

# Technical Information

## Deltabar PMD55B

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)
- Static pressure: up to 250 bar (3 750 psi)
- Accuracy: up to  $\pm 0.055\%$

### 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 guarantees excellent readability.

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## About this document

### Symbols

#### Safety symbols



This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.



This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.



This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.



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

#### Electrical symbols

Ground connection:  $\perp$

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:

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.

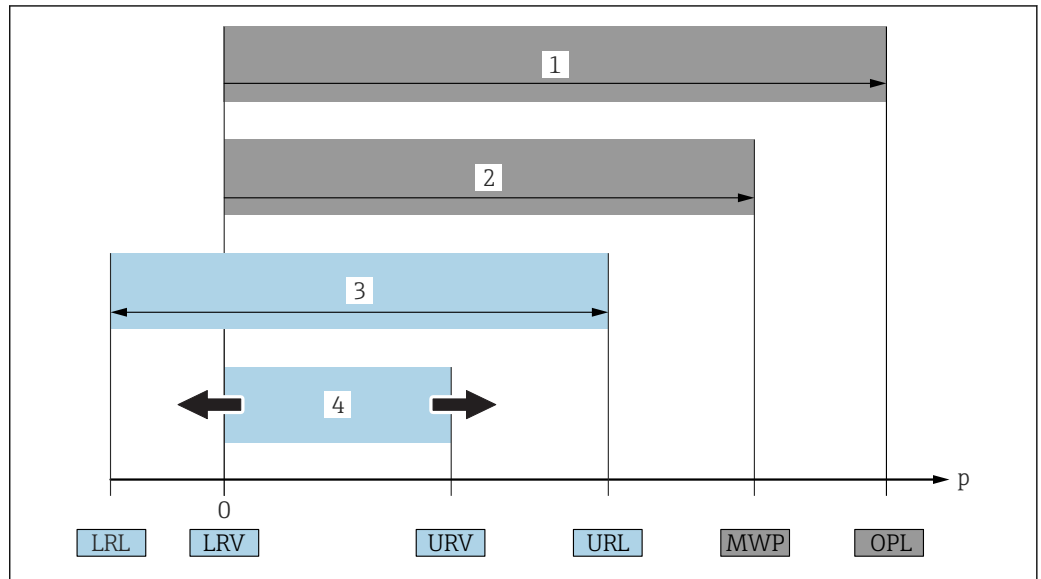
Views: A, B, C, ...

#### 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 = sensor 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 MWP: The MWP (maximum working pressure) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. 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 sensor measuring range corresponds to the span between the LRL and URL. This sensor 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

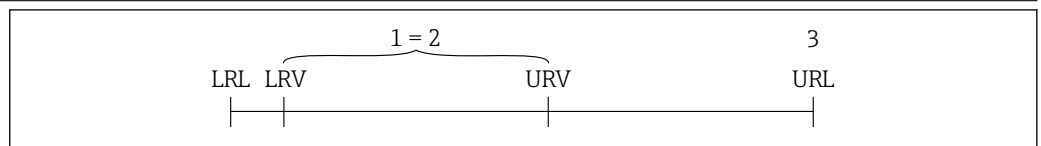
URL Upper range limit

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:

- Sensor: 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)

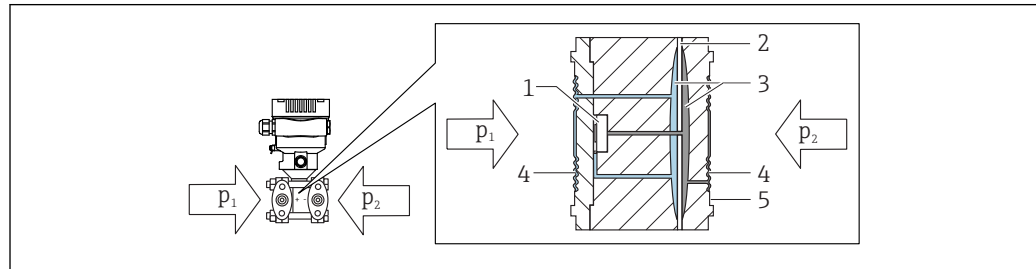
$$TD = \frac{URL}{|URV - LRV|}$$

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 metal process membrane



A0043083

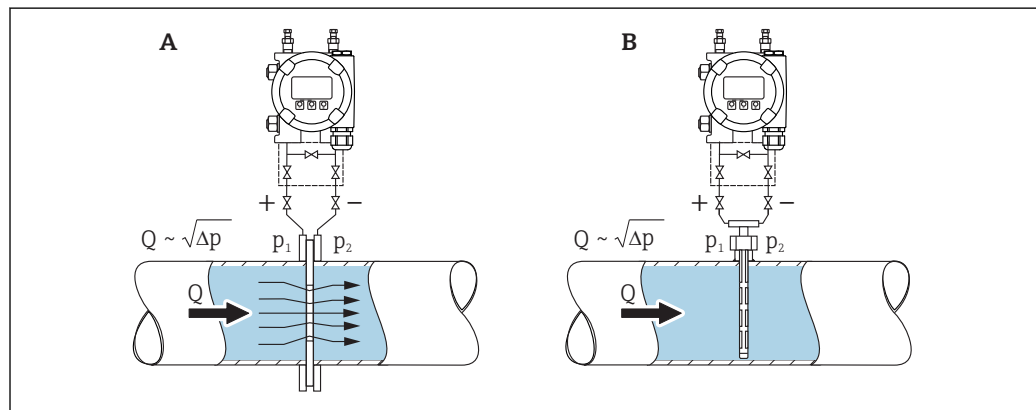
- 1 Measuring element
- 2 Middle diaphragm
- 3 Fill fluid
- 4 Process membrane
- 5 Seal
- $p_1$  Pressure 1
- $p_2$  Pressure 2

The process membrane is deflected on both sides by the pressures that are applied. A fill fluid transfers the pressure to a side of the measuring element where a resistance bridge is located (semiconductor technology). The differential pressure-dependent change in the bridge output voltage is measured and processed further.

### Measuring system

#### Flow measurement

Flow measurement with Deltabar and differential pressure sensor:



A0038340

- A Orifice plate
- B Pitot tube
- Q Flow
- $\Delta p$  Differential pressure,  $\Delta p = p_1 - p_2$

#### Advantages:

- A specific unit is defined
- With the **Low flow cut off** parameter, positive zero return can be configured in the lower measuring range.

### Communication and data processing

- 4 to 20 mA with HART communication protocol
- Bluetooth (optional)
- PROFINET-APL 10BASE-T1L communication protocol

## Dependability for devices with HART, Bluetooth, PROFINET APL

### 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 Bluetooth, FieldCare, DeviceCare, AMS, PDM)

Function/interface	Factory setting	Recommendation
Access code (also applies for Web server login or FieldCare connection)	Not enabled (0000)	Assign a customized access code during commissioning.
Web server	Enabled	On an individual basis following risk assessment.
Service interface (CDI)	–	On an individual basis following risk assessment.
Write protection via hardware write protection switch	Not enabled	On an individual basis following risk assessment.

### Protecting access via a password

Different passwords are available to protect write access to the parameters of the device.

Protect write access to the parameters of the device via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare). Access authorization is clearly regulated through the use of a user-specific access code.

### User-specific access code

Write access to the parameters of the device via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare) can be protected using the editable, user-specific access code.

### General notes on the use of passwords

- The access code and network key that were used when the device was delivered from the factory must be changed during commissioning
- When defining and managing the access code, comply with the general rules for the generation of a secure password
- The user is responsible for managing the access code and for using the code with due care

### Access via Web server

The device can be operated and configured via a Web browser with the integrated Web server. For device versions with the EtherNet/IP and PROFINET communication protocols, the connection can also be established via the terminal connection for signal transmission with EtherNet/IP or PROFINET.

The Web server is enabled when the device is delivered. The Web server can be disabled via the **Web server functionality** parameter if necessary (e.g. after commissioning).

The device and status information can be hidden on the login page. This prevents unauthorized access to the information.



Detailed information on the device parameters:  
"Description of Device Parameters" document

## Input

<b>Measured variable</b>	<b>Measured process variables</b> <ul style="list-style-type: none"> <li>■ Differential pressure</li> <li>■ Gauge pressure</li> </ul>
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<b>Measuring range</b>	Depending on the device configuration, the maximum working pressure (MWP) and the overpressure limit (OPL) can deviate from the values in the tables.
------------------------	---

**Standard: PN 160 / 16 MPa / 2400 psi**

Sensor	Maximum sensor measuring range		Smallest calibratable span <sup>1)</sup>
	lower (LRL)	upper (URL)	
[mbar (psi)]	[mbar (psi)]	[mbar (psi)]	[mbar (psi)]
30 (0.45)	-30 (-0.45)	+30 (+0.45)	0.3 (0.0045)
100 (1.5)	-100 (-1.5)	+100 (+1.5)	1 (0.015)
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

Sensor	MWP	OPL	
		on one side	on both sides
[mbar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]
30 (0.45)	100 (1500)	150 (2250)	150 (2250)
100 (1.5)	160 (2400) <sup>1)</sup>	160 (2400)	240 (3600)
500 (7.5)	160 (2400) <sup>1)</sup>	160 (2400)	240 (3600)
3000 (45)	160 (2400) <sup>1)</sup>	160 (2400)	240 (3600)
16000 (240)	160 (2400) <sup>1)</sup>	160 (2400)	240 (3600)
40000 (600)	160 (2400) <sup>1) 2)</sup>	"+" side: 160 (2400) "-" side: 100 (1500)	240 (3600)

1) If CRN approval is selected, the following limited MWP values apply: with copper seals: 124 bar (1 798.5 psi)

2) If pressure is applied on the negative side only, the MWP is 100 bar (1 500 psi).

**Standard: PN 250 / 25 MPa / 3626 psi**

Sensor	Maximum sensor measuring range		Smallest calibratable span <sup>1)</sup>
	lower (LRL)	upper (URL)	
[mbar (psi)]	[mbar (psi)]	[mbar (psi)]	[mbar (psi)]
100 (1.5)	-100 (-1.5)	+100 (+1.5)	1 (0.015)
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



Sensor	MWP <sup>1)</sup>	OPL	
		on one side	on both sides
[mbar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]
100 (1.5)	250 (3626) <sup>2)</sup>	250 (3626)	375 (5625)
500 (7.5)	250 (3626) <sup>2)</sup>	250 (3626)	375 (5625)
3000 (45)	250 (3626) <sup>2)</sup>	250 (3626)	375 (5625)
16000 (240)	250 (3626) <sup>2)</sup>	250 (3626)	375 (5625)
40000 (600)	250 (3626) <sup>2) 3)</sup>	"+" side: 250 (3626) "-" side: 100 bar (1 500 psi)	375 (5625)

1) MWP only on both sides.

2) If a CRN approval is selected, the following limited MWPs apply: with side venting: 179 bar (2 596.2 psi); with copper seals: 124 bar (1 798.5 psi)

3) If pressure is applied on the negative side only, the MWP is 100 bar (1 500 psi).

