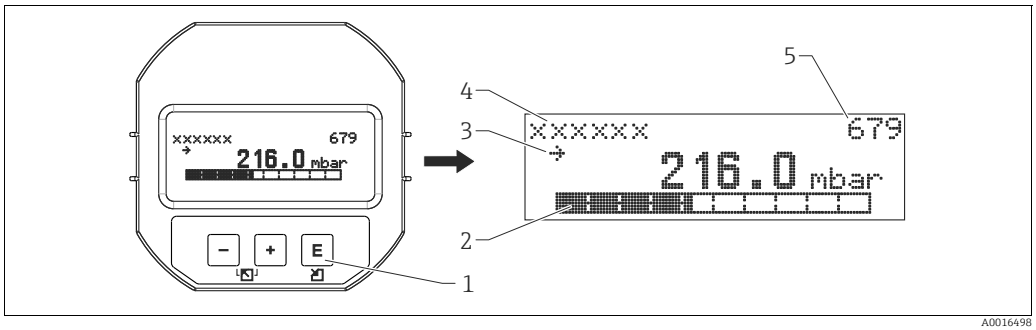
Operating the device using onsite display (optional)

A 4-line liquid crystal display (LCD) is used for display and operation. The onsite 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 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
  - PROFIBUS PA as graphic display of the standardized value of the AI Block
  - FOUNDATION Fieldbus as graphic display of the transducer output.
- Simple and complete menu guidance thanks to separation of the parameters into several levels and groups.
- Menu guidance up to 8 languages

- Each parameter is given a 3-digit ID number for easy navigation.
- Option for configuring the display according to individual requirements and preferences, 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.

Overview



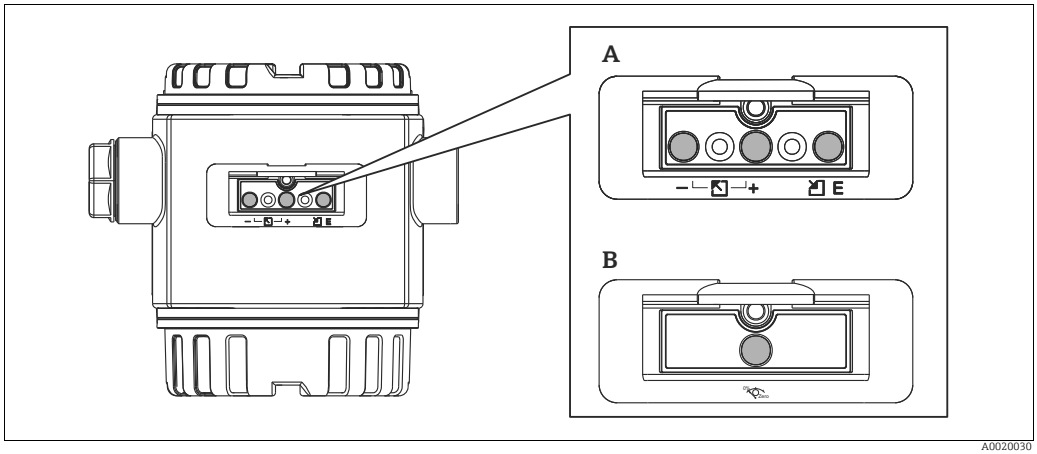
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1 Operating keys
2 Bar graph
3 Symbol
4 Header line
5 Parameter identification number

Ordering information:
Product Configurator, order code for "Output, operation"

Operating keys on the exterior of the device

With the aluminum housing (T14), the operating keys are located either outside on the housing, under the protection cap or inside on the electronic insert. With the T17 housing (stainless steel), the operating keys are located inside the housing on the electronic insert.



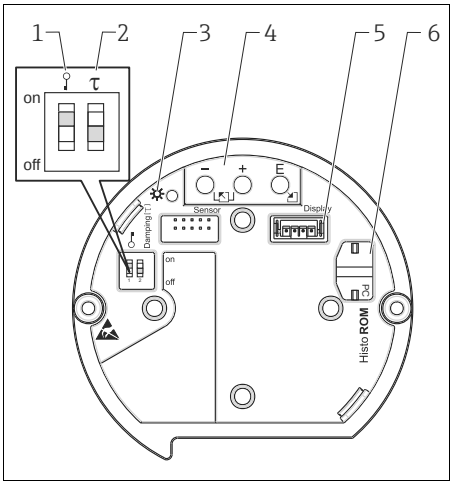
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A 4 to 20 mA HART
B PROFIBUS PA and FOUNDATION Fieldbus

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.

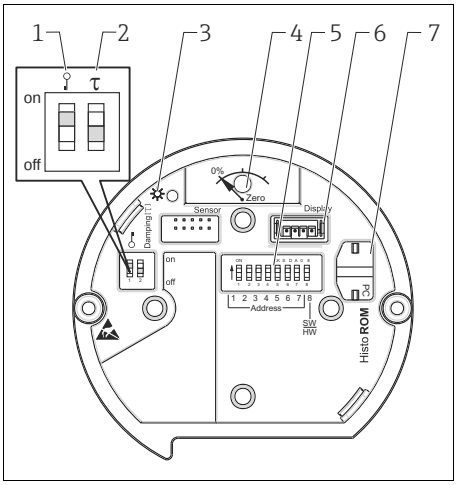
Ordering information:
Product Configurator, order code for "Output, operation"

Operating keys and elements located internally on the electronic insert



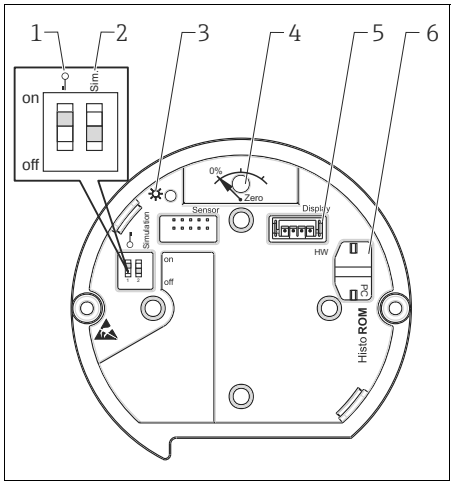
Electronic insert HART

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



Electronic insert PROFIBUS PA

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



Electronic insert FOUNDATION Fieldbus

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

Ordering information:
Product Configurator, order code for "Output, operation"

