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Valid as of version
01.06.zz (Device firmware)



# Operating Instructions
# **Proline Promag W 300**

Electromagnetic flowmeter
HART


Endress+Hauser
People for Process Automation

- Make sure the document is stored in a safe place such that it is always available when working on or with the device.
- 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 required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to installation, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.

## 1.2 Symbols

### 1.2.1 Safety symbols

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

⚠ WARNING
This symbol alerts you to a 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. |
| ⊜ | **Potential equalization connection (PE: protective earth)**<br>Ground terminals that must be connected to ground prior to establishing any other connections.<br>The ground terminals are located on the interior and exterior of the device:<br>▪ Interior ground terminal: potential equalization is connected to the supply network.<br>▪ Exterior ground terminal: device is connected 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. |
| | **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 |
|---|---|
|  | Flat-blade screwdriver |
|  | Allen key |
|  | 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 |
|  | Hazardous area |

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

## 1.3 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

### 1.3.1 Document function

| Document type | Purpose and content of the document |
|---|---|
| Technical Information (TI) | **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. |
| Brief Operating Instructions (KA) | **Guide that takes you quickly to the 1st measured value**<br>The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning. |
| Operating Instructions (BA) | **Your reference guide**<br>These Operating Instructions contain all the information that is required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning, through to troubleshooting, maintenance and disposal. |
| Description of Device Parameters (GP) | **Reference for your parameters**<br>The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations. |
| Safety Instructions (XA) | Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. They are an integral part of the Operating Instructions.<br>The nameplate indicates which Safety Instructions (XA) apply to the device in question. |
| 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, Texas, 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 with a minimum conductivity of 5 µS/cm.

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 pressure and 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).
- Use the measuring device only for media to which the process-wetted materials are sufficiently resistant.
- 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.

**⚠ WARNING**

**Danger of breakage due to corrosive or abrasive fluids and ambient conditions!**
- Verify the compatibility of the process fluid with the sensor material.
- Ensure the resistance of all fluid-wetted materials in the process.
- Keep within the specified pressure and temperature range.

NOTICE

**Verification for borderline cases:**

- For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability as minute changes in the temperature, concentration or level of contamination in the process can alter the corrosion resistance properties.

**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

When working on and with the device:

- Wear the required personal protective equipment as per national regulations.

## 2.4 Operational safety

Risk of injury!

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

**Modifications to the device**

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

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

**Repair**

To ensure continued operational safety and reliability:

- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to the repair of an electrical device.
- Use only original spare parts and accessories.

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

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

## 2.7 Device-specific IT security

The device offers 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 → 🖹 11 | Not enabled | On an individual basis following risk assessment |
| Access code (also applies for Web server login or FieldCare connection) → 🖹 12 | Not enabled (0000) | Assign a customized access code during commissioning |
| WLAN (order option in display module) | Enabled | On an individual basis following risk assessment |
| WLAN security mode | Enabled (WPA2-PSK) | Do not change |
| WLAN passphrase (password) → 🖹 12 | 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 → 🖹 13 | – | On an individual basis following risk assessment |

### 2.7.1 Protecting access via hardware write protection

Write access to the parameters of the device via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare) can be disabled via a write protection switch (DIP switch on the main electronics module). When hardware write protection is enabled, only read access to the parameters is possible.

Hardware write protection is disabled when the device is delivered → 🖹 129.

### 2.7.2 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.
- Infrastructure mode
  When the device is operated in infrastructure mode, the WLAN passphrase corresponds to the WLAN passphrase configured on the operator side.

#### User-specific access code

Write access to the device parameters via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code (→ 127).

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 (→ 77), 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 (→ 121).

#### Infrastructure mode

A connection between the device and WLAN access point is protected by means of an SSID and passphrase on the system side. Please contact the relevant system administrator for access.

#### 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 → 127

### 2.7.3 Access via Web server

The device can be operated and configured via a Web browser with the integrated Web server (→ 68). 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 → 205.

### 2.7.4 Access via OPC-UA

The device can communicate with OPC UA clients using the "OPC UA Server" application package.

The OPC UA server integrated in the device can be accessed via the WLAN access point using the WLAN interface - which can be ordered as an optional extra - or the service interface (CDI- RJ45) via Ethernet network. Access rights and authorization as per separate configuration.

The following Security Modes are supported as per the OPC UA Specification (IEC 62541):
- None
- Basic128Rsa15 – signed
- Basic128Rsa15 – signed and encrypted

### 2.7.5 Access via service interface (CDI-RJ45)

The device can be connected to a network via the service interface (CDI-RJ45). Device-specific functions guarantee the secure operation of the device in a network.

The use of relevant industrial standards and guidelines that have been defined by national and international safety committees, such as IEC/ISA62443 or the IEEE, is recommended. This includes organizational security measures such as the assignment of access authorization as well as technical measures such as network segmentation.

Transmitters with an Ex de approval may not be connected via the service interface (CDI-RJ45)!

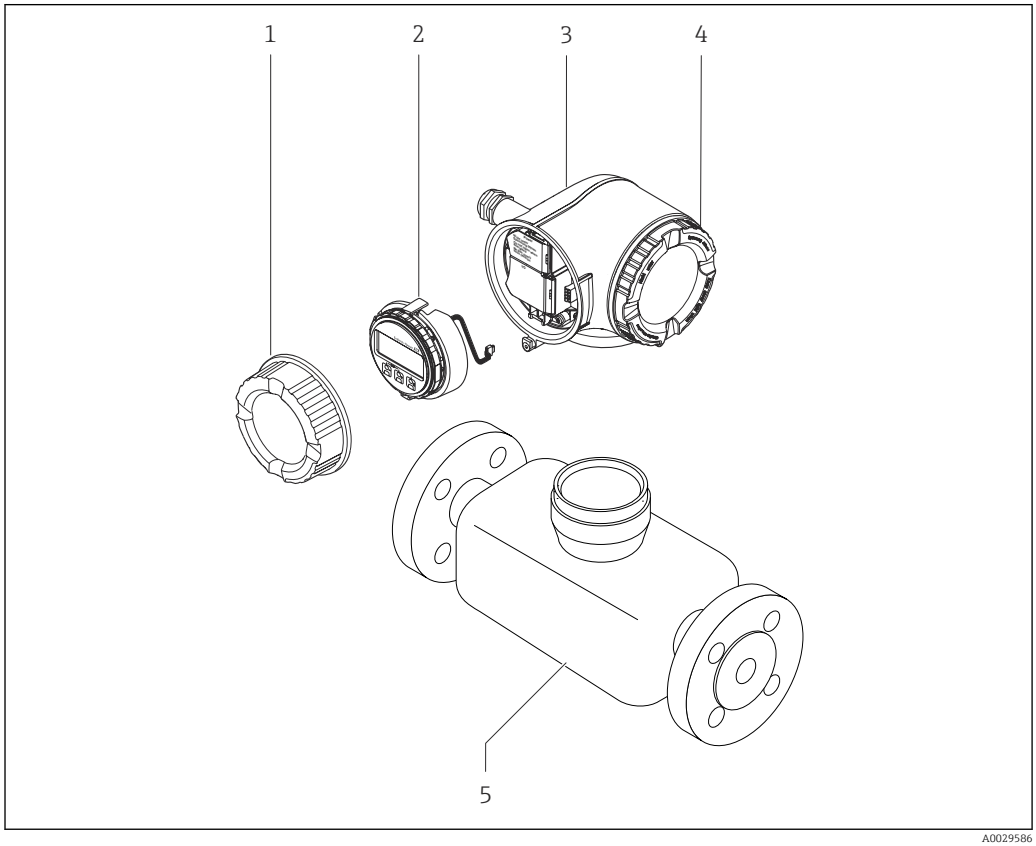
Order code for "Approval transmitter + sensor", options (Ex de): BA, BB, C1, C2, GA, GB, MA, MB, NA, NB

# 3 Product description

The device consists of a transmitter and a sensor.

The device is available as a compact version:
The transmitter and sensor form a mechanical unit.

## 3.1 Product design

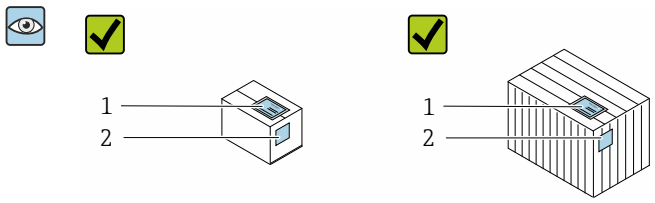



*1 Important components of a measuring device*

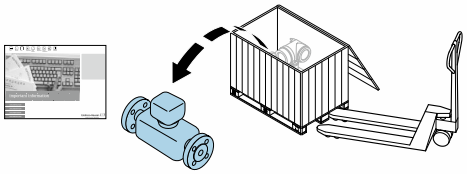
1 *Connection compartment cover*
2 *Display module*
3 *Transmitter housing*
4 *Electronics compartment cover*
5 *Sensor*

# 4 Incoming acceptance and product identification

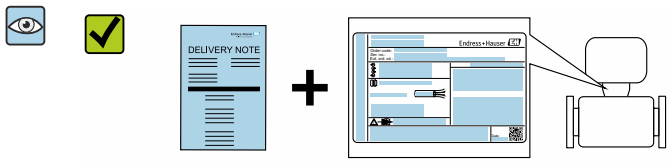
## 4.1 Incoming acceptance




Are the order codes on the delivery note (1) and the product sticker (2) identical?



Are the goods undamaged?




Do the data on the nameplate 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.

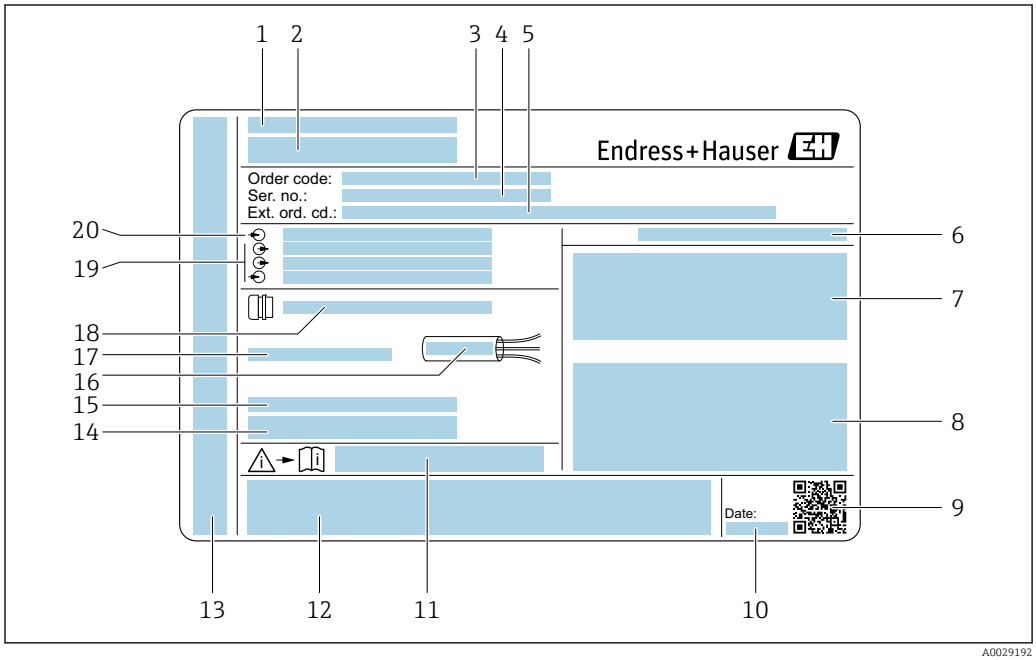
## 4.2 Product identification

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 the *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" and "Supplementary device-dependent documentation"
- The *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.

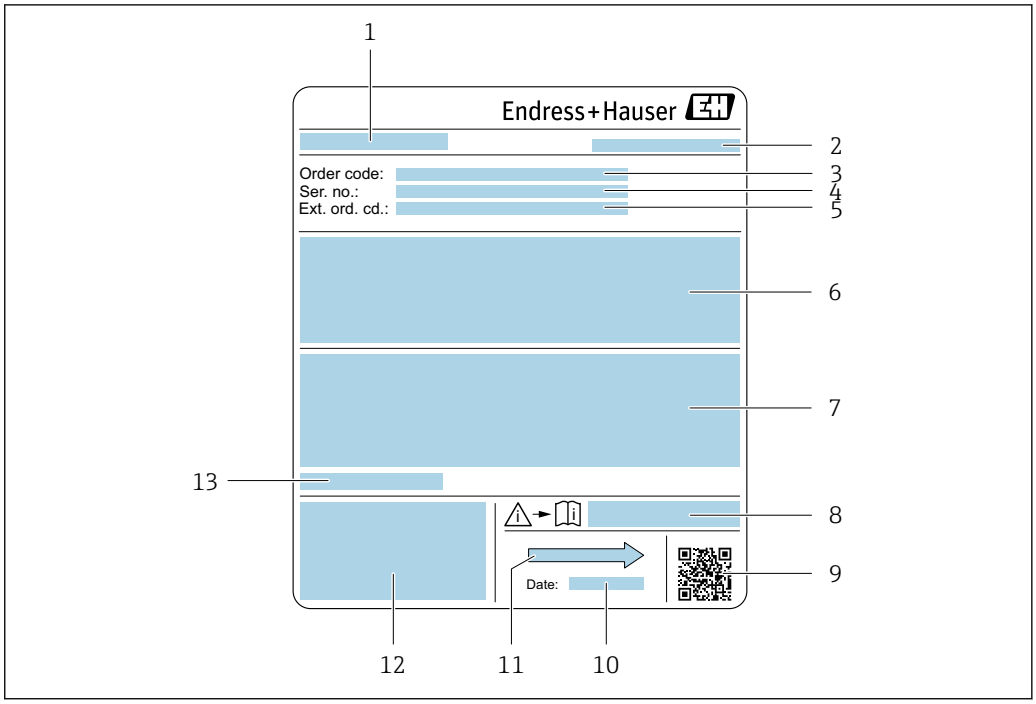
### 4.2.1 Transmitter nameplate




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 *Degree of protection*
7 *Space for approvals: use in hazardous areas*
8 *Electrical connection data: available inputs and outputs*
9 *2-D matrix code*
10 *Date of manufacture: year-month*
11 *Document number of safety-related supplementary documentation*
12 *Space for approvals and certificates: e.g. CE mark, RCM tick*
13 *Space for degree of protection of connection and electronics compartment when used in hazardous areas*
14 *Firmware version (FW) and device revision (Dev.Rev.) from the factory*
15 *Space for additional information in the case of special products*
16 *Permitted temperature range for cable*
17 *Permitted ambient temperature ($T_a$)*
18 *Information on cable gland*
19 *Available inputs and outputs, supply voltage*
20 *Electrical connection data: supply voltage*

### 4.2.2 Sensor nameplate




3 *Example of sensor nameplate*

1 *Name of the sensor*
2 *Place of manufacture*
3 *Order code*
4 *Serial number (Ser. no.)*
5 *Extended order code (Ext. ord. cd.)*
6 *Flow; nominal diameter of the sensor; pressure rating; nominal pressure; system pressure; medium temperature range; material of liner and electrodes*
7 *Approval information for explosion protection, Pressure Equipment Directive and degree of protection*
8 *Document number of safety-related supplementary documentation*
9 *2-D matrix code*
10 *Date of manufacture: year-month*
11 *Flow direction*
12 *CE mark, RCM-Tick mark*
13 *Permitted ambient temperature ($T_a$)*

**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

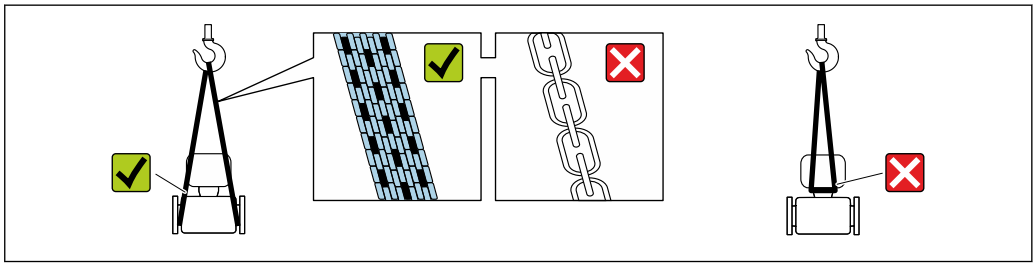
## 5.1 Storage conditions

Observe the following notes for storage:
- Store in the original packaging to ensure protection from shock.
- Do not remove protective covers or protective caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring pipe.
- Protect from direct sunlight to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus and bacteria infestation can damage the liner.
- Store in a dry and dust-free place.
- Do not store outdoors.

Storage temperature → 184

## 5.2 Transporting the product

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



A0029252

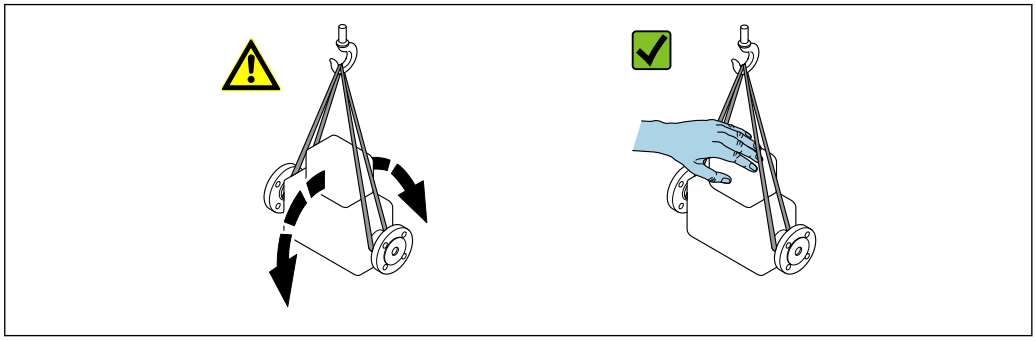
Do not remove protective covers or caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.

### 5.2.1 Measuring devices without lifting lugs

**WARNING**

**Center of gravity of the measuring device is higher than the suspension points of the webbing slings.**

Risk of injury if the measuring device slips.
- Secure the measuring device against slipping or turning.
- Observe the weight specified on the packaging (stick-on label).



A0029214

### 5.2.2 Measuring devices with lifting lugs

**⚠ CAUTION**

**Special transportation instructions for devices with lifting lugs**

- ▶ Only use the lifting lugs fitted on the device or flanges to transport the device.
- ▶ The device must always be secured at two lifting lugs at least.

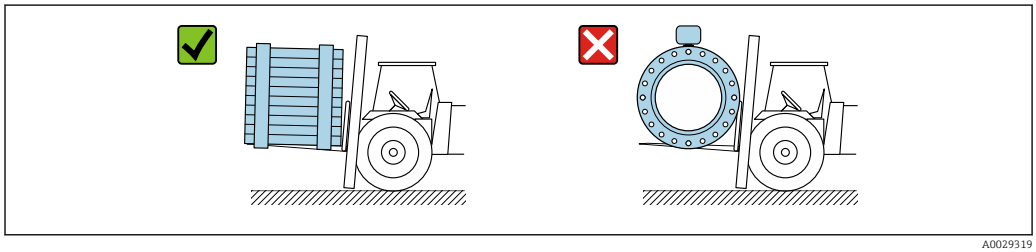
### 5.2.3 Transporting with a fork lift

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

**⚠ CAUTION**

**Risk of damaging the magnetic coil**

- ▶ If transporting by forklift, do not lift the sensor by the metal casing.
- ▶ This would buckle the casing and damage the internal magnetic coils.



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## 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

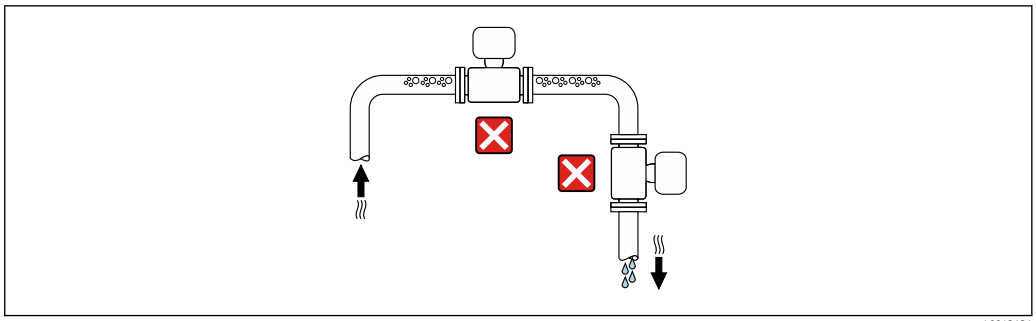
# 6 Mounting

## 6.1 Mounting requirements

### 6.1.1 Mounting position

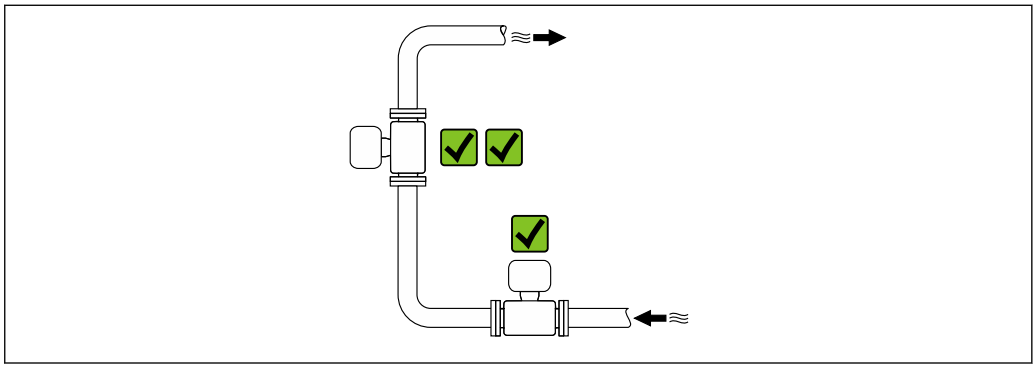
**Mounting location**

- Do not install the device at the highest point of the pipe.
- Do not install the device upstream from a free pipe outlet in a down pipe.



A0042131

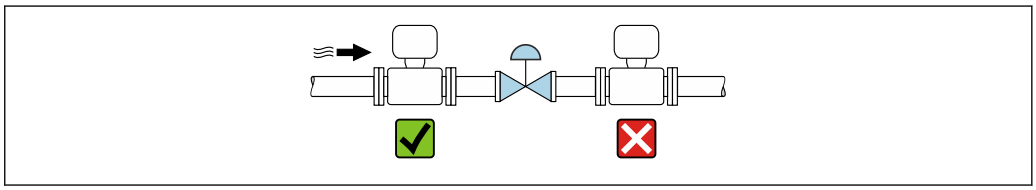
The device should ideally be installed in an ascending pipe.



A0042317

*Installation near valves*

Install the device in the direction of flow upstream from the valve.



