BA02011P/00/EN/09.25-00
71713182
2025-08-01

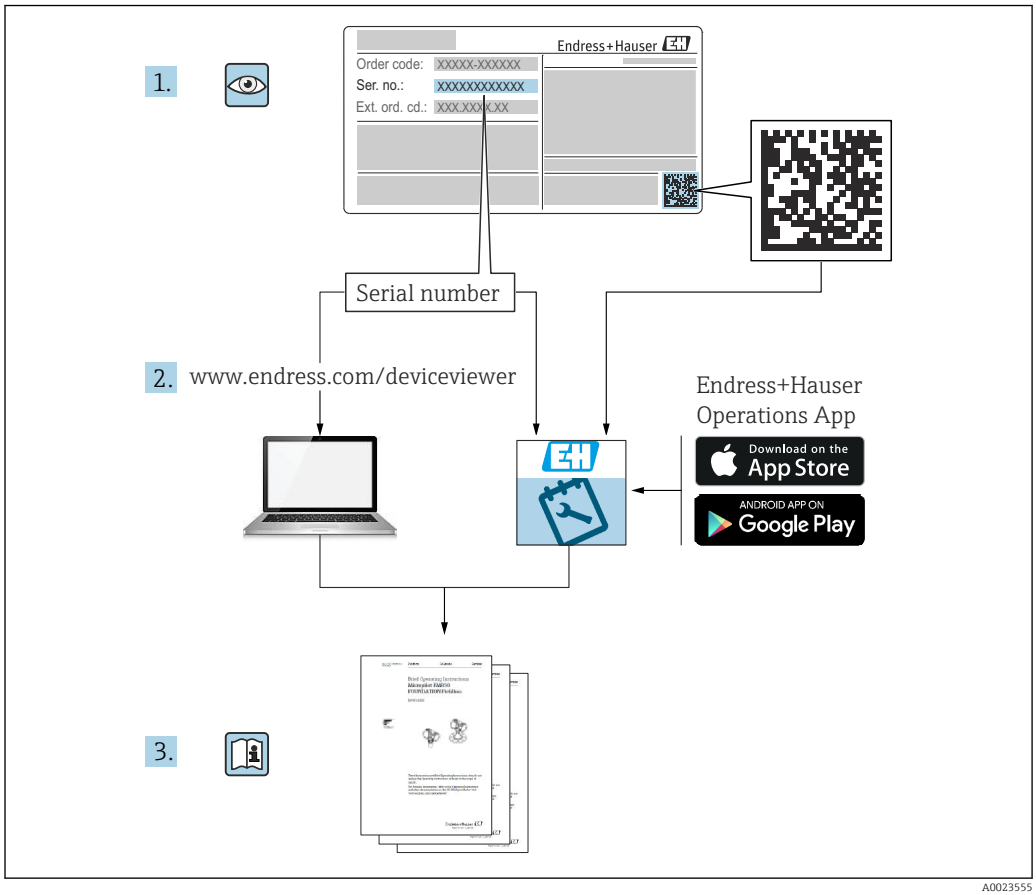
Valid as of version
01.00.zz (Device firmware)



# Operating Instructions
# **Cerabar PMP51B**

Process pressure measurement
4-20mA HART

Endress+Hauser
People for Process Automation




- 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.

# Table of contents

# 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.

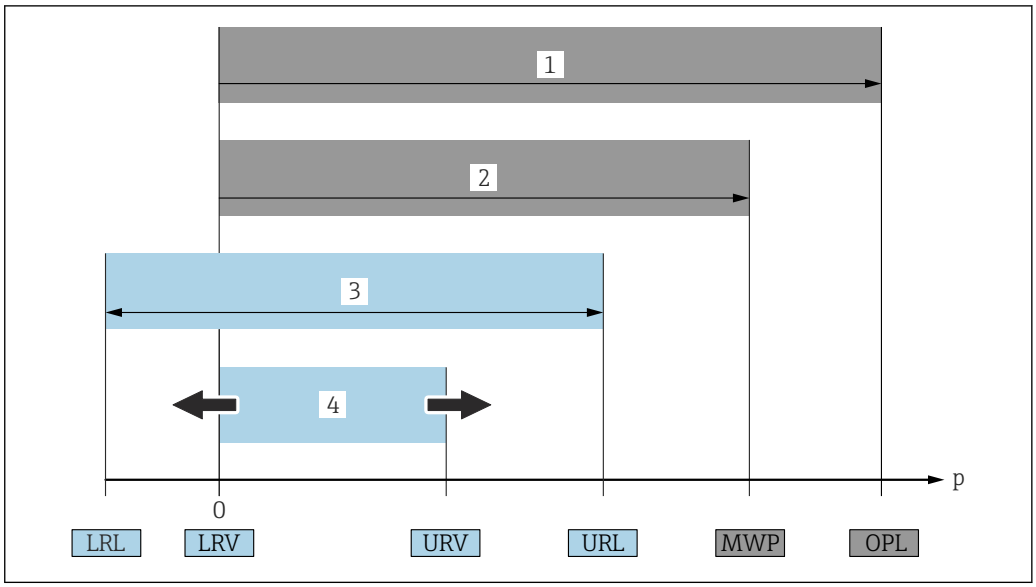
**Views: A, B, C, ...**

### 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*

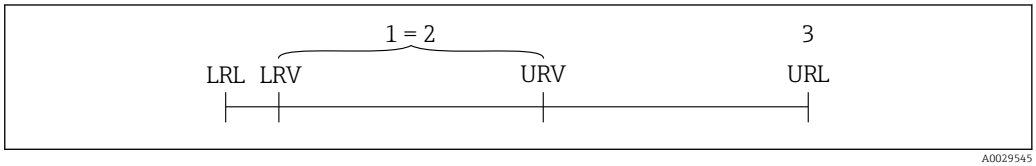
*URL Upper range limit*

*LRV Lower range value*

*URV Upper range value*

*TD Turn down Example - see the following section.*

## 1.4 Turn down calculation




*1 Calibrated/adjusted span*

*2 Zero point-based span*

*3 Upper range limit*

Example:

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

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

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

## 1.5 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

### 1.5.1 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.

## 1.6 Registered trademarks

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

**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 Cerabar is a pressure transmitter for measuring level and 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 Functional Safety SIL (optional)

The Functional Safety Manual must be strictly observed for devices that are used in functional safety applications.

## 2.7 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.

## 2.8 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:

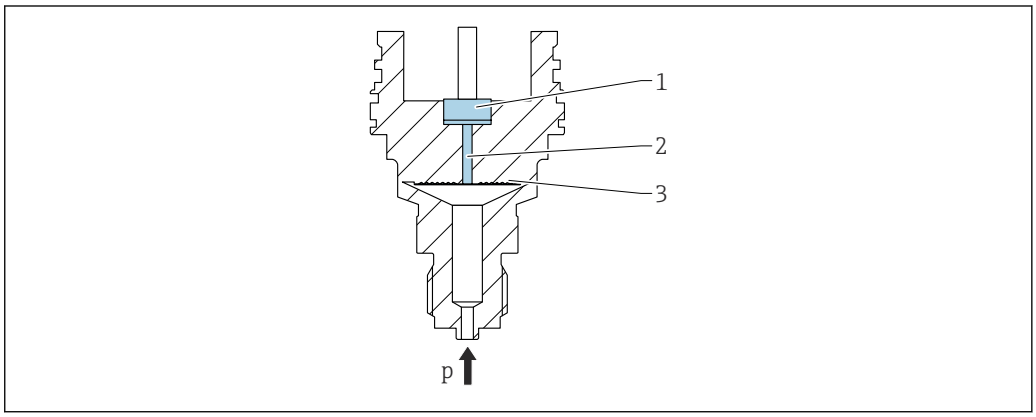
- Write protection via hardware write protection switch
- Access code to change user role (applies to operation via Bluetooth, FieldCare, DeviceCare, Asset Management Tools (e.g. AMS, PDM)

# 3 Product description

## 3.1 Product design

### 3.1.1 Equipment architecture

**Standard device**

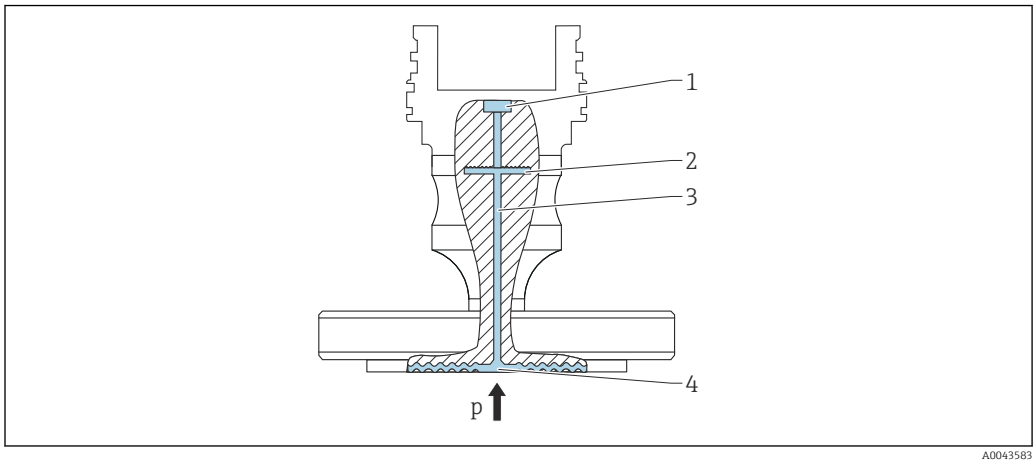



*1 Measuring element*
*2 Channel with fill fluid*
*3 Metallic membrane*
*p Pressure*

The pressure deflects the metallic membrane of the measuring cell. A fill fluid transfers the pressure to a Wheatstone bridge (semiconductor technology). The pressure-dependent change in the bridge output voltage is measured and evaluated.

**Advantages:**
- Can be used for high pressures
- High long-term stability
- High overload resistance
- Secondary containment for enhanced integrity
- Very low thermal effect e.g. compared to diaphragm seal systems with capillaries

**Device with diaphragm seal (diaphragm seal system)**




*1 Measuring element*
*2 Internal membrane*
*3 Channel with fill fluid*
*4 Metallic membrane*
*p Pressure*

The pressure acts on the membrane of the diaphragm seal and is transferred to the internal membrane by a fill fluid. The internal membrane is deflected. A fill fluid transfers the pressure to the measuring element on which a resistance bridge is located. The pressure-dependent change in the bridge output voltage is measured and evaluated.

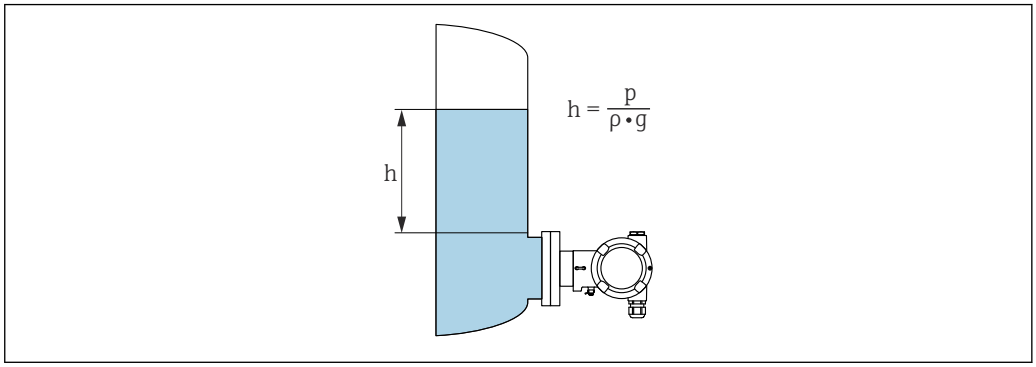
**Advantages:**
- Depending on the version, can be used for pressures up to 400 bar (6 000 psi) and extreme process temperatures
- High long-term stability
- High overload resistance
- Standard device: secondary containment for enhanced integrity

*Applications for diaphragm seals*

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

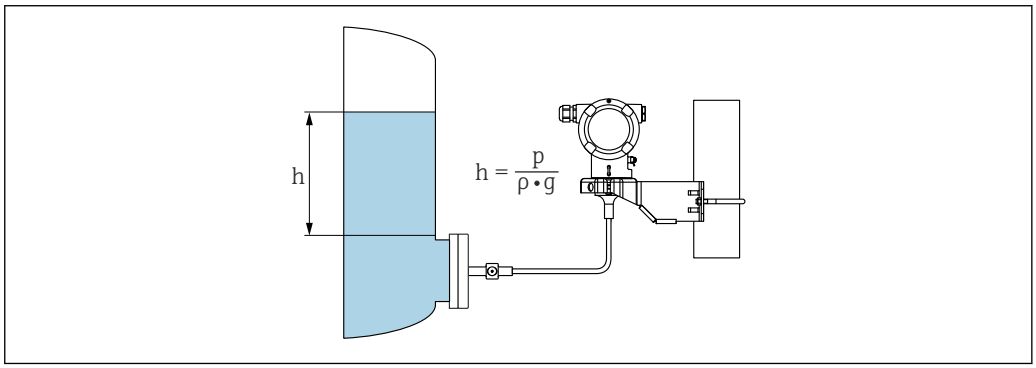
### 3.1.2 Level measurement (level, volume and mass)

**Standard device or device with diaphragm seal**




*h* *Height (level)*
*p* *Pressure*
*ρ* *Density of the medium*
*g* *Acceleration due to gravity*

**Device with diaphragm seal and capillary**




*1 Sample illustration: diaphragm seal with capillary*

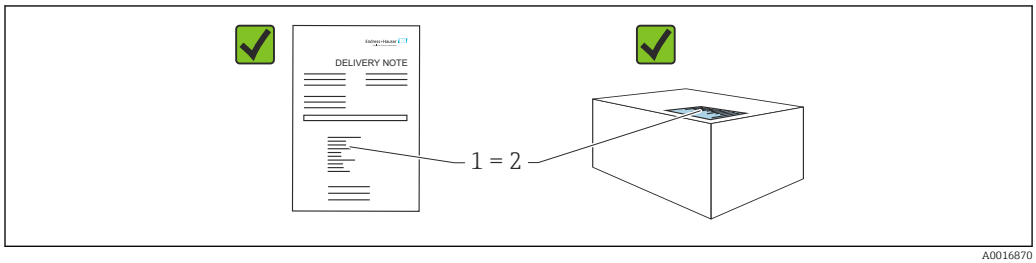
*h* *Height (level)*
*p* *Pressure*
*ρ* *Density of the medium*
*g* *Acceleration due to gravity*

**Advantages:**

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

# 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 → 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): 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

## 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

- Standard devices are installed according to the same guidelines as pressure gauges (DIN EN837-2).
- 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.
- Use flushing rings for flanges, flange seals and pancake seals if buildup or clogging can be expected at the membrane
  - The flushing ring is clamped between the process connection and the flange, flange seal or pancake seal.
  - Material buildup in front of the membrane is flushed away and the pressure chamber is vented via the two lateral flushing holes.
- For measurements in media containing solids (e.g. dirty liquids), it makes sense to install separators and drain valves.
- Using a valve 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 thread

- Device with G 1 ½" thread:
  Place the flat seal on the sealing surface of the process connection
  Avoid additional strain on the membrane: do not seal the thread with hemp or similar materials
- Device with NPT thread:
  - Wrap Teflon tape around the thread to seal it
  - Tighten the device at the hexagon bolt only; do not turn it by the housing
  - When screwing in, do not overtighten the thread; tighten the NPT thread to the required depth according to the standard
- For the following process connections, a tightening torque of max. 40 Nm (29.50 lbf ft) is specified:
  - Thread ISO228 G ½" with flush membrane
  - Thread DIN13 M20 x 1.5 with flush membrane
  - NPT 3/4" with flush membrane

### 5.1.4 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 ≥ 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 ≥ 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.

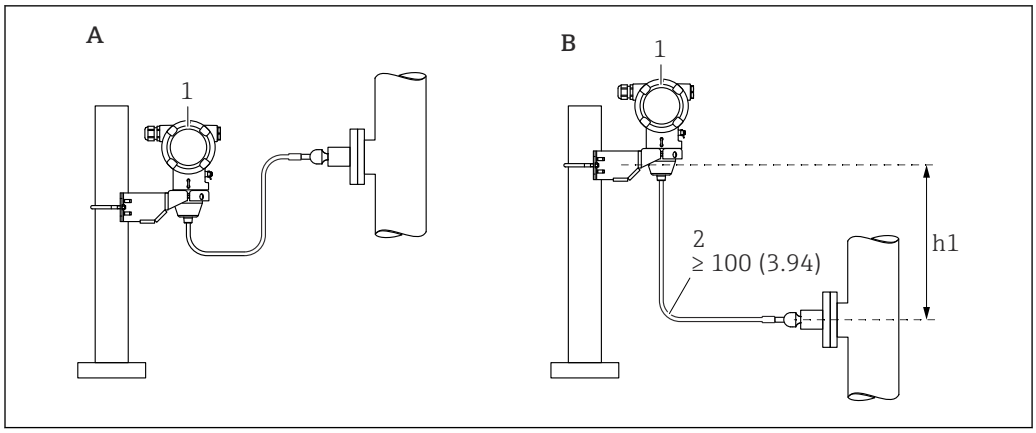
Additional installation instructions are provided in the Applicator "Sizing Diaphragm Seal".

#### Vacuum applications

For vacuum applications, pressure transmitters with a ceramic measuring membrane (oil-free) are preferable.

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 h1. The height difference h1 is shown in the Applicator "Sizing Diaphragm Seal".




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

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

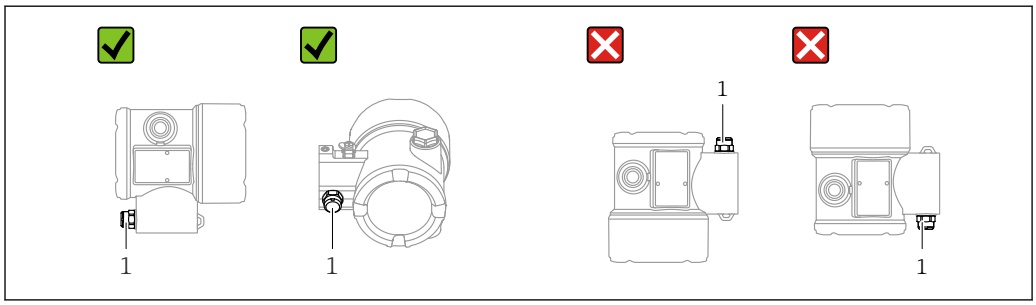
### 5.1.5 Orientation

NOTICE

**Damage to the device!**

If a heated measuring device is cooled during a cleaning process (e.g. by cold water), a vacuum develops for a short time. As a result of this, moisture can enter the measuring cell via the pressure compensation element (1).

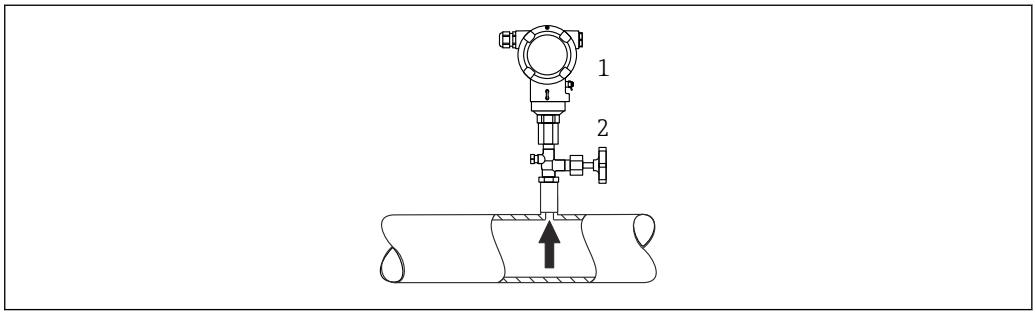
▶ Mount the device as follows.




