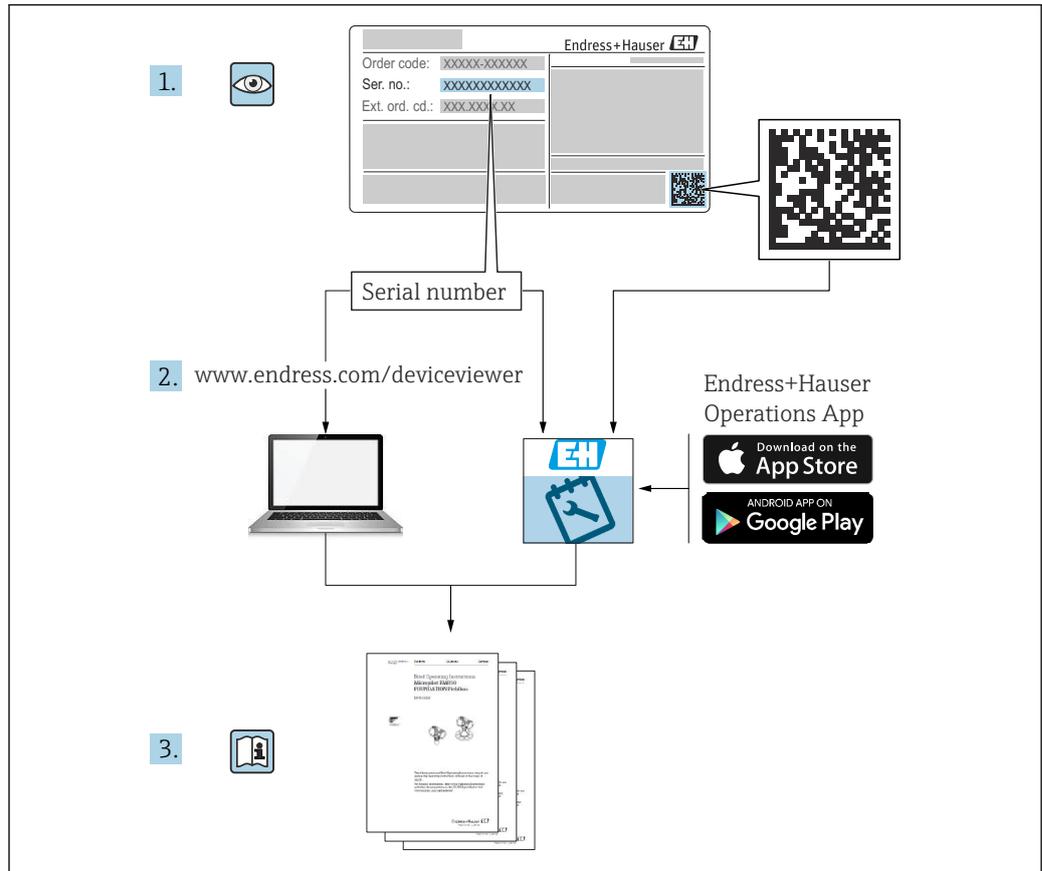


# Operating Instructions

## Deltabar PMD63B

Differential pressure measurement  
PROFIBUS PA





A0023555

- Make sure the document is stored in a safe place such that it is always available when working on or with the device
- Avoid danger to individuals or the facility: read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures

The manufacturer reserves the right to modify technical data without prior notice. The Endress+Hauser sales organization will supply you with current information and updates to these instructions.

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# 1 About this document

## 1.1 Document function

These Operating Instructions contain all the information that is required in 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.

## 1.2 Symbols

### 1.2.1 Warning 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 potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

** CAUTION**

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

**NOTICE**

This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

### 1.2.2 Electrical symbols

**Ground connection:** 

Terminal for connection to the grounding system.

### 1.2.3 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:** 

## 1.2.4 Symbols in graphics

**Item numbers:** 1, 2, 3 ...

**Series of steps:** [1](#), [2](#), [3](#)

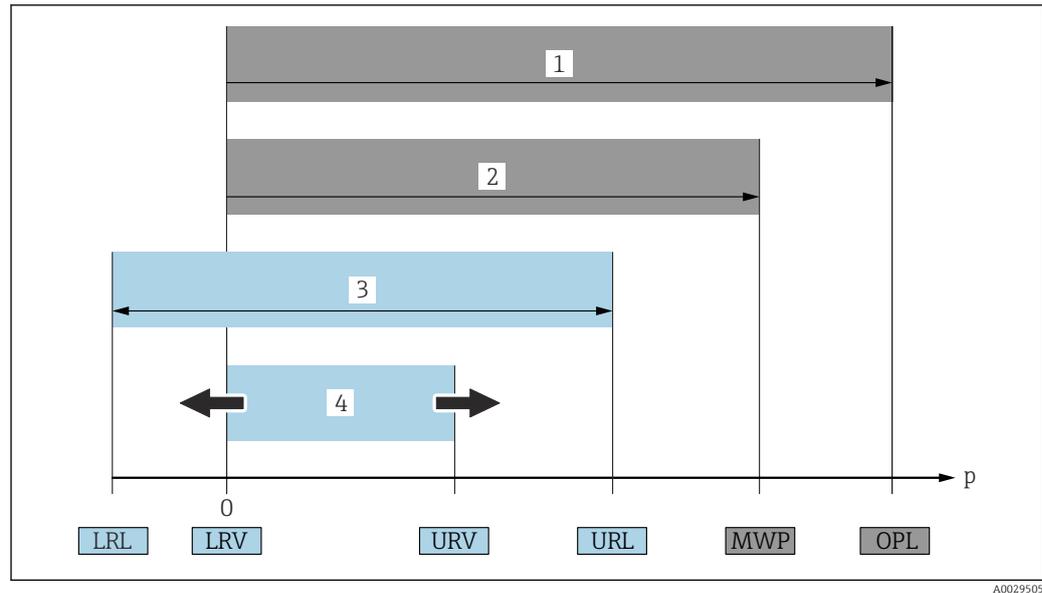
**Views:** A, B, C, ...

## 1.2.5 Symbols on the device

**Safety instructions:**  → 

Observe the safety instructions contained in the associated Operating Instructions.

## 1.3 List of abbreviations



- 1 OPL: The OPL (over pressure limit = measuring cell overpressure limit) for the device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection must be taken into consideration in addition to the measuring cell. Observe pressure-temperature dependency. OPL (Over Pressure Limit) is a test pressure.
  - 2 MWP: 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 also has to be taken into consideration besides the measuring cell. Observe pressure-temperature dependency. The maximum working pressure may be applied at the device for an unlimited period of time. The maximum working pressure 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 span that can be calibrated/adjusted.
  - 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.

## 1.4 Documentation

All available documents can be downloaded using:

- the serial number of the device (see cover page for description) or
- the data matrix code of the device (see cover page for description) or
- the "Downloads" area of the website [www.endress.com](http://www.endress.com)

### 1.4.1 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.

## 1.5 Registered trademarks

### PROFIBUS®

PROFIBUS and the associated trademarks (The Association Trademark, the Technology Trademarks, the Certification Trademark and the Certified by PI Trademark) are registered

trademarks of the PROFIBUS User Organization e.V. (Profibus User Organization), Karlsruhe - Germany

**Bluetooth®**

The Bluetooth® wordmark and logos are registered trademarks of Bluetooth SIG, Inc. and any use of these trademarks by Endress+Hauser is licensed. Other trademarks and trade names are those of their respective owners.

**Apple®**

Apple, the Apple logo, iPhone, and iPod touch are trademarks of Apple Inc., registered in the U.S. and other countries. App Store is a service mark of Apple Inc.

**Android®**

Android, Google Play and the Google Play logo are trademarks of Google Inc.

## 2 Basic safety requirements

### 2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- ▶ Trained, qualified specialists must have a relevant qualification for this specific function and task
- ▶ Are authorized by the plant owner/operator
- ▶ Are familiar with federal/national regulations
- ▶ Before beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- ▶ Follow instructions and comply with conditions

The operating personnel must fulfill the following requirements:

- ▶ Being instructed and authorized according to the requirements of the task by the facility's owner-operator
- ▶ Following the instructions in these Operating Instructions

### 2.2 Intended use

The Deltabar is a differential pressure transmitter for measuring pressure, flow, level and differential pressure.

#### 2.2.1 Incorrect use

The manufacturer is not liable for damage caused by improper or non-intended use.

Verification for borderline cases:

- ▶ For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability.

### 2.3 Workplace safety

When working on and with the device:

- ▶ Wear the required personal protective equipment according to federal/national regulations.
- ▶ Switch off the supply voltage before connecting the device.

### 2.4 Operational safety

Risk of injury!

- ▶ Operate the device only if it is in proper technical condition, free from errors and faults.
- ▶ The operator is responsible for the interference-free operation of the device.

#### Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:

- ▶ If, despite this, modifications are required, consult with Endress+Hauser.

#### Repair

To ensure continued operational safety and reliability:

- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe federal/national regulations pertaining to the repair of an electrical device.

- ▶ Use original spare parts and accessories from Endress+Hauser only.

#### **Hazardous area**

To eliminate the risk of danger to persons or the facility when the device is used in the approval-related area (e.g. explosion protection, pressure equipment safety):

- ▶ Check the nameplate to verify if the device ordered can be put to its intended use in the approval-related area.
- ▶ Observe the specifications in the separate supplementary documentation that is an integral part of these Instructions.

## **2.5 Product safety**

This device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EC directives listed in the device-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

## **2.6 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.

## **2.7 Device-specific IT security**

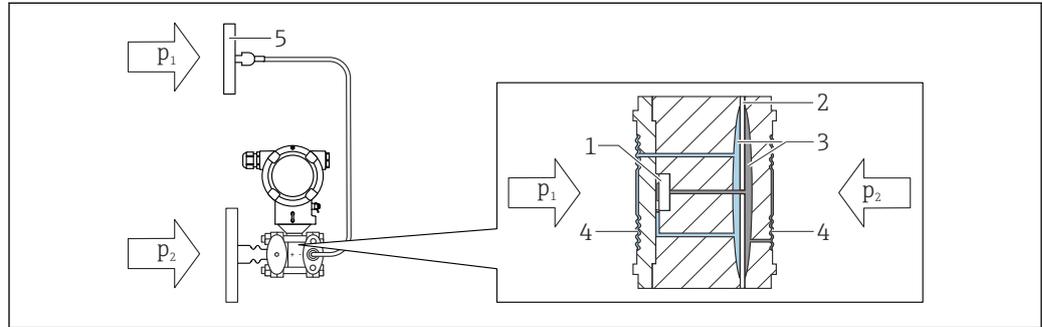
The device offers specific functions to support protective measures by the operator. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. An overview of the most important functions is provided in the following section:

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

## 3 Product description

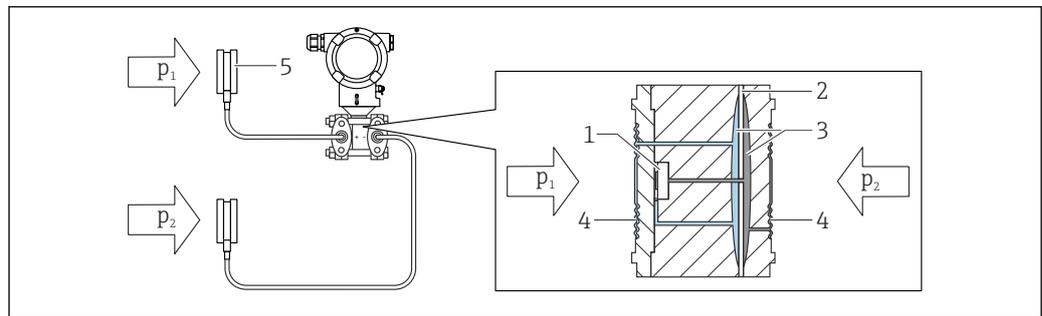
### 3.1 Product design

#### 3.1.1 Equipment architecture



1 Capillary on the second side ( $P_1$ ) 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.

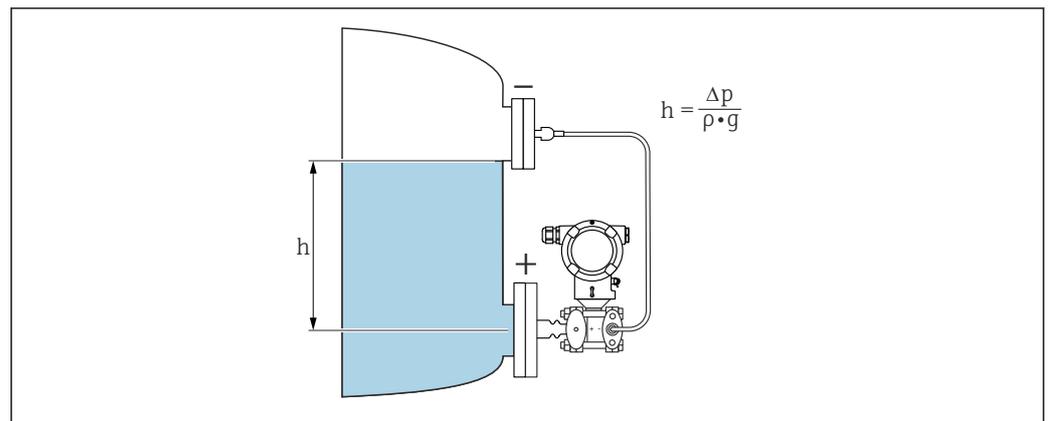
**Applications for diaphragm seals**

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 high 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
- For mounting locations that are difficult to access

**3.1.2 Level measurement (volume and mass):**

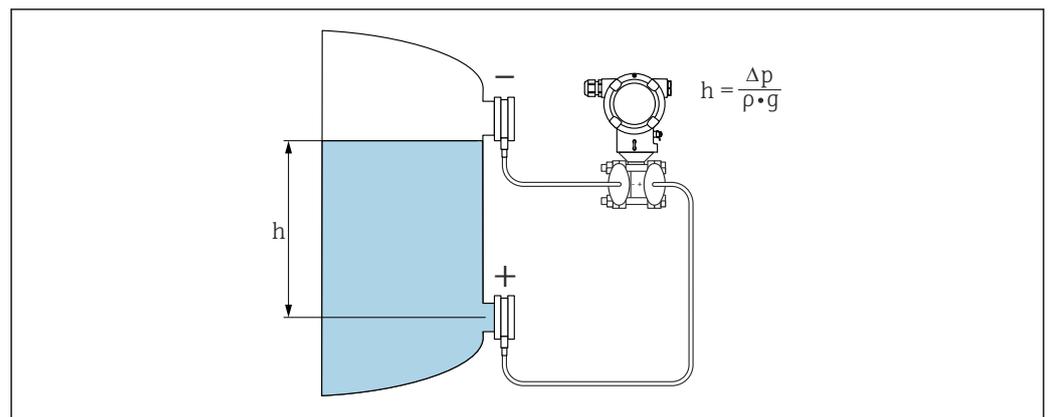
**Diaphragm seal with temperature isolator on both sides**



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- h* Height (level)
- Δp* Differential pressure
- ρ* Density of the medium
- g* Acceleration due to gravity

**Diaphragm seal on both sides with capillary**



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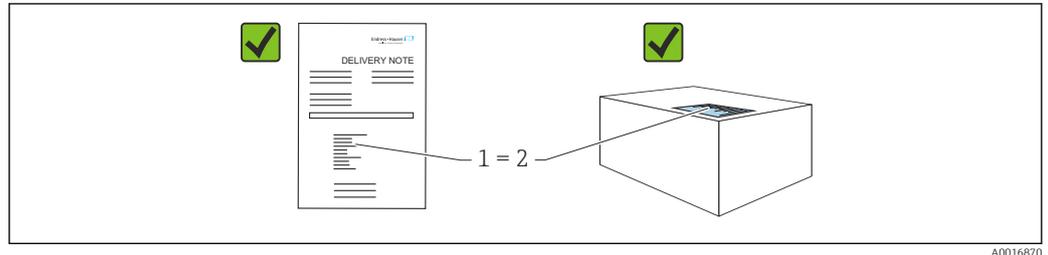
- h* Height (level)
- Δp* Differential pressure
- ρ* Density of the medium
- g* Acceleration due to gravity

**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

## 4 Incoming acceptance and product identification

### 4.1 Incoming acceptance



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- Is the order code on the delivery note (1) identical to the order code on the product sticker (2)?
- Are the goods undamaged?
- Do the data on the nameplate correspond to the order specifications and the delivery note?
- Is the documentation available?
- If required (see nameplate): are the Safety Instructions (XA) provided?

 If you can answer "no" to any of these questions, please contact Endress+Hauser.

#### 4.1.1 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

### 4.2 Product identification

The following options are available for identification of the device:

- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter the serial numbers from the nameplates in *Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): all the information about the device is displayed.

#### 4.2.1 Manufacturer address

Endress+Hauser SE+Co. KG  
 Hauptstraße 1  
 79689 Maulburg, Germany  
 Place of manufacture: See nameplate.

### 4.2.2 Nameplate

Different nameplates are used depending on the device version.

The nameplates contain the following information:

- Manufacturer name and device name
- Address of the certificate holder and country of manufacture
- Order code and serial number
- Technical data
- Approval-specific information

Compare the data on the nameplate with your order.

## 4.3 Storage and transport

### 4.3.1 Storage conditions

- Use the original packaging
- Store the device in clean and dry conditions and protect from damage caused by shocks

#### Storage temperature range

See Technical Information.

### 4.3.2 Transporting the product to the measuring point

#### WARNING

##### **Incorrect transport!**

Housing and membrane may become damaged, and there is a risk of injury!

- ▶ Transport the device to the measuring point in the original packaging.

#### WARNING

##### **Incorrect transport!**

Capillaries may become damaged, and there is a risk of injury!

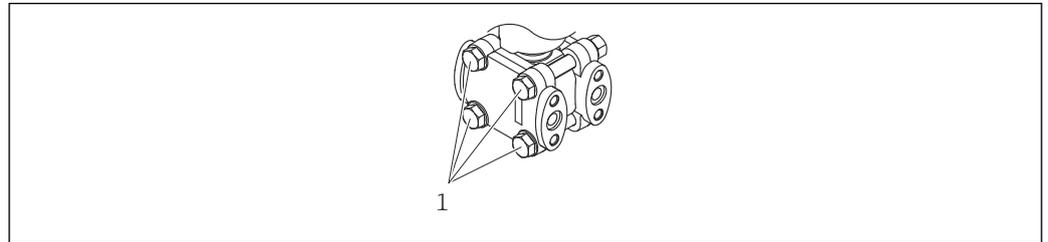
- ▶ Do not use capillaries as a carrying aid for the diaphragm seals.

## 5 Installation

### NOTICE

**The device can be damaged if handled incorrectly!**

- ▶ The removal of the screws with item number (1) is not permissible under any circumstances and will void the warranty.



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### 5.1 Installation requirements

#### 5.1.1 General instructions

- Do not clean or touch the membrane with hard and/or pointed objects.
- Do not remove the protection on the membrane until just before installation.

Always firmly tighten the housing cover and the cable entries.