Remote operation

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

Hardware and software for remote operation	HART	PROFIBUS PA	FOUNDATION Fieldbus
FieldCare → 🖹 68 ff	✔ 1)	✔ 2)	✔
FieldXpert SFX100 → 🖹 69 ff	✔	–	✔
NI-FBUS Configurator → 🖹 69 ff	–	–	✔
HistoROM®/M-DAT → 🖹 70 ff	✔	✔	✔

1) Commubox FXA195 required → 🖹 69 ff

2) Profiboard or Proficard required → 🖹 69 ff

FieldCare

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

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

Connection options:
- HART via Commubox FXA195 and the USB port on a computer
- PROFIBUS PA via segment coupler and PROFIBUS interface card
- Service interface with Commubox FXA291 and ToF adapter FXA291 (USB).

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

Field Xpert SFX100

Field Xpert is an industrial PDA with integrated 3.5" touchscreen from Endress+Hauser based on Windows Mobile. It communicates via wireless with the optional VIATOR Bluetooth modem or wireless via WiFi and Endress+Hauser's Fieldgate FXA520. Field Xpert also works as a stand-alone device for asset management applications. For details, refer to BA00060S/04/EN.

Commubox FXA195

For intrinsically safe HART communication with FieldCare via the USB interface. For details refer to TI00404F/00/EN.

Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field devices with a CDI interface (=Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook. For details refer to TI00405C/07/EN.

For the following Endress+Hauser devices 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 devices of the ToF platform, pressure equipment and Gammapilot via the USB interface of a personal computer or a notebook. For details refer to KA00271F.

Profiboard

For connecting a PC to PROFIBUS.

Proficard

For connecting a laptop to PROFIBUS

FF configuration program

FF configuration program, such as NI-FBUS Configurator, to
- connect devices with "FOUNDATION Fieldbus signal" into an FF-network
- set FF-specific parameters

Remote operation via:
- 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

HistoROM®/M-DAT (optional)

HistoROM®/M-DAT is a memory module which can be attached to every 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 diagnosis 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).

A CD with an 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.

Ordering information:
Product Configurator, order code for "Additional options 1" or "Additional options 2" option "N" or
Product Configurator, order code for "Application package:" option "EN" or
as a separate accessory (part no.: 52027785).



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

System integration

The device can be given a tag name (max. 8 alphanumeric characters).

Description	Option [1]
Measuring point (TAG), see additional spec.	Z1
Bus address, see additional spec.	Z2

1) Product Configurator, order code for "Identification"

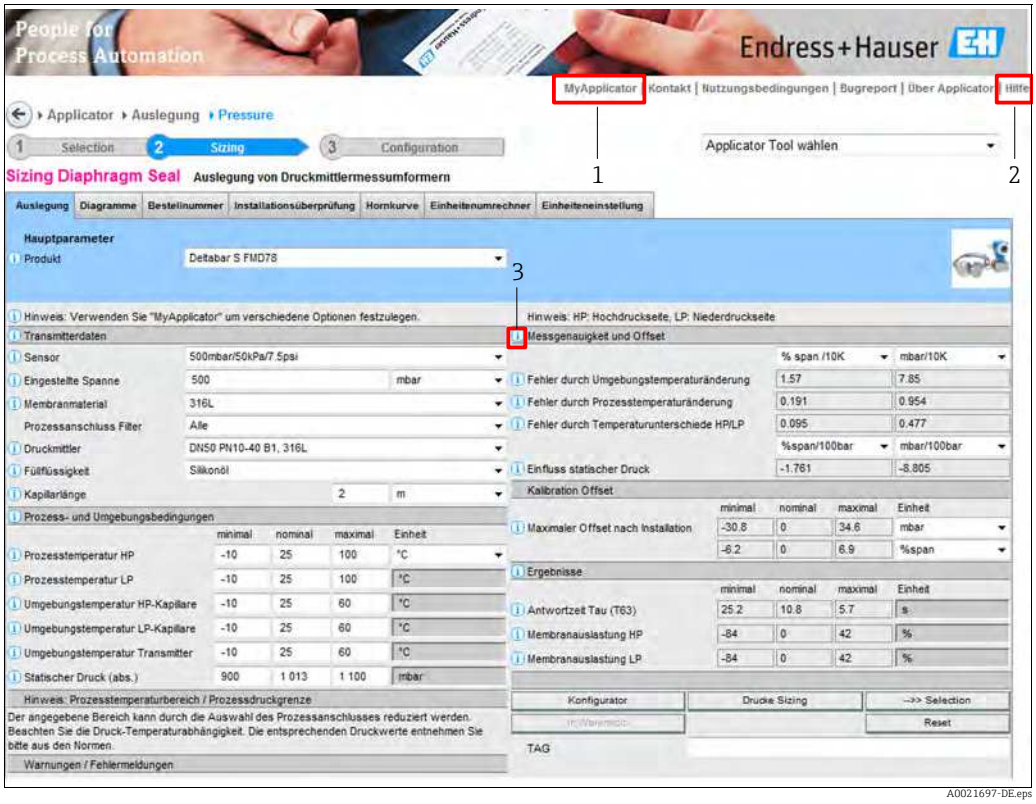
Planning instructions, diaphragm seal systems

NOTICE

Incorrect sizing/ordering of diaphragm seal systems

The performance and the permitted range of application of a diaphragm seal system depend on the process isolating diaphragm used, the filling oil, the coupling, the unit design and on the process and ambient conditions present in the individual application.

- To help you select the right diaphragm seal systems for your applications, Endress+Hauser provides its customers with the free "Applicator Sizing Diaphragm Seal" tool, which is available on DVD or at "www.endress.com/applicator".



1 My Applicator - Configuration of the Applicator settings

2 Applicator help

3 Mouse-Over help - slide with the mouse pointer over these fields and get short informations

For more detailed information or the layout of the optimum diaphragm seal solution for your application, please contact your local Endress+Hauser Sales Center.