- Keep the pressure compensation element (1) free from contamination
- A position-dependent zero point shift (when the vessel is empty the measured value does not display zero) can be corrected
- Diaphragm seals also shift the zero point, depending on the installation position
- The use of shutoff devices and/or siphons is recommended for installation.
- The orientation depends on the measuring application

## 5.2 Installing the device

### 5.2.1 Pressure measurement in gases

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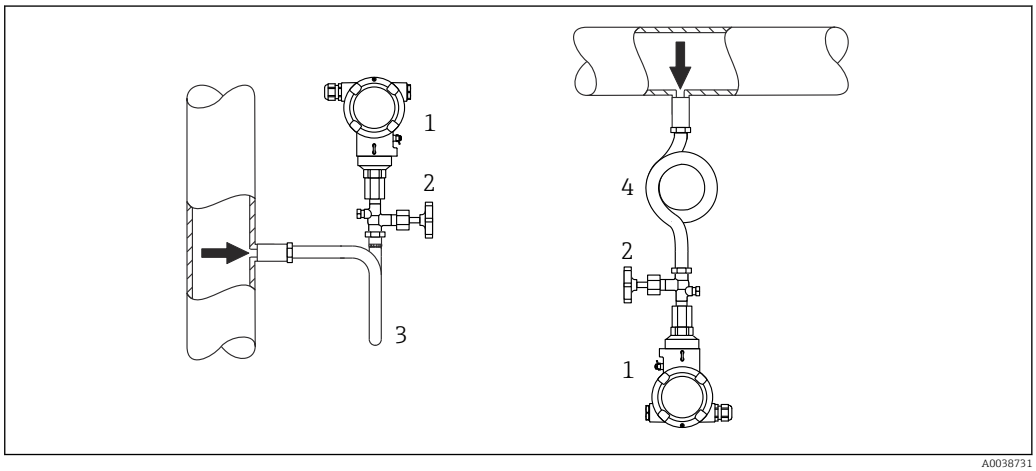
*1 Device*
*2 Shutoff device*

Mount the device with the shutoff device above the tapping point so that any condensate can flow into the process.

### 5.2.2 Pressure measurement in steam

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*1 Device*
*2 Shutoff device*
*3 U-shaped siphon*
*4 Circular siphon*

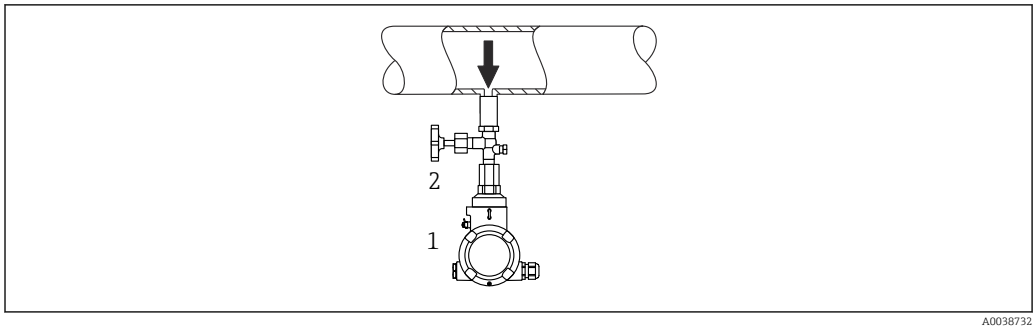
Observe the maximum permitted ambient temperature of the transmitter!

Installation:
- Preferably install the device with a circular siphon below the tapping point. The device may also be installed above the tapping point.
- Fill the siphon with fluid before commissioning.

Advantages of using siphons:
- Protects the measuring instrument from hot, pressurized media by forming and accumulating condensate
- Dampens pressure shocks
- The defined water column only causes minimal (negligible) measurement errors and minimal (negligible) thermal effects on the device.

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

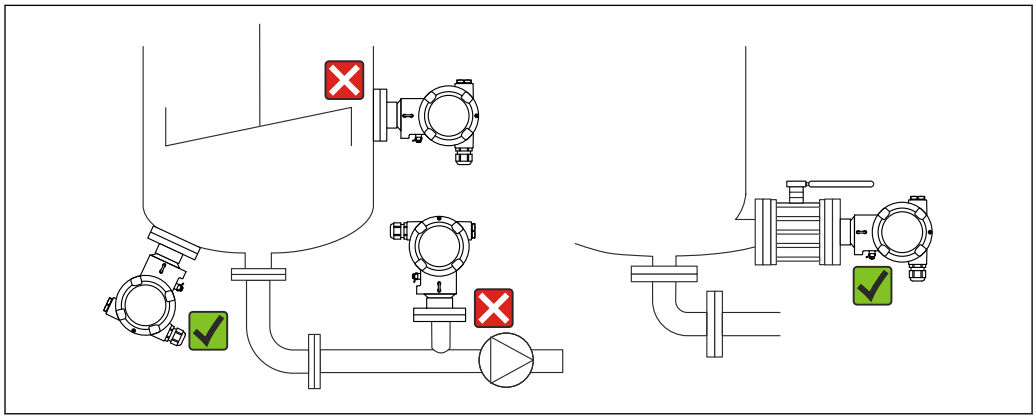
### 5.2.3 Pressure measurement in liquids




*1 Device*
*2 Shutoff device*

Mount the device with the shutoff device below or at the same level as the tapping point.

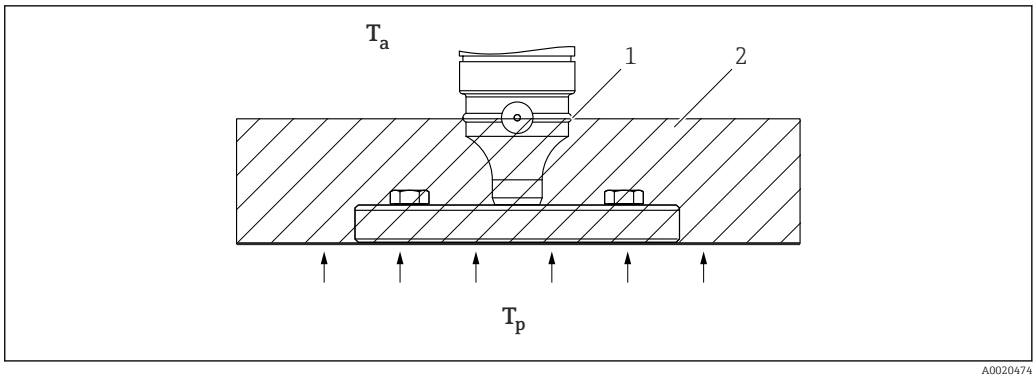
### 5.2.4 Level measurement




- Always install the device below the lowest measuring point.
- Do not install the device at the following positions:
  - In the filling curtain
  - In the tank outlet
  - In the suction area of a pump
  - At a point in the tank that could be affected by pressure pulses from the agitator
- Install the device downstream from a shutoff device: the functional test and adjustment can then be carried out more easily.

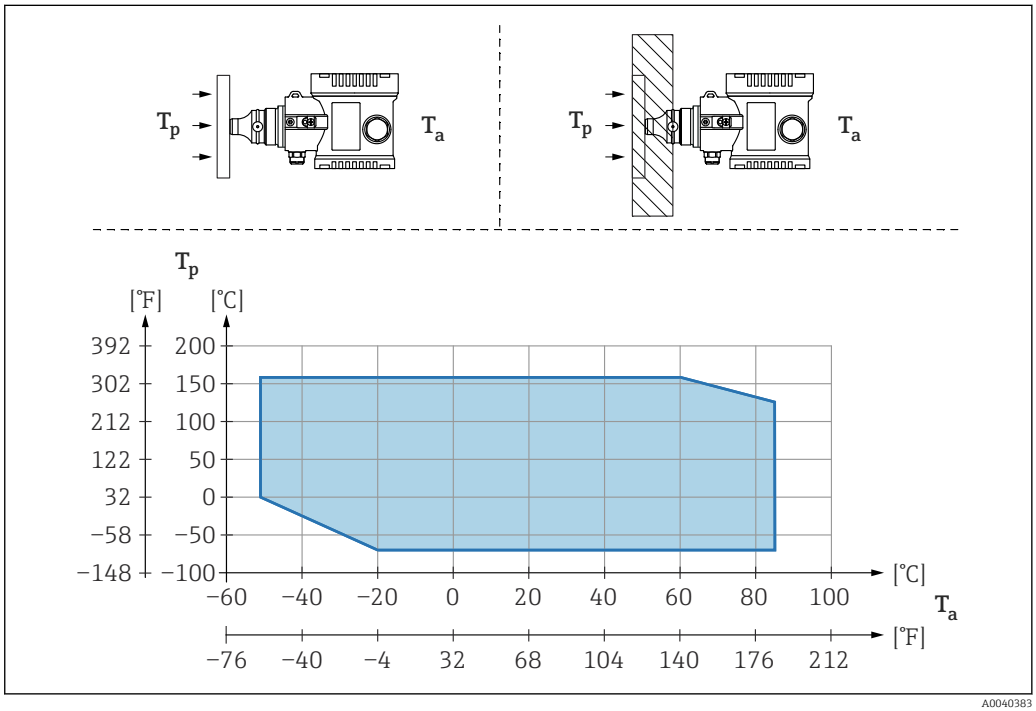
### 5.2.5 Thermal insulation with diaphragm seal directly mounted

The device may only be insulated up to a certain height. The maximum permitted insulation height is indicated on the device and applies to an insulation material with a heat conductivity ≤ 0.04 W/(m x K) and to the maximum permitted ambient and process temperature. The data were determined under the most critical application "quiescent air". Maximum permitted insulation height, indicated here on a device with a flange:




*$T_a$ Ambient temperature at transmitter*
*$T_p$ Maximum process temperature*
*1 Maximum permitted insulation height*
*2 Insulation material*

### 5.2.6 Mounting with "Compact" diaphragm seal type




*$T_a$ Ambient temperature at transmitter*
*$T_p$ Maximum process temperature*

| $T_a$ | $T_p$ |
|---|---|
| +85 °C (+185 °F) | −70 to +120 °C (−94 to +248 °F) |
| +60 °C (+140 °F) | −70 to +160 °C (−94 to +320 °F) |
| −20 °C (−4 °F) | −70 to +160 °C (−94 to +320 °F) |
| −50 °C (−58 °F) | 0 to +160 °C (+32 to +320 °F) |

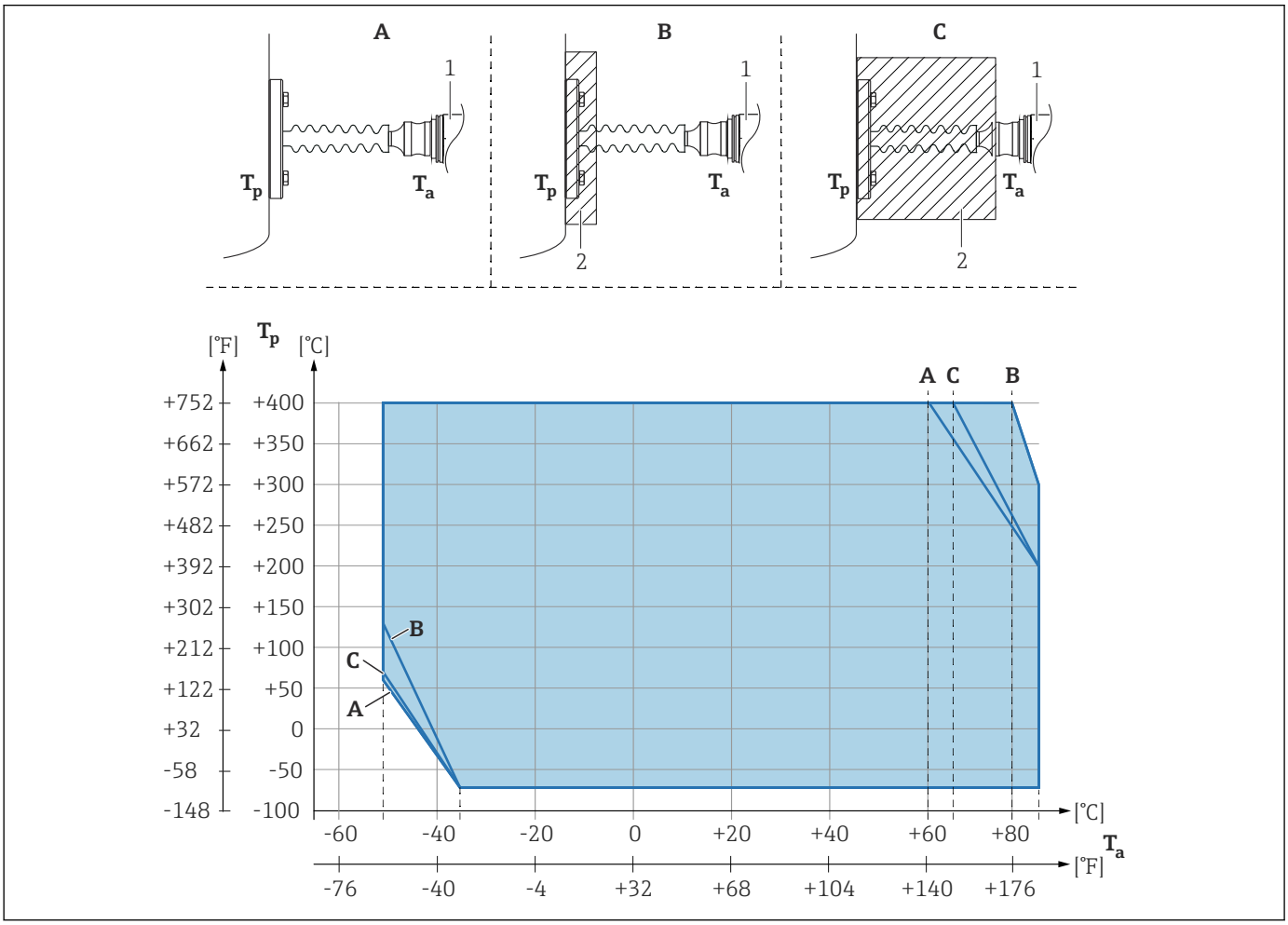
### 5.2.7 Thermal insulation when mounting with a "Temperature isolator" diaphragm seal type

Use of temperature isolators in the event of constant extreme medium temperatures which cause the maximum permissible electronics temperature of +85 °C (+185 °F) to be exceeded. Diaphragm seal systems with temperature isolators can be used up to a

maximum temperature of +400 °C (+752 °F) depending on the fill fluid used. For details, see the Technical Information. To minimize the influence of rising heat, mount the device horizontally or with the housing pointing downwards. The additional installation height brings about a zero point shift due to the hydrostatic column in the temperature isolator. This zero point shift can be corrected on the device.

The maximum ambient temperature $T_a$ at the transmitter depends on the maximum process temperature $T_p$.

The maximum process temperature depends on the fill fluid used.




*A No insulation*
*B Insulation 30 mm (1.18 in)*
*C Maximum insulation*
*1 Transmitter*
*2 Insulation material*

| Position | $T_a$ [1] | $T_p$ [2] |
|---|---|---|
| **A** | 60 °C (140 °F) | 400 °C (752 °F) [3] |
| | 85 °C (185 °F) | 200 °C (392 °F) |
| | −50 °C (−58 °F) | 60 °C (140 °F) |
| | −35 °C (−31 °F) | −70 °C (−94 °F) |
| **B** | 80 °C (176 °F) | 400 °C (752 °F) [3] |
| | 85 °C (185 °F) | 300 °C (572 °F) |
| | −50 °C (−58 °F) | 130 °C (266 °F) |
| | −35 °C (−31 °F) | −70 °C (−94 °F) |

| Position | $T_a$ [1] | $T_p$ [2] |
|---|---|---|
| C | 67 °C (153 °F) | 400 °C (752 °F) [3] |
| | 85 °C (185 °F) | 200 °C (392 °F) |
| | −50 °C (−58 °F) | 70 °C (158 °F) |
| | −35 °C (−31 °F) | −70 °C (−94 °F) |

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

### 5.2.8 Oxygen applications (gaseous)

Oxygen and other gases can react explosively to oils, grease and plastics. The following precautions must be taken:

- All components of the system, such as devices, must be cleaned in accordance with national requirements.
- Depending on the materials used, a certain maximum temperature and a maximum pressure must not be exceeded for oxygen applications.

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

| $T_{max}$ | $P_{max}$ [1] |
|---|---|
| 80 °C (176 °F) | 80 bar (1 200 psi) |
| > 80 to 120 °C (176 to 248 °F) | 70 bar (1 050 psi) |

1) Depends on the lowest-rated element, with regard to pressure, of the selected components: overpressure limit (OPL) of the measuring cell, process connection (1.5 x PN) or fill fluid

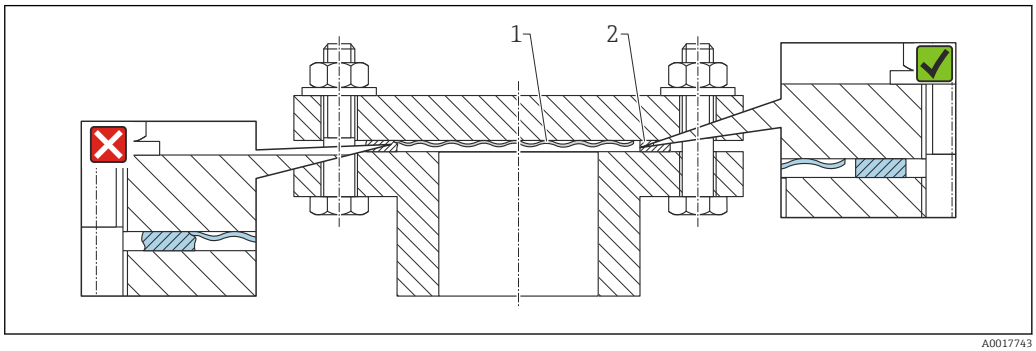
### 5.2.9 Seal for flange mounting

NOTICE

**Seal pressing against the membrane!**

Incorrect measurement results!

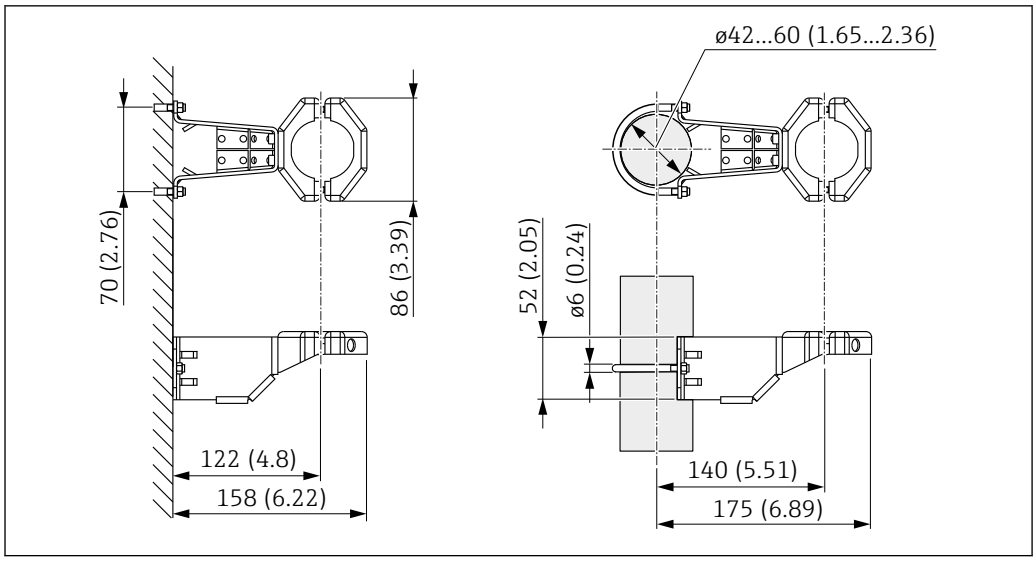
► Ensure that the seal is not touching the membrane.