#### Minimum system pressure

- Minimum system pressure at reference operating conditions for silicone oil: 25 mbar (0.0375 psi)  
<sub>abs</sub>
- Minimum system pressure at 85 °C (185 °F) for silicone oil: to 250 mbar (4 psi)  
<sub>abs</sub>

## Output

Output signal	<p><b>Current output</b></p> <p>4 to 20 mA with superimposed digital communication protocol HART, 2-wire PROFINET-APL 10BASE-T1L, 2-wire 10 Mbit</p> <p>The current output offers a choice of three different operating modes:</p> <ul style="list-style-type: none"> <li>■ 4.0 to 20.5 mA</li> <li>■ NAMUR NE 43: 3.8 to 20.5 mA (factory setting)</li> <li>■ US mode: 3.9 to 20.8 mA</li> </ul>
Signal on alarm	<p>Signal on alarm in accordance with NAMUR recommendation NE 43.</p> <ul style="list-style-type: none"> <li>■ 4 to 20 mA HART: Options: <ul style="list-style-type: none"> <li>■ Max alarm: can be set from 21.5 to 23 mA</li> <li>■ Min. alarm: &lt; 3.6 mA (factory setting)</li> </ul> </li> <li>■ Ethernet-APL: According to "Application Layer protocol for decentralized periphery", Version 2.3</li> </ul>
Load	<p><b>4 to 20 mA HART</b></p> <div data-bbox="408 875 1442 1346"> </div> <p>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 <math>R_{Lmax}</math> maximum load resistance U Supply voltage</p> <p><b>i</b> Operation via handheld terminal or PC with operating program: take minimum communication resistance of 250 Ω into consideration.</p>
Damping	<p>A damping affects all outputs (output signal, display). Damping can be enabled as follows:</p> <ul style="list-style-type: none"> <li>■ Via the DIP switch on the electronic insert</li> <li>■ Factory setting: 1 s</li> </ul>
Ex connection data	<p>See the separate technical documentation (Safety Instructions (XA)) on <a href="http://www.endress.com/download">www.endress.com/download</a>.</p>
Linearization	<p>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.</p>
Flow measurement with Deltabar and differential pressure sensor	<p><b>Low flow cut off</b> parameter: When the <b>Low flow cut off</b> parameter is activated, small flows which can lead to large fluctuations in the measured value are suppressed.</p>

The **Low flow cut off** parameter is set to 5% by default when the **Output current transfer function** parameter is set to **Square root** option.

#### 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](http://www.endress.com)
  - [www.fieldcommgroup.org](http://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) <sup>1)</sup>	Pressure <sup>2)</sup>
Secondary variable (SV)	Sensor temperature
Tertiary variable (TV)	Electronic temperature
Quaternary variable (QV)	Sensor pressure <sup>3)</sup>

- 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 sensor signal before damping and position adjustment.

*Choice of HART device variables*

- **Pressure** option (after position correction and damping)
- Scaled variable
- Sensor temperature
- Sensor pressure  
Sensor Pressure is the raw signal from sensor before damping and position adjustment.
- Electronics temperature
- 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

##### PROFINET

<b>Protocol</b>	Application layer protocol for decentral device periphery and distributed automation, Version 2.3
<b>Communication type</b>	10 Mbit/s
<b>Conformance Class</b>	Conformance Class B
<b>Netload Class</b>	Netload Class II
<b>Baud rates</b>	Automatic 10 Mbit/s with full-duplex detection
<b>Cycle times</b>	From 32 ms
<b>Polarity</b>	Auto-polarity for automatic correction of crossed TxD and RxD pairs
<b>Media Redundancy Protocol (MRP)</b>	Yes
<b>System redundancy support</b>	System redundancy S2 (2 AR with 1 NAP)

<b>Device profile</b>	Application interface identifier 0xF600 Generic device
<b>Manufacturer ID</b>	0x11
<b>Device type ID</b>	
<b>Device description files (GSD, FDI, DTM, DD)</b>	Information and files under: <ul style="list-style-type: none"> <li>▪ <a href="http://www.endress.com">www.endress.com</a> On the product page for the device: Documents/Software → Device drivers</li> <li>▪ <a href="http://www.profibus.org">www.profibus.org</a></li> </ul>
<b>Supported connections</b>	<ul style="list-style-type: none"> <li>▪ 2 x AR (IO Controller AR)</li> <li>▪ 1 x AR (IO-Supervisor Device AR connection allowed)</li> <li>▪ 1 x Input CR (Communication Relation)</li> <li>▪ 1 x Output CR (Communication Relation)</li> <li>▪ 1 x Alarm CR (Communication Relation)</li> </ul>
<b>Configuration options for device</b>	<ul style="list-style-type: none"> <li>▪ Manufacturer-specific software (FieldCare, DeviceCare)</li> <li>▪ Web browser</li> <li>▪ Device master file (GSD), can be read out via the integrated Web server of the device</li> </ul>
<b>Configuration of the device name</b>	<ul style="list-style-type: none"> <li>▪ DCP protocol</li> <li>▪ Process Device Manager (PDM)</li> <li>▪ Integrated Web server</li> </ul>
<b>Supported functions</b>	<ul style="list-style-type: none"> <li>▪ Identification &amp; maintenance Simple device identification via: <ul style="list-style-type: none"> <li>▪ Control system</li> <li>▪ Nameplate</li> </ul> </li> <li>▪ Measured value status The process variables are communicated with a measured value status</li> <li>▪ Blinking feature via the local display for simple device identification and assignment</li> <li>▪ Device operation via operating tools (e.g. FieldCare, DeviceCare, SIMATIC PDM)</li> </ul>
<b>System integration</b>	For information on system integration, see the Operating Instructions <ul style="list-style-type: none"> <li>▪ Cyclic data transmission</li> <li>▪ Overview and description of the modules</li> <li>▪ Status coding</li> <li>▪ Startup configuration</li> <li>▪ Factory setting</li> </ul>

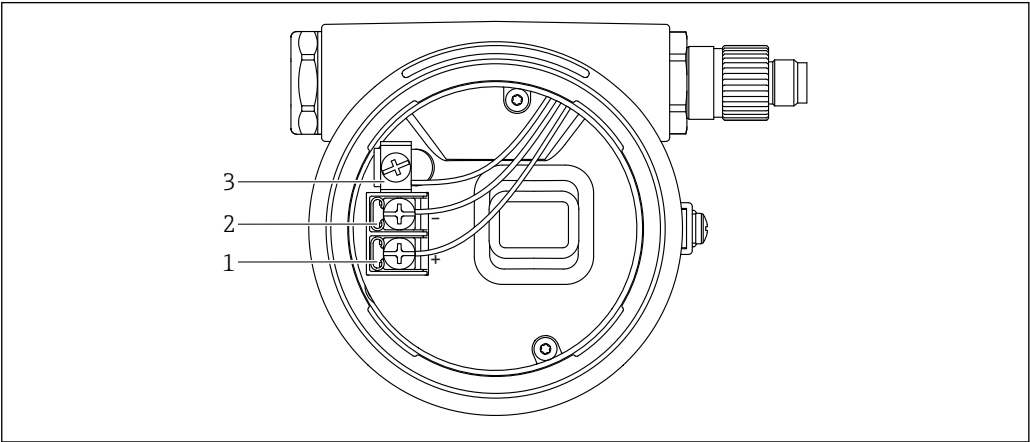
**Wireless HART data**


- 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

### Single compartment housing

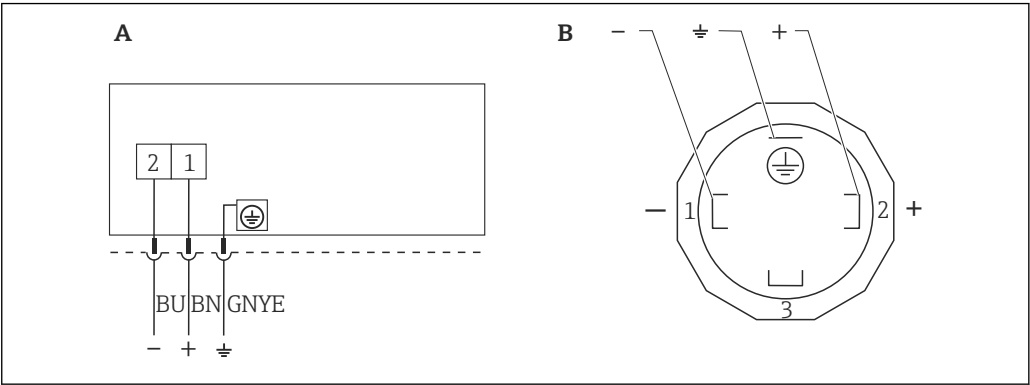



-  1 Connection terminals and ground terminal in the connection compartment
- 1 Positive terminal
- 2 Negative terminal
- 3 Internal ground terminal

### 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.

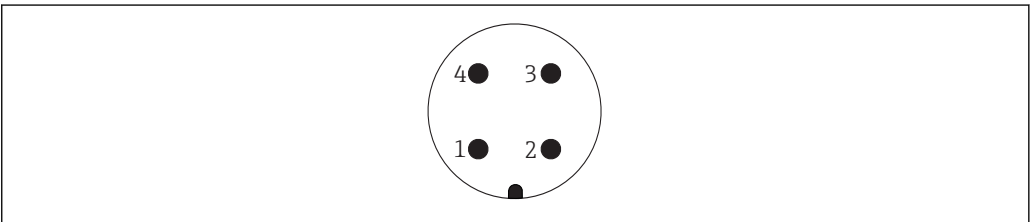
### Devices with valve plug



-  2 BN = brown, BU = blue, GNYE = green/yellow
- A Electrical connection for devices with valve connector
- B View of the plug-in connection on the device

Material: PA 6.6

### Devices with M12 plug



Pin	Analog/HART
1	Signal +
2	Not assigned
3	Signal -
4	Ground

Pin	Ethernet-APL
1	APL signal -
2	APL signal +
3	Shielding
4	Not assigned

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 (not for Ethernet-APL)

■ Material:

Body: PBT; union nut: nickel-plated die-cast zinc; seal: NBR

■ Degree of protection (fully locked): IP67

■ Order number: 71114212

Cable 4x0.34 mm<sup>2</sup> (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

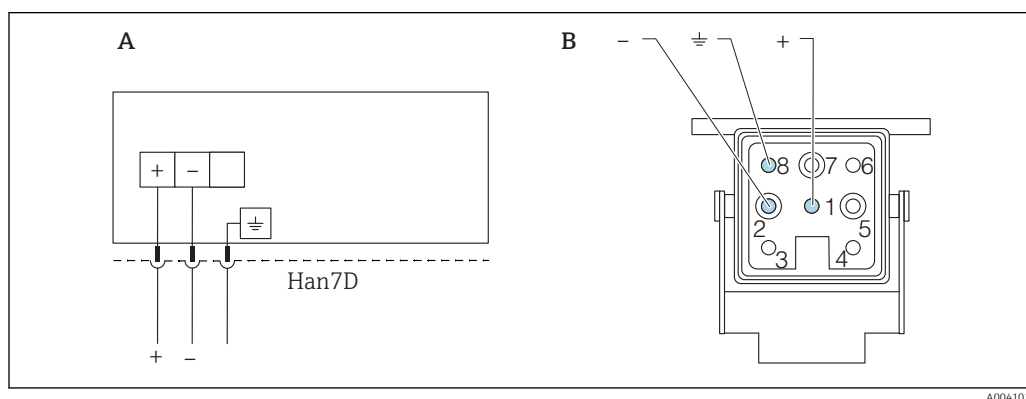
■ 1 = BN = brown

■ 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**

- Ex d, Ex e, non Ex: supply voltage: 10.5 to 35 V<sub>DC</sub>
- Ex i: supply voltage: 10.5 to 30 V<sub>DC</sub>
- Ethernet-APL Power Class A (9.6 to 15 V<sub>DC</sub> 540 mW)
- Nominal current: 4 to 20 mA HART

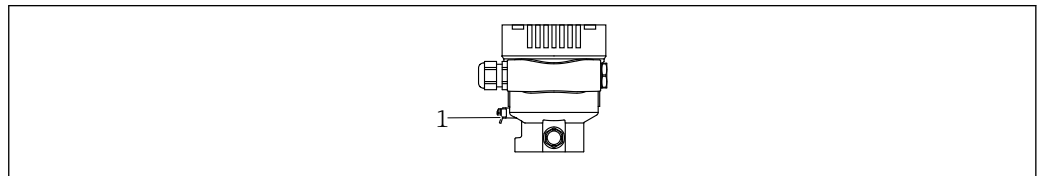


The power unit must be tested to ensure it meets safety requirements (e.g. PELV, SELV, Class 2).