1. Counter-tighten the cable entries.
2. Tighten the coupling nut.

#### 5.1.2 Installation instructions

- To ensure optimal readability of the local display, align the housing and local display.
- Endress+Hauser offers a mounting bracket for installing the device on pipes or walls.
- For measurements in media containing solids (e.g. dirty liquids), it makes sense to install separators and drain valves.
- Using a allows for easy commissioning, installation and maintenance without interrupting the process.
- When installing the device, establishing the electrical connection and during operation: prevent moisture from entering the housing.
- Point the cable and connector downwards where possible to prevent moisture from entering (e.g. rain or condensation water).

#### 5.1.3 Installation instructions for devices with diaphragm seals

### NOTICE

**Incorrect handling!**

Damage to the device!

- ▶ The diaphragm seal and pressure transmitter together form a sealed, calibrated system filled with fill fluid. Do not open the fill openings under any circumstances.
- ▶ Ensure strain relief to prevent the capillaries from bending (bending radius  $\geq$  100 mm (3.94 in)).
- ▶ Do not use capillaries as a carrying aid for the diaphragm seals.
- ▶ Keep within the application limits of the fill fluid.

#### General information

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, the nominal measuring cell range may be overdriven as a result of a position adjustment (position adjustment due to the zero offset caused by the installation position of the fluid column of the fill fluid).

For devices with a capillary, a suitable fastening device (mounting bracket) is recommended for installation.

During installation, ensure sufficient strain relief for the capillary to prevent it from bending (capillary bending radius  $\geq 100$  mm (3.94 in)).

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

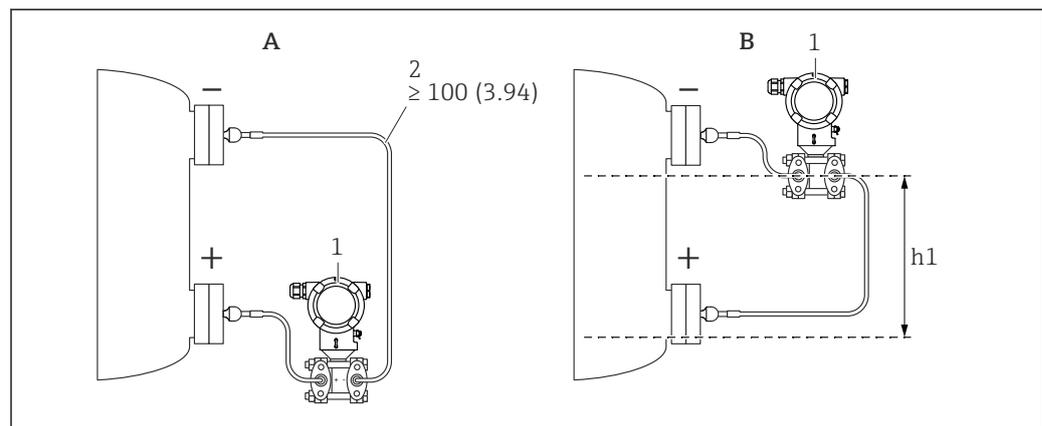
Do not mount capillaries in the vicinity of heating or cooling lines and protect them against direct sunlight.

Additional 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 installed above the diaphragm seal, do not exceed the maximum height difference  $h_1$ . The height difference  $h_1$  is shown in the Applicator "[Sizing Diaphragm Seal](#)".



A0038720

Unit of measurement mm (in)

A Recommended installation in a vacuum application

B Installation above the lower diaphragm seal

$h_1$  Height difference (is shown in the Applicator "[Sizing Diaphragm Seal](#)")

1 Device

2 Bending radius  $\geq 100$  mm (3.94 in). Ensure strain relief to prevent the capillary from bending.

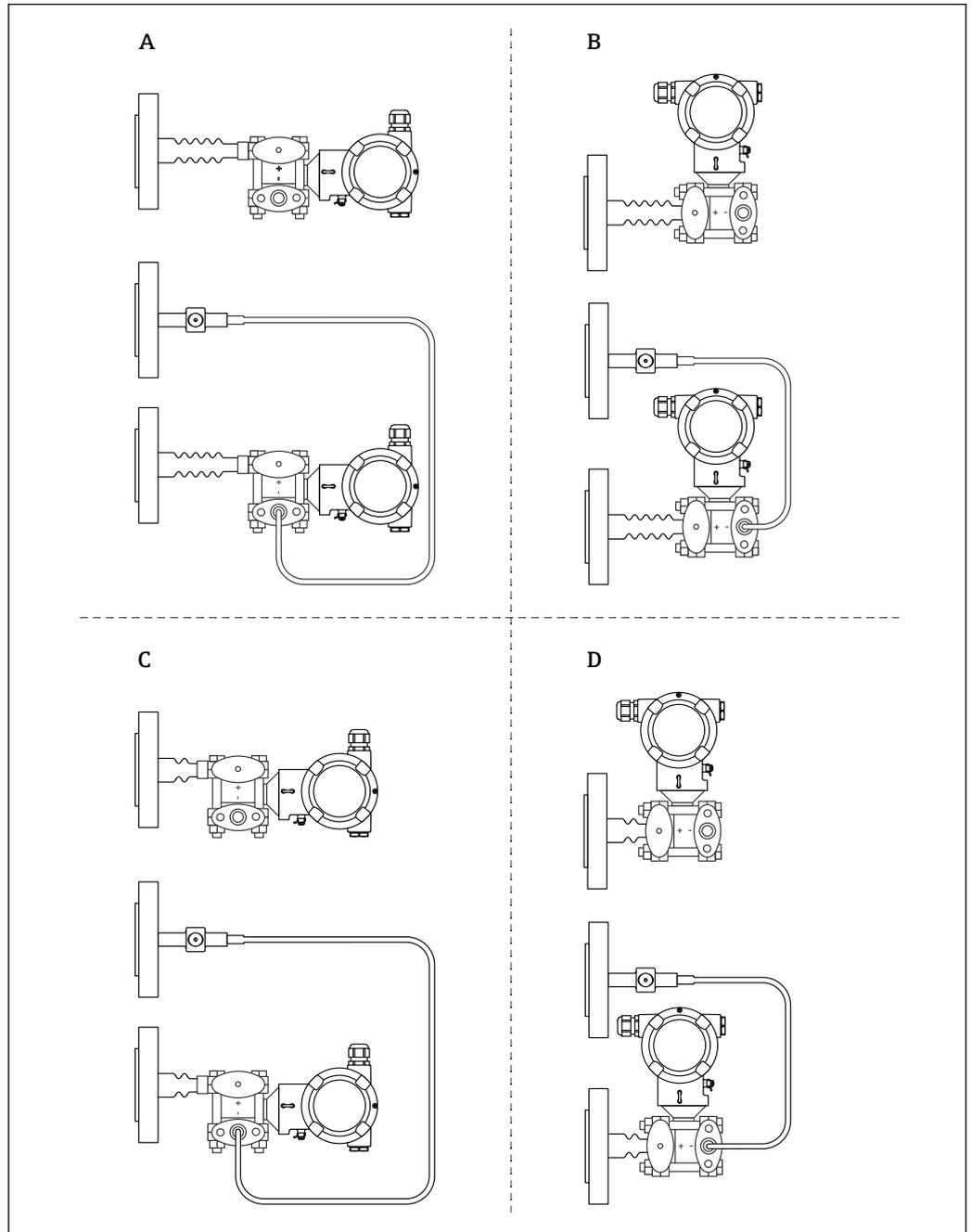
The maximum height difference depends on the density of the fill fluid and the lowest absolute pressure that can ever occur at the diaphragm seal (empty vessel).

### 5.1.4 Installing pressure piping

- For recommendations for routing pressure piping, refer to DIN 19210 "Differential pressure piping for flow measurement devices" or the corresponding national or international standards
- When routing the pressure piping outdoors, ensure sufficient anti-freeze protection, e.g. by using pipe heat tracing
- Install the pressure piping with a monotonic gradient of at least 10%

### 5.1.5 Orientation

#### Diaphragm seal on one side or both sides with temperature isolator

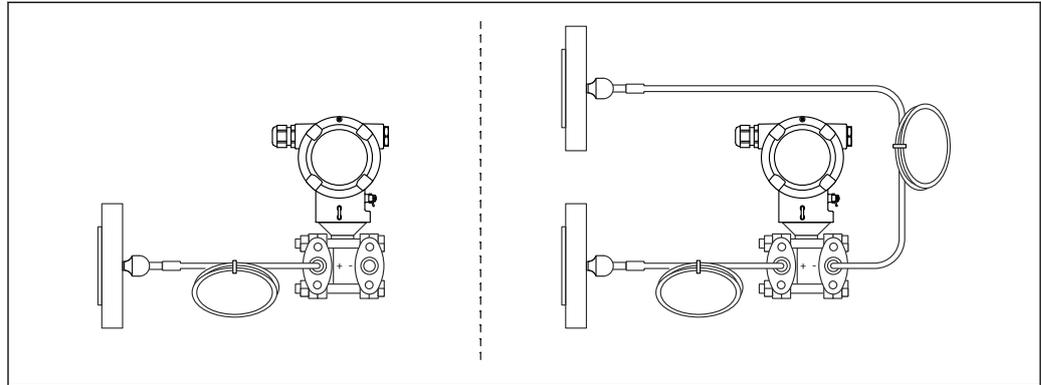


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- A Design HP side: Transmitter horizontal, temperature isolator long
- B Design HP side: Transmitter vertical, temperature isolator long
- C Design HP side: Transmitter horizontal, temperature isolator short
- D Design HP side: Transmitter vertical,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



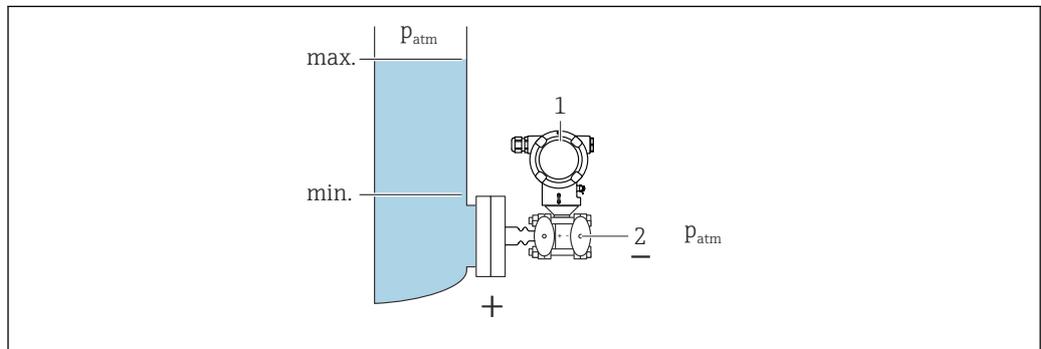
A0039528

**i** Use "[Sizing Diaphragm Seal](#)" for the installation check.

## 5.2 Installing the device

### 5.2.1 Level measurement

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

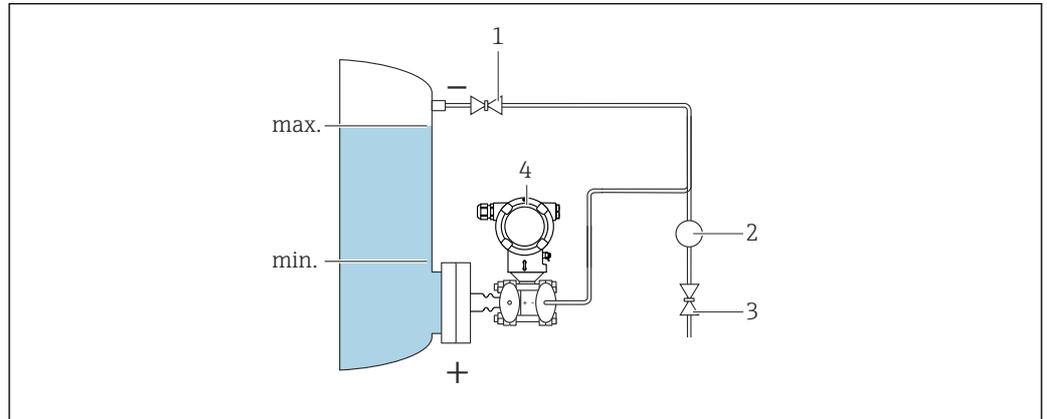


A0038702

- 1 Device
- 2 The negative side is open to atmospheric pressure

- 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**

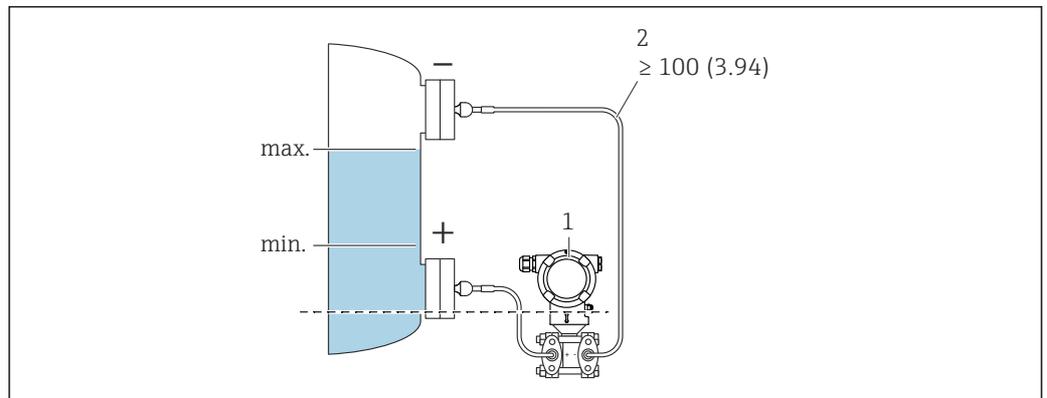


A0038703

- 1 Shut-off valve
- 2 Separator
- 3 Drain valve
- 4 Device

- 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**



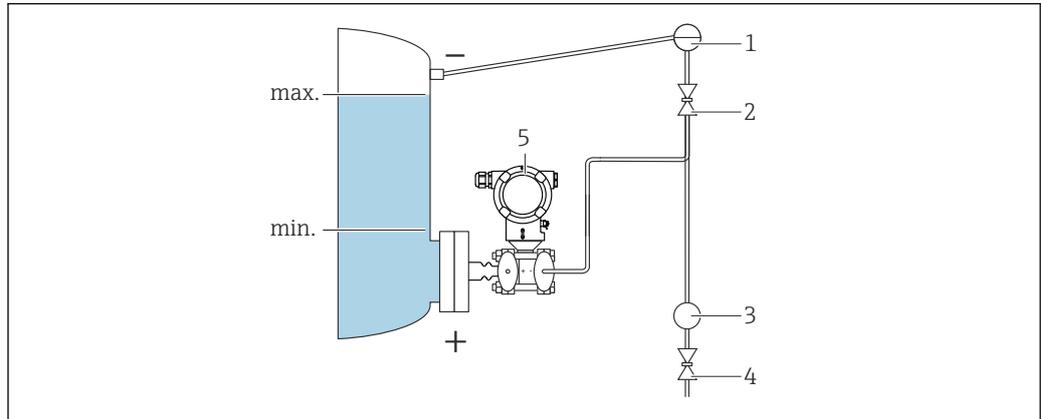
A0038705

- 1 Device
- 2 Ensure strain relief to prevent the capillary from bending (bending radius  $\geq 100$  mm (3.94 in)).

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**



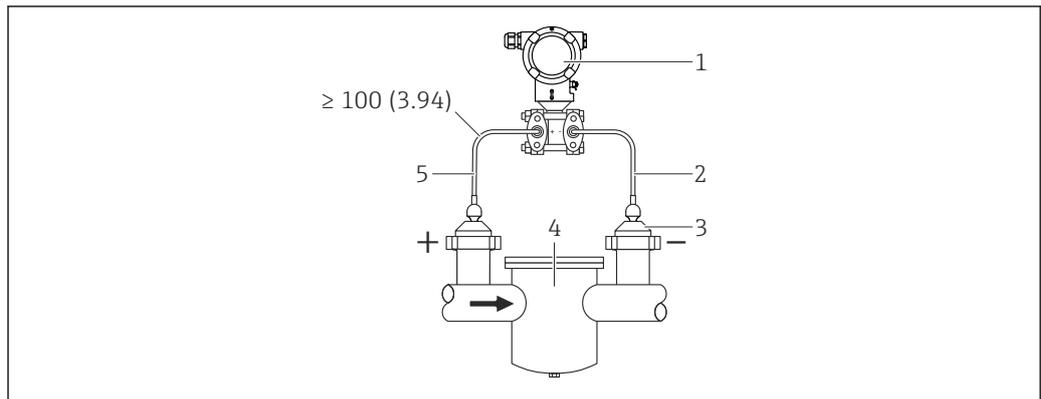
A0038707

- 1 Condensate trap
- 2 Shut-off valve
- 3 Separator
- 4 Drain valve
- 5 Device

- 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

**5.2.2 Differential pressure measurement**

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



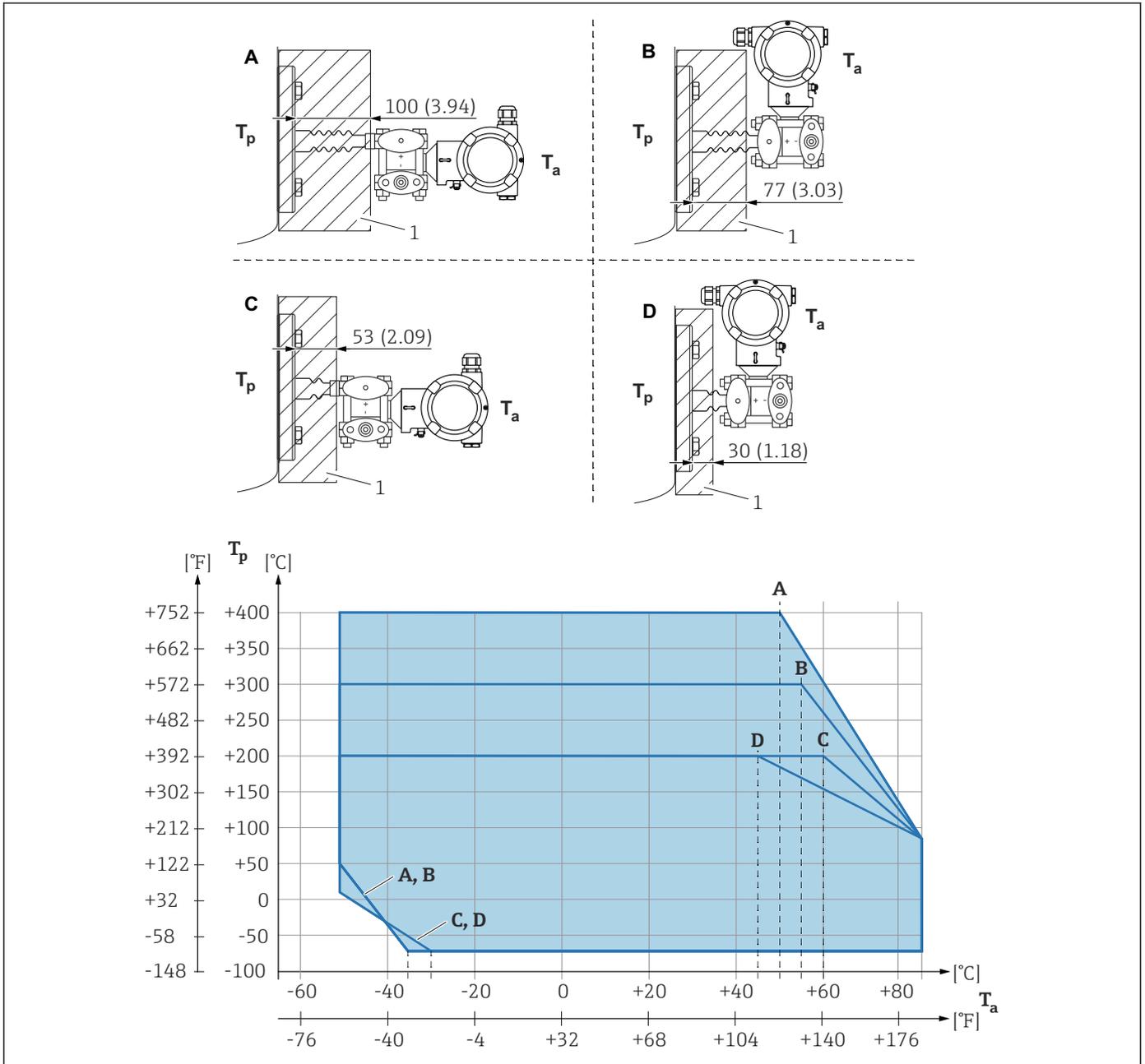
A0038710

- 1 Device
- 2 Capillary
- 3 Diaphragm seal
- 4 e.g. filter
- 5 Ensure strain relief to prevent the capillary from bending (bending radius  $\geq 100$  mm (3.94 in)).

