

Technical Information

Deltabar S

PMD75, FMD77, FMD78

Differential pressure measurement

Differential pressure transmitter with metal sensors



Applications

The device is used for the following measuring tasks:

- Flow measurement (volume flow or mass flow) in conjunction with differential pressure sensors in gases, vapors and liquids
- Level, volume or mass measurements in liquids
- High process temperatures up to 400 °C (752 °F) possible with diaphragm seal mount

Your benefits

- Very good reproducibility and long-term stability
- High reference accuracy up to 0.035 %
- Turn down up to 100:1, higher on request
- Used for flow and differential pressure monitoring up to SIL3, 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
- Easy electronic replacement guaranteed with HistoROM®/M-DAT
- Uniform platform for differential pressure, hydrostatics and pressure (Deltabar S – Deltapilot S – Cerabar S)
- Practical user navigation for quick and easy commissioning
- Extensive diagnostic functions
- Cost-effective installation with Deltabar S FMD77, capillary on low-pressure side

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Document information

| | |
|--------------------------|---|
| Document function | The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device. |
|--------------------------|---|

Symbols used

Safety symbols

| Symbol | Meaning |
|---|--|
|  | DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury. |
|  | WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury. |
|  | CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury. |
|  | NOTE! This symbol contains information on procedures and other facts which do not result in personal injury. |

Electrical symbols

| Symbol | Meaning | Symbol | Meaning |
|---|--|--|---|
|  | Protective ground connection A terminal which must be connected to ground prior to establishing any other connections. |  | Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system. |

Symbols for certain types of information

| Symbol | Meaning |
|---|--|
|  | Permitted Procedures, processes or actions that are permitted. |
|  | Preferred Procedures, processes or actions that are preferred. |
|  | Forbidden Procedures, processes or actions that are forbidden. |
|  | Tip Indicates additional information. |
|  | Reference to documentation |
|  | Reference to page |
|  | Reference to graphic |
|  | Visual inspection |

Symbols in graphics

| Symbol | Meaning |
|--------------------|-----------------|
| 1, 2, 3 ... | Item numbers |
| 1., 2., 3. ... | Series of steps |
| A, B, C, ... | Views |
| A-A, B-B, C-C, ... | Sections |

Documentation

See the "Supplementary documentation" section →  106



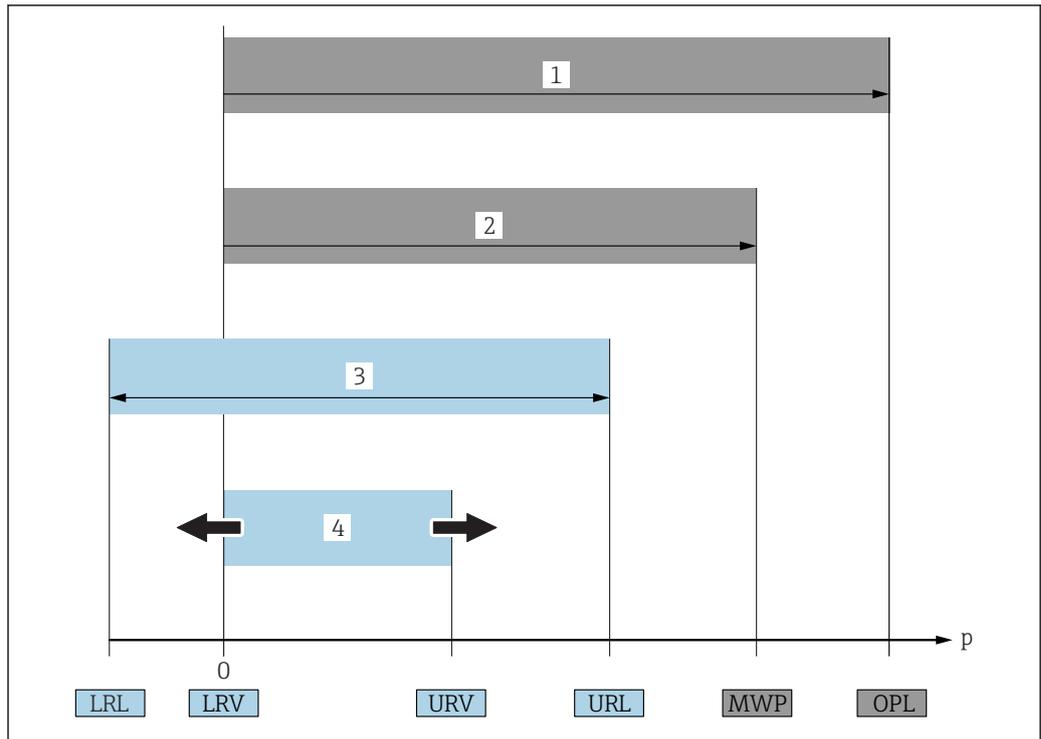
The document types listed are available:

In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

Safety Instructions (XA)

See the "Safety instructions" section →  106

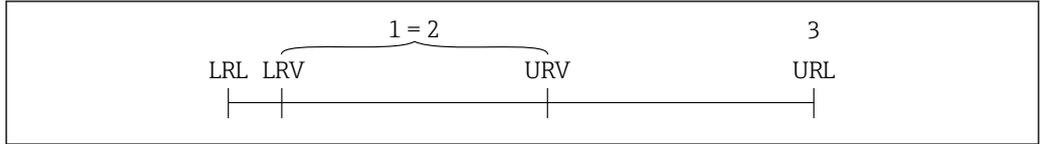
Terms and abbreviations



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| Item | Term/abbreviation | Explanation |
|------|--------------------------------|---|
| 1 | OPL | The OPL (over pressure limit = sensor overload limit) for the measuring device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional information, see the "Pressure specifications" → 43 section. The OPL may only be applied for a limited period of time. |
| 2 | MWP | The MWP (maximum working pressure) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional information, see the "Pressure specifications" → 43 section. The MWP may be applied at the device for an unlimited period. The MWP can also be found on the nameplate. |
| 3 | Maximum sensor measuring range | Span between LRL and URL This sensor measuring range is equivalent to the maximum calibratable/adjustable span. |
| 4 | Calibrated/adjusted span | Span between LRV and URV Factory setting: 0 to URL Other calibrated spans can be ordered as customized spans. |
| p | - | Pressure |
| - | LRL | Lower range limit |
| - | URL | Upper range limit |
| - | LRV | Lower range value |
| - | URV | Upper range value |
| - | TD (turn down) | Turn down Example - see the following section. |

Turn down calculation



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- 1 Calibrated/adjusted span
- 2 Zero point-based span
- 3 URL sensor

Example

- Sensor: 10 bar (150 psi)
- Upper range value (URL) = 10 bar (150 psi)
- Calibrated/adjusted span: 0 to 5 bar (0 to 75 psi)
- Lower range value (LRV) = 0 bar (0 psi)
- Upper range value (URV) = 5 bar (75 psi)

Turn down (TD):

$$TD = \frac{URL}{|URV - LRV|}$$

$$TD = \frac{10 \text{ bar (150 psi)}}{|5 \text{ bar (75 psi)} - 0 \text{ bar (0 psi)}|} = 2$$

In this example, the TD is 2:1.
This span is based on the zero point.

Registered trademarks

HART®

Registered trademark of the FieldComm Group, Austin, USA

PROFIBUS®

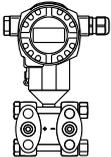
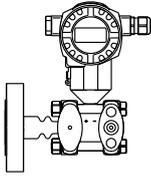
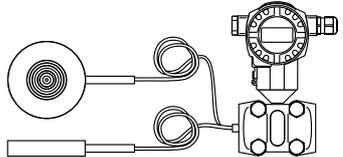
Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

FOUNDATION™Fieldbus

Registered trademark of the FieldComm Group, Austin, Texas, USA

Function and system design

Device features

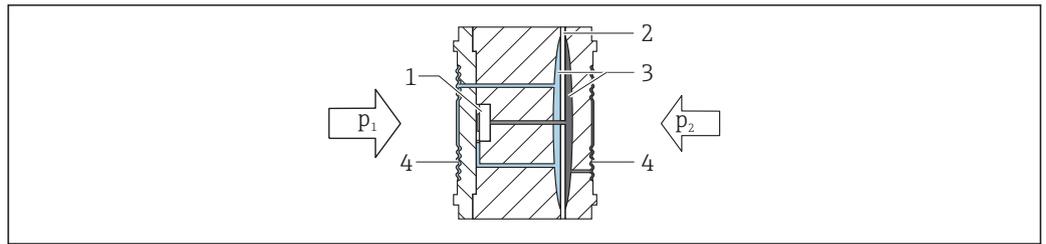
| | PMD75 | FMD77 | FMD78 |
|---|--|---|---|
| |  A0023922 |  A0023923 |  A0023924 |
| | | with mounted diaphragm seal | with capillary diaphragm seals |
| Field of application | <ul style="list-style-type: none"> Flow Level Differential pressure | <ul style="list-style-type: none"> Level Differential pressure | <ul style="list-style-type: none"> Level Differential pressure |
| Process connections | <ul style="list-style-type: none"> 1/4 – 18 NPT RC 1/4 | Low-pressure side (-): <ul style="list-style-type: none"> 1/4 – 18 NPT RC 1/4 Alternatively available with capillary and diaphragm seal High-pressure side (+): <ul style="list-style-type: none"> DN 50 – DN 100 ASME NPS 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 (6 300 psi) on both sides: up to 630 bar (9 450 psi) | on one side: up to 160 bar (2 400 psi) on both sides: up to 240 bar (3 600 psi) | on one side: up to 160 bar (2 400 psi) on both sides: up to 240 bar (3 600 psi) |
| Process temperature range ¹⁾ | -40 to +85 °C (-40 to +185 °F) | -70 to +400 °C (-94 to +752 °F) (depends on filling oil) | -70 to +400 °C (-94 to +752 °F) (depends on filling oil) |
| Ambient temperature range | <ul style="list-style-type: none"> Without LCD display: -40 to +85 °C (-40 to +185 °F) ²⁾ With LCD display: -20 to +70 °C (-4 to +158 °F) Separate housing: -20 to +60 °C (-4 to +140 °F) Diaphragm seal systems depending on the version | | |
| Reference accuracy | Up to ±0.035 % of the set span | Up to ±0.075 % of the set span | |
| Supply voltage non-Ex | <ul style="list-style-type: none"> 4 to 20 mA HART: 10.5 to 45 V DC PROFIBUS PA and FOUNDATION Fieldbus: 9 to 32 V DC | | |
| Supply voltage 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 (10 500 psi) | - | - |
| | HistoROM®/M-DAT memory chip | | |
| Specialties | <ul style="list-style-type: none"> p_{stat} up to 420 bar (6 300 psi) Process isolating diaphragm: tantalum | For high media temperatures | Wide range of diaphragm seals |

1) (temperature at process connection)

2) lower temperatures on request

Measuring principle

Metal process isolating diaphragm



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- 1 Measuring element
- 2 Middle diaphragm
- 3 Filling oil
- 4 Process isolating diaphragm

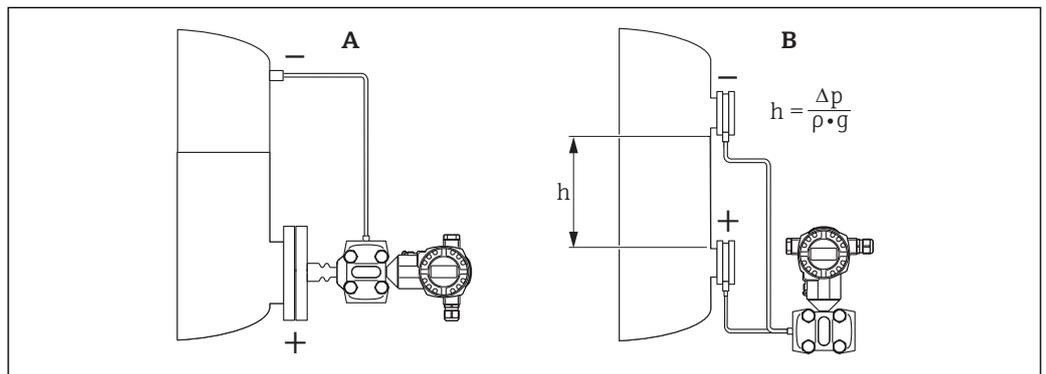
The process isolating diaphragms are deflected on both sides by the acting pressures. A filling oil transfers the pressure to a resistance bridge (semiconductor technology). The change in the bridge output voltage, which depends on the differential pressure, is measured and processed

Advantages:

- Standard operating pressures: 160 bar (2 400 psi) and 420 bar (6 300 psi)
- High long-term stability
- Very high single-sided overload resistance

Product design

Level measurement (level, volume and mass):



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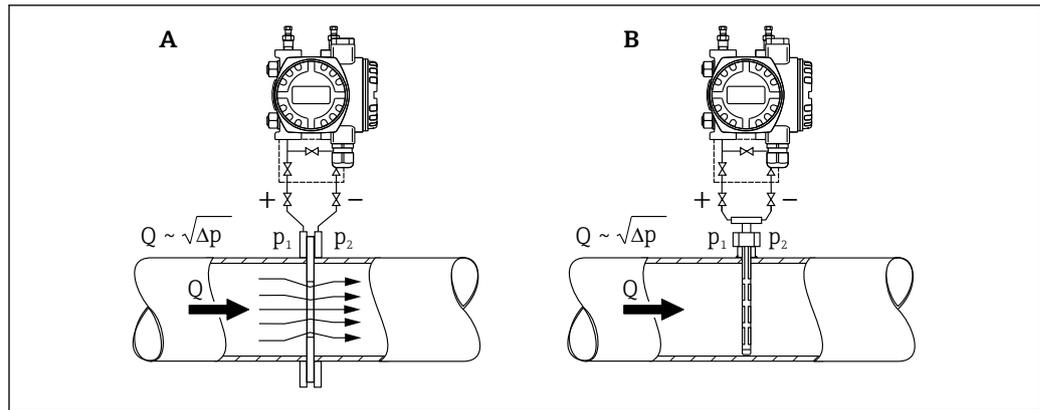
- A Level measurement with FMD77
- B Level measurement with FMD78
- h Height (level)
- Δp Differential pressure
- ρ Density of the medium
- g Gravitational constant

Your benefits

- Selection of the level operating mode which is optimum for your application in the device software
- Volume and mass measurements in any container 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 containers with agitators or screen fittings
 - in the event of liquid gases
 - for standard level measurement

Flow measurement

Flow measurement with Deltabar S and primary device:



A0023920

- A Orifice plate
 B 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.

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 a low current consumption of $13 \text{ mA} \pm 1 \text{ mA}$, the following number of devices can be operated on one bus segment if installing as per FISCO: up to 7 devices for Ex ia, CSA IS and FM IS applications or up to 27 devices 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 a low current consumption of $15.5 \text{ mA} \pm 1 \text{ mA}$, the following number of devices can be operated on one bus segment if installing as per FISCO: up to 6 devices for Ex ia, CSA IS and FM IS applications or up to 24 devices 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 | Measured process variables Differential pressure Calculated process variables <ul style="list-style-type: none"> ■ Flow rate (volume flow or mass flow) ■ Level (level, volume or mass) |
|--------------------------|---|

Measuring range

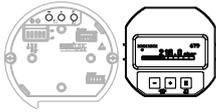
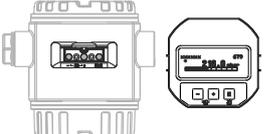
| Nominal value | Range limit | | Lowest calibratable span ¹⁾ | MWP | OPL | | Min. operating pressure ²⁾ | Option ³⁾ |
|---|---------------|---------------|--|--------------------------|-------------|---------------|---|--|
| | lower (LRL) | upper (URL) | | | on one side | on both sides | | |
| [mbar (psi)] | [mbar (psi)] | [mbar (psi)] | [mbar (psi)] | [bar (psi)] | [bar (psi)] | [bar (psi)] | [mbar _{abs} (psi _{abs})] | |
| FMD77, FMD78, PMD75: Option PN 160 / 16 MPa / 2400 psi | | | | | | | | |
| 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) | 160 (2400) ⁶⁾ | 160 (2400) | 240 (3600) | | 7C |
| 100 (1.5) | -100 (-1.5) | +100 (+1.5) | 1/5 (0.015/0.075) ⁵⁾ | | | | | 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) |
| PMD75: Option PN 420 / 42 MPa / 6300 psi | | | | | | | | |
| 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) | 420 (6300) | 420 (6300) | 630 (9450) | | 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) |

- 1) Turndown > 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 selecting filling oil → 91. For vacuum applications, follow the installation instructions → 96.
- 3) Product Configurator, order code for "Nominal range; PN"
- 4) Screws → 44
- 5) Smallest calibratable span for the PMD75: 1 mbar (0.015 psi); Smallest calibratable span for the FMD77 and FMD78: 5 mbar (0.075 psi)
- 6) All PMD75 process connections are CRN-approved. If O-rings are used, the MWP is 315 bar (4 725 psi); if PTFE and CU seals are used, the MWP is 120 bar (1 800 psi).
- 7) "-" side: 100 bar (1 500 psi)

Output

Output Signal

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

| Output | Internal + LCD | External + LCD | Internal |
|----------------------|---|--|---|
| |  |  |  |
| | Option ¹⁾ | | |
| 4 to 20mA HART | B | A | C |
| 4 to 20mA HART, Li=0 | E | D | F |
| PROFIBUS PA | N | M | O |
| FOUNDATION Fieldbus | Q | P | R |

1) Product Configurator, order code for "Display, operation:"

Signal range 4 to 20 mA 3.8 mA to 20.5 mA

Signal on alarm

4 to 20 mA HART

As per NAMUR NE43.

- 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

As per NAMUR NE43.

Can be set in the Analog Input Block.

Options:

- Last Valid Out Value (factory setting)
- Fail Safe Value
- Status bad

FOUNDATION Fieldbus

As per NAMUR NE43.

Can be set in the Analog Input Block.

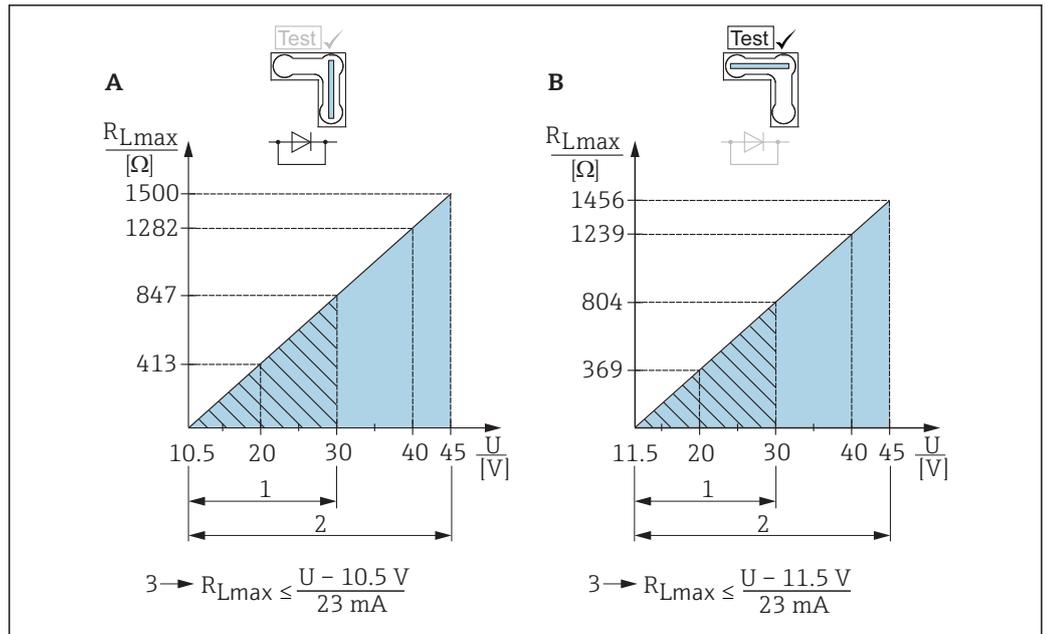
Options:

- Last Good Value
- Fail Safe Value (factory setting)
- Wrong Value

Load

4 to 20 mA HART

In order to guarantee sufficient terminal voltage in two-wire devices, a maximum load resistance R (including line resistance) must not be exceeded depending on the supply voltage U_0 of the supply unit. In the following load diagrams, observe the position of the jumper and the explosion protection:



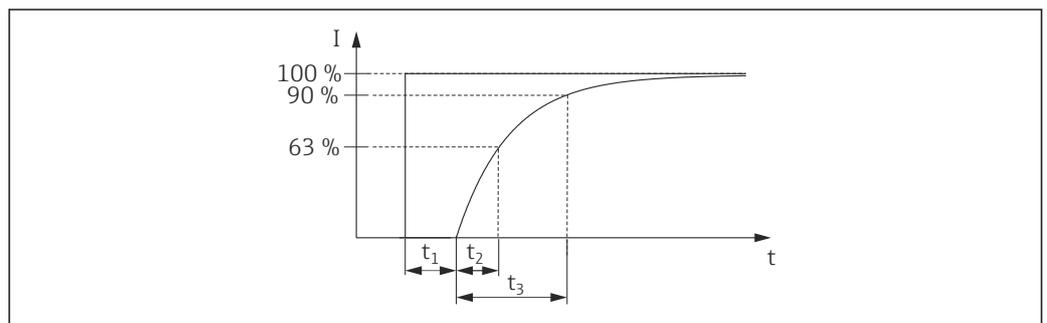
A0019988

- 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, 1GD 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

i When operating via a handheld terminal or via a PC with an operating program, a minimum communication resistance of 250 Ω must be taken into account.

Dead time, time constant

Presentation of the dead time and the time constant:



A0019786

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. | <ul style="list-style-type: none"> ■ 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 | <ul style="list-style-type: none"> ■ 450 ■ 60 ■ 45 ■ 40 ■ 60 | <ul style="list-style-type: none"> ■ 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 (t ₁) [ms] + Time constant T63 (t ₂) [ms] | Dead time (t ₁) [ms] + Time constant T90 (t ₃) [ms] |
|-----------------|------|---|----------------------------------|--|--|
| PMD75 | Min. | <ul style="list-style-type: none"> ▪ 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 | <ul style="list-style-type: none"> ▪ 655 ▪ 265 ▪ 250 ▪ 245 ▪ 265 | <ul style="list-style-type: none"> ▪ 1200 ▪ 298 ▪ 264 ▪ 252 ▪ 298 |
| | max. | <ul style="list-style-type: none"> ▪ 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 | <ul style="list-style-type: none"> ▪ 1455 ▪ 1065 ▪ 1050 ▪ 1045 ▪ 1065 | <ul style="list-style-type: none"> ▪ 2000 ▪ 1098 ▪ 1064 ▪ 1052 ▪ 1098 |
| FMD77, FMD78 | max. | Dependent on the diaphragm seal | | | |

Reading cycle

- Acyclic: max. 3/s, typically 1/s (depending on command # and number of preambles)
- Cyclic (burst): max. 3/s, typically 2/s

The device commands the BURST MODE functionality for cyclical value transmission via the HART communication protocol.

Cycle time (update time)

Cyclic (burst): min. 300 ms

Response time

- Acyclic: min. 330 ms, typically 590 ms (depending on command # and number of preambles)
- Cyclic (burst): min. 160 ms, typically 350 ms (depending 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 (t ₁) [ms] + Time constant T63 (t ₂) [ms] | Dead time (t ₁) [ms] + Time constant T90 (t ₃) [ms] |
|-----------------|------|---|----------------------------------|--|--|
| PMD75 | Min. | <ul style="list-style-type: none"> ▪ 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 | <ul style="list-style-type: none"> ▪ 530 ▪ 140 ▪ 125 ▪ 120 ▪ 140 | <ul style="list-style-type: none"> ▪ 1075 ▪ 173 ▪ 139 ▪ 127 ▪ 173 |
| | max. | <ul style="list-style-type: none"> ▪ 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 | <ul style="list-style-type: none"> ▪ 1730 ▪ 1340 ▪ 1325 ▪ 1320 ▪ 1340 | <ul style="list-style-type: none"> ▪ 2275 ▪ 1373 ▪ 1339 ▪ 1327 ▪ 1373 |
| FMD77, FMD78 | max. | Dependent on the diaphragm seal | | | |

Reading cycle (PLC)

- Acyclic: Typically 25/s
- Cyclic: Typically 30/s (depending on the number and type of the function blocks used in the closed-control loop)

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 measured value can be determined up to five times a second.

Response time

- Acyclic: Approx. 60 ms to 70 ms (depending on Min. Slave Interval)
- Cyclic: Approx. 10 ms to 13 ms (depending 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 (t ₁) [ms] + Time constant T63 (t ₂) [ms] | Dead time (t ₁) [ms] + Time constant T90 (t ₃) [ms] |
|-----------------|------|---|----------------------------------|--|--|
| PMD75 | Min. | <ul style="list-style-type: none"> ▪ 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 | <ul style="list-style-type: none"> ▪ 540 ▪ 150 ▪ 135 ▪ 130 ▪ 150 | <ul style="list-style-type: none"> ▪ 1085 ▪ 183 ▪ 149 ▪ 137 ▪ 183 |
| | max. | <ul style="list-style-type: none"> ▪ 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 | <ul style="list-style-type: none"> ▪ 1540 ▪ 1150 ▪ 1135 ▪ 1130 ▪ 1150 | <ul style="list-style-type: none"> ▪ 2085 ▪ 1183 ▪ 1149 ▪ 1137 ▪ 1183 |
| FMD77, FMD78 | max. | Dependent on the diaphragm seal | | | |

Reading cycle

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

Cycle time (update time)

Cyclic: Min. 100 ms

Response time

- Acyclic: Typically 100 ms (for standard bus parameter settings)
- Cyclic: max. 20 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, continuously 0 to 999 s
- Also 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 | J |
| Min alarm current + HART burst mode PV | J |

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

Firmware version

| Description | Option ¹⁾ |
|---------------------------------|----------------------|
| 02.20.zz, HART 7, DevRev22 | 72 |
| 02.11.zz, HART 5, DevRev21 | 73 |
| 04.00.zz, FF, DevRev07 | 74 |
| 04.01.zz, PROFIBUS PA, DevRev03 | 75 |

| Description | Option ¹⁾ |
|----------------------------|----------------------|
| 02.10.zz, HART 5, DevRev21 | 76 |
| 03.00.zz, FF, DevRev06 | 77 |
| 04.00.zz, PROFIBUS PA | 78 |

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

HART protocol-specific data

| | |
|------------------------------------|--|
| Manufacturer ID | 17 (11 hex) |
| Device type code | 23 (17 hex) |
| Device revision | <ul style="list-style-type: none"> ▪ 21 (15 hex) - SW version 02.1y.zz - HART specification 5 ▪ 22 (16 hex) - SW version 02.2y.zz - HART specification 7 |
| HART specification | <ul style="list-style-type: none"> ▪ 5 ▪ 7 |
| DD revision | <ul style="list-style-type: none"> ▪ 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 at: <ul style="list-style-type: none"> ▪ www.endress.com ▪ www.hartcomm.org |
| HART load | Min. 250 Ω |
| HART device variables | <p>The measured values are assigned to the device variables as follows:</p> <p>Measured values for PV (primary variable)</p> <ul style="list-style-type: none"> ▪ Pressure ▪ Flow ▪ Level ▪ Tank content <p>Measured values for SV, TV (second and third variable)</p> <ul style="list-style-type: none"> ▪ Pressure ▪ Totalizer <p>Measured values for QV (fourth variable)</p> <p>Temperature</p> |
| Supported functions | <ul style="list-style-type: none"> ▪ Burst mode ▪ Additional transmitter status ▪ Device locking ▪ Alternative operating modes |

PROFIBUS PA protocol-specific data

| | |
|-----------------------|---|
| Manufacturer ID | 17 (11 hex) |
| Identification number | 1542 hex |
| Profile version | 3.0 <ul style="list-style-type: none"> ▪ SW version 03.00.zz ▪ SW version 04.00.zz 3.02 SW version 04.01.zz (device revision 3) Compatibility with SW version 03.00.zz and higher. |
| GSD revision | <ul style="list-style-type: none"> ▪ 4 (SW version 3.00.zz and 4.00.zz) ▪ 5 (device revision 3) |
| DD revision | <ul style="list-style-type: none"> ▪ 1 (SW version 3.00.zz and 4.00.zz) ▪ 1 (device revision 3) |
| GSD file | Information and files at: |
| DD files | <ul style="list-style-type: none"> ▪ www.endress.com ▪ www.profibus.org |

| | |
|---------------------|--|
| Output values | <p>Measured value for PV (via Analog Input Function Block)</p> <ul style="list-style-type: none"> ▪ Pressure ▪ Level ▪ Flow ▪ Tank content <p>Measured value for SV</p> <ul style="list-style-type: none"> ▪ Pressure ▪ Temperature <p>Measured value for QV</p> <p>Totalizer</p> |
| Input values | Input value sent from PLC, can be shown on display |
| Supported functions | <ul style="list-style-type: none"> ▪ Identification & maintenance Simplest device identifier on the control system and nameplate ▪ Condensed status (only with Profile Version 3.02) ▪ Automatic ID number adjustment and switchable to the following ID numbers (only with Profile Version 3.02): <ul style="list-style-type: none"> - 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 generation (FMD77, FMD78, PMD75). ▪ Device locking: The device can be locked by hardware or software. |

FOUNDATION Fieldbus protocol-specific data

| | |
|--|--|
| Manufacturer ID | 452B48 hex |
| Device type | 1009 hex |
| Device revision | <ul style="list-style-type: none"> ▪ 6 - SW version 03.00.zz ▪ 7 - SW version 04.00.zz (FF-912) |
| DD revision | <ul style="list-style-type: none"> ▪ 3 (device revision 6) ▪ 2 (device revision 7) |
| CFE revision | <ul style="list-style-type: none"> ▪ 4 (device revision 6) ▪ 1 (device revision 7) |
| DD files | Information and files at: |
| CFE files | <ul style="list-style-type: none"> ▪ www.endress.com ▪ www.fieldbus.org |
| Device tester version (ITK version) | <ul style="list-style-type: none"> ▪ 5.0 (device revision 6) ▪ 6.01 (device revision 7) |
| Number of ITK test campaign | <ul style="list-style-type: none"> ▪ IT054700 (Device Revision 6) ▪ IT085400 (Device Revision 7) |
| Link Master (LAS) capable | Yes |
| Choice of "Link Master" and "Basic Device" | Yes, factory setting is Basic Device |
| Node address | Factory setting: 247 (F7 hex) |
| Supported functions | <p>Field diagnostics profile (only with FF912)</p> <p>The following methods are supported:</p> <ul style="list-style-type: none"> ▪ Restart ▪ Configure error as warning or alarm ▪ HistoROM ▪ Peakhold ▪ Alarm info ▪ Sensor trim |
| Number of VCRs | <ul style="list-style-type: none"> ▪ 44 (device revision 6) ▪ 24 (device revision 7) |
| Number of link objects in VFD | 50 |

Virtual communication references (VCRs)

| | Device revision 6 | Device revision 7 |
|-------------------|-------------------|-------------------|
| Permanent entries | 44 | 1 |
| Client VCRs | 0 | 0 |
| Server VCRs | 5 | 10 |
| 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 | <ul style="list-style-type: none"> ▪ Pressure, flow or level (channel 1) ▪ Process temperature (channel 2) |
| Service Block | Contains service information | <ul style="list-style-type: none"> ▪ 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 blocks | Execution time | | Functionality | |
|--|--|---------------|-------------------|---|-------------------|-------------------|
| | | | Device Revision 6 | Device Revision 7 | Device Revision 6 | Device Revision 7 |
| Resource Block | This block contains all the data that uniquely identifies the device; it is an electronic version of a nameplate for 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 (without trend and alarm reports) | 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 |

| Block | Content | Number blocks | Execution time | | Functionality | |
|----------------------------|---|---------------|-------------------|-------------------|-------------------|-------------------|
| | | | Device Revision 6 | Device Revision 7 | Device Revision 6 | Device Revision 7 |
| 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 | This block is used as a proportional-integral-derivative controller and can be used universally for closed-loop-control in the field. It enables cascade mode and feedforward control. 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 can be used as a totalizer that counts up until a reset, or as a batch totalizer whereby the integrated value is compared against a target value generated before or during the control routine and generates a binary signal when the target value 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:

| | | |
|---|-----|-----|
| Instantiatable function blocks | YES | YES |
| Number of additional instantiatable function blocks | 9 | 4 |

Power supply

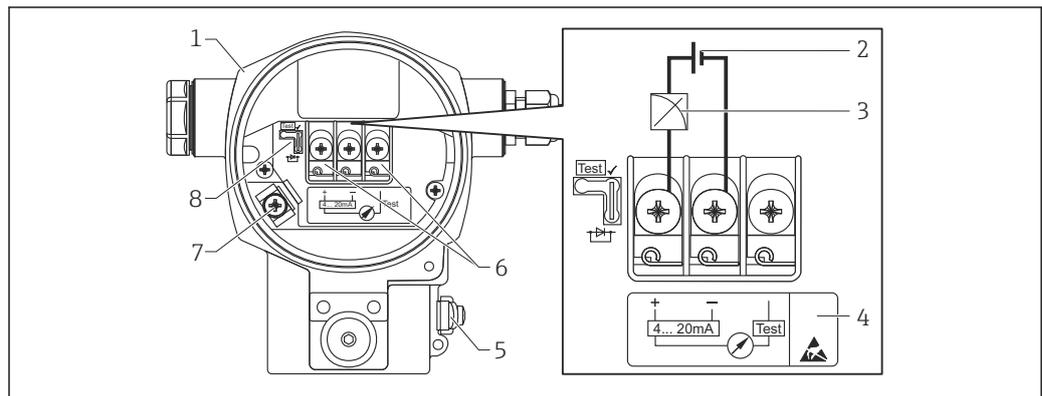
⚠ WARNING

Electrical safety is compromised by an incorrect connection!

