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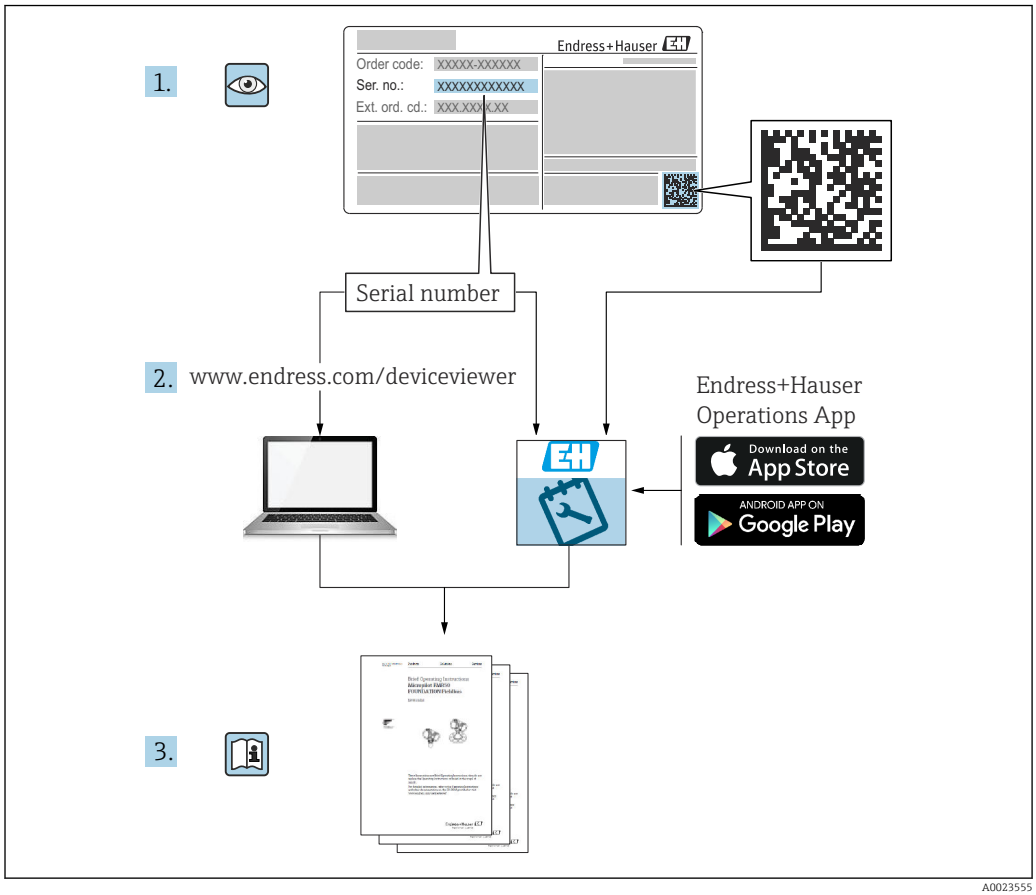
Valid as of version
01.00.zz (Device firmware)

Operating Instructions
Liquiphant FTL43

Vibronic
IO-Link
Level switch for liquids

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 Tool symbols

Open-ended wrench

1.2.3 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)".

1.2.4 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:

1.2.5 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

MWP
Maximum working pressure
The MWP is indicated on the nameplate.

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)

1.4 Documentation

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

1.5 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.

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 device described in this manual is intended only for the level measurement of liquids.

Incorrect use
The manufacturer is not liable for damage 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 media 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
Due to the transfer of heat from the process and power dissipation within the electronics, the temperature of the housing may increase to up to 80 °C (176 °F) during operation. 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 as per 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 approval-related area (e.g. explosion protection, pressure equipment safety):
- Check the nameplate to verify if the device ordered can be put to its intended use in the hazardous area.
- Observe the specifications in the separate supplementary documentation included as an integral part of these instructions.

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 Bluetooth or FieldCare, DeviceCare or asset management tools (e.g. AMS, PDM).

2.7.1 Access via Bluetooth® wireless technology

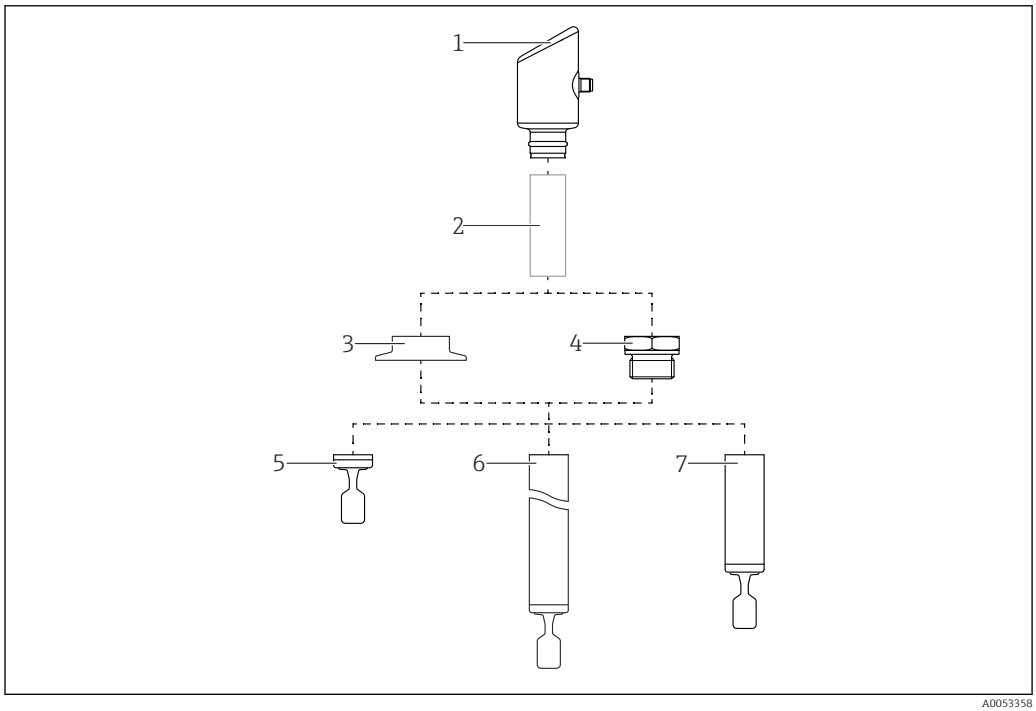
Secure signal transmission via Bluetooth® wireless technology uses an encryption method tested by the Fraunhofer Institute.

- 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 onsite operation or via SmartBlue.

3 Product description

Level switch for all liquids, for minimum or maximum detection in tanks, vessels and pipes.

3.1 Product design

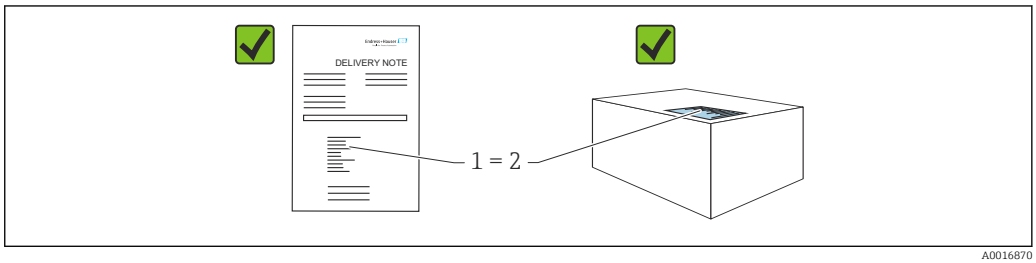


1 Product design

1 *Housing with electronics module*
2 *Temperature spacer, pressure-tight feedthrough (second line of defense), optional*
3 *Process connection, e.g. clamp/Tri-Clamp*
4 *Process connection, e.g. thread*
5 *Compact probe version with tuning fork*
6 *Pipe extension probe with tuning fork*
7 *Short pipe version of probe with tuning fork*

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): 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)

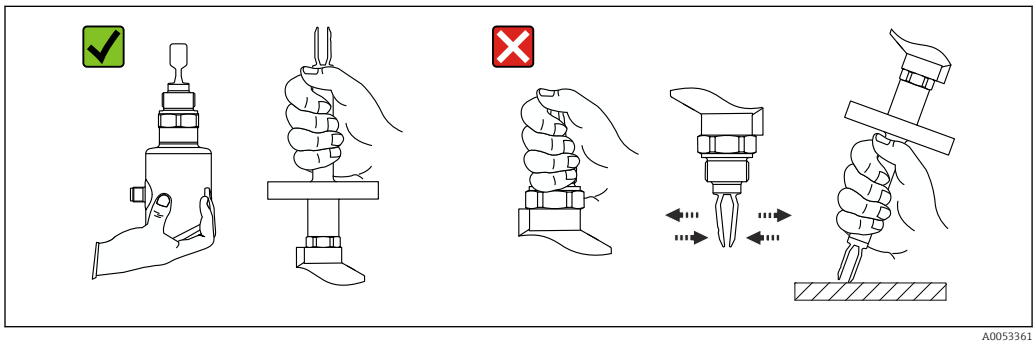
4.3.2 Transporting the product to the measuring point

⚠ WARNING

Incorrect transport!