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

### 5.2.3 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  $\leq 0.04 \text{ W}/(\text{m} \times \text{K})$  and to the maximum permitted ambient temperature and process temperature. The data were determined under the application "quiescent air".



- 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

Item	$T_a^{1)}$	$T_p^{2) 3)}$
A	50 °C (122 °F)	400 °C (752 °F)
	85 °C (185 °F)	85 °C (185 °F)

Item	T <sub>a</sub> <sup>1)</sup>	T <sub>p</sub> <sup>2) 3)</sup>
	-50 °C (-58 °F)	50 °C (122 °F)
	-35 °C (-31 °F)	-70 °C (-94 °F)
<b>B</b>	55 °C (131 °F)	300 °C (572 °F)
	85 °C (185 °F)	85 °C (185 °F)
	-50 °C (-58 °F)	50 °C (122 °F)
	-35 °C (-31 °F)	-70 °C (-94 °F)
<b>C</b>	60 °C (140 °F)	200 °C (392 °F)
	85 °C (185 °F)	85 °C (185 °F)
	-50 °C (-58 °F)	10 °C (50 °F)
	-30 °C (-22 °F)	-70 °C (-94 °F)
<b>D</b>	67 °C (153 °F)	200 °C (392 °F)
	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 depending on the fill fluid used.

Without insulation, the ambient temperature decreases by 5 K.

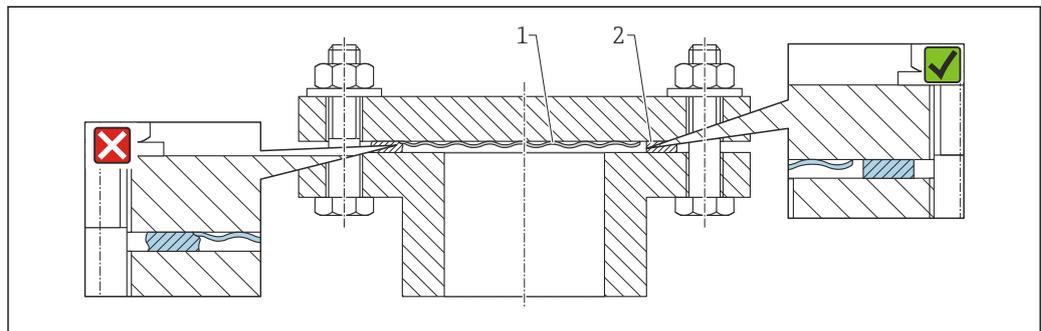
### 5.2.4 Seal for flange mounting

**NOTICE**

**Seal pressing against the membrane!**

Incorrect measurement results!

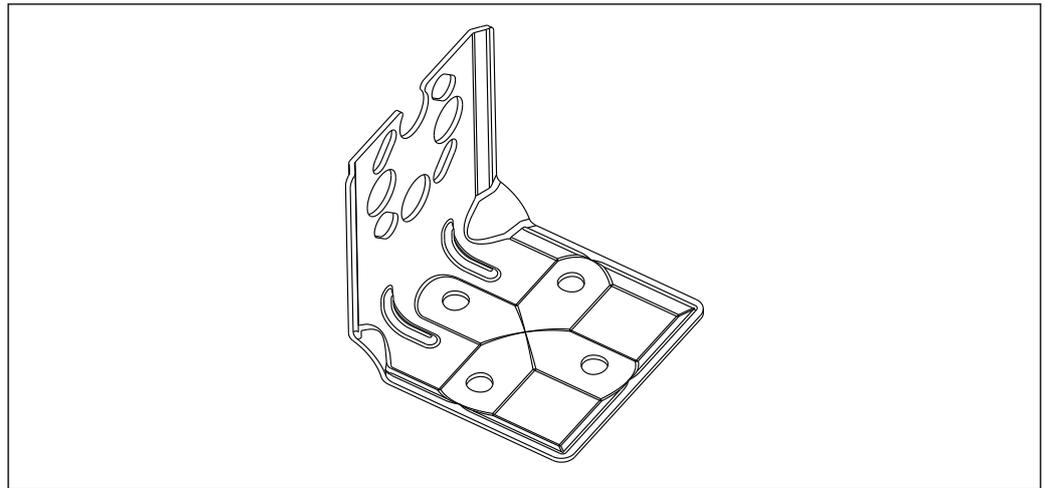
- ▶ Ensure that the seal is not touching the membrane.



A0017743

- 1 Membrane
- 2 Seal

### 5.2.5 Wall and pipe mounting



A0091326

- 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.

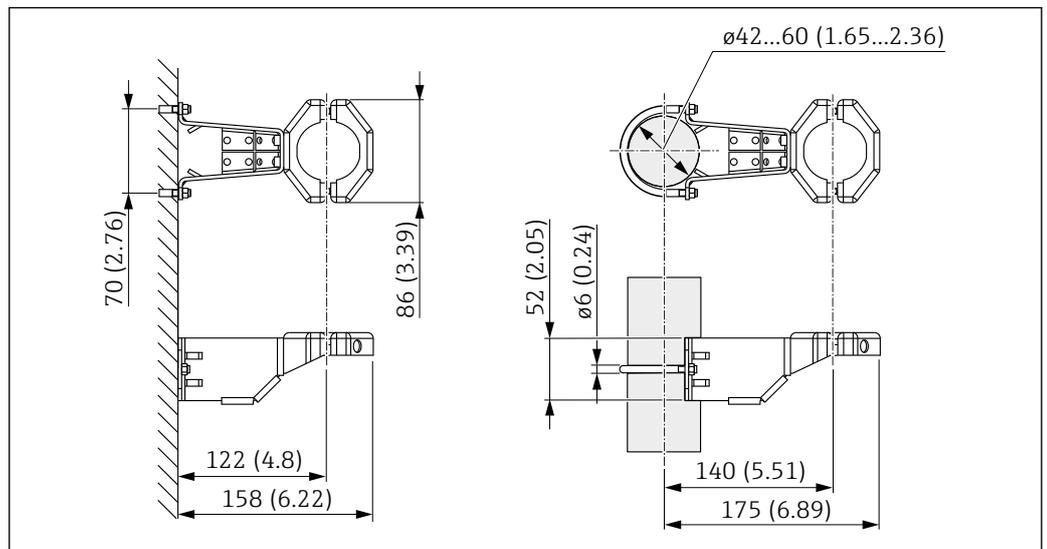
### 5.2.6 Wall and pipe mounting with a manifold (optional)

- Mount the device on a shutoff device, e.g. manifold or shutoff valve
- Use the bracket provided. This make device removal easier.

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

### 5.2.7 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.



A0028493

Unit of measurement mm (in)

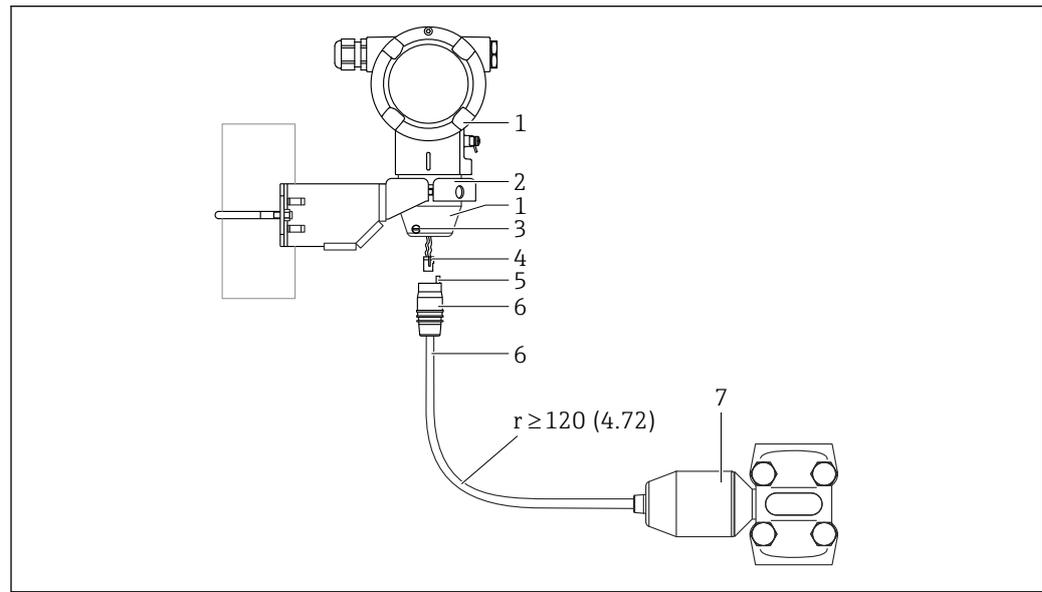
Ordering information:

Can be ordered as a separate accessory, part number 71102216

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

When mounting on a pipe, tighten the nuts on the bracket uniformly with a torque of at least 5 Nm (3.69 lbf ft).

### 5.2.8 Assembling and installing the separate housing



A0043809

Unit of measurement mm (in)

- 1 Housing mounted with housing adapter, included
- 2 Mounting bracket provided, suitable for pipe and wall mounting (for pipe diameters from 1 ¼" to 2")
- 3 Locking screw
- 4 Plug
- 5 Pressure compensation
- 6 Cable with connection jack
- 7 In the separate housing version, the measuring cell is delivered with the process connection and cable already mounted.

#### Assembly and installation

1. Insert the connector (item 4) into the corresponding connection jack of the cable (item 6).
2. Insert the cable with the socket (item 6) into the housing adapter (item 1) to the end stop.
3. Tighten the locking screw (item 3).
4. Mount the housing on a wall or pipe with the mounting bracket (item 2). When mounting on a pipe, tighten the nuts on the bracket uniformly with a torque of at least 5 Nm (3.69 lbf ft). Mount the cable with a bending radius ( $r$ )  $\geq$  120 mm (4.72 in).

### 5.2.9 Turning the display module

#### **⚠ WARNING**

#### Supply voltage switched on!

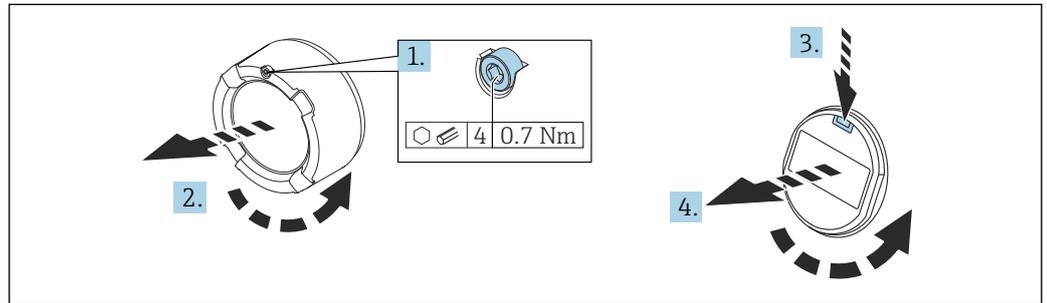
Risk of electric shock and/or explosion!

- Switch off the supply voltage before opening the device.

**⚠ CAUTION**

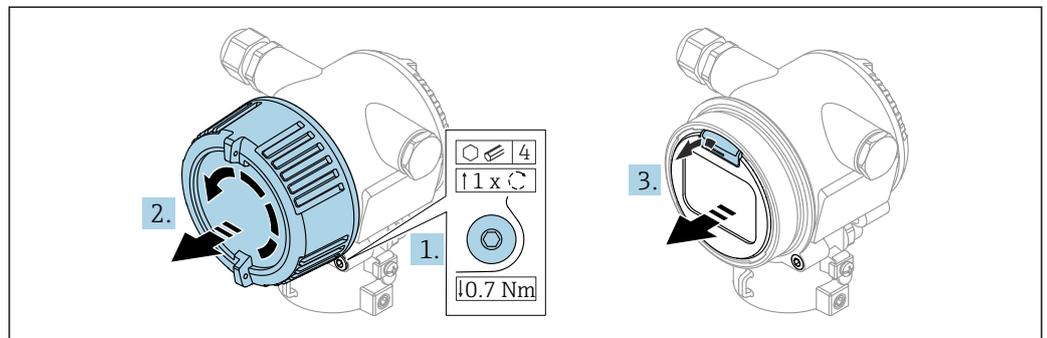
**Dual-compartment housing:** When opening the terminal compartment cover, fingers can get trapped between the cover and the pressure compensation filter.

- ▶ Open the cover slowly.



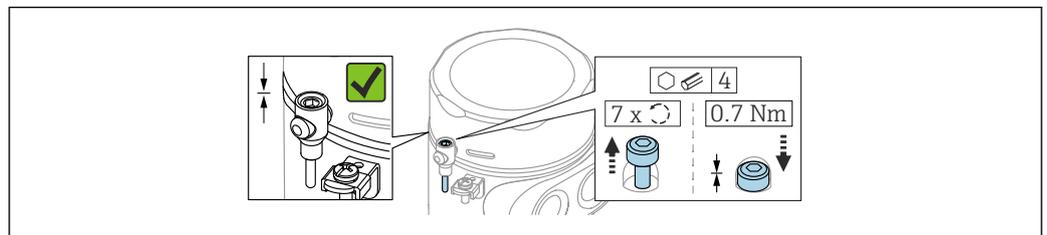
A0038224

2 Single-compartment housing and dual-compartment housing



A0058966

3 Dual-compartment housing, precision casting



A0050983

4 Hygienic housing, cover with securing screw (only for dust explosion protection)

1. If fitted: release the screw of the cover lock for the electronics compartment cover using the Allen key.
2. Unscrew the electronics compartment cover from the transmitter housing and check the cover seal. Dual-compartment housing, precision casting: Ensure there is no tension between the cover and cover locking screw. Release any tension by turning the cover locking screw in the tightening direction.
3. Press the release mechanism and remove the display module.
4. Turn the display module to the desired position: maximum  $4 \times 90^\circ$  in each direction. Fit the display module on the electronics compartment in the desired position until it clicks into place. Screw the electronics compartment cover back onto the transmitter housing. If provided: tighten the screw of the cover lock using the Allen key 0.7 Nm (0.52 lbf ft)  $\pm$  0.2 Nm (0.15 lbf ft).

## 5.2.10 Closing the housing covers

### NOTICE

#### Thread and housing cover damaged from dirt and fouling!

- ▶ Remove dirt (e.g. sand.) on the thread of the cover and housing.
- ▶ If you continue to encounter resistance when closing the cover, check the thread again for fouling.

### **i** Housing thread

The threads of the electronics and connection compartment can be coated with an anti-friction coating.

The following applies for all housing materials:

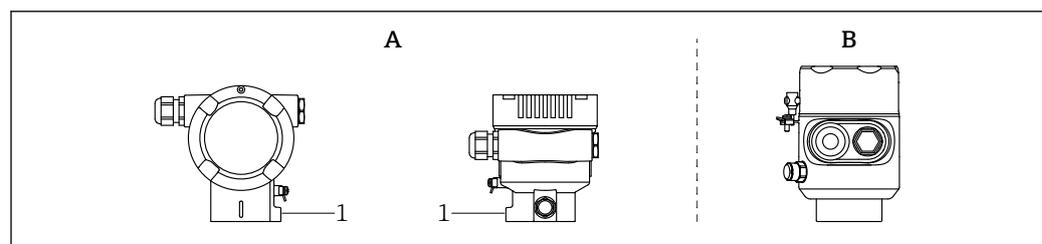
- ✗ **Do not lubricate the housing threads.**

## 5.2.11 Rotating the housing

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

### Your benefits

- Easy installation due to optimum alignment of housing
- Convenient access to the device's operating elements
- Optimum readability of the local display (optional)



- A Housing with set screw  
 B Housing without set screw  
 1 Set screw

### NOTICE

#### The housing cannot be unscrewed fully.

- ▶ Loosen the external set screw by a maximum of 1.5 turns. If the screw is turned further or completely removed (beyond the screw anchor point), small parts (counter disk) may become loose and fall out.
- ▶ Tighten the securing screw (hexagon socket 4 mm (0.16 in)) with maximum 3.5 Nm (2.58 lbf ft) ± 0.3 Nm (0.22 lbf ft).

## 5.3 Post-mounting check

- Is the device undamaged (visual inspection)?
- Are the measuring point identification and labeling correct (visual inspection)?
- Is the device protected against precipitation and direct sunlight?
- Are the securing screws and cover lock tightened securely?
- Does the measuring device meet the measuring point specifications?  
 For example:
  - Process temperature
  - Process pressure
  - Ambient temperature
  - Measuring range

## 6 Electrical connection

### 6.1 Connection requirements

#### 6.1.1 Potential equalization

The protective ground on the device must not be connected. If necessary, the potential matching line can be connected to the outer ground terminal of the device before the device is connected.

#### **⚠ WARNING**

#### **Ignitable sparks.**

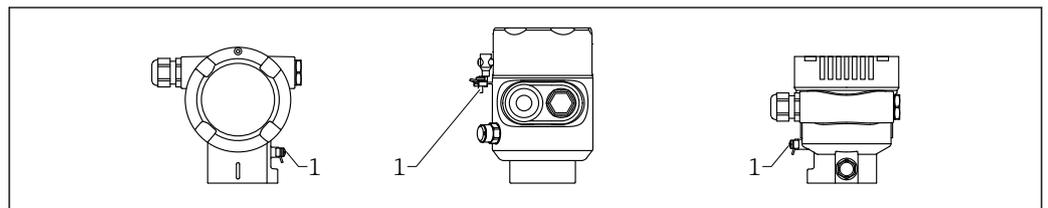
Explosion hazard!

- ▶ Please refer to the separate documentation on applications in hazardous areas for the safety instructions.