- ▶ When using the measuring device in hazardous areas, the relevant national standards and regulations as well as the Safety Instructions or Installation or Control Drawings must be observed. → 106
- ▶ All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all Ex-systems. → 106
- ▶ Devices with integrated overvoltage protection must be grounded. → 23
- ▶ Protective circuits against reverse polarity, HF influences and overvoltage peaks are integrated.

Terminal assignment

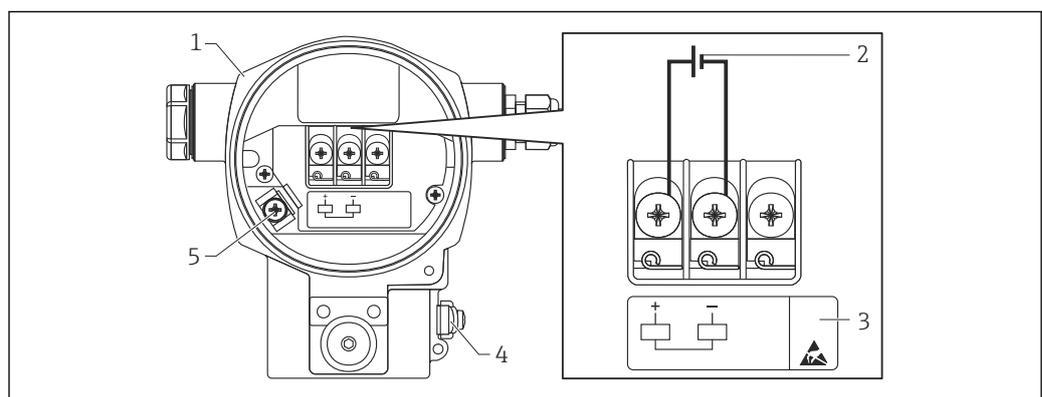
4 to 20 mA HART



A0019989

- 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 → 21

PROFIBUS PA and FOUNDATION Fieldbus



A0020158

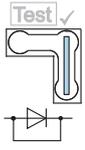
- 1 Housing
- 2 Supply voltage
- 3 Devices with integrated overvoltage protection are labeled "OVP" (overvoltage protection) here.
- 4 External ground terminal
- 5 Internal ground terminal

Supply voltage

4 to 20 mA HART

| Electronic version | Jumper for 4 to 20 mA test signal in "Test" position (delivery status) | Jumper for 4 to 20 mA test signal in "Non-test" position |
|--|--|--|
| Version for non-hazardous area | 11.5 to 45 V DC | 10.5 to 45 V DC |
| Intrinsically safe | 11.5 to 30 V DC | 10.5 to 30 V DC |
| <ul style="list-style-type: none"> ▪ Other types of protection ▪ Devices without certificate | 11.5 to 45 V DC (versions with 35 V DC plug-in connection) | 10.5 to 45 V DC (versions with 35 V DC plug-in connection) |

Measuring a 4 to 20 mA test signal

| Jumper position for test signal | Description |
|---|--|
|  <p style="text-align: right; font-size: small;">A0019992</p> | <ul style="list-style-type: none"> ▪ Measurement of 4 to 20 mA test signal via the positive 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 |
|  <p style="text-align: right; font-size: small;">A0019993</p> | <ul style="list-style-type: none"> ▪ Measurement of 4 to 20 mA test signal via positive 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 2.1
- FOUNDATION Fieldbus: 15.5 mA ±1 mA, switch-on current corresponds to IEC 61158-2, Clause 2.1

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

- Supply voltage and internal ground terminal: 0.5 to 2.5 mm² (20 to 14 AWG)
- External ground terminal: 0.5 to 4 mm² (20 to 12 AWG)

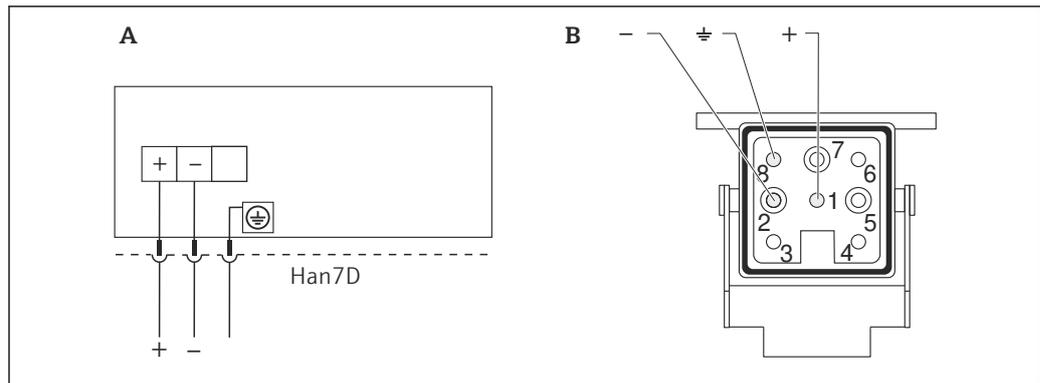
Cable entries

| Approval | Cable gland | Clamping area |
|---|----------------------|--------------------------------|
| Standard, II 1/2 G Ex ia, IS | Plastic M20x1.5 | 5 to 10 mm (0.2 to 0.39 in) |
| ATEX II 1/2 D, II 1/3 D, II 1/2 GD Ex ia, II 1 GD Ex ia, II 3 G 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 → 45

Device plug

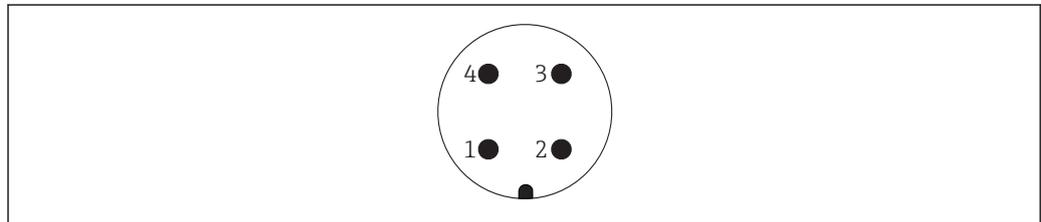
Devices with Harting plug Han7D



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

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

Devices with M12 plug



1 Signal +
 2 Not assigned
 3 Signal -
 4 Ground

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

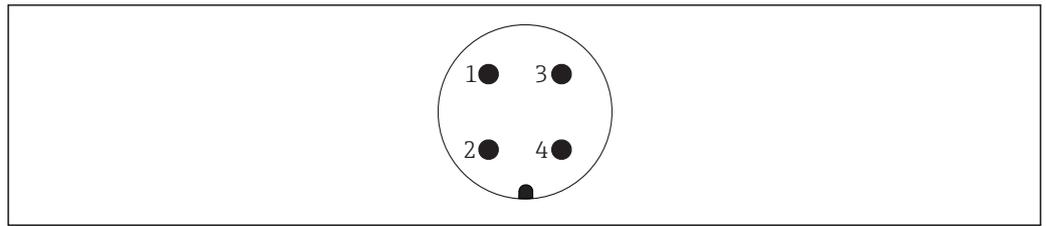
Plug-in jack M 12x1, elbowed

- 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



A0011176

- 1 Signal -
- 2 Signal +
- 3 Not assigned
- 4 Shielding

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 → 22

PROFIBUS PA

Use a twisted, shielded twin-core cable, preferably cable type A.

i For further information regarding cable specifications, see the 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 twin-core cable, preferably cable type A.

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

Startcurrent

12 mA

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 $\hat{i} = 20$ kA satisfied as per DIN EN 60079-14: 8/20 μ s
 - Arrester AC current check I = 10 A satisfied
- Ordering information: Product Configurator, order code for "Additional options 1" or Additional options 2", version "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 of the differential pressure transmitter (sensor module + electronics module)

Preamble

The performance characteristic of the dP transmitter refers to "Accuracy of the transmitter". The factors influencing accuracy can be divided into 2 groups

- Total performance of transmitter → 25
- Installation dependent influencing factors

Total performance of transmitter

→ 25 Transmitter total performance comprises the reference accuracy, the ambient temperature effect and the static pressure and is calculated using the following formula:

$$\text{Total performance} = \pm \sqrt{(E1)^2 + (E2)^2 + (E3)^2}$$

E1 = Reference accuracy → 24

E2 = Ambient temperature effect per $\pm 28^\circ\text{C}$ (50°F) (corresponds to the range of -3 to $+53^\circ\text{C}$ ($+27$ to $+127^\circ\text{F}$)) → 26

E3 = Static pressure effect → 27

Reference accuracy [E1]

| Reference accuracy ¹⁾ - PMD75 | | |
|--|--|--|
| Measuring cell | Standard reference accuracy ²⁾ | Platinum reference accuracy ²⁾ |
| 10 mbar (0.15 psi) | <ul style="list-style-type: none"> ■ TD 1:1 = ± 0.075 ■ TD > 1:1 = $\pm 0.075 \cdot \text{TD}$ | <ul style="list-style-type: none"> ■ TD 1:1 = ± 0.05 ■ TD > 1:1 = $\pm 0.075 \cdot \text{TD}$ |
| 30 mbar (0.45 psi) | <ul style="list-style-type: none"> ■ TD \leq 3:1 = ± 0.075 ■ TD > 3:1 = $\pm 0.025 \cdot \text{TD}$ | <ul style="list-style-type: none"> ■ TD 1:1 = ± 0.05 ■ TD > 1:1 = See standard |
| 100 mbar (1.5 psi) | <ul style="list-style-type: none"> ■ TD \leq 5:1 = ± 0.05 ■ TD > 5:1 = $\pm [0.009 \cdot \text{TD} + 0.005]$ | <ul style="list-style-type: none"> ■ TD 1:1 = ± 0.04 ■ TD > 1:1 = See standard |
| 500 mbar (7.5 psi), 3 bar (45 psi) 16 bar (240 psi), 40 bar (600 psi) | <ul style="list-style-type: none"> ■ TD \leq 15:1 = ± 0.05 ■ TD > 15:1 = $\pm [0.0015 \cdot \text{TD} + 0.0275]$ | <ul style="list-style-type: none"> ■ TD 1:1 = ± 0.035 ■ TD > 1:1 = See standard |

- 1) The reference accuracy contains the non-linearity [DIN EN 61298-2 3.11] including the hysteresis [DIN EN 61298-23.13] and non-repeatability [DIN EN 61298-2 3.11] in accordance with the limit point method as per [DIN EN 60770]. The specifications refer to the calibrated span/Upper Range Value (URV).
- 2) Valid for all membrane materials.

| Reference accuracy ¹⁾ - FMD77, FMD78 | | |
|---|--|--|
| Measuring cell | FMD77 ²⁾ reference accuracy | FMD77 with capillary on low-pressure side and FMD78 ²⁾ reference accuracy |
| 100 mbar (1.5 psi) | <ul style="list-style-type: none"> ■ TD \leq 5:1 = ± 0.10 ■ TD > 5:1 = $\pm [0.02 \cdot \text{TD}]$ | <ul style="list-style-type: none"> ■ TD \leq 5:1 = ± 0.15 ■ TD > 5:1 = $\pm [0.03 \cdot \text{TD}]$ |
| 500 mbar (7.5 psi) | <ul style="list-style-type: none"> ■ TD \leq 15:1 = ± 0.075 ■ TD > 15:1 = $\pm [0.0015 \cdot \text{TD} + 0.053]$ | <ul style="list-style-type: none"> ■ TD \leq 5:1 = ± 0.15 ■ TD > 5:1 = $\pm [0.03 \cdot \text{TD}]$ |
| 3 bar (45 psi), 16 bar (240 psi) | <ul style="list-style-type: none"> ■ TD \leq 15:1 = ± 0.075 ■ TD > 15:1 = $\pm [0.0015 \cdot \text{TD} + 0.053]$ | <ul style="list-style-type: none"> ■ TD \leq 15:1 = ± 0.1 ■ TD > 15:1 = $\pm [0.006 \cdot \text{TD} + 0.01]$ |
| 40 bar (600 psi) | N/A | <ul style="list-style-type: none"> ■ TD \leq 15:1 = ± 0.1 ■ TD > 15:1 = $\pm [0.006 \cdot \text{TD} + 0.01]$ |

- 1) The reference accuracy contains the non-linearity [DIN EN 61298-2 3.11] including the hysteresis [DIN EN 61298-23.13] and non-repeatability [DIN EN 61298-2 3.11] in accordance with the limit point method as per [DIN EN 60770]. The specifications refer to the calibrated span/Upper Range Value (URV).
- 2) FMD77/FMD78: Total performance excludes diaphragm seal errors. Diaphragm seal errors are calculated separately in the Applicator diaphragm seal calculation module. Link to online tool Applicator: www.endress.com/applicator → Sizing Diaphragm Seal



Please refer to the next chapter "Detailed performance explanation and calculation" for further explanations on "Ambient temperature effect" as well as "Static pressure effect".

**Total performance –
Specification values**

| Total performance - PMD75 | | | | | | | | | | |
|---------------------------|------------------------------|--------|--------|--------|--------|------------------------------|--------|--------|--------|--------|
| Measuring cell | Standard ^{1) 2) 3)} | | | | | Platinum ^{1) 2) 3)} | | | | |
| | TD 1:1 | TD 2:1 | TD 3:1 | TD 4:1 | TD 5:1 | TD 1:1 | TD 2:1 | TD 3:1 | TD 4:1 | TD 5:1 |
| 10 mbar (0.15 psi) | ±0.30 | ±0.52 | ±0.74 | ±0.96 | ±1.18 | ±0.26 | ±0.44 | ±0.61 | ±0.79 | ±0.97 |
| 30 mbar (0.45 psi) | ±0.87 | ±1.59 | ±2.30 | ±3.03 | ±3.75 | ±0.46 | ±0.74 | ±1.03 | ±1.32 | ±1.61 |
| 100 mbar (1.5 psi) | ±0.40 | ±0.61 | ±0.82 | ±1.03 | ±1.24 | ±0.30 | ±0.40 | ±0.51 | ±0.61 | ±0.71 |
| 500 mbar (7.5 psi) | ±0.20 | ±0.28 | ±0.35 | ±0.43 | ±0.50 | ±0.16 | ±0.21 | ±0.25 | ±0.29 | ±0.33 |
| 3 bar (45 psi) | ±0.14 | ±0.18 | ±0.23 | ±0.28 | ±0.33 | ±0.11 | ±0.14 | ±0.16 | ±0.18 | ±0.21 |
| 16 bar (240 psi) | ±0.12 | ±0.16 | ±0.20 | ±0.25 | ±0.30 | ±0.09 | ±0.12 | ±0.14 | ±0.16 | ±0.18 |
| 40 bar (600 psi) | ±0.12 | ±0.16 | ±0.20 | ±0.25 | ±0.30 | ±0.09 | ±0.12 | ±0.14 | ±0.16 | ±0.18 |

- 1) Valid for membrane material AISI 316L (1.4435), Alloy C.
- 2) The specification values apply to the temperature range per $\pm 28\text{ }^{\circ}\text{C}$ ($50\text{ }^{\circ}\text{F}$) (corresponds to the range of $-3\text{ to }+53\text{ }^{\circ}\text{C}$ ($+27\text{ to }+127\text{ }^{\circ}\text{F}$)) for all measuring cells. The specification values are applicable to the process static pressure P_{st} as is per static pressure effect definitions. →  27 The specification values are applicable to analog output (i.e. inclusion of electronics error).
- 3) The specifications refer to the calibrated span/Upper Range Value (URV).

Long-term stability

| Long term stability - PMD75 | | | |
|-----------------------------|---|---------|----------|
| Measuring cell | Standard & platinum % of the upper range limit / | | |
| | 1 year | 5 years | 10 years |
| 10 mbar (0.15 psi) | ± 0.200 | ± 0.280 | ± 0.310 |
| 30 mbar (0.45 psi) | ± 0.200 | ± 0.280 | ± 0.310 |
| 100 mbar (1.5 psi) | ± 0.080 | ± 0.140 | ± 0.270 |
| 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 |
| 40 bar (600 psi) | ± 0.050 | ± 0.070 | ± 0.100 |

Detailed Performance Explanation and Calculation

To calculate the total performance outside the -3 to $+53$ °C ($+27$ to $+127$ °F) temperature range or for a membrane material other than 1.4435/316L or Alloy C 276, please refer to the following sections: "Ambient temperature effect" and "Influence of the static pressure" and "Calculation of total performance".

Ambient temperature effect [E2]

- $E2 = (E2_M \cdot CF_1 \cdot CF_2) + E2_E$
- $E2_M$ = Main temperature error
- CF_1 = Temperature range correction factor
- CF_2 = Membrane material correction factor (thermal)
- $E2_E$ = Electronics error for analog current output

$E2_M$ - Main temperature error

 The output changes due to the effect of ambient temperature [IEC 61298-3] with respect to reference temperature [DIN 16086]. The values specify the maximum error due to min./max. ambient or process temperature conditions.

| Ambient temperature effect per ± 28 °C (50 °F) (corresponds to the range of -3 to $+53$ °C ($+27$ to $+127$ °F)) ¹⁾ | | |
|---|--------------------------------|--------------------------------|
| Measuring cell | Standard | Platinum |
| 10 mbar (0.15 psi), 30 mbar (0.45 psi) | $\pm (0.14 \cdot TD + 0.04)$ | $\pm (0.14 \cdot TD + 0.04)$ |
| 100 mbar (1.5 psi) | $\pm (0.07 \cdot TD + 0.07)$ | $\pm (0.07 \cdot TD + 0.07)$ |
| 500 mbar (7.5 psi) | $\pm (0.03 \cdot TD + 0.017)$ | $\pm (0.03 \cdot TD + 0.017)$ |
| 3 bar (45 psi), 16 bar (240 psi), 40 bar (600 psi) | $\pm (0.012 \cdot TD + 0.017)$ | $\pm (0.012 \cdot TD + 0.017)$ |

1) The electronics error, on the other hand, applies to the entire temperature range of the transmitter -40 to $+85$ °C (-40 to $+185$ °F).

CF_1 - Temperature range correction factor

| Measuring cell | Temperature range | Factor, CF_1 |
|--|---|----------------|
| 10 mbar (0.15 psi), 30 mbar (0.45 psi), 100 mbar (1.5 psi), 500 mbar (7.5 psi), 3 bar (45 psi), 16 bar (240 psi), 40 bar (600 psi) | 25 °C (corresponds to the range of -3 to $+53$ °C ($+27$ to $+127$ °F)) | 1 |
| | -32 to -4 °C (-26 to $+25$ °F) and $+54$ to $+85$ °C ($+129$ to $+185$ °F) | 2 |
| | -40 to -33 °C (-40 to -27 °F) | 2.3 |

CF_2 - Membrane material correction factor (thermal) (only for PMD75)

| Measuring cell | AISI 316L | Alloy C | Gold-Rhodium | Monel | Tantalum |
|--------------------|-----------|---------|--------------|-------|----------|
| 10 mbar (0.15 psi) | 1.0 | 1.0 | 2.5 | 2.8 | 2.3 |
| 30 mbar (0.45 psi) | 1.0 | 1.0 | 2.5 | 2.8 | 2.3 |
| 100 mbar (1.5 psi) | 1.0 | 1.0 | 1.1 | 1.1 | 1.1 |
| 500 mbar (7.5 psi) | 1.0 | 1.0 | 1.8 | 1.8 | 1.8 |
| 3 bar (45 psi) | 1.0 | 1.0 | 3.1 | 3.1 | 3.1 |
| 16 bar (240 psi) | 1.0 | 1.0 | 4.7 | 4.7 | 4.7 |
| 40 bar (600 psi) | 1.0 | 1.0 | 3.1 | 3.1 | 3.1 |

$E2_E$ - Electronics error

| Measuring cell | Electronics | Error (%) |
|-------------------------|------------------------------------|-----------|
| For all measuring cells | Digital output (HART/PA/FF) | 0 % |
| | Analog output (4 to 20 mA/1 to 5V) | 0.05 % |

Static pressure effect [E3]

- $E3 = E3_M \cdot CF_3$
- $E3_M$ = Main static pressure error ($E3_M$ = Zero point + Span)
- CF_3 = Membrane material correction factor (static pressure)

$E3_M$ - Main static pressure error

 Static pressure effect refers to the effect on the output due to changes in process static pressure. It is the difference between the output at each static pressure and the output at atmospheric pressure [IEC 61298-3]. It is the combination of influence of the operating pressure on the zero point and span.

| Static pressure effect - PMD75, FMD77, FMD78 | | | | |
|--|---|-------------------------------------|---|-------------------------------------|
| Measuring cell | Standard ¹⁾ | | Platinum ¹⁾ | |
| | on the zero point ²⁾ | on the span | on the zero point ²⁾ | on the span |
| 10 mbar (0.15 psi) | $\pm 0.15 \cdot TD$ per 7 bar (105 psi) | ± 0.035 per 7 bar (105 psi) | $\pm 0.07 \cdot TD$ per 7 bar (105 psi) | ± 0.035 per 7 bar (105 psi) |
| 30 mbar (0.45 psi) | $\pm 0.70 \cdot TD$ per 70 bar (1050 psi) | ± 0.14 per 70 bar (1050 psi) | $\pm 0.25 \cdot TD$ per 70 bar (1050 psi) | ± 0.14 per 70 bar (1050 psi) |
| 100 mbar (1.5 psi) | $\pm 0.203 \cdot TD$ per 70 bar (1050 psi) | ± 0.15 per 70 bar (1050 psi) | $\pm 0.077 \cdot TD$ per 70 bar (1050 psi) | ± 0.15 per 70 bar (1050 psi) |
| 500 mbar (7.5 psi) | $\pm 0.07 \cdot TD$ per 70 bar (1050 psi) | ± 0.10 per 70 bar (1050 psi) | $\pm 0.028 \cdot TD$ per 70 bar (1050 psi) | ± 0.10 per 70 bar (1050 psi) |
| 3 bar (45 psi) | $\pm 0.049 \cdot TD$ per 70 bar (1050 psi) | ± 0.05 per 70 bar (1050 psi) | $\pm 0.021 \cdot TD$ per 70 bar (1050 psi) | ± 0.05 per 70 bar (1050 psi) |
| 16 bar (240 psi), 40 bar (600 psi) | $\pm 0.049 \cdot TD$ per 70 bar (1050 psi) | ± 0.02 per 70 bar (1050 psi) | $\pm 0.021 \cdot TD$ per 70 bar (1050 psi) | ± 0.02 per 70 bar (1050 psi) |

- 1) The specifications refer to the calibrated span/Upper Range Value (URV).
- 2) The influence of the operating pressure on the zero point can be corrected. Please refer to operating instructions and chapter Commissioning → Position adjustment.

CF_3 - Membrane material correction factor (static pressure) (applicable only to PMD75)

| Measuring cell | AISI 316L | Alloy C | Gold-Rhodium | Monel | Tantalum |
|--------------------|-----------|---------|--------------|-------|----------|
| 10 mbar (0.15 psi) | 1.0 | 1.0 | 1.0 | 1.4 | 2.1 |
| 30 mbar (0.45 psi) | 1.0 | 1.0 | 1.5 | 2.0 | 3.1 |
| 100 mbar (1.5 psi) | 1.0 | 1.0 | 2.5 | 2.5 | 2.5 |
| 500 mbar (7.5 psi) | 1.0 | 1.0 | 1.2 | 1.2 | 1.8 |
| 3 bar (45 psi) | 1.0 | 1.0 | 2.1 | 2.1 | 2.8 |
| 16 bar (240 psi) | 1.0 | 1.0 | 3.0 | 3.0 | 4.0 |
| 40 bar (600 psi) | 1.0 | 1.0 | 3.0 | 3.0 | 4.0 |

Total error

Total error = total performance + long-term stability

Total performance in % of the set span with TD1:1 → 25

Long-term stability in % of the upper range limit (URL) → 25

| Total error - PMD75 | | | | | | |
|---------------------|--|---------|----------|--|---------|----------|
| Measuring cell | Standard ^{1) 2)} | | | Platinum ^{1) 2)} | | |
| | AISI 316L or Alloy C % of the upper range limit / | | | AISI 316L or Alloy C % of the upper range limit / | | |
| | 1 year | 5 years | 10 years | 1 year | 5 years | 10 years |
| 10 mbar (0.15 psi) | ± 0.50 | ± 0.58 | ± 0.61 | ± 0.46 | ± 0.54 | ± 0.57 |
| 30 mbar (0.45 psi) | ± 1.07 | ± 1.15 | ± 1.18 | ± 0.66 | ± 0.74 | ± 0.77 |
| 100 mbar (1.5 psi) | ± 0.48 | ± 0.54 | ± 0.67 | ± 0.38 | ± 0.44 | ± 0.57 |
| 500 mbar (7.5 psi) | ± 0.23 | ± 0.25 | ± 0.28 | ± 0.19 | ± 0.21 | ± 0.24 |
| 3 bar (45 psi) | ± 0.18 | ± 0.22 | ± 0.29 | ± 0.15 | ± 0.19 | ± 0.26 |
| 16 bar (240 psi) | ± 0.15 | ± 0.23 | ± 0.33 | ± 0.12 | ± 0.20 | ± 0.30 |
| 40 bar (600 psi) | ± 0.17 | ± 0.19 | ± 0.22 | ± 0.14 | ± 0.16 | ± 0.19 |

1) Applies to membrane material AISI 316L (1.4435), Alloy C 276.

2) The specification values applies to the temperature range per $\pm 28\text{ }^{\circ}\text{C}$ ($50\text{ }^{\circ}\text{F}$) (corresponds to the range of -3 to $+53\text{ }^{\circ}\text{C}$ ($+27$ to $+127\text{ }^{\circ}\text{F}$)) for all measuring cells. The specification values are applicable to the process static pressure P_{st} is as per static pressure effect definitions. → 27 The specification values are applicable to analog output (i.e. inclusion of electronics error).

Performance characteristics - calculation example and additional information

Calculating the total performance in 5 steps

Data (Example)

| Measuring Conditions / Device configuration | |
|--|--|
| dP range (URV) | 8 bar (116 psi) |
| Min./ Max. temp. differential pressure transmitter (ambient/process) | Ambient temp.:0 to 45 °C (32 to 113 °F) Max. Process temp.:50 °C (122 °F) |
| Membrane material | AISI 316L |
| Reference accuracy (± 0.05%) | Standard |
| PMD75 - suitable measuring cell (upper range limit, URL) | 16 bar (240 psi) with TD 2:1 |
| Static pressure | 35 bar (508 psi) |
| Output Signal | 4 to 20 mA |

Formula

$$\text{Total performance} = \pm \sqrt{(E1)^2 + (E2)^2 + (E3)^2}$$

$$E1 = \text{Reference accuracy} \rightarrow \text{24}$$

$$E2 = \text{Ambient temperature effect per } \pm 28 \text{ }^\circ\text{C (50 }^\circ\text{F)} \text{ (corresponds to the range of } -3 \text{ to } +53 \text{ }^\circ\text{C (+27 to +127 }^\circ\text{F))} \rightarrow \text{26}$$

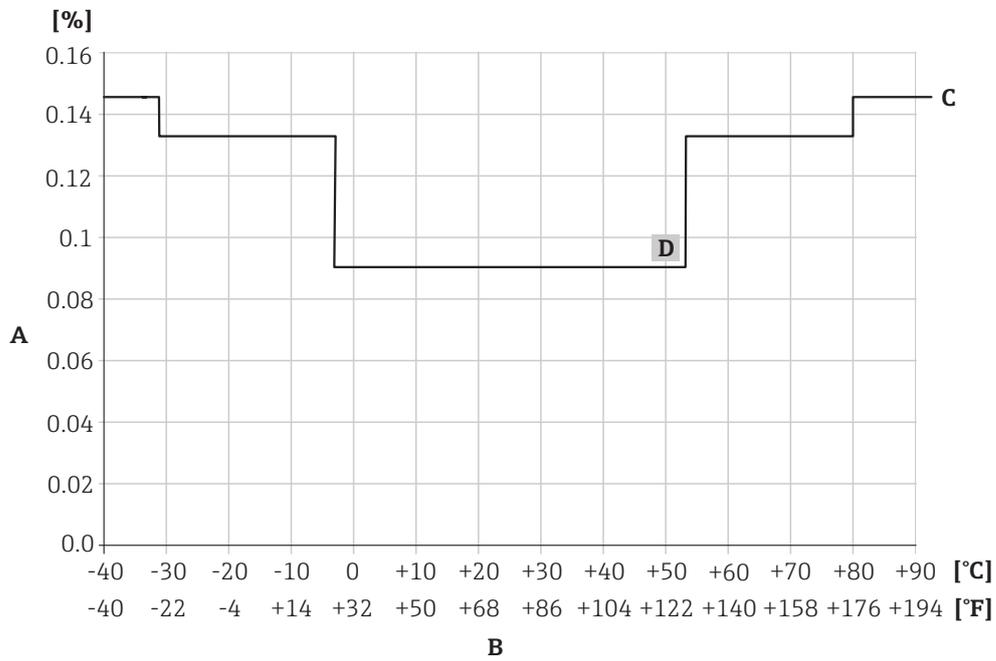
$$E3 = \text{Static pressure effect} \rightarrow \text{27}$$

Calculation

| | |
|--|------------------------------------|
| Step 1: Calculation of the turn down → 7 | |
| Turn down, TD = URL / [URV] | = 16 bar (240 psi)/8 bar (116 psi) |
| | = TD = 2:1 |
| Step 2: Calculation of the reference accuracy (E1) → 24 | |
| For the measuring conditions, | |
| Reference accuracy, E1 | = ± 0.05 (% of the set span) |
| | = ± (0.05/100) · 8 bar (116 psi) |
| | = ±0.0040 bar (0.0580 psi) |
| E1 | = ± 0.05 (% of the set span) |
| (or) | ±0.0040 bar (0.0580 psi) |

Step 3: Calculation of the ambient temperature effect [E2 = (E2_M · CF₁ · CF₂) + E2_E → 26]

| | |
|--|--|
| For the measuring conditions, | |
| Main temperature error, E2 _M | = ± (0.012 · TD + 0.017) % of the set span |
| Temperature correction factor, CF ₁ | = 1 |
| Membrane material correction factor, CF ₂ | = 1 |
| Electronics error, E2 _E | = 0.05 % |
| Ambient temperature effect, E2 | = ± [(0.012 · TD + 0.017) · 1 · 1] + 0.05 |
| | = ± [(0.012 · 2 + 0.017) · 1 · 1] + 0.05 |
| | = ± 0.091 (% of the set span) |
| | = ± (0.091/100) · 8 bar (116 psi) |
| | = ±0.0073 bar (0.10585 psi) |
| E2 | = ± 0.091 (% of the set span) |
| | (or) ±0.0073 bar (0.10585 psi) |



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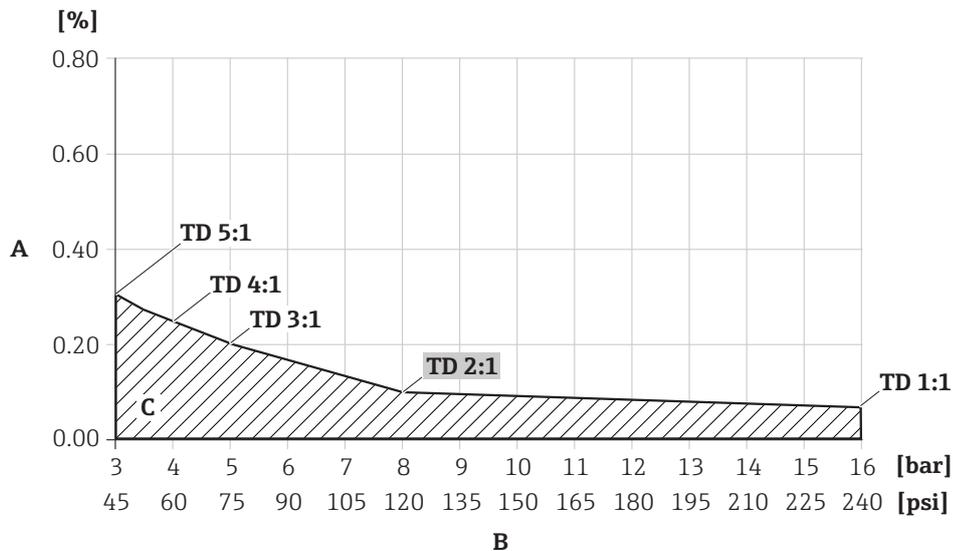
- A Error (% of the set span)
- B Temperature
- C Measuring membrane made from 316L or Alloy C
- D Ambient temperature effect: 0.091 (% of the set span) (E₂ at 50 °C (122 °F))

Step 4: Calculation of the static pressure effect (E3 = E3_M · CF₃ → 27)

| | | |
|--|------|---|
| For the measuring conditions, Main static pressure error, E3 _M | = | ± (0.049 · TD) on the zero point and ± 0.02 on the span (% of the set span) per 70 bar (1015 psi) |
| | = | [± (0.049 · TD) on the zero point and ± 0.02 on the span] · (35/70) (% of the set span) per 35 bar (507.50 psi) |
| Error factor dependent on membrane material, CF ₃ | = | 1 |
| Static pressure effect, E3 | = | ± (0.049 · TD + 0.02) · (35/70) · CF ₃ (% of the set span) |
| | = | ± (0.049 · 2 + 0.02) · (0.5) · 1 |
| | = | ± 0.059 (% of the set span) |
| | = | ± (0.059/100) · 8 bar (116 psi) |
| | = | ±0.0047 bar (0.06815 psi) |
| E3 | = | ± 0.059 (% of the set span) |
| | (or) | ±0.0047 bar (0.06815 psi) |

Step 5: Calculation of total performance

| | | |
|---|------|---|
| Total performance | = | ± √ ((E1) ² + (E2) ² + (E3) ²) |
| | | E1 = Reference accuracy E2 = Ambient temperature effect per ±28 °C (50 °F) (corresponds to the range of -3 to +53 °C (+27 to +127 °F)) E3 = Static Pressure Effect |
| Total performance, in mbar | = | ± √ ((0.004) ² + (0.0073) ² + (0.0047) ²) |
| | = | ± 0.0095 bar (0.13775 psi) or 9.5 mbar (0.13775 psi) |
| | ~ | 0.119 % of 8 bar (116 psi) |
| | (or) | |
| Total performance, in % of the set span | = | ± √ ((0.05) ² + (0.091) ² + (0.059) ²) |
| | = | ± 0.119 (% of the set span) |
| Total performance | = | ± 0.119 (% of the set span) |
| | (or) | ±0.0095 bar (0.13775 psi) |



A Error (% of the set span)
B Set span [bar]
C Standard measuring cell

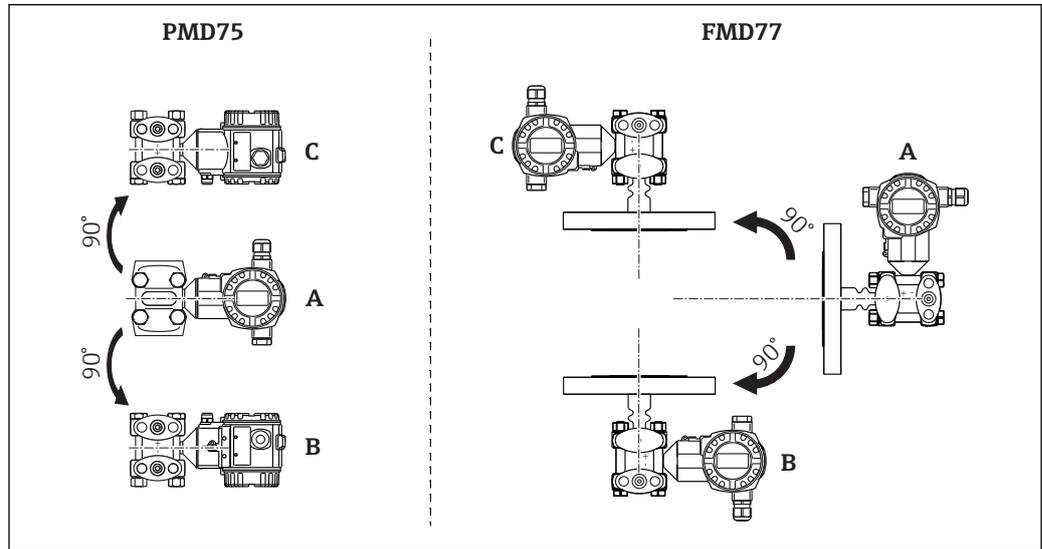
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Installation factors

Some of the influencing factors are:

- Influence of installation position
- Vibration effects

Influence of installation position



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| Device | Calibration position (A) | Device rotated vertically downwards (B) | Device rotated vertically upwards (C) |
|------------------------|--------------------------|--|--|
| PMD75 and Silicone Oil | No additional error | <+4 mbar (+0.06 psi) The value is doubled for inert oil. | <-4 mbar (-0.06 psi) The value is doubled for inert oil. |
| FMD77 and Silicone Oil | No additional error | <+32 mbar (+0.46 psi) The value is doubled for inert oil. | <-32 mbar (-0.46 psi) The value is doubled for inert oil. |

i A position-dependent zero point shift can be corrected. Please refer to operating instructions chapter Commissioning → Position adjustment.