Housing and tuning fork may become damaged, and there is a risk of injury.

- ▶ Transport the device to the measuring point in the original packaging.
- ▶ Hold the device by the housing, temperature spacer, process connection or extension pipe.
- ▶ Do not bend, shorten or extend the tuning fork.



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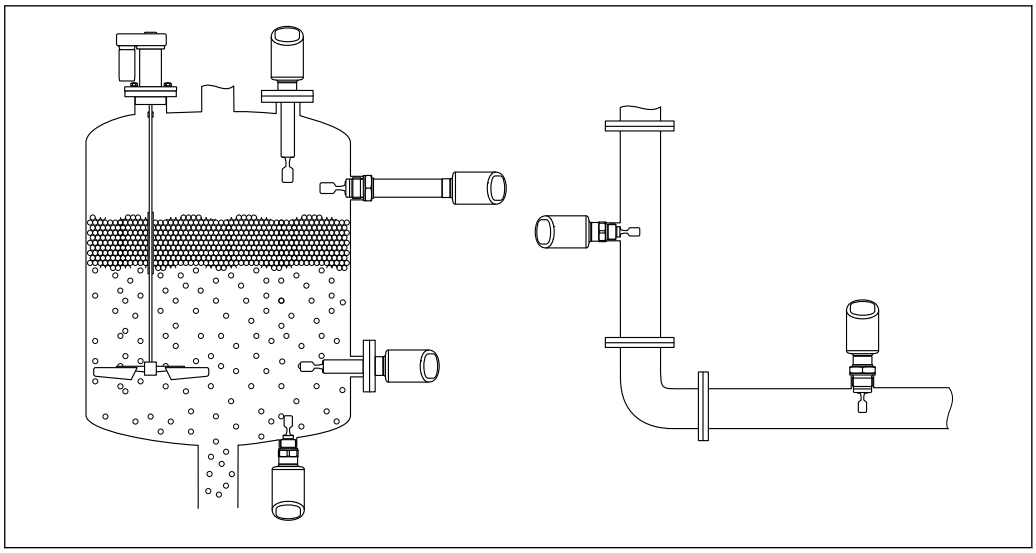
2 Handling the device

5 Installation

- Any orientation for compact version or version with a pipe length up to approx. 500 mm (19.7 in)
- Vertical orientation from above for device with long pipe
- Minimum distance between the vibrating fork and the tank wall or pipe wall: 10 mm (0.39 in)



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3 *Installation examples for a vessel, tank or pipe*

5.1 Installation requirements

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.

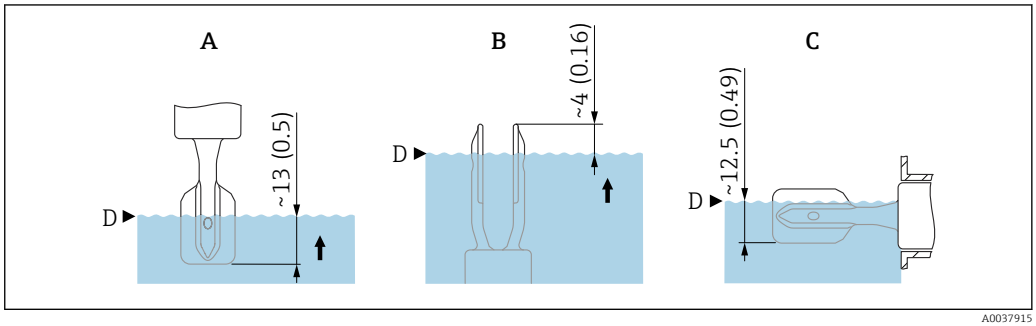
- Devices in North America are intended for indoor use
  Devices are suitable for use in wet environments in accordance with IEC 61010-1
- Protect the housing against impact

5.1.1 Take switch point into consideration

The following are typical switch points, depending on the orientation of the level switch.

Water +23 °C (+73 °F)

Minimum distance between the tuning fork and the tank wall or pipe wall:
10 mm (0.39 in)



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4 *Typical switch points. Unit of measurement mm (in)*

A Installation from above
B Installation from below
C Installation from the side
D Switch point

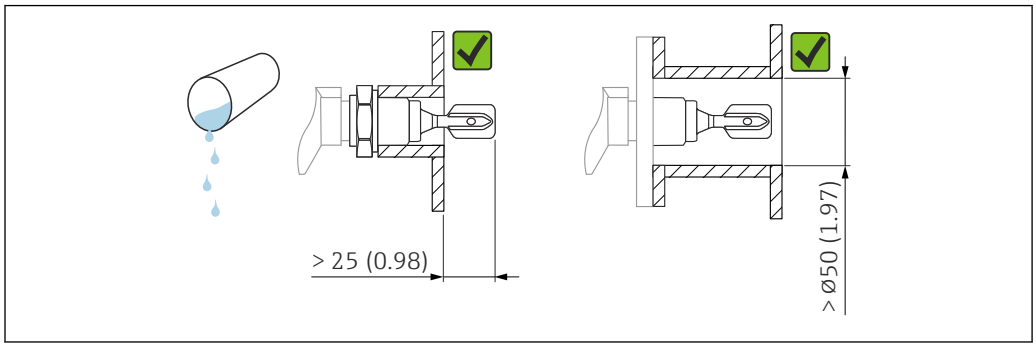
5.1.2 Take viscosity into consideration

Viscosity values
- Low viscosity : < 2 000 mPa·s
- High viscosity: > 2 000 to 10 000 mPa·s

Low viscosity

Low viscosity, e.g. water: < 2 000 mPa·s

It is permitted to position the tuning fork within the installation socket.



5 *Installation example for low-viscosity liquids. Unit of measurement mm (in)*

High viscosity

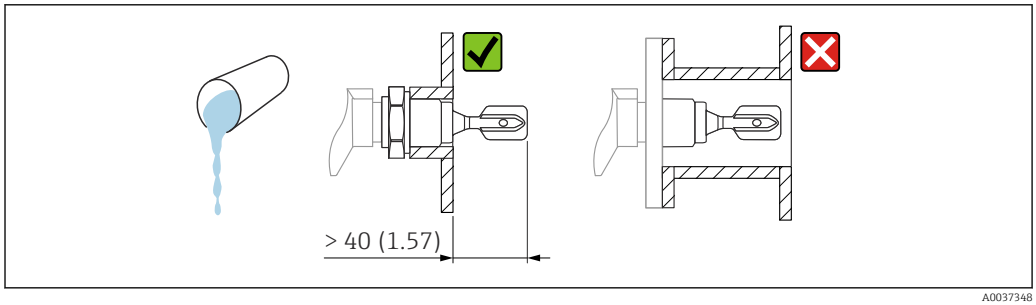
NOTICE

Highly viscous liquids may cause switching delays.

- ▶ Make sure that the liquid can run off the tuning fork easily.
- ▶ Deburr the socket surface.

