Operating Instructions
# Proline Prosonic Flow I 400

Ultrasonic transit time flowmeter
HART

**HART**
COMMUNICATION PROTOCOL

Endress+Hauser

People for Process Automation

- Make sure the document is stored in a safe place such that it is always available when working on or with the device.
- To 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. Your Endress+Hauser Sales Center will supply you with current information and updates to these instructions.

# Table of contents

# 1    About this document

## 1.1    Document function

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

## 1.2    Symbols

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

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

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

### 1.2.2    Electrical symbols

| Symbol | Meaning |
|--------|---------|
| ⎓ | Direct current |
| ∼ | Alternating current |
| ⏦ | Direct current and alternating current |
| ⏚ | **Ground connection**<br>A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system. |
| ⏛ | **Protective Earth (PE)**<br>A terminal which must be connected to ground prior to establishing any other connections.<br><br>The ground terminals are situated inside and outside the device:<br>• Inner ground terminal: Connects the protectiv earth to the mains supply.<br>• Outer ground terminal: Connects the device to the plant grounding system. |

### 1.2.3    Communication-specific symbols

| Symbol | Meaning |
|--------|---------|
| 📶 | **Wireless Local Area Network (WLAN)**<br>Communication via a wireless, local network. |
| ᛒ | **Bluetooth**<br>Wireless data transmission between devices over a short distance. |
| ▣ | **LED**<br>Light emitting diode is off. |

| Symbol | Meaning |
|--------|---------|
| ☼ | **LED**<br>Light emitting diode is on. |
| ☀ | **LED**<br>Light emitting diode is flashing. |

### 1.2.4 Tool symbols

| Symbol | Meaning |
|--------|---------|
| ✪ | Torx screwdriver |
| ✛ | Phillips head screwdriver |
| 🗲 | Open-ended wrench |

### 1.2.5 Symbols for certain types of information

| Symbol | Meaning |
|--------|---------|
| ☑ | **Permitted**<br>Procedures, processes or actions that are permitted. |
| ☑☑ | **Preferred**<br>Procedures, processes or actions that are preferred. |
| ✕ | **Forbidden**<br>Procedures, processes or actions that are forbidden. |
| 🛈 | **Tip**<br>Indicates additional information. |
| 📖 | Reference to documentation |
| 📄 | Reference to page |
| 🖼 | Reference to graphic |
| ▶ | Notice or individual step to be observed |
| 1., 2., 3.... | Series of steps |
| ↳ | Result of a step |
| ？ | Help in the event of a problem |
| 👁 | Visual inspection |

### 1.2.6 Symbols in graphics

| Symbol | Meaning |
|--------|---------|
| 1, 2, 3, ... | Item numbers |
| 1., 2., 3., ... | Series of steps |
| A, B, C, ... | Views |
| A-A, B-B, C-C, ... | Sections |
| ⚠EX | Hazardous area |

| Symbol | Meaning |
|--------|---------|
| ⊠ | Safe area (non-hazardous area) |
| ≈➡ | Flow direction |

## 1.3    Documentation

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

ℹ️ Detailed list of the individual documents along with the documentation code

### 1.3.1    Standard documentation

| Document type | Purpose and content of the document |
|---------------|-------------------------------------|
| Technical Information | **Planning aid for your device**<br>The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device. |
| Sensor Brief Operating Instructions | **Getting the 1st measured value quickly - Part 1**<br>The Sensor Brief Operating Instructions are aimed at specialists with responsibility for installing the measuring device.<br><br>• Incoming acceptance and product identification<br>• Storage and transport<br>• Installation |
| Transmitter Brief Operating Instructions | **Getting the 1st measured value quickly - Part 2**<br>The Transmitter Brief Operating Instructions are aimed at specialists with responsibility for commissioning, configuring and parameterizing the measuring device (until the first measured value).<br><br>• Product description<br>• Installation<br>• Electrical connection<br>• Operation options<br>• System integration<br>• Commissioning<br>• Diagnostic information |
| Description of Device Parameters | **Reference for your parameters**<br>The document provides a detailed explanation of each individual parameter in the Expert operating menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations. |

### 1.3.2    Supplementary device-dependent documentation

Additional documents are supplied depending on the device version ordered: Always comply strictly with the instructions in the supplementary documentation. The supplementary documentation is an integral part of the device documentation.

## 1.4    Registered trademarks

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

# 2     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

**Application and media**
The measuring device described in this manual is intended only for the flow measurement of liquids.

Depending on the version ordered, the measuring device can also measure potentially explosive, flammable, poisonous and oxidizing media.

Measuring devices for use in hazardous areas, in hygienic applications or in applications where there is an increased risk due to process pressure, are marked accordingly on the nameplate.

To ensure that the measuring device remains in proper condition for the operation time:
▶ Keep within the specified temperature range.
▶ Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
▶ Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
▶ If the ambient temperature of the measuring device is outside the atmospheric temperature, it is absolutely essential to comply with the relevant basic conditions as specified in the device documentation→ 🕮 8.
▶ Protect the measuring device permanently against corrosion from environmental influences.

**Incorrect use**
Non-designated use can compromise safety. The manufacturer is not liable for damage caused by improper or non-designated use.

**Residual risks**

⚠ **WARNING**

**If the temperature of the media or electronics unit is high or low, this may cause the surfaces of the device to become hot or cold. This poses a risk of burns or frostbite!**
▶ In the case of hot or cold medium temperatures, install appropriate protection against contact.

## 2.3 Workplace safety

For work on and with the device:
▸ Wear the required personal protective equipment according to national regulations.

For welding work on the piping:
▸ Do not ground the welding unit via the measuring device.

If working on and with the device with wet hands:
▸ Due to the increased risk of electric shock, wear suitable gloves.

## 2.4 Operational safety

Risk of injury.
▸ Operate the device in proper technical condition and fail-safe condition only.
▸ The operator is responsible for interference-free operation of the device.

### Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.
▸ If, despite this, modifications are required, consult with Endress+Hauser.

### Repair

To ensure continued operational safety and reliability,
▸ Carry out repairs on the device only if they are expressly permitted.
▸ Observe federal/national regulations pertaining to repair of an electrical device.
▸ Use original spare parts and accessories from Endress+Hauser only.

## 2.5 Product safety

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

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

Furthermore, the device meets the legal requirements of the applicable UK regulations (Statutory Instruments). These are listed in the UKCA Declaration of Conformity along with the designated standards.

By selecting the order option for UKCA marking, Endress+Hauser confirms a successful evaluation and testing of the device by affixing the UKCA mark.

Contact address Endress+Hauser UK:
Endress+Hauser Ltd.
Floats Road
Manchester M23 9NF
United Kingdom
www.uk.endress.com

## 2.6 IT security

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

IT security measures, which provide additional protection for the device 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 a range of specific functions to support protective measures on the operator's side. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. An overview of the most important functions is provided in the following section:

| Function/interface | Factory setting | Recommendation |
|---|---|---|
| Write protection via hardware write protection switch | Not enabled | On an individual basis following risk assessment |
| Access code<br>(also applies for Web server login or FieldCare connection) → 🖺 11 | Not enabled (0000) | Assign a customized access code during commissioning |
| WLAN<br>(order option in display module) | Enabled | On an individual basis following risk assessment |
| WLAN security mode | Enabled (WPA2-PSK) | Do not change |
| WLAN passphrase<br>(password) → 🖺 11 | Serial number | Assign a customized WLAN passphrase during commissioning |
| WLAN mode | Access point | On an individual basis following risk assessment |
| Web server → 🖺 12 | Enabled | On an individual basis following risk assessment |
| CDI-RJ45 service interface | – | On an individual basis following risk assessment |

### 2.7.1     Protecting access via a password

Different passwords are available to protect write access to the device parameters or access to the device via the WLAN interface.

- User-specific access code
  Protect write access to the device parameters via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare). Access authorization is clearly regulated through the use of a user-specific access code.
- WLAN passphrase
  The network key protects a connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface which can be ordered as an option.

**User-specific access code**

Write access to the device parameters via the local display or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code (→ 🖺 101).

When the device is delivered, the device does not have an access code and is equivalent to *0000* (open).

**WLAN passphrase: Operation as WLAN access point**

A connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface (→ 🖺 62), which can be ordered as an optional extra, is protected by the network key. The WLAN authentication of the network key complies with the IEEE 802.11 standard.

When the device is delivered, the network key is pre-defined depending on the device. It can be changed via the **WLAN settings** submenu in the **WLAN passphrase** parameter (→ 🖺 96).

**General notes on the use of passwords**

- The access code and network key supplied with the device should be changed during commissioning.
- Follow the general rules for generating a secure password when defining and managing the access code or network key.
- The user is responsible for the management and careful handling of the access code and network key.
- For information on configuring the access code or on what to do if you lose the password, for example, see the "Write protection via access code" section → 🕮 101

### 2.7.2    Access via Web server

The device can be operated and configured via a Web browser with the integrated Web server (→ 🕮 56). The connection is via the service interface (CDI-RJ45) or the WLAN interface.

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

The device and status information can be hidden on the login page. This prevents unauthorized access to the information.
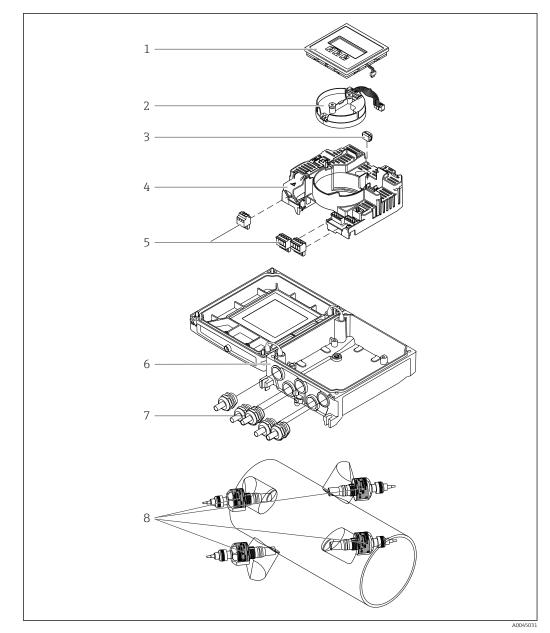
📖 For detailed information on device parameters, see:
The "Description of Device Parameters" document .

# 3    Product description

The measuring system consists of a transmitter and one or two sensor sets. The transmitter and sensor sets are mounted in physically separate locations. They are interconnected by sensor cables.

The sensors function as sound generators and sound receivers. The sensors in a sensor pair are always arranged opposite one another and send/receive the ultrasonic signals directly (1-traverse positioning) → 🕮 22.

The transmitter serves to control the sensor sets, to prepare, process and evaluate the measuring signals, and to convert the signals to the desired output variable.

# 3.1 Product design



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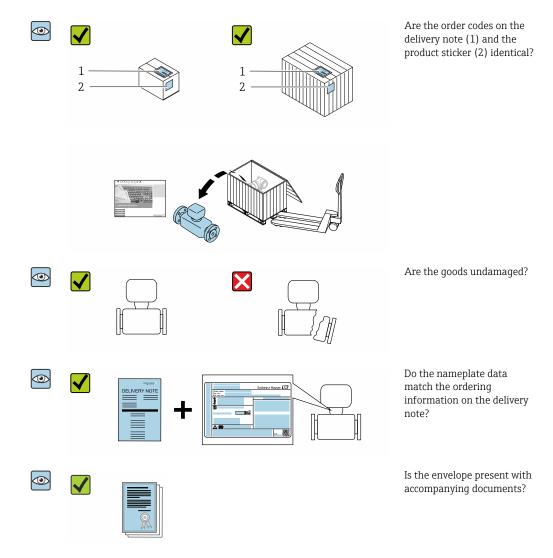
⊡ *1    Important components*

*1    Display module*
*2    Smart sensor electronics module*
*3    HistoROM DAT (plug-in memory)*
*4    Main electronics module*
*5    Terminals (screw terminals, some available as plug-in terminals) or fieldbus connectors*
*6    Transmitter housing*
*7    Cable glands*
*8    Sensor (2 versions)*

# 4 Incoming acceptance and product identification

## 4.1 Incoming acceptance

| | |
|---|---|
| | Are the order codes on the delivery note (1) and the product sticker (2) identical? |
| | Are the goods undamaged? |
| | Do the nameplate data match the ordering information on the delivery note? |
| | Is the envelope present with accompanying documents? |

- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- The Technical Documentation is available via the Internet or via the *Endress+Hauser Operations App*, see the "Product identification" section → 🗎 16.

## 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 *W@M Device Viewer* (www.endress.com/deviceviewer): all the information about the device is displayed.
- Enter the serial numbers from the nameplates into the *Endress+Hauser Operations App* or scan the DataMatrix code on the nameplate with the *Endress+Hauser Operations App*: all the information about the device is displayed.

For an overview of the scope of the associated Technical Documentation, refer to the following:
• The chapters "Additional standard documentation on the device" → 🖹 8 and "Supplementary device-dependent documentation" → 🖹 8
• The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer)
• The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the DataMatrix code on the nameplate.
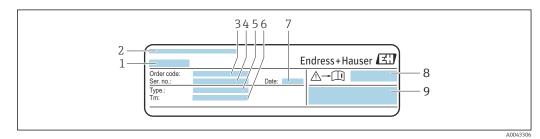
### 4.2.1   Transmitter nameplate



*🖻 2    Example of a transmitter nameplate*

*1    Place of manufacture*
*2    Name of the transmitter*
*3    Order code*
*4    Serial number (Ser. no.)*
*5    Extended order code (Ext. ord. cd.)*
*6    Permitted ambient temperature ($T_a$)*
*7    Firmware version (FW) and device revision (Dev.Rev.) from the factory*
*8    Degree of protection*
*9    Permitted temperature range for cable*
*10   2-D matrix code*
*11   Date of manufacture: year-month*
*12   CE mark, RCM-Tick mark*
*13   Electrical connection data, e.g. available inputs and outputs, supply voltage*

### 4.2.2   Sensor nameplate



*🖻 3    Example of sensor nameplate, "front"*

*1    Name of sensor*
*2    Place of manufacture*
*3    Order code*
*4    Serial number (Ser. no.)*
*5    Type*
*6    Medium temperature range*
*7    Date of manufacture: year-month*
*8    Document number of safety-related supplementary documentation*
*9    Additional information*

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 4    *Example of sensor nameplate, "back"*

*1    CE mark, RCM-Tick mark, approval information on explosion protection and degree of protection*

**Order code**
The measuring device is reordered using the order code.

**Extended order code**
- The device type (product root) and basic specifications (mandatory features) are always listed.
- Of the optional specifications (optional features), only the safety and approval-related specifications are listed (e.g. LA). If other optional specifications are also ordered, these are indicated collectively using the **#** placeholder symbol (e.g. #LA#).
- If the ordered optional specifications do not include any safety and approval-related specifications, they are indicated by the + placeholder symbol (e.g. XXXXXX-ABCDE +).

### 4.2.3    Symbols on measuring device

| Symbol | Meaning |
|---|---|
| ⚠ | **WARNING!**<br>This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury. To determine the nature of the potential hazard and the measures required to avoid it, consult the documentation accompanying the measuring device. |
| 📖 | **Reference to documentation**<br>Refers to the corresponding device documentation. |
| ⏚ | **Protective ground connection**<br>A terminal which must be connected to ground prior to establishing any other connections. |

# 5    Storage and transport

## 5.1    Storage conditions

Observe the following notes for storage:
▸  Store in the original packaging to ensure protection from shock.
▸  Protect from direct sunlight to avoid unacceptably high surface temperatures.
▸  Store in a dry and dust-free place.
▸  Do not store outdoors.

Storage temperature → 🕮 146

## 5.2    Transporting the product

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

### 5.2.1    Transporting with a fork lift

If transporting in wood crates, the floor structure enables the crates to be lifted lengthwise or at both sides using a forklift.

## 5.3    Packaging disposal

All packaging materials are environmentally friendly and 100 % recyclable:
• Outer packaging of device
  Polymer stretch wrap, complying with EU Directive 2002/95/EC (RoHS)
• Packaging
  • Wooden crate treated in accordance with ISPM 15 standard, confirmed by IPPC logo
  • Cardboard box in accordance with European packaging guideline 94/62EC,
    recyclability confirmed by Resy symbol
• Carrying and securing materials
  • Disposable plastic pallet
  • Plastic straps
  • Plastic adhesive strips
• Filler material
  Paper pads
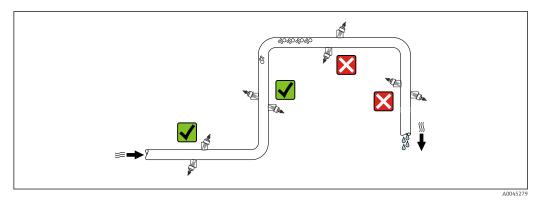
# 6    Mounting

## 6.1    Mounting requirements

### 6.1.1    Mounting position

**Mounting location**



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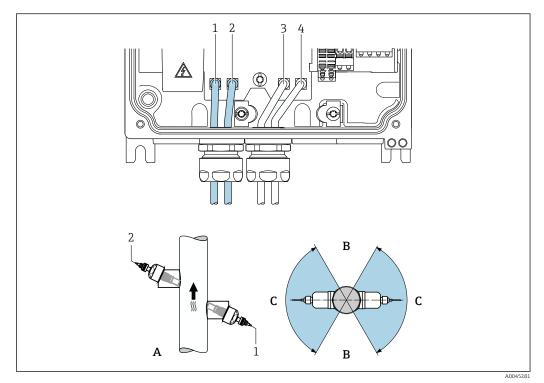
To prevent measuring errors arising from accumulation of gas bubbles in the measuring pipe, avoid the following mounting locations in the piping:
• Highest point of a pipeline.
• Directly upstream of a free pipe outlet in a down pipe.

**Orientation**



🖼 *5      Orientation views*

*1    Channel 1 upstream*
*2    Channel 1 downstream*
*3    Channel 2 upstream*
*4    Channel 2 downstream*
*A    Recommended orientation with upward direction of flow*
*B    Non-recommended installation range with horizontal orientation (60°)*
*C    Recommended installation range max. 120°*

**Vertical**
Recommended orientation with upward direction of flow (View A). With this orientation, entrained solids will sink and gases will rise away from the sensor area when the medium is not flowing. Furthermore, the pipe can be completely drained and protected against the buildup of deposits.
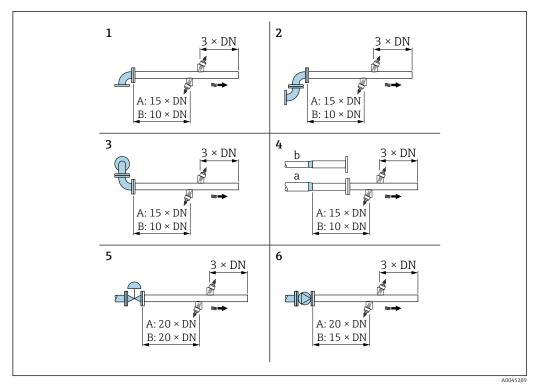
**Horizontal**
In the recommended installation range with a horizontal orientation (View B), gas and air accumulations at the top of the pipe and interference from deposit buildup at the bottom of the pipe can influence the measurement to a lesser degree.

**Inlet and outlet runs**

If possible, the sensor should be installed upstream from valves, T-sections, pumps etc. If this is not possible, the inlet and outlet runs indicated below must be maintained at the very minimum in order to attain the specified level of accuracy of the measuring device. If there are several flow disturbances present, the longest specified inlet run must be maintained.
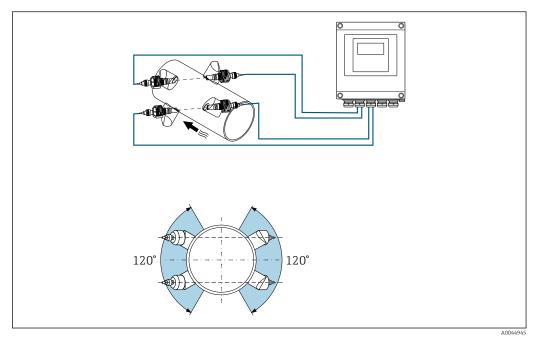
*6    *Minimum inlet and outlet runs for various flow obstructions (A: single-path measurement, B: two-path measurement)*

*1    Pipe bend*
*2    Two pipe bends (on one plane)*
*3    Two pipe bends (on two planes)*
*4a   Reduction*
*4b   Extension*
*5    Control valve (2/3 open)*
*6    Pump*

*Operation*

*Single-path measurement*

→ ⊡ 6, 🗐 21

*Two-path measurement*



 *7*   *Two-path measurement: example for the horizontal arrangement of the sensor sets at a measuring point*

*Dimensions*
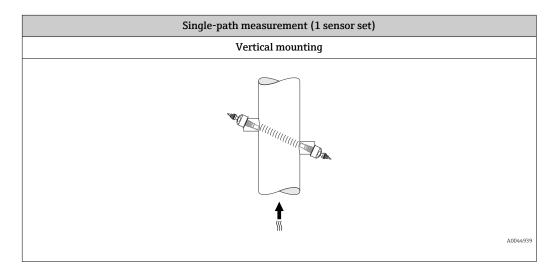
For the dimensions and installed lengths of the device, see the "Technical Information" document, "Mechanical construction" section
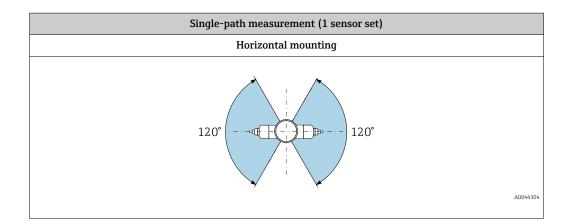
### 6.1.2   Sensor set selection and arrangement
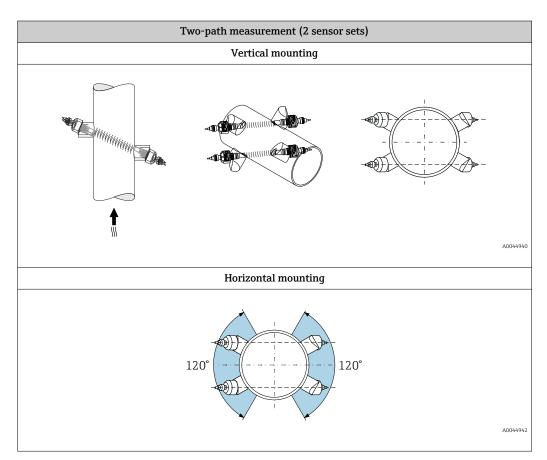
If mounting horizontally, always mount the sensor set so that it is offset at an angle of at least ±30° to the top of the measuring pipe to avoid incorrect measurements caused by empty space at the top of the pipe.

The sensors can be arranged in different ways:
- Mounting arrangement for measurement with 1 sensor set (1 measuring path):
  The sensors are located on opposite sides of the pipe (offset by 180°)
- Mounting arrangement for measurement with 2 sensor sets (2 measuring paths):
  1 sensor of each sensor set is located on the opposite side of the pipe

| Single-path measurement (1 sensor set) |
| :---: |
| **Vertical mounting** |
|  |

| Single-path measurement (1 sensor set) |
|---|
| Horizontal mounting |
| 

120°                                              120°

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| Two-path measurement (2 sensor sets) |
|---|
| Vertical mounting |
| 

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| Horizontal mounting |
| 

120°                                              120°

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### 6.1.3   Environment and process requirements

**Ambient temperature range**

| Transmitter | −40 to +60 ℃ (−40 to +140 ℉) |
|---|---|
| Readability of the local display | −20 to +60 ℃ (−4 to +140 ℉)<br>The readability of the display may be impaired at temperatures outside the temperature range. |

| Sensor | Standard: –40 to +80 °C (–40 to +176 °F) |
|---|---|
| Sensor cable (connection between transmitter and sensor) | Standard:<br>TPE halogen-free: –40 to +80 °C (–40 to +176 °F) |

🛈 In principle, it is permitted to insulate the sensors mounted on the pipe. In the case of insulated sensors, make sure that the process temperature does not exceed or drop below the specified cable temperature.

▶ If operating outdoors:
  Avoid direct sunlight, particularly in warm climatic regions.

**Medium pressure range**

Maximum nominal pressure PN 16 (16 bar (232 psi))

### 6.1.4    Special mounting instructions

**Display guard**

▶ To ensure that the display guard can be easily opened, maintain the following minimum head clearance: 350 mm (13.8 in)

## 6.2    Mounting the measuring device

### 6.2.1    Required tools

**For transmitter**

- Torque wrench
- For wall mounting:
  Open-ended wrench for hexagonal screw max. M5
- For pipe mounting:
  - Open-ended wrench AF 8
  - Phillips head screwdriver PH 2

**For sensor**

For installation on the measuring pipe: use a suitable mounting tool

### 6.2.2    Preparing the measuring device

1. Remove all remaining transport packaging.

2. Remove stick-on label on the electronics compartment cover.

### 6.2.3    Mounting the sensor
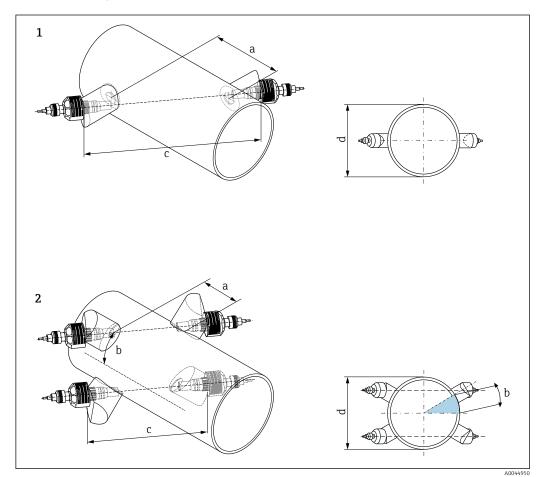
### Sensor configuration and settings

| DN 200 to 4000 (8 to 160") | |
| --- | --- |
| Single-path version [mm (in)] | Two-path version [mm (in)] |
| Sensor distance [1] | Sensor distance [1] |
| Path length → ▣ 8, ▤ 25 | Path length → ▣ 8, ▤ 25 Arc length → ▣ 8, ▤ 25 |

1) Depends on the conditions at the measuring point (measuring pipe etc.). The sensor mounting position can be determined via FieldCare or Applicator. See also the **Result Sensor Type / Sensor Distance** parameter in the **Measuring point** submenu

### Determining the sensor mounting positions

*Mounting description*
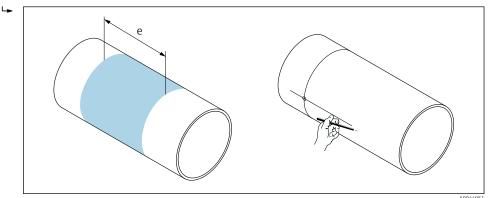


▣ *8    Sensor mounting: terminology*

*1    Single-path version*
*2    Two-path version*
*a    Sensor distance*
*b    Arc length*
*c    Path length*
*d    Measuring pipe outer diameter*
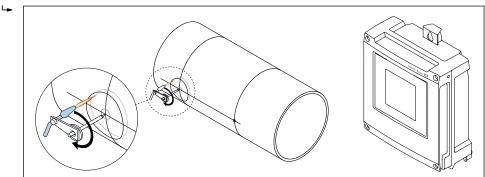
*Sensor holder for single-path version*

Procedure:
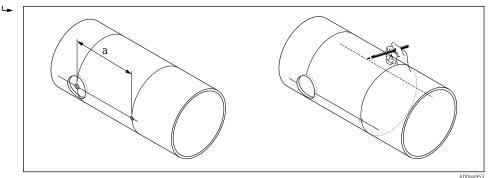
1. Determine the mounting area (e) on the pipe section (space required at measuring point approx. 1x pipe diameter).

2. Draw a center line on the measuring pipe at the mounting location and mark the first drill hole (drill hole diameter: 65 mm (2.56 in)). Make the center line longer than the hole to be drilled.



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3. Cut the first drill hole with a plasma cutter for example. Measure the wall thickness of the measuring pipe if it is not already known.

4. Determine the sensor distance → 🖺 25.



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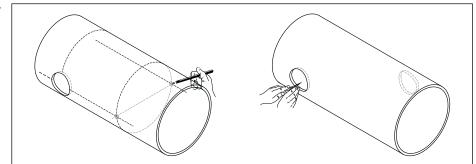
5. Starting from the center line of the first drill hole, plot the sensor distance (a).

6. Project the center line onto the rear of the measuring pipe and draw the line.



A0044953
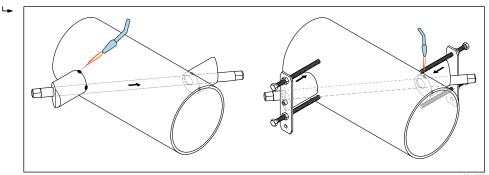
7. Mark the drill hole on the rear center line.
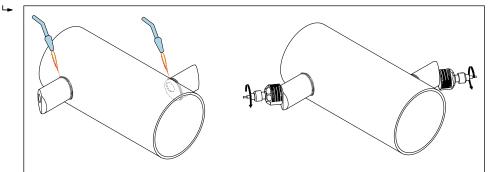
8.  Cut out the second drill hole and prepare the holes (deburr, clean) to weld in the sensor holders.

&#x21b3;



A0044954

9.  Insert the sensor holders into both holes. To set the weld-in depth, both sensor holders can be fixed in place with the special tool to regulate the insertion depth (optionally available → 🖺 135) and then aligned using the path rod. The sensor holder must be flush with the inside of the measuring pipe.