Vibration effects

| Device/accessory | Measuring cells | Housing | Test standard | Vibration resistance |
|------------------|---|---|---------------|--|
| PMD75 | 10 mbar (0.15 psi), 30 mbar (0.45 psi) | T14 stainless steel T15 aluminum T17 aluminum | IEC 61298-3 | ≤ 0.15% URL to 10 to 38 Hz: ±0.35 mm (0.0138 in); 38 to 2000 Hz: 2 g in all 3 planes |
| | | T14 aluminum | IEC 61298-3 | ≤ 0.15% URL to 10 to 60 Hz: ±0.21 mm (0.0083 in); 60 to 2000 Hz: 3 g in all 3 planes |
| | ≥100 mbar (1.5 psi) | T14 stainless steel T15 aluminum | IEC 61298-3 | ≤ 0.075 % URL to 10 to 38 Hz: ±0.35 mm (0.0138 in); 38 to 2000 Hz: 2 g in all 3 planes |
| | | T14 aluminum | IEC 61298-3 | ≤ 0.075 % URL to 10 to 60 Hz: ±0.35 mm (0.0138 in); 60 to 2000 Hz: 5 g in all 3 planes |

Performance Characteristics Conformance

All performance characteristics are in conformance to $\geq \pm 3$ sigma.

Resolution

Current output: 1 μ A

Warm-up period

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

Reference operating conditions

- As per IEC 60770
- Ambient temperature T_A = constant, in the range +21 to +33 °C (+70 to +91 °F)
- Humidity ϕ = constant, in the range: 5 to 80 % RH \pm 5 %
- Ambient pressure p_A = constant, in range: 860 to 1060 mbar (12.47 to 15.37 psi)
- Position of measuring cell: horizontal $\pm 1^\circ$ (see also "Influence of the installation position" section)
- Input of LOW SENSOR TRIM and HIGH SENSOR TRIM for lower range value and upper range value
- Zero based span
- Membrane material for PMD75: AISI 316L (1.4435), Alloy C276, gold/rhodium-coated, Monel
- Membrane material for FMD77, FMD78: AISI 316L (1.4435)
- Filling oil: silicone oil
- Supply voltage: 24 V DC \pm 3 V DC
- Load with HART: 250 Ω
- Turn down, TD = URL / |URV |; zero based span

Installation

General installation instructions

- A 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. →  92
- The device housing can be rotated up to 380°.
- Endress+Hauser offers a mounting bracket for installing the device on pipes or walls. →  35
- 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.
- 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.
- Point the cable and connector downwards where possible to prevent moisture from entering (e.g. rain or condensation water).

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 points and at the same distance from Deltabar S.

Level measurement

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

Measuring arrangement for level measurement in open containers

- 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 containers and closed containers 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 vapors, mount the condensate traps at the same level as the tapping points and at the same distance from Deltabar S.

Measuring arrangement for devices with diaphragm seals – FMD77 and FMD78

→  89

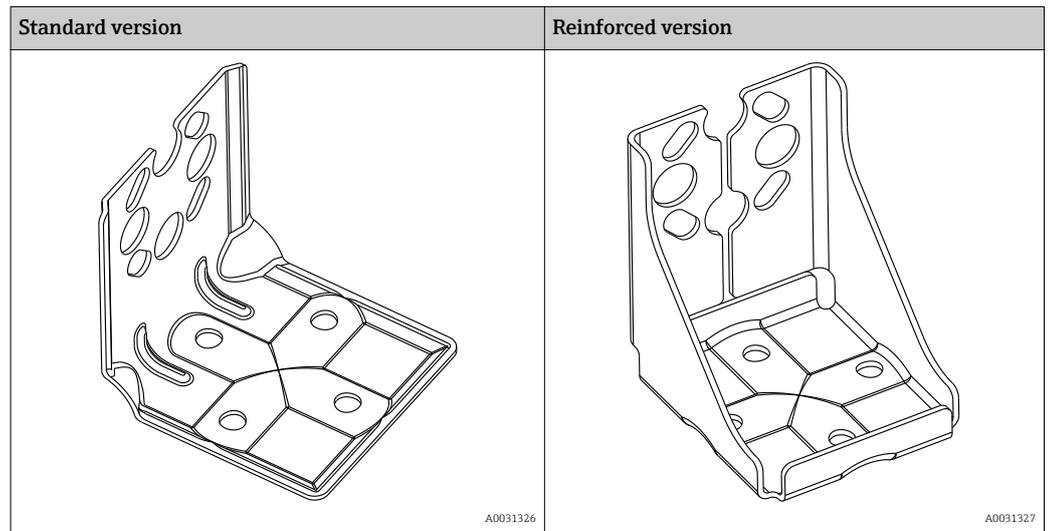
Orientation

The orientation may cause a zero point shift, see .

This position-dependent zero point shift can be corrected directly at the device via the operating key, and also in hazardous areas in the case of devices with external operation (position adjustment).

Wall and pipe mounting, transmitter (optional)

Endress+Hauser offers the following mounting bracket for installing the device on pipes or walls:

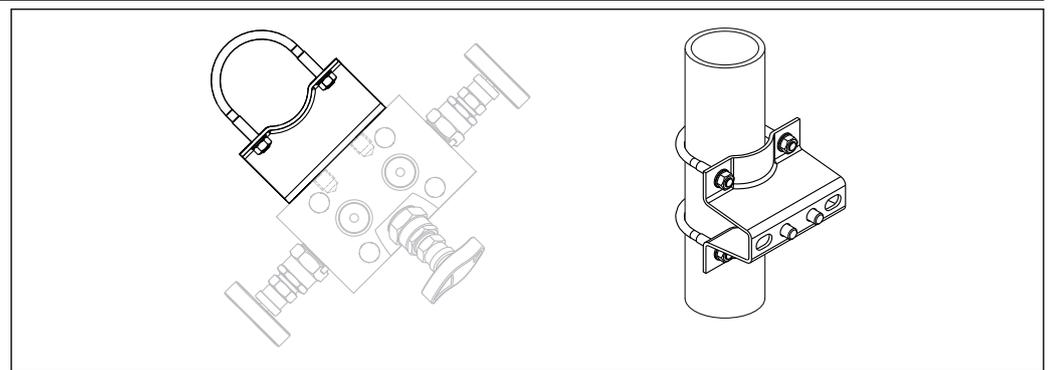


- The standard mounting bracket version is **not** suitable for use in an application subject to vibrations.
- The vibration resistance of the reinforced version of the mounting bracket has been tested according to IEC 61298-3, see the "Vibration resistance" section → 40.
- If a valve block is used, its dimensions should also be taken into consideration.
- Bracket for wall and pipe mounting including retaining bracket for pipe mounting and two nuts.
- The material of the screws used to secure the device depend on the order code.
- For the technical data (such as the dimensions or order numbers for screws), see the document SD01553P/00/EN.

Ordering information:

- Standard version: Product Configurator, order code for "Additional options" option "Q" or
- Standard version: Product Configurator, order code for "Accessories enclosed" option "PD"
- Reinforced version: Product Configurator, order code for "Additional options" option "U" or
- Reinforced version: Product Configurator, order code for "Accessories enclosed" option "PB"

Wall and pipe mounting, valve manifold (optional)



For the technical data (such as the dimensions or order numbers for screws), see the document SD01553P/00/EN.

Ordering information:

Product Configurator, order code for "Accessories enclosed", option "PJ"

"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 and
- If the measuring point is exposed to vibrations.

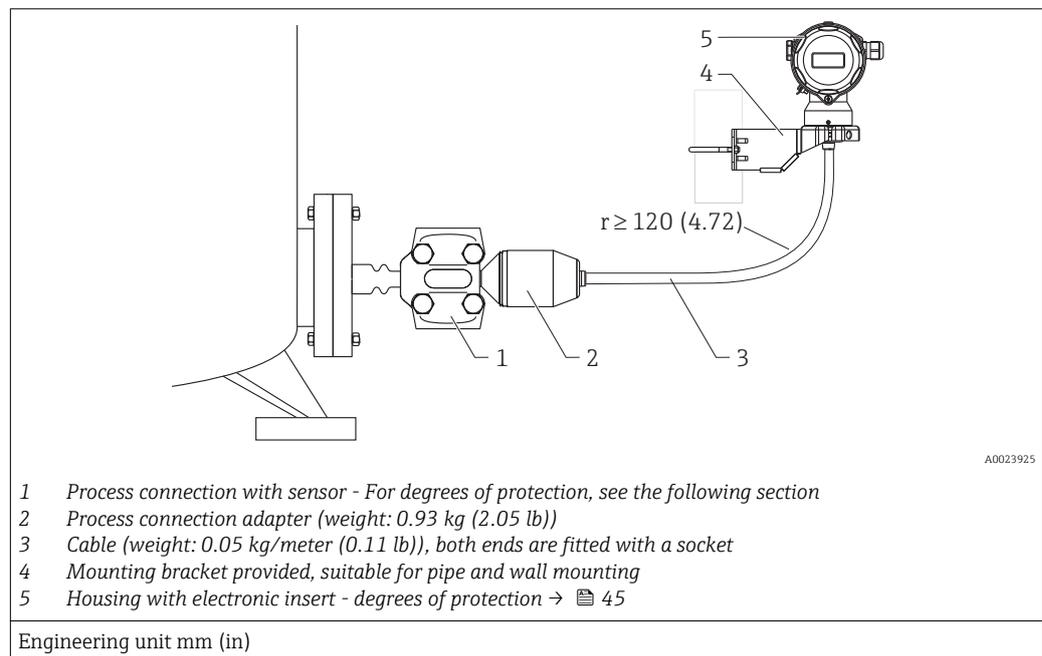
You can choose between different cable versions:

- PE: 2 m (6.6 ft), 5 m (16 ft) and 10 m (33 ft)
- FEP: 5 m (16 ft).

Ordering information: Product Configurator, order code for "Additional options 2", version "G".

Dimensions

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.



Degree of protection for the process connection and sensor with the use of

- FEP cable:
 - IP 69¹⁾
 - IP 66 NEMA 4/6P
 - IP 68 (1.83 mH₂O for 24 h) NEMA 4/6P
- PE cable:
 - IP 66 NEMA 4/6P
 - IP 68 (1.83 mH₂O 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 (101.16 lbf)
- Resistance to UV light

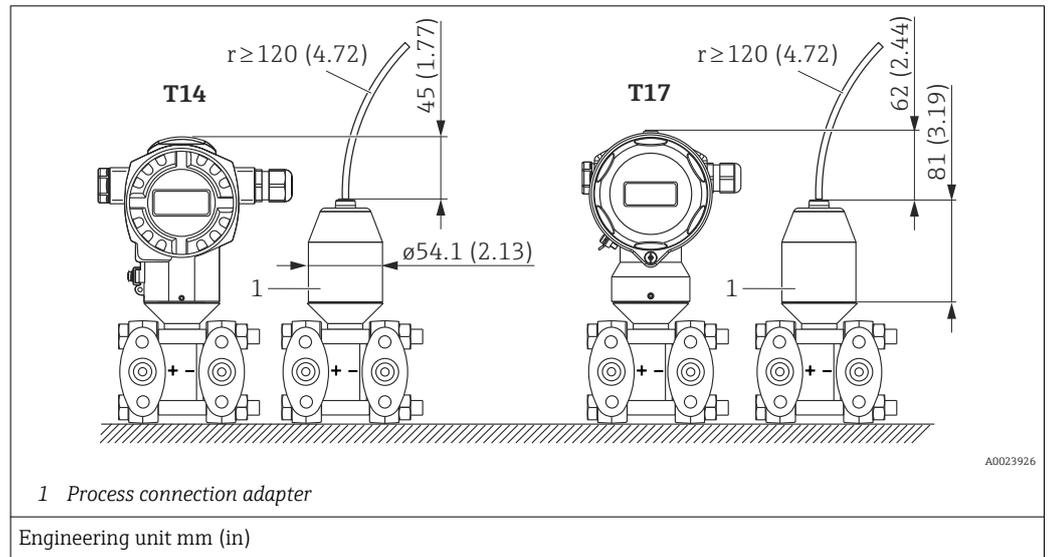
Use in hazardous area:

- Intrinsically safe installations (Ex ia/IS)
- FM/CSA IS: for Div. 1 installation only

1) Designation of the IP protection class according to DIN EN 60529. Previous designation "IP69K" according to DIN 40050 Part 9 is no longer valid (standard withdrawn on November 1, 2012). The tests required by both standards are identical.

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.

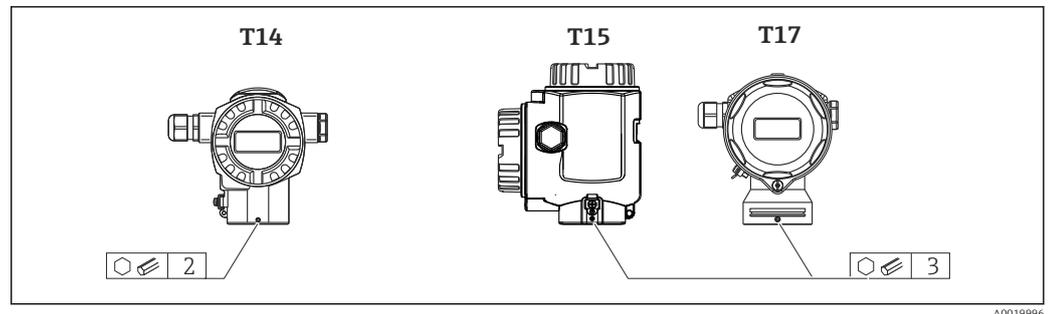


Turning the housing

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

Your benefits

- Easy mounting due to optimum alignment of 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} .

HB = Cleaned for oxygen service

| Order code for devices ¹⁾ , cleaned for oxygen applications | p_{\max} for oxygen applications | T_{\max} for oxygen applications |
|--|---|------------------------------------|
| PMD75 - * * * * * K * * or PMD75 - * * * * * H * * HB | 160 bar (2 400 psi) | 85 °C (185 °F) |
| PMD75 - * * * * * 2 * * or PMD75 - * * * * * A * * HB | 160 bar (2 400 psi) | 60 °C (140 °F) |
| PMD75 - * * * * * 3 * * or PMD75 - * * * * * C * * HB | 160 bar (2 400 psi) | 60 °C (140 °F) |
| FMD77 - * * * * * T * F * * or FMD77 - * * * * * D * F * * HB | PN of the flange | 60 °C (140 °F) |
| FMD78 - * * * * * 4 * * or FMD78 - * * * * * 6 * * HB FMD78 - * * * * * D * * or FMD78 - * * * * * F * * HB | Depends on filling oil: max. 160 bar (2 400 psi) | 85 °C (185 °F) |

1) Devices only, 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

A **gold-plated** metal process isolating diaphragm offers universal protection against hydrogen diffusion, both in gas applications and in applications with aqueous solutions.

Applications with hydrogen in aqueous solutions

A **gold/rhodium-plated** metal process isolating diaphragm (AU/Rh) offers effective protection against hydrogen diffusion.

Environment

- Ambient temperature range**
- -40 to +85 °C (-40 to +185 °F). Devices for lower temperatures available on request.
 - Local 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)
 - FMD77 and FMD78: Ambient temperature range and process temperature range are mutually dependent - see "Heat insulation" section →  94

Hazardous areas

- For devices for use in hazardous areas, see Safety Instructions, Installation or Control Drawing . →  106
- Pressure measuring devices that have the usual explosion protection certificates (e.g. ATEX/ FM/ CSA/ IEC Ex,...) can be used in hazardous areas at 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 measurement-specific testing of the device is performed only down to -40 °C (-40 °F). If the device is operated at an ambient temperature below -40 °C (-40 °F), the technical data in this document are no longer valid. Functional restrictions can be expected.

- Storage temperature range**
- -40 to +90 °C (-40 to +194 °F)
 - Local display: -40 to +85 °C (-40 to +185 °F)
 - Separate housing -40 to +60 °C (-40 to +140 °F)
 - Devices with PVC-sheathed capillary: -25 to +90 °C (-13 to +194 °F)

- Degree of protection**
- Depends on the deployed
- Housing →  45
 - Separate housing →  36

- 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.)

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

For further details refer to the Declaration of Conformity.

Vibration resistance

| Device/accessory | Measuring cells | Housing | Test standard | Vibration resistance |
|--|---|---|------------------|--|
| PMD75 | 10 mbar (0.15 psi), 30 mbar (0.45 psi) | T14 stainless steel T15 aluminum T17 aluminum | IEC 61298-3 | Guaranteed for 10 to 38 Hz: ±0.35 mm (0.0138 in); 38 to 2000 Hz: 2 g in all 3 planes |
| | | T14 aluminum | IEC 61298-3 | Guaranteed for 10 to 60 Hz: ±0.21 mm (0.0083 in); 60 to 2000 Hz: 3 g in all 3 planes |
| | ≥100 mbar (1.5 psi) | T14 stainless steel T15 aluminum | IEC 61298-3 | Guaranteed for 10 to 38 Hz: ±0.35 mm (0.0138 in); 38 to 2000 Hz: 2 g in all 3 planes |
| | | T14 aluminum | 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 |
| With mounting bracket (heavy duty design) | All | All | 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 |
| FMD77 | All | All | IEC 61298-3:1998 | Guaranteed for 10 to 60 Hz: ±0.075 mm (0.0030 in); 60 to 150 Hz: 1 g in all 3 planes |

Process

Process temperature limits (temperature at transmitter)

PMD75

- Process connections made of 316L or Alloy C276: -40 to +85 °C (-40 to +185 °F)
- Process connections made of C22.8: -10 to +85 °C (+14 to +185 °F)
- For oxygen applications, →  38, see "Oxygen applications" section.
- Pay attention to the process temperature range of the seal. See also the following section "Process temperature range, seals".

FMD77

- Depends on the design (see the following table)
- Depends on the diaphragm seal and filling oil (→  91): up to +400 °C (752 °F)
- For oxygen applications, →  38, see "Oxygen applications" section.
- Pay attention to the process temperature range of the seal. See also the following section "Process temperature range, seals".
- Please observe the temperature application limits of the diaphragm seal oil. →  91, "Diaphragm seal filling oils" section.
- Please observe the maximum gauge pressure and maximum temperature.



| Design | Temperature isolator | Temperature | Option ¹⁾ |
|---|----------------------|-----------------|----------------------|
| Transmitter horizontal | long | 400 °C (752 °F) | MA |
| Transmitter vertical | long | 300 °C (572 °F) | MB |
| Transmitter horizontal | short | 200 °C (392 °F) | MC |
| Transmitter vertical | short | 200 °C (392 °F) | MD |
| U-bracket, Transmitter horizontal (for devices which require a CRN approval) | - | 400 °C (752 °F) | ²⁾ |

- 1) Product Configurator, order code for "Process connection"
- 2) In combination with CSA approval.

FMD78

- Depends on diaphragm seal and filling oil: up to +400 °C (752 °F)
- For oxygen applications, →  38, see "Oxygen applications" section.
- Please observe the temperature application limits of the diaphragm seal oil. →  91, "Diaphragm seal filling oils" section.
- Please observe the maximum gauge pressure and maximum temperature.

FMD77 and FMD78: Devices with PTFE-coated process isolating diaphragm

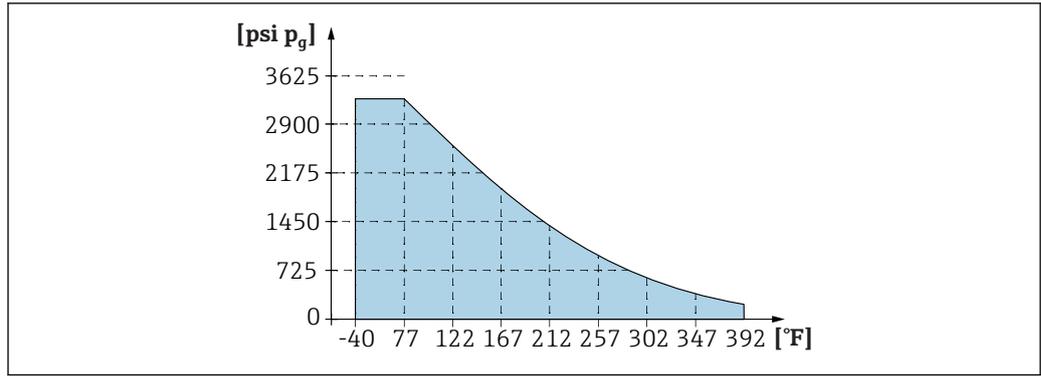
The non-stick coating has excellent gliding properties and is used to protect the process isolating diaphragm against abrasive media.

NOTICE

Incorrect use of the PTFE foil will destroy the device!

- ▶ The PTFE foil is designed to protect the unit against abrasion. It does not provide protection against corrosive media.

For the range of application of the 0.25 mm (0.01 in) PTFE foil on an AISI 316L (1.4404/1.4435) process isolating diaphragm, see the following diagram:

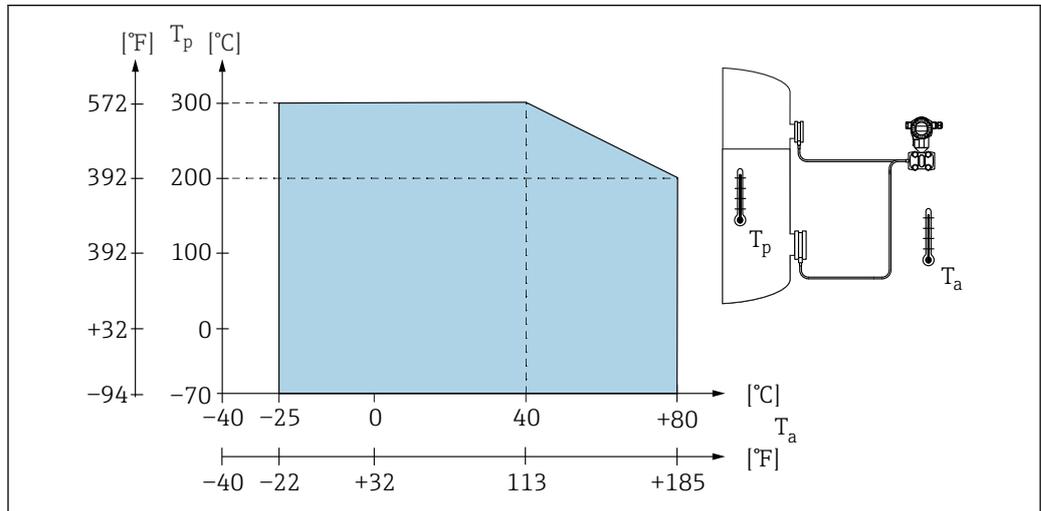


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i For vacuum applications: $p_{abs} \leq 1 \text{ bar (14.5 psi)}$ to $0.05 \text{ bar (0.725 psi)}$ up to max. $+150 \text{ °C (302 °F)}$.

Process temperature limits of capillary armoring: FMD77 and FMD78

- 316L: No restrictions
- PTFE: No restrictions
- PVC: See the following diagram



A0028096

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 or H ³⁾ |
| 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 or A |
| PTFE, cleaned for oxygen applications | -20 to +60 °C (-4 to +140 °F) | 3 or C |

- 1) lower temperatures on request
- 2) Product Configurator, order code for "Seal"
- 3) with option "HB", see Product Configurator, order code for "Service"

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 the "Measuring range" section "FMD77, FMD78, PMD75: Option PN 160 / 16 MPa / 2400 psi" → ☞ 11. | | 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 or D ³⁾ |
| 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) | |
| Diaphragm seal and capillary, welded | Please observe the temperature application limits of the diaphragm seal oil. → ☞ 91, "Diaphragm seal filling oils" section. | | | |

1) lower temperatures on request

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

3) with option "HB", see Product Configurator, order code for "Service"

Pressure specifications

⚠ WARNING

The maximum pressure for the measuring device depends on the lowest-rated element with regard to pressure.

- ▶ For pressure specifications, see the "Measuring range" section and the "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 refers to a reference temperature of +20 °C (68°F) and may be applied to the device for an unlimited time. Observe temperature dependency of the MWP. The pressure values permitted at higher temperatures can be found in the standards EN 1092-1: 2001 Tab. 18 (With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.), 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 individual sensors (OPL = 1.5 x MWP) and may be applied only for a limited period of time to prevent any lasting damage.
- ▶ The Pressure Equipment Directive (2014/68/EU) 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 must not be exceeded → ☞ 38.
- ▶ For the PMD75, the MWP applies to the temperature ranges specified in the "Ambient temperature range" → ☞ 39 and "Process temperature limits" → ☞ 41 sections.

Mechanical construction

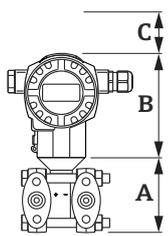
Device height

The device height is calculated from

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

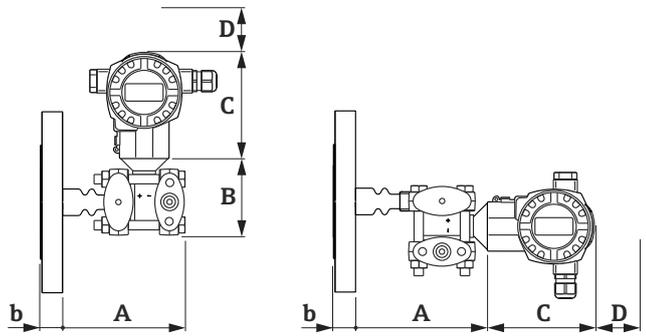
The individual heights of the components can be found in the following sections. To calculate the device height, simply add up the individual heights of the components. If necessary, the installation space (the space used to install the device) must also be taken into account. You can use the following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

PMD75

| Description | Item | Dimension | Example |
|--------------------|------|-----------------|--|
| Side flanges | (A) | 85 mm (3.35 in) |  |
| Height of housing | (B) | → 45 ff. | |
| Installation space | (C) | - | |
| Device height | | | |

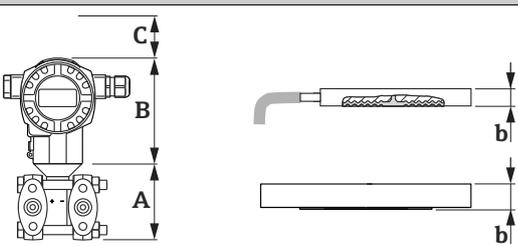
A0023927

FMD77

| Description | Item | Dimension | Example |
|---------------------|------|-----------------|--|
| Mounted parts | (A) | → 53 |  |
| Side flanges | (B) | 85 mm (3.35 in) | |
| Height of housing | (C) | → 45 ff. | |
| Installation space | (D) | - | |
| Process connections | (b) | → 47 | |
| Device height | | | |

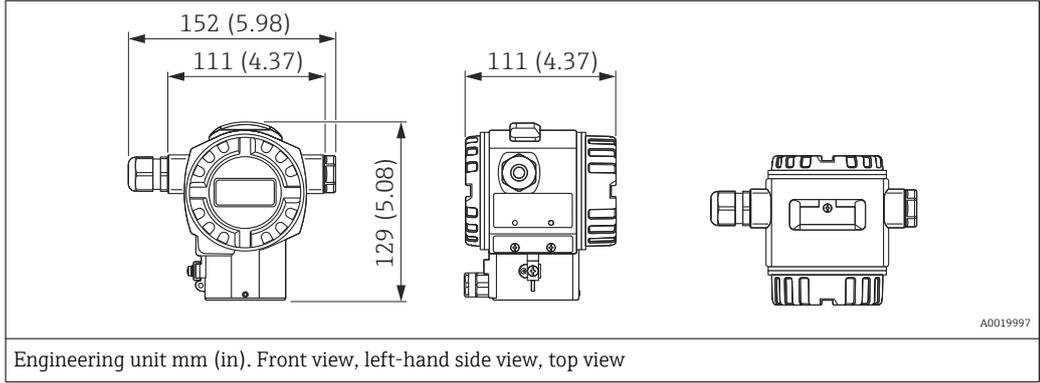
A0025880

FMD78

| Description | Item | Dimension | Example |
|---------------------|------|-----------------|--|
| Side flanges | (A) | 85 mm (3.35 in) |  |
| Height of housing | (B) | → 45 ff. | |
| Installation space | (C) | - | |
| Process connections | (b) | → 47 | |
| Device height | | | |

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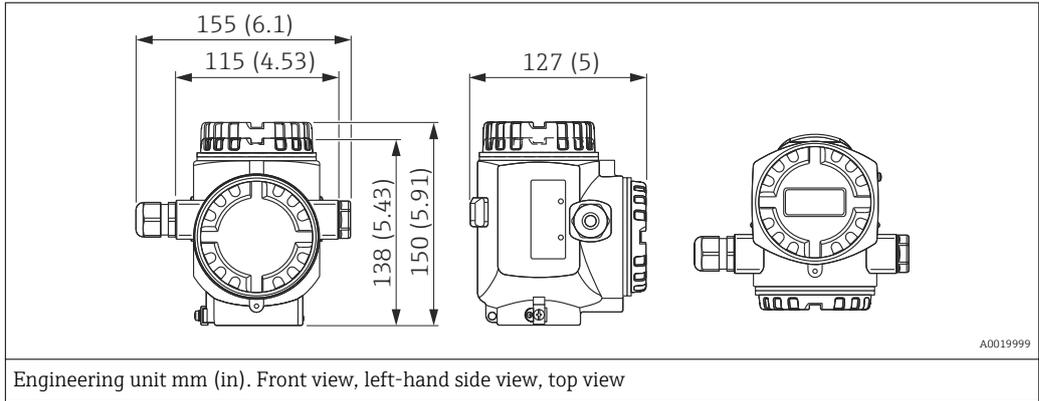
T14 housing, optional display on the side



| Material | | Degree of protection | Cable entry | Weight in kg (lb) | | 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, degree of protection"