Applications

Diaphragm seal systems should be used if the process and the device should be separated. Diaphragm seal systems offer clear advantages in the following instances:

- In the case of extreme process temperatures
- For aggressive media
- 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 extreme measuring point cleaning is necessary, or for very humid mounting locations
- If the measuring point is exposed to severe 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 media.

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

- A differential pressure transmitter

The process pressure acts via the process isolating diaphragm of the diaphragm seal 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.

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

Diameter of the process isolating diaphragm

The greater the diameter of the process isolating diaphragm (less stiff), the smaller the temperature effect on the measurement result.

Stiffness of the process isolating diaphragm

The stiffness depends on the diameter of the process isolating diaphragm, the material, any existing coating and the thickness and shape of the process isolating diaphragm. The process isolating diaphragm thickness and the shape are determined by the design. The stiffness of a process isolating diaphragm of a diaphragm seal influences the temperature operating range and the measuring error caused by temperature effects.

The new TempC diaphragm achieves the highest level of accuracy and process safety when measuring pressure and differential pressure with diaphragm seals

To ensure even greater measurement accuracy and increased process safety in these applications, Endress+Hauser has developed the TempC diaphragm which is based on a completely revolutionary technology. The diaphragm guarantees the highest level of accuracy and process safety in diaphragm seal applications.
- The very low temperature effect minimizes the effect of fluctuations in process and ambient temperature, thereby guaranteeing accurate and reliable measurements. Measurement inaccuracies caused by temperature are reduced to a minimum.
- The TempC diaphragm can be used at temperatures between -40 °C (-40 °F) and +250 °C (+482 °F). This guarantees maximum process safety even for very long sterilization and cleaning cycles (SIP/CIP) in tanks and pipes at high temperatures.
- Smaller instrumentation is possible thanks to the TempC diaphragm. With a smaller process connection, the new diaphragm measures at least as accurately as a conventional diaphragm with a larger diameter.
- Short recovery times after temperature shocks mean less downtime during batch processes and therefore a far higher level of availability of the production facilities.
- In addition, the TempC diaphragm excels in terms of its improved hygienic cleanability and its insensitivity to substantial changes in the pressure load.

Ordering information:
See the Product Configurator for the individual process connection and the choice of process isolating diaphragm.
Selection in the Applicator:
Under "Transmitter data" in the "Diaphragm material" field.

Capillary

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

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

The capillary tube influences the thermal change, the ambient temperature operating range and the response time of a diaphragm seal system as a result of its length and internal diameter.

Filling oil

When selecting the filling oil, the process 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 media. 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 thermal change, the temperature operating range of a diaphragm seal system and the response time. A temperature change results in a volume change of the filling oil. The volume change is dependent on the expansion coefficient and the volume of the filling oil at calibration temperature (constant in the range: +21 to +33 °C (+70 to 91 °F)).
For example, the filling oil expands in the event of a temperature increase. The additional volume presses against the process isolating diaphragm of a diaphragm seal. 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.

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 optimized with regard to the minimum volume change and side flange.

Diaphragm seal filling oils

Option [1]	Filling oil	Permissible temperature range [2] at 0.05 bar (0.725 psi) ≤ p_{abs} ≤ 1 bar (14.5 psi)	Permissible temperature [2] range at p_{abs} ≥ 1 bar (14.5 psi)	Density [g/cm³] / [SGU]	Viscosity [mm²/s] / [cSt] at 25 °C (77 °F)]	Coefficient of thermal expansion [1/K]	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	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	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	Oil for ultrapure 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	Suitable for foods FDA 21 CFR 172.856
FMD77: L FMD78: E, 5	Low-temperature oil	−70 to +80 °C (-94 to +176 °F)	−70 to +180 °C (-94 to +356 °F)	0.92	4.4	0.00108	Low temperatures

1) Product Configurator, order code for "Fill fluid"

2) Observe temperature limits of the device (→ 34) and the system (→ 71).

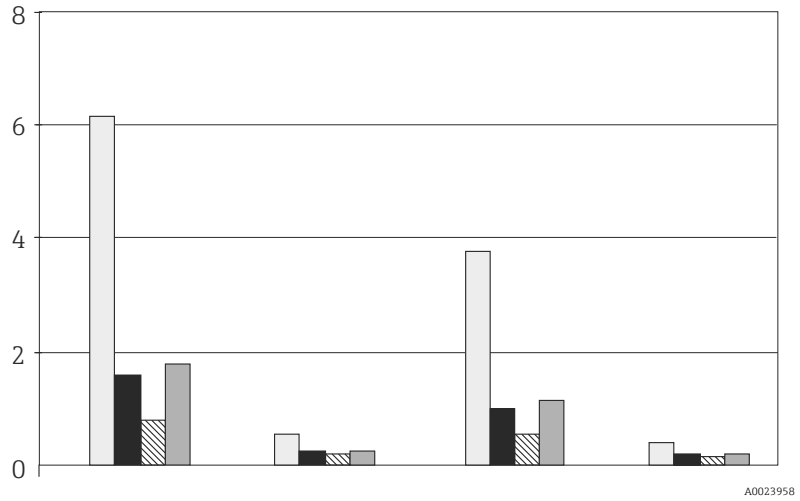
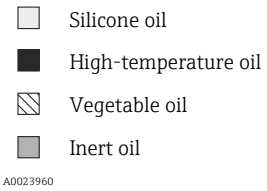
Operating temperature range

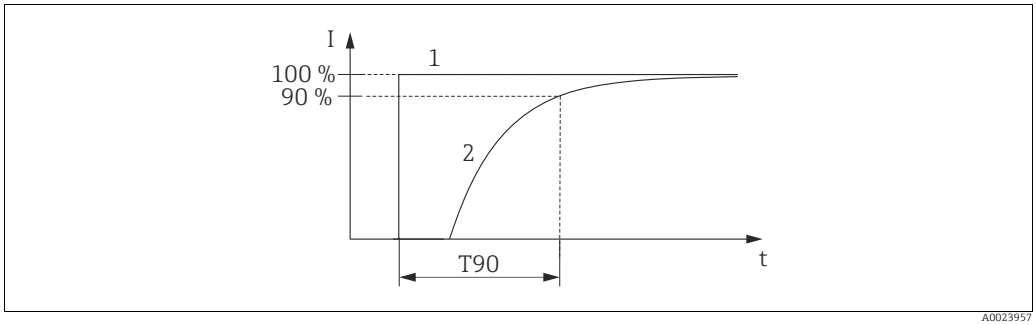
The operating temperature range of a diaphragm seal system depends on the fill fluid, capillary length and internal diameter, process temperature and oil volume of the diaphragm seal.
The range of application can be extended by using a fill fluid with a smaller expansion coefficient and a shorter capillary.