For optimum electromagnetic compatibility:

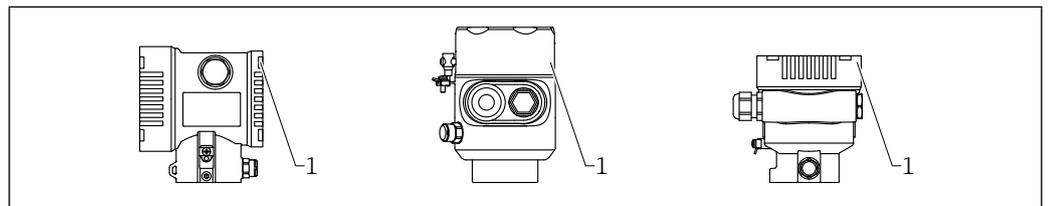
- Use the shortest possible potential matching line.
- Ensure a cross-section of at least 2.5 mm<sup>2</sup> (14 AWG).



A0057850

1 Ground terminal for connecting the potential matching line

### 6.2 Connecting the device



A0058264

1 Connection compartment cover



#### **Housing thread**

The threads of the electronics and connection compartment can be coated with an anti-friction coating.

The following applies for all housing materials:

- ✘ **Do not lubricate the housing threads.**

#### 6.2.1 Supply voltage

- Non-hazardous, Ex d, Ex e: 9 to 32 V<sub>DC</sub>
- Ex i FISCO principle: 9 to 17.5 V<sub>DC</sub>
- Ex i entity concept: 9 to 24 V<sub>DC</sub>
- Nominal current: 14 mA
- Failure current FDE (Fault Disconnection Electronic): 0 mA

PROFIBUS PA: Depending on the supply voltage at the time the device is powered on

- the background lighting is deactivated (supply voltage <12 V)
- the Bluetooth function (order option) is also deactivated (supply voltage <10 V)
- i** ▪ Use only suitable and certified PROFIBUS PA components (e.g. DP/PA segment coupler) for the power supply
  - FISCO/FNICO-compliant according to IEC 60079-27
  - The supply is not polarity-dependent

### 6.2.2 Terminals

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

### 6.2.3 Cable specification

- Protective ground or grounding of the cable shield: rated cross-section > 1 mm<sup>2</sup> (17 AWG)  
Rated cross-section of 0.5 mm<sup>2</sup> (20 AWG) to 2.5 mm<sup>2</sup> (13 AWG)
- Cable outer diameter: Ø5 to 12 mm (0.2 to 0.47 in) depends on the cable gland used (see Technical Information)

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

For further information on the cable specification:

-  Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning"
-  PROFIBUS Assembling Guideline 8.022
-  IEC 61158-2 (MBP).

### 6.2.4 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 against transient overvoltages are applied (IEC/DIN EN 61000-4-5 Surge):

Test level on DC power ports and input/output ports is 1 000 V line to earth

#### Devices with optional overvoltage protection

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

#### NOTICE

**The device may be damaged by excessively high electrical voltages.**

- ▶ Always ground the device with integrated overvoltage protection.

#### Overvoltage category

Overvoltage category II

## 6.2.5 Wiring

### **⚠ WARNING**

#### **Supply voltage might be connected!**

Risk of electric shock and/or explosion!

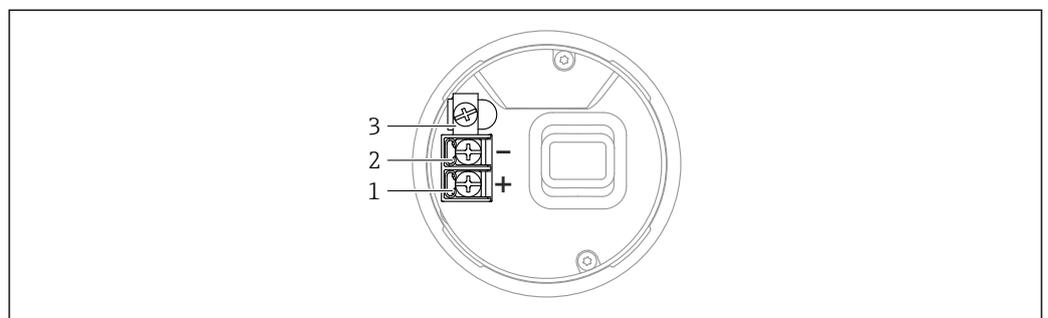
- ▶ When operating the device in hazardous areas, ensure compliance with national standards and the specifications outlined in the Safety Instructions (XAs). Use the specified cable gland.
- ▶ The supply voltage must match the specifications on the nameplate.
- ▶ Switch off the supply voltage before connecting the device.
- ▶ If necessary, the potential matching line can be connected to the outer ground terminal of the device before the power supply lines are connected.
- ▶ FISCO/FNICO compliant according to IEC 60079-27.
- ▶ A suitable circuit breaker should be provided for the device in accordance with IEC/EN 61010.
- ▶ The supply does not depend on the polarity.
- ▶ The cables must be adequately insulated, with due consideration given to the supply voltage and the overvoltage category.
- ▶ The connecting cables must offer adequate temperature stability, with due consideration given to the ambient temperature.
- ▶ Only operate the device with the covers closed.
- ▶ Protective circuits against HF influences and overvoltage peaks are installed.

Connect the device in the following order:

1. Release the cover lock (if provided).
2. Unscrew the cover.
3. Guide the cables into the cable glands or cable entries.
4. Connect the cables.
5. Tighten the cable glands or cable entries so that they are leak-tight. Counter-tighten the housing entry. Use a suitable tool with width across flats AF24/25  
8 Nm (5.9 lbf ft) for the M20 cable gland.
6. Screw the cover securely back onto the connection compartment.
7. If provided: tighten the screw of the cover lock using the Allen key  
0.7 Nm (0.52 lbf ft)  $\pm$ 0.2 Nm (0.15 lbf ft).

## 6.2.6 Terminal assignment

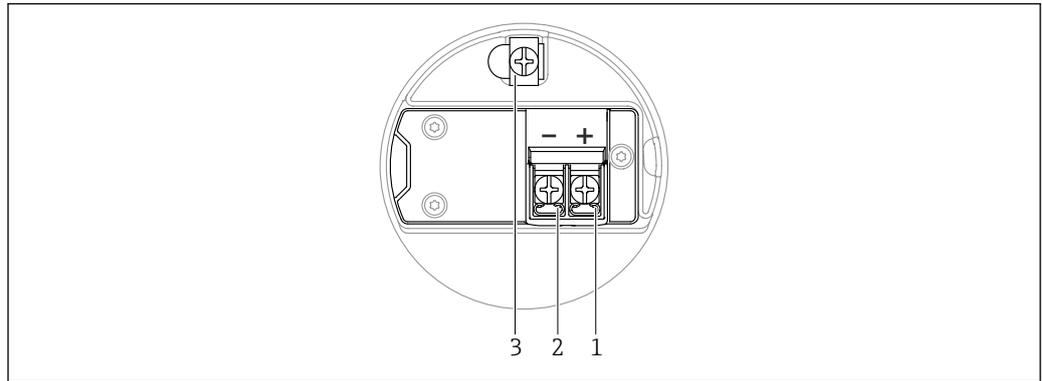
### Single compartment housing



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

- 1 Plus terminal
- 2 Minus terminal
- 3 Internal ground terminal

### Dual-compartment housing



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

- 1 Plus terminal
- 2 Minus terminal
- 3 Internal ground terminal

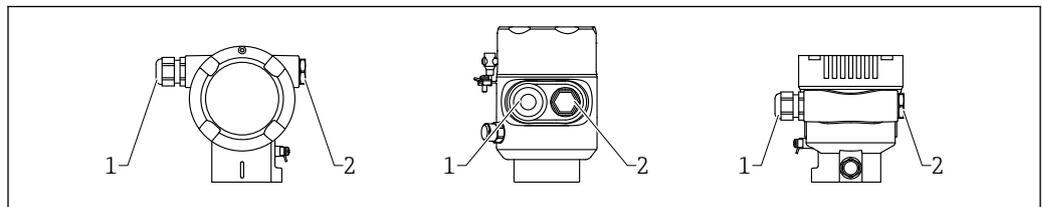
A0042803

### 6.2.7 Cable entries

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

**i** 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.



- 1 Cable entry
- 2 Blind plug

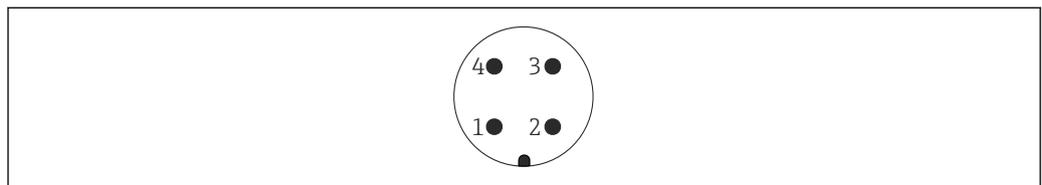
A0057851

### 6.2.8 Available device plugs

**i** 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



- 1 Signal +
- 2 Not used
- 3 Signal -
- 4 Earth

A0011175

## 6.3 Ensuring the degree of protection

### 6.3.1 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
  - M12 plug
- 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

#### **M12 plug: incorrect installation 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.

## 6.4 Post-connection check

After wiring the device, perform the following checks:

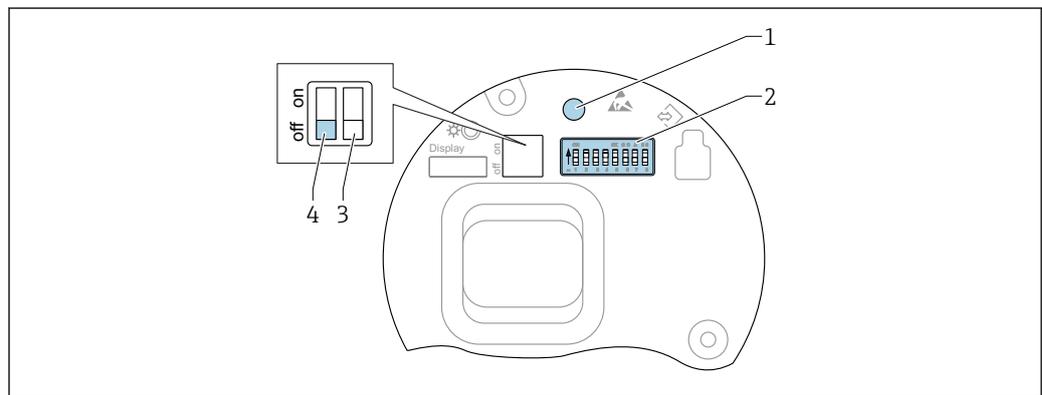
- Is the potential matching line connected?
- Is the terminal assignment correct?
- Are the cable glands and dummy plugs leak-tight?
- Are the fieldbus connectors properly secured?
- Are the covers screwed down correctly?

## 7 Operation options

### 7.1 Overview of operation options

- Operation via operating keys and DIP switches on the electronic insert
- Operation via optical operating keys on the device display (optional)
- Operation via Bluetooth® wireless technology (with optional Bluetooth device display) with SmartBlue app or FieldXpert, DeviceCare
- Operation via operating tool (Endress+Hauser FieldCare/DeviceCare, PDM, etc)

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



- 1 Operating key for position adjustment (zero point correction), device reset and password reset (for Bluetooth login and user role)
- 2 DIP switch for address configuration
- 3 DIP switch with no function
- 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).

### 7.3 Structure and function of the operating menu

The differences between the structure of the operating menus of the local display and the Endress+Hauser FieldCare or DeviceCare operating tools can be summarized as follows:

The local display is suitable for configuring simple applications.

More elaborate applications can be configured with the Endress+Hauser FieldCare or DeviceCare tools as well as Bluetooth and the SmartBlue app and the device display.

Wizards help the user to commission the various applications. The user is guided through the individual configuration steps.

#### 7.3.1 User roles and related access authorization

The two user roles **Operator** and **Maintenance** (as-delivered state) have different write access to the parameters if a device-specific access code has been defined. This access code protects the device configuration from unauthorized access.

If an incorrect access code is entered, the user retains the **Operator** option user role.

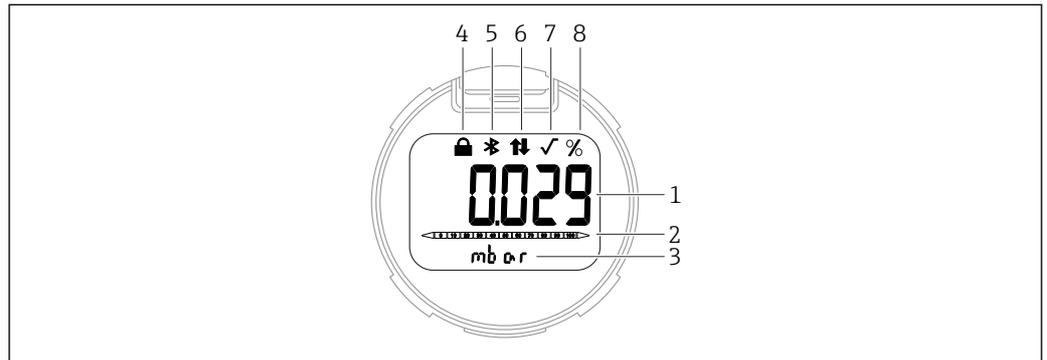
## 7.4 Access to the operating menu via local display

### 7.4.1 Device display (optional)

Functions:

- Display 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.

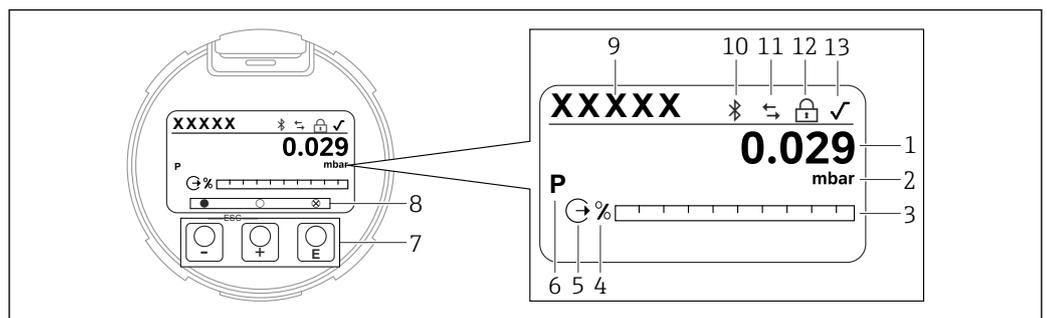


A0047143

 7 Segment display

- 1 Measured value (up to 5 digits)
- 2 Bar graph (refers to the specified pressure range) (not for PROFIBUS PA)
- 3 Unit of measured value
- 4 Locking (symbol appears when device is locked)
- 5 Bluetooth (symbol flashes if Bluetooth connection is active)
- 6 PROFIBUS PA communication (symbol appears when PROFIBUS PA communication is enabled)
- 7 Not supported for PROFIBUS PA
- 8 Measured value output in %

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



A0047141

 8 Graphic display with optical operating keys.

- 1 Measured value (up to 12 digits)
- 2 Unit of measured value
- 3 Bar graph (refers to the specified pressure range) (not for PROFIBUS PA)
- 4 Bar graph unit
- 5 Symbol for current output (not for PROFIBUS PA)
- 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 PROFIBUS PA communication (symbol appears when PROFIBUS PA communication is enabled)
- 12 Locking (symbol appears when device is locked)
- 13 Not supported for PROFIBUS PA

-  key
  - Navigate downwards in the selection list
  - Edit the numerical values or characters within a function
-  key
  - Navigate upwards in the selection list
  - Edit the numerical values or characters within a function
-  key
  - Confirm entry
  - Jump to the next item
  - Select a menu item and activate edit mode
  - Unlock/lock the display operation
  - Press and hold the  key to display a short description of the selected parameter (if available)
-  key and  key (ESC function)
  - Exit the edit mode for a parameter without saving the changed value
  - Menu at a selection level: pressing the keys simultaneously takes the user back up a level in the menu
  - Press and hold the keys simultaneously to return to the upper level

### 7.4.2 Operation via Bluetooth® wireless technology (optional)

Prerequisite

- Device with device display including Bluetooth® wireless technology
- Smartphone or tablet with Endress+Hauser SmartBlue app or PC with DeviceCare from version 1.07.05 or Field Xpert 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 a Bluetooth® connection is established.

An available Bluetooth® connection is indicated by a flashing Bluetooth symbol.

 If the Bluetooth® display is removed from one device and installed in another device.

- All login data are stored only in the Bluetooth® display and not in the device.
- The password changed by the user is also stored in the Bluetooth® display.

 Special Documentation SD02530P

#### Operation via SmartBlue app

The device can be operated and configured with the SmartBlue App.

- The SmartBlue app must be downloaded onto a mobile device for this purpose
- For information on the compatibility of the SmartBlue app with mobile devices, see **Apple App Store (iOS devices)** or **Google Play Store (Android devices)**
- Incorrect operation by unauthorized persons is prevented by means of encrypted communication and password encryption.
- The Bluetooth® function can be deactivated after initial device setup.



A0033202

 9 QR code for free Endress+Hauser SmartBlue App

Download and installation:

1. Scan the QR code or enter **SmartBlue** in the search field of the Apple App Store (iOS) or Google Play Store (Android).
2. Install and start the SmartBlue app.
3. For Android devices: enable location tracking (GPS) (not required for iOS devices).
4. Select a device that is ready to receive from the device list displayed.

Login:

1. Enter the user name: admin
2. Enter the initial password: serial number of the device
3. Change the password after logging in for the first time



#### **Information on password and reset code**

For devices that meet the requirements of IEC 62443-4-1 "Secure product development lifecycle management" ("ProtectBlue"):

- If the user-defined password is lost: refer to the user management instructions and the reset button in the operating manual.
- Refer to the associated Security Manual (SD).

For all other devices (without "ProtectBlue"):

- If the user-defined password is lost, access can be restored via a reset code. The reset code is the serial number of the device in reverse. The original password is once again valid after the reset code has been entered.
- The reset code can also be changed in addition to the password.
- If the user-defined reset code is lost, the password can no longer be reset via the SmartBlue app. Contact Endress+Hauser Service in this case.

