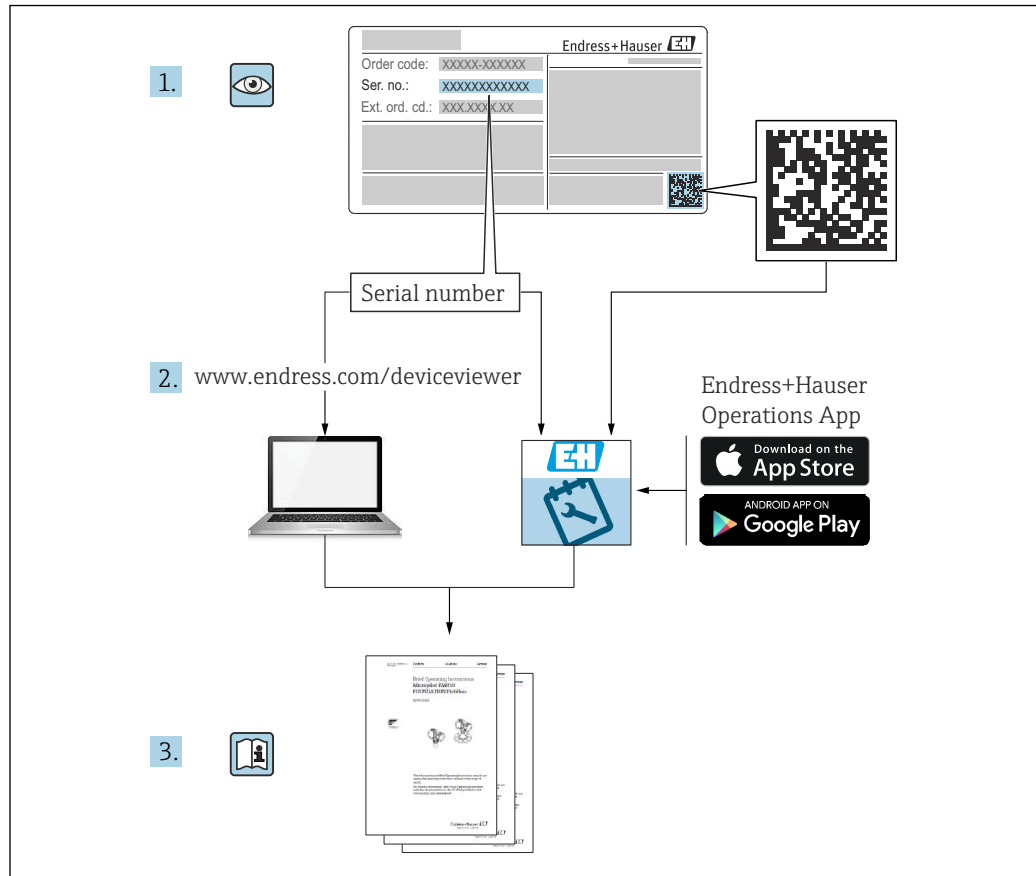


# Operating Instructions

## Cerabar PMP43

Process pressure measurement  
IO-Link





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

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

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# 1 About this document

## 1.1 Document function

These Operating Instructions contain all the information required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to installation, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.

## 1.2 Symbols

### 1.2.1 Safety symbols

#### **DANGER**

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

#### **WARNING**

This symbol alerts you to a 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 Communication-specific symbols

#### **Bluetooth®:**

Wireless data transmission between devices over a short distance.

#### **IO-Link:** **IO-Link**

Communications system for connecting intelligent sensors and actuators to an automation system. In the IEC 61131-9 standard, IO-Link is standardized under the description "Single-drop digital communication interface for small sensors and actuators (SDCI)".

### 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, ...

## 1.3 List of abbreviations

### **PN**

Nominal pressure

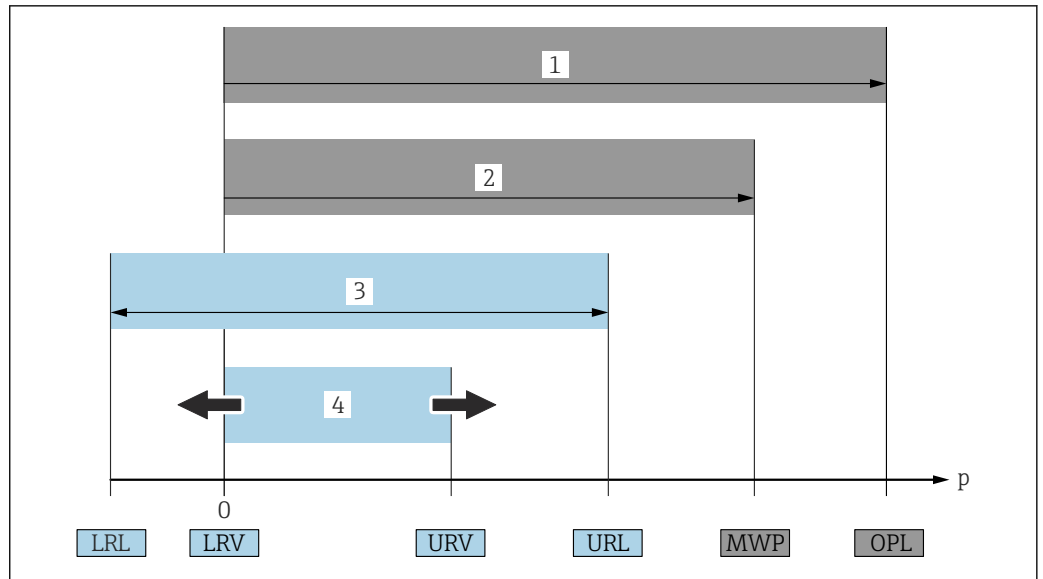
### **Operating tool**

The term "operating tool" is used in place of the following operating software:

- FieldCare / DeviceCare for operation via IO-Link communication and PC
- SmartBlue app for operation using an Android or iOS smartphone or tablet

### **PLC**

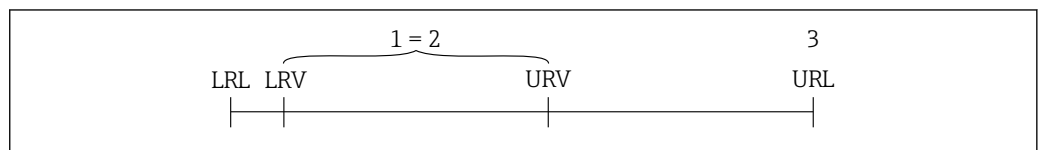
Programmable logic controller (PLC)



A0029505

- 1 OPL: The OPL (overpressure limit = measuring cell overload limit) for the device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection must be taken into consideration in addition to the measuring cell. Pay attention to the pressure-temperature dependency. The OPL may only be applied for a short period of time.
  - 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. Pay attention to the 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



A0029545

- 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

 For an overview of the scope of the associated Technical Documentation, refer to the following:

- *Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

## 1.6 Registered trademarks

### 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.

### Bluetooth®

The *Bluetooth*® word mark and logos are registered trademarks owned by the Bluetooth SIG, Inc. and any use of such marks by Endress+Hauser is under license. Other trademarks and trade names are those of their respective owners.

### IO-Link®

Is a registered trademark. It may only be used in conjunction with products and services by members of the IO-Link Community or by non-members who hold an appropriate license. For more detailed information on its use, refer to the rules of the IO-Link Community at: [www.io.link.com](http://www.io.link.com).

# 2 Basic safety instructions

## 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 starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- ▶ Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

- ▶ Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- ▶ Follow the instructions in this manual.

## 2.2 Intended use

The Cerabar is a pressure transmitter for measuring level and pressure.



**Incorrect use**

The manufacturer is not liable for harm caused by improper or unintended use.

Avoid mechanical damage:

- ▶ Do not touch or clean device surfaces with pointed or hard objects.

Clarification 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.

**Residual risks**

During operation, the housing can heat up to 80 °C (176 °F) due to heat transfer from the process and power loss in the electronics. When in operation, the sensor can reach a temperature close to the medium temperature.

Danger of burns from contact with surfaces!

- ▶ In the event of elevated fluid temperatures, ensure protection against contact to prevent burns.

## 2.3 Workplace safety

For work 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 ensuring that the device is in good working order.

**Modifications to the device**

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

- ▶ If modifications are nevertheless required, consult with the manufacturer.

**Repair**

To ensure continued operational safety and reliability:

- ▶ Only use original accessories.

**Hazardous area**

To eliminate the risk of danger to persons or the facility when the device is used in the hazardous 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 hazardous area.
- ▶ Comply with the instructions in the separate supplementary documentation, which is an integral part of this manual.

## 2.5 Product safety

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

The device fulfills general safety requirements and legal requirements. It also complies with the EU directives listed in the device-specific EU declaration of conformity. Endress+Hauser confirms this fact by affixing the CE mark to the device.

## 2.6 IT security

The manufacturer warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

## 2.7 Device-specific IT security

The device offers specific functions to support protective measures by the operator. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. The user role can be changed with an access code (applies to operation via the onsite display, Bluetooth or FieldCare, DeviceCare, asset management tools e.g. AMS, PDM).

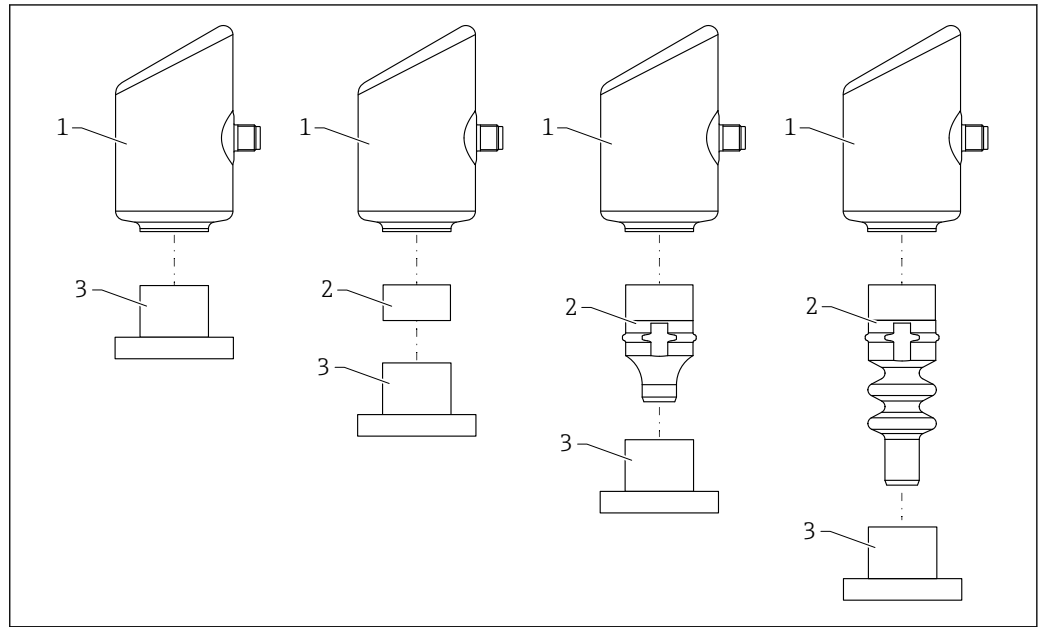
### 2.7.1 Access via Bluetooth® wireless technology

Secure signal transmission via Bluetooth® wireless technology uses an encryption method tested by the Fraunhofer Institute.

- Without the SmartBlue app, the device is not visible via Bluetooth® wireless technology.
- Only one point-to-point connection is established between the device and a smartphone or tablet.
- The Bluetooth® wireless technology interface can be disabled via local operation or via SmartBlue/FieldCare/DeviceCare.

## 3 Product description

### 3.1 Product design

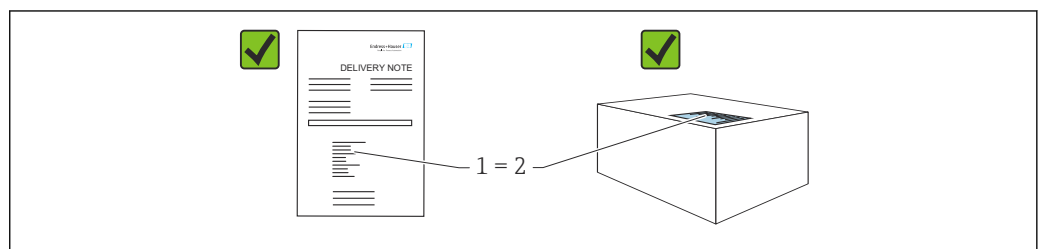


A0055927

- 1 Housing
- 2 Configuration-dependent mounted parts
- 3 Process connection

## 4 Incoming acceptance and product identification

### 4.1 Incoming acceptance



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Check the following during incoming acceptance:

- 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 provided?
- If required (see nameplate), are the Safety Instructions (XA) provided?



If one of these conditions is not met, please contact the manufacturer's sales office.

## 4.2 Product identification

The following options are available for identification of the device:

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

### 4.2.1 Nameplate

The information that is required by law and is relevant to the device is shown on the nameplate, e.g.:

- Manufacturer identification
- Order number, extended order code, serial number
- Technical data, degree of protection
- Firmware version, hardware version
- Approval-specific information
- DataMatrix code (information about the device)

Compare the data on the nameplate with your order.