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, 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 meter 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.

Ambient temperature 20 °C (68 °F)					Oil
Response time (T90) [sec/m] 					
Nominal diameter	DN 50	DN 80	DN 50	DN 80	
Internal diameter of capillary	1 mm (0.04 in)	2 mm (0.08 in)	1 mm (0.04 in)	2 mm (0.08 in)	
Measuring cell	500 mbar (7.5 psi)		3 bar (45 psi)		



Presentation of the response time (T90%)

1 Pressure increase
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 media. – Observe the filling oil operating limits.

Cleaning instructions

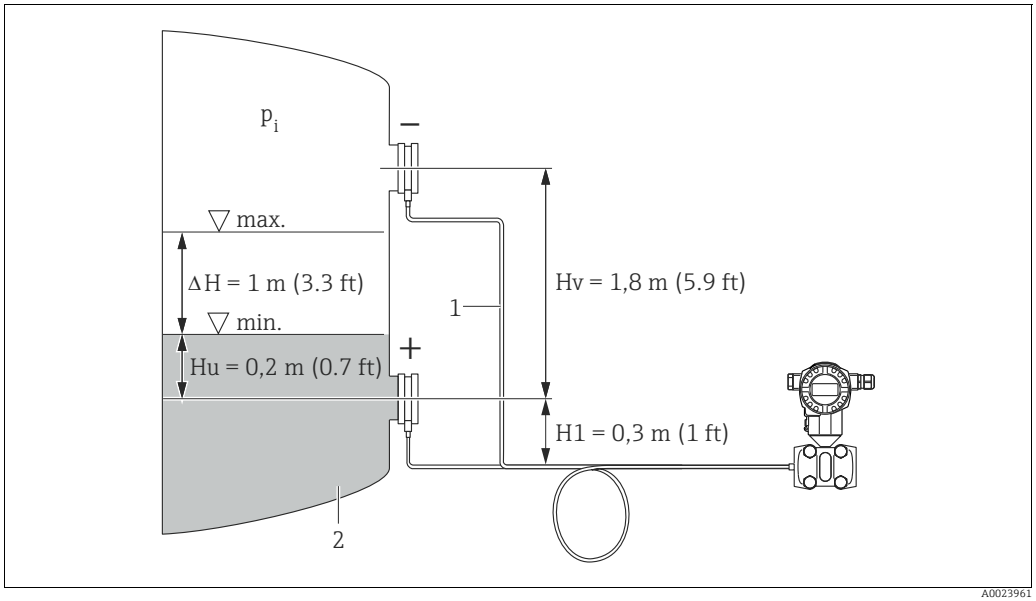
- Endress+Hauser offer flushing rings as accessories to clean process isolating diaphragms without taking the transmitters out of the process.
  For further information please contact your local Endress+Hauser Sales Center.
- We recommend you perform CIP (cleaning in place (hot water)) before SIP (sterilization in place (steam)) for pipe diaphragm seals.
  A frequent use of sterilization in place (SIP) will increase the stress on the process isolating diaphragm. Under unfavorable circumstances in the long term view we cannot exclude that a frequent temperature change could lead to a material fatigue of the process isolating diaphragm and possibly to a leakage.

Installation instructions

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 a 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 (capillary bending radius ≥ 100 mm (3.94 in)).
- 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 liquid column in the capillaries!)



1 Capillary with silicone oil.. $\rho_{FI} = 0.96$ kg dm^3
2 Vessel with water. $\rho_M = 1.0$ kg dm^3

Pressure on the negative side of the differential pressure transmitter (p_-) when the vessel is empty (minimum level):

$$p_- = p_{HV} + p_{H1} = Hv \cdot \rho_{FI} \cdot g + H1 \cdot \rho_{FI} \cdot g + p_i$$
$$= 1{,}8\ \text{m} \cdot 0{,}96 \frac{\text{kg}}{\text{dm}^3} \cdot 9{,}81 \frac{\text{m}}{\text{s}^2} + 0{,}3\ \text{m} \cdot 0{,}96 \frac{\text{kg}}{\text{dm}^3} \cdot 9{,}81 \frac{\text{m}}{\text{s}^2} + p_i$$
$$= 197{,}77\ \text{mbar} + p_i$$

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Pressure on the positive side of the differential pressure transmitter (p_+) when the vessel is empty (minimum level):

$$p_+ = p_{HU} + p_{H1} = Hu \cdot \rho_M \cdot g + H1 \cdot \rho_{FI} \cdot g + p_i$$
$$= 0{,}2\ m \cdot 1 \frac{kg}{dm^3} \cdot 9{,}81 \frac{m}{s^2} + 0{,}3\ m \cdot 0{,}96 \frac{kg}{dm^3} \cdot 9{,}81 \frac{m}{s^2} + p_i$$
$$= 47{,}87\ mbar + p_i$$

A0023981

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

$$\Delta p_{Transmitter} = p_+ - p_-$$
$$= 47{,}87\ mbar - 197{,}77\ mbar$$
$$= -149{,}9\ mbar$$

A0023982

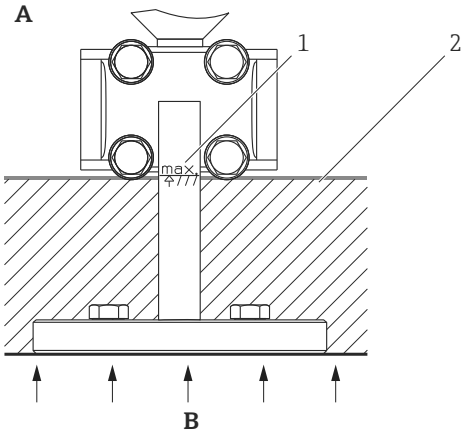
Result:
If the vessel were full, a differential pressure of −51.80 mbar (-0.762 psi) would be present at the differential pressure transmitter. When the tank is empty, a differential pressure of −149.90 mbar (2.2485 psi) is present. Therefore, a 500 mbar (7.5 psi) measuring cell is required for this application.