High viscosity, e.g. viscous oils: ≤ 10 000 mPa·s

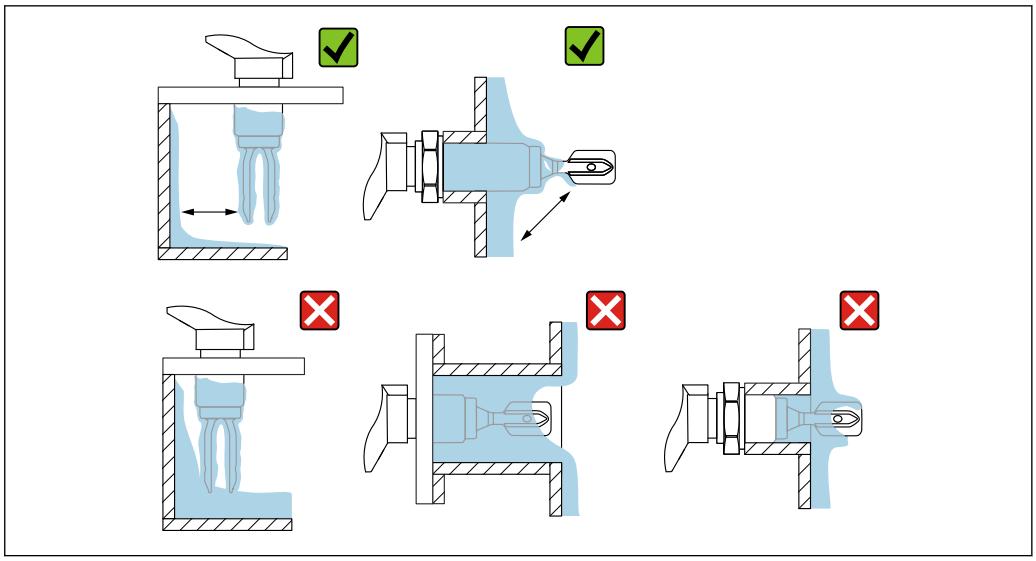
The tuning fork must be located outside the installation socket!



6 *Installation example for a highly viscous liquid. Unit of measurement mm (in)*

5.1.3 Avoid buildup

- Use short installation sockets to ensure that the tuning fork projects freely into the vessel
- Leave sufficient distance between the buildup expected on the tank wall and the tuning fork



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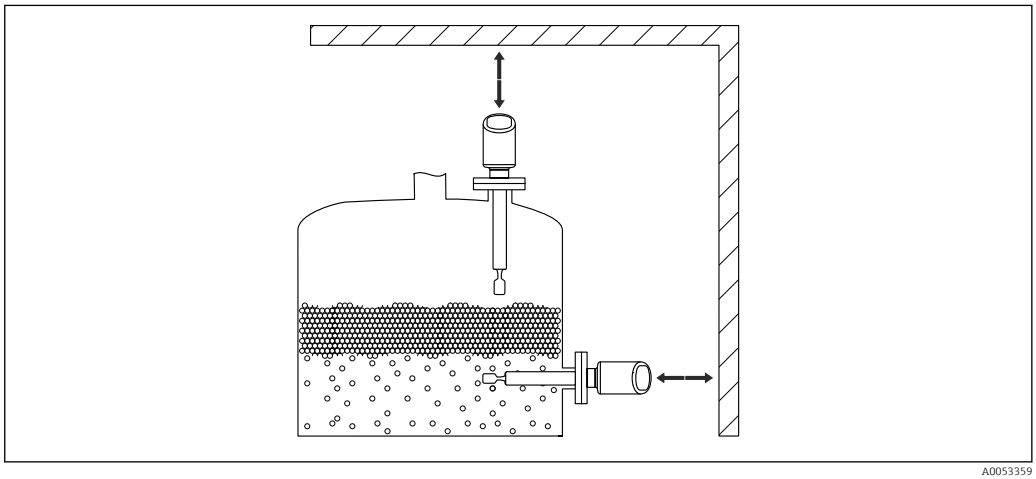
7 *Installation examples for a highly viscous process medium*

5.1.4 Take clearance into consideration

Allow sufficient clearance outside the tank for mounting and electrical connection.



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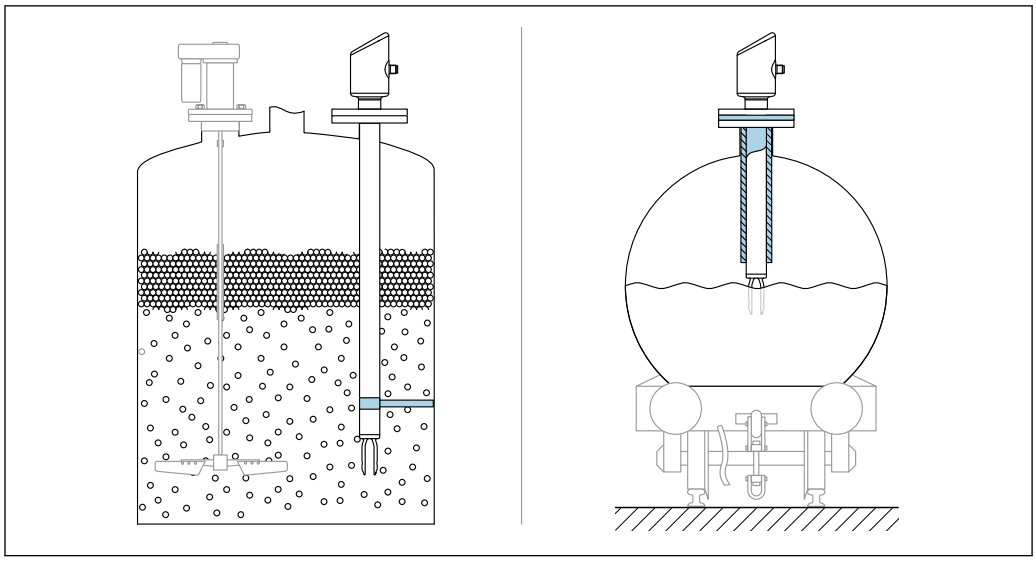
8 *Take clearance into consideration*

5.1.5 Support the device

Support the device in the event of severe dynamic load. Maximum lateral loading capacity of the pipe extensions and sensors: 75 Nm (55 lbf ft).



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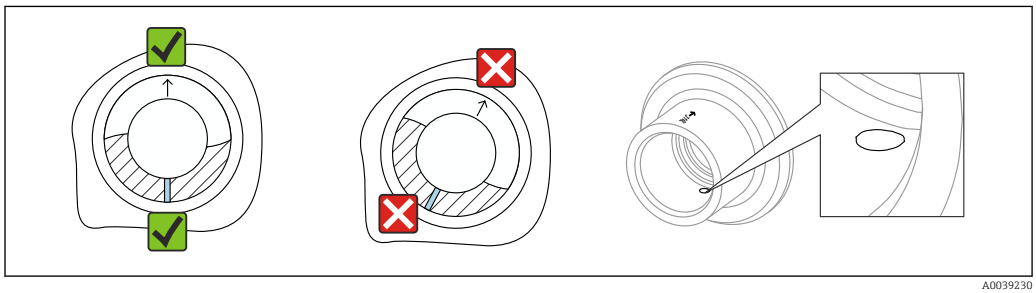
9 *Examples of support in the event of dynamic load*

5.1.6 Weld-in adapter with leakage hole

Weld in the weld-in adapter in such a way that the leakage hole is pointing downwards. This enables any leaks to be detected quickly.



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10 *Weld-in adapter with leakage hole*

5.2 Installing the device

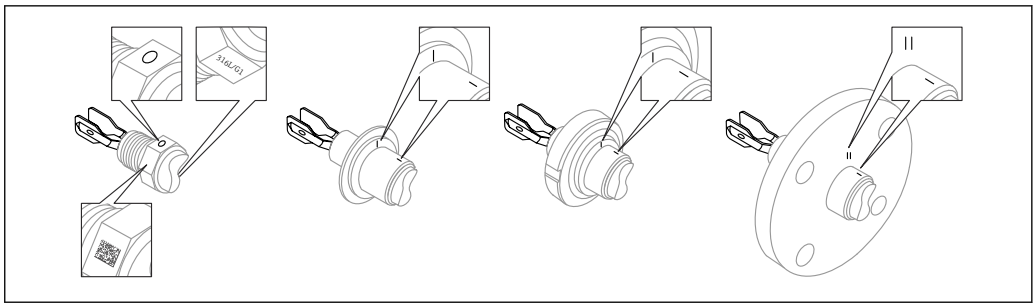
5.2.1 Installation procedure

Align the vibrating fork using the marking

The vibrating fork can be aligned using the marking in such a way that the medium drains off easily and buildup is avoided.