### 4.2.2 Manufacturer address

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

## 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

–40 to +85 °C (–40 to +185 °F)

### 4.3.2 Transporting the product to the measuring point



#### 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.

## 5 Installation

### 5.1 Installation requirements

**i** During installation, it is important to ensure that the sealing element used has a permanent operating temperature that corresponds to the maximum temperature of the process.

- Devices in North America are intended for indoor use
- Devices are suitable for use in wet environments in accordance with IEC/EN 61010-1
- Use the operating menu to position the local display to ensure optimum readability
- The local display can be adapted to the light conditions (for color scheme, see  operating menu)
- The devices are mounted according to the same guidelines as manometers
- Protect the housing against impact

### 5.2 Installing the device

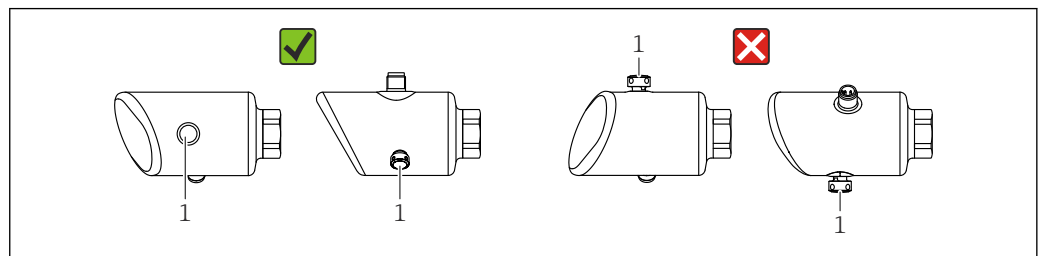
#### 5.2.1 Orientation

##### NOTICE

**If a heated device is cooled during a cleaning process (e.g. by cold water), a vacuum develops for a short time. Moisture can get into the measuring cell via the pressure compensation filter (1) as a result of the vacuum. Whether or not a filter element is installed depends on the device version.**

Device could be destroyed!

- Mount the device as follows.



A0054016

- Keep the filter element (1) free from contamination.
- The orientation of the device depends on the measuring application.
- A position-dependent zero point shift (when the vessel is empty the measured value does not display zero) can be corrected

### 5.3 Post-mounting checks

- ☐ Is the device undamaged (visual inspection)?
- ☐ Are the measuring point identification and labeling correct (visual inspection)?
- ☐ Is the device properly secured?
- ☐ Is the filter element pointing downwards at an angle or to the side?
- ☐ Does the device comply with the measuring point specifications?

For example:

- ☐ Process temperature
- ☐ Pressure
- ☐ Ambient temperature

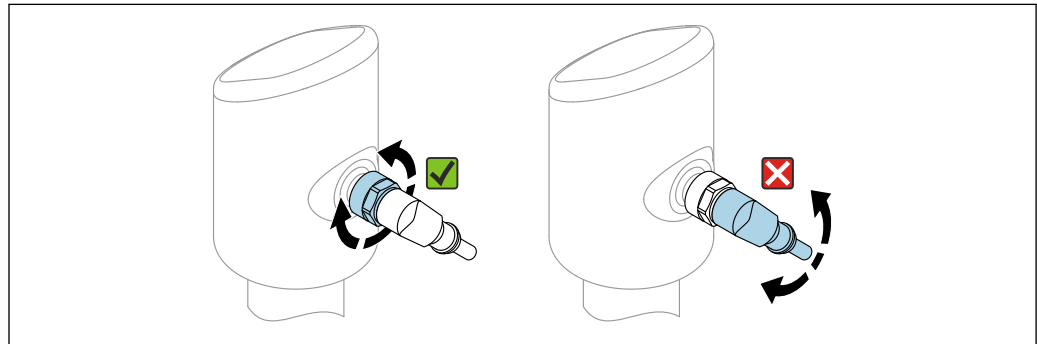
- ☐ Measuring range

## 6 Electrical connection

### 6.1 Connecting the device

#### 6.1.1 Notes for M12 plug

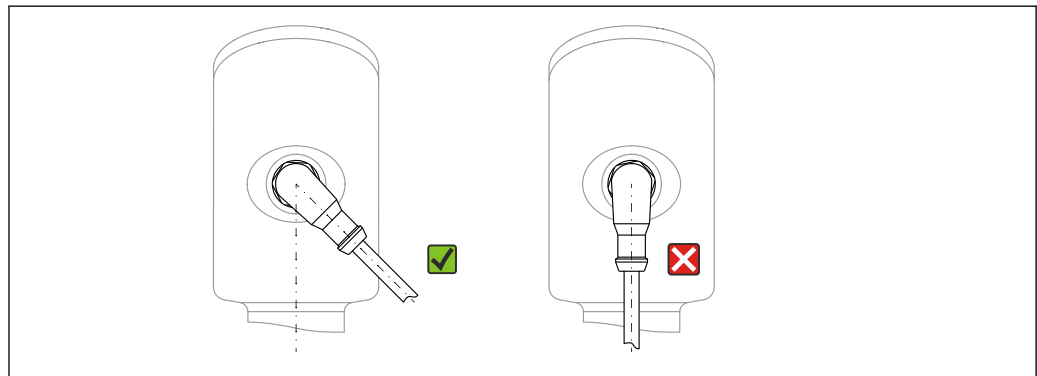
Turn the plug by the nut only, maximum torque 0.6 Nm (0.44 lbf ft).



A0058673

 1 M12 plug connection

Correct alignment of the M12 plug: Approx. 45° to the vertical axis.



A0058672

 2 Alignment of M12 plug

#### 6.1.2 Potential equalization

If necessary, establish potential equalization using the process connection or the grounding clamp supplied by the customer.

#### 6.1.3 Supply voltage

DC 12 to 30 V on a DC power unit

IO-Link communication is guaranteed only if the supply voltage is at least 18 V.

 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.

Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.

### 6.1.4 Power consumption

Non-hazardous area: To meet device safety specifications according to the IEC 61010 standard, the installation must ensure that the maximum current is limited to 500 mA.

### 6.1.5 Overvoltage protection

The device satisfies the IEC 61326-1 product standard (Table 2 Industrial environment). Depending on the type of connection (DC power supply, input line, output line), different test levels are used to prevent transient overvoltages (IEC 61000-4-5 Surge) in accordance with IEC EN 61326-1: Test level for DC power supply lines and IO lines: 1 000 V wire to ground.

#### Overvoltage category

In accordance with IEC 61010-1, the device is intended for use in networks with overvoltage protection category II.

### 6.1.6 Range of adjustment

Switch points can be configured via IO-Link.

Lower range value (LRV) and upper range value (URV) can be set anywhere within the sensor range (LRL - URL).

### 6.1.7 Switching capacity

- Switch status ON:  $I_a \leq 200 \text{ mA}$  <sup>1)</sup>; Switch status OFF:  $I_a < 0.1 \text{ mA}$  <sup>2)</sup>
- Switch cycles:  $> 1 \cdot 10^7$
- Voltage drop PNP:  $\leq 2 \text{ V}$
- Overload protection: Automatic load testing of switching current;
  - Max. capacitive load:  $1 \mu\text{F}$  at max. supply voltage (without resistive load)
  - Max. cycle duration:  $0.5 \text{ s}$ ; min.  $t_{\text{on}}$ :  $40 \mu\text{s}$
  - Periodic disconnection from protective circuit in the event of overcurrent ( $f = 1 \text{ Hz}$ )

### 6.1.8 Terminal assignment

#### WARNING

#### Supply voltage might be connected!

Risk of electric shock and/or explosion

- ▶ Ensure that no supply voltage is applied when connecting.
- ▶ The supply voltage must match the specifications on the nameplate.
- ▶ A suitable circuit breaker should be provided for the device in accordance with IEC 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.
- ▶ Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.

1) If the "1 x PNP + 4 to 20 mA" outputs are used at the same time, the switch output OUT1 can be loaded with up to 100 mA load current over the entire temperature range. The switching current may be up to 200 mA up to an ambient temperature of  $50^\circ\text{C}$  ( $122^\circ\text{F}$ ) and up to a process temperature of  $85^\circ\text{C}$  ( $185^\circ\text{F}$ ). If the "1 x PNP" or "2 x PNP" configuration is used, the switch outputs can be loaded with a total of up to 200 mA over the entire temperature range.

2) Different for switch output OUT2, for switch status OFF:  $I_a < 3.6 \text{ mA}$  and  $U_a < 2 \text{ V}$  and for switch status ON: voltage drop PNP:  $\leq 2.5 \text{ V}$

**⚠ WARNING****An incorrect connection compromises the electrical safety!**

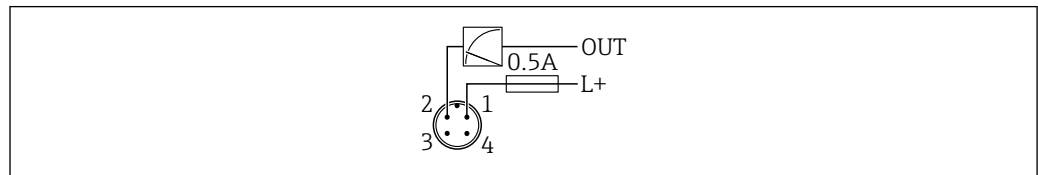
- ▶ Non-hazardous area: To meet device safety specifications according to the IEC 61010 standard, the installation must ensure that the maximum current is limited to 500 mA.

**NOTICE****Damage to analog input of PLC resulting from incorrect connection**

- ▶ Do not connect the active PNP switch output of the device to the 4 to 20 mA input of a PLC.

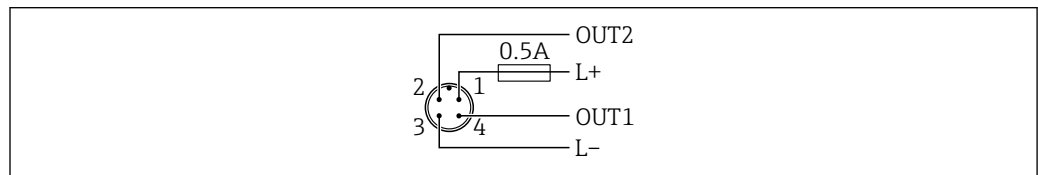
Connect the device in the following order:

1. Check that the supply voltage corresponds to the supply voltage indicated on the nameplate.
2. Connect the device as indicated in the following diagram.
3. Switch on the supply voltage.

**2-wire**

A0052660

- 1 Supply voltage L+, brown wire (BN)
- 2 OUT (L-), white wire (WH)

**3-wire or 4-wire**

A0052457

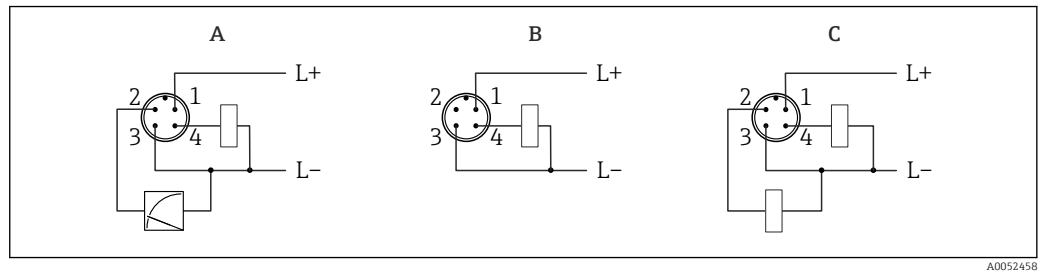
- 1 Supply voltage L+, brown wire (BN)
- 2 Switch or analog output (OUT2), white wire (WH)
- 3 Supply voltage L-, blue wire (BU)
- 4 Switch output or IO-Link output (OUT1), black wire (BK)



If the device detects an IO-Link master at OUT1, the output is used for digital IO-Link communication. If not, then OUT1 is automatically configured as a switch output (SIO mode).



### Connection examples



- A 1 x PNP switch and analog output  
 B 1 x PNP switch output (current output must be deactivated. If the current output has not been deactivated, a message appears. In the case of local display: fault is displayed. In the case of LED indicator: operating status LED permanently red), default setting  
 C 2 x PNP switch output (set second output to switch output)

## 6.2 Ensuring the degree of protection

For mounted M12 connecting cable: IP66/68/69, NEMA type 4X/6P

### NOTICE

#### Loss of IP protection class due to incorrect installation!

- ▶ 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 the intended protection class.

## 6.3 Post-connection check

- ☐ Is the device or cable undamaged (visual check)?
- ☐ Does the cable used comply with the requirements?
- ☐ Is the mounted cable strain-relieved?
- ☐ Is the screw connection properly mounted?
- ☐ Does the supply voltage match the specifications on the nameplate?
- ☐ No reverse polarity, terminal assignment correct?
- ☐ If supply voltage is present: is the device ready for operation and does an indication appear on the onsite display or is the green operating status LED lit?