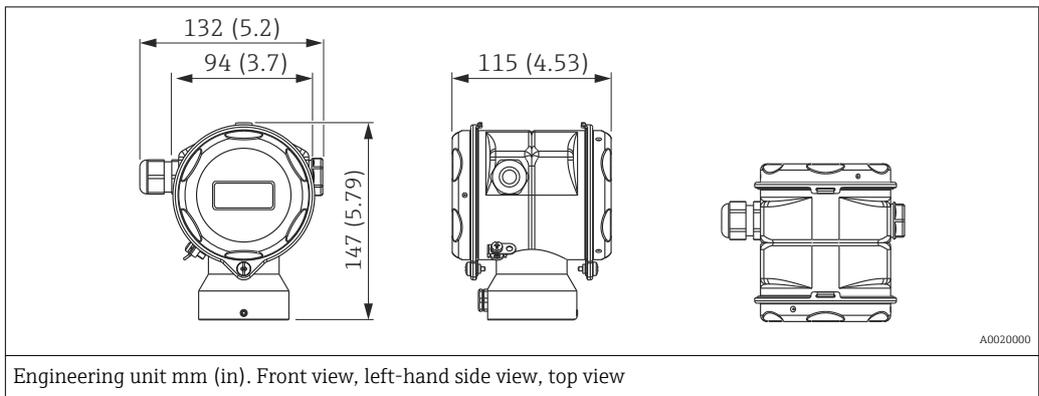
T15 housing, optional display on the top



| Material | | Degree of protection | Cable entry | Weight in kg (lb) | | 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, degree of protection"

T17 housing (hygienic), optional display on the side

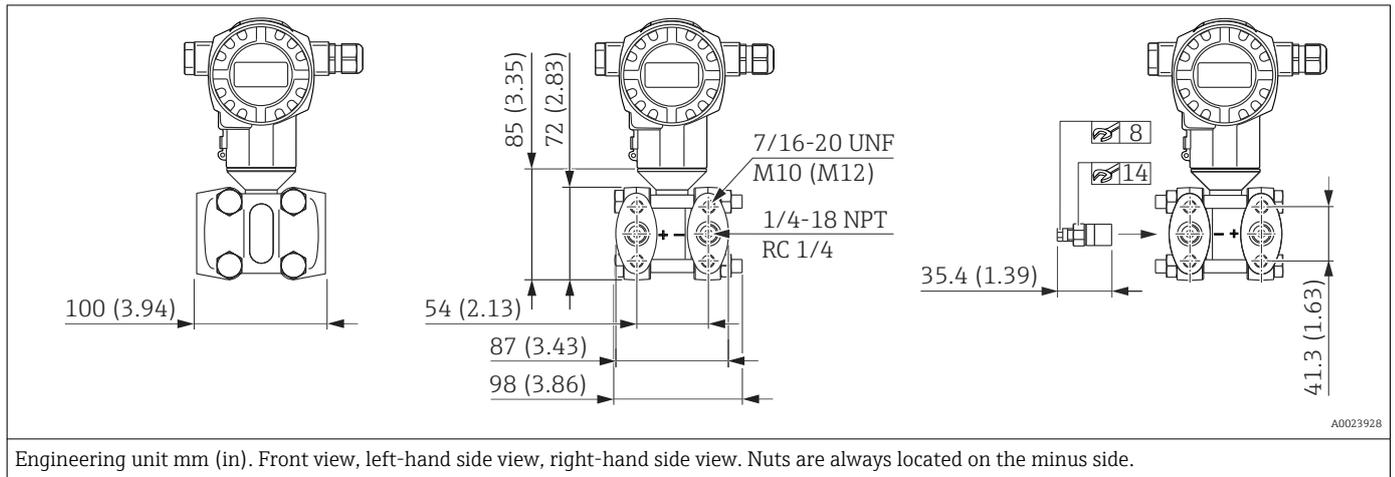


| Material | | Degree of protection ¹⁾ | Cable entry | Weight in kg (lb) | | Option ²⁾ |
|----------|------------|------------------------------------|---------------|-------------------|-----------------|----------------------|
| Housing | Cover seal | | | with display | without display | |
| 316L | 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 mH₂O for 24 h

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

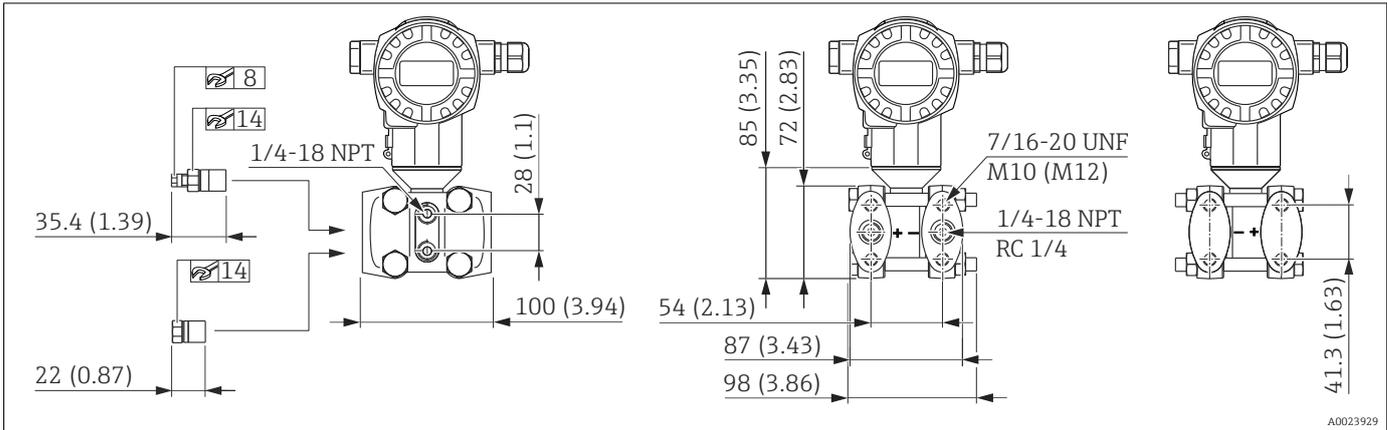
Process connections PMD75 Oval flange, connection 1/4-18 NPT or RC 1/4



| Connection | Mounting | Material | Accessories | Weight ¹⁾ | Option ²⁾ |
|----------------------|--|---|--|----------------------|----------------------|
| | | | | kg (lbs) | |
| 1/4-18 NPT IEC 61518 | 7/16-20 UNF | Steel C 22.8 (1.0460/Zn5) ³⁾ | Including 2 vent valves AISI 316L (1.4404) | 4.2 (9.26) | B |
| 1/4-18 NPT IEC 61518 | 7/16-20 UNF | 1.4408 / CF3M ⁴⁾ / AISI 316L AISI 316L (1.4404) ⁵⁾ | | | D |
| 1/4-18 NPT IEC 61518 | 7/16-20 UNF | Alloy C276 (2.4819) | Vent valves Alloy C276 (2.4819) ⁶⁾ | 4.5 (9.92) | F |
| RC 1/4 | 7/16-20 UNF | 1.4408 / CF3M ⁴⁾ / AISI 316L AISI 316L (1.4404) ⁵⁾ | Including 2 vent valves AISI 316L (1.4404) | 4.2 (9.26) | U |
| 1/4-18 NPT IEC 61518 | <ul style="list-style-type: none"> ■ PN 160: M10 ■ PN 420: M12 | Steel C 22.8 (1.0460/Zn5) ³⁾ | | | 1 |
| 1/4-18 NPT IEC 61518 | <ul style="list-style-type: none"> ■ PN 160: M10 ■ PN 420: M12 | AISI 316L (1.4404) | | | 2 |
| 1/4-18 NPT IEC 61518 | <ul style="list-style-type: none"> ■ PN 160: M10 ■ PN 420: M12 | Alloy C276 (2.4819) | Vent valves Alloy C276 (2.4819) ⁶⁾ | 4.5 (9.92) | 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 \geq 100 mbar (1.5 psi) weigh approx. 800 g (28.22 oz) less.
- 2) Product Configurator, order code for "Process connection"
- 3) The C22.8 side flanges are coated with anti-corrosion protection (zinc, chrome). To prevent the formation of hydrogen and thereby diffusion through the diaphragm, Endress+Hauser recommends the use of 316L side flanges for applications involving water. Hydrogen diffusion through the diaphragm leads to measurement errors, or in extreme cases to a device failure.
- 4) Cast equivalent to material AISI 316L
- 5) For devices with CSA approval: Product Configurator, order code for "Approval", options D, E, F, U, V, W and X
- 6) Product Configurator, order code for "Additional options 2"

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

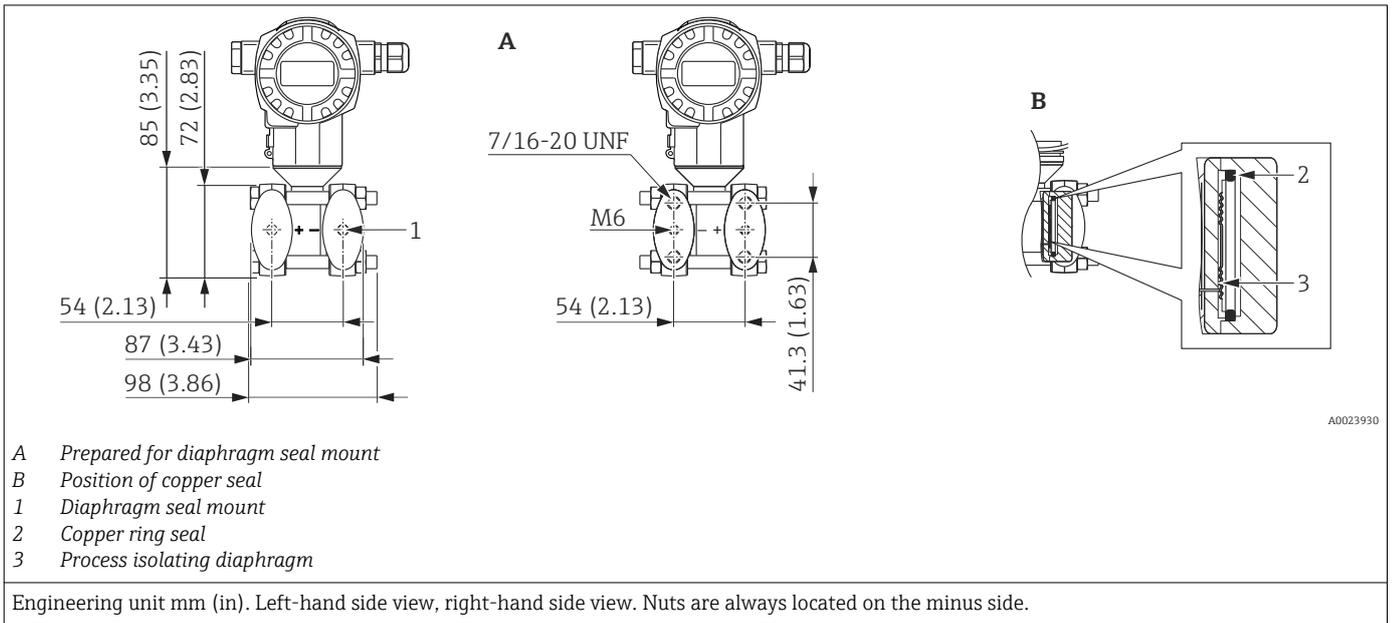


Engineering unit mm (in). Front view, left-hand side view, right-hand side view. Nuts are always located on the minus side.

| Connection | Mounting | Material | Accessories | Weight ¹⁾ | | Option ²⁾ |
|----------------------|-------------|---|---|----------------------|--------|----------------------|
| | | | | kg | (lbs) | |
| 1/4-18 NPT IEC 61518 | 7/16-20 UNF | Steel C 22.8 (1.0460/Zn5) ³⁾ | Including 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 | 1.4408 / CF3M ⁴⁾ / AISI 316L AISI 316L (1.4404) ⁵⁾ | | | | E |
| 1/4-18 NPT IEC 61518 | 7/16-20 UNF | Alloy C276 (2.4819) | Vent valves Alloy C276 (2.4819) ⁶⁾ | 4.5 | (9.92) | H |
| RC 1/4 | 7/16-20 UNF | 1.4408 / CF3M ⁴⁾ / AISI 316L AISI 316L (1.4404) ⁵⁾ | Including 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 \geq 100 mbar (1.5 psi) weigh approx. 800 g (28.22 oz) less.
- 2) Product Configurator, order code for "Process connection"
- 3) The C22.8 side flanges are coated with anti-corrosion protection (zinc, chrome). To prevent the formation of hydrogen and thereby diffusion through the diaphragm, Endress+Hauser recommends the use of 316L side flanges for applications involving water. Hydrogen diffusion through the diaphragm leads to measurement errors, or in extreme cases to a device failure.
- 4) Cast equivalent to material AISI 316L
- 5) For devices with CSA approval: Product Configurator, order code for "Approval", options D, E, F, U, V, W and X
- 6) Product Configurator, order code for "Additional options 2"

Process connections PMD75 Oval flange, prepared for diaphragm seal mount

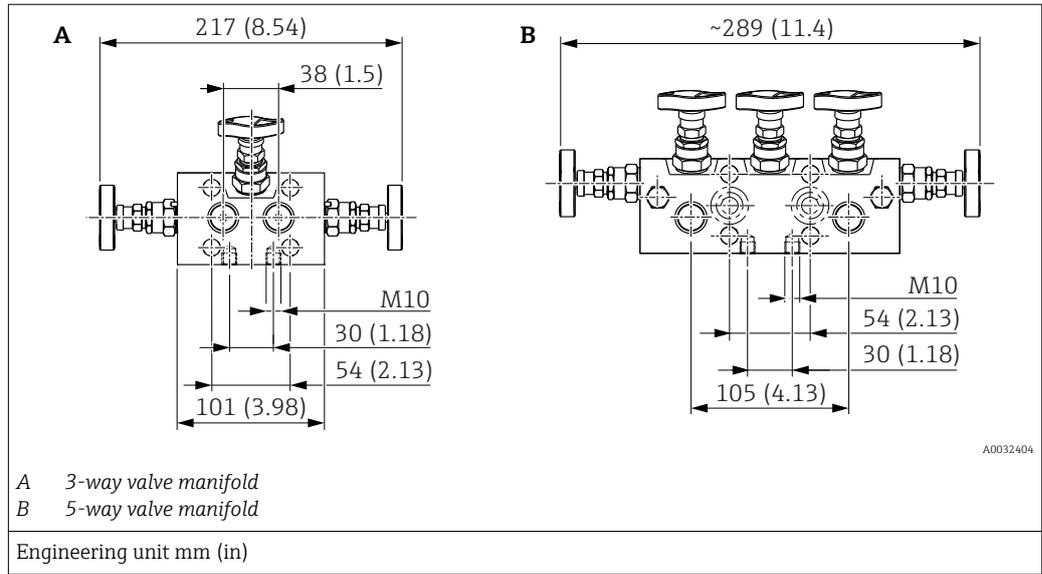


| Material | Option ¹⁾ |
|---|----------------------|
| 1.4408 / CF3M ²⁾ / AISI 316L | W |
| AISI 316L (1.4404) ³⁾ | |

- 1) Product Configurator, order code for "Process connection"
- 2) Cast equivalent to material AISI 316L
- 3) For devices with CSA approval: Product Configurator, order code for "Approval", options D, E, F, U, V, W and X

Valve manifold DA63M (optional)

Endress+Hauser supplies milled valve manifolds via the transmitter's product structure in the following versions:



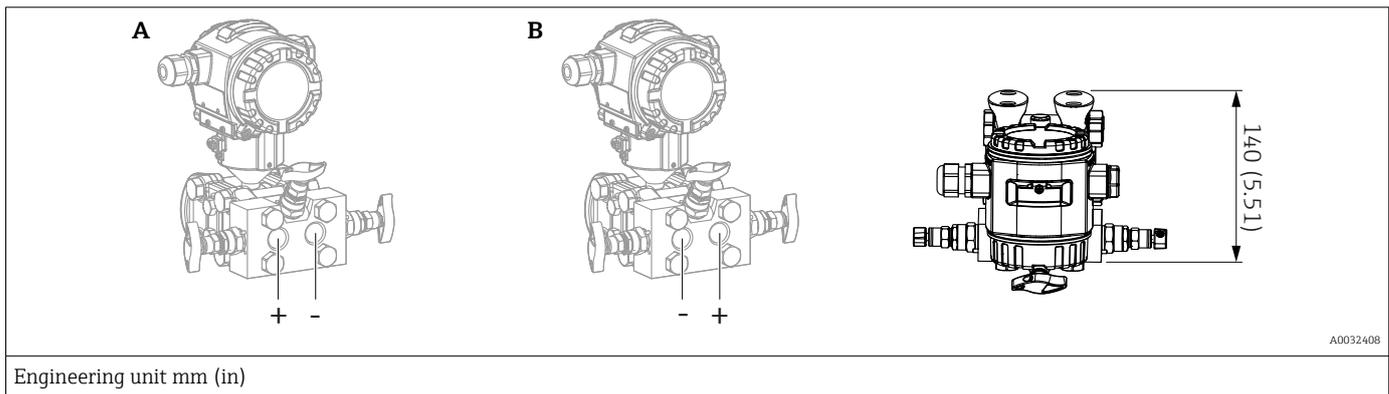
- 3-way or 5-way valve manifolds in 316L or AlloyC can be
- ordered as an **enclosed** accessory (screws and seals for mounting are enclosed)
 - ordered as a **mounted** accessory (mounted valve manifolds are supplied with a documented leakage test).

Certificates ordered with the equipment (e.g. 3.1 material certificate and NACE) and tests (e.g. PMI and pressure test) apply to the transmitter and the valve manifold.

For other details (order option, dimension, weight, materials), see SD01553P/00/EN "Mechanical accessories for pressure measuring devices".

During the operating life of the valves, it may be necessary to re-tighten the packing.

Mounting on valve manifold



| Position | Description | Option ¹⁾ |
|----------|---------------------------------------|----------------------|
| A | Mounting from above on valve manifold | NV |
| B | Mounting from below on valve manifold | NW |

1) Product Configurator, order code for "Accessories mounted"

FMD77: Selecting the process connection and capillary line

The device can be fitted with different process connections on the high-pressure side (HP) and on the low-pressure side (LP).

The FMD77 can also be fitted with capillary lines on the low-pressure side (LP).

When using diaphragm seal systems with a capillary, sufficient strain relief must be provided to prevent the capillary from bending (capillary bending radius ≥ 100 mm (3.94 in)).

Example:

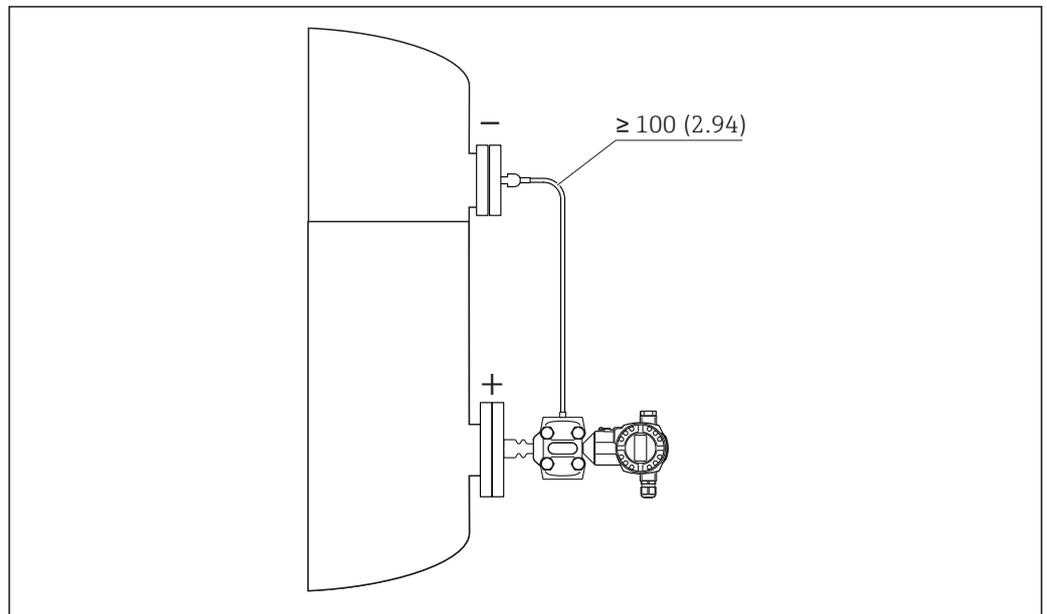
- Process connection on high-pressure side = DN80 flange
- Process connection on low-pressure side = DN50 flange

Your benefits:

- Thanks to the variety of order options, the devices can be optimally adapted to the given installation situation
- Reduced costs due to optimum system design
- Easier installation due to adjusted length of capillary line
- Easier adaptation to existing installation situations

Ordering information:

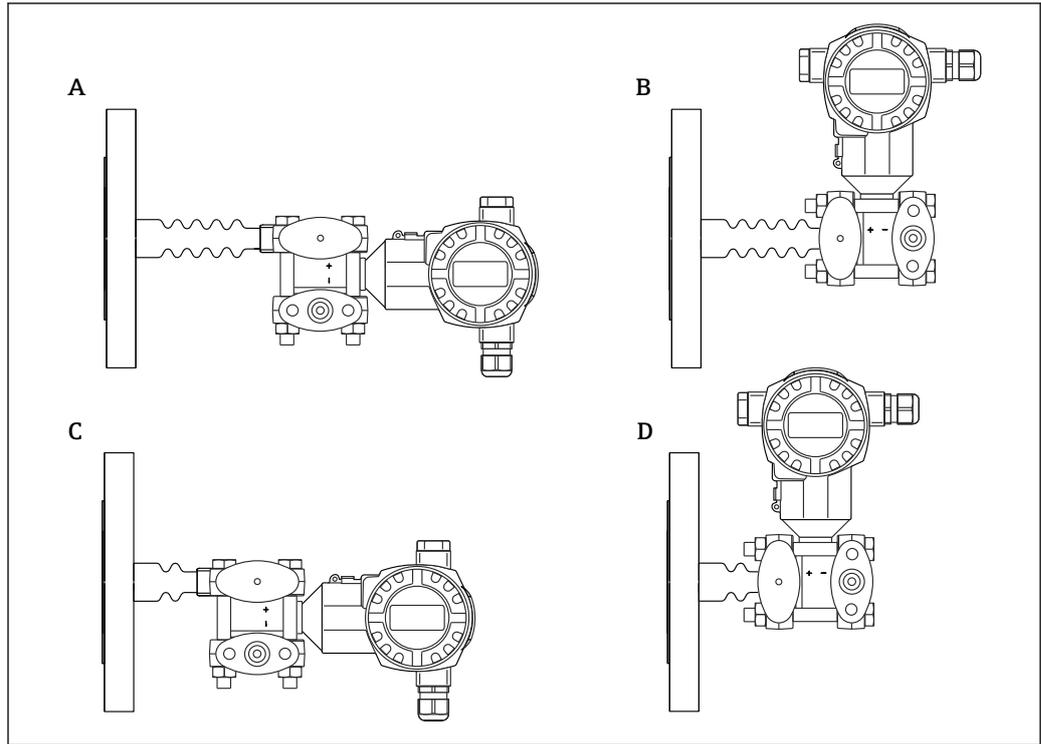
- Process connections are indicated in the relevant section by HP (high-pressure side) and LP (low-pressure side)
- Order details for capillary lengths



A0027889

i Due to the use of different process connections and capillary lines, it is essential that the device be designed/ordered using the "Applicator Sizing Diaphragm Seal" selection tool, which is available free of charge. Additional information can be found in the "Planning instructions, diaphragm seal systems" section → 89

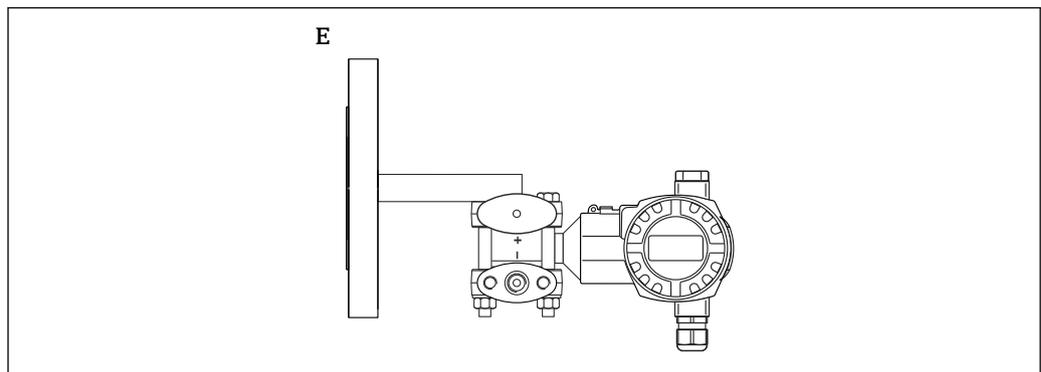
FMD77 - Overview



A0025157

| Item | Design | Temperature isolator | Page | Option ¹⁾ |
|------|------------------------|----------------------|------|----------------------|
| A | Transmitter horizontal | long | → 53 | MA ²⁾ |
| B | Transmitter vertical | long | → 53 | MB |
| C | Transmitter horizontal | short | → 53 | MC |
| D | Transmitter vertical | short | → 53 | MD |

- 1) Product Configurator, order code for "Design; temperature isolator"
- 2) Standard



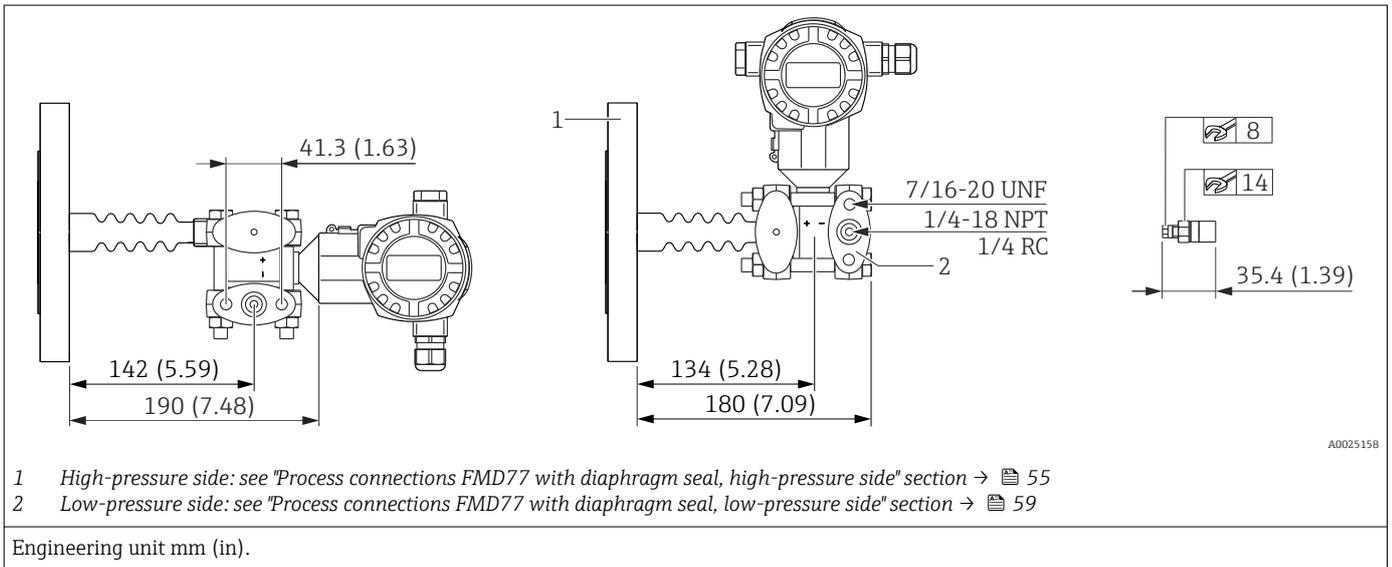
A0025252

| Item | Design | Page | Option ¹⁾ |
|------|---|------|-----------------------------------|
| E | U-bracket, Transmitter horizontal (for devices which require a CRN approval) | → 54 | In combination with CSA approval. |

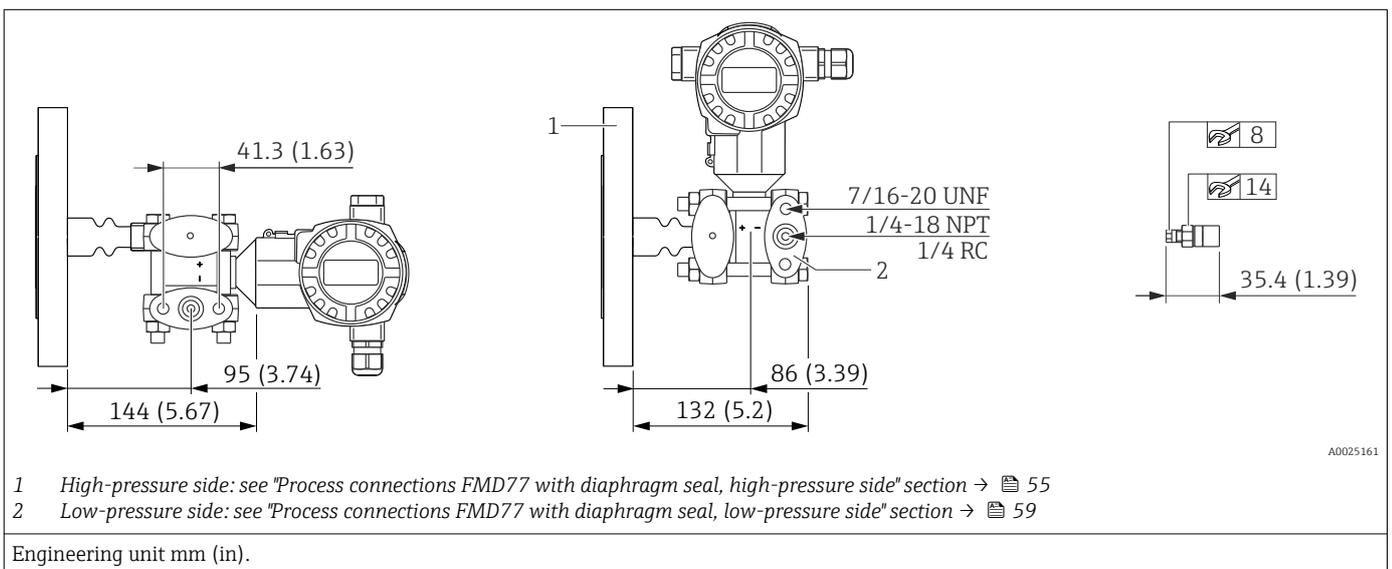
- 1) Product Configurator, order code for "Process connection"

**Process connections FMD77
with diaphragm seal, high-
pressure side**

Device with long temperature isolator

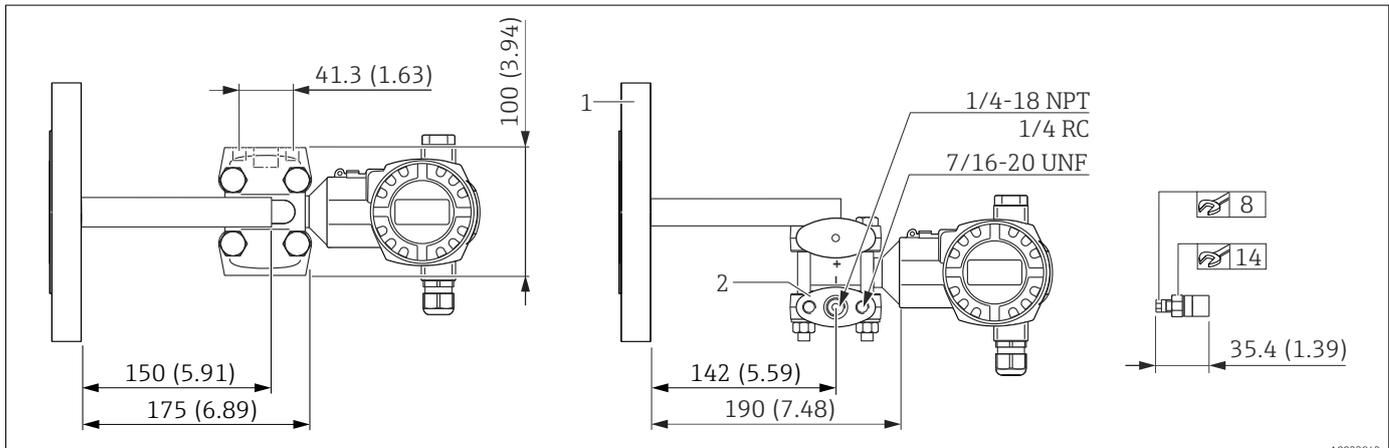


Device with short temperature isolator



**Process connections FMD77
with diaphragm seal, high-
pressure side**

U-bracket with CRN approval



A0023942

- 1 High-pressure side: see "Process connections FMD77 with diaphragm seal, high-pressure side" section → 55
- 2 Low-pressure side: see "Process connections FMD77 with diaphragm seal, low-pressure side" section → 59

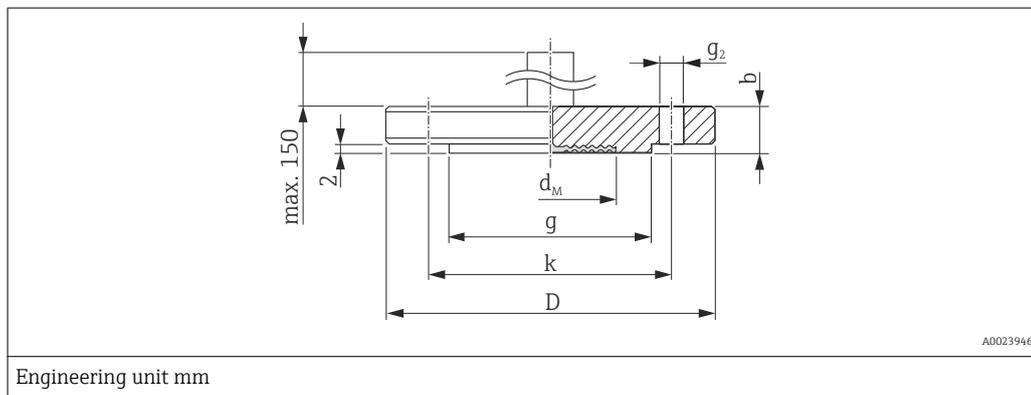
Engineering unit mm (in).