A0041091

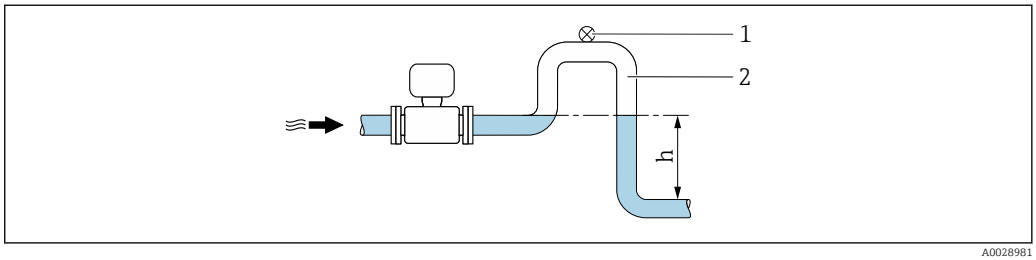
*Installation upstream from a down pipe*

**NOTICE**

**Negative pressure in the measuring pipe can damage the liner!**

- If installing upstream of down pipes whose length h ≥ 5 m (16.4 ft): install a siphon with a vent valve downstream of the device.

This arrangement prevents the flow of liquid stopping in the pipe and air entrainment.

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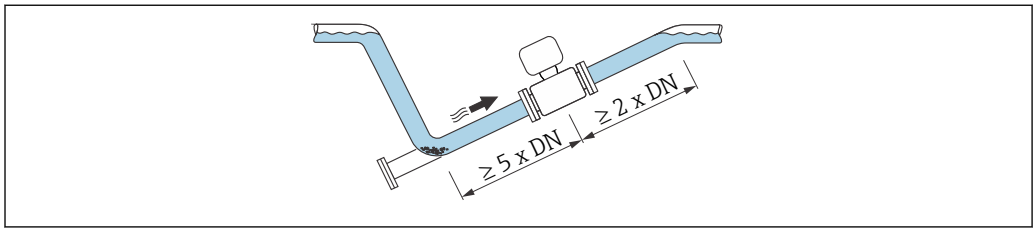
1 *Vent valve*
2 *Pipe siphon*
h *Length of down pipe*

*Installation with partially filled pipes*

- Partially filled pipes with a gradient require a drain-type configuration.
- The installation of a cleaning valve is recommended.




A0041088

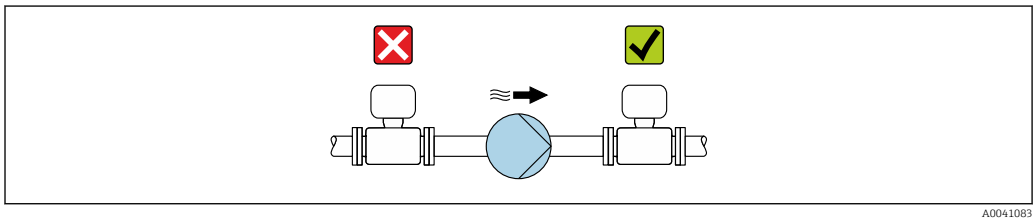
No inlet and outlet runs for devices with the order code for "Design": Option C, H or I.

*Installation near pumps*

NOTICE

**Negative pressure in the measuring pipe can damage the liner!**

- ▶ In order to maintain the system pressure, install the device in the flow direction downstream from the pump.
- ▶ Install pulsation dampers if reciprocating, diaphragm or peristaltic pumps are used.



A0041083

- Information on the liner's resistance to partial vacuum → 186
- Information on the measuring system's resistance to vibration and shock → 184

*Installation of very heavy devices*

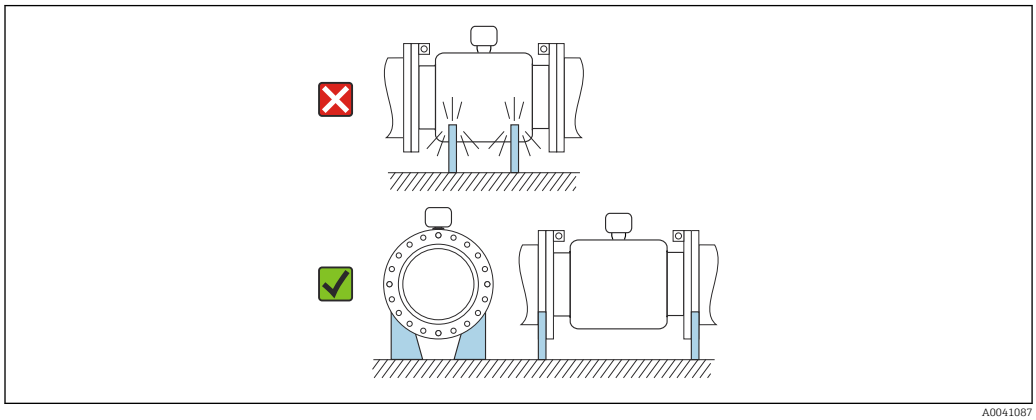
Support required for nominal diameters of DN ≥ 350 mm (14 in).

NOTICE

**Damage to the device!**

If incorrect support is provided, the sensor housing could buckle and the internal magnetic coils could be damaged.

- ▶ Only provide supports at the pipe flanges.



A0041087

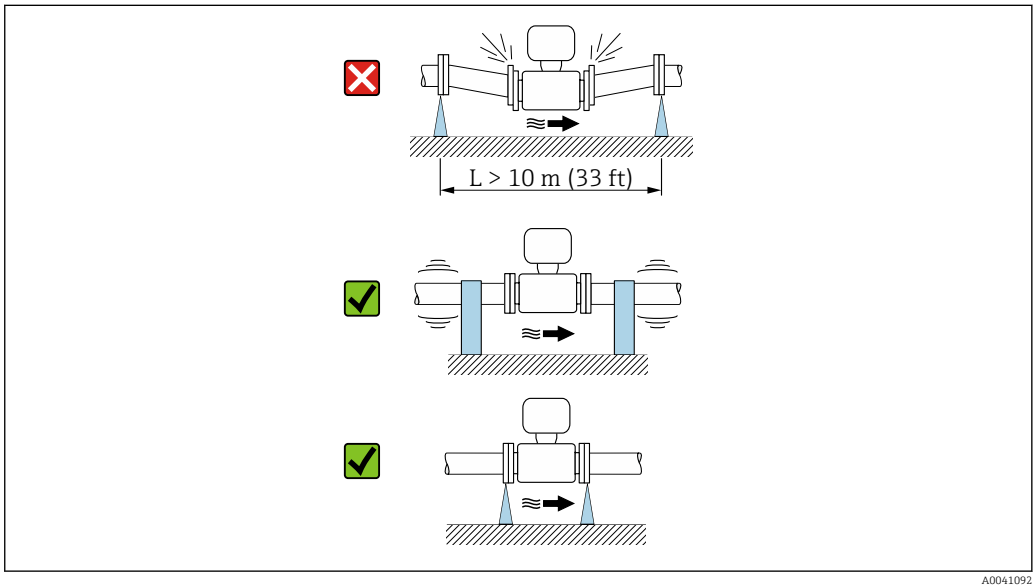
*Installation in event of pipe vibrations*

A remote version is recommended in the event of strong pipe vibrations.

**NOTICE**

**Pipe vibrations can damage the device!**

- Do not expose the device to strong vibrations.
- Support the pipe and fix it in place.
- Support the device and fix it in place.
- Mount the sensor and transmitter separately.

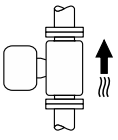
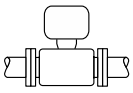


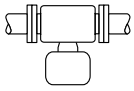
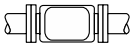

A0041092

Information on the measuring system's resistance to vibration and shock → 184

## Orientation

The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

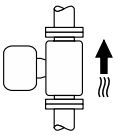
| Orientation | | Recommendation |
|---|---|---|
| Vertical orientation |  A0015591 | ✓✓ |
| Horizontal orientation, transmitter at top |  A0015589 | ✓✓ [1] |

| Orientation | | Recommendation |
|---|---|---|
| Horizontal orientation, transmitter at bottom |  A0015590 | ✓✓ 2) 3) ✗ 4) |
| Horizontal orientation, transmitter at side |  A0015592 | ✗ |

1) Applications with low process temperatures may reduce the ambient temperature. To maintain the minimum ambient temperature for the transmitter, this orientation is recommended.
2) Applications with high process temperatures may increase the ambient temperature. To maintain the maximum ambient temperature for the transmitter, this orientation is recommended.
3) To prevent the electronics from overheating in the event of strong heat formation (e.g. CIP or SIP cleaning process), install the device with the transmitter part pointing downwards.
4) When the empty pipe detection function is switched on, empty pipe detection only works if the transmitter housing is pointing upwards.

*Vertical*

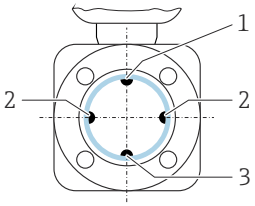
Optimum for self-emptying pipe systems and for use in conjunction with empty pipe detection.



A0015591

*Horizontal*

- Ideally, the measuring electrode plane should be horizontal. This prevents brief insulation of the measuring electrodes by entrained air bubbles.
- Empty pipe detection only works if the transmitter housing is pointing upwards as otherwise there is no guarantee that the empty pipe detection function will actually respond to a partially filled or empty measuring tube.




A0029344

*1 EPD electrode for empty pipe detection*
*2 Measuring electrodes for signal detection*
*3 Reference electrode for potential equalization*

## Inlet and outlet runs

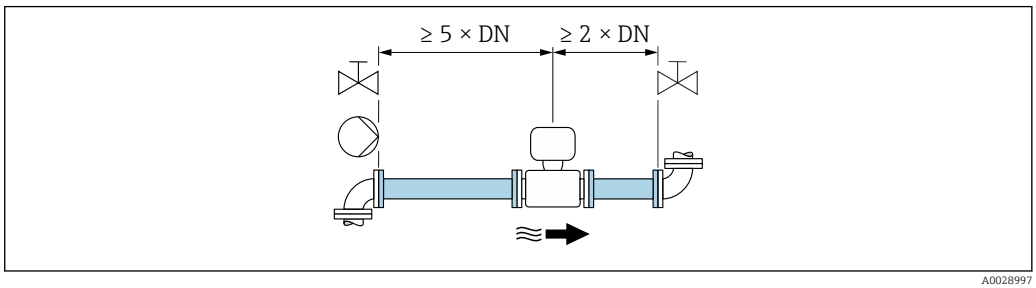
*Installation with inlet and outlet runs*

Installation requires inlet and outlet runs: devices with the order code for "Design", option D, E, F and G.

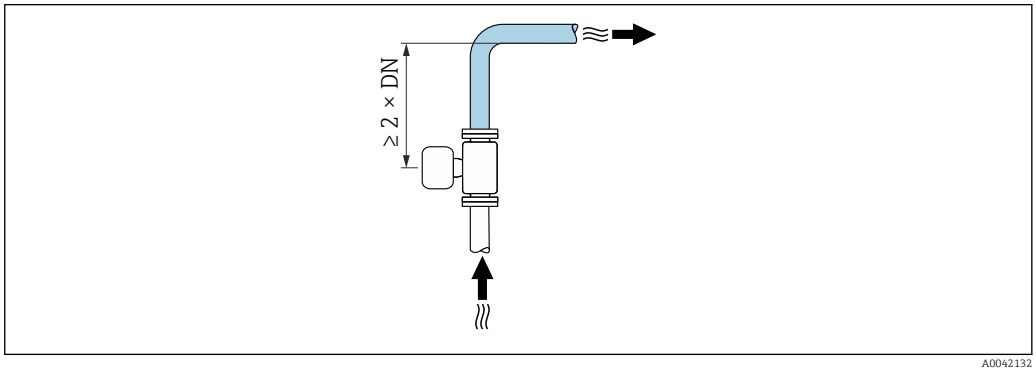
*Installation with elbows, pumps or valves*

To avoid a vacuum and to maintain the specified level of accuracy, if possible install the device upstream from assemblies that produce turbulence (e.g. valves, T-sections) and downstream from pumps.

Maintain straight, unimpeded inlet and outlet runs.




A0028997




A0042132

*Installation without inlet and outlet runs*

Depending on the device design and installation location, the inlet and outlet runs can be reduced or omitted entirely.

**Maximum measured error**
When the device is installed with the inlet and outlet runs described, a maximum measured error of ±0.5 % of the reading ±1 mm/s (0.04 in/s) can be guaranteed.

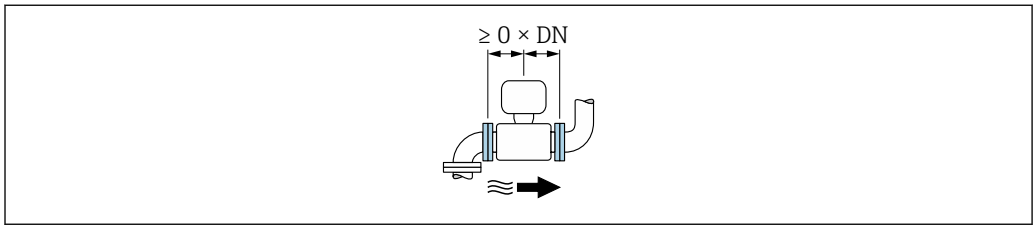
*Devices and possible order options*

| Order code for "Design" | | |
|---|---|---|
| **Option** | **Description** | **Design** |
| C | Fixed flange, constricted measuring tube, 0 x DN inlet/outlet runs | Constricted measuring tube [1] |
| H | Lap joint flange, 0 x DN inlet/outlet runs | Full Bore [2] |
| I | Fixed flange, 0 x DN inlet/outlet runs | |
| J | Fixed flange, short installed length, 0 x DN inlet/ outlet runs | |
| K | Fixed flange, long installed length, 0 x DN inlet/ outlet runs | |

1) "Constricted measuring tube" stands for a reduction of the internal diameter of the measuring tube. The reduced internal diameter causes a higher flow velocity inside the measuring tube.
2) "Full Bore" stands for the full diameter of the measuring tube. There is no pressure loss with a full diameter.

*Installation before or after bends*

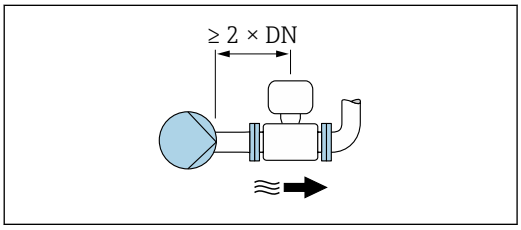
Installation without inlet and outlet runs is possible: devices with the order code for "Design", option C, H, I, J and K.




*Installation downstream of pumps*

Installation without inlet and outlet runs is possible: devices with the order code for "Design", option C, H and I.

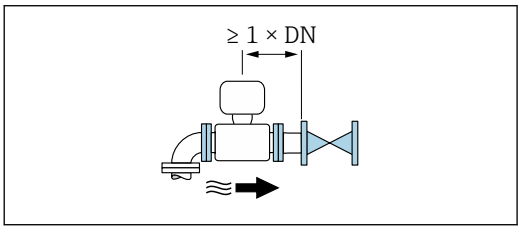
In the case of devices with the order code for "Design", option J and K, an inlet run of only ≥ 2 x DN must be taken into consideration.




*Installation upstream of valves*

Installation without inlet and outlet runs is possible: devices with the order code for "Design", option C, H and I.

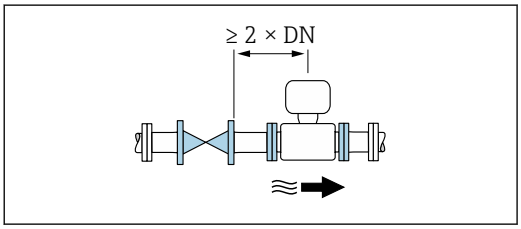
In the case of devices with the order code for "Design", option J and K, an outlet run of only ≥ 1 x DN must be taken into consideration.




*Installation downstream of valves*

Installation without inlet and outlet runs is possible if the valve is 100% open during operation: devices with the order code for "Design", option C, H and I.

In the case of devices with the order code for "Design", option J and K, an inlet run of only ≥ 2 x DN must be taken into consideration if the valve is 100% open during operation.




**Dimensions**

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

## 6.1.2 Environment and process requirements

### Ambient temperature range

| | |
|---|---|
| Transmitter | Standard: −40 to +60 °C (−40 to +140 °F) |
| Local display | −20 to +60 °C (−4 to +140 °F), the readability of the display may be impaired at temperatures outside the temperature range. |
| Sensor | ▪ Process connection material, carbon steel: −10 to +60 °C (+14 to +140 °F)<br>▪ Process connection material, stainless steel: −40 to +60 °C (−40 to +140 °F) |
| Liner | Do not exceed or fall below the permitted temperature range of the liner . |

If operating outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.

### System pressure

Installation near pumps → 22

### Vibrations

Installation in event of pipe vibrations → 23

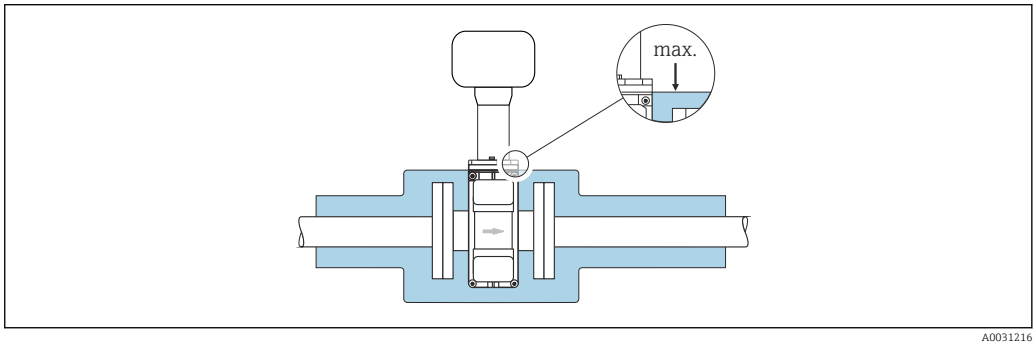
### Thermal insulation

If process fluids are very hot, it is necessary to insulate pipes in order to reduce energy loss and to prevent individuals from accidentally coming into contact with hot pipes. Please observe the applicable standards and guidelines for insulating pipes.

**⚠ WARNING**

**Electronics overheating on account of thermal insulation!**

▶ The housing support is used for heat dissipation and must be completely free (i.e. uncovered). At the very maximum, the sensor insulation may extend as far as the upper edge of the two sensor half-shells.




A0031216

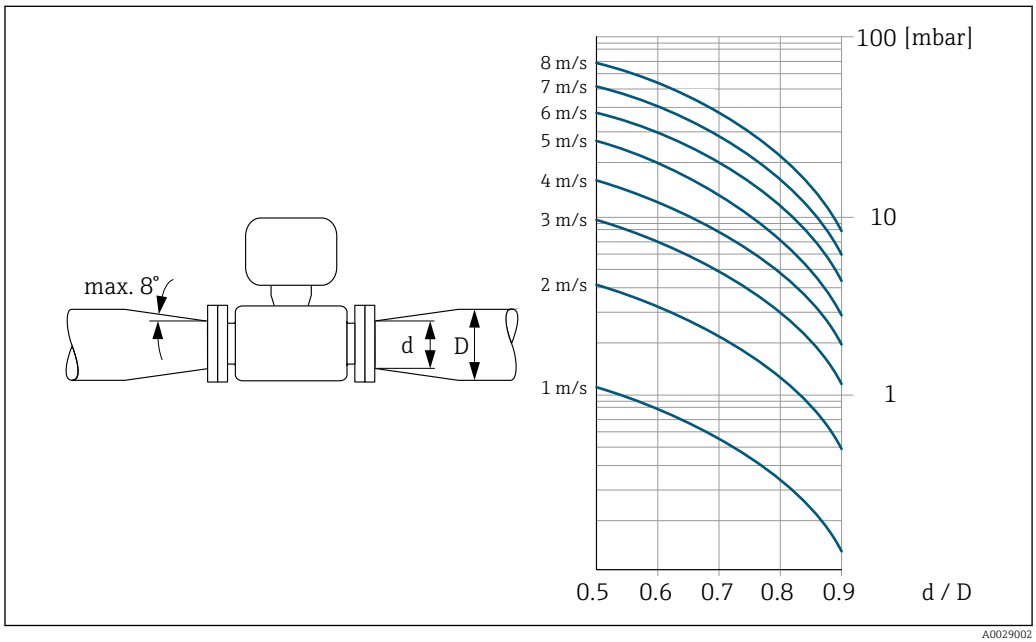
### Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring

accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

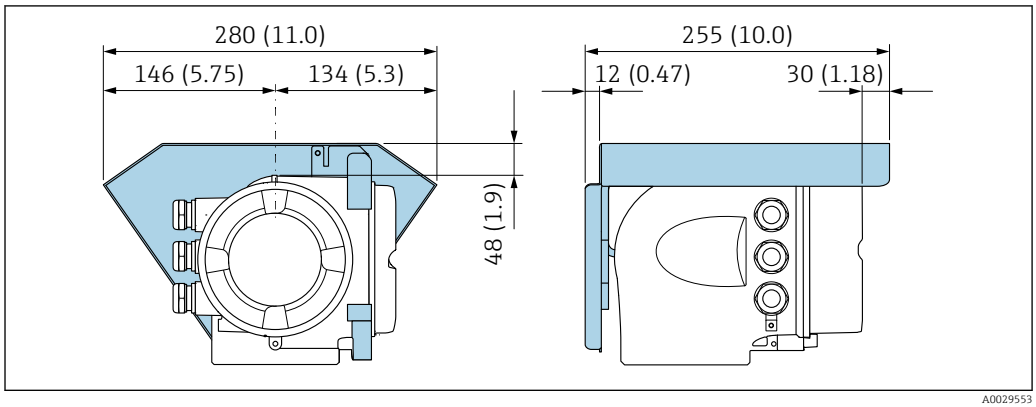
The nomogram only applies to liquids with a viscosity similar to that of water.

1. Calculate the ratio of the diameters d/D.
2. From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.




### 6.1.3 Special mounting instructions

#### Weather protection cover




4 *Engineering unit mm (in)*

## 6.2 Mounting the measuring device

### 6.2.1 Required tools

#### For sensor

For flanges and other process connections: use a suitable mounting tool

### 6.2.2 Preparing the measuring device

1. Remove all remaining transport packaging.
2. Remove any protective covers or protective caps present from the sensor.
3. Remove stick-on label on the electronics compartment cover.