# 7 Operation options

## 7.1 Overview of operation options

- Operation via , LED indicator operating key
- Operation via onsite display
- Operation via Bluetooth®
- Operation via Endress+Hauser operating tool
- Operation via IO-Link master

## 7.2 Structure and function of the operating menu

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

The local display has a reduced menu to configure basic settings on the device.

The full operating menu is available via the SmartBlue app, allowing more complex settings to be configured on the device.

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

### 7.2.1 Overview of the operating menu

#### "Guidance" menu

The Guidance main menu contains functions that enable the user to carry out basic tasks quickly, e.g. commissioning. This menu primarily consists of guided wizards and special functions covering multiple areas.

#### "Diagnostics" menu

Diagnostic information and settings as well as help for troubleshooting.

#### "Application" menu

Functions for detailed adjustment of the process for optimum integration of the device into the application.

#### "System" menu

System settings for device management, user administration or safety.

### 7.2.2 User roles and related access authorization

This device supports 2 user roles: **Maintenance** and **Operator**

- The **Maintenance** user role (as delivered to customer) has read/write access.
- The **Operator** user role has read access only.

The current user role is displayed in the main menu.

The device parameters can be fully configured with the **Maintenance** user role. Afterwards, access to the configuration can be locked by assigning a password. This password acts as an access code and protects device configuration from unauthorized access.

Blocking changes the **Maintenance** user role to the **Operator** user role. The configuration can be accessed again by entering the access code.

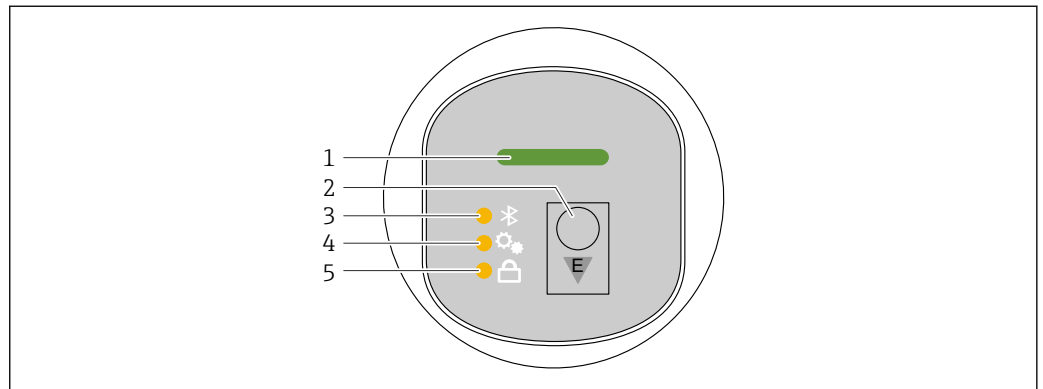
If an incorrect access code is entered, the user obtains the access rights of the **Operator** role.

Assign password, change user role:

- Navigation: System → User management

## 7.3 Access to operating menu via LED indicator

### 7.3.1 Overview



A0052426

- 1 Operating status LED
- 2 Operating key "E"
- 3 Bluetooth LED
- 4 Position adjustment LED
- 5 Keypad lock LED



Operation via the LED indicator is not possible if the Bluetooth connection is enabled.

#### Operating status LED (1)

See diagnostic events section.

#### Bluetooth LED (3)

- LED lit: Bluetooth® connection enabled
- LED not lit: Bluetooth® connection disabled or Bluetooth® option not ordered
- LED flashing: Bluetooth® connection established

#### Keypad lock LED (5)

- LED lit: Key locked
- LED not lit: Key released

### 7.3.2 Operating

The device is operated by pressing operating key "E" briefly (< 2 s) or pressing and holding it (> 2 s).

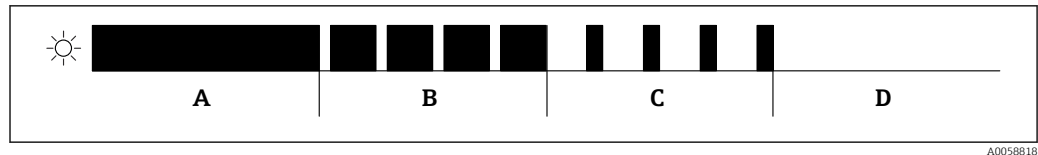
#### Navigation and LED flashing status

Press operating key "E" briefly: Switch between the functions

Press and hold down operating key "E": Select a function

The LED flashes if a function is selected.

Different flashing states indicate whether the function is active or inactive:



3 Graphic display of different flashing states of the LEDs when a function is selected

- A Function active
- B Function active and selected
- C Function inactive and selected
- D Function inactive

### Disabling the keypad lock

1. Press and hold down operating key "E".  
↳ Bluetooth LED flashes.
2. Briefly press operating key "E" repeatedly until the keypad lock LED flashes.
3. Press and hold down operating key "E".  
↳ Keypad lock is disabled.

### Enabling or disabling Bluetooth® connection

1. If necessary, disable the keypad lock.
2. Repeatedly press the "E" key briefly until the Bluetooth LED flashes.
3. Press and hold down operating key "E".  
↳ Bluetooth® connection is enabled (Bluetooth LED is lit) or Bluetooth® is disabled (Bluetooth LED goes out).

## 7.4 Access to operating menu via local display

Functions:

- Display measured values and fault and notice messages
- Display a symbol in the event of an error
- Electronically adjustable local display (automatic or manual adjustment of display in 90° increments)
  -  The measured value display rotates automatically depending on the orientation when the device is started.<sup>3)</sup>
- Basic settings via the local display with touch control<sup>4)</sup>
  - Locking On/Off
  - Select the operating language
  - Start Heartbeat Verification with passed/failed feedback message on the local display
  - Bluetooth On/Off
  - Commissioning wizard for basic settings
  - Read the device information, such as the name, serial number and firmware version
  - Active diagnostics and status
  - Device reset
  - Invert colors for bright lighting conditions

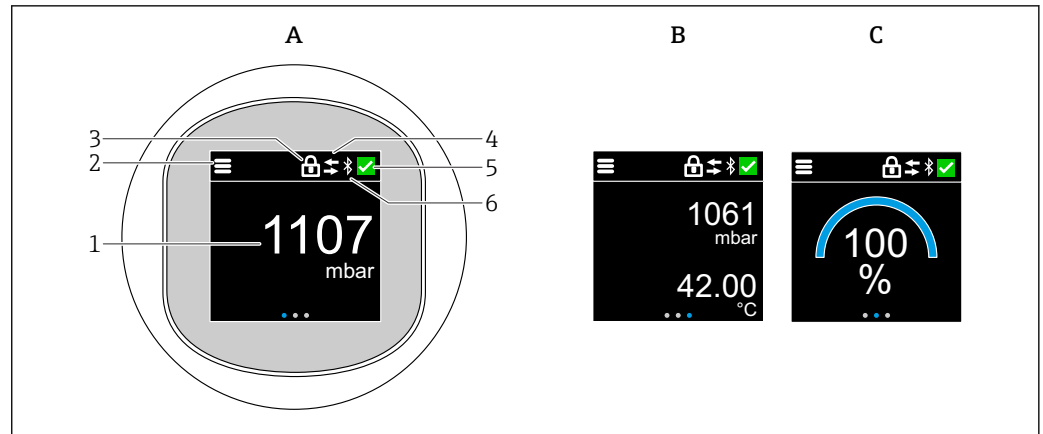
The backlighting is reduced with lower terminal voltage.

 The following figure is an example. The information displayed depends on the settings of the local display.

Optional display by swiping from left to right (see A, B and C in the following graphic). Swiping only works if the display has been ordered with touch control and the display has been unlocked beforehand.

3) The measured value display only rotates automatically if automatic alignment is switched on.

4) In devices without touch control, settings can be made using the SmartBlue app.

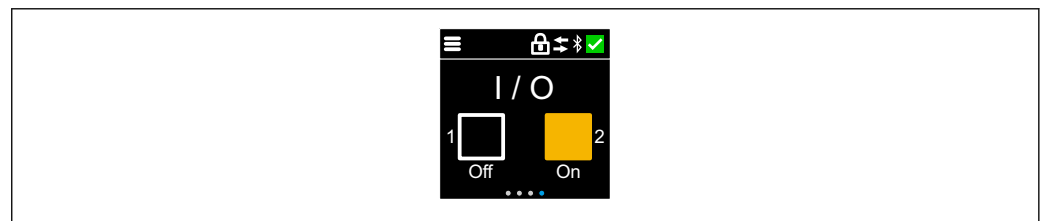


A0052427

- A Standard display: 1 measured value with unit (adjustable)  
 B 2 measured values, each with unit (adjustable)  
 C Graphic measured value display in %  
 1 Measured value  
 2 Menu or home symbol  
 3 Locking (locking only visible if locked via the "Safety mode" wizard. "Safety mode" wizard is available if the WHG option or Heartbeat Verification option have been selected)  
 4 Communication (symbol appears if communication is enabled)  
 5 Diagnostic symbol  
 6 Bluetooth (symbol flashes when Bluetooth connection is enabled)

The default display can be permanently set via the operating menu.

The physical switch outputs are displayed via an additional setting in the local display.



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- D Switch status display of outputs OUT1 and OUT2

**i** When the switch output is active, the button turns yellow and the display changes from "Off" to "On".

### 7.4.1 Operation

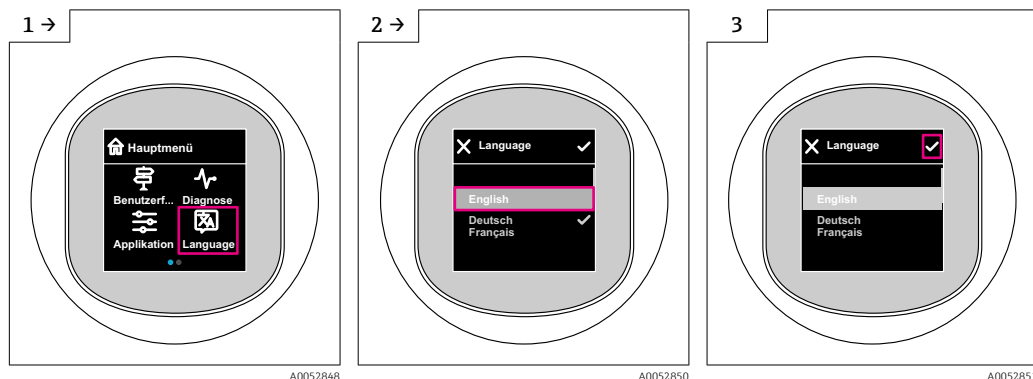
#### Navigation

Navigation by swiping with finger.

**i** Operation via the LED indicator is not possible if the Bluetooth connection is enabled.

### Selecting option and confirming

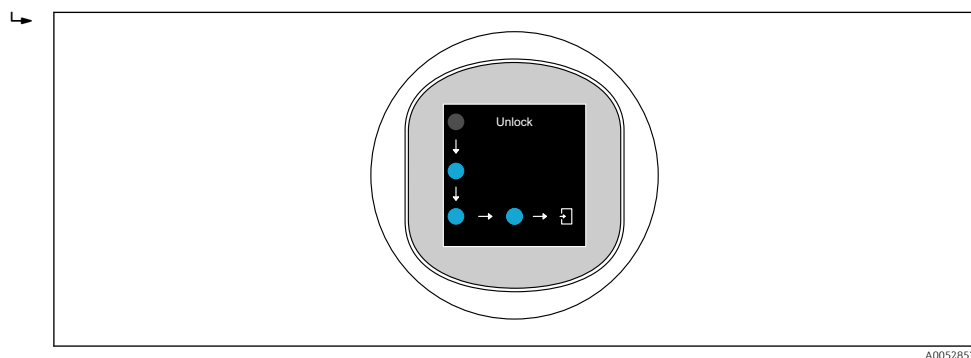
Select the required option and confirm using the checkmark at the top right (see screens below).



## 7.5 Onsite display, locking or unlocking procedure

### 7.5.1 Unlocking procedure

1. Tap the center of the display for the following view:



2. Use a finger to follow the arrows without interruption.  
 ↳ The display is unlocked.

### 7.5.2 Locking procedure

**i** Operation locks automatically (except in **Safety mode** wizard):

- after 1 min on the main page
- after 10 min within the operating menu

## 7.6 Access to the operating menu via the operating tool

### 7.6.1 Connecting the operating tool

Access via the operating tool is possible:

- Via IO-Link, e.g. Fieldport SFP20, via IODD Interpreter DTM in FieldCare/DeviceCare
- Via Bluetooth® wireless technology (optional) with the SmartBlue app

## 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 takes place via digital communication (IO-Link).

Typical functions:

- Parameter configuration of transmitters
- Loading and saving of device data (upload/download)
- Documentation of the measuring point
- Visualization of the measured value memory (line recorder) and event logbook



For additional information on FieldCare: See operating instructions for FieldCare.

## DeviceCare

### Range of functions

Tool to connect and configure Endress+Hauser field devices.



For details, see Innovation Brochure IN01047S.