- Markings for threaded connections: Circle (material specification/thread designation opposite)
- Markings for flange or clamp connections: Line or double line

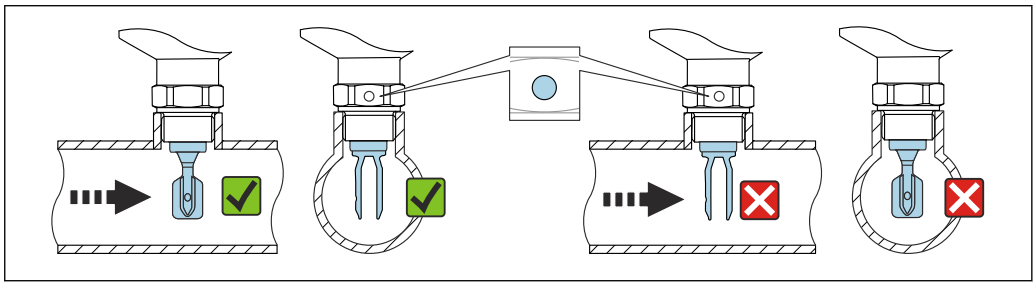
In addition, the threaded connections have a matrix code that is **not** used for alignment.



11 *Position of the vibrating fork when installed horizontally in the vessel using the marking*

Installing the device in piping

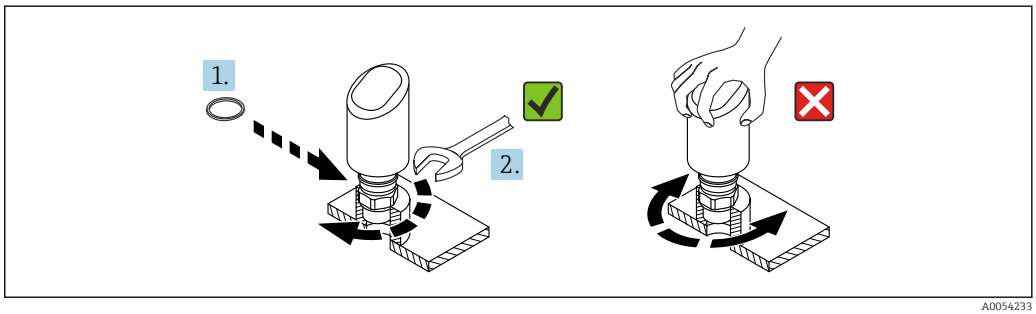
- Flow velocity up to 5 m/s with a viscosity of 1 mPa·s and density of 1 g/cm³ (62.4 lb/ft³) (SGU).
  Check for correct functioning in the event of other process medium conditions.
- The flow will not be significantly impeded if the tuning fork is correctly aligned and the marking is pointing in the direction of flow.
- The marking is visible when installed.



12 *Installation in pipes (take fork position and marking into consideration)*

Screwing in the device (for process connections with thread)

- Turn by the hex bolt only, 15 to 30 Nm (11 to 22 lbf ft)
- Do not turn at the housing!



13 *Screwing in the device*

5.3 Post-mounting check

❑ Is the device undamaged (visual inspection)?

❑ Are the measuring point identification and labeling correct (visual inspection)?

❑ Is the device properly secured?

❑ Does the device comply with the measuring point specifications?

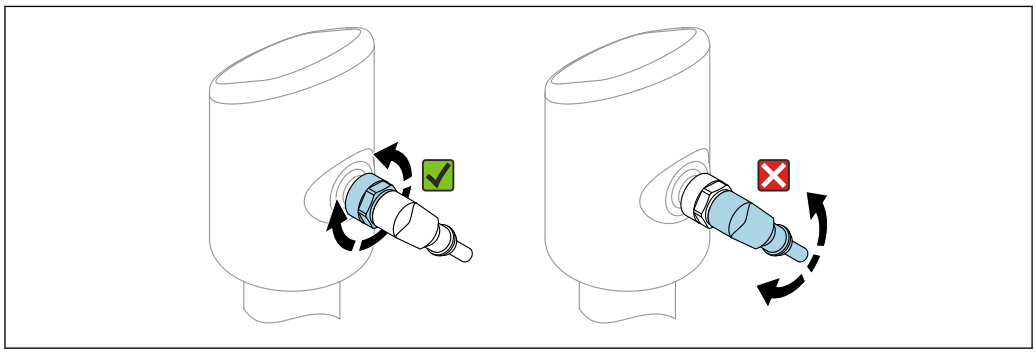
For example:
- Process temperature
- Process pressure
- Ambient temperature
- Measuring range

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).



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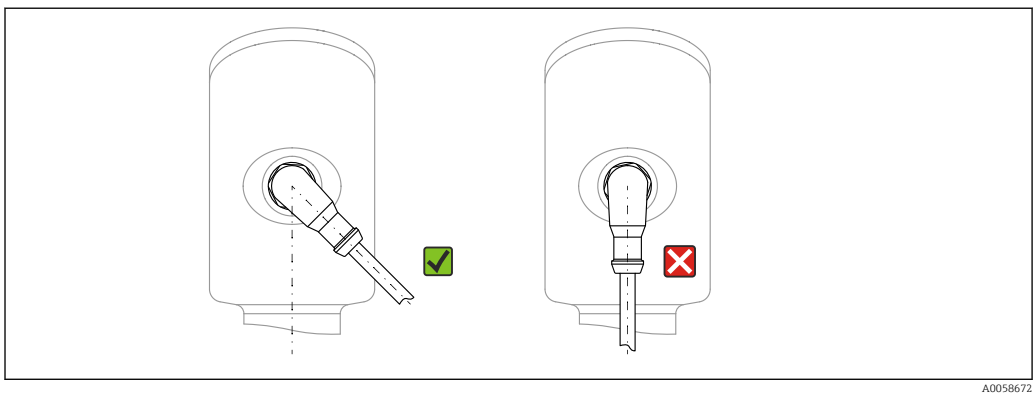
14 M12 plug connection

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



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15 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

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: 1000 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.

6.1.7 Switching capacity

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

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 mAload current over the entire temperature range. The switching current may be up to 200 mA up to an ambient temperature of 50 °C (122 °F) and up to a process temperature of 85 °C (185 °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: $I_a < 3.6$ mA and $U_a < 2$ V and for switch status ON: voltage drop PNP: ≤ 2.5 V

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.

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

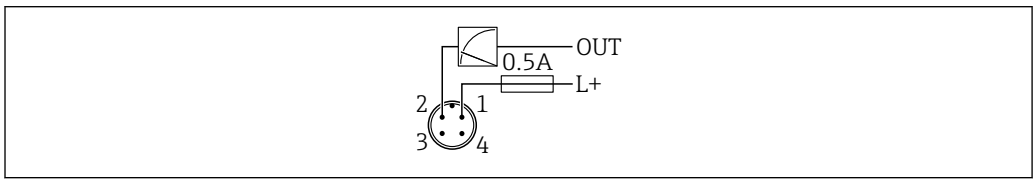
Damage to analog input of PLC resulting from incorrect connection

- 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:

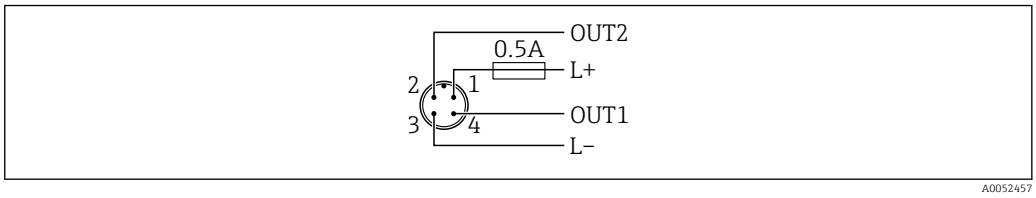
1. Check that the supply voltage corresponds to the supply voltage indicated on the nameplate.
2. Connect the device as indicated in the following diagram.
3. Switch on the supply voltage.

2-wire



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

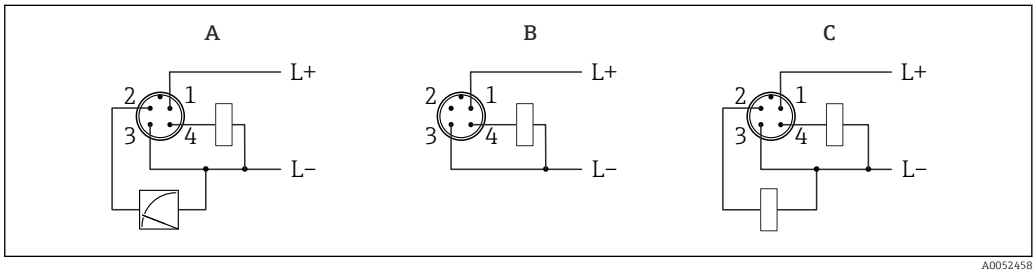
3-wire or 4-wire



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 LED indicator: operating status LED permanently red.)
C 2 x PNP switch output, standard setting

6.1.9 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.