## **7.5 Access to the operating menu via the operating tool**

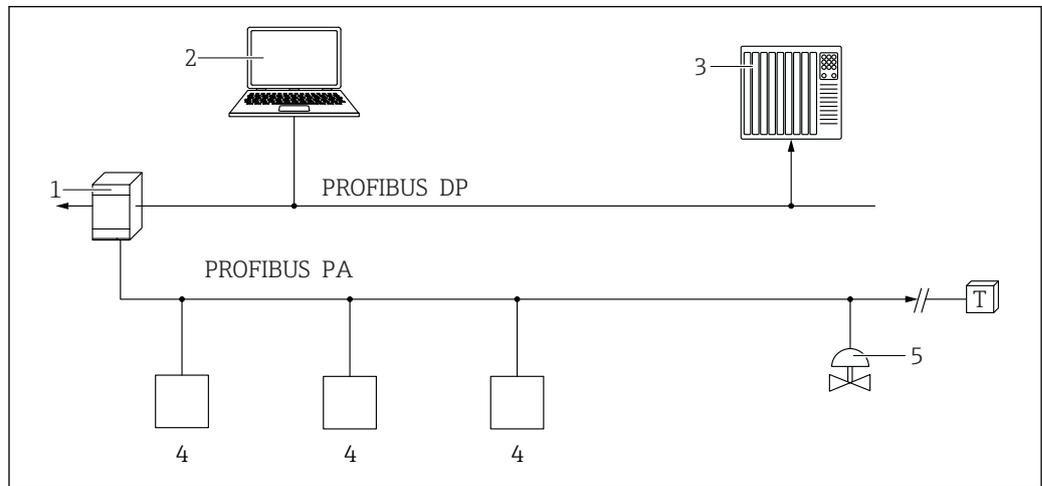
Access via the operating tool is possible:

- Via Profibus PA communication
- Via Endress+Hauser Commubox FXA291

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

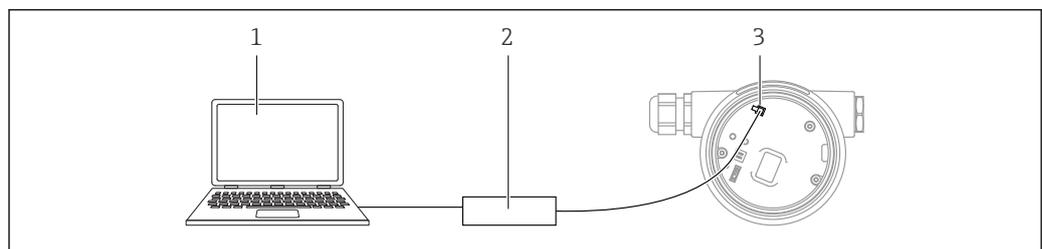
## 7.5.1 Connecting the operating tool

### Via PROFIBUS PA protocol



- 1 Segment coupler
- 2 Computer with PROFibus and operating tool (e.g. DeviceCare/FieldCare )
- 3 PLC (programmable logic controller)
- 4 Transmitter
- 5 Additional functions (valves etc.)

### Service interface



- 1 Computer with FieldCare/DeviceCare operating tool
- 2 Commubox FXA291
- 3 Service interface (CDI) of the device (= Endress+Hauser Common Data Interface)

## 7.5.2 DeviceCare

### Function scope

Tool for connecting and configuring Endress+Hauser field devices.

The fastest way to configure Endress+Hauser field devices is with the dedicated "DeviceCare" tool. Together with the device type managers (DTMs), DeviceCare presents a convenient, comprehensive solution.

 For details, see Innovation Brochure IN01047S.

## 7.5.3 FieldCare

### Function scope

FDT-based plant asset management tool from Endress+Hauser. FieldCare can configure all intelligent field devices in a system and helps you manage them. By using the status

information, FieldCare is also a simple but effective way of checking their status and condition.

Access is via:

- CDI service interface
- PROFIBUS PA communication

Typical functions:

- Configuration of transmitter parameters
- Loading and saving of instrument data (upload/download)
- Documentation of the measuring point
- Visualization of the measured value memory (line recorder) and event logbook



For additional information about FieldCare, see Operating Instructions BA00027S and BA00059S

## 7.6 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.

## 8 System integration

According to EN 50170 Volume 2, IEC 61158-2 (MBP) type 1 PROFIBUS PA Profile Version 3.02

### 8.1 PROFIBUS PA

**Manufacturer ID:**

17 (0x11)

**Ident number:**

0x1574 or 0x9700

**Profile version:**

3.02

**GSD file and version**

Information and files at:

- [www.endress.com](http://www.endress.com)

On the product page for the device: Documents/Software → Device drivers

- [www.profibus.com](http://www.profibus.com)

#### 8.1.1 Output values

**Analog Input:**

- Pressure
- Scaled variable
- Sensor temperature
- Sensor pressure
- Electronics temperature
- **Median of pressure signal** option (only available if the "Heartbeat Verification + Monitoring" application package was selected).
- **Noise of pressure signal** option (only available if the "Heartbeat Verification + Monitoring" application package was selected).

**Digital Input:**

 Only available if the "Heartbeat Verification + Monitoring" application package was selected

Heartbeat Technology → SSD: Statistical Sensor Diagnostics

Heartbeat Technology → Process Window

#### 8.1.2 Input values

**Analog Output:**

Analog value from PLC to be indicated on the display

### 8.1.3 Supported functions

- Identification & maintenance  
Simple device identification via control system and nameplate
- Automatic Ident Number Adoption  
GSD compatibility mode for generic profile 0x9700 "Transmitter with 1 Analog Input"
- Physical Layer Diagnostics  
Installation check of the PROFIBUS segment and device using terminal voltage and message monitoring
- PROFIBUS upload/download  
Reading and writing parameters is up to ten times faster with PROFIBUS upload/download
- Condensed status  
Straightforward and self-explanatory diagnostic information through categorization of occurring diagnostic messages

## 8.2 Device master file (GSD)

In order to integrate the field devices into the bus system, the PROFIBUS system needs a description of the device parameters, such as output data, input data, data format, data volume and supported transmission rate. These data are available in the general station description (GSD) which is provided to the PROFIBUS Master when the communication system is commissioned.

In addition, device bit maps, which appear as icons in the network structure, can also be integrated.

With the Profile 3.0 device master file (GSD) it is possible to exchange field devices made by different manufacturers without having to reconfigure.

Generally speaking, two different GSD versions are possible with Profile 3.0 and higher.

-  Before configuring, the user must decide which GSD should be used to operate the system.
  - The setting can be changed via a Class 2 master.

### 8.2.1 Manufacturer-specific GSD

This GSD guarantees the unrestricted functionality of the measuring instrument. Device-specific process parameters, functions and all device diagnostics are therefore available.

Manufacturer-specific GSD	ID number	File name
PROFIBUS PA	0x1574	EH3x1574.gsd

If the manufacturer-specific GSD is to be used, this is specified in the **Ident number selector** parameter by choosing the "0x1574" option.

-  Where to acquire the manufacturer-specific GSD:  
[www.endress.com](http://www.endress.com) → Download

### 8.2.2 Profile GSD

Differs in terms of the number of Analog Input blocks (AI) and the measured values. If a system is configured with a Profile GSD, it is possible to exchange devices made by different manufacturers. However, it is essential to ensure that the order of the cyclic process values is correct.

ID number	Supported blocks
0x9700	1 Analog Input

The GSD profile to be used is defined via the **Ident number selector** parameter by choosing the **0x9700 (1AI)** option or the "0x1574" option.

### 8.2.3 Compatibility with other devices

This device ensures compatibility in cyclic data exchange with the automation system (Class 1 master) for the following devices:

Generic Transmitter 1 AI PROFIBUS PA (Profile version 3.02, ident number 0x9700)

It is possible to replace these devices without the need to reconfigure the PROFIBUS network in the automation unit although the name and identification number of the devices are different.

Once replaced, the device is either identified automatically (factory setting) or device identification can be set manually.

#### Automatic identification (factory setting)

The device automatically recognizes the generic profile configured in the automation system and makes the same input data and measured value status information available for cyclic data exchange. Automatic identification is set in the **Ident number selector** parameter using the **Automatic mode** option (factory setting).

#### Manual setting

The manual setting is made in the **Ident number selector** parameter via the "0x1574" option (manufacturer) or the **0x9700 (1AI)** option (generic).

Afterwards, the device makes the same input and output data and measured status information available for cyclic data exchange.

-  If the device is acyclically configured via an operating program (Class 2 master), access is directly via the block structure or the parameters of the device.
- If parameters were changed in the device to be replaced (parameter setting no longer corresponds to the original factory setting), these parameters have to be adapted accordingly in the new device used via an operating program (Class 2 master) to guarantee identical behavior
- The cyclic data exchange of the Deltabar PMD63B is not downward compatible with the Deltabar PMD77 or Deltabar PMD78.

## 8.3 Cyclic data transmission

Cyclic data transmission when using the device master file (GSD).

### 8.3.1 Block model

The block model shows which input and output data the measuring instrument makes available for cyclic data exchange. The cyclic data exchange is performed with a PROFIBUS master (Class 1), e.g. a control system.

#### Transducer block

- Analog Input Block 1 to 6; AI output values →
- Digital Input Block 1 to 2; DI output values →
- Analog Output Block 1; AO input value ←

#### Defined order of modules

The device works as a modular PROFIBUS slave. In contrast to a compact slave, a modular slave has a variable design and consists of several individual modules. The device master

file (GSD) contains a description of the individual modules (input and output data) along with their individual properties.

The modules are permanently assigned to the slots, i.e. when configuring the modules, the order and the arrangement of the modules must be respected.

Slot	Module	Function block
01 to 06	AI	Analog Input block 1 to 6
07 to 08	DI	Digital Input Block 1 to 2
09	AO	Analog Output Block 1

To optimize the data throughput rate of the PROFIBUS network, it is advisable to only configure modules that are processed in the PROFIBUS master system. If this results in gaps between the configured modules, these gaps must be assigned to the EMPTY\_MODULE.

### 8.3.2 Description of the modules

The data structure is described from the perspective of the PROFIBUS master:

- Input data: Sent from the measuring instrument to the PROFIBUS master.
- Output data: Sent from the PROFIBUS master to the measuring instrument

#### AI module (Analog Input)

Transmit an input variable from the measuring instrument to the PROFIBUS master (Class 1).

The selected input variable, including the status, is cyclically transmitted to the PROFIBUS master (Class 1) via the AI module. The input variable is depicted in the first four bytes in the form of a floating point number as per the IEEE 754 standard. The fifth byte contains standardized status information pertaining to the input variable.

Six Analog Input blocks are available (slot 1 to 6); **Analog input 1 to 6** submenu

*Input variable:*

The input variable can be determined using the **Channel** parameter.

Application → Profibus → Analog input → Analog input 1 to 6 → Channel

Selection:

- Pressure
- Scaled variable
- Sensor temperature
- Sensor pressure
- Electronics temperature
- Median of pressure signal (only available if the "Heartbeat Verification + Monitoring" application package was selected).
- Noise of pressure signal (only available if the "Heartbeat Verification + Monitoring" application package was selected).

*Data structure*

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measured value: Floating point number (IEEE 754)				Status

#### AO module (Analog Output)

Transmit display information from the PROFIBUS master (Class 1) to the measuring instrument.

An analog output value, along with the status, can be transmitted cyclically from the PROFIBUS master (Class 1) to the measuring instrument via the AO module and output on the local display. The value is displayed in the first four bytes in the form of a floating point number as per the IEEE 754 standard. The fifth byte contains standardized status information pertaining to the output value.

One Analog Output block is available (slot 9).

 Application → Profibus → Analog output → Analog output 1 → Out value **Out value** parameter; Shows an analog output value (AO) that is output from the controller to the device and can be shown on the local display. To show the AO on the local display, it must be assigned to a display output parameter as a value. This assignment is made in the menu under "System-Display".

#### Data structure

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measured value: Floating point number (IEEE 754)				Status

#### DI module (digital input)

Transmit discrete input values from the measuring instrument to the PROFIBUS master (Class 1). Discrete input values are used by the measuring instrument to transmit the state of device functions to the PROFIBUS master (Class 1).

The DI module cyclically transmits the discrete input value, along with the status, to the PROFIBUS master (Class 1). The discrete input value is depicted in the first byte. The second byte contains standardized status information pertaining to the input value.

Two digital input blocks are available (slot 7 to 8).

The digital input blocks are only available if the option Heartbeat Technology is available. In addition, at least one of the following Heartbeat Monitoring functions must be configured:

- **Statistical Sensor Diagnostics**
- **Process window**

#### Assignment of the digital inputs:

The assignment of the digital inputs can be defined using the **Channel** parameter.

Application → Profibus → Digital input → Digital input 1 to 2 → Channel

Selection:

- None
- Process alert pressure
- Process alert scaled variable
- Process alert temperature
- Low signal noise detected
- High signal noise detected
- Min signal noise detected
- Out of range signal detected

Factory setting: **None** option

#### Data structure

Byte 1	Byte 2
Digital	Status

#### EMPTY\_MODULE module

This module is used to assign empty spaces arising from modules not being used in the slots.

The device works as a modular PROFIBUS slave. In contrast to a compact slave, a modular PROFIBUS slave has a variable design and consists of several individual modules. The GSD file contains a description of the individual modules along with their individual properties.

The modules are permanently assigned to the slots. When configuring the modules, it is absolutely essential to observe the sequence/arrangement of the modules. Any gaps between the configured modules must be filled with the `EMPTY_MODULE`.

## 9 Commissioning

### 9.1 Preparatory steps

The measuring range and the unit in which the measured value is transmitted correspond to the specifications on the nameplate.

#### **⚠ WARNING**

#### **Process pressure above or below permitted maximum/minimum!**

Risk of injury if parts burst! Warnings are displayed if the pressure is too high.

- ▶ If a pressure smaller than the minimum permitted pressure or greater than the maximum permitted pressure is present at the device, a message is output.
- ▶ Only use the device within the measuring range limits.

#### 9.1.1 As-delivered state

If no customized settings were ordered:

- Calibration values defined by defined measuring cell nominal value
- DIP switch to Off position
- If Bluetooth is ordered, then Bluetooth is switched on

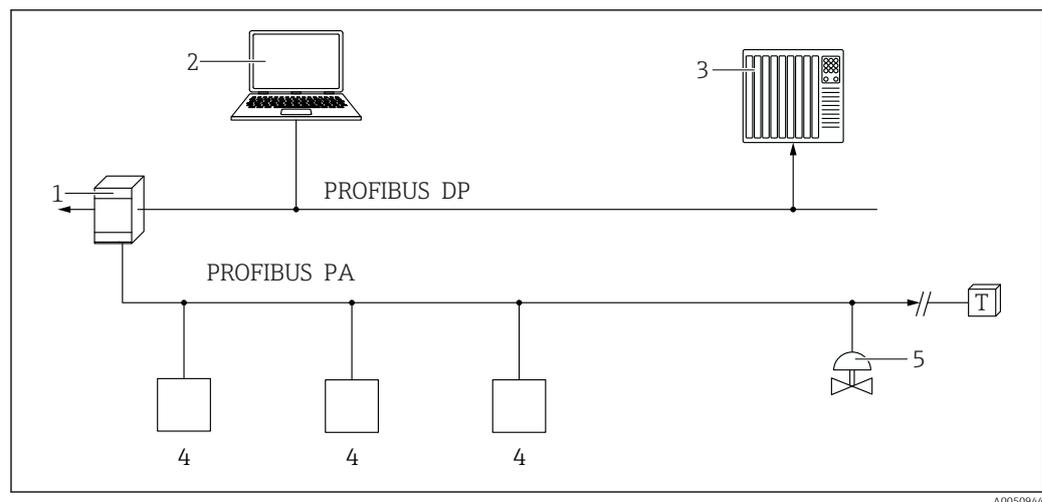
### 9.2 Function check

Perform a function check before putting the measuring point into operation:

- "Post-installation check" checklist (see the "Installation" section)
- "Post-connection check" checklist (see the "Electrical connection" section)

### 9.3 Establishing a connection via FieldCare and DeviceCare

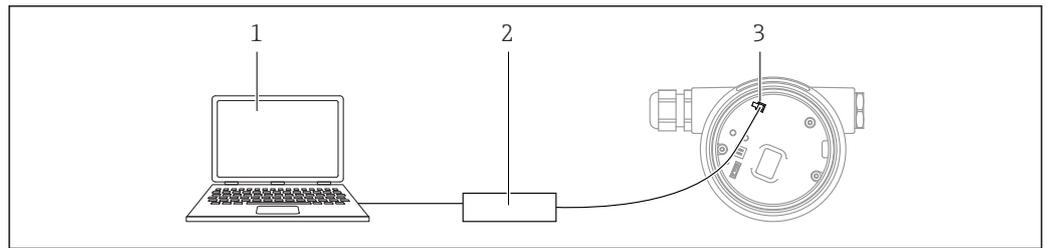
#### 9.3.1 Via PROFIBUS PA protocol



- 1 Segment coupler
- 2 Computer with PROFIBUS and operating tool (e.g. DeviceCare/FieldCare)
- 3 PLC (programmable logic controller)
- 4 Transmitter
- 5 Other actuators or sensors (valves etc.)

A0050944

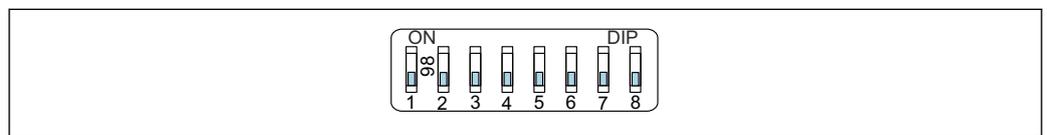
### 9.3.2 FieldCare/DeviceCare via service interface (CDI)



A0039148

- 1 Computer with FieldCare/DeviceCare operating tool
- 2 Commubox FXA291
- 3 Service interface (CDI) of the device (= Endress+Hauser Common Data Interface)

### 9.4 Configuring the device address via software



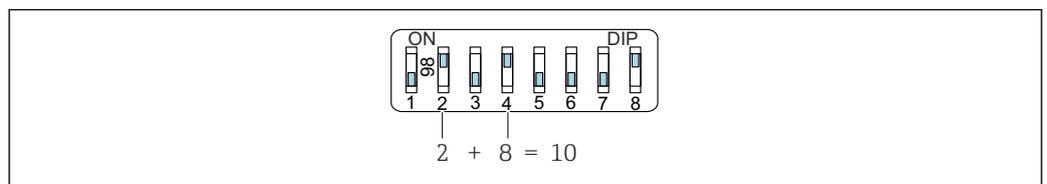
A0053771

10 Example of software addressing; switch 8 is set to the "OFF" position; the address is defined in the operating menu

1. Set switch 8 to "OFF".
2. The device restarts automatically and reports the PROFIBUS address stored in the device. The factory setting is PROFIBUS address 126 or the PROFIBUS address ordered with order code "Marking", "Bus address" option.
3. Configure the address via the operating menu: Application → Profibus → Configuration → Device address

### 9.5 Hardware settings

#### 9.5.1 Hardware addressing



A0053770

11 Example of hardware addressing; switch 8 is set to the "ON" position; switches 1 to 7 define the address.

1. Set switch 8 to the "ON" position.
  2. Using switches 1 to 7, set the address as indicated in the table below.
- The change of address takes effect after 10 seconds. The device is restarted.

Assignment of switch values

Switch	1	2	3	4	5	6	7
Value in "ON" position	1	2	4	8	16	32	64
Value in "OFF" position	0	0	0	0	0	0	0

## 9.6 Setting the operating language

### 9.6.1 Local display

#### Setting the operating language

 To set the operating language, the display first needs to be unlocked:

1. Press the  key for at least 2 s.
  - ↳ A dialog box appears.
2. Unlock the display operation.
3. In the main menu, select the **Language** parameter.
4. Press the  key.
5. Select the desired language with the  key.
6. Press the  key.

 Display operation locks automatically in the following cases:

- after 1 min on the main page if no key has been pressed
- after 10 min within the operating menu if no key has been pressed

#### Display operation - locking or unlocking

The  key must be pressed for at least 2 seconds in order to lock or unlock the optical keys. Display operation can be locked or unlocked in the dialog that appears.