10. Spot-weld both sensor holders. To align the path rod, screw the two guides into the sensor holders.

&#x21b3;



A0044955

11. Weld in both sensor holders.

12. Check the distance between the drill holes again and determine the path length → 🖺 25.

13. Screw the sensors into the sensor holders by hand. If using a tool, do not tighten by more than 30 Nm.

14. Guide the sensor cable plugs into the openings provided for this purpose and tighten the plugs manually to the end stop.

&#x21b3;



A0044956
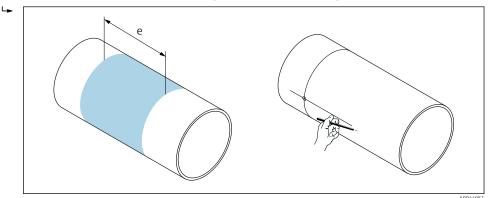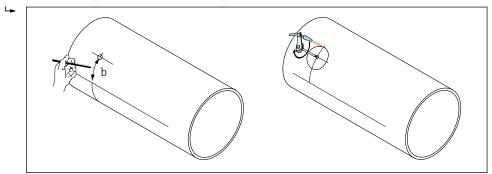
*Sensor holder for two-path version*

Procedure:
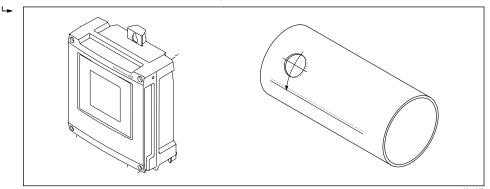
1. Determine the mounting area (e) on the pipe section (space required at measuring point approx. 1x pipe diameter).

2. Mark the center line on the measuring pipe at the mounting location.



A0044951

3. At the mounting location of the sensor holder, mark the arc length (b) to one side of the center line. Take approximately 1/12 of the pipe circumference as the measure for the length of the arc. Mark the first drill hole (drill hole diameter: 81 to 82 mm (3.19 to 3.23 in)). Make the center line longer than the hole to be drilled.

4. Cut the first drill hole with a plasma cutter for example. Measure the wall thickness of the measuring pipe if it is not already known.



A0044957

5. Determine the sensor distance and arc length → 🖹 25.

6. Correct the center line with the arc length determined.



A0044958
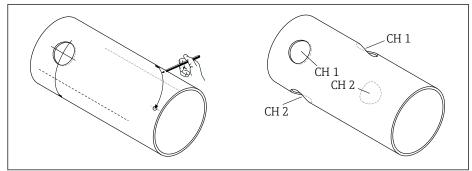
7. Project the corrected center line onto the opposite side of the pipe and draw the line (half pipe circumference).
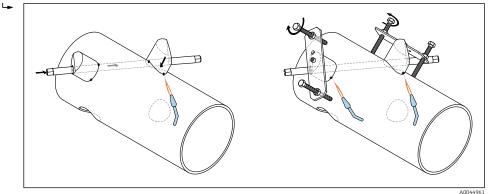
8. Mark the sensor distance on the center line and project it onto the center line on the rear of the pipe.

↳



A0044959

9. Mark the length of the arc to both sides of the center line and mark the drill holes.

10. Cut out the drill holes and prepare the holes (deburr, clean) to weld in the sensor holders. The holes for the sensor holders are in pairs (CH 1 - CH 1 and CH 2 - CH 2).

↳



A0044960

11. Insert sensor holders into the first two drill holes and align with the path rod (alignment tool). Spot-weld with the welding machine and then securely weld both sensor holders. To align the path rod, screw the two guides into the sensor holders.

↳



A0044961
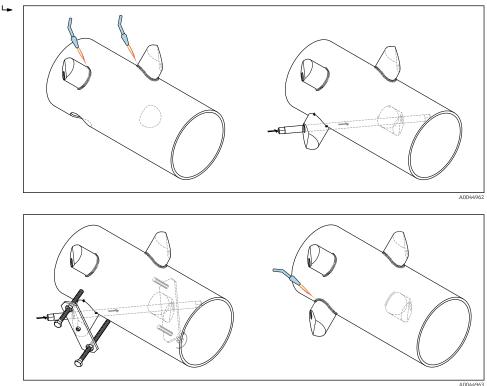
12. Weld in both sensor holders.
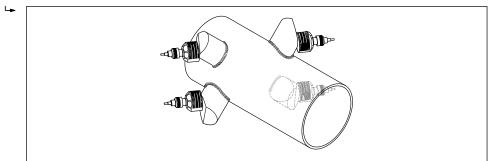
13. Check the path length, sensor distances and arc lengths once again. Any deviations from the correct length can be entered later as correction factors when commissioning the measuring point.

14. Insert the second pair of sensor holders into the two remaining drill holes as explained in step 11 and then weld in place.



A0044962



A0044963

15. Screw the sensors into the sensor holders by hand. If using a tool, do not tighten by more than 30 Nm.

16. Guide the sensor cable plugs into the openings provided for this purpose and tighten the plugs manually to the end stop.



A0044964

### 6.2.4    Mounting the transmitter

**⚠ CAUTION**

**Ambient temperature too high!**
Danger of electronics overheating and housing deformation.
▸ Do not exceed the permitted maximum ambient temperature → 🖹 23.
▸ If operating outdoors: Avoid direct sunlight and exposure to weathering, particularly in warm climatic regions.

**⚠ CAUTION**
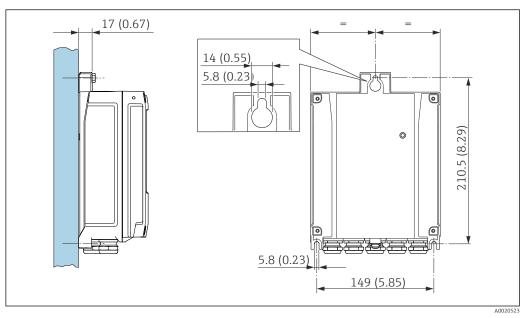
**Excessive force can damage the housing!**
▸ Avoid excessive mechanical stress.

The transmitter of the remote version can be mounted in the following ways:
• Wall mounting
• Pipe mounting

### Wall mounting



*🖼 9      Engineering unit mm (in)*

1. Drill the holes.

2. Insert wall plugs into the drilled holes.

3. Screw the securing screws in slightly.

4. Fit the transmitter housing over the securing screws and mount in place.

5. Tighten the securing screws.
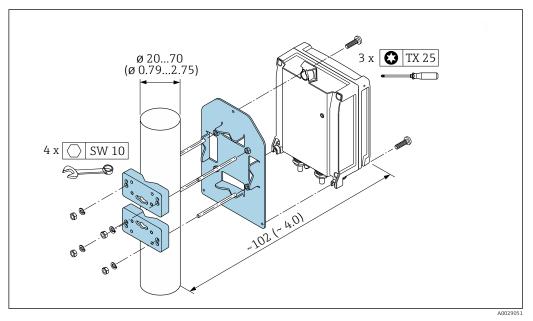
### Post mounting

⚠️ **WARNING**

**Excessive tightening torque applied to the fixing screws!**
Risk of damaging the plastic transmitter.
▶ Tighten the fixing screws as per the tightening torque: 2 Nm (1.5 lbf ft)
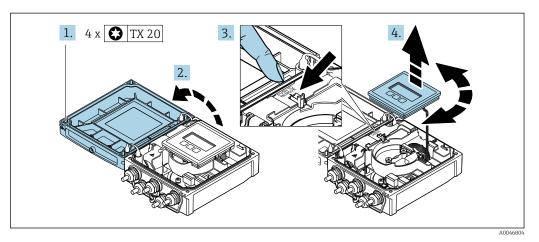


*🖼 10     Engineering unit mm (in)*

### 6.2.5 Turning the display module

The display module can be turned to optimize display readability and operability.



A0046804

1. Loosen the fixing screws of the housing cover.

2. Open the housing cover.

3. Unlock the display module.

4. Pull out the display module and turn it to the desired position in increments of 90°.

**Mounting the transmitter housing**

**⚠ WARNING**

**Excessive tightening torque applied to the fixing screws!**
Damage to the transmitter.
▶ Tighten the fixing screws with the specified torques.

1. Insert the display module and lock it when doing so.

2. Close the housing cover.

3. Tighten the fixing screws of the housing cover: tightening torque for aluminum housing 2.5 Nm (1.8 lbf ft) – plastic housing 1 Nm (0.7 lbf ft).

## 6.3 Post-mounting check

| | |
|---|---|
| Is the device undamaged (visual inspection)? | ❑ |
| Does the measuring device meet the measuring point specifications?<br><br>For example:<br>• Process temperature → 🖹 146<br>• Inlet run conditions<br>• Ambient temperature<br>• Measuring range | ❑ |
| Has the correct orientation for the sensor been selected → 🖹 20?<br><br>• According to sensor type<br>• According to medium temperature<br>• According to medium properties (outgassing, with entrained solids) | ❑ |
| Are the sensors correctly connected to the transmitter (upstream/downstream) → 🖾 5, 🖹 20? | ❑ |
| Are the sensors mounted correctly (distance, path length, arc length) → 🖹 22? | ❑ |
| Are the measuring point identification and labeling correct (visual inspection)? | ❑ |
| Is the device adequately protected from precipitation and direct sunlight? | ❑ |

| Are the securing screw and securing clamp tightened securely? | ❏ |
|---|---|
| Is potential equalization established at the sensor holder (in the event of different potentials between the sensor holder and transmitter) ? | ❏ |

# 7    Electrical connection

> **NOTICE**
>
> **The measuring device does not have an internal circuit breaker.**
> ▸ For this reason, assign the measuring device a switch or power-circuit breaker so that the power supply line can be easily disconnected from the mains.
> ▸ Although the measuring device is equipped with a fuse, additional overcurrent protection (maximum 16 A) should be integrated into the system installation.

## 7.1    Electrical safety

In accordance with applicable national regulations.

## 7.2    Connection conditions

### 7.2.1    Required tools

- Torque wrench
- For cable entries: Use corresponding tools
- Wire stripper
- When using stranded cables: Crimper for wire end ferrule

### 7.2.2    Requirements for connecting cable

The connecting cables provided by the customer must fulfill the following requirements.

**Permitted temperature range**

- The installation guidelines that apply in the country of installation must be observed.
- The cables must be suitable for the minimum and maximum temperatures to be expected.

**Power supply cable (incl. conductor for the inner ground terminal)**

Standard installation cable is sufficient.

**Signal cable**

*Current output 0/4 to 20 mA*

Standard installation cable is sufficient.

*Current output 4 to 20 mA HART*

A shielded cable is recommended. Observe grounding concept of the plant.

*Pulse/frequency/switch output*

Standard installation cable is sufficient.

*Status input*

Standard installation cable is sufficient.

**Sensor cable for sensor - transmitter**

| Standard cable | TPE halogen-free: -40 to +80 ℃ (-40 to +176 ℉) |
|---|---|
| Cable length (max.) | 30 m (90 ft) |

| Cable lengths (available for order) | 5 m (15 ft), 10 m (30 ft), 15 m (45 ft), 30 m (90 ft) |
|---|---|
| Operating temperature | Depends on the device version and how the cable is installed: Standard version: <br> • Cable, fixed installation [1]: minimum −40 °C (−40 °F) <br> • Cable, movable: minimum −25 °C (−13 °F) |

1)      Compare details under the "Standard cable" row

**Cable diameter**

- Cable glands supplied:
  - For standard cable: M20 × 1.5 with cable ⌀ 6 to 12 mm (0.24 to 0.47 in)
  - For reinforced cable: M20 × 1.5 with cable ⌀ 9.5 to 16 mm (0.37 to 0.63 in)
- (Plug-in) spring terminals for wire cross-sections 0.5 to 2.5 mm$^2$ (20 to 14 AWG)

### 7.2.3   Terminal assignment

**Transmitter**

The sensor can be ordered with terminals.

| Connection methods available | | Possible options for order code "Electrical connection" |
|---|---|---|
| Outputs | Power supply | |
| Terminals | Terminals | • Option **A**: coupling M20x1 <br> • Option **B**: thread M20x1 <br> • Option **C**: thread G ½" <br> • Option **D**: thread NPT ½" |

*Supply voltage*

| Order code "Power supply" | Terminal numbers | terminal voltage | | Frequency range |
|---|---|---|---|---|
| Option **L** (wide range power unit) | 1 (L+/L), 2 (L-/N) | DC 24 V | ±25% | – |
| | | AC 24 V | ±25% | 50/60 Hz, ±4 Hz |
| | | AC 100 to 240 V | −15 to +10% | 50/60 Hz, ±4 Hz |

*Signal transmission for current output 0 to 20 mA/4 to 20 mA HART and other outputs and inputs*

| Order code for "Output" and "Input" | Terminal numbers | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Output 1 | | Output 2 | | Output 3 | | Input | |
| | 26 (+) | 27 (-) | 24 (+) | 25 (-) | 22 (+) | 23 (-) | 20 (+) | 21 (-) |
| Option **H** | Current output <br> • 4 to 20 mA HART (active) <br> • 0 to 20 mA (active) | | Pulse/frequency output (passive) | | Switch output (passive) | | - | |
| Option **I** | Current output <br> • 4 to 20 mA HART (active) <br> • 0 to 20 mA (active) | | Pulse/frequency/ switch output (passive) | | Pulse/frequency/ switch output (passive) | | Status input | |

### 7.2.4    Preparing the measuring device

Carry out the steps in the following order:

1.  Mount the sensor and transmitter.

2.  Sensor connection housing: Connect sensor cable.

3.  Transmitter: Connect sensor cable.

4.  Transmitter: Connect signal cable and cable for supply voltage.

**NOTICE**

**Insufficient sealing of the housing!**

Operational reliability of the measuring device could be compromised.

▸  Use suitable cable glands corresponding to the degree of protection.

1.  Remove dummy plug if present.

2.  If the measuring device is supplied without cable glands:
    Provide suitable cable gland for corresponding connecting cable.

3.  If the measuring device is supplied with cable glands:
    Observe requirements for connecting cables → 🖺 34.

## 7.3    Connecting the measuring device

**⚠ WARNING**

**Risk of electric shock! Components carry dangerous voltages!**

▸  Have electrical connection work carried out by correspondingly trained specialists only.

▸  Observe applicable federal/national installation codes and regulations.

▸  Comply with local workplace safety regulations.

▸  Observe grounding concept of the plant.

▸  Never mount or wire the measuring device while it is connected to the supply voltage.

▸  Before the supply voltage is applied, connect the protective ground to the measuring device.

### 7.3.1    Connecting the sensor and transmitter
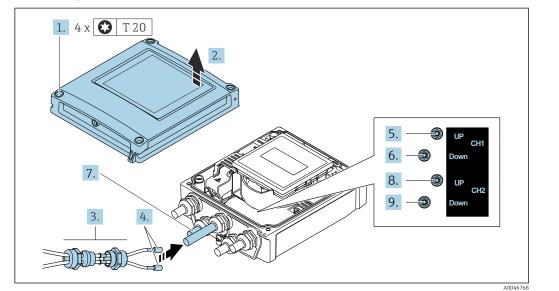
**⚠ WARNING**

**Risk of damaging electronic components!**

▸  Connect the sensor and transmitter to the same potential equalization.

▸  Only connect the sensor to a transmitter with the same serial number.

The following sequence of steps is recommended when connecting:

1.  Mount the sensor and transmitter.

2.  Connect the sensor cable.

3.  Connect the transmitter.

**Connecting the sensor cable to the transmitter**



🖼 *11 Transmitter: main electronics module with terminals*

1. Loosen the 4 fixing screws on the housing cover.

2. Open the housing cover.

3. Route the two sensor cables of channel 1 through the slackened top union nut of the cable entry. To ensure tight sealing, mount a sealing insert on the sensor cables (push the cables through the slotted sealing insert).

4. Mount the screw part in the center cable entry at the top and then guide both sensor cables through the entry. Then fit the coupling nut with the sealing insert on the screw part and tighten. Ensure that the sensor cables are positioned in the cut-outs provided in the screw part.

5. Connect sensor cable to channel 1 upstream.

6. Connect sensor cable to channel 1 downstream.

7. For a two-path measurement: proceed as per steps 3+4

8. Connect sensor cable to channel 2 upstream.

9. Connect sensor cable to channel 2 downstream.

10. Tighten the cable gland(s).
    ↳ This concludes the process for connecting the sensor cable(s).

11. ⚠ **WARNING**

    **Housing degree of protection may be voided due to insufficient sealing of the housing.**
    ▶ Screw in the screw without using any lubricant.

Reverse the removal procedure to reassemble the transmitter.

### 7.3.2    Connecting the transmitter

**⚠ WARNING**
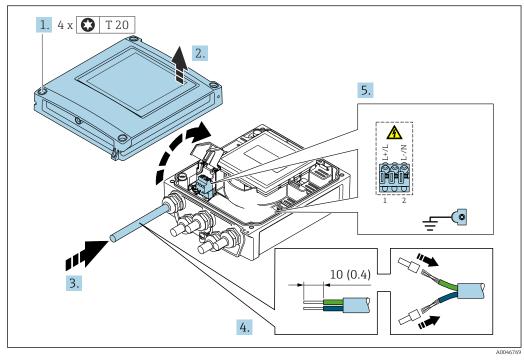
**Housing degree of protection may be voided due to insufficient sealing of the housing.**

▶ Screw in the screw without using any lubricant. The threads on the cover are coated with a dry lubricant.

*Tightening torques for plastic housing*

| Housing cover fixing screw | 1 Nm (0.7 lbf ft) |
|---|---|
| Cable entry | 5 Nm (3.7 lbf ft) |
| Ground terminal | 2.5 Nm (1.8 lbf ft) |

When connecting the cable shield to the ground terminal, observe the grounding concept of the facility.



*A0046769*

⊠ *12    Connecting the supply voltage and 0-20 mA/4-20 mA HART with additional outputs and inputs*

1. Loosen the 4 fixing screws on the housing cover.

2. Open the housing cover.

3. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.

4. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.

5. Connect the cable according to the terminal assignment → 🗎 35. For supply voltage: open the shock protection cover.

6. Firmly tighten the cable glands.

**Reassembling the transmitter**

1. Close the shock protection cover.

2. Close the housing cover.

3.  **⚠ WARNING**

**Housing degree of protection may be voided due to insufficient sealing of the housing.**

▶ Screw in the screw without using any lubricant.

Tighten the 4 fixing screws on the housing cover.

### 7.3.3 Potential equalization

**Requirements**
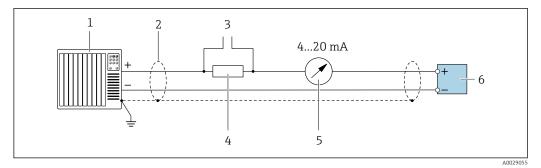
For potential equalization:
- Pay attention to in-house grounding concepts
- Take account of operating conditions like the pipe material and grounding
- Connect the sensor and transmitter to the same electrical potential
- Use a ground cable with a minimum cross-section of 6 mm² (0.0093 in²) for the potential equalization connections

# 7.4 Special connection instructions

## 7.4.1 Connection examples

**Current output 4 to 20 mA HART**



A0029055
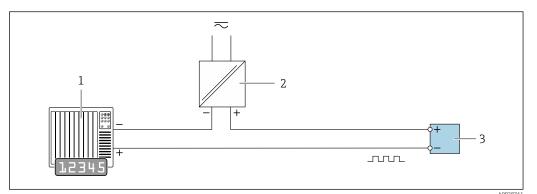
🖾 *13    Connection example for 4 to 20 mA HART current output (active)*

*1    Automation system with current input (e.g. PLC)*
*2    Ground the cable shield at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
*3    Connection for HART operating devices → 🖺 62*
*4    Resistor for HART communication (≥ 250 Ω): observe maximum load → 🖺 139*
*5    Analog display unit: observe maximum load → 🖺 139*
*6    Transmitter*
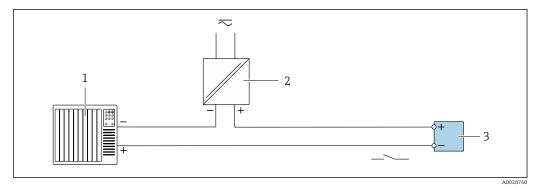
### Pulse/frequency output



*🖼 14   Connection example for pulse/frequency output (passive)*

*1   Automation system with pulse/frequency input (e.g. PLC)*

*2   Power supply*

*3   Transmitter: Observe input values → 🖹 139*
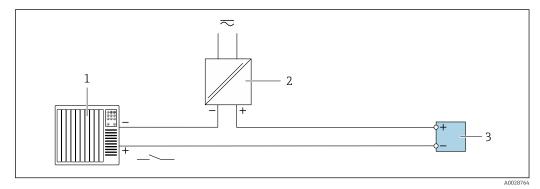
### Switch output



*🖼 15   Connection example for switch output (passive)*

*1   Automation system with switch input (e.g. PLC)*

*2   Power supply*

*3   Transmitter: Observe input values → 🖹 139*

### Status input



*🖼 16   Connection example for status input*

*1   Automation system with status output (e.g. PLC)*

*2   Power supply*

*3   Transmitter*
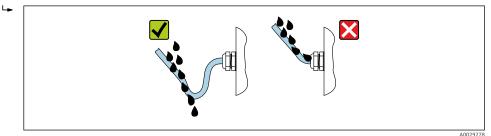
## 7.5 Ensuring the degree of protection

### 7.5.1 Degree of protection IP66/67, Type 4X enclosure

The measuring device fulfills all the requirements for the IP66/67 degree of protection, Type 4X enclosure.

To guarantee IP66/67 degree of protection, Type 4X enclosure, carry out the following steps after the electrical connection:

1. Check that the housing seals are clean and fitted correctly. Dry, clean or replace the seals if necessary.

2. Tighten all housing screws and screw covers.

3. Firmly tighten the cable glands.

4. To ensure that moisture does not enter the cable entry, route the cable so that it loops down before the cable entry ("water trap").



A0029278

5. Insert dummy plugs (corresponding to the housing degree of protection) into unused cable entries.

**NOTICE**
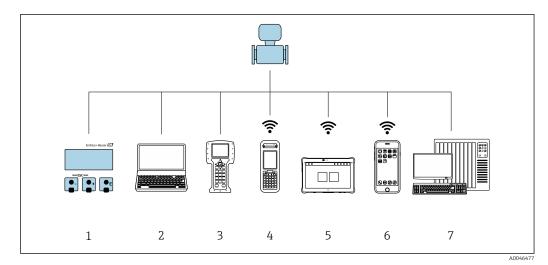
**Standard dummy plugs used for transportation do not have the appropriate degree of protection and can result in damage to the device!**
▶ Use suitable dummy plugs corresponding to the degree of protection.

## 7.6 Post-connection check

| | |
|---|---|
| Are cables or the device undamaged (visual inspection)? | ❑ |
| Do the cables comply with the requirements → 🖹 34? | ❑ |
| Do the cables have adequate strain relief? | ❑ |
| Are all cable glands installed, securely tightened and leak-tight? Cable run with "water trap" → 🖹 41? | ❑ |
| Does the supply voltage match the specifications on the transmitter nameplate → 🖹 142? | ❑ |
| Is the terminal assignment correct → 🖹 35? | ❑ |
| If supply voltage is present, do values appear on the display module? | ❑ |
| Are all housing covers installed and the screws tightened with the correct tightening torque? | ❑ |

# 8 Operation options
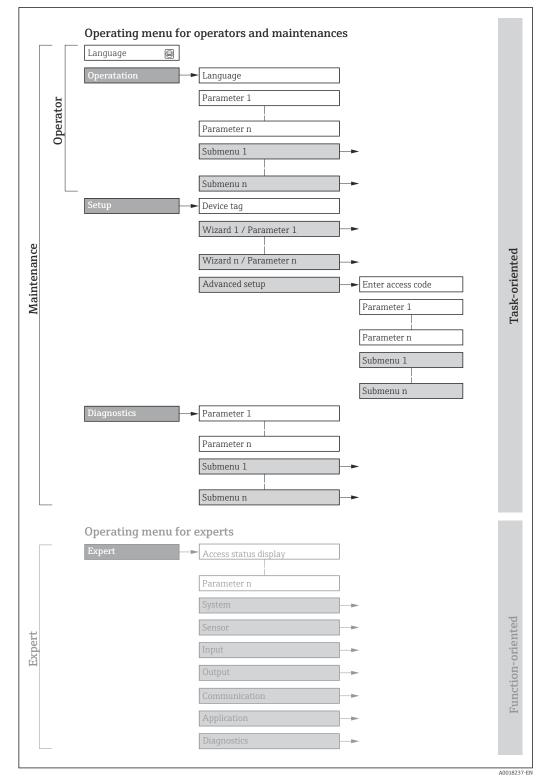
## 8.1 Overview of operation methods



A0046477

*1   Local operation via display module*
*2   Computer with Web browser (e.g. Internet Explorer) or with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM)*
*3   Field Communicator 475*
*4   Field Xpert SFX350 or SFX370*
*5   Field Xpert SMT70*
*6   Mobile handheld terminal*
*7   Control system (e.g. PLC)*

## 8.2 Structure and function of the operating menu

### 8.2.1 Structure of the operating menu

For an overview of the operating menu for experts: see the "Description of Device Parameters" document supplied with the device → 🖺 154



*🖻 17   Schematic structure of the operating menu*
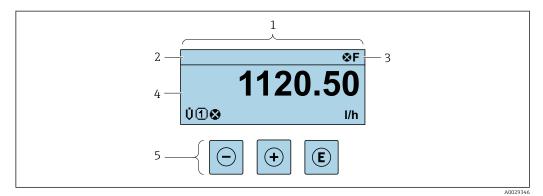
### 8.2.2    Operating philosophy

The individual parts of the operating menu are assigned to certain user roles (operator, maintenance etc.). Each user role contains typical tasks within the device lifecycle.

| Menu/parameter | | User role and tasks | Content/meaning |
|---|---|---|---|
| Language | task-oriented | **Role "Operator", "Maintenance"** <br>Tasks during operation: <br>• Configuration of the operational display <br>• Reading off measured values | • Definition of the operating language <br>• Definition of the Web server operating language <br>• Resetting and controlling totalizers |
| Operation | | | • Configuration of the operational display (e.g. display format, display contrast) <br>• Resetting and controlling totalizers |
| Setup | | **"Maintenance" role** <br>Commissioning: <br>• Configuration of the measurement <br>• Configuration of the outputs | Wizards for fast commissioning: <br>• Configuration of the measuring point <br>• Configuration of the system units <br>• Configuration of the input <br>• Configuration of the outputs <br>• Configuration of the operational display <br>• Definition of output conditioning <br>• Setting the low flow cut off <br><br>Advanced setup <br>• For more customized configuration of the measurement (adaptation to special measuring conditions) <br>• Configuration of the totalizers <br>• Configuration of WLAN settings <br>• Administration (define access code, reset measuring device) |
| Diagnostics | | **"Maintenance" role** <br>Troubleshooting: <br>• Diagnostics and elimination of process and device errors <br>• Measured value simulation | Contains all parameters for error detection and analyzing process and device errors: <br>• Diagnostic list <br>Contains up to 5 currently pending diagnostic messages. <br>• Event logbook <br>Contains event messages that have occurred. <br>• Device information <br>Contains information for identifying the device. <br>• Measured values <br>Contains all current measured values. <br>• **Data logging** submenu with the "Extended HistoROM" order option <br>Storage and visualization of measured values <br>• Heartbeat <br>The functionality of the device is checked on demand and the verification results are documented. <br>• Simulation <br>Is used to simulate measured values or output values. |
| Expert | function-oriented | Tasks that require detailed knowledge of the function of the device: <br>• Commissioning measurements under difficult conditions <br>• Optimal adaptation of the measurement to difficult conditions <br>• Detailed configuration of the communication interface <br>• Error diagnostics in difficult cases | Contains all the parameters of the device and makes it possible to access these parameters directly using an access code. The structure of this menu is based on the function blocks of the device: <br>• System <br>Contains all higher-order device parameters that do not pertain either to the measurement or measured value communication. <br>• Sensor <br>Configuration of the measurement. <br>• Input <br>Configuration of the status input. <br>• Output <br>Configuration of the analog current outputs as well as the pulse/frequency and switch output. <br>• Communication <br>Configuration of the digital communication interface and the Web server. <br>• Application <br>Configuration of the functions that go beyond the actual measurement (e.g. totalizer). <br>• Diagnostics <br>Error detection and analysis of process and device errors and for device simulation and Heartbeat Technology. |

## 8.3 Access to the operating menu via the local display

### 8.3.1 Operational display



*1  Operational display*
*2  Device tag →  🖩 72*
*3  Status area*
*4  Display area for measured values (4-line)*
*5  Operating elements →  🖩 50*
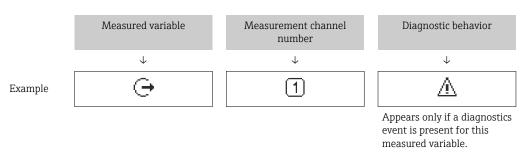
**Status area**

The following symbols appear in the status area of the operational display at the top right:
- Status signals→  🖩 116
  - **F**: Failure
  - **C**: Function check
  - **S**: Out of specification
  - **M**: Maintenance required
- Diagnostic behavior→  🖩 117
  - 🗴: Alarm
  - ⚠: Warning
- 🔒: Locking (the device is locked via the hardware )
- ↔: Communication (communication via remote operation is active)

**Display area**

In the display area, each measured value is prefaced by certain symbol types for further description:

| Measured variable | Measurement channel number | Diagnostic behavior |
|---|---|---|
| ↓ | ↓ | ↓ |
| Example | | |
| ⟼ | [1] | ⚠ |
| | | Appears only if a diagnostics event is present for this measured variable. |

*Measured variables*

| Symbol | Meaning |
|---|---|
| ⋃̇ | Volume flow |
| ṁ | Mass flow |

| | |
|---|---|
| ⌂ | Speed of sound |
| ⟳ | Flow velocity |
| SNR | Signal to noise ratio |
| ▂▃▅ | Signal strength |
| Σ | Totalizer<br>ℹ️ The measurement channel number indicates which of the three totalizers is displayed. |
| ⟿ | Output<br>ℹ️ The measurement channel number indicates which of the outputs is displayed. |
| ⟿ | Status input |

*Measurement channel numbers*
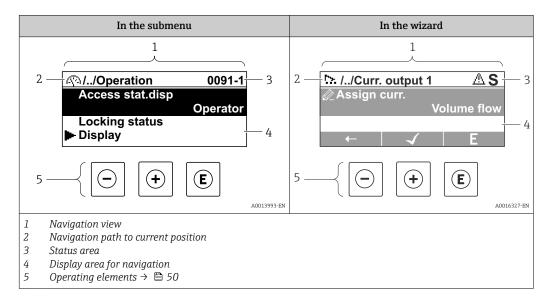
| Symbol | Meaning |
|---|---|
| ⓵ ... ⓸ | Measurement channel 1 to 4 |
| The measurement channel number is displayed only if more than one channel is present for the same measured variable type (e.g. Totalizer 1 to 3). | |

*Diagnostic behavior*

| |
|---|
| The diagnostic behavior pertains to a diagnostic event that is relevant to the displayed measured variable. For information on the symbols → 🖹 117 |
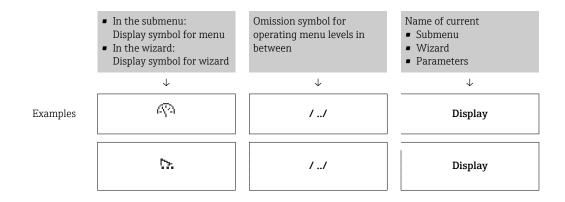
ℹ️ The number and display format of the measured values can be configured via the **Format display** parameter (→ 🖹 86).