Capillary

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 or above the reference temperature
- with a bending radius of ≥ 100 mm (3.94 in).

Heat insulation – FMD77

The FMD77 must only be insulated up to a certain height. The maximum permitted insulation height is indicated 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. The data were determined under the most critical application "quiescent air".



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Maximum insulation height, here indicated on a PMP75 with a flange

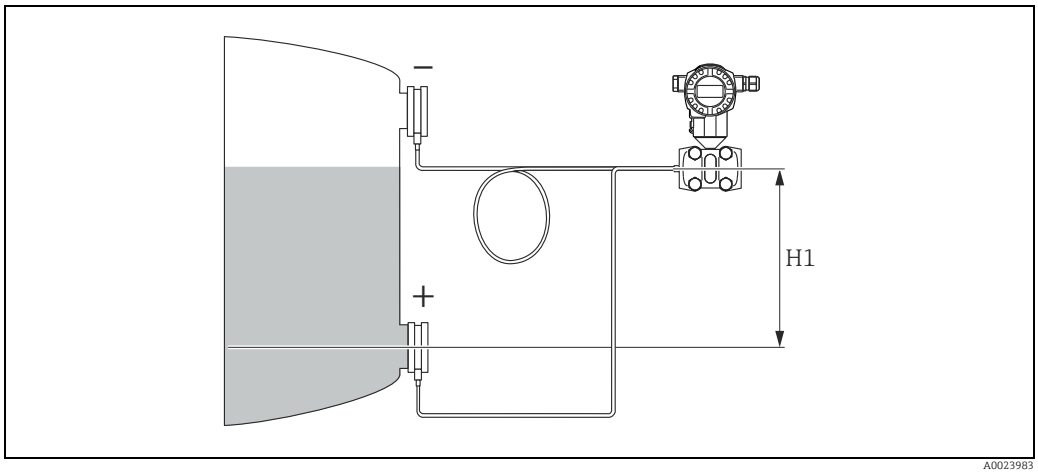
A Ambient temperature
B Process temperature
1 Maximum permitted insulation height
2 Insulation material

Vacuum applications

Installation instructions

For applications under vacuum, Endress+Hauser recommends mounting the pressure transmitter below the lower diaphragm seal. This prevents a vacuum load of the diaphragm seal caused by the presence of filling oil in the capillaries.

When the pressure transmitter is mounted above the lower diaphragm seal, the maximum height difference H1, as per the following illustrations, must not be exceeded:



Installation above the lower diaphragm seal

The maximum height difference is dependent on the density of the filling oil and the lowest pressure that is ever allowed to occur at the diaphragm seal on the positive side (empty vessel), see the following illustration.

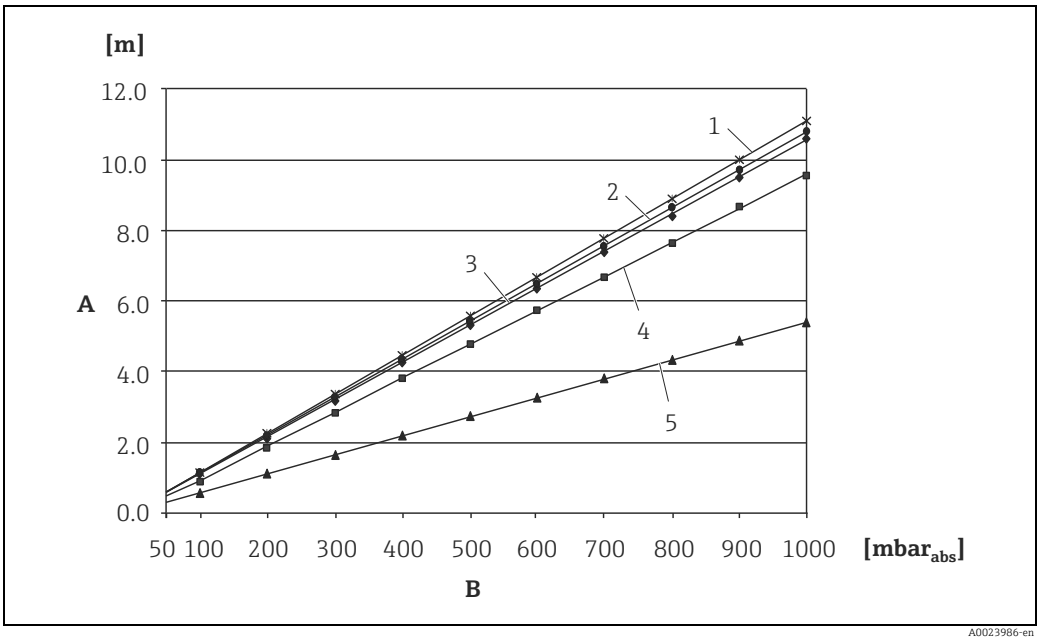


Diagram of maximum installation height above the lower diaphragm seal for vacuum applications dependent on the pressure at the diaphragm seal on the positive side

A Height difference H1
B Pressure at diaphragm seal
1 Low-temperature oil
2 Vegetable oil
3 Silicone oil
4 High-temperature oil
5 Inert oil

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.

C-tick symbol

The measuring system complies with the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

Ex approvals

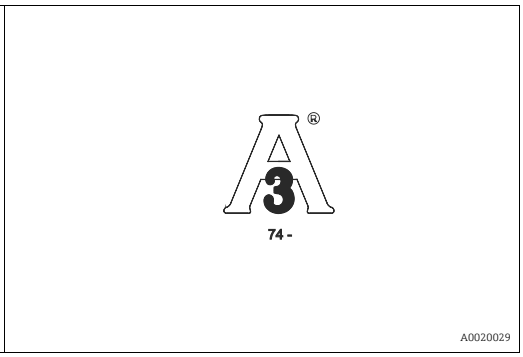
- ATEX
- FM
- CSA
- NEPSI
- IECEx
- GOST on request
- Also combinations of different approvals

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.
→ 84, "Safety Instructions" and "Installation/Control Drawings" sections.