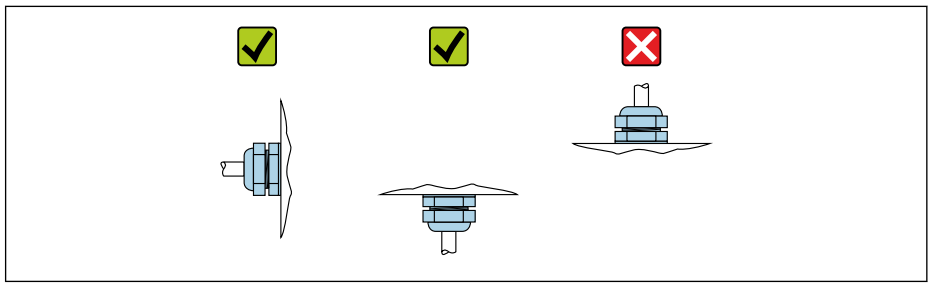
### 6.2.3 Mounting the sensor

**⚠ WARNING**

**Danger due to improper process sealing!**

- ▶ Ensure that the inside diameters of the gaskets are greater than or equal to that of the process connections and piping.
- ▶ Ensure that the seals are clean and undamaged.
- ▶ Secure the seals correctly.

1. Ensure that the direction of the arrow on the sensor matches the flow direction of the medium.
2. To ensure compliance with device specifications, install the measuring device between the pipe flanges in a way that it is centered in the measurement section.
3. If using ground disks, comply with the Installation Instructions provided.
4. Observe the necessary screw tightening torques → 30.
5. Install the measuring device or turn the transmitter housing so that the cable entries do not point upwards.



A0029263

#### Mounting the seals

**⚠ CAUTION**

**An electrically conductive layer could form on the inside of the measuring tube!**
Risk of measuring signal short circuit.

- ▶ Do not use electrically conductive sealing compounds such as graphite.

Comply with the following instructions when installing seals:

1. Make sure that the seals do not protrude into the piping cross-section.
2. For DIN flanges: only use seals according to DIN EN 1514-1.
3. For a "hard rubber" liner: additional seals are **always** required.
4. For a "polyurethane" liner: additional seals are generally **not** required.

#### Mounting the ground cable/ground disks

Comply with the information on potential equalization and detailed mounting instructions for the use of ground cables/ground disks .

### Screw tightening torques

Please note the following:
- The screw tightening torques listed below apply only to lubricated threads and to pipes not subjected to tensile stress.
- Tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing surface or damage the seal.
- For hard rubber liners, seals made of rubber or rubber-like materials are recommended.

Nominal screw tightening torques → 35

NOTICE

**Insufficient sealing!**

Operational reliability of the measuring device could be compromised. Overtightening the screws can deform or damage the liner in the area of the sealing surface.

► The values for the screw tightening torques depend on variables such as the seal, screws, lubricants, tightening methods etc. These variables are outside the control of the manufacturer. The values indicated are therefore guideline values only.

*Maximum screw tightening torques*

*Maximum screw tightening torques for EN 1092-1 (DIN 2501)*

| Nominal diameter | | Pressure rating | Screws | Flange thickness | Max. screw tightening torque [Nm] | | |
|---|---|---|---|---|---|---|---|
| [mm] | [in] | [bar] | [mm] | [mm] | HG | PUR | PTFE |
| 25 | 1 | PN 40 | 4 × M12 | 18 | – | 15 | 26 |
| 32 | – | PN 40 | 4 × M16 | 18 | – | 24 | 41 |
| 40 | 1 ½ | PN 40 | 4 × M16 | 18 | – | 31 | 52 |
| 50 | 2 | PN 40 | 4 × M16 | 20 | 48 | 40 | 65 |
| 65 [1)] | – | PN 16 | 8 × M16 | 18 | 32 | 27 | 44 |
| 65 | – | PN 40 | 8 × M16 | 22 | 32 | 27 | 44 |
| 80 | 3 | PN 16 | 8 × M16 | 20 | 40 | 34 | 53 |
| | | PN 40 | 8 × M16 | 24 | 40 | 34 | 53 |
| 100 | 4 | PN 16 | 8 × M16 | 20 | 43 | 36 | 57 |
| | | PN 40 | 8 × M20 | 24 | 59 | 50 | 79 |
| 125 | – | PN 16 | 8 × M16 | 22 | 56 | 48 | 75 |
| | | PN 40 | 8 × M24 | 26 | 83 | 71 | 112 |
| 150 | 6 | PN 16 | 8 × M20 | 22 | 74 | 63 | 99 |
| | | PN 40 | 8 × M24 | 28 | 104 | 88 | 137 |
| 200 | 8 | PN 10 | 8 × M20 | 24 | 106 | 91 | 141 |
| | | PN 16 | 12 × M20 | 24 | 70 | 61 | 94 |
| | | PN 25 | 12 × M24 | 30 | 104 | 92 | 139 |
| 250 | 10 | PN 10 | 12 × M20 | 26 | 82 | 71 | 110 |
| | | PN 16 | 12 × M24 | 26 | 98 | 85 | 132 |
| | | PN 25 | 12 × M27 | 32 | 150 | 134 | 201 |
| 300 | 12 | PN 10 | 12 × M20 | 26 | 94 | 81 | 126 |
| | | PN 16 | 12 × M24 | 28 | 134 | 118 | 179 |
| | | PN 25 | 16 × M27 | 34 | 153 | 138 | 204 |
| 350 | 14 | PN 6 | 12 × M20 | 22 | 111 | 120 | – |

| Nominal diameter | | Pressure rating | Screws | Flange thickness | Max. screw tightening torque [Nm] | | |
|---|---|---|---|---|---|---|---|
| [mm] | [in] | [bar] | [mm] | [mm] | HG | PUR | PTFE |
| | | PN 10 | 16 × M20 | 26 | 112 | 118 | – |
| | | PN 16 | 16 × M24 | 30 | 152 | 165 | – |
| | | PN 25 | 16 × M30 | 38 | 227 | 252 | – |
| 400 | 16 | PN 6 | 16 × M20 | 22 | 90 | 98 | – |
| | | PN 10 | 16 × M24 | 26 | 151 | 167 | – |
| | | PN 16 | 16 × M27 | 32 | 193 | 215 | – |
| | | PN 25 | 16 × M33 | 40 | 289 | 326 | – |
| 450 | 18 | PN 6 | 16 × M20 | 22 | 112 | 126 | – |
| | | PN 10 | 20 × M24 | 28 | 153 | 133 | – |
| | | PN 16 | 20 × M27 | 40 | 198 | 196 | – |
| | | PN 25 | 20 × M33 | 46 | 256 | 253 | – |
| 500 | 20 | PN 6 | 20 × M20 | 24 | 119 | 123 | – |
| | | PN 10 | 20 × M24 | 28 | 155 | 171 | – |
| | | PN 16 | 20 × M30 | 34 | 275 | 300 | – |
| | | PN 25 | 20 × M33 | 48 | 317 | 360 | – |
| 600 | 24 | PN 6 | 20 × M24 | 30 | 139 | 147 | – |
| | | PN 10 | 20 × M27 | 28 | 206 | 219 | – |
| 600 | 24 | PN 16 | 20 × M33 | 36 | 415 | 443 | – |
| 600 | 24 | PN 25 | 20 × M36 | 58 | 431 | 516 | – |
| 700 | 28 | PN 6 | 24 × M24 | 24 | 148 | 139 | – |
| | | PN 10 | 24 × M27 | 30 | 246 | 246 | – |
| | | PN 16 | 24 × M33 | 36 | 278 | 318 | – |
| | | PN 25 | 24 × M39 | 46 | 449 | 507 | – |
| 800 | 32 | PN 6 | 24 × M27 | 24 | 206 | 182 | – |
| | | PN 10 | 24 × M30 | 32 | 331 | 316 | – |
| | | PN 16 | 24 × M36 | 38 | 369 | 385 | – |
| | | PN 25 | 24 × M45 | 50 | 664 | 721 | – |
| 900 | 36 | PN 6 | 24 × M27 | 26 | 230 | 637 | – |
| | | PN 10 | 28 × M30 | 34 | 316 | 307 | – |
| | | PN 16 | 28 × M36 | 40 | 353 | 398 | – |
| | | PN 25 | 28 × M45 | 54 | 690 | 716 | – |
| 1000 | 40 | PN 6 | 28 × M27 | 26 | 218 | 208 | – |
| | | PN 10 | 28 × M33 | 34 | 402 | 405 | – |
| | | PN 16 | 28 × M39 | 42 | 502 | 518 | – |
| | | PN 25 | 28 × M52 | 58 | 970 | 971 | – |
| 1200 | 48 | PN 6 | 32 × M30 | 28 | 319 | 299 | – |
| | | PN 10 | 32 × M36 | 38 | 564 | 568 | – |
| | | PN 16 | 32 × M45 | 48 | 701 | 753 | – |
| 1400 | – | PN 6 | 36 × M33 | 32 | 430 | – | – |
| | | PN 10 | 36 × M39 | 42 | 654 | – | – |
| | | PN 16 | 36 × M45 | 52 | 729 | – | – |

| Nominal diameter | | Pressure rating | Screws | Flange thickness | Max. screw tightening torque [Nm] | | |
|---|---|---|---|---|---|---|---|
| [mm] | [in] | [bar] | [mm] | [mm] | HG | PUR | PTFE |
| 1600 | – | PN 6 | 40 × M33 | 34 | 440 | – | – |
| | | PN 10 | 40 × M45 | 46 | 946 | – | – |
| | | PN 16 | 40 × M52 | 58 | 1007 | – | – |
| 1800 | 72 | PN 6 | 44 × M36 | 36 | 547 | – | – |
| | | PN 10 | 44 × M45 | 50 | 961 | – | – |
| | | PN 16 | 44 × M52 | 62 | 1108 | – | – |
| 2000 | – | PN 6 | 48 × M39 | 38 | 629 | – | – |
| | | PN 10 | 48 × M45 | 54 | 1047 | – | – |
| | | PN 16 | 48 × M56 | 66 | 1324 | – | – |
| 2200 | – | PN 6 | 52 × M39 | 42 | 698 | – | – |
| | | PN 10 | 52 × M52 | 58 | 1217 | – | – |
| 2400 | – | PN 6 | 56 × M39 | 44 | 768 | – | – |
| | | PN 10 | 56 × M52 | 62 | 1229 | – | – |

1) Sizing as per EN 1092-1 (not DIN 2501)

*Maximum screw tightening torques for ASME B16.5*

| Nominal diameter | | Pressure rating | Screws | Max. screw tightening torque | | | |
|---|---|---|---|---|---|---|---|
| | | | | HG | | PUR | |
| [mm] | [in] | [psi] | [in] | [Nm] | [lbf · ft] | [Nm] | [lbf · ft] |
| 25 | 1 | Class 150 | 4 × ½ | – | – | 7 | 5 |
| 25 | 1 | Class 300 | 4 × 5/8 | – | – | 8 | 6 |
| 40 | 1 ½ | Class 150 | 4 × ½ | – | – | 10 | 7 |
| 40 | 1 ½ | Class 300 | 4 × ¾ | – | – | 15 | 11 |
| 50 | 2 | Class 150 | 4 × 5/8 | 35 | 26 | 22 | 16 |
| 50 | 2 | Class 300 | 8 × 5/8 | 18 | 13 | 11 | 8 |
| 80 | 3 | Class 150 | 4 × 5/8 | 60 | 44 | 43 | 32 |
| 80 | 3 | Class 300 | 8 × ¾ | 38 | 28 | 26 | 19 |
| 100 | 4 | Class 150 | 8 × 5/8 | 42 | 31 | 31 | 23 |
| 100 | 4 | Class 300 | 8 × ¾ | 58 | 43 | 40 | 30 |
| 150 | 6 | Class 150 | 8 × ¾ | 79 | 58 | 59 | 44 |
| 150 | 6 | Class 300 | 12 × ¾ | 70 | 52 | 51 | 38 |
| 200 | 8 | Class 150 | 8 × ¾ | 107 | 79 | 80 | 59 |
| 250 | 10 | Class 150 | 12 × 7/8 | 101 | 74 | 75 | 55 |
| 300 | 12 | Class 150 | 12 × 7/8 | 133 | 98 | 103 | 76 |
| 350 | 14 | Class 150 | 12 × 1 | 135 | 100 | 158 | 117 |
| 400 | 16 | Class 150 | 16 × 1 | 128 | 94 | 150 | 111 |
| 450 | 18 | Class 150 | 16 × 1 1/8 | 204 | 150 | 234 | 173 |
| 500 | 20 | Class 150 | 20 × 1 1/8 | 183 | 135 | 217 | 160 |
| 600 | 24 | Class 150 | 20 × 1 ¼ | 268 | 198 | 307 | 226 |

*Maximum screw tightening torques for JIS B2220*

| Nominal diameter | Pressure rating | Screws | Max. screw tightening torque [Nm] | |
|---|---|---|---|---|
| [mm] | [bar] | [mm] | HG | PUR |
| 25 | 10K | 4 × M16 | – | 19 |
| 25 | 20K | 4 × M16 | – | 19 |
| 32 | 10K | 4 × M16 | – | 22 |
| 32 | 20K | 4 × M16 | – | 22 |
| 40 | 10K | 4 × M16 | – | 24 |
| 40 | 20K | 4 × M16 | – | 24 |
| 50 | 10K | 4 × M16 | 40 | 33 |
| 50 | 20K | 8 × M16 | 20 | 17 |
| 65 | 10K | 4 × M16 | 55 | 45 |
| 65 | 20K | 8 × M16 | 28 | 23 |
| 80 | 10K | 8 × M16 | 29 | 23 |
| 80 | 20K | 8 × M20 | 42 | 35 |
| 100 | 10K | 8 × M16 | 35 | 29 |
| 100 | 20K | 8 × M20 | 56 | 48 |
| 125 | 10K | 8 × M20 | 60 | 51 |
| 125 | 20K | 8 × M22 | 91 | 79 |
| 150 | 10K | 8 × M20 | 75 | 63 |
| 150 | 20K | 12 × M22 | 81 | 72 |
| 200 | 10K | 12 × M20 | 61 | 52 |
| 200 | 20K | 12 × M22 | 91 | 80 |
| 250 | 10K | 12 × M22 | 100 | 87 |
| 250 | 20K | 12 × M24 | 159 | 144 |
| 300 | 10K | 16 × M22 | 74 | 63 |
| 300 | 20K | 16 × M24 | 138 | 124 |

*Maximum screw tightening torques for AWWA C207, Class D*

| Nominal diameter | | Screws | Max. screw tightening torque | | | |
|---|---|---|---|---|---|---|
| [mm] | [in] | [in] | HG | | PUR | |
| | | | [Nm] | [lbf · ft] | [Nm] | [lbf · ft] |
| 700 | 28 | 28 × 1 ¼ | 247 | 182 | 292 | 215 |
| 750 | 30 | 28 × 1 ¼ | 287 | 212 | 302 | 223 |
| 800 | 32 | 28 × 1 ½ | 394 | 291 | 422 | 311 |
| 900 | 36 | 32 × 1 ½ | 419 | 309 | 430 | 317 |
| 1000 | 40 | 36 × 1 ½ | 420 | 310 | 477 | 352 |
| – | 42 | 36 × 1 ½ | 528 | 389 | 518 | 382 |
| – | 48 | 44 × 1 ½ | 552 | 407 | 531 | 392 |
| – | 54 | 44 × 1 ¾ | 730 | 538 | – | – |
| – | 60 | 52 × 1 ¾ | 758 | 559 | – | – |
| – | 66 | 52 × 1 ¾ | 946 | 698 | – | – |
| – | 72 | 60 × 1 ¾ | 975 | 719 | – | – |

| Nominal diameter | | Screws | Max. screw tightening torque | | | |
|---|---|---|---|---|---|---|
| [mm] | [in] | [in] | HG | | PUR | |
| | | | [Nm] | [lbf · ft] | [Nm] | [lbf · ft] |
| – | 78 | 64 × 2 | 853 | 629 | – | – |
| – | 84 | 64 x 2 | 931 | 687 | – | – |
| – | 90 | 64 x 2 ¼ | 1048 | 773 | – | – |

*Maximum screw tightening torques for AS 2129, Table E*

| Nominal diameter | Screws | Max. screw tightening torque [Nm] | |
|---|---|---|---|
| [mm] | [mm] | HG | PUR |
| 50 | 4 × M16 | 32 | – |
| 80 | 4 × M16 | 49 | – |
| 100 | 8 × M16 | 38 | – |
| 150 | 8 × M20 | 64 | – |
| 200 | 8 × M20 | 96 | – |
| 250 | 12 × M20 | 98 | – |
| 300 | 12 × M24 | 123 | – |
| 350 | 12 × M24 | 203 | – |
| 400 | 12 × M24 | 226 | – |
| 450 | 16 × M24 | 226 | – |
| 500 | 16 × M24 | 271 | – |
| 600 | 16 × M30 | 439 | – |
| 700 | 20 × M30 | 355 | – |
| 750 | 20 × M30 | 559 | – |
| 800 | 20 × M30 | 631 | – |
| 900 | 24 × M30 | 627 | – |
| 1000 | 24 × M30 | 634 | – |
| 1200 | 32 × M30 | 727 | – |

*Maximum screw tightening torques for AS 4087, PN 16*

| Nominal diameter | Screws | Max. screw tightening torque [Nm] | |
|---|---|---|---|
| [mm] | [mm] | HG | PUR |
| 50 | 4 × M16 | 32 | – |
| 80 | 4 × M16 | 49 | – |
| 100 | 4 × M16 | 76 | – |
| 150 | 8 × M20 | 52 | – |
| 200 | 8 × M20 | 77 | – |
| 250 | 8 × M20 | 147 | – |
| 300 | 12 × M24 | 103 | – |
| 350 | 12 × M24 | 203 | – |
| 375 | 12 × M24 | 137 | – |
| 400 | 12 × M24 | 226 | – |

| Nominal diameter [mm] | Screws [mm] | Max. screw tightening torque [Nm] | |
|---|---|---|---|
| | | HG | PUR |
| 450 | 12 × M24 | 301 | – |
| 500 | 16 × M24 | 271 | – |
| 600 | 16 × M27 | 393 | – |
| 700 | 20 × M27 | 330 | – |
| 750 | 20 × M30 | 529 | – |
| 800 | 20 × M33 | 631 | – |
| 900 | 24 × M33 | 627 | – |
| 1000 | 24 × M33 | 595 | – |
| 1200 | 32 × M33 | 703 | – |

*Nominal screw tightening torques*

*Nominal screw tightening torques for EN 1092-1 (DIN 2501); calculated according to EN 1591-1:2014 for flanges according to EN 1092-1:2013*

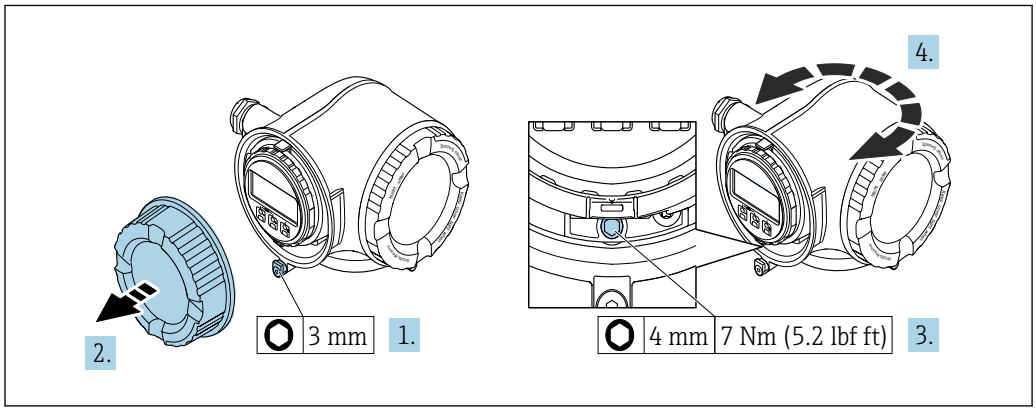
| Nominal diameter | | Pressure rating | Screws | Flange thickness | Nom. screw tightening torque [Nm] | | |
|---|---|---|---|---|---|---|---|
| [mm] | [in] | [bar] | [mm] | [mm] | HG | PUR | PTFE |
| 1000 | 40 | PN 6 | 28 × M27 | 38 | 175 | 185 | – |
| | | PN 10 | 28 × M33 | 44 | 350 | 360 | – |
| | | PN 16 | 28 × M39 | 59 | 630 | 620 | – |
| | | PN 25 | 28 × M52 | 63 | 1300 | 1290 | – |
| 1200 | 48 | PN 6 | 32 × M30 | 42 | 235 | 250 | – |
| | | PN 10 | 32 × M36 | 55 | 470 | 480 | – |
| | | PN 16 | 32 × M45 | 78 | 890 | 900 | – |
| 1400 | – | PN 6 | 36 × M33 | 56 | 300 | – | – |
| | | PN 10 | 36 × M39 | 65 | 600 | – | – |
| | | PN 16 | 36 × M45 | 84 | 1050 | – | – |
| 1600 | – | PN 6 | 40 × M33 | 63 | 340 | – | – |
| | | PN 10 | 40 × M45 | 75 | 810 | – | – |
| | | PN 16 | 40 × M52 | 102 | 1420 | – | – |
| 1800 | 72 | PN 6 | 44 × M36 | 69 | 430 | – | – |
| | | PN 10 | 44 × M45 | 85 | 920 | – | – |
| | | PN 16 | 44 × M52 | 110 | 1600 | – | – |
| 2000 | – | PN 6 | 48 × M39 | 74 | 530 | – | – |
| | | PN 10 | 48 × M45 | 90 | 1040 | – | – |
| | | PN 16 | 48 × M56 | 124 | 1900 | – | – |
| 2200 | – | PN 6 | 52 × M39 | 81 | 580 | – | – |
| | | PN 10 | 52 × M52 | 100 | 1290 | – | – |
| 2400 | – | PN 6 | 56 × M39 | 87 | 650 | – | – |
| | | PN 10 | 56 × M52 | 110 | 1410 | – | – |

*Nominal screw tightening torques for JIS B2220*

| Nominal diameter [mm] | Pressure rating [bar] | Screws [mm] | Nom. screw tightening torque [Nm] | |
|---|---|---|---|---|
| | | | HG | PUR |
| 350 | 10K | 16 × M22 | 109 | 109 |
| | 20K | 16 × M30×3 | 217 | 217 |
| 400 | 10K | 16 × M24 | 163 | 163 |
| | 20K | 16 × M30×3 | 258 | 258 |
| 450 | 10K | 16 × M24 | 155 | 155 |
| | 20K | 16 × M30×3 | 272 | 272 |
| 500 | 10K | 16 × M24 | 183 | 183 |
| | 20K | 16 × M30×3 | 315 | 315 |
| 600 | 10K | 16 × M30 | 235 | 235 |
| | 20K | 16 × M36×3 | 381 | 381 |
| 700 | 10K | 16 × M30 | 300 | 300 |
| 750 | 10K | 16 × M30 | 339 | 339 |

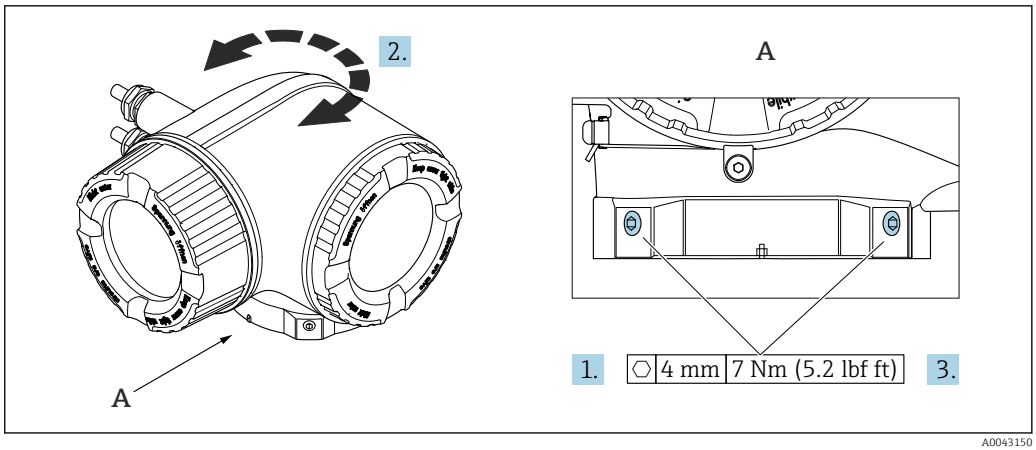
### 6.2.4 Turning the transmitter housing

To provide easier access to the connection compartment or display module, the transmitter housing can be turned.