### 8.3.2    Navigation view



*1    Navigation view*
*2    Navigation path to current position*
*3    Status area*
*4    Display area for navigation*
*5    Operating elements → 🖹 50*

**Navigation path**

The navigation path - displayed at the top left in the navigation view - consists of the following elements:

| | In the submenu:<br>Display symbol for menu<br> In the wizard:<br>Display symbol for wizard | Omission symbol for operating menu levels in between | Name of current<br> Submenu<br> Wizard<br> Parameters |
|---|---|---|---|
| | ↓ | ↓ | ↓ |
| Examples | ⟨symbol⟩ | / ../ | **Display** |
| | ⟨symbol⟩ | / ../ | **Display** |
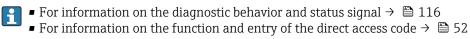
For more information about the icons in the menu, refer to the "Display area" section → 🗎 47

### Status area

The following appears in the status area of the navigation view in the top right corner:
- In the submenu
  - The direct access code for the parameter you are navigating to (e.g. 0022-1)
  - If a diagnostic event is present, the diagnostic behavior and status signal
- In the wizard
  If a diagnostic event is present, the diagnostic behavior and status signal

- For information on the diagnostic behavior and status signal → 🗎 116
- For information on the function and entry of the direct access code → 🗎 52

### Display area

*Menus*

| Symbol | Meaning |
|---|---|
| ⟨symbol⟩ | **Operation**<br>Appears:<br> In the menu next to the "Operation" selection<br> At the left in the navigation path in the **Operation** menu |
| ⟨symbol⟩ | **Setup**<br>Appears:<br> In the menu next to the "Setup" selection<br> At the left in the navigation path in the **Setup** menu |
| ⟨symbol⟩ | **Diagnostics**<br>Appears:<br> In the menu next to the "Diagnostics" selection<br> At the left in the navigation path in the **Diagnostics** menu |
| ⟨symbol⟩ | **Expert**<br>Appears:<br> In the menu next to the "Expert" selection<br> At the left in the navigation path in the **Expert** menu |

*Submenus, wizards, parameters*

| Symbol | Meaning |
|---|---|
| ⟨symbol⟩ | Submenu |
| ⟨symbol⟩ | Wizard |
| ⟨symbol⟩ | Parameters within a wizard<br><br>No display symbol exists for parameters in submenus. |
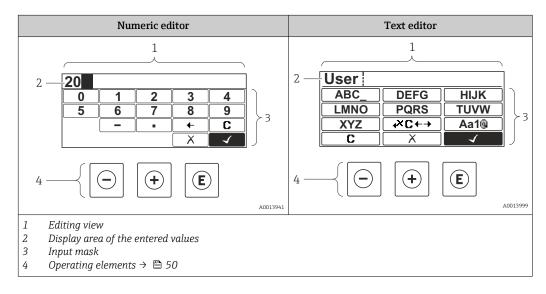
*Locking*

| Symbol | Meaning |
|--------|---------|
| 🔒 | **Parameter locked**<br>When displayed in front of a parameter name, indicates that the parameter is locked.<br>• By a user-specific access code<br>• By the hardware write protection switch |

*Wizard operation*

| Symbol | Meaning |
|--------|---------|
| ← | Switches to the previous parameter. |
| ✓ | Confirms the parameter value and switches to the next parameter. |
| E | Opens the editing view of the parameter. |

### 8.3.3   Editing view



*1   Editing view*
*2   Display area of the entered values*
*3   Input mask*
*4   Operating elements → 🖥 50*

**Input mask**

The following input symbols are available in the input mask of the numeric and text editor:

*Numeric editor*

| Symbol | Meaning |
|--------|---------|
| 0 ... 9 | Selection of numbers from 0 to 9. |
| . | Inserts decimal separator at the input position. |
| – | Inserts minus sign at the input position. |
| ✓ | Confirms selection. |
| ← | Moves the input position one position to the left. |

| | Exits the input without applying the changes. |
|---|---|
| | Clears all entered characters. |

*Text editor*

| Symbol | Meaning |
|---|---|
| Aa1@ | Toggle<br>• Between upper-case and lower-case letters<br>• For entering numbers<br>• For entering special characters |
| ABC_<br>...<br>XYZ | Selection of letters from A to Z. |
| abc_<br>...<br>xyz | Selection of letters from a to z. |
| '''^_<br>...<br>~&_ | Selection of special characters. |
| ✓ | Confirms selection. |
| | Switches to the selection of the correction tools. |
| X | Exits the input without applying the changes. |
| C | Clears all entered characters. |

*Correction symbols under*

| Symbol | Meaning |
|---|---|
| C | Clears all entered characters. |
| | Moves the input position one position to the right. |
| | Moves the input position one position to the left. |
| | Deletes one character immediately to the left of the input position. |

### 8.3.4    Operating elements

| Key | Meaning |
|---|---|
| ⊟ | **Minus key**<br><br>*In menu, submenu*<br>Moves the selection bar upwards in a picklist.<br><br>*With a wizard*<br>Confirms the parameter value and goes to the previous parameter.<br><br>*For text and numeric editor*<br>In the input mask, moves the selection bar to the left (backwards). |
| ⊕ | **Plus key**<br><br>*In menu, submenu*<br>Moves the selection bar downwards in a picklist.<br><br>*With a wizard*<br>Confirms the parameter value and goes to the next parameter.<br><br>*For text and numeric editor*<br>In the input mask, moves the selection bar to the right (forwards). |
| Ⓔ | **Enter key**<br><br>*For operational display*<br>Pressing the key for 2 s opens the context menu including the selection for activating the keypad lock.<br><br>*In menu, submenu*<br>• Pressing the key briefly:<br>   • Opens the selected menu, submenu or parameter.<br>   • Starts the wizard.<br>   • If help text is open, closes the help text of the parameter.<br>• Pressing the key for 2 s in a parameter:<br>   If present, opens the help text for the function of the parameter.<br><br>*With a wizard*<br>Opens the editing view of the parameter.<br><br>*For text and numeric editor*<br>• Pressing the key briefly:<br>   • Opens the selected group.<br>   • Carries out the selected action.<br>• Pressing the key for 2 s confirms the edited parameter value. |
| ⊟ + ⊕ | **Escape key combination (press keys simultaneously)**<br><br>*In menu, submenu*<br>• Pressing the key briefly:<br>   • Exits the current menu level and takes you to the next level up.<br>   • If help text is open, closes the help text of the parameter.<br>• Pressing the key for 2 s returns you to the operational display ("home position").<br><br>*With a wizard*<br>Exits the wizard and takes you to the next level up.<br><br>*For text and numeric editor*<br>Closes the text or numeric editor without applying changes. |
| ⊟ + ⊕ + Ⓔ | **Minus/Plus/Enter key combination (press and hold down the keys simultaneously)**<br><br>*For operational display*<br>Enables or disables the keypad lock (only SD02 display module). |

### 8.3.5    Opening the context menu
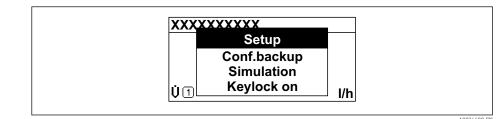
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Simulation

**Calling up and closing the context menu**

The user is in the operational display.

1. Press the ⊟ and ⊑ keys for longer than 3 seconds.
   ↳ The context menu opens.

```
┌──────────────────────────────────────────────┐
│  XXXXXXXXX                                     │
│         ████Setup████████                      │
│         Conf.backup                            │
│         Simulation                             │
│         Keylock on                             │
│  Ů ①                                    l/h    │
└──────────────────────────────────────────────┘
```

2. Press ⊟ + ⊞ simultaneously.
   ↳ The context menu is closed and the operational display appears.

**Calling up the menu via the context menu**

1. Open the context menu.

2. Press ⊞ to navigate to the desired menu.

3. Press ⊑ to confirm the selection.
   ↳ The selected menu opens.
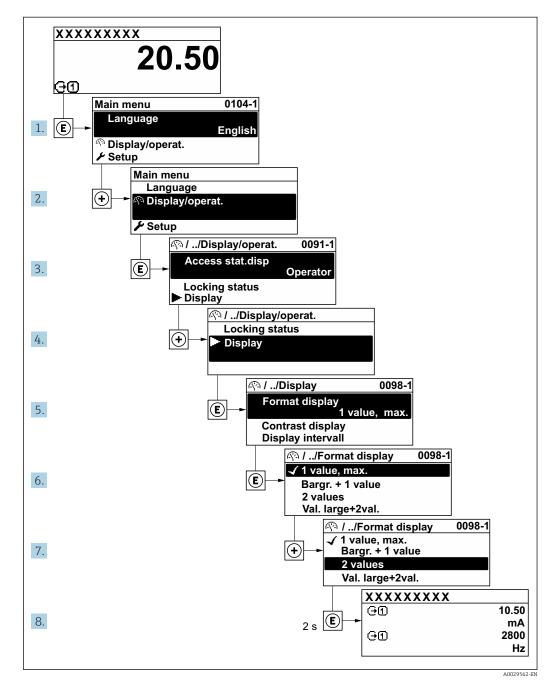
### 8.3.6    Navigating and selecting from list

Different operating elements are used to navigate through the operating menu. The navigation path is displayed on the left in the header. Icons are displayed in front of the individual menus. These icons are also shown in the header during navigation.

For an explanation of the navigation view with symbols and operating elements → 🖻 46

**Example: Setting the number of displayed measured values to "2 values"**

A0029562-EN
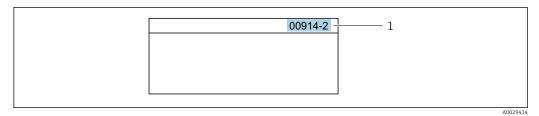
### 8.3.7    Calling the parameter directly

A parameter number is assigned to every parameter to be able to access a parameter directly via the onsite display. Entering this access code in the **Direct access** parameter calls up the desired parameter directly.

**Navigation path**
Expert → Direct access

The direct access code consists of a 5-digit number (at maximum) and the channel number, which identifies the channel of a process variable: e.g. 00914-2. In the navigation view, this appears on the right-hand side in the header of the selected parameter.



*1     Direct access code*

Note the following when entering the direct access code:
- The leading zeros in the direct access code do not have to be entered.
  Example: Enter **"914"** instead of **"00914"**
- If no channel number is entered, channel 1 is opened automatically.
  Example: Enter **00914** → **Assign process variable** parameter
- If a different channel is opened: Enter the direct access code with the corresponding channel number.
  Example: Enter **00914-2** → **Assign process variable** parameter

For the direct access codes of the individual parameters, see the "Description of Device Parameters" document for the device

### 8.3.8    Calling up help text
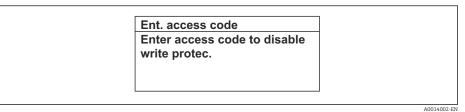
Help text is available for some parameters and can be called up from the navigation view. The help text provides a brief explanation of the parameter function and thereby supports swift and safe commissioning.

**Calling up and closing the help text**

The user is in the navigation view and the selection bar is on a parameter.

1.  Press Ⓔ for 2 s.
    ↳ The help text for the selected parameter opens.
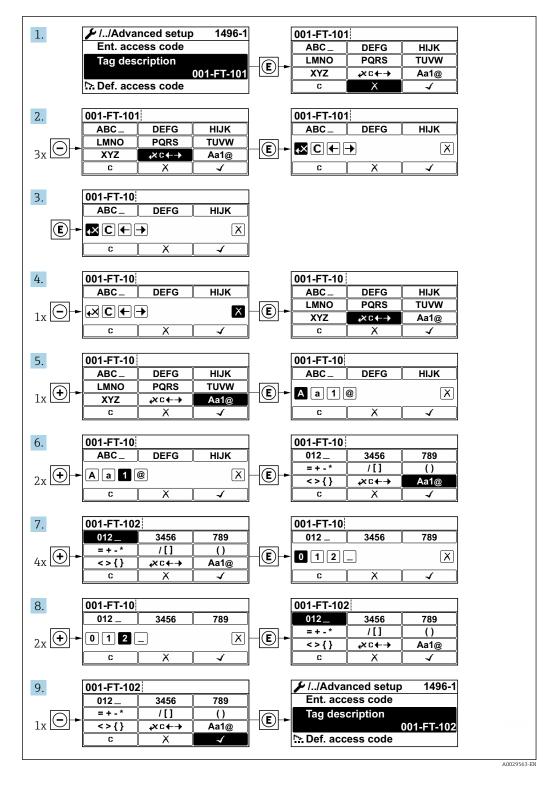


🖾 *18     Example: Help text for parameter "Enter access code"*

2.  Press ⊟ + ⊞ simultaneously.
    ↳ The help text is closed.

### 8.3.9 Changing the parameters

For a description of the editing view - consisting of the text editor and numeric editor - with symbols → 🖬 48, for a description of the operating elements → 🖬 50

**Example:** Changing the tag name in the "Tag description" parameter from 001-FT-101 to 001-FT-102



A0029563-EN

A message is displayed if the value entered is outside the permitted value range.

```
                        ┌─────────────────────────────────┐
                        │ Ent. access code                │
                        │ Invalid or out of range input   │
                        │ value                           │
                        │ Min:0                           │
                        │ Max:9999                        │
                        └─────────────────────────────────┘
```

### 8.3.10    User roles and related access authorization

The two user roles "Operator" and "Maintenance" have different write access to the parameters if the customer defines a user-specific access code. This protects the device configuration via the local display from unauthorized access → 🖩 101.

**Defining access authorization for user roles**

An access code is not yet defined when the device is delivered from the factory. Access authorization (read and write access) to the device is not restricted and corresponds to the "Maintenance" user role.

▶ Define the access code.
  ↳ The "Operator" user role is redefined in addition to the "Maintenance" user role. Access authorization differs for the two user roles.

*Access authorization to parameters: "Maintenance" user role*

| Access code status | Read access | Write access |
|---|:---:|:---:|
| An access code has not yet been defined (factory setting). | ✔ | ✔ |
| After an access code has been defined. | ✔ | ✔ [1] |

1)    The user only has write access after entering the access code.

*Access authorization to parameters: "Operator" user role*

| Access code status | Read access | Write access |
|---|:---:|:---:|
| After an access code has been defined. | ✔ | ‒‒ [1] |

1)    Despite the defined access code, certain parameters can always be modified and thus are excepted from the write protection, as they do not affect the measurement. Refer to the "Write protection via access code" section

🛈 The user role with which the user is currently logged on is indicated by the **Access status display** parameter. Navigation path: Operation → Access status display

### 8.3.11    Disabling write protection via access code

If the 🔒-symbol appears on the local display in front of a parameter, the parameter is write-protected by a user-specific access code and its value cannot be changed at the moment using local operation → 🖩 101.

Parameter write protection via local operation can be disabled by entering the user-specific access code in the **Enter access code** parameter (→ 🖩 90) via the respective access option.

1. After you press 🗉, the input prompt for the access code appears.

2. Enter the access code.
   ↳ The 🔒-symbol in front of the parameters disappears; all previously write-protected parameters are now re-enabled.

### 8.3.12  Enabling and disabling the keypad lock

The keypad lock makes it possible to block access to the entire operating menu via local operation. As a result, it is no longer possible to navigate through the operating menu or change the values of individual parameters. Users can only read the measured values on the operational display.

The keypad lock is switched on and off via the context menu.

**Switching on the keypad lock**

The keypad lock is switched on automatically:
- If the device has not been operated via the display for > 1 minute.
- Each time the device is restarted.

**To activate the keylock manually:**

1. The device is in the measured value display.
   Press the ⊟ and 𝔼 keys for 3 seconds.
   ↳  A context menu appears.

2. In the context menu select the **Keylock on** option.
   ↳  The keypad lock is switched on.

If the user attempts to access the operating menu while the keypad lock is active, the **Keylock on** message appears.

**Switching off the keypad lock**

▶ The keypad lock is switched on.
   Press the ⊟ and 𝔼 keys for 3 seconds.
   ↳  The keypad lock is switched off.

## 8.4      Access to the operating menu via the Web browser

### 8.4.1  Function scope

Thanks to the integrated Web server the device can be operated and configured via a Web browser and via a standard Ethernet switch (RJ45) or via a WLAN interface. The structure of the operating menu is the same as the menu on the local display. In addition to the measured values, status information about the device is also displayed and allows the user to monitor the status of the device. Furthermore the device data can be managed and the network parameters can be configured.

A device that has a WLAN interface (can be ordered as an option) is required for the WLAN connection: order code for "Display", option G "4-line, illuminated; Touch Control +WLAN". The device acts as an Access Point and enables communication by computer or a mobile handheld terminal.

For additional information on the Web server, refer to the Special Documentation for the device → 🖹 154

### 8.4.2  Requirements

*Computer hardware*

| Interface  | The computer must have an RJ45 interface.                      |
|------------|---------------------------------------------------------------|
| Connection | Standard Ethernet cable with RJ45 connector.                  |
| Screen     | Recommended size: ≥12" (depends on the screen resolution)    |

*Computer software*

| Recommended operating systems | Microsoft Windows 7 or higher. |
| --- | --- |
| | Microsoft Windows XP is supported. |
| Web browsers supported | • Microsoft Internet Explorer 8 or higher<br>• Microsoft Edge<br>• Mozilla Firefox<br>• Google Chrome<br>• Safari |

*Computer settings*

| User rights | Appropriate user rights (e.g. administrator rights) for TCP/IP and proxy server settings are necessary (for adjusting the IP address, subnet mask etc.). |
| --- | --- |
| Proxy server settings of the Web browser | The Web browser setting *Use proxy server for LAN* must be **disabled**. |
| JavaScript | JavaScript must be enabled. |
| | If JavaScript cannot be enabled:<br>enter http://192.168.1.212/basic.html in the address line of the Web browser. A fully functional but simplified version of the operating menu structure starts in the Web browser. |
| | When installing a new firmware version: To enable correct data display, clear the temporary memory (cache) of the Web browser under **Internet options**. |
| Network connections | Only the active network connections to the measuring device should be used. |
| | Switch off all other network connections such as WLAN. |

In the event of connection problems: → 🖺 114

*Measuring device: Via CDI-RJ45 service interface*

| Device | CDI-RJ45 service interface |
| --- | --- |
| Measuring device | The measuring device has an RJ45 interface. |
| Web server | Web server must be enabled; factory setting: ON |
| | For information on enabling the Web server → 🖺 61 |

*Measuring device: via WLAN interface*

| Device | WLAN interface |
| --- | --- |
| Measuring device | The measuring device has a WLAN antenna:<br>Transmitter with integrated WLAN antenna |
| Web server | Web server and WLAN must be enabled; factory setting: ON |
| | For information on enabling the Web server → 🖺 61 |

### 8.4.3    Establishing a connection

**Via service interface (CDI-RJ45)**

*Preparing the measuring device*

*Configuring the Internet protocol of the computer*

The following information refers to the default Ethernet settings of the device.

IP address of the device: 192.168.1.212 (factory setting)

1. Switch on the measuring device.

2. Connect to the computer using a cable .

3. If a 2nd network card is not used, close all the applications on the notebook.
   ↳ Applications requiring Internet or a network, such as e-mail, SAP applications, Internet or Windows Explorer.

4. Close any open Internet browsers.

5. Configure the properties of the Internet protocol (TCP/IP) as defined in the table:

| IP address | 192.168.1.XXX; for XXX all numerical sequences except: 0, 212 and 255 → e.g. 192.168.1.213 |
|---|---|
| Subnet mask | 255.255.255.0 |
| Default gateway | 192.168.1.212 or leave cells empty |

**Via WLAN interface**

*Configuring the Internet protocol of the mobile terminal*

**NOTICE**

**If the WLAN connection is lost during the configuration, settings made may be lost.**

▶ Make sure that the WLAN connection is not disconnected while configuring the device.

**NOTICE**

**In principle, avoid simultaneous access to the measuring device via the service interface (CDI-RJ45) and the WLAN interface from the same mobile terminal. This could cause a network conflict.**

▶ Only activate one service interface (CDI-RJ45 service interface or WLAN interface).
▶ If simultaneous communication is necessary: configure different IP address ranges, e.g. 192.168.0.1 (WLAN interface) and 192.168.1.212 (CDI-RJ45 service interface).

*Preparing the mobile terminal*

▶ Enable WLAN reception on the mobile terminal.

*Establishing a connection from the mobile terminal to the measuring device*

1. In the WLAN settings of the mobile terminal:
   Select the measuring device using the SSID (e.g. EH_Prosonic Flow_400_A802000).

2. If necessary, select the WPA2 encryption method.

3. Enter the password: serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ LED on display module flashes: it is now possible to operate the measuring device with the Web browser, FieldCare or DeviceCare.

ℹ The serial number can be found on the nameplate.

ℹ To ensure the safe and swift assignment of the WLAN network to the measuring point, it is advisable to change the SSID name. It should be possible to clearly assign the SSID name to the measuring point (e.g. tag name) as it is displayed as the WLAN network.

*Disconnecting*

▶ After configuring the device:
   Terminate the WLAN connection between the operating unit and measuring device.

**Starting the Web browser**

1. Start the Web browser on the computer.
2. Enter the IP address of the Web server in the address line of the Web browser: 192.168.1.212
   ↳ The login page appears.



A0029417

*1 Picture of device*
*2 Device name*
*3 Device tag (→ 🖹 73)*
*4 Status signal*
*5 Current measured values*
*6 Operating language*
*7 User role*
*8 Access code*
*9 Login*
*10 Reset access code (→ 🖹 98)*

If a login page does not appear, or if the page is incomplete → 🖹 114
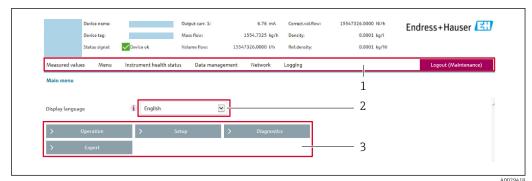
### 8.4.4 Logging on

1. Select the preferred operating language for the Web browser.
2. Enter the user-specific access code.
3. Press **OK** to confirm your entry.

| Access code | 0000 (factory setting); can be changed by customer |
|---|---|

If no action is performed for 10 minutes, the Web browser automatically returns to the login page.

### 8.4.5   User interface



*1   Function row*
*2   Local display language*
*3   Navigation area*

#### Header

The following information appears in the header:
• Device name
• Device tag
• Device status with status signal → 🖹 119
• Current measured values

#### Function row

| Functions | Meaning |
|---|---|
| Measured values | Displays the measured values of the device |
| Menu | • Access to the operating menu from the measuring device<br>• The structure of the operating menu is the same as for the local display<br><br>📖 For detailed information on the structure of the operating menu, see the Operating Instructions for the measuring device |
| Device status | Displays the diagnostic messages currently pending, listed in order of priority |
| Data management | Data exchange between PC and measuring device:<br>• Device configuration:<br>  • Load settings from the device<br>    (XML format, save configuration)<br>  • Save settings to the device<br>    (XML format, restore configuration)<br>• Logbook - Export Event logbook (.csv file)<br>• Documents - Export documents:<br>  • Export backup data record<br>    (.csv file, create documentation of the measuring point configuration)<br>  • Verification report<br>    (PDF file, only available with the "Heartbeat Verification" application package) |
| Network configuration | Configuration and checking of all the parameters required for establishing the connection to the measuring device:<br>• Network settings (e.g. IP address, MAC address)<br>• Device information (e.g. serial number, firmware version) |
| Logout | End the operation and call up the login page |

#### Navigation area

If a function is selected in the function bar, the submenus of the function open in the navigation area. The user can now navigate through the menu structure.

**Working area**

Depending on the selected function and the related submenus, various actions can be performed in this area:
- Configuring parameters
- Reading measured values
- Calling up help text
- Starting an upload/download

### 8.4.6 Disabling the Web server

The Web server of the measuring device can be switched on and off as required using the **Web server functionality** parameter.

**Navigation**

"Expert" menu → Communication → Web server

**Parameter overview with brief description**

| Parameter | Description | Selection |
|---|---|---|
| Web server functionality | Switch the Web server on and off. | • Off<br>• On |

**Function scope of the "Web server functionality" parameter**

| Option | Description |
|---|---|
| Off | • The web server is completely disabled.<br>• Port 80 is locked. |
| On | • The complete functionality of the web server is available.<br>• JavaScript is used.<br>• The password is transferred in an encrypted state.<br>• Any change to the password is also transferred in an encrypted state. |

**Enabling the Web server**

If the Web server is disabled it can only be re-enabled with the **Web server functionality** parameter via the following operating options:
- Via local display
- Via Bedientool "FieldCare"
- Via "DeviceCare" operating tool

### 8.4.7 Logging out

Before logging out, perform a data backup via the **Data management** function (upload configuration from device) if necessary.

1. Select the **Logout** entry in the function row.
   ↳ The home page with the Login box appears.

2. Close the Web browser.

3. If no longer needed:
   Reset modified properties of the Internet protocol (TCP/IP) → 🖥 57.
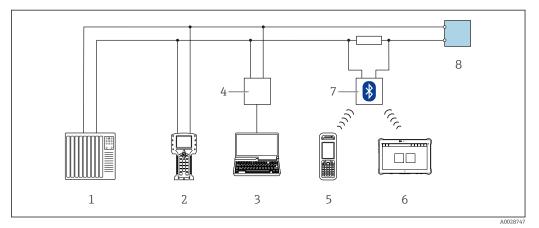
## 8.5 Access to the operating menu via the operating tool

The structure of the operating menu in the operating tools is identical to operation via the local display.

### 8.5.1 Connecting the operating tool

**Via HART protocol**
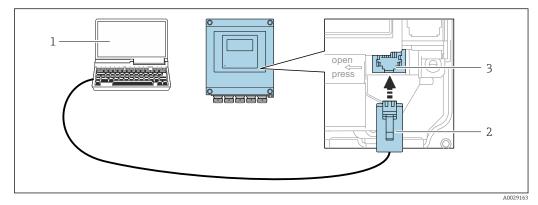
This communication interface is available in device versions with a HART output.



🖾 *19    Options for remote operation via HART protocol*

*1    Control system (e.g. PLC)*
*2    Field Communicator 475*
*3    Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)*
*4    Commubox FXA195 (USB)*
*5    Field Xpert SFX350 or SFX370*
*6    Field Xpert SMT70*
*7    VIATOR Bluetooth modem with connecting cable*
*8    Transmitter*

**Via service interface (CDI-RJ45)**
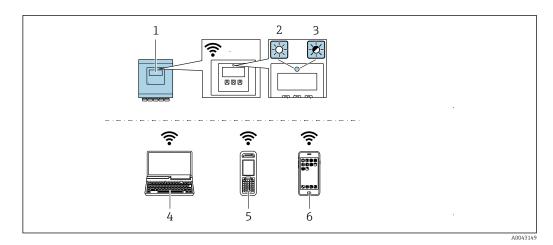


🖾 *20    Connection via service interface (CDI-RJ45)*

*1    Computer with Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or with "FieldCare", "DeviceCare" operating tool with COM DTM "CDI Communication TCP/IP"*
*2    Standard Ethernet connecting cable with RJ45 plug*
*3    Service interface (CDI-RJ45) of the measuring device with access to the integrated Web server*

**Via WLAN interface**

The optional WLAN interface is available on the following device version:
Order code for "Display; operation", option G "4-line, illuminated; touch control + WLAN"

A0043149

*1  Transmitter with integrated WLAN antenna*
*2  LED lit constantly: WLAN reception is enabled on measuring device*
*3  LED flashing: WLAN connection established between operating unit and measuring device*
*4  Computer with WLAN interface and Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or with operating tool (e.g. FieldCare, DeviceCare)*
*5  Mobile handheld terminal with WLAN interface and Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or operating tool (e.g. FieldCare, DeviceCare)*
*6  Smart phone or tablet (e.g. Field Xpert SMT70)*

| Function | WLAN: IEEE 802.11 b/g (2.4 GHz) |
|---|---|
| Encryption | WPA2-PSK AES-128 (in accordance with IEEE 802.11i) |
| Configurable WLAN channels | 1 to 11 |
| Degree of protection | IP67 |
| Available antenna | Internal antenna |
| Range | Typically 10 m (32 ft) |

*Configuring the Internet protocol of the mobile terminal*

### NOTICE

**If the WLAN connection is lost during the configuration, settings made may be lost.**
▶ Make sure that the WLAN connection is not disconnected while configuring the device.