The field switch must be tested to ensure it meets safety requirements (e.g. PELV, SELV, Class 2).

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

**Potential equalization**

A0045411

- 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 transmitter before the device is connected.

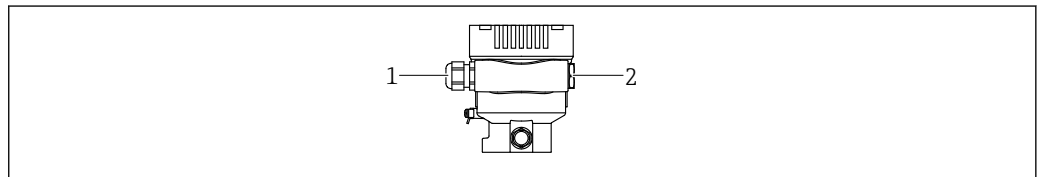


For optimum electromagnetic compatibility:

- Keep the potential matching line as short as possible
- Maintain a cross-section of at least 2.5 mm<sup>2</sup> (14 AWG)

**Terminals**

- Supply voltage and internal ground terminal: 0.5 to 2.5 mm<sup>2</sup> (20 to 14 AWG)
- External ground terminal: 0.5 to 4 mm<sup>2</sup> (20 to 12 AWG)

**Cable entries**

A0045413

- 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

**Overvoltage category**

Overvoltage category II



## Performance characteristics

<b>Response time</b>	<ul style="list-style-type: none"> <li>■ HART: acyclic: min. 330 ms, typically 590 ms (depends on commands and number of preambles)</li> <li>■ HART: cyclic (burst): min. 160 ms, typically 350 ms (depends on commands and number of preambles)</li> <li>■ Cyclic: min. 32 ms</li> </ul>
<b>Reference operating conditions</b>	<ul style="list-style-type: none"> <li>■ As per IEC 62828-2</li> <li>■ Ambient temperature <math>T_A</math> = constant, in the range of +22 to +28 °C (+72 to +82 °F)</li> <li>■ Humidity <math>\phi</math> = constant, in the range of: 5 to 80 % rF <math>\pm</math> 5 %</li> <li>■ Ambient pressure <math>p_A</math> = constant, in the range of: 860 to 1 060 mbar (12.47 to 15.37 psi)</li> <li>■ Position of the measuring cell: horizontal <math>\pm</math>1°</li> <li>■ Input of LOW SENSOR TRIM and HIGH SENSOR TRIM for lower range value and upper range value</li> <li>■ Membrane material: AISI 316L (1.4435), Alloy C276</li> <li>■ Supply voltage: 24 V DC <math>\pm</math>3 V DC</li> <li>■ Load with HART: 250 <math>\Omega</math></li> <li>■ Turn down (TD) = URL/   URV - LRV  </li> <li>■ Zero based span</li> </ul>
<b>Total performance</b>	<p>The performance characteristics refer to the accuracy of the device. The factors that influence the accuracy can be divided into two groups</p> <ul style="list-style-type: none"> <li>■ Total performance of device</li> <li>■ Installation factors</li> </ul> <p>All of the performance characteristics meet the requirement of <math>\geq \pm 3</math> sigma.</p> <p>The total performance of the device comprises the reference accuracy and the ambient temperature effect and is calculated using the following formula:</p> $\text{Total performance} = \pm \sqrt{(E1)^2 + (E2)^2 + (E3)^2}$ <p>E1 = Reference accuracy  E2 = Ambient temperature effect  E3 = Static pressure effect</p> <p>Calculation of E2:</p> <p>Ambient temperature effect per <math>\pm 28</math> °C (50 °F)  (Corresponds to a range of <math>-3</math> to <math>+53</math> °C (+27 to +127 °F))</p> $E2 = E2_M + E2_E$ <p><math>E2_M</math> = Main temperature error  <math>E2_E</math> = Electronics error</p> <ul style="list-style-type: none"> <li>■ The values apply to process membranes made of 316L (1.4435)</li> <li>■ The values refer to the calibrated span.</li> </ul>

**Reference accuracy [E1]**

The reference accuracy comprises the non-linearity according to the limit point method, pressure hysteresis and non-repeatability in accordance with [IEC 62828-1 / IEC 61298-2]. Reference accuracy for standard up to TD 100:1, for platinum up to TD 10:1.

Sensor	Standard	Platinum
30 mbar (0.45 psi)	TD 1:1 to 3:1 = $\pm 0.1 \%$ TD > 3:1 = $\pm (0.03 \% \cdot TD + 0.01 \%)$	not available
100 mbar (1.5 psi)	TD 1:1 to 5:1 = $\pm 0.075 \%$ TD > 5:1 = $\pm (0.014 \% \cdot TD + 0.005 \%)$	TD 1:1 to 5:1 = $\pm 0.055 \%$ TD > 5:1 to 10:1 = $\pm (0.01 \% \cdot TD + 0.005 \%)$
500 mbar (7.5 psi) 3 bar (45 psi) 16 bar (240 psi) 40 bar (600 psi)	TD 1:1 to 15:1 = $\pm 0.075 \%$ TD > 15:1 = $\pm (0.004 \% \cdot TD + 0.015 \%)$	TD 1:1 to 10:1 = $\pm 0.055 \%$

**Temperature effect [E2]***E2<sub>M</sub> - 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.

30 mbar (0.45 psi) sensor

- Standard:  $\pm (0.31 \% \cdot TD + 0.5 \%)$
- Platinum: not available

100 mbar (1.5 psi) sensor

- Standard:  $\pm (0.18 \% \cdot TD + 0.02 \%)$
- Platinum:  $\pm (0.18 \% \cdot TD + 0.02 \%)$

500 mbar (7.5 psi) and 3 bar (45 psi) sensor

- Standard:  $\pm (0.08 \% \cdot TD + 0.05 \%)$
- Platinum:  $\pm (0.08 \% \cdot TD + 0.05 \%)$

16 bar (240 psi) sensor

- Standard:  $\pm (0.1 \% \cdot TD + 0.1 \%)$
- Platinum:  $\pm (0.1 \% \cdot TD + 0.1 \%)$

40 bar (600 psi) sensor

- Standard:  $\pm (0.08 \% \cdot TD + 0.05 \%)$
- Platinum:  $\pm (0.08 \% \cdot TD + 0.05 \%)$

*E2<sub>E</sub> - Electronics error*

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

*E3<sub>M</sub> - 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).

30 mbar (0.45 psi) sensor

- Standard
  - Influence on the zero point:  $\pm 0.07 \% \cdot TD$  per 70 bar (1 050 psi)
  - Influence on the span:  $\pm 0.07 \%$  per 70 bar (1 050 psi)
- Platinum: not available

- 100 mbar (1.5 psi) sensor
- Standard
    - Influence on the zero point:  $\pm 0.15 \% \cdot \text{TD}$  per 70 bar (1050 psi)
    - Influence on the span:  $\pm 0.15 \%$  per 70 bar (1050 psi)
  - Platinum
    - Influence on the zero point:  $\pm 0.15 \% \cdot \text{TD}$  per 70 bar (1015 psi)
    - Influence on the span:  $\pm 0.14 \%$  per 70 bar (1050 psi)
- 500 mbar (7.5 psi), 3 bar (45 psi), 16 bar (240 psi) and 40 bar (600 psi) sensor
- Standard
    - Influence on the zero point:  $\pm 0.075 \% \cdot \text{TD}$  per 70 bar (1015 psi)
    - Influence on the span:  $\pm 0.14 \%$  per 70 bar (1050 psi)
  - Platinum
    - Influence on the zero point:  $\pm 0.075 \% \cdot \text{TD}$  per 70 bar (1050 psi)
    - Influence on the span:  $\pm 0.14 \%$  per 70 bar (1015 psi)

**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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**Resolution** Current output:  $<1 \mu\text{A}$

**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"](#).



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**Long-term stability**

The specifications refer to the upper range limit (URL).

30 mbar (0.45 psi) sensor

- 1 year:  $\pm 0.25\%$
- 5 years:  $\pm 1.25\%$
- 10 years:  $\pm 1.50\%$

100 mbar (1.5 psi) sensor

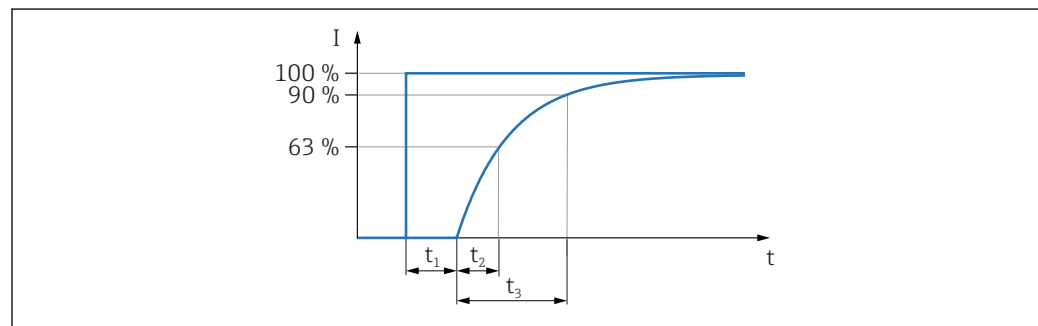
- 1 year:  $\pm 0.18\%$
- 5 years:  $\pm 0.35\%$
- 10 years:  $\pm 0.50\%$

500 mbar (7.5 psi), 3 bar (45 psi), 16 bar (240 psi) and 40 bar (600 psi) sensor

- 1 year:  $\pm 0.05\%$
- 5 years:  $\pm 0.13\%$
- 10 years:  $\pm 0.23\%$

**Response time T63 and T90****Dead time, time constant**

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



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**Dynamic behavior, current output (HART electronics)**

30 mbar (0.45 psi) sensor:

- Dead time ( $t_1$ ): maximum 50 ms
- Time constant T63 ( $t_2$ ): maximum 450 ms
- Time constant T90 ( $t_3$ ): maximum 1100 ms

100 mbar (1.5 psi) sensor:

- Dead time ( $t_1$ ): maximum 50 ms
- Time constant T63 ( $t_2$ ): maximum 120 ms
- Time constant T90 ( $t_3$ ): maximum 200 ms

All other sensors:

- Dead time ( $t_1$ ): maximum 50 ms
- Time constant T63 ( $t_2$ ): maximum 85 ms
- Time constant T90 ( $t_3$ ): maximum 200 ms