Suitability for hygienic processes

- Materials in contact with food are in conformity to framework regulation EG No. 1935/2004.
- The Deltabar S is suitable for use in hygienic processes.
  Overview of suitable process connections from → 39 ff.
  Many versions meet the requirements of 3A-Sanitary Standard No. 74 and are certified by the EHEDG.
  Suitable fittings and seals must be used to ensure hygiene-compliant design according to the specifications of 3A and EHEDG.





The gap-free connections can be cleaned without residue using the usual cleaning methods.

Marine certificate

- GL: FMD78, PMD75
- ABS: FMD78, PMD75

Ordering information:
Product Configurator, order code for "Additional options 2" option "S".

Functional Safety SIL / IEC 61508 Declaration of Conformity (optional)

The Deltabar S with 4 to 20 mA output signal has been developed to IEC 61508 standard. The device 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 to the "Functional Safety Manual - Deltabar S" SD00189P.
For devices with SIL / IEC 61508 Declarations of Conformity, see:
Ordering information:
Product Configurator, order code for "Additional options 1" option "E"

Overfill prevention

WHG. See "Ordering information"
Ordering information:
Product Configurator, order code for "Approval" option "F".

CRN approvals

Some device versions have CRN approval. A CRN-approved process connection (see order code for "Process connection") with a CSA approval must be ordered for a CRN-approved device. These devices are fitted with a separate plate bearing the registration number 0F10524.5C.
Ordering information:
Product Configurator, order code for "Process connection; Material" and
Product Configurator, order code for "Approval"

Pressure Equipment Directive (PED)

The devices PMD75, FMD77 and FMD78 correspond to Article 3 (3) of the EC directive 97/23/EG (Pressure Equipment Directive) and have been designed and manufactured according to good engineering practice.

The following also 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 performance evaluation

DIN 16086:
Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments,
concepts, specifications on data sheets

EN 61326-X:
EMC product family standard for electrical equipment for measurement, control and laboratory use.

Classification of process sealing between electrical systems and (flammable or combustible) process fluids in accordance with ANSI/ISA 12.27.01

Endress+Hauser devices are designed in accordance with ANSI/ISA 12.27.01. allowing the user to waive the use and save the cost of installing external secondary process seals in the conduit as required by the process sealing sections of ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC). These instruments comply with the North American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous fluids. Please refer to the following table for the seal class assigned (single seal or dual seal):

Device	Approval	Single seal MWP
PMD75	CSA C/ US IS, XP	420 bar (6300 psi)
FMD77	CSA C/ US IS, XP	160 bar (2400 psi)
FMD78	CSA C/ US IS, XP	160 bar (2400 psi)

Further information can be found in the control drawings of the relevant devices.

Inspection certificate

Description	FMD77	FMD78	PMD75	Option
3.1 Material documentation, wetted metal parts, EN10204-3.1 inspection certificate	✔	✔	✔	B[1)]
3.1 Material documentation, wetted metal parts, EN10204-3.1 inspection certificate	✔	✔	✔	YES[2)]
3.1 Material documentation, wetted metal parts, EN10204-3.1 inspection certificate	—	—	✔	B[3)]
EN10204-3.1 material, NACE MR0175, wetted metal parts, inspection certificate	✔	✔	✔	D [1)]
Declaration of Conformity NACE MR0175, wetted metal parts	✔	✔	✔	JB [2)]
Declaration of Conformity NACE MR0175, wetted metal parts	✔	✔	✔	C [1)]
EN10204-3.1 routine test, inspection certificate	✔	✔	✔	3 [1) 4)]
EN10204-3.1 pressure test, inspection certificate	✔	✔	✔	4 [1) 4)]
EN10204-3.1 material wetted parts +Ra, Ra= surface roughness, dimensional check, inspection certificate	—	✔	—	6 [1) 4)]
EN10204-3.1 Delta-Ferrit content test, inspection certificate	—	✔	—	8 [1) 4)]

1) Product Configurator, order code for "Additional options 1"

2) Product Configurator, order code for "Test, certificate"

3) Product Configurator, order code for "Additional options 1"

4) Product Configurator, order code for "Additional options 2"

Calibration

Description	FMD77	FMD78	PMD75	Option [1)]
Nominal range; mbar/bar	✔	✔	✔	1
Nominal range; kPa/MPa	✔	✔	✔	2
Nominal range; mmH2O/mH2O	✔	✔	✔	3
Nominal range; inH2O/ftH2O	✔	✔	✔	4
Nominal range; psi	✔	✔	✔	6
Configured for Deltatop; see additional specification	—	—	✔	8
Customer-specific; see additional specification	✔	✔	✔	B
Factory calibration certificate, 5-point; see additional specification	✔	✔	✔	C
DKD/DAkkS certificate; see additional specification	✔	✔	✔	D
Customised pressure; see additional specification	✔	✔	✔	E
Customised level; see additional specification	✔	✔	✔	F
Customised flow; see additional specification	—	—	✔	G
Customized pressure + 5-point factory calibration certificate; see additional specification	✔	✔	✔	H
Customised level + 5-point works calibration certificate; see additional specification	✔	✔	✔	I
Customized flow + 5-point factory calibration certificate; see additional specification	✔	✔	✔	J
Platinum; see additional specification	—	—	✔	K
Platinum + factory calibration certificate 5-point; see additional specification	—	—	✔	L
Platinum + DKD/DAkkS certificate; see additional specification	—	—	✔	M

1) Product Configurator, order code for "Calibration; Unit"

Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Configuration data sheet

Pressure

The following configuration data sheet must be completed and included with the order if the option "E" or the option "H" has been selected in the Product Configurator for the order code for "Calibration; Unit".