### NOTICE

**In principle, avoid simultaneous access to the measuring device via the service interface (CDI-RJ45) and the WLAN interface from the same mobile terminal. This could cause a network conflict.**
▶ Only activate one service interface (CDI-RJ45 service interface or WLAN interface).
▶ If simultaneous communication is necessary: configure different IP address ranges, e.g. 192.168.0.1 (WLAN interface) and 192.168.1.212 (CDI-RJ45 service interface).

*Preparing the mobile terminal*

▶ Enable WLAN reception on the mobile terminal.

*Establishing a connection from the mobile terminal to the measuring device*

1. In the WLAN settings of the mobile terminal:
   Select the measuring device using the SSID (e.g. EH_Prosonic Flow_400_A802000).

2. If necessary, select the WPA2 encryption method.

3. Enter the password: serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ LED on display module flashes: it is now possible to operate the measuring device with the Web browser, FieldCare or DeviceCare.

ℹ The serial number can be found on the nameplate.

ℹ To ensure the safe and swift assignment of the WLAN network to the measuring point, it is advisable to change the SSID name. It should be possible to clearly assign the SSID name to the measuring point (e.g. tag name) as it is displayed as the WLAN network.

*Disconnecting*

▸ After configuring the device:
  Terminate the WLAN connection between the operating unit and measuring device.

### 8.5.2 FieldCare

**Function scope**

FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field devices in a 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.

Access is via:
• HART protocol
• CDI-RJ45 service interface

Typical functions:
• Parameterization of transmitters
• Loading and saving device data (upload/download)
• Documentation of the measuring point
• Visualization of the measured value memory (line recorder) and event logbook

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

**Source for device description files**
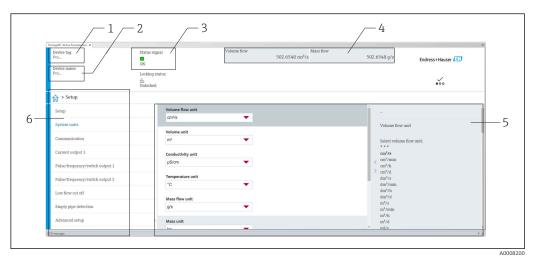
See information → 🖺 67

**Establishing a connection**

1. Start FieldCare and launch the project.

2. In the network: Add a device.
   ↳ The **Add device** window opens.

3. Select the **CDI Communication TCP/IP** option from the list and press **OK** to confirm.

4. Right-click **CDI Communication TCP/IP** and select the **Add device** option in the context menu that opens.

5. Select the desired device from the list and press **OK** to confirm.
   ↳ The **CDI Communication TCP/IP (Configuration)** window opens.

6. Enter the device address in the **IP address** field: 192.168.1.212 and press **Enter** to confirm.

7. Establish the online connection to the device.

📖 For additional information, see Operating Instructions BA00027S and BA00059S

**User interface**



*A0008200*

*1   Device name*
*2   Tag name*
*3   Status area with status signal → 🖹 119*
*4   Display area for current measured values*
*5   Edit bar with additional functions*
*6   Navigation area with operating menu structure*
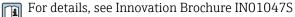
### 8.5.3   DeviceCare

**Function scope**

Tool for connecting and configuring Endress+Hauser field devices.

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

📖  For details, see Innovation Brochure IN01047S

**Source for device description files**
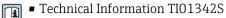
See information → 🖹 67

### 8.5.4   Field Xpert SMT70, SMT77

**Field Xpert SMT70**

The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress.

This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle.

📖  • Technical Information TI01342S
   • Operating Instructions BA01709S
   • Product page: www.endress.com/smt70

ℹ️  Source for device description files: → 🖹 67

**Field Xpert SMT77**

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

- Technical Information TI01418S
- Operating Instructions BA01923S
- Product page: www.endress.com/smt77

Source for device description files: → 🖺 67

### 8.5.5 AMS Device Manager

**Function scope**

Program from Emerson Process Management for operating and configuring measuring devices via HART protocol.

**Source for device description files**

See data → 🖺 67

### 8.5.6 SIMATIC PDM

**Function scope**

SIMATIC PDM is a standardized, manufacturer-independent program from Siemens for the operation, configuration, maintenance and diagnosis of intelligent field devices via HART protocol.

**Source for device description files**

See information on → 🖺 67

# 9    System integration

## 9.1    Overview of device description files

### 9.1.1    Current version data for the device

| Firmware version | 01.00.zz | • On the title page of the Operating Instructions<br>• On the transmitter nameplate<br>• Firmware version<br>  Diagnostics → Device information → Firmware version |
|---|---|---|
| Release date of firmware version | 12.2021 | --- |
| Manufacturer ID | 0x11 | Manufacturer ID<br>Diagnostics → Device information → Manufacturer ID |
| Device type ID | 0x5D | Device type<br>Diagnostics → Device information → Device type |
| HART protocol revision | 7 | --- |
| Device revision | 1 | • On the transmitter nameplate<br>• Device revision<br>  Diagnostics → Device information → Device revision |

For an overview of the various firmware versions for the device →  🖺 131

### 9.1.2    Operating tools

The suitable device description file for the individual operating tools is listed in the table below, along with information on where the file can be acquired.

| Operating tool via<br>HART protocol | Sources for obtaining device descriptions |
|---|---|
| FieldCare | • www.endress.com → Download Area<br>• CD–ROM (contact Endress+Hauser)<br>• DVD (contact Endress+Hauser) |
| DeviceCare | • www.endress.com → Download Area<br>• CD–ROM (contact Endress+Hauser)<br>• DVD (contact Endress+Hauser) |
| • Field Xpert SMT70<br>• Field Xpert SMT77 | Use update function of handheld terminal |
| AMS Device Manager<br>(Emerson Process Management) | www.endress.com → Download Area |
| SIMATIC PDM<br>(Siemens) | www.endress.com → Download Area |
| Field Communicator 475<br>(Emerson Process Management) | Use update function of handheld terminal |

## 9.2    Measured variables via HART protocol

The following measured variables (HART device variables) are assigned to the dynamic variables at the factory:

| Dynamic variables | Measured variables (HART device variables) |
|---|---|
| Primary dynamic variable (PV) | Volume flow |
| Secondary dynamic variable (SV) | Totalizer 1 |
| Tertiary dynamic variable (TV) | Totalizer 2 |
| Quaternary dynamic variable (QV) | Totalizer 3 |

The assignment of the measured variables to the dynamic variables can be modified and assigned as desired via local operation and the operating tool using the following parameters:

- Expert → Communication → HART output → Output → Assign PV
- Expert → Communication → HART output → Output → Assign SV
- Expert → Communication → HART output → Output → Assign TV
- Expert → Communication → HART output → Output → Assign QV

The following measured variables can be assigned to the dynamic variables:

**Measured variables for PV (primary dynamic variable)**
- Measured variables which are generally available:
  - Volume flow
  - Mass flow
  - Flow velocity
  - Sound velocity
  - Electronics temperature
- Additional measured variables with the Heartbeat Verification + Monitoring application package:
  - Signal strength
  - Signal to noise ratio
  - Acceptance rate
  - Turbulence

**Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)**
- Measured variables which are always available:
  - Volume flow
  - Mass flow
  - Flow velocity
  - Sound velocity
  - Electronics temperature
  - Totalizer 1
  - Totalizer 2
  - Totalizer 3
  - HART input
  - Current input 1 [1]
  - Current input 2 [1]
  - Current input 3 [1]
- Additional measured variables with the Heartbeat Verification + Monitoring application package:
  - Signal strength
  - Signal to noise ratio
  - Acceptance rate
  - Turbulence

---

1) Visible depending on the order options or device settings

## 9.3 Other settings

Burst mode functionality in accordance with HART 7 Specification:

**Navigation**

"Expert" menu → Communication → HART output → Burst configuration → Burst configuration 1 to n

| ► Burst configuration 1 to n | |
|---|---|
| Burst mode 1 to n | → 🖹 69 |
| Burst command 1 to n | → 🖹 69 |
| Burst variable 0 | → 🖹 70 |
| Burst variable 1 | → 🖹 70 |
| Burst variable 2 | → 🖹 70 |
| Burst variable 3 | → 🖹 70 |
| Burst variable 4 | → 🖹 70 |
| Burst variable 5 | → 🖹 70 |
| Burst variable 6 | → 🖹 70 |
| Burst variable 7 | → 🖹 70 |
| Burst trigger mode | → 🖹 70 |
| Burst trigger level | → 🖹 70 |
| Min. update period | → 🖹 70 |
| Max. update period | → 🖹 70 |

**Parameter overview with brief description**

| Parameter | Description | Selection / User entry |
|---|---|---|
| Burst mode 1 to n | Activate the HART burst mode for burst message X. | • Off<br>• On |
| Burst command 1 to n | Select the HART command that is sent to the HART master. | • Command 1<br>• Command 2<br>• Command 3<br>• Command 9<br>• Command 33<br>• Command 48 |

| Parameter | Description | Selection / User entry |
|---|---|---|
| Burst variable 0 | For HART command 9 and 33: select the HART device variable or the process variable. | • Not used<br>• Volume flow<br>• Mass flow<br>• Sound velocity<br>• Flow velocity<br>• Signal strength [*]<br>• Signal to noise ratio [*]<br>• Turbulence [*]<br>• Acceptance rate [*]<br>• Temperature [*]<br>• Density [*]<br>• Totalizer 1<br>• Totalizer 2<br>• Totalizer 3<br>• Measured current<br>• Percent of range<br>• Primary variable (PV)<br>• Quaternary variable (QV)<br>• Secondary variable (SV)<br>• Tertiary variable (TV) |
| Burst variable 1 | For HART command 9 and 33: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. |
| Burst variable 2 | For HART command 9 and 33: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. |
| Burst variable 3 | For HART command 9 and 33: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. |
| Burst variable 4 | For HART command 9: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. |
| Burst variable 5 | For HART command 9: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. |
| Burst variable 6 | For HART command 9: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. |
| Burst variable 7 | For HART command 9: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. |
| Burst trigger mode | Select the event that triggers burst message X. | • Continuous<br>• Window [*]<br>• Rising [*]<br>• Falling [*]<br>• On change |
| Burst trigger level | Enter the burst trigger value.<br><br>Together with the option selected in the **Burst trigger mode** parameter the burst trigger value determines the time of burst message X. | Signed floating-point number |
| Min. update period | Enter the minimum time span between two burst commands of burst message X. | Positive integer |
| Max. update period | Enter the maximum time span between two burst commands of burst message X. | Positive integer |

\*     Visibility depends on order options or device settings

# 10    Commissioning

## 10.1    Function check

Before commissioning the measuring device:

▸  Make sure that the post-installation and post-connection checks have been performed.

- "Post-installation check" checklist→ 🖺 32
- "Post-connection check" checklist→ 🖺 41
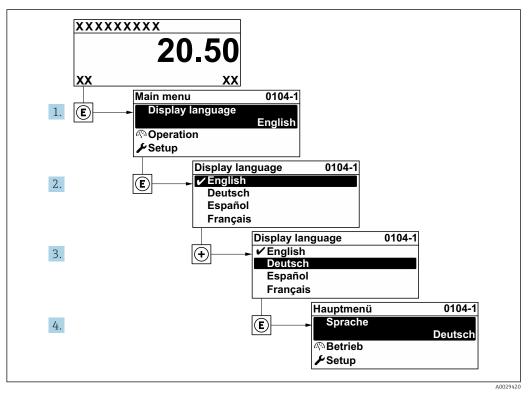
## 10.2    Switching on the measuring device

▸  After a successful function check, switch on the measuring device.
   ↳  After a successful startup, the local display switches automatically from the startup display to the operational display.

ℹ  If nothing appears on the local display or a diagnostic message is displayed, refer to the section on "Diagnostics and troubleshooting" → 🖺 113.

## 10.3    Setting the operating language
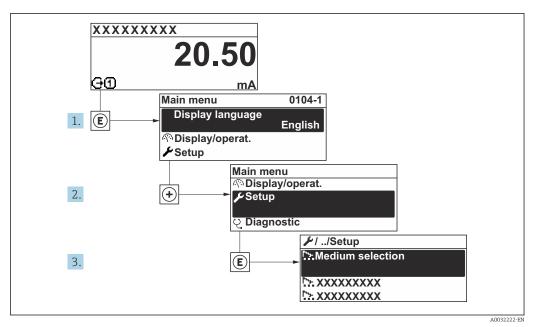
Factory setting: English or ordered local language



🖻 21    *Taking the example of the local display*
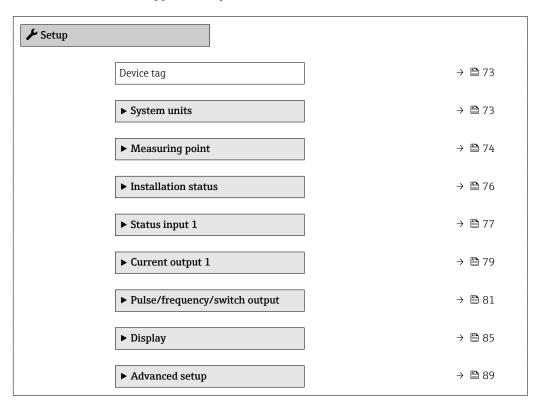
## 10.4    Configuring the measuring device

- The **Setup** menu with its guided wizards contains all the parameters needed for standard operation.
- Navigation to the **Setup** menu
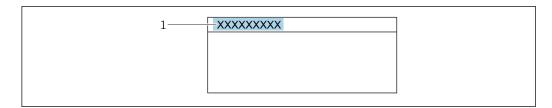
*■ 22    Taking the example of the local display*

The number of submenus and parameters can vary depending on the device version.
Certain submenus and parameters in these submenus are not described in the
Operation Instructions. Instead a description is provided in the Special Documentation
for the device (→ "Supplementary documentation" section).

| ✕ Setup | | |
|---|---|---|
| Device tag | → ▤ | 73 |
| ▸ System units | → ▤ | 73 |
| ▸ Measuring point | → ▤ | 74 |
| ▸ Installation status | → ▤ | 76 |
| ▸ Status input 1 | → ▤ | 77 |
| ▸ Current output 1 | → ▤ | 79 |
| ▸ Pulse/frequency/switch output | → ▤ | 81 |
| ▸ Display | → ▤ | 85 |
| ▸ Advanced setup | → ▤ | 89 |

### 10.4.1    Defining the tag name

To enable fast identification of the measuring point within the system, you can enter a
unique designation using the **Device tag** parameter and thus change the factory setting.

*A0029422*

*■ 23    Header of the operational display with tag name*

*1    Tag name*

Enter the tag name in the "FieldCare" operating tool → 🖹 65

**Navigation**
"Setup" menu → Device tag

**Parameter overview with brief description**

| Parameter | Description | User entry |
|-----------|-------------|------------|
| Device tag | Enter the name for the measuring point. | Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /). |

### 10.4.2    Setting the system units

In the **System units** submenu the units of all the measured values can be set.

**Navigation**
"Setup" menu → System units

| ‣ System units | |
|----------------|---|
| Volume flow unit | → 🖹 74 |
| Volume unit | → 🖹 74 |
| Mass flow unit | → 🖹 74 |
| Mass unit | → 🖹 74 |
| Velocity unit | → 🖹 74 |
| Temperature unit | → 🖹 74 |
| Density unit | → 🖹 74 |
| Length unit | → 🖹 74 |

Parameter overview with brief description

| Parameter | Description | Selection | Factory setting |
|---|---|---|---|
| Volume flow unit | Select volume flow unit.<br><br>*Effect*<br><br>The selected unit applies for:<br>• Output<br>• Low flow cut off<br>• Simulation process variable | Unit choose list | Country-specific:<br>• m³/h<br>• ft³/min |
| Volume unit | Select volume unit. | Unit choose list | Country-specific:<br>• m³<br>• ft³ |
| Mass flow unit | Select mass flow unit.<br><br>*Effect*<br><br>The selected unit applies for:<br>• Output<br>• Low flow cut off<br>• Simulation process variable | Unit choose list | Country-specific:<br>• kg/h<br>• lb/min |
| Mass unit | Select mass unit. | Unit choose list | Country-specific:<br>• kg<br>• lb |
| Velocity unit | Select velocity unit.<br><br>*Effect*<br><br>The selected unit applies for:<br>• Flow velocity<br>• Sound velocity | Unit choose list | Country-specific:<br>• m/s<br>• ft/s |
| Temperature unit | Select temperature unit.<br><br>*Effect*<br><br>The selected unit applies for:<br>• Temperature<br>• **Electronic temperature** parameter (6053)<br>• **External temperature** parameter (6080)<br>• **Reference temperature** parameter (1816) | Unit choose list | Country-specific:<br>• ℃<br>• ℉ |
| Density unit | Select density unit.<br><br>*Effect*<br><br>The selected unit applies for:<br>• Output<br>• Simulation process variable | Unit choose list | Country-specific:<br>• kg/dm³<br>• lb/ft³ |
| Length unit | Select the unit of length. | Unit choose list | Country-specific:<br>• mm<br>• in |

### 10.4.3   Configuring the measuring point

The **"Measuring point "** wizard guides you systematically through all the parameters that must be set for the configuration of the measuring point.

**Navigation**
"Setup" menu → Measuring point

> ▸ **Measuring point**
>
>          Measuring point configuration             → 🗎 75

| | Process fluid | → 🗐 75 |
|---|---|---|
| | Medium temperature | → 🗐 75 |
| | Sound velocity | → 🗐 76 |
| | Viscosity | → 🗐 76 |
| | Pipe dimensions | → 🗐 76 |
| | Pipe circumference | → 🗐 76 |
| | Pipe outer diameter | → 🗐 76 |
| | Pipe wall thickness | → 🗐 76 |
| | Liner material | → 🗐 76 |
| | Liner sound velocity | → 🗐 76 |
| | Liner thickness | → 🗐 76 |
| | Sensor type | → 🗐 76 |
| | Cable length | → 🗐 76 |
| | Result sensor type / sensor distance | → 🗐 76 |
| | Result path length / arc length | → 🗐 76 |

**Parameter overview with brief description**

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|---|---|---|---|---|
| Measuring point configuration | – | Select configuration for the measuring point. | • 1 measuring point - signal path 1<br>• 1 measuring point - signal path 2 *<br>• 1 measuring point - 2 signal paths * | Depending on the sensor version |
| Process fluid | – | Select process fluid. | • Water<br>• Sea water<br>• Distilled water<br>• Ammonia NH3<br>• Benzene<br>• Ethanol<br>• Glycol<br>• Milk<br>• Methanol<br>• User-specific liquid | – |
| Medium temperature | – | Enter a fixed value for process temperature. | −200 to 550 ℃ | – |

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|---|---|---|---|---|
| Sound velocity | The **User-specific liquid** option is selected in the **Process fluid** parameter. | Enter sound velocity of fluid. | 200 to 3 000 m/s | – |
| Viscosity | The **User-specific liquid** option is selected in the **Process fluid** parameter. | Enter medium viscosity at installation temperature. | 1E-10 to 0.01 m²/s | – |
| Pipe dimensions | – | Select if pipe dimensions are defined by diameter or circumference. | • Diameter<br>• Pipe circumference | – |
| Pipe circumference | The **Pipe circumference** option is selected in the **Pipe dimensions** parameter. | Define the pipe circumference. | 30 to 62 800 mm | – |
| Pipe outer diameter | The **Diameter** option is selected in the **Pipe dimensions** parameter. | Define the outer diameter of the pipe. | 10 to 5 000 mm | 100 mm |
| Pipe wall thickness | – | Enter the pipe wall thickness. | Positive floating point number | 3 mm |
| Liner material | – | Select liner material. | • None<br>• Cement<br>• Rubber<br>• Epoxy resin<br>• Unknown liner material | – |
| Liner sound velocity | The **Unknown liner material** option is selected in the **Liner material** parameter. | Define the sound velocity of liner material. | 800.0 to 3 800.0 m/s | – |
| Liner thickness | One of the following options is selected in the **Liner material** parameter:<br>• Cement<br>• Rubber<br>• Epoxy resin<br>• Unknown liner material | Define the thickness of liner. | 0 to 100 mm | – |
| Sensor type | – | Select sensor type. | I-100-A * | I-100-A |
| Cable length | – | Enter length of sensor cables. | 0 to 200 000 mm | As per order |
| Result sensor type / sensor distance | – | Shows the sensor type and sensor distance calculated for installation. | Character string comprising numbers, letters and special characters | – |
| Result path length / arc length | – | Shows the path length calculated and (if applicable) the calculated arc length. | Character string comprising numbers, letters and special characters | – |

\*      Visibility depends on order options or device settings

### 10.4.4   Checking the installation status

The status of individual parameters can be checked in the **Installation status** submenu.

**Navigation**
"Setup" menu → Installation status

┌─────────────────────────────────────────┐
│ ► Installation status                     │
└─────────────────────────────────────────┘
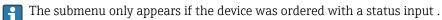
| | | |
|---|---|---|
| Installation status | → 🗎 77 | |
| Signal strength | → 🗎 77 | |
| Signal to noise ratio | → 🗎 77 | |
| Sound velocity | → 🗎 77 | |

**Parameter overview with brief description**

| Parameter | Description | User interface |
|---|---|---|
| Installation status | Shows the device status on installation based on the measured values displayed.<br><br>Displays the device status after installation according to the displayed measured values.<br>• **Good** option: No further optimization required<br>• **Acceptable** option: Measuring performance ok, optimize if possible. You should always aim for the status **Good** option.<br>• **Bad** option: Optimization is required. Poor and unstable measuring performance.<br><br>ℹ Check the following points to optimize the sensor installation:<br>　• Sensor distance<br>　• Alignment of sensors<br>　• Check the measuring point parameters in the configuration | • Good<br>• Acceptable<br>• Bad |
| Signal strength | Displays the current signal strength (0 to 100 dB).<br><br>Assessment of the signal strength:<br>• < 10 dB: bad<br>• > 90 dB: very good | Signed floating-point number |
| Signal to noise ratio | Displays the current signal to noise ratio (0 to 100 dB).<br><br>Assessment of the signal to noise ratio:<br>• < 20 dB: bad<br>• > 50 dB: very good | Signed floating-point number |
| Sound velocity | Displays the sound velocity that is currently measured.<br><br>Assessment of the sound velocity:<br>• < 1 %: Good<br>• 1 to 2 %: Acceptable<br>• > 2 %: Bad | Signed floating-point number |

### 10.4.5   Configuring the status input

The **Status input** submenu guides the user systematically through all the parameters that have to be set for configuring the status input.

ℹ  The submenu only appears if the device was ordered with a status input .

**Navigation**

"Setup" menu → Status input

**Structure of the submenu**

| ▶ Status input | | |
|---|---|---|
| | Assign status input | → 🖺 78 |
| | Active level | → 🖺 78 |
| | Response time status input | → 🖺 78 |

**Parameter overview with brief description**

| Parameter | Description | Selection / User entry |
|---|---|---|
| Assign status input | Select function for the status input. | ▪ Off<br>▪ Reset totalizer 1<br>▪ Reset totalizer 2<br>▪ Reset totalizer 3<br>▪ Reset all totalizers<br>▪ Flow override |
| Active level | Define input signal level at which the assigned function is triggered. | ▪ High<br>▪ Low |
| Response time status input | Define the minimum amount of time the input signal level must be present before the selected function is triggered. | 5 to 200 ms |

### 10.4.6 Configuring the current output

The **Current output** wizard guides you systematically through all the parameters that have to be set for configuring the current output.

**Navigation**
"Setup" menu → Current output 1

| ► Current output 1 | |
| --- | --- |
| Process variable current output | → 🖺 79 |
| Current range output | → 🖺 79 |
| Lower range value output | → 🖺 80 |
| Upper range value output | → 🖺 80 |
| Fixed current | → 🖺 80 |
| Damping current output | → 🖺 80 |
| Failure behavior current output | → 🖺 80 |
| Failure current | → 🖺 80 |

**Parameter overview with brief description**

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
| --- | --- | --- | --- | --- |
| Process variable current output | – | Select process variable for current output. | • Off <sup>*</sup><br>• Volume flow<br>• Mass flow<br>• Sound velocity<br>• Flow velocity<br>• Signal strength <sup>*</sup><br>• Signal to noise ratio <sup>*</sup><br>• Turbulence <sup>*</sup><br>• Acceptance rate <sup>*</sup><br>• Temperature <sup>*</sup><br>• Density <sup>*</sup><br>• Electronics temperature | – |
| Current range output | – | Select current range for process value output and upper/lower level for alarm signal. | • 4…20 mA NE (3.8…20.5 mA)<br>• 4…20 mA US (3.9…20.8 mA)<br>• 4…20 mA (4…20.5 mA)<br>• 0…20 mA (0…20.5 mA)<br>• Fixed value | Country-specific:<br>• 4…20 mA NE (3.8…20.5 mA)<br>• 4…20 mA US (3.9…20.8 mA) |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Lower range value output | One of the following options is selected in the **Current span** parameter (→ 🖺 79): <br>• 4...20 mA NE (3.8...20.5 mA) <br>• 4...20 mA US (3.9...20.8 mA) <br>• 4...20 mA (4... 20.5 mA) <br>• 0...20 mA (0... 20.5 mA) | Enter lower range value for the measured value range. | Signed floating-point number | Country-specific: <br>• m³/h <br>• ft³/h |
| Upper range value output | In the **Current span** parameter (→ 🖺 79), one of the following options is selected: <br>• 4...20 mA NE (3.8...20.5 mA) <br>• 4...20 mA US (3.9...20.8 mA) <br>• 4...20 mA (4... 20.5 mA) <br>• 0...20 mA (0... 20.5 mA) | Enter upper range value for the measured value range. | Signed floating-point number | Depends on country and nominal diameter |
| Fixed current | The **Fixed current** option is selected in the **Current span** parameter (→ 🖺 79). | Defines the fixed output current. | 0 to 22.5 mA | 22.5 mA |
| Damping current output | A process variable is selected in the **Assign current output** parameter (→ 🖺 79) and one of the following options is selected in the **Current span** parameter (→ 🖺 79): <br>• 4...20 mA NE (3.8...20.5 mA) <br>• 4...20 mA US (3.9...20.8 mA) <br>• 4...20 mA (4... 20.5 mA) <br>• 0...20 mA (0... 20.5 mA) | Set reaction time for output signal to fluctuations in the measured value. | 0.0 to 999.9 s | – |
| Failure behavior current output | A process variable is selected in the **Assign current output** parameter (→ 🖺 79) and one of the following options is selected in the **Current span** parameter (→ 🖺 79): <br>• 4...20 mA NE (3.8...20.5 mA) <br>• 4...20 mA US (3.9...20.8 mA) <br>• 4...20 mA (4... 20.5 mA) <br>• 0...20 mA (0... 20.5 mA) | Define output behavior in alarm condition. | • Min. <br>• Max. <br>• Last valid value <br>• Actual value <br>• Fixed value | – |
| Failure current | The **Defined value** option is selected in the **Failure mode** parameter. | Enter current output value in alarm condition. | 0 to 22.5 mA | – |

\*      Visibility depends on order options or device settings

### 10.4.7   Configuring the pulse/frequency/switch output

The **Pulse/frequency/switch output** wizard guides you systematically through all the parameters that can be set for configuring the selected output type.