*1 Membrane*
*2 Seal*

### 5.2.10 Mounting bracket for device or separate housing

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



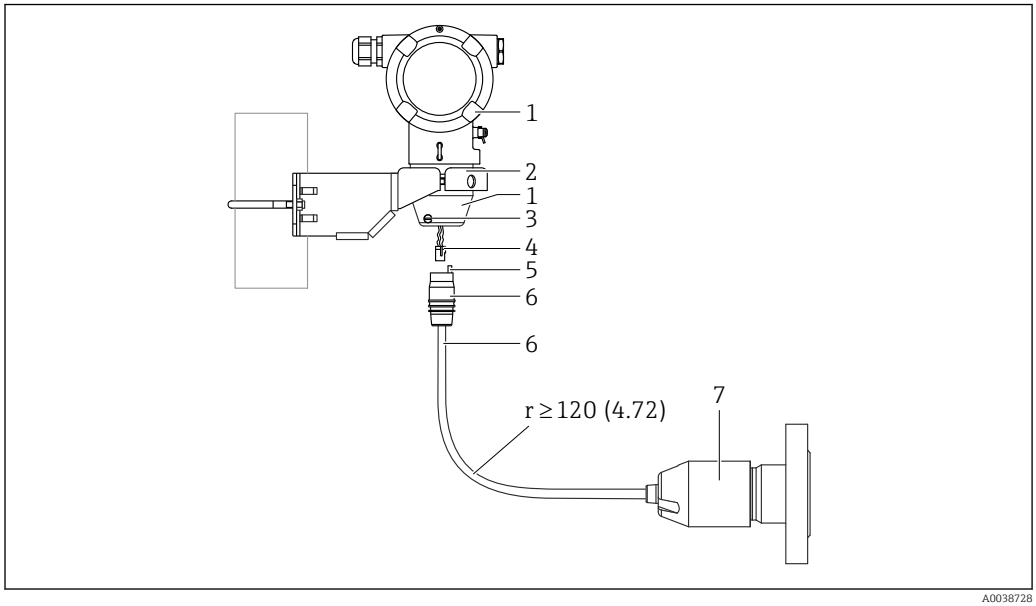

*Unit of measurement mm (in)*

Ordering information:
- Can be ordered via the Product Configurator
- Can be ordered as a separate accessory, part number 71102216

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

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

## 5.2.11 Assembling and installing the separate housing




*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) ≥ 120 mm (4.72 in).

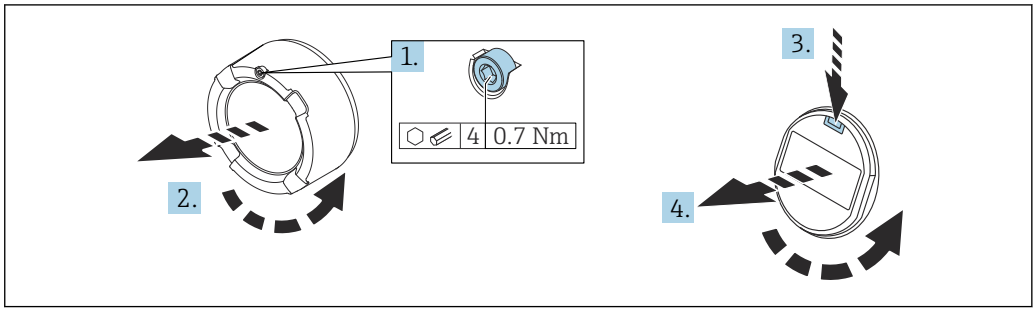
## 5.2.12 Turning the display module

**⚠ WARNING**

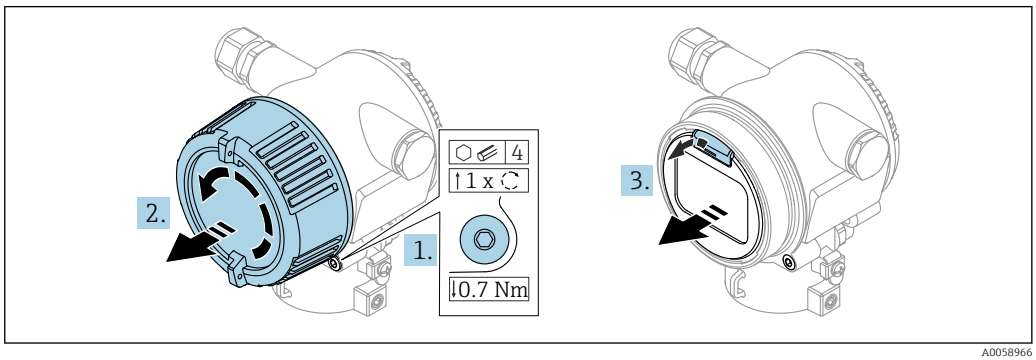
**Supply voltage switched on!**
Risk of electric shock and/or explosion!
▶ Switch off the supply voltage before opening the device.

**⚠ 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.




2 *Single-compartment housing and dual-compartment housing*




3 *Dual-compartment housing, precision casting*

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 × 90 ° 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) ±0.2 Nm (0.15 lbf ft).

### 5.2.13 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.

**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:

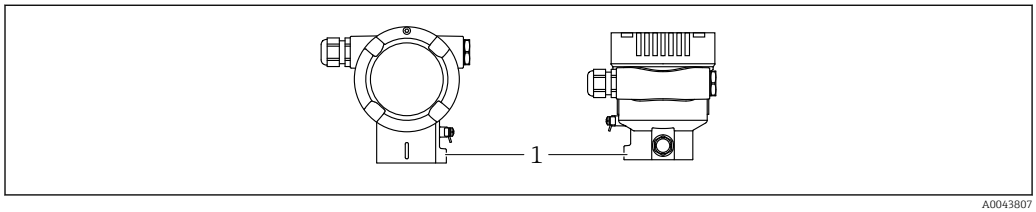
☒ **Do not lubricate the housing threads.**

### 5.2.14 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)




A0043807

*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

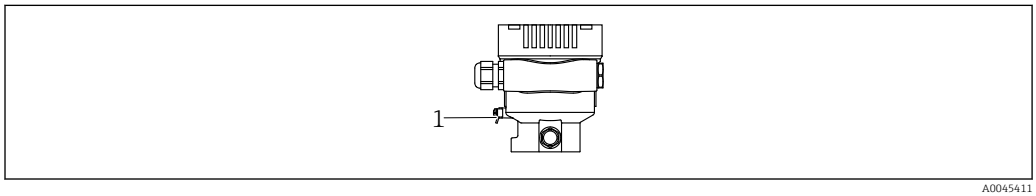
The protective ground on the device must not be connected. If necessary, the potential matching line can be connected to the outer ground terminal of the device before the device is connected.

**⚠ 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 mm² (14 AWG).

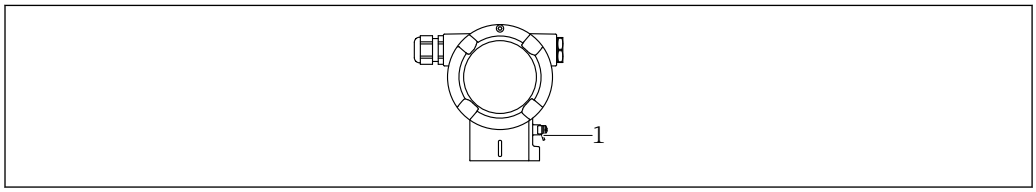
**Single-compartment housing**




A0045411

*1 Ground terminal for connecting the potential matching line*

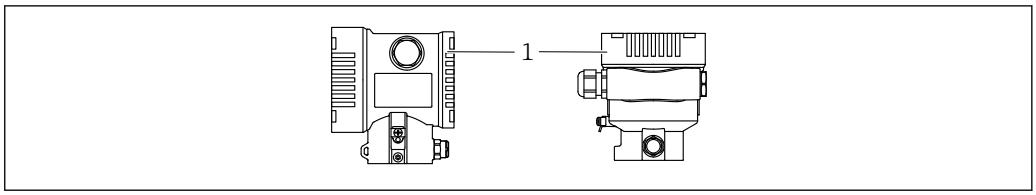
**Dual-compartment housing**




A0045412

*1 Ground terminal for connecting the potential matching line*

## 6.2 Connecting the device




*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

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

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

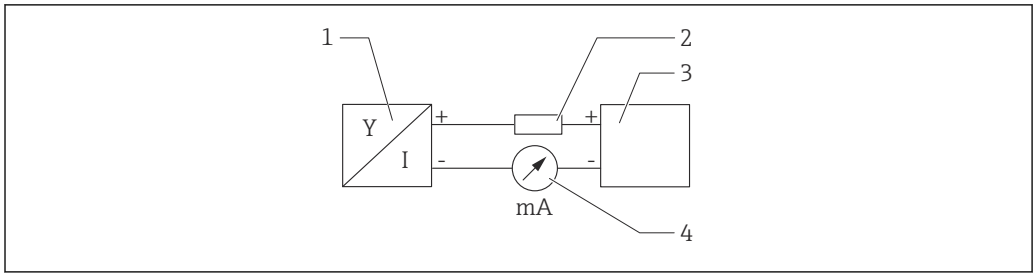
### 6.2.2 Terminals

- Supply voltage and inner ground terminal
  Clamping range: 0.5 to 2.5 $mm^2$ (20 to 14 AWG)
- External ground terminal
  Clamping range: 0.5 to 4 $mm^2$ (20 to 12 AWG)

### 6.2.3 Cable specification

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

### 6.2.4 4-20 mA HART




4 *Block diagram of HART connection*

*1 Device with HART communication*
*2 HART communication resistor*
*3 Power supply*
*4 multimeter*

The HART communication resistor of 250 Ω in the signal line is always necessary in the case of a low-impedance power supply.

**Take the voltage drop into consideration:**
Maximum 6 V for a communication resistor of 250 Ω

### 6.2.5 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

**Overvoltage category**

Overvoltage category II

### 6.2.6 Wiring

**⚠ WARNING**

**Supply voltage might be connected!**
Risk of electric shock and/or explosion!

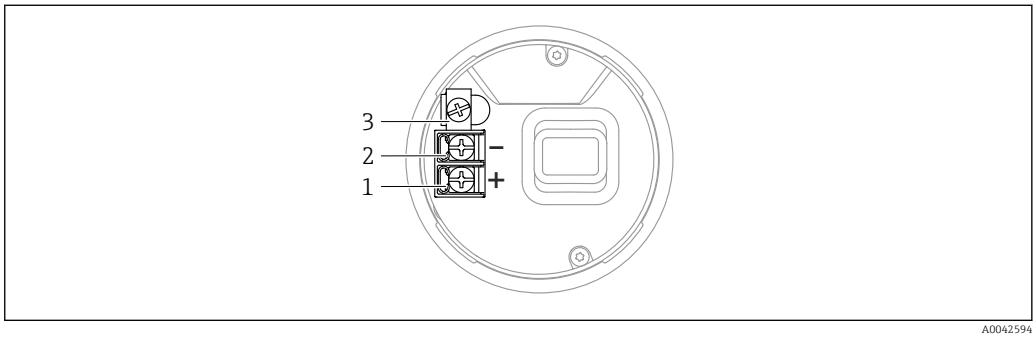
- When operating the device in hazardous areas, ensure compliance with national standards and the specifications outlined in the Safety Instructions (XAs). Use the specified cable gland.
- The supply voltage must match the specifications on the nameplate.
- Switch off the supply voltage before connecting 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.
- A suitable circuit breaker should be provided for the device in accordance with IEC/EN 61010.
- 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 reverse polarity, 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) ±0.2 Nm (0.15 lbf ft).

### 6.2.7 Terminal assignment

#### Single compartment housing

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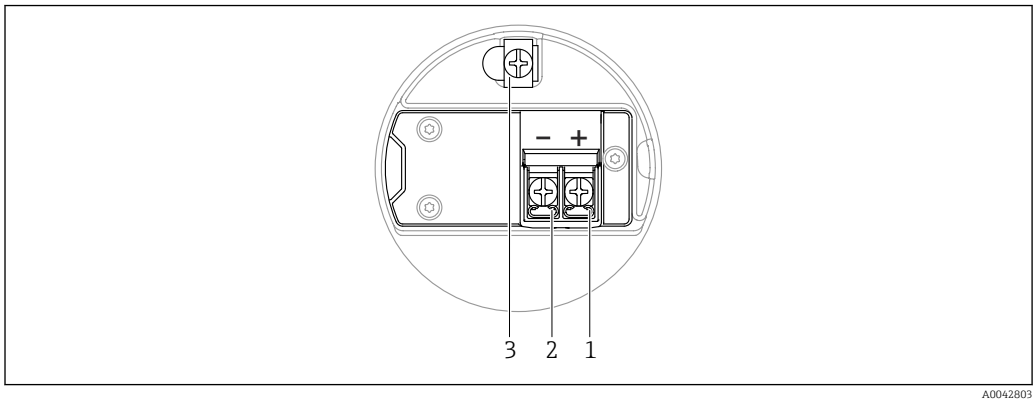
5 *Connection terminals and ground terminal in the connection compartment*

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*

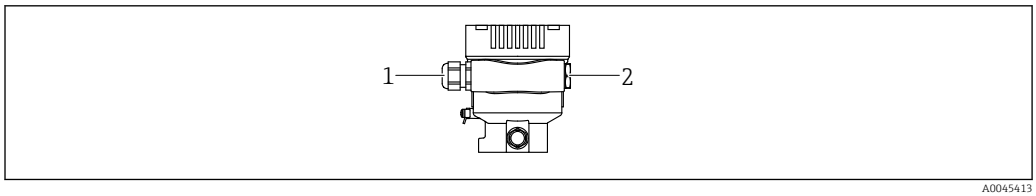
## 6.2.8 Cable entries

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

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

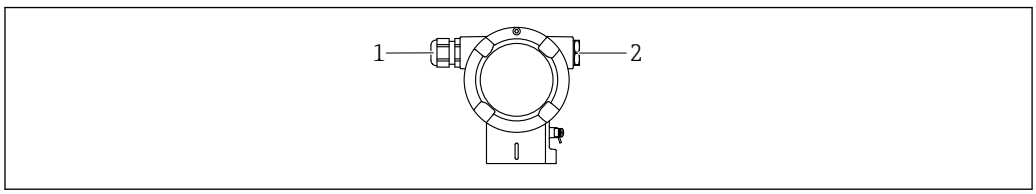
If necessary, create a drip loop or use a weather protection cover.

### Single-compartment housing




*1 Cable entry*
*2 Blind plug*

### Dual-compartment housing



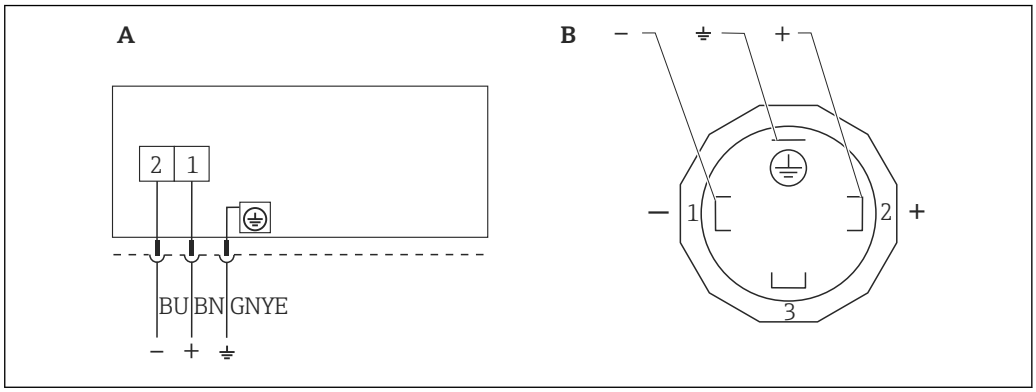

*1 Cable entry*
*2 Blind plug*

## 6.2.9 Available device plugs

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

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

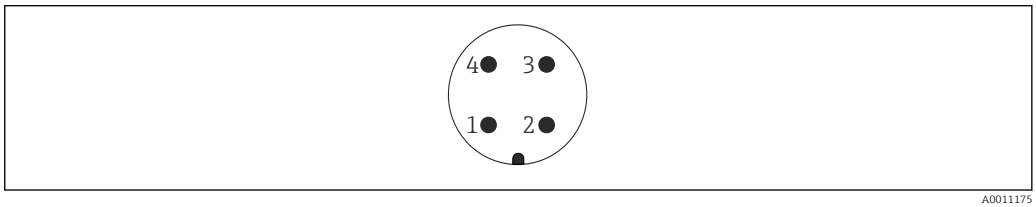
### Devices with valve plug




7 *BN = brown, BU = blue, GNYE = green/yellow*

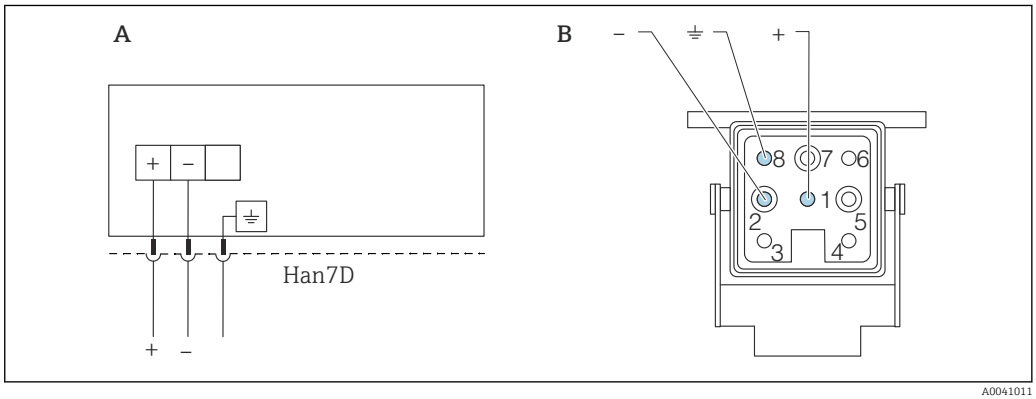
*A Electrical connection for devices with valve connector*
*B View of the plug-in connection on the device*

### Devices with M12 plug




*1 Signal +*
*2 Not used*
*3 Signal –*
*4 Earth*

### Devices with a Harting plug Han7D




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

## 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
- *Cable 5 m, IP66/68 TYPE 4X/6P pressure compensation via cable
- *Valve plug ISO4400 M16, IP65 TYPE 4X
- HAN7D plug, 90 degrees, IP65 NEMA Type 4X
- 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 and HAN7D 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?

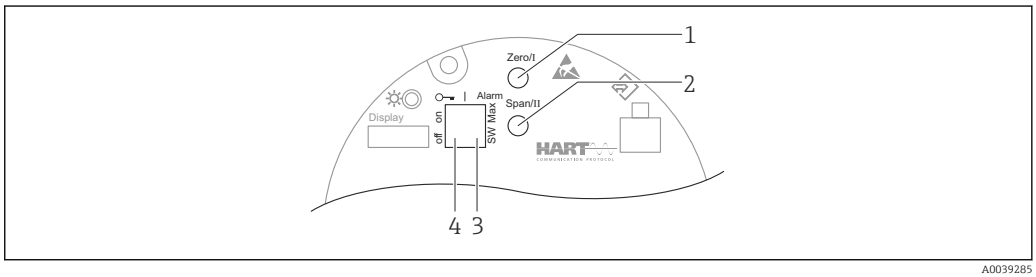
❑ Are the covers screwed down correctly?

# 7 Operation options

## 7.1 Overview of operation options

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

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




A0039285

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

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

## 7.3 Structure and function of the operating menu

More elaborate applications can be configured with the Endress+Hauser FieldCare or DeviceCare tools and Bluetooth and the SmartBlue App.

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** optionuser role.

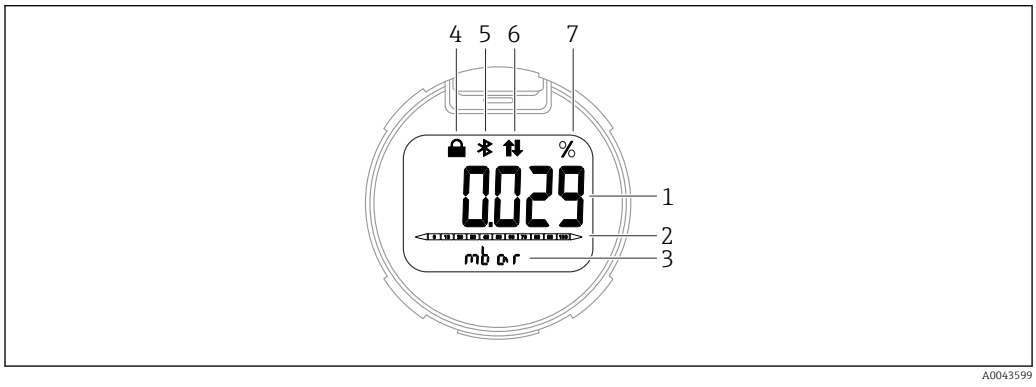
## 7.4 Access to the operating menu via local display

### 7.4.1 Device display (optional)

Functions:
- Display measured values and fault and notice messages
- The device display can be removed for easier operation

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

Depending on the supply voltage and the current consumption, Bluetooth (optional) is switched on or off.