Display operation locks automatically:

- After 1 minute on the main page if no key has been pressed
- After 10 minutes within the operating menu if no key has been pressed

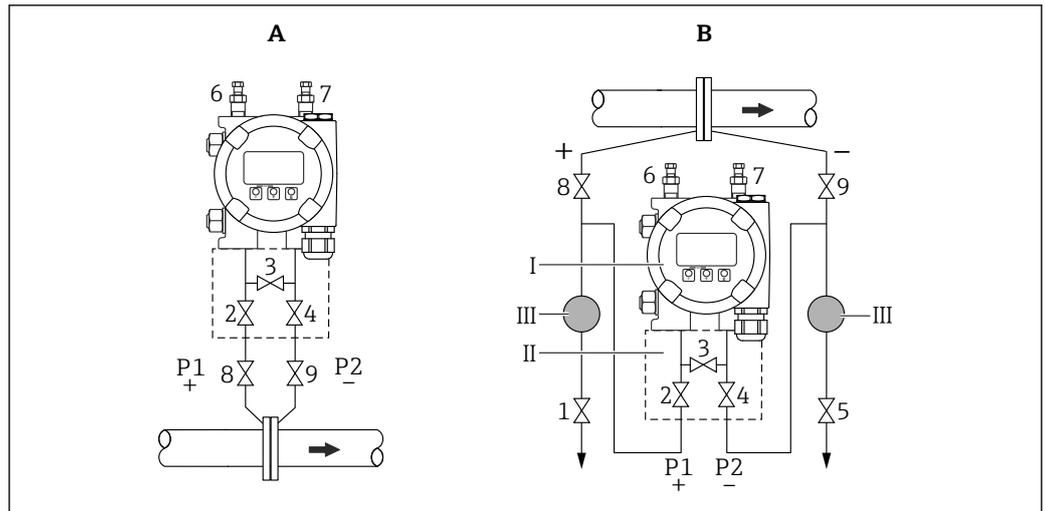
### 9.6.2 Operating tool

See the description of the relevant operating tool.

## 9.7 Configuring the device

### 9.7.1 Differential pressure measurement (e.g. flow measurement)

Before adjusting the device, the piping may need to be cleaned and filled with medium.



A0030036

- A Preferred installation for gases  
 B Preferred installation for liquids  
 I Device  
 II Three-valve manifold  
 III Separator  
 1, 5 Drain valves  
 2, 4 Inlet valves  
 3 Equalization valve  
 6, 7 Vent valves on device  
 8, 9 Shutoff valves

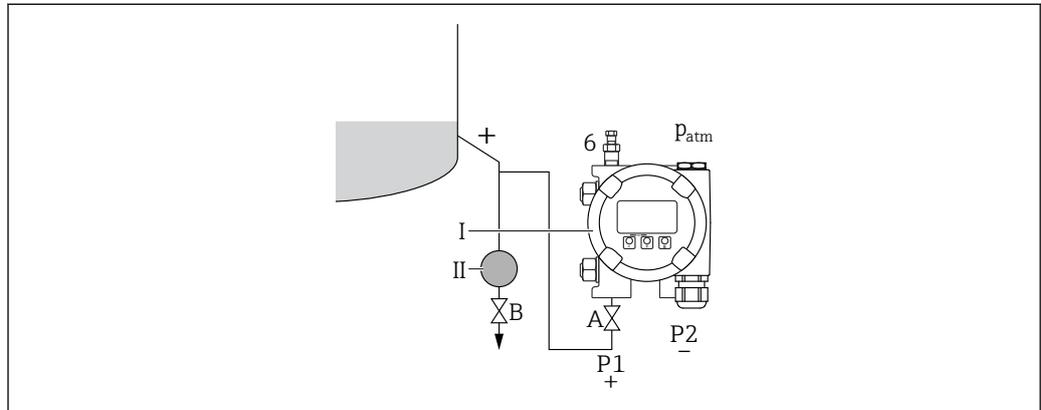
1. Close 3.
2. Fill the measuring system with medium.
  - ↳ Open A, B, 2, 4. Fluid flows in.
3. Vent device.
  - ↳ Liquids: Open 6 and 7 until the system (piping, valves and side flanges) is completely filled with medium.
  - ↳ Gases: Open 6 and 7 until the system (piping, valves and side flanges) is completely filled with gas and free from condensation.
  - Close 6 and 7.

 Check the adjustment and perform again if necessary.

## 9.7.2 Level measurement

### Open vessel

Before adjusting the device, the piping may need to be cleaned and filled with medium.



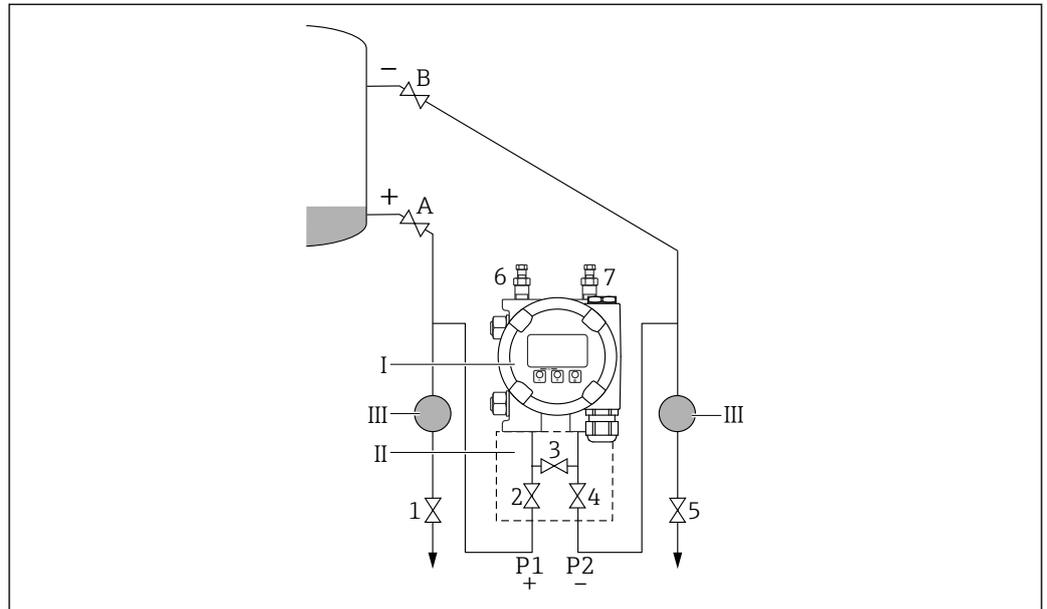
A0030038

- I* Device
- II* Separator
- 6* Vent valve on device
- A* Shutoff valve
- B* Drain valve

1. Fill the vessel to above the lower tapping point.
2. Fill the measuring system with medium.
  - ↳ Open A (shutoff valve).
3. Vent device.
  - ↳ Open 6 until the system (piping, valve and side flange) is completely filled with medium.

### Closed vessel

Before adjusting the device, the piping may need to be cleaned and filled with medium.

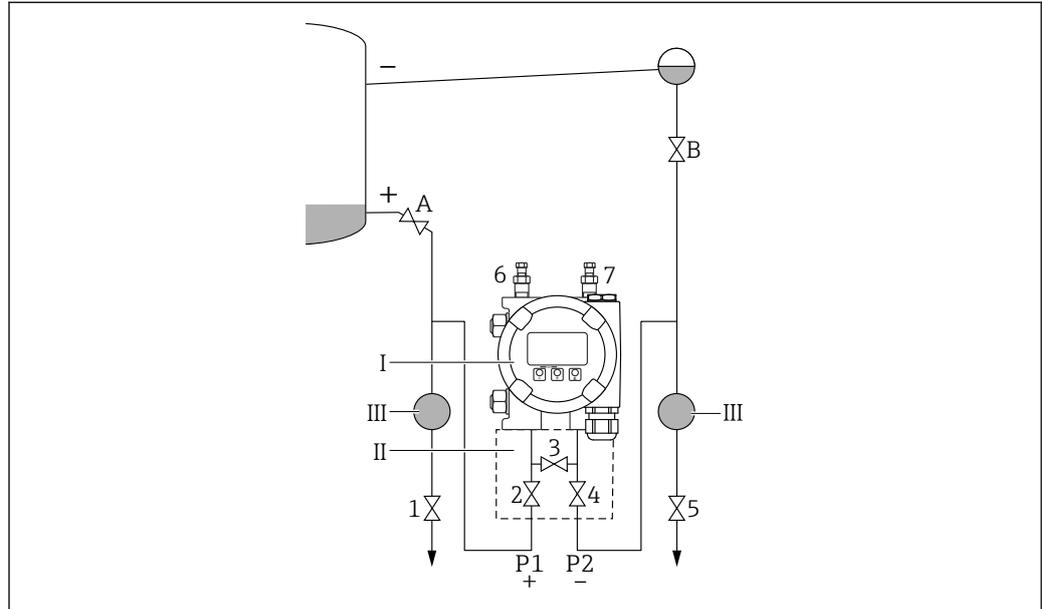


- I Device
- II Three-valve manifold
- III Separator
- 1, 5 Drain valves
- 2, 4 Inlet valves
- 3 Equalization valve
- 6, 7 Vent valves on device
- A, B Shutoff valves

1. Fill the vessel to above the lower tapping point.
2. Fill the measuring system with medium.
  - ↳ Close 3 (separate high-pressure side and low-pressure side).  
Open A and B (shutoff valves).
3. Vent high-pressure side (empty low-pressure side if necessary).
  - ↳ Open 2 and 4 (introduce fluid on high-pressure side).  
Open 6 until the system (piping, valve and side flange) is completely filled with medium.  
Open 7 until the system (piping, valve and side flange) is completely empty.

### Closed vessel with superimposed vapor

Before adjusting the device, the piping may need to be cleaned and filled with medium.



- I Device  
 II Three-valve manifold  
 III Separator  
 1, 5 Drain valves  
 2, 4 Inlet valves  
 3 Equalization valve  
 6, 7 Vent valves on device  
 A, B Shutoff valves

1. Fill the vessel to above the lower tapping point.
2. Fill the measuring system with medium.
  - ↳ Open A and B (shutoff valves).  
Fill the negative pressure piping to the height of the condensate trap.
3. Vent device.
  - ↳ Open 2 and 4 (introduce fluid).  
Open 6 and 7 until the system (piping, valve and side flange) is completely filled with medium.

### 9.7.3 Commissioning with keys on the electronic insert

The following functions are possible via the keys on the electronic insert:

- Position adjustment (zero point correction)
  - The orientation of the device may cause a pressure shift
  - This pressure shift can be corrected by a position adjustment
- Resetting the device

#### Performing position adjustment

1. Device installed in required position and no pressure is applied.
2. Press "Zero" for at least 3 s.
3. When the LED flashes twice, the pressure present has been accepted for position adjustment.

#### Resetting the device

- ▶ Press and hold the "Zero" key for at least 12 seconds.

### 9.7.4 Commissioning with the Commissioning wizard

In FieldCare, DeviceCare, SmartBlue and on the display, the **Commissioning** wizard is available to guide the user through the initial commissioning steps.

Complete this wizard to commission the device.

For each parameter, enter the appropriate value or select the appropriate option.

#### NOTE

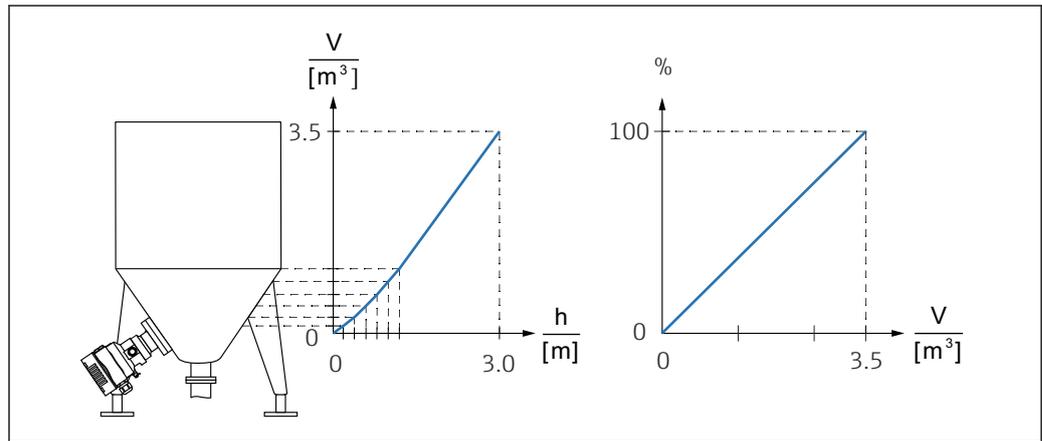
If you exit the wizard before completing all required parameters, the changes you have made will be saved. For this reason, the device may then be in an undefined state! In this case, a reset to the default settings is recommended.

### 9.7.5 Linearization

In the following example, the volume in a tank with a conical outlet should be measured in  $\text{m}^3$ .

Prerequisites:

- Points for linearization table are known
- Level calibration is performed
- Linearization characteristic must continually increase or decrease



A0046625

1. The scaled variable is communicated via PROFIBUS using a correspondingly configured Analog Input Block.
2. The linearization table can be opened via the **Go to linearization table** parameter **Table** option.
  - ↳ Menu path: Application → Sensor → Scaled variable → Scaled variable transfer function
3. Enter the desired table values.
4. The table is activated once all the points in the table have been entered.
5. Activate the table using the **Activate table** parameter.

Result:

The measured value after linearization is displayed.

- i
  - Error message F435 "Linearization" and the alarm current appear as long as the table is being entered and until the table is activated
  - The 0% value is defined by the smallest point in the table
  - The 100% value is defined by the largest point in the table

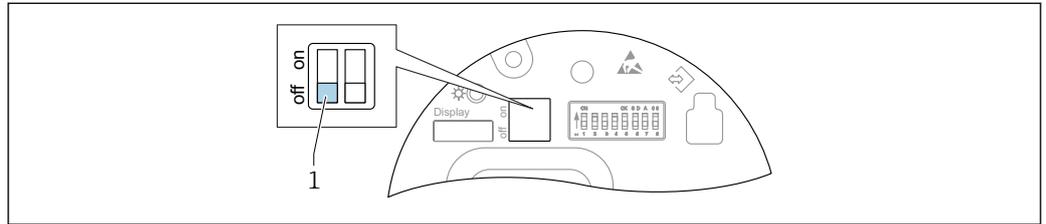
### 9.8 "Simulation" submenu

With the **Simulation** submenu, the pressure and diagnostic events can be simulated.

Menu path: Diagnostics → Simulation

## 9.9 Protecting settings from unauthorized access

### 9.9.1 Hardware locking or unlocking



A0059190

- 1 Operating key for position adjustment (zero point correction), reset device (reset) and password (for Bluetooth login and user role)

DIP switch 1 on the electronic insert is used to lock or unlock operation.

If operation is locked via the DIP switch, you can only unlock operation again via the DIP switch.

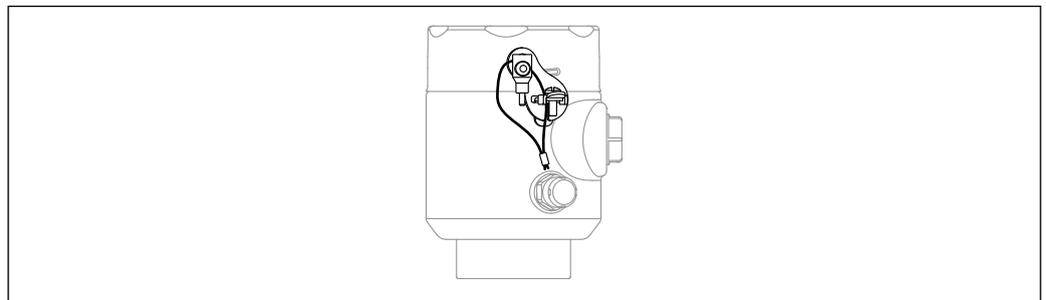
If operation is locked via the operating menu, you can only unlock operation again via the operating menu.

If operation is locked via the DIP switch, the key symbol  appears on the local display.

### Sealing

-  The device can be sealed. The system operator or the competent calibration authority (weights and measures services) is responsible for applying the optional seal. The device can be sealed with sealing screws.

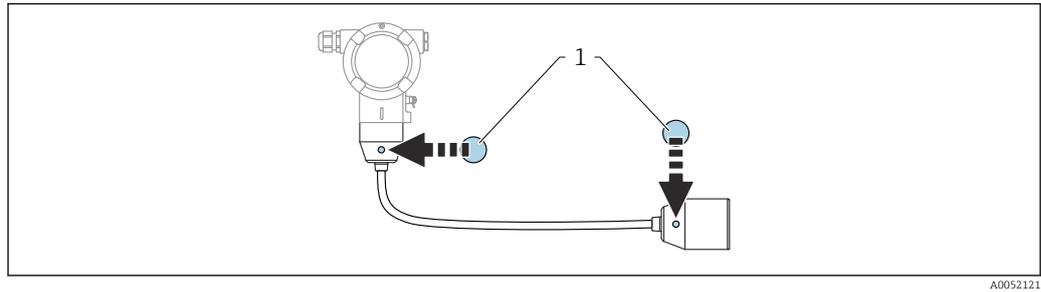
### Housing



A0059012

1. Pull the wire through the screw holes. In doing so, ensure that the wire is taut and there is no leeway for the screw to loosen.
2. Twist the wire.
3. Seal the wire ends together.

Sensor, remote



A0052121

1 Official sticker seal

### 9.9.2 Display operation - locking or unlocking

The  key must be pressed for at least 2 seconds in order to lock or unlock the optical keys. Display operation can be locked or unlocked in the dialog that appears.

Display operation locks automatically:

- After 1 minute on the main page if no key has been pressed
- After 10 minutes within the operating menu if no key has been pressed

### 9.9.3 Software locking or unlocking

 If operation is locked by means of the DIP switch, you can only unlock operation again by means of the DIP switch.

#### Locking via password in display / FieldCare / DeviceCare / SmartBlue

Access to parameter configuration of the device can be locked by assigning a password. When the device is delivered from the factory, the user role is set to **Maintenance** option. The device can be configured completely with the **Maintenance** option user role. Afterwards, access to the configuration can be locked by assigning a password. The **Maintenance** option switches to the **Operator** option as a result of this locking. The configuration can be accessed by entering the password.

The password is defined under:

**System** menu **User management** submenu

The user role is changed from the **Maintenance** option to the **Operator** option under:

System → User management

#### Disabling the lock via the display / FieldCare / DeviceCare / SmartBlue

After entering the password, you can enable parameter configuration of the device as an **Operator** option with the password. The user role then changes to **Maintenance** option.

If necessary, the password can be deleted in the **User management** submenu: System → User management

## 10 Operation

### 10.1 Reading off the device locking status

Displaying active write protection in the **Locking status** parameter

- Local display :  
The  symbol appears on the main page
- Operating tool (FieldCare/DeviceCare) :  
Navigation: System → Device management → Locking status

### 10.2 Reading off measured values

All the measured values can be read off using the **Measured values** submenu.