**Configuring the pulse output**

*Navigation*

"Setup" menu → Pulse/frequency/switch output 1 to n

| | |
|---|---|
| ▶ **Pulse/frequency/switch output 1 to n** | |
| Operating mode | → 🖹 81 |
| Assign pulse output | → 🖹 81 |
| Value per pulse | → 🖹 81 |
| Pulse width | → 🖹 81 |
| Failure mode | → 🖹 81 |
| Invert output signal | → 🖹 81 |

*Parameter overview with brief description*

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Operating mode | – | Define the output as a pulse, frequency or switch output. | • Pulse *<br>• Frequency *<br>• Switch * | – |
| Assign pulse output | The **Pulse** option is selected in the **Operating mode** parameter. | Select process variable for pulse output. | • Off<br>• Volume flow<br>• Mass flow | – |
| Pulse scaling | The **Pulse** option is selected in the **Operating mode** parameter (→ 🖹 81) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 81). | Enter quantity for measured value at which a pulse is output. | Positive floating point number | Depends on country and nominal diameter |
| Pulse width | The **Pulse** option is selected in the **Operating mode** parameter (→ 🖹 81) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 81). | Define time width of the output pulse. | 0.05 to 2 000 ms | – |
| Failure mode | The **Pulse** option is selected in the **Operating mode** parameter (→ 🖹 81) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 81). | Define output behavior in alarm condition. | • Actual value<br>• No pulses | – |
| Invert output signal | – | Invert the output signal. | • No<br>• Yes | – |

\*     Visibility depends on order options or device settings

**Configuring the frequency output**

**Navigation**

"Setup" menu → Pulse/frequency/switch output 1 to n

| ▶ Pulse/frequency/switch output 1 to n | | |
|---|---|---|
| | Operating mode | → 🗎 82 |
| | Assign frequency output | → 🗎 82 |
| | Minimum frequency value | → 🗎 82 |
| | Maximum frequency value | → 🗎 83 |
| | Measuring value at minimum frequency | → 🗎 83 |
| | Measuring value at maximum frequency | → 🗎 83 |
| | Failure mode | → 🗎 83 |
| | Failure frequency | → 🗎 83 |
| | Invert output signal | → 🗎 83 |

**Parameter overview with brief description**

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Operating mode | – | Define the output as a pulse, frequency or switch output. | • Pulse[*] <br> • Frequency[*] <br> • Switch[*] | – |
| Assign frequency output | The **Frequency** option is selected in the **Operating mode** parameter (→ 🗎 81). | Select process variable for frequency output. | • Off <br> • Volume flow <br> • Mass flow <br> • Sound velocity <br> • Flow velocity <br> • Signal strength[*] <br> • Signal to noise ratio[*] <br> • Turbulence[*] <br> • Acceptance rate[*] <br> • Temperature[*] <br> • Density[*] <br> • Electronics temperature | – |
| Minimum frequency value | The **Frequency** option is selected in the **Operating mode** parameter (→ 🗎 81) and a process variable is selected in the **Assign frequency output** parameter (→ 🗎 82). | Enter minimum frequency. | 0.0 to 10 000 Hz | – |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Maximum frequency value | The **Frequency** option is selected in the **Operating mode** parameter (→ 🖹 81) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 82). | Enter maximum frequency. | 0.0 to 10 000 Hz | – |
| Measuring value at minimum frequency | The **Frequency** option is selected in the **Operating mode** parameter (→ 🖹 81) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 82). | Enter measured value for minmum frequency. | Signed floating-point number | Depends on country and nominal diameter |
| Measuring value at maximum frequency | The **Frequency** option is selected in the **Operating mode** parameter (→ 🖹 81) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 82). | Enter measured value for maximum frequency. | Signed floating-point number | Depends on country and nominal diameter |
| Failure mode | The **Frequency** option is selected in the **Operating mode** parameter (→ 🖹 81) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 82). | Define output behavior in alarm condition. | • Actual value • Defined value • 0 Hz | – |
| Failure frequency | The **Frequency** option is selected in the **Operating mode** parameter (→ 🖹 81) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 82). | Enter frequency output value in alarm condition. | 0.0 to 12 500.0 Hz | – |
| Invert output signal | – | Invert the output signal. | • No • Yes | – |

\*      Visibility depends on order options or device settings

**Configuring the switch output**

Navigation
"Setup" menu → Pulse/frequency/switch output 1 to n

```
▶ Pulse/frequency/switch output
  1 to n
```

| | |
|---|---|
| Operating mode | → 🖹 84 |
| Switch output function | → 🖹 84 |
| Assign diagnostic behavior | → 🖹 84 |
| Assign limit | → 🖹 84 |

| Assign flow direction check | → 🕮 85 |
|---|---|
| Assign status | → 🕮 85 |
| Switch-on value | → 🕮 85 |
| Switch-off value | → 🕮 85 |
| Switch-on delay | → 🕮 85 |
| Switch-off delay | → 🕮 85 |
| Failure mode | → 🕮 85 |
| Invert output signal | → 🕮 85 |

**Parameter overview with brief description**

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Operating mode | – | Define the output as a pulse, frequency or switch output. | <ul><li>Pulse<sup>*</sup></li><li>Frequency<sup>*</sup></li><li>Switch<sup>*</sup></li></ul> | – |
| Switch output function | The **Switch** option is selected in the **Operating mode** parameter parameter. | Select function for switch output. | <ul><li>Off</li><li>On</li><li>Diagnostic behavior</li><li>Limit</li><li>Flow direction check</li><li>Status</li></ul> | – |
| Assign diagnostic behavior | <ul><li>In the **Operating mode** parameter, the **Switch** option is selected.</li><li>In the **Switch output function** parameter, the **Diagnostic behavior** option is selected.</li></ul> | Select diagnostic behavior for switch output. | <ul><li>Alarm</li><li>Alarm or warning</li><li>Warning</li></ul> | – |
| Assign limit | <ul><li>The **Switch** option is selected in the **Operating mode** parameter.</li><li>The **Limit** option is selected in the **Switch output function** parameter.</li></ul> | Select process variable for limit function. | <ul><li>Off</li><li>Volume flow</li><li>Mass flow</li><li>Sound velocity</li><li>Flow velocity</li><li>Signal strength<sup>*</sup></li><li>Signal to noise ratio<sup>*</sup></li><li>Turbulence<sup>*</sup></li><li>Acceptance rate<sup>*</sup></li><li>Temperature<sup>*</sup></li><li>Density<sup>*</sup></li><li>Electronics temperature</li><li>Totalizer 1</li><li>Totalizer 2</li><li>Totalizer 3</li></ul> | – |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Assign flow direction check | • The **Switch** option is selected in the **Operating mode** parameter.<br>• The **Flow direction check** option is selected in the **Switch output function** parameter. | Select process variable for flow direction monitoring. | • Off<br>• Volume flow<br>• Mass flow<br>• Flow velocity | – |
| Assign status | • The **Switch** option is selected in the **Operating mode** parameter.<br>• The **Status** option is selected in the **Switch output function** parameter. | Select device status for switch output. | • Off<br>• Low flow cut off | – |
| Switch-on value | • The **Switch** option is selected in the **Operating mode** parameter.<br>• The **Limit** option is selected in the **Switch output function** parameter. | Enter measured value for the switch-on point. | Signed floating-point number | Country-specific |
| Switch-off value | • The **Switch** option is selected in the **Operating mode** parameter.<br>• The **Limit** option is selected in the **Switch output function** parameter. | Enter measured value for the switch-off point. | Signed floating-point number | Country-specific |
| Switch-on delay | • The **Switch** option is selected in the **Operating mode** parameter.<br>• The **Limit** option is selected in the **Switch output function** parameter. | Define delay for the switch-on of status output. | 0.0 to 100.0 s | – |
| Switch-off delay | • The **Switch** option is selected in the **Operating mode** parameter.<br>• The **Limit** option is selected in the **Switch output function** parameter. | Define delay for the switch-off of status output. | 0.0 to 100.0 s | – |
| Failure mode | – | Define output behavior in alarm condition. | • Actual status<br>• Open<br>• Closed | – |
| Invert output signal | – | Invert the output signal. | • No<br>• Yes | – |

\*    Visibility depends on order options or device settings

### 10.4.8   Configuring the local display

The **Display** wizard guides you systematically through all the parameters that can configured for configuring the local display.

**Navigation**

"Setup" menu → Display

```
▶ Display

            Format display                                → 🖺 86
```

| | | |
|---|---|---|
| Value 1 display | | → 🖺 86 |
| 0% bargraph value 1 | | → 🖺 86 |
| 100% bargraph value 1 | | → 🖺 86 |
| Value 2 display | | → 🖺 86 |
| Value 3 display | | → 🖺 86 |
| 0% bargraph value 3 | | → 🖺 86 |
| 100% bargraph value 3 | | → 🖺 87 |
| Value 4 display | | → 🖺 87 |

**Parameter overview with brief description**

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Format display | A local display is provided. | Select how measured values are shown on the display. | <ul><li>1 value, max. size</li><li>1 bargraph + 1 value</li><li>2 values</li><li>1 value large + 2 values</li><li>4 values</li></ul> | 1 value, max. size |
| Value 1 display | A local display is provided. | Select the measured value that is shown on the local display. | <ul><li>Volume flow</li><li>Mass flow</li><li>Sound velocity</li><li>Flow velocity</li><li>Signal strength *</li><li>Signal to noise ratio *</li><li>Turbulence *</li><li>Acceptance rate *</li><li>Temperature *</li><li>Density *</li><li>Electronics temperature</li><li>Totalizer 1</li><li>Totalizer 2</li><li>Totalizer 3</li><li>Current output 1</li></ul> | Volume flow |
| 0% bargraph value 1 | A local display is provided. | Enter 0% value for bar graph display. | Signed floating-point number | Country-specific |
| 100% bargraph value 1 | A local display is provided. | Enter 100% value for bar graph display. | Signed floating-point number | Depends on country and nominal diameter |
| Value 2 display | A local display is provided. | Select the measured value that is shown on the local display. | Picklist, see **Value 1 display** parameter | – |
| Value 3 display | A local display is provided. | Select the measured value that is shown on the local display. | Picklist, see **Value 1 display** parameter | – |
| 0% bargraph value 3 | A selection was made in the **Value 3 display** parameter. | Enter 0% value for bar graph display. | Signed floating-point number | Country-specific |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| 100% bargraph value 3 | A selection was made in the **Value 3 display** parameter. | Enter 100% value for bar graph display. | Signed floating-point number | – |
| Value 4 display | A local display is provided. | Select the measured value that is shown on the local display. | Picklist, see **Value 1 display** parameter | – |
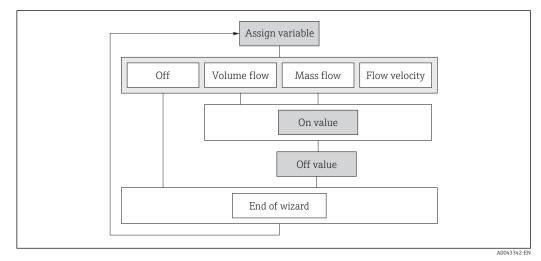
\*        Visibility depends on order options or device settings

### 10.4.9    Configuring the low flow cut off

The **Low flow cut off** wizard systematically guides the user through all the parameters that must be set to configure low flow cut off.

**Structure of the wizard**



🖾 *24     "Low flow cutoff" wizard in the "Setup" menu*

**Navigation**
"Setup" menu → Low flow cut off
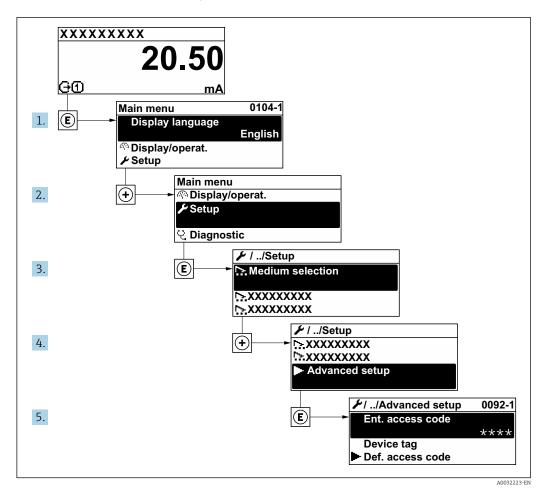
Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Assign process variable | – | Select process variable for low flow cut off. | • Off<br>• Volume flow<br>• Mass flow<br>• Flow velocity | Flow velocity |
| On value low flow cutoff | A process variable is selected in the **Assign process variable** parameter (→ 🖹 88). | Enter on value for low flow cut off. | Positive floating-point number | 0.3 m/s |
| Off value low flow cutoff | A process variable is selected in the **Assign process variable** parameter (→ 🖹 88). | Enter off value for low flow cut off. | 0 to 100.0 % | – |

## 10.5 Advanced settings

The **Advanced setup** submenu together with its submenus contains parameters for specific settings.

*Navigation to the "Advanced setup" submenu*
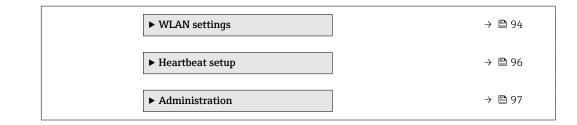


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The number of submenus and parameters can vary depending on the device version. Certain submenus and parameters in these submenus are not described in the Operation Instructions. Instead a description is provided in the Special Documentation for the device (→ "Supplementary documentation" section).

**Navigation**
"Setup" menu → Advanced setup

| ▶ Advanced setup | |
|---|---|
| Enter access code | → 🗎 90 |
| ▶ Sensor adjustment | → 🗎 90 |
| ▶ Totalizer 1 to n | → 🗎 90 |
| ▶ Display | → 🗎 92 |

| | | |
|---|---|---|
| ▶ WLAN settings | → 🗏 94 |
| ▶ Heartbeat setup | → 🗏 96 |
| ▶ Administration | → 🗏 97 |

### 10.5.1 Using the parameter to enter the access code

**Navigation**
"Setup" menu → Advanced setup

#### Parameter overview with brief description

| Parameter | Description | User entry |
|---|---|---|
| Enter access code | Enter access code to disable write protection of parameters. | Max. 16-digit character string comprising numbers, letters and special characters |

### 10.5.2 Carrying out a sensor adjustment

The **Sensor adjustment** submenu contains parameters that pertain to the functionality of the sensor.

**Navigation**
"Setup" menu → Advanced setup → Sensor adjustment

| ▶ Sensor adjustment | |
|---|---|
| | Installation direction → 🗏 90 |

#### Parameter overview with brief description

| Parameter | Description | Selection |
|---|---|---|
| Installation direction | Select sign of flow direction. | • Forward flow<br>• Reverse flow |

### 10.5.3 Configuring the totalizer

In the **"Totalizer 1 to n" submenu** the individual totalizer can be configured.

**Navigation**
"Setup" menu → Advanced setup → Totalizer 1 to n

| ▶ Totalizer 1 to n | |
|---|---|
| | Assign process variable → 🗏 91 |
| | Unit totalizer 1 to n → 🗏 91 |

| Totalizer operation mode | → 🗎 91 |
|---|---|
| Failure mode | → 🗎 91 |

**Parameter overview with brief description**

| Parameter | Prerequisite | Description | Selection | Factory setting |
|---|---|---|---|---|
| Assign process variable | – | Select process variable for totalizer. | • Off<br>• Volume flow<br>• Mass flow | Volume flow |
| Unit totalizer 1 to n | A process variable is selected in the **Assign process variable** parameter (→ 🗎 91) of the **Totalizer 1 to n** submenu. | Select the unit for the process variable of the totalizer. | • g *<br>• kg *<br>• t *<br>• oz *<br>• lb *<br>• STon *<br>• cm³ *<br>• dm³ *<br>• m³ *<br>• ml *<br>• l *<br>• hl *<br>• Ml Mega *<br>• af *<br>• ft³ *<br>• Mft³ *<br>• Mft³ *<br>• fl oz (us) *<br>• gal (us) *<br>• kgal (us) *<br>• Mgal (us) *<br>• bbl (us;liq.) *<br>• bbl (us;beer) *<br>• bbl (us;oil) *<br>• bbl (us;tank) *<br>• gal (imp) *<br>• Mgal (imp) *<br>• bbl (imp;beer) *<br>• bbl (imp;oil) *<br>• None * | Country-specific:<br>• m³<br>• ft³ |
| Totalizer operation mode | A process variable is selected in the **Assign process variable** parameter (→ 🗎 91) of the **Totalizer 1 to n** submenu. | Select totalizer calculation mode. | • Net flow total<br>• Forward flow total<br>• Reverse flow total | Net flow total |
| Failure mode | A process variable is selected in the **Assign process variable** parameter (→ 🗎 91) of the **Totalizer 1 to n** submenu. | Select totalizer behavior in the event of a device alarm. | • Stop<br>• Actual value<br>• Last valid value | Stop |

\*      Visibility depends on order options or device settings

### 10.5.4 Carrying out additional display configurations

In the **Display** submenu you can set all the parameters associated with the configuration of the local display.

**Navigation**
"Setup" menu → Advanced setup → Display

| ▶ Display | | |
|---|---|---|
| Format display | → 🗎 93 |
| Value 1 display | → 🗎 93 |
| 0% bargraph value 1 | → 🗎 93 |
| 100% bargraph value 1 | → 🗎 93 |
| Decimal places 1 | → 🗎 93 |
| Value 2 display | → 🗎 93 |
| Decimal places 2 | → 🗎 93 |
| Value 3 display | → 🗎 93 |
| 0% bargraph value 3 | → 🗎 93 |
| 100% bargraph value 3 | → 🗎 93 |
| Decimal places 3 | → 🗎 93 |
| Value 4 display | → 🗎 93 |
| Decimal places 4 | → 🗎 94 |
| Display language | → 🗎 94 |
| Display interval | → 🗎 94 |
| Display damping | → 🗎 94 |
| Header | → 🗎 94 |
| Header text | → 🗎 94 |
| Separator | → 🗎 94 |
| Backlight | → 🗎 94 |

## Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Format display | A local display is provided. | Select how measured values are shown on the display. | • 1 value, max. size<br>• 1 bargraph + 1 value<br>• 2 values<br>• 1 value large + 2 values<br>• 4 values | 1 value, max. size |
| Value 1 display | A local display is provided. | Select the measured value that is shown on the local display. | • Volume flow<br>• Mass flow<br>• Sound velocity<br>• Flow velocity<br>• Signal strength *<br>• Signal to noise ratio *<br>• Turbulence *<br>• Acceptance rate *<br>• Temperature *<br>• Density *<br>• Electronics temperature<br>• Totalizer 1<br>• Totalizer 2<br>• Totalizer 3<br>• Current output 1 | Volume flow |
| 0% bargraph value 1 | A local display is provided. | Enter 0% value for bar graph display. | Signed floating-point number | Country-specific |
| 100% bargraph value 1 | A local display is provided. | Enter 100% value for bar graph display. | Signed floating-point number | Depends on country and nominal diameter |
| Decimal places 1 | A measured value is defined in the **Value 1 display** parameter. | Select the number of decimal places for the display value. | • x<br>• x.x<br>• x.xx<br>• x.xxx<br>• x.xxxx | x.xx |
| Value 2 display | A local display is provided. | Select the measured value that is shown on the local display. | Picklist, see **Value 1 display** parameter | – |
| Decimal places 2 | A measured value is specified in the **Value 2 display** parameter. | Select the number of decimal places for the display value. | • x<br>• x.x<br>• x.xx<br>• x.xxx<br>• x.xxxx | – |
| Value 3 display | A local display is provided. | Select the measured value that is shown on the local display. | Picklist, see **Value 1 display** parameter | – |
| 0% bargraph value 3 | A selection was made in the **Value 3 display** parameter. | Enter 0% value for bar graph display. | Signed floating-point number | Country-specific |
| 100% bargraph value 3 | A selection was made in the **Value 3 display** parameter. | Enter 100% value for bar graph display. | Signed floating-point number | – |
| Decimal places 3 | A measured value is specified in the **Value 3 display** parameter. | Select the number of decimal places for the display value. | • x<br>• x.x<br>• x.xx<br>• x.xxx<br>• x.xxxx | – |
| Value 4 display | A local display is provided. | Select the measured value that is shown on the local display. | Picklist, see **Value 1 display** parameter | – |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Decimal places 4 | A measured value is specified in the **Value 4 display** parameter. | Select the number of decimal places for the display value. | <ul><li>x</li><li>x.x</li><li>x.xx</li><li>x.xxx</li><li>x.xxxx</li></ul> | – |
| Display language | A local display is provided. | Set display language. | <ul><li>English</li><li>Deutsch</li><li>Français</li><li>Español</li><li>Italiano</li><li>Nederlands</li><li>Portuguesa</li><li>Polski</li><li>русский язык (Russian)</li><li>Svenska</li><li>Türkçe</li><li>中文 (Chinese)</li><li>日本語 (Japanese)</li><li>한국어 (Korean)</li><li>Bahasa Indonesia</li><li>tiếng Việt (Vietnamese)</li><li>čeština (Czech)</li></ul> | English (alternatively, the ordered language is preset in the device) |
| Display interval | A local display is provided. | Set time measured values are shown on display if display alternates between values. | 1 to 10 s | – |
| Display damping | A local display is provided. | Set display reaction time to fluctuations in the measured value. | 0.0 to 999.9 s | – |
| Header | A local display is provided. | Select header contents on local display. | <ul><li>Device tag</li><li>Free text</li></ul> | – |
| Header text | In the **Header** parameter, the **Free text** option is selected. | Enter display header text. | Max. 12 characters such as letters, numbers or special characters (e.g. @, %, /) | – |
| Separator | A local display is provided. | Select decimal separator for displaying numerical values. | <ul><li>. (point)</li><li>, (comma)</li></ul> | . (point) |
| Backlight | A local display is provided. | Switch the local display backlight on and off. | <ul><li>Disable</li><li>Enable</li></ul> | – |

\*	Visibility depends on order options or device settings

### 10.5.5 WLAN configuration

The **WLAN Settings** submenu guides the user systematically through all the parameters that have to be set for the WLAN configuration.

**Navigation**
"Setup" menu → Advanced setup → WLAN settings

| ▸ WLAN settings | |
|---|---|
| WLAN | → 🖹 95 |
| WLAN mode | → 🖹 95 |

| | SSID name | | → 🖹 95 |
|---|---|---|---|
| | Network security | | → 🖹 95 |
| | Security identification | | → 🖹 95 |
| | User name | | → 🖹 95 |
| | WLAN password | | → 🖹 95 |
| | WLAN IP address | | → 🖹 95 |
| | WLAN MAC address | | → 🖹 96 |
| | WLAN passphrase | | → 🖹 96 |
| | Assign SSID name | | → 🖹 96 |
| | SSID name | | → 🖹 96 |
| | Connection state | | → 🖹 96 |
| | Received signal strength | | → 🖹 96 |

### Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|---|---|---|---|---|
| WLAN | – | Switch WLAN on and off. | • Disable<br>• Enable | – |
| WLAN mode | – | Select WLAN mode. | WLAN access point | – |
| SSID name | The client is activated. | Enter the user-defined SSID name (max. 32 characters). | – | – |
| Network security | – | Select the security type of the WLAN network. | • Unsecured<br>• WPA2-PSK<br>• EAP-PEAP with MSCHAPv2 *<br>• EAP-PEAP MSCHAPv2 no server authentic. *<br>• EAP-TLS* | – |
| Security identification | – | Select security settings and download these settings via menu Data management > Security > WLAN. | • Trusted issuer certificate<br>• Device certificate<br>• Device private key | – |
| User name | – | Enter user name. | – | – |
| WLAN password | – | Enter WLAN password. | – | – |
| WLAN IP address | – | Enter IP address of the WLAN interface of the device. | 4 octet: 0 to 255 (in the particular octet) | – |

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|---|---|---|---|---|
| WLAN MAC address | – | Enter MAC address of the WLAN interface of the device. | Unique 12-digit character string comprising letters and numbers | Each measuring device is given an individual address. |
| WLAN passphrase | The **WPA2-PSK** option is selected in the **Security type** parameter. | Enter the network key (8 to 32 characters). <br><br> The network key supplied with the device should be changed during commissioning for security reasons. | 8 to 32-digit character string comprising numbers, letters and special characters (without spaces) | Serial number of the measuring device (e.g. L100A802000) |
| Assign SSID name | – | Select which name will be used for SSID: device tag or user-defined name. | • Device tag<br>• User-defined | – |
| SSID name | • The **User-defined** option is selected in the **Assign SSID name** parameter.<br>• The **WLAN access point** option is selected in the **WLAN mode** parameter. | Enter the user-defined SSID name (max. 32 characters). <br><br> The user-defined SSID name may only be assigned once. If the SSID name is assigned more than once, the devices can interfere with one another. | Max. 32-digit character string comprising numbers, letters and special characters | EH_device designation_last 7 digits of the serial number (e.g. EH_Prosonic_Flow_400_A802000) |
| Connection state | – | Displays the connection status. | • Connected<br>• Not connected | – |
| Received signal strength | – | Shows the received signal strength. | • Low<br>• Medium<br>• High | – |
| Apply changes | – | Use changed WLAN settings. | • Cancel<br>• Ok | – |

* Visibility depends on order options or device settings

### 10.5.6 Performing Heartbeat basic setup

**Heartbeat setup** submenu guides the user systematically through all the parameters that can be used for the Heartbeat basic setup.

The wizard only appears if the device has the Heartbeat Verification +Monitoring application package.

**Navigation**
"Setup" menu → Advanced setup → Heartbeat setup

| ▶ Heartbeat setup | |
|---|---|
| ▶ Heartbeat base settings | → 🗎 97 |

**"Heartbeat base settings" submenu**

**Navigation**
"Setup" menu → Advanced setup → Heartbeat setup → Heartbeat base settings

| ▸ Heartbeat base settings | |
|---|---|
| Plant operator | → 🖺 97 |
| Location | → 🖺 97 |

**Parameter overview with brief description**

| Parameter | Description | User entry |
|---|---|---|
| Plant operator | Enter the plant operator. | Max. 32 characters such as letters, numbers or special characters (e.g. @, %, /) |
| Location | Enter the location. | Max. 32 characters such as letters, numbers or special characters (e.g. @, %, /) |

### 10.5.7 Using parameters for device administration

The **Administration** submenu systematically guides the user through all the parameters that can be used for device administration purposes.

**Navigation**
"Setup" menu → Advanced setup → Administration

| ▸ Administration | |
|---|---|
| ▸ Define access code | → 🖺 97 |
| ▸ Reset access code | → 🖺 98 |
| Device reset | → 🖺 98 |

**Using the parameter to define the access code**

**Navigation**
"Setup" menu → Advanced setup → Administration → Define access code

| ▸ Define access code | |
|---|---|
| Define access code | → 🖺 98 |
| Confirm access code | → 🖺 98 |

Parameter overview with brief description

| Parameter | Description | User entry |
|---|---|---|
| Define access code | Restrict write-access to parameters to protect the configuration of the device against unintentional changes. | Max. 16-digit character string comprising numbers, letters and special characters |
| Confirm access code | Confirm the entered access code. | Max. 16-digit character string comprising numbers, letters and special characters |

**Using the parameter to reset the access code**

**Navigation**
"Setup" menu → Advanced setup → Administration → Reset access code

| | |
|---|---|
| ▶ Reset access code | |
| Operating time | → 🗎 98 |
| Reset access code | → 🗎 98 |

Parameter overview with brief description

| Parameter | Description | User interface / User entry |
|---|---|---|
| Operating time | Indicates how long the device has been in operation. | Days (d), hours (h), minutes (m) and seconds (s) |
| Reset access code | Reset access code to factory settings.<br><br>ℹ For a reset code, contact your Endress+Hauser service organization.<br><br>The reset code can only be entered via:<br>• Web browser<br>• DeviceCare, FieldCare (via CDI-RJ45 service interface)<br>• Fieldbus | Character string comprising numbers, letters and special characters |

**Using the parameter to reset the device**

**Navigation**
"Setup" menu → Advanced setup → Administration

Parameter overview with brief description

| Parameter | Description | Selection |
|---|---|---|
| Device reset | Reset the device configuration - either entirely or in part - to a defined state. | • Cancel<br>• To delivery settings<br>• Restart device<br>• Restore S-DAT backup [*] |

\*     Visibility depends on order options or device settings

## 10.6   Simulation

The **Simulation** submenu enables you to simulate, without a real flow situation, various process variables in the process and the device alarm mode and to verify downstream signal chains (switching valves or closed-control loops).

The parameters displayed depend on:
- The selected device order
- The set operating mode of the pulse/frequency/switch outputs

**Navigation**

"Diagnostics" menu → Simulation

| ‣ Simulation | | |
|---|---|---|
| | Assign simulation process variable | → 🖻 100 |
| | Process variable value | → 🖻 100 |
| | Status input simulation 1 | → 🖻 100 |
| | Input signal level 1 | → 🖻 100 |
| | Current output 1 simulation | → 🖻 100 |
| | Current output value | → 🖻 100 |
| | Frequency output 1 to n simulation | → 🖻 100 |
| | Frequency output 1 to n value | → 🖻 100 |
| | Pulse output simulation 1 to n | → 🖻 100 |
| | Pulse value 1 to n | → 🖻 100 |
| | Switch output simulation 1 to n | → 🖻 100 |
| | Switch state 1 to n | → 🖻 100 |
| | Device alarm simulation | → 🖻 100 |
| | Diagnostic event category | → 🖻 100 |
| | Diagnostic event simulation | → 🖻 100 |

Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry |
|---|---|---|---|
| Assign simulation process variable | – | Select a process variable for the simulation process that is activated. | <ul><li>Off</li><li>Volume flow</li><li>Mass flow</li><li>Sound velocity</li><li>Flow velocity *</li><li>Temperature *</li><li>Density *</li></ul> |
| Process variable value | A process variable is selected in the **Assign simulation process variable** parameter (→ 🖺 100). | Enter the simulation value for the selected process variable. | Depends on the process variable selected |
| Status input simulation 1 | For the following order code: "Output; input", option I "4-20mA HART, 2x pul./freq./switch output; status input" | Switch simulation of the status input on and off. | <ul><li>Off</li><li>On</li></ul> |
| Input signal level 1 | In the **Status input simulation** parameter, the **On** option is selected. | Select the signal level for the simulation of the status input. | <ul><li>High</li><li>Low</li></ul> |
| Current output 1 simulation | – | Switch the simulation of the current output on and off. | <ul><li>Off</li><li>On</li></ul> |
| Current output value | In the **Current output simulation** parameter, the **On** option is selected. | Enter the current value for simulation. | 3.59 to 22.5 mA |
| Frequency output 1 to n simulation | In the **Operating mode** parameter, the **Frequency** option is selected. | Switch the simulation of the frequency output on and off. | <ul><li>Off</li><li>On</li></ul> |
| Frequency output 1 to n value | In the **Frequency simulation 1 to n** parameter, the **On** option is selected. | Enter the frequency value for the simulation. | 0.0 to 12 500.0 Hz |
| Pulse output simulation 1 to n | In the **Operating mode** parameter, the **Pulse** option is selected. | Set and switch off the pulse output simulation.<br><br>ℹ️ For **Fixed value** option: **Pulse width** parameter (→ 🖺 81) defines the pulse width of the pulses output. | <ul><li>Off</li><li>Fixed value</li><li>Down-counting value</li></ul> |
| Pulse value 1 to n | In the **Pulse output simulation 1 to n** parameter, the **Down-counting value** option is selected. | Enter the number of pulses for simulation. | 0 to 65 535 |
| Switch output simulation 1 to n | In the **Operating mode** parameter, the **Switch** option is selected. | Switch the simulation of the switch output on and off. | <ul><li>Off</li><li>On</li></ul> |
| Switch state 1 to n | – | Select the status of the status output for the simulation. | <ul><li>Open</li><li>Closed</li></ul> |
| Device alarm simulation | – | Switch the device alarm on and off. | <ul><li>Off</li><li>On</li></ul> |
| Diagnostic event category | – | Select a diagnostic event category. | <ul><li>Sensor</li><li>Electronics</li><li>Configuration</li><li>Process</li></ul> |
| Diagnostic event simulation | – | Select a diagnostic event to simulate this event. | <ul><li>Off</li><li>Diagnostic event picklist (depends on the category selected)</li></ul> |

\*     Visibility depends on order options or device settings

## 10.7 Protecting settings from unauthorized access

The following options exist for protecting the configuration of the measuring device from unintentional modification after commissioning:
- Write protection via access code for the local display and Web browser
- Write protection via write protection switch
- Write protection via keypad lock

### 10.7.1 Write protection via access code

The effects of the user-specific access code are as follows:
- Via local operation, the parameters for the measuring device configuration are write-protected and their values can no longer be changed.
- Device access is protected via the Web browser, as are the parameters for the measuring device configuration.