8 *Segment display*

1 *Measured value (up to 5 digits)*
2 *Bar graph (refers to the specified pressure range) proportional to the current output*
3 *Unit of measured value*
4 *Locking (symbol appears when device is locked)*
5 *Bluetooth (symbol flashes if Bluetooth connection is active)*
6 *HART communication (symbol appears when HART communication is enabled)*
7 *Measured value output in %*

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

Prerequisite
- Device with device display including Bluetooth
- Smartphone or tablet with Endress+Hauser SmartBlue app or PC with DeviceCare from version 1.07.05 or FieldXpert SMT70

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

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

A flashing Bluetooth symbol indicates that a Bluetooth connection is available.

**Please note the following**
If the Bluetooth display is removed from one device and installed in another device:
- All the log-in data are only saved in the Bluetooth display and not in the device
- The password changed by the user is also saved in the Bluetooth display

#### Operation via the 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


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

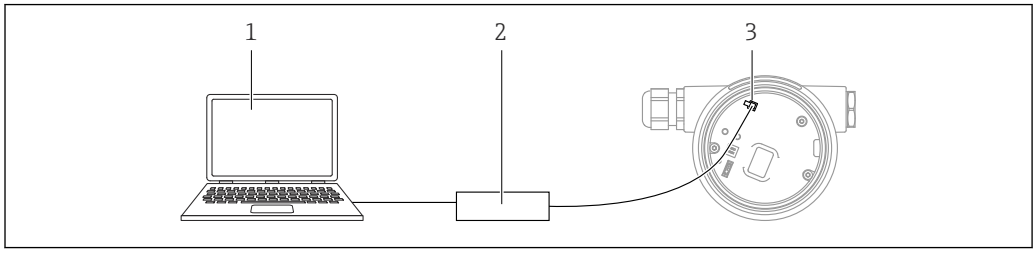
**Notes on the password and reset code**
- If the user-defined password is lost, access can be restored via a reset code. The reset code is the serial number of the device in reverse. The original password is once again valid after the reset code has been entered.
- The reset code can also be changed 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

The structure of the operating menu in the operating tools is the same as for operation via the local display. The range of functions is different however.

### 7.5.1 Connecting the operating tool

#### Service interface




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

At least 22 mA is required to update (flash) the device firmware.

### 7.5.2 DeviceCare

#### Range of functions

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

#### Range of functions

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
- HART communication

Typical functions:
- Configuration of transmitter parameters
- Loading and saving of device data (upload/download)
- Documenting the measuring point
- Visualizing the measured value memory (line recorder) and event logbook

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

# 8 System integration

## 8.1 Overview of device description files

- Manufacturer ID: 17 (0x0011)
- Device type ID: 0x112A
- HART specification: 7.6
- DD files, information and files can be found at:
  - www.endress.com
  - www.fieldcommgroup.org

## 8.2 Measured variables via HART protocol

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

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

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

The assignment of the measured values to the device variables can be changed in the following submenu:
Application → HART output → HART output

In a HART Multidrop loop, only one device may use the analog current value for signal transmission. For all other devices in the **"Loop current mode" parameter**, select the **Disable** option.

### 8.2.1 Device variables and measured values

The following codes are assigned to the device variables at the factory:

| Device variable | Device variable code |
|---|---|
| Pressure | 0 |
| Scaled variable | 1 |
| Sensor temperature | 2 |
| Sensor pressure | 3 |
| Electronics temperature | 4 |
| Terminal current | 5 |
| Terminal voltage | 6 |
| Median of pressure signal | 7 |
| Noise of pressure signal | 8 |
| Percent of range | 244 |

| Device variable | Device variable code |
|---|---|
| Loop current | 245 |
| Not used | 250 |

The device variables can be queried by a HART® master using HART® command 9 or 33.

### 8.2.2 System units

The following table describes the supported pressure measuring units.

| Index number | Description | Hart unit code |
|---|---|---|
| 0 | mbar | 8 |
| 1 | bar | 7 |
| 2 | Pa | 11 |
| 3 | kPa | 12 |
| 4 | MPa | 237 |
| 5 | psi | 6 |
| 6 | torr | 13 |
| 7 | atm | 14 |
| 8 | mmH2O | 4 |
| 9 | mmH2O (4°C) | 239 |
| 10 | mH2O | 240 |
| 11 | mH2O (4°C) | 240 |
| 10 | ftH2O | 3 |
| 11 | inH2O | 1 |
| 12 | inH2O (4°C) | 238 |
| 13 | mmHg | 5 |
| 14 | inHg | 2 |
| 15 | gf/cm² | 9 |
| 16 | kgf/cm² | 10 |

# 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**

**The settings of the current output are relevant for safety!**
This situation can result in product overflow.
- ▶ The setting of the current output depends on the setting in the **Assign PV** parameter.
- ▶ After changing the **Assign PV** parameter, check the settings for the range (LRV and URV) and reconfigure them if necessary.

**⚠ 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:

- **Assign PV** parameter **Pressure** option
- Calibration values defined by defined measuring cell nominal value
- The alarm current is set to min. (3.6 mA), (only if no other option was selected when ordering)
- DIP switch to Off position
- If Bluetooth is ordered, then Bluetooth is switched on

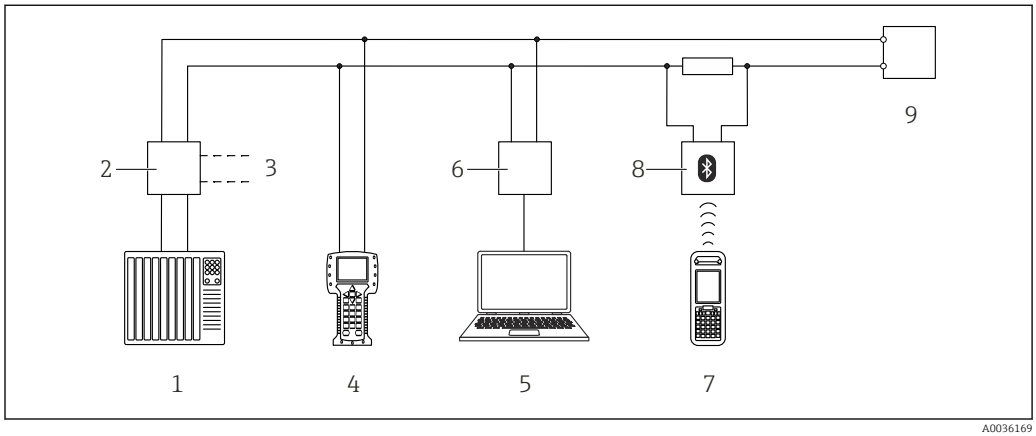
## 9.2 Function check

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 Connecting via FieldCare and DeviceCare

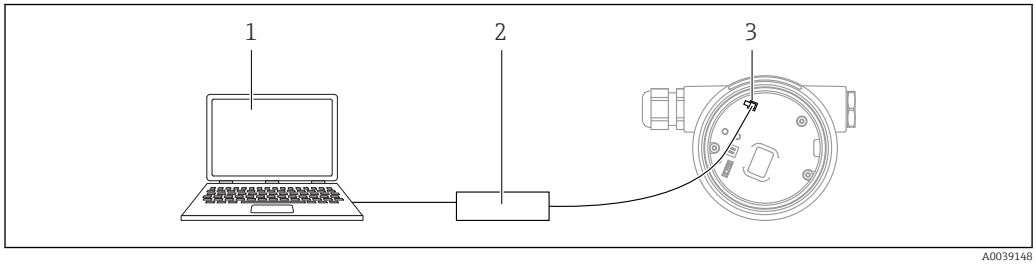
### 9.3.1 Via HART protocol




10 *Options for remote operation via HART protocol*

1 *PLC (programmable logic controller)*
2 *Transmitter power supply unit, e.g. RN221N (with communication resistor)*
3 *Connection for Commubox FXA195 and Field Communicator 375, 475*
4 *Field Communicator 475*
5 *Computer with operating tool (e.g. FieldCare/DeviceCare, AMS Device Manager, SIMATIC PDM)*
6 *Commubox FXA195 (USB)*
7 *Field Xpert SFX350/SFX370*
8 *VIATOR Bluetooth modem with connecting cable*
9 *Device*

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




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

At least 22 mA is required to update (flash) the device firmware.

## 9.4 Configuring the device address via software

Please refer to the **HART address** parameter.

Menu path: Application → HART output → Configuration → HART address

## 9.5 Setting the operating language

### 9.5.1 Operating tool

See the description of the relevant operating tool.

## 9.6 Configuring the device

### 9.6.1 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
- Setting the lower range value and upper range value
  The pressure applied must be within the nominal pressure limits of the sensor (see the specifications on the nameplate)
- Resetting the device

**Performing position adjustment**

1. Device installed in required position and no pressure is applied.
2. Press the "Zero" and "Span" keys simultaneously for at least 3 seconds.
3. When the LED lights up briefly, the pressure present has been accepted for position adjustment.

**Setting the lower range value (pressure or scaled variable)**

1. The desired pressure for the lower range value is present at the device.
2. Press "Zero" for at least 3 s.
3. When the LED lights up briefly, the pressure present has been accepted for the lower range value.

**Setting the upper range value (pressure or scaled variable)**

1. The desired pressure for the upper range value is present at the device.
2. Press "Span" for at least 3 seconds.
3. When the LED lights up briefly, the pressure present has been accepted for the upper range value.
4. Does the LED on the electronic insert not light up?
   ↳ Applied pressure for upper range value has not been accepted.
   Wet calibration is not possible if, in the **Assign PV** parameter **Scaled variable** option and in **Scaled variable transfer function** parameter **Table** option has been selected.

**Checking the settings (pressure or scaled variable)**

1. Press "Zero" key briefly (approx. 1 second) to display the lower range value.
2. Press "Span" key briefly (approx. 1 second) to display the upper range value.
3. Press "Zero" and "Span" keys briefly and at the same time (approx. 1 second) to display the calibration offset.

**Resetting the device**

- Press and hold "Zero" and "Span" simultaneously for at least 12 seconds.

### 9.6.2 Commissioning with the commissioning wizard

In FieldCare, DeviceCare [1], SmartBlue and on the display, the **Commissioning** wizard for guiding the user through the initial commissioning steps is available. Commissioning can also be carried out via the Asset Management Solution (AMS) and Process Device Manager (PDM).

1. Connect the device with FieldCare or DeviceCare.
2. Open the device in FieldCare or DeviceCare.
   ↳ The dashboard (homepage) of the device is displayed:
3. In the **Guidance** menu, click the **Commissioning** wizard to open the wizard.
4. Enter the appropriate value in each parameter or select the appropriate option. These values are written directly to the device.
5. Click "Next" to go to the next page.
6. Once all the pages are completed, click "End" to close the **Commissioning** wizard.

If the **Commissioning** wizard is canceled before all necessary parameters have been configured, the device may be in an undefined state. In such situations, it is advisable to reset the device to the factory default settings.

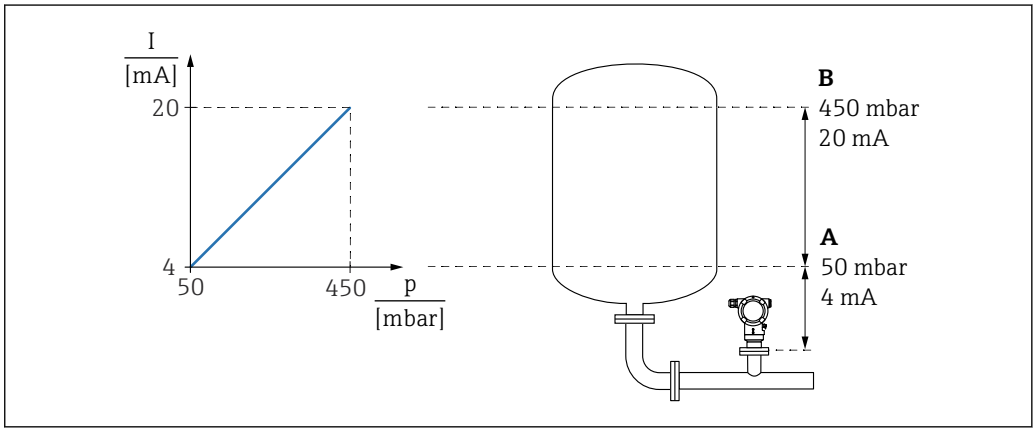
1) DeviceCare is available for download at www.software-products.endress.com. You must register in the Endress+Hauser software portal to download the product.

**Example: Outputting of the pressure value at the current output**

Pressure and temperature units are converted automatically. Other units are not converted.

In the following example, the pressure value should be measured in a tank and output on the current output. The maximum pressure of 450 mbar (6.75 psi) corresponds to the 20 mA current. The 4 mA current corresponds to a pressure of 50 mbar (0.75 psi).

Prerequisites:
- Measured variable in direct proportion to the pressure
- Due to the orientation of the device, there may be pressure shifts in the measured value (when the vessel is empty or partly filled, the measured value is not zero)
  Perform a position adjustment if necessary
- In the **Assign PV** parameter, the **Pressure** option must be selected (factory setting).
  Display: In the **Guidance** menu **Commissioning** wizard, keep pressing the ⊞ key until the **Assign PV** parameter is reached. Press the Ⓔ key to confirm, select the **Pressure** option and press Ⓔ to confirm.




*A Lower range value output*
*B Upper range value output*

Adjustment:

1. Enter the pressure value for the 4 mA current via the **Lower range value output** parameter (50 mbar (0.75 psi)).
2. Enter the pressure value for the 20 mA current via the **Upper range value output** parameter (450 mbar (6.75 psi))

Result: The measuring range is set to 4 to 20 mA.

## 9.6.3 Commissioning without the commissioning wizard

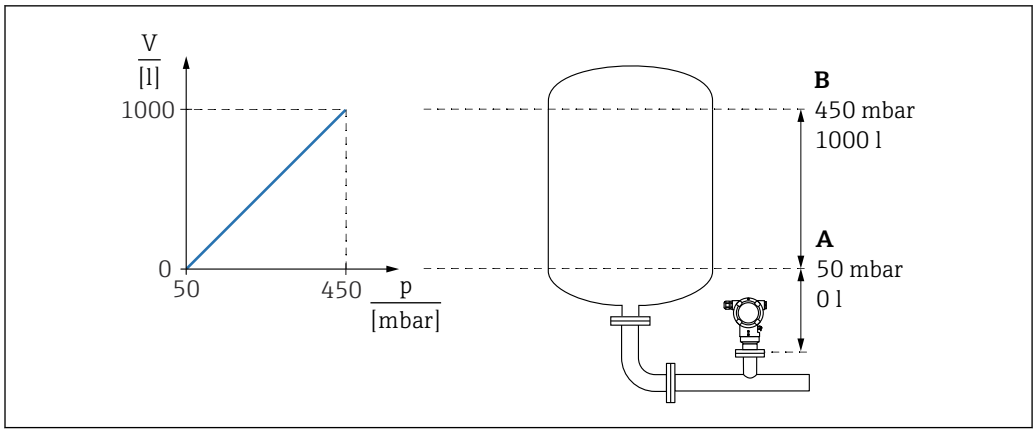
**Example: Commissioning a volume measurement in the tank**

Pressure and temperature units are converted automatically. Other units are not converted.

In the following example, the volume in a tank should be measured in liters. The maximum volume of 1 000 l (264 gal) corresponds to a pressure of 450 mbar (6.75 psi).

The minimum volume of 0 liters corresponds to a pressure of 50 mbar (0.75 psi).

Prerequisites:
- Measured variable in direct proportion to the pressure
- Due to the orientation of the device, there may be pressure shifts in the measured value (when the vessel is empty or partly filled, the measured value is not zero)
  Perform position adjustment if necessary




*A "Pressure value 1" parameter and "Scaled variable value 1" parameter*
*B "Pressure value 2" parameter and "Scaled variable value 2" parameter*

The pressure present is displayed in the operating tool on the same settings page in the "Pressure" field.

1. Enter the pressure value for the lower calibration point via the **Pressure value 1** parameter: 50 mbar (0.75 psi)
   ↳ Menu path: Application → Sensor → Scaled variable → Pressure value 1
2. Enter the volume value for the lower calibration point via the **Scaled variable value 1** parameter: 0 l (0 gal)
   ↳ Menu path: Application → Sensor → Scaled variable → Scaled variable value 1
3. Enter the pressure value for the upper calibration point via the **Pressure value 2** parameter: 450 mbar (6.75 psi)
   ↳ Menu path: Application → Sensor → Scaled variable → Pressure value 2
4. Enter the volume value for the upper calibration point via the **Scaled variable value 2** parameter: 1 000 l (264 gal)
   ↳ Menu path: Application → Sensor → Scaled variable → Scaled variable value 2

Result: The measuring range is set for 0 to 1 000 l (0 to 264 gal). Only the **Scaled variable value 1** parameter and **Scaled variable value 2** parameter are set with this setting. This setting has no effect on the current output.

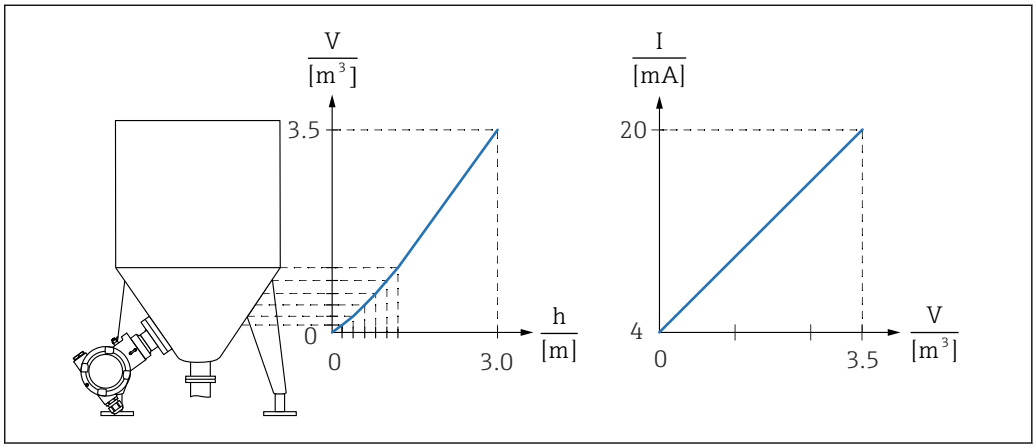
### 9.6.4 Linearization

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

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

**⚠ WARNING**

**The settings of the current output are relevant for safety!**
This situation can result in product overflow.
- ▶ The setting of the current output depends on the setting in the **Assign PV** parameter.
- ▶ After changing the **Assign PV** parameter, check the settings for the range (LRV and URV) and reconfigure them if necessary.




1. In the **Assign PV** parameter, the **Scaled variable** option must be set.
   ↳ Menu path: Application → HART output → HART output → Assign PV
2. Set the desired unit in the **Scaled variable unit** parameter.
   ↳ Menu path: Application → Sensor → Scaled variable → Scaled variable unit
3. 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
4. Enter the desired table values.
5. The table is activated once all the points in the table have been entered.
6. Activate the table using the **Activate table** parameter.

Result:

The measured value after linearization is displayed.

- 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 (= 4 mA) is defined by the smallest point in the table
  The 100% value (= 20 mA) is defined by the largest point in the table
- The assignment of the volume/mass values to the current values can be changed with the **Lower range value output** parameter and **Upper range value output** parameter.