6.1.10 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 power is supplied: Is the device ready for operation and is the operating status LED lit?

7 Operation options

7.1 Overview of operation options

- Operation via LED indicator operating key
- Operation via Bluetooth® wireless technology
- Operation via Endress+Hauser operating tool
- Operation via IO-Link master

7.2 Structure and function of the operating menu

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.

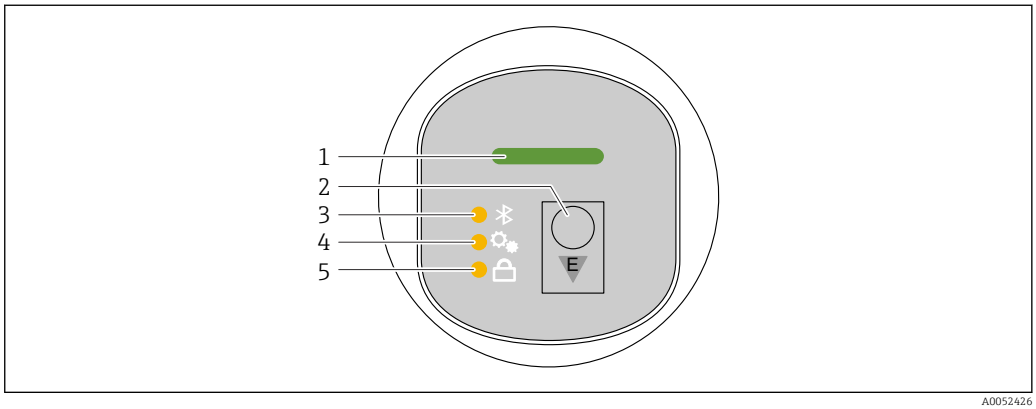
If an incorrect access code is entered, the user obtains the access rights of the**Operator** role.

Assign password, change user role:

▶ Navigation: System → User management

7.3 Access to operating menu via LED indicator

7.3.1 Overview



1 Operating status LED
2 Operating key "E"
3 Bluetooth LED
4 Trigger proof test or function test 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

Trigger proof test or function test LED (4)

LED flashing: Proof test or function test currently running.

See "Proof test function" section

Keypad lock LED (5)

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

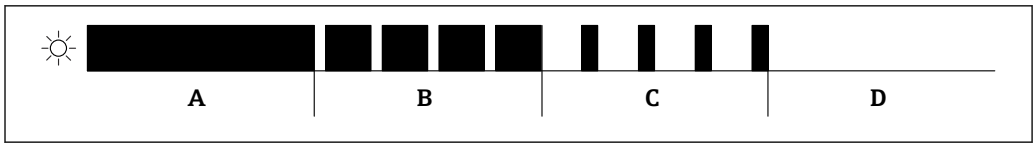
7.3.2 Operating

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:



16 *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

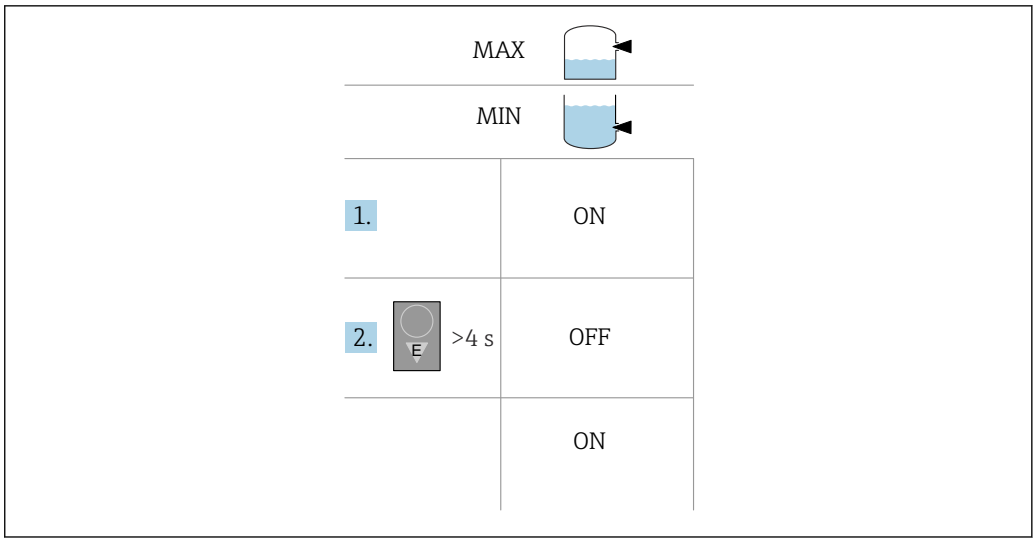
1. If necessary, disable the keypad lock.
2. Repeatedly press the "E" key briefly until the Bluetooth LED flashes.
3. Press and hold down operating key "E".
   ↳ Bluetooth® connection is enabled (Bluetooth LED is lit) or Bluetooth® is disabled (Bluetooth LED goes out).

7.3.3 Proof test function

For proof testing in safety instrumented systems according to WHG

- The operating status LED indicates the status of the vibrating fork
  - Green LED = vibrating fork uncovered
  - Yellow LED = vibrating fork covered
  These two states refer to the setting of the switch output (OUT1).
- Settings for the switch output (OUT1):
  MIN mode = High active
  MAX mode = Low active

The operating status LED shows the simulation status generated by the proof test.



1. Make sure that no undesired switching operations are triggered!
   ↳ The proof test must take place in the 'OK status': MAX safety and sensor uncovered or MIN safety and sensor covered.
   If necessary, disable the keypad lock (see "Disabling the keypad lock" section).
   Repeatedly press the "E" key briefly until the 'Trigger proof test or function test' LED flashes.
2. Press and hold down operating key "E" for more than 4 s.
   ↳ The device function check is performed.
   The output changes from the OK status to demand mode (OFF).
   The proof test or function test LED flashes during the proof test.

The proof test or function test LED is lit continuously for 12 s on successful completion of the function check. The keypad lock LED and Bluetooth LED are off. The device switches back to normal operation.

The operating status LED lights up in red and outputs OUT1 and OUT2 are OFF if the function check is not completed successfully. The device remains in this state until a restart.

If the Bluetooth LED, proof test or function test LED and keypad lock LED flash simultaneously, the proof test cannot be carried out.

The proof test is not performed in demand mode.

Duration of function check: 10 s at least

7.4 Access to the operating menu via the operating tool

7.4.1 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

7.4.2 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

17 *QR code for free Endress+Hauser SmartBlue App*

Download and installation:

1. Scan the QR code or enter **SmartBlue** in the search field of the Apple App Store (iOS) or Google Play Store (Android).

2. Install and start the SmartBlue app.
3. For Android devices: enable location tracking (GPS) (not required for iOS devices).
4. Select a device that is ready to receive from the device list displayed.

Login:

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

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

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

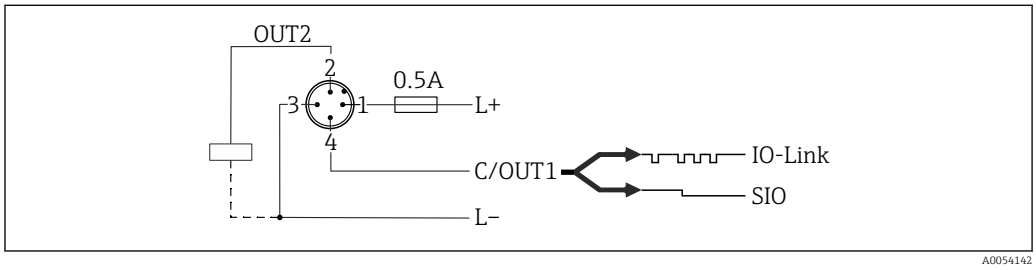
8.2 Process data

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.