Process connections FMD77 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.
- Note "Planning instructions, diaphragm seal systems" section → 89
- For further information please contact your local Endress+Hauser Sales Center.

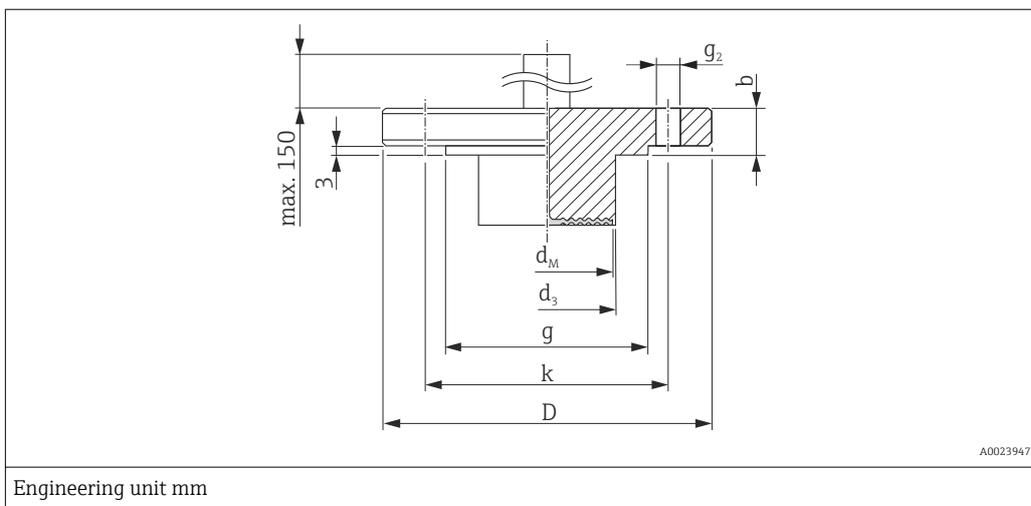
EN/DIN flanges, connection dimensions in accordance with EN 1092-1/DIN 2527



| Flange ^{1) 2) 3)} | | | | | | Boltholes | | | Diaphragm seal | | Option | |
|----------------------------|------------------|---------------------|------|-----------|-------------|-----------|----------------|-------------|---|-------------|--------|----|
| Nominal diameter | Nominal pressure | Shape ⁴⁾ | D | Thickness | Raised face | Number | g ₂ | Hole circle | max. diameter process isolating diaphragm | Weight | | |
| | | | | b | g | | | k | | | | |
| | | | [mm] | [mm] | [mm] | | | [mm] | [mm] | | | |
| DN 50 | PN 10-40 | B1 (D) | 165 | 20 | 102 | 4 | 18 | 125 | 59 | 3.0 (6.62) | A | TA |
| DN 80 | PN 10-40 | B1 (D) | 200 | 24 | 138 | 8 | 18 | 160 | 89 | 5.2 (11.47) | B | TB |
| DN 100 | PN 10-16 | B1 (C) | 220 | 20 | - | 8 | 18 | 180 | 89 | 4.8 (10.58) | F | TC |
| DN 100 | PN 25-40 | B1 (D) | 235 | 24 | 162 | 8 | 22 | 190 | 89 | 6.7 (14.77) | G | TD |

- 1) material: AISI 316L
- 2) The roughness of the surface in contact with the medium including the raised face of the flanges (all standards) made of Alloy C276, Monel, tantalum, rhodium-gold or PTFE is R_a < 0.8 μm (31.5 μin). Reduced surface roughness on request.
- 3) The raised face of the flange is made of the same material as the process isolating diaphragm.
- 4) Description as per DIN 2527 provided in brackets
- 5) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 6) Product Configurator, order code for "Alternative process connection LP side:"

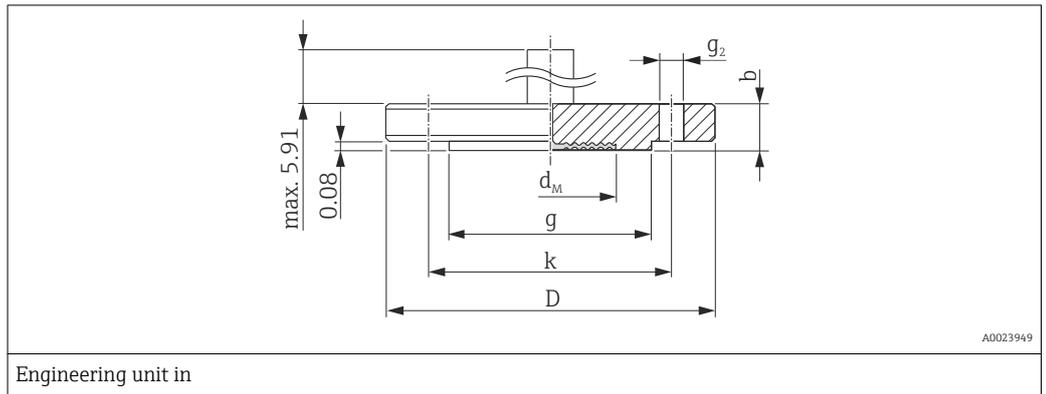
EN/DIN flanges with barrel (extended diaphragm seal), connection dimensions in accordance with EN 1092-1/DIN 2527



| Flange ^{1) 2)} | | | | | | | Boltholes | | | Diaphragm seal | | Option ³⁾ (HP + LP) | |
|-------------------------|------------------|---------------------|------|-----------|-------------|---|---|--------|----------------|----------------|---|-----------------------------------|--------|
| Nominal diameter | Nominal pressure | Shape ⁴⁾ | D | Thickness | Raised face | Barrel (extended diaphragm seal) length | Barrel (extended diaphragm seal) diameter | Number | g ₂ | Hole circle | max. diameter process isolating diaphragm | | Weight |
| | | | | | b | g | L | | | d ₃ | k | | |
| | | | [mm] | [mm] | [mm] | [mm] | [mm] | | | [mm] | [mm] | | |
| DN 80 | PN 10-40 | B1 (D) | 200 | 24 | 138 | 50 | 76 | 8 | 18 | 160 | 72 | 6.2 (13.67) | C |
| | | | | | | 100 | | | | | | 6.7 (14.77) | |
| | | | | | | 200 | | | | | | 7.8 (17.20) | |

- 1) material: AISI 316L
- 2) In the case of process isolating diaphragms made of Alloy C276, Monel oder tantalum, the raised face of the flange and the barrel pipe are made of 316L.
- 3) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 4) Description as per DIN 2527 provided in brackets

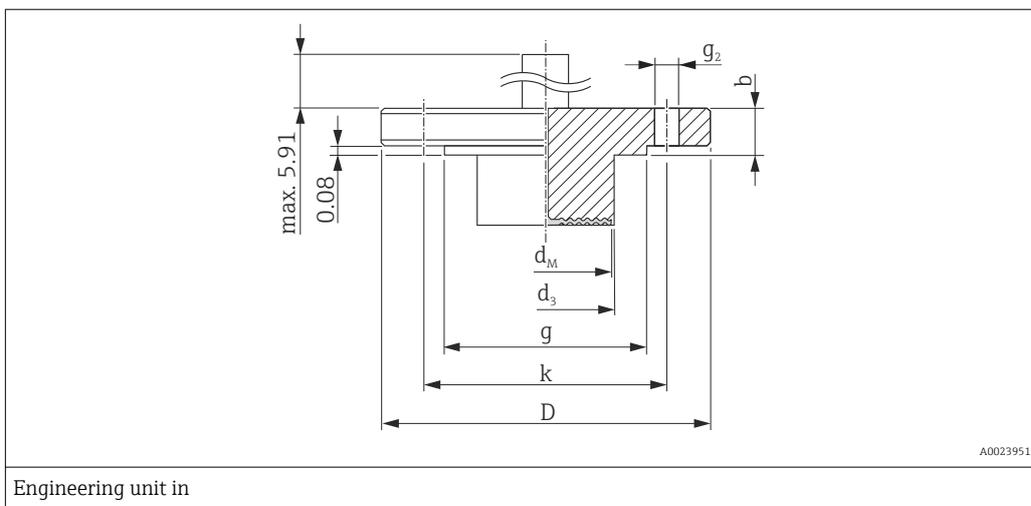
Process connections FMD77 with diaphragm seal ASME flanges, connection dimensions in accordance with B 16.5, raised face RF



| Flange ^{1) 2) 3)} | | | | | Boltholes | | | Diaphragm seal | Weight | Approval ⁴⁾ | Option | |
|----------------------------|-------------|------|-----------|-------------|-----------|----------------|-------------|--|-------------|------------------------|-----------|------------------|
| Nominal diameter | Class | D | Thickness | Raised face | Number | g ₂ | Hole circle | max. diameter of the process isolating diaphragm | | | [kg (lb)] | HP ⁵⁾ |
| [in] | [lb./sq.in] | [in] | b | g | | | [in] | [in] | k | d _M | | |
| 2 | 150 | 6 | 0.75 | 3.62 | 4 | 0.75 | 4.75 | 2.32 | 2.6 (5.73) | CRN | N | TE |
| 2 | 300 | 6.5 | 0.88 | 3.62 | 8 | 0.75 | 5 | 2.32 | 3.4 (7.5) | CRN | O | TF |
| 2 | 400/600 | 6.5 | 1 | 3.62 | 8 | 0.75 | 5 | 2.32 | 4.3 (9.48) | - | J | - |
| 3 | 150 | 7.5 | 0.94 | 5 | 4 | 0.75 | 6 | 3.5 | 5.1 (11.25) | CRN | P | TG |
| 3 | 300 | 8.25 | 1.12 | 5 | 8 | 0.75 | 6 | 3.5 | 7.0 (15.44) | CRN | R | TH |
| 4 | 150 | 9 | 0.94 | 6.19 | 8 | 0.75 | 7.5 | 3.5 | 7.2 (15.88) | CRN | T | TI |
| 4 | 300 | 10 | 1.25 | 6.19 | 8 | 0.88 | 7.88 | 3.5 | 11.7 (25.8) | CRN | W | TJ |

- 1) Material: AISI 316/316L. Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)
- 2) The roughness of the surface in contact with the medium including the raised face of the flanges (all standards) made of Alloy C276, Monel, tantalum, rhodium-gold or PTFE is $R_a < 0.8 \mu\text{m}$ (31.5 μin). Reduced surface roughness on request.
- 3) 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, HP/ HP+LP:"
- 6) Product Configurator, order code for "Alternative process connection LP side:"

ASME flanges with barrel (extended diaphragm seal), connection dimensions in accordance with ASME B 16.5, raised face RF

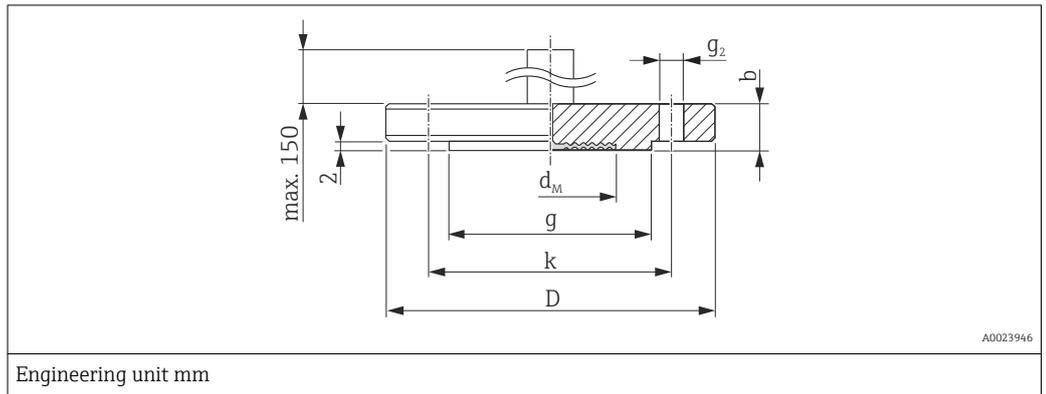


| Flange ^{1) 2)} | | | | | | | Boltholes | | | Diaphragm seal | Weight | Option ³⁾ (HP + LP) |
|-------------------------|-------------|------|-----------|-------------|---|---|-----------|----------------|-------------|---|----------------|-----------------------------------|
| Nominal diameter | Class | D | Thickness | Raised face | Barrel (extended diaphragm seal) length | Barrel (extended diaphragm seal) diameter | Number | g ₂ | Hole circle | max. diameter process isolating diaphragm | | |
| [in] | [lb./sq.in] | [in] | [in] | [in] | [in] | [in] | | [in] | [in] | [in] | d _M | [kg (lb)] |
| 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) | |

- 1) material: AISI 316/316L
- 2) In the case of process isolating diaphragms made of Alloy C276, Monel oder tantalum, the raised face of the flange and the barrel pipe are made of 316L.
- 3) Product Configurator, order code for "Process connection, HP/ HP+LP:"

Process connections FMD77 with diaphragm seal

JIS flanges, connection dimensions in accordance with JIS B 2220 BL, raised face RF



| Flange ^{1) 2) 3)} | | | | | Boltholes | | | Diaphragm seal | Weight | Option | |
|----------------------------|------------------|------|-----------|-------------|-----------|----------------|-------------|----------------|-------------|-----------|------------------|
| Nominal diameter | Nominal pressure | D | Thickness | Raised face | Number | g ₂ | Hole circle | d _M | | [kg (lb)] | HP ⁴⁾ |
| | | [mm] | b | g | | | k | | | | |
| | | [mm] | [mm] | [mm] | | [mm] | [mm] | [mm] | | | |
| 50 A | 10 K | 155 | 16 | 96 | 4 | 19 | 120 | 59 | 2.3 (5.07) | X | TK |
| 80 A | 10 K | 185 | 18 | 126 | 8 | 19 | 150 | 89 | 3.5 (7.72) | 1 | TL |
| 100 A | 10 K | 210 | 18 | 151 | 8 | 19 | 175 | 89 | 4.7 (10.36) | 4 | TM |

- 1) material: AISI 316
- 2) The roughness of the surface in contact with the medium including the raised face of the flanges (all standards) made of Alloy C276, Monel, tantalum, rhodium-gold or PTFE is $R_a < 0.8 \mu\text{m}$ (31.5 μin). Reduced surface roughness on request.
- 3) The raised face of the flange is made of the same material as the process isolating diaphragm.
- 4) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 5) Product Configurator, order code for "Alternative process connection LP side:"

Process connections FMD77 with diaphragm seal, low-pressure side

| Process connection low-pressure side | Material | Seal | 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 | B |
| 1/4 – 18 NPT IEC 61518, | AISI 316L | FKM Viton | D |
| 1/4 – 18 NPT IEC 61518 | Alloy C276 | FKM Viton | F |
| 1/4 – 18 NPT IEC 61518 | AISI 316L | PTFE+C4-ring | H |
| 1/4 – 18 NPT IEC 61518 | Alloy C276 | PTFE+C4-ring | J |
| 1/4 – 18 NPT IEC 61518 | AISI 316L | EPDM | K |
| 1/4 – 18 NPT IEC 61518 | Alloy C276 | EPDM | L |
| 1/4 – 18 NPT IEC 61518 | AISI 316L | Kalrez | M |
| 1/4 – 18 NPT IEC 61518 | Alloy C276 | Kalrez | N |
| 1/4 – 18 NPT IEC 61518 | AISI 316L | Chemraz | P |
| 1/4 – 18 NPT IEC 61518 | Alloy C276 | Chemraz | Q |
| 1/4 – 18 NPT IEC 61518 | AISI 316L | FKM Viton, cleaned from oil and grease | S |
| 1/4 – 18 NPT IEC 61518 | AISI 316L | FKM Viton, cleaned for oxygen service | T |
| RC 1/4 | AISI 316L | FKM Viton | U |
| LP diaphragm seal and capillary | AISI 316L | welded | 1 |

- 1) Product Configurator, order code for "Process connection, LP side; seal:"

FMD78: Selecting the process connection and capillary line

The device can be fitted with different process connections on the high-pressure side (HP) and on the low-pressure side (LP).

The FMD78 can also be fitted with different capillary lengths on the high-pressure side (HP) and on the low-pressure side (LP).

When using diaphragm seal systems with a capillary, sufficient strain relief must be provided to prevent the capillary from bending (capillary bending radius ≥ 100 mm (3.94 in)).

Example:

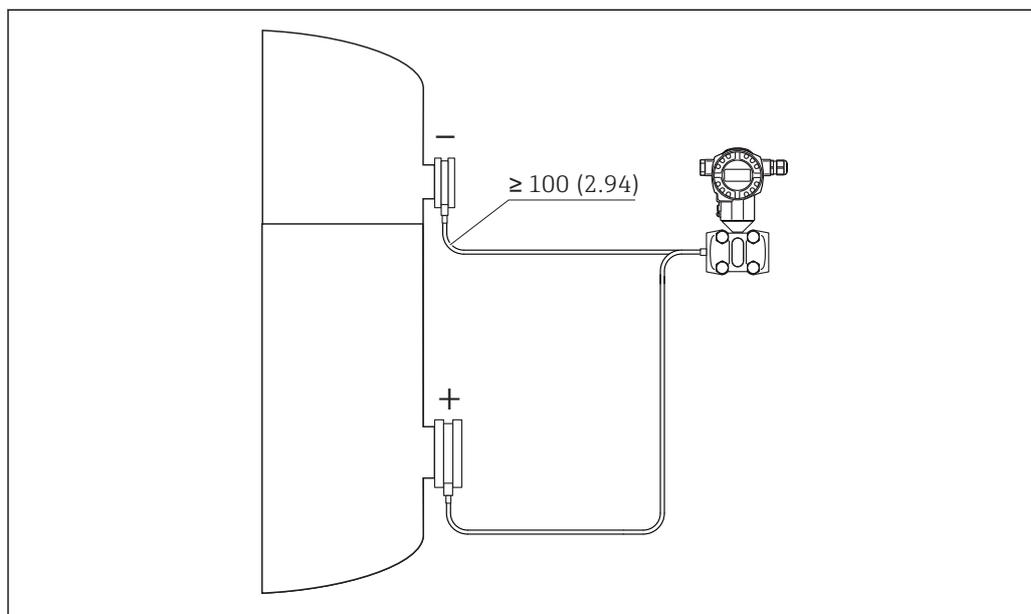
- Process connection on high-pressure side = DN80 flange
- Process connection on low-pressure side = DN50 flange
- Capillary length on high-pressure side = 2 m (6.6 ft)
- Capillary length on low-pressure side = 5 m (16 ft)

Your benefits:

- Thanks to the variety of order options, the devices can be optimally adapted to the given installation situation
- Reduced costs due to optimum system design
- Easier installation due to adjusted length of capillary on low-pressure side and high-pressure side
- Easier adaptation to existing installation situations

Ordering information:

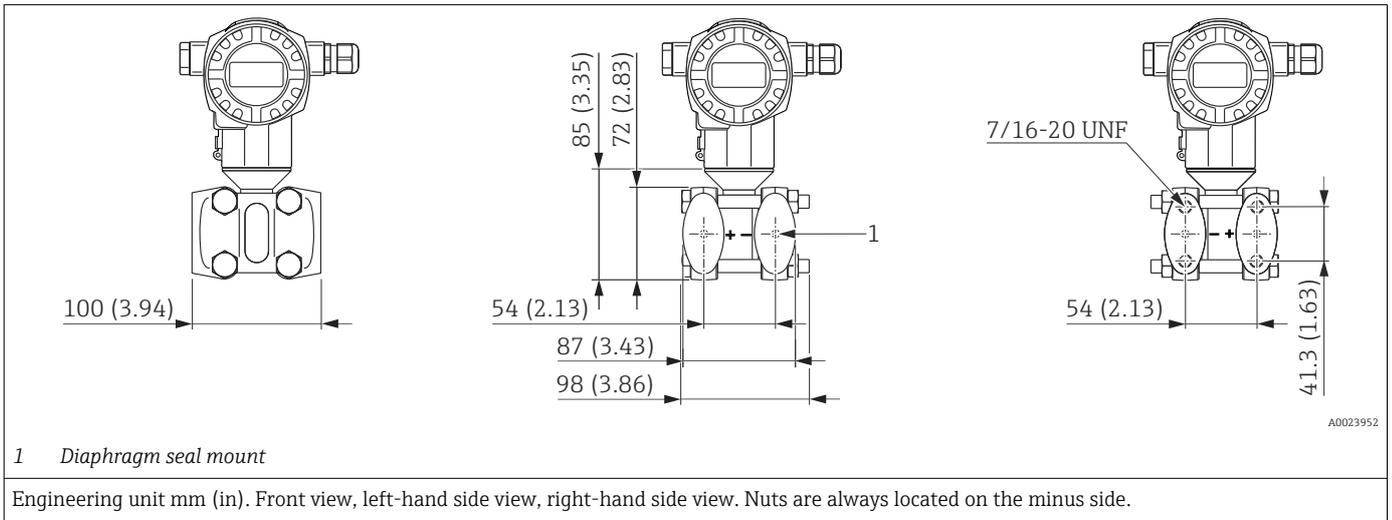
- Process connections are indicated in the relevant section by HP (high-pressure side) and LP (low-pressure side)
- Order details for capillary lengths



A0027891

 Due to the use of different process connections and capillary lines, it is essential that the device be designed/ordered using the "Applicator Sizing Diaphragm Seal" selection tool, which is available free of charge. Additional information can be found in the "Planning instructions, diaphragm seal systems" section →  89

FMD78 basic device

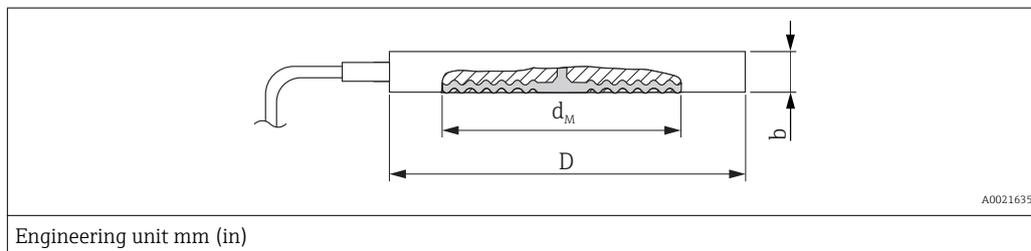


Process connections FMD78 with diaphragm seal



- 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.
- Note "Planning instructions, diaphragm seal systems" section → 89
- For further information please contact your local Endress+Hauser Sales Center.

Diaphragm seal cell structure

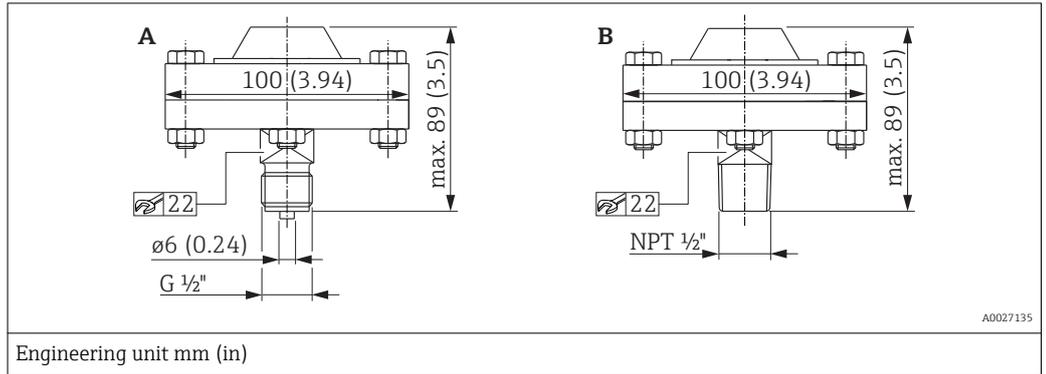


| Flange | | | | Diaphragm seal | | Approval ¹⁾ | Option | | |
|-----------|------------------|--------------------------------|------------|----------------|--|------------------------|---|------------------|------------------|
| Material | Nominal diameter | Nominal pressure ²⁾ | D | Thickness b |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

- 1) CSA approval: Product Configurator, order code for "Approval"
- 2) 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 → 43.
- 3) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 4) Product Configurator, order code for "Alternative process connection LP side:"

Process connections FMD78 with diaphragm seal

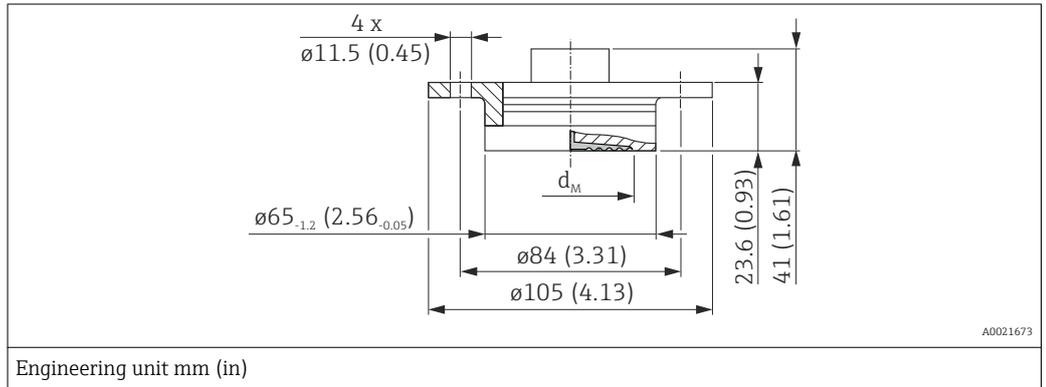
Threaded separators



| Position | Description | Material | Measuring range | Nominal pressure | Weight | Option ¹⁾ |
|----------|---|---------------------------------|-----------------|------------------|-------------|----------------------|
| | | | [bar (psi)] | | [kg (lb)] | |
| A | Threaded, ISO 228 G 1/2 A EN837 with PTFE seal -40 to +260 °C (-40 to +500 °F) | AISI 316L, screws made of A4 | ≤ 40 (580) | PN 40 | 1.43 (3.15) | GA |
| B | Threaded, ANSI 1/2 MNPT with PTFE seal -40 to +260 °C (-40 to +500 °F) | | | | | RL |

1) Product Configurator, order code for "Process connection, HP/ HP+LP:"

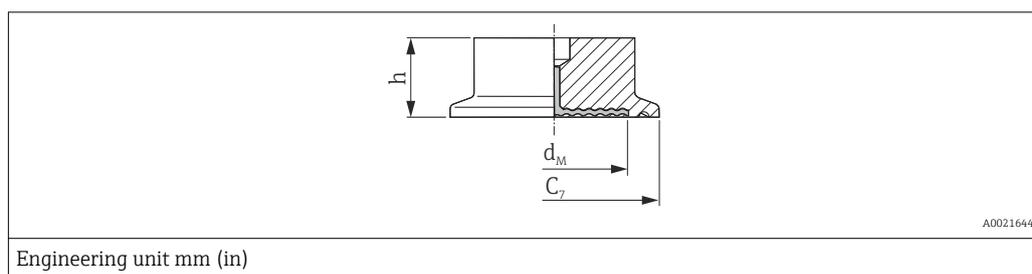
DRD DN50 (65 mm)



| Material ¹⁾ | Nominal pressure | Max. diameter of the process isolating diaphragm | | Weight | Option | |
|------------------------|------------------|--|---------------------|-------------|------------------|------------------|
| | | Standard | with TempC membrane | | HP ²⁾ | LP ³⁾ |
| | | d _M | d _M | | | |
| | | [mm] | [mm] | | | |
| AISI 316L | PN 25 | 50 | 48 | 0.75 (1.65) | TK ⁴⁾ | UH ⁴⁾ |

- 1) Surface roughness of the wetted surfaces $R_a < 0.76 \mu\text{m}$ (29.9 μin) as standard.
- 2) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 3) Product Configurator, order code for "Alternative process connection LP side:"
- 4) Alternatively available with TempC membrane.