#### Navigation

"Application" menu → Measured values

### 10.3 Adapting the device to process conditions

The following are available for this purpose:

- Basic settings using the **Guidance** menu
- Advanced settings using the **Diagnostics** menu, **Application** menu and **System** menu

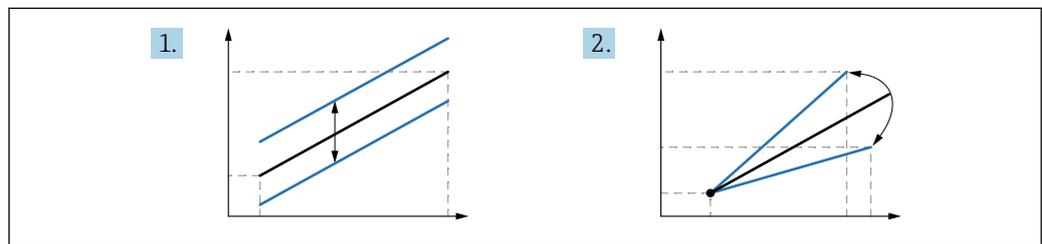
### 10.3.1 Sensor calibration <sup>1)</sup>.

In the course of their life cycle, pressure measuring cells **can** deviate, or drift, <sup>2)</sup> from the original pressure characteristic curve. This deviation depends on the operating conditions and can be corrected in the **Sensor calibration** submenu.

Set the value of the zero point shift before the Sensor calibration to 0.00. Application

→ Sensor → Sensor calibration → Zero adjustment offset

1. Apply the lower pressure value (value measured with pressure reference) to the device. Enter this pressure value in the **Lower sensor trim** parameter. Application → Sensor → Sensor calibration → Lower sensor trim
  - ↳ The value entered causes a parallel shift of the pressure characteristic in relation to the current Sensor calibration.
2. Apply the upper pressure value (value measured with pressure reference) to the device. Enter this pressure value in the **Upper sensor trim** parameter. Application → Sensor → Sensor calibration → Upper sensor trim
  - ↳ The value entered causes a change in the slope of the current Sensor calibration.



A0052045

**i** The accuracy of the pressure reference determines the accuracy of the device. The pressure reference must be more accurate than the device.

1) Not possible via display operation

2) Deviations caused by physical factors are also known as "Sensor drift".

# 11 Diagnostics and troubleshooting

## 11.1 General troubleshooting

### 11.1.1 General faults

#### Device is not responding

- Possible cause: Supply voltage does not match the specification on the nameplate  
Remedial action: Apply the correct voltage
- Possible cause: The polarity of the supply voltage is wrong  
Remedial action: Correct the polarity
- Possible cause: The connecting cables are not in contact with the terminals.  
Remedial action: Check the electrical contact between cables and correct if necessary
- Possible cause: Load resistance too high  
Remedial action: Increase the supply voltage to reach the minimum terminal voltage

#### No values visible on the display

- Possible cause: Graphic display is set too bright or too dark  
Remedial action: Increase or decrease the contrast with the **Contrast display** parameter  
Navigation path: System → Display → Contrast display
- Possible cause: The plug of the display cable is not connected correctly  
Remedial action: Connect the plug correctly
- Possible cause: Display is defective  
Remedial action: Replace the display

#### Communication via CDI interface not working

Possible cause: Wrong setting of the COM port on the computer

Remedial action: Check the setting of the COM port on the computer and correct it if necessary

### 11.1.2 Error - SmartBlue operation

Operation via SmartBlue is only possible on devices that have a display with Bluetooth (optionally available).

#### Device is not visible in the live list

- Possible cause: Supply voltage too low  
Remedial action: Increase the supply voltage.
- Possible cause: No Bluetooth connection available  
Remedial action: Enable Bluetooth in the field device via display or software tool and/or in the smartphone/tablet
- Possible cause: Bluetooth signal outside range  
Remedial action: Reduce distance between field device and smartphone/tablet  
The connection has a range of up to 25 m (82 ft)
- Possible cause: Geopositioning is not enabled on Android devices or is not permitted for the SmartBlue app.  
Remedial action: Enable/permit the geopositioning service on Android device for the SmartBlue app

#### Device appears in the live list but a connection cannot be established

- Possible cause: The device is already connected with another smartphone/tablet via Bluetooth.  
Only one point-to-point connection is permitted  
Remedial action: Disconnect the smartphone/tablet from the device
- Possible cause: Incorrect user name and password  
Remedial action: The standard user name is "admin" and the password is the device serial number indicated on the device nameplate (only if the password was not changed by the user beforehand)  
If the password has been forgotten:

**Connection via SmartBlue not possible**

- Possible cause: Incorrect password entered  
Remedial action: Enter the correct password, paying attention to lower/upper case
- Possible cause: Forgotten password  
Remedy:

**No communication with device via SmartBlue**

- Possible cause: Supply voltage too low  
Remedial action: Increase the supply voltage.
- Possible cause: No Bluetooth connection available  
Remedial action: Enable the Bluetooth function on the smartphone, tablet and device
- Possible cause: The device is already connected with another smartphone/tablet  
Remedial action: Disconnect the device from the other smartphone/tablet
- Ambient conditions (e.g. walls/tanks) disturbing the Bluetooth connection  
Remedial action: Establish direct line-of-sight connection
- Display does not have Bluetooth

**Device cannot be operated via SmartBlue**

- Possible cause: Incorrect password entered  
Remedial action: Enter the correct password, paying attention to lower/upper case
- Possible cause: Forgotten password  
Remedy:
- Possible cause: **Operator** option has no authorization  
Remedial action: Change to the **Maintenance** option

**11.1.3 Corrective action**

Take the following measures if an error message is displayed:

- Check the cable/power supply.
- Check the plausibility of the pressure value.
- Restart the device.
- Perform a reset (the device may need to be reconfigured).

If the measures do not rectify the problem, contact your Endress+Hauser office.

### 11.1.4 Additional tests

If no clear cause of the error can be identified or the source of the problem can be both the device and the application, the following additional tests can be performed:

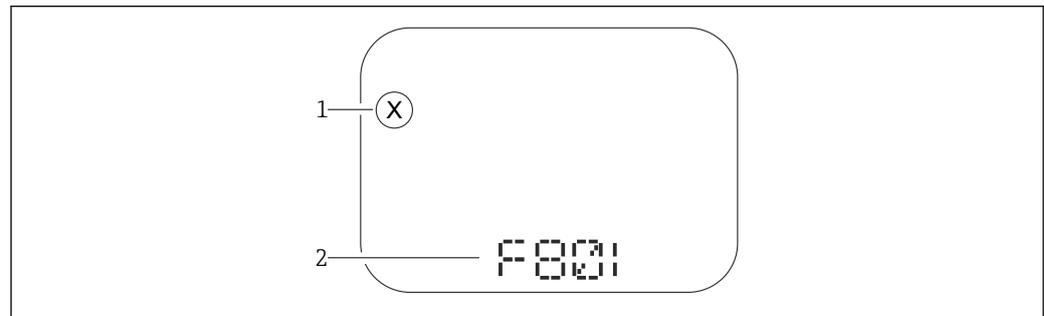
1. Check the digital pressure value (display, PROFIBUS, etc. ).
2. Check that the device concerned is functioning correctly. Replace the device if the digital value does not correspond to the expected pressure value.
3. Switch on the simulation and check the measured value in Pressure AI, Slot 1/Subslot 1. Replace the main electronics if the displayed value does not correspond to the simulated value.

## 11.2 Diagnostic formation on local display

### 11.2.1 Diagnostic message

#### Measured value display and diagnostic message in the event of a failure

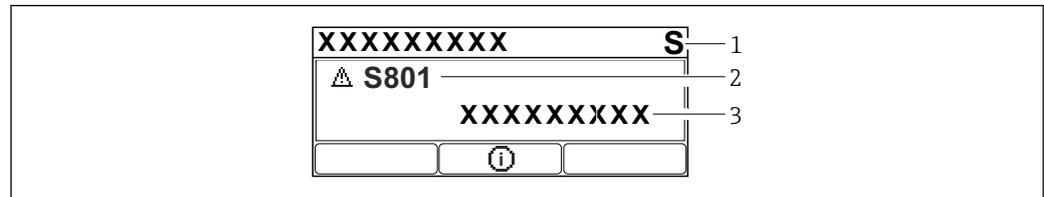
Failures detected by the device's self-monitoring system are displayed as a diagnostic message in alternation with the unit.



A0043759

- 1 Status signal  
2 Status symbol with diagnostic event

Faults detected by the device's self-monitoring system are displayed as a diagnostic message in alternation with the measured value display.



A0043103

- 1 Status signal  
2 Status symbol with diagnostic event  
3 Event text

#### Status signals

*F*

##### "Failure (F)" option

A device error has occurred. The measured value is no longer valid.

*C*

##### "Function check (C)" option

The device is in the service mode (e.g. during a simulation).

*S*

##### "Out of specification (S)" option

The device is operated:

- Outside of its technical specifications (e.g. during startup or a cleaning)
- Outside of the configuration performed by the user (e.g. level outside configured span)

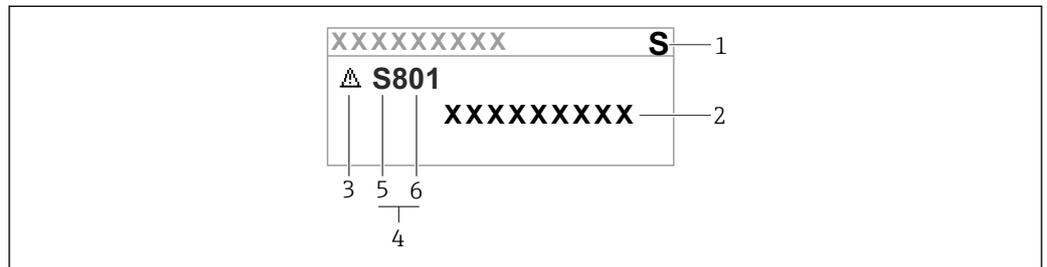
*M*

##### "Maintenance required (M)" option

Maintenance required. The measured value remains valid.

### Diagnostic event and event text

The failure can be identified by means of the diagnostic event. The event text helps you by providing information about the failure. In addition, the associated status symbol is displayed in front of the diagnostic event.



A0038013

- 1 Status signal
- 2 Event text
- 3 Status symbol
- 4 Diagnostic event
- 5 Status signal
- 6 Diagnostic number

If several diagnostic events are pending at the same time, only the diagnostic message with the highest priority is displayed.

### "Active diagnostics" parameter

key

Opens the message about the remedial actions.

key

Acknowledge warnings.

key

Back to operating menu.

## 11.3 Diagnostic list

All the diagnostic messages that are currently queued can be displayed in the **Diagnostic list** submenu.

### Navigation path

Diagnostics → Diagnostic list

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
<b>Diagnostic of sensor</b>				
062	Sensor connection faulty	Check sensor connection	F	Alarm
081	Sensor initialization faulty	1. Restart device 2. Contact service	F	Alarm
100	Sensor error	1. Restart the device 2. Contact Endress+Hauser Service	F	Alarm
101	Sensor temperature	1. Check process temperature 2. Check ambient temperature	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
102	Sensor incompatible error	1. Restart device 2. Contact service	F	Alarm
<b>Diagnostic of electronic</b>				
242	Firmware incompatible	1. Check software 2. Flash or change main electronic module	F	Alarm
252	Module incompatible	1. Check if correct electronic module is plugged 2. Replace electronic module	F	Alarm
263	Incompatibility detected	Check electronic module type	M	Warning
270	Main electronics defective	Replace main electronics or device.	F	Alarm
272	Main electronics faulty	1. Restart device 2. Contact service	F	Alarm
273	Main electronics defective	Replace main electronics or device.	F	Alarm
282	Data storage inconsistent	Restart device	F	Alarm
283	Memory content inconsistent	1. Restart device 2. Contact service	F	Alarm
287	Memory content inconsistent	1. Restart device 2. Contact service	M	Warning
388	Electronics and HistoROM defective	1. Restart device 2. Replace electronics and HistoROM 3. Contact service	F	Alarm
<b>Diagnostic of configuration</b>				
410	Data transfer failed	1. Retry data transfer 2. Check connection	F	Alarm
412	Processing download	Download active, please wait	C	Warning
435	Linearization faulty	Check data points and min span	F	Alarm
437	Configuration incompatible	1. Update firmware 2. Execute factory reset	F	Alarm
438	Dataset different	1. Check dataset file 2. Check device parameterization 3. Download new device parameterization	M	Warning
482	Block in OOS	Set Block in AUTO mode	F	Alarm
484	Failure mode simulation active	Deactivate simulation	C	Alarm
485	Process variable simulation active	Deactivate simulation	C	Warning
495	Diagnostic event simulation active	Deactivate simulation	S	Warning
497	Block output simulation active	Deactivate simulation	C	Warning
500	Process alert pressure	1. Check process pressure 2. Check configuration of process alert	S	Warning <sup>1)</sup>

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
501	Process alert scaled variable	1. Check process conditions 2. Check scaled variable configuration	C	Warning <sup>1)</sup>
502	Process alert temperature	1. Check process temperature 2. Check configuration of process alert	C	Warning <sup>1)</sup>
503	Zero adjustment	1. Check measuring range 2. Check position adjustment	M	Warning
<b>Diagnostic of process</b>				
801	Supply voltage too low	Increase supply voltage	F	Alarm
802	Supply voltage too high	Decrease supply voltage	S	Warning
822	Sensor temperature out of range	1. Check process temperature 2. Check ambient temperature	M	Warning <sup>1)</sup>
825	Electronics temperature out of range	1. Check ambient temperature 2. Check process temperature	S	Warning
841	Operating range	1. Check the process pressure 2. Check the sensor range	S	Warning
900	High signal noise detected	1. Check impulse line 2. Check valve position 3. Check process	M	Warning <sup>1)</sup>
901	Low signal noise detected	1. Check impulse line 2. Check valve position 3. Check process	M	Warning <sup>1)</sup>
902	Min signal noise detected	1. Check impulse line 2. Check valve position 3. Check process	M	Warning <sup>1)</sup>
906	Out of range signal detected	1. Process Information. No action 2. Rebuild baseline 3. Adapt signal range thresholds	C	Warning <sup>1)</sup>

1) Diagnostic behavior can be changed.

## 11.4 Event logbook

### 11.4.1 Event history

The **Event list** submenu provides a chronological overview of the event messages that have occurred. <sup>3)</sup>

#### Navigation path

Diagnostics → Event logbook

A maximum of 100 event messages can be displayed in chronological order.

The event history includes entries for:

- Diagnostic events
- Information events

3) If operating via FieldCare, the event list can be displayed with the "Event List/HistoROM" function in FieldCare

In addition to the operating time when the event occurred, each event is also assigned a symbol that indicates whether the event has occurred or is finished:

- Diagnostic event
  - ☺: Occurrence of the event
  - ☹: End of the event
- Information event
  - ☺: Occurrence of the event

### 11.4.2 Filtering the event logbook

Filters can be used to determine which category of event messages is displayed in the **Event list** submenu.

#### Navigation path

Diagnostics → Event logbook

### 11.4.3 Overview of information events

Info number	Info name
I1000	----- (Device ok)
I1079	Sensor changed
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I11074	Device verification active
I1110	Write protection switch changed
I11104	Loop diagnostics
I11341	SSD baseline created
I1151	History reset
I1154	Reset terminal voltage min/max
I1155	Reset electronics temperature
I1157	Memory error event list
I1256	Display: access status changed
I1335	Firmware changed
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1440	Main electronic module changed
I1444	Device verification passed
I1445	Device verification failed
I1461	Sensor verification failed
I1512	Download started
I1513	Download finished
I1514	Upload started
I1515	Upload finished
I1551	Assignment error fixed
I1552	Failed: Main electronic verification

Info number	Info name
I1556	Safety mode off
I1956	Reset

## 11.5 Resetting the device

### 11.5.1 Reset password via operating tool

Enter a code to reset the current "Maintenance" password.  
The code is delivered by your local support.

Navigation: System → User management → Reset password → Reset password

Reset password

 For details see the "Description of device parameters" documentation.

### 11.5.2 Reset device via operating tool

Reset the device configuration - either entirely or in part - to a defined state

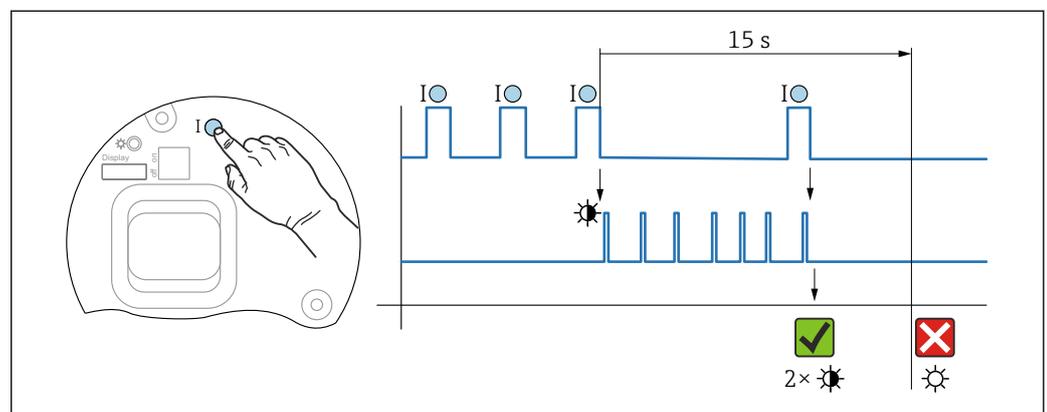
Navigation: System → Device management → Reset device

Reset device parameter

 For details see the "Description of device parameters" documentation.

### 11.5.3 Resetting the device via keys on the electronic insert

Reset password



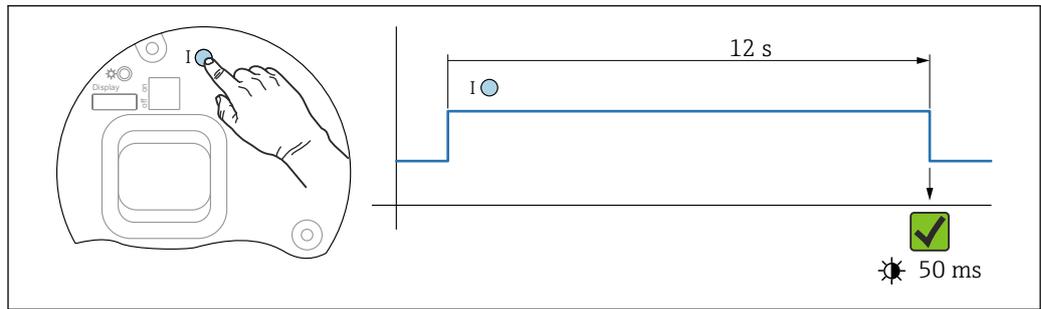
 12 Sequence for resetting the password

#### Delete/reset the password

1. Press operating key **I** three times.
  - ↳ The Reset Password function is started; the LED flashes.
2. Press operating key **I** once within 15 s.
  - ↳ The password is reset, the LED flashes briefly.