## FieldXpert SMT70, SMT77

The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous (Ex Zone 2) and non-hazardous areas. It is suitable for commissioning and maintenance staff. It manages Endress+Hauser and third-party field instruments with a digital communication interface and documents the progress of the work. The SMT70 is designed as a complete solution. It comes with a pre-installed driver library and is an easy-to-use, touch-enabled tool for managing field devices throughout their entire life cycle.



Technical Information TI01342S

The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1.

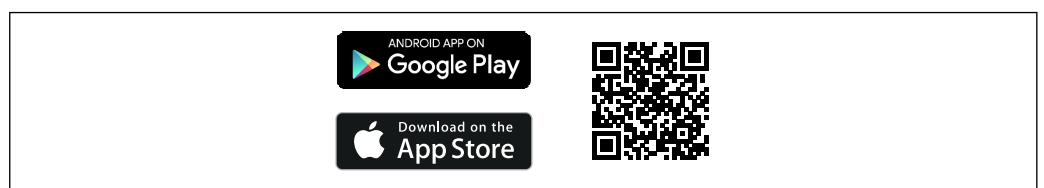


Technical Information TI01418S

## 7.6.2 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



4 QR code for free Endress+Hauser SmartBlue App

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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.

## 8 System integration

### 8.1 IO-Link download

#### Download device drivers

- <http://www.endress.com/download>
- Select **device drivers and firmware**
- **Type:** Select "IO Device Description (IODD)"
- Enter **product root**
- **Search**  
The result is displayed

#### ioddfinder

- <https://ioddfinder.io-link.com/>
- Search by
  - Manufacturer
  - Article number
  - Product type
  - Device ID

#### Download IO-Link function block library (for Siemens)

- <http://www.endress.com/download>
- Select **software**
- **Text search:** Enter IO-Link
- Enter **product root**
- **Search**  
The result is displayed

### 8.2 Process data

The device has 2 outputs with multiple configuration options.

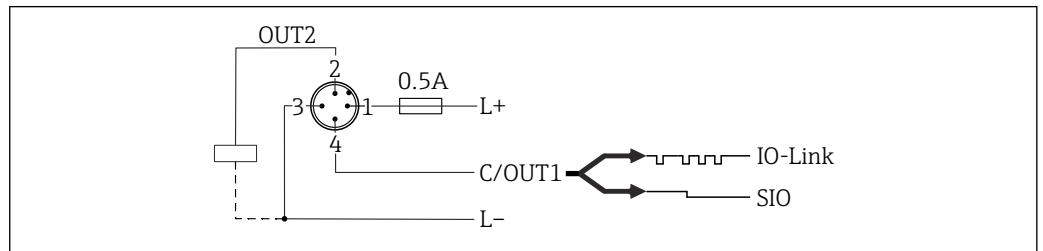
The status of the switch outputs (SSC), the measured value (MDC) and the Endress+Hauser-specific extended device status are transmitted via IO-Link in the form of



process data. The process data are cyclically transmitted in accordance with the IO-Link Smart Sensor Profile type 4.3.

If the device detects an IO-Link master on pin 4 of the M12 plug, the output is used for digital IO-Link communication. If not, then OUT1 is automatically configured as a switch output (SIO mode).

The process data are transmitted cyclically in accordance with the function class "Measurement Data Channel, (floating point) [0x800E]". For the switch outputs, 1 or DC 24 V corresponds to the logical state "Closed" on the switch output.



A0054142

- 1 Supply voltage L+, brown wire (BN)
- 2 Switch or analog output (OUT2), white wire (WH)
- 3 Supply voltage L-, blue wire (BU)
- 4 Switch output or IO-Link output (OUT1), black wire (BK)

The following table shows a sample illustration of a process data frame:

| Bit offset             | 16       | 8                      | 6      | 1      | 0      |
|------------------------|----------|------------------------|--------|--------|--------|
| ← SDCI<br>A0054022     | Float32T | UInt8T                 |        | BOOL   | BOOL   |
| Transmission direction | MDC2     | Extended device status | unused | SSC1.2 | SSC1.1 |

| Name (IODD)                                                       | Bit offset | Data type      | Permitted values                                                                                                                                                                                                                                                                                                                                                                                                    | Offset/gradient                                                                                                                                                           | Description                                               |
|-------------------------------------------------------------------|------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| Pressure (MDC1)                                                   | 16         | Float32T       | -                                                                                                                                                                                                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>■ bar: 0/0.00001</li> <li>■ mmH2O: 0/0.101973</li> <li>■ Pa: 0/1</li> <li>■ kPa: 0/0.001</li> <li>■ psi: 0/0.0001450326</li> </ul> | Current pressure (measured value)                         |
| Extended device status                                            | 8          | 8-bit UInteger | <ul style="list-style-type: none"> <li>■ 36 = Failure</li> <li>■ 37 = Failure - simulation</li> <li>■ 60 = Function check</li> <li>■ 61 = Function check - simulation</li> <li>■ 120 = Out of spec</li> <li>■ 121 = Out of spec - simulation</li> <li>■ 164 = Maintenance</li> <li>■ 165 = Maintenance - simulation</li> <li>■ 128 = Good</li> <li>■ 129 = Good - simulation</li> <li>■ 0 = Non-specific</li> </ul> | -                                                                                                                                                                         | Extended Endress+Hauser device status according to NE 107 |
| Process Data Input.Switching Signal Channel 1.2 (SSC1.2) Pressure | 1          | BooleanT       | 0 = False<br>1 = True                                                                                                                                                                                                                                                                                                                                                                                               | -                                                                                                                                                                         | Switching signal status SSC 1.2 (via OUT2)                |
| Process Data Input.Switching Signal Channel 1.1 (SSC1.1) Pressure | 0          | BooleanT       | 0 = False<br>1 = True                                                                                                                                                                                                                                                                                                                                                                                               | -                                                                                                                                                                         | Switching signal status SSC 1.1 (via OUT1)                |

### 8.3 Reading out and writing device data (ISDU – Indexed Service Data Unit)

Device data are always exchanged acyclically and at the request of the IO-Link master. Parameter values or device statuses can be read out using the device data. All device data and parameters (Endress+Hauser and IO-Link-specific as well as system commands) can be found in the separate device parameter documentation for the device.

### 8.4 Switching signals

The switching signals offer a simple way of monitoring the measured values for limit violations.

Each switching signal is clearly assigned to a process value and provides a status. This status is transmitted with the process data. Its switching behavior must be configured using the configuration parameters of a "Switching Signal Channel" (SSC). In addition to manual configuration for switch points SP 1 and SP 2, a teach mechanism is available in the "Teach" menu. This mechanism writes the current process value to the selected SSC via a system command. The "Logic" parameter is always "High active" in these cases. If the logic is to be inverted, the "Logic" parameter can be set to "Low active". For details, see the "Configuring process monitoring" section.

### 8.5 IO-Link information

IO-Link is a point-to-point connection for communication between the device and an IO-Link master. The device features an IO-Link communication interface type "COM2" with a second IO function on pin 4. This requires an IO-Link-compatible assembly (IO-Link master) for operation.

The IO-Link communication interface enables direct access to the process and diagnostic data. It also provides the option of configuring the device while in operation.

Physical layer, the device supports the following features:

- Version 1.1.3 specification
- Device Identification & Diagnostic Profile [0x4000]
  - Device Identification [0x8000]
  - Process Data Mapping [0x8002]
  - Device Diagnosis [0x8003]
  - Extended Identification [0x8100]
- Smart Sensor Profile type 4.3.1 [0x0018] with the following function classes:
  - Multiple Adjustable Switching Signal Channel [0x800D]
    - Function classes: Quantity detection [0x8014]
  - Measurement Data Channel, (floating point) [0x800E]
  - Multi Teach Single Point [0x8010]
- SIO mode: Yes
- Speed: COM2; 38.4 kBaud
- Minimum cycle time: 14.8 ms
- Process data width: 48 bit
- Data storage: Yes
- Block configuration: Yes
- Device operational
  - The device is operational within 4 seconds maximum after the supply voltage is applied

## 9 Commissioning

### 9.1 Preliminaries

#### **⚠ WARNING**

Settings on the current output can result in a safety-related condition (e.g., product overflow)!

- ▶ Check current output settings.
- ▶ The setting of the current output depends on the setting in the **Measuring mode current output** parameter.

### 9.2 Installation and function check

Before commissioning the measuring point, check that the post-installation and post-connection checks have been performed:

-  "Post-mounting check" section
-  "Post-connection check" section

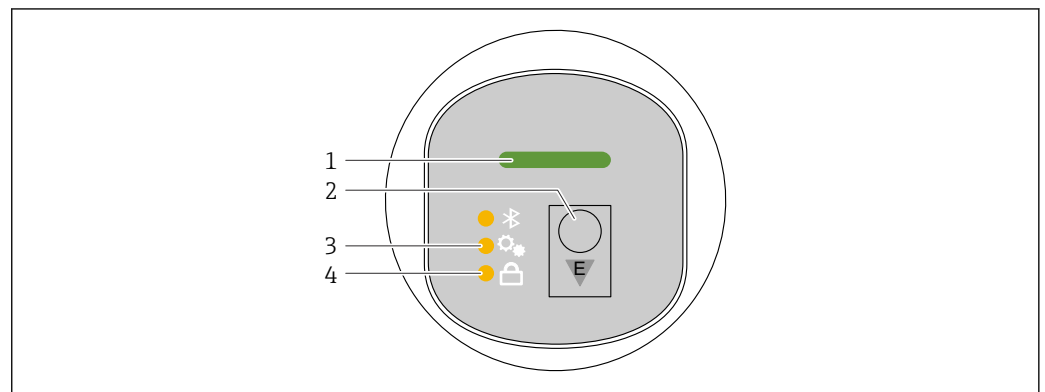
### 9.3 Switching on the device

Once the supply voltage has been switched on, the device adopts the normal mode after a maximum of 4 s. During the start-up phase, the outputs are in the same state as when switched off.

### 9.4 Overview of commissioning options

- Commissioning via LED display operating key
- Commissioning via onsite display
- Commissioning with the SmartBlue app  
(see  "Operation via SmartBlue app" section)
- Commissioning via FieldCare/DeviceCare/Field Xpert
- Commissioning via additional operating tools (AMS, PDM, etc.)

### 9.5 Commissioning via LED display operating key



- 1 Operating status LED
- 2 Operating key "E"
- 3 Position adjustment LED
- 4 Keypad lock LED

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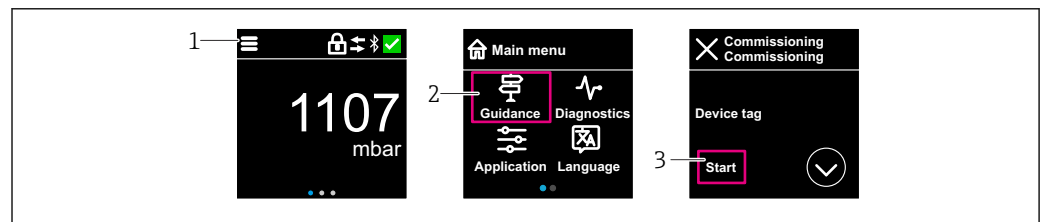
1. If necessary, disable the keypad lock (see  section "Access to operating menu via LED display" > "Operation").
2. Repeatedly press the "E" key briefly until the position adjustment LED flashes.
3. Press the "E" key for longer than 4 seconds.
  - ↳ Position adjustment LED is activated.
 The position adjustment LED flashes during activation. The keypad lock LED and Bluetooth LED are off.

Once activated successfully, the position adjustment LED lights up continuously for 12 seconds. The keypad lock LED and Bluetooth LED are off.

If not successfully activated, the position adjustment LED, keypad lock LED and Bluetooth LED flash quickly for 12 seconds.

## 9.6 Commissioning via onsite display

1. If necessary, enable operation (see  section "Onsite display, locking or unlocking procedure" > "Unlocking").
2. Start **Commissioning** wizard (see graphic below).



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- 1 Press the menu icon.
- 2 Press "Guidance" menu.
- 3 Start "Commissioning" wizard.

### 9.6.1 Notes on "Commissioning" wizard

The **Commissioning** wizard enables simple, user-guided commissioning.

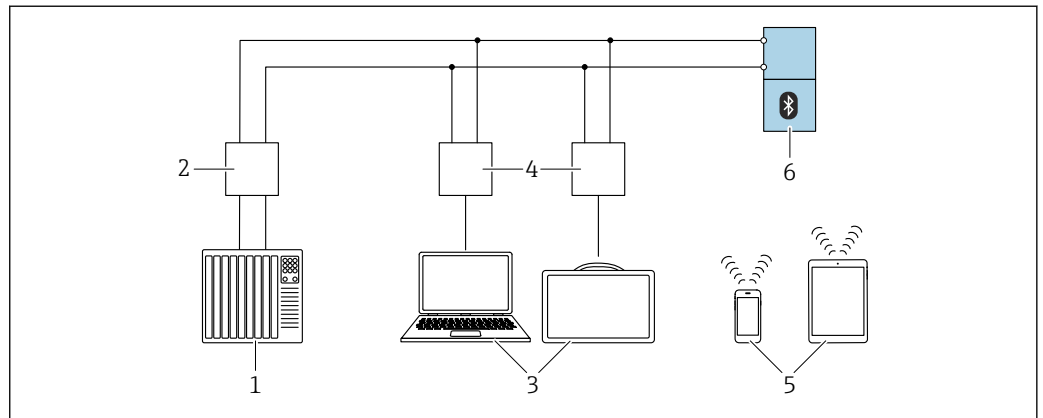
1. Once you have started the **Commissioning** wizard, enter the appropriate value in each parameter or select the appropriate option. These values are written directly to the device.
2. Click > to go to the next page.
3. Once all pages have been completed, click OK to close the **Commissioning** wizard.