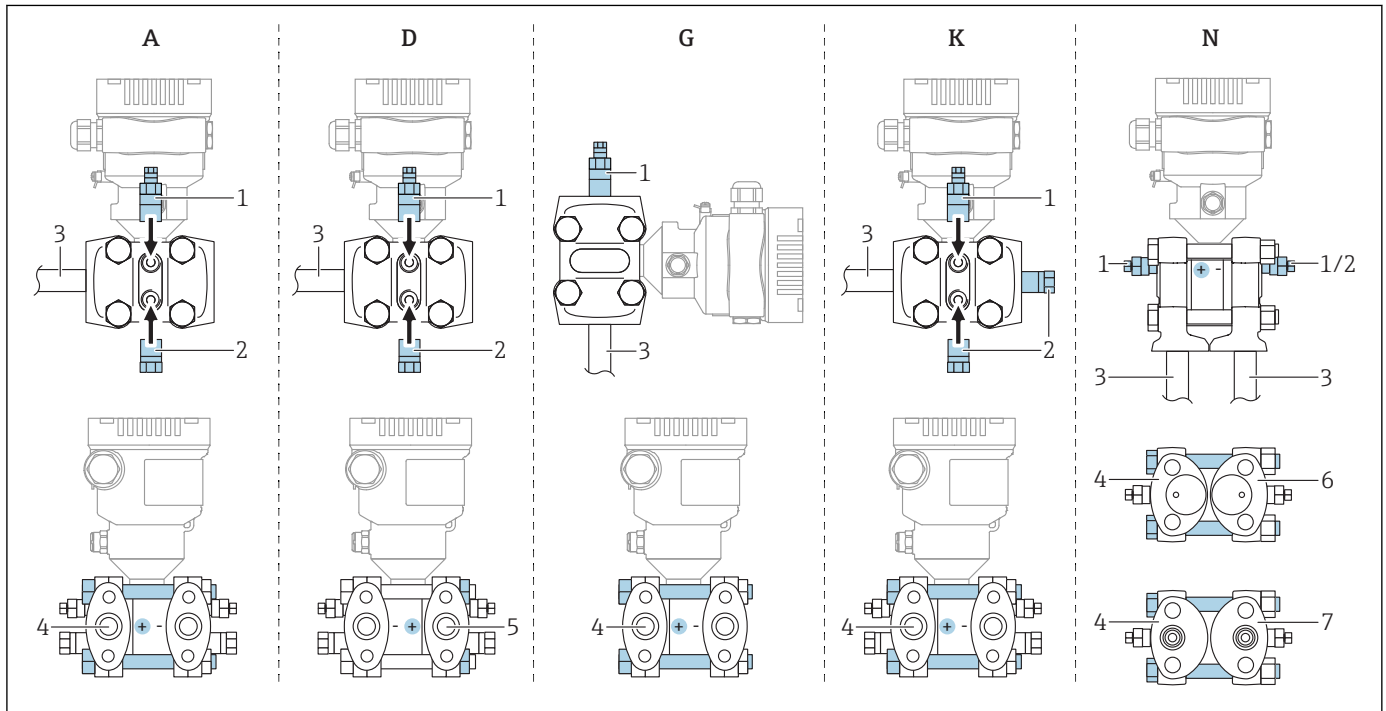
**Warm-up time (according to IEC62828-4)**

$\leq 5$  s

## Installation

### Orientation

The installation depends on how the impulse lines are connected.



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#### 3 A, D, G, K, N: order options

- A Horizontal impulse line, left side HP (screw head side), with side vent. Thread on one side and side thread for horizontal impulse line.
- D Horizontal impulse line, right side HP (nut side), with side vent. Thread on one side and side thread for horizontal impulse line.
- G Vertical impulse line, left or right side HP (screw head side), with vent. Thread on each side for vertical impulse line.
- K Universal side flange, left or right side HP (screw head side), with vent. Thread on each side and side thread for universal mounting.
- N Bottom process connection, left side HP (screw head side), vent. Thread on each side and side thread for mounting on existing manifolds.
- 1 Vent valve
- 2 Sealing plug
- 3 Impulse line
- 4 High-pressure (HP) side (screw head side)
- 5 High-pressure (HP) side (nut side)
- 6 Coplanar compatible, view from below
- 7 IEC upright, view from below

### Sensor selection and arrangement

#### Flow measurement

##### Flow measurement in gases

Mount the device above the measuring point so that condensate can drain into the process pipe.

##### Flow measurement in vapors

- Mount the device below the measuring point
- Mount the condensate traps at the same height as the tapping points and at the same distance to the device
- Prior to commissioning, fill the impulse lines to the height of the condensate traps

*Flow measurement in liquids*

- Mount the device below the measuring point so that the impulse lines are always filled with liquid and gas bubbles can run back into the process pipe
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment

**Level measurement***Level measurement in open vessels*

- Mount the device below the lower measuring connection so that the impulse lines are always filled with liquid
- The low-pressure side is open to atmospheric pressure
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment

*Level measurement in a closed vessel*

- Mount the device below the lower measuring connection so that the impulse lines are always filled with liquid
- Always connect the low-pressure side above the maximum level
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment

*Level measurement in a closed vessel with superimposed vapor*

- Mount the device below the lower measuring connection so that the impulse lines are always filled with liquid
- Always connect the low-pressure side above the maximum level
- The condensate trap ensures constant pressure on the low-pressure side
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment

**Pressure measurement***Pressure measurement with 160 bar (2 400 psi) and 250 bar (3 750 psi) measuring cell*

Mount the device above the measuring point so that the condensate can drain into the process pipe

**Differential pressure measurement***Differential pressure measurement in gases and vapors*

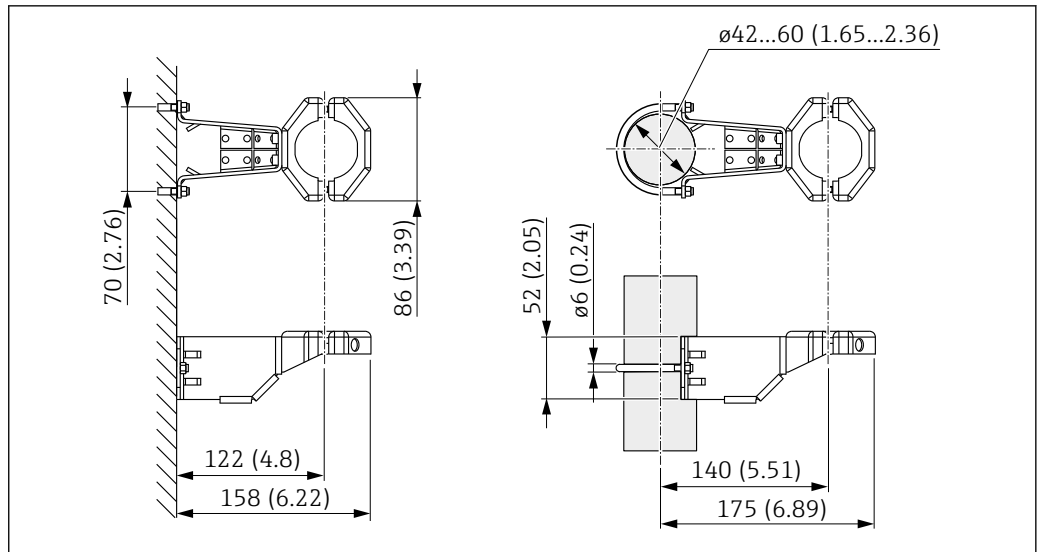
Mount the device above the measuring point so that condensate can drain into the process pipe.

*Differential pressure measurement in liquids*

Mount the device below the measuring point so that the impulse lines are always filled with liquid and gas bubbles can run back into the process pipe

**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.



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Unit of measurement mm (in)

Ordering information:

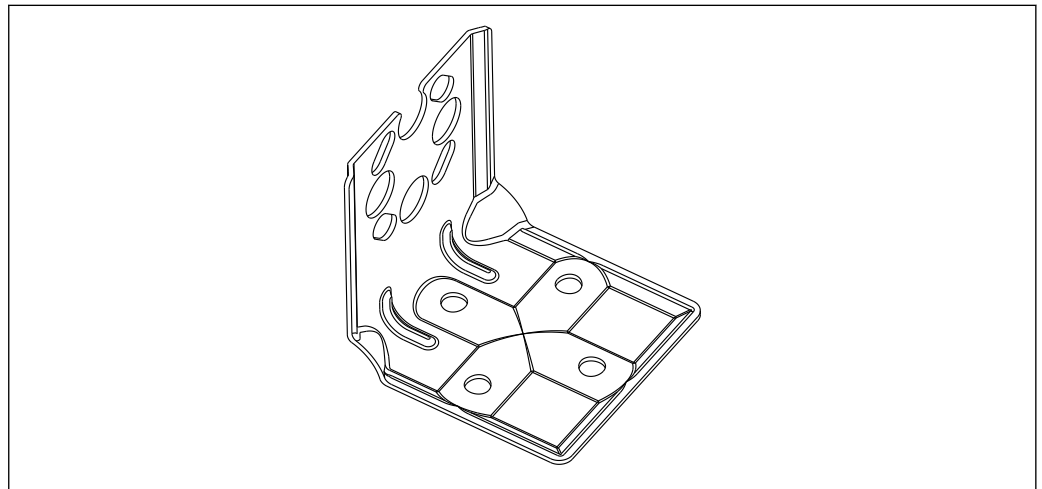
Can be ordered as a separate accessory, part number 71102216



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:



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- If a valve manifold is used, its dimensions should also be taken into consideration
- Bracket for wall and pipe mounting including retaining bracket for pipe mounting and two nuts
- The material of the screws used to secure the device depends on the order code



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

### Special mounting instructions

#### Wall and pipe mounting with a manifold (optional)

If the device is mounted on a shutoff device (e.g. manifold or shutoff valve), then use the bracket provided for this purpose. This makes it easier to disassemble the device.

For technical data, see the SD01553P accessory document.

**Sensor, remote (separate housing)**

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

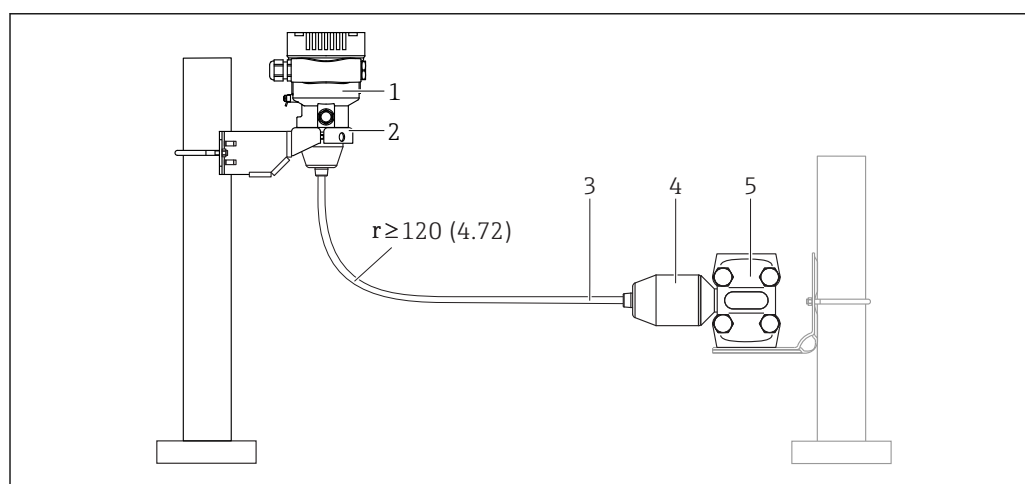
This version therefore facilitates trouble-free measurement:

- 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.