Pressure unit

❑ mbar	❑ mmH_2O [1]	❑ mmHg [2]	❑ Pascal	❑ torr
❑ bar	❑ mH_2O [1]	❑ inHg [2]	❑ hPa	
	❑ ftH_2O [1]		❑ kPa	❑ g/cm^2
❑ psi	❑ inH_2O [1]	❑ gf/cm^2	❑ MPa	❑ kg/cm^2
		❑ kgf/cm^2		
				❑ lb/ft^2
				❑ atm

[1] The conversion factor for the pressure unit is based on a reference temperature of 4 °C (39.2 °F).
[2] The conversion factor for the pressure unit is based on a reference temperature of 0 °C (32 °F).

Calibration Range / Output

Low range value (LRV): _____ [pressure engineering unit)]

Upper range value (URV): _____ [pressure engineering unit)]

Display Information

Display the contents of the main line [1]
❑ Main Value [PV] (Default)
❑ Main Value [%]
❑ Pressure
❑ Current [mA] (HART only)
❑ Temperature
❑ Error number
❑ Alternating display

[1] Depending on sensor and comunication variant

Damping

Damping: _____ sec (Default 2 sec)

Smallest span (factory calibration) → 10.

Level

The following configuration data sheet must be completed and included with the order if the option "F" or the option "T" has been selected in the Product Configurator for the order code for "Calibration; Unit".

Pressure unit

❑ mbar	❑ mmH_2O [1]	❑ mmHg [2]	❑ Pascal	❑ torr
❑ bar	❑ mH_2O [1]	❑ inHg [2]	❑ hPa	
	❑ ftH_2O [1]		❑ kPa	❑ g/cm^2
❑ psi	❑ inH_2O [1]	❑ gf/cm^2	❑ MPa	❑ kg/cm^2
		❑ kgf/cm^2		
				❑ lb/ft^2
				❑ atm

Output Unit (Scaled unit)

Mass	Length	Volume	Volume	Percent
❑ kg	❑ m	❑ l	❑ USgal	❑ %
❑ t	❑ dm	❑ hl	❑ impgal	
❑ lb	❑ cm		❑ USbblPETR	
	❑ mm	❑ m^3		
		❑ ft^3		
	❑ ft			
	❑ inch			

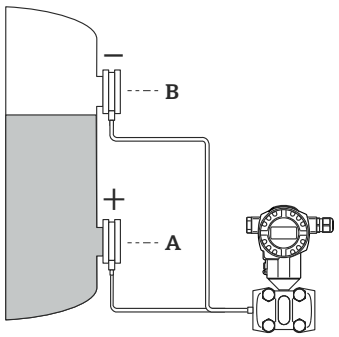
Empty pressure [a]:
Low pressure value (empty) _____ [pressure engineering unit)]

Empty calibration [a]:
Low level value (empty) _____ [Scaled Unit]

Full pressure [b]:
High pressure value (full) _____ [pressure engineering unit)]

Full calibration [b]:
High level value (full) _____ [Scaled Unit]

Example



A0023985

A *500 mbar (7.25 psi) / 100 m^3*
B *50 mbar (1 psi) / 3 m^3*

[1] The conversion factor for the pressure unit is based on a reference temperature of 4 °C (39.2 °F).
[2] The conversion factor for the pressure unit is based on a reference temperature of 0 °C (32 °F).

Display Information

Display the contents of the main line [1]
❑ Main Value [PV] (Default)
❑ Main Value [%]
❑ Pressure
❑ Current [mA] (HART only)
❑ Temperature
❑ Level before lin.
❑ Tank content
❑ Error number
❑ Alternating display

[1] Depending on sensor and comunication variant

Damping

Damping: _____ sec (Default 2 sec)

Flow

The following configuration data sheet must be completed and included with the order if the option "G" or the option "J" has been selected in the Product Configurator for the order code for "Calibration; Unit".

Pressure unit

❑ mbar	❑ mmH_2O [1]	❑ mmHg [2]	❑ Pascal	❑ torr
❑ bar	❑ mH_2O [1]	❑ inHg [2]	❑ hPa	
	❑ ftH_2O [1]		❑ kPa	❑ g/cm^2
❑ psi	❑ inH_2O [1]	❑ gf/cm^2	❑ MPa	❑ kg/cm^2
		❑ kgf/cm^2		
				❑ lb/ft^2
				❑ atm

Flow Unit / Measured Value (PV)

❑ Mass	❑ Volume Operation Condition	❑ Volume Norm Condition	❑ Volume Standard Condition
❑ kg/s	❑ m^3/s	❑ Nm^3/s	❑ Sm^3/s
❑ kg/min	❑ m^3/min	❑ Nm^3/min	❑ Sm^3/min
❑ kg/h	❑ m^3/h	❑ Nm^3/h	❑ Sm^3/h
❑ t/s	❑ l/s	❑ Nm^3/d	❑ Sm^3/d
❑ t/min	❑ l/min		❑ Scf/s
❑ t/h	❑ l/h		❑ Scf/min
❑ oz/s	❑ US Gal/s		❑ Scf/h
❑ oz/min	❑ US Gal/min		❑ Scf/d
❑ lb/s	❑ US Gal/h		
❑ lb/min	❑ ACFS		
❑ lb/h	❑ ACFM		
	❑ ACFH		

[1] The conversion factor for the pressure unit is based on a reference temperature of 4 °C (39.2 °F).
[2] The conversion factor for the pressure unit is based on a reference temperature of 0 °C (32 °F).