#### Defining the access code via local display

1. Navigate to the **Define access code** parameter (→ 🖺 98).

2. Define a max. 16-digit character string comprising numbers, letters and special characters as the access code.

3. Enter the access code again in the to confirm the code.
   - ↳ The 🔏-symbol appears in front of all write-protected parameters.

The device automatically locks the write-protected parameters again if a key is not pressed for 10 minutes in the navigation and editing view. The device locks the write-protected parameters automatically after 60 s if the user skips back to the operational display mode from the navigation and editing view.

> - If parameter write protection is activated via an access code, it can also only be deactivated via this access code → 🖺 55.
> - The user role with which the user is currently logged on via the local display → 🖺 55 is indicated by the **Access status display** parameter. Navigation path: Operation → Access status display

#### Parameters which can always be modified via the local display

Certain parameters that do not affect the measurement are excepted from parameter write protection via the local display. Despite the user-specific access code, they can always be modified, even if the other parameters are locked.

| | Parameters for configuring the local display | Parameters for configuring the totalizer |
|---|---|---|
| | ↓ | ↓ |
| Language | Format display | Control Totalizer |
| | Contrast display | Preset value |
| | Display interval | Reset all totalizers |

#### Defining the access code via the Web browser

1. Navigate to the **Define access code** parameter (→ 🖺 98).

2. Define a max. 16-digit numeric code as an access code.

3. Enter the access code again in the to confirm the code.

   ↳ The Web browser switches to the login page.

🛈 If no action is performed for 10 minutes, the Web browser automatically returns to the login page.
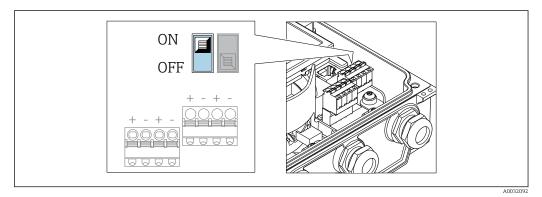
🛈 • If parameter write protection is activated via an access code, it can also only be deactivated via this access code → 🖺 55.
   • The user role with which the user is currently logged on via Web browser is indicated by the **Access status tooling** parameter. Navigation path: Operation → Access status tooling

### 10.7.2 Write protection via write protection switch

Unlike parameter write protection via a user-specific access code, this allows the user to lock write access to the entire operating menu - apart from the **"Contrast display" parameter**.
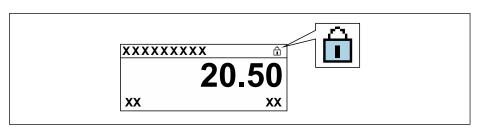
The parameter values are now read only and cannot be edited any more (exception **"Contrast display" parameter**):
• Via local display
• Via service interface (CDI-RJ45)
• Via HART protocol



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1. Loosen the 4 fixing screws on the housing cover and open the housing cover.

2. Setting the write protection switch (WP) on the main electronics module to the **ON** position enables the hardware write protection. Setting the write protection switch (WP) on the main electronics module to the **OFF** position (factory setting) disables the hardware write protection.

   ↳ If the hardware write protection is enabled: The **Hardware locked** option is displayed in the **Locking status** parameter . In addition, on the local display the 🔒 symbol appears in front of the parameters in the header of the operational display and in the navigation view.



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If hardware write protection is disabled: No option is displayed in the **Locking status** parameter . On the local display, the 🔒 symbol disappears from in front of the parameters in the header of the operational display and in the navigation view.

3.  ⚠ WARNING

**Excessive tightening torque applied to the fixing screws!**
Risk of damaging the plastic transmitter.
▶ Tighten the fixing screws as per the tightening torque .

Reverse the removal procedure to reassemble the transmitter.

# 11    Operation

## 11.1    Reading the device locking status

Device active write protection: **Locking status** parameter

Operation → Locking status

*Function scope of the "Locking status" parameter*

| Options | Description |
|---|---|
| None | The access status displayed in the **Access status display** parameter applies → 🖹 55. Only appears on local display. |
| Hardware locked | The DIP switch for hardware locking is activated on the main electronics module. This locks write access to the parameters (e.g. via local display or operating tool) → 🖹 102. |
| Temporarily locked | Write access to the parameters is temporarily locked on account of internal processes running in the device (e.g. data upload/download, reset etc.). Once the internal processing has been completed, the parameters can be changed once again. |

## 11.2    Adjusting the operating language

Detailed information:
- To configure the operating language → 🖹 71
- For information on the operating languages supported by the measuring device → 🖹 148

## 11.3    Configuring the display

Detailed information:
- On the basic settings for the local display → 🖹 85
- On the advanced settings for the local display → 🖹 92

## 11.4    Reading off measured values

With the **Measured values** submenu, it is possible to read all the measured values.

**Navigation**
"Diagnostics" menu → Measured values

| ▸ Measured values | |
|---|---|
| ▸ Process variables | → 🖹 105 |
| ▸ System values | → 🖹 105 |
| ▸ Input values | → 🖹 106 |
| ▸ Output values | → 🖹 107 |
| ▸ Totalizer | → 🖹 108 |

### 11.4.1 Process variables

The **Process variables** submenu contains all the parameters needed to display the current measured values for each process variable.

**Navigation**

"Diagnostics" menu → Measured values → Process variables

| ► Process variables | |
|---|---|
| Volume flow | → 📄 105 |
| Mass flow | → 📄 105 |
| Sound velocity | → 📄 105 |
| Density | → 📄 105 |
| Flow velocity | → 📄 105 |
| Temperature | → 📄 105 |

Parameter overview with brief description
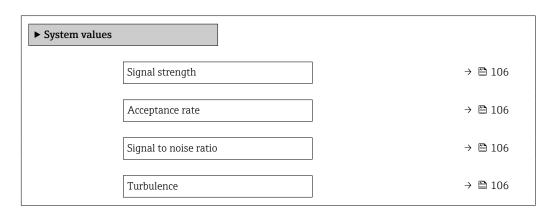
| Parameter | Description | User interface |
|---|---|---|
| Volume flow | Displays the volume flow that is currently measured.<br><br>*Dependency*<br>The unit is taken from: **Volume flow unit** parameter (→ 📄 74) | Signed floating-point number |
| Mass flow | Displays the mass flow that is currently calculated.<br><br>*Dependency*<br>The unit is taken from the **Mass flow unit** parameter (→ 📄 74). | Signed floating-point number |
| Sound velocity | Displays the sound velocity that is currently measured.<br><br>*Dependency*<br>The unit is taken from the **Velocity unit** parameter. | Signed floating-point number |
| Density | Displays the density that is currently calculated.<br><br>*Dependency*<br>The unit is taken from the **Density unit** parameter. | Signed floating-point number |
| Flow velocity | Displays the average flow velocity that is currently calculated.<br><br>*Dependency*<br>The unit is taken from the **Velocity unit** parameter. | Signed floating-point number |
| Temperature | Displays the temperature that is currently measured.<br><br>*Dependency*<br>The unit is taken from the **Temperature unit** parameter. | Signed floating-point number |

### 11.4.2 System values

The **System values** submenu contains all the parameters needed to display the current measured values for every system value.

**Navigation**

"Diagnostics" menu → Measured values → System values

| ► System values | | |
|---|---|---|
| Signal strength | → | 🖹 106 |
| Acceptance rate | → | 🖹 106 |
| Signal to noise ratio | → | 🖹 106 |
| Turbulence | → | 🖹 106 |

**Parameter overview with brief description**

| Parameter | Description | User interface |
|---|---|---|
| Signal strength | Displays the current signal strength (0 to 100 dB).<br><br>Assessment of the signal strength:<br>• < 10 dB: bad<br>• > 90 dB: very good | Signed floating-point number |
| Acceptance rate | Displays the ratio of the number of ultrasonic signals accepted for flow calculation and the total number of ultrasonic signals emitted. | 0 to 100 % |
| Signal to noise ratio | Displays the current signal to noise ratio (0 to 100 dB).<br><br>Assessment of the signal to noise ratio:<br>• < 20 dB: bad<br>• > 50 dB: very good | Signed floating-point number |
| Turbulence | Displays the current turbulence. | Signed floating-point number |

### 11.4.3   Input values

The **Input values** submenu guides you systematically to the individual input values.

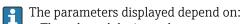ℹ️ The submenu appears only if the device was ordered with a status input → 🖹 35.

**Navigation**

"Diagnostics" menu → Measured values → Input values

| ► Input values | | |
|---|---|---|
| Value status input | → | 🖹 107 |

**Parameter overview with brief description**

| Parameter | Prerequisite | Description | User interface |
|---|---|---|---|
| Value status input | For the following order code: <br>• "Output; input", option **I** "4-20mA HART, 2x pul./freq./switch output; status input" <br>• "Output; input", option **J** "4-20mA HART, certified pulse output, switch output; status input" | Shows the current input signal level. | • High <br>• Low |

### 11.4.4 Output values

The **Output values** submenu contains all the parameters needed to display the current measured values for every output.

The parameters displayed depend on:
• The selected device order
• The set operating mode of the pulse/frequency/switch outputs

**Navigation**
"Diagnostics" menu → Measured values → Output values

```
▶ Output values

        Output current 1          → 🕮 107

        Measured current 1        → 🕮 107

        Pulse output 1            → 🕮 107

        Output frequency 1        → 🕮 108

        Switch state 1            → 🕮 108

        Output frequency 2        → 🕮 108

        Pulse output 2            → 🕮 107

        Switch state 2            → 🕮 108
```

**Parameter overview with brief description**

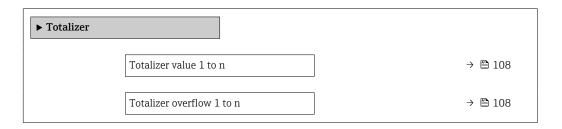| Parameter | Prerequisite | Description | User interface |
|---|---|---|---|
| Output current | – | Displays the current value currently calculated for the current output. | 3.59 to 22.5 mA |
| Measured current | – | Displays the current value currently measured for the current output. | 0 to 30 mA |
| Pulse output 1 to n | The **Pulse** option is selected in the **Operating mode** parameter parameter. | Displays the pulse frequency currently output. | Positive floating-point number |

| Parameter | Prerequisite | Description | User interface |
|---|---|---|---|
| Output frequency 1 to n | In the **Operating mode** parameter, the **Frequency** option is selected. | Displays the value currently measured for the frequency output. | 0.0 to 12 500.0 Hz |
| Switch state 1 to n | In the **Operating mode** parameter, the **Switch** option is selected. | Displays the current switch output status. | • Open<br>• Closed |

### 11.4.5 "Totalizer" submenu

The **Totalizer** submenu contains all the parameters needed to display the current measured values for every totalizer.

#### Navigation

"Diagnostics" menu → Measured values → Totalizer

| ▶ Totalizer | | |
|---|---|---|
| | Totalizer value 1 to n | → 🗎 108 |
| | Totalizer overflow 1 to n | → 🗎 108 |

#### Parameter overview with brief description

| Parameter | Prerequisite | Description | User interface |
|---|---|---|---|
| Totalizer value 1 to n | One of the following options is selected in the **Assign process variable** parameter (→ 🗎 91) of the **Totalizer 1 to n** submenu:<br>• Volume flow<br>• Mass flow | Displays the current totalizer counter reading. | Signed floating-point number |
| Totalizer overflow 1 to n | One of the following options is selected in the **Assign process variable** parameter (→ 🗎 91) of the **Totalizer 1 to n** submenu:<br>• Volume flow<br>• Mass flow | Displays the current totalizer overflow. | Integer with sign |

## 11.5 Adapting the measuring device to the process conditions

The following are available for this purpose:
• Basic settings using the**Setup** menu (→ 🗎 71)
• Advanced settings using the**Advanced setup** submenu (→ 🗎 89)

## 11.6 Performing a totalizer reset

The totalizers are reset in the **Operation** submenu:
• Control Totalizer
• Reset all totalizers

**Navigation**

"Operation" menu → Totalizer handling

| ▸ **Totalizer handling** | |
|---|---|
| Control Totalizer 1 to n | → 🗎 109 |
| Preset value 1 to n | → 🗎 109 |
| Reset all totalizers | → 🗎 109 |

Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Control Totalizer 1 to n | A process variable is selected in the **Assign process variable** parameter (→ 🗎 91) of the **Totalizer 1 to n** submenu. | Control totalizer value. | • Totalize<br>• Reset + hold<br>• Preset + hold<br>• Reset + totalize<br>• Preset + totalize<br>• Hold | – |
| Preset value 1 to n | A process variable is selected in the **Assign process variable** parameter (→ 🗎 91) of the **Totalizer 1 to n** submenu. | Specify start value for totalizer.<br><br>*Dependency*<br>ℹ The unit of the selected process variable is specified for the totalizer in the **Unit totalizer** parameter (→ 🗎 91). | Signed floating-point number | Country-specific:<br>• 0 m³<br>• 0 ft³ |
| Reset all totalizers | – | Reset all totalizers to 0 and start. | • Cancel<br>• Reset + totalize | – |

### 11.6.1 Function scope of the "Control Totalizer" parameter

| Options | Description |
|---|---|
| Totalize | The totalizer is started or continues running. |
| Reset + hold | The totaling process is stopped and the totalizer is reset to 0. |
| Preset + hold | The totaling process is stopped and the totalizer is set to its defined start value from the **Preset value** parameter. |
| Reset + totalize | The totalizer is reset to 0 and the totaling process is restarted. |
| Preset + totalize | The totalizer is set to the defined start value from the **Preset value** parameter and the totaling process is restarted. |

### 11.6.2 Function scope of the "Reset all totalizers" parameter

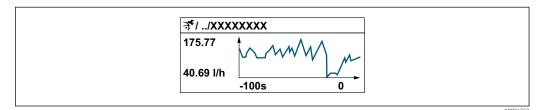| Options | Description |
|---|---|
| Cancel | No action is executed and the user exits the parameter. |
| Reset + totalize | Resets all totalizers to 0 and restarts the totaling process. This deletes all the flow values previously totalized. |

## 11.7    Show data logging

The **Extended HistoROM** application package must be enabled in the device (order option) for the **Data logging** submenu to appear. This contains all the parameters for the measured value history.

Data logging is also available via:
- Plant Asset Management Tool FieldCare → 🖺 64.
- Web browser

**Function scope**
- A total of 1000 measured values can be stored
- 4 logging channels
- Adjustable logging interval for data logging
- Display of the measured value trend for each logging channel in the form of a chart

- x-axis: depending on the number of channels selected displays 250 to 1000 measured values of a process variable.
- y-axis: displays the approximate measured value span and constantly adapts this to the ongoing measurement.

If the length of the logging interval or the assignment of the process variables to the channels is changed, the content of the data logging is deleted.

**Navigation**
"Diagnostics" menu → Data logging

| ► Data logging | | |
|---|---|---|
| Assign channel 1 | | → 🖺 111 |
| Assign channel 2 | | → 🖺 111 |
| Assign channel 3 | | → 🖺 111 |
| Assign channel 4 | | → 🖺 111 |
| Logging interval | | → 🖺 111 |
| Clear logging data | | → 🖺 111 |
| Data logging | | → 🖺 111 |
| Logging delay | | → 🖺 111 |
| Data logging control | | → 🖺 111 |

| Data logging status | → 🖹 112 |
| Entire logging duration | → 🖹 112 |

## Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry / User interface |
|---|---|---|---|
| Assign channel 1 | The **Extended HistoROM** application package is available. | Assign process variable to logging channel. | • Off<br>• Volume flow<br>• Mass flow<br>• Sound velocity<br>• Flow velocity<br>• Signal strength *<br>• Signal to noise ratio *<br>• Turbulence *<br>• Acceptance rate *<br>• Temperature *<br>• Density *<br>• Electronics temperature<br>• Current output 1 |
| Assign channel 2 | The **Extended HistoROM** application package is available.<br><br>ℹ The software options currently enabled are displayed in the **Software option overview** parameter. | Assign process variable to logging channel. | For the picklist, see the **Assign channel 1** parameter (→ 🖹 111) |
| Assign channel 3 | The **Extended HistoROM** application package is available.<br><br>ℹ The software options currently enabled are displayed in the **Software option overview** parameter. | Assign process variable to logging channel. | For the picklist, see the **Assign channel 1** parameter (→ 🖹 111) |
| Assign channel 4 | The **Extended HistoROM** application package is available.<br><br>ℹ The software options currently enabled are displayed in the **Software option overview** parameter. | Assign process variable to logging channel. | For the picklist, see the **Assign channel 1** parameter (→ 🖹 111) |
| Logging interval | The **Extended HistoROM** application package is available. | Define the logging interval for data logging. This value defines the time interval between the individual data points in the memory. | 0.1 to 3 600.0 s |
| Clear logging data | The **Extended HistoROM** application package is available. | Clear the entire logging data. | • Cancel<br>• Clear data |
| Data logging | – | Select the data logging method. | • Overwriting<br>• Not overwriting |
| Logging delay | In the **Data logging** parameter, the **Not overwriting** option is selected. | Enter the time delay for measured value logging. | 0 to 999 h |
| Data logging control | In the **Data logging** parameter, the **Not overwriting** option is selected. | Start and stop measured value logging. | • None<br>• Delete + start<br>• Stop |

| Parameter | Prerequisite | Description | Selection / User entry / User interface |
|---|---|---|---|
| Data logging status | In the **Data logging** parameter, the **Not overwriting** option is selected. | Displays the measured value logging status. | • Done<br>• Delay active<br>• Active<br>• Stopped |
| Entire logging duration | In the **Data logging** parameter, the **Not overwriting** option is selected. | Displays the total logging duration. | Positive floating-point number |

\*       Visibility depends on order options or device settings

# 12      Diagnostics and troubleshooting

## 12.1      General troubleshooting

*For local display*

| Error | Possible causes | Remedy |
|---|---|---|
| Local display dark and no output signals | Supply voltage does not match that specified on the nameplate. | Apply the correct supply voltage → 🖺 38. |
| Local display dark and no output signals | No contact between connecting cables and terminals. | Check the connection of the cables and correct if necessary. |
| Local display dark and no output signals | Terminals are not plugged into the main electronics module correctly. | Check terminals. |
| Local display dark and no output signals | Main electronics module is defective. | Order spare part → 🖺 133. |
| Local display dark and no output signals | The connector between the main electronics module and display module is not plugged in correctly. | Check the connection and correct if necessary. |
| Local display dark and no output signals | The connecting cable is not plugged in correctly. | 1. Check the connection of the electrode cable and correct if necessary.<br>2. Check the connection of the coil current cable and correct if necessary. |
| Local display is dark, but signal output is within the valid range | Display is set too bright or too dark. | • Set the display brighter by simultaneously pressing ⊞ + 🗉.<br>• Set the display darker by simultaneously pressing ⊟ + 🗉. |
| Local display is dark, but signal output is within the valid range | Display module is defective. | Order spare part → 🖺 133. |
| Backlighting of local display is red | Diagnostic event with "Alarm" diagnostic behavior has occurred. | Take remedial measures → 🖺 122 |
| Text on local display appears in a foreign language and cannot be understood. | Incorrect operating language is configured. | 1. Press 2 s ⊟ + ⊞ ("home position").<br>2. Press 🗉.<br>3. Set the desired language in the **Display language** parameter (→ 🖺 94). |
| Message on local display: "Communication Error" "Check Electronics" | Communication between the display module and the electronics is interrupted. | • Check the cable and the connector between the main electronics module and display module.<br>• Order spare part → 🖺 133. |

*For output signals*

| Error | Possible causes | Remedial action |
|---|---|---|
| Signal output outside the valid range | Main electronics module is defective. | Order spare part → 🖺 133. |
| Device shows correct value on local display, but signal output is incorrect, though in the valid range. | Parametrization errors | Check parameterization and correct it. |
| Device measures incorrectly. | Configuration error or device is operated outside the application. | 1. Check and correct parameter configuration.<br>2. Observe limit values specified in the "Technical Data". |

*For access*

| Error | Possible causes | Remedial action |
|---|---|---|
| No write access to parameters | Hardware write protection enabled | Set the write protection switch on main electronics module to the **OFF** position → 🖺 102. |
| No write access to parameters | Current user role has limited access authorization | 1. Check user role → 🖺 55.<br>2. Enter correct customer-specific access code → 🖺 55. |
| No connection via HART protocol | Communication resistor missing or incorrectly installed. | Install the communication resistor (250 Ω) correctly. Observe the maximum load → 🖺 139. |
| No connection via HART protocol | Commubox<br>• Connected incorrectly<br>• Configured incorrectly<br>• Drivers not installed correctly<br>• USB interface on computer configured incorrectly | Observe the documentation for the Commubox.<br>📖 FXA195 HART: Document "Technical Information" TI00404F |
| No connection to Web server | Web server disabled | Via the "FieldCare" or "DeviceCare" operating tool, check whether the Web server of the measuring device is enabled and enable it if necessary→ 🖺 61. |
| | Incorrect settings for the Ethernet interface of the computer | 1. Check the properties of the Internet protocol (TCP/IP) → 🖺 57→ 🖺 57.<br>2. Check the network settings with the IT manager. |
| No connection to Web server | Incorrect IP address | Check the IP address: 192.168.1.212 → 🖺 57→ 🖺 57 |
| No connection to Web server | Incorrect WLAN access data | • Check WLAN network status.<br>• Log on to the device again using WLAN access data.<br>• Check that WLAN is enabled on the measuring device and operating device . |
| | WLAN communication disabled | – |
| Not connecting to Web server, FieldCare or DeviceCare | No WLAN network available | • Check if WLAN reception is present: LED on display module is lit blue<br>• Check if WLAN connection is enabled: LED on display module flashes blue<br>• Switch on instrument function. |
| Network connection not present or unstable | WLAN network is weak. | Operating device is outside of reception range: Check network status on operating device. |
| | Parallel WLAN and Ethernet communication | • Check network settings.<br>• Temporarily enable only the WLAN as an interface. |
| Web browser frozen and operation no longer possible | Data transfer active | Wait until data transfer or current action is finished. |
| | Connection lost | 1. Check cable connection and power supply.<br>2. Refresh the Web browser and restart if necessary. |
| Content of Web browser incomplete or difficult to read | Not using optimum version of Web server. | 1. Use the correct Web browser version → 🖺 56.<br>2. Clear the Web browser cache and restart the Web browser. |

| Error | Possible causes | Remedial action |
|---|---|---|
|  | Unsuitable view settings. | Change the font size/display ratio of the Web browser. |
| No or incomplete display of contents in the Web browser | • JavaScript not enabled<br>• JavaScript cannot be enabled | 1. Enable JavaScript.<br>2. Enter http://192.168.1.212/basic.html as the IP address. |
| Operation with FieldCare or DeviceCare via CDI-RJ45 service interface (port 8000) | Firewall of computer or network is preventing communication | Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access. |
| Flashing of firmware with FieldCare or DeviceCare via CDI-RJ45 service interface (via port 8000 or TFTP ports) | Firewall of computer or network is preventing communication | Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access. |

## 12.2    Diagnostic information via light emitting diodes
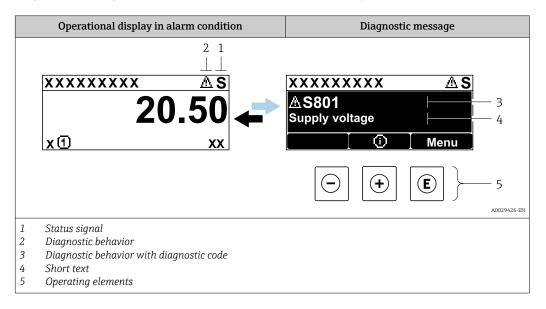
### 12.2.1    Transmitter

Different LEDs in the transmitter provide information on the device status.

| LED | Color | Meaning |
|---|---|---|
| Supply voltage | Off | Supply voltage is off or too low |
|  | Green | Supply voltage is ok |
| Link/Activity | Orange | Link available but no activity |
|  | Flashing orange | Activity present |
| Communication | Flashing white | HART communication is active. |
| Alarm | Green | Measuring device is ok |
|  | Flashing green | Measuring device not configured |
|  | Off | Firmware error |
|  | Red | Main error |
|  | Flashing red | Error |
|  | Flashing red/green | Start measuring device |

## 12.3     Diagnostic information on local display

### 12.3.1    Diagnostic message

Faults detected by the self-monitoring system of the measuring device are displayed as a diagnostic message in alternation with the operational display.

| Operational display in alarm condition | Diagnostic message |
|---|---|



*1     Status signal*
*2     Diagnostic behavior*
*3     Diagnostic behavior with diagnostic code*
*4     Short text*
*5     Operating elements*

If two or more diagnostic events are pending simultaneously, only the message of the diagnostic event with the highest priority is shown.
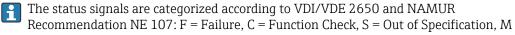
Other diagnostic events that have occurred can be displayed in the **Diagnostics** menu:
• Via parameter → 🖺 125
• Via submenus → 🖺 126

**Status signals**

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

The status signals are categorized according to VDI/VDE 2650 and NAMUR Recommendation NE 107: F = Failure, C = Function Check, S = Out of Specification, M = Maintenance Required
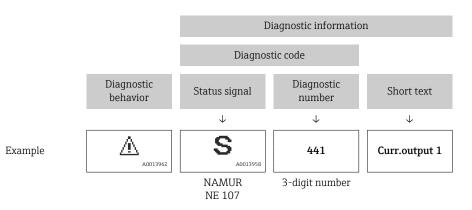
| Symbol | Meaning |
|---|---|
| F | **Failure**<br>A device error has occurred. The measured value is no longer valid. |
| C | **Function check**<br>The device is in service mode (e.g. during a simulation). |
| S | **Out of specification**<br>The device is operated:<br>• Outside its technical specification limits (e.g. outside the process temperature range)<br>• Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**) |
| M | **Maintenance required**<br>Maintenance is required. The measured value remains valid. |

**Diagnostic behavior**

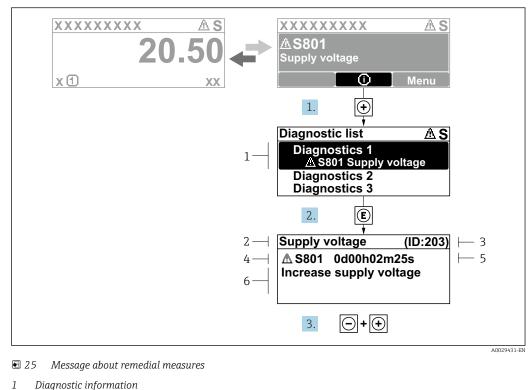| Symbol | Meaning |
|--------|---------|
|  | **Alarm** <br> • Measurement is interrupted. <br> • Signal outputs and totalizers assume the defined alarm condition. <br> • A diagnostic message is generated. <br> • The background lighting changes to red. |
|  | **Warning** <br> Measurement is resumed. The signal outputs and totalizers are not affected. A diagnostic message is generated. |

**Diagnostic information**

The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.



**Operating elements**

| Key | Meaning |
|-----|---------|
| ⊕ | **Plus key** <br> *In a menu, submenu* <br> Opens the message about remedy information. |
| Ⓔ | **Enter key** <br> *In a menu, submenu* <br> Opens the operating menu. |

### 12.3.2    Calling up remedial measures



*25   Message about remedial measures*

*1    Diagnostic information*
*2    Short text*
*3    Service ID*
*4    Diagnostic behavior with diagnostic code*
*5    Operation time of occurrence*
*6    Remedial measures*

1. The user is in the diagnostic message.
   Press ⊞ (ⓘ symbol).
      ↳ The **Diagnostic list** submenu opens.

2. Select the desired diagnostic event with ⊞ or ⊟ and press ⊑ .
      ↳ The message about the remedial measures opens.

3. Press ⊟ + ⊞ simultaneously.
      ↳ The message about the remedial measures closes.
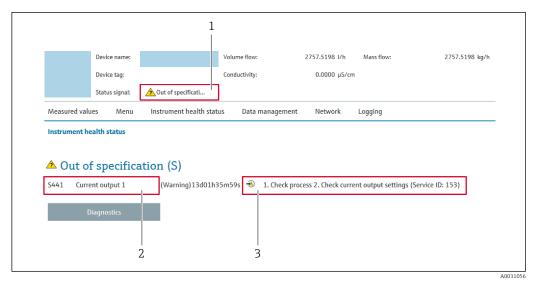
The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the **Diagnostic list** submenu or **Previous diagnostics** parameter.