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- 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

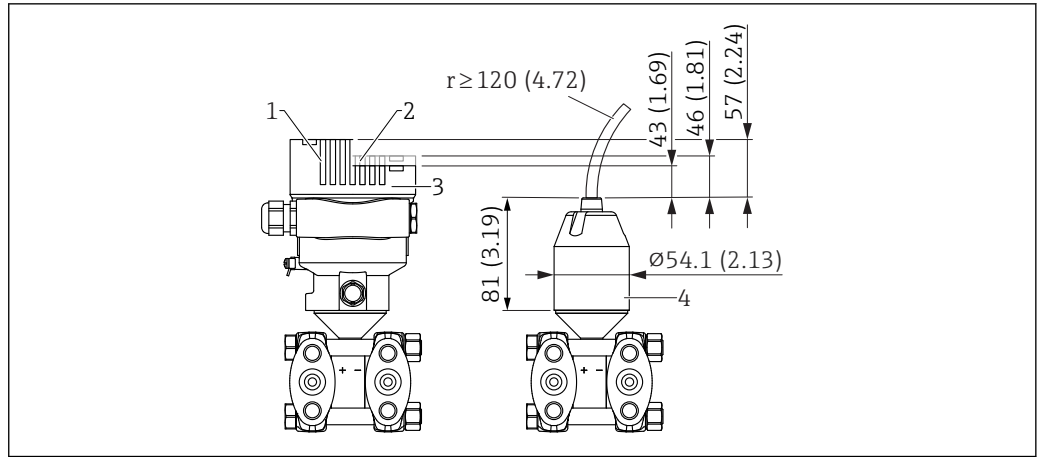
Use in hazardous area:

- 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.





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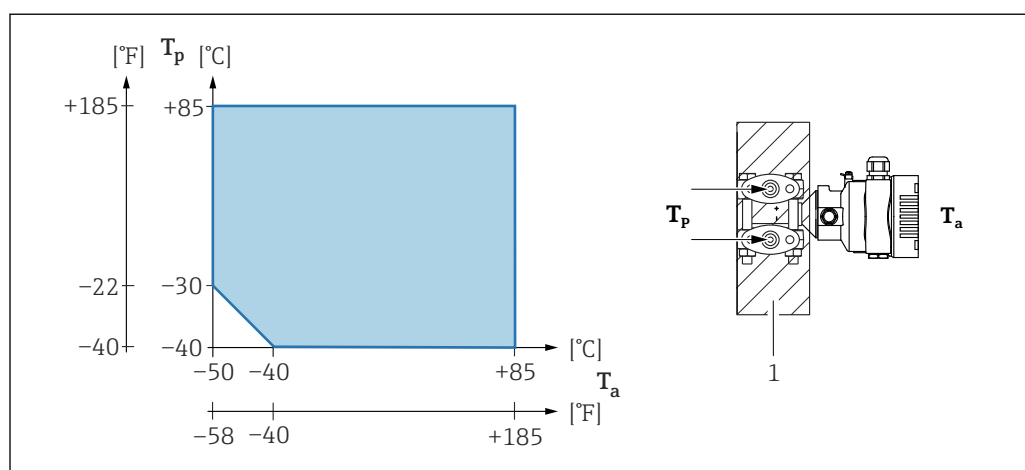
- 1 Device with display, cover with glass viewing window (devices for Ex d, dust Ex)
- 2 Device with display, cover with plastic viewing window
- 3 Device without display, cover without viewing window
- 4 Process connection adapter

## Environment

<b>Ambient temperature range</b>	<p>The following values apply up to a process temperature of +85 °C (+185 °F). At higher process temperatures, the permitted ambient temperature is reduced.</p> <ul style="list-style-type: none"> <li>■ Without LCD display: Standard: -40 to +85 °C (-40 to +185 °F)</li> <li>■ With LCD 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)</li> <li>■ Separate housing: -20 to +60 °C (-4 to +140 °F)</li> </ul>
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### Ambient temperature $T_a$ depending on the process temperature $T_p$

The process connection must be fully insulated for ambient temperatures below -40 °C (-40 °F).



1 Insulation material

### 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 up to the ambient temperature.

<b>Storage temperature</b>	<ul style="list-style-type: none"> <li>■ Without LCD display: Standard: -40 to +90 °C (-40 to +194 °F)</li> <li>■ With LCD display: -40 to +85 °C (-40 to +185 °F)</li> <li>■ Separate housing: -40 to +60 °C (-40 to +140 °F)</li> </ul> <p>With M12 plug, elbowed: -25 to +85 °C (-13 to +185 °F)</p>
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<b>Operating altitude</b>	Up to 5 000 m (16 404 ft) above sea level.
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<b>Climate class</b>	<p>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.</p> <p>Condensation is possible.</p>
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<b>Atmosphere</b>	<p><b>Operation in very corrosive environment</b></p> <p>Anodic corrosion protection can be ordered as a "mounted accessory".</p>
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<b>Degree of protection</b>	Test as per IEC 60529 and NEMA 250-2014
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### Housing and process connection

IP66/68, TYPE 4X/6P  
(IP68: (1.83 mH<sub>2</sub>O 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<sub>2</sub>O for 24 h) TYPE 4/6P

*PE cable*

- IP69 (on sensor side)
- IP66 TYPE 4/6P
- IP68 (1.83 mH<sub>2</sub>O for 24 h) TYPE 4/6P

**Vibration resistance****Single compartment housing**

Measuring range	Sine wave oscillation IEC 61298-3:2008	Shock
30 mbar (0.45 psi)	10 Hz to 60 Hz: ±0.21 mm (0.0083 in) 60 Hz to 2000 Hz: 3 g	30 g
0.1 to 160 bar (1.5 to 2 400 psi)	10 Hz to 60 Hz: ±0.35 mm (0.0138 in) 60 Hz to 1000 Hz: 5 g	30 g

**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

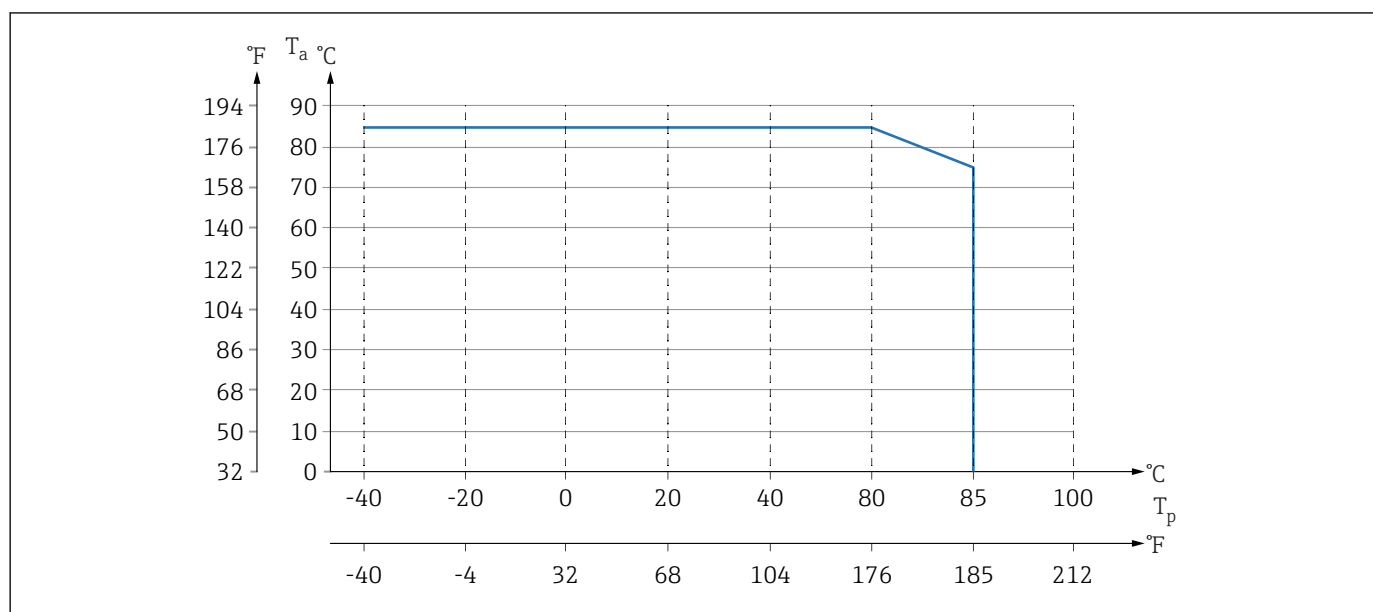
### Process temperature range

#### 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.

### Devices without a manifold



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4 Values apply for vertical mounting without insulation.

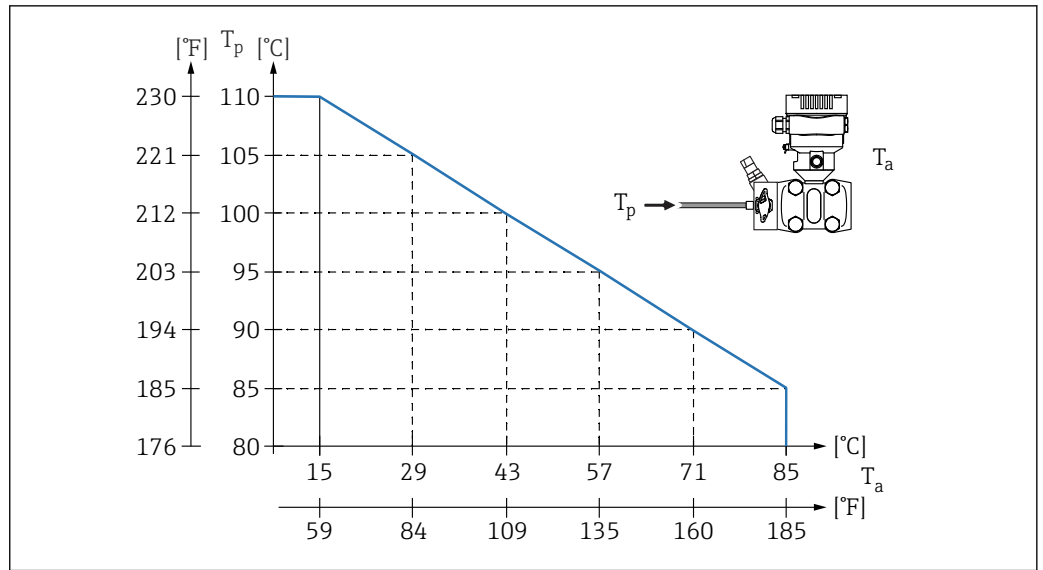
$T_p$  Process temperature

$T_a$  Ambient temperature

### Devices with a manifold

The maximum permitted process temperature at the manifold is 110 °C (230 °F).

For process temperatures >85 °C (185 °F) where non-insulated side flanges are installed horizontally on a manifold, a reduced ambient temperature applies (see the following graphic).



$T_a$  Maximum ambient temperature at the manifold

$T_p$  Maximum process temperature at the manifold

### 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.

- $p_{\max}$ : 80 bar (1 200 psi)
- $T_{\max}$ : 60 °C (140 °F)

### Seals

#### Process temperature range (temperature at transmitter)

##### Device without a manifold

- -40 to +85 °C (-40 to +185 °F)
- Pay attention to the process temperature range of the seal

##### Device with a manifold

The maximum permitted process temperature at the manifold is 110 °C (230 °F) (restricted by IEC standard).