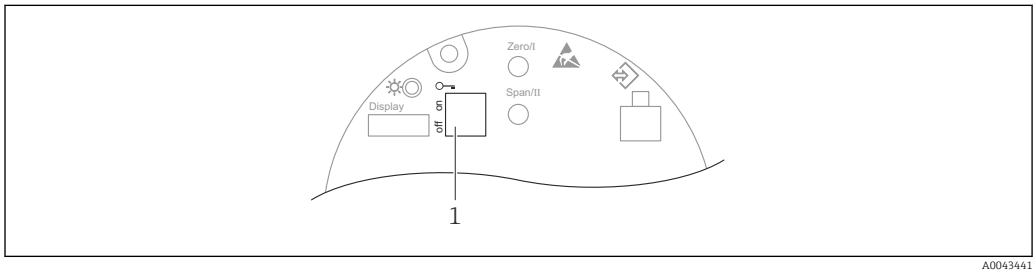
## 9.7 "Simulation" submenu

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

Menu path: Diagnostics → Simulation

## 9.8 Protecting settings from unauthorized access

### 9.8.1 Hardware locking or unlocking




*1 DIP switch for locking and unlocking the device*

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.

### 9.8.2 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
  Menu path of local display: at the top operating level
  Menu path of operating tool: System → Device management
- In the operating tool (FieldCare/DeviceCare) in the DTM header

## 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

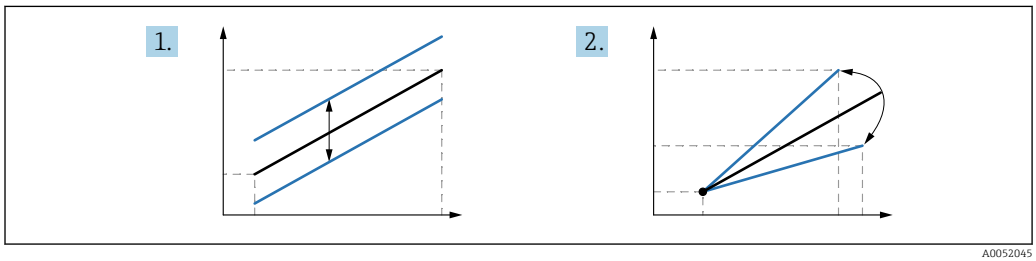
The following are available for this purpose:
- Basic settings using the **Guidance** menu
- Advanced settings using the **Diagnostics** menu, **Application** menu and **System** menu

### 10.3.1 Sensor calibration [2].

In the course of their life cycle, pressure measuring cells **can** deviate, or drift, [3] 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.




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

2) Not possible via display operation
3) 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: 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 error" is indicated on the display when the device is started or the display is connected**
- Possible cause: Electromagnetic interference influence
  Remedial action: Check grounding of the device
- Possible cause: Defective cable connection or display plug
  Remedial action: Replace the display

**HART communication is not working**
- Possible cause: Communication resistor missing or incorrectly installed
  Remedial action: Install the communication resistor (250 Ω) correctly.
- Possible cause: Commubox is connected incorrectly
  Remedial action: Connect Commubox correctly

**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: → 🖹 60

**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: → 🖹 60

**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: → 🖹 60
- 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, HART, 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 current output. Replace the main electronics if the current output does not correspond to the simulated value.

### 11.1.5 Behavior of the current output in the event of a failure

The behavior of the current output in the event of failures is defined by the **Failure behavior current output** parameter.

**Parameter overview with brief description**

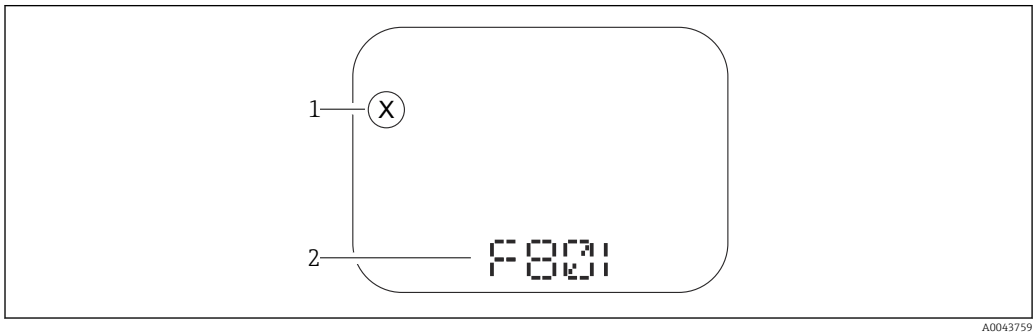
| Parameter | Description | Selection / User entry |
|---|---|---|
| Failure behavior current output | Defines which current the output assumes in the case of an error.<br>Min: < 3.6 mA<br>Max: >21.5 mA<br>Note: The hardware DIP Switch for alarm current has priority over software setting. | ▪ Min.<br>▪ Max. |
| Failure current | Enter current output value in alarm condition. | 21.5 to 23 mA |

## 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.




*1 Status signal*
*2 Status symbol with diagnostic event*

**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.

## 11.3 Diagnostic event in the operating tool

If a diagnostic event has occurred in the device, the status signal appears in the top left status area of the operating tool together with the corresponding symbol for the event level according to NAMUR NE 107:

- Failure (F)
- Function check (C)
- Out of specification (S)
- Maintenance required (M)

Click the status signal to see the detailed status signal.

The diagnostic events and remedial measures can be printed out in the **Diagnostic list** submenu.

## 11.4 Adapting the diagnostic information

The event level can be configured:

Menu path: Diagnostics → Diagnostic settings → Configuration

## 11.5 Queued diagnostic messages

The display alternates between the queued diagnostic messages and the measured value.

Queued diagnostic messages can also be displayed in the **Active diagnostics** parameter.

Menu path: Diagnostics → Active diagnostics

## 11.6 Diagnostic list

All of the diagnostic messages currently pending can be displayed in the **Diagnostic list** submenu.

**Navigation path**
Diagnostics → Diagnostic list

### 11.6.1 List of diagnostic events

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| **Diagnostic of sensor** | | | | |
| 062 | Sensor connection faulty | Check sensor connection | F | Alarm |
| 081 | Sensor initialization faulty | 1. Restart device<br>2. Contact service | F | Alarm |
| 100 | Sensor error | 1. Restart the device<br>2. Contact Endress+Hauser Service | F | Alarm |
| 101 | Sensor temperature | 1. Check process temperature<br>2. Check ambient temperature | F | Alarm |
| 102 | Sensor incompatible error | 1. Restart device<br>2. Contact service | F | Alarm |
| **Diagnostic of electronic** | | | | |
| 203 | HART Device Malfunction | Check device specific diagnosis. | S | Warning |
| 204 | HART Electronic Defect | Check device specific diagnosis. | F | Alarm |
| 242 | Firmware incompatible | 1. Check software<br>2. Flash or change main electronic module | F | Alarm |
| 252 | Module incompatible | 1. Check if correct electronic module is plugged<br>2. Replace electronic module | F | Alarm |
| 263 | Incompatibility detected | Check electronic module type | M | Warning |
| 270 | Main electronics defective | Replace main electronics | F | Alarm |
| 272 | Main electronics faulty | 1. Restart device<br>2. Contact service | F | Alarm |
| 273 | Main electronics defective | Replace main electronics | F | Alarm |
| 282 | Data storage inconsistent | Restart device | F | Alarm |
| 283 | Memory content inconsistent | 1. Restart device<br>2. Contact service | F | Alarm |
| 287 | Memory content inconsistent | 1. Restart device<br>2. Contact service | M | Warning |
| 388 | Electronics and HistoROM defective | 1. Restart device<br>2. Replace electronics and HistoROM<br>3. Contact service | F | Alarm |
| **Diagnostic of configuration** | | | | |
| 410 | Data transfer failed | 1. Retry data transfer<br>2. Check connection | F | Alarm |
| 412 | Processing download | Download active, please wait | C | Warning |
| 420 | HART Device Configuration Locked | Check device locking configuration. | S | Warning |
| 421 | HART Loop Current fixed | Check Multi-drop mode or current simulation. | S | Warning |
| 431 | Trim required | Carry out trim | C | Warning |
| 435 | Linearization faulty | Check data points and min span | F | Alarm |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| 437 | Configuration incompatible | 1. Update firmware<br>2. Execute factory reset | F | Alarm |
| 438 | Dataset different | 1. Check dataset file<br>2. Check device parameterization<br>3. Download new device parameterization | M | Warning |
| 441 | Current output 1 saturated | 1. Check process<br>2. Check current output settings | S | Warning |
| 484 | Failure mode simulation active | Deactivate simulation | C | Alarm |
| 485 | Process variable simulation active | Deactivate simulation | C | Warning |
| 491 | Current output simulation active | Deactivate simulation | C | Warning |
| 495 | Diagnostic event simulation active | Deactivate simulation | S | Warning |
| 500 | Process alert pressure | 1. Check process pressure<br>2. Check configuration of process alert | S | Warning [1)] |
| 501 | Process alert scaled variable | 1. Check process conditions<br>2. Check scaled variable configuration | S | Warning [1)] |
| 502 | Process alert temperature | 1. Check process temperature<br>2. Check configuration of process alert | S | Warning [1)] |
| 503 | Zero adjustment | 1. Check measuring range<br>2. Check position adjustment | M | Warning |
| **Diagnostic of process** | | | | |
| 801 | Supply voltage too low | Increase supply voltage | F | Alarm |
| 802 | Supply voltage too high | Decrease supply voltage | S | Warning |
| 805 | Loop current faulty | 1. Check wiring<br>2. Replace electronics | F | Alarm |
| 806 | Loop diagnostics | 1. Check supply voltage<br>2. Check wiring and terminals | M | Warning [1)] |
| 807 | No Baseline due to insuf. volt. at 20 mA | Increase supply voltage | M | Warning |
| 822 | Sensor temperature out of range | 1. Check process temperature<br>2. Check ambient temperature | S | Warning [1)] |
| 825 | Electronics temperature | 1. Check ambient temperature<br>2. Check process temperature | S | Warning |
| 841 | Operating range | 1. Check the process pressure<br>2. Check the sensor range | S | Warning [1)] |
| 846 | HART Non-Primary Variable Out of Limit | Check device specific diagnosis. | S | Warning |
| 847 | HART Primary Variable Out of Limit | Check device specific diagnosis. | S | Warning |
| 848 | HART Device Variable Alert | Check device specific diagnosis. | S | Warning |
| 900 | High signal noise detected | 1. Check impulse line<br>2. Check valve position<br>3. Check process | M | Warning [1)] |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| 901 | Low signal noise detected | 1. Check impulse line<br>2. Check valve position<br>3. Check process | M | Warning [1] |
| 902 | Min signal noise detected | 1. Check impulse line<br>2. Check valve position<br>3. Check process | M | Warning [1] |
| 906 | Out of range signal detected | 1. Process Information. No action<br>2. Rebuild baseline<br>3. Adapt signal range thresholds | S | Warning [1] |

1) Diagnostic behavior can be changed.

## 11.7 Event logbook

### 11.7.1 Event history

The**Event list** submenu provides a chronological overview of the event messages that have occurred. [4].

**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

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

### 11.7.2 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

### 11.7.3 Overview of information events

| Info number | Info name |
|---|---|
| I1000 | --------(Device ok) |
| I1079 | Sensor changed |
| I1089 | Power on |
| I1090 | Configuration reset |

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

| Info number | Info name |
|---|---|
| I1091 | Configuration changed |
| I11074 | Device verification active |
| I1110 | Write protection switch changed |
| I11104 | Loop diagnostics |
| I11284 | DIP MIN setting to HW active |
| I11285 | DIP SW setting active |
| 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 |
| I1264 | Safety sequence aborted |
| 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 |
| I1554 | Safety sequence started |
| I1555 | Safety sequence confirmed |
| I1556 | Safety mode off |
| I1956 | Reset |

## 11.8 Resetting the device

### 11.8.1 Resetting the device via the operating tool

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

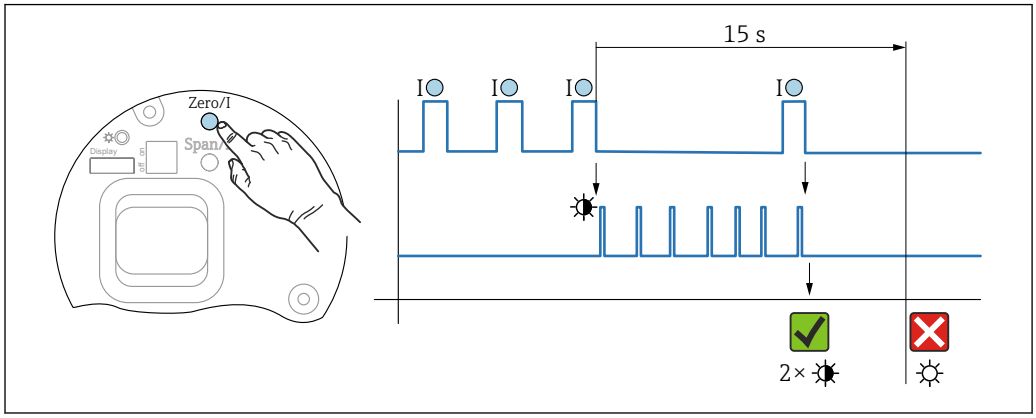
Navigation: System → Device management → Reset device

**Reset device** parameter

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

### 11.8.2 Resetting the device via the electronic insert keys

#### Resetting Bluetooth password and user role (as of SW 1/1/2000)



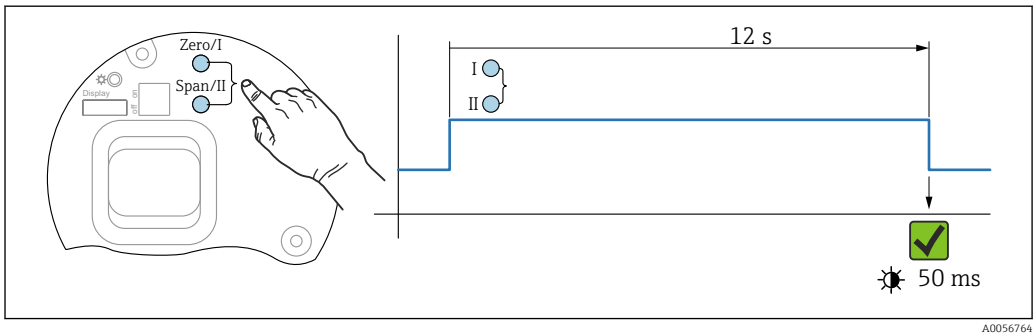

11 *Sequence for resetting the password*

#### 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




12 *Operating keys on the electronic insert*

#### Resetting the device to the factory setting

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

## 11.9 Device information

All the device information is contained in the **Information** submenu.

Menu path: System → Information

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

## 11.10 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.

### 11.10.1 Version 01.00.zz

Original software

### 11.10.2 Version 01.01.zz

- Heartbeat Technology extended functionality
- HART condensed status

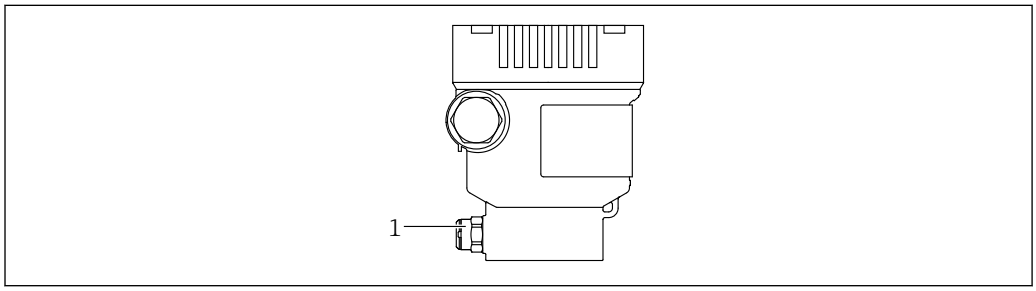
# 12 Maintenance

## 12.1 Maintenance work

This chapter describes the maintenance of physical device components.

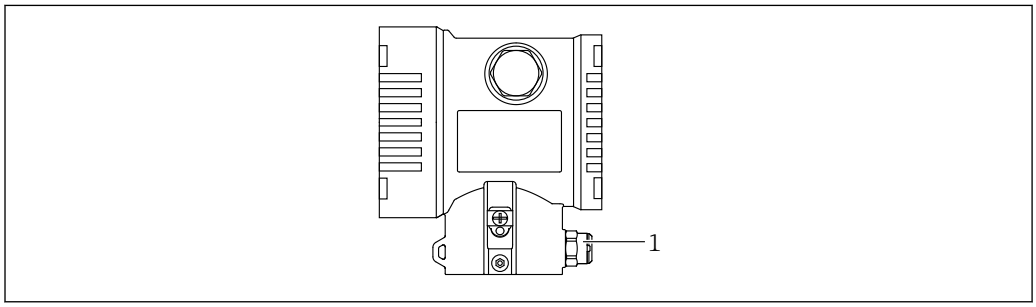
### 12.1.1 Pressure compensation filter

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




A0043756

*1 Pressure compensation filter*




A0038667

*1 Pressure compensation filter*

### 12.1.2 Flushing rings

The use of flushing rings allows the membrane to be cleaned without removing the device from the process.

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

### 12.1.3 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) 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.

## 13.4 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
- Mounting bracket for block & bleed valves
- Block&Bleed valves:
  - Block&Bleed valves can be ordered as **enclosed** accessories (seal for mounting is enclosed)
  - Block and bleed valves can be ordered as **mounted** accessories (mounted manifolds are supplied with a documented leak test)
  - Certificates (e.g. 3.1 material certificate and NACE) and tests (e.g. PMI and pressure test) that are ordered with the device apply for the transmitter and the manifold.
  - During the operating life of the valves, it may be necessary to re-tighten the pack.
- Siphons (PZW)
- Flushing rings
- Weather protective cover

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

### 14.1.2 Plug connectors

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

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

### 14.1.3 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**

- Absolute pressure
- Gauge 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.

*Absolute pressure*

| Measuring cell | Maximum measuring range [1] | | Smallest calibratable span (preset at factory) [2] | |
|---|---|---|---|---|
| | lower (LRL) | upper (URL) | | |
| | [$bar_{abs}$ ($psi_{abs}$)] | [$bar_{abs}$ ($psi_{abs}$)] | [bar (psi)] | Platinum |
| 400 mbar (6 psi) | 0 | +0.4 (+6) | 0.005 (0.075) [3] | 80 mbar (1.2 psi) |
| 1 bar (15 psi) | 0 | +1 (+15) | 0.01 (0.15) [4] | 200 mbar (3 psi) |
| 2 bar (30 psi) | 0 | +2 (+30) | 0.02 (0.3) [4] | 400 mbar (6 psi) |
| 4 bar (60 psi) | 0 | +4 (+60) | 0.04 (0.6) [4] | 800 mbar (12 psi) |
| 10 bar (150 psi) | 0 | +10 (+150) | 0.1 (1.5) [4] | 2 bar (30 psi) |
| 40 bar (600 psi) | 0 | +40 (+600) | 0.4 (6) [4] | 8 bar (120 psi) |
| 100 bar (1500 psi) | 0 | +100 (+1500) | 1.0 (15) [4] | 20 bar (300 psi) |
| 400 bar (6000 psi) | 0 | +400 (+6000) | 4 (60) [4] | 80 bar (1200 psi) |

1) Device with diaphragm seal: Within the measuring range, the minimum upper range value of 80 $mbar_{abs}$ (1.16 $psi_{abs}$) must be observed.
2) The maximum TD is 5:1 in the case of platinum.
3) Largest factory-configurable turn down: 80:1
4) Largest factory-configurable turn down: 100:1

*Absolute pressure*

| Measuring cell | MWP | OPL | Vacuum resistance [1] | Burst pressure [2] |
|---|---|---|---|---|
| | [$bar_{abs}$ ($psi_{abs}$)] | [$bar_{abs}$ ($psi_{abs}$)] | [$bar_{abs}$ ($psi_{abs}$)] | [bar (psi)] |
| 400 mbar (6 psi) | 4 (60) | 6 (90) | ▪ Silicone oil: 0.01 (0.15)<br>▪ Inert oil: 0.04 (0.6) | 100 (1450) |
| 1 bar (15 psi) | 6.7 (100) | 10 (150) | | 100 (1450) |
| 2 bar (30 psi) | 13.3 (200) | 20 (300) | | 100 (1450) |
| 4 bar (60 psi) | 18.7 (280.5) | 28 (420) | | 100 (1450) |
| 10 bar (150 psi) | 26.7 (400.5) | 40 (600) | | 100 (1450) |
| 40 bar (600 psi) | 100 (1500) | 160 (2400) | | 250 (3625) |
| 100 bar (1500 psi) | 100 (1500) | 400 (6000) | | 1000 (14500) |
| 400 bar (6000 psi) | 400 (6000) | 600 (9000) | | 2000 (29000) |

1) The vacuum resistance applies for the measuring cell under reference operating conditions. A ceramic membrane is recommended for applications in the limit range. Device with diaphragm seal: Observe the pressure and temperature application limits of the selected fill fluid.
2) The information applies to the standard device (without a diaphragm seal).