If operating key **I** is not pressed within 15 s, the action is canceled and the LED is no longer lit.

### Resetting the device to the factory setting



 13 Sequence for resetting to factory setting

A0050015

### Resetting the device to the factory setting

- ▶ Press operating key **I** for at least 12 s.
  - ↳ Device data are reset to the factory setting; the LED flashes briefly.

## 11.6 Firmware history

-  The firmware version can explicitly be ordered via the product structure. This makes it possible to ensure the compatibility of the firmware version with an existing or planned system integration.

### 11.6.1 Version 01.00.zz

Original software

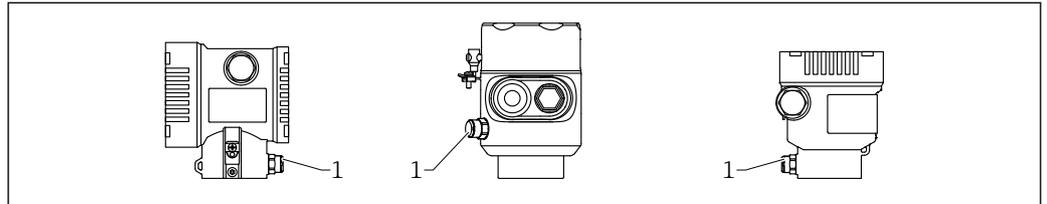
## 12 Maintenance

### 12.1 Maintenance work

This chapter describes the maintenance of physical device components.

#### 12.1.1 Pressure compensation filter

Keep the pressure compensation filter (1) free from contamination.



A0058265

1 Pressure compensation filter

#### 12.1.2 Exterior cleaning

##### Notes on cleaning

- The cleaning agents used should not corrode the surfaces and the seals
- Mechanical damage to the membrane, e.g. due to sharp objects, must be avoided
- Observe the degree of protection of the device

## 13 Repair

### 13.1 General information

#### 13.1.1 Repair concept

Under the Endress+Hauser repair concept, devices have a modular design and repairs are carried out by Endress+Hauser Service or by properly trained customers.

Spare parts are grouped into logical kits with the associated replacement instructions.

For more information on service and spare parts contact Endress+Hauser Service.

#### 13.1.2 Repair of Ex-certified devices

##### WARNING

##### **Incorrect repair can compromise electrical safety!**

Explosion Hazard!

- ▶ Repairs to Ex-certified devices must be carried out by Endress+Hauser Service or by specialist personnel according to national regulations.
- ▶ Relevant standards and national regulations on hazardous areas, safety instructions and certificates must be observed.
- ▶ Use only original Endress+Hauser spare parts.
- ▶ Please note the device designation on the nameplate. Only identical parts may be used as replacements.
- ▶ Carry out repairs according to the instructions.
- ▶ Only the Endress+Hauser service team is permitted to modify a certified device and convert it to another certified version.

### 13.2 Spare parts

- Some replaceable device components are identified by a spare part nameplate. This contains information about the spare part.
- All the spare parts for the measuring device, along with the order code, are listed in the *Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)) and can be ordered. If available, users can also download the associated Installation Instructions.



Device serial number:

- Located on the device and spare part nameplate.
- Can be read out via the device software.

### 13.3 Replacement

##### CAUTION

**Data upload/download is not permitted if the device is used for safety-related applications.**

- ▶ After an entire device or an electronics module has been replaced, the parameters can be downloaded to the device again via the communication interface. For this, the data must have been uploaded to the PC beforehand using the "FieldCare/DeviceCare" software.

### 13.3.1 HistoROM

It is not necessary to perform a new device calibration after replacing the display or transmitter electronics. The parameters are saved in the HistoROM.

-  After replacing the transmitter electronics, remove the HistoROM and insert it into the new replacement part.

## 13.4 Return

The device must be returned in the event of a factory calibration, or if the wrong device has been ordered or delivered.

As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium. To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Endress+Hauser website <http://www.endress.com/support/return-material>.

- ▶ Select country.
  - ↳ The website of the responsible sales office opens with all the relevant information relating to returns.
- 1. If the desired country is not listed:
  - Click on the "Choose your location" link.
    - ↳ An overview of Endress+Hauser sales offices and representatives opens.
- 2. Contact the Endress+Hauser sales organization responsible for your area.

## 13.5 Disposal

-  If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

## 14 Accessories

### 14.1 Device-specific accessories

#### 14.1.1 Mechanical accessories

- Mounting bracket for housing
- Prepared for sealing, PMO-compliant
- Weather protection covers



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

#### 14.1.2 Weld-in accessory



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

### 14.2 Device Viewer

All the spare parts for the device, along with the order code, are listed in the *Device Viewer* (<https://www.endress.com/de/pages/supporting-tools/device-viewer>).

## 15 Technical data

### 15.1 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) <sup>1) 2)</sup>
	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 or can be configured at the device
- 2) The maximum TD is 5:1 in the case of platinum.

*PN 160 / 16 MPa / 2400 psi*

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

- 1) MWP depends on the selected process connection.
- 2) Applies to the process seal materials FKM, PTFE, FFKM, EPDM and for pressure applied on both sides.
- 3) If the side vent valves (sv) and PTFE seal option is selected, the burst pressure is 600 bar (8 700 psi)
- 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)<sub>abs</sub>  
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

## 15.2 Output

Output signal	<p><b>PROFIBUS PA</b></p> <p>According to EN 50170 Volume 2, IEC 61158-2</p> <p><b>Signal coding:</b> Manchester Bus Powered (MBP) type 1</p> <p><b>Data transmission rate:</b> 31.25 kBit/s, voltage mode</p> <p><b>Galvanic isolation:</b> Yes</p>
Signal on alarm	<p>PROFIBUS PA</p> <ul style="list-style-type: none"> <li>■ Diagnostics in accordance with PROFIBUS PA Profile 3.02</li> <li>■ Status signal (as per NAMUR recommendation NE 107) plain text display</li> </ul>
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 onsite display, Bluetooth, handheld terminal or PC with operating program, continuous from 0 to 999 seconds</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>
Protocol-specific data	<p><b>PROFIBUS PA</b></p> <p><b>Manufacturer ID:</b> 17 (0x11)</p> <p><b>Ident number:</b> 0x1574 or 0x9700</p> <p><b>Profile version:</b> 3.02</p> <p><b>GSD file and version</b> Information and files at:</p> <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.com">www.profibus.com</a></li> </ul> <p><i>Output values</i></p> <p><b>Analog Input:</b></p> <ul style="list-style-type: none"> <li>■ Pressure</li> <li>■ Scaled variable</li> <li>■ Sensor temperature</li> <li>■ Sensor pressure</li> </ul>

- Electronics temperature
- **Median of pressure signal** option (only available if the "Heartbeat Verification + Monitoring" application package was selected).
- **Noise of pressure signal** option (only available if the "Heartbeat Verification + Monitoring" application package was selected).

**Digital Input:**

 Only available if the "Heartbeat Verification + Monitoring" application package was selected

Heartbeat Technology → SSD: Statistical Sensor Diagnostics

Heartbeat Technology → Process Window

*Input values***Analog Output:**

Analog value from PLC to be indicated on the display

*Supported functions*

- Identification & maintenance  
Simple device identification via control system and nameplate
- Automatic Ident Number Adoption  
GSD compatibility mode for generic profile 0x9700 "Transmitter with 1 Analog Input"
- Physical Layer Diagnostics  
Installation check of the PROFIBUS segment and device using terminal voltage and message monitoring
- PROFIBUS upload/download  
Reading and writing parameters is up to ten times faster with PROFIBUS upload/download
- Condensed status  
Straightforward and self-explanatory diagnostic information through categorization of occurring diagnostic messages

## 15.3 Environment

Ambient temperature range	<p>The following values apply up to a process temperature of +85 °C (+185 °F). The permitted ambient temperature is reduced at higher process temperatures.</p> <ul style="list-style-type: none"> <li>■ Without segment display or graphic display: Standard: -40 to +85 °C (-40 to +185 °F)</li> <li>■ 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 for example. Can be used without limitations up to -20 to +60 °C (-4 to +140 °F)</li> <li>■ Devices with PVC-coated capillary armor: -25 to +80 °C (-13 to +176 °F)</li> <li>■ Separate housing: -20 to +60 °C (-4 to +140 °F)</li> </ul> <p>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!</p> <p>If vibrations additionally occur in the application: use a device with a capillary.</p>
<b>Hazardous area</b>	
For devices for use in hazardous areas, see the Safety Instructions, Installation Drawing or Control Drawing	
Storage temperature	<ul style="list-style-type: none"> <li>■ Without device display: Standard: -40 to +90 °C (-40 to +194 °F)</li> <li>■ With device 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> <p>Devices with PVC-coated capillary armor: -25 to +90 °C (-13 to +194 °F)</p>
Operating altitude	Up to 5 000 m (16 404 ft) above sea level.
Climate class	<p>Class 4K26 (air temperature: -20 to +50 °C (-4 to +122 °F), relative air humidity: 4 to 100 %) in accordance with IEC/EN 60721-3-4.</p> <p>Condensation is possible.</p>
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<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
- Gland M20, hygienic, IP66/68/69 NEMA 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
- M12 plug
  - 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**

**M12 plug: incorrect installation 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*

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

Vibration resistance

**Aluminum single-compartment housing**

Measuring range	Sinusoidal vibration IEC62828-1	Shock
0.1 to 40 bar (1.5 to 600 psi)	10 Hz to 60 Hz: ±0.35 mm (0.0138 in) 60 Hz to 1000 Hz: 5 g	30 g

**Stainless steel single-compartment housing, hygienic**

Description	Sinusoidal vibration IEC62828-1	Shock
Device with temperature isolator	10 Hz to 60 Hz: ±0.35 mm (0.0138 in) 60 Hz to 1000 Hz: 5 g	30 g

**Aluminum dual-compartment housing**

Measuring range	Sinusoidal vibration IEC62828-1	Shock
0.1 to 40 bar (1.5 to 600 psi)	10 Hz to 60 Hz: ±0.35 mm (0.0138 in) 60 Hz to 1000 Hz: 5 g	30 g

Description	Sinusoidal vibration IEC62828-1	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

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**Electromagnetic compatibility (EMC)**

- Electromagnetic compatibility as per IEC 61326 series and NAMUR recommendation EMC (NE21)
- With regard to the safety function (SIL), the requirements of IEC 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.

## 15.4 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	$P_{abs} = 0.05 \text{ bar (0.725 psi)}^1$	$P_{abs} \geq 1 \text{ bar (14.5 psi)}^2$
Silicone oil	-40 to +180 °C (-40 to +356 °F)	-40 to +250 °C (-40 to +482 °F)
Vegetable oil	-10 to +160 °C (+14 to +320 °F)	-10 to +220 °C (+14 to +428 °F)

- 1) Permitted temperature range at  $p_{abs} = 0.05 \text{ bar (0.725 psi)}$  (observe temperature limits of the device and the system!)
- 2) Permitted temperature range at  $p_{abs} \geq 1 \text{ bar (14.5 psi)}$  (observe temperature limits of the device and the system!)

Fill fluid	Density <sup>1)</sup> kg/m <sup>3</sup>
Silicone oil	970
Vegetable oil	920

- 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, vacuum and temperature ranges, are done separately in the Applicator "[Sizing Diaphragm Seal](#)".



A0038925

### 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)	-
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)

Seal on the LP side (-)	Temperature	Pressure specifications
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)

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

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: -40 to +250 °C (-40 to +482 °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: 250 °C (482 °F)
- Transmitter vertical, temperature isolator long: 250 °C (482 °F)
- Transmitter horizontal, temperature isolator short: 200 °C (392 °F)
- Transmitter vertical, temperature isolator short: 200 °C (392 °F)

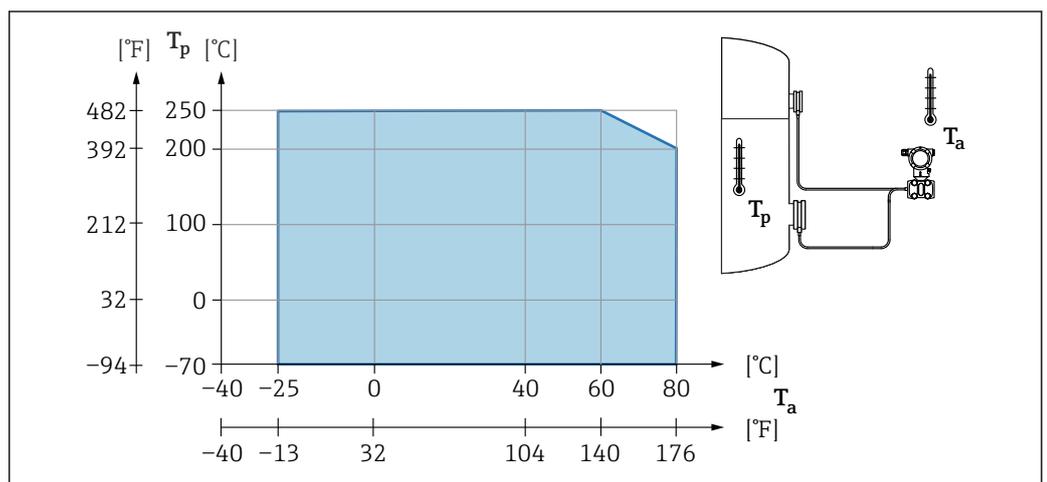
**Diaphragm seal on one side or both sides with capillary**

- Depending on diaphragm seal and fill fluid: -40 °C (-40 °F) up to +250 °C (+482 °F)
- Observe the maximum gauge pressure and maximum temperature

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**

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

Components are: process connection, optional mounting parts, or accessories.

**⚠ WARNING****Incorrect design or use of the device may cause injury due to bursting parts!**

- ▶ Only operate the device within the specified limits for the components!
- ▶ MWP (maximum working pressure): The maximum working pressure is specified on the nameplate. This value refers to a reference temperature of +20 °C (+68 °F) and may be applied to the device for an unlimited time. 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). Maximum working pressure data that deviate from this are provided in the relevant sections of the Technical Information.
- ▶ The overpressure limit is the maximum pressure that a device may be subjected to during a test. The overpressure limit exceeds 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.
- ▶ The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PT". The abbreviation "PT" corresponds to the OPL (Over Pressure Limit) of the device. OPL (Over Pressure Limit) is a test pressure.
- ▶ In the case of measuring cell range and process connection combinations where the overpressure limit (OPL) of the process connection is less 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).

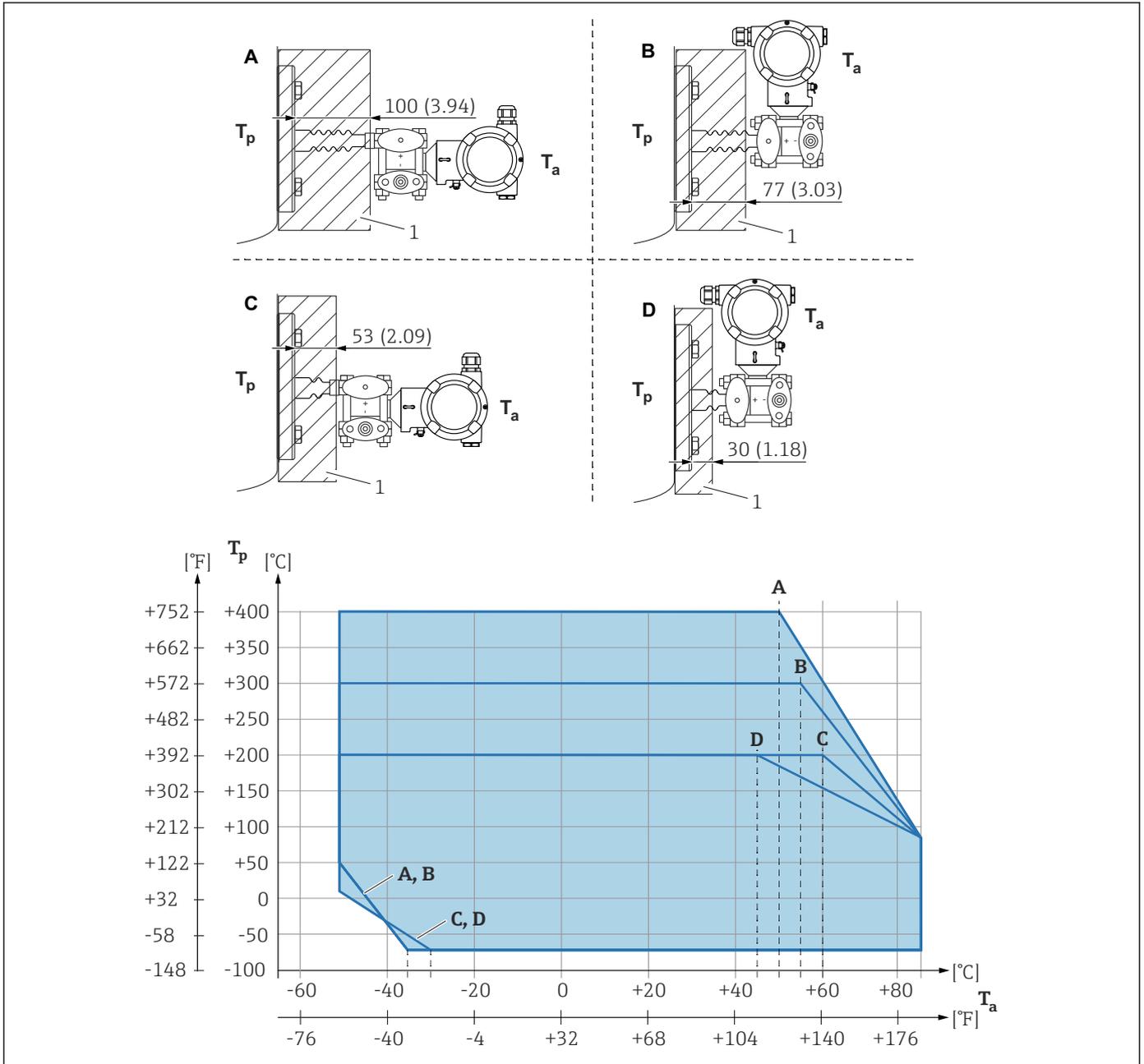
**Burst pressure**

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.

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**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  $\leq 0.04 \text{ W}/(\text{m} \times \text{K})$  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

Item	$T_a$ <sup>1)</sup>	$T_p$ <sup>2) 3)</sup>
A	50 °C (122 °F)	400 °C (752 °F)
	85 °C (185 °F)	85 °C (185 °F)
	-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)
	85 °C (185 °F)	85 °C (185 °F)
	-50 °C (-58 °F)	50 °C (122 °F)

Item	T <sub>a</sub> <sup>1)</sup>	T <sub>p</sub> <sup>2) 3)</sup>
	-35 °C (-31 °F)	-70 °C (-94 °F)
<b>C</b>	60 °C (140 °F)	200 °C (392 °F)
	85 °C (185 °F)	85 °C (185 °F)
	-50 °C (-58 °F)	10 °C (50 °F)
	-30 °C (-22 °F)	-70 °C (-94 °F)
<b>D</b>	67 °C (153 °F)	200 °C (392 °F)
	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 depending on the fill fluid used.

Without insulation, the ambient temperature decreases by 5 K.

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