For process temperatures >85 °C (185 °F) where non-insulated side flanges are installed horizontally on a manifold, a reduced ambient temperature applies up to a maximum ambient temperature, calculated according to the following formula:

$$T_{\text{Ambient\_Temperature\_max}} = 85 \text{ °C} - 2.8 \cdot (T_{\text{Process\_Temperature}} - 85 \text{ °C})$$

$$T_{\text{Ambient\_Temperature\_max}} = 185 \text{ °F} - 2.8 \cdot (T_{\text{Process\_Temperature}} - 185 \text{ °F})$$

$$T_{\text{Ambient\_Temperature\_max}} = \text{maximum ambient temperature in °C or °F}$$

$$T_{\text{Process\_Temperature}} = \text{process temperature at a manifold in °C or °F}$$

## 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 is based on a reference temperature of +20 °C (+68 °F) and may be applied to the device for an unlimited period of 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 corresponds to the overpressure limit OPL of the entire device. 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 sensor range and process connection combinations where the overpressure limit (OPL) of the process connection is smaller than the nominal value of the sensor, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If the entire sensor 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  $T_{\max}$ .
- ▶ For the 30 mbar (0.45 psi) sensors, use FKM, EPDM or FFKM seals in the event of frequent load changes > 0 to 100 bar (0 to 1 450 psi).

**Burst pressure**

## PN160

- Measuring range: ≤40 bar (580 psi)
- Burst pressure: 690 bar (10 005 psi)

Applies for the process seal materials FKM, PTFE, FFKM, EPDM and for pressure applied on both sides

If the side vent valves (sv) option is selected and a PTFE seal is used, the burst pressure is 600 bar (8 700 psi)

## PN250

- Measuring range: ≤40 bar (580 psi)
- Burst pressure: 1 320 bar (19 140 psi)

Applies for the process seal materials FKM, FFKM, EPDM and for pressure applied on both sides

If the side vent valves (sv) option is selected, the burst pressure is 690 bar (10 005 psi)

For the process seal material PTFE, the burst pressure is 1 250 bar (18 125 psi)

## 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.

## Mechanical construction



For the dimensions, see the Product Configurator: [www.endress.com](http://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](http://www.endress.com).

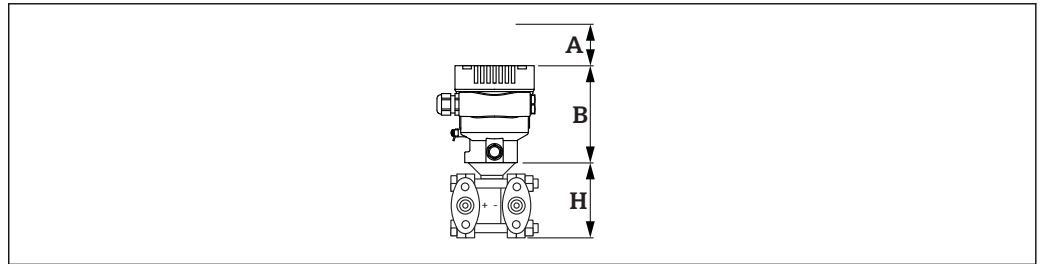
### Design, dimensions

#### Device height

The device height is calculated from

- the height of the housing
- 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).

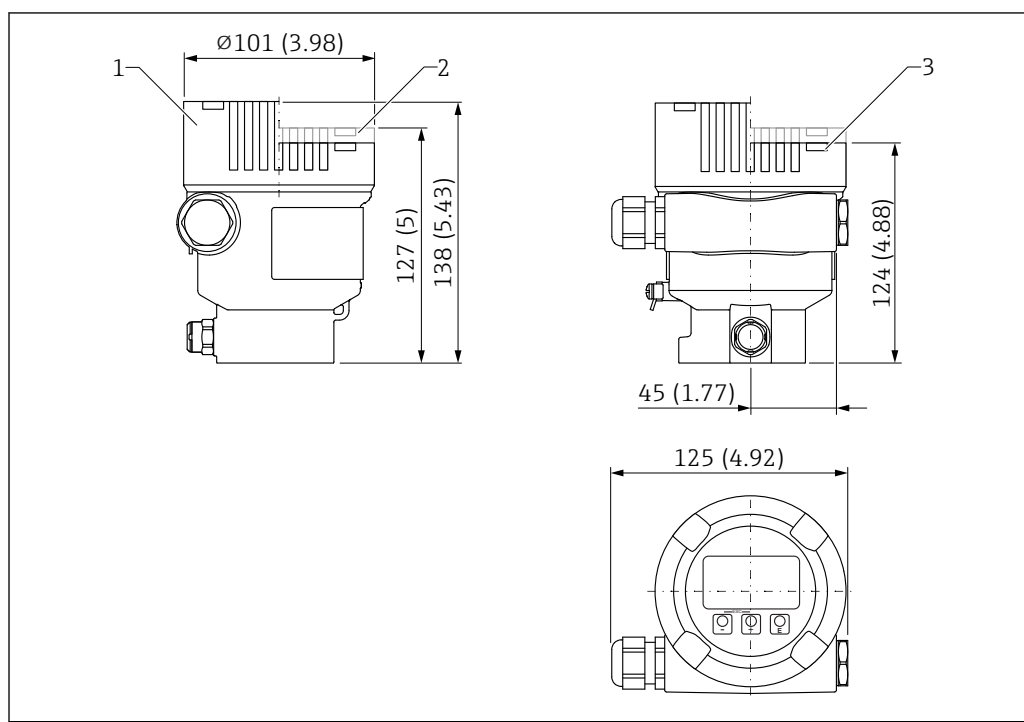


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- A    *Installation clearance*  
B    *Height of the housing*  
H    *Height of the sensor assembly*

## Dimensions

## Single compartment housing



A0038380

Unit of measurement mm (in)

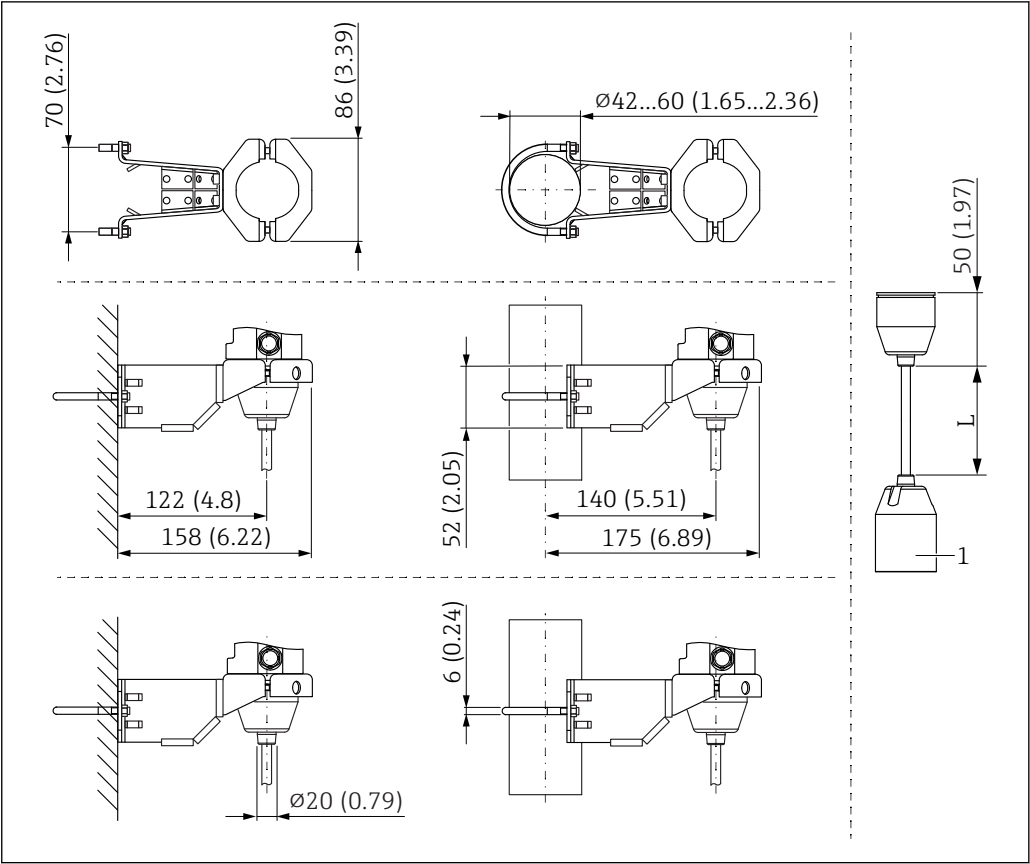
- 1 Device with display, cover with glass viewing window (devices for Ex d, dust Ex): 138 mm (5.43 in)
- 2 Device with display, cover with plastic viewing window: 127 mm (5 in)
- 3 Device without display, cover without viewing window: 124 mm (4.88 in)



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



Sensor, remote (separate housing)



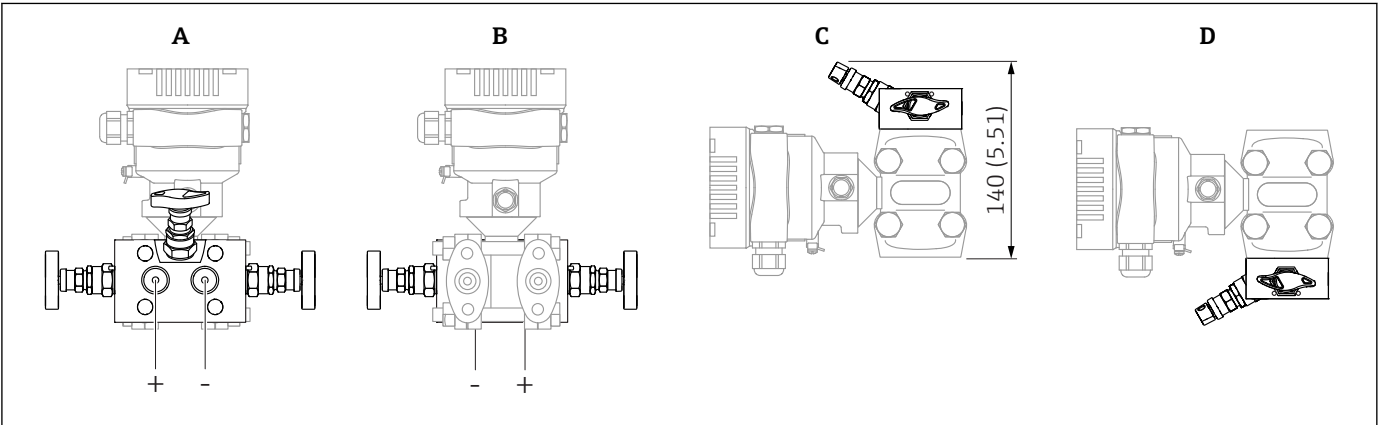
A0038214

Unit of measurement mm (in)

1 81 mm (3.19 in)