 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.

## 9.7 Commissioning via FieldCare/DeviceCare, Field Xpert

1. Download IO-Link IODD Interpreter DTM: <https://www.software-products.endress.com>.
2. Download IODD: <https://ioddfinder.io-link.com/>.
3. Integrate the IODD (IO Device Description) in IODD Interpreter. Then start FieldCare and update the DTM catalog.

### 9.7.1 Connecting via FieldCare, DeviceCare, Field Xpert and SmartBlue app



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5 Options for remote operation via IO-Link

- 1 PLC (programmable logic controller)
- 2 IO-Link master
- 3 Computer with operating tool, e.g. DeviceCare/FieldCare or Field Xpert SMT70/SMT77
- 4 FieldPort SFP20
- 5 Smartphone or tablet with SmartBlue app (iOS and Android)
- 6 Transmitter

## 9.8 Commissioning via additional operating tools (AMS, PDM, etc.)

Download the device-specific drivers: <https://www.endress.com/en/downloads>

For more details, see the help for the relevant operating tool.

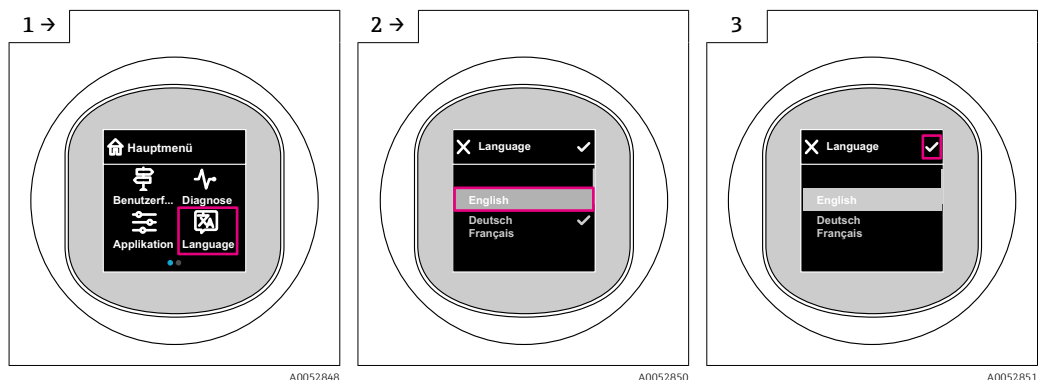
## 9.9 Configuring the operating language

### 9.9.1 Onsite display

#### Configuring the operating language

**i** Before you can set the operating language, you must first unlock the onsite display:

1. Open the operating menu.
2. Select the Language button.



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9.9.2 Operating tool

Set display language

System → Display → Language

9.10 Configuring the device

9.10.1 Configuring process monitoring

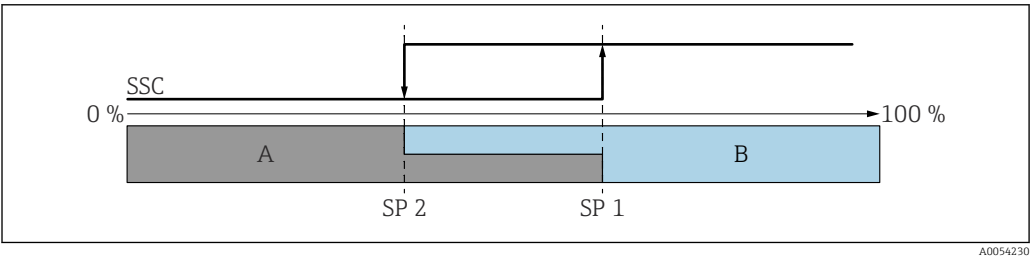
Digital process monitoring (switch output)

It is possible to select defined switch points and switchback points which act as NO or NC contacts depending on whether a window function or hysteresis function is configured.

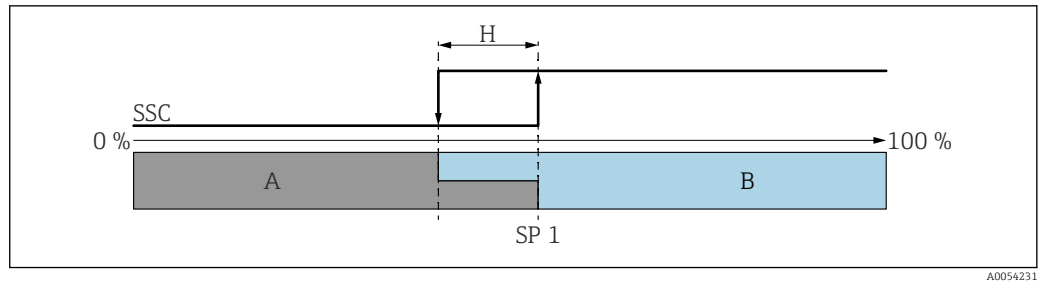
| Possible setting           |                           |                              |                              | Output<br>(OUT1/OUT2)                       |
|----------------------------|---------------------------|------------------------------|------------------------------|---------------------------------------------|
| Function<br>(Config. Mode) | Invert<br>(Config. Logic) | Switch points<br>(Param.SPx) | Hysteresis<br>(Config. Hyst) |                                             |
| Two point                  | High active (MIN)         | SP1 (float32)                | N/A                          | Normally-open contact (NO <sup>1)</sup> )   |
|                            |                           | SP2 (float32)                |                              |                                             |
|                            | Low active (MAX)          | SP1 (float32)                | N/A                          | Normally-closed contact (NC <sup>2)</sup> ) |
|                            |                           | SP2 (float32)                |                              |                                             |
| Window                     | High active               | SP1 (float32)                | Hyst (float32)               | Normally-open contact (NO <sup>1)</sup> )   |
|                            |                           | SP2 (float32)                |                              |                                             |
|                            | Low active                | SP1 (float32)                | Hyst (float32)               | Normally-closed contact (NC <sup>2)</sup> ) |
|                            |                           | SP2 (float32)                |                              |                                             |
| Single point               | High active (MIN)         | SP1 (float32)                | Hyst (float32)               | Normally-open contact (NO <sup>1)</sup> )   |
|                            | Low active (MAX)          | SP1 (float32)                | Hyst (float32)               | Normally-closed contact (NC <sup>2)</sup> ) |

- 1) NO = normally open
- 2) NC = normally closed

If the device is restarted within the given hysteresis, the switch output is open (0 V present at the output).

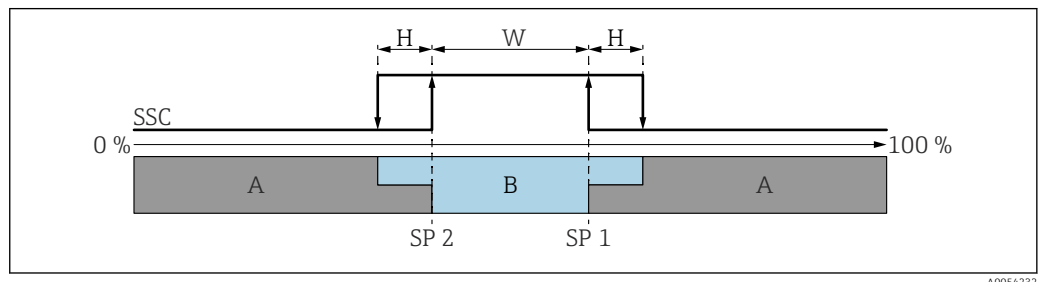


6 SSC, two point  
SP 2 Switch point with lower measured value  
SP 1 Switch point with higher measured value  
A Inactive  
B Active



7 SSC, single point

*H* Hysteresis  
*SP 1* Switch point  
*A* Inactive  
*B* Active



8 SSC, window

*H* Hysteresis  
*W* Window  
*SP 2* Switch point with lower measured value  
*SP 1* Switch point with higher measured value  
*A* Inactive  
*B* Active

### Teach process (IODD)

A switch point is not entered manually for the teach process, but is defined by assigning the current process value of a switching signal channel (SSC) to the switch point. To assign the process value, the corresponding switch point, e.g. "SP 1" is selected in the next step in the **Teach select** parameter.

By activating "Teach SP 1" or "Teach SP 2", the current process measured values can be adopted as switch point SP 1 or SP 2. The hysteresis is only relevant in Window mode and Single point mode. The value can be entered in the relevant menu.

### Sequence in teach process

Navigation: Parameter → Application → ...

1. Define switch signal channel (SSC) via **Teach select**.
2. Set Config.Mode (choice of two point, window, single point).
  - ↳ **If two point is selected:**
    - Approach switch point 1 and then trigger Teach SP1.
    - Approach switch point 2 and then trigger Teach SP2.
  - If 'Window' is selected:**
    - Approach switch point 1 and then trigger Teach SP1.
    - Approach switch point 2 and then trigger Teach SP2.
    - Enter hysteresis manually.
  - If 'Single point' is selected:**
    - Approach switch point 1 and then trigger Teach SP1.
    - Enter hysteresis manually.
3. If necessary, check the switch point of the adjusted switch signal channel.

## 9.11 Protecting settings from unauthorized access

### 9.11.1 Software locking or unlocking

#### Locking via password in SmartBlue app

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 the **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

#### Deactivating the lock via the SmartBlue app

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

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

## 10 Operation

### 10.1 Reading off the device locking status

#### 10.1.1 LED indicator

Keypad lock LED

-  LED lit: Device is locked
-  LED not lit: Device is unlocked

#### 10.1.2 Onsite display

Onsite display locked:

The main page does **not** display the menu symbol   

#### 10.1.3 Operating tool

 Operating tool (FieldCare/DeviceCare/FieldXpert/SmartBlue app)

Navigation: System → Device management → Locking status



## 10.2 Adapting the device to process conditions

Via the SmartBlue app  
Advanced settings in:

- **Diagnostics** menu
- **Application** menu
- **System** menu



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

## 10.3 Heartbeat Technology (optional)

### 10.3.1 Heartbeat Verification

#### "Heartbeat Verification" wizard

This wizard is used to start an automatic verification of the device functionality. The results can be documented as a verification report.

- The wizard can be used via the operating tools and the local display  
The wizard can be started on the local display, but only shows the result **Passed** option or **Failed** option.
- The wizard guides the user through the entire process for creating the verification report



Start Heartbeat Verification and Status Result are available via IODD. The **Heartbeat Verification** wizard is available via the SmartBlue app.

### 10.3.2 Heartbeat Verification/Monitoring



This **Heartbeat** submenu is only available when operating via the SmartBlue app. The submenu contains the wizards that are available with the Heartbeat Verification and Heartbeat Monitoring application packages.

Heartbeat Verification is shown in the IODD. Heartbeat Monitoring must be set in the operating menu of the SmartBlue app. The Heartbeat Monitoring results can be read out in the IODD via the active and last diagnosis.



Documentation on the Heartbeat Technology: Endress+Hauser website:  
[www.endress.com](http://www.endress.com) → Downloads.

## 10.4 Displaying the measured value history



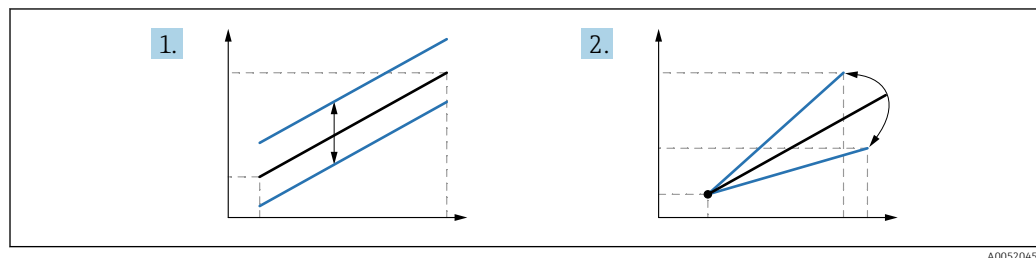
See Special Documentation for SD Heartbeat Technology.

## 10.5 Sensor calibration <sup>5)</sup> <sup>6)</sup>

In the course of their life cycle, pressure measuring cells **can** deviate, or drift, <sup>7)</sup> from the original pressure characteristic curve. This deviation depends on the operating conditions and can be corrected in the **Sensor calibration** submenu.