5 *Non-Ex housing*

1. Depending on the device version: Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Loosen the securing screw.
4. Turn the housing to the desired position.
5. Tighten the securing screw.
6. Screw on the connection compartment cover.
7. Depending on the device version: Attach the securing clamp of the connection compartment cover.



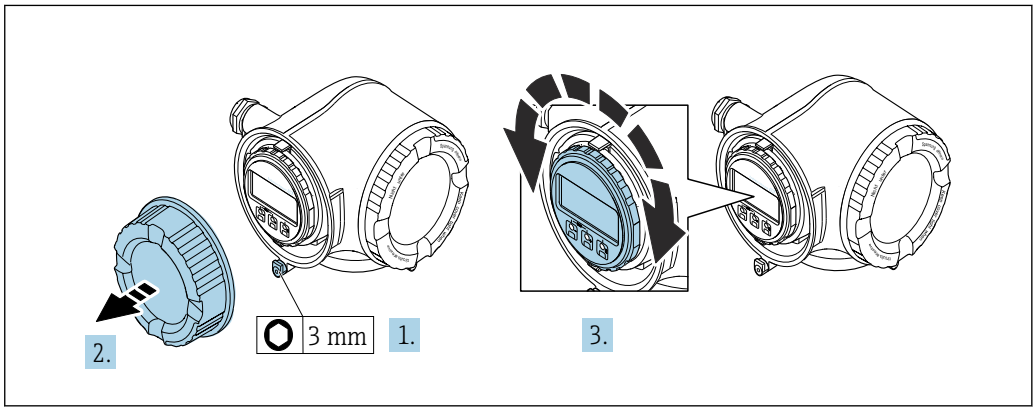

A0043150

6 *Ex housing*

1. Loosen the fixing screws.
2. Turn the housing to the desired position.
3. Tighten the securing screws.

### 6.2.5 Turning the display module

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




A0030035

1. Depending on the device version: Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Turn the display module to the desired position: max. 8 × 45° in each direction.
4. Screw on the connection compartment cover.
5. Depending on the device version: Attach the securing clamp of the connection compartment cover.

## 6.3 Post-installation check

| | |
|---|---|
| Is the device undamaged (visual inspection)? | ❑ |
| Does the measuring device conform to the measuring point specifications?<br><br>For example:<br>▪ Process temperature<br>▪ Process pressure (refer to the section on "Pressure-temperature ratings" in the "Technical Information" document )<br>▪ Ambient temperature<br>▪ Measuring range | ❑ |
| Has the correct orientation been selected for the sensor → 🖹 23 ?<br><br>▪ According to sensor type<br>▪ According to medium temperature<br>▪ According to medium properties (outgassing, with entrained solids) | ❑ |
| Does the arrow on the sensor nameplate match the actual direction of flow of the fluid through the piping → 🖹 23? | ❑ |
| Are the measuring point identification and labeling correct (visual inspection)? | ❑ |
| Is the device adequately protected from precipitation and direct sunlight? | ❑ |
| Have the fixing screws been tightened with the correct tightening torque? | ❑ |

# 7 Electrical connection

**⚠ WARNING**

**Live parts! Incorrect work performed on the electrical connections can result in an electric shock.**

- ▶ Set up a disconnecting device (switch or power-circuit breaker) to easily disconnect the device from the supply voltage.
- ▶ In addition to the device fuse, include an overcurrent protection unit with max. 10 A in the plant installation.

## 7.1 Electrical safety

In accordance with applicable national regulations.

## 7.2 Connecting requirements

### 7.2.1 Required tools

- For cable entries: Use corresponding tools
- For securing clamp: Allen key 3 mm
- Wire stripper
- When using stranded cables: Crimper for wire end ferrule
- For removing cables from terminal: Flat blade screwdriver ≤ 3 mm (0.12 in)

### 7.2.2 Requirements for connecting cable

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

**Protective grounding cable for the outer ground terminal**

Conductor cross-section < 2.1 $mm^2$ (14 AWG)

The use of a cable lug enables the connection of larger cross-sections.

The grounding impedance must be less than 2 Ω.

**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 4 to 20 mA HART*

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

*Current output 0/4 to 20 mA*

Standard installation cable is sufficient

*Pulse /frequency /switch output*

Standard installation cable is sufficient

*Double pulse output*

Standard installation cable is sufficient

*Relay output*

Standard installation cable is sufficient.

*Current input 0/4 to 20 mA*

Standard installation cable is sufficient

*Status input*

Standard installation cable is sufficient

### Cable diameter

- Cable glands supplied:
  M20 × 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in)
- Spring-loaded terminals: Suitable for strands and strands with ferrules.
  Conductor cross-section 0.2 to 2.5 mm² (24 to 12 AWG).

### Requirements for connecting cable – remote display and operating module DKX001

*Optionally available connecting cable*

A cable is supplied depending on the order option
- Order code for measuring device: order code **030** for "Display; operation", option **O**
  or
- Order code for measuring device: order code **030** for "Display; operation", option **M**
  and
- Order code for DKX001: order code **040** for "Cable", option **A, B, D, E**

| | |
|---|---|
| **Standard cable** | 2 × 2 × 0.34 mm² (22 AWG) PVC cable with common shield (2 pairs, pair-stranded) |
| **Flame resistance** | According to DIN EN 60332-1-2 |
| **Oil resistance** | According to DIN EN 60811-2-1 |
| **Shield** | Tin-plated copper braid, optical cover ≥ 85 % |
| **Capacitance: core/shield** | ≤ 200 pF/m |
| **L/R** | ≤ 24 µH/Ω |
| **Available cable length** | 5 m (15 ft)/10 m (35 ft)/20 m (65 ft)/30 m (100 ft) |
| **Operating temperature** | When mounted in a fixed position: –50 to +105 °C (–58 to +221 °F); when cable can move freely: –25 to +105 °C (–13 to +221 °F) |

*Standard cable - customer-specific cable*

With the following order option, no cable is supplied with the device and must be provided by the customer:
Order code for DKX001: Order code **040** for "Cable", option **1** "None, provided by customer, max 300 m"

A standard cable with the following minimum requirements can be used as the connecting cable, even in the hazardous area (Zone 2, Class I, Division 2 and Zone 1, Class I, Division 1):

| | |
|---|---|
| **Standard cable** | 4 wires (2 pairs); pair-stranded with common shield, minimum wire cross-section 0.34 mm² (22 AWG) |
| **Shield** | Tin-plated copper braid, optical cover ≥ 85 % |
| **Cable impedance (pair)** | Minimum 80 Ω |

| | |
|---|---|
| **Cable length** | Maximum 300 m (1 000 ft), maximum loop impedance 20 Ω |
| **Capacitance: core/shield** | Maximum 1 000 nF for Zone 1, Class I, Division 1 |
| **L/R** | Maximum 24 µH/Ω for Zone 1, Class I, Division 1 |

### 7.2.3 Terminal assignment

**Transmitter: supply voltage, input/outputs**

The terminal assignment of the inputs and outputs depends on the individual order version of the device. The device-specific terminal assignment is documented on an adhesive label in the terminal cover.

| Supply voltage | | Input/output 1 | | Input/output 2 | | Input/output 3 | |
|---|---|---|---|---|---|---|---|
| 1 (+) | 2 (–) | 26 (+) | 27 (–) | 24 (+) | 25 (–) | 22 (+) | 23 (–) |
| | | Device-specific terminal assignment: adhesive label in terminal cover. | | | | | |

Terminal assignment of the remote display and operating module → 45.

### 7.2.4 Preparing the measuring device

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 → 39.

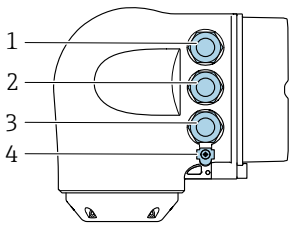
## 7.3 Connecting the measuring device

NOTICE

**Limitation of electrical safety due to incorrect connection!**

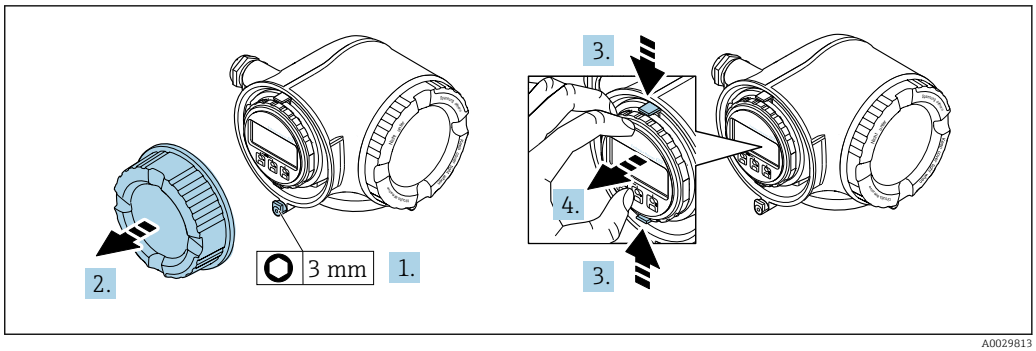
- Have electrical connection work carried out by appropriately trained specialists only.
- Observe applicable federal/national installation codes and regulations.
- Comply with local workplace safety regulations.
- Always connect the protective ground cable ⏚ before connecting additional cables.
- For use in potentially explosive atmospheres, observe the information in the device-specific Ex documentation.

### 7.3.1 Connecting the transmitter



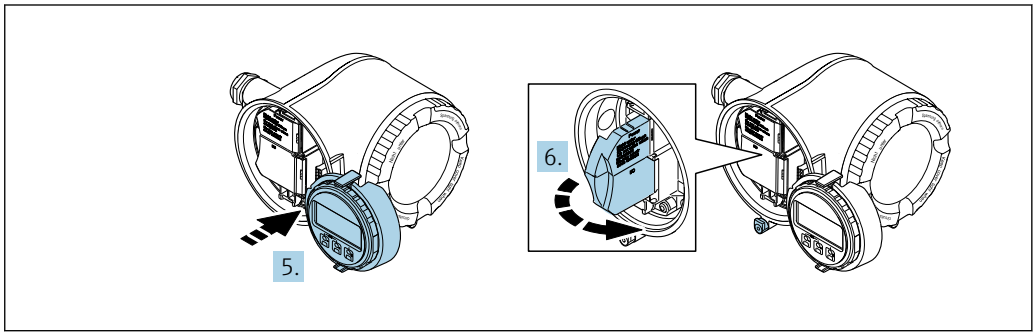

A0026781

1 *Terminal connection for supply voltage*
2 *Terminal connection for signal transmission, input/output*
3 *Terminal connection for signal transmission, input/output or terminal connection for network connection via service interface (CDI-RJ45); optional: connection for external WLAN antenna or remote display and operating module DKX001*
4 *Protective earth (PE)*



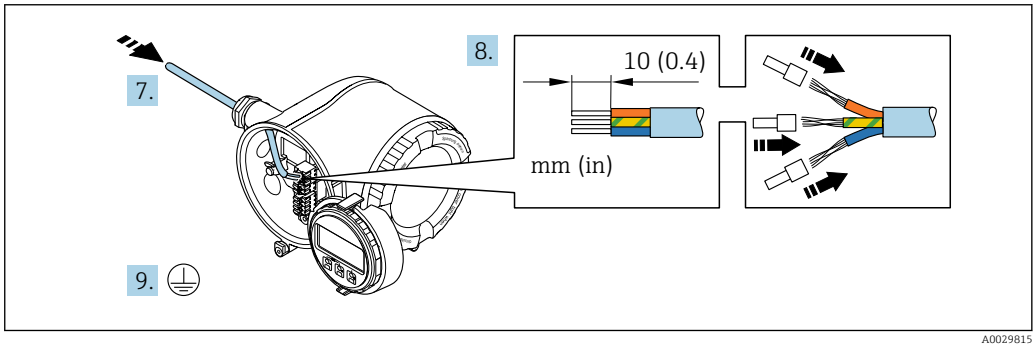

A0029813

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Squeeze the tabs of the display module holder together.
4. Remove the display module holder.



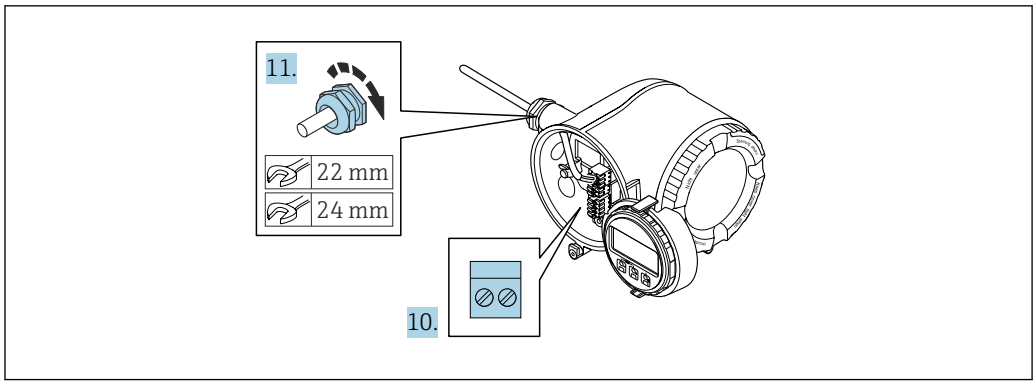

A0029814

5. Attach the holder to the edge of the electronics compartment.
6. Open the terminal cover.



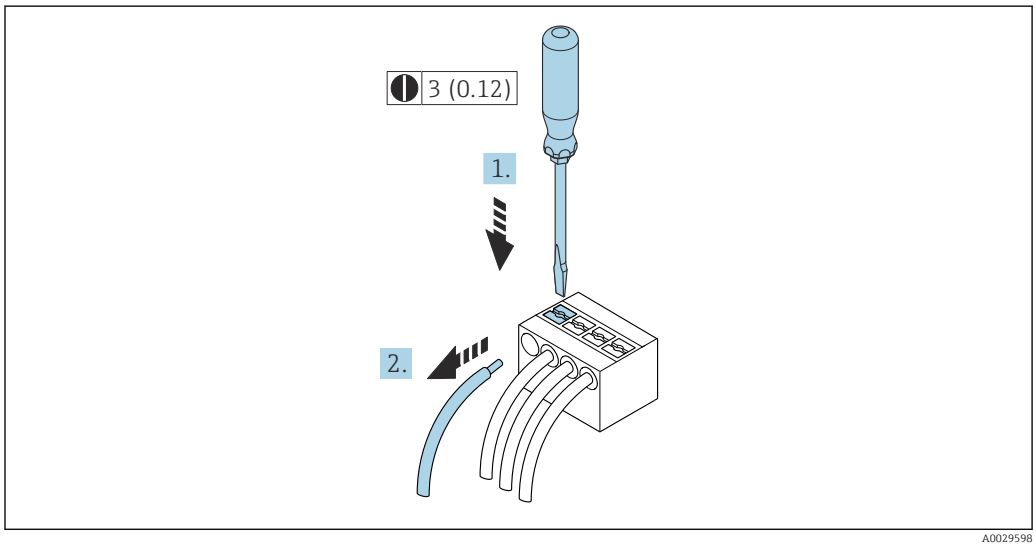

A0029815

7. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
8. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
9. Connect the protective ground.




10. Connect the cable according to the terminal assignment.
    ↳ **Signal cable terminal assignment:** The device-specific terminal assignment is documented on an adhesive label in the terminal cover.
    **Supply voltage terminal assignment:** Adhesive label in the terminal cover or → 📄 42.
11. Firmly tighten the cable glands.
    ↳ This concludes the cable connection process.
12. Close the terminal cover.
13. Fit the display module holder in the electronics compartment.
14. Screw on the connection compartment cover.
15. Secure the securing clamp of the connection compartment cover.

### Removing a cable



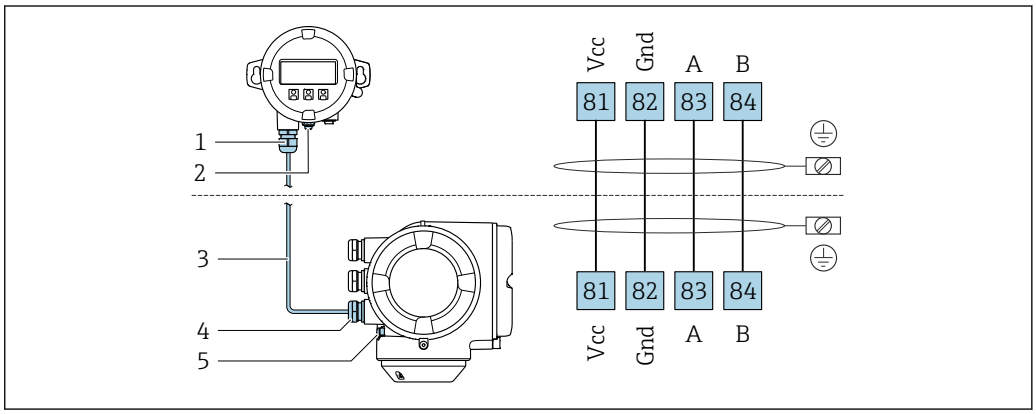

7 *Engineering unit mm (in)*

1. To remove a cable from the terminal, use a flat-blade screwdriver to push the slot between the two terminal holes
2. while simultaneously pulling the cable end out of the terminal.

### 7.3.2 Connecting the remote display and operating module DKX001

The remote display and operating module DKX001 is available as an optional extra → 165.

- The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring device. Display or operation at the transmitter is not possible in this case.
- If ordered subsequently, the remote display and operating module DKX001 may not be connected at the same time as the existing measuring device display module. Only one display or operation unit may be connected to the transmitter at any one time.




1 *Remote display and operating module DKX001*
2 *Terminal connection for potential equalization (PE)*
3 *Connecting cable*
4 *Measuring device*
5 *Terminal connection for potential equalization (PE)*

## 7.4 Ensuring potential equalization

### 7.4.1 Introduction

Correct potential equalization (equipotential bonding) is a prerequisite for stable and reliable flow measurement. Inadequate or incorrect potential equalization can result in device failure and present a safety hazard.

The following requirements must be observed to ensure correct, trouble-free measurement:

- The principle that the medium, the sensor and the transmitter must be at the same electrical potential applies.
- Take in-company grounding guidelines, materials and the grounding conditions and potential conditions of the pipe into consideration.
- The necessary potential equalization connections must be established using a ground cable with a minimum cross-section of 6 $mm^2$ (0.0093 $in^2$) and a cable lug.
- In the case of remote device versions, the ground terminal in the example always refers to the sensor and not to the transmitter.

You can order accessories such as ground cables and ground disks directly from Endress+Hauser → 165

For devices intended for use in hazardous areas, observe the instructions in the Ex documentation (XA).

**Abbreviations used**

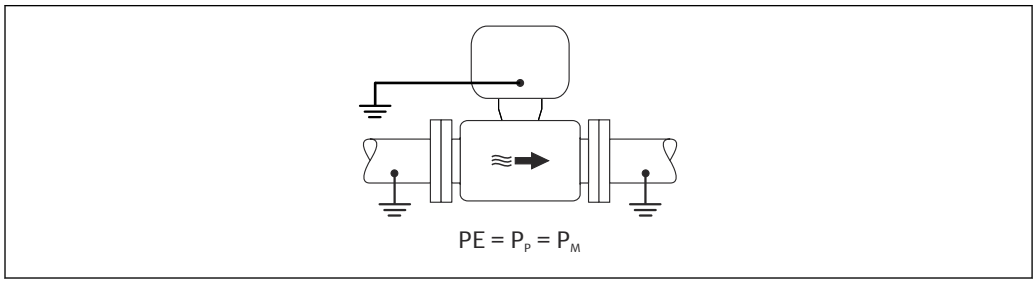
- PE (Protective Earth): potential at the protective earth terminals of the device
- $P_P$ (Potential Pipe): potential of the pipe, measured at the flanges
- $P_M$ (Potential Medium): potential of the medium

### 7.4.2 Connection examples for standard situations

**Unlined and grounded metal pipe**

- Potential equalization is via the measuring pipe.
- The medium is set to ground potential.

Starting conditions:
- Pipes are correctly grounded on both sides.
- Pipes are conductive and at the same electrical potential as the medium



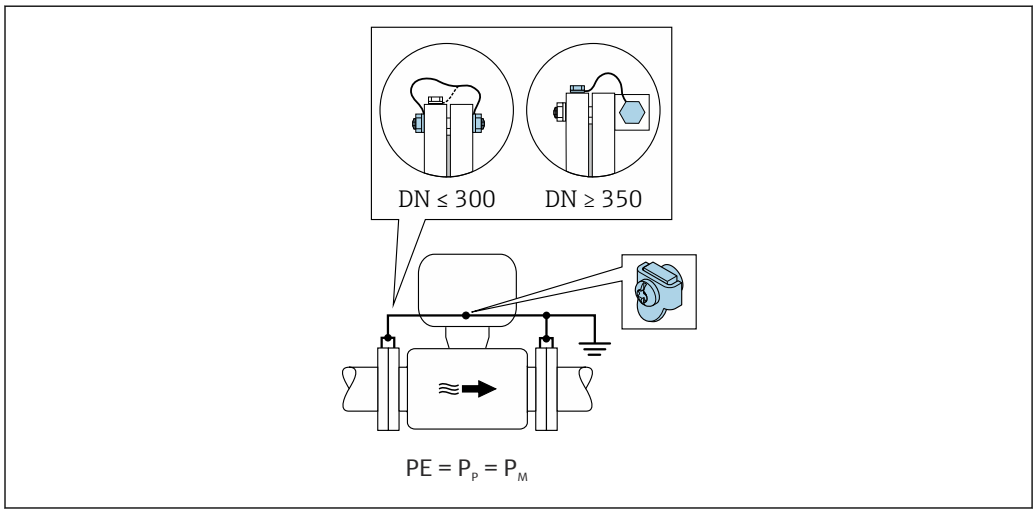

A0044854

▶ Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for this purpose.