*Gauge pressure*

| Measuring cell | Maximum measuring range | | Smallest calibratable span (preset at factory) [1] | |
|---|---|---|---|---|
| | lower (LRL) | upper (URL) | | |
| | [bar (psi)] | [bar (psi)] | [bar (psi)] | Platinum |
| 400 mbar (6 psi) | −0.4 (−6) | +0.4 (+6) | 0.005 (0.075) [2] | 80 mbar (1.2 psi) |
| 1 bar (15 psi) | −1 (−15) | +1 (+15) | 0.01 (0.15) [3] | 200 mbar (3 psi) |
| 2 bar (30 psi) | −1 (−15) | +2 (+30) | 0.02 (0.3) [3] | 400 mbar (6 psi) |
| 4 bar (60 psi) | −1 (−15) | +4 (+60) | 0.04 (0.6) [3] | 800 mbar (12 psi) |
| 10 bar (150 psi) | −1 (−15) | +10 (+150) | 0.1 (1.5) [3] | 2 bar (30 psi) |
| 40 bar (600 psi) | −1 (−15) | +40 (+600) | 0.4 (6) [3] | 8 bar (120 psi) |
| 100 bar (1 500 psi) | −1 (−15) | +100 (+1500) | 1.0 (15) [3] | 20 bar (300 psi) |
| 400 bar (6 000 psi) | −1 (−15) | +400 (+6000) | 4 (60) [3] | 80 bar (1 200 psi) |

1) The maximum TD is 5:1 in the case of platinum.
2) Largest factory-configurable turn down: 80:1
3) Largest factory-configurable turn down: 100:1

*Gauge pressure*

| Measuring cell | MWP | OPL | Vacuum resistance [1] | Burst pressure [2] |
|---|---|---|---|---|
| | [bar (psi)] | [bar (psi)] | [$bar_{abs}$ ($psi_{abs}$)] | [bar (psi)] |
| 400 mbar (6 psi) | 4 (60) | 6 (90) | ▪ Silicone oil: 0.01 (0.15)<br>▪ Inert oil: 0.04 (0.6) | 100 (1450) |
| 1 bar (15 psi) | 6.7 (100) | 10 (150) | | 100 (1450) |
| 2 bar (30 psi) | 13.3 (200) | 20 (300) | | 100 (1450) |
| 4 bar (60 psi) | 18.7 (280.5) | 28 (420) | | 100 (1450) |
| 10 bar (150 psi) | 26.7 (400.5) | 40 (600) | | 100 (1450) |
| 40 bar (600 psi) | 100 (1500) | 160 (2400) | | 250 (3625) |
| 100 bar (1 500 psi) | 100 (1500) | 400 (6000) | | 1000 (14500) |
| 400 bar (6 000 psi) | 400 (6000) | 600 (9000) | | 2000 (29000) |

1) The vacuum resistance applies to the measuring cell under reference operating conditions. A ceramic membrane is recommended for applications in the limit range. Device with diaphragm seal: Observe the pressure and temperature application limits of the selected fill fluid.
2) The information applies to the standard device (without a diaphragm seal).

## 15.2 Output

**Output signal**

**Current output**

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

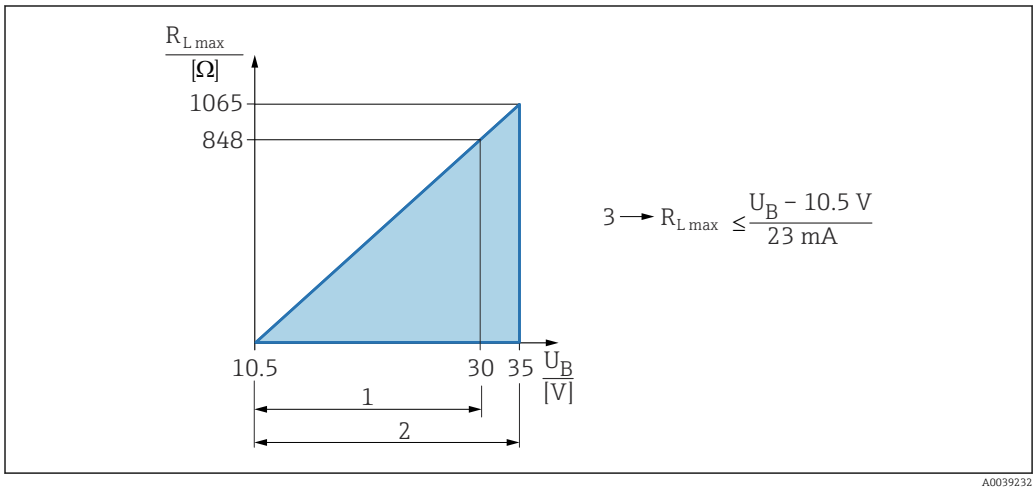
The current output offers a choice of three different operating modes:
- 4.0 to 20.5 mA
- NAMUR NE 43: 3.8 to 20.5 mA (factory setting)
- US mode: 3.9 to 20.8 mA

**Signal on alarm**

4 to 20 mA HART:
Options:
- Max alarm: can be set from 21.5 to 23 mA
- Min. alarm: < 3.6 mA (factory setting)
- Signal on alarm in accordance with NAMUR recommendation NE 43.

**Load**

**4 to 20 mA HART**




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

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

**Damping**

A damping affects all outputs (output signal, display). Damping can be enabled as follows:
Factory setting: 1 s

**Ex connection data**

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

**Linearization**

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

Protocol-specific data

**HART**

- Manufacturer ID: 17 (0x11{hex})
- Device type ID: 0x112A
- Device revision: 1
- HART specification: 7
- DD revision: 1
- Device description files (DTM, DD) information and files at:
  - www.endress.com
  - www.fieldcommgroup.org
- HART load: min. 250 Ohm

*HART device variables (preset at the factory)*

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

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

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

The assignment of the measured values to the device variables can be changed in the following submenu:
Application → HART output → HART output

In a HART Multidrop loop, only one device may use the analog current value for signal transmission. For all other devices in the **"Loop current mode" parameter**, select the **Disable** option.

*Choice of HART device variables*

- **Pressure** option (after position correction and damping)
- Scaled variable
- Sensor temperature
- Sensor pressure
  Sensor Pressure is the raw signal from sensor before damping and position adjustment.
- Electronics temperature
- Percent of range
- Loop current
  The loop current is the output current set by the applied pressure.

*Supported functions*

- Burst mode
- Additional transmitter status
- Device locking

**PROFIBUS PA**

**Manufacturer ID:**
17 (0x11)

**Ident number:**

**Profile version:**
3.02

**GSD file and version**
Information and files at:
- www.endress.com
  On the product page for the device: Documents/Software → Device drivers
- www.profibus.com

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

Heartbeat Technology → SSD: Statistical Sensor Diagostics

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

Wireless HART data

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

## 15.3 Environment

**Ambient temperature range**

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

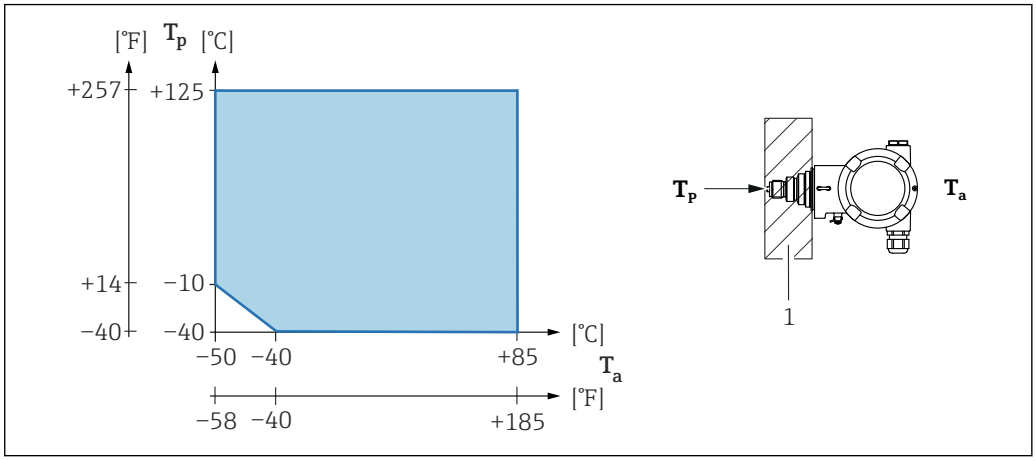
- Without segment display or graphic display:
  Standard:–40 to +85 °C (–40 to +185 °F)
- With segment display or graphic display: –40 to +85 °C (–40 to +185 °F) with limitations in optical properties such as display speed and contrast for example. Can be used without limitations up to –20 to +60 °C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

Applications with very high temperatures: use diaphragm seals with a temperature isolator or capillaries. Use a mounting bracket!

If vibrations additionally occur in the application: use a device with a capillary. Diaphragm seal with temperature isolator: use a mounting bracket!

### Ambient temperature $T_a$ depending on the process temperature $T_p$

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




*1 Insulation material*

### Hazardous area

- For devices for use in hazardous areas, see the Safety Instructions, Installation Drawing or Control Drawing
- Devices that have the most common explosion protection certificates (e.g. ATEX/ IEC Ex, etc.) can be used in explosive atmospheres up to the ambient temperature.

**Storage temperature**

- Without device display:
  Standard: –40 to +90 °C (–40 to +194 °F)
- With device display: –40 to +85 °C (–40 to +185 °F)
- Separate housing: –40 to +60 °C (–40 to +140 °F)

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

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

**Operating altitude**

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

Climate class

Class 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.

Condensation is possible.

Atmosphere

**Operation in very corrosive environment**

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

Degree of protection

Test as per IEC 60529 and NEMA 250-2014

**Housing and process connection**

IP66/68, TYPE 4X/6P

(IP68: (1.83 $mH_2O$ for 24 h))

**Cable entries**

- Gland M20, plastic, IP66/68 TYPE 4X/6P
- Gland M20, brass nickel plated, IP66/68 TYPE 4X/6P
- Gland M20, 316L, IP66/68 TYPE 4X/6P
- Thread M20, IP66/68 TYPE 4X/6P
- Thread G1/2, IP66/68 TYPE 4X/6P
  If the G1/2 thread is selected, the device is delivered with an M20 thread as standard and a G1/2 adapter is included with the delivery, along with the corresponding documentation
- Thread NPT1/2, IP66/68 TYPE 4X/6P
- Dummy plug transport protection: IP22, TYPE 2
- HAN7D plug, 90 degrees, IP65 NEMA Type 4X
- 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 and HAN7D 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 $mH_2O$ for 24 h) TYPE 4/6P

*PE cable*

- IP66 TYPE 4/6P
- IP68 (1.83 $mH_2O$ for 24 h) TYPE 4/6P

Vibration resistance

### Aluminum single-compartment housing

| Description | Sinusoidal vibration IEC62828-1 | Shock |
|---|---|---|
| Device | 10 Hz to 60 Hz: ±0.35 mm (0.0138 in)<br>60 Hz to 1000 Hz: 5 g | 30 g |
| Device with "Compact" or "Temperature isolator" diaphragm seal type [1] | 10 Hz to 60 Hz: ±0.15 mm (0.0059 in)<br>60 Hz to 1000 Hz: 2 g | 30 g |

1) For applications with very high temperatures, either a device with a temperature isolator or with a capillary can be used. If vibrations also occur in the application,Endress+Hauser recommends using a device with a capillary. If a device with a temperature isolator or capillary is used, it must be mounted with a mounting bracket.

### Aluminum dual-compartment housing

| Description | Sinusoidal vibration IEC62828-1 | Shock |
|---|---|---|
| Device | 10 Hz to 60 Hz: ±0.15 mm (0.0059 in)<br>60 Hz to 1000 Hz: 2 g | 30 g |
| Device with "Compact" or "Temperature isolator" diaphragm seal type [1] | 10 Hz to 60 Hz: ±0.15 mm (0.0059 in)<br>60 Hz to 1000 Hz: 2 g | 30 g |

1) For applications with very high temperatures, either a device with a temperature isolator or with a capillary can be used. If vibrations also occur in the application, Endress+Hauser recommends using a device with a capillary. If a device with a temperature isolator or capillary is used, it must be mounted with a mounting bracket.

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

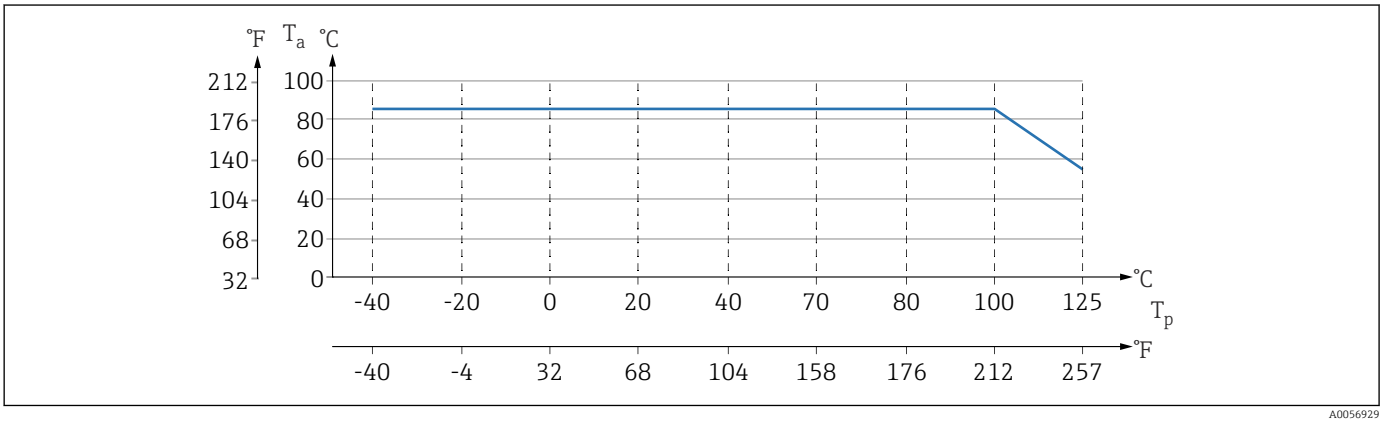
Process temperature range

**Standard device**

**NOTICE**

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

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




13 *Values apply for vertical mounting without insulation.*

$T_p$ *Process temperature*
$T_a$ *Ambient temperature*

### Diaphragm seal fill fluid

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

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

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

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

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

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### Oxygen applications (gaseous)

Oxygen and other gases can react explosively to oils, grease and plastics. The following precautions must be taken:

- All components of the system, such as devices, must be cleaned in accordance with national requirements.
- Depending on the materials used, a certain maximum temperature and a maximum pressure must not be exceeded for oxygen applications.

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

| $T_{max}$ | $P_{max}$ [1] |
|---|---|
| 80 °C (176 °F) | 80 bar (1 200 psi) |
| > 80 to 120 °C (176 to 248 °F) | 70 bar (1 050 psi) |

1) Depends on the lowest-rated element, with regard to pressure, of the selected components: overpressure limit (OPL) of the measuring cell, process connection (1.5 x PN) or fill fluid

### Standard device

- Process connections with internal membrane: −40 to +125 °C (−40 to +257 °F) ; 150 °C (302 °F) for max. one hour
- Process connections with flush membrane:
  - Thread (ISO228, ASME, metric DIN13) and flanges (EN, ASME, JIS): −40 to +100 °C (−40 to +212 °F)
  - Exceptions with seal supplied (M20 x 1.5, G1/2 DIN3852): −20 to +85 °C (−4 to +185 °F)

### Devices with diaphragm seal

- Depending on diaphragm seal and fill fluid:−70 °C (−94 °F)up to +400 °C (+752 °F)
- Observe the maximum gauge pressure and maximum temperature

### Diaphragm seal with tantalum membrane

−70 to +300 °C (−94 to +572 °F)

### Devices with PTFE-coated diaphragm seal membrane

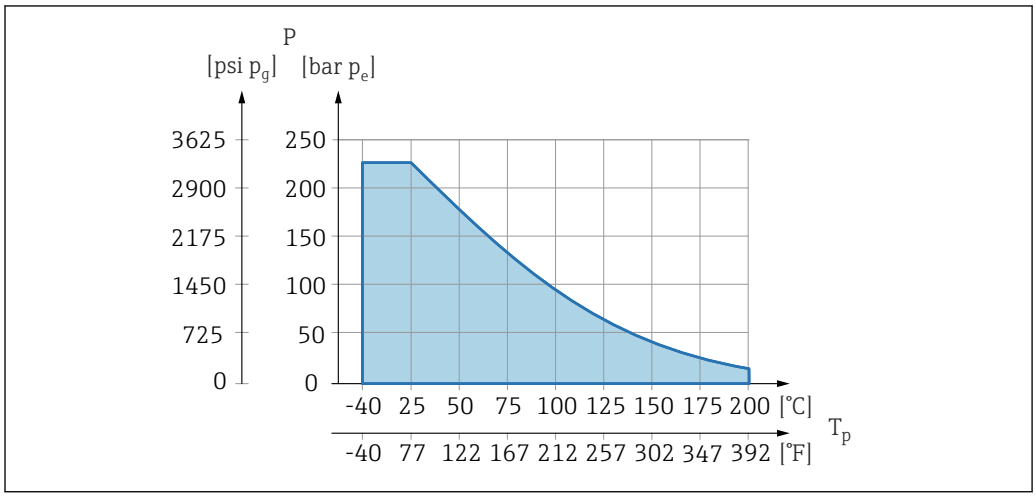
The anti-stick coating has very good anti-friction properties and protects the membrane against abrasive media.

**NOTICE**

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

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

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



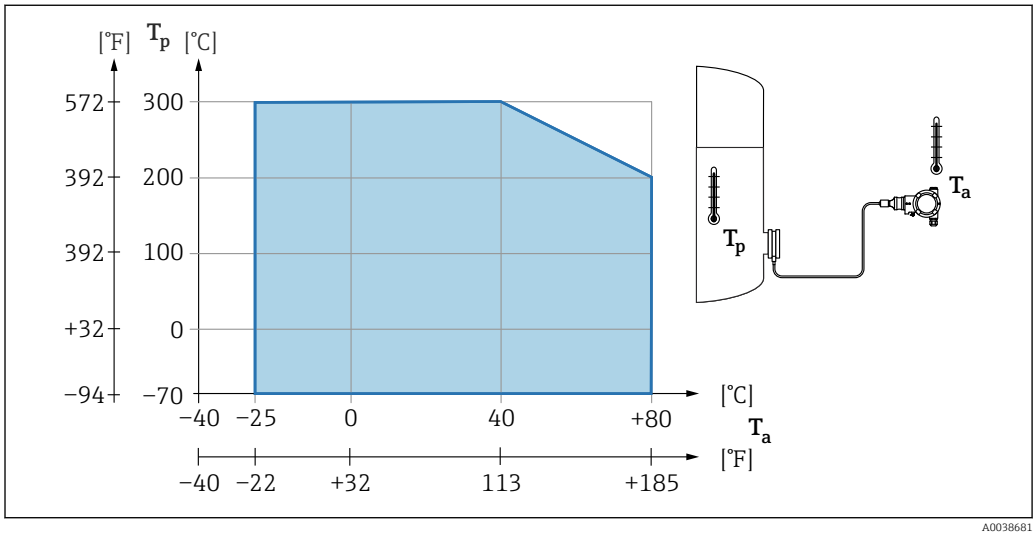

For vacuum applications: $p_{abs} \leq 1$ bar (14.5 psi) to 0.05 bar (0.725 psi) to max. +150 °C (302 °F).

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

### Diaphragm seal capillary armor

Process temperature depending on the ambient temperature.

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



Process pressure range

**Pressure specifications**

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).
- Oxygen applications: do not exceed values for $P_{max}$ and $T_{max}$.