Set the value of the zero point shift before the Sensor calibration to 0.00. Application  
→ Sensor → Sensor calibration → Zero adjustment offset

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



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

## 11 Diagnostics and troubleshooting

### 11.1 General troubleshooting

#### 11.1.1 General errors

##### Device not starting

- 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

#### 11.1.2 Error - SmartBlue operation with Bluetooth®

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

5) Available for devices with Bluetooth

6) Not possible with color display

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

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

- 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)  
Operating radius with intervisibility 10 m (33 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
- Display does not have Bluetooth

**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, contact Endress+Hauser Service ([www.addresses.endress.com](http://www.addresses.endress.com))

**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  
If the password has been forgotten, contact Endress+Hauser Service ([www.addresses.endress.com](http://www.addresses.endress.com))

**Login via SmartBlue not possible**

- Possible cause: Device is being put into operation for the first time  
Remedial action: Enter the user name "admin" and the password (device serial number), paying attention to lower/upper case
- Possible cause: The electric current and voltage are not correct.  
Remedial action: Increase the supply voltage.

**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  
If the password has been forgotten, contact Endress+Hauser Service ([www.addresses.endress.com](http://www.addresses.endress.com))
- Possible cause: **Operator** option has no authorization  
Remedial action: Change to the **Maintenance** option

**11.1.3 Measures**

For information on measures in the case of an error message: See  "Diagnostic list" section.

If the measures do not rectify the fault, 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 value (e.g. value from onsite display).

2. Check that the device concerned is functioning correctly. Replace the device if the digital value does not correspond to the expected value.
3. Switch on simulation and check the current output. Replace the device if the current output does not correspond to the simulated value.
4. Reset the device to the factory setting.

### 11.1.5 Behavior of the device in the event of a power outage

In the event of an unexpected power outage, the dynamic data are stored permanently (according to NAMUR NE 032).

### 11.1.6 Behavior of the device in the event of a failure

The device displays warnings and failures via IO-Link. All the device warnings and failures are for information purposes only and do not have a safety function. The errors diagnosed by the device are displayed via IO-Link in accordance with NE 107. Depending on the diagnostic message, the device behaves in accordance with a warning or failure. A distinction must be made between the following types of error here:

- **Warning:**
  - The device continues measuring if this type of error occurs. The output signal is not affected (exception: simulation is active)
  - The switch output remains in the state defined by the switch points
- **Failure:**
  - The device does **not** continue measuring if this type of error occurs. The output signal adopts its fault state (value in the event of an error - see the following section )
  - The fault state is displayed via IO-Link
  - The switch output changes to the "open" state
  - For the analog output option, an error is signaled with the configured alarm current behavior

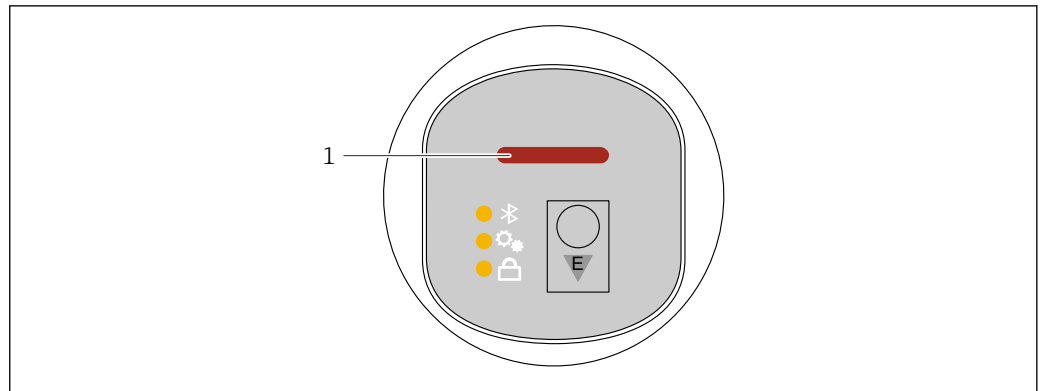
### 11.1.7 Behavior of the current output in the event of a failure

The behavior of the current output in the event of a failure is regulated in accordance with NAMUR NE 43.

The behavior of the current output in the event of failures is defined in the following parameters:

- **Failure current** parameter **Min.** option (default value): Lower alarm current ( $\leq 3.6$  mA)
  - **Failure current** parameter, **Max.** option: Upper alarm current ( $\geq 21$  mA)
-  ■ The selected alarm current is used for all faults
- Errors and warning messages are displayed via IO-Link
  - It is not possible to acknowledge errors and warnings. The relevant message disappears if the event is no longer pending

## 11.2 Diagnostic information on operating status LED



1 Operating status LED

- Operating status LED is continuously lit in green: everything is OK
- Operating status LED is continuously lit in red: diagnostic type "Alarm" is active
- In the case of Bluetooth connection: operating status LED flashes while the function is executed  
The LED flashes independently of the color currently displayed.

## 11.3 Diagnostic information on onsite display

### 11.3.1 Diagnostic message

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

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

#### Status signals

*F*

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

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

*C*

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

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

*S*

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

The device is operated:

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

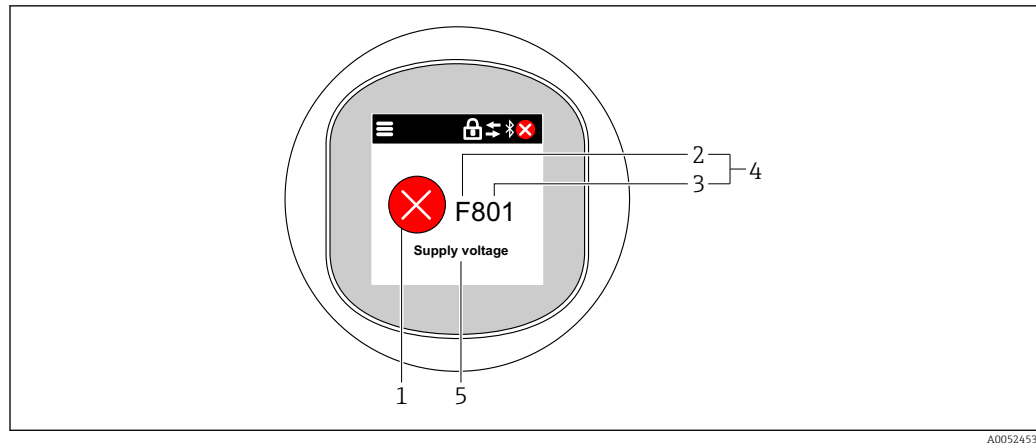
*M*

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

Maintenance required. The measured value remains valid.

#### Diagnostic event and event text

The fault can be identified by means of the diagnostic event.



- 1 Status symbol
- 2 Status signal
- 3 Event number
- 4 Diagnostic event
- 5 Brief description of the diagnostic event

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

## 11.4 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 from the **Diagnostic list** submenu.

## 11.5 Adapting the diagnostic information

The event level can be configured:

Navigation: Diagnostics → Diagnostic settings → Configuration

## 11.6 Pending diagnostic messages

Pending diagnostic messages are displayed in alternating sequence with the measured value display in the onsite display.

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

Navigation: Diagnostics → Active diagnostics

## 11.7 Diagnostic list

### 11.7.1 List of diagnostic events



Diagnosis 242 and 252 cannot occur with this device.

For diagnoses 270, 273, 803 and 805: The device must be replaced if the electronics are replaced.

| Diagnostic number                  | Short text                         | Remedy instructions                                                              | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|------------------------------------|------------------------------------|----------------------------------------------------------------------------------|----------------------------------|----------------------------------------|
| <b>Diagnostic of sensor</b>        |                                    |                                                                                  |                                  |                                        |
| 062                                | Sensor connection faulty           | Check sensor connection                                                          | F                                | Alarm                                  |
| 081                                | Sensor initialization faulty       | 1. Restart device<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                                  |
| <b>Diagnostic of electronic</b>    |                                    |                                                                                  |                                  |                                        |
| 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 or device.                                              | F                                | Alarm                                  |
| 272                                | Main electronics faulty            | 1. Restart device<br>2. Contact service                                          | F                                | Alarm                                  |
| 273                                | Main electronics defective         | Replace main electronics or device.                                              | F                                | Alarm                                  |
| 282                                | Data storage inconsistent          | Restart device                                                                   | F                                | Alarm                                  |
| 283                                | Memory content inconsistent        | 1. Restart device<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                                  |
| <b>Diagnostic of configuration</b> |                                    |                                                                                  |                                  |                                        |
| 410                                | Data transfer failed               | 1. Retry data transfer<br>2. Check connection                                    | F                                | Alarm                                  |
| 412                                | Processing download                | Download active, please wait                                                     | C                                | Warning                                |
| 419                                | Power cycle required               | Power cycle device                                                               | F                                | Alarm                                  |
| 431                                | Trim required                      | Carry out trim                                                                   | M                                | 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 1 simulation active       | Deactivate simulation                                                                                 | C                                | Warning                                |
| 494                          | Switch output 1 simulation active        | Deactivate switch output 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 <sup>1)</sup>                  |
| 501                          | Process alert scaled variable            | 1. Check process conditions<br>2. Check scaled variable configuration                                 | S                                | Warning <sup>1)</sup>                  |
| 502                          | Process alert temperature                | 1. Check process temperature<br>2. Check configuration of process alert                               | S                                | Warning <sup>1)</sup>                  |
| 503                          | Zero adjustment                          | 1. Check measuring range<br>2. Check position adjustment                                              | M                                | Warning                                |
| <b>Diagnostic of process</b> |                                          |                                                                                                       |                                  |                                        |
| 801                          | Supply voltage too low                   | Increase supply voltage                                                                               | F                                | Alarm                                  |
| 802                          | Supply voltage too high                  | Decrease supply voltage                                                                               | S                                | Warning                                |
| 803                          | Loop current faulty                      | 1. Check wiring<br>2. Replace electronics                                                             | F                                | Alarm                                  |
| 804                          | Switch output overloaded                 | 1. Reduce load at the output.<br>2. Check output.<br>3. Replace device.                               | S                                | Warning                                |
| 805                          | Loop current 1 faulty                    | 1. Check wiring<br>2. Replace electronics or device                                                   | F                                | Alarm                                  |
| 806                          | Loop diagnostics                         | 1. Only with a passive I/O: Check supply voltage of current loop.<br>2. Check wiring and connections. | M                                | Warning <sup>1)</sup>                  |
| 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 <sup>1)</sup>                  |
| 825                          | Electronics temperature out of range     | 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 <sup>1)</sup>                  |



| Diagnostic number | Short text                   | Remedy instructions                                                                          | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|-------------------|------------------------------|----------------------------------------------------------------------------------------------|----------------------------------|----------------------------------------|
| 900               | High signal noise detected   | 1. Check impulse line<br>2. Check valve position<br>3. Check process                         | M                                | Warning <sup>1)</sup>                  |
| 901               | Low signal noise detected    | 1. Check impulse line<br>2. Check valve position<br>3. Check process                         | M                                | Warning <sup>1)</sup>                  |
| 902               | Min signal noise detected    | 1. Check impulse line<br>2. Check valve position<br>3. Check process                         | M                                | Warning <sup>1)</sup>                  |
| 906               | Out of range signal detected | 1. Process Information. No action<br>2. Rebuild baseline<br>3. Adapt signal range thresholds | C                                | Warning <sup>1)</sup>                  |

1) Diagnostic behavior can be changed.

## 11.8 Event logbook

### 11.8.1 Event history

A chronological overview of the event messages that have occurred is provided in the **"Event logbook" submenu**.

Navigation: 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

### 11.8.2 Filtering the event logbook

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

Navigation: Diagnostics → Event logbook

#### Filter categories

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

### 11.8.3 Overview of information events

 Not all of the following information events occur.

| Info number | Info name                            |
|-------------|--------------------------------------|
| I1000       | ----- (Device ok)                    |
| I1079       | Sensor changed                       |
| I1089       | Power on                             |
| I1090       | Configuration reset                  |
| I1091       | Configuration changed                |
| I11074      | Device verification active           |
| I1110       | Write protection switch changed      |
| I11104      | Loop diagnostics                     |
| 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                                |

## 11.9 Device reset

### 11.9.1 Reset via digital communication

The device can be reset with the **Device reset** parameter.

Navigation: System → Device management

 Any customer-specific configuration carried out at the factory is not affected by a reset (customer-specific configuration remains).

| Device reset                      | Description and effect                                                                              |
|-----------------------------------|-----------------------------------------------------------------------------------------------------|
| Application reset                 | Restores the default settings of the IODD parameters.                                               |
| Back-to-box                       | Restores the factory settings and calibration data and stops IO-Link communication until a restart. |
| To factory defaults <sup>1)</sup> | Restores the factory settings and calibration data.                                                 |
| Restart device <sup>2)</sup>      | Enables device restart.                                                                             |

- 1) Visible depending on the order options or device settings.
- 2) Visible via Bluetooth applications.

11.9.2 Resetting the password via the SmartBlue app

Enter a code to reset the current "Maintenance" password.  
The code is delivered by your local support.  
Navigation: System → User management → Forgotten your password → Reset password

11.10 Device information

All device information is contained in the **Information** submenu (SmartBlue app) or identification (IODD).  
Navigation: System → Information  
 For details see the "Description of device parameters" documentation.