L Length of cable versions

Mounted on manifold



A0038641

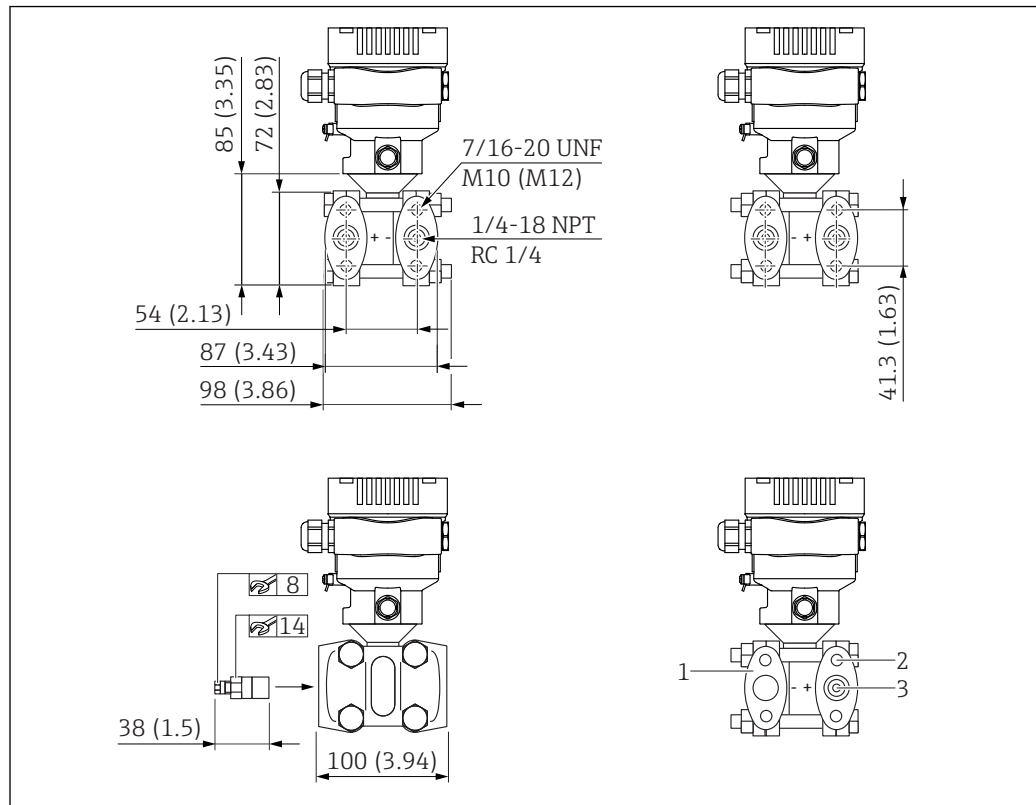
Unit of measurement mm (in)

A Mounted backside of manifold

B Mounted frontside of manifold

C Mounted bottom of manifold

D Mounted top of manifold

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


5 Front view, left-hand side view, right-hand side view. Unit of measurement mm (in)

- 1 Blind flange
- 2 Thread depth: 15 mm (0.59 in)
- 3 Thread depth: 12 mm (0.47 in)(±1 mm (0.04 in))

**7/16-20 UNF**

Connections including 2 vent valves:

- <PN 160: 1/4-18 NPT IEC 61518
- PN 160: M10
- PN 420: M12

*7/16-20 UNF with blind flange on LP side (version with absolute pressure sensor or gauge pressure sensor)*

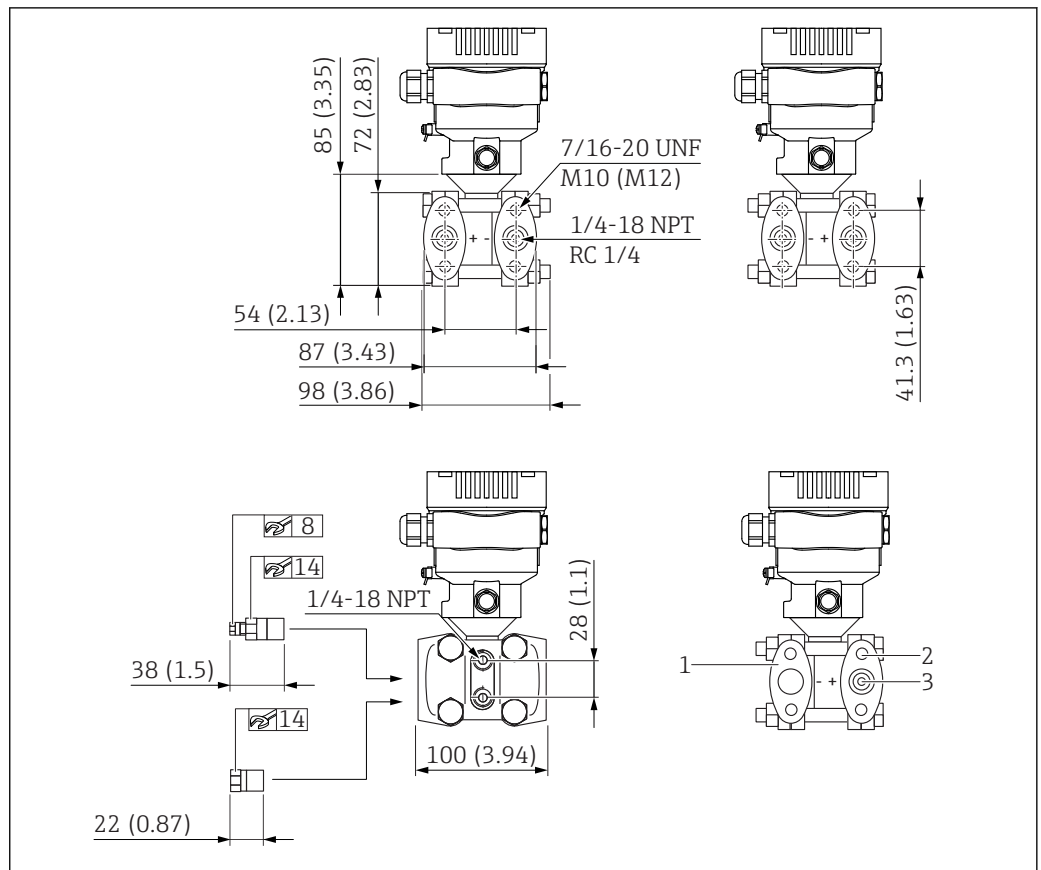
Connections including vent valve:

1/4-18 NPT IEC 61518

**RC 1/4**

Connections including 2 vent valves:

- <PN 160: 1/4-18 NPT IEC 61518
- PN 160: RC 1/4
- PN 420: RC 1/4

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

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

- 1 blind flange
- 2 Thread depth: 15 mm (0.59 in)
- 3 Thread depth: 12 mm (0.47 in) ( $\pm 1$  mm (0.04 in))

**7/16-20 UNF**

Connections including 4 locking screws and 2 vent valves:  
1/4-18 NPT IEC 61518

7/16-20 UNF with blind flange on LP side (version with absolute pressure sensor or gauge pressure sensor)

Connections including vent valve:  
1/4-18 NPT IEC 61518

**RC 1/4**

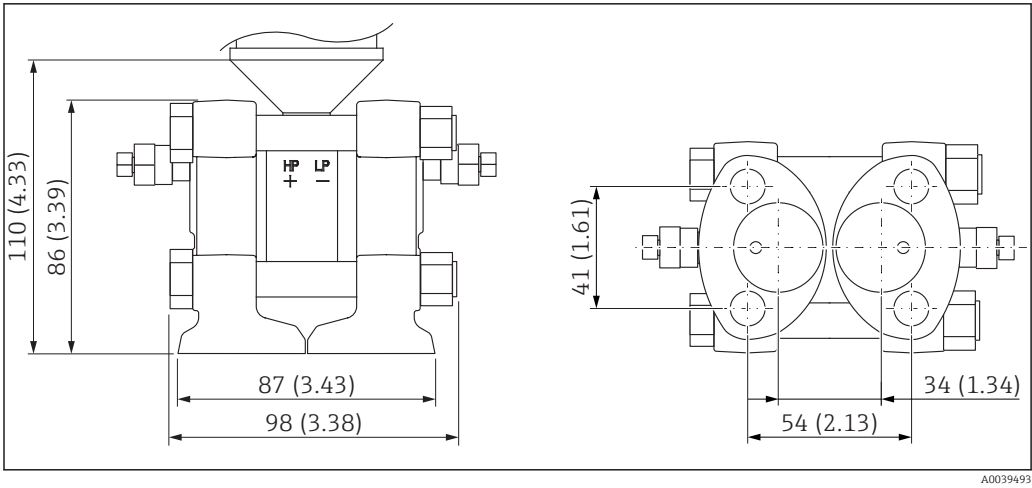
Connections including 4 locking screws and 2 vent valves:

- <PN 160: 1/4-18 NPT IEC 61518
- PN 160: RC 1/4
- PN 420: RC 1/4

**Bottom process connection NPT1/4-18 coplanar compatible**

For mounting on existing coplanar manifolds.

Seal is supplied, as per selected seal material.



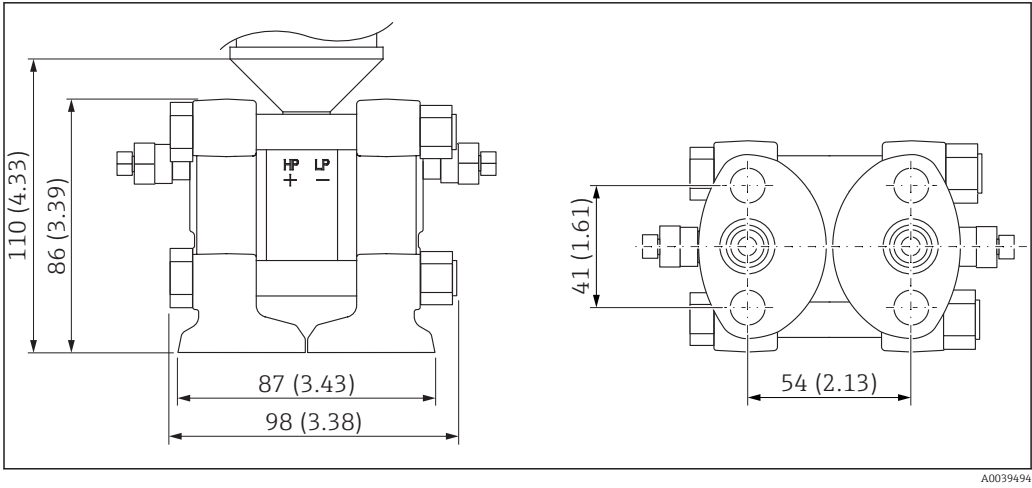
A0039493

Seal of sensor flange	Seal of coplanar process connection <sup>1)</sup>
PTFE	PTFE
FKM	FKM
EPDM	
FFKM	

1) Flange manifold: cannot be selected!

**Bottom process connection, NPT1/4-18 IEC61518 UNF7/16-20**

For mounting on IEC manifolds in an upright position.



A0039494

**Weight**

**Housing**

Weight including electronics and display.