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**	**2**	**1**	**0**
SDCI A0054022	**Float32T**	**IntegerT(14)**	**BOOL**	**BOOL**
Transmission direction	MDC1	Extended device status	SSC1.2	SSC1.1

Name (IODD)	**Bit offset**	**Data type**	**Permitted values**	**Offset/ gradient**	**Description**
Frequency (MDC1)	16	Float32T	-	Fork frequency Unit is Hz	Current fork frequency
Extended device status	8	8-bit UInteger	▪ 36 = Failure ▪ 37 = Failure - simulation ▪ 60 = Function check ▪ 61 = Function check - simulation ▪ 120 = Out of spec ▪ 121 = Out of spec - simulation ▪ 164 = Maintenance ▪ 165 = Maintenance - simulation ▪ 128 = Good ▪ 129 = Good - simulation ▪ 0 = Non-specific	-	Extended Endress+Hauser device status according to NE 107
Process Data Input.Switching Signal Channel 1.2 (SSC1.2) Frequency	1	BooleanT	0 = False 1 = True	-	Switching signal status SSC 1.2 (via OUT2)
Process Data Input.Switching Signal Channel 1.1 (SSC 1.1) Frequency	0	BooleanT	0 = False 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 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.

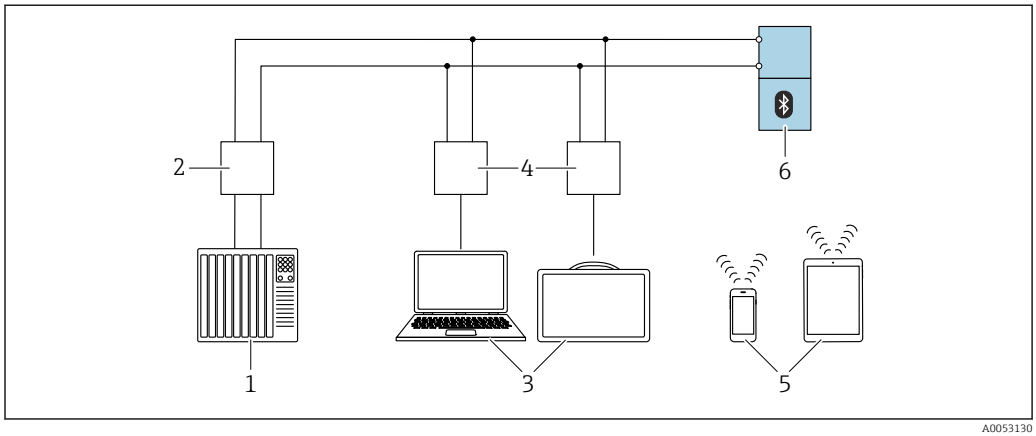
9.4 Overview of commissioning options

- Commissioning with the SmartBlue app
- Commissioning via FieldCare/DeviceCare/Field Xpert
- Commissioning via additional operating tools (AMS, PDM, etc.)

9.5 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.

9.5.1 Connecting via FieldCare, DeviceCare, Field Xpert and SmartBlue app



18 *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*

9.6 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.

9.7 Configuring the device

9.7.1 Configuring process monitoring

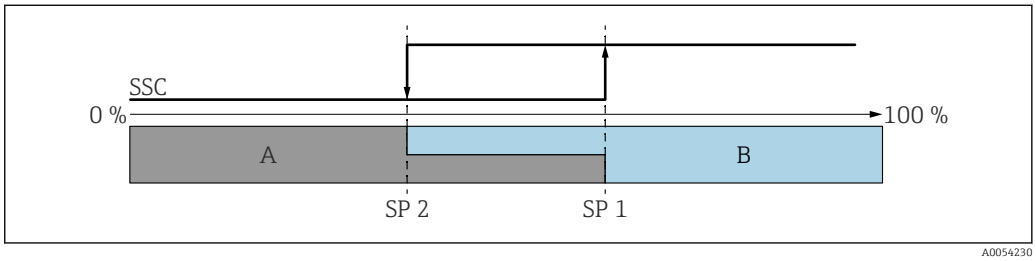
Digital process monitoring (switch output)

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 (OUT1/OUT2)
Function (Config. Mode)	**Invert (Config. Logic)**	**Switch points (Param.SPx)**	**Hysteresis (Config. Hyst)**	
Density presettings (>0.7/>0.5/>0.4) [1]	High active (MIN)	SP1: N/A	N/A	Normally open contact (NO [2])
		SP2: N/A		
	Low active (MAX)	SP1: N/A	N/A	Normally closed contact (NC [3])
		SP2: N/A		
Two point	High active (MIN)	SP1 (float32)	N/A	Normally open contact (NO [2])
		SP2 (float32)		
	Low active (MAX)	SP1 (float32)	N/A	Normally closed contact (NC [3])
		SP2 (float32)		
Window	High active	SP1 (float32)	Hyst (float32)	Normally open contact (NO [2])
		SP2 (float32)		
	Low active	SP1 (float32)	Hyst (float32)	Normally closed contact (NC [3])
		SP2 (float32)		
Single point	High active (MIN)	SP1 (float32)	Hyst (float32)	Normally open contact (NO [2])
	Low active (MAX)	SP1 (float32)	Hyst (float32)	Normally closed contact (NC [3])

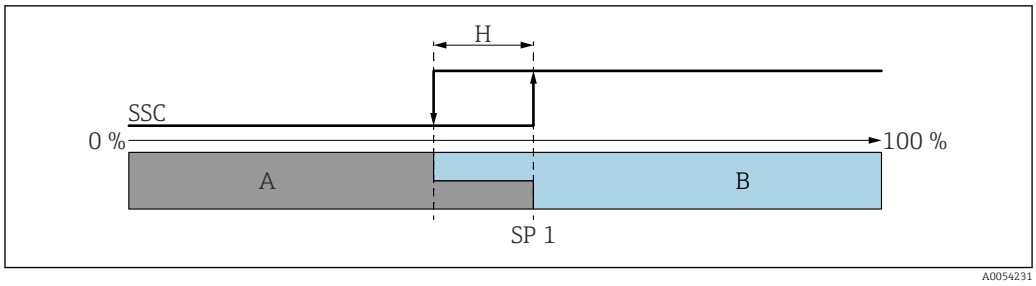
1) A teach process cannot be carried out with the factory density presettings.
2) NO = normally open
3) NC = normally closed

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



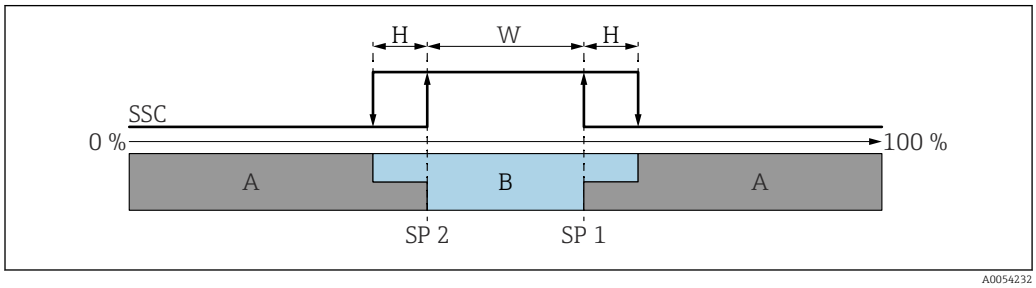
19 SSC, two point

SP 2 Switch point with lower measured value
SP 1 Switch point with higher measured value
A Inactive
B Active



20 SSC, single point

H Hysteresis
SP 1 Switch point
A Inactive
B Active



21 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.

Advanced sensor monitoring

The Advanced sensor monitoring function is enabled by default.

This diagnostic function detects if the oscillation of the sensor is disturbed by external influences, for example:
- Strong vibrations from the outside. (e.g. from pumps)
- Turbulence around the vibrating fork if the sensor is installed incorrectly
- Very high flow velocity in pipes

The device issues a warning if these conditions could affect the oscillation of the sensor. The warning is displayed via the available communication interfaces. The switch output and the current output remain unchanged.

If this warning is already in place when performing a function test (proof test), the warning is converted to a fault. In this case, the device enters the safe state. The fault is not reset until the device is restarted.

The function can be activated or deactivated via the SmartBlue app for example:

Navigation: Diagnostics → Diagnostic settings → Properties → 946 Advanced sensor monitoring

9.8 Protecting settings from unauthorized access

9.8.1 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 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
- 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 → Downloads.