**Burst pressure**

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

Ultrapure gas applications

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

Hydrogen applications

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

Steam applications and saturated steam applications

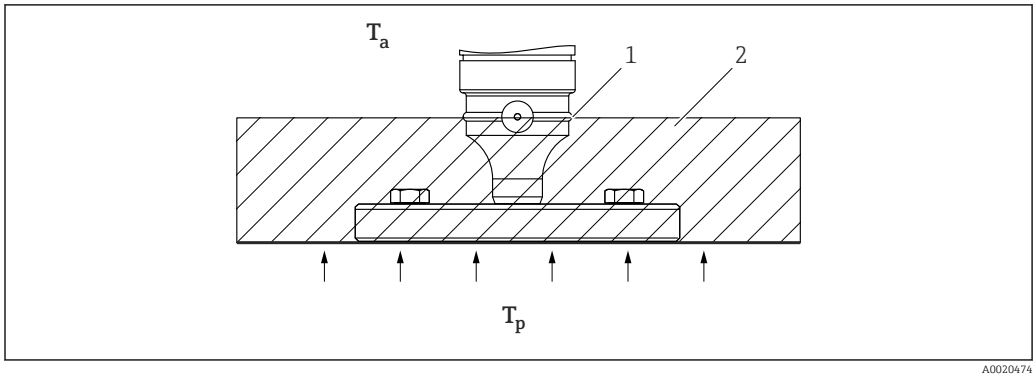
For steam and saturated steam applications: Use a device with a metallic membrane or provide a siphon for temperature decoupling when installing.

Thermal insulation

**Thermal insulation with diaphragm seal directly mounted**

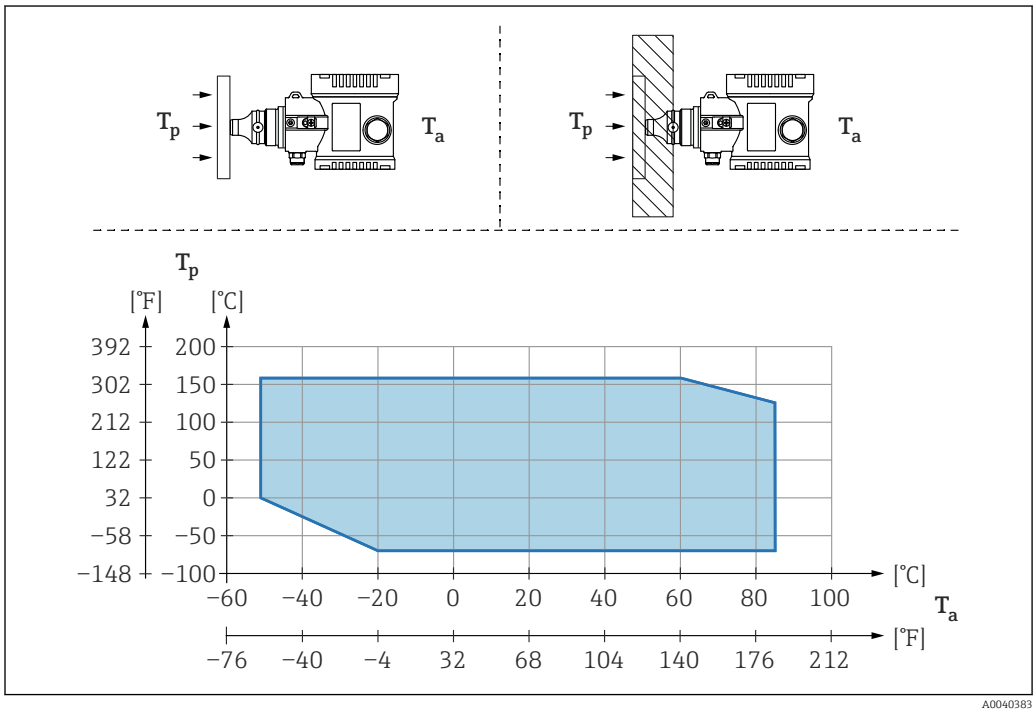
The device may only be insulated up to a certain height. The maximum permitted insulation height is indicated on the device and applies to an insulation material with a heat conductivity ≤ 0.04 W/(m x K) and to the maximum permitted ambient and process

temperature. The data were determined under the most critical application "quiescent air". Maximum permitted insulation height, indicated here on a device with a flange:




*$T_a$ Ambient temperature at transmitter*
*$T_p$ Maximum process temperature*
*1 Maximum permitted insulation height*
*2 Insulation material*

### Mounting with "Compact" diaphragm seal type




*$T_a$ Ambient temperature at transmitter*
*$T_p$ Maximum process temperature*

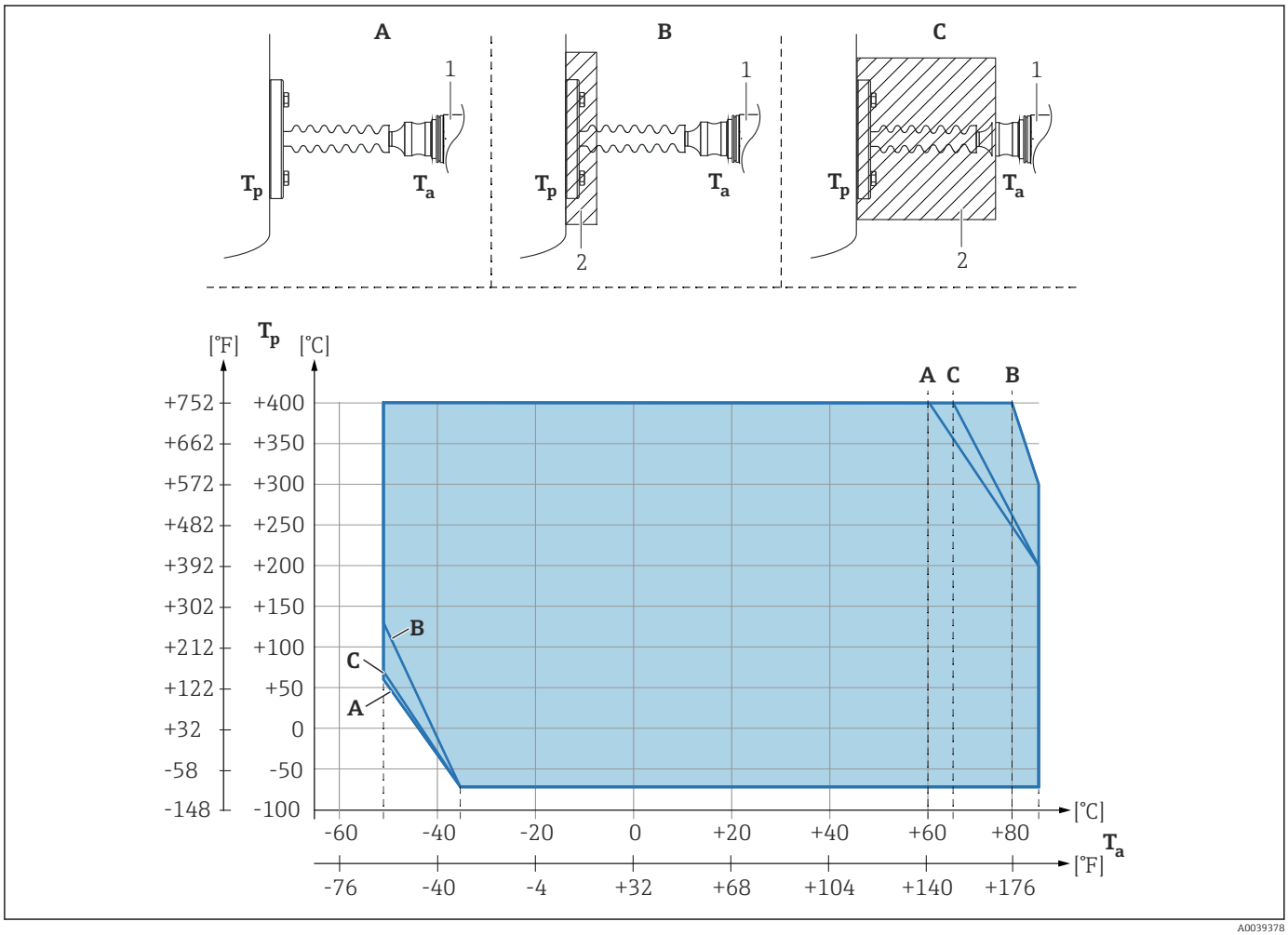
| $T_a$ | $T_p$ |
|---|---|
| +85 °C (+185 °F) | −70 to +120 °C (−94 to +248 °F) |
| +60 °C (+140 °F) | −70 to +160 °C (−94 to +320 °F) |
| −20 °C (−4 °F) | −70 to +160 °C (−94 to +320 °F) |
| −50 °C (−58 °F) | 0 to +160 °C (+32 to +320 °F) |

### Thermal insulation when mounting with a "Temperature isolator" diaphragm seal type

Use of temperature isolators in the event of constant extreme medium temperatures which cause the maximum permissible electronics temperature of +85 °C (+185 °F) to be exceeded. Diaphragm seal systems with temperature isolators can be used up to a maximum temperature of +400 °C (+752 °F) depending on the fill fluid used. For details, see the Technical Information. To minimize the influence of rising heat, mount the device horizontally or with the housing pointing downwards. The additional installation height brings about a zero point shift due to the hydrostatic column in the temperature isolator. This zero point shift can be corrected on the device.

The maximum ambient temperature $T_a$ at the transmitter depends on the maximum process temperature $T_p$.

The maximum process temperature depends on the fill fluid used.

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*A No insulation*
*B Insulation 30 mm (1.18 in)*
*C Maximum insulation*
*1 Transmitter*
*2 Insulation material*

| Position | $T_a$ [1] | $T_p$ [2] |
|---|---|---|
| A | 60 °C (140 °F) | 400 °C (752 °F) [3] |
| | 85 °C (185 °F) | 200 °C (392 °F) |
| | −50 °C (−58 °F) | 60 °C (140 °F) |
| | −35 °C (−31 °F) | −70 °C (−94 °F) |

| Position | $T_a$ 1) | $T_p$ 2) |
|---|---|---|
| B | 80 °C (176 °F) | 400 °C (752 °F) 3) |
| | 85 °C (185 °F) | 300 °C (572 °F) |
| | −50 °C (−58 °F) | 130 °C (266 °F) |
| | −35 °C (−31 °F) | −70 °C (−94 °F) |
| C | 67 °C (153 °F) | 400 °C (752 °F) 3) |
| | 85 °C (185 °F) | 200 °C (392 °F) |
| | −50 °C (−58 °F) | 70 °C (158 °F) |
| | −35 °C (−31 °F) | −70 °C (−94 °F) |

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

## 15.5 Diaphragm seal China, order code 105

This section describes all the technical information of diaphragm seal versions with order code 105, option "8A" to "8N ". All other technical information not described in this section can be found in the remaining sections of this document.

Performance characteristics

### Total performance

*Performance of the basic unit*

The calculation of the total performance for the basic unit remains unchanged.

Calculation of the diaphragm seal error: The resulting diaphragm seal error is different to the data in the Applicator, "Sizing Diaphragm Seal". The influence of the diaphragm seal error is not specified further. Specific sizing is not possible for this device version.

*Long-term stability*

The influence of the long-term stability for the basic unit can be determined by means of the Applicator, "Sizing Pressure Performance". The influence of the diaphragm seal system is not specified further.

*Total error*

The total error can be determined for the basic unit only without diaphragm seal mount.

*Response time*

The response time can be determined for the basic unit only without diaphragm seal mount. The influence of the diaphragm seal system is not specified further.

*Continuous and alternating load capacity*

The device version is designed and validated in accordance with the specifications and requirements of EN 837. Contrary to IEC 62828, a lower load resistance (temperature and pressure) must be assumed.

*Vibration resistance*

The device version is designed and validated in accordance with the specifications and requirements of EN 837.

### Oxygen applications

This device version must **not** be used for oxygen applications.

Process

### Process temperature range

| Fill fluid | $P_{abs}$ = 0.05 bar (0.725 psi) [1] | $P_{abs}$ ≥1 bar (14.5 psi) [2] |
|---|---|---|
| Silicone oil | −40 to +180 °C (−40 to +356 °F) | −40 to +250 °C (−40 to +482 °F) |
| High-temperature oil | −10 to +200 °C (+14 to +392 °F) | −10 to +360 °C (+14 to +680 °F) |
| Low-temperature oil | −98 to +60 °C (−144 to +140 °F) | −98 to +100 °C (−144 to +212 °F) |
| Vegetable oil | −10 to +160 °C (+14 to +320 °F) | −10 to +220 °C (+14 to +428 °F) |
| Inert oil | −40 to +100 °C (−40 to +212 °F) | −40 to +175 °C (−40 to +347 °F) |

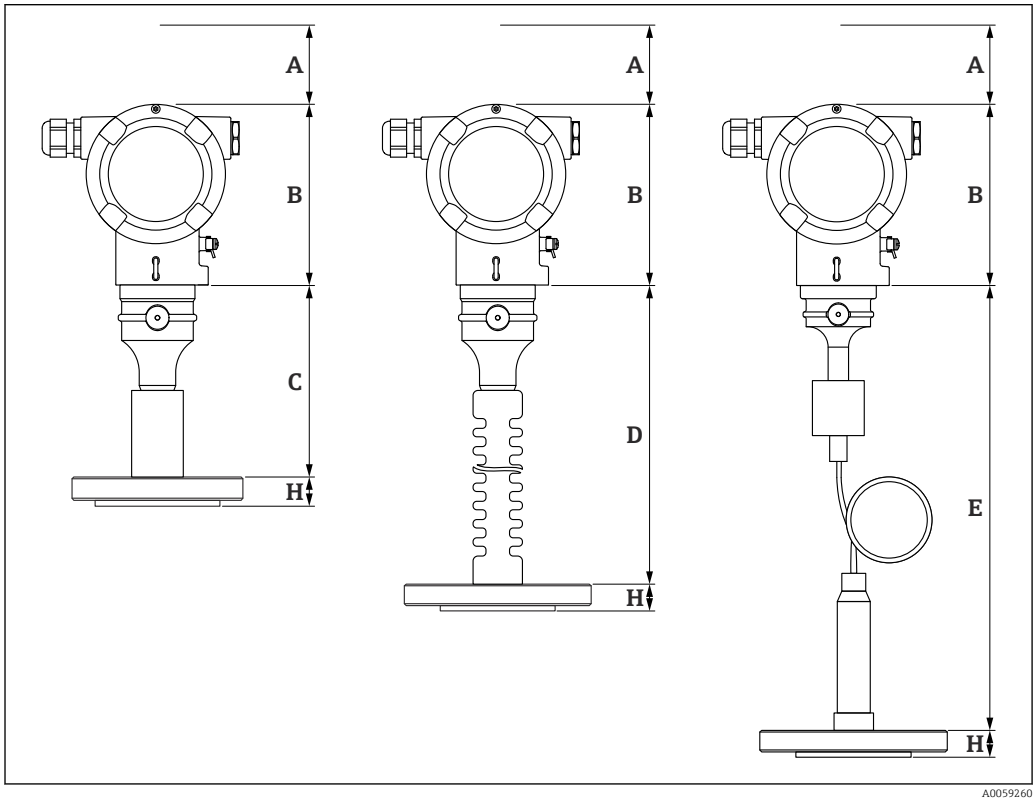
1) Permitted temperature range at $p_{abs}$ = 0.05 bar (0.725 psi) (observe temperature limits of the device and the system!)
2) Permitted temperature range at $p_{abs}$ ≥1 bar (14.5 psi) (observe temperature limits of the device and the system!)

Mechanical construction

**Design, dimensions**

*Device height, diaphragm seal*

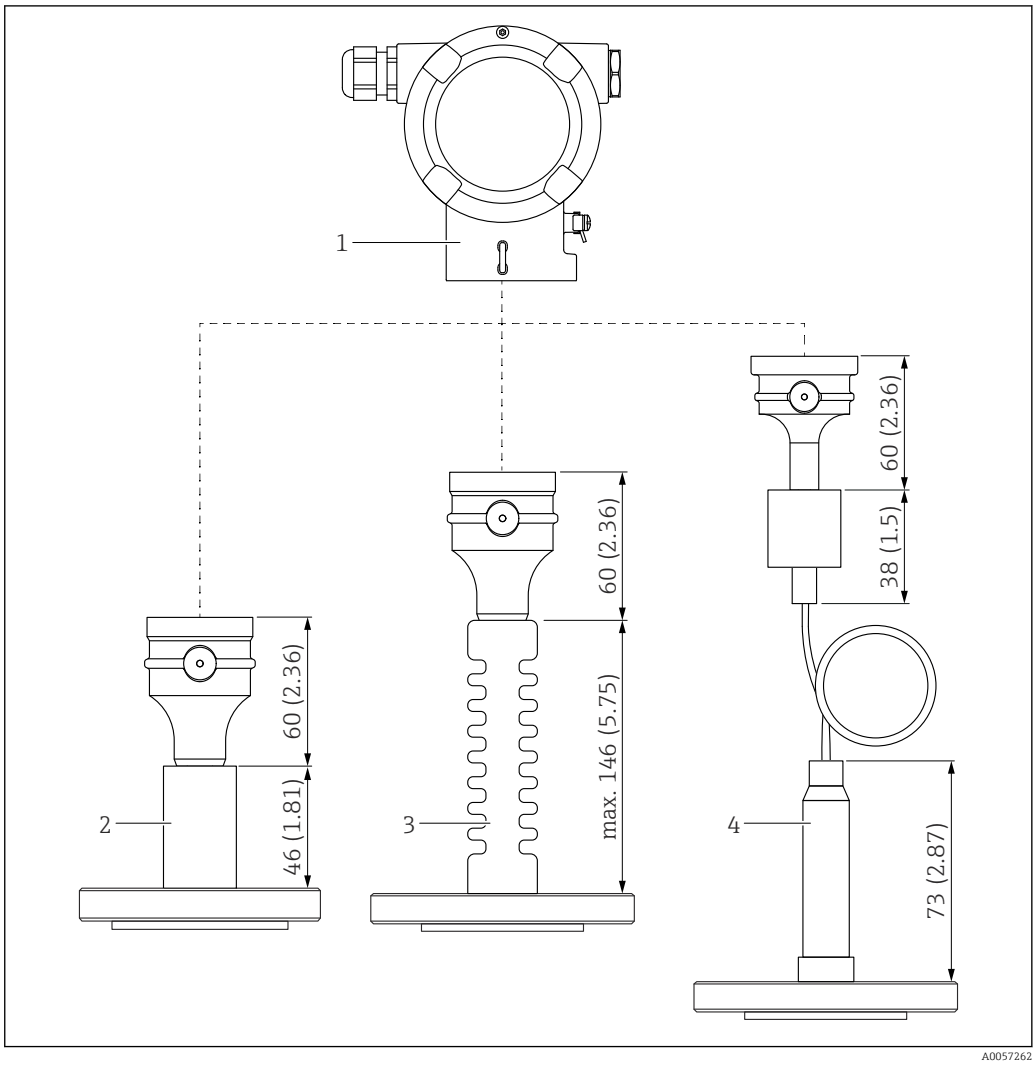
The device height is calculated from
- the height of the housing
- the height of optional mounted parts such as temperature isolators or capillaries
- the height of the individual process connection




*A Installation clearance*
*B Height of the housing*
*C Height of the mounted parts, with the "Compact" diaphragm seal here, for example*
*D Height of the mounted parts, with the "Temperature isolator" diaphragm seal type here, for example*
*E Height of the mounted parts, here with the "Capillary" diaphragm seal type for example*
*H Height of the process connection*

### Dimensions

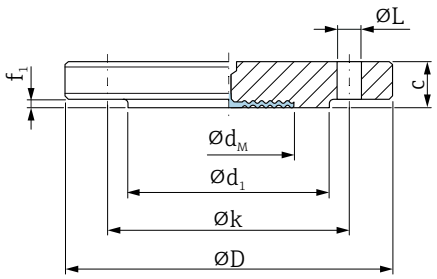
*Mounted parts, diaphragm seal*




*1 Housing*
*2 Diaphragm seal, e.g. flange diaphragm seal here*
*3 Diaphragm seal with temperature isolator*
*4 Process connections with capillaries are 73 mm (2.87 in) higher than process connections without capillaries*

*Flange EN1092-1, Form B1 and B2, flush membrane, diaphragm seal*

Connection dimensions according to EN1092-1.