11.11 Firmware history

11.11.1 Version

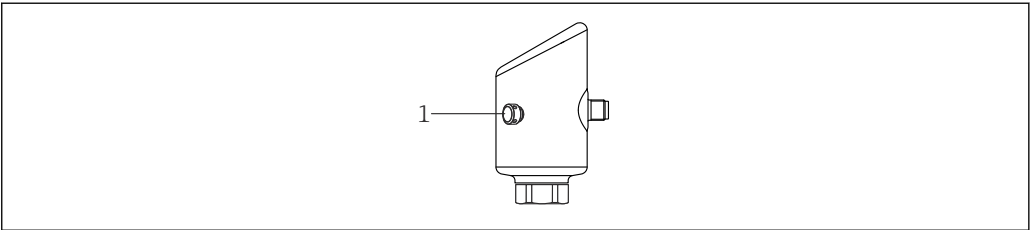
01.00.00  
Initial software

12 Maintenance

12.1 Maintenance work

12.1.1 Filter element

Keep the filter element (1) free from contamination. The device version determines whether or not a filter element is installed.



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### 12.1.2 Exterior cleaning

The cleaning agents used should not corrode the surface and the seals.

The following cleaning agents can be used:

- Ecolab P3 topaktive 200
- Ecolab P3 topaktive 500
- Ecolab P3 topaktive OKTO
- Ecolab P3 topax 66
- Ecolab TOPAZ AC5

Avoid mechanical damage to the membrane (e.g. caused by pointed objects).

Observe the degree of protection of the device.

## 13 Repair

### 13.1 General information

#### 13.1.1 Repair concept

The Endress+Hauser repair concept is devised in such a way that repairs can only be carried out through device replacement.

#### 13.1.2 Replacing a device

After the device is replaced, previously saved parameters can be copied to the newly installed device.

In IO-Link, all parameters that are visible in IO-DD can be transferred to the new device (see the  description of device parameters document). This is possible via the data storage function in IO-Link. However, the user must first activate this function on the master tool (TMG, etc.) to upload the saved values from the IO-Link master to the device. If the parameter is only available via Bluetooth and not in the IO-DD, the changes made for this parameter via Bluetooth will be lost.

After an entire device has been replaced, the parameters can be downloaded to the device again via the communication interface. The data must have been uploaded to the PC beforehand using the "FieldCare/DeviceCare" software.

### 13.2 Return

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the web page for information:  
<https://www.endress.com/support/return-material>  
↳ Select the region.
2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.

## 13.3 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

Accessories currently available for the product can be selected via the Product Configurator at [www.endress.com](http://www.endress.com):

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.

### 14.1 Device-specific accessories

#### 14.1.1 M12 socket

M12 socket, straight

- Material:  
Body: PA; union nut: stainless steel; seal: EPDM
- Degree of protection (fully locked): IP69
- Order number: 71638191

M12 socket, elbowed

- Material:  
Body: PA; union nut: stainless steel; seal: EPDM
- Degree of protection (fully locked): IP69
- Order number: 71638253

#### 14.1.2 Cables

Cable 4 x 0.34 mm<sup>2</sup> (20 AWG) with M12 socket, elbowed, screw plug, length 5 m (16 ft)

- Material: body: TPU; union nut: nickel-plated die-cast zinc; cable: PVC
- Degree of protection (fully locked): IP68/69
- Order number: 52010285
- Wire colors
  - 1 = BN = brown
  - 2 = WT = white
  - 3 = BU = blue
  - 4 = BK = black

#### 14.1.3 Welding neck, process adapter and flange



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

#### 14.1.4 Mechanical accessories



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

## 14.2 DeviceCare SFE100

Configuration tool for IO-Link, HART, PROFIBUS and FOUNDATION Fieldbusfield devices  
DeviceCare is available for download free of charge at [www.software-products.endress.com](http://www.software-products.endress.com). You need to register in the Endress+Hauser software portal to download the application.



Technical Information TI01134S

## 14.3 FieldCare SFE500

FDT-based plant asset management tool

It can configure all intelligent field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.



Technical Information TI00028S

## 14.4 Device Viewer

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

## 14.5 Field Xpert SMT70

Universal, high-performance tablet PC for device configuration in Ex Zone 2 and non-Ex areas



For details, see "Technical Information" TI01342S

## 14.6 Field Xpert SMT77

Universal, high-performance tablet PC for device configuration in Ex Zone 1 areas



For details, see "Technical Information" TI01418S

## 14.7 SmartBlue app

Mobile app for easy configuration of devices on site via Bluetooth® wireless technology.

## 15 Technical data

### 15.1 Input

#### 15.1.1 Measured variable

##### Measured process variables

- Absolute pressure
- Gauge pressure

##### Calculated process variables

Pressure

#### 15.1.2 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 |              | Smallest factory-calibratable span |                   |
|---------------------|-------------------------|--------------|------------------------------------|-------------------|
|                     | lower (LRL)             | upper (URL)  | Standard                           | Platinum          |
|                     | [bar (psi)]             | [bar (psi)]  | [bar (psi)]                        |                   |
| 400 mbar (6 psi)    | 0                       | +0.4 (+6)    | 0.05 (0.75) <sup>1)</sup>          | 80 mbar (1.2 psi) |
| 1 bar (15 psi)      | 0                       | +1 (+15)     | 0.05 (0.75) <sup>2)</sup>          | 200 mbar (3 psi)  |
| 2 bar (30 psi)      | 0                       | +2 (+30)     | 0.10 (1.50) <sup>2)</sup>          | 400 mbar (6 psi)  |
| 4 bar (60 psi)      | 0                       | +4 (+60)     | 0.20 (3.00) <sup>2)</sup>          | 800 mbar (12 psi) |
| 10 bar (150 psi)    | 0                       | +10 (+150)   | 0.50 (7.50) <sup>2)</sup>          | 2 bar (30 psi)    |
| 40 bar (600 psi)    | 0                       | +40 (+600)   | 2.00 (30.0) <sup>2)</sup>          | 8 bar (120 psi)   |
| 100 bar (1 500 psi) | 0                       | +100 (+1500) | 5.00 (73) <sup>2)</sup>            | 20 bar (300 psi)  |

1) Largest factory-configurable turn down: 8:1

2) Largest factory-configurable turn down: 20:1

##### Absolute pressure

| Measuring cell      | MWP          | OPL         | Factory settings <sup>1)</sup> |
|---------------------|--------------|-------------|--------------------------------|
|                     | [bar (psi)]  | [bar (psi)] |                                |
| 400 mbar (6 psi)    | 1 (14.5)     | 1.6 (23)    | 0 to 400 mbar (0 to 6 psi)     |
| 1 bar (15 psi)      | 2.7 (39)     | 4 (58)      | 0 to 1 bar (0 to 15 psi)       |
| 2 bar (30 psi)      | 6.7 (97)     | 10 (145)    | 0 to 2 bar (0 to 30 psi)       |
| 4 bar (60 psi)      | 10.7 (155)   | 16 (232)    | 0 to 4 bar (0 to 60 psi)       |
| 10 bar (150 psi)    | 25 (362)     | 40 (580)    | 0 to 10 bar (0 to 150 psi)     |
| 40 bar (600 psi)    | 100 (1450)   | 160 (2320)  | 0 to 40 bar (0 to 600 psi)     |
| 100 bar (1 500 psi) | 103.5 (1500) | 160 (2320)  | 0 to 100 bar (0 to 1 500 psi)  |

1) Different measuring ranges (e.g. -1 to +5 bar (-15 to +75 psi)) can be ordered with customized settings. It is possible to invert the output signal (LRV = 20 mA; URV = 4 mA). Prerequisite: URV < LRV

*Gauge pressure*

| Measuring cell      | Maximum measuring range |              | Smallest factory-calibratable span <sup>1)</sup> |                   |
|---------------------|-------------------------|--------------|--------------------------------------------------|-------------------|
|                     | lower (LRL)             | upper (URL)  | Standard                                         | Platinum          |
|                     | [bar (psi)]             | [bar (psi)]  | [bar (psi)]                                      |                   |
| 400 mbar (6 psi)    | -0.4 (-6)               | +0.4 (+6)    | 0.05 (0.75) <sup>2)</sup>                        | 80 mbar (1.2 psi) |
| 1 bar (15 psi)      | -1 (-15)                | +1 (+15)     | 0.05 (0.75) <sup>3)</sup>                        | 200 mbar (3 psi)  |
| 2 bar (30 psi)      | -1 (-15)                | +2 (+30)     | 0.10 (1.50) <sup>3)</sup>                        | 400 mbar (6 psi)  |
| 4 bar (60 psi)      | -1 (-15)                | +4 (+60)     | 0.20 (3.00) <sup>3)</sup>                        | 800 mbar (12 psi) |
| 10 bar (150 psi)    | -1 (-15)                | +10 (+150)   | 0.50 (7.50) <sup>3)</sup>                        | 2 bar (30 psi)    |
| 25 bar (375 psi)    | -1 (-15)                | +25 (+375)   | 1.25 (18.50) <sup>3)</sup>                       | 5 bar (75 psi)    |
| 40 bar (600 psi)    | -1 (-15)                | +40 (+600)   | 2.00 (30.00) <sup>3)</sup>                       | 8 bar (120 psi)   |
| 100 bar (1 500 psi) | -1 (-15)                | +100 (+1500) | 5.00 (73) <sup>3)</sup>                          | 20 bar (300 psi)  |

1) Largest factory-configurable turn down: 5:1.

2) Largest factory-configurable turn down: 8:1

3) Largest factory-configurable turn down: 20:1

*Gauge pressure*

| Measuring cell      | MWP          | OPL         | Factory settings <sup>1)</sup> |
|---------------------|--------------|-------------|--------------------------------|
|                     | [bar (psi)]  | [bar (psi)] |                                |
| 400 mbar (6 psi)    | 1 (14.5)     | 1.6 (23)    | 0 to 400 mbar (0 to 6 psi)     |
| 1 bar (15 psi)      | 2.7 (39)     | 4 (58)      | 0 to 1 bar (0 to 15 psi)       |
| 2 bar (30 psi)      | 6.7 (97)     | 10 (145)    | 0 to 2 bar (0 to 30 psi)       |
| 4 bar (60 psi)      | 10.7 (155)   | 16 (232)    | 0 to 4 bar (0 to 60 psi)       |
| 10 bar (150 psi)    | 25 (363)     | 40 (580)    | 0 to 10 bar (0 to 150 psi)     |
| 25 bar (375 psi)    | 25.8 (375)   | 100 (1450)  | 0 to 25 bar (0 to 375 psi)     |
| 40 bar (600 psi)    | 100 (1450)   | 160 (2320)  | 0 to 40 bar (0 to 600 psi)     |
| 100 bar (1 500 psi) | 103.5 (1500) | 160 (2320)  | 0 to 100 bar (0 to 1 500 psi)  |

1) Different measuring ranges (e.g. -1 to +5 bar (-15 to +75 psi)) can be ordered with customized settings. It is possible to invert the output signal (LRV = 20 mA; URV = 4 mA). Prerequisite: URV < LRV

## 15.2 Output

### 15.2.1 Output signal

- 2 outputs, configurable as switch output, analog output or IO-Link output
- The current output offers a choice of three different operating modes:
  - 4 to 20.5 mA
  - NAMUR NE 43: 3.8 to 20.5 mA (factory setting)
  - US mode: 3.9 to 20.5 mA



### 15.2.2 Switching capacity

- Switch status ON:  $I_a \leq 200 \text{ mA}$  <sup>8)</sup>; switch status OFF:  $I_a < 0.1 \text{ mA}$  <sup>9)</sup>
- Switch cycles:  $> 1 \cdot 10^7$
- Voltage drop PNP:  $\leq 2 \text{ V}$
- Overload protection: Automatic load testing of switching current;
  - Max. capacitive load:  $1 \mu\text{F}$  at max. supply voltage (without resistive load)
  - Max. cycle duration:  $0.5 \text{ s}$ ; min.  $t_{\text{on}}$ :  $40 \mu\text{s}$
  - Periodic disconnection from protective circuit in the event of overcurrent ( $f = 1 \text{ Hz}$ )

### 15.2.3 Signal on alarm for devices with current output

#### Current output

Signal on alarm in accordance with NAMUR recommendation NE 43.

- Max. alarm: can be set from  $21.5$  to  $23 \text{ mA}$
- Min. alarm:  $< 3.6 \text{ mA}$  (factory setting)

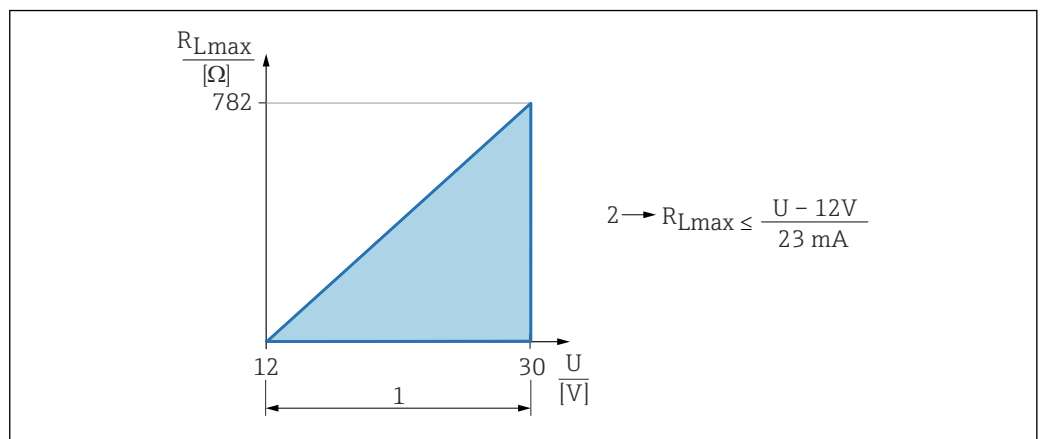
#### Onsite display and operating tool via digital communication

Status signal (according to NAMUR Recommendation NE 107):

Plain text display

### 15.2.4 Load

For the current output, the following applies: In order to guarantee sufficient terminal voltage, a maximum load resistance  $R_L$  (including line resistance) must not be exceeded, depending on the supply voltage  $U$  of the supply unit.