- Single compartment housing: 1.1 kg (2.43 lb)
- Dual compartment housing
  - Aluminum: 1.4 kg (3.09 lb)
  - Stainless steel: 3.3 kg (7.28 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)

#### **Process connections**

- Process connections made of 316L: 3.2 kg (7.06 lb)
- Process connections made of Alloy C276: 3.5 kg (7.72 lb)
- NPT1/4-18 coplanar compatible, Super Duplex: 3.14 kg (6.92 lb)

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)
  - Alloy C276
- The flange raised face is made from the same material as the process membrane

##### **Seal**

- PTFE
- FKM
- EPDM

##### **Process connections**

- NPT1/4-18 IEC61518 UNF7/16-20  
Side flange: AISI 316/316L (1.4408) / CF3M (cast equivalent to material AISI 316L)
- NPT1/4-18 IEC61518 UNF7/16-20, Super Duplex  
Side flange: 1.4410
- NPT1/4-18 DIN19213 M10  
■ Side flange: 316L
- 
- NPT1/4-18 DIN19213 M12  
Side flange: 316L
- RC 1/4  
■ Side flange: AISI 316/316L (1.4408) / CF3M (cast equivalent to material AISI 316L)
- 
- NPT1/4-18 coplanar compatible, Super Duplex  
Side flange: 1.4469 (resistant to sea water, Super Duplex cast)
- NPT1/4-18 coplanar IEC  
■ Side flange: 1.4469 (resistant to sea water, Super Duplex cast)
- Measuring cell body: 316L (1.4404)
- Screws: A4-70

##### *Vent valves*

Depending on process connection ordered:

- AISI 316L (1.4404)
- Alloy C22 (2.4602)

##### *Locking screws*

AISI 316L (1.4404), Alloy C22 (2.4602)

## Accessories



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

## Materials not in contact with process

### Single compartment housing and cover

Polyester powder coating on aluminum as per EN1706 AC43400 (reduced copper content  $\leq 0.1$  % 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)

### 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
- Inert oil

### Connecting parts

- Connection between housing and process connection: AISI 316L (1.4404)
- Screws and nuts
  - Hex.-headed bolt DIN 931-M12x90-A4-70
  - Hex.-headed nut DIN 934-M12-A4-70
- Screws and nuts
  - PN 160: hex.-headed bolt DIN 931-M12x90-A4-70
  - PN 160: hex.-headed nut DIN 934-M12-A4-70
  - PN 250, PN 320 and PN 420: hex.-headed bolt ISO 4014-M12x90-A4
  - PN 250, PN 320 and PN 420: hex.-headed nut ISO 4032-M12-A4-bs
- Measuring cell body: AISI 316L (1.4404)

- Setscrew: DIN 915 M 6x8 A2-70
- Bearing: DIN 5401 (1.3505)
- Side flanges: AISI 316/316L (1.4408) / CF3M (cast equivalent to material AISI 316L)

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**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
- Access to the device via Web server

#### Efficient diagnostic behavior increases measurement availability

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

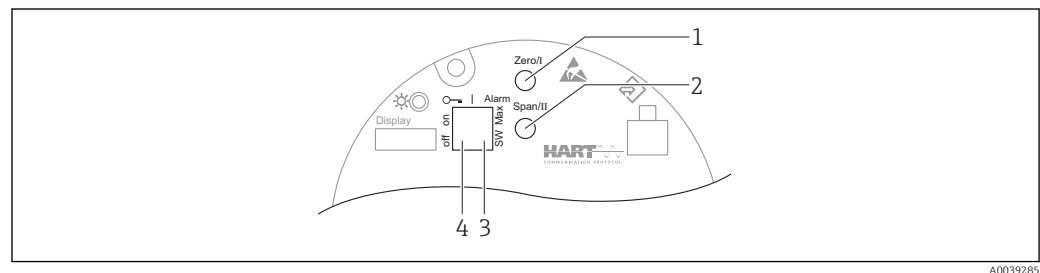
#### Bluetooth module (optionally integrated in local display)

- 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

### Local operation

#### Operating keys and DIP switches on the electronic insert

##### HART

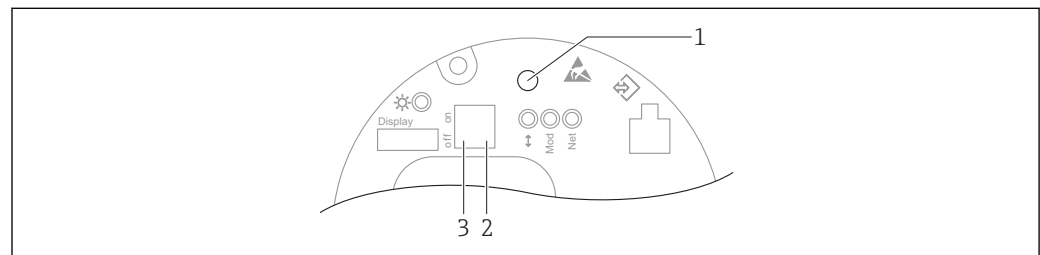


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- 1 Operating key for lower range value (Zero)
- 2 Operating key for upper range value (Span)
- 3 DIP switch for alarm current
- 4 DIP switch for locking and unlocking the device

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

##### Ethernet-APL



A0046061

- 1 Operating key for lower range value (Zero)
- 2 DIP switch for setting the service IP address
- 3 DIP switch for locking and unlocking the device

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



Local display

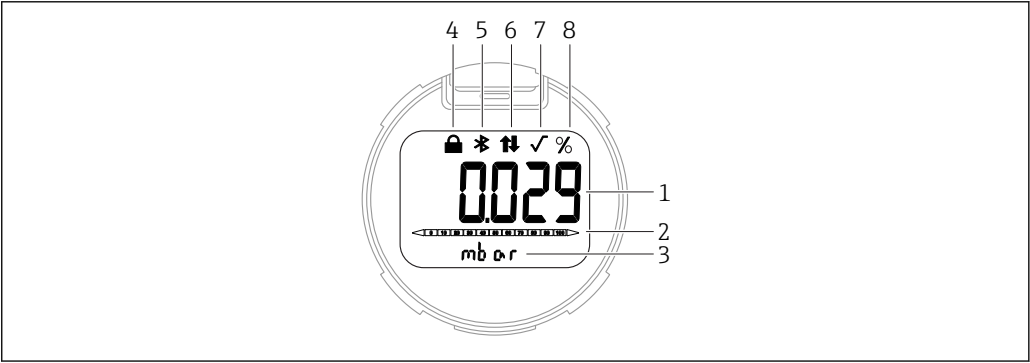
Device display (optional)

Functions:

Display of measured values and fault and notice messages



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



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7 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 appears if HART communication is active) , or APL communication (symbol appears if APL communication is active)
- 7 Square root extraction (appears if a square root extraction of the measured value is output)
- 8 Measured value output in %

Remote operation

Via HART protocol

Via Ethernet-APL PROFINET protocol

Via Web server

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.

System integration

HART

Version 7

Ethernet-APL


PROFINET Profile 4.0


Supported operating tools

Smartphone or tablet with Endress+Hauser SmartBlue (app), DeviceCare, version 1.07.00 and higher, FieldCare, DTM, AMS and PDM.

PC with Web server via fieldbus protocol.

## Certificates and approvals

 Certificates, approvals and other documentation that are currently available can be accessed on the Endress+Hauser website: [www.endress.com](http://www.endress.com) → Downloads.

<b>CE mark</b>	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.
<b>RCM-Tick marking</b>	<p>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.</p> <div data-bbox="403 595 1444 750" data-label="Image">  </div> <p>A0029561</p>
<b>Ex approvals</b>	<ul style="list-style-type: none"> <li>■ ATEX</li> <li>■ CSA (in preparation)</li> <li>■ NEPSI (in preparation)</li> <li>■ INMETRO (in preparation)</li> <li>■ KC (in preparation)</li> <li>■ EAC (in preparation)</li> <li>■ JPN (in preparation)</li> <li>■ Also combinations of different approvals</li> </ul> <p>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.</p> <p>Additional approvals in preparation.</p> <p><b>Explosion-protected smartphones and tablets</b></p> <p>If used in hazardous areas, mobile end devices with an Ex approval must be used.</p>
<b>EAC conformity</b>	<p>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.</p> <p>Endress+Hauser confirms successful testing of the device by affixing to it the EAC mark.</p>
<b>Drinking water approval</b>	<ul style="list-style-type: none"> <li>■ NSF/ANSI 61 drinking water approval</li> <li>■ KTW drinking water approval W 270</li> </ul>
<b>Overfill protection (in preparation)</b>	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).
<b>Functional safety SIL/ IEC 61508 Declaration of Conformity (optional)</b>	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".
<b>Marine approval (pending)</b>	<ul style="list-style-type: none"> <li>■ ABS (American Bureau of Shipping)</li> <li>■ LR (Lloyd's Register)</li> <li>■ BV (Bureau Veritas)</li> <li>■ DNV GL (Det Norske Veritas / Germanischer Lloyd)</li> </ul>
<b>Radio approval</b>	Displays with Bluetooth LE have radio licenses according to CE and FCC. The relevant certification information and labels are provided on display.
<b>CRN approval</b>	A CRN approval (Canadian Registration Number) is available for some device versions. These devices are fitted with a separate plate bearing the registration number CRN 0F20813.5C. In order to obtain

a CRN-approved device, a CRN-approved process connection must be ordered along with the option "CRN" in the order code for "Additional approvals".

## 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 metal parts), declaration, excluding process membrane
- ASME B31.3 process piping, declaration
- ASME B31.1 power piping, declaration
- 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](http://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](http://www.endress.com) → Download

## Pressure Equipment Directive 2014/68/EU (PED)

### Pressure equipment with allowable pressure $\leq 200$ bar (2 900 psi)

Pressure equipment (maximum working pressure  $PS \leq 200$  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  $\leq 200$  bar (2 900 psi) and the pressurized volume of the pressure equipment is  $\leq 0.1$  l, the pressure equipment is subject to the Pressure Equipment Directive (see Pressure Equipment Directive 2014/68/EU, Art.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).

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

Pressure equipment designated for application in every process fluid having a pressurized volume of  $< 0.1$  l and a max. allowable pressure  $PS > 200$  bar (2 900 psi) shall satisfy the essential safety requirements set out in Annex I of the Pressure Equipment Directive 2014/68/EU. According to Article 13 pressure equipment shall be classified by category in accordance with Annex II. Taking

into account the low pressurized volume discussed above, the pressure devices are classed as category I pressure equipment. These devices must then bear the CE marking.

*Reasons:*

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

*Note:*

A partial examination shall be performed for pressure instruments that are part of 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).

<b>Oxygen application</b>	Verified cleaned, suitable for O2 service (wetted parts)
<b>PWIS-free applications</b>	Special cleaning of the transmitter to remove paint-wetting impairment substances, for use in paint shops, for instance.
<b>China RoHS symbol</b>	The device is visibly identified according to SJ/T 11363-2006 (China-RoHS).
<b>RoHS</b>	The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU (RoHS 2).
<b>Certification PROFINET-APL</b>	<p><b>PROFINET interface</b></p> <p>The device is certified and registered by the PNO (PROFIBUS Nutzerorganisation / PROFIBUS User Organization). The measuring system meets all the requirements of the following specifications:</p> <ul style="list-style-type: none"> <li>■ Certified according to: <ul style="list-style-type: none"> <li>■ Test specification for PROFINET devices</li> <li>■ PROFINET Security Level – Netload Class</li> </ul> </li> <li>■ The device can also be operated with certified devices of other manufacturers (interoperability)</li> </ul>
<b>Additional certification</b>	<p><b>Classification of process sealing between electrical systems and (flammable or combustible) process liquids according to UL 122701 (previously ANSI/ISA 12.27.01)</b></p> <p>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:</p> <p>CSA C/US IS, XP, NI:</p> <p>250 bar (3 750 psi)</p> <p>Further information can be found in the control drawings of the relevant devices.</p> <p><b>Metrological accreditation</b></p> <p>With the order option "China", the device is supplied with a Chinese nameplate in accordance with the Chinese Quality Law.</p>

## Ordering information

### Ordering information

Detailed ordering information is available from the nearest sales organization [www.addresses.endress.com](http://www.addresses.endress.com) or in the Product Configurator under [www.endress.com](http://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](http://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 *W@M Device Viewer*:

Enter the serial number from the nameplate ([www.endress.com/deviceviewer](http://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.

## Accessories

### Device-specific accessories

#### Mechanical accessories

- Mounting bracket for housing
- Mounting bracket for manifolds
- Manifolds:
  - Manifolds can be ordered as an **enclosed** accessory (screws and seals for mounting are enclosed)
  - Manifolds can be ordered as a **mounted** accessory (mounted manifolds are supplied with a documented leak test)
  - Certificates (e.g. 3.1 material certificate and NACE) and tests (e.g. PMI and pressure test) that are ordered with the device apply for the transmitter and the manifold
  - During the operating life of the valves, it may be necessary to re-tighten the pack
- Oval flange adapter
- Calibration adapter 5/16"-24 UNF, to screw into vent valves
- 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](http://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](http://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.

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