Output Characteristic

❑ linear (HART only)

Operation Point
Max Pressure _____ [pressure engineering unit)]
Max Flow _____ [flow unit]
LRV _____ [pressure engineering unit)]
(Lower Range Value (HART only))

❑ square root (HART only)

Operation Point
Max Pressure _____ [pressure engineering unit)]
Max Flow _____ [flow unit]
LRV _____ [flow unit]
(Lower Range Value (HART only))

Low flow cut off

Value: _____ [%] (default = 5%)

Display Information

Display the contents of the main line [1]
❑ Main Value [PV] (Default)
❑ Main Value [%]
❑ Pressure
❑ Current [mA] (HART only)
❑ Temperature
❑ Flow
❑ Totalizer 1
❑ Totalizer 2
❑ Error number
❑ Alternating display
[1] Depending on sensor and comunication variant

Damping

Damping: _____ sec (Default 2 sec)

Additional documentation

Field of Activities

- Pressure measurement, powerful instruments for process pressure, differential pressure, level and flow: FA00004P/00/EN

Technical Information

- Deltapilot S: TI00416P/00/EN
- Cerabar S: TI00383P/00/EN
- Deltatop:
  - Orifice plate (TI00422P/00/EN)
  - Pitot tube (TI00425P/00/EN)
- EMC test procedures: TI00241F/00/EN

Operating Instructions

4 to 20 mA HART:
- Deltabar S: BA00270P/00/EN
- Description of device functions Cerabar S/Deltabar S/Deltapilot S: BA00274P/00/EN

PROFIBUS PA:
- Deltabar S: BA00294P/00/EN
- Description of device functions Cerabar S/Deltabar S/Deltapilot S: BA00296P/00/EN

FOUNDATION Fieldbus:
- Deltabar S: BA00301P/00/EN
- Description of device functions Cerabar S/Deltabar S/Deltapilot S: BA00303P/00/EN

Brief Operating Instructions

- 4 to 20 mA HART, Deltabar S: KA01018P/00/EN
- PROFIBUS PA, Deltabar S: KA01021P/00/EN
- FOUNDATION Fieldbus, Deltabar S: KA01024P/00/EN

Functional safety manual (SIL)

- Deltabar S (4 to 20 mA): SD00189P/00/EN

Safety Instructions

Directive	Device	Electronic insert	Documentation	Option [1)]
ATEX II 1/2G Ex ia IIC T6 (WHG)	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00235P	1 (6)
ATEX II 1/2D Ex tD	PMD75, FMD77, FMD78	– 4 to 20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– XA00237P – XA00280P	2
ATEX II 1/3D Ex tD	PMD75, FMD77, FMD78	– 4 to 20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– XA00239P – XA00282P	4
ATEX II 2 G Ex d IIC T6 Gb	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00240P	5
ATEX II 3 G Ex nA II T6	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00241P	7
ATEX II 1/2G Ex ia + II 1/2D Ex iaD	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00243P	3
ATEX II 1G Ex ia + II 1D Ex iaD	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00275P	8
ATEX II 1/2G Ex ia IIC T6+II 2G Ex d IIC T6	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00242P	B
ATEX II Ex ia / Ex d + FM/CSA IS + XP ATEX II 1/2G Ex ia IIC T6+ ATEX II 2G Ex d IIC T6+FM/CSA IS + XP Cl.I.II Div.1 Gr.A-G/B-GFM/CSA: Zone 1,2	PMD75, FMD77, FMD78	– 4 to 20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– XA00242P, ZD00153P, XA01196P – XA00242P, XA01198P, ZD00191P	F
IECEx Zone 0/1 Ex ia IIC T6	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XB00004P	I
IEC Ex d IIC T6 Gb	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00512P	M

Directive	Device	Electronic insert	Documentation	Option [1]
NEPSI Ex ia IIC T6	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00550P	H
NEPSI Ex d IIC T6	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00552P	G

1) Product Configurator, order code for "Approval"

Directive	Device	Electronic insert	Documentation	Option [1]
TIIS Ex do IIC T6	PMD75, FMD77, FMD78	– 4 to 20 mA HART	– TC18007, TC18008	L

1) Product Configurator, order code for "Approval"

Directive	Device	Electronics	Documentation	Option [1]
INMETRO Ex ia IIC T6 Ga/Gb	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA01318P/00	J
INMETRO Ex d IIC T6 Gb	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA01281P/00	O
INMETRO Ex ta IIIC Da/Db	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA01316P/00	Z

1) Product Configurator, order code for "Approval"

Installation/Control Drawings

Directive	Device	Electronic insert	Documentation	Option [1]
FM IS Cl.I,II,III Div.1 Gr.A-G, NI Cl.I Div.2 Gr.A-D, AEx ia, Zone 0,1,2,20,21,22	PMD75, FMD77, FMD78	– 4 to 20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– XA01058P – XA01060P	S
FM/CSA IS + XP Cl.I Div.1 Gr.A-D, FM/CSA: Zone 1,2	PMD75, FMD77, FMD78	– 4 to 20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– XA00591P, XA01196P – XA00590P, XA01198P	E
FM DIP Cl.II,III Div.1 Gr.E-G, Zone 21,22	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– FM3017778	Q
CSA C/US IS Cl.I,II,III Div.1 Gr.A-G, Cl.I Div.2 Gr.A-D, Ex ia, C: Zone 0,1,2/ US: Zone 0,1,2,20,21,22	PMD75, FMD77, FMD78	– 4 to 20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD00142P – ZD00189P	U
FM IS + XP Cl.I Div.1 Gr.A-D, Zone 1,2	PMD75, FMD77, FMD78	– 4 to 20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– XA01196P – XA01198P	C
FM NI Cl.I Div.2 Gr.A-D, Zone 2	PMD75, FMD77, FMD78	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA01064P	R
FM XP Cl.I Div.1 Gr.A-D, AEx d, Zone 1,2	PMD75, FMD77, FMD78	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA01071P	T
CSA C/US IS + XP Cl.I Div.1 Gr.A-D, Zone 1,2	PMD75, FMD77, FMD78	– 4 to 20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD00153P – ZD00191P	D
ATEX II Ex ia / Ex d + FM/CSA IS + XP ATEX II 1/2G Ex ia IIC T6+ ATEX II 2G Ex d IIC T6+FM/CSA IS + XP Cl.I.II Div.1 Gr.A-G/B-GFM/CSA: Zone 1,2	PMD75, FMD77, FMD78	– 4 to 20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– XA00242P, ZD00153P, XA01196P – XA00242P, XA01198P, ZD00191P	F

Directive	Device	Electronic insert	Documentation	Option [1]
CSA C/US XP Cl.I Div.1 Gr.B-D, Ex d, Zone 1,2	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– ZD00229P	V
CSA C/US Cl.II, III Div.1 Gr.E-G	PMD75, FMD77, FMD78	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– CSA1509834	W

1) Product Configurator, order code for "Approval"

Overfill prevention

- WHG: ZE00259P/00/DE

Registered trademarks

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