**Metal pipe without liner**

- Potential equalization is via the ground terminal and pipe flanges.
- The medium is set to ground potential.

Starting conditions:
- Pipes are not sufficiently grounded.
- Pipes are conductive and at the same electrical potential as the medium



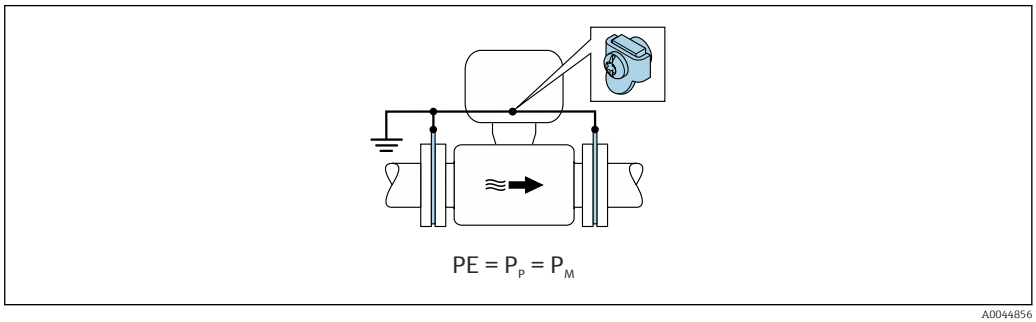

A0042089

1. Connect both sensor flanges to the pipe flange via a ground cable and ground them.
2. Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for this purpose.
3. For DN ≤ 300 (12"): Mount the ground cable directly on the conductive flange coating of the sensor with the flange screws.
4. For DN ≥ 350 (14"): Mount the ground cable directly on the metal transport bracket. Observe the screw tightening torques: see the Brief Operating Instructions for the sensor.

**Plastic pipe or pipe with insulating liner**

- Potential equalization is via the ground terminal and ground disks.
- The medium is set to ground potential.

Starting conditions:
- The pipe has an insulating effect.
- Low-impedance medium grounding close to the sensor is not guaranteed.
- Equalizing currents through the medium cannot be ruled out.




A0044856

1. Connect the ground disks to the ground terminal of the transmitter or sensor connection housing via the ground cable.
2. Connect the connection to ground potential.

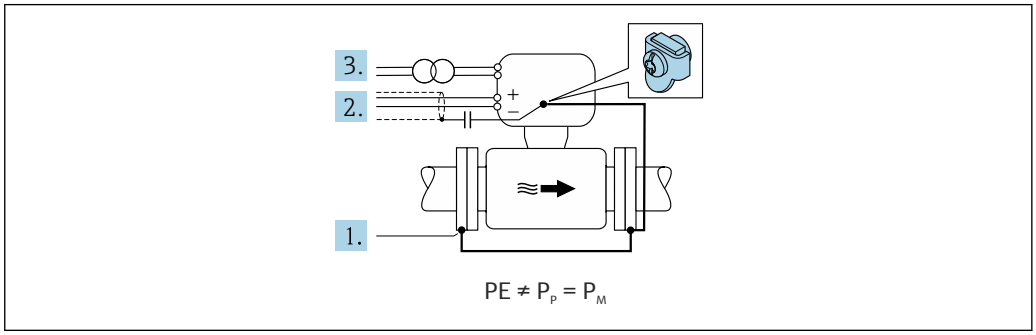
### 7.4.3 Connection example with the potential of medium not equal to protective ground without the "Floating measurement" option

In these cases, the medium potential can differ from the potential of the device.

**Metal, ungrounded pipe**

The sensor and transmitter are installed in a way that provides electrical insulation from PE, e.g. applications for electrolytic processes or systems with cathodic protection.

Starting conditions:
- Unlined metal pipe
- Pipes with an electrically conductive liner




A0042253

1. Connect the pipe flanges and transmitter via the ground cable.
2. Route the shielding of the signal lines via a capacitor (recommended value 1.5µF/ 50V).
3. Device connected to power supply such that it is floating in relation to the protective earth (isolation transformer). This measure is not required in the case of 24V DC supply voltage without PE (= SELV power unit).

### 7.4.4 Connection examples with the potential of medium not equal to protective ground with the "Floating measurement" option

In these cases, the medium potential can differ from the potential of the device.

#### Introduction

The "Floating measurement" option enables the galvanic isolation of the measuring system from the device potential. This minimizes harmful equalizing currents caused by differences in potential between the medium and the device. The "Floating measurement" option is optionally available: order code for "Sensor option", option CV

*Operating conditions for the use of the "Floating measurement" option*

| | |
|---|---|
| Device version | Compact version and remote version (length of connecting cable ≤ 10 m) |
| Differences in voltage between medium potential and device potential | As small as possible, usually in the mV range |
| Alternating voltage frequencies in the medium or at ground potential (PE) | Below typical power line frequency in the country |

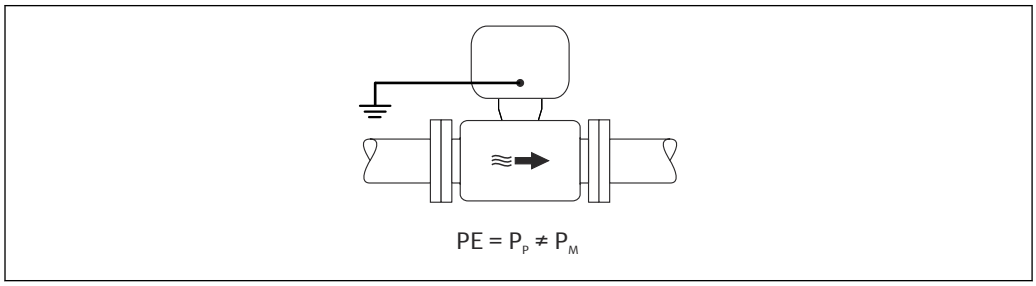
To achieve the specified conductivity measuring accuracy, a conductivity calibration is recommended when the device is installed.

A full pipe adjustment is recommended when the device is installed.

#### Plastic pipe

Sensor and transmitter are correctly grounded. A difference in potential can occur between the medium and protective earth. Potential equalization between $P_M$ and PE via the reference electrode is minimized with the "Floating measurement" option.

Starting conditions:
- The pipe has an insulating effect.
- Equalizing currents through the medium cannot be ruled out.



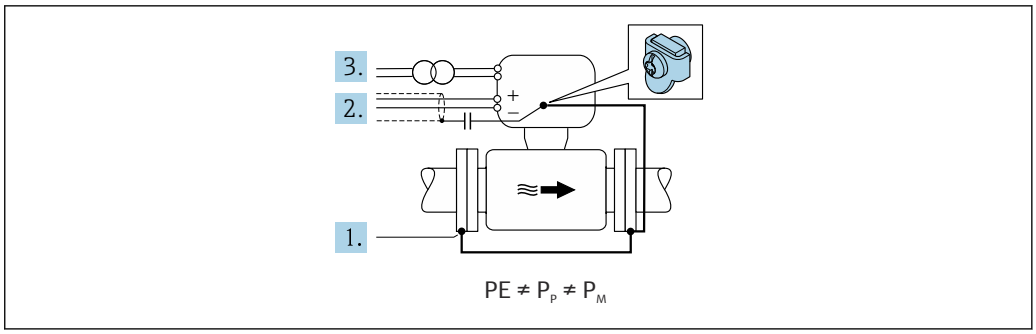

A0044855

1. Use the "Floating measurement" option, while also observing the operating conditions for floating measurement.
2. Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for this purpose.

#### Metal, ungrounded pipe with insulating liner

The sensor and transmitter are installed in a way that provides electrical insulation from PE. The medium and pipe have different potentials. The "Floating measurement" option minimizes harmful equalizing currents between $P_M$ and $P_P$ via the reference electrode.

Starting conditions:
- Metal pipe with insulating liner
- Equalizing currents through the medium cannot be ruled out.



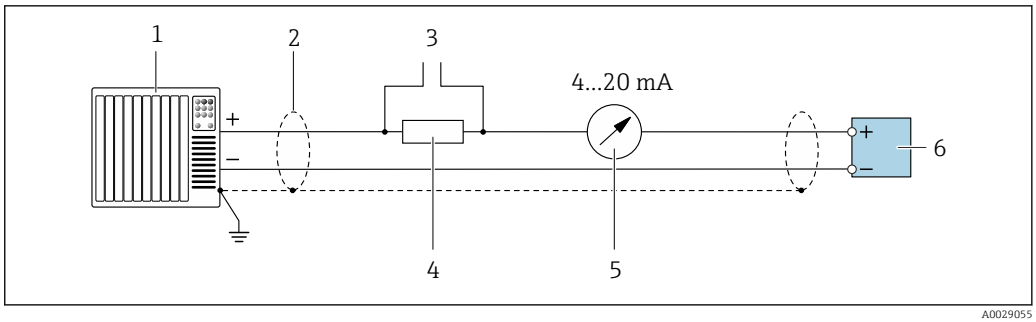

A0044857

1. Connect the pipe flanges and transmitter via the ground cable.
2. Route the shielding of the signal cables via a capacitor (recommended value 1.5µF/ 50V).
3. Device connected to power supply such that it is floating in relation to the protective earth (isolation transformer). This measure is not required in the case of 24V DC supply voltage without PE (= SELV power unit).
4. Use the "Floating measurement" option, while also observing the operating conditions for floating measurement.

## 7.5 Special connection instructions

### 7.5.1 Connection examples

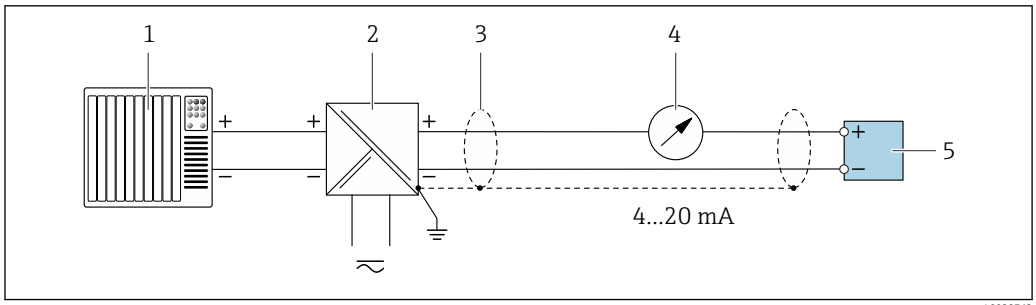
#### Current output 4 to 20 mA HART




A0029055

8 *Connection example for 4 to 20 mA HART current output (active)*

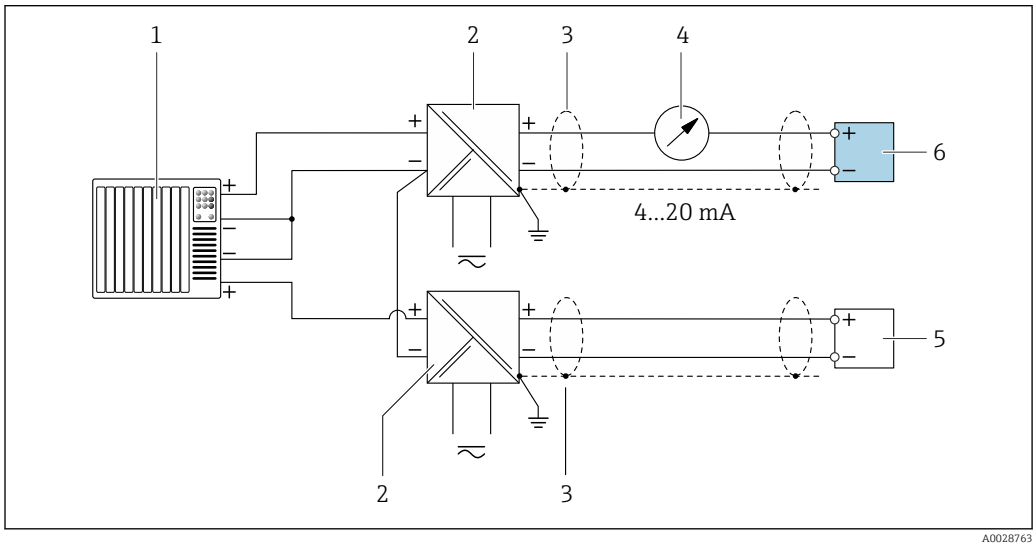
1 *Automation system with current input (e.g. PLC)*
2 *Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
3 *Connection for HART operating devices → 75*
4 *Resistor for HART communication (≥ 250 Ω): observe maximum load → 174*
5 *Analog display unit: observe maximum load → 174*
6 *Transmitter*




*9 Connection example for 4 to 20 mA HART current output (passive)*

1 *Automation system with current input (e.g. PLC)*
2 *Power supply*
3 *Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *Analog display unit: observe maximum load → 174*
5 *Transmitter*

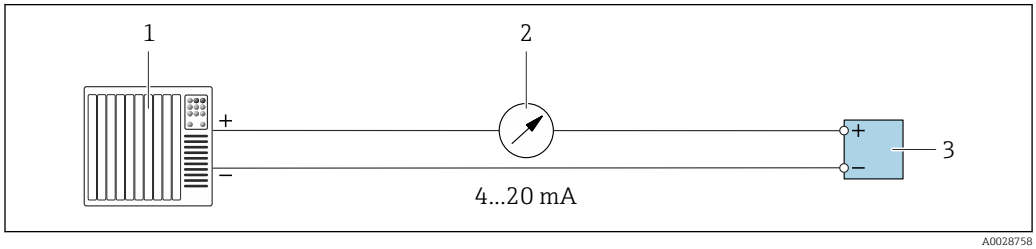
## HART input




*10 Connection example for HART input with a common negative (passive)*

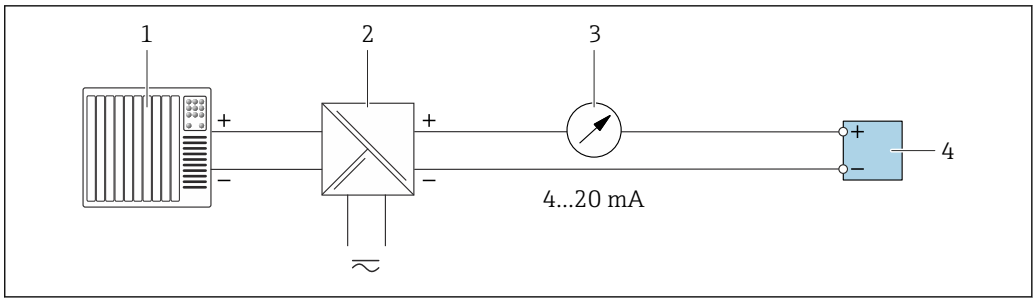
1 *Automation system with HART output (e.g. PLC)*
2 *Active barrier for power supply (e.g. RN221N)*
3 *Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *Analog display unit: observe maximum load → 174*
5 *Pressure transmitter (e.g. Cerabar M, Cerabar S): see requirements*
6 *Transmitter*

## Current output 4-20 mA




*11 Connection example for 4-20 mA current output (active)*

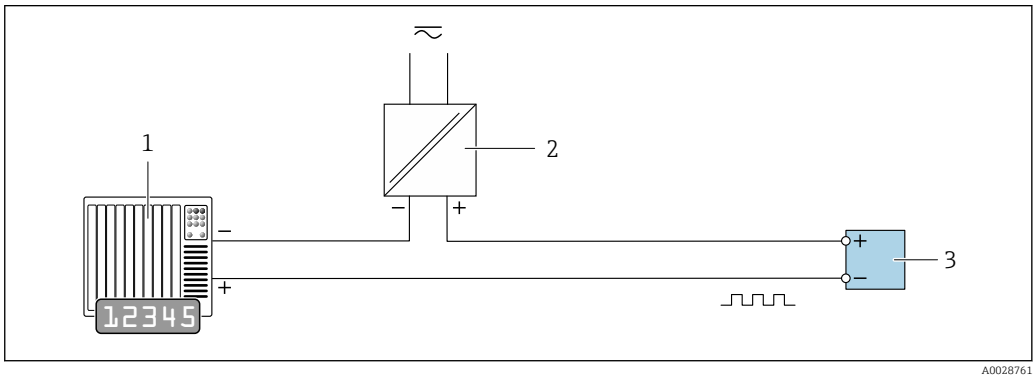
1 *Automation system with current input (e.g. PLC)*
2 *Analog display unit: observe maximum load → 174*
3 *Transmitter*




12 *Connection example for 4-20 mA current output (passive)*

1 *Automation system with current input (e.g. PLC)*
2 *Active barrier for power supply (e.g. RN221N)*
3 *Analog display unit: observe maximum load → 174*
4 *Transmitter*

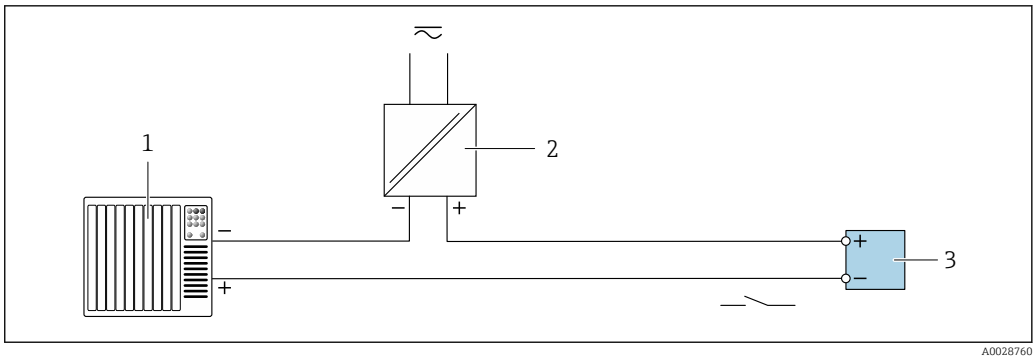
### Pulse/frequency output




13 *Connection example for pulse/frequency output (passive)*

1 *Automation system with pulse/frequency input (e.g. PLC with 10 kΩ pull-up or pull-down resistor)*
2 *Power supply*
3 *Transmitter: observe input values → 176*

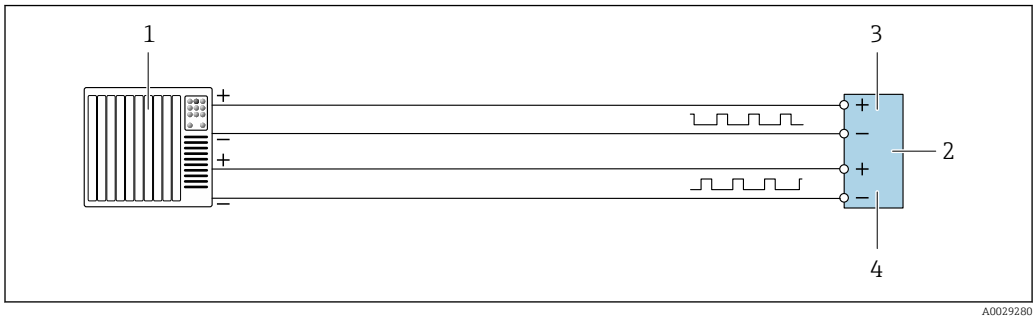
### Switch output




14 *Connection example for switch output (passive)*

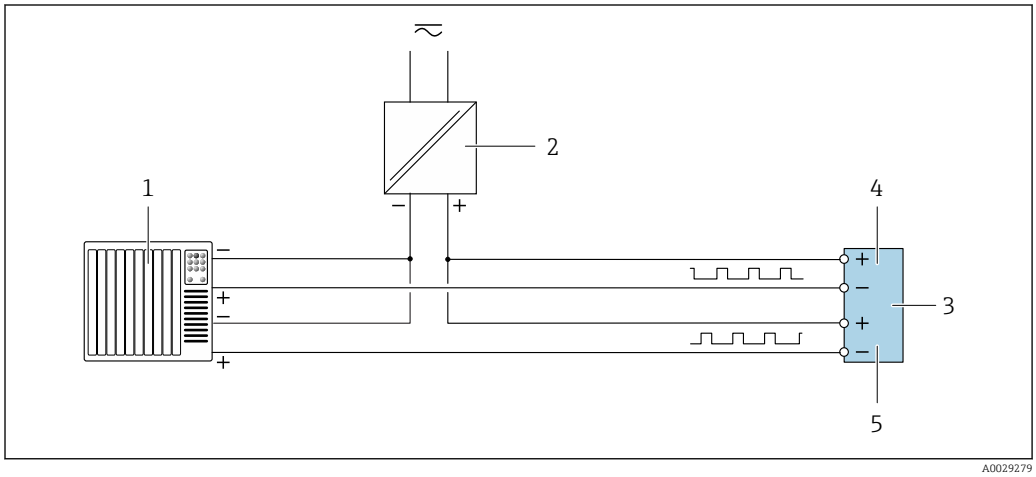
1 *Automation system with switch input (e.g. PLC with a 10 kΩ pull-up or pull-down resistor)*
2 *Power supply*
3 *Transmitter: observe input values → 176*

## Double pulse output




15 *Connection example for double pulse output (active)*

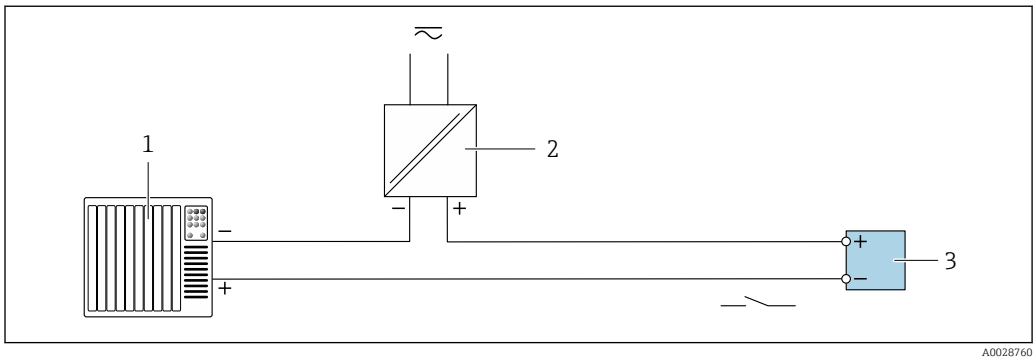
1 *Automation system with double pulse input (e.g. PLC)*
2 *Transmitter: observe input values → 177*
3 *Double pulse output*
4 *Double pulse output (slave), phase-shifted*




16 *Connection example for double pulse output (passive)*

1 *Automation system with double pulse input (e.g. PLC with a 10 kΩ pull-up or pull-down resistor)*
2 *Power supply*
3 *Transmitter: observe input values → 177*
4 *Double pulse output*
5 *Double pulse output (slave), phase-shifted*