10.3.3 Mode of medium detection

Standard setting of the "Mode of operation" (factory setting): "Level limit detection" of liquids. This setting is suitable for most applications.

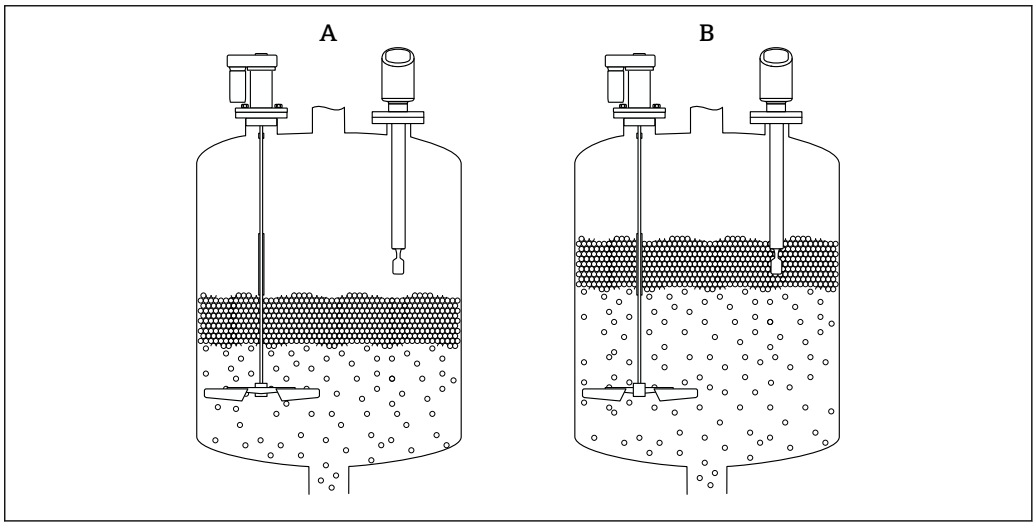
The following options can be selected in combination with the Heartbeat Verification + Monitoring application package:
- Detect foam
- Ignore foam

"Detect foam" option

Area of application: point level measurement in liquids with foam generation. The device detects the foam and switches as soon as the vibrating fork is immersed in the foam.
Detection of light foams, for example:
- Beer foam
- Milk foam

Influences on switching behavior:
- Particularly large air bubbles in the foam
- Significantly reduced liquid content in the foam
- Change in the properties of the foam during operation

Application in accordance with the WHG (German Water Resources Act) is not possible in this mode.



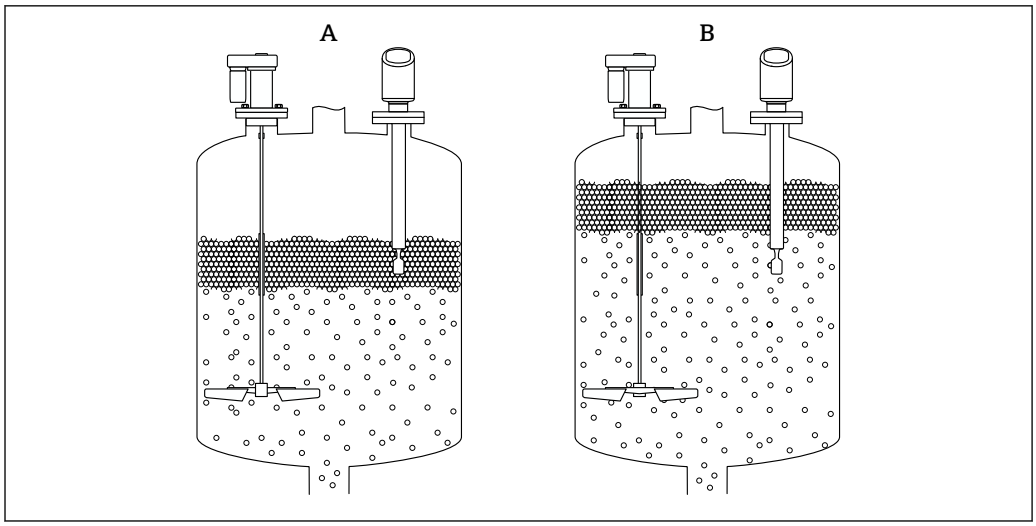
22 *Functionality for Detect foam*

A uncovered
B covered

"Ignore foam" option

Area of application: point level measurement in liquids with foam generation. The device only switches when immersed in a homogeneous liquid. In this setting, the device does not react to the foam (the foam is ignored).

Application in accordance with the WHG (German Water Resources Act) is not possible in this mode.



23 Functionality for Ignore foam

A uncovered
B covered

10.4 Displaying the measured value history

See Special Documentation for SD Heartbeat Technology.

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).

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)

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)

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)
- 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 that the device concerned is functioning correctly. Replace the device if the digital value does not correspond to the expected value.
2. Switch on simulation and check the current output. Replace the device if the current output does not correspond to the simulated value.
3. 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

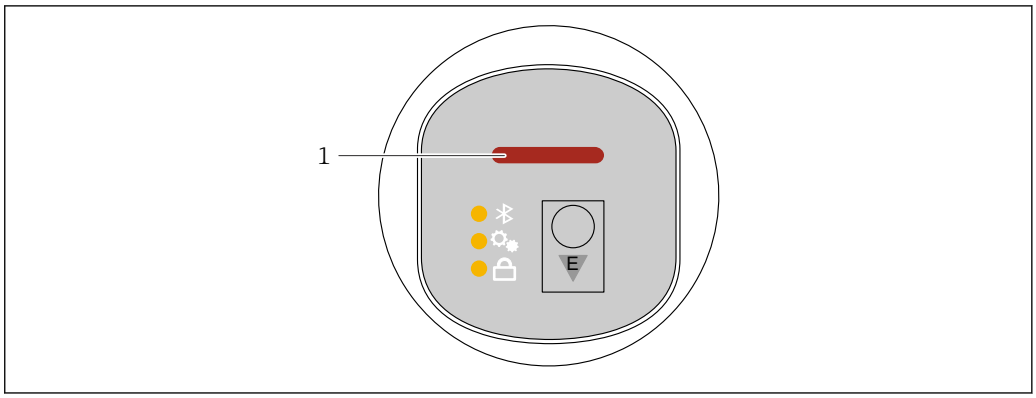
The behavior of the current output in the event of a failure is regulated in accordance with NAMUR NE 43.

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 (≤ 3.6 mA)
- **Failure current** parameter, **Max.** option: Upper alarm current (≥ 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

The operating status LED indicates the status of the vibrating fork:
Green LED = vibrating fork uncovered

Yellow LED = vibrating fork covered

These two states refer to the setting of the switch output (OUT1).

Settings for the switch output (OUT1):
- MIN mode = High active
- MAX mode = Low active

Red LED = Fault
Switch outputs OUT1 and OUT2 are OFF

LED flashing = a function is currently running:
- In the case of Bluetooth connection (SmartBlue app)
- If the **Device search** parameter is enabled (IODD)
  The LED flashes independently of the color currently displayed.

11.3 Diagnostic list

11.3.1 List of diagnostic events

Some of the remedial actions of the generic software are not applicable (e.g. electronics replacement is not possible).

The device must be replaced in these cases.