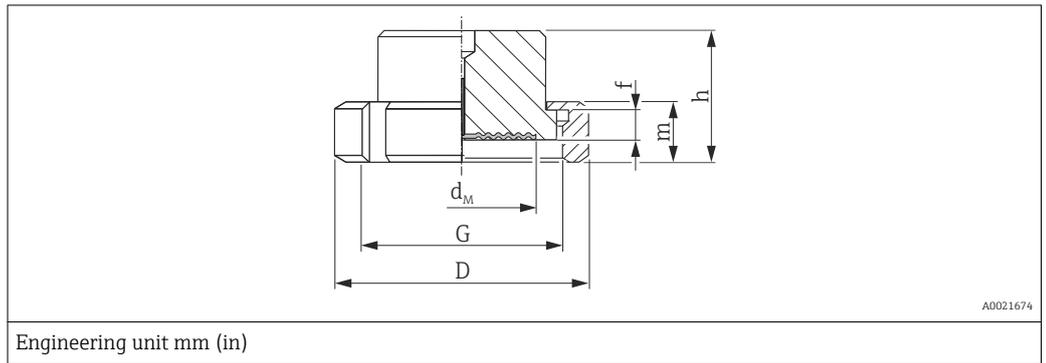
Tri-Clamp ISO 2852



| Material ¹⁾ | Nominal diameter ISO 2852 | Nominal diameter DIN 32676 | Nominal diameter | Diameter | Max. diameter of the process isolating diaphragm | | Altitude | Weight | Approval ²⁾ | Option | |
|------------------------|---------------------------|----------------------------|------------------|----------------|--|---------------------|----------|-------------|------------------------|---------------------|---------------------|
| | | | | | Standard | with TempC membrane | | | | HP ³⁾ | LP ⁴⁾ |
| | | | | C ₇ | d _M | d _M | h | | | | |
| | | | | [in] | [mm] | [mm] | [mm] | [mm] | | [kg (lb)] | |
| AISI 316L | ND 25 / 33.7 | DN 25 | 1 | 50.5 | 24 | - | 37 | 0.32 (0.71) | EHEDG, 3A | TB | UA |
| | ND 38 | DN 40 | 1 ½ | 50.5 | 36 | 36 | 30 | 1 (2.21) | EHEDG, 3A | TC ^{5) 6)} | UB ^{5) 6)} |
| | ND 51 / 40 | DN 50 | 2 | 64 | 48 | 41 | 30 | 1.1 (2.43) | EHEDG, 3A | TD ^{5) 6)} | UC ^{5) 6)} |
| | ND 63.5 | DN 50 | 2 ½ | 77.5 | 61 | 61 | 30 | 0.7 (1.54) | EHEDG, 3A | TE ⁷⁾ | UD ⁷⁾ |
| | ND 76.1 | - | 3 | 91 | 73 | 61 | 30 | 1.2 (2.65) | EHEDG, 3A | TF ⁶⁾ | UE ⁶⁾ |

- 1) Surface roughness of the wetted surfaces $R_a < 0.76 \mu\text{m}$ ($29.9 \mu\text{in}$) as standard. Lower surface roughness on request.
- 2) CSA approval: Product Configurator, order code for "Approval"
- 3) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 4) Product Configurator, order code for "Alternative process connection LP side:"
- 5) Optionally available as ASME-BPE-compliant diaphragm seal version for use in biochemical processes, surfaces in contact with medium $R_a < 0.38 \mu\text{m}$ ($15 \mu\text{in}$), electropolished; order using the order code for "Additional options 1" or "Additional options 2", option "O".
- 6) Alternatively available with TempC membrane.
- 7) With TempC membrane

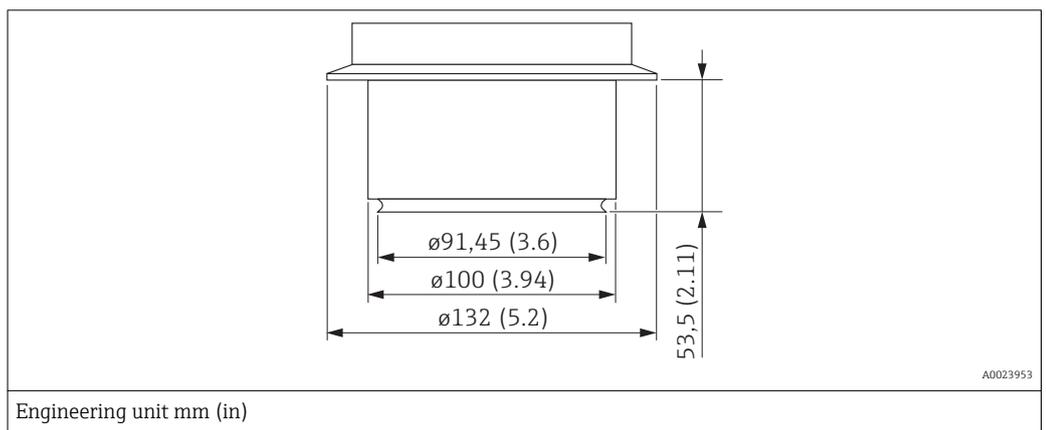
Process connections FMD78 with diaphragm seal **SMS nozzles with coupling nut**



| Material ¹⁾ | Nominal diameter | Nominal pressure | D | Nozzle height | Thread | Altitude | Altitude | max. diameter of the process isolating diaphragm | Weight | Approval | Option | | | | | | |
|------------------------|------------------|------------------|----|---------------|-------------|----------|----------|--|-------------|-----------|------------------|------------------|------|------|----------------|------------------|------------------|
| | | | | | | | | | | | f | G | m | h | d _M | HP ²⁾ | LP ³⁾ |
| | | | | | | | | | | | [mm] | [mm] | [mm] | [mm] | [mm] | | |
| AISI 316L | 1 ½ | PN 25 | 74 | 4 | Rd 60 – 1/6 | 25 | 57 | 36 | 0.65 (1.43) | 3A, EHEDG | TH ⁴⁾ | UF ⁴⁾ | | | | | |
| | 2 | PN 25 | 84 | 4 | Rd 70 – 1/6 | 26 | 62 | 48 | 1.05 (2.32) | 3A, EHEDG | TI ⁴⁾ | UG ⁴⁾ | | | | | |

- 1) Surface roughness of the wetted surfaces $R_a < 0.76 \mu\text{m}$ (29.9 μin) as standard.
- 2) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 3) Product Configurator, order code for "Alternative process connection LP side:"
- 4) With TempC membrane

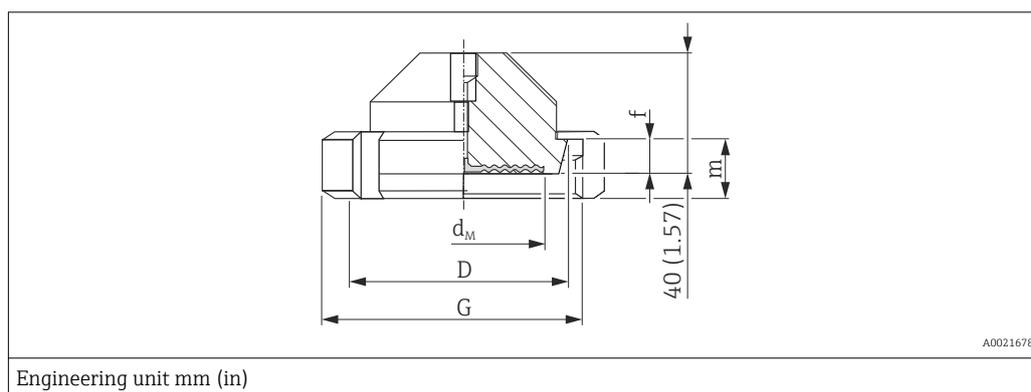
Hygienic connection, sanitary tank spud, barrel (extended diaphragm seal) 2"



| Material ¹⁾ | Weight kg (lbs) | Approval | Option ²⁾ |
|------------------------|-----------------|----------|----------------------|
| AISI 316L | 2.5 (5.51) | 3A | WH |

- 1) Roughness of wetted surfaces $R_a < 0.76 \mu\text{m}$ (29.9 μin) as standard. Lower surface roughness on request.
- 2) Product Configurator, order code for "Process connection, HP/ HP+LP:"

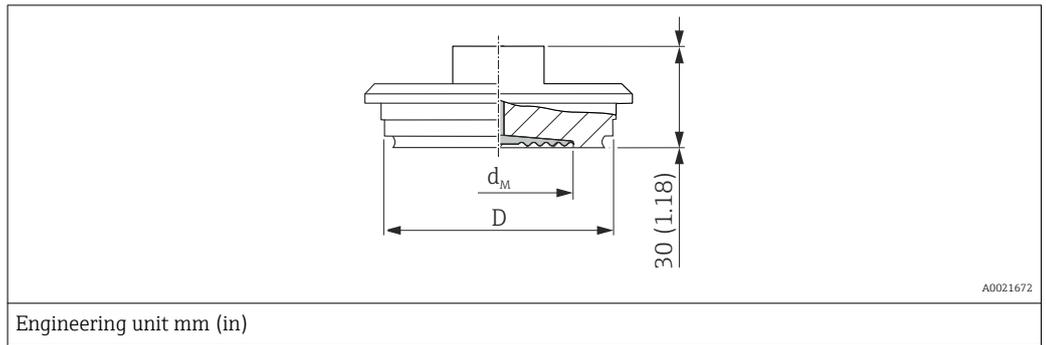
Taper adapter with coupling nut, DIN 11851



| Material 1) | Taper adapter | | | | Slotted nut | | Diaphragm seal | | | Approval | Option | |
|----------------|------------------|------------------|------|---------------|---------------|----------|--|---------------------|-------------|------------------|------------------|------------------|
| | | | | | | | Max. diameter of the process isolating diaphragm | | Weight | | | |
| | Nominal diameter | Nominal pressure | D | Nozzle height | Thread | Altitude | Standard | with TempC membrane | | | | |
| | | | | | | | | PN | f | | G | m |
| [bar] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [kg (lb)] | HP ²⁾ | LP ³⁾ | |
| AISI 316L | DN 32 | PN 40 | 50 | 10 | Rd 58 x 1/6" | 21 | 32 | 28 | 0.45 (0.99) | 3A, EHEDG | MI ⁴⁾ | TP ⁴⁾ |
| | DN 40 | PN 40 | 56 | 10 | Rd 65 x 1/6" | 21 | 38 | 36 | 0.45 (0.99) | 3A, EHEDG | MZ ⁴⁾ | TU ⁴⁾ |
| | DN 50 | PN 25 | 68.5 | 11 | Rd 78 x 1/6" | 19 | 52 | 48 | 1.1 (2.43) | 3A, EHEDG | MR ⁵⁾ | TR ⁵⁾ |
| | DN 65 | PN 25 | 86 | 12 | Rd 95 x 1/6" | 21 | 66 | 61 | 2.0 (4.41) | 3A, EHEDG | MS ⁵⁾ | TS ⁵⁾ |
| | DN 80 | PN 25 | 100 | 12 | Rd 110 x 1/4" | 26 | 81 | 61 | 2.55 (5.62) | 3A, EHEDG | MT ⁵⁾ | TT ⁵⁾ |

- 1) Surface roughness of the wetted surfaces $R_a < 0.76 \mu\text{m}$ (29.9 μin) as standard.
- 2) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 3) Product Configurator, order code for "Alternative process connection LP side:"
- 4) with TempC membrane
- 5) Alternatively available with TempC membrane.

Process connections FMD78 with diaphragm seal **Varivent for pipes**



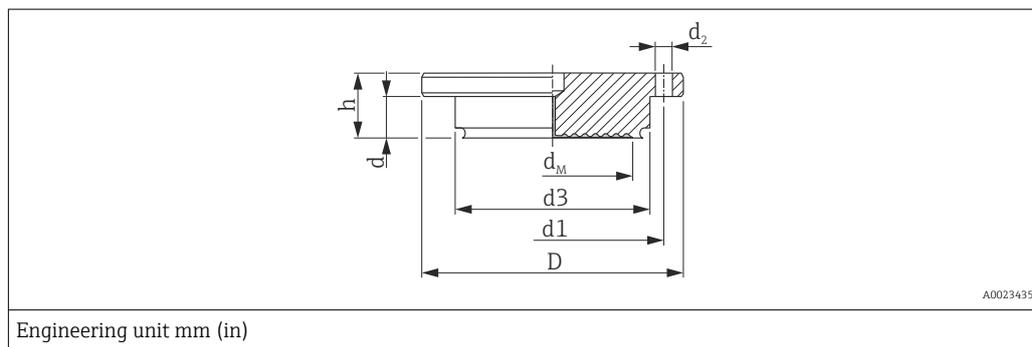
| Material ¹⁾ | Description | Nominal pressure | D | Max. diameter of the process isolating diaphragm | | Weight | Approval | Option | |
|------------------------|---------------------------------|------------------|----|--|---------------------|------------|-----------|------------------|------------------|
| | | | | Standard | with TempC membrane | | | HP ²⁾ | LP ³⁾ |
| | | | | d _M | d _M | | | | |
| | | | | [mm] | [mm] | | | [mm] | [kg (lb)] |
| AISI 316L | Type F for pipes DN 25 - DN 32 | PN 40 | 50 | 34 | 36 | 0.4 (0.88) | EHEDG, 3A | TU ⁴⁾ | UK ⁴⁾ |
| AISI 316L | Type N for pipes DN 40 - DN 162 | PN 40 | 68 | 58 | 61 | 0.8 (1.76) | EHEDG, 3A | TR ⁵⁾ | - |

- 1) Surface roughness of the wetted surfaces $R_a < 0.76 \mu\text{m}$ (29.9 μin) as standard.
- 2) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 3) Product Configurator, order code for "Alternative process connection LP side."
- 4) With TempC membrane
- 5) Alternatively available with TempC membrane.

**Process connections FMD78
with diaphragm seal**

NEUMO BioControl

Process temperature range: -10 to +200 °C (+14 to +392 °F)



| Material ¹⁾ | NEUMO BioControl | | | | | | | Diaphragm seal | | | Approval | Option | |
|------------------------|--------------------------|------------------|----------|----------------|----------------|----------------|--------|--|---------------------|---------------|----------|------------------|----|
| | | | | | | | | Max. diameter of the process isolating diaphragm | | Weight | | | |
| | Nominal of the diaphragm | Nominal pressure | Diameter | | | Hole circle | Height | Standard | with TempC membrane | | | | |
| | | PN | D | d ₂ | d ₃ | d ₁ | h | d _M | d _M | [kg (lb)] | | | |
| AISI 316L | DN 50 | PN 16 | 90 | 4 x Ø 9 | 50 | 70 | 27 | 40 | 36 | 1.1 (2.43) | 3A | S4 ⁴⁾ | TV |
| | DN 80 | PN 16 | 140 | 4 x Ø 11 | 87.4 | 115 | 37 | 61 | 61 | 2.6 (5.73) | 3A | S6 | TW |

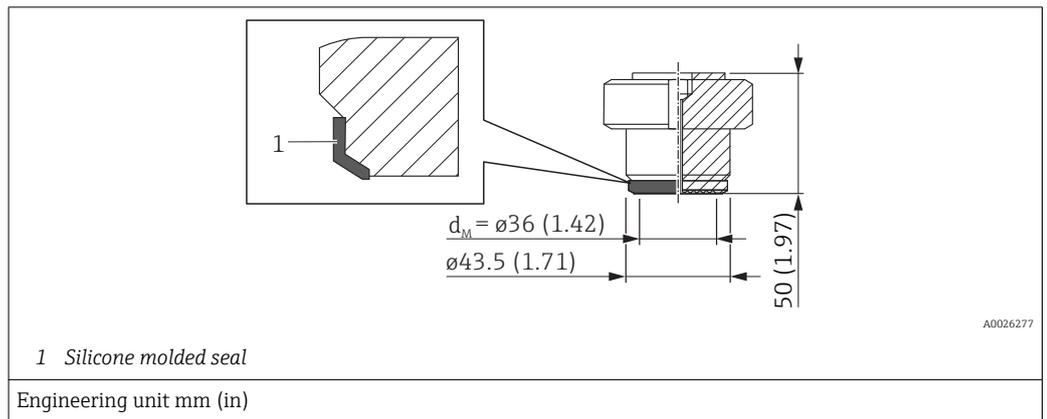
1) Surface roughness of the wetted surfaces $R_a < 0.76 \mu\text{m}$ (29.9 μin) as standard.

2) Product Configurator, order code for "Process connection, HP/ HP+LP:"

3) Product Configurator, order code for "Alternative process connection LP side:"

4) With TempC membrane

Universal process adapter

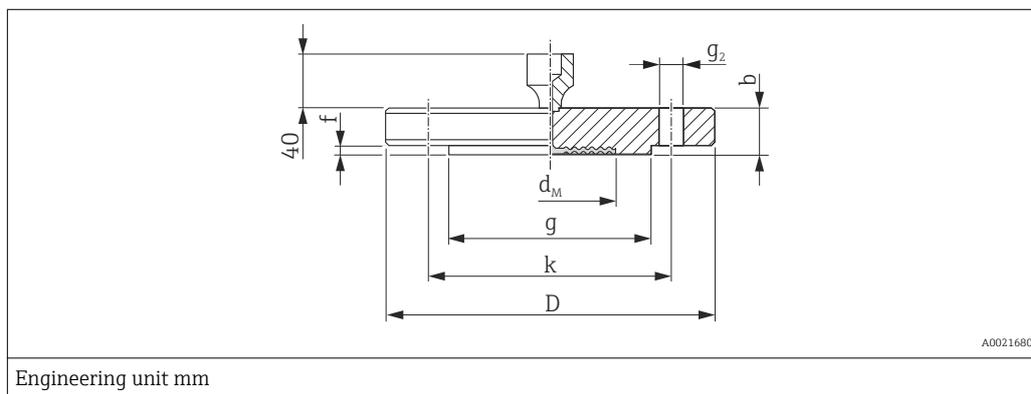


| Description | Nominal pressure | Material ¹⁾ | Weight | Approval | Option | |
|---|------------------|------------------------|------------|-----------|---------------------|------------------|
| | | | [kg (lb)] | | HP ²⁾ | LP ³⁾ |
| Universal process adapter incl. silicone molded seal (spare parts no.: 52023572) FDA 21CFR177.2600/USP Class VI | PN 10 | AISI 316L (1.4435) | 0.8 (1.76) | 3A, EHEDG | 00 ^{4) 5)} | UT |

- 1) Surface roughness of the wetted surfaces $R_a < 0.76 \mu\text{m}$ (29.9 μin) as standard.
- 2) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 3) Product Configurator, order code for "Alternative process connection LP side."
- 4) 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).
- 5) With TempC membrane.

Process connections FMD78
with diaphragm seal

EN/DIN flanges, connection dimensions in accordance with EN 1092-1/DIN 2527,
JIS flanges, connection dimensions in accordance with JIS B 2220 BL



| Flange ^{1) 2) 3)} | | | | | | | Boltholes | | | Diaphragm seal | | Option | | |
|----------------------------|------------------|---------------------|------|-----------|------|-------------|-----------|--------|----------------|----------------|---|--------|------------------|------------------|
| Nominal diameter | Nominal pressure | Shape ⁴⁾ | D | Thickness | | Raised face | | Number | g ₂ | Hole circle | max. diameter process isolating diaphragm | Weight | HP ⁵⁾ | LP ⁶⁾ |
| | | | | b | g | f | k | | | | | | | |
| | | | [mm] | [mm] | [mm] | [mm] | [mm] | | | [mm] | | | | |
| DN 50 | PN 10-40 | B1 (D) | 165 | 20 | 102 | 3 | 4 | 18 | 125 | 59 | 3.0 (6.62) | B3 | TA | |
| DN 80 | PN 10-40 | B1 (D) | 200 | 24 | 138 | 3.5 | 8 | 18 | 160 | 89 | 5.3 (11.69) | B5 | TB | |
| DN 100 | PN 10-16 | B1 (C) | 220 | 20 | - | 4 | 8 | 18 | 180 | 89 | 4.5 (9.92) | BT | TC | |
| DN 100 | PN 25-40 | B1 (D) | 235 | 24 | 162 | 5 | 8 | 22 | 190 | 89 | 7 (15.44) | B6 | TD | |

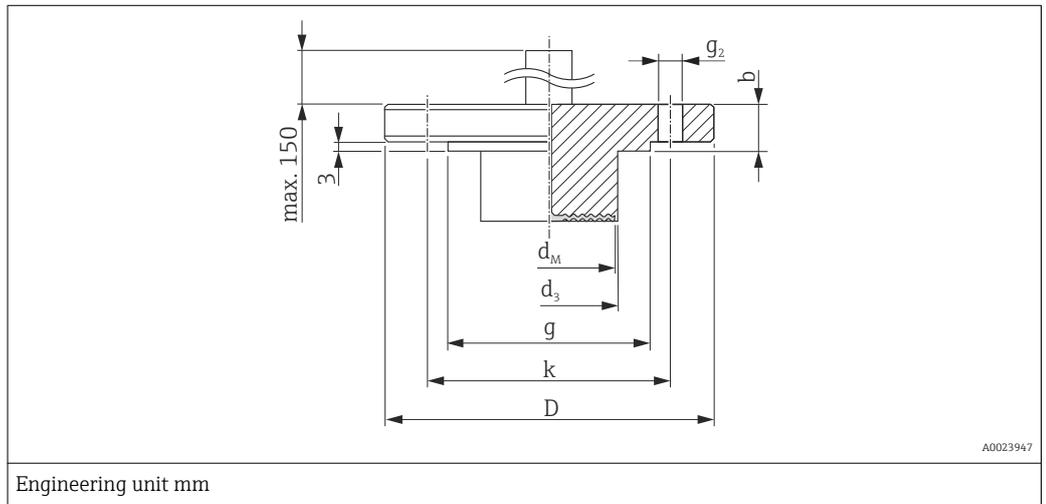
- 1) material: AISI 316L
- 2) The roughness of the surface in contact with the medium including the raised face of the flanges (all standards) made of Alloy C276, Monel, tantalum, rhodium-gold or PTFE is $R_a < 0.8 \mu\text{m}$ ($31.5 \mu\text{in}$). Reduced surface roughness on request.
- 3) The raised face of the flange is made of the same material as the process isolating diaphragm.
- 4) Description as per DIN 2527 provided in brackets
- 5) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 6) Product Configurator, order code for "Alternative process connection LP side:"

| Flange ^{1) 2) 3)} | | | | | | Boltholes | | | Diaphragm seal | | Option | | |
|----------------------------|------------------|------|-----------|------|-------------|-----------|--------|----------------|----------------|---|--------|------------------|------------------|
| Nominal diameter | Nominal pressure | D | Thickness | | Raised face | | Number | g ₂ | Hole circle | max. diameter process isolating diaphragm | Weight | HP ⁴⁾ | LP ⁵⁾ |
| | | | b | g | f | k | | | | | | | |
| | | [mm] | [mm] | [mm] | [mm] | [mm] | | | [mm] | | | | |
| 50 A | 10 K | 155 | 16 | 96 | 2 | 4 | 19 | 120 | 59 | 2.3 (5.07) | CF | TK | |
| 80 A | 10 K | 185 | 18 | 127 | 2 | 8 | 19 | 150 | 89 | 3.3 (7.28) | KL | TL | |
| 100 A | 10 K | 210 | 18 | 151 | 2 | 8 | 19 | 175 | 89 | 4.4 (9.7) | KH | TM | |

- 1) material: AISI 316L
- 2) The roughness of the surface in contact with the medium including the raised face of the flanges (all standards) made of Alloy C276, Monel, tantalum, rhodium-gold or PTFE is $R_a < 0.8 \mu\text{m}$ ($31.5 \mu\text{in}$). Reduced surface roughness on request.
- 3) The raised face of the flange is made of the same material as the process isolating diaphragm.
- 4) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 5) Product Configurator, order code for "Alternative process connection LP side:"

Process connections FMD78 with diaphragm seal

EN/DIN flanges with barrel (extended diaphragm seal), connection dimensions in accordance with EN 1092-1/DIN 2527 and DIN 2501-1

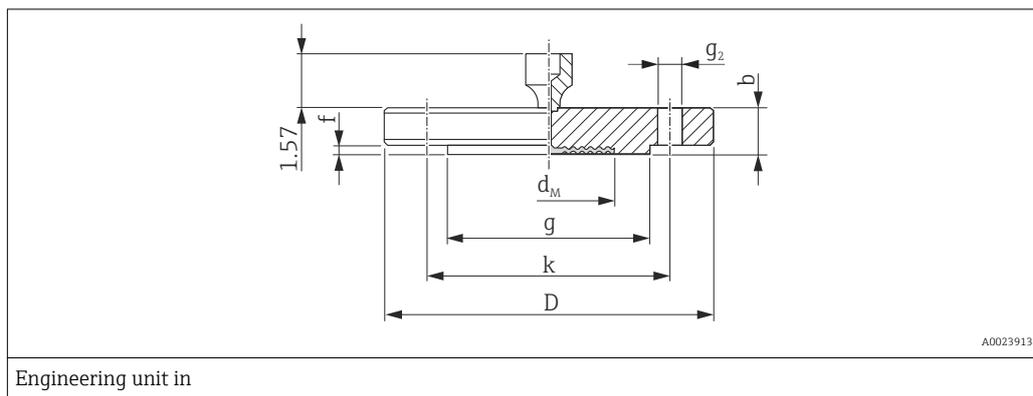


Engineering unit mm

| Flange ^{1) 2)} | | | | | | | Boltholes | | | Diaphragm seal | | Option ³⁾ (HP + LP) | | |
|-------------------------|------------------|---------------------|------|-----------|-------------|---|---|--------|----------------|----------------|---|-----------------------------------|--------|-------------|
| Nominal diameter | Nominal pressure | Shape ⁴⁾ | D | Thickness | Raised face | Barrel (extended diaphragm seal) length | Barrel (extended diaphragm seal) diameter | Number | g ₂ | Hole circle | max. diameter process isolating diaphragm | | Weight | |
| | | | | | b | g | L | | | d ₃ | | | | k |
| | | | [mm] | [mm] | [mm] | [mm] | [mm] | | | [mm] | | | | [mm] |
| DN 80 | PN 10-40 | B1 (D) | 200 | 24 | 138 | 50 | 76 | 8 | 18 | 160 | 72 | 6.2 (13.67) | D4 | |
| | | | | | | 100 | | | | | | | | 6.7 (14.77) |
| | | | | | | 200 | | | | | | | | 7.8 (17.20) |

- 1) material: AISI 316L
- 2) In the case of process isolating diaphragms made of Alloy C276, Monel oder tantalum, the raised face of the flange and the barrel pipe are made of 316L.
- 3) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 4) Description as per DIN 2527 provided in brackets

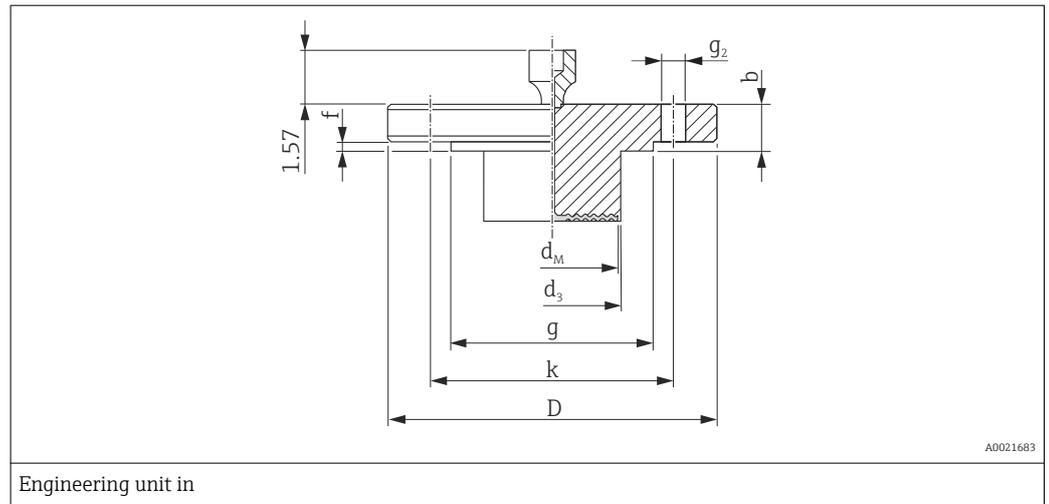
Process connections FMD78 with diaphragm seal ASME flanges, in accordance with connection dimensions ASME B 16.5, raised face RF



| Flange ^{1) 2) 3)} | | | | | | Boltholes | | | Diaphragm seal | | Approval ⁴⁾ | Option | |
|----------------------------|-------------|------|-----------|-------------|------|-----------|----------------|-------------|--|-------------|------------------------|------------------|------------------|
| Nominal diameter | Class | D | Thickness | Raised face | | Number | g ₂ | Hole circle | max. diameter of the process isolating diaphragm | Weight | | HP ⁵⁾ | LP ⁶⁾ |
| | | | | b | g | | | | | | | | |
| [in] | [lb./sq.in] | [in] | [in] | [in] | [in] | | [in] | [in] | [in] | [kg (lb)] | | | |
| 2 | 150 | 6 | 0.75 | 3.62 | 0.06 | 4 | 0.75 | 4.75 | 2.32 | 2.2 (4.85) | CRN | AF | TE |
| 2 | 300 | 6.5 | 0.88 | 3.62 | 0.06 | 8 | 0.75 | 5 | 2.32 | 3.4 (7.5) | CRN | AR | TF |
| 2 | 400/600 | 6.5 | 1 | 3.62 | 0.25 | 8 | 0.75 | 5 | 2.32 | 4.3 (9.48) | - | AJ | - |
| 3 | 150 | 7.5 | 0.94 | 5 | 0.06 | 4 | 0.75 | 6 | 3.5 | 5.1 (11.25) | CRN | AG | TG |
| 3 | 300 | 8.25 | 1.12 | 5 | 0.06 | 8 | 0.75 | 6 | 3.5 | 7.0 (15.44) | CRN | AS | TH |
| 4 | 150 | 9 | 0.94 | 6.19 | 0.06 | 8 | 0.75 | 7.5 | 3.5 | 7.2 (15.88) | CRN | AH | TI |
| 4 | 300 | 10 | 1.25 | 6.19 | 0.06 | 8 | 0.88 | 7.88 | 3.5 | 11.7 (25.8) | CRN | AT | TJ |

- 1) material AISI 316/316L: Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)
- 2) The roughness of the surface in contact with the medium including the raised face of the flanges (all standards) made of Alloy C276, Monel, tantalum, rhodium-gold or PTFE is $R_a < 0.8 \mu\text{m}$ ($31.5 \mu\text{in}$). Lower surface roughness on request.
- 3) The flange raised face 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, HP/ HP+LP:"
- 6) Product Configurator, order code for "Alternative process connection LP side:"

ASME flanges with barrel (extended diaphragm seal), connection dimensions in accordance with ASME B 16.5, raised face RF



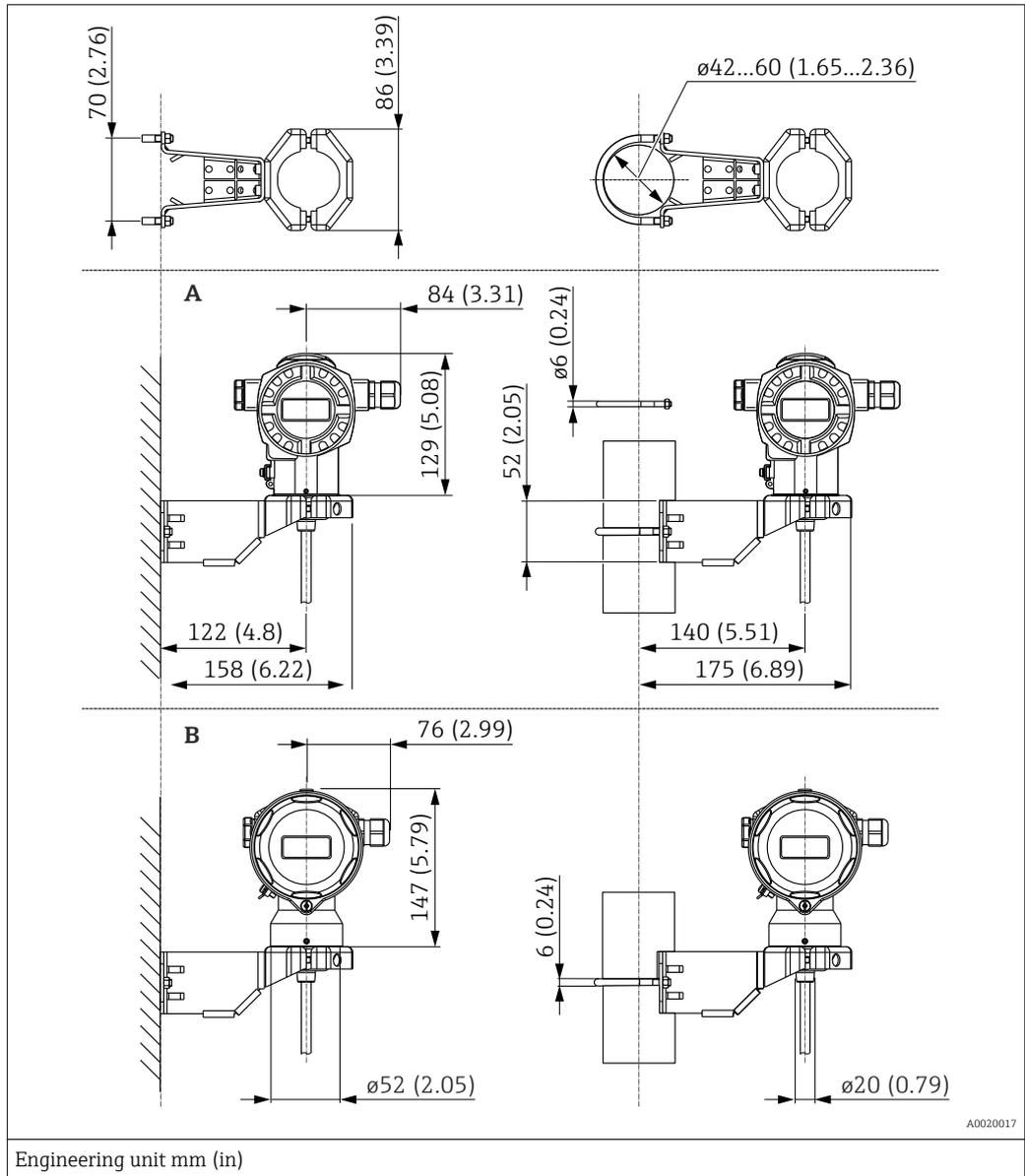
| Flange ^{1) 2)} | | | | | | Boltholes | | | Diaphragm seal | | Approval ³⁾ | Option ⁴⁾ (HP + LP) |
|-------------------------|-------------|------|-----------|------|------|-----------|----------------|-------------|--|---------------|------------------------|-----------------------------------|
| Nominal diameter | Class | D | Thickness | | | Number | g ₂ | Hole circle | max. diameter of the process isolating diaphragm | Weight | | |
| | | | b | g | f | | | | | | | |
| [in] | [lb./sq.in] | [in] | [in] | [in] | [in] | | [in] | [in] | [in] | [kg (lb)] | | |
| 3 | 150 | 7.5 | 0.94 | 5 | 0.06 | 4 | 0.75 | 6 | 2.83 | ⁵⁾ | CRN | J4 ⁵⁾ |
| 4 | 150 | 9 | 0.94 | 6.19 | 0.06 | 8 | 0.75 | 7.5 | 3.5 | ⁵⁾ | CRN | J5 ⁵⁾ |

- 1) Material: AISI 316/316L. Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)
- 2) In the case of process isolating diaphragms made of Alloy C276, Monel or tantalum, the raised face of the flange and the barrel pipe are made of 316L.
- 3) CSA approval: Product Configurator, order code for "Approval"
- 4) Product Configurator, order code for "Process connection, HP/ HP+LP:"
- 5) Choice of 2", 4", 6" or 8" barrel (extended diaphragm seal), for diameter and weight of barrel (extended diaphragm seal) see the following table

| Option ¹⁾ | Nominal diaphragm | Class | Barrel (extended diaphragm seal) length | | Barrel (extended diaphragm seal) process isolating diaphragm | Weight |
|----------------------|-------------------|-------------|--|--|--|---|
| | | | (L) | | | |
| | [in] | [lb./sq.in] | in (mm) | | in (mm) | [kg (lb)] |
| 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

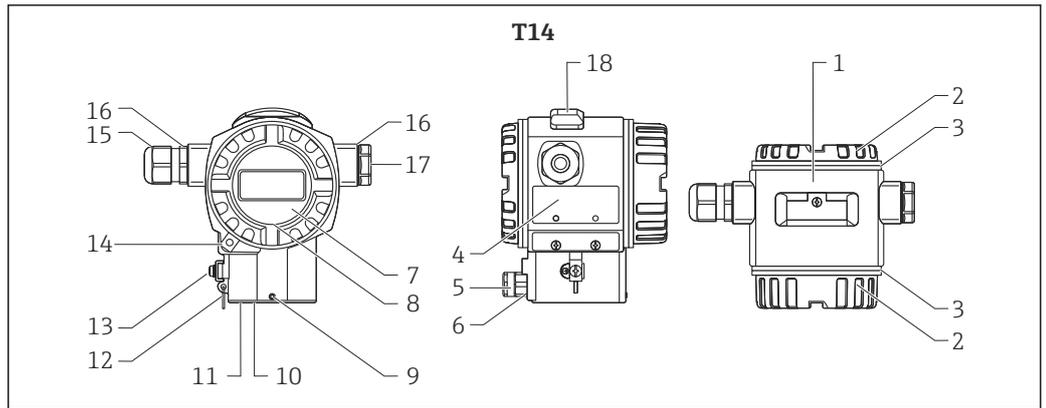


| Position | Description | Weight in kg (lb) | | Option ¹⁾ |
|----------|--|----------------------|------------------|----------------------|
| | | Housing (T14 or T17) | Mounting bracket | |
| A | Dimensions with T14 housing, optional side display | → 45 | 0.5 (1.10) | U |
| B | Dimensions with T17 housing, optional side display | | | |