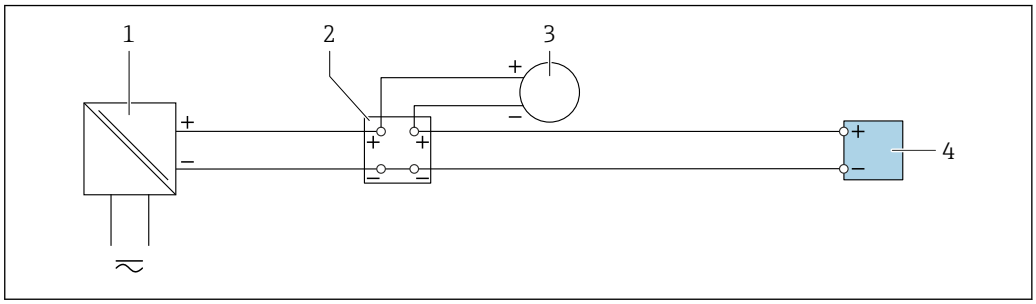
## Relay output




17 *Connection example for relay output (passive)*

1 *Automation system with relay input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: observe input values → 177*

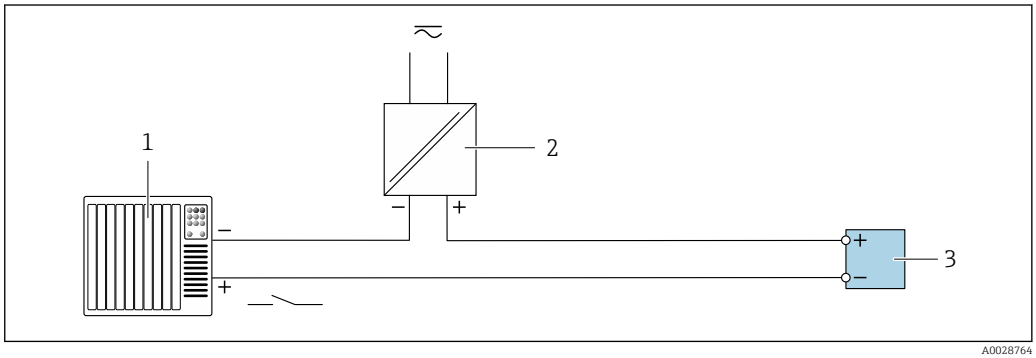
### Current input




18 *Connection example for 4 to 20 mA current input*

1 *Power supply*
2 *Terminal box*
3 *External measuring device (to read in pressure or temperature, for instance)*
4 *Transmitter*

### Status input




19 *Connection example for status input*

1 *Automation system with status output (e.g. PLC)*
2 *Power supply*
3 *Transmitter*

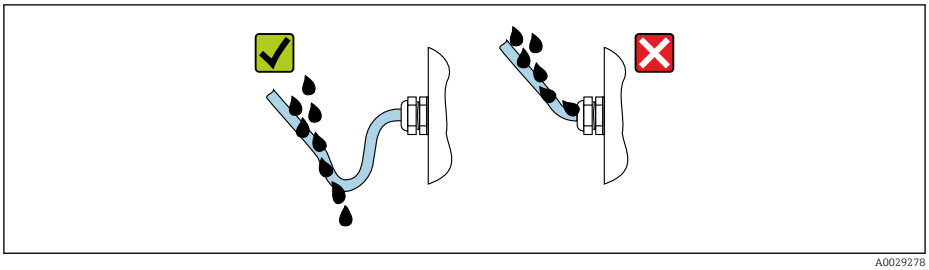
## 7.6 Ensuring the degree of protection

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

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

1. Check that the housing seals are clean and fitted correctly.
2. Dry, clean or replace the seals if necessary.
3. Tighten all housing screws and screw covers.
4. Firmly tighten the cable glands.

5. To ensure that moisture does not enter the cable entry:
   Route the cable so that it loops down before the cable entry ("water trap").
   ↳



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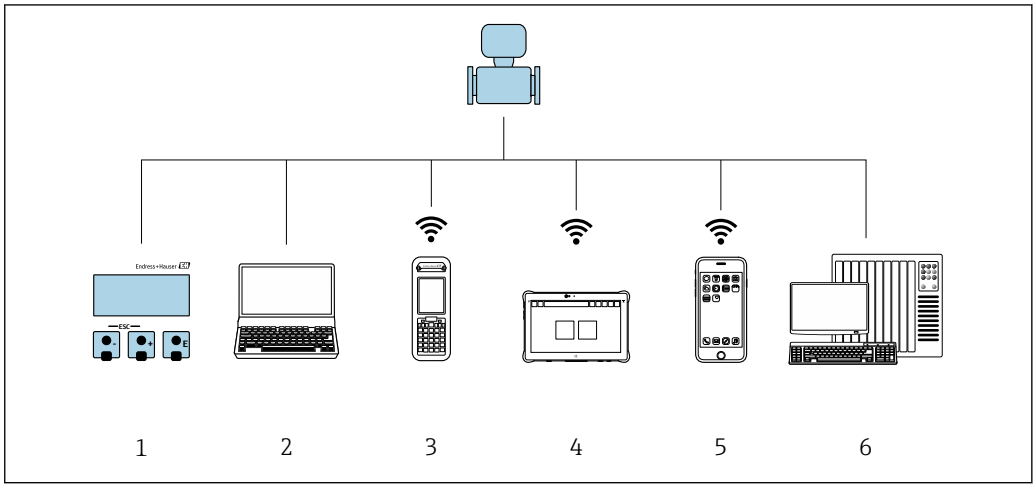
6. Insert dummy plugs (corresponding to the housing degree of protection) into unused cable entries.

## 7.7 Post-connection check

| | |
|---|---|
| Are cables or the device undamaged (visual inspection)? | ❑ |
| Is the protective earthing established correctly? | |
| Do the cables used comply with the requirements ? | ❑ |
| Do the mounted cables have adequate strain relief? | ❑ |
| Are all cable glands installed, securely tightened and leak-tight? Cable run with "water trap" → 🖹 53? | ❑ |
| Is the terminal assignment correct ? | ❑ |
| If supply voltage is present, do values appear on the display module? | ❑ |
| Is the potential equalization established correctly ? | ❑ |
| Are dummy plugs inserted in unused cable entries and have transportation plugs been replaced with dummy plugs? | |

# 8 Operation options

## 8.1 Overview of operation options

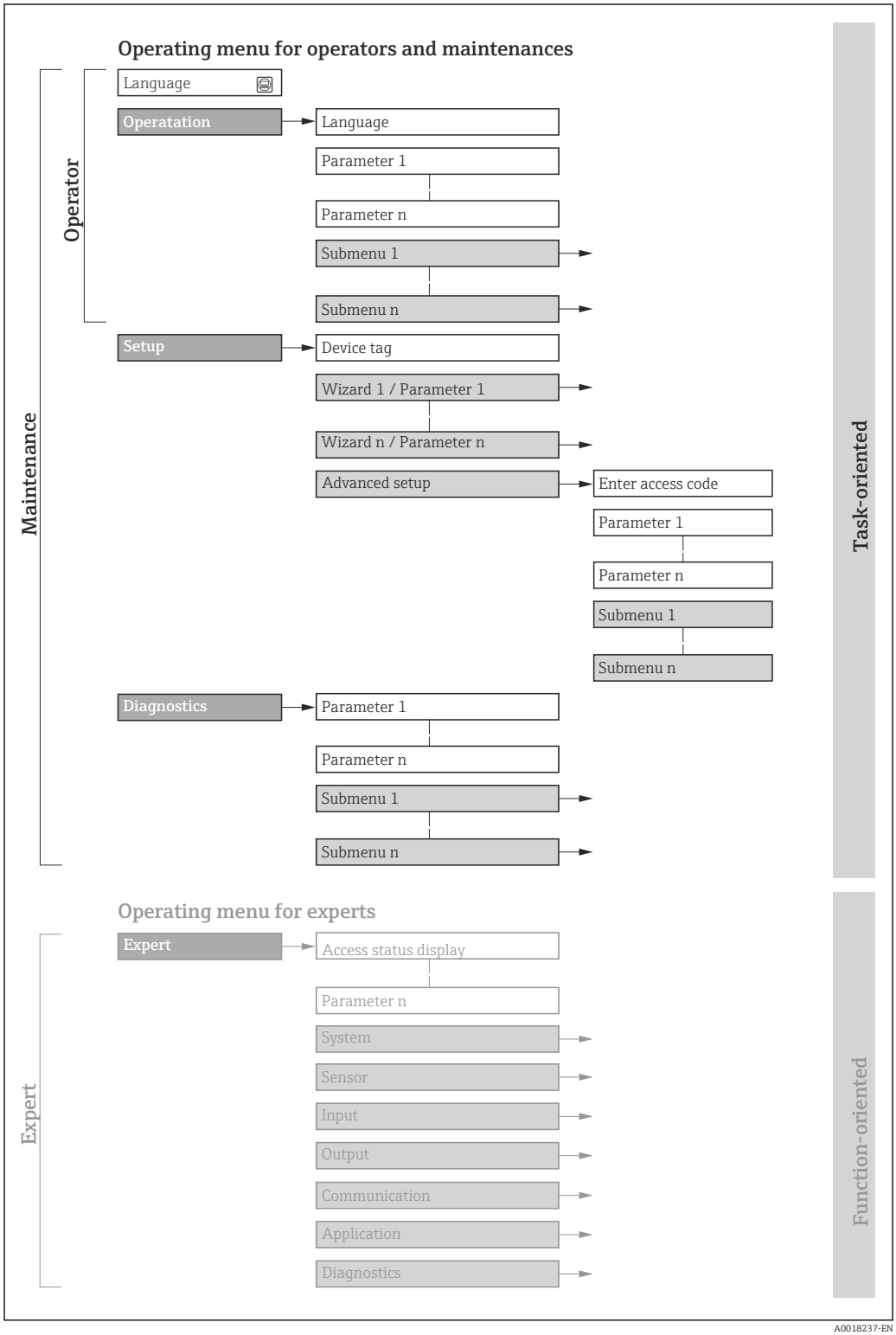



1 *Local operation via display module*
2 *Computer with Web browser (e.g. Internet Explorer) or with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM)*
3 *Field Xpert SFX350 or SFX370*
4 *Field Xpert SMT70*
5 *Mobile handheld terminal*
6 *Control system (e.g. PLC)*

## 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 → 205




20 *Schematic structure of the operating menu*

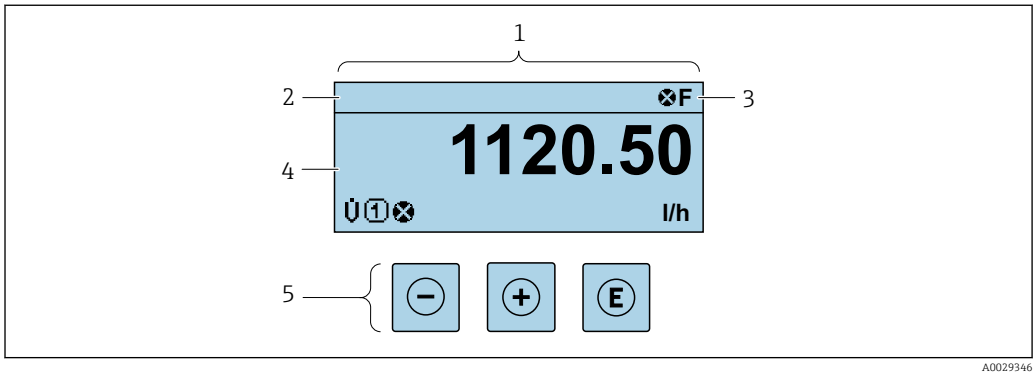
### 8.2.2 Operating philosophy

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 measured values | ▪ Defining the operating language<br>▪ Defining the Web server operating language<br>▪ Resetting and controlling totalizers |
| Operation | | | ▪ Configuring 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 inputs and outputs<br>▪ Configuration of the communication interface | Wizards for fast commissioning:<br>▪ Configuration of the system units<br>▪ Displaying the I/O configuration<br>▪ Configuration of the inputs<br>▪ Configuration of the outputs<br>▪ Configuration of the operational display<br>▪ Configuration of the low flow cut off<br>▪ Configuration of empty pipe detection<br><br>Advanced setup<br>▪ For more customized configuration of the measurement (adaptation to special measuring conditions)<br>▪ Configuration of totalizers<br>▪ Configuration of electrode cleaning (optional)<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-level device parameters that do not pertain either to the measurement or to 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



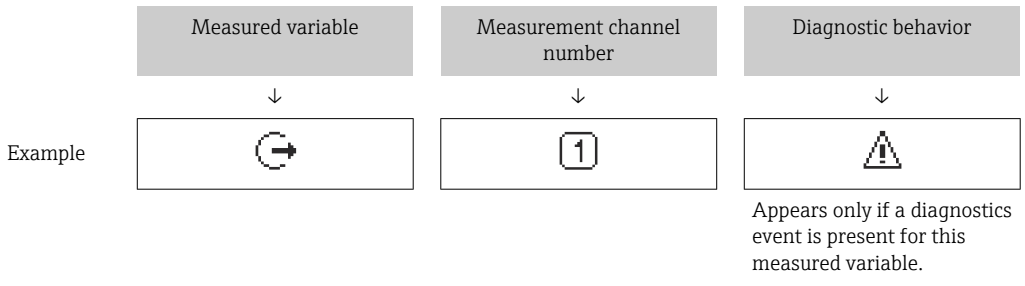

1 *Operational display*
2 *Device tag → 88*
3 *Status area*
4 *Display area for measured values (4-line)*
5 *Operating elements → 63*

#### Status area

The following symbols appear in the status area of the operational display at the top right:
- Status signals→ 144
  - **F**: Failure
  - **C**: Function check
  - **S**: Out of specification
  - **M**: Maintenance required
- Diagnostic behavior→ 145
  - : 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 variables*

| Symbol | Meaning |
|---|---|
| U̇ | Volume flow |
| G | Conductivity |

| | |
|---|---|
| | Mass flow |
| | Totalizer<br>The measurement channel number indicates which of the three totalizers is displayed. |
| | Output<br>The measurement channel number indicates which of the outputs is displayed. |
| | Status input |

*Measurement channel numbers*

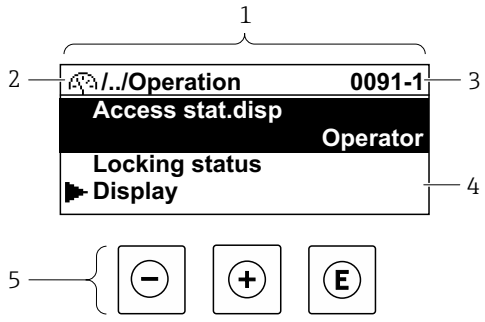
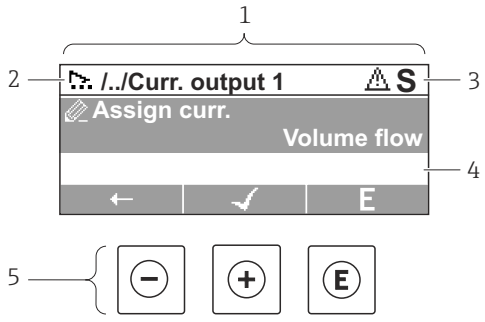
| Symbol | Meaning |
|---|---|
| 1 ... 4 | Measurement channel 1 to 4 |
| The measurement channel number is displayed only if more than one channel is present for the same measured variable type (e.g. Totalizer 1 to 3). | |

*Diagnostic behavior*

| |
|---|
| The diagnostic behavior pertains to a diagnostic event that is relevant to the displayed measured variable.<br>For information on the symbols → 145 |

The number and display format of the measured values can be configured via the **Format display** parameter (→ 102).

## 8.3.2 Navigation view

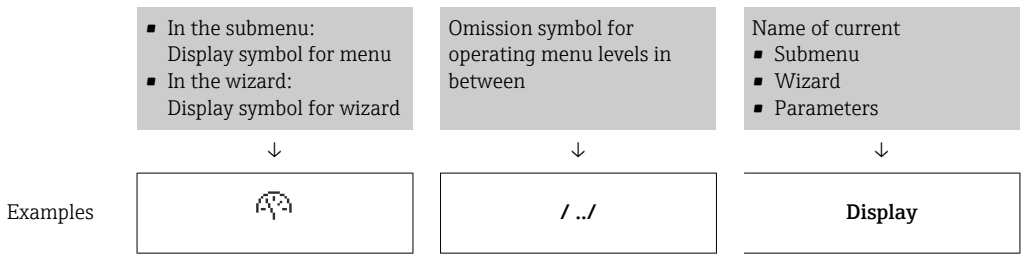
| In the submenu | In the wizard |
|---|---|
|  |  |

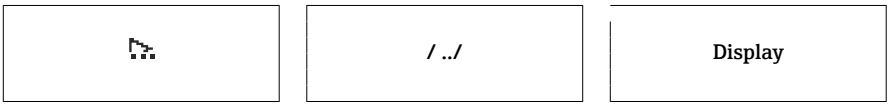


*1 Navigation view*
*2 Navigation path to current position*
*3 Status area*
*4 Display area for navigation*
*5 Operating elements → 63*

### Navigation path

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






For more information about the icons in the menu, refer to the "Display area" section → 60

### 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 → 144
- For information on the function and entry of the direct access code → 65

### Display area

*Menus*

| Symbol | Meaning |
|---|---|
| | **Operation**<br>Appears:<br>▪ In the menu next to the "Operation" selection<br>▪ At the left in the navigation path in the **Operation** menu |
| | **Setup**<br>Appears:<br>▪ In the menu next to the "Setup" selection<br>▪ At the left in the navigation path in the **Setup** menu |
| | **Diagnostics**<br>Appears:<br>▪ In the menu next to the "Diagnostics" selection<br>▪ At the left in the navigation path in the **Diagnostics** menu |
| | **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 |
|---|---|
| | Submenu |
| | Wizard |
| | Parameters within a wizard<br>No display symbol exists for parameters in submenus. |

*Locking*

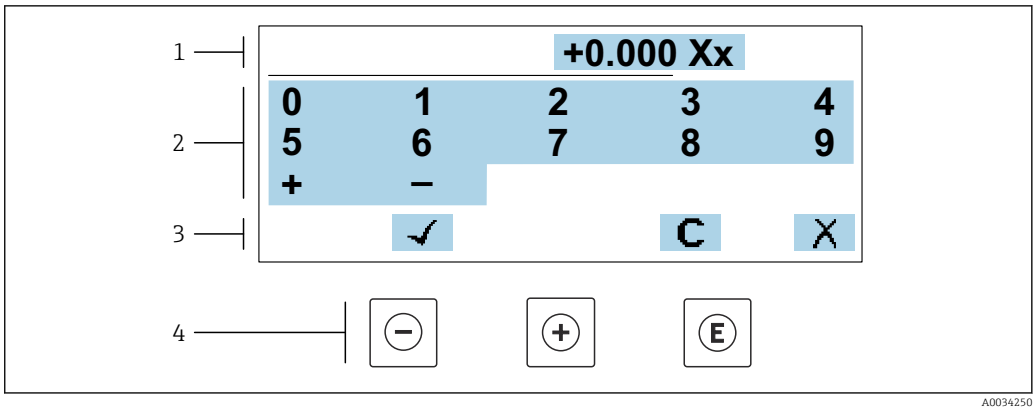
| Symbol | Meaning |
|---|---|
| | **Parameter locked**<br>When displayed in front of a parameter name, indicates that the parameter is locked.<br>▪ By a user-specific access code<br>▪ By the hardware write protection switch |

*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

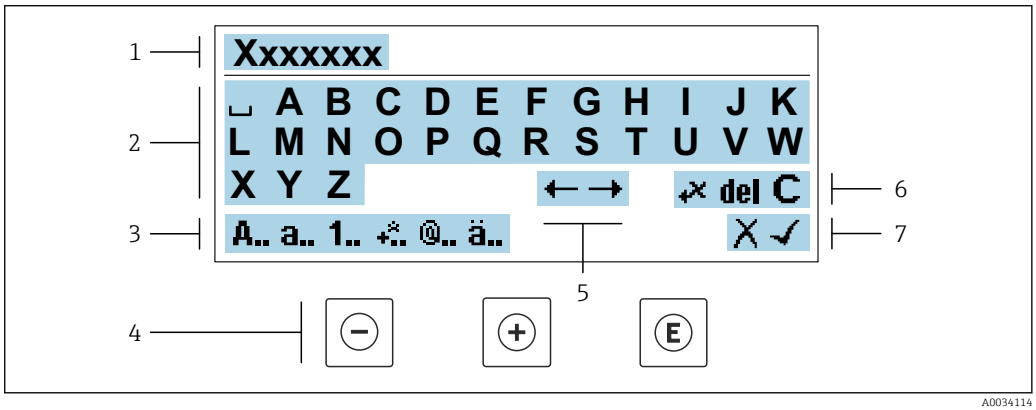
### Numeric editor




21 *For entering values in parameters (e.g. limit values)*

1 *Entry display area*
2 *Input screen*
3 *Confirm, delete or reject entry*
4 *Operating elements*

### Text editor




22 *For entering text in parameters (e.g. tag name)*

1 *Entry display area*
2 *Current input screen*
3 *Change input screen*
4 *Operating elements*
5 *Move entry position*
6 *Delete entry*
7 *Reject or confirm entry*

*Using the operating elements in the editing view*

| Key | Meaning |
|---|---|
| ⊖ | **Minus key**<br>Move the entry position to the left. |
| ⊕ | **Plus key**<br>Move the entry position to the right. |
| Ⓔ | **Enter key**<br>▪ Pressing the key briefly confirms the selection.<br>▪ Pressing the key for 2 s confirms your entry. |
| ⊖ + ⊕ | **Escape key combination (press keys simultaneously)**<br>Close the editing view without accepting a change. |

*Input screens*

| Symbol | Meaning |
|---|---|
| A.. | Upper case |
| a.. | Lower case |
| 1.. | Numbers |
| +- | Punctuation marks and special characters: = + – * / ² ³ ¼ ½ ¾ ( ) [ ] < > { } |
| @.. | Punctuation marks and special characters: ' " ` ^ . , ; : ? ! % µ ° € $ £ ¥ § @ # / \ I ~ & _ |
| ä.. | Umlauts and accents |

*Controlling data entries*

| Symbol | Meaning |
|---|---|
| ←→ | Move entry position |
| X | Reject entry |
| ✓ | Confirm entry |
| ←x | Delete character immediately to the left of the entry position |
| del | Delete character immediately to the right of the entry position |
| C | Clear all the characters entered |

### 8.3.4 Operating elements

| Key | Meaning |
|---|---|
| ⊖ | **Minus key**<br>*In menu, submenu*<br>Moves the selection bar upwards in a picklist.<br>*With a wizard*<br>Confirms the parameter value and goes to the previous parameter.<br>*For text and numeric editor*<br>Move the entry position to the left. |
| ⊕ | **Plus key**<br>*In menu, submenu*<br>Moves the selection bar downwards in a picklist.<br>*With a wizard*<br>Confirms the parameter value and goes to the next parameter.<br>*For text and numeric editor*<br>Move the entry position to the right. |
| Ⓔ | **Enter key**<br>*For operational display*<br>Pressing the key briefly opens the operating menu.<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>*With a wizard*<br>Opens the editing view of the parameter.<br>*For text and numeric editor*<br>▪ Pressing the key briefly confirms the selection.<br>▪ Pressing the key for 2 s confirms your entry. |
| ⊖ + ⊕ | **Escape key combination (press keys simultaneously)**<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>*With a wizard*<br>Exits the wizard and takes you to the next level up.<br>*For text and numeric editor*<br>Closes the editing view without applying changes. |
| ⊖ + Ⓔ | **Minus/Enter key combination (press and hold down the keys simultaneously)**<br>▪ If the keypad lock is enabled:<br>  Pressing the key for 3 s disables the keypad lock.<br>▪ If the keypad lock is not enabled:<br>  Pressing the key for 3 s opens the context menu including the selection for activating the keypad lock. |

### 8.3.5 Opening the context menu

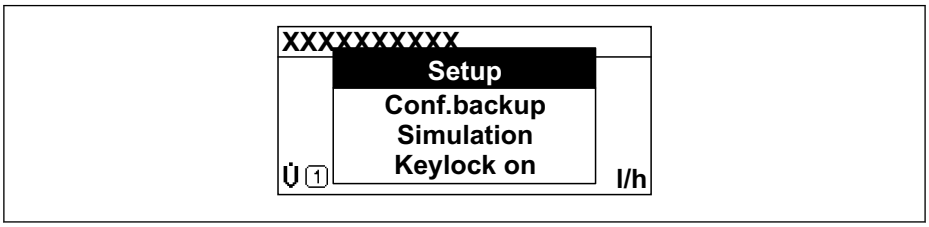
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Data backup
- 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.