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
004	Sensor defective	1. Restart device 2. Replace electronics 3. Replace device	F	Alarm
007	Sensor defective	1. Check fork 2. Replace device	F	Alarm
042	Sensor corroded	1. Check fork 2. Replace device	F	Alarm
049	Sensor corroded	1. Check fork 2. Replace device	M	Warning [1)]

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
061	Sensor electronics faulty	Replace electronics	F	Alarm
062	Sensor connection faulty	1. Check Main to sensor connection 2. Replace electronics	F	Alarm
081	Sensor initialization faulty	1. Restart device 2. Contact service	F	Alarm
Diagnostic of electronic				
201	Electronics faulty	1. Restart device 2. Replace electronics	F	Alarm
242	Firmware incompatible	1. Check software 2. Flash or change main electronic module	F	Alarm
252	Module incompatible	1. Check if correct electronic module is plugged 2. Replace electronic module	F	Alarm
270	Main electronics defective	Replace main electronics or device.	F	Alarm
272	Main electronics faulty	1. Restart device 2. Contact service	F	Alarm
273	Main electronics defective	Replace main electronics or device.	F	Alarm
282	Data storage inconsistent	Restart device	F	Alarm
283	Memory content inconsistent	1. Restart device 2. Contact service	F	Alarm
287	Memory content inconsistent	1. Restart device 2. Contact service	M	Warning
388	Electronics and HistoROM defective	1. Restart device 2. Replace electronics and HistoROM 3. Contact service	F	Alarm
Diagnostic of configuration				
410	Data transfer failed	1. Retry data transfer 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
437	Configuration incompatible	1. Update firmware 2. Execute factory reset	F	Alarm
438	Dataset different	1. Check dataset file 2. Check device parameterization 3. Download new device parameterization	M	Warning
441	Current output 1 saturated	1. Check process 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
490	Output simulation	Deactivate simulation	C	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
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
538	Configuration Sensor Unit invalid	1. Check sensor configuration 2. Check device configuration	M	Warning
Diagnostic of process				
801	Supply voltage too low	Increase supply voltage	F	Alarm
802	Supply voltage too high	Decrease supply voltage	S	Warning
803	Loop current faulty	1. Check wiring 2. Replace electronics	F	Alarm
804	Switch output overloaded	1. Reduce load at the output. 2. Check output. 3. Replace device.	S	Warning
805	Loop current 1 faulty	1. Check wiring 2. Replace electronics or device	F	Alarm
806	Loop diagnostics	1. Only with a passive I/O: Check supply voltage of current loop. 2. Check wiring and connections.	M	Warning [1)]
807	No Baseline due to insuf. volt. at 20 mA	Increase supply voltage	M	Warning
825	Electronics temperature out of range	1. Check ambient temperature 2. Check process temperature	S	Warning [1)]
826	Sensor temperature out of range	1. Check ambient temperature 2. Check process temperature	S	Warning [1)]
842	Process limit	1. Check process density 2. Check fork	F	Alarm
900	Process alert frequency too low	Check process conditions	M	Warning [1)]
901	Process alert frequency too high	Check process conditions	M	Warning [1)]
946	Vibration detected	Check installation	S	Warning

1) Diagnostic behavior can be changed.

11.4 Event logbook

11.4.1 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

11.4.2 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

11.4.3 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
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

Info number	Info name
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
I1908	Sensor check ok
I1956	Reset

11.5 Device reset

11.5.1 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 [1)]	Restores the factory settings and calibration data.
Restart device [2)]	Enables device restart.

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

11.5.2 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

11.6 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.

11.7 Firmware history

11.7.1 Version

01.00.00
Initial software

12 Maintenance

12.1 Maintenance work

12.1.1 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
- 30 % H_2O_2 solution (vaporisation)

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:

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^2 (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".

14.2 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. 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).

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 Output

15.1.1 Output signal

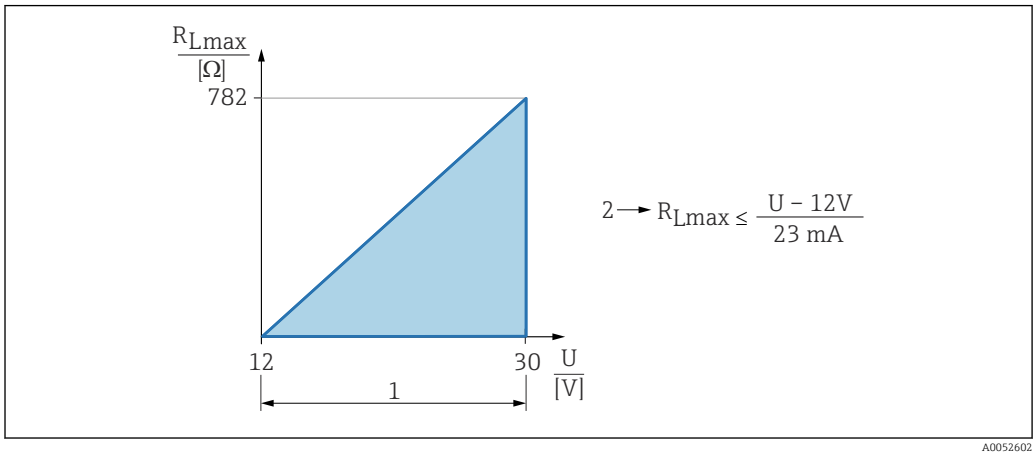
- 2 outputs, configurable as switch output, analog output or IO-Link output
- The current output offers a choice of three different operating modes:
  - 4 to 20.5 mA
  - NAMUR NE 43: 3.8 to 20.5 mA (factory setting)
  - US mode: 3.9 to 20.5 mA

15.1.2 Switching capacity

- Switch status ON: $I_a \leq 200$ mA [3]; switch status OFF: $I_a < 0.1$ mA [4]
- Switch cycles: $> 1 \cdot 10^7$
- Voltage drop PNP: ≤ 2 V
- Overload protection: Automatic load testing of switching current;
  - Max. capacitive load: 1 µF at max. supply voltage (without resistive load)
  - Max. cycle duration: 0.5 s; min. t_{on}: 40 µs
  - Periodic disconnection from protective circuit in the event of overcurrent (f = 1 Hz)

15.1.3 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.



1 Power supply 12 to 30 V
2 R_{Lmax} 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

3) 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 °C (122 °F) ambient temperature and up to 85 °C (185 °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.

4) Differing for switch output OUT2, for switch status OFF: $I_a < 3.6$ mA and $U_a < 2$ V and for switch status ON: voltage drop PNP: ≤ 2.5 V

15.1.4 Damping

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

15.1.5 Protocol-specific data

IO-Link specification 1.1.3

Device type ID:
0x91 0xDF 0x01

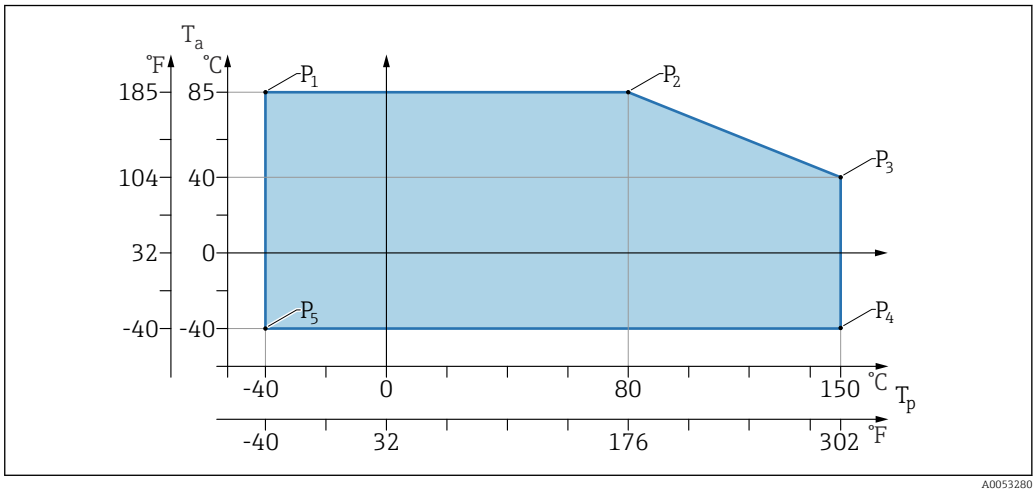
15.2 Environment

15.2.1 Ambient temperature range

–40 to +85 °C (–40 to +185 °F)

The permitted ambient temperature is reduced at higher process temperatures.

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



24 *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	+80 °C (+176 °F)	+85 °C (+185 °F)
P3	+150 °C (+302 °F)	+40 °C (+77 °F)
P4	+150 °C (+302 °F)	–40 °C (–40 °F)
P5	–40 °C (–40 °F)	–40 °C (–40 °F)

15.2.2 Storage temperature

–40 to +85 °C (–40 to +185 °F)

15.2.3 Operating height

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

15.2.4 Climate class

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

15.2.5 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_2O for 24 h))

15.2.6 Pollution degree

Pollution degree 2 in accordance with IEC 61010-1.

15.2.7 Vibration resistance

- Stochastic noise (random sweep) as per DIN EN 60068-2-64 Case 2/ IEC 60068-2-64 Case 2
- Guaranteed for 5 to 2 000 Hz: 1.25 $(m/s^2)^2/Hz$, ~ 5 g

15.2.8 Shock resistance

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

15.2.9 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.

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