1. Press ⊑ .
      ↳ The message for the remedial measures for the selected diagnostic event opens.

2. Press ⊟ + ⊞ simultaneously.
      ↳ The message for the remedial measures closes.

## 12.4    Diagnostic information in the Web browser

### 12.4.1    Diagnostic options

Any faults detected by the measuring device are displayed in the Web browser on the home page once the user has logged on.

*1   Status area with status signal*
*2   Diagnostics information → ▨ 117*
*3   Remedial measures with service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter → ▨ 125
- Via submenu → ▨ 126

**Status signals**

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

| Symbol | Meaning |
|---|---|
| | **Failure**<br>A device error has occurred. The measured value is no longer valid. |
| | **Function check**<br>The device is in service mode (e.g. during a simulation). |
| | **Out of specification**<br>The device is operated:<br>• Outside its technical specification limits (e.g. outside the process temperature range)<br>• Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**) |
| | **Maintenance required**<br>Maintenance is required. The measured value is still valid. |

The status signals are categorized in accordance with VDI/VDE 2650 and NAMUR Recommendation NE 107.

### 12.4.2   Calling up remedy information

Remedy information is provided for every diagnostic event to ensure that problems can be rectified quickly. These measures are displayed in red along with the diagnostic event and the related diagnostic information.

## 12.5    Diagnostic information in FieldCare or DeviceCare

### 12.5.1    Diagnostic options

Any faults detected by the measuring device are displayed on the home page of the operating tool once the connection has been established.



*1    Status area with status signal →  🖪  116*
*2    Diagnostics information →  🖪  117*
*3    Remedial measures with service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter →  🖪  125
- Via submenu →  🖪  126

**Diagnostic information**

The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.

### 12.5.2 Calling up remedy information

Remedy information is provided for every diagnostic event to ensure that problems can be rectified quickly:
- On the home page
  Remedy information is displayed in a separate field below the diagnostics information.
- In the **Diagnostics** menu
  Remedy information can be called up in the working area of the user interface.

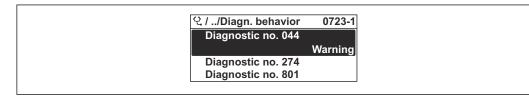The user is in the **Diagnostics** menu.

1. Call up the desired parameter.

2. On the right in the working area, mouse over the parameter.
   ↳ A tool tip with remedy information for the diagnostic event appears.

## 12.6     Adapting the diagnostic information

### 12.6.1 Adapting the diagnostic behavior

Each item of diagnostic information is assigned a specific diagnostic behavior at the factory. The user can change this assignment for specific diagnostic information in the **Diagnostic behavior** submenu.

Expert → System → Diagnostic handling → Diagnostic behavior



*26     Taking the example of the local display*

You can assign the following options to the diagnostic number as the diagnostic behavior:

| Options | Description |
|---|---|
| Alarm | The device stops measurement. The signal outputs and totalizers assume the defined alarm condition. A diagnostic message is generated.<br>The background lighting changes to red. |
| Warning | The device continues to measure. The signal outputs and totalizers are not affected. A diagnostic message is generated. |
| Logbook entry only | The device continues to measure. The diagnostic message is displayed only in the **Event logbook** submenu (**Event list** submenu) and is not displayed in alternation with the operational display. |
| Off | The diagnostic event is ignored, and no diagnostic message is generated or entered. |

### 12.6.2 Adapting the status signal

Each item of diagnostic information is assigned a specific status signal at the factory. The user can change this assignment for specific diagnostic information in the **Diagnostic event category** submenu.

Expert → Communication → Diagnostic event category

**Available status signals**

Configuration as per HART 7 Specification (Condensed Status), in accordance with NAMUR NE107.

| Symbol | Meaning |
|---|---|
| **F** <br> A0013956 | **Failure** <br> A device error is present. The measured value is no longer valid. |
| **C** <br> A0013959 | **Function check** <br> The device is in service mode (e.g. during a simulation). |
| **S** <br> A0013958 | **Out of specification** <br> The device is being operated: <br> • Outside its technical specification limits (e.g. outside the process temperature range) <br> • Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**) |
| **M** <br> A0013957 | **Maintenance required** <br> Maintenance is required. The measured value is still valid. |
| **N** <br> A0023076 | Has no effect on the condensed status. |

## 12.7    Overview of diagnostic information

The amount of diagnostic information and the number of measured variables affected increase if the measuring device has one or more application packages.

In the case of some items of diagnostic information, the status signal and the diagnostic behavior can be changed. Change the diagnostic information → 🖺 121

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| **Diagnostic of sensor** | | | | |
| 019 | Device initialization active | Device initialization in progress, please wait | S | Warning [1] |
| 082 | Data storage | 1. Check module connections <br> 2. Change electronic modules | F | Alarm |
| 083 | Memory content | 1. Restart device <br> 2. Restore HistoROM S-DAT backup ('Device reset' parameter) <br> 3. Replace HistoROM S-DAT | F | Alarm |
| 104 | Sensor signal path 1 to n | 1. Check process conditions <br> 2. Clean/repl. transd. (inline) / check sensor pos. and coupling (clamp on) <br> 3. Replace sensor electronic module (ISEM) | F | Alarm |
| 105 | Downstream transducer path 1 to n defective | 1. Check connection to the downstream transducer <br> 2. Replace downstream transducer | F | Alarm |
| 106 | Upstream transducer path 1 to n defective | 1. Check connection to the upstream transducer <br> 2. Replace upstream transducer | F | Alarm |
| 160 | Signal path switched off | Contact service | M | Warning [1] |
| **Diagnostic of electronic** | | | | |
| 201 | Device failure | Restart device | F | Alarm |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| 242 | Software incompatible | 1. Check software<br>2. Flash or change main electronic module | F | Alarm |
| 252 | Modules incompatible | 1. Check electronic modules<br>2. Check if correct modules are available (e.g. NEx, Ex)<br>3. Replace electronic modules | F | Alarm |
| 252 | Modules incompatible | 1. Check if correct electronic module is plugged<br>2. Replace electronic module | F | Alarm |
| 261 | Electronic modules | 1. Restart device<br>2. Check electronic modules<br>3. Change I/O module or main electronics | F | Alarm |
| 262 | Sensor electronics connection faulty | 1. Check/replace connection cable between sensor electronic module (ISEM) and main electr.<br>2. Check/replace module cartridge, ISEM, main electr. | F | Alarm |
| 270 | Main electronics failure | Change main electronic module | F | Alarm |
| 271 | Main electronics failure | 1. Restart device<br>2. Change main electronic module | F | Alarm |
| 272 | Main electronics failure | Restart device | F | Alarm |
| 273 | Main electronics failure | Change electronics | F | Alarm |
| 275 | I/O module defective | Change I/O module | F | Alarm |
| 276 | I/O module faulty | 1. Restart device<br>2. Change I/O module | F | Alarm |
| 281 | Electronic initialization | Firmware update active, please wait! | F | Alarm |
| 283 | Memory content | Reset device | F | Alarm |
| 283 | Memory content | Restart device | F | Alarm |
| 302 | Device verification in progress | Device verification active, please wait. | C | Warning |
| 311 | Electronic failure | 1. Do not reset device<br>2. Contact service | M | Warning |
| 372 | Sensor electronics (ISEM) faulty | 1. Restart device<br>2. Check if failure recurs<br>3. Replace sensor electronic module (ISEM) | F | Alarm |
| 373 | Sensor electronics (ISEM) faulty | Transfer data or reset device | F | Alarm |
| 375 | I/O- communication failed | 1. Restart device<br>2. Check if failure recurs<br>3. Replace module rack inclusive electronic modules | F | Alarm |
| 378 | Supply voltage ISEM faulty | Check supply voltage to the ISEM | F | Alarm |
| 382 | Data storage | 1. Insert T-DAT<br>2. Replace T-DAT | F | Alarm |
| 383 | Memory content | 1. Restart device<br>2. Delete T-DAT via 'Reset device' parameter<br>3. Replace T-DAT | F | Alarm |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| 384 | Transmitter circuit | 1. Restart device<br>2. Check if failure recurs<br>3. Replace sensor electronic module (ISEM) | F | Alarm |
| 385 | Amplifier circuit | 1. Restart device<br>2. Check if failure recurs<br>3. Replace sensor electronic module (ISEM) | F | Alarm |
| 386 | Time of flight | 1. Restart device<br>2. Check if failure recurs<br>3. Replace sensor electronic module (ISEM) | F | Alarm |
| 387 | HistoROM data faulty | Contact service organization | F | Alarm |
| **Diagnostic of configuration** | | | | |
| 410 | Data transfer | 1. Check connection<br>2. Retry data transfer | F | Alarm |
| 412 | Processing download | Download active, please wait | C | Warning |
| 431 | Trim 1 | Carry out trim | C | Warning |
| 437 | Configuration incompatible | Restart device | F | Alarm |
| 438 | Dataset | 1. Check data set file<br>2. Check device configuration<br>3. Up- and download new configuration | M | Warning |
| 441 | Current output | 1. Check process<br>2. Check current output settings | S | Warning [1] |
| 442 | Frequency output 1 to n | 1. Check process<br>2. Check frequency output settings | S | Warning [1] |
| 443 | Pulse output 1 to n | 1. Check process<br>2. Check pulse output settings | S | Warning [1] |
| 453 | Flow override | Deactivate flow override | C | Warning |
| 484 | Failure mode simulation | Deactivate simulation | C | Alarm |
| 485 | Measured variable simulation | Deactivate simulation | C | Warning |
| 491 | Current output 1 simulation | Deactivate simulation | C | Warning |
| 492 | Simulation frequency output 1 to n | Deactivate simulation frequency output | C | Warning |
| 493 | Pulse output 1 to n simulation active | Deactivate pulse output simulation | C | Warning |
| 494 | Switch output simulation 1 to n | Deactivate simulation switch output | C | Warning |
| 495 | Diagnostic event simulation | Deactivate simulation | C | Warning |
| 496 | Status input simulation | Deactivate simulation status input | C | Warning |
| 537 | Configuration | 1. Check IP addresses in network<br>2. Change IP address | F | Warning |
| **Diagnostic of process** | | | | |
| 803 | Current loop | 1. Check wiring<br>2. Change I/O module | F | Alarm |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| 832 | Electronics temperature too high | Reduce ambient temperature | S | Warning [1] |
| 833 | Electronics temperature too low | Increase ambient temperature | S | Warning [1] |
| 840 | Sensor range | Check flow velocity | S | Warning [1] |
| 842 | Process limit | Low flow cut off active!<br>1. Check low flow cut off configuration | S | Warning [1] |
| 870 | Measuring inaccuracy increased | 1. Check process conditions<br>2. Increase flow velocity | S | Warning [1] |
| 881 | Sensor signal path 1 to n | 1. Check process conditions<br>2. Clean/repl. transd. (inline) / check sensor pos. and coupling (clamp on)<br>3. Replace sensor electronic module (ISEM) | F | Alarm |
| 882 | Input signal | 1. Check input configuration<br>2. Check external device or process conditions | F | Alarm |
| 930 | Sound velocity too high | 1. Check process conditions<br>2. Clean/repl. transd. (inline) / check sensor pos. and coupling (clamp on)<br>3. Replace sensor electronic module (ISEM) | S | Warning [1] |
| 931 | Sound velocity too low | 1. Check process conditions<br>2. Clean/repl. transd. (inline) / check sensor pos. and coupling (clamp on)<br>3. Replace sensor electronic module (ISEM) | S | Warning [1] |
| 953 | Asymmetry noise signal too high path 1 to n | 1. Check process conditions<br>2. Clean/repl. transd. (inline) / check sensor pos. and coupling (clamp on)<br>3. Replace sensor electronic module (ISEM) | F | Alarm |

1)      Diagnostic behavior can be changed.

## 12.8     Pending diagnostic events

The **Diagnostics** menu allows the user to view the current diagnostic event and the previous diagnostic event separately.
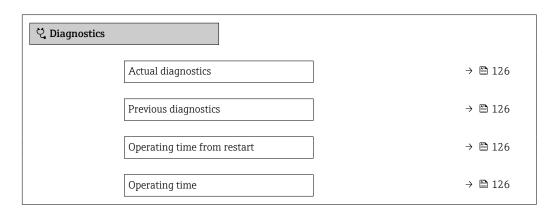
To call up the measures to rectify a diagnostic event:
- Via local display → 🖻 118
- Via web browser → 🖻 119
- Via "FieldCare" operating tool → 🖻 121
- Via "DeviceCare" operating tool → 🖻 121

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu → 🖻 126

**Navigation**

"Diagnostics" menu

| ⟳ **Diagnostics** | | |
|---|---|---|
| Actual diagnostics | → ▤ | 126 |
| Previous diagnostics | → ▤ | 126 |
| Operating time from restart | → ▤ | 126 |
| Operating time | → ▤ | 126 |

**Parameter overview with brief description**

| Parameter | Prerequisite | Description | User interface |
|---|---|---|---|
| Actual diagnostics | A diagnostic event has occurred. | Shows the current occured diagnostic event along with its diagnostic information.<br><br>ⓘ If two or more messages occur simultaneously, the message with the highest priority is shown on the display. | Symbol for diagnostic behavior, diagnostic code and short message. |
| Previous diagnostics | Two diagnostic events have already occurred. | Shows the diagnostic event that occurred prior to the current diagnostic event along with its diagnostic information. | Symbol for diagnostic behavior, diagnostic code and short message. |
| Operating time from restart | – | Shows the time the device has been in operation since the last device restart. | Days (d), hours (h), minutes (m) and seconds (s) |
| Operating time | – | Indicates how long the device has been in operation. | Days (d), hours (h), minutes (m) and seconds (s) |

## 12.9    Diagnostic list

Up to 5 currently pending diagnostic events can be displayed in the **Diagnostic list** submenu along with the associated diagnostic information. If more than 5 diagnostic events are pending, the events with the highest priority are shown on the display.

**Navigation path**

Diagnostics → Diagnostic list

*A0014006-EN*

*✎ 27    Taking the example of the local display*

To call up the measures to rectify a diagnostic event:
- Via local display → 🗎 118
- Via web browser → 🗎 119
- Via "FieldCare" operating tool → 🗎 121
- Via "DeviceCare" operating tool → 🗎 121
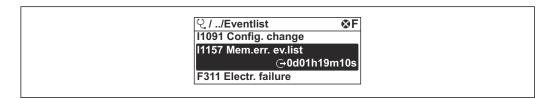
## 12.10   Event logbook

### 12.10.1  Reading out the event logbook

A chronological overview of the event messages that have occurred is provided in the **Events list** submenu.

**Navigation path**
**Diagnostics** menu → **Event logbook** submenu → Event list



*A0014008-EN*

*✎ 28    Taking the example of the local display*

- A maximum of 20 event messages can be displayed in chronological order.
- If the **Extended HistoROM** application package (order option) is enabled in the device, the event list can contain up to 100 entries .

The event history includes entries for:
- Diagnostic events → 🗎 122
- Information events → 🗎 128

In addition to the operation time of its occurrence, each event is also assigned a symbol that indicates whether the event has occurred or is ended:
- Diagnostic event
  - ⊕: Occurrence of the event
  - ⊖: End of the event
- Information event
  ⊕: Occurrence of the event

To call up the measures to rectify a diagnostic event:
- Via local display → 🗎 118
- Via web browser → 🗎 119
- Via "FieldCare" operating tool → 🗎 121
- Via "DeviceCare" operating tool → 🗎 121

For filtering the displayed event messages → 🗎 128

### 12.10.2 Filtering the event logbook

Using the **Filter options** parameter you can define which category of event message is displayed in the **Events list** submenu.

**Navigation path**
Diagnostics → Event logbook → Filter options

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

### 12.10.3 Overview of information events

Unlike a diagnostic event, an information event is displayed in the event logbook only and not in the diagnostic list.

| Info number | Info name |
|---|---|
| I1000 | --------(Device ok) |
| I1079 | Sensor changed |
| I1089 | Power on |
| I1090 | Configuration reset |
| I1091 | Configuration changed |
| I1092 | HistoROM backup deleted |
| I1137 | Electronics changed |
| I1151 | History reset |
| I1155 | Reset electronics temperature |
| I1156 | Memory error trend |
| I1157 | Memory error event list |
| I1256 | Display: access status changed |
| I1278 | I/O module restarted |
| I1327 | Zero point adjust failed signal path |
| I1335 | Firmware changed |
| I1361 | Web server: login failed |
| I1397 | Fieldbus: access status changed |
| I1398 | CDI: access status changed |
| I1444 | Device verification passed |
| I1445 | Device verification failed |
| I1457 | Measurement error verification failed |
| I1459 | I/O module verification failed |
| I1461 | Sensor verification failed |
| I1462 | Sensor electronic module verific. failed |
| I1512 | Download started |
| I1513 | Download finished |
| I1514 | Upload started |
| I1515 | Upload finished |

| Info number | Info name |
|---|---|
| I1622 | Calibration changed |
| I1624 | All totalizers reset |
| I1625 | Write protection activated |
| I1626 | Write protection deactivated |
| I1627 | Web server: login successful |
| I1628 | Display: login successful |
| I1629 | CDI: login successful |
| I1631 | Web server access changed |
| I1632 | Display: login failed |
| I1633 | CDI: login failed |
| I1634 | Reset to factory settings |
| I1635 | Reset to delivery settings |
| I1649 | Hardware write protection activated |
| I1650 | Hardware write protection deactivated |
| I1725 | Sensor electronic module (ISEM) changed |

## 12.11   Resetting the measuring device

Using the **Device reset** parameter (→ 🖺 98) it is possible to reset the entire device configuration or some of the configuration to a defined state.

### 12.11.1  Function scope of the "Device reset" parameter

| Options | Description |
|---|---|
| Cancel | No action is executed and the user exits the parameter. |
| To delivery settings | Every parameter for which a customer-specific default setting was ordered is reset to this customer-specific value. All other parameters are reset to the factory setting. |
| Restart device | The restart resets every parameter whose data are in the volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged. |

## 12.12   Device information

The **Device information** submenu contains all parameters that display different information for device identification.

**Navigation**
"Diagnostics" menu → Device information

| ► Device information | |
|---|---|
| Device tag | → 🖺 130 |
| Serial number | → 🖺 130 |

| | | | |
|---|---|---|---|
| | Firmware version | → 🖹 130 | |
| | Order code | → 🖹 130 | |
| | Extended order code 1 | → 🖹 130 | |
| | Extended order code 2 | → 🖹 130 | |
| | Extended order code 3 | → 🖹 131 | |
| | ENP version | → 🖹 131 | |
| | Device revision | → 🖹 131 | |
| | Device ID | → 🖹 131 | |
| | Device type | → 🖹 131 | |
| | Manufacturer ID | → 🖹 131 | |

**Parameter overview with brief description**

| Parameter | Description | User interface | Factory setting |
|---|---|---|---|
| Device tag | Shows name of measuring point. | Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /). | – |
| Serial number | Shows the serial number of the measuring device. | Max. 11-digit character string comprising letters and numbers. | – |
| Firmware version | Shows the device firmware version installed. | Character string in the format xx.yy.zz | – |
| Device name | Shows the name of the transmitter.  ℹ The name can be found on the nameplate of the transmitter. | Max. 32 characters such as letters or numbers. | – |
| Order code | Shows the device order code.  ℹ The order code can be found on the nameplate of the sensor and transmitter in the "Order code" field. | Character string composed of letters, numbers and certain punctuation marks (e.g. /). | – |
| Extended order code 1 | Shows the 1st part of the extended order code.  ℹ The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field. | Character string | – |
| Extended order code 2 | Shows the 2nd part of the extended order code.  ℹ The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field. | Character string | – |

| Parameter | Description | User interface | Factory setting |
|---|---|---|---|
| Extended order code 3 | Shows the 3rd part of the extended order code.<br><br>ℹ️ The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field. | Character string | – |
| ENP version | Shows the version of the electronic nameplate (ENP). | Character string | – |
| Device revision | Shows the device revision with which the device is registered with the HART Communication Foundation. | 2-digit hexadecimal number | – |
| Device ID | Shows the device ID for identifying the device in a HART network. | 6-digit hexadecimal number | – |
| Device type | Shows the device type with which the measuring device is registered with the HART Communication Foundation. | 2-digit hexadecimal number | 0x69 (for Prosonic Flow I 400) |
| Manufacturer ID | Shows the device's manufacturer ID registered with the HART Communication Foundation. | 2-digit hexadecimal number | 0x11 (for Endress+Hauser) |

## 12.13 Firmware history

| Release date | Firmware version | Order code for "Firmware version" | Firmware changes | Documentation type | Documentation |
|---|---|---|---|---|---|
| 12.2021 | 01.00.00 | Option 78 | Original firmware | Operating Instructions | BA02085D/06 |

ℹ️ It is possible to flash the firmware to the current version or the previous version using the service interface.

📖 For the compatibility of the firmware version with the previous version, the installed device description files and operating tools, observe the information about the device in the "Manufacturer's information" document.

ℹ️ The manufacturer's information is available:
- In the Download Area of the Endress+Hauser web site: www.endress.com → Downloads
- Specify the following details:
  - Product root: e.g. 9I4B
    The product root is the first part of the order code: see the nameplate on the device.
  - Text search: Manufacturer's information
  - Media type: Documentation – Technical Documentation

# 13      Maintenance

## 13.1      Maintenance tasks

No special maintenance work is required.

### 13.1.1      Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing or the seals.

## 13.2      Measuring and test equipment

Endress+Hauser offers a wide variety of measuring and test equipment, such as W@M or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

List of some of the measuring and testing equipment: → 🖹 137→ 🖹 135

## 13.3      Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as recalibration, maintenance service or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

# 14     Repair

## 14.1     General information

### 14.1.1     Repair and conversion concept

The Endress+Hauser repair and conversion concept provides for the following:
- The measuring devices have a modular design.
- Spare parts are grouped into logical kits with the associated Installation Instructions.
- Repairs are carried out by Endress+Hauser Service or by appropriately trained customers.
- Certified devices can only be converted to other certified devices by Endress+Hauser Service or at the factory.

### 14.1.2     Notes for repair and conversion

For repair and modification of a measuring device, observe the following notes:
- ▶  Use only original Endress+Hauser spare parts.
- ▶  Carry out the repair according to the Installation Instructions.
- ▶  Observe the applicable standards, federal/national regulations, Ex documentation (XA) and certificates.
- ▶  Document every repair and each conversion and enter them into the *W@M* life cycle management database and Netilion Analytics.

## 14.2     Spare parts

*W@M Device Viewer* ([www.endress.com/deviceviewer](www.endress.com/deviceviewer)):
All the spare parts for the measuring device, along with the order code, are listed here and can be ordered. If available, users can also download the associated Installation Instructions.

Measuring device serial number:
- Is located on the nameplate of the device.
- Can be read out via the **Serial number** parameter (→ 🖹 130) in the **Device information** submenu.

## 14.3     Endress+Hauser services

Endress+Hauser offers a wide range of services.

Your Endress+Hauser Sales Center can provide detailed information on the services.

## 14.4     Return

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

1.  Refer to the website for more information:
    [http://www.endress.com/support/return-material](http://www.endress.com/support/return-material)

2.  Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

## 14.5    Disposal

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

### 14.5.1    Removing the measuring device

1.  Switch off the device.

**⚠ WARNING**

**Danger to persons from process conditions!**
▶ Pay attention to high temperatures.

2.  Carry out the mounting and connection steps from the "Mounting the measuring device" and "Connecting the measuring device" sections in reverse order. Observe the safety instructions.

### 14.5.2    Disposing of the measuring device

Observe the following notes during disposal:
▶ Observe valid federal/national regulations.
▶ Ensure proper separation and reuse of the device components.

# 15    Accessories

Various accessories, which can be ordered with the device or subsequently from Endress
+Hauser, are available for the device. Detailed information on the order code in question is
available from your local Endress+Hauser sales center or on the product page of the
Endress+Hauser website: www.endress.com.

## 15.1    Device-specific accessories

### 15.1.1    For the transmitter

| Accessories | Description |
| --- | --- |
| Transmitter<br>Prosonic Flow 400 | Transmitter for replacement or storage. Use the order code to define the following specifications:<br>• Approvals<br>• Output / input<br>• Display/operation<br>• Housing<br>• Software<br><br>📖  For details, see Installation Instructions EA00104D |
| Post mounting kit | Post mounting kit for transmitter. |
| External WLAN antenna | External WLAN antenna with 1.5 m (59.1 in) connecting cable and two angle brackets. Order code for "Accessory enclosed", option P8 "Wireless antenna wide area".<br><br>ℹ️  • The external WLAN antenna is not suitable for use in hygienic applications.<br>     • Additional information regarding the WLAN interface → 🔖 62.<br><br>ℹ️  Order number: 71351317<br><br>📖  Installation Instructions EA01238D |
| Sensor cable<br>Proline 400<br>Sensor – transmitter | The sensor cable can be ordered directly with the measuring device (order code for "Cable") or as an accessory (order number DK9017).<br><br>The following cable lengths are available:<br>Temperature: −40 to +80 ℃ (−40 to +176 ℉)<br>• Option AA: 5 m (15 ft)<br>• Option AB: 10 m (30 ft)<br>• Option AC: 15 m (45 ft)<br>• Option AD: 30 m (90 ft)<br><br>ℹ️  Possible cable length for a Proline 400 sensor cable: Max. 30 m (90 ft) |

### 15.1.2    For the sensor

| Accessories | Description |
| --- | --- |
| Sensor set (DK9018) | Sensor set 1 MHz (I-100) |
| Sensor holder set (DK9014) | Sensor holder set 1 MHz |
| Installation set (DK9016) | • Installation set, DN200-DN1800, 8"-72"<br>• Installation set, DN1800-DN4000, 72"-160" |
| Conduit adapter set (DK9003) | • Without conduit adapter + sensor cable gland<br>• Conduit adapter M20x1.5 + sensor cable gland<br>• Conduit adapter NPT1/2" + sensor cable gland<br>• Conduit adapter G1/2" + sensor cable gland |

## 15.2 Communication-specific accessories

| Accessories | Description |
|---|---|
| Commubox FXA195 HART | For intrinsically safe HART communication with FieldCare via the USB interface.<br><br>📖 Technical Information TI00404F |
| Commubox FXA291 | Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop.<br><br>📖 Technical Information TI405C/07 |
| HART Loop Converter HMX50 | Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values.<br><br>📖 • Technical Information TI00429F<br>• Operating Instructions BA00371F |
| Wireless HART adapter SWA70 | Is used for the wireless connection of field devices.<br>The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity.<br><br>📖 Operating Instructions BA00061S |
| Fieldgate FXA42 | Is used to transmit the measured values of connected 4 to 20 mA analog measuring devices, as well as digital measuring devices<br><br>📖 • Technical Information TI01297S<br>• Operating Instructions BA01778S<br>• Product page: www.endress.com/fxa42 |
| Field Xpert SMT70 | The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress.<br>This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle.<br><br>📖 • Technical Information TI01342S<br>• Operating Instructions BA01709S<br>• Product page: www.endress.com/smt70 |
| Field Xpert SMT77 | The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1.<br><br>📖 • Technical Information TI01418S<br>• Operating Instructions BA01923S<br>• Product page: www.endress.com/smt77 |

## 15.3 Service-specific accessories

| Accessory | Description |
|---|---|
| Applicator | Software for selecting and sizing Endress+Hauser measuring devices:<br>• Choice of measuring devices with industrial requirements<br>• Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy.<br>• Graphic illustration of the calculation results<br>• Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project.<br><br>Applicator is available:<br>• Via the Internet: https://portal.endress.com/webapp/applicator<br>• As a downloadable DVD for local PC installation. |
| W@M | W@M Life Cycle Management<br>Improved productivity with information at your fingertips. Data relevant to a plant and its components is generated from the first stages of planning and during the asset's complete life cycle.<br>W@M Life Cycle Management is an open and flexible information platform with online and on-site tools. Instant access for your staff to current, in-depth data shortens your plant's engineering time, speeds up procurement processes and increases plant uptime.<br>Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, see: www.endress.com/lifecyclemanagement |
| FieldCare | FDT-based plant asset management tool from Endress+Hauser.<br>It can configure all smart 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.<br><br>📖 Operating Instructions BA00027S and BA00059S |
| DeviceCare | Tool for connecting and configuring Endress+Hauser field devices.<br><br>📖 Innovation brochure IN01047S |

## 15.4 System components

| Accessories | Description |
|---|---|
| Memograph M graphic data manager | The Memograph M graphic data manager provides information on all the relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick.<br><br>📖 • Technical Information TI00133R<br>• Operating Instructions BA00247R |

# 16    Technical data

## 16.1    Application

The measuring device is only suitable for flow measurement of liquids.

To ensure that the device remains in proper operating condition for its service life, use the measuring device only for media against which the process-wetted materials are sufficiently resistant.