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

### Calling up the menu via the context menu

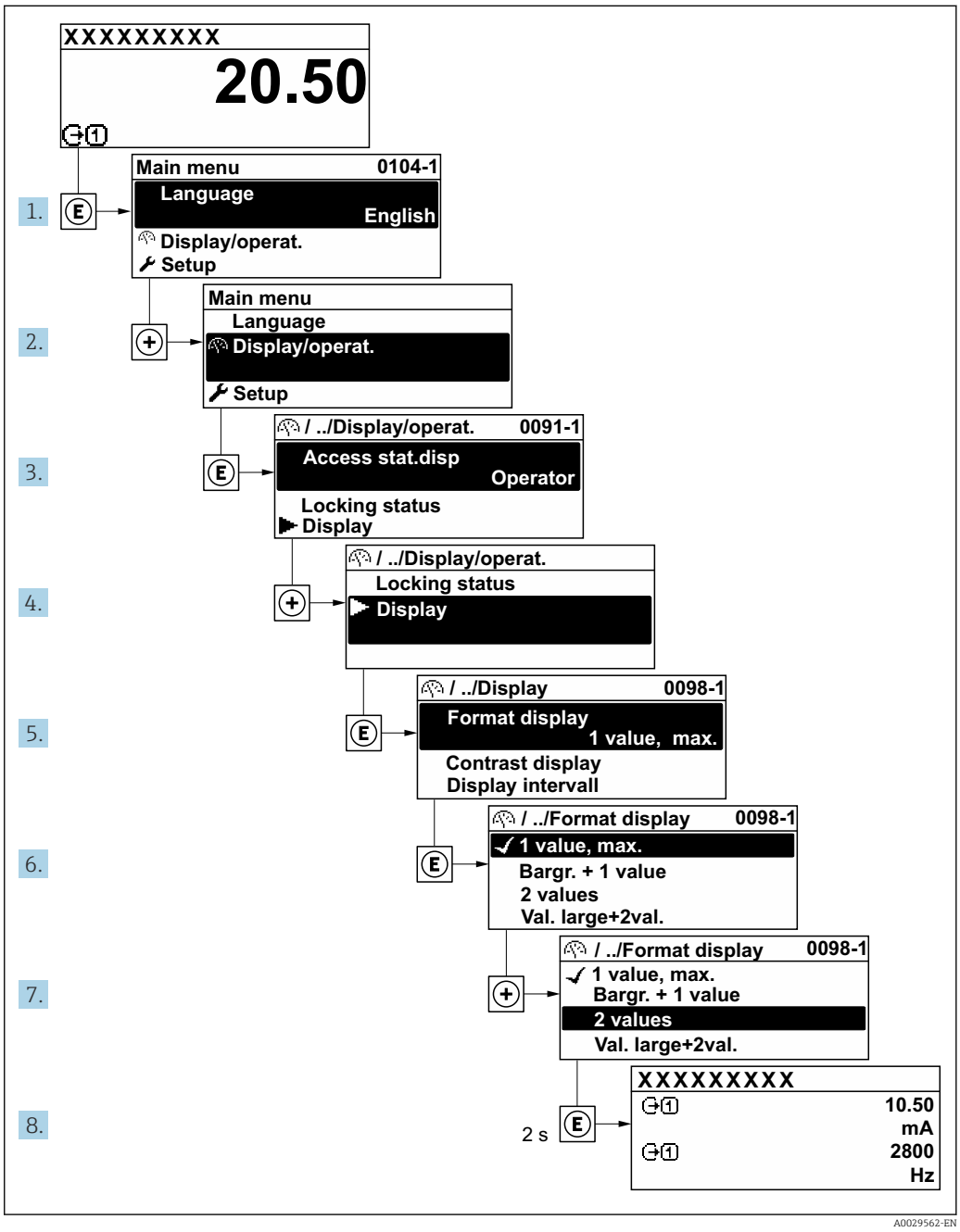
1. Open the context menu.
2. Press ⊕ to navigate to the desired menu.
3. Press Ⓔ to confirm the selection.
   ↳ The selected menu opens.

### 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
→ 59

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

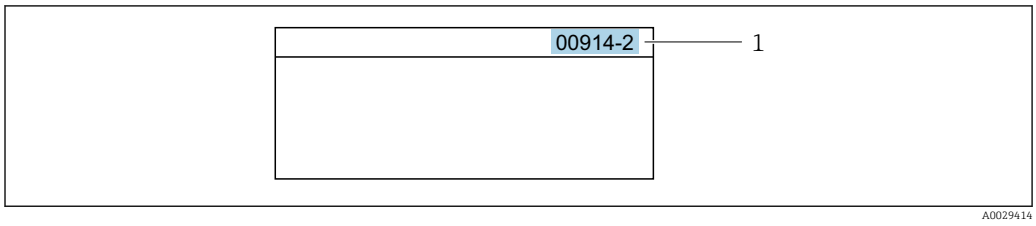



### 8.3.7 Calling the parameter directly

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

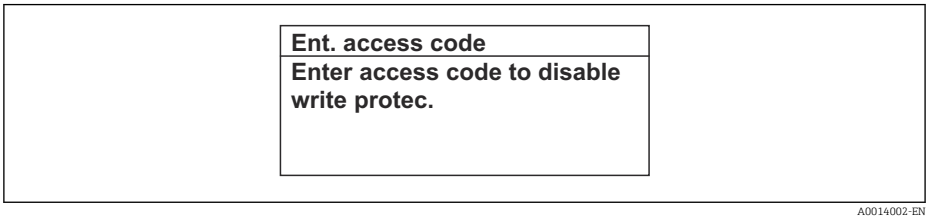
## 8.3.8 Calling up help text

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



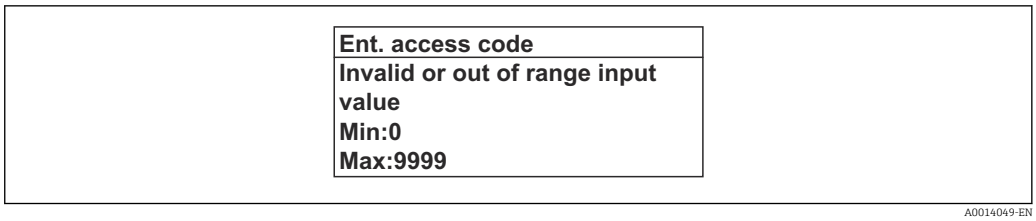

*23 Example: Help text for parameter "Enter access code"*

2. Press − + + simultaneously.
   ↳ The help text is closed.

## 8.3.9 Changing the parameters

Parameters can be changed via the numeric editor or text editor.
- Numeric editor: Change values in a parameter, e.g. specifications for limit values.
- Text editor: Enter text in a parameter, e.g. tag name.

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

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For a description of the editing view - consisting of the text editor and numeric editor - with symbols → 61, for a description of the operating elements → 63

## 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 → 127.

### 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 excluded 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** parameter. Navigation path: Operation → Access status

## 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 → 127.

Parameter write protection via local operation can be disabled by entering the user-specific access code in the **Enter access code** parameter (→ 113) via the respective access option.

1. After you press E, 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 Ⓔ 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 Ⓔ 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 the service interface (CDI-RJ45) or via the WLAN interface. The structure of the operating menu is the same as for the local display. In addition to the measured values, device status information is also displayed and allows users 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; operation", 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

### 8.4.2 Requirements

*Computer hardware*

| Hardware | Interface | |
|---|---|---|
| | **CDI-RJ45** | **WLAN** |
| Interface | The computer must have an RJ45 interface. | The operating unit must have a WLAN interface. |
| Connection | Ethernet cable with RJ45 connector. | Connection via Wireless LAN. |
| Screen | Recommended size: ≥12" (depends on the screen resolution) | |

*Computer software*

| Software | Interface | |
|---|---|---|
| | **CDI-RJ45** | **WLAN** |
| Recommended operating systems | ▪ Microsoft Windows 8 or higher.<br>▪ Mobile operating systems:<br>  ▪ iOS<br>  ▪ Android<br>Microsoft Windows XP is supported.<br>Microsoft Windows 7 is supported. | |
| Web browsers supported | ▪ Microsoft Internet Explorer 8 or higher<br>▪ Microsoft Edge<br>▪ Mozilla Firefox<br>▪ Google Chrome<br>▪ Safari | |

*Computer settings*

| Settings | Interface | |
|---|---|---|
| | **CDI-RJ45** | **WLAN** |
| 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.<br>If JavaScript cannot be enabled: Enter http://192.168.1.212/servlet/basic.html in the address bar of the web browser. A fully functional but simplified version of the operating menu structure starts in the Web browser.<br>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. | Switch off all other network connections. |

In the event of connection problems: → 141

*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<br>For information on enabling the Web server → 74 |

*Measuring device: via WLAN interface*

| Device | WLAN interface |
|---|---|
| Measuring device | The measuring device has a WLAN antenna:<br>▪ Transmitter with integrated WLAN antenna<br>▪ Transmitter with external WLAN antenna |
| Web server | Web server and WLAN must be enabled; factory setting: ON<br>For information on enabling the Web server → 74 |

## 8.4.3 Establishing a connection

### Via service interface (CDI-RJ45)

*Preparing the measuring device*

1. Depending on the housing version:
   Loosen the securing clamp or fixing screw of the housing cover.
2. Depending on the housing version:
   Unscrew or open the housing cover.
3. The location of the connection socket depends on the measuring device and the communication protocol:
   Connect the computer to the RJ45 plug via the standard Ethernet connecting cable .

*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 → 76.
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_Promag_300_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 a web browser, FieldCare or DeviceCare.

The serial number can be found on the nameplate.

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 new SSID name to the measuring point (e.g. tag name) because it is displayed as the WLAN network.

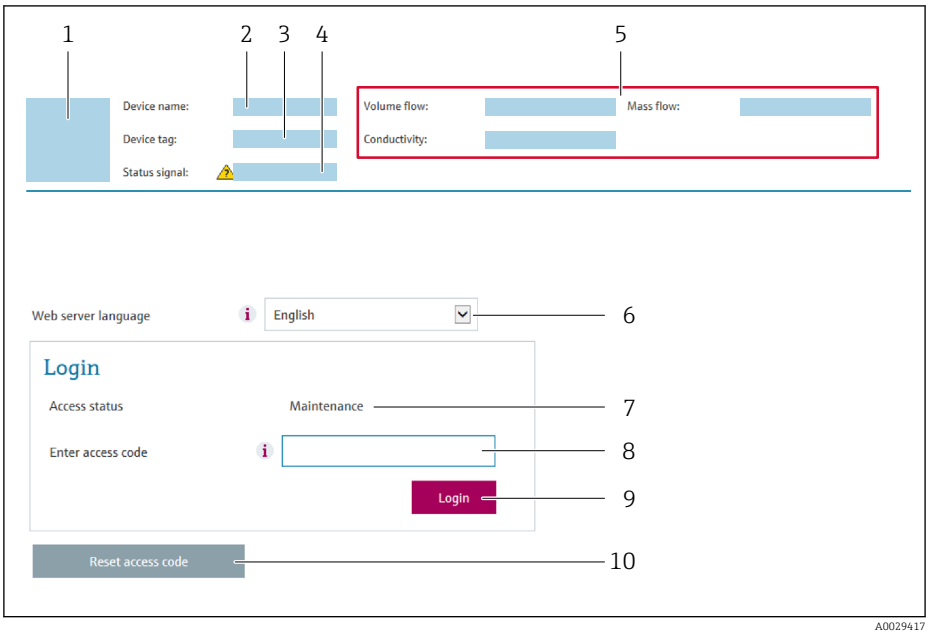
*Disconnecting*

- 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.




1 *Picture of device*
2 *Device name*
3 *Device tag (→ 88)*
4 *Status signal*
5 *Current measured values*
6 *Operating language*
7 *User role*
8 *Access code*
9 *Login*
10 *Reset access code (→ 124)*

If a login page does not appear, or if the page is incomplete → 141

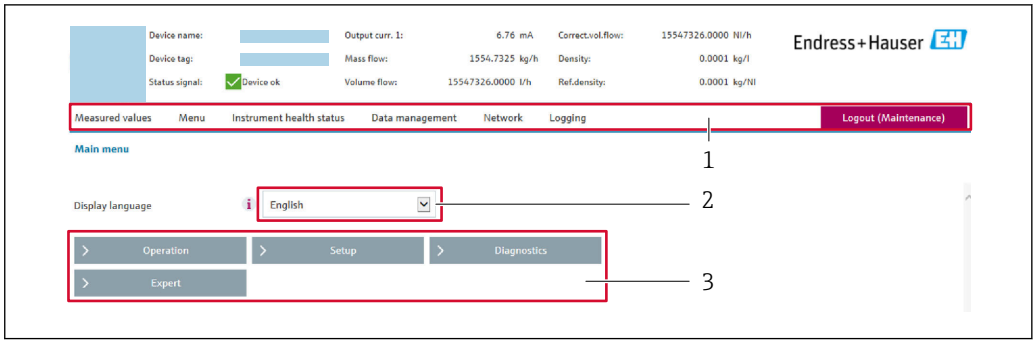
### 8.4.4 Logging on

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 (default 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




A0029418

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 → 147
- 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>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 (XML format, save configuration)<br>  ▪ Save settings to the device (XML format, restore configuration)<br>▪ Logbook - Export Event logbook (.csv file)<br>▪ Documents - Export documents:<br>  ▪ Export backup data record (.csv file, create documentation of the measuring point configuration)<br>  ▪ Verification report (PDF file, only available with the "Heartbeat Verification" application package)<br>▪ Firmware update - Flashing a firmware version |
| 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 | Factory setting |
|---|---|---|---|
| Web server functionality | Switch the Web server on and off. | ▪ Off<br>▪ HTML Off<br>▪ On | On |

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

| Option | Description |
|---|---|
| Off | ▪ The Web server is completely disabled.<br>▪ Port 80 is locked. |
| HTML Off | The HTML version of the Web server is not available. |
| On | ▪ The complete Web server functionality 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 the modified properties of the Internet protocol (TCP/IP) → 70.

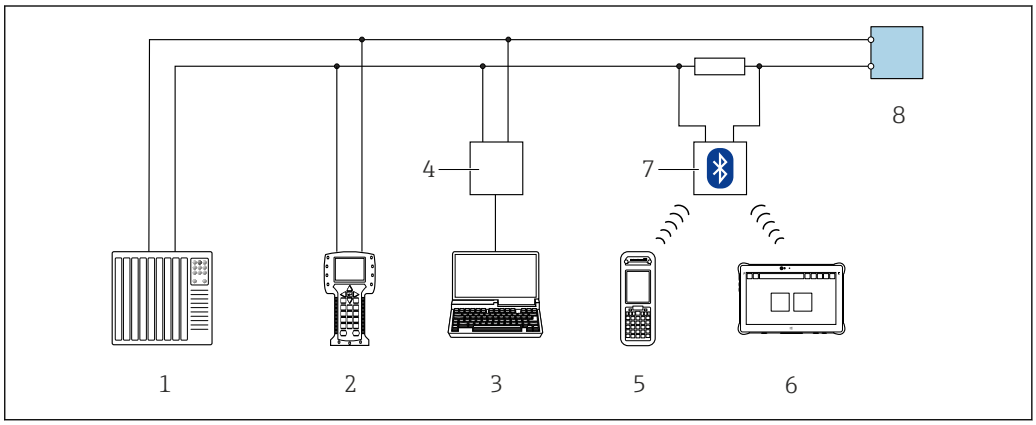
## 8.5 Access to the operating menu via the operating tool

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

### 8.5.1 Connecting the operating tool

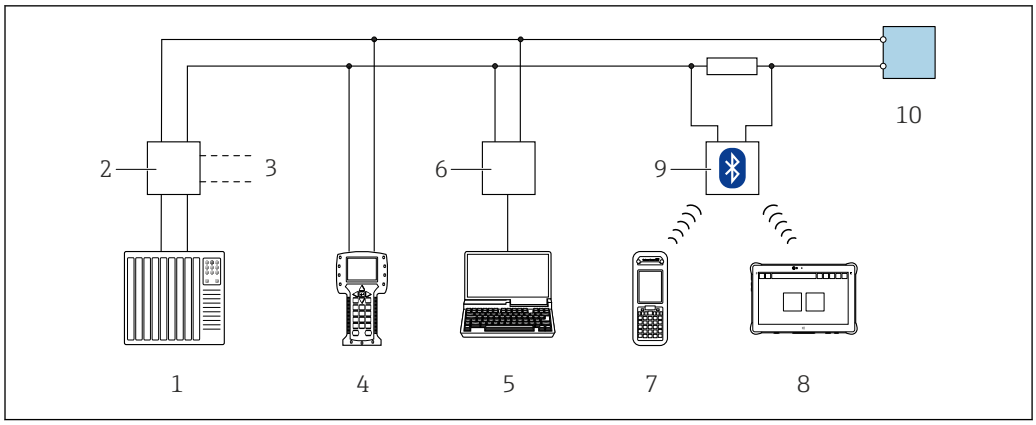
#### Via HART protocol

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




24 *Options for remote operation via HART protocol (active)*

1 *Control system (e.g. PLC)*
2 *Field Communicator 475*
3 *Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or computer with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"*
4 *Commubox FXA195 (USB)*
5 *Field Xpert SFX350 or SFX370*
6 *Field Xpert SMT70*
7 *VIATOR Bluetooth modem with connecting cable*
8 *Transmitter*




25 *Options for remote operation via HART protocol (passive)*

1 *Control system (e.g. PLC)*
2 *Transmitter power supply unit, e.g. RN221N (with communication resistor)*
3 *Connection for Commubox FXA195 and Field Communicator 475*
4 *Field Communicator 475*
5 *Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or computer with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"*
6 *Commubox FXA195 (USB)*
7 *Field Xpert SFX350 or SFX370*
8 *Field Xpert SMT70*
9 *VIATOR Bluetooth modem with connecting cable*
10 *Transmitter*

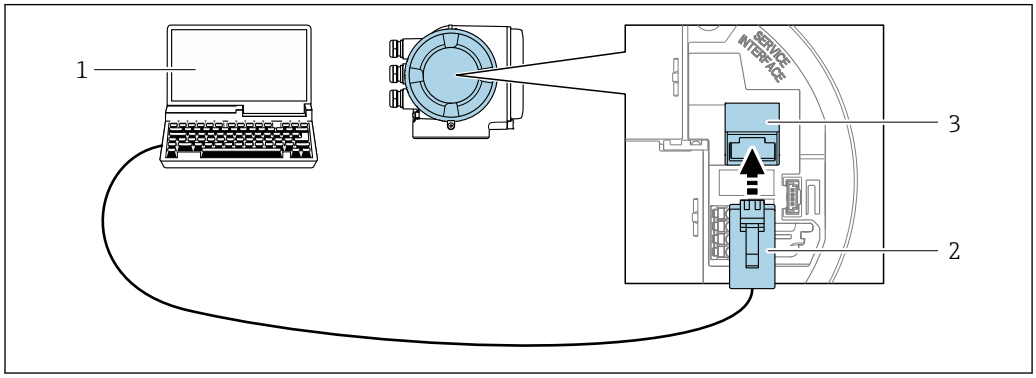
### Service interface

*Via service interface (CDI-RJ45)*

A point-to-point connection can be established via onsite device configuration. With the housing open, the connection is established directly via the service interface (CDI-RJ45) of the device.

An adapter for RJ45 to the M12 plug is optionally available:
Order code for "Accessories", option **NB**: "Adapter RJ45 M12 (service interface)"

The adapter connects the service interface (CDI-RJ45) to an M12 plug mounted in the cable entry. The connection to the service interface can be established via an M12 plug without opening the device.

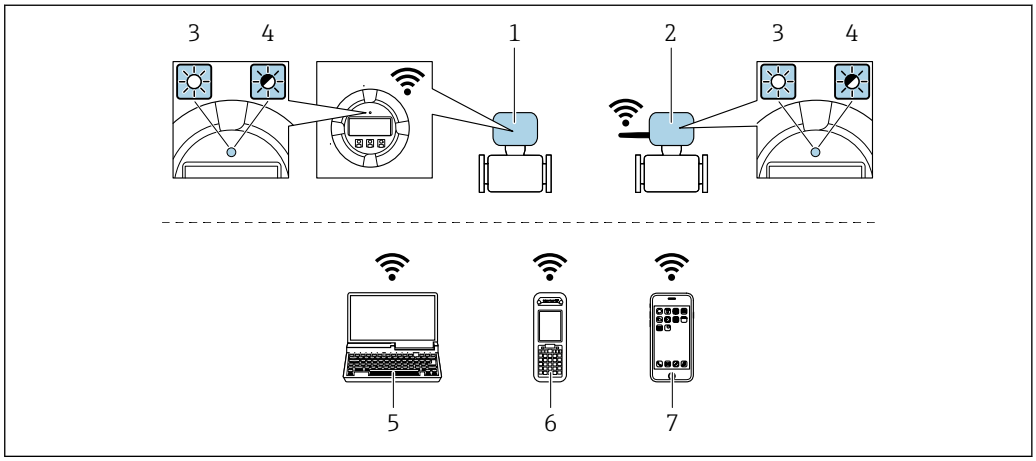



26 *Connection via service interface (CDI-RJ45)*

1 *Computer with Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated 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"




1 *Transmitter with integrated WLAN antenna*
2 *Transmitter with external WLAN antenna*
3 *LED lit constantly: WLAN reception is enabled on measuring device*
4 *LED flashing: WLAN connection established between operating unit and measuring device*
5 *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)*
6 *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)*
7 *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 antennas | ▪ Internal antenna<br>▪ External antenna (optional)<br>In the event of poor transmission/reception conditions at the place of installation.<br>Only 1 antenna is active at any one time! |
| Range | ▪ Internal antenna: typically 10 m (32 ft)<br>▪ External antenna: typically 50 m (164 ft) |
| Materials (external antenna) | ▪ Antenna: ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass<br>▪ Adapter: Stainless steel and nickel-plated brass<br>▪ Cable: Polyethylene<br>▪ Plug: Nickel-plated brass<br>▪ Angle bracket: Stainless steel |

*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_Promag_300_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 a web browser, FieldCare or DeviceCare.