A0052602

- 1 Power supply 12 to 30 V  
 2  $R_{L\text{max}}$  maximum load resistance  
 U Supply voltage

If load is too great:

- Failure current is indicated and error message is displayed (indication: MIN alarm current)
- Periodic checking to establish if it is possible to quit fault state

8) If outputs "1 x PNP + 4 to 20 mA" are used at the same time, switch output OUT1 can be loaded with up to 100 mA load current over the entire temperature range. Up to  $50^\circ\text{C}$  ( $122^\circ\text{F}$ ) ambient temperature and up to  $85^\circ\text{C}$  ( $185^\circ\text{F}$ ) process temperature, the switching current may be up to 200 mA. If the "1 x PNP" or "2 x PNP" configuration is used, the switch outputs can be loaded in total with up to 200 mA over the entire temperature range.

9) Differing for switch output OUT2, for switch status OFF:  $I_a < 3.6 \text{ mA}$  and  $U_a < 2 \text{ V}$  and for switch status ON: voltage drop PNP:  $\leq 2.5 \text{ V}$

15.2.5 Damping

- A damping affects all continuous outputs: Damping can be enabled as follows:
- Via onsite display, Bluetooth, handheld terminal or PC with operating program continuously from 0 to 999 s, in increments of 0.1 s
  - Factory setting: 1 s (adjustable from 0 to 999 s)

15.2.6 Protocol-specific data

IO-Link specification 1.1.3

Device type ID:  
0x92 0xC5 0x01

15.3 Environment

15.3.1 Ambient temperature range

-40 to +85 °C (-40 to +185 °F)

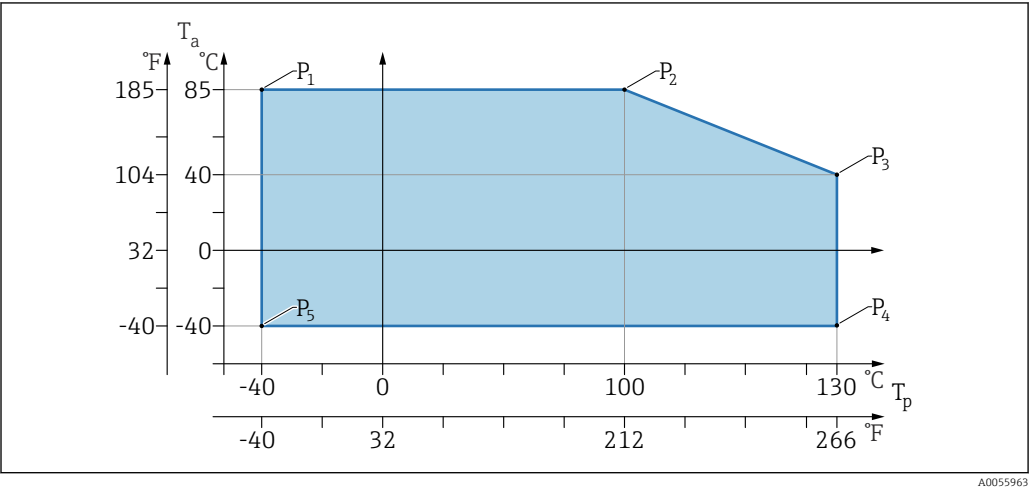
The permitted ambient temperature is reduced at higher process temperatures.

**i** The following information only takes into account functional aspects. Additional restrictions may apply for certified device versions.

The permitted process temperature varies, depending on the process connection used.  
For an overview of the process connections, see Section "Process temperature range".

Maximum process temperature +130 °C (+266 °F)

(Product feature "Application"; order option "B")

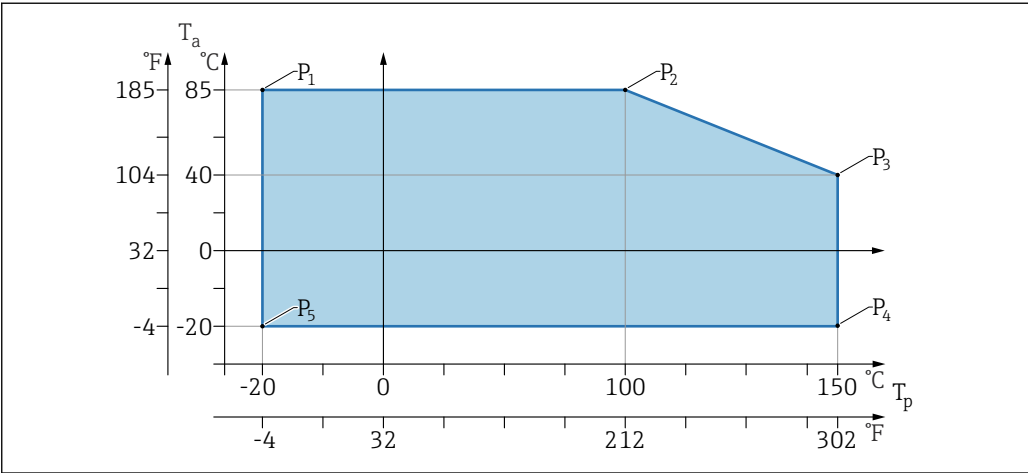


9 Ambient temperature  $T_a$  depending on the process temperature  $T_p$

| P  | $T_p$             | $T_a$            |
|----|-------------------|------------------|
| P1 | -40 °C (-40 °F)   | +85 °C (+185 °F) |
| P2 | +100 °C (+212 °F) | +85 °C (+185 °F) |
| P3 | +130 °C (+266 °F) | +40 °C (+77 °F)  |
| P4 | +130 °C (+266 °F) | -40 °C (-40 °F)  |
| P5 | -40 °C (-40 °F)   | -40 °C (-40 °F)  |

**Maximum process temperature +150 °C (+302 °F)**

(Product feature "Application"; order option "C")

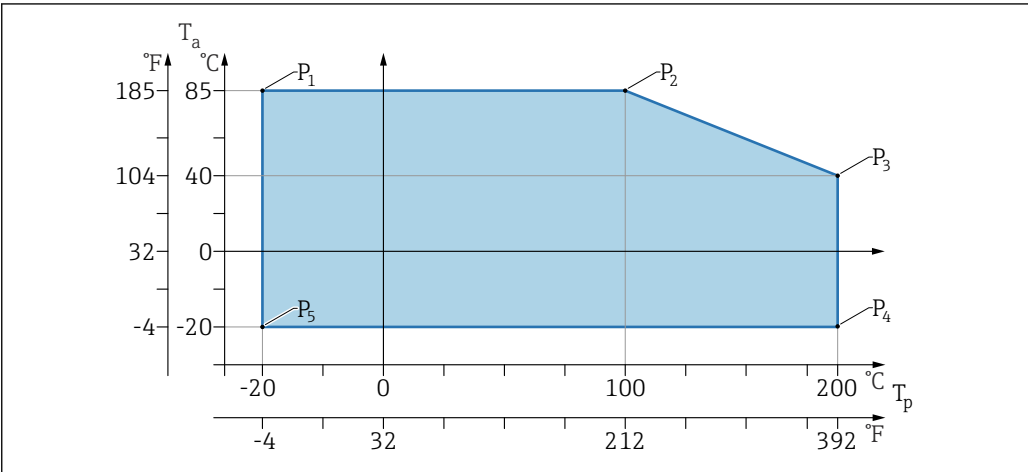


**10** Ambient temperature  $T_a$  depending on the process temperature  $T_p$

| P  | $T_p$             | $T_a$            |
|----|-------------------|------------------|
| P1 | -20 °C (-4 °F)    | +85 °C (+185 °F) |
| P2 | +100 °C (+212 °F) | +85 °C (+185 °F) |
| P3 | +150 °C (+302 °F) | +40 °C (+77 °F)  |
| P4 | +150 °C (+302 °F) | -20 °C (-4 °F)   |
| P5 | -20 °C (-4 °F)    | -20 °C (-4 °F)   |

**Maximum process temperature +200 °C (+392 °F)**

(Product feature "Application"; order option "D")



**11** Ambient temperature  $T_a$  depending on the process temperature  $T_p$

| P  | $T_p$             | $T_a$            |
|----|-------------------|------------------|
| P1 | -20 °C (-4 °F)    | +85 °C (+185 °F) |
| P2 | +100 °C (+212 °F) | +85 °C (+185 °F) |
| P3 | +200 °C (+392 °F) | +40 °C (+77 °F)  |

| P  | T <sub>p</sub>    | T <sub>a</sub> |
|----|-------------------|----------------|
| P4 | +200 °C (+392 °F) | -20 °C (-4 °F) |
| P5 | -20 °C (-4 °F)    | -20 °C (-4 °F) |

### 15.3.2 Storage temperature

-40 to +85 °C (-40 to +185 °F)

### 15.3.3 Operating height

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

### 15.3.4 Climate class

According to IEC 60068-2-38 test Z/AD (relative humidity 4 to 100 %).

### 15.3.5 Degree of protection

Test as per IEC 60529 Edition 2.2 2013-08/ DIN EN 60529:2014-09 and NEMA 250-2014

For mounted M12 connecting cable: IP66/68/69, NEMA type 4X/6P  
/IP68,: (1.83 mH<sub>2</sub>O for 24 h))

### 15.3.6 Pollution degree

Pollution degree 2 in accordance with IEC 61010-1.

### 15.3.7 Vibration resistance

- Stochastic noise (random sweep) as per IEC/DIN EN 60068-2-64 Case 2 /
- Guaranteed for 5 to 2 000 Hz: 1.25 (m/s<sup>2</sup>)<sup>2</sup>/Hz, ~ 5 g
- Sinusoidal vibration according to IEC 62828-1:2017 with 10 to 60 Hz ±0.35 mm;  
60 to 1 000 Hz 5 g

### 15.3.8 Shock resistance

- Test standard: IEC 60068-2-27 Case 2
- Shock resistance: 30 g (18 ms) in all 3 axes

### 15.3.9 Electromagnetic compatibility (EMC)

- Electromagnetic compatibility as per IEC 61326 series and NAMUR recommendation EMC (NE21)
- Maximum deviation under interference influence: < 0.5 %

For more details refer to the EU Declaration of Conformity.

## 15.4 Process

### 15.4.1 Process temperature

| Maximum process temperature                         | Version <sup>1)</sup> |
|-----------------------------------------------------|-----------------------|
| +100 °C (+212 °F)                                   | A                     |
| +130 °C (+266 °F)(+150 °C (+302 °F) <sup>2)</sup> ) | B                     |
| +150 °C (+302 °F)                                   | C                     |
| +200 °C (+392 °F)                                   | D                     |

- 1) Product Configurator, "Application" feature  
 2) Temperature for maximum one hour (device in operation but not within measurement specification)

#### Fill fluid

| Fill fluid         | Process temperature range                                         | Version <sup>1)</sup> |
|--------------------|-------------------------------------------------------------------|-----------------------|
| Synthetic oil, FDA | -40 to +130 °C (-40 to +266 °F)(+150 °C (+302 °F) <sup>2)</sup> ) | 3                     |
| Vegetable oil, FDA | -20 to +200 °C (-4 to +392 °F)                                    | 4                     |

- 1) Product Configurator, "Fill fluid" feature  
 2) Temperature for one hour maximum (device in operation but not within measurement specification)

### 15.4.2 Process pressure range

#### Pressure specifications

##### WARNING

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

- ▶ Only operate the device within the specified limits for the components!
- ▶ MWP (maximum working pressure): The 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 maximum working pressure. For higher temperatures, refer to the following standards for the permitted pressure values for flanges: EN 1092-1 (materials 1.4435 and 1.4404 are identical with regard to their stability/temperature property and are grouped together in under 13EO in EN 1092-1 Tab. 18; the chemical composition of the two materials can be identical), ASME B 16.5a (the latest version of the standard applies in each case).
- ▶ The overpressure limit is the maximum pressure that a device may be subjected to during a test. It exceeds the maximum working pressure by a certain factor. This value refers to a reference temperature of +20 °C (+68 °F).
- ▶ In the case of sensor 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 MWP; MWP = PN).
- ▶ The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the maximum working pressure of the device.
- ▶ For maximum working pressure data that deviate from this, see the "Mechanical construction" section.
- ▶ Avoid dynamic-mechanical stress on the membrane.

### **15.4.3 Cleaned of oil and grease**

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

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