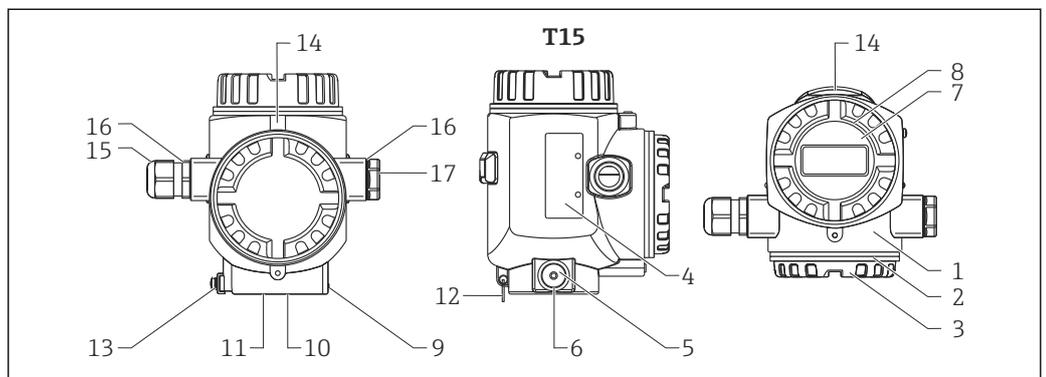
1) Product Configurator, order code for "Additional options 2", version "G"

Also available for order as a separate accessory: Part number 71102216

Materials not in contact with process Transmitter housing



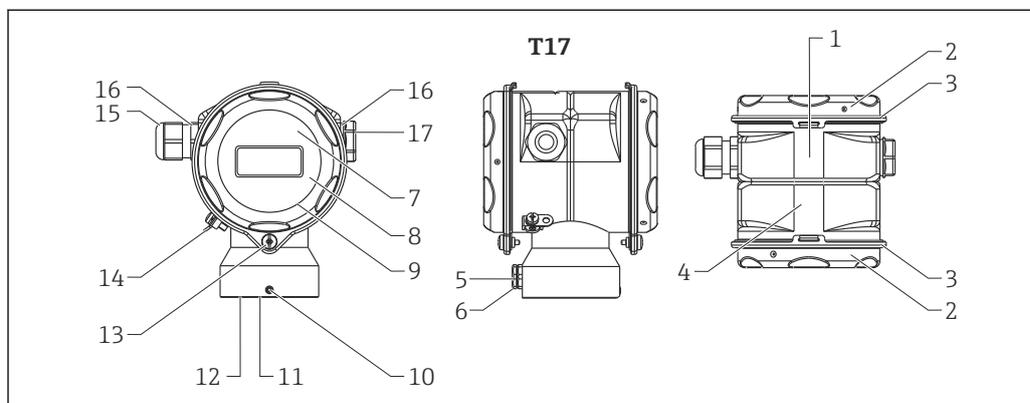
A0020019



A0020020

| Item number | Component part | Material |
|-------------|--------------------------------------|---|
| 1 | T14 and T15 housing, RAL 5012 (blue) | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> AISI 316L (1.4404), if T14 housing is precision-cast Anodized aluminum, if housing T14/T15 of die-cast aluminum |
| 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 plug | Silicone (VMQ) |

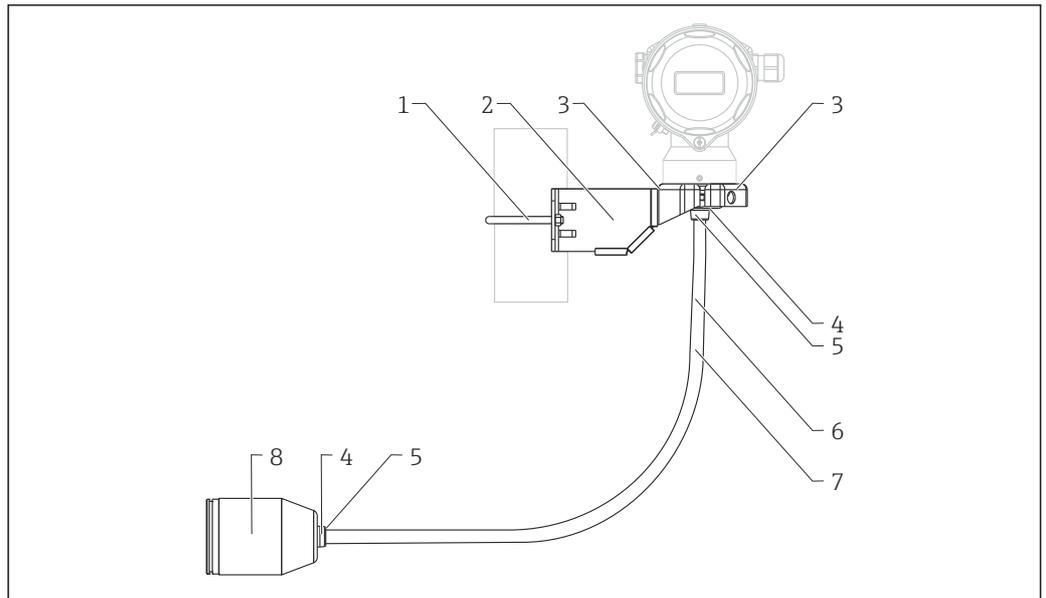
| Item number | Component part | Material |
|-------------|--|--|
| 17 | Blind plug | PBT-GF30 FR, for dust ignition-proof: AISI 316L (1.4435) |
| 18 | External operation (keys and key cover), RAL 7035 (gray) | Polycarbonate PC-FR, screw A4 |



A0020021

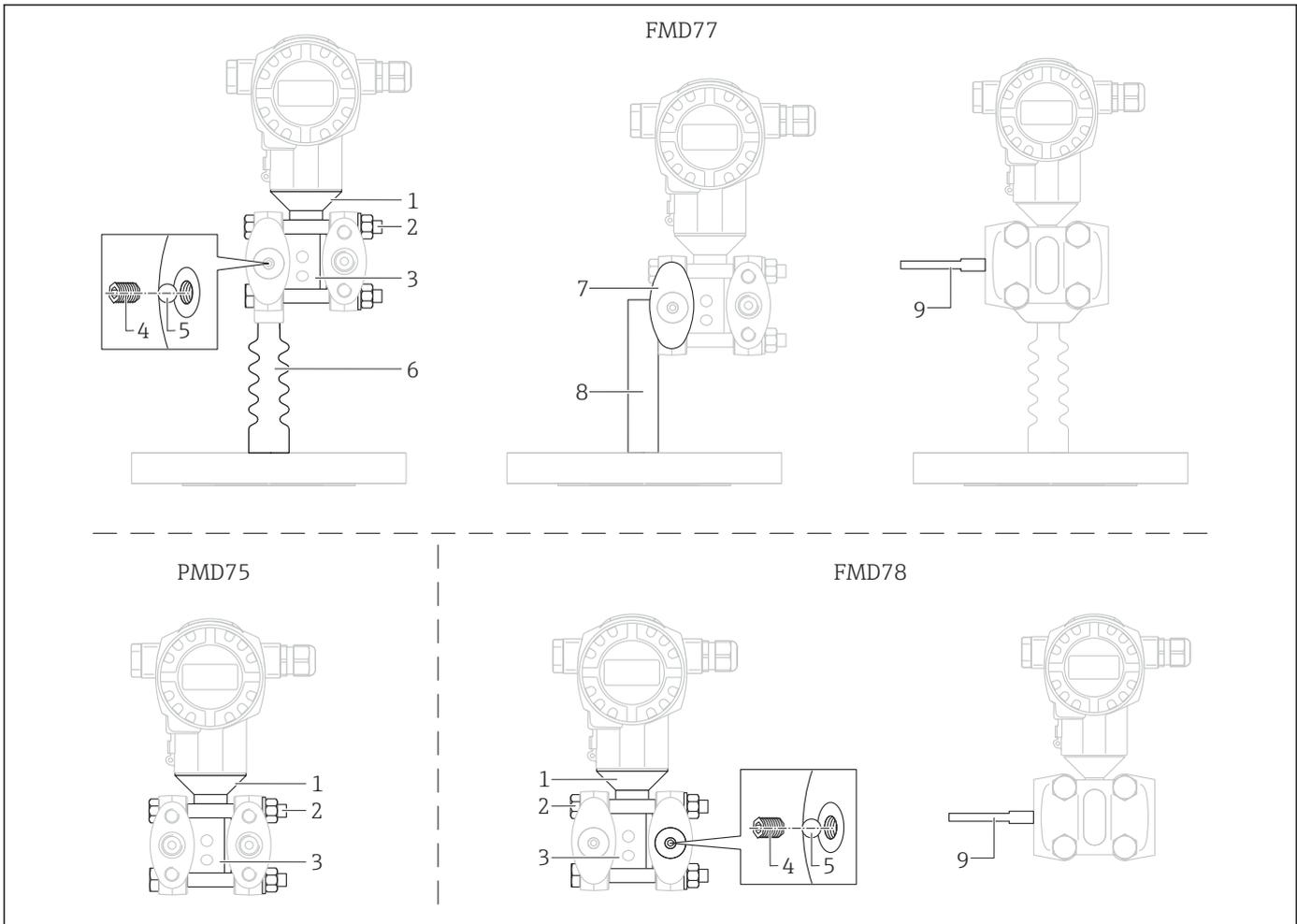
| Item number | Component part | Material |
|-------------|--|---|
| 1 | T17 housing | AISI 316L (1.4404) |
| 2 | Cover | |
| 3 | Cover seal | EPDM |
| 4 | Nameplates | Lasered on |
| 5 | Pressure compensation filter | AISI 316L (1.4404) and PBT-FR |
| 6 | Pressure compensation filter, O-ring | VMQ or 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 Thread coating: Heat-curing lubricant varnish |
| 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 plug | Silicone (VMQ) |
| 17 | Blind plug | PBT-GF30 FR, for dust ignition-proof: AISI 316L (1.4435) |

Connecting parts



A0026172

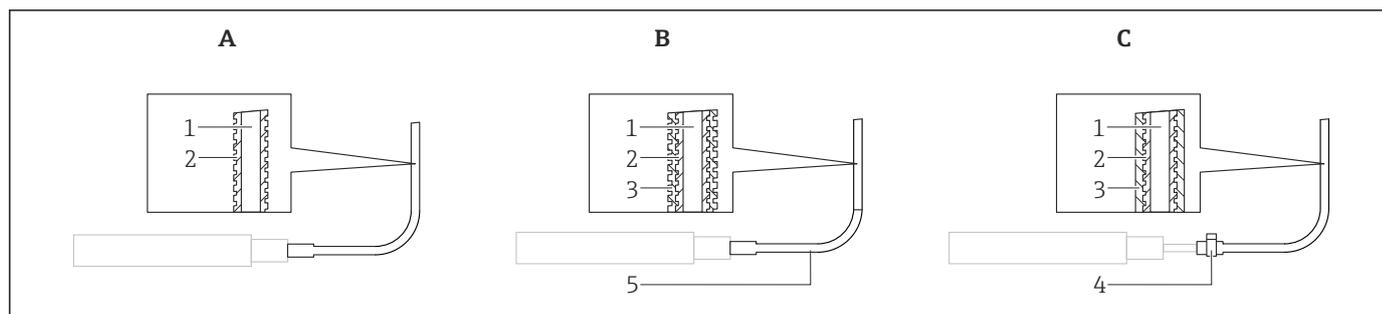
| Item number | Component part | Material |
|-------------|---|--|
| 1 | Mounting bracket | Bracket AISI 316L (1.4404) |
| 2 | | Screw and nuts A4-70 |
| 3 | | Half-shells: AISI 316L (1.4404) |
| 4 | Seal for cable from separate housing | EPDM |
| 5 | Gland for cable from separate housing | AISI 316L (1.4404) |
| 6 | 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 |
| 7 | FEP cable for separate housing | Abrasion-proof cable; shielded using galvanized steel wire netting; insulated with fluorinated ethylene propylene (FEP), black; copper cores, twisted, UV-resistant |
| 8 | Process connection adapter for separate housing | AISI 316L (1.4404) |



A0023955

| Item number | Component part | Material |
|-------------|---|--|
| 1 | Connection between the housing and process connection | AISI 316L (1.4404) |
| 2 | Screw and nuts | PMD75 PN 160, FMD77, FMD78: <ul style="list-style-type: none"> ■ Hex.-headed bolt DIN 931-M12x90-A4-70 ■ Hex.-headed nut DIN 934-M12-A4-70 PMD75 PN 420: <ul style="list-style-type: none"> ■ Hex.-headed bolt ISO 4014-M12x90-A4 ■ Hex.-headed nut ISO 4032-M12-A4-bs |
| 3 | Cell body | AISI 316L (1.4404) |
| 4 | Threaded pin | DIN 915 M 6x8 A2-70 |
| 5 | Bearing | DIN 5401 (1.3505) |
| 6 | Temperature isolator | AISI 316L (1.4404) |
| 7 | Side flanges | 1.4408 / CF3M ¹⁾ / AISI 316L |
| 8 | U-bracket | AISI 304 (1.4301) |
| 9 | Heat-shrink tube available only if flexible armor for capillary has PVC coating or PTFE hose. (available only if flexible armor for capillary has PVC coating or PTFE hose) | Polyolefin |

1) Cast equivalent to material AISI 316L



A0028087

| Position | Component part | A Standard Armor for capillary | B PVC-coated Armor for capillary | C PTFE hose Armor for capillary |
|----------|-------------------------------------|--------------------------------------|--|---------------------------------------|
| 1 | Capillary | AISI 316 Ti (1.4571) | AISI 316 Ti (1.4571) | AISI 316 Ti (1.4571) |
| 2 | Flexible armor for capillary | AISI 316L (1.4404) ¹⁾ | AISI 316L (1.4404) | AISI 316L (1.4404) |
| 3 | Coating/armor | - | PVC ²⁾ | PTFE ³⁾ |
| 4 | Single-ear clamp | - | - | 1.4301 |
| 5 | Shrink tubing at capillary junction | - | Polyolefin | - |

- 1) Product Configurator, order code for "Armor for capillary:" option "SA"
- 2) Product Configurator, order code for "Capillary armoring:" option "SB"
- 3) Product Configurator, order code for "Capillary armoring:" option "SC"

Weight

| Component part | Weight |
|--|---|
| Housing | See "Housing" section |
| Process connection | See "Process connections" section |
| Capillary with armoring made of AISI 316L (1.4404) | 0.16 kg/m (0.35 lb/m) + 0.2 kg (0.44 lb) (weight per capillary line) |
| Capillary with armoring made of AISI 316L (PVC) | 0.21 kg/m (0.46 lb/m) + 0.2 kg (0.44 lb) (weight per capillary line) |
| Capillary with armoring made of AISI 316L (PTFE) | 0.29 kg/m (0.64 lb/m) + 0.2 kg (0.44 lb) (weight per capillary line) |

Materials in contact with process

NOTICE

- ▶ The device components in contact with the process are specified in the "Mechanical construction" and "Ordering information" sections. → 44 → 102

Delta-ferrite content

A delta-ferrite content of $\leq 3\%$ can be guaranteed and certified for the wetted parts of the FMD78 if option "8" is selected in the "Additional options 1" or "Additional options 2" order code in the Product Configurator.

TSE Certificate of Suitability (Transmissible Spongiform Encephalopathy)

The following applies to all device components in contact with the process:

- 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 process connections": 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.
- Some process connections are also available in alloy C276 (DIN/EN material number 2.4819). For this purpose see the information in the "Mechanical construction" section.
- Side flanges: 316L, C 22.8 with zinc plating or alloy C 276. The C22.8 side flanges are coated with anti-corrosion protection (zinc, chrome). To prevent the formation of hydrogen and thereby diffusion through the membrane, Endress+Hauser recommends the use of 316L side flanges for applications involving water. Hydrogen diffusion through the membrane leads to measurement errors, or in extreme cases to a device failure.

Process isolating diaphragm

| Sensor | Description | Option ¹⁾ |
|---|--|----------------------|
| FMD77 | AISI 316L, high-pressure side (HP) | 1 |
| | Alloy C 276, high-pressure side (HP) ²⁾ | 2 |
| | Monel (2.4360), high-pressure side (HP) | 3 |
| | Tantalum (UNS R05200), high-pressure side (HP) | 5 |
| | AISI 316L with gold-rhodium coating, high-pressure side (HP) | 6 |
| | AISI 316L with 0.25 mm (0.01 in)PTFE coating, high-pressure side (HP) | 8 |
| FMD77 with capillaries on low-pressure side (LP) | AISI 316L, high-pressure side (HP) + low-pressure side (LP) | H |
| | Alloy C 276, high-pressure side (HP) + low-pressure side (LP) | J |
| | Monel (2.4360), high-pressure side (HP) + low-pressure side (LP) | K |
| | Tantalum (UNS R05200), high-pressure side (HP) + low-pressure side (LP) | L |
| | AISI 316L with gold-rhodium coating, high-pressure side (HP) + low-pressure side (LP) | M |
| | AISI 316L with 0.25 mm (0.01 in)PTFE coating, high-pressure side (HP) + low-pressure side (LP) | N |
| FMD78 | AISI 316L, TempC | E |
| | AISI 316L | 1 |
| | Alloy C 276 | 2 |
| | Monel (2.4360) | 3 |
| | Tantalum (UNS R05200) | 5 |
| | AISI 316L with gold-rhodium coating | 6 |
| | AISI 316L with 0.25 mm (0.01 in) PTFE foil (FDA 21 CFR 177.1550) | 8 |
| PMD75 | AISI 316L | 1 |
| | Alloy C 276 (2.4819) | 2 |
| | Monel (2.4360) | 3 |
| | Tantalum (UNS R05200) | 5 |
| | Alloy C 276 with gold-rhodium coating | 6 |

1) Product Configurator, order code for "Membrane material"

2) The material used in the raised face of the flange is the same as that used in the process isolating diaphragm. For devices with a barrel (extended diaphragm seal), the flange raised face and the barrel pipe are made of 316L.

Seals

| Device | Description | Option ¹⁾ |
|--------|---|----------------------|
| PMD75 | FKM Viton | A |
| | PTFE (PN160bar/16MPa/2400psi) | C ²⁾ |
| | 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"
 2) Suitable for foodstuffs FDA21 CFR 177.1550

Fill fluid

FMD77

| Process connection | Description | Option ^{1) 2)} |
|-------------------------|--|-------------------------|
| High-pressure side (HP) | Silicone oil (food-safe FDA 21 CFR 175.105) | A |
| | Vegetable oil (food-safe FDA 21 CFR 172.856) | D |
| | Inert oil | F |
| | Low-temperature oil | L |
| | High-temperature oil | V |
| Low-pressure side (LP) | m capillary, silicone oil | M |
| | m capillary, vegetable oil | N |
| | m capillary, inert oil | O |
| | m capillary; low-temperature oil | P |
| | m capillary; high-temperature oil | Q |
| |ft capillary; silicone oil | R |
| | ft capillary; vegetable oil | S |
| | ft capillary, inert oil | T |
| | ft capillary; low-temperature oil | U |
| | ft capillary; high-temperature oil | W |

- 1) Product Configurator, order code for "Fill fluid"
 2) For diaphragm seal devices with 3-A and EHEDG certificates, only select filling oils with FDA approval!

FMD78

| Capillary length; | Description | Option ¹⁾ |
|---|--|----------------------|
| Symmetrical | ft capillary; silicone oil (food-safe FDA 21 CFR 175.105) | A ²⁾ |
| | ft capillary; vegetable oil (food-safe FDA 21 CFR 172.856) | 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 |
| | ft capillary, inert oil | F |
| | m capillary; silicone oil (food-safe FDA 21 CFR 175.105) | 1 |
| | m capillary; vegetable oil (food-safe FDA 21 CFR 172.856) | 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 |
| | m capillary, inert oil | 6 |
| Asymmetrical Low-pressure side (LP) | m capillary, silicone oil, LP side | M |
| | m capillary, vegetable oil, LP side | N |
| | m capillary, inert oil, LP side | O |
| | m capillary, low-temperature oil, LP side | P |
| | m capillary, high-temperature oil, LP side | Q |
| | ft capillary, silicone oil, LP side | R |
| | ft capillary, vegetable oil, LP side | S |
| | ft capillary, inert oil, LP side | T |
| | ft capillary, low-temperature oil, LP side | U |
| | ft capillary, high-temperature oil, LP side | W |
| Asymmetrical High-pressure side (HP) | ft capillary, HP side | V ³⁾ |
| | m capillary, HP side | W |

1) For diaphragm seal devices with 3-A and EHEDG certificates, only select filling oils with FDA approval!

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

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

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnostics

Fast 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 operation

Efficient diagnostics increase measurement availability

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

Local operation

Functions

| Function | External operation (operating keys, optional, not T17 housing) | Internal operation (electronic insert) | Onsite 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 | ✓ (only if display is connected) | ✓ (HART and PA only) | ✓ |
| Configuring the bus address of the device (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 can be removed for easy operation.

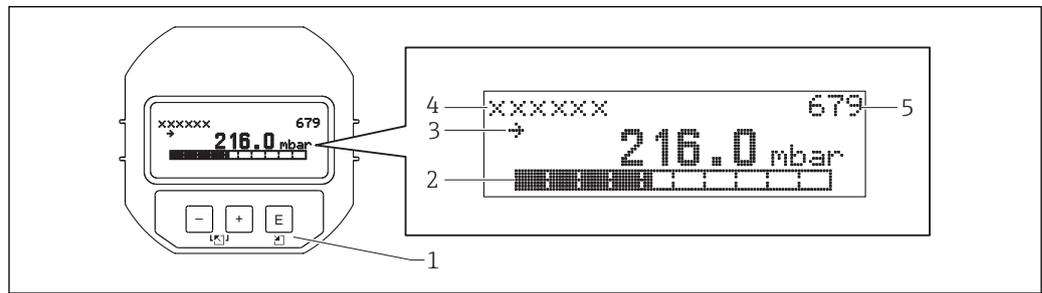
The device display can be turned in 90° steps.

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 incl. leading 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 due to breakdown of parameters into several levels and groups
- Menu guidance in 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

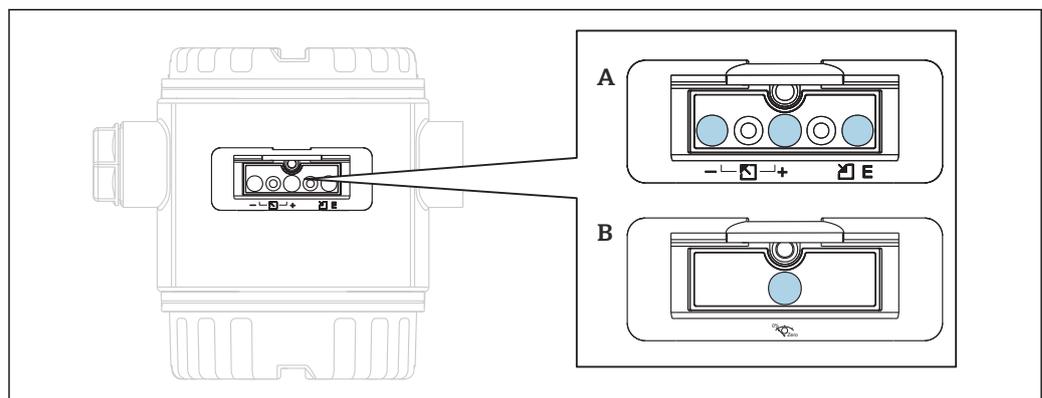


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- 1 Operating keys
- 2 Bargraph
- 3 Symbol
- 4 Header
- 5 Parameter ID number

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 stainless steel housing (T17), the operating keys are always located inside the housing on the electronic insert.



A0020030

- 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:

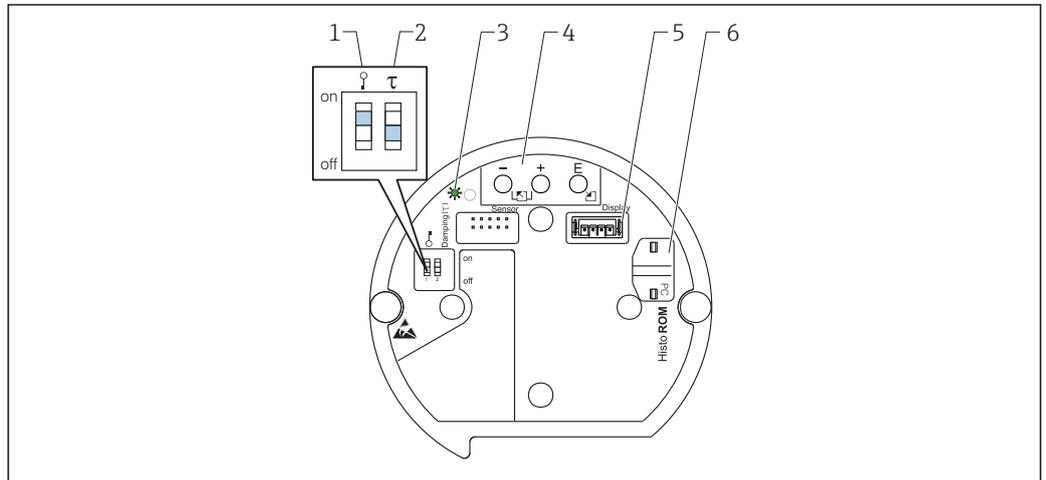
Product Configurator, order code for "Output, operation"

Operating keys and elements located internally on the electronic insert

Ordering information:

Product Configurator, order code for "Output, operation"

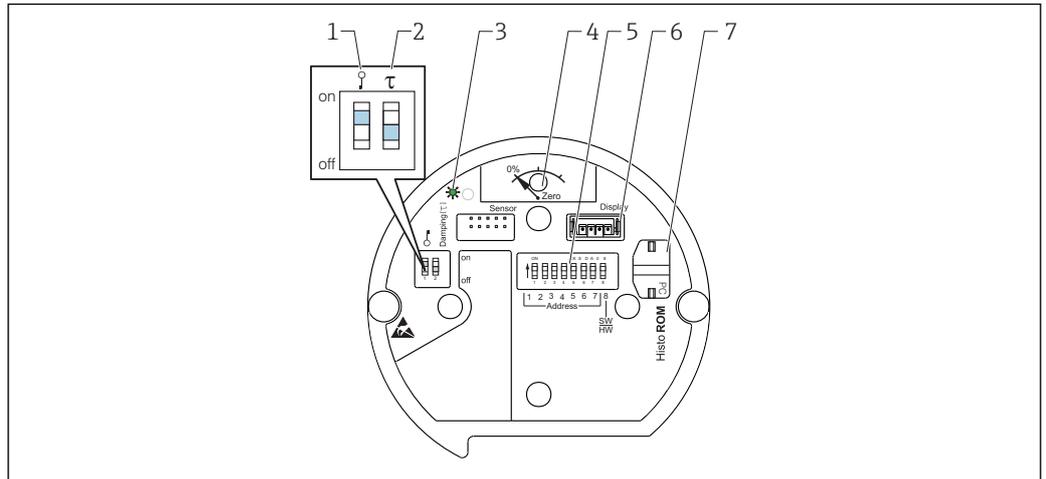
HART



A0020031

- 1 *DIP switch for locking/unlocking parameters relevant to the measured value*
- 2 *DIP switch for switching 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*

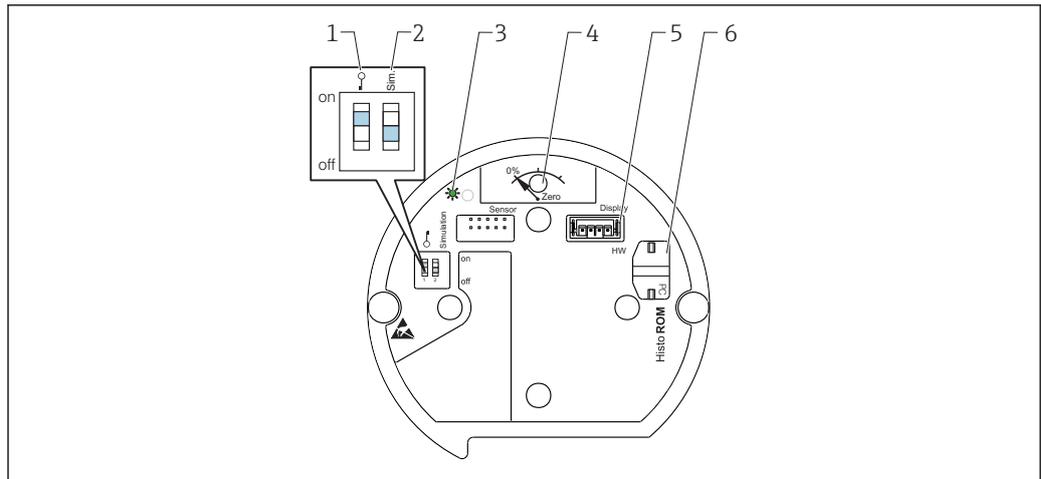
PROFIBUS PA



A0020032

- 1 *DIP switch for locking/unlocking parameters relevant to the measured value*
- 2 *DIP switch for switching 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*

FOUNDATION Fieldbus



A0020033

- 1 DIP switch for locking/unlocking parameters relevant to the measured value
- 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

Remote operation

All software parameters are accessible depending on the position of the write protection switch on the device.

| Hardware and software for remote operation | HART | PROFIBUS PA | FOUNDATION Fieldbus |
|--|------|-------------|---------------------|
| FieldCare | ✓ | ✓ | ✓ |
| FieldXpert SFX100 | ✓ | – | ✓ |
| NI-FBUS Configurator | – | – | ✓ |
| HistoROM®/M-DAT | ✓ | ✓ | ✓ |

FieldCare

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

FieldCare supports the following functions:

- Configuration of transmitters in offline and online mode
- Device data upload/download
- HistoROM®/M-DAT analysis
- Documentation of the measuring point

Connection options:

- HART via Commubox FXA195 and the USB interface of 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 offers wireless communication via the optional VIATOR Bluetooth modem from Endress+Hauser. 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 the NI-FBUS Configurator:

The NI-FBUS Configurator is an easy-to-use graphical environment for creating linkages, field-based control loops and schedules based on the FOUNDATION 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. 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, 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:", version "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 system 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".

A0021695-EN

- 1 My Applicator - configuration of the Applicator settings
- 2 Applicator Help
- 3 Mouse-over help - hover the cursor over these fields for brief information

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.

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 diameter of the process isolating diaphragm
- The stiffness and material of the process isolating diaphragm
- 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 thickness of the process isolating diaphragm 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 membrane: Highest accuracy and process safety in pressure and differential pressure measurement with diaphragm seals

To measure even more precisely in such applications and to increase process safety, Endress+Hauser has developed the TempC membrane based on a completely revolutionary technology. This membrane guarantees the highest level of accuracy and process safety in diaphragm seal applications.

- The very low temperature effect minimizes the influence of fluctuations of both process and ambient temperatures, thus guaranteeing accurate and stable measurements. Measurement inaccuracies caused by temperature are reduced to a minimum.
- The TempC membrane can be used at temperatures between -40 °C (-40 °F) and $+250\text{ °C}$ ($+482\text{ °F}$). This guarantees maximum process safety even for very long sterilization and cleaning cycles (SIP/CIP) in tanks and pipes at high temperatures.
- Thanks to the TempC membrane, smaller dimension process connections are possible. With a smaller process connection, the new membrane measures at least as accurately as a conventional membrane 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 membrane 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 "Membrane material" field.

Capillary

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

- \leq 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 media 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 may be used in the food industry, such as vegetable oil or silicone oil (see also the following section on "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 on the volume of the filling oil at calibration temperature (constant in range: +21 to +33 °C (+70 to +91 °F)). The application range can be extended by a filling oil with a lower expansion coefficient and a shorter capillary.

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 process isolating 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 TK 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

| Filling oil | Permitted temperature range ¹⁾ at 0.05 bar (0.725 psi) ≤ p _{abs} ≤ 1 bar (14.5 psi) | Permitted temperature range ¹⁾ at p _{abs} ≥ 1 bar (14.5 psi) | Density [g/cm ³] / [SGU] | Viscosity [mm ² /s] / [cSt] at 25 °C (77 °F) | Expansion coefficient ²⁾ [1/K] | Note ³⁾ | Option ⁴⁾ |
|----------------------|---|--|--------------------------------------|---|---|---|-------------------------|
| 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 use in food FDA 21 CFR 175.105) | FMD77: A FMD78: A, 1 |
| High-temperature oil | -10 to +200 °C (+14 to +392 °F) | -10 to +400 °C (+14 to +752 °F) ^{5) 6) 7)} | 1.00 | 150 | 0.00096 | (High temperatures) | FMD77: V FMD78: C, 3 |
| Inert oil | -40 to +80 °C (-40 to +176 °F) | -40 to +175 °C (-40 to +347 °F) | 1.87 | 27 | 0.000876 | (For ultrapure gas and oxygen applications) | FMD77: F FMD78: D, 4 |
| 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 use in food FDA 21 CFR 172.856) | FMD77: D FMD78: B, 2 |
| 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) | FMD77: L FMD78: E, 5 |

- 1) Observe temperature limits of the device and the system.
- 2) Please refer to the "Applicator Sizing Diaphragm Seal" selection tool for the thermal change of the diaphragm seal and other important technical characteristics.
- 3) For diaphragm seal devices with 3-A and EHEDG certificates, only select filling oils with FDA approval!
- 4) Product Configurator, order code for "Fill fluid"
- 5) 325 °C (617 °F) at ≥ 1 bar (14.5 psi) absolute pressure.
- 6) 350 °C (662 °F) at ≥ 1 bar (14.5 psi) absolute pressure (max. 200 hours).
- 7) 400 °C (752 °F) at ≥ 1 bar (14.5 psi) absolute pressure (max. 10 hours).