The serial number can be found on the nameplate.

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 new SSID name to the measuring point (e.g. tag name) because 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 Field Xpert SFX350, SFX370

### Function range

Field Xpert SFX350 and Field Xpert SFX370 are mobile computers for commissioning and maintenance. They enable efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-hazardous area** (SFX350, SFX370) and **hazardous area** (SFX370).

For details, see Operating Instructions BA01202S

### Source for device description files

See information → 82

## 8.5.3 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 → 76
- WLAN interface → 77

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

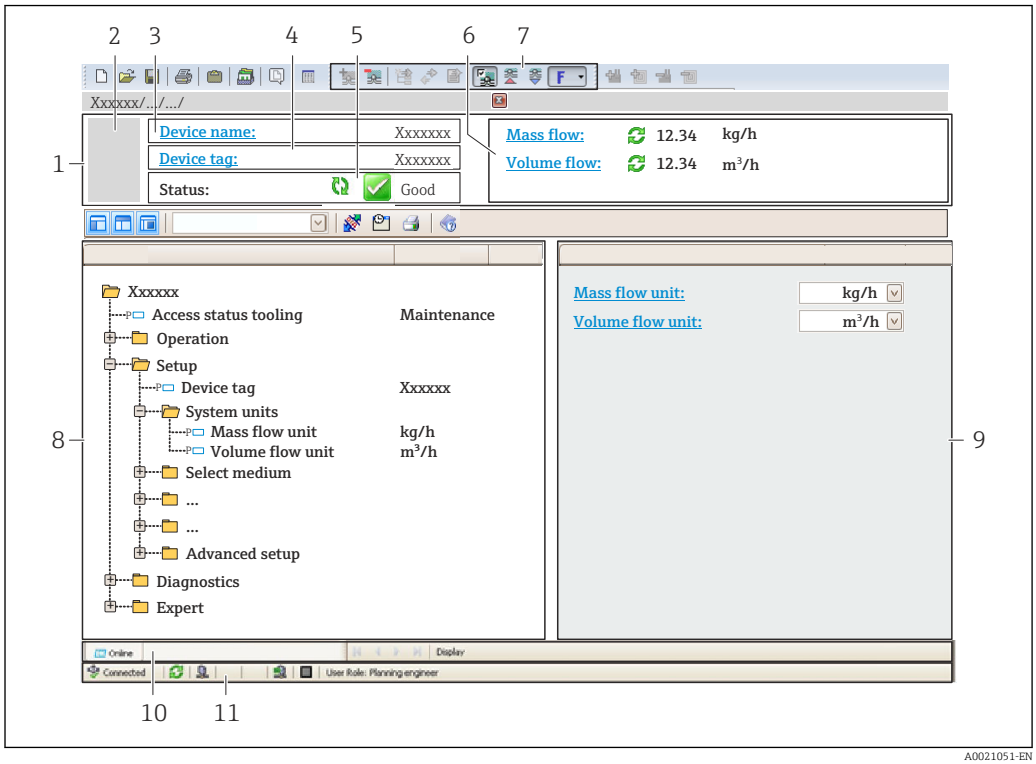
See information → 82

### 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




1 *Header*
2 *Picture of device*
3 *Device name*
4 *Tag name*
5 *Status area with status signal* → 🖹 *147*
6 *Display area for current measured values*
7 *Edit bar with additional functions such as save/load, event list and document creation*
8 *Navigation area with operating menu structure*
9 *Working area*
10 *Range of action*
11 *Status area*

## 8.5.4 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 → 🖹 82

## 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 → 82

### 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 → 82

### 8.5.7 Field Communicator 475

**Function scope**

Industrial handheld terminal from Emerson Process Management for remote configuration and measured value display via HART protocol.

**Source for device description files**

See data → 82

# 9 System integration

## 9.1 Overview of device description files

### 9.1.1 Current version data for the device

| | | |
|---|---|---|
| Firmware version | 01.06.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 | 08.2022 | --- |
| Manufacturer ID | 0x11 | Manufacturer ID<br>Diagnostics → Device information → Manufacturer ID |
| Device type ID | 0x3C | Device type<br>Diagnostics → Device information → Device type |
| HART protocol revision | 7 | HART revision<br>Expert → Communication → HART output → Information → HART revision |
| 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 → 160

### 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 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 (Emerson Process Management) | www.endress.com → Download Area |
| SIMATIC PDM (Siemens) | www.endress.com → Download Area |
| Field Communicator 475 (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)**
- Off
- Volume flow
- Mass flow
- Corrected volume flow
- Flow velocity
- Conductivity [1)]
- Electronics temperature

**Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)**
- Volume flow
- Mass flow
- Corrected volume flow
- Flow velocity
- Conductivity [2)]
- Electronics temperature
- Totalizer 1
- Totalizer 2
- Totalizer 3

The range of options increases if the measuring device has one or more application packages.

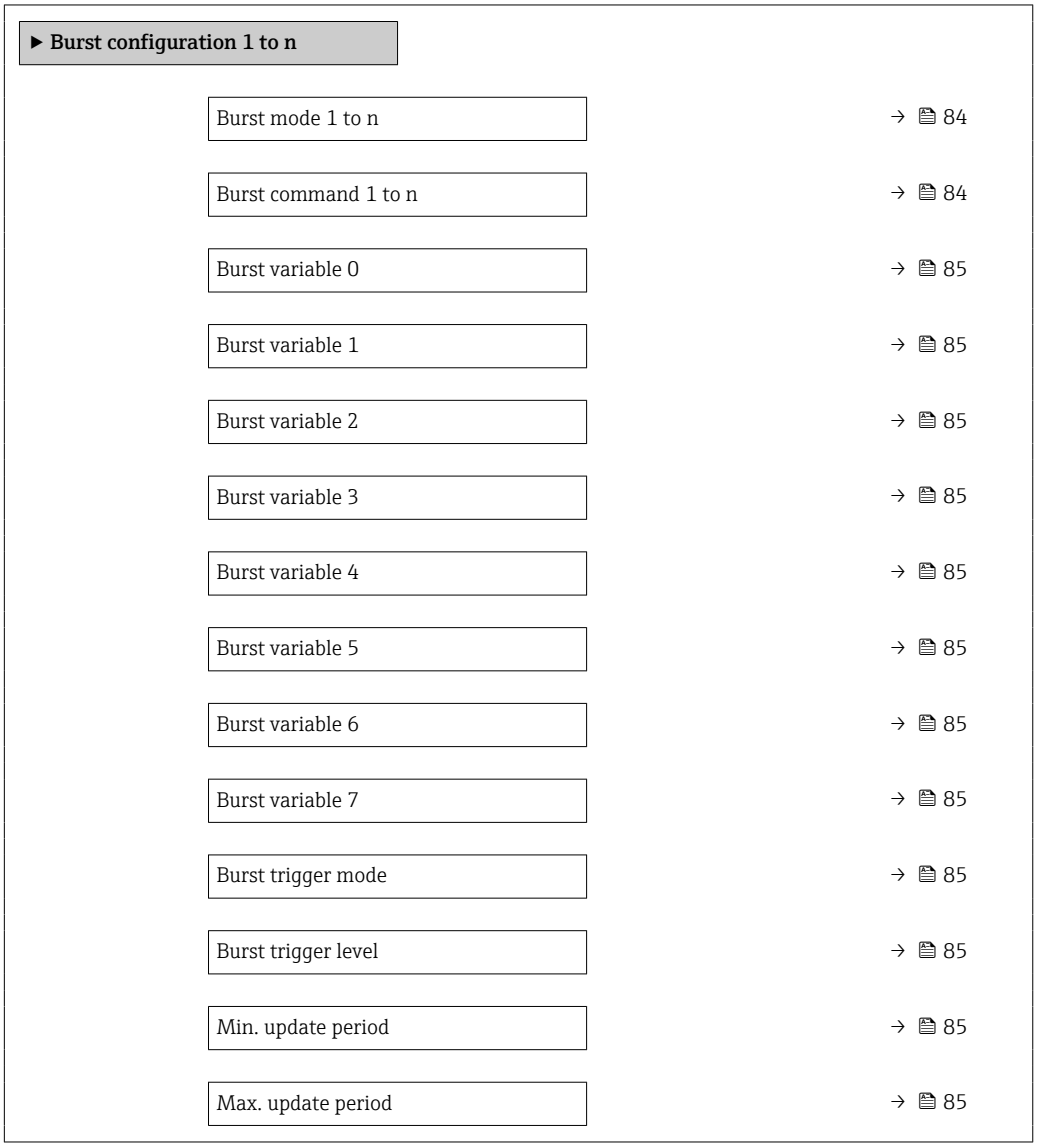
**Device variables**
The device variables are permanently assigned. A maximum of 8 device variables can be transmitted:
- 0 = volume flow
- 1 = mass flow
- 2 = corrected volume flow
- 3 = flow velocity
- 4 = conductivity
- 7 = electronic temperature
- 8 = totalizer 1
- 9 = totalizer 2
- 10 = totalizer 3

1) Visibility depends on order options or device settings
2) Visibility depends on 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




### Parameter overview with brief description

| Parameter | Description | Selection / User entry | Factory setting |
|---|---|---|---|
| Burst mode 1 to n | Activate the HART burst mode for burst message X. | ▪ Off<br>▪ On | Off |
| 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 | Command 2 |

| Parameter | Description | Selection / User entry | Factory setting |
|---|---|---|---|
| Burst variable 0 | For HART command 9 and 33: select the HART device variable or the process variable. | ▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Conductivity *<br>▪ Electronics temperature<br>▪ HBSI *<br>▪ Totalizer 1<br>▪ Totalizer 2<br>▪ Totalizer 3<br>▪ Density<br>▪ HART input<br>▪ Percent of range<br>▪ Measured current<br>▪ Primary variable (PV)<br>▪ Secondary variable (SV)<br>▪ Tertiary variable (TV)<br>▪ Quaternary variable (QV)<br>▪ Not used | Volume flow |
| Burst variable 1 | For HART command 9 and 33: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. | Not used |
| Burst variable 2 | For HART command 9 and 33: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. | Not used |
| Burst variable 3 | For HART command 9 and 33: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. | Not used |
| Burst variable 4 | For HART command 9: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. | Not used |
| Burst variable 5 | For HART command 9: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. | Not used |
| Burst variable 6 | For HART command 9: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. | Not used |
| Burst variable 7 | For HART command 9: select the HART device variable or the process variable. | See the **Burst variable 0** parameter. | Not used |
| Burst trigger mode | Select the event that triggers burst message X. | ▪ Continuous<br>▪ Window *<br>▪ Rising *<br>▪ Falling *<br>▪ On change | Continuous |
| Burst trigger level | Enter the burst trigger value.<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 | 1 000 ms |
| Max. update period | Enter the maximum time span between two burst commands of burst message X. | Positive integer | 2 000 ms |

* 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.

- Checklist for "Post-mounting check" → 38
- Checklist for "Post-connection check" → 54

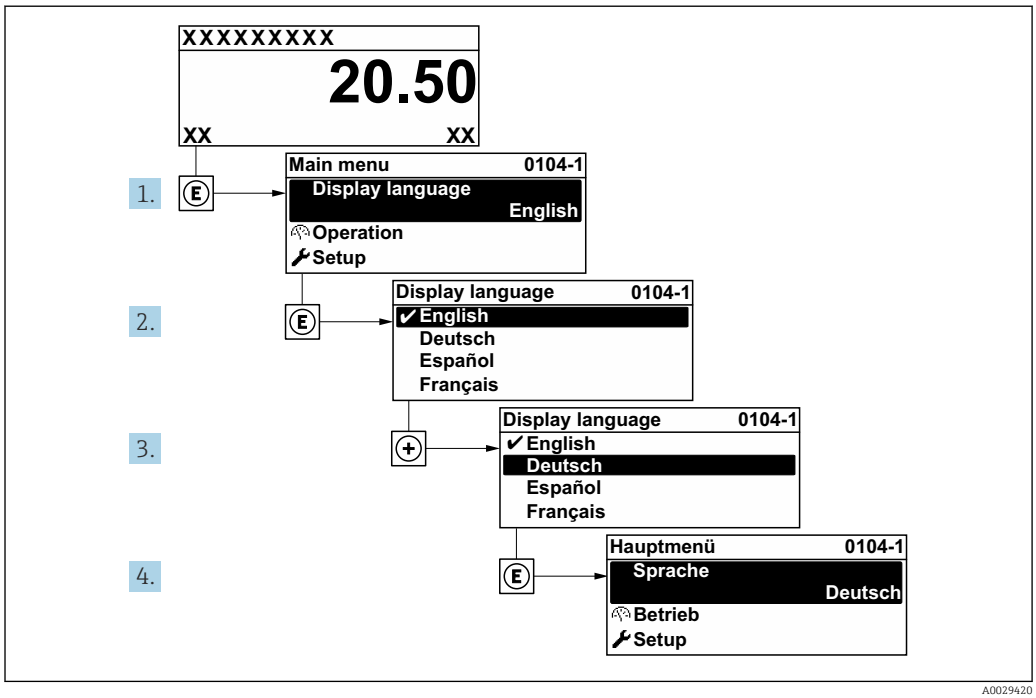
## 10.2 Switching on the measuring device

▶ 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.

If nothing appears on the local display or a diagnostic message is displayed, refer to the section on "Diagnostics and troubleshooting" → 140.

## 10.3 Setting the operating language

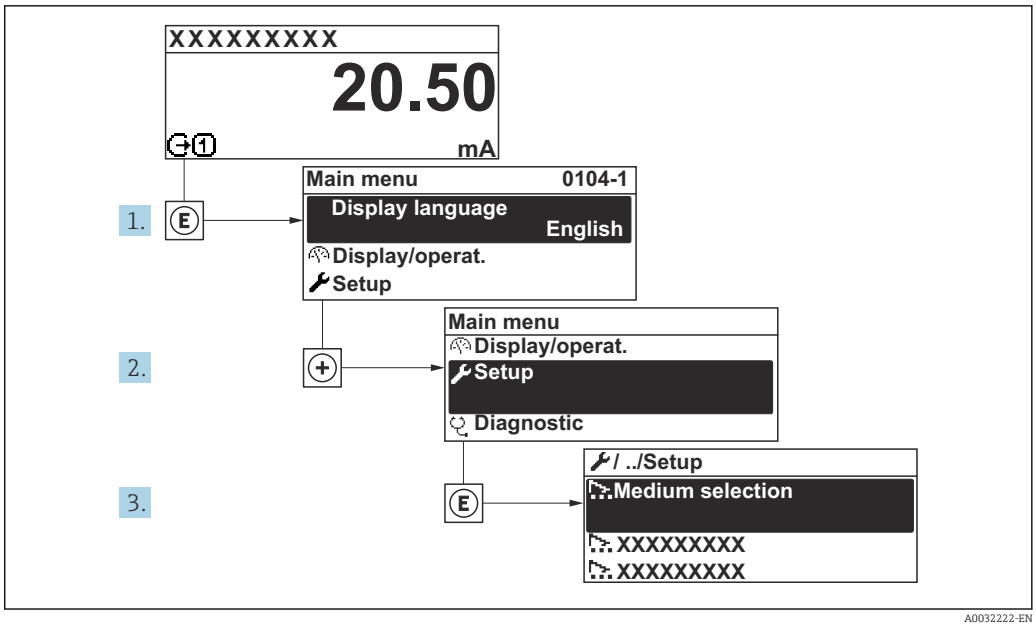
Factory setting: English or ordered local language




27 *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

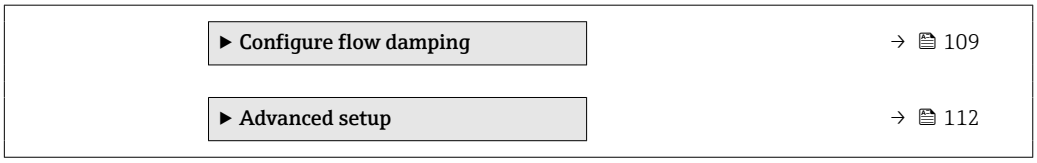



28 *Taking the example of the local display*

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).

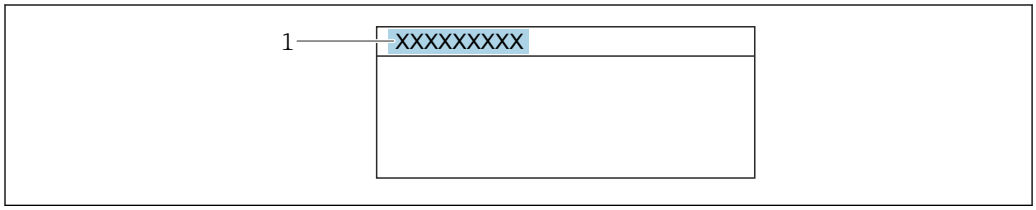
**Setup**

| | |
|---|---|
| Device tag | → 88 |
| ▶ System units | → 88 |
| ▶ I/O configuration | → 89 |
| ▶ Current input 1 to n | → 91 |
| ▶ Status input 1 to n | → 90 |
| ▶ Current output 1 to n | → 92 |
| ▶ Pulse/frequency/switch output 1 to n | → 95 |
| ▶ Relay output 1 to n | → 107 |
| ▶ Double pulse output | → 108 |
| ▶ Display | → 101 |
| ▶ Low flow cut off | → 103 |
| ▶ Empty pipe detection | → 104 |




### 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.




*29 Header of the operational display with tag name*

*1 Tag name*

Enter the tag name in the "FieldCare" operating tool → 80

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

**Parameter overview with brief description**

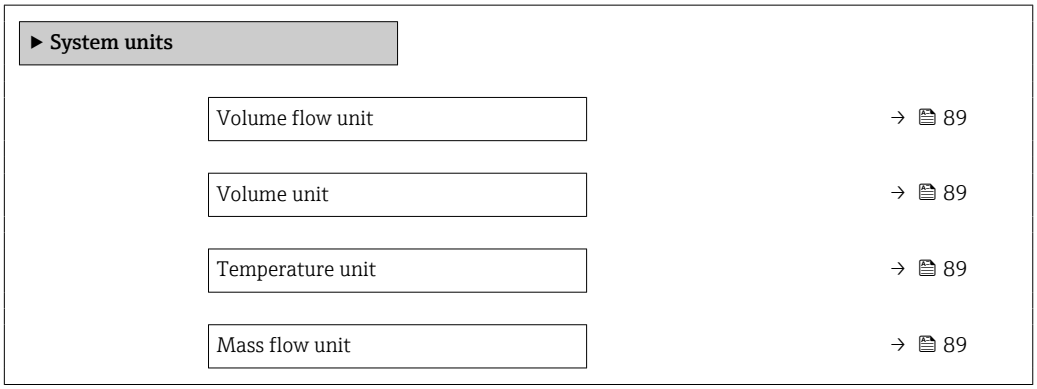
| Parameter | Description | User entry | Factory setting |
|---|---|---|---|
| Device tag | Enter the name for the measuring point. | Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /). | Promag |

### 10.4.2 Setting the system units

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

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 → System units



| | |
|---|---|
| Mass unit | → 89 |
| Density unit | → 89 |

### Parameter overview with brief description

| Parameter | Description | Selection | Factory setting |
|---|---|---|---|
| Volume flow unit | Select volume flow unit.<br>*Effect*<br>The selected unit applies for:<br>▪ Output<br>▪ Low flow cut off<br>▪ Simulation process variable | Unit choose list | Depends on country:<br>▪ l/h<br>▪ gal/min (us) |
| Volume unit | Select volume unit. | Unit choose list | Country-specific:<br>▪ $m^3$<br>▪ gal (us) |
| Temperature unit | Select temperature unit.<br>*Effect*<br>The selected unit applies for:<br>▪ **Temperature** parameter<br>▪ **Maximum value** parameter<br>▪ **Minimum value** parameter<br>▪ **External temperature** parameter<br>▪ **Maximum value** parameter<br>▪ **Minimum value** parameter | Unit choose list | Country-specific:<br>▪ °C<br>▪ °F |
| Mass flow unit | Select mass flow unit.<br>*Effect*<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 |
| Density unit | Select density unit.<br>*Effect*<br>The selected unit applies for:<br>▪ Output<br>▪ Simulation process variable | Unit choose list | Country-specific:<br>▪ kg/l<br>▪ $lb/ft^3$ |

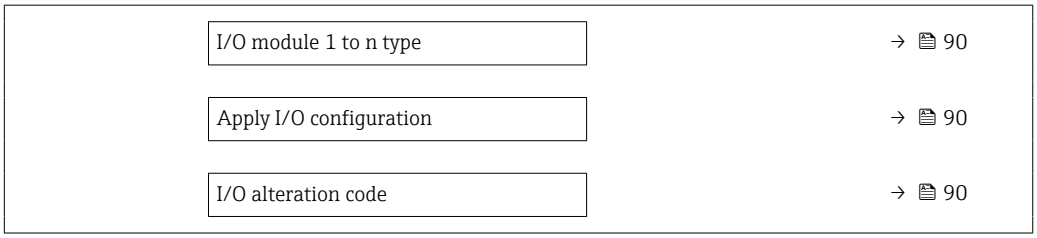
## 10.4.3 Displaying the I/O configuration

The **I/O configuration** submenu guides the user systematically through all the parameters in which the configuration of the I/O modules is displayed.

### Navigation

"Setup" menu → I/O configuration

| | | |
|---|---|---|
| ▶ **I/O configuration** | | |
| | I/O module 1 to n terminal numbers | → 90 |
| | I/O module 1 to n information | → 90 |




### Parameter overview with brief description

| Parameter | Description | User interface / Selection / User entry | Factory setting |
|---|---|---|---|
| I/O module 1 to n terminal numbers | Shows the terminal numbers used by the I/O module. | ▪ Not used<