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Technical Information
Deltabar PMD78B

Differential pressure, level and flow measurement in liquids or gases

Digital differential pressure transmitter with metal process membrane

Applications

- Pressure measuring ranges: up to 40 bar (600 psi)
- Process temperatures: up to 400 °C (752 °F) with diaphragm seal
- Static pressure: up to 160 bar (2 400 psi)
- Accuracy: up to ±0.075%

Advantages

The new Deltabar generation introduces a robust pressure transmitter that combines numerous benefits: Easiest local or remote operation, allows condition-based maintenance and offers smart safety in processes. The firmware is designed to ensure extremely easy handling. Intuitive and clear wizard navigation guides the user through the commissioning and verification of the device. The Bluetooth connectivity provides safe and remote operation. The large display with backlight guarantees excellent readability. The Heartbeat Technology software package offers an on-demand verification and monitoring function to detect undesired anomalies. These undesired anomalies include dynamic pressure shocks or changes in the supply voltage, for example. Capillary tubes attenuate the pressure shocks.

Endress+Hauser
People for Process Automation

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About this document

Symbols

Safety symbols

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.

NOTICE

This symbol contains information on procedures and other facts which do not result in personal injury.

Electrical symbols

Ground connection: ⏚

Terminal for connection to the grounding system.

Symbols for certain types of information

Permitted: ✓

Procedures, processes or actions that are permitted.

Forbidden: ✗

Procedures, processes or actions that are forbidden.

Additional information: ℹ

Reference to documentation: 📖

Reference to page: 📄

Series of steps: 1., 2., 3.

Result of an individual step: ↳

Symbols in graphics

Item numbers: 1, 2, 3 ...

Series of steps: 1., 2., 3.

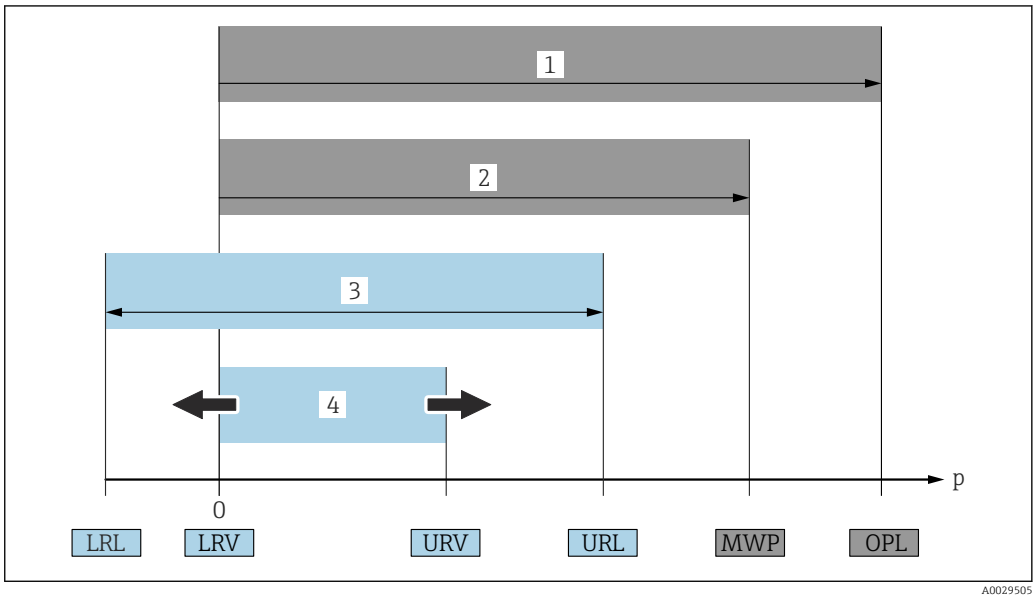
Views: A, B, C, ...

Symbols on the device

Safety instructions: ⚠ → 📖

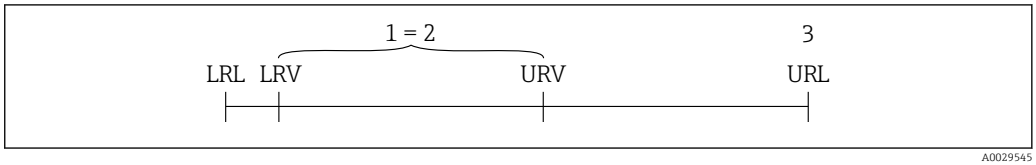
Observe the safety instructions contained in the associated Operating Instructions.

List of abbreviations



1 *OPL: The OPL (overpressure limit = measuring cell overload limit) for the 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. Pay attention to the pressure/temperature dependency.*
2 *The MWP (maximum working pressure) for the measuring cells 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. Pay attention to the pressure/temperature dependency. The MWP may be applied at the device for an unlimited period of time. The MWP can be found on the nameplate.*
3 *The maximum measuring range corresponds to the span between the LRL and URL. This measuring range is equivalent to the maximum calibratable/adjustable span.*
4 *The calibrated/adjusted span corresponds to the span between the 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. Example - see the following section.

Turn down calculation



1 *Calibrated/adjusted span*
2 *Zero point-based span*
3 *Upper range limit*

Example:
- Measuring cell: 16 bar (240 psi)
- Upper range limit (URL) = 16 bar (240 psi)
- Calibrated/adjusted span: 0 to 8 bar (0 to 120 psi)
- Lower range value (LRV) = 0 bar (0 psi)
- Upper range value (URV) = 8 bar (120 psi)

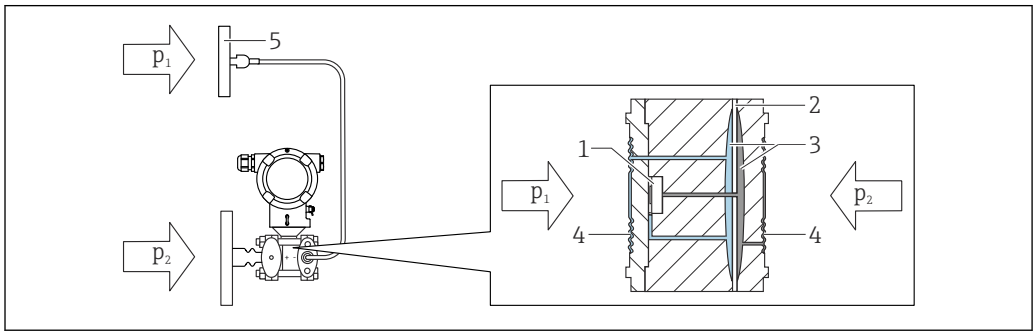
$$TD = \frac{URL}{|URV - LRV|}$$

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

Function and system design

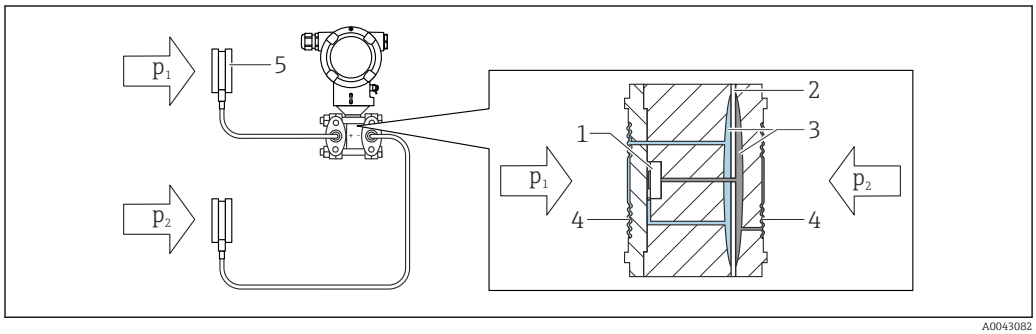
Measuring principle

Measuring cell for differential pressure with metallic membrane



1 *Capillary on the second side (P1) is optional*

1 *Measuring element*
2 *Middle diaphragm*
3 *Fill fluid*
4 *Internal membrane*
5 *Membrane of the diaphragm seal*
p_1 *Pressure 1*
p_2 *Pressure 2*



1 *Measuring element*
2 *Middle diaphragm*
3 *Fill fluid*
4 *Internal membrane*
5 *Membrane of the diaphragm seal*
p_1 *Pressure 1*
p_2 *Pressure 2*

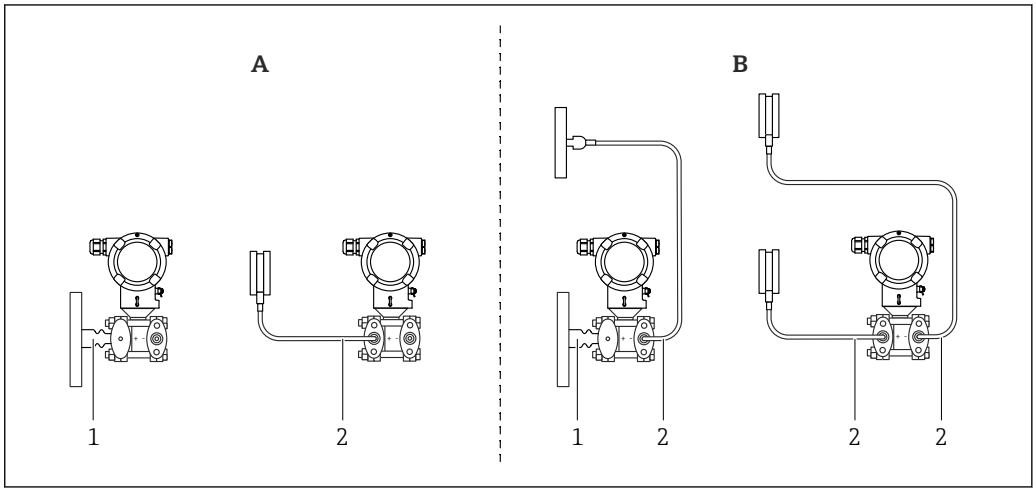
The pressures applied are transferred from the membrane of the diaphragm seal to the internal membrane of the measuring cell by means of an incompressible fill fluid. This causes a deflection of the membranes on both sides. A second fill fluid transfers the pressure to a side of the measuring element where a resistance bridge is located (semiconductor technology). The change in the bridge output voltage, which depends on the differential pressure, is measured and processed further.

Applications for diaphragm seals

Diaphragm seal systems are used if the process and the device need to be separated. Diaphragm seal systems offer clear advantages in the following instances:
- In the case of extreme process temperatures - through the use of temperature isolators or capillaries
- In the case of strong vibrations - decouple the process from the device by using a capillary
- In the case of aggressive or corrosive media - through the use of high-durability membrane materials
- In the case of media that crystallize or contain solids - through the choice of suitable coatings
- In the case of heterogeneous and fibrous process media
- If extreme measuring point cleaning is necessary, or in the event of very damp mounting locations
- For mounting locations that are difficult to access

Measuring system

Device versions



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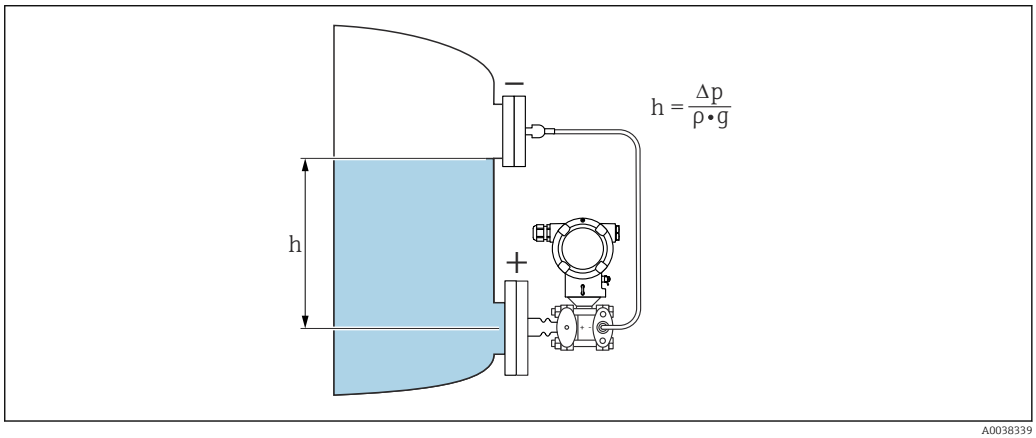
A Diaphragm seal, one side
1 With temperature isolator on HP side
2 With capillary on HP side
B Diaphragm seal, both sides
1 With temperature isolator on HP side and with capillary on LP side
2 With capillary on HP side and with capillary on LP side

Level measurement (volume and mass):

Diaphragm seal with temperature isolator on both sides



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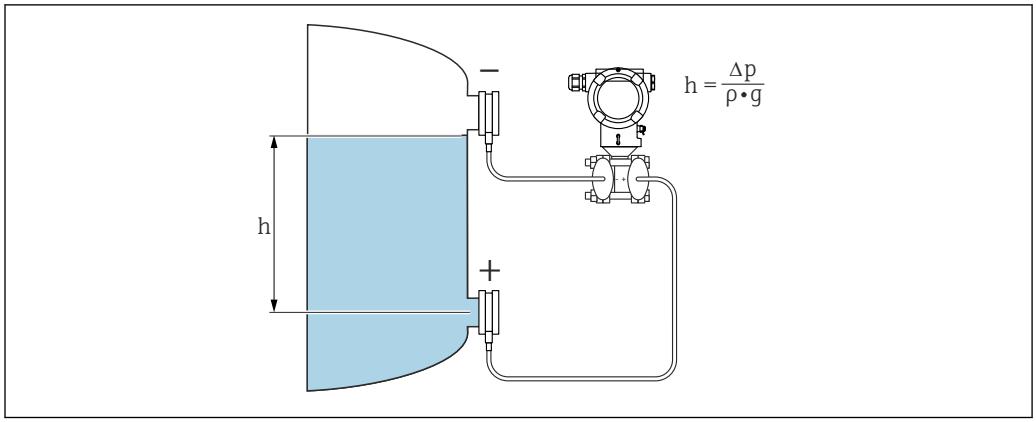
h Height (level)
Δp Differential pressure
ρ Density of the medium
g Gravitational acceleration

Diaphragm seal on both sides with capillary



h *Height (level)*
Δp *Differential pressure*
ρ *Density of the medium*
g *Gravitational acceleration*

Advantages:

- Volume and mass measurements in any vessel shape with a freely programmable characteristic curve
- Has a wide range of uses, e.g.:
  - For level measurement in vessels with pressure overlay
  - For foam formation
  - In vessels with agitators or screen fittings
  - For liquid gases
  - For standard level measurement

Communication and data processing

- 4 to 20 mA with HART communication protocol
- Bluetooth (optional)

Dependability for devices with HART, Bluetooth

IT security

Endress+Hauser can only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings. IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

Device-specific IT security

The device offers specific functions to support protective measures by the operator. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. An overview of the most important functions is provided in the following section:

- Write protection via hardware write protection switch
- Access code to change the user role (applies for operation via display, Bluetooth, or FieldCare, DeviceCare, Asset Management Tools (e.g. AMS, PDM)

Input

Measured variable

Measured process variables

Differential pressure

Measuring range

Depending on the device configuration, the maximum working pressure (MWP) and the overpressure limit (OPL) can deviate from the values in the tables.

PN 160 / 16 MPa / 2400 psi

Measuring cell	Maximum measuring range		Smallest calibratable span (preset at factory) [1]
	lower (LRL)	upper (URL)	
[mbar (psi)]	[mbar (psi)]	[mbar (psi)]	[mbar (psi)]
100 (1.5)	−100 (-1.5)	+100 (+1.5)	5 (0.075)
500 (7.5)	−500 (-7.5)	+500 (+7.5)	5 (0.075)
3000 (45)	−3000 (-45)	+3000 (+45)	30 (0.45)
16000 (240)	−16000 (-240)	+16000 (+240)	160 (2.4)
40000 (600)	−40000 (-600)	+40000 (+600)	400 (6)

1) Turn down > 100:1 on request

PN 160 / 16 MPa / 2400 psi

Measuring cell	Burst pressure [1] [2]	MWP [3]	OPL	
			[bar (psi)]	on both sides
[mbar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]
100 (1.5)	690 (10005)	160 (2400)	160 (2400)	240 (3600)
500 (7.5)	690 (10005)	160 (2400)	160 (2400)	240 (3600)
3000 (45)	690 (10005)	160 (2400)	160 (2400)	240 (3600)
16000 (240)	690 (10005)	160 (2400)	160 (2400)	240 (3600)
40000 (600)	690 (10005)	160 (2400) [4]	"+" side: 160 (2400) "–" side: 100 (1500)	240 (3600)

1) Applies for the process seal materials FKM, PTFE, FFKM, EPDM and for pressure applied at both sides.
2) If the side vent valves (sv) and PTFE seal option is selected, the burst pressure is 600 bar (8 700 psi)
3) MWP depends on the selected process connection.
4) If pressure is applied on the negative side only, the MWP is 100 bar (1 500 psi).

Minimum static pressure

- Minimum static pressure: 50 mbar (0.75 psi)$_{abs}$
  Observe the pressure and temperature application limits of the selected fill fluid
- Observe the pressure and temperature application limits of the selected fill fluid
- Vacuum applications: pay attention to the installation instructions

Output

Output signal

Current output

4 to 20 mA with superimposed digital communication protocol HART, 2-wire

The current output offers a choice of three different operating modes:
- 4.0 to 20.5 mA
- NAMUR NE 43: 3.8 to 20.5 mA (factory setting)
- US mode: 3.9 to 20.8 mA

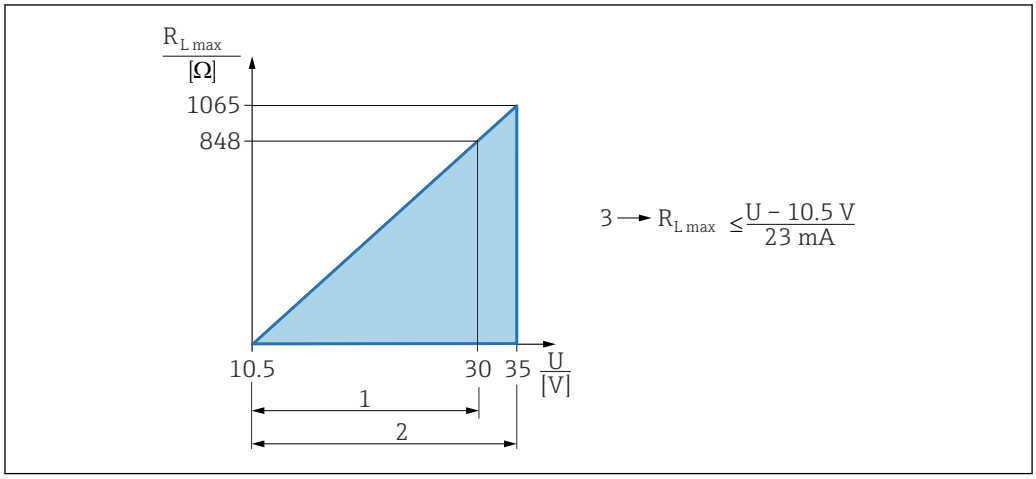
Signal on alarm

Signal on alarm in accordance with NAMUR recommendation NE 43.

4 to 20 mA HART:
Options:
- Max alarm: can be set from 21.5 to 23 mA
- Min. alarm: < 3.6 mA (factory setting)

Load

4 to 20 mA HART



1 Power supply 10.5 to 30 VDC Ex i
2 Power supply 10.5 to 35 VDC, for other types of protection and non-certified device versions
3 R_{Lmax} maximum load resistance
U Supply voltage

Operation via handheld terminal or PC with operating program: take minimum communication resistance of 250 Ω into consideration.