## 16.2    Function and system design

| | |
|---|---|
| Measuring principle | Proline Prosonic Flow uses a measurement method based on the transit time difference. |
| Measuring system | The measuring system consists of a transmitter and one or two sensor sets. The transmitter and sensor sets are mounted in physically separate locations. They are interconnected by sensor cables.<br><br>The sensors function as sound generators and sound receivers. The sensors in a sensor pair are always arranged opposite one another and send/receive the ultrasonic signals directly (1-traverse positioning) → 🖹 22.<br><br>The transmitter serves to control the sensor sets, to prepare, process and evaluate the measuring signals, and to convert the signals to the desired output variable.<br><br>Information on the structure of the device → 🖹 13 |

## 16.3    Input

| | |
|---|---|
| Measured variable | **Direct measured variables**<br><br>• Volume flow<br>• Flow velocity<br>• Sound velocity<br><br>**Calculated measured variables**<br><br>Mass flow |
| Measuring range | v = 0 to 15 m/s (0 to 50 ft/s) |
| Operable flow range | Over 150 : 1 |
| Input signal | **External measured values**<br><br>Interfaces that allow externally measured variables (temperature, density) to be transmitted to the measuring device are optionally available for the device.<br><br>*HART protocol*<br><br>The measured values are written from the automation system to the measuring device via the HART protocol. The temperature and density measuring device must support the following protocol-specific functions:<br>• HART protocol<br>• Burst mode |

### Status input

| Maximum input values | • DC 30 V<br>• 6 mA |
|---|---|
| Response time | Configurable: 5 to 200 ms |
| Input signal level | • Low signal (low): DC −3 to +5 V<br>• High signal (high): DC 12 to 30 V |
| Assignable functions | • Off<br>• Reset totalizers 1-3 separately<br>• Reset all totalizers<br>• Flow override |

## 16.4    Output

Output signal

### Current output

| Current output | Can be set as:<br>• 4 to 20 mA NAMUR<br>• 4 to 20 mA US<br>• 4 to 20 mA HART<br>• 0 to 20 mA |
|---|---|
| Maximum output values | • DC 24 V (no flow)<br>• 22.5 mA |
| Load | 250 to 700 Ω |
| Resolution | 0.38 µA |
| Damping | Adjustable: 0 to 999.9 s |
| Assignable measured variables | • Volume flow<br>• Mass flow<br>• Sound velocity<br>• Flow velocity<br>• Electronic temperature<br><br>The range of options increases if the measuring device has one or more application packages. |

### Pulse/frequency/switch output

| Function | • With the order code for "Output; Input", option **H**: output 2 can be set as a pulse or frequency output<br>• With the order code for "Output; Input", option **I**: output 2 and 3 can be set as a pulse, frequency or switch output |
|---|---|
| Version | Passive, open collector |
| Maximum input values | • DC 30 V<br>• 250 mA |
| Voltage drop | At 25 mA: ≤ DC 2 V |
| **Pulse output** | |
| Pulse width | Adjustable: 0.05 to 2 000 ms |
| Maximum pulse rate | 10 000 Impulse/s |
| Pulse value | Adjustable |
| Assignable measured variables | • Volume flow<br>• Mass flow |
| **Frequency output** | |
| Output frequency | Adjustable: 0 to 12 500 Hz |

| Damping | Adjustable: 0 to 999 s |
|---|---|
| Pulse/pause ratio | 1:1 |
| Assignable measured variables | • Volume flow<br>• Mass flow<br>• Sound velocity<br>• Flow velocity<br>• Electronic temperature |
| Switch output | |
| Switching behavior | Binary, conductive or non-conductive |
| Switching delay | Adjustable: 0 to 100 s |
| Number of switching cycles | Unlimited |
| Assignable functions | • Off<br>• On<br>• Diagnostic behavior<br>• Limit value<br>  • Volume flow<br>  • Mass flow<br>  • Sound velocity<br>  • Flow velocity<br>  • Totalizer 1-3<br>  • Electronic temperature<br>• Flow direction monitoring<br>• Status<br>Low flow cut off |

Signal on alarm          Depending on the interface, failure information is displayed as follows:

**Current output 4 to 20 mA**

*4 to 20 mA*

| Failure mode | Choose from:<br>• 4 to 20 mA in accordance with NAMUR recommendation NE 43<br>• 4 to 20 mA in accordance with US<br>• Min. value: 3.59 mA<br>• Max. value: 22.5 mA<br>• Freely definable value between: 3.59 to 22.5 mA<br>• Actual value<br>• Last valid value |
|---|---|

*0 to 20 mA*

| Failure mode | Choose from:<br>• Maximum alarm: 22 mA<br>• Freely definable value between: 0 to 22.5 mA |
|---|---|

**HART current output**

| Device diagnostics | Device condition can be read out via HART Command 48 |
|---|---|

**Pulse/frequency/switch output**

| Pulse output | |
|---|---|
| Failure mode | Choose from:<br>• Actual value<br>• No pulses |

| Frequency output | |
|---|---|
| Failure mode | Choose from:<br>• Actual value<br>• 0 Hz<br>• Defined value: 0 to 12 500 Hz |
| Switch output | |
| Failure mode | Choose from:<br>• Current status<br>• Open<br>• Closed |

### Local display

| Plain text display | With information on cause and remedial measures |
|---|---|
| Backlight | Red backlighting indicates a device error. |

**ℹ** Status signal as per NAMUR recommendation NE 107

### Interface/protocol

• Via digital communication:
  HART protocol
• Via service interface
  • CDI-RJ45 service interface
  • WLAN interface

| Plain text display | With information on cause and remedial measures |
|---|---|

### Web browser

| Plain text display | With information on cause and remedial measures |
|---|---|

### Light emitting diodes (LED)

| Status information | Status indicated by various light emitting diodes |
|---|---|
| | The following information is displayed depending on the device version:<br>• Supply voltage active<br>• Data transmission active<br>• Device alarm/error has occurred<br><br>**ℹ** Diagnostic information via light emitting diodes → 🖹 115 |

Low flow cut off
The switch points for low flow cut off are user-selectable.

Galvanic isolation
The following connections are galvanically isolated from each other:
• Inputs
• Outputs
• Power supply

Protocol-specific data      **HART**
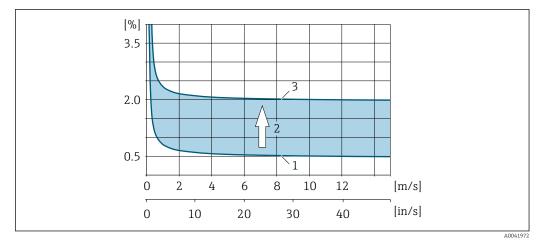
| Manufacturer ID | 0x11 |
|---|---|
| Device type ID | 0x1169 |
| HART protocol revision | 7 |
| Device description files (DTM, DD) | Information and files under: www.endress.com |
| HART load | Min. 250 Ω |
| Dynamic variables PV, SV, TV, QV | • Read out the dynamic variables via HART command 3<br>• The measured variables can be freely assigned to the dynamic variables |
| Device variables | • Read out the device variables via HART command 9<br>• The measured variables can be freely assigned<br>• A maximum of 8 device variables can be transmitted |
| System integration | |

## 16.5   Power supply

Terminal assignment         → �append 35

Supply voltage              **Transmitter**

| Order code for "Power supply" | terminal voltage | | Frequency range |
|---|---|---|---|
| Option **L** | DC 24 V | ±25% | – |
| | AC 24 V | ±25% | 50/60 Hz, ±4 Hz |
| | AC 100 to 240 V | −15 to +10% | 50/60 Hz, ±4 Hz |

Power consumption

| Order code for "Output" | Maximum power consumption |
|---|---|
| Option **H**: 4-20mA HART, pulse/frequency output, switch output | 30 VA/8 W |
| Option **I**: 4-20mA HART, 2 x pulse/frequency/switch output, status input | 30 VA/8 W |

Current consumption         **Transmitter**

| Order code for "Power supply" | Maximum Current consumption | Maximum switch-on current |
|---|---|---|
| Option **L**: AC 100 to 240 V | 145 mA | 25 A (< 5 ms) |
| Option **L**: AC/DC 24 V | 350 mA | 27 A (< 5 ms) |

Power supply failure        • Totalizers stop at the last value measured.
                            • Depending on the device version, the configuration is retained in the device memory or in the pluggable data memory (HistoROM DAT).
                            • Error messages (incl. total operated hours) are stored.

Electrical connection       → 🖹 36

Potential equalization      → 🖹 39

| Terminals | **Transmitter** |
|---|---|
| | Supply voltage cable: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG) |

| Cable entries | **Cable entry thread** |
|---|---|
| | • M20 x 1.5 |
| | • Via adapter: |
| | • NPT ½" |
| | • G ½" |
| | **Cable gland** |
| | M20 × 1.5 with cable $\phi$ 6 to 12 mm (0.24 to 0.47 in) |
| | ℹ️ If metal cable entries are used, use a grounding plate. |

| Cable specification | → 🔖 34 |
|---|---|

## 16.6    Performance characteristics

| Reference operating conditions | • Error limits following ISO/DIS 11631 |
|---|---|
| | • Specifications as per measurement report |
| | • Accuracy information is based on accredited calibration rigs that are traced to ISO 17025. |
| | ℹ️ To obtain measured errors, use the *Applicator* sizing tool → 🔖 137 |

| Maximum measured error | o.r. = of reading |
|---|---|
| | The measured error depends on a number of factors. A distinction is made between the measured error of the device (0.5% o.r.) and an additional installation-specific measured error (typically 1.5% o.r.) that is independent of the device. |
| | The installation-specific measured error depends on the installation conditions on site, such as the nominal diameter, accuracy of sensor mounting (sensor holder welding), real pipe geometry or medium. The sum of the two measured errors is the measured error at the measuring point. |

*29    Example of the measured error in a pipe with a nominal diameter DN > 200 (8")*

1    *Measured error of measuring device: 0.5% o.r. ± 3 mm/s (0.12 in/s)*
2    *Measured error due to installation conditions: typically 1.5% o.r.*
3    *Measured error at the measuring point: 0.5% o.r. ± 3 mm/s (0.12 in/s) + 1.5% o.r. = 2% o.r. ±*
     *3 mm/s (0.12 in/s)*

### Measured error at the measuring point

The measured error at the measuring point is made up of the measured error of the device (0.5% o.r.) and the measured error resulting from the installation conditions on site. With a flow velocity > 0.3 m/s (1 ft/s) and a Reynolds number > 10000, the following are typical error limits:

| Nominal diameter | Device error limits | + | Installation-specific error limits (typical) | → | Error limits at the measuring point (typical) | Field calibration [1] |
|---|---|---|---|---|---|---|
| ≥ DN 200 (8") | ±0.5% o.r. ± 3 mm/s (0.12 in/s) | + | ±1.5% o.r. | → | ±2% o.r. ± 3 mm/s (0.12 in/s) | ±0.5% o.r. ± 3 mm/s (0.12 in/s) |

1)    Adjustment in relation to a reference with correction values written back to the transmitter

### Measurement report
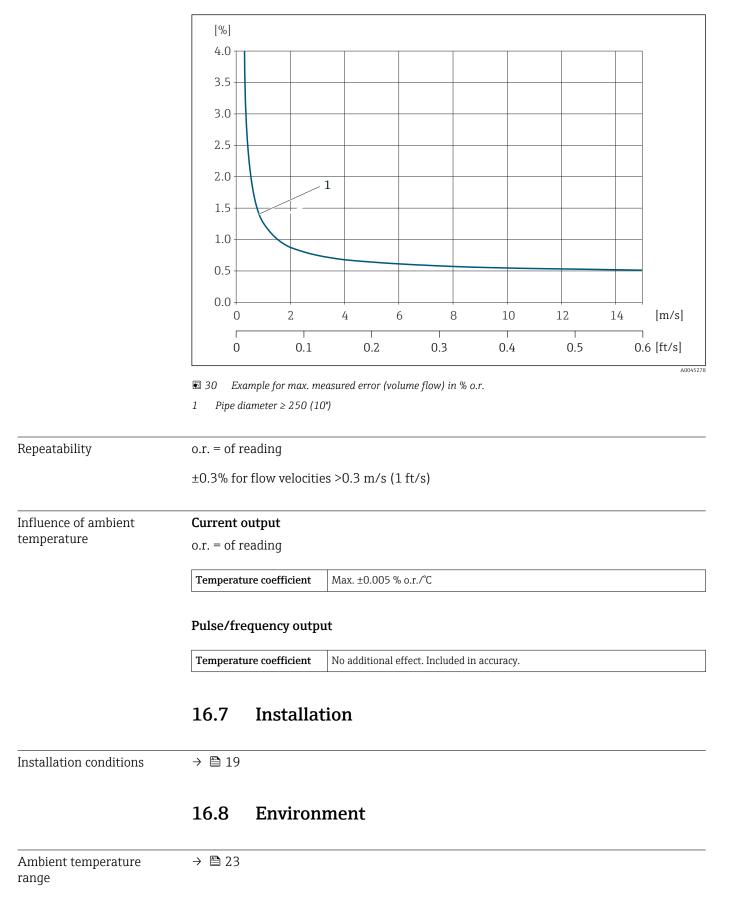
If required, the device can be supplied with a factory measurement report. A measurement is performed under reference conditions to verify the performance of the device. Here, the sensors are mounted on a pipe with a nominal diameter of DN 250 (10") or 400 (16").

With a flow velocity of > 0.3 m/s (1 ft/s) and a Reynolds number > 10000, the following error limits are guaranteed with the measurement report:

| Nominal diameter | Device error limits |
|---|---|
| 250 (10"); single-path | ±0.5% o.r. ± 3 mm/s (0.12 in/s) |
| 400 (16"); dual-path | ±0.5% o.r. ± 3 mm/s (0.12 in/s) |

The specification applies for Reynolds numbers Re ≥ 10000. Larger measured errors can occur for Reynolds numbers Re < 10000.

**Example for max. measured error (volume flow)**



*▣ 30    Example for max. measured error (volume flow) in % o.r.*

*1    Pipe diameter ≥ 250 (10")*

| Repeatability | o.r. = of reading |
|---|---|
| | ±0.3% for flow velocities >0.3 m/s (1 ft/s) |

**Influence of ambient temperature**

**Current output**

o.r. = of reading

| Temperature coefficient | Max. ±0.005 % o.r./℃ |
|---|---|

**Pulse/frequency output**

| Temperature coefficient | No additional effect. Included in accuracy. |
|---|---|

# 16.7    Installation

| Installation conditions | → 🖹 19 |
|---|---|

# 16.8    Environment

| Ambient temperature range | → 🖹 23 |
|---|---|

| Storage temperature | The storage temperature for all components (except display modules) corresponds to the ambient temperature range → 🖹 23. |

| Degree of protection | **Transmitter** |

- IP66/67, Type 4X enclosure, suitable for pollution degree 4
- When the housing is open: IP20, Type 1 enclosure, suitable for pollution degree 2
- Display module: IP20, Type 1 enclosure, suitable for pollution degree 2

**Sensor**

- Standard: IP66/67, Type 4X enclosure, suitable for pollution degree 4
- Optionally available: IP68, Type 6P enclosure, suitable for pollution degree 4

**External WLAN antenna**

IP67

| Vibration- and shock-resistance | **Vibration sinusoidal, according to IEC 60068-2-6** |

- 2 to 8.4 Hz, 7.5 mm peak
- 8.4 to 2 000 Hz, 2 g peak

**Vibration broad-band random, according to IEC 60068-2-64**

- 10 to 200 Hz, 0.01 $g^2$/Hz
- 200 to 2 000 Hz, 0.003 $g^2$/Hz
- Total: 2.70 g rms

**Shock half-sine, according to IEC 60068-2-27**

6 ms 50 g

**Rough handling shocks according to IEC 60068-2-31**

| Electromagnetic compatibility (EMC) | • As per IEC/EN 61326<br>• Complies with emission limits for industry as per EN 55011 (Class A) |

📖 Details are provided in the Declaration of Conformity.

## 16.9    Process

| Medium temperature range |

| Sensor version | Frequency | Temperature |
|---|---|---|
| I-100-A | 1 MHz | −40 to +80 °C (−40 to +176 °F) |

| Sound velocity range | 600 to 2 100 m/s (1 969 to 6 890 ft/s) |

| Medium pressure range | Maximum nominal pressure PN 16 (16 bar (232 psi)) |

| Pressure loss | There is no pressure loss. |
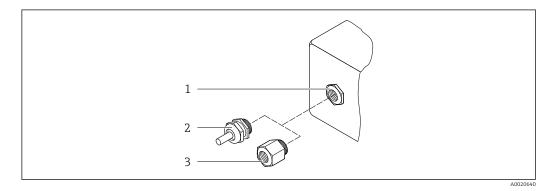
## 16.10 Mechanical construction

| | |
|---|---|
| Design, dimensions | For the dimensions and installed lengths of the device, see the "Technical Information" document, "Mechanical construction" section |

| | |
|---|---|
| Weight | Weight specifications excluding packaging material. |

### Transmitter
• Proline 400 polycarbonate plastic: 1.2 kg (2.65 lb)
• Proline 400 aluminum, coated: 6.0 kg (13.2 lb)

### Sensor
Including mounting material
• Single path installation version: 4.5 kg (9.92 lb)
• Two-path installation version: 9 kg (19.9 lb)

Materials

### Remote version (wall-mount housing)

• Order code for "Housing", option **P** "Remote, alu, coated":
  Aluminum, AlSi10Mg, coated
• Order code for "Housing", option **N**: polycarbonate plastic
• Window material:
  • For order code for "Housing", option **P**: glass
  • For order code for "Housing", option **N**: plastic

### Cable entries/cable glands



🖼 *31      Possible cable entries/cable glands*

*1      Female thread M20 × 1.5*
*2      Cable gland M20 × 1.5*
*3      Adapter for cable entry with female thread G ½" or NPT ½"*

*remote version*

| Cable entry/cable gland | Material |
|---|---|
| Cable gland M20 × 1.5 | • Plastic<br>• Nickel-plated brass |
| Cable gland of sensor cable | Nickel-plated brass |
| Power cable gland | Plastic |
| Adapter for cable entry with female thread G ½" or NPT ½" | Nickel-plated brass |

**Sensor - transmitter cable**

ℹ️ UV rays can impair the cable outer sheath. Protect the cable from exposure to sun as much as possible.

Sensor cable, TPE halogen-free
• Cable sheath: TPE halogen-free
• Cable plug: nickel-plated brass

**Ultrasonic transducer**

• Holder: stainless steel 1.4301 (304), 1.4404 (316L)
• Housing: stainless steel 1.4301 (304), 1.4404 (316L)

**Accessories**

*External WLAN antenna*

• Antenna: ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass
• Adapter: Stainless steel and nickel-plated brass
• Cable: Polyethylene
• Plug: Nickel-plated brass
• Angle bracket: Stainless steel

## 16.11   Operability

| | |
|---|---|
| Languages | Can be operated in the following languages:<br>• Via local operation:<br>English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech, Swedish<br>• Via "FieldCare", "DeviceCare" operating tool:<br>English, German, French, Spanish, Italian, Chinese, Japanese<br>• Via Web browser<br>English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech, Swedish |
| Local operation | **Via display module**<br><br>Equipment:<br>• Standard features 4-line, illuminated, graphic display; touch control<br>• Order code for "Display; operation", option G "4-line, illuminated; Touch Control +WLAN" offers standard equipment features in addition to access via Web browser<br><br>ℹ️ Information about WLAN interface → 🖺 62 |



A0032074

🖾 *32    Operation with touch control*

*Display elements*

- 4-line, illuminated, graphic display
- White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured
- Permitted ambient temperature for the display: –20 to +60 °C (–4 to +140 °F)
  The readability of the display may be impaired at temperatures outside the temperature range.

*Operating elements*

- External operation via touch control (3 optical keys) without opening the housing: ⊞, ⊟, 𝔼
- Operating elements also accessible in the various zones of the hazardous area

| | |
|---|---|
| Remote operation | → 🕮 62 |

| | |
|---|---|
| Service interface | → 🕮 62 |

| | |
|---|---|
| Supported operating tools | Different operating tools can be used for local or remote access to the measuring device. Depending on the operating tool used, access is possible with different operating units and via a variety of interfaces. |

| Supported operating tools | Operating unit | Interface | Additional information |
|---|---|---|---|
| Web browser | Notebook, PC or tablet with Web browser | • CDI-RJ45 service interface <br> • WLAN interface | Special Documentation for the device |
| DeviceCare SFE100 | Notebook, PC or tablet with Microsoft Windows system | • CDI-RJ45 service interface <br> • WLAN interface <br> • Fieldbus protocol | → 🕮 137 |
| FieldCare SFE500 | Notebook, PC or tablet with Microsoft Windows system | • CDI-RJ45 service interface <br> • WLAN interface <br> • Fieldbus protocol | → 🕮 137 |
| Device Xpert | Field Xpert SFX 100/350/370 | Fieldbus protocol HART | Operating Instructions BA01202S <br><br> Device description files: Use update function of handheld terminal |

ℹ️ Other operating tools based on FDT technology with a device driver such as DTM/iDTM or DD/EDD can be used for device operation. These operating tools are available from the individual manufacturers. Integration into the following operating tools, among others, is supported:

- FactoryTalk AssetCentre (FTAC) from Rockwell Automation → www.rockwellautomation.com
- Process Device Manager (PDM) from Siemens → www.siemens.com
- Asset Management Solutions (AMS) from Emerson → www.emersonprocess.com
- FieldCommunicator 375/475 from Emerson → www.emersonprocess.com
- Field Device Manager (FDM) from Honeywell → www.honeywellprocess.com
- FieldMate from Yokogawa → www.yokogawa.com
- PACTWare → www.pactware.com

The related device description files are available: www.endress.com → Downloads

**Web server**

Thanks to the integrated Web server the device can be operated and configured via a Web browser and via a standard Ethernet switch (RJ45) or via a WLAN interface. The structure of the operating menu is the same as the menu on the local display. In addition to the measured values, status information about the device is also displayed and allows the user to monitor the status of the device. Furthermore the device data can be managed and the network parameters can be configured.

A device that has a WLAN interface (can be ordered as an option) is required for the WLAN connection: order code for "Display", option G "4-line, illuminated; Touch Control +WLAN". The device acts as an Access Point and enables communication by computer or a mobile handheld terminal.

*Supported functions*
Data exchange between the operating unit (such as a notebook for example) and the measuring device:

- Upload the configuration from the measuring device (XML format, create configuration back-up)
- Save the configuration to the measuring device (XML format, restore configuration)
- Export event list (.csv file)
- Export parameter settings (.csv file or PDF file, document the measuring point configuration)
- Export the Heartbeat verification log (PDF file, only available with the "Heartbeat Verification" application package)
- Flash firmware version for device firmware upgrade, for instance
- Download driver for system integration
- Display up to 1000 saved measured values (only available with the **Extended HistoROM** application package → 🖺 153)

📖 Web server special documentation

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| HistoROM data management | The measuring device features HistoROM data management. HistoROM data management comprises both the storage and import/export of key device and process data, making operation and servicing far more reliable, secure and efficient. |

**Additional information on the data storage concept**

*There are different types of data storage units in which device data are stored and used by the device:*

|  | HistoROM backup | T-DAT | S-DAT |
|---|---|---|---|
| **Available data** | • Event logbook such as diagnostic events for example<br>• Device firmware package | • Measured value logging ("Extended HistoROM" order option)<br>• Current parameter data record (used by firmware at run time)<br>• Peakhold indicator (min/max values)<br>• Totalizer values | • Sensor data: etc.<br>• Serial number<br>• Device configuration (e.g. SW options, fixed I/O or multi I/O) |
| **Storage location** | Fixed on the user interface board in the connection compartment | Attachable to the user interface board in the connection compartment | Fixed on the sensor connection board |

**Data backup**

**Automatic**
- The most important device data (sensor and transmitter) are automatically saved in the DAT modules
- If the transmitter or measuring device is replaced: once the T-DAT containing the previous device data has been exchanged, the new measuring device is ready for operation again immediately without any errors
- If the sensor is replaced: once the sensor has been replaced, new sensor data are transferred from the S-DAT in the measuring device and the measuring device is ready for operation again immediately without any errors

**Data transmission**

**Manual**
Transfer of a device configuration to another device using the export function of the specific operating tool, e.g. with FieldCare, DeviceCare or Web server: to duplicate the configuration or to store in an archive (e.g. for backup purposes)

**Event list**

**Automatic**
- Chronological display of up to 20 event messages in the events list
- If the **Extended HistoROM** application package (order option) is enabled: up to 100 event messages are displayed in the events list along with a time stamp, plain text description and remedial measures
- The events list can be exported and displayed via a variety of interfaces and operating tools e.g. DeviceCare, FieldCare or Web server

**Data logging**

**Manual**
If the **Extended HistoROM** application package (order option) is enabled:
- Record up to 1000 measured values via 1 to 4 channels
- User configurable recording interval
- Record up to 250 measured values via each of the 4 memory channels
- Export the measured value log via a variety of interfaces and operating tools e.g. FieldCare, DeviceCare or web server

## 16.12   Certificates and approvals

Current certificates and approvals for the product are available via the Product Configurator at www.endress.com.

1. Select the product using the filters and search field.

2. Open the product page.

The **Configuration** button opens the Product Configurator.

| | |
|---|---|
| CE mark | The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.<br><br>Endress+Hauser confirms successful testing of the device by affixing to it the CE mark. |
| UKCA marking | The device meets the legal requirements of the applicable UK regulations (Statutory Instruments). These are listed in the UKCA Declaration of Conformity along with the designated standards. By selecting the order option for UKCA marking, Endress+Hauser confirms a successful evaluation and testing of the device by affixing the UKCA mark. |

Contact address Endress+Hauser UK:
Endress+Hauser Ltd.
Floats Road
Manchester M23 9NF
United Kingdom
[www.uk.endress.com](www.uk.endress.com)

| | |
|---|---|
| RCM mark | The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)". |
| Ex approval | The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Control Drawing" document. Reference is made to this document on the nameplate. |

**HART certification**

**HART interface**

The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:
• Certified according to HART 7
• The device can also be operated with certified devices of other manufacturers (interoperability)

**Radio approval**

The measuring device has radio approval.

    For detailed information regarding radio approval, see the Special Documentation
→ 🖺 154

**Other standards and guidelines**

• EN 60529
  Degrees of protection provided by enclosures (IP code)
• EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
• IEC/EN 61326-2-3
  Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
• ANSI/ISA-61010-1 (82.02.01)
  Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1 General Requirements
• CAN/CSA-C22.2 No. 61010-1-12
  Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1 General Requirements
• NAMUR NE 32
  Data retention in the event of a power failure in field and control instruments with microprocessors
• NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
• NAMUR NE 53
  Software of field devices and signal-processing devices with digital electronics
• NAMUR NE 105
  Specifications for integrating fieldbus devices in engineering tools for field devices
• NAMUR NE 107
  Self-monitoring and diagnosis of field devices
• NAMUR NE 131
  Requirements for field devices for standard applications

## 16.13   Application packages

Many different application packages are available to enhance the functionality of the device. Such packages might be needed to address safety aspects or specific application requirements.

The application packages can be ordered with the device or subsequently from Endress+Hauser. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Detailed information on the application packages:
Special Documentation for the device → 🕮 154

| Diagnostics functions | Package | Description |
|---|---|---|
| | Extended HistoROM | Comprises extended functions concerning the event log and the activation of the measured value memory. |
| | | Event log:<br>Memory volume is extended from 20 message entries (standard version) to up to 100 entries. |
| | | Data logging (line recorder):<br>• Memory capacity for up to 1000 measured values is activated.<br>• 250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user.<br>• Measured value logs can be accessed via the local display or operating tool e.g. FieldCare, DeviceCare or Web server. |

| Heartbeat Technology | Package | Description |
|---|---|---|
| | Heartbeat Verification +Monitoring | **Heartbeat Verification**<br>Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 7.6 a) "Control of monitoring and measuring equipment".<br>• Functional testing in the installed state without interrupting the process.<br>• Traceable verification results on request, including a report.<br>• Simple testing process via local operation or other operating interfaces.<br>• Clear measuring point assessment (pass/fail) with high test coverage within the framework of manufacturer specifications.<br>• Extension of calibration intervals according to operator's risk assessment. |
| | | **Heartbeat Monitoring**<br>Continuously supplies data, which are characteristic of the measuring principle, to an external condition monitoring system for the purpose of preventive maintenance or process analysis. These data enable the operator to:<br>• Draw conclusions - using these data and other information - about the impact the measuring application has on the measuring performance over time.<br>• Schedule servicing in time.<br>• Monitor the process or product quality, e.g. gas pockets. |

## 16.14   Accessories

Overview of accessories available for order → 🕮 135

## 16.15   Documentation

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

Standard documentation

**Brief Operating Instructions**

*Brief Operating Instructions for the sensor*

| Measuring device | Documentation code |
|---|---|
| Proline Prosonic Flow I | KA01511D |

*Brief Operating Instructions for the transmitter*

| Measuring device | Documentation code |
|---|---|
| Proline 400 | KA01510D |

**Technical Information**

| Measuring device | Documentation code |
|---|---|
| Prosonic Flow I 400 | TI01567D |

**Description of device parameters**

| Measuring device | Documentation code HART |
|---|---|
| Prosonic Flow I 400 | GP01166D |

Supplementary device-dependent documentation

**Special Documentation**

| Contents | Documentation code |
|---|---|
| Radio approvals for WLAN interface for A309/A310 display module | SD01793D |
| Heartbeat Technology | SD02712D |
| Web server | SD02713D |

**Installation Instructions**

| Content | Comment |
|---|---|
| Installation instructions for spare part sets and accessories | ▪ Access the overview of all the available spare part sets via *W@M Device Viewer* → 🖪 133<br>▪ Accessories available for order with Installation Instructions → 🖪 135 |

# Index

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