*ØD Diameter of flange*
*c Thickness*
*Ød$_1$ Raised face*
*$f_1$ Raised face*
*Øk Bolt circle diameter*
*ØL Diameter of hole*
*Ød$_M$ Max. diameter of membrane*

Unit mm (in)

| Flange [1) 2)] | | | | | | | Boltholes | | | Order option [3)] |
|---|---|---|---|---|---|---|---|---|---|---|
| DN | PN | Form | ØD | c | Ød$_1$ | f$_1$ | Number | ØL | Øk | |
| | | | mm | mm | mm | mm | | mm | mm | |
| DN 25 | PN 10-40 | B1 | 115 | 18 | 68 | 2 | 4 | 14 | 85 | H0J |
| DN 50 | PN 10-40 | B1 | 165 | 20 | 102 | 2 | 4 | 18 | 125 | H3J |
| DN 80 | PN 10-40 | B1 | 200 | 24 | 138 | 2 | 8 | 18 | 160 | H5J |

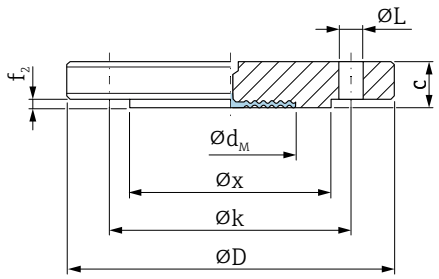
1) Material: AISI 316L
2) The flange raised face is made from the same material as the membrane.
3) Product Configurator order code for "Process connection"

*Maximum diameter of membrane Ød$_M$*

| DN | PN | Ød$_M$ (mm) | | | |
|---|---|---|---|---|---|
| | | 316L | Alloy C276 | Tantalum | Monel (Alloy 400) |
| DN 25 | PN 10-40 | 33.5 | 51 | 51 | 51 |
| DN 50 | PN 10-40 | 60 | 92 | 92 | 92 |
| DN 80 | PN 10-40 | 89 | 127 | 127 | 127 |

*Flange EN1092-1, Form E, flush membrane, diaphragm seal*

Connection dimensions according to EN1092-1.

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*ØD Diameter of flange*
*c Thickness*
*Øx Raised face*
*f2 Raised face*
*Øk Bolt circle diameter*
*ØL Diameter of hole*
*Ød$_M$ Max. diameter of membrane*

Unit mm (in)

| Flange [1) 2)] | | | | | | | Boltholes | | | Order option [3)] |
|---|---|---|---|---|---|---|---|---|---|---|
| DN | PN | Form | ØD | c | Øx | f2 | Number | ØL | Øk | |
| | | | mm | mm | mm | mm | | mm | mm | |
| DN 25 | PN 10-40 | E | 115 | 18 | 57 | 4.5 | 4 | 14 | 85 | H0J |
| DN 50 | PN 10-40 | E | 165 | 20 | 87 | 4.5 | 4 | 18 | 125 | H3J |
| DN 80 | PN 10-40 | E | 200 | 24 | 120 | 4.5 | 8 | 18 | 160 | H5J |

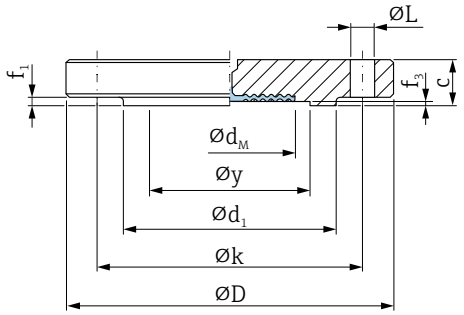
1) Material: AISI 316L
2) The flange raised face is made from the same material as the membrane.
3) Product Configurator order code for "Process connection"

*Maximum diameter of membrane Ød$_M$*

| DN | PN | Ød$_M$ (mm) | | | |
|---|---|---|---|---|---|
| | | 316L | Alloy C276 | Tantalum | Monel (Alloy 400) |
| DN 25 | PN 10-40 | 33.5 | 51 | 51 | 51 |
| DN 50 | PN 10-40 | 60 | 92 | 92 | 92 |
| DN 80 | PN 10-40 | 89 | 127 | 127 | 127 |

*Flange EN1092-1, Form F, flush membrane, diaphragm seal*

Connection dimensions according to EN1092-1.




*ØD Diameter of flange*
*c Thickness*
*Ød$_1$ Raised face*
*$f_1$ Raised face*
*f3 Groove height*
*Øk Bolt circle diameter*
*ØL Diameter of hole*
*Ød$_M$ Max. diameter of membrane*

Unit mm (in)

| Flange [1) 2)] | | | | | | | | | Boltholes | | | Order option [3)] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DN | PN | Form | ØD | c | Ød$_1$ | Øy | $f_1$ | f3 | Number | ØL | Øk | |
| | | | mm | mm | mm | mm | mm | mm | | mm | mm | |
| DN 25 | PN 10-40 | F | 115 | 18 | 68 | 58 | 2 | 4 | 4 | 14 | 85 | H0J |
| DN 50 | PN 10-40 | F | 165 | 20 | 102 | 88 | 3 | 4 | 4 | 18 | 125 | H3J |
| DN 80 | PN 10-40 | F | 200 | 24 | 138 | 121 | 3 | 4 | 8 | 18 | 160 | H5J |

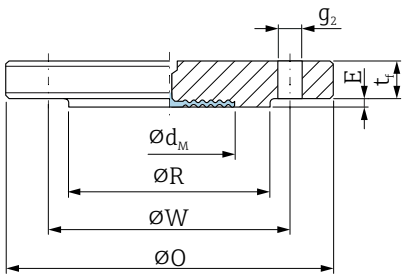
1) Material: AISI 316L
2) The flange raised face is made from the same material as the membrane.
3) Product Configurator order code for "Process connection"

*Maximum diameter of membrane Ød$_M$*

| DN | PN | Ød$_M$ (mm) | | | |
|---|---|---|---|---|---|
| | | 316L | Alloy C276 | Tantalum | Monel (Alloy 400) |
| DN 25 | PN 10-40 | 33.5 | 51 | 51 | 51 |
| DN 50 | PN 10-40 | 60 | 92 | 92 | 92 |
| DN 80 | PN 10-40 | 89 | 127 | 127 | 127 |

*Flange ASME B16.5, Form RF and LM, flush membrane, diaphragm seal*

Connection dimensions in accordance with ASME B 16.5.

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*ØO Diameter of flange*
*tf Thickness*
*ØR Raised face*
*E Raised face*
*ØW Bolt circle diameter*
*Ø$g_2$ Diameter of hole*
*Ø$d_M$ Max. diameter of the membrane*

Unit mm (in)

| **Flange** [1) 2)] | | | | | | **Boltholes** | | | **Order option** [3)] |
|---|---|---|---|---|---|---|---|---|---|
| **NPS** | **Class** | **ØO** | **tf** | **ØR** | **E** | **Number** | **Ø$g_2$** | **ØW** | |
| **in** | | **in** | **in** | **in** | **in** | | **in** | **in** | |
| 1 | 150 | 4.33 | 0.55 | 2.01 | 0.08 | 4 | 5/8 | 3.13 | AAJ |
| 1 | 300 | 4.92 | 0.63 | 2.01 | 0.08 | 4 | 3/4 | 3.5 | AMJ |
| 1 ½ | 150 | 4.92 | 0.63 | 2.87 | 0.08 | 4 | 5/8 | 3.87 | ACJ |
| 1 ½ | 300 | 6.10 | 0.75 | 2.87 | 0.08 | 4 | 7/8 | 4.5 | APJ |
| 2 | 150 | 6 | 0.71 | 3.63 | 0.08 | 4 | 3/4 | 4.75 | ADJ |
| 2 | 300 | 6.5 | 0.81 | 3.63 | 0.08 | 8 | 3/4 | 5 | AQJ |
| 3 | 150 | 7.5 | 0.88 | 5 | 0.08 | 4 | 3/4 | 6 | AFJ |
| 3 | 300 | 8.23 | 1.06 | 5 | 0.08 | 8 | 7/8 | 6.63 | ASJ |

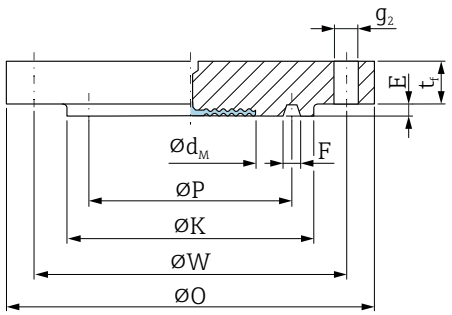
1) Material: AISI 316L
2) The flange raised face is made from the same material as the membrane.
3) Product Configurator order code for "Process connection"

*Maximum diameter of membrane $Ød_M$*

| NPS | Class | $Ød_M$ (in) | | | |
|---|---|---|---|---|---|
| | | 316L | Alloy C276 | Tantalum | Monel (Alloy 400) |
| 1 | 150 | 1.32 | 2.01 | 2.01 | 2.01 |
| 1 | 300 | 1.32 | 2.01 | 2.01 | 2.01 |
| 1 ½ | 150 | 1.77 | 2.87 | 2.87 | 2.87 |
| 1 ½ | 300 | 1.77 | 2.87 | 2.87 | 2.87 |
| 2 | 150 | 2.36 | 3.63 | 3.63 | 3.63 |
| 2 | 300 | 2.36 | 3.63 | 3.63 | 3.63 |
| 3 | 150 | 3.50 | 5.00 | 5.00 | 5.00 |
| 3 | 300 | 3.50 | 5.00 | 5.00 | 5.00 |

*Flange ASME B16.5, Form RTJ, flush membrane, diaphragm seal*

Connection dimensions in accordance with ASME B 16.5.




A0059096

*ØO Diameter of flange*
*tf Thickness*
*ØK Raised face*
*E Raised face*
*F Groove width*
*P Pitch circle diameter*
*ØW Bolt circle diameter*
*Øg$_2$ Diameter of hole*
*Ød$_M$ Max. diameter of the membrane*

| Flange [1) 2)] | | | | | | | | Boltholes | | | Order option [3)] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NPS | Class | ØO | tf | P | E | F | ØK | Number | Øg$_2$ | ØW | |
| in | | in | in | in | in | in | in | | in | in | |
| 1 | 150 | 4.33 | 0.55 | 47.62 | 6.35 | 8.74 | 63.5 | 4 | 5/8 | 3.13 | AAJ |
| 1 | 300 | 4.92 | 0.63 | 50.8 | 6.35 | 8.74 | 69.8 | 4 | 3/4 | 3.5 | AMJ |
| 1 ½ | 150 | 4.92 | 0.63 | 65.07 | 6.35 | 8.74 | 82.6 | 4 | 5/8 | 3.87 | ACJ |
| 1 ½ | 300 | 6.10 | 0.75 | 68.28 | 6.35 | 8.74 | 90.4 | 4 | 7/8 | 4.5 | APJ |
| 2 | 150 | 6 | 0.71 | 82.55 | 6.35 | 8.74 | 102 | 4 | 3/4 | 4.75 | ADJ |
| 2 | 300 | 6.5 | 0.81 | 82.55 | 7.92 | 11.91 | 108 | 8 | 3/4 | 5 | AQJ |
| 3 | 150 | 7.5 | 0.88 | 114.30 | 6.35 | 8.74 | 133 | 4 | 3/4 | 6 | AFJ |
| 3 | 300 | 8.23 | 1.06 | 123.82 | 7.92 | 11.91 | 146 | 8 | 7/8 | 6.63 | ASJ |

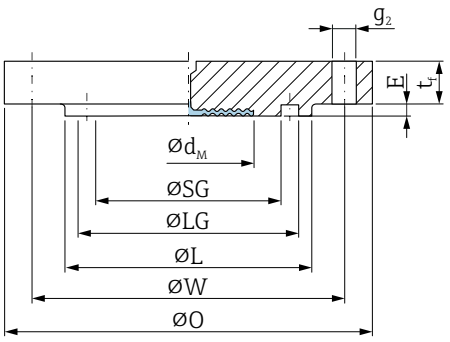
1) Material: AISI 316L
2) The flange raised face is made from the same material as the membrane.
3) Product Configurator order code for "Process connection"

*Maximum diameter of membrane $Ød_M$*

| NPS | Class | $Ød_M$ (in) | | | |
|---|---|---|---|---|---|
| | | 316L | Alloy C276 | Tantalum | Monel (Alloy 400) |
| 1 | 150 | 1.32 | 2.01 | 2.01 | 2.01 |
| 1 | 300 | 1.32 | 2.01 | 2.01 | 2.01 |
| 1 ½ | 150 | 1.77 | 2.87 | 2.87 | 2.87 |
| 1 ½ | 300 | 1.77 | 2.87 | 2.87 | 2.87 |
| 2 | 150 | 2.36 | 3.63 | 3.63 | 3.63 |
| 2 | 300 | 2.36 | 3.63 | 3.63 | 3.63 |
| 3 | 150 | 3.50 | 5.00 | 5.00 | 5.00 |
| 3 | 300 | 3.50 | 5.00 | 5.00 | 5.00 |

*Flange ASME B16.5, Form LG, flush membrane, diaphragm seal*

Connection dimensions in accordance with ASME B 16.5.




A0059097

*ØO Diameter of flange*
*tf Thickness*
*ØL Raised face*
*f Raised face*
*SG Groove internal diameter*
*LG Groove internal diameter*
*ØW Bolt circle diameter*
*Øg$_2$ Diameter of hole*
*Ød$_M$ Max. diameter of the membrane*

| Flange [1) 2)] | | | | | | | | Boltholes | | | Order option [3)] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NPS | Class | ØO | tf | ØL | f | SG | LG | Number | Øg$_2$ | ØW | |
| in | | in | in | in | in | mm | mm | | in | in | |
| 1 | 150 | 4.33 | 0.55 | 2.01 | 0.08 | 36.6 | 52.3 | 4 | 5/8 | 3.13 | AAJ |
| 1 | 300 | 4.92 | 0.63 | 2.01 | 0.08 | 36.6 | 52.3 | 4 | 3/4 | 3.5 | AMJ |
| 1 ½ | 150 | 4.92 | 0.63 | 2.87 | 0.08 | 52.3 | 74.7 | 4 | 5/8 | 3.87 | ACJ |
| 1 ½ | 300 | 6.10 | 0.75 | 2.87 | 0.08 | 52.3 | 74.7 | 4 | 7/8 | 4.5 | APJ |
| 2 | 150 | 6 | 0.71 | 3.63 | 0.08 | 71.4 | 93.7 | 4 | 3/4 | 4.75 | ADJ |
| 2 | 300 | 6.5 | 0.81 | 3.63 | 0.08 | 71.4 | 93.7 | 8 | 3/4 | 5 | AQJ |
| 3 | 150 | 7.5 | 0.88 | 5 | 0.08 | 106.4 | 128.5 | 4 | 3/4 | 6 | AFJ |
| 3 | 300 | 8.23 | 1.06 | 5 | 0.08 | 106.4 | 128.5 | 8 | 7/8 | 6.63 | ASJ |

1) Material: AISI 316L
2) The flange raised face is made from the same material as the membrane.
3) Product Configurator order code for "Process connection"

*Maximum diameter of membrane $Ød_M$*

| NPS | Class | $Ød_M$ (in) | | | |
|---|---|---|---|---|---|
| | | 316L | Alloy C276 | Tantalum | Monel (Alloy 400) |
| 1 | 150 | 1.32 | 2.01 | 2.01 | 2.01 |
| 1 | 300 | 1.32 | 2.01 | 2.01 | 2.01 |
| 1 ½ | 150 | 1.77 | 2.87 | 2.87 | 2.87 |
| 1 ½ | 300 | 1.77 | 2.87 | 2.87 | 2.87 |
| 2 | 150 | 2.36 | 3.63 | 3.63 | 3.63 |
| 2 | 300 | 2.36 | 3.63 | 3.63 | 3.63 |
| 3 | 150 | 3.50 | 5.00 | 5.00 | 5.00 |
| 3 | 300 | 3.50 | 5.00 | 5.00 | 5.00 |

## Weight

*Process connections*

| Weight [1] | Order option [2] |
|---|---|
| 1.20 kg (2.65 lb) | AAJ |
| 1.50 kg (3.31 lb) | AMJ |
| 1.60 kg (3.53 lb) | ACJ |
| 2.70 kg (5.95 lb) | APJ |
| 2.50 kg (5.51 lb) | ADJ |
| 3.40 kg (7.50 lb) | AQJ |
| 5.10 kg (11.25 lb) | AFJ |
| 7.00 kg (15.44 lb) | ASJ |
| 1.70 kg (3.75 lb) | AXJ |
| 4.30 kg (9.48 lb) | A0J |
| 8.60 kg (18.96 lb) | A1J |
| 13.30 kg (29.33 lb) | BAJ |
| 3.70 kg (8.16 lb) | BDJ |
| 10.30 kg (22.71 lb) | BFJ |
| 21.80 kg (48.07 lb) | BGJ |
| 15.80 kg (34.84 lb) | BLJ |
| 39.00 kg (86.00 lb) | BMJ |
| 1.70 kg (3.75 lb) | BJJ |
| 1.38 kg (3.04 lb) | H0J |
| 3.20 kg (7.06 lb) | H3J |
| 5.54 kg (12.22 lb) | H5J |

1) Total weight consisting of sensor assembly and process connection.
2) Product Configurator order code for "Process connection"

### Materials in contact with process

*Membrane material*

- 316L
- Alloy C276
  The flange raised face is made from the same material as the membrane.
- Tantalum
  The flange raised face is made from the same material as the membrane.
- Monel (Alloy 400)
  The flange raised face is made from the same material as the membrane.

*Membrane coating*

PTFE:
- Coating: 50 to 65 µm (0.0019 to 0.0025 µin)
- Maximum process pressure:
  - Process temperature ≤ +40 °C (+104 °F): maximum process pressure +150 bar (+2 175 psi)
  - Process temperature ≤ +150 °C (+302 °F): maximum process pressure +50 bar (+725 psi)
  - Process temperature ≤ +200 °C (+392 °F): maximum process pressure +20 bar (+290 psi)
- Permitted process temperature:
  - −40 to +260 °C (−40 to +500 °F)
  - Under vacuum or negative pressure conditions at $p_{abs}$ ≤ 1 bar: −40 to +200 °C (−40 to +392 °F)
- PTFE coating serves as anti-adhesive layer and protects against abrasion

Gold:
Coating: 25 µm (0.00098 µin)

### Materials not in contact with process

*Armor for capillary*

*316L*

- Capillary: ASTM 312 - 316L
- Protective sleeve for capillary: ASTM A240 - 316 L

Certificates and approvals

**Corrosion test**

Standards and test methods are available for specific versions.

Contact Endress+Hauser for a more detailed specification with the selected system configuration and order code.

**Overfill protection system**

This device version **has not** been validated as overfill protection in accordance with §63 WHG (German Water Resources Act).

**Marine approval**

This device version **does not** have marine approval.

**CRN approval**

This device version **does not** have CRN approval.

**Drinking water approval**

This device version does **not** have drinking water approval.

**Test reports**

*Test, certificate, declarations*

This device version does **not** meet the following requirements:
- AD 2000 (wetted metal parts), declaration, excluding process membrane
- NACE MR0175 / ISO 15156 (wetted metallic parts), declaration
- ASME B31.3 process piping, declaration
- ASME B31.1 power piping, declaration
- NACE MR0103/ISO 17945 (wetted metal parts), test report

The following tests **cannot** be provided for this device version:
- Helium leak test, internal procedure, test report
- Welding documentation, wetted/pressurized seams
- Inspection certificate 3.1, EN10204 (material certificate, wetted metallic parts)
- PMI test, internal procedure (wetted metallic parts), test report
- Penetrant testing ISO23277-1 (PT), wetted/pressurized metallic parts, test report
- NACE MR0103/ISO 17945 (wetted metal parts), test report

*Manufacturer declarations*

**No** valid manufacturer declarations are currently available for this device version.

Contact Endress+Hauser if necessary.

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Endress+Hauser

People for Process Automation