Damping

A damping affects all outputs (output signal, display). Damping can be enabled as follows:
- Via the onsite display, Bluetooth, handheld terminal or PC with operating program, continuous from 0 to 999 seconds
- Factory setting: 1 s

Ex connection data

See the separate technical documentation (Safety Instructions (XA)) on www.endress.com/download.

Linearization

The device's linearization function allows the user to convert the measured value to any units of height or volume. User-defined linearization tables of up to 32 value pairs can be entered if necessary.

Protocol-specific data

HART

- Manufacturer ID: 17 (0x11{hex})
- Device type ID: 0x1131
- Device revision: 1
- HART specification: 7

- DD revision: 1
- Device description files (DTM, DD) information and files at:
  - www.endress.com
  - www.fieldcommgroup.org
- HART load: min. 250 Ohm

HART device variables (preset at the factory)

The following measured values are assigned to the device variables at the factory:

Device variable	Measured value
Primary variable (PV) [1]	Pressure [2]
Secondary variable (SV)	Sensor temperature
Tertiary variable (TV)	Electronic temperature
Quaternary variable (QV)	Sensor pressure [3]

1) The PV is always applied to the current output.
2) The pressure is the calculated signal after damping and position adjustment.
3) The Sensor pressure is the raw signal of the measuring cell before damping and position adjustment.

Choice of HART device variables

- **Pressure** option (after position adjustment and damping)
- Scaled variable
- Sensor temperature
- Sensor pressure
  Sensor Pressure is the raw signal from sensor before damping and position adjustment.
- Electronics temperature
- Terminal current
  The terminal current is the read-back current on terminal block.
- Terminal voltage 1
  Visibility depends on order options or device settings
- **Noise of pressure signal** option and **Median of pressure signal** option
  Visible if Heartbeat Technology ordered
- Percent of range
- Loop current
  The loop current is the output current set by the applied pressure.

Supported functions

- Burst mode
- Additional transmitter status
- Device locking

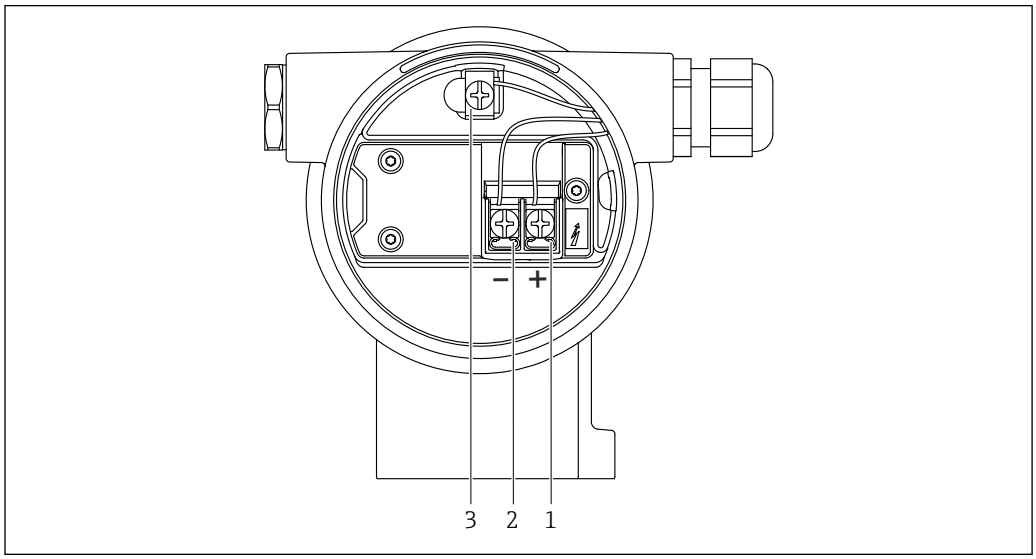
Wireless HART data

- Minimum starting voltage: 10.5 V
- Start-up current: 3.6 mA
- Start-up time: <5 s
- Minimum operating voltage: 10.5 V
- Multidrop current: 4 mA

Power supply

Terminal assignment

Dual compartment housing



2 *Connection terminals and ground terminal in the connection compartment*

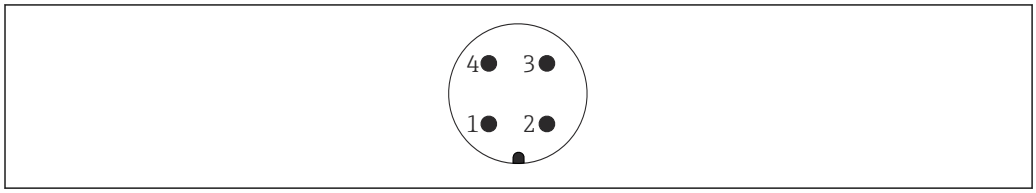
1 *Positive terminal*
2 *Negative terminal*
3 *Internal ground terminal*

Available device plugs

In the case of devices with a plug, it is not necessary to open the housing for connection purposes.

Use the enclosed seals to prevent the penetration of moisture into the device.

Devices with M12 plug



3 *View of the plug-in connection on the device*

Pin	HART
1	Signal +
2	Not assigned
3	Signal −
4	Ground

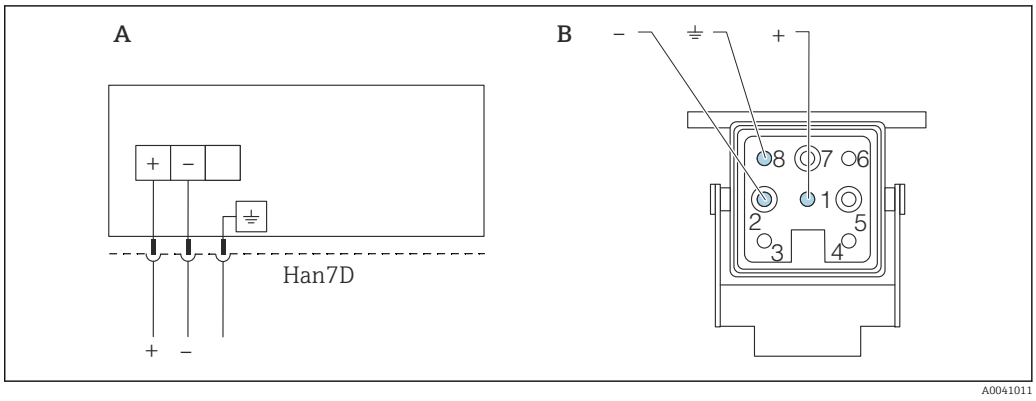
Endress+Hauser offers the following accessories for devices with an M12 plug:

Plug-in jack M 12x1, straight
- Material:
  Body: PBT; union nut: nickel-plated die-cast zinc; seal: NBR
- Degree of protection (fully locked): IP67
- Order number: 52006263

Plug-in jack M 12x1, elbowed
- Material:
  Body: PBT; union nut: nickel-plated die-cast zinc; seal: NBR
- Degree of protection (fully locked): IP67
- Order number: 71114212

Cable 4x0.34 mm² (20 AWG) with M12 plug-in jack, elbowed, screw plug, length 5 m (16 ft)
- Material: body: TPU; union nut: nickel-plated die-cast zinc; cable: PVC
- Degree of protection (fully locked): IP67/68
- Order number: 52010285
- Cable colors
  - 1 = BN = brown
  - 2 = WT = white
  - 3 = BU = blue
  - 4 = BK = black

Devices with a Harting plug Han7D



A Electrical connection for devices with Harting plug Han7D
B View of the plug-in connection on the device
- Brown
⏚ Green/yellow
+ Blue

Material: CuZn, gold-plated contacts of the plug-in jack and plug

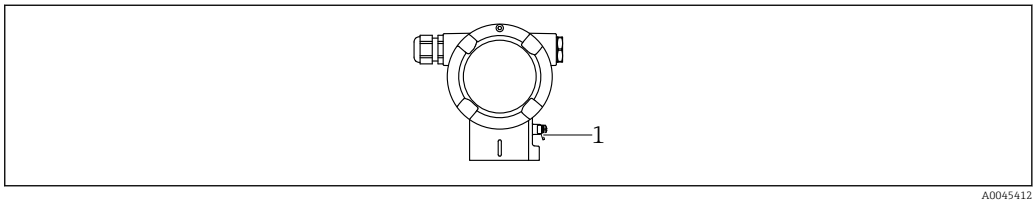
Supply voltage

- Analog/HART: Ex d, Ex e, non-Ex: supply voltage: 10.5 to 35 V_{DC}
- Analog/HART: Ex i: supply voltage: 10.5 to 30 V_{DC}
- HART: Nominal current: 4 to 20 mA HART

Analog/HART: The power unit must be tested to ensure it meets safety requirements (e.g., PELV, SELV, Class 2) and must comply with the relevant protocol specifications. The requirements for 4 to 20 mA are the same as those for HART.

A suitable circuit breaker should be provided for the device in accordance with IEC/EN 61010.

Potential equalization



1 Ground terminal for connecting the potential matching line

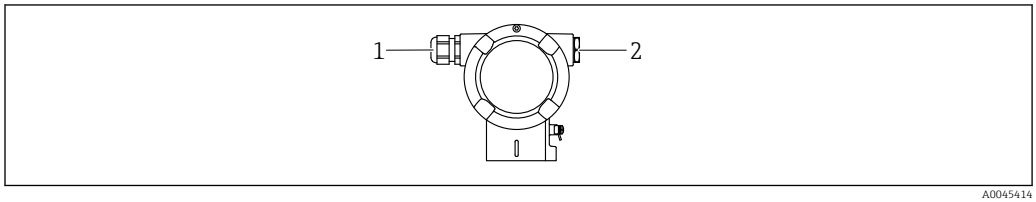
If necessary, the potential matching line can be connected to the outer ground terminal of the device before the device is connected.

For optimum electromagnetic compatibility:
- Keep the potential matching line as short as possible
- Maintain a cross-section of at least 2.5 mm² (14 AWG)

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



1 Cable entry
2 Dummy plug

The type of cable entry depends on the device version ordered.

Always route connecting cables downwards so that moisture cannot penetrate the connection compartment.

If necessary, create a drip loop or use a weather protection cover.

Cable specification

- The cable outer diameter depends on the cable entry used
- Cable outer diameter
  - Plastic: Ø5 to 10 mm (0.2 to 0.38 in)
  - Nickel-plated brass: Ø7 to 10.5 mm (0.28 to 0.41 in)
  - Stainless steel: Ø7 to 12 mm (0.28 to 0.47 in)

Overvoltage protection

Devices without optional overvoltage protection

Equipment from Endress+Hauser fulfills the requirements of the product standard IEC / DIN EN 61326-1 (Table 2 Industrial Environment).

Depending on the type of port (DC power supply, input/output port) different testing levels according to IEC / DIN EN 61326-1 against transient overvoltages (Surge) are applied (IEC / DIN EN 61000-4-5 Surge):
Test level on DC power ports and input / output ports is 1000 V line to earth

Devices with optional overvoltage protection

- Spark-over voltage: min. 400 V DC
- Tested according to IEC / DIN EN 60079-14 sub chapter 12.3 (IEC / DIN EN 60060-1 chapter 7)
- Nominal discharge current: 10 kA

Overvoltage category

Overvoltage category II

Performance characteristics

Response time

- HART: acyclic: min. 330 ms, typically 590 ms (depends on commands and number of preambles)
- HART: cyclic (burst): min. 160 ms, typically 350 ms (depends on commands and number of preambles)

Reference operating conditions

- As per IEC 62828-2
- Ambient temperature T_A = constant, in the range of +22 to +28 °C (+72 to +82 °F)
- Humidity φ = constant, in the range of: 5 to 80 % rF ± 5 %
- Ambient pressure p_A = constant, in the range of: 860 to 1060 mbar (12.47 to 15.37 psi)
- Position of the measuring cell: horizontal ±1°
- Input of LOW SENSOR TRIM and HIGH SENSOR TRIM for lower range value and upper range value
- Membrane material: AISI 316L (1.4435)
- Supply voltage: 24 V DC ±3 V DC
- Load with HART: 250 Ω
- Turn down (TD) = URL/ | URV - LRV |
- Zero based span

Total performance

The performance characteristics refer to the accuracy of the device. The factors influencing accuracy can be divided into two groups

- Total performance of device
- Installation factors

All performance characteristics are in conformance with ≥ ± 3 sigma.

The total performance of the device comprises the reference accuracy and the ambient temperature effect and is calculated using the following formula:

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

E1 = Reference accuracy

E2 = Ambient temperature effect

E3 = Static pressure effect

Influence of diaphragm seal (calculation performed with Applicator "Sizing Diaphragm Seal")

Calculation of E2:

Ambient temperature effect per ±28 °C (50 °F)

(corresponds to the range from −3 to +53 °C (+27 to +127 °F))

$E2 = E2_M + E2_E$

$E2_M$ = Main temperature error

$E2_E$ = Electronics error

- The values apply to membranes made of 316L (1.4435)
- The values refer to the calibrated span.

Calculation of the total performance with the Endress+Hauser Applicator

Detailed inaccuracies, e.g. for other temperature ranges, can be calculated with the Applicator "Sizing Pressure Performance".

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Calculation of the diaphragm seal error with the Endress+Hauser Applicator

Diaphragm seal errors are not taken into consideration. They are calculated separately in the Applicator "Sizing Diaphragm Seal".

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Reference accuracy [E1]

The reference accuracy comprises the non-linearity according to the limit point method, pressure hysteresis and non-repeatability in accordance with [IEC62828-1 / IEC 61298-2]. Reference accuracy for standard up to TD 100:1.

Diaphragm seal on one side with temperature isolator

Measuring cell	Standard	Platinum
100 mbar (1.5 psi)	TD 1:1 to 5:1 = ±0.10 % TD > 5:1 = ±0.02 % · TD	not available
500 mbar (7.5 psi)	TD 1:1 to 15:1 = ±0.075 % TD > 15:1 = ±(0.0015 % · TD + 0.053 %)	not available
3 bar (45 psi) 16 bar (240 psi) 40 bar (600 psi)	TD 1:1 to 15:1 = ±0.075 % TD > 15:1 = ±(0.0015 % · TD + 0.053 %)	not available

Version "Diaphragm seal one side or two sides with capillary" or version "Diaphragm seal with temperature isolator on HP side and with capillary on LP side"

Measuring cell	Standard	Platinum
100 mbar (1.5 psi)	TD 1:1 to 5:1 = ±0.15 % TD > 5:1 = ±0.03 % · TD	not available
500 mbar (7.5 psi)	TD 1:1 to 5:1 = ±0.15 % TD > 5:1 = ±0.03 % · TD	not available
3 bar (45 psi) 16 bar (240 psi) 40 bar (600 psi)	TD 1:1 to 15:1 = ±0.1 % TD > 15:1 = ±(0.006 % · TD + 0.01 %)	not available

Temperature effect [E2]

$E2_M$ - Main temperature error

The output changes due to the effect of the ambient temperature [IEC 62828-1 / IEC 61298-3] with respect to the reference temperature [IEC 62828-1]. The values specify the maximum error due to min./max. ambient or process temperature conditions.

100 mbar (1.5 psi) measuring cell
±(0.07 % · TD + 0.07 %)

500 mbar (7.5 psi) measuring cell
±(0.03 % · TD + 0.017 %)

3 bar (45 psi), 16 bar (240 psi) and 40 bar (600 psi) measuring cell
±(0.012 % · TD + 0.017 %)

$E2_E$ - Electronics error

- 4 to 20 mA: 0.05 %
- Digital output HART: 0 %

$E3_M$ - Main static pressure error

The static pressure effect refers to the effect on the output due to changes in the static pressure of the process (difference between the output at each static pressure and the output at atmospheric pressure [IEC 62828-2 / IEC 61298-3] and therefore the combination of the influence of the operating pressure on the zero point and the span).

100 mbar (1.5 psi) measuring cell
Standard
- Influence on the zero point: ±0.203 % · TD per 70 bar (1 050 psi)
- Influence on the span: ±0.15 % per 70 bar (1 050 psi)

500 mbar (7.5 psi) measuring cell
Standard
- Influence on the zero point: ±0.07 % · TD per 70 bar (1 050 psi)
- Influence on the span: ±0.10 % per 70 bar (1 050 psi)

3 bar (45 psi) measuring cell
Standard
- Influence on the zero point: ±0.049 % · TD per 70 bar (1 050 psi)
- Influence on the span: ±0.05 % per 70 bar (1 050 psi)

16 bar (240 psi) and 40 bar (600 psi) measuring cell
Standard
- Influence on the zero point: ±0.049 % · TD per 70 bar (1 050 psi)
- Influence on the span: ±0.02 % per 70 bar (1 050 psi)

Resolution

Current output: <1 µA

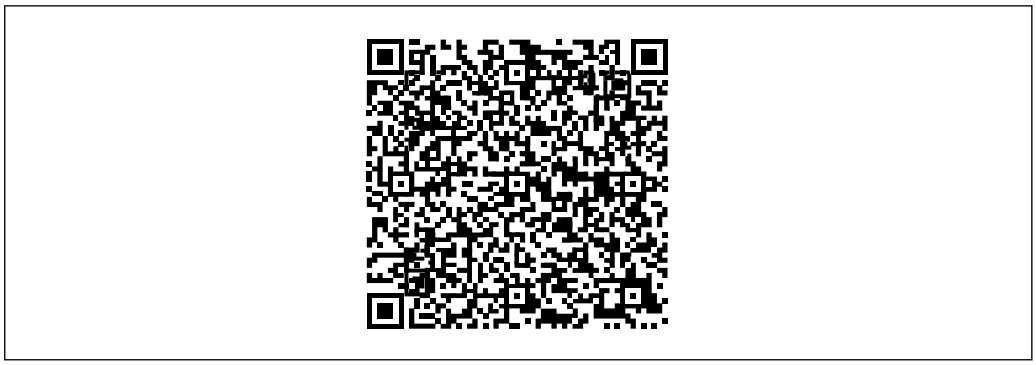
Total error

The total error of the device comprises the total performance and the long-term stability effect and is calculated using the following formula:

Total error = total performance + long-term stability

Calculation of the total error with the Endress+Hauser Applicator

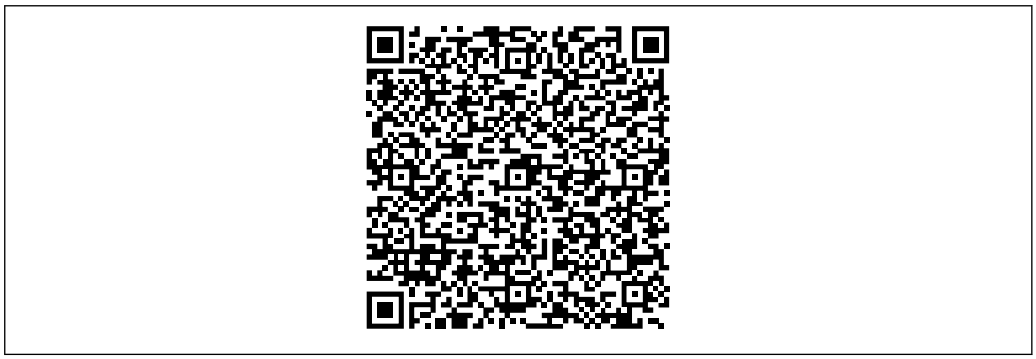
Detailed inaccuracies, e.g. for other temperature ranges, can be calculated with the Applicator "Sizing Pressure Performance".