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 application range can be extended by using a filling oil 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.

To help you select the right diaphragm seal system 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".

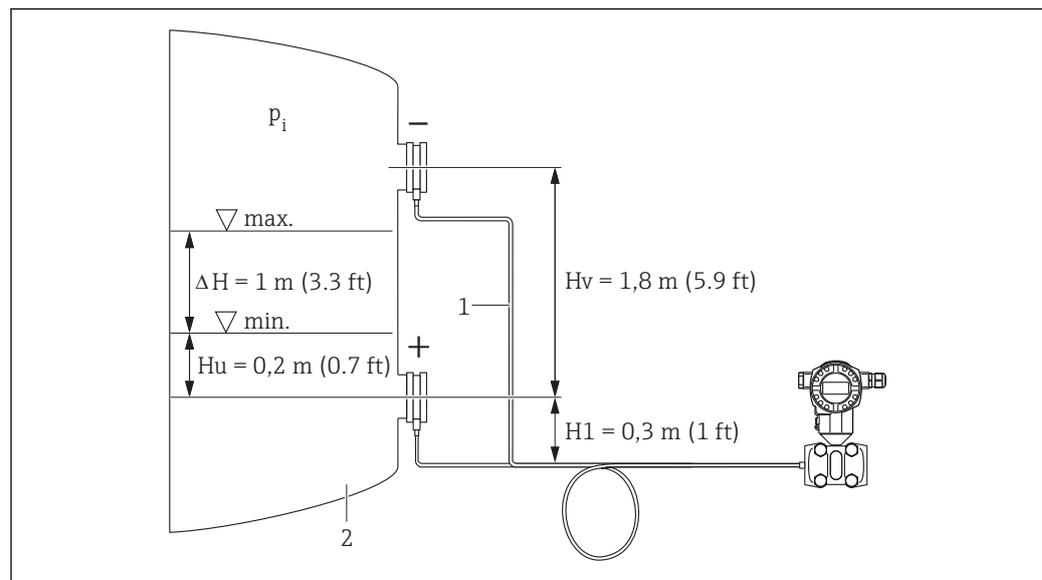
Information on cleaning

- Endress+Hauser provides flushing rings as an accessory to enable cleaning of the process isolating diaphragm without removing the transmitter from 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 figure and the example below).
- For devices with a capillary a suitable fastening device (mounting bracket) is recommended.
- When mounting, sufficient strain relief must be provided for the capillary line to prevent the capillary from bending (capillary bending radius ≥ 100 mm (3.94 in))
- For more detailed installation instructions, Endress+Hauser provides its customers with the free "Applicator Sizing Diaphragm Seal" tool, which is available on CD or can be downloaded online at www.endress.com/applicator".

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 (2.12 lb) dm^3

2 Vessel with water: $\rho_M = 1.0$ kg (2.21 lb) dm^3

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

$$\begin{aligned}
 p_- &= p_{HV} + p_{H1} = H_v \cdot \rho_{FI} \cdot g + H_1 \cdot \rho_{FI} \cdot g + p_i \\
 &= 1,8 \text{ m} \cdot 0,96 \frac{\text{kg}}{\text{dm}^3} \cdot 9,81 \frac{\text{m}}{\text{s}^2} + 0,3 \text{ m} \cdot 0,96 \frac{\text{kg}}{\text{dm}^3} \cdot 9,81 \frac{\text{m}}{\text{s}^2} + p_i \\
 &= 197,77 \text{ mbar} + p_i
 \end{aligned}$$

A0023962

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

$$\begin{aligned}
 p_+ &= p_{HU} + p_{H1} = H_u \cdot \rho_M \cdot g + H_1 \cdot \rho_{FI} \cdot g + p_i \\
 &= 0,2 \text{ m} \cdot 1 \frac{\text{kg}}{\text{dm}^3} \cdot 9,81 \frac{\text{m}}{\text{s}^2} + 0,3 \text{ m} \cdot 0,96 \frac{\text{kg}}{\text{dm}^3} \cdot 9,81 \frac{\text{m}}{\text{s}^2} + p_i \\
 &= 47,87 \text{ mbar} + p_i
 \end{aligned}$$

A0023981

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

$$\begin{aligned}
 \Delta p_{\text{transmitter}} &= p_+ - p_- \\
 &= 47,87 \text{ mbar} - 197,77 \text{ mbar} \\
 &= -149,9 \text{ mbar}
 \end{aligned}$$

A0023982

Result:

When the vessel is full, a differential pressure of -51.80 mbar (-0.762 psi) is present at the differential pressure transmitter. When the vessel is empty, a differential pressure of -149.90 mbar (-2.2485 psi) is present. A 500 mbar (7.5 psi) measuring cell is therefore necessary for this application.

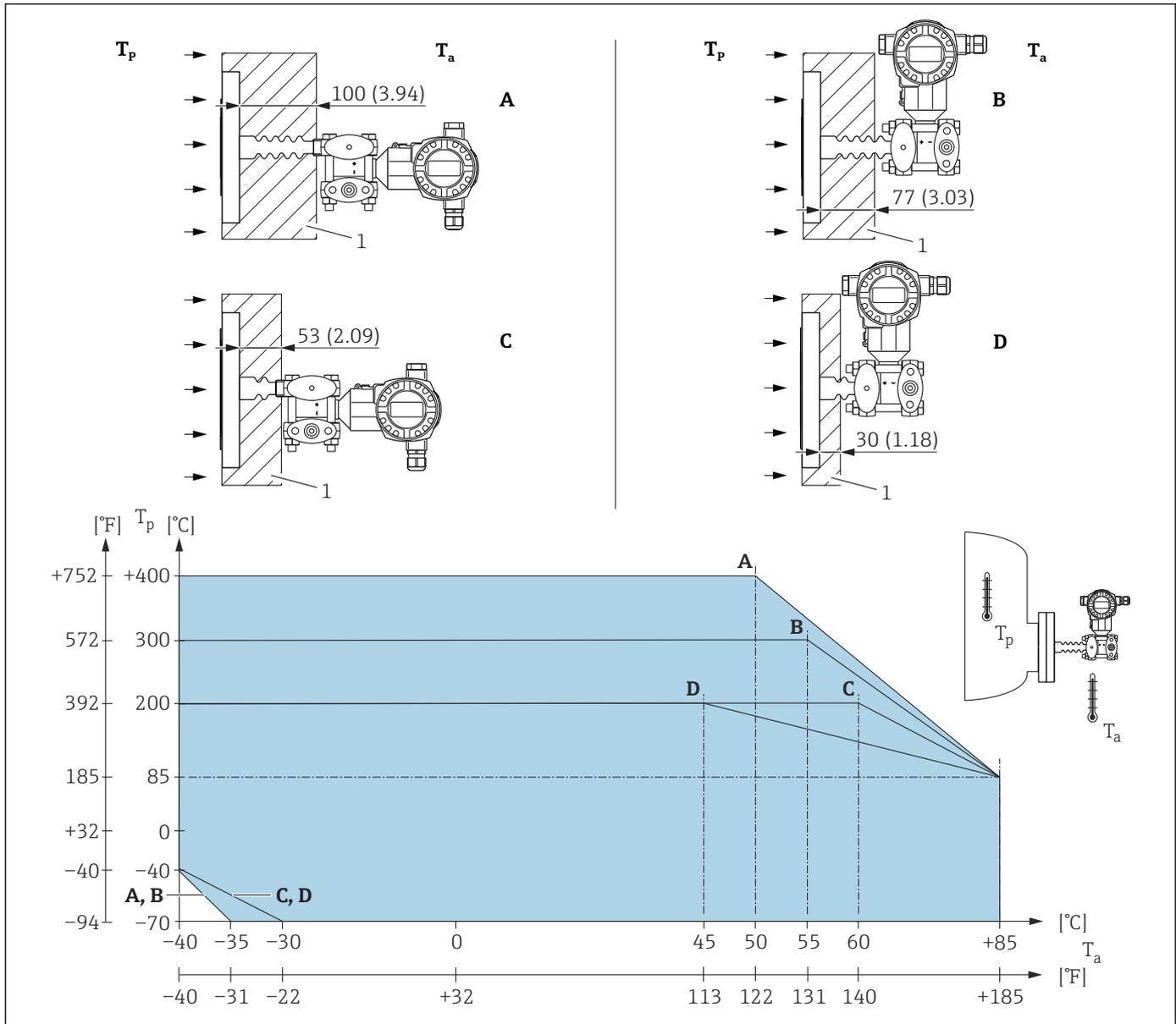
Capillary

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 $\geq 100 \text{ mm}$ (3.94 in)
- When using diaphragm seal systems with a capillary, sufficient strain relief must be provided to prevent the capillary from bending (capillary bending radius $\geq 100 \text{ mm}$ (3.94 in)).
- 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, a position adjustment can cause range violation.

Heat insulation – FMD77

The FMD77 must only be insulated up to a certain height. The maximum permitted insulation height applies to an insulation material with a heat conductivity $\leq 0.04 \text{ W}/(\text{m} \times \text{K})$ and to the maximum permitted ambient and process temperature. The data were determined under the most critical application "quiescent air".



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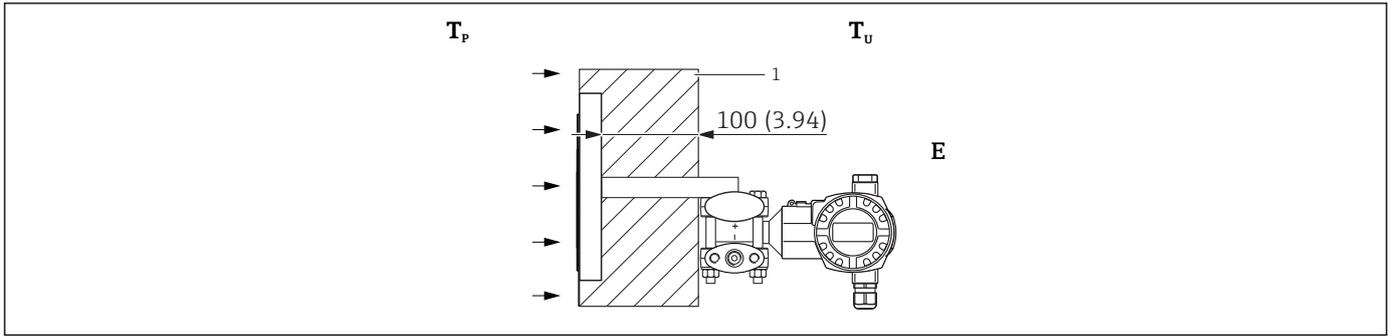
1 Insulation material

Without insulation, the ambient temperature decreases by 5 K.

| Position | Design | Temperature isolator | Option ¹⁾ |
|----------|------------------------|----------------------|----------------------|
| A | Transmitter horizontal | long | MA ²⁾ |
| B | Transmitter vertical | long | MB |
| C | Transmitter horizontal | short | MC |
| D | Transmitter vertical | short | MD |

1) Product Configurator, order code for "Design; temperature isolator"

2) Standard



A0023984

1 Insulation material

| Position | Design | Ambient temperature T_U | Process temperature T_P | Option ¹⁾ |
|----------|---|------------------------------|--|----------------------|
| E | U-bracket, Transmitter horizontal (for devices which require a CRN approval) | $\leq 70\text{ °C}$ (158 °F) | max. 350 °C (662 °F) depending on diaphragm seal filling oil used | ²⁾ |

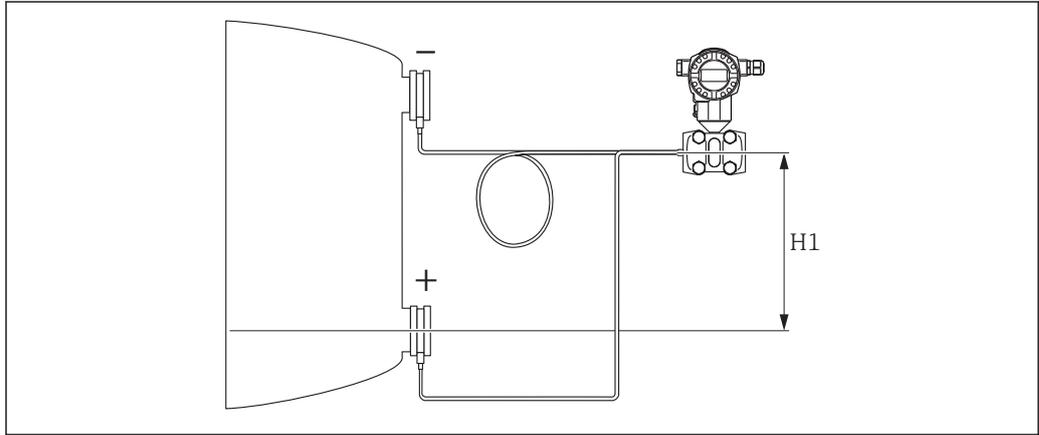
- 1) Product Configurator, order code for "Process connection"
- 2) In combination with CSA approval.

Vacuum applications

Installation instructions

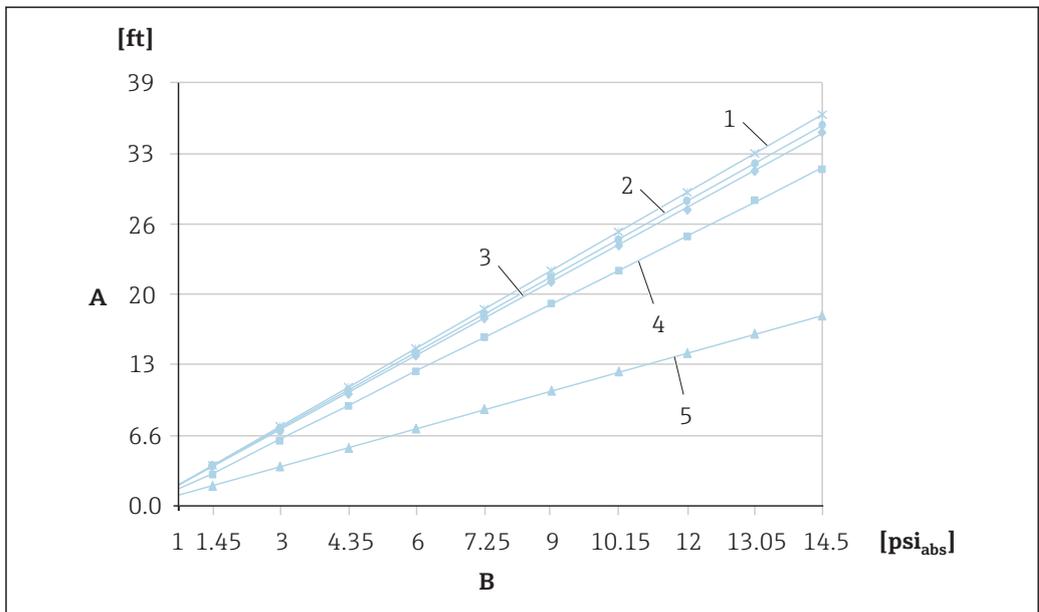
For applications under vacuum, Endress+Hauser recommends mounting the pressure transmitter below the lower diaphragm seal. This prevents a vacuum load of the diaphragm seal caused by the presence of filling oil in the capillaries.

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



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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 container), see the following illustration:



A0023986-EN

- 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.

RCM-Tick marking The supplied product or measuring system meets the ACMA (Australian Communications and Media Authority) requirements for network integrity, interoperability, performance characteristics as well as health and safety regulations. Here, especially the regulatory arrangements for electromagnetic compatibility are met. The products are labelled with the RCM- Tick marking on the name plate.



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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 Ex-systems . → 106

EAC conformity The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity together with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the EAC mark.

Suitable for hygiene applications The device is available with hygienic process connections (overview: see order code). The materials of the hygienic process connections in contact with foodstuffs comply with framework Regulation (EC) 1935/2004.

⚠ CAUTION

Contamination in the process!

Risk of contamination if incorrect seals and parts are used!

- ▶ To avoid the risk of contamination, when installing the device comply with the design principles of EHEDG, Guideline 37 "Hygienic Design and Application of Sensors" and Guideline 16 "Hygienic Pipe Couplings".
- ▶ Suitable assemblies and seals must be used to ensure hygienic design in accordance with 3-A SSI and EHEDG specifications.
- ▶ The leak-proof connections can be cleaned with the cleaning methods typical of this industry (CIP and SIP). Attention must be paid to the pressure and temperature specifications of the sensor and process connections for CIP and SIP processes (clean in place/sterilize in place).
- ▶ For diaphragm seal devices with 3-A and EHEDG certificates, only select filling oils with FDA approval!



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 The gap-free connections can be cleaned of all residue using the usual cleaning methods within this industry.

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

The Deltabar S with a 4 to 20 mA output signal has been developed in accordance with the 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 functional safety data, see the "Functional safety manual - Deltabar S" SD00189P.

For devices up to SIL 3 / IEC 61508 Declarations of Conformity see:

Ordering information:

Product Configurator, order code for "Additional options 1", version "E"

Overfill protection

WHG (see document ZE00259P/00/EN)

Ordering information:

Product Configurator, order code for "Approval", option "6".

CRN approval

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 nameplate with the registration number CRN OF10524.5C .

Ordering information:

Product Configurator, order code for "Process connection; material" and

Product Configurator, order code for "Approval" (only in conjunction with an approved process connection)

Other standards and guidelines

The applicable European guidelines and standards can be found in the relevant EU Declarations of Conformity. The following were also applied:

DIN EN 60770 (IEC 60770):

Transmitters for use in industrial-process control systems. Part 1: Methods for operating 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.

EN 60529:

Degrees of protection provided by enclosures (IP code)

Pressure Equipment Directive 2014/68/EU (PED)

Pressure equipment with allowable pressure ≤ 200 bar (2 900 psi)

Pressure equipment (having a maximum allowable pressure $PS \leq 200$ bar (2 900 psi)) can be classified as pressurized equipment in accordance with Pressure Equipment Directive 2014/68/EU. If the maximum allowable pressure is ≤ 200 bar (2 900 psi) and the pressurized volume of the pressure

equipment is ≤ 0.1 l, the pressure equipment is subject to the Pressure Equipment Directive (cf. Pressure Equipment Directive 2014/68/EU, Article 4, point 3). The Pressure Equipment Directive only requires that the pressure equipment shall be designed and manufactured in accordance with the "sound engineering practice of a Member State".

Reasons:

- Pressure Equipment Directive (PED) 2014/68/EU Article 4, point 3
- Pressure equipment directive 2014/68/EU, Commission's Working Group "Pressure", Guideline A-05 + A-06

Note:

A partial examination shall be performed for pressure instruments that are part of safety equipment for the protection of a pipe or vessel from exceeding allowable limits (equipment with safety function in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).

Pressure equipment with allowable pressure > 200 bar (2 900 psi)

Pressure equipment designated for application in every process fluid having a pressurized volume of < 0.1 l and a max. allowable pressure $PS > 200$ bar (2 900 psi) shall satisfy the essential safety requirements set out in Annex I of the Pressure Equipment Directive 2014/68/EU. According to Article 13 pressure equipment shall be classified by category in accordance with Annex II. The conformity assessment of the pressure equipment shall be determined by the category I under consideration of the above-mentioned low pressurized volume. These devices shall be provided with CE marking.

Reasons:

- Pressure Equipment Directive 2014/68/EU, Article 13, Annex II
- Pressure equipment directive 2014/68/EU, Commission's Working Group "Pressure", Guideline A-05

Note:

A partial examination shall be performed for pressure instruments that are part of safety equipment for the protection of a pipe or vessel from exceeding allowable limits (equipment with safety function in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).

The following also applies:

- FMD78 with pipe diaphragm seal ≥ 1.5 "/PN40:
Suitable for stable gases in group 1, category II, module A2
- PMD75, PN 420
Suitable for stable gases in group 1, category I, module A

Manufacturer declarations

Depending on the desired configuration, the following documents can be ordered additionally with the device:

- FDA conformity
- TSE-free: materials free from animal origin
- Regulation (EC) No. 2023/2006 (GMP)
- Regulation (EC) No. 1935/2004 on materials and articles intended to come into contact with food

Downloading the Declaration of Conformity

<http://www.endress.com/en/download>

Downloads

Search and download operating manuals, brochures, publications, software updates, videos, certificates and a whole host of other documents!

Media Type 1 — Approvals & Certificates 2 — Manufact. Declaration

Product Code 3 —

Text Search

Advanced Search
Reset
Search 4

A0031778

1. Select "Approvals & Certificates"
2. Select "Manufact. Declaration"
3. Enter the required product code
4. Click "Search"

The available downloads are displayed.

Marine approval

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

Ordering information:

Product Configurator, order code for "Additional options 1" or "Additional options 2", version "S".

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 (6 300 psi) |
| FMD77 | CSA C/US IS, XP | 160 bar (2 400 psi) |
| FMD78 | CSA C/US IS, XP | 160 bar (2 400 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⁾ |
| Declaration of Conformity NACE MR0175, wetted metal parts | ✓ | ✓ | ✓ | C |
| EN10204-3.1 material, NACE MR0175, wetted metal parts, inspection certificate | ✓ | ✓ | ✓ | D |
| Individual test, test report | ✓ | ✓ | ✓ | 3 ²⁾ |
| Pressure test, internal procedure, test report | ✓ | ✓ | ✓ | 4 |
| EN10204-3.1 material wetted parts +Ra, Ra= surface roughness, dimensional check, inspection certificate | — | ✓ | — | 6 |
| Delta-Ferrit measurement, internal procedure, wetted metallic parts, inspection certificate | — | ✓ | — | 8 |
| 3.1 Material documentation, wetted metal parts, EN10204-3.1 inspection certificate | ✓ | ✓ | ✓ | JA ^{3) 4)} |
| Declaration of Conformity NACE MR0175, wetted metal parts | ✓ | ✓ | ✓ | JB |

| Description | FMD77 | FMD78 | PMD75 | Option |
|--|-------|-------|-------|--------|
| Declaration of Conformity NACE MR0103, wetted metal parts | ✓ | ✓ | ✓ | JE |
| Helium leak test, internal procedure, inspection certificate | ✓ | ✓ | ✓ | KD |
| Pressure test, internal procedure, inspection certificate | ✓ | ✓ | ✓ | KE |
| PMI test (XRF), internal procedure, metal parts in contact with the medium | ✓ | ✓ | ✓ | KG |

- 1) Product Configurator, order code for "Additional options 1"
- 2) Product Configurator, order code for "Additional options 2"
- 3) Product Configurator, order code for "Test, Certificate"
- 4) The choice of this feature for coated process isolating diaphragms/process connections refers to the metal base material.

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 |
| Factory calibration certificate, 5-point; see additional specification | ✓ | ✓ | ✓ | C |
| DKD/DAkkS certificate; see additional specification | ✓ | ✓ | ✓ | D |
| Customized pressure; see additional specification | ✓ | ✓ | ✓ | E |
| Customized level; see additional specification | ✓ | ✓ | ✓ | F |
| Customized flow; see additional specification | – | – | ✓ | G |
| Customized pressure + 5-point factory calibration certificate; see additional specification | ✓ | ✓ | ✓ | H |
| Customized level + 5-point factory 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"

Service

| Description | Option ¹⁾ |
|---|----------------------|
| Cleaned of oil+grease ²⁾ | HA |
| Cleaned for oxygen service | HB |
| Cleaned of PWIS (paint-wetting impairment substances) | HC |

- 1) Product Configurator, order code for "Service"
- 2) Device only, not accessories or enclosed accessories.

Ordering information

Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: www.endress.com -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center: www.addresses.endress.com

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 from the Endress+Hauser Online Shop

Scope of delivery

- Measuring device
- Optional accessories
- Brief Operating Instructions
- Certificates of calibration
- Optional certificates

Configuration data sheet

Pressure

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

| Pressure unit | | | | |
|-------------------------------|---|--|---------------------------------|---|
| <input type="checkbox"/> mbar | <input type="checkbox"/> mmH ₂ O ¹⁾ | <input type="checkbox"/> mmHg ²⁾ | <input type="checkbox"/> Pascal | <input type="checkbox"/> torr |
| <input type="checkbox"/> bar | <input type="checkbox"/> mH ₂ O ¹⁾ | <input type="checkbox"/> inHg ²⁾ | <input type="checkbox"/> hPa | <input type="checkbox"/> g/cm ² |
| <input type="checkbox"/> psi | <input type="checkbox"/> ftH ₂ O ¹⁾ | <input type="checkbox"/> gf/cm ² | <input type="checkbox"/> kPa | <input type="checkbox"/> kg/cm ² |
| | <input type="checkbox"/> inH ₂ O ¹⁾ | <input type="checkbox"/> kgf/cm ² | <input type="checkbox"/> MPa | <input type="checkbox"/> lb/ft ² |
| | | | | <input type="checkbox"/> 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 of the pressure unit refers to a reference temperature of 0 °C (32 °F).

| Calibration range / Output | |
|----------------------------|-----------------------|
| Lower range value (LRV): | _____ [pressure unit] |
| Upper range value (URV): | _____ [pressure unit] |

| Display |
|--|
| Display of the content of the main line (option depends on sensor and communication variant) |
| <input type="checkbox"/> Primary value [PV] (default) |
| <input type="checkbox"/> Primary value [%] |
| <input type="checkbox"/> Pressure |
| <input type="checkbox"/> Current [mA] (HART only) |
| <input type="checkbox"/> Temperature |
| <input type="checkbox"/> Error number |
| <input type="checkbox"/> Alternating display |

| Damping |
|------------------------------------|
| Damping: _____ sec (Default 2 sec) |

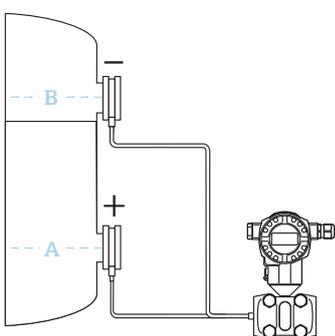
Smallest span (factory calibration) → 11

Level

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

| Pressure unit | | | | Output unit (scaled unit) | | | | | |
|--|---|--|---------------------------------|--|-----------------------------|-------------------------------|--|----------------------------------|----------------------------|
| <input type="checkbox"/> mbar | <input type="checkbox"/> mmH ₂ O ¹⁾ | <input type="checkbox"/> mmHg ²⁾ | <input type="checkbox"/> Pascal | <input type="checkbox"/> torr | Mass | Lengths | Volume | Volume | Percent |
| <input type="checkbox"/> bar | <input type="checkbox"/> mH ₂ O ¹⁾ | <input type="checkbox"/> inHg ²⁾ | <input type="checkbox"/> hPa | <input type="checkbox"/> g/cm ² | <input type="checkbox"/> kg | <input type="checkbox"/> m | <input type="checkbox"/> l | <input type="checkbox"/> USgal | <input type="checkbox"/> % |
| <input type="checkbox"/> psi | <input type="checkbox"/> ftH ₂ O ¹⁾ | <input type="checkbox"/> gf/cm ² | <input type="checkbox"/> kPa | <input type="checkbox"/> kg/cm ² | <input type="checkbox"/> t | <input type="checkbox"/> dm | <input type="checkbox"/> hl | <input type="checkbox"/> impgal | |
| | <input type="checkbox"/> inH ₂ O ¹⁾ | <input type="checkbox"/> kgf/cm ² | <input type="checkbox"/> MPa | <input type="checkbox"/> lb/ft ² | <input type="checkbox"/> lb | <input type="checkbox"/> cm | <input type="checkbox"/> m ³ | <input type="checkbox"/> USbbIPE | |
| | | | | <input type="checkbox"/> atm | | <input type="checkbox"/> mm | <input type="checkbox"/> ft ³ | TR | |
| | | | | | | <input type="checkbox"/> ft | | | |
| | | | | | | <input type="checkbox"/> inch | | | |
| Empty calibration [a]: _____ Low pressure value (empty) [pressure unit] | | | | Empty calibration [a]: _____ Low measured value (empty) [Scaled unit] | | | | | |
| Full calibration [b]: _____ High pressure value (full) [pressure unit] | | | | Full calibration [b]: _____ High level value (full) [Scaled unit] | | | | | |

Example



A0023985

A 500 mbar (7.25 psi) / 100 m³
B 50 mbar (1 psi) / 3 m³

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

Display

Display of the content of the main line (option depends on sensor and communication variant)

- Primary value [PV] (default)
- Primary value [%]
- Pressure
- Current [mA] (HART only)
- Temperature
- Level before lin.
- Tank content
- Error number
- Alternating display

Damping

Damping: _____ sec (Default 2 sec)

Accessories

HistoROM®/M-DAT

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

Ordering information:

Product Configurator, order code for "Additional options 1" or "Additional options 2", version "N" or as a separate accessory (part no.: 52027785).

Welding flanges and welding neck

For details refer to TI00426F/00/EN "Weld-in adapter and flanges".

Manifolds

→  50See .

For further details, see SD01553P/00/EN "Mechanical accessories for pressure measuring devices".

Additional mechanical accessories

Oval flange adapters, pressure gauge valves, shutoff valves, siphons, condensate pots, cable shortening kits, adapter test, flushing rings, block&bleed valves, protective roofs.

For details see SD01553P/00/EN "Mechanical accessories for pressure measuring devices".

Supplementary documentation

| | |
|---------------------------------------|---|
| Field of Activities | Pressure measurement, powerful instruments for process pressure, differential pressure, level and flow: FA00004P/00/EN |
| Technical Information | <ul style="list-style-type: none"> ■ Cerabar S: TI00383P/00/EN ■ Deltapilot S: TI00416P/00/EN ■ EMC test procedures: TI00241F/00/EN ■ Weld-in adapters, process adapters and flanges: TI00426F/00/EN |
| Special Documentation | Mechanical accessories for pressure measuring devices: SD01553P/00/EN |
| Operating Instructions | <p>4 to 20 mA HART:</p> <ul style="list-style-type: none"> ■ Deltabar S: BA00270P/00/EN ■ Description of Device Functions Cerabar S/Deltabar S/Deltapilot S: BA00274P/00/EN <p>PROFIBUS PA:</p> <ul style="list-style-type: none"> ■ Deltabar S: BA00294P/00/EN ■ Description of Device Functions Cerabar S/Deltabar S/Deltapilot S: BA00296P/00/EN <p>FOUNDATION Fieldbus:</p> <ul style="list-style-type: none"> ■ Deltabar S: BA00301P/00/EN ■ Description of Device Functions Cerabar S/Deltabar S/Deltapilot S: BA00303P/00/EN |
| Brief Operating Instructions | <ul style="list-style-type: none"> ■ 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 |
| Overfill protection | WHG: ZE00259P/00/DE |
| Safety Instructions (XA) | Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions. |

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

| Directive | Electronic insert | Documentation | Option ¹⁾ |
|--------------------|---|---------------|----------------------|
| NEPSI Ex ia IIC T6 | 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus | XA00550P | H |
| NEPSI Ex d IIC T6 | 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus | XA00552P | G |

1) Product Configurator, order code for "Approval"

| Directive | Electronic insert | Documentation | Option ¹⁾ |
|-------------------|-------------------|--------------------|----------------------|
| TIIS Ex do IIC T6 | 4 to 20 mA HART | TC18007 TC18008 | L |

1) Product Configurator, order code for "Approval"

| Directive | Electronic insert | Documentation | Option ¹⁾ |
|----------------------------|---|---------------|----------------------|
| INMETRO Ex ia IIC T6 Ga/Gb | 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus | XA01318P | J |
| INMETRO Ex d IIC T6 Gb | 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus | XA01281P | O |
| INMETRO Ex ta IIIC Da/Db | 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus | XA01316P | Z |

1) Product Configurator, order code for "Approval"

Installation/Control

Drawings

| Directive | 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 | 4 to 20 mA HART | XA01058P | S |
| | PROFIBUS PA, FOUNDATION Fieldbus | XA01060P | |
| FM/CSA IS + XP Cl.I Div.1 Gr.A-D, FM/CSA: Zone 1,2 | 4 to 20 mA HART | XA00591P XA01196P | Q |
| | PROFIBUS PA, FOUNDATION Fieldbus | XA00590P XA01198P | |
| FM DIP Cl.II,III Div.1 Gr.E-G, Zone 21,22 | 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 | 4 to 20 mA HART | ZD00142P | U |
| | PROFIBUS PA, FOUNDATION Fieldbus | ZD00189P | |
| FM IS + XP Cl.I Div.1 Gr.A-D, Zone 1,2 | 4 to 20 mA HART | XA01196P | C |
| | PROFIBUS PA, FOUNDATION Fieldbus | XA01198P | |
| FM NI Cl.I Div.2 Gr.A-D, Zone 2 | 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus | XA01064P | R |
| FM XP Cl.I Div.1 Gr.A-D, AEx d, Zone 1,2 | 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus | XA01071P | T |
| CSA C/US IS + XP Cl.I Div.1 Gr.A-D, Zone 1,2 | 4 to 20 mA HART | ZD00153P | D |
| | PROFIBUS PA, FOUNDATION Fieldbus | ZD00191P | |
| 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.II Div.1 Gr.A-G/B-GFM/CSA: Zone 1,2 | 4 to 20 mA HART | XA00242P ZD00153P XA01196P | F |
| | PROFIBUS PA, FOUNDATION Fieldbus | XA00242P XA01198P ZD00191P | |
| CSA C/US XP Cl.I Div.1 Gr.B-D, Ex d, Zone 1,2 | 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus | ZD00229P | V |
| CSA C/US Cl.II, III Div.1 Gr.E-G | 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus | CSA1509834 | W |
| CSA C/US General Purpose | 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus | - | Z |

1) Product Configurator, order code for "Approval"



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