A0038927

Calculation of the diaphragm seal error with the Endress+Hauser Applicator

Diaphragm seal errors are not taken into consideration. They are calculated separately in the Applicator "Sizing Diaphragm Seal".



A0038925

Long-term stability

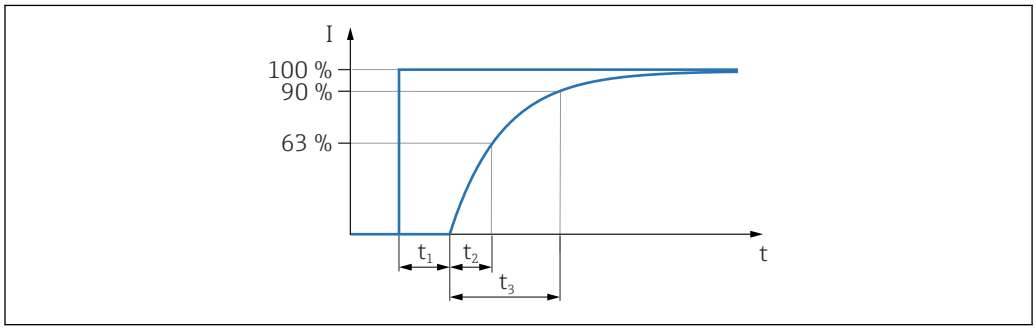
100 mbar (1.5 psi) measuring cell
- 1 year: ±0.08 %
- 5 years: ±0.12 %
- 10 years: ±0.20 %
- 15 years: ±0.28 %

500 mbar (7.5 psi), 3 bar (45 psi), 16 bar (240 psi) and 40 bar (600 psi) measuring cell
- 1 year: ±0.025 %
- 5 years: ±0.05 %
- 10 years: ±0.10 %
- 15 years: ±0.15 %

Response time T63 and T90

Dead time, time constant

Representation of dead time and time constant as per IEC62828-1:



A0019786

Dynamic behavior, current output

Depends on the diaphragm seal. Calculate in the Applicator.

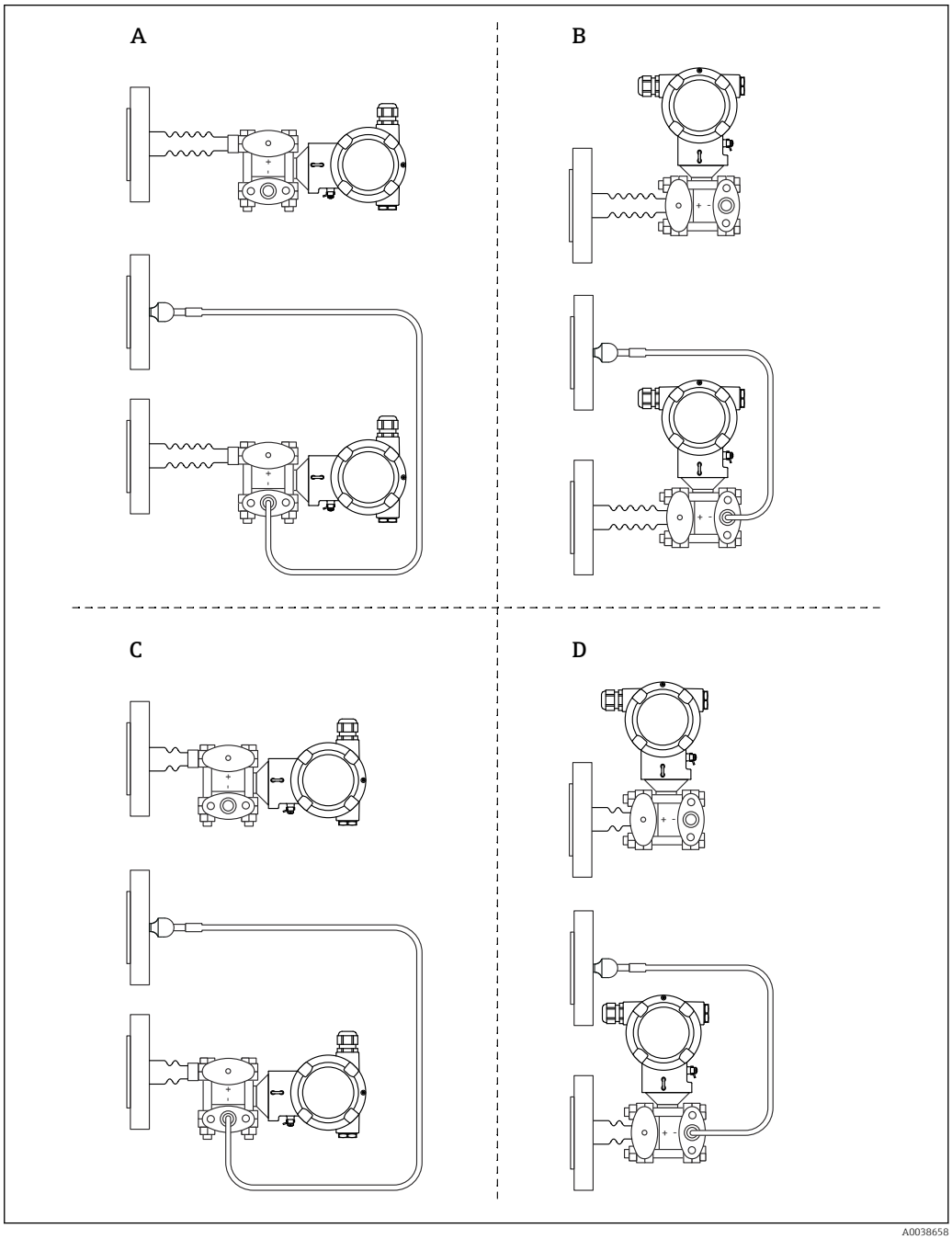
Warm-up time (according to IEC62828-4)

≤5 s

Installation

Orientation

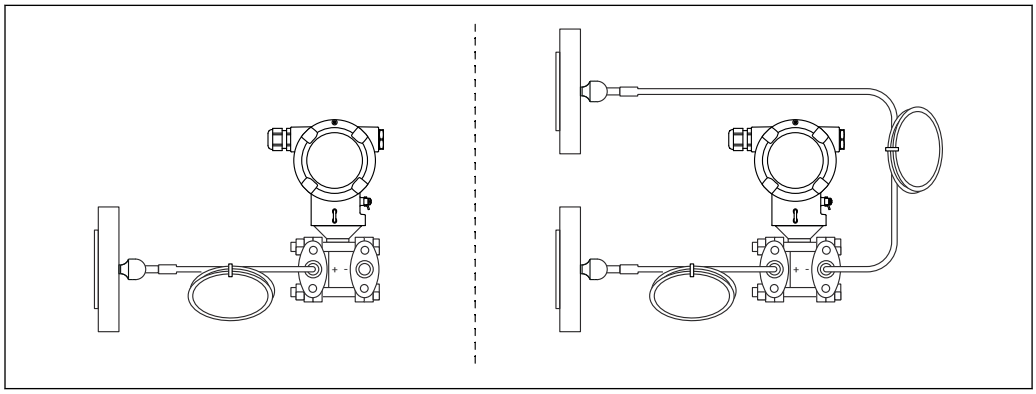
Diaphragm seal on one side or both sides with temperature isolator



A Design HP side: Transmitter horizontal, temperature isolator long
B Design HP side: Transmitter vertical, temperature isolator long
C Design HP side: Transmitter horizontal, temperature isolator short
D Design HP side: Transmitter vertical, temperature isolator short

Diaphragm seal on one side or both sides with capillary

In vacuum applications, mount the pressure transmitter below the lower diaphragm seal.



A0039528

Use "Sizing Diaphragm Seal" for the installation check.

Order options:
- ..... m capillary, 316L (standard capillary armor)
- ..... m capillary, PVC-coated capillary armor on 316L
- ..... m capillary, PTFE-jacketed capillary armor on 316L
- ..... ft capillary, 316L (standard capillary armor)
- ..... ft capillary, PVC-coated capillary armor on 316L
- ..... ft capillary, PTFE-jacketed capillary armor on 316L

Installation instructions for devices with diaphragm seals

General information

A diaphragm seal together with the transmitter form a closed, calibrated system, which has been filled through openings in the diaphragm seal and in the transmitter's measurement system. These openings 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. Perform zero adjustment if necessary. If a measuring cell with a small measuring range is selected, a position adjustment can cause the measuring cell to go over range (position adjustment due to zero point offset, caused by the orientation of the fill fluid liquid column).

For devices with a capillary, use a suitable bracket (mounting bracket) for mounting.

When mounting, sufficient strain relief must be provided for the capillary to prevent the capillary from bending (capillary bending radius ≥ 100 mm (3.94 in)).

Mount the capillary so that it is vibration-free (in order to avoid additional pressure fluctuations).

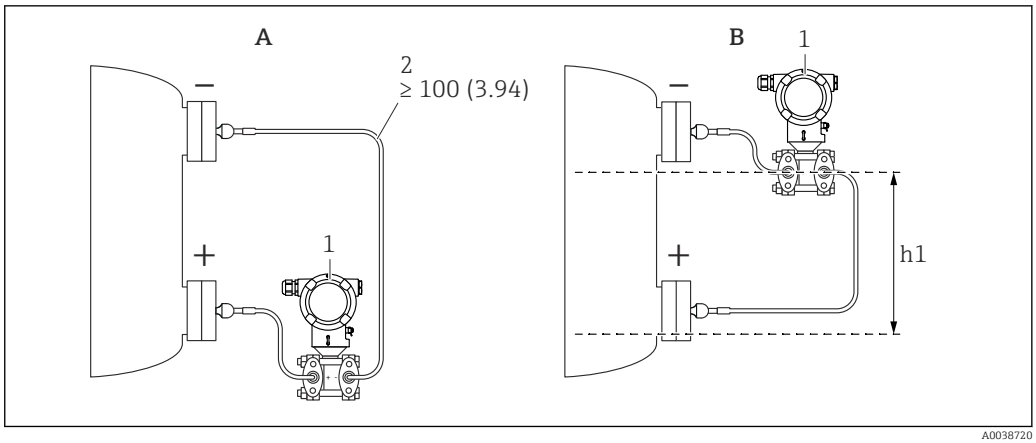
Do not mount capillaries in the vicinity of heating or cooling lines and protect them against direct sunlight.

More detailed installation instructions are provided in the Applicator "Sizing Diaphragm Seal".

Vacuum applications

In vacuum applications, mount the pressure transmitter below the diaphragm seal. This prevents additional vacuum loading of the diaphragm seal caused by the presence of fill fluid in the capillary.

If the pressure transmitter is mounted above the diaphragm seal, do not exceed the maximum height difference h1. The height difference h1 is shown in the Applicator "Sizing Diaphragm Seal".



Unit of measurement mm (in)

A Recommended installation in a vacuum application
B Installation above the lower diaphragm seal
h1 Height difference (is shown in the Applicator "Sizing Diaphragm Seal")
1 Device
2 Bending radius ≥ 100 mm (3.94 in). Ensure strain relief to prevent the capillary from bending.

The maximum height difference depends on the density of the fill fluid and the lowest absolute pressure that can ever occur at the diaphragm seal (empty vessel).

Information on cleaning

Endress+Hauser provides flushing rings as an accessory to enable the membrane to be cleaned without removing the transmitter from the process.

For more information: contact the Endress+Hauser sales office.

Sensor selection and arrangement

Level measurement

Level measurement in an open vessel, diaphragm seal on one side with temperature isolator

- Mount the device directly on the vessel
- The negative side is open to atmospheric pressure

Level measurement in a closed vessel, diaphragm seal on one side with temperature isolator

- Mount the device directly on the vessel
- Always connect the piping on the negative side above the maximum level

Level measurement in a closed vessel, diaphragm seal on one side or both sides with capillary

Mount the device below the lower diaphragm seal

Level measurement is only guaranteed between the upper edge of the lower diaphragm seal and the lower edge of the upper diaphragm seal.

Level measurement in a closed vessel with superimposed vapor, diaphragm seal on one side with temperature isolator

- Mount the device directly on the vessel
- Always connect the piping on the negative side above the maximum level
- The condensate trap ensures constant pressure on the negative side
- When measuring in media with solid parts (such as dirty liquids) installing separators and drain valves is useful for capturing and removing sediment

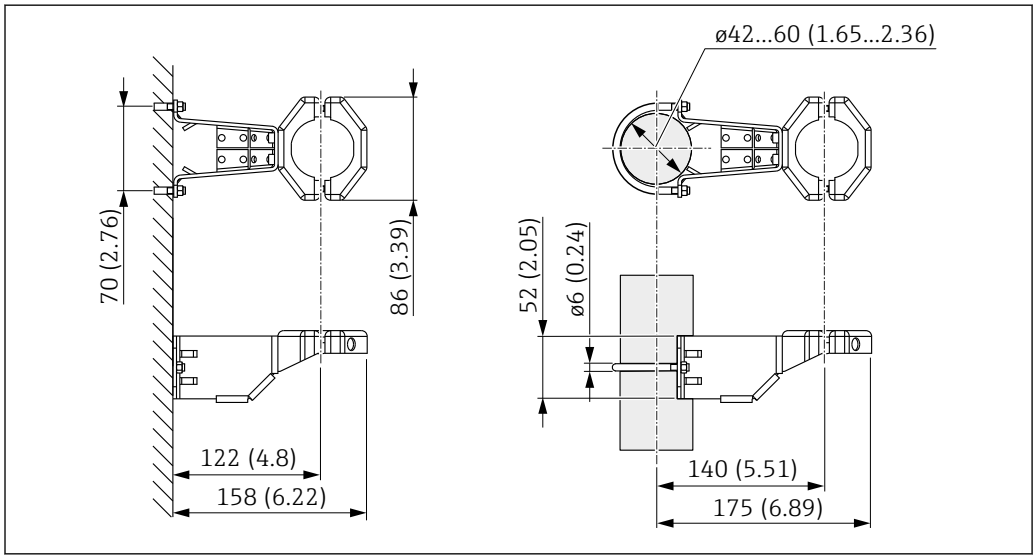
Differential pressure measurement

Differential pressure measurement in gases, vapors and liquids, diaphragm seal on one side or two sides with capillary

- Mount diaphragm seals with capillaries on pipes at the top or side
- In vacuum applications, mount the device below the measuring point

Mounting bracket for separate housing

The separate housing can be mounted on walls or pipes (for pipes with a diameter of 1 ¼" to 2") using the mounting bracket.



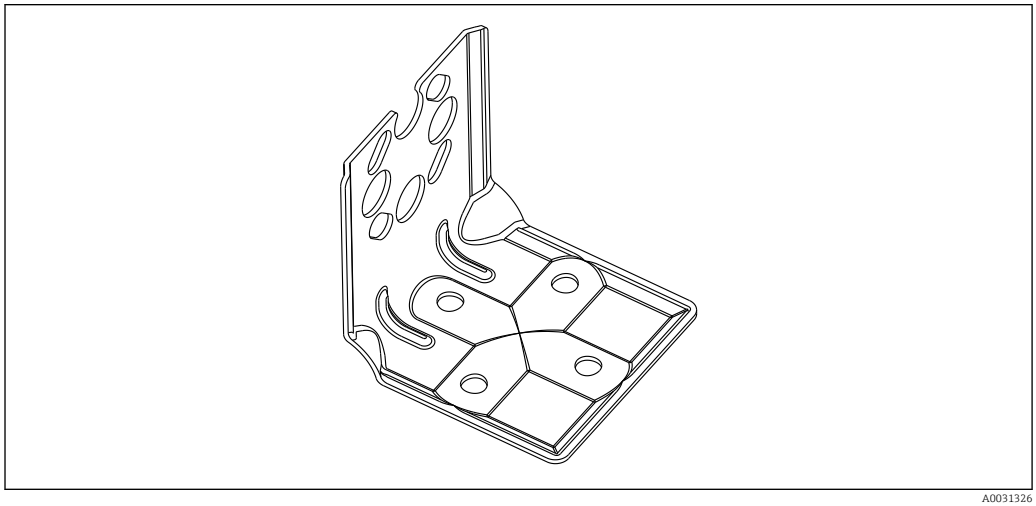
Unit of measurement mm (in)

Ordering information:
Can be ordered as a separate accessory, part number 71102216

The mounting bracket is included in the delivery if you order the device with a separate housing.

Wall and pipe mounting

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



- 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 depends on the order code

For technical data (e.g. materials, dimensions or order numbers), see the accessory document SD01553P.

Special mounting instructions

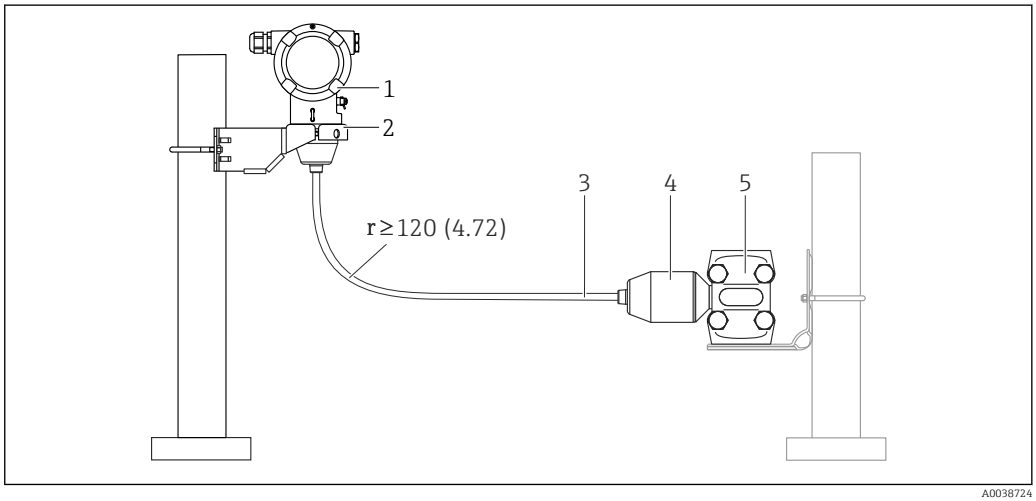
Sensor, remote (separate housing)

The device housing (including the electronic insert) is mounted at a distance from the measuring point.

This version therefore facilitates trouble-free measurement:
- Under particularly difficult measuring conditions (at installation locations that are cramped or difficult to access)
- If the measuring point is exposed to vibrations

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

The sensor is delivered with the process connection and cable already mounted. The housing (including the electronic insert) 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 (including the electronic insert) and the sensor.



1 Sensor, remote (including electronic insert)
2 Mounting bracket enclosed, suitable for wall or pipe mounting
3 Cable, both ends are fitted with a socket
4 Process connection adapter
5 Process connection with sensor

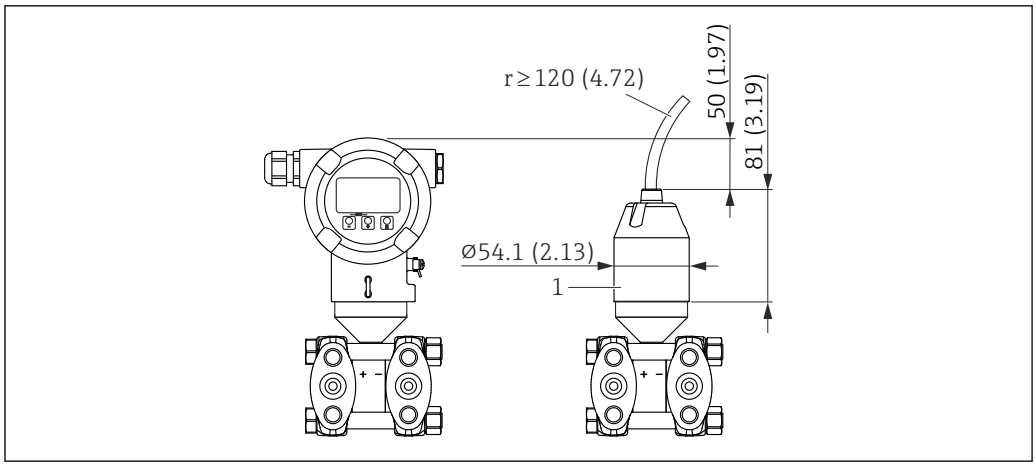
Ordering information:
- Remote sensor (including electronic insert) including the mounting bracket can be ordered via the Product Configurator
- The mounting bracket can also be ordered as a separate accessory, part number 71102216

Technical data for cables:
- Minimum bending radius: 120 mm (4.72 in)
- Cable extraction force: max. 450 N (101.16 lbf)
- Resistance to UV light

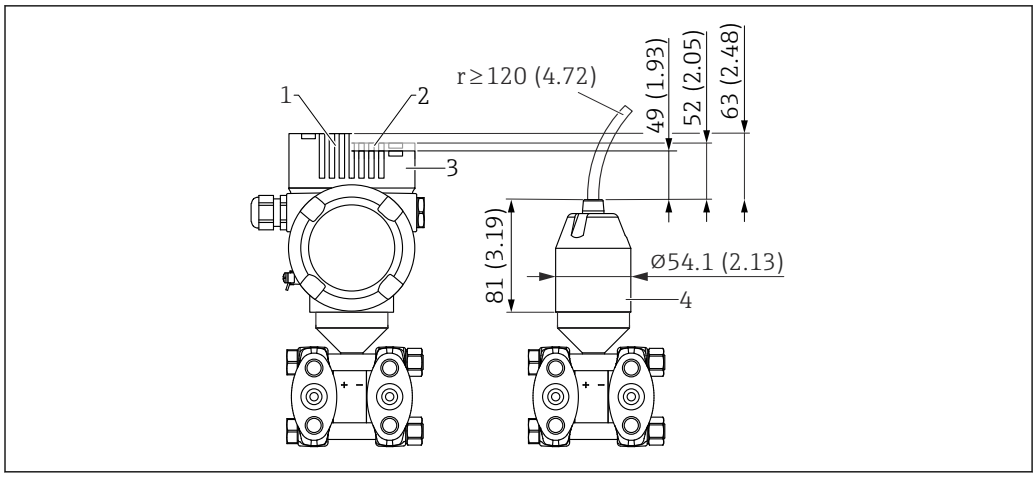
Use in hazardous area:
- Intrinsically safe installations (Ex ia/IS)
- FM/CSA IS for Div. 1 installation only

Reduction of installation height

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



1 Process connection adapter



1 Device with display, cover with glass viewing window (devices for Ex d, dust Ex)
2 Device with display, cover with plastic viewing window
3 Device without display, cover without viewing window
4 Process connection adapter

Environment

Ambient temperature range

The following values apply up to a process temperature of +85 °C (+185 °F). At higher process temperatures, the permitted ambient temperature is reduced.

- Without segment display or graphic display:
  - Standard: −40 to +85 °C (−40 to +185 °F)
  - Optionally available: −50 to +85 °C (−58 to +185 °F) with restricted operating life and performance
  - Optionally available: −54 to +85 °C (−65 to +185 °F); below −50 °C (−58 °F): devices can be permanently damaged
- With segment display or graphic display: −40 to +85 °C (−40 to +185 °F) with limitations in optical properties such as display speed and contrast. Can be used without limitations up to −20 to +60 °C (−4 to +140 °F)
  Segment display: up to −50 to +85 °C (−58 to +185 °F) with restricted operating life and performance
- Devices with PVC-coated capillary armor: −25 to +80 °C (−13 to +176 °F)
- Separate housing: −20 to +60 °C (−4 to +140 °F)

Applications with very high temperatures: use either a diaphragm seal on one side with a temperature isolator, or a diaphragm seal on one side or both sides with a capillary. Use a mounting bracket!

If vibrations additionally occur in the application: use a device with a capillary.

Hazardous area

- For devices for use in hazardous areas, see the Safety Instructions, Installation Drawing or Control Drawing
- Devices that have the most common explosion protection certificates (e.g. ATEX/ IEC Ex, etc.) can be used in explosive atmospheres with an ambient temperature of −54 to +85 °C (−65 to +185 °F) (optionally available). The functionality of the explosion protection Ex ia is guaranteed for ambient temperatures to −50 °C (−58 °F) (optionally available).
  At temperatures ≤ −50 °C (−58 °F), explosion protection is guaranteed by the housing in the case of flameproof enclosure (Ex d) type of protection. The functionality of the transmitter cannot be fully guaranteed. The Ex ia capability can no longer be guaranteed.

Storage temperature

- Without LCD display:
  - Standard: −40 to +90 °C (−40 to +194 °F)
  - Optionally available: −50 to +90 °C (−58 to +194 °F) with restricted operating life and performance
  - Optionally available: −54 to +90 °C (−65 to +194 °F); below −50 °C (−58 °F): Ex d devices can be permanently damaged
- With LCD display: −40 to +85 °C (−40 to +185 °F)
- Separate housing: −40 to +60 °C (−40 to +140 °F)

With M12 plug, elbowed: −25 to +85 °C (−13 to +185 °F)

Devices with PVC-coated capillary armor: −25 to +90 °C (−13 to +194 °F)

Operating altitude

Up to 5 000 m (16 404 ft) above sea level.

Climate class

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

Condensation is possible.

Atmosphere

Operation in very corrosive environment

For corrosive environments (e.g. maritime environment / coastal areas), Endress+Hauser recommends the use of a PVC-coated capillary armor or a PTFE capillary armor for capillaries and the stainless steel housing. The transmitter can be additionally protected by a special coating (**T**echnical **S**pecial **P**roduct (TSP)).

Degree of protection

Test as per IEC 60529 and NEMA 250-2014

Housing and process connection

IP66/68, TYPE 4X/6P

(IP68: (1.83 mH_2O for 24 h))

Cable entries

- Gland M20, plastic, IP66/68 TYPE 4X/6P
- Gland M20, brass nickel plated, IP66/68 TYPE 4X/6P
- Gland M20, 316L, IP66/68 TYPE 4X/6P
- Thread M20, IP66/68 TYPE 4X/6P
- Thread G1/2, IP66/68 TYPE 4X/6P
  If the G1/2 thread is selected, the device is delivered with an M20 thread as standard and a G1/2 adapter is included with the delivery, along with the corresponding documentation
- Thread NPT1/2, IP66/68 TYPE 4X/6P
- Dummy plug transport protection: IP22, TYPE 2
- Plug HAN7D, 90 deg. IP65 NEMA Type 4X
- Plug M12
  When housing is closed and connecting cable is plugged in: IP66/67 NEMA Type 4X
  When housing is open or connecting cable is not plugged in: IP20, NEMA Type 1

NOTICE

Plug M12 and plug HAN7D: incorrect mounting can invalidate the IP protection class!

- ▶ The degree of protection only applies if the connecting cable used is plugged in and screwed tight.
- ▶ The degree of protection only applies if the connecting cable used is specified according to IP67 NEMA Type 4X.
- ▶ The IP protection classes are only maintained if the dummy cap is used or the cable is connected.

Process connection and process adapter when using the separate housing

FEP cable

- IP69 (on sensor side)
- IP66 TYPE 4/6P
- IP68 (1.83 mH_2O for 24 h) TYPE 4/6P

PE cable

- IP69 (on sensor side)
- IP66 TYPE 4/6P
- IP68 (1.83 mH_2O for 24 h) TYPE 4/6P

Vibration resistance

Aluminum dual compartment housing

Mechanical construction	Sine wave oscillation IEC62828-1 / IEC61298-3	Shock
Device with temperature isolator	10 Hz to 60 Hz: ±0.075 mm (0.0030 in) 60 Hz to 500 Hz: 1 g	15 g

Stainless steel dual compartment housing

Mechanical construction	Sine wave oscillation IEC62828-1 / IEC61298-3	Shock
Device with temperature isolator	10 Hz to 60 Hz: ±0.075 mm (0.0030 in) 60 Hz to 500 Hz: 1 g	15 g

Dual compartment housing, L-form

Mechanical construction	Sine wave oscillation IEC62828-1 / IEC61298-3	Shock
Device with temperature isolator [1)]	10 Hz to 60 Hz: ±0.075 mm (0.0030 in) 60 Hz to 500 Hz: 1 g	15 g

1) Use either a device with a temperature isolator or with a capillary in applications with very high temperatures. If vibrations additionally occur in the application, Endress+Hauser recommends the use of a device with a capillary. If a device with a temperature isolator or capillary is used, the device must be mounted with a mounting bracket.

Electromagnetic compatibility (EMC)

- Electromagnetic compatibility as per EN 61326 series and NAMUR recommendation EMC (NE21)
- With regard to the safety function (SIL), the requirements of EN 61326-3-x are satisfied
- Maximum deviation with interference influence: < 0.5% of span with full measuring range (TD 1:1)

For more details refer to the EU Declaration of Conformity.

Process

Process temperature range

NOTICE

The permitted process temperature depends on the process connection, the ambient temperature and the type of approval.

- All the temperature data in this document must be taken into consideration when selecting the device.

Diaphragm seal fill fluid

Fill fluid	P_{abs} = 0.05 bar (0.725 psi) [1]	P_{abs} ≥1 bar (14.5 psi) [2]
Silicone oil	−40 to +180 °C (−40 to +356 °F)	−40 to +250 °C (−40 to +482 °F)
High-temperature oil	−20 to +200 °C (−4 to +392 °F)	−20 to +400 °C (−4 to +752 °F) [3] [4] [5]
Low-temperature oil	−70 to +120 °C (−94 to +248 °F)	−70 to +180 °C (−94 to +356 °F)
Vegetable oil	−10 to +160 °C (+14 to +320 °F)	−10 to +220 °C (+14 to +428 °F)
Inert oil	−40 to +100 °C (−40 to +212 °F)	−40 to +175 °C (−40 to +347 °F) [6] [7]

1) Permitted temperature range at p_{abs} = 0.05 bar (0.725 psi) (observe temperature limits of the device and the system!)
2) Permitted temperature range at p_{abs} ≥1 bar (14.5 psi) (observe temperature limits of the device and the system!)
3) 325 °C (617 °F) at ≥1 bar (14.5 psi) absolute pressure
4) 350 °C (662 °F) at ≥1 bar (14.5 psi) absolute pressure (max. 200 hours)
5) 400 °C (752 °F) at ≥1 bar (14.5 psi) absolute pressure (max. 10 hours)
6) 150 °C (302 °F) at ≥1 bar (14.5 psi) absolute pressure
7) 175 °C (347 °F) at ≥1 bar (14.5 psi) absolute pressure (max. 200 hours)

Fill fluid	Density [1] kg/m³
Silicone oil	970
High-temperature oil	995
Low-temperature oil	940
Vegetable oil	920
Inert oil	1900

1) Density of the diaphragm seal fill fluid at 20 °C (68 °F).

The calculation of the operating temperature range of a diaphragm seal system depends on the fill fluid, capillary length and capillary internal diameter, process temperature and oil volume of the diaphragm seal. Detailed calculations, e.g. for temperature ranges, negative pressure and temperature ranges, are done separately in the Applicator "Sizing Diaphragm Seal".

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Oxygen applications (gaseous)

Oxygen and other gases can react explosively to oils, grease and plastics. The following precautions must be taken:
- All components of the system, such as measuring devices, must be cleaned in accordance with the national requirements.
- Depending on the materials used, a certain maximum temperature and a maximum pressure must not be exceeded with oxygen applications.

The cleaning of the device (not accessories) is offered as an optional service.

- p_{max}: PN of flange, max. 80 bar (1 200 psi)
- T_{max}: 60 °C (140 °F)

Seals

Seal on the LP side (–)	Temperature	Pressure specifications
FKM	–20 to +85 °C (–4 to +185 °F)	-
FKM Cleaned of oil and grease	–10 to +85 °C (+14 to +185 °F)	-
FKM Cleaned for oxygen service	–10 to +60 °C (+14 to +140 °F)	-
FFKM	–10 to +85 °C (+14 to +185 °F)	MWP: 160 bar (2 320 psi)
	–25 to +85 °C (–13 to +185 °F)	MWP: 100 bar (1 450 psi)
EPDM	–40 to +85 °C (–40 to +185 °F)	-
PTFE	–40 to +85 °C (–40 to +185 °F)	PN > 160 bar (2 320 psi) Minimum process temperature: –20 °C (–4 °F)
PTFE Cleaned for oxygen applications	–20 to +60 °C (–4 to +140 °F)	PN > 160 bar (2 320 psi) Minimum process temperature: –20 °C (–4 °F)

- Diaphragm seal and capillary welded: Pay attention to the temperature application limits of the fill fluid
- PMD78B generally OPL on one side 160 bar (2 320 psi), on both sides 240 bar (3 480 psi)
  Lower temperatures on request

Process temperature range (temperature at transmitter)

Diaphragm seal on one side with temperature isolator

- Dependent on design (see "Design" section)
- Dependent on diaphragm seal and fill fluid: –70 to +400 °C (–94 to +752 °F)
- Observe the temperature application limits of the fill fluid.
- Observe the maximum gauge pressure and maximum temperature
- Pay attention to the process temperature range of the seal

Design:
- Transmitter horizontal, temperature isolator long: 400 °C (752 °F)
- Transmitter vertical, temperature isolator long: 300 °C (572 °F)
- Transmitter horizontal, temperature isolator short: 200 °C (392 °F)
- Transmitter vertical, temperature isolator short: 200 °C (392 °F)

Diaphragm seal on one side or both sides with capillary

- Depends on diaphragm seal and fill fluid: –70 °C (–94 °F) up to +400 °C (+752 °F)
- A4 screws of process connection, threaded separator: T_{min} –60 °C (–76 °F)
- Observe the maximum gauge pressure and maximum temperature

Diaphragm seal with tantalum membrane

–70 to +300 °C (–94 to +572 °F)

Devices with PTFE-coated diaphragm seal membrane

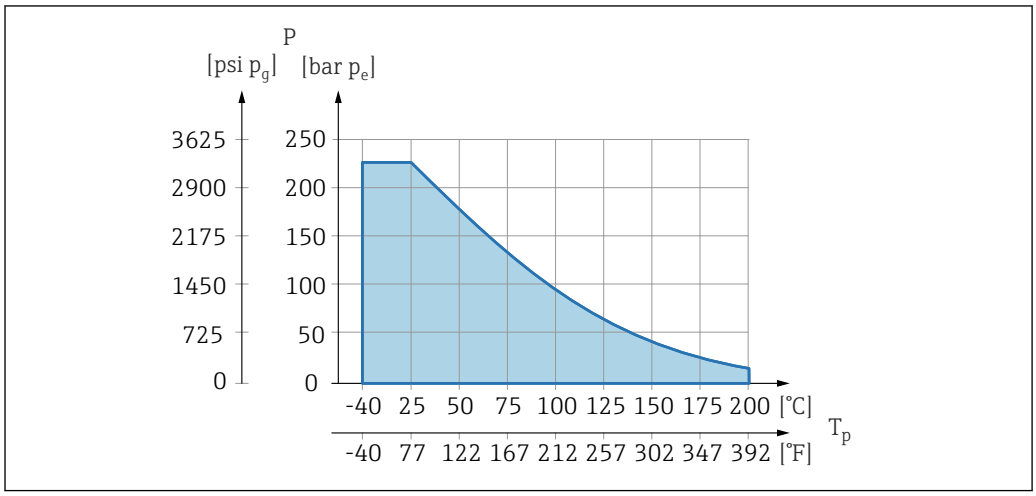
The anti-stick coating has very good anti-friction properties and protects the membrane against abrasive media.

NOTICE

Destruction of the device due to incorrect use of PTFE coating!

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

Area of application of the 0.25 mm (0.01 in) PTFE foil on AISI 316L (1.4404/1.4435) membrane, see the following graphic:



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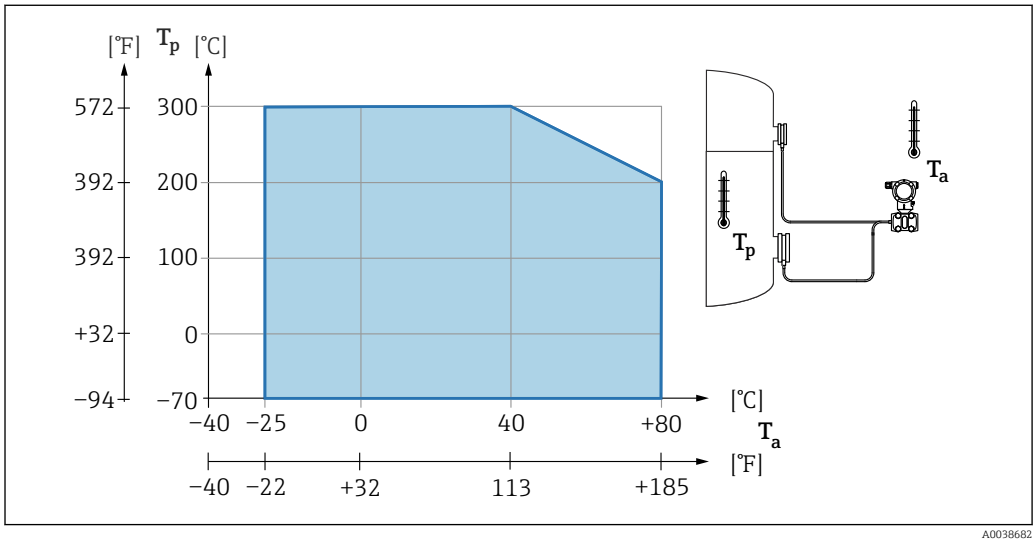
For vacuum applications: $p_{abs} \leq 1$ bar (14.5 psi) to 0.05 bar (0.725 psi) to max.+150 °C (302 °F).

If a PTFE coating has been selected, a conventional membrane is always delivered.

Diaphragm seal capillary armor

Process temperature depending on the ambient temperature.

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



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Process pressure range

Pressure specifications

WARNING

The maximum pressure for the device depends on the lowest-rated component with regard to pressure (components are: process connection, optional mounted parts or accessories).

- Only operate the device within the specified limits for the components!
- MWP (maximum working pressure): The MWP 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. Note temperature dependence of MWP. For flanges, refer to the following standards for the permitted pressure values at higher temperatures: EN 1092-1 (with regard to their stability/ temperature property, the materials 1.4435 and 1.4404 are grouped together under EN 1092-1; the chemical composition of the two materials can be identical.), ASME B 16.5a, JIS B 2220 (the latest version of the standard applies in each case). MWP data that deviate from this are provided in the relevant sections of the Technical Information.
- The overpressure limit is the maximum pressure a device may be subjected to during a test. It is greater than the maximum working pressure by a certain factor. This value refers to a reference temperature of +20 °C (+68 °F).
- The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the device.
- In the case of measuring cell range and process connection combinations where the overpressure limit (OPL) of the process connection is smaller than the nominal value of the measuring cell, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If the entire measuring cell range must be used, select a process connection with a higher OPL value (1.5 x PN; MWP = PN).
- Oxygen applications: do not exceed values for P_{max} and T_{max}.

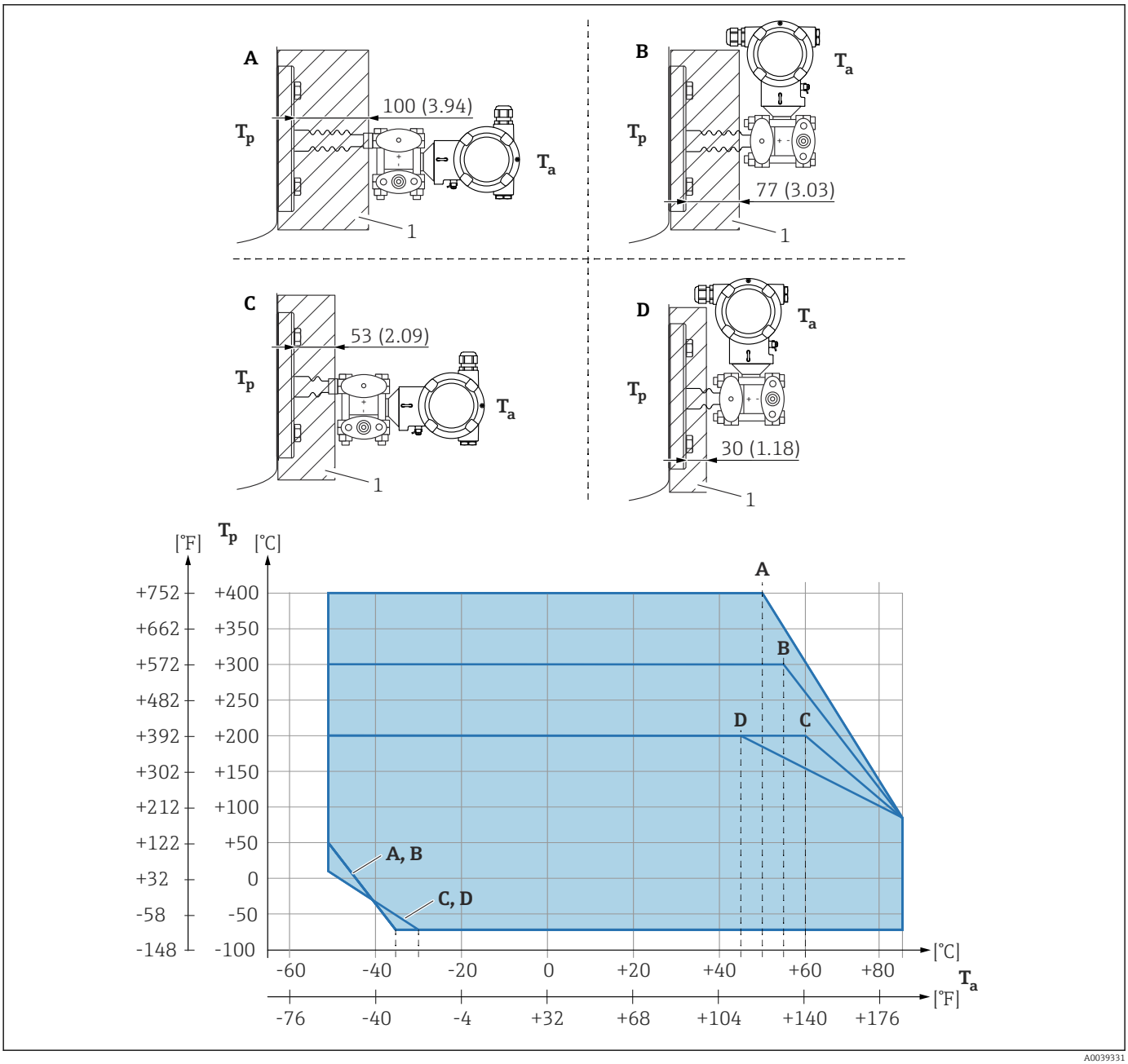
Burst pressure

As of the specified burst pressure, the complete destruction of the pressure-bearing parts and/or a device leak must be expected. It is therefore imperative to avoid such operating conditions by carefully planning and sizing your facility.

Thermal insulation

Thermal insulation when mounting with a temperature isolator

The device may only be insulated up to a certain height. The maximum permitted insulation height applies to an insulation material with a thermal conductivity ≤ 0.04 W/(m x K) and to the maximum permitted ambient temperature and process temperature. The data were determined under the application "quiescent air".



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1 Insulation material
A Transmitter horizontal, temperature isolator long
B Transmitter vertical, temperature isolator long
C Transmitter horizontal, temperature isolator short
D Transmitter vertical, temperature isolator short

Without insulation, the ambient temperature decreases by 5 K.

Item	T_a [1]	T_p [2]
A	50 °C (122 °F)	400 °C (752 °F)
	85 °C (185 °F)	85 °C (185 °F) [3].
	−50 °C (−58 °F)	50 °C (122 °F)
	−35 °C (−31 °F)	−70 °C (−94 °F)
B	55 °C (131 °F)	300 °C (572 °F) [3]
	85 °C (185 °F)	85 °C (185 °F)
	−50 °C (−58 °F)	50 °C (122 °F)

Item	T_a [1]	T_p [2]
	−35 °C (−31 °F)	−70 °C (−94 °F)
C	60 °C (140 °F)	200 °C (392 °F) [3]
	85 °C (185 °F)	85 °C (185 °F)
	−50 °C (−58 °F)	10 °C (50 °F)
	−30 °C (−22 °F)	−70 °C (−94 °F)
D	67 °C (153 °F)	200 °C (392 °F) [3]
	85 °C (185 °F)	85 °C (185 °F)
	−50 °C (−58 °F)	10 °C (50 °F)
	−30 °C (−22 °F)	−70 °C (−94 °F)

1) Maximum ambient temperature at transmitter
2) Maximum process temperature
3) Process temperature: max. +400 °C (+752 °F), depending on the fill fluid used

Ultrapure gas applications

Endress+Hauser also offers devices for special applications, such as for ultrapure gas, that are cleaned of oil and grease. No special restrictions regarding the process conditions apply to these devices.

Hydrogen applications

A **gold-coated** metallic membrane offers universal protection against hydrogen diffusion, both in gas applications and in applications with water-based solutions.

Mechanical construction

For the dimensions, see the Product Configurator: www.endress.com

Search for product → Start configuration → after configuration, click "CAD"

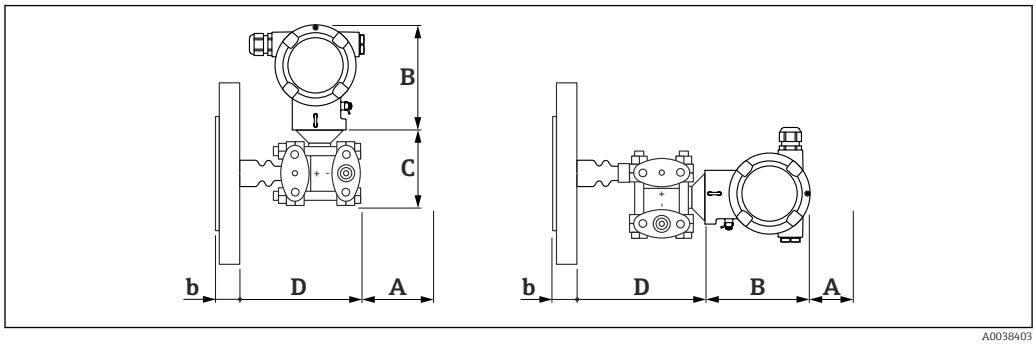
The following dimensions are rounded values. For this reason, the dimensions may deviate from the values on www.endress.com.

Design, dimensions

Device height

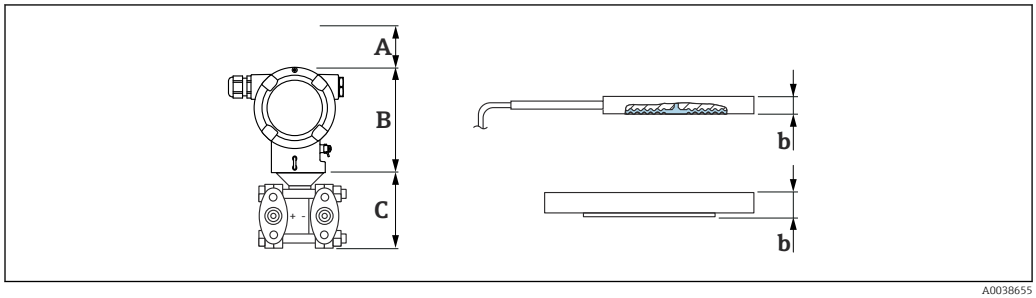
The device height is calculated from
- the height of the housing
- the height of optional mounted parts such as temperature isolators or capillaries
- the height of the individual process connection

The individual heights of the components can be found in the following sections. To calculate the device height, add the individual heights of the components. Take the installation clearance into consideration (space that is used to install the device).



A0038403

A Installation clearance
B Height of the housing
b Height of the process connection
C Height of the sensor assembly
D Width of the mounted parts including sensor assembly

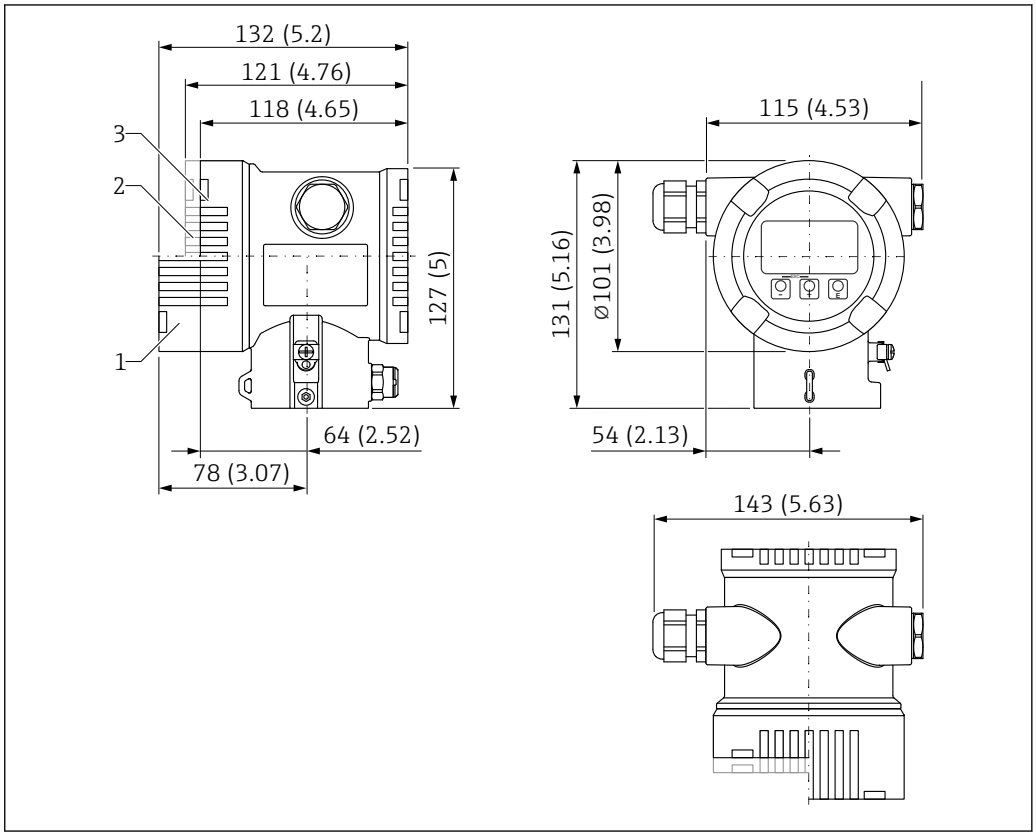


A0038655

A Installation clearance
B Height of housing
C Side flanges
b Process connections

Dimensions

Dual compartment housing

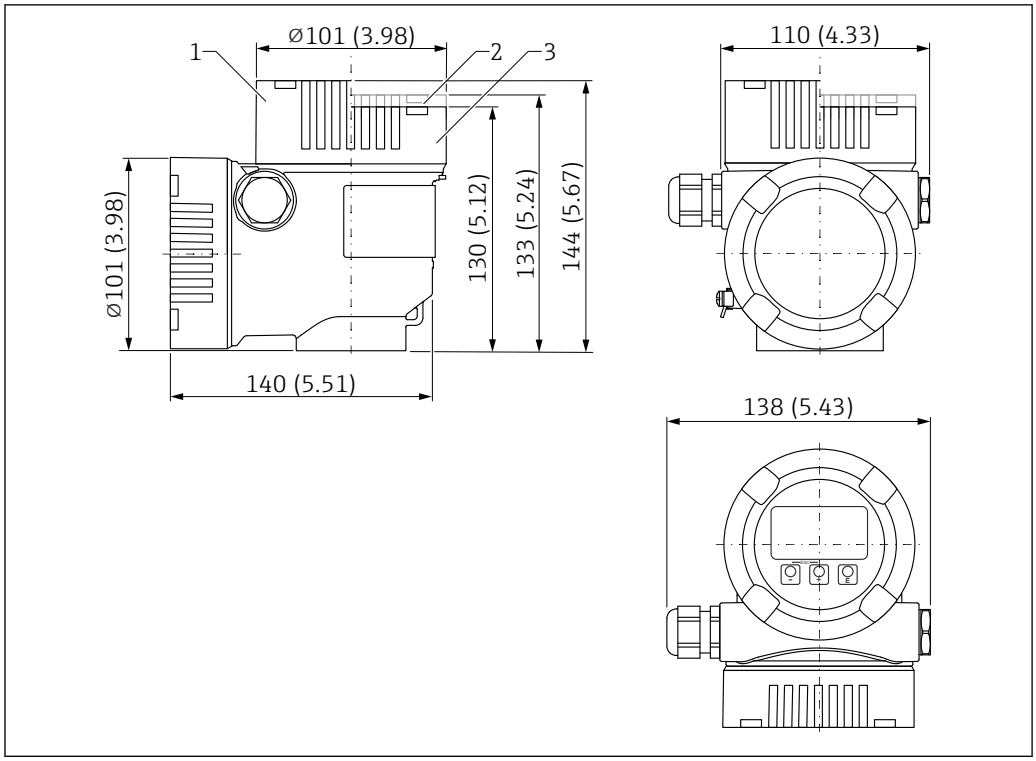


Unit of measurement mm (in)

1 Device with display, cover with glass viewing window (devices for Ex d, dust Ex): 132 mm (5.2 in)
2 Device with display, cover with plastic viewing window: 121 mm (4.76 in)
3 Device without display, cover without viewing window: 118 mm (4.65 in)

Cover optionally with ANSI Safety Red (color RAL3002) coating.

Dual compartment housing, L-form

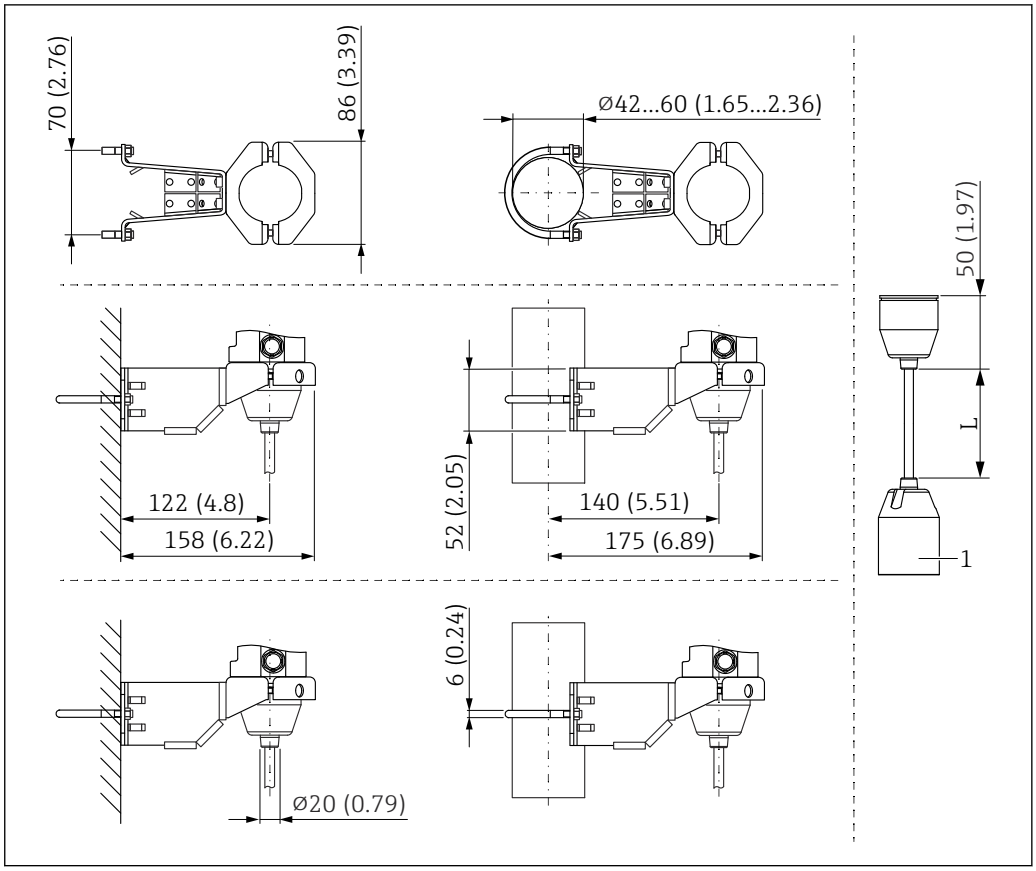


Unit of measurement mm (in)

1 144 mm (5.67 in) height with cover with glass viewing window (devices for Ex d, dust Ex)
2 133 mm (5.24 in) height with cover with plastic viewing window
3 Cover without viewing window

Cover optionally with ANSI Safety Red (color RAL3002) coating.

Sensor, remote (separate housing)



Unit of measurement mm (in)

1 81 mm (3.19 in)
L Length of cable versions

Process connections for devices with temperature isolators

Selecting the process connection and capillary line

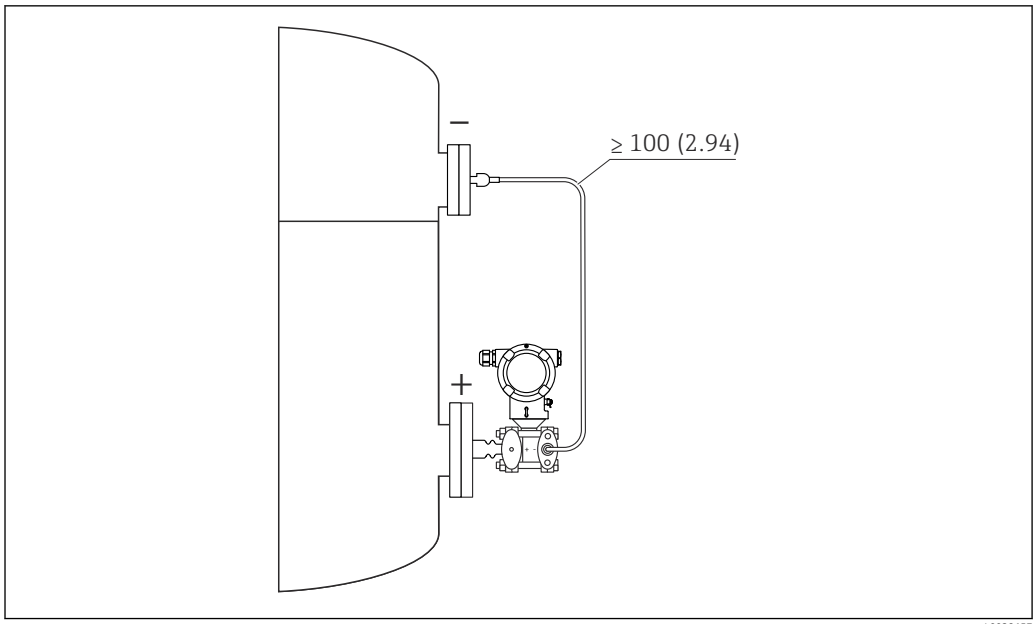
The device can be fitted with different process connections on the high-pressure side (HP) and on the low-pressure side (LP).

The device 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

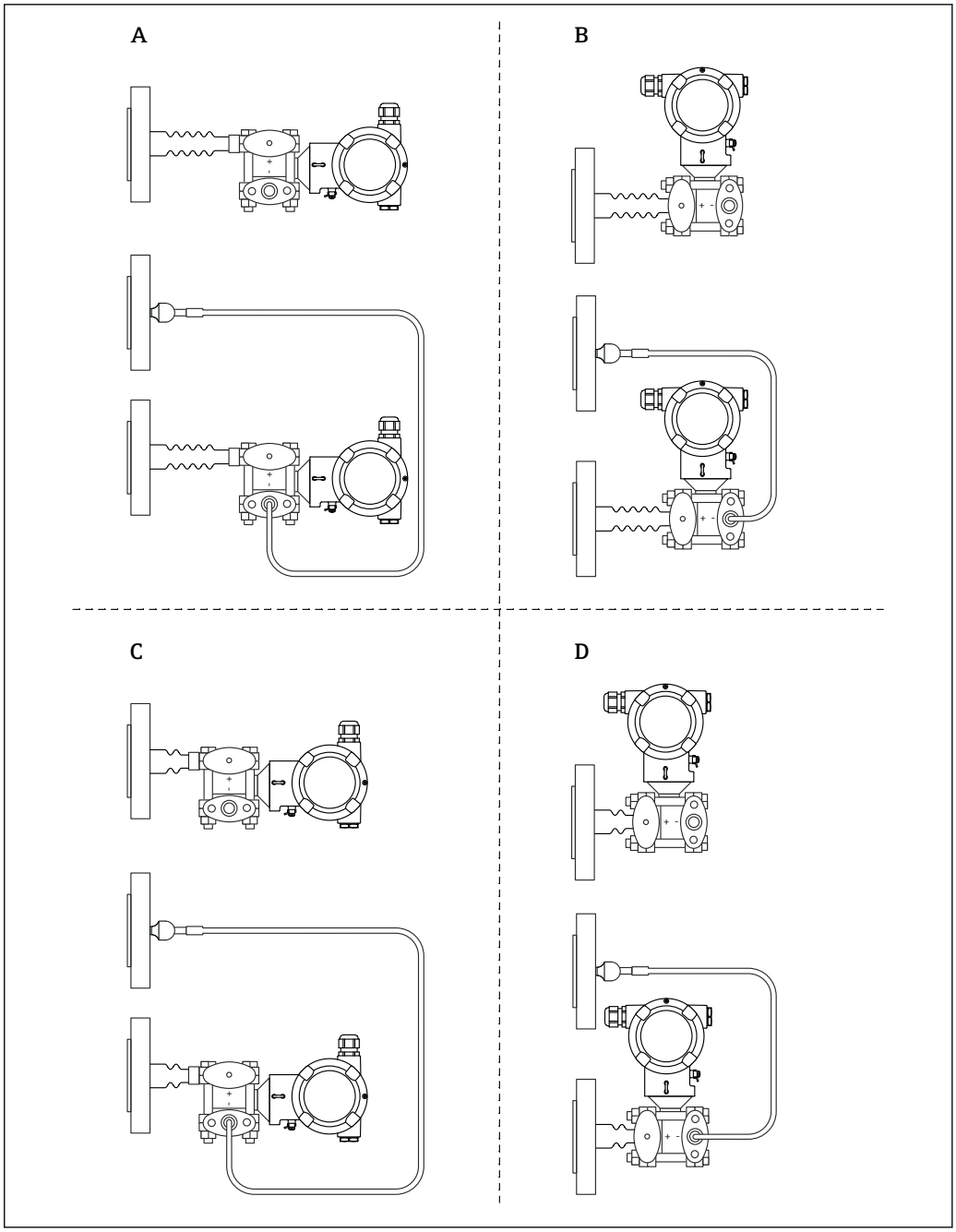
Your benefits:
- Thanks to the variety of order options, the devices can be optimally adapted to the given installation situation
- Reduced costs due to optimum system design
- Easier installation due to adjusted length of capillary line
- Easier adaptation to existing installation situations



Unit of measurement mm (in)

If different process connections and capillary lines are used, it is essential to size and order the device using the free "Sizing Diaphragm Seal" selection tool.

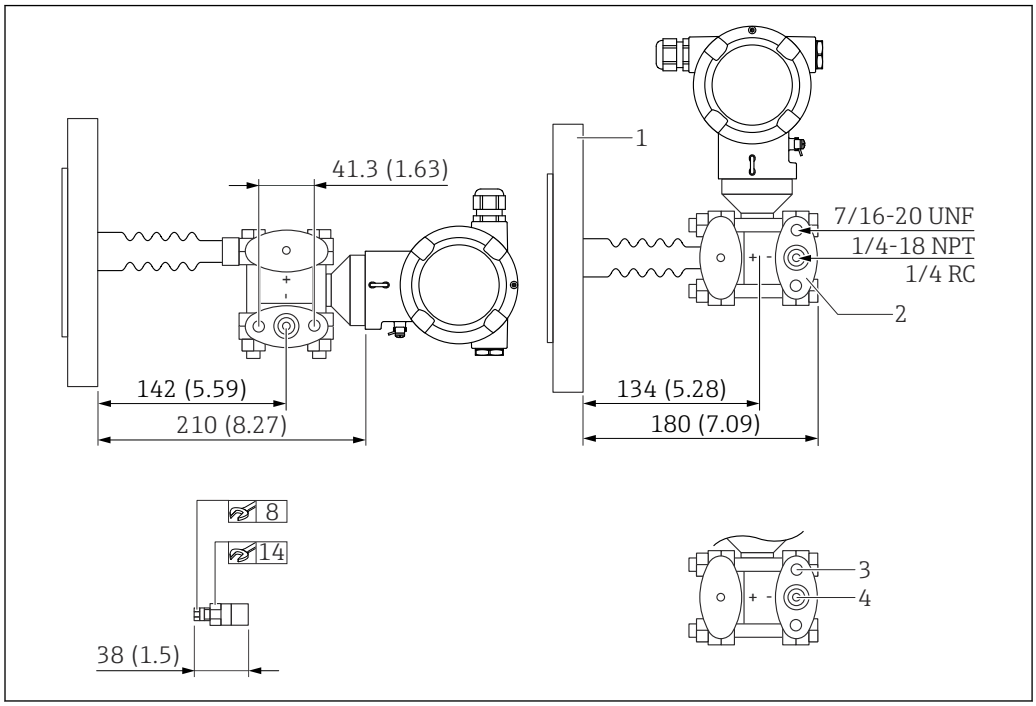
Overview: Diaphragm seal on one side or both sides with temperature isolator



A Transmitter horizontal, temperature isolator long
B Transmitter vertical, temperature isolator long
C Transmitter horizontal, temperature isolator short
D Transmitter vertical, temperature isolator short

Process connections with diaphragm seal on one side, high-pressure side

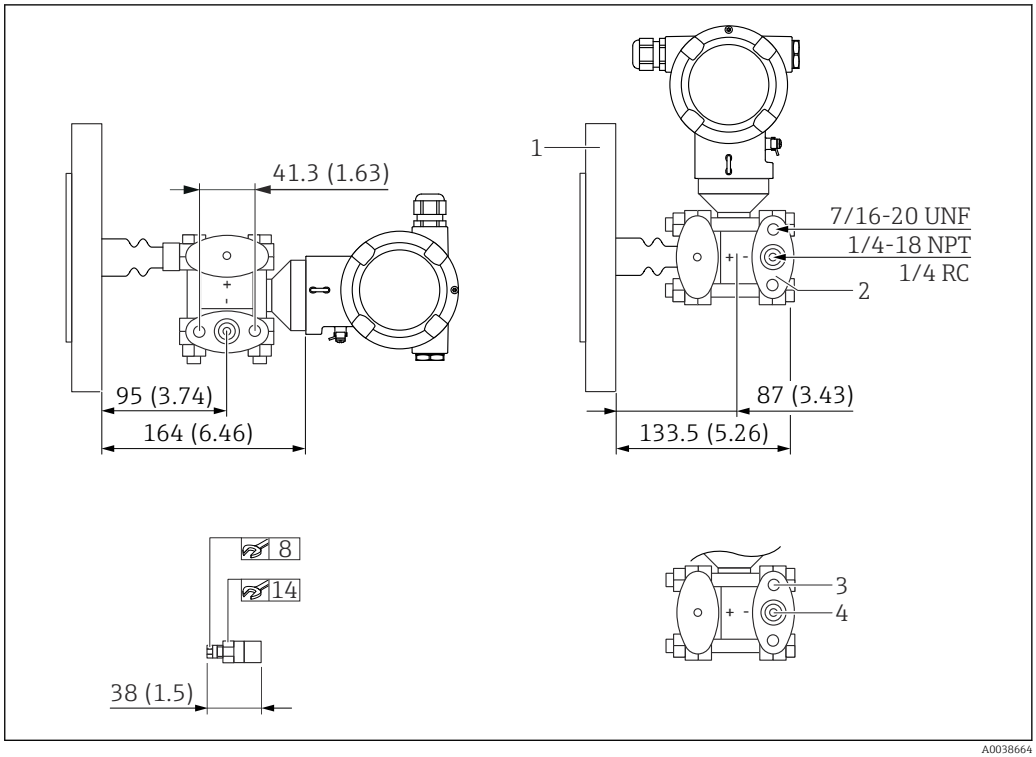
Device with long temperature isolator



Unit of measurement mm (in)

1 *High-pressure side*
2 *Low-pressure side*
3 *Thread depth: 15 mm (0.59 in)*
4 *Thread depth: 12 mm (0.47 in)(±1 mm (0.04 in))*

Device with short temperature isolator



Unit of measurement mm (in)

1 High-pressure side
2 Low-pressure side
3 Thread depth: 15 mm (0.59 in)
4 Thread depth: 12 mm (0.47 in)(±1 mm (0.04 in))

Process connections for devices with 2 capillaries

Selecting the process connection and capillary line

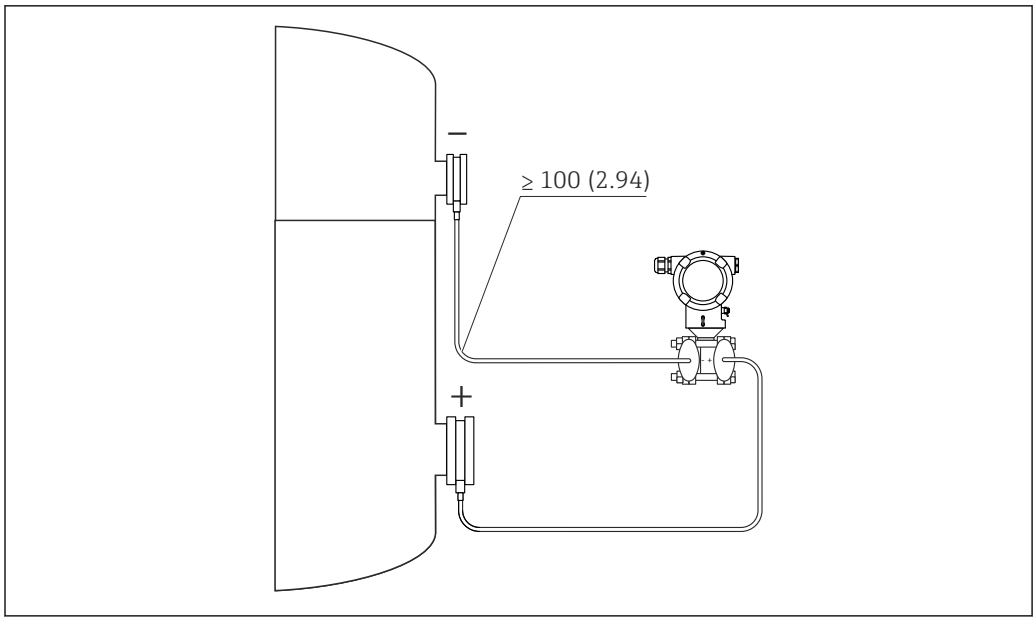
The device can be fitted with different process connections on the high-pressure side (HP) and on the low-pressure side (LP).

The device 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)

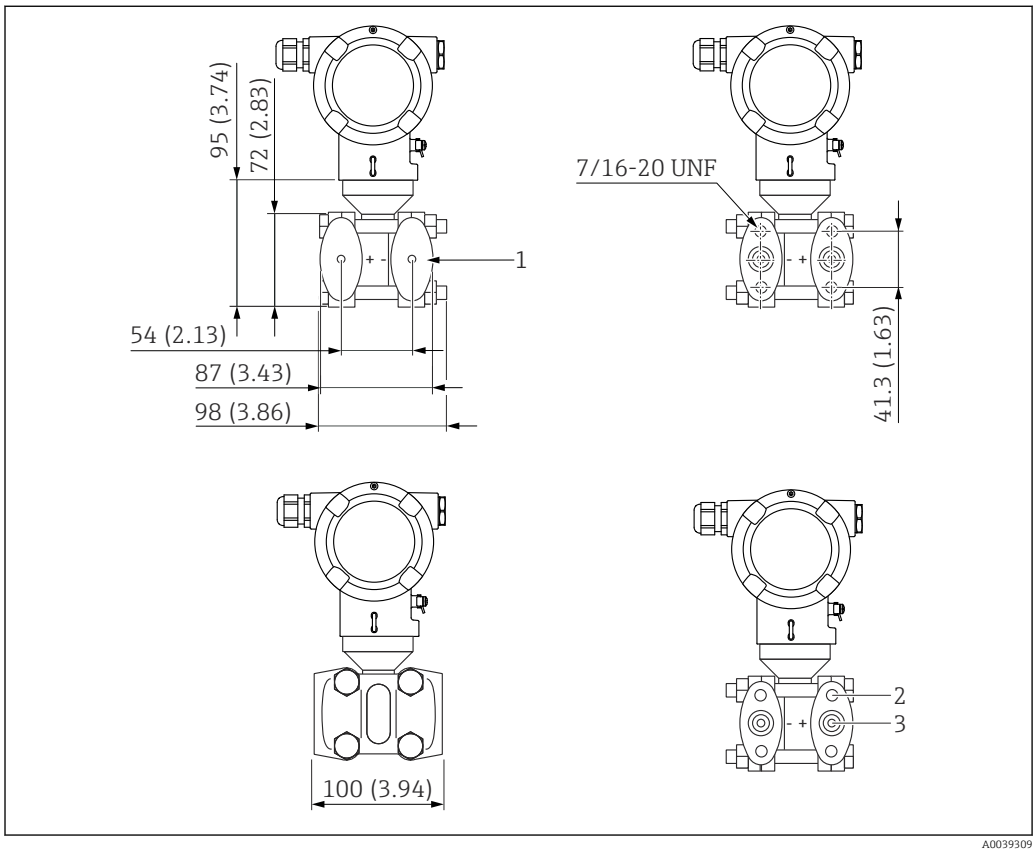
Your benefits:
- Thanks to the variety of order options, the devices can be optimally adapted to the given installation situation
- Reduced costs due to optimum system design
- Easier installation due to adjusted length of capillary on low-pressure side and high-pressure side
- Easier adaptation to existing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



Unit of measurement mm (in)

If different process connections and capillary lines are used, it is essential to size and order the device using the free "Sizing Diaphragm Seal" selection tool.

Basic unit



4 *Front view, left-hand side view, right-hand side view. Nuts are always located on the minus side. Unit of measurement mm (in)*

1 *Diaphragm seal mount*
2 *Thread depth: 15 mm (0.59 in)*
3 *Thread depth: 12 mm (0.47 in)(±1 mm (0.04 in))*

Process connections with diaphragm seal

- The following drawings are schematic diagrams
  The dimensions of a diaphragm seal supplied may deviate from the dimensions given in this document
- For more information: contact the Endress+Hauser sales office

Process connections

OPL and MWP

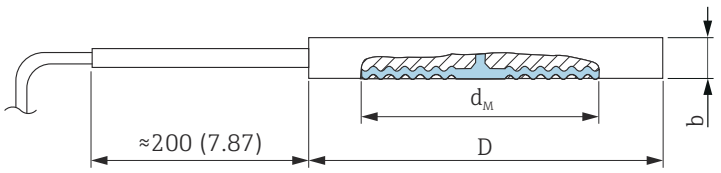
The maximum overpressure limit (OPL) and the maximum working pressure (MWP) of the sensor can deviate from the maximum OPL and MWP of the process connection.

For the maximum OPL and MWP, see the technical documentation of the process connection.

Explanation of terms

- DN or NPS or A = alphanumeric designation of the flange size
- PN or Class or K = alphanumeric pressure rating of a component

Pancake seal with flush membrane



D Diameter
d_M Max. diameter of the membrane
b Thickness

Engineering unit mm (in)

Material [1]	DN	PN [2]	D mm	b mm	Weight kg (lb)
AISI 316L	DN 50	PN 16-400	102	20 - 22	1.3 (2.87)
	DN 80	PN 16-400	138	20 - 22	2.3 (5.07)
	DN 100	PN 16-400	162	20 - 22	3.1 (6.84)

1) Supplied with conventional membrane if a PTFE membrane coating is ordered.
2) The specified nominal pressure applies for the diaphragm seal. The maximum pressure for the device depends on the lowest-rated element, with regard to pressure, of the selected component.

Material	NPS	Class [1]	D in	b in	Weight kg (lb)
AISI 316L	2	150-2500	3.62	0.79 - 0.87	1.3 (2.87)
	3	150-2500	5.00	0.79 - 0.87	2.3 (5.07)
	4	150-2500	6.22	0.79 - 0.87	3.1 (6.84)

1) The specified nominal pressure applies for the diaphragm seal. The maximum pressure for the device depends on the lowest-rated element, with regard to pressure, of the selected component.

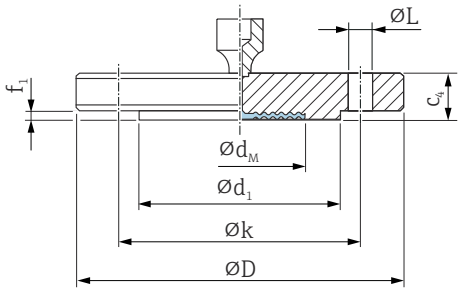
Maximum diameter of membrane Ød_M

DN	PN	Ød_M (mm)					
		316L TempC	316L	Alloy C276	Tantalum	Monel (Alloy 400)	PTFE
50	16-400	61	-	62	60	59	52
80	16-400	89	-	90	92	89	80
100	16-400	-	89	90	92	89	-

NPS	Class	Ød_M (in)					
in		316L TempC	316L	Alloy C276	Tantalum	Monel (Alloy 400)	PTFE
2	150-2500	2.40	-	2.32	2.36	2.32	2.05
3	150-2500	3.50	-	3.54	3.62	3.50	3.14
4	150-2500	-	3.14	3.50	3.62	3.50	-

Flange EN1092-1, flush membrane, diaphragm seal

Connection dimensions according to EN1092-1.



A0045226

ØD Diameter of flange
c_4 Thickness
Ød$_1$ Raised face
f_1 Raised face
Øk Pitch diameter
ØL Diameter of hole
Ød$_M$ Max. diameter of the membrane

Engineering unit mm

Flange [1) 2) 3) 4)]							Boltholes			Diaphragm seal
DN	PN	Form	ØD	c_4	Ød$_1$	f_1	Quantity	ØL	Øk	Weight
			mm	mm	mm	mm		mm	mm	kg (lb)
DN 50	PN 10-40	B1	165	20	102	3	4	18	125	3.2 (7.06)
DN 50	PN 63	B2	180	26	102	3	4	22	135	4.52 (9.97)
DN 50	PN 100-160	B2	195	30	102	3	4	26	145	6.07 (13.38)
DN 80	PN 10-40	B1	200	24	138	3	8	18	160	5.54 (12.22)
DN 80	PN 100	B2	230	32	138	3	8	26	180	8.85 (19.51)
DN 100	PN 10-16	B1	220	20	158	3	8	18	180	5.65 (12.46)
DN 100	PN 25-40	B1	235	24	162	3	8	22	190	7.6 (16.76)
DN 100	PN 100	B2	265	36	162	3	8	30	210	13.3 (29.33)

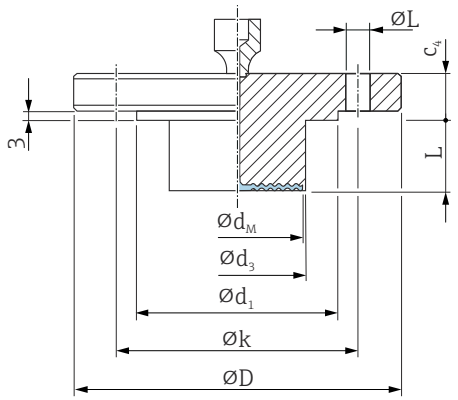
1) Material: AISI 316L
2) The roughness of the surface in contact with the medium including the raised face of the flanges (all standards) made of Alloy C276, Monel, tantalum, gold > 316L or PTFE is R_a< 0.8 µm (31.5 µin). Lower surface roughness on request.
3) The flange raised face is made from the same material as the membrane.
4) Supplied with conventional membrane if a PTFE membrane coating is ordered.

Maximum diameter of membrane $Ød_M$

DN	PN	$Ød_M$ (mm)					
		316L TempC	316L	Alloy C276	Tantalum	Monel (Alloy 400)	PTFE
DN 50	PN 10-40	61	-	57	60	59	52
DN 50	PN 63	-	52	62	60	59	-
DN 50	PN 100-160	-	52	62	60	59	-
DN 80	PN 10-40	89	-	89	92	89	80
DN 80	PN 100	-	80	90	92	90	-
DN 100	PN 10-16	-	80	90	92	89	-
DN 100	PN 25-40	-	80	90	92	89	-
DN 100	PN 100	-	80	90	92	89	-

Barrel, flange, EN1092-1, flush membrane, diaphragm seal

Connection dimensions in accordance with EN 1092-1.



A0045227

ØD Diameter of flange
c_4 Thickness
$Ød_1$ Raised face
Øk Pitch diameter
$ØL_2$ Diameter of hole
$Ød_M$ Max. diameter of the membrane
$Ød_3$ Barrel diameter
L Barrel length

Engineering unit mm

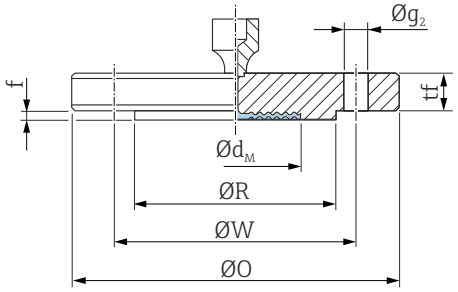
Flange [1) 2)]						Boltholes			Diaphragm seal
DN	PN	Form	ØD	c_4	$Ød_1$	Quantity	ØL	Øk	$Ød_M$ [3)]
			mm	mm	mm		mm	mm	mm
DN 50	PN 10-40	B1	165	20	102	4	18	125	48
DN 80	PN 10-40	B1	200	24	138	8	18	160	73

1) Material: AISI 316L
2) In the case of membranes made of Alloy C276, the flange raised face and barrel are made of 316L
3) Maximum membrane diameter

Barrel				
DN	PN	L	$Ød_3$	Weight
		mm	mm	kg (lb)
DN 50	PN 10-40	50 / 100 / 150 / 200	48.3	3.44 (7.59) / 3.8 (8.4) / 4.1 (9.04) / 4.4 (9.7)
DN 80	PN 10-40	50 /100 / 150 / 200	76	6.2 (13.7) / 6.7 (14.8) / 7.27 (16.03) / 7.8 (17.2)

Flange ASME B16.5, flush membrane, diaphragm seal

Connection dimensions in accordance with ASME B 16.5, raised face RF



A0045230

ØO Diameter of flange
tf Thickness
ØR Raised face
f Raised face
ØW Pitch diameter
Øg$_2$ Diameter of hole
Ød$_M$ Max. membrane diameter

Engineering unit in

Flange [1) 2) 3)]						**Boltholes**			**Diaphragm seal**
NPS	**Class**	**ØO**	**tf**	**ØR**	**f**	**Quantity**	**Øg$_2$**	**ØW**	**Weight**
in		**in**	**in**	**in**	**in**		**in**	**in**	**kg (lb)**
2	150	6	0.69	3.62	0.06	4	3/4	4.75	2.5 (5.51)
2	300	6.5	0.81	3.62	0.06	8	3/4	5	3.4 (7.5)
2	400/600	6.5	1	3.62	0.25	8	3/4	5	4.3 (9.48)
2	900/1500	8.5	1.5	3.62	0.25	8	1	6.5	10.3 (22.71)
2	2500	9.25	2	3.62	0.25	8	1 1/8	6.75	15.8 (34.84)
3	150	7.5	0.88	5	0.06	4	3/4	6	5.1 (11.25)
3	300	8.25	1.06	5	0.06	8	7/8	6.62	7.0 (15.44)
3	400/600	6.5	1.25	5	0.25	8	7/8	6.62	8.6 (18.96)
3	900	9.5	1.5	5	0.25	8	1	7.5	13.3 (29.33)
4	150	9	0.88	6.19	0.06	8	3/4	7.5	7.2 (15.88)
4	300	10	1.19	6.19	0.06	8	7/8	7.88	11.7 (25.8)

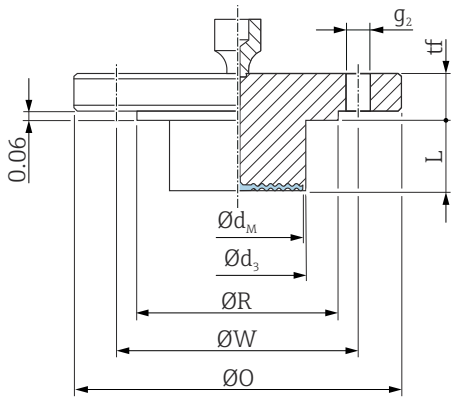
1) Material AISI 316/316L: Combination of AISI 316 for necessary pressure resistance and AISI 316L for necessary chemical resistance (dual rated)
2) The roughness of the surface in contact with the medium including the raised face of the flanges (all standards) made of Alloy C276, Monel, tantalum, gold or PTFE is R_a< 0.8 µm (31.5 µin). Lower surface roughness on request.
3) The flange raised face is made from the same material as the membrane.

Maximum diameter of membrane $Ød_M$

NPS	Class	$Ød_M$ (in)				
		316L TempC	316L	Alloy C276	Tantalum	Monel (Alloy 400)
2	150	2.40	-	2.44	2.44	2.44
2	300	2.40	-	2.44	2.44	2.44
2	400/600	-	2.05	2.44	2.44	2.44
2	900/1500	-	2.05	2.44	2.44	2.44
2	2500	-	2.05	2.44	2.44	2.44
3	150	3.50	-	3.62	3.62	3.62
3	300	3.50	-	3.62	3.62	3.62
3	400/600	-	3.15	3.62	3.62	3.62
3	900	-	3.15	3.62	3.62	3.62
4	150	-	3.15	3.62	3.62	3.62
4	300	-	3.15	3.62	3.62	3.62

Barrel, flange ASME B16.5, flush membrane, diaphragm seal

Connection dimensions in accordance with ASME B 16.5, raised face RF



A0045232

ØO Diameter of flange
tf Thickness
ØR Raised face
ØW Pitch diameter
Øg_2 Diameter of hole
Ød_M Max. diameter of the membrane
Ød_3 Barrel diameter
L Barrel length

Engineering unit in

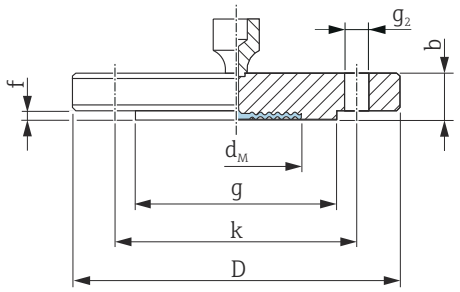
Flange [1) 2) 3)]					Boltholes			Diaphragm seal
NPS	Class	ØO	tf	ØR	Quantity	Øg_2	ØW	Ød_M [4)]
in		in	in	in		in	in	in
2	150	6	0.69	3.62	4	3/4	4.75	1.9
3	150	7.5	0.88	5	4	3/4	6	2.87
4	150	9	0.88	6.19	8	3/4	7.5	3.5

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 membranes made of Alloy C276, the flange raised face is made of 316L.
3) Supplied with a conventional membrane if a PTFE membrane coating is ordered.
4) Maximum membrane diameter

Barrel				
NPS	Class	L	d_3	Weight
in		in (mm)	in (mm)	kg (lb)
2	150	2 (50.8) / 4 (101.6) / 6 (152.4) / 8 (203.2)	1.9 (48.3)	3.84 (8.47)/ 4.16 (9.17)/ 4.47 (9.86)/ 4.77 (10.52)
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)
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)

Flange JIS, flush membrane, diaphragm seal

Connection dimensions in accordance with JIS B 2220 BL, raised face RF.



A0021680

D *Diameter of flange*
b *Thickness*
g *Raised face*
f *Thickness of raised face*
k *Pitch diameter*
g_2 *Diameter of hole*

Engineering unit mm

Flange [1) 2) 3)]						Boltholes			Diaphragm seal
A [4)]	K [5)]	D	b	g	f	Quantity	g_2	k	Weight
		mm	mm	mm	mm		mm	mm	kg (lb)
50 A	10 K	155	16	96	2	4	19	120	2.3 (5.07)
80 A	10 K	185	18	127	2	8	19	150	3.3 (7.28)
100 A	10 K	210	18	151	2	8	19	175	4.4 (9.7)

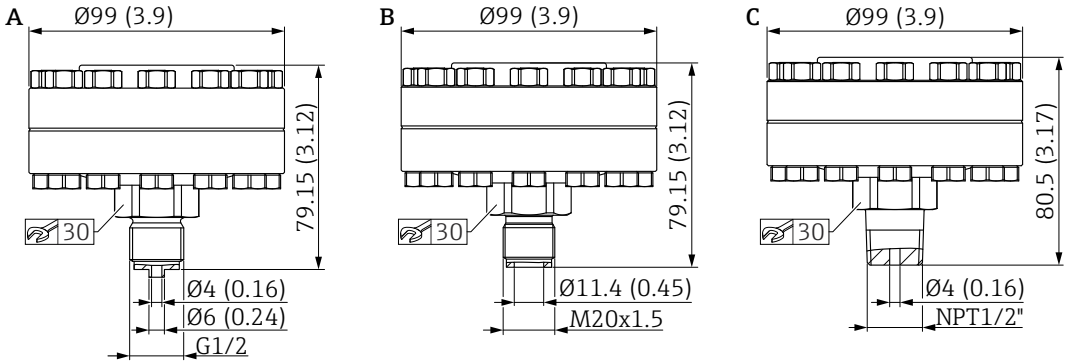
1) Material: AISI 316L
2) The roughness of the surface in contact with the medium, including the raised face of the flanges (all standards) made of Alloy C276, Monel, tantalum, gold or PTFE, is R_a< 0.8 µm (31.5 µin). Lower surface roughness on request.
3) The flange raised face is made from the same material as the membrane.
4) Alphanumeric designation of the flange size.
5) Alphanumeric pressure rating of a component.

Maximum diameter of membrane Ød_M

A [1)]	K [2)]	Ød_M (mm)					
		316L TempC	316L	Alloy C276	Tantalum	Monel (Alloy 400)	PTFE
50 A	10 K	-	52	62	60	59	-
80 A	10 K	-	80	-	-	-	-
100 A	10 K	-	80	-	-	-	-

1) Alphanumeric designation of the flange size.
2) Alphanumeric pressure rating of a component.

Separator ISO228, ASME, DIN13, threaded, diaphragm seal, membrane material 316L, TempC



Engineering unit mm (in)

Item	Designation	Material	Measuring range	PN	Weight
			bar (psi)		kg (lb)
A	Threaded, ISO228 G½ EN837 with metal seal (silver-plated) −60 to +400 °C (−76 to +752 °F)	AISI 316L, Screws made of A4	≤ 100 (1450)	PN 100	2.35 kg (5.18 lb)
B	Threaded, DIN13 M20x1.5 with metal seal (silver-plated) −60 to +400 °C (−76 to +752 °F)				2.30 kg (5.07 lb)
C	Threaded, ASME MNPT ½ with metal seal (silver-plated) −60 to +400 °C (−76 to +752 °F)				2.35 kg (5.18 lb)

Weight

Housing

Weight including electronics and display.

- Dual compartment housing
  - Aluminum: 1.4 kg (3.09 lb)
  - Stainless steel: 3.3 kg (7.28 lb)
- Dual compartment housing, L-form: 1.7 kg (3.75 lb)

Sensor, remote (separate housing)

- Housing: see the Housing section
- Housing adapter: 0.55 kg (1.21 lb)
- Process connection adapter: 0.36 kg (0.79 lb))
- Cable:
  - PE cable, 2 meters: 0.18 kg (0.40 lb)
  - PE cable, 5 meters: 0.35 kg (0.77 lb)
  - PE cable, 10 meters: 0.64 kg (1.41 lb)
  - FEP cable, 5 meters: 0.62 kg (1.37 lb)
- Mounting bracket: 0.46 kg (1.01 lb)

Basic weight of the measuring cell including side flanges and mounting material

3.3 kg (7.28 lb)

Temperature isolator

- Temperature isolator, short, : 0.22 kg (0.49 lb)
- Temperature isolator, long: 0.40 kg (0.88 lb)

Capillary

- 316L (standard capillary armor):
  0.16 kg/m (0.35 lb/m) + 0.2 kg (0.44 lb)
  (Weight per capillary in m)
- PVC-coated capillary armor on 316L:
  0.21 kg/m (0.46 lb/m) + 0.2 kg (0.44 lb)
  (Weight per capillary in m)
- PTFE-jacketed capillary armor on 316L:
  0.29 kg/m (0.64 lb/m) + 0.2 kg (0.44 lb)
  (Weight per capillary in m)

Process connections

Weight, see the specific process connection.

Ex d version: 0.63 kg (1.39 lb)

Accessories

Mounting bracket: 0.5 kg (1.10 lb)

Materials in contact with process

Membrane material

- 316L (1.4435)
- 316L (1.4435), TempC
  TempC membrane stands for "Temperature Compensatory Membrane"
  This membrane reduces the process and environmental influences for diaphragm seals compared to conventional systems
- Alloy C276
  The flange raised face is made from the same material as the membrane
  In the case of devices with a barrel, the flange raised face is made of 316L
  - 316L in the case of EN 1092-1 flanges
  - F316/316L in the case of ASME flanges
- Tantalum
  The flange raised face is made from the same material as the membrane
  In the case of devices with a barrel, the flange raised face is made of 316L
  - 316L in the case of EN 1092-1 flanges
  - F316/316L in the case of ASME flanges
- Monel (Alloy 400)
  The flange raised face is made from the same material as the membrane
  In the case of devices with a barrel, the flange raised face is made of 316L
  - 316L in the case of EN 1092-1 flanges
  - F316/316L in the case of ASME flanges

Membrane coating

- PTFE, 0.25 mm (0.01 in)
  PTFE is standard only with conventional membranes
- Gold, 25 µm
  The gold-plated TempC membrane does not offer any corrosion protection!
  Gold is standard only for TempC membranes

Seal

- PTFE
- FKM (FDA 21 CFR 177.2600)
- EPDM
- FFKM
- FFKM Chemraz

Process connections

See the specific process connection.

Accessories

For technical data (e.g. materials, dimensions or order numbers), see the accessory document SD01553P.

Materials not in contact with process

Dual compartment housing and cover

- Polyester powder coating on aluminum as per EN1706 AC43400 (reduced copper content ≤0.1 % to prevent corrosion)
- Stainless steel (ASTM A351 : CF3M (cast equivalent to material AISI 316L) / DIN EN 10213 : 1.4409)

Dual compartment housing and cover, L-form

Polyester powder coating on aluminum as per EN1706 AC43400 (reduced copper content ≤0.1 % to prevent corrosion)

Separate housing

- Mounting bracket
  - Bracket: AISI 316L (1.4404)
  - Screw and nuts: A4-70
  - Half-shells: AISI 316L (1.4404)
- Seal for cable from separate housing: EPDM
- Gland for cable of separate housing: AISI 316L (1.4404)
- 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
- 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
- Process connection adapter for separate housing: AISI 316L (1.4404)

Aluminum housing nameplate

- Adhesive polyester label
- Versions that can be ordered for use at reduced ambient temperatures: metal wired-on tag plate made of 316L (1.4404)

Nameplate of stainless steel housing

- Metal nameplate made of 316L (1.4404)
  Nameplate fasteners (rivets) made of 316Ti (1.4571)
- Versions that can be ordered for use at reduced ambient temperatures: metal wired-on tag plate made of 316L (1.4404)

Cable entries

- M20 gland:
  Plastic, brass nickel plated or 316L (depends on version ordered)
  Dummy plug made of plastic, aluminum or 316L (depends on version ordered)
- Thread M20:
  Dummy plug made of aluminum or 316L (depends on version ordered)
- Thread G1/2:
  Adapter made of aluminum or 316L (depends on version ordered)
  If the G1/2 thread is selected, the device is delivered with an M20 thread as standard and a G1/2 adapter is included with the delivery, along with the corresponding documentation
- Thread NPT1/2:
  Dummy plug made of aluminum or 316L (depends on version ordered)
- Plug M12:
  CuZn nickel-plated or 316L (depends on version ordered)
  Dummy plug made of aluminum or 316L (depends on version ordered)
- Plug HAN7D:
  Aluminum, die-cast zinc, steel
  Dummy plug made of aluminum or 316L (depends on version ordered)

Fill fluid

- Silicone oil, FDA 21 CFR 175.105
- Vegetable oil, FDA 21 CFR 172.856
- High-temperature oil
- Low-temperature oil
- Inert oil (not suitable for temperatures below −20 °C (−4 °F))

Connecting parts

- Connection between housing and process connection: AISI 316L (1.4404)
- Screws and nuts
  - PN 160: hex.-headed bolt DIN 931-M12x90-A4-70
  - PN 160: hex.-headed nut DIN 934-M12-A4-70
- Measuring cell body: AISI 316L (1.4404)
- Setscrew: DIN 915 M 6x8 A2-70
- Bearing: DIN 5401 (1.3505)
- Temperature isolator: AISI 316L (1.4404)
- Side flanges: AISI 316/316L (1.4408) / CF3M (cast equivalent to material AISI 316L)
- Heat shrink tube (only available for PVC-coated capillary armor or PTFE capillary armor): polyolefin

Armor for capillary

AISI 316L

- Capillary: AISI 316 Ti (1.4571)
- Protective hose for capillary: AISI 316L (1.4404)

PVC-coated

- Capillary: AISI 316 Ti (1.4571)
- Protective hose for capillary: AISI 316L (1.4404)
- Coating: PVC
- Heat shrink tube at capillary junction: polyolefin

PTFE-armored

- Capillary: AISI 316 Ti (1.4571)
- Protective hose for capillary: AISI 316L (1.4404)
- Armor: PTFE
- Single-ear clamp: 1.4301

Accessories

For technical data (e.g. materials, dimensions or order numbers), see the accessory document SD01553P.

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks
- User navigation
- Diagnostics
- Application
- System

Fast and safe commissioning
- Interactive wizard with graphical user interface for guided commissioning in FieldCare, DeviceCare or DTM, AMS and PDM-based third-party tools or SmartBlue
- Menu guidance with short explanations of the individual parameter functions
- Standardized operation at the device and in the operating tools

Integrated HistoROM data memory
- Adoption of data configuration when electronics modules are replaced
- Up to 100 event messages recorded in the device

Efficient diagnostic behavior increases measurement availability
- Remedial measures are integrated in plain text
- Diverse simulation options

Bluetooth module (optionally integrated in local display)
- Quick and easy setup with SmartBlue app or PC with DeviceCare, version 1.07.00 and higher, or FieldXpert SMT70
- No additional tools or adapters required
- Encrypted single point-to-point data transmission (tested by Fraunhofer Institute) and password-protected communication via *Bluetooth*® wireless technology

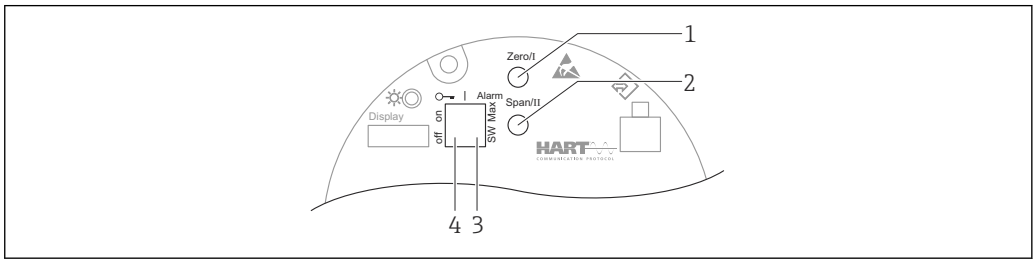
Languages

Operating languages
- English (English is set at the factory if no other language is ordered)
- Deutsch
- Français
- Español
- Italiano
- Nederlands
- Portuguesa
- Polski
- русский язык (Russian)
- Türkçe
- 中文 (Chinese)
- 日本語 (Japanese)
- 한국어 (Korean)
- Bahasa Indonesia
- tiếng Việt (Vietnamese)
- čeština (Czech)
- Svenska

Local operation

Operating keys and DIP switches on the electronic insert

HART



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1 Operating key for lower range value (Zero)
2 Operating key for upper range value (Span)
3 DIP switch for alarm current
4 DIP switch for locking and unlocking the device

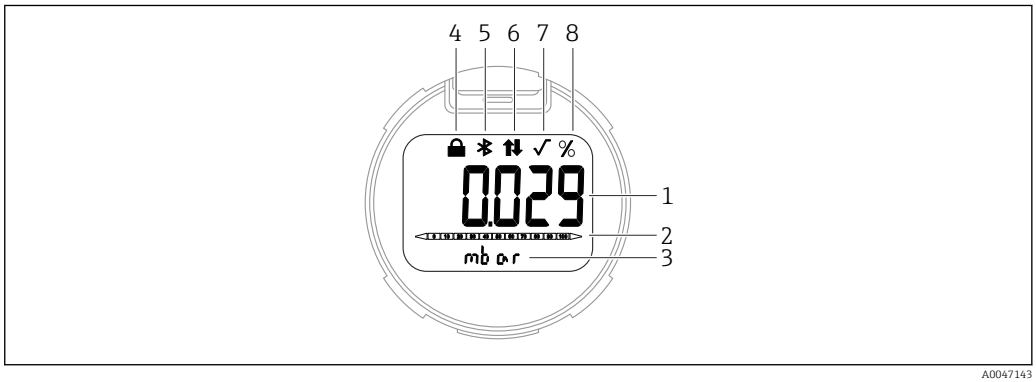
The setting of the DIP switches has priority over the settings made via other operation methods (e.g. FieldCare/DeviceCare).

Local display

Device display (optional)

Functions:
- Display of measured values and fault and notice messages
- Background lighting, which switches from green to red in the event of an error
- The device display can be removed for easier operation

The device displays are available with the additional option of Bluetooth® wireless technology.



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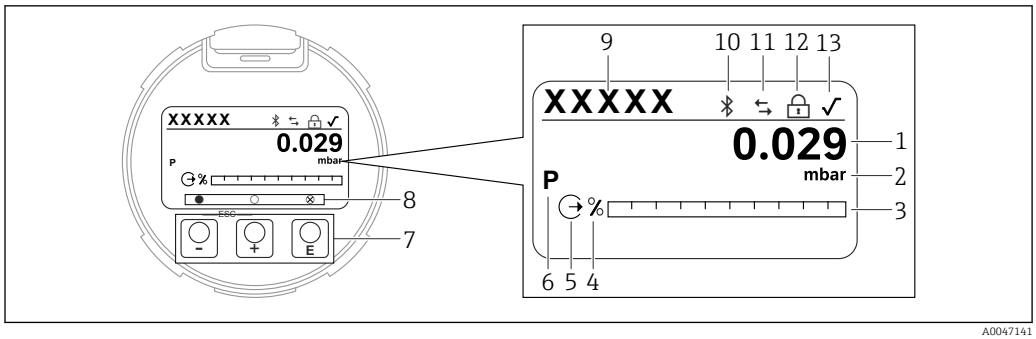
5 Segment display

1 Measured value
2 Bar graph proportional to the current output
3 Unit of measured value
4 Locked (symbol appears when the device is locked)
5 Bluetooth (symbol flashes if Bluetooth connection is active)
6 HART communication (symbol is displayed if HART communication is active) , or
7 Square root extraction (appears if a square root extraction of the measured value is output)
8 Measured value output in %

The following graphics are examples. The display depends on the display settings.

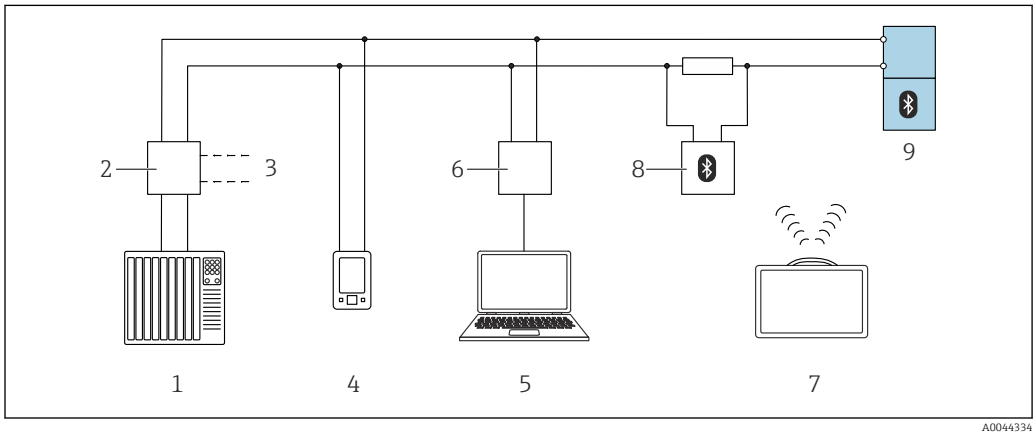


6 Graphic display with optical operating keys.

1 *Measured value*
2 *Unit of measured value*
3 *Bar graph proportional to the current output*
4 *Bar graph unit*
5 *Symbol for current output*
6 *Symbol for displayed measured value (e.g. p = pressure)*
7 *Optical operating keys*
8 *Symbols for key feedback. Different display symbols are possible: circle (not filled in) = key pressed briefly; circle (filled in) = key pressed for longer; circle (with X) = no operation possible due to Bluetooth connection*
9 *Device Tag*
10 *Bluetooth (symbol flashes if Bluetooth connection is active)*
11 *HART communication (symbol is displayed if HART communication is active) , or*
12 *Locked (symbol appears when the device is locked)*
13 *Symbol for square root extraction*

Remote operation

Via HART protocol or Bluetooth



7 Options for remote operation via HART protocol

1 *PLC (programmable logic controller)*
2 *Transmitter power supply unit, e.g. RN221N (with communication resistor)*
3 *Connection for Commubox FXA195 and AMS Trex™ device communicator*
4 *AMS Trex™ device communicator*
5 *Computer with operating tool (e.g. DeviceCare/FieldCare , AMS Device View, SIMATIC PDM)*
6 *Commubox FXA195 (USB)*
7 *Field Xpert SMT70*
8 *Bluetooth modem with connecting cable (e.g. VIATOR)*
9 *Transmitter*

Via service interface (CDI)

With the Commubox FXA291, a CDI connection is established with the device interface and a Windows PC/notebook with a USB port.

Operation via Bluetooth® wireless technology (optional)

Prerequisite
- Device with Bluetooth display
- Smartphone or tablet with Endress+Hauser SmartBlue app or PC with DeviceCare from version 1.07.00 or FieldXpert SMT70

The connection has a range of up to 25 m (82 ft). The range can vary depending on environmental conditions such as attachments, walls or ceilings.

The operating keys on the display are locked as soon as the device is connected via Bluetooth.

System integration	**HART** Version 7
Supported operating tools	Smartphone or tablet with Endress+Hauser SmartBlue (app), DeviceCare, version 1.07.00 and higher, FieldCare, DTM, AMS and PDM.
HistoROM	When replacing the electronic insert, the stored data is transferred by reconnecting the HistoROM. The device does not work without HistoROM. The device serial number is saved in the HistoROM. The electronics serial number is saved in the electronics.

Certificates and approvals

Current certificates and approvals that are available for the product can be selected via the Product Configurator at www.endress.com:

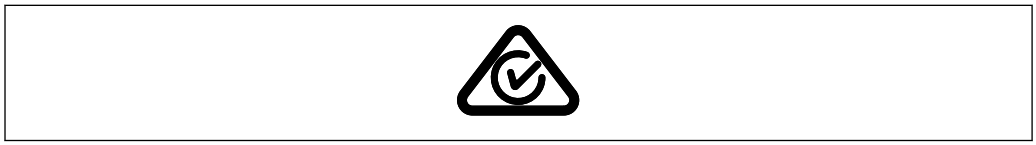
1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Configuration**.

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 bear the RCM-Tick marking on the nameplate.



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Ex approvals

- ATEX
- CSA
- NEPSI
- UKCA
- INMETRO
- KC
- EAC (in preparation)
- JPN
- Also combinations of different approvals

All the data related to explosion protection is provided in separate Ex documentation which is also available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.

Additional approvals in preparation.

Explosion-protected smartphones and tablets

If used in hazardous areas, mobile terminals with an Ex approval must be used.

EAC conformity

The device meets the legal requirements of the applicable EAC Directives. These are listed in the corresponding EAC Declaration of Conformity along with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the EAC mark.

Overfill protection (in preparation)

The device is tested in accordance with the approval guidelines for overfill protection units (ZG-ÜS:2012-07) as overfill protection as per Section 63 of the German Water Resources Act (WHG).

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

The devices with a 4-20 mA output signal have been developed according to the IEC 61508 standard. These devices can be used to monitor the process level and pressure up to SIL 3. For a detailed description of the safety functions, settings and functional safety data, see the "Functional Safety Manual".

Marine approval

- ABS (American Bureau of Shipping)
- LR (Lloyd's Register)
- BV (Bureau Veritas)
- DNV GL (Det Norske Veritas / German Lloyd)

Radio approval

Displays with Bluetooth LE have radio licenses according to CE and FCC. The relevant certification information and labels are provided on display.

Test reports

Test, certificate, declarations

- Inspection certificate 3.1, EN10204 (material certificate, wetted metallic parts)
- NACE MR0175 / ISO 15156 (wetted metallic parts), declaration
- NACE MR0103 / ISO 17945 (wetted metallic parts), declaration
- AD 2000 (wetted metallic parts), declaration, excluding membrane
- ASME B31.3 process piping, declaration
- ASME B31.1 power piping, declaration
- Ambient temperature for transmitter (−50 to +85 °C (−58 to +185 °F)); for sensor, see specification
- Ambient temperature for transmitter (−54 to +85 °C (−65 to +185 °F)); for sensor, see specification
- Pressure test, internal procedure, test report
- Helium leak test, internal procedure, test report
- PMI test, internal procedure (wetted metallic parts), test report
- Welding documentation, wetted/pressurized seams, declaration

Test reports, declarations and inspection certificates are provided electronically in the Device Viewer: enter the serial number of the nameplate (www.endress.com/deviceviewer).

Applicable for the order codes "Calibration" and "Test, certificate" .

Product documentation on paper

Test reports, declarations and inspection certificates in hard copy can optionally be ordered with the order option "Product documentation on paper". These documents are supplied with the ordered product.

Calibration

5-point calibration certificate

10-point calibration certificate, traceable to ISO/IEC 17025

Manufacturer declarations

A variety of manufacturer declarations can be downloaded from the Endress+Hauser website. Other manufacturer declarations can be ordered through the Endress+Hauser sales office.

Downloading the Declaration of Conformity

www.endress.com → Download

Pressure Equipment Directive 2014/68/EU (PED)

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

Pressure equipment (maximum working pressure PS ≤ 200 bar (2 900 psi)) can be classified as pressure accessories according to the Pressure Equipment Directive 2014/68/EU. If the maximum working 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 (see 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 a safety instrumented system for the protection of a pipe or vessel from exceeding allowable limits (safety accessory in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).

Oxygen application

Verified cleaned, suitable for O2 service (wetted parts)

PWIS-free applications

Special cleaning of the transmitter to remove paint-wetting impairment substances, for use in paint shops, for instance.

China RoHS symbol

The device is visibly identified according to SJ/T 11363-2006 (China-RoHS).

RoHS

The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU (RoHS 2).

Additional certification

Classification of process sealing between electrical systems and (flammable or combustible) process liquids according to UL 122701 (previously ANSI/ISA 12.27.01)

Endress+Hauser devices are designed according to UL 122701 (previously ANSI/ISA 12.27.01) and allow the user to waive the use of - 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 devices comply with the North-American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous media. The devices are assigned to "single seal" as follows:

CSA C/US IS, XP, NI:

160 bar (2 400 psi)

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

Metrological accreditation

With the order option "China", the device is supplied with a Chinese nameplate in accordance with the Chinese Quality Law.

Ordering information

Ordering information

Detailed ordering information is available from the nearest sales organization www.addresses.endress.com or in the Product Configurator under www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.

The **Configuration** button opens the Product Configurator.

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

Scope of delivery

The scope of delivery comprises:
- Device
- Optional accessories

Accompanying documentation:
- Brief Operating Instructions
- Final inspection report
- Additional Safety Instructions for devices with approvals (e.g. ATEX, IECEx, NEPSI, etc.)
- Optional: factory calibration form, test certificates

The Operating Instructions are available on the Internet at:

www.endress.com → Download

Measuring point (tag)

- Order code: marking
- Option: Z1, tagging (TAG), see additional specification
- Location of tag identifier: to be selected in the additional specifications
  - Tag plate, stainless steel
  - Self-adhesive paper label
  - Supplied plate
  - RFID TAG
  - RFID TAG + tag plate stainless steel
  - RFID TAG + self-adhesive paper label
  - RFID TAG + supplied label/plate
- Definition of tag name: to be defined in the additional specifications
  3 lines, each containing up to maximum 18 characters
  The specified tag name appears on the selected label and/or the RFID TAG
- Identification on electronic nameplate (ENP): 32 digits

Test reports, declarations and inspection certificates

All test reports, declarations and inspection certificates are provided electronically in the *Device Viewer*:
Enter the serial number from the nameplate (www.endress.com/deviceviewer)

Product documentation on paper
Test reports, declarations and inspection certificates in hard copy can optionally be ordered with feature 570 "Service", Version I7 "Product documentation on paper". The documents are then provided with the device upon delivery.

Application packages

Heartbeat Technology

Availability

Available in all device versions.

Heartbeat Verification + Monitoring, optional.

Heartbeat Diagnostics

- Continuous self-monitoring of the device
- Diagnostic messages output to
  - the local display
  - an asset management system (e.g. FieldCare or DeviceCare)
  - an automation system (e.g. PLC)
  - Web server

Heartbeat Verification

- Device monitoring in installed state without interrupting the process, including report
- Clear measuring point assessment (pass/fail) with high total test coverage within the framework of the manufacturer's specifications
- Can be used to document normative requirements

Heartbeat Monitoring

- Statistical Sensor Diagnostics: statistical analysis and evaluation of the pressure signal, including signal noise, to detect process anomalies (e.g. blocked impulse lines)
- Loop Diagnostics: detection of elevated measuring circuit resistance values or declining power supply
- Process window: user-definable pressure and temperature limits to detect dynamic pressure surges or faulty trace heating systems or insulation
- Continuously supplies additional monitoring data to an external condition monitoring system for the purpose of predictive maintenance or process monitoring

Detailed description

See Special Documentation for SD Heartbeat Technology.

Accessories

Device-specific accessories

Mechanical accessories

- Mounting bracket for housing
- Flushing rings
- Weather protection covers

For technical data (e.g. materials, dimensions or order numbers), see the accessory document SD01553P.

Plug connectors

- Plug connector M12 90 deg, IP67 5m cable, union nut, Cu Sn/Ni
- Plug connector M12, IP67 union nut, Cu Sn/Ni
- Plug connector M12, 90 deg IP67 union nut, Cu Sn/Ni

The IP protection classes are only maintained if the dummy cap is used or the cable is connected.

Weld-in accessory

For details, refer to TI00426F/00/EN "Weld-in adapters, process adapters and flanges".

Device Viewer

All the spare parts for the device, along with the order code, are listed in the *Device Viewer* (www.endress.com/deviceviewer).

Supplementary documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *Device Viewer* (www.endress.com/deviceviewer): enter the serial number from the nameplate
- *Endress+Hauser Operations App*: enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

Standard documentation

- Technical Information: planning guide
  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
- Brief Operating Instructions: takes you quickly to the 1st measured value
  The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning
- Operating Instructions: reference manual
  The Operating Instructions contain all the information that is required in the various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal

Supplementary device-dependent documentation

Additional documents are supplied depending on the device version ordered: Always comply strictly with the instructions in the supplementary documentation. The supplementary documentation is an integral part of the device documentation.

Field of Activities

Document FA00004P

Pressure measurement, powerful devices for process pressure, differential pressure, level and flow

Special Documentation

Document SD01553P

Mechanical accessories for pressure equipment

The documentation provides an overview of available manifolds, oval flange adapters, pressure gauge valves, shutoff valves, water pocket pipes, condensate pots, cable shortening kits, test adapters, flushing rings, Block&Bleed valves and protective roofs.

Registered trademarks

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

Bluetooth®
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www.addresses.endress.com

Endress+Hauser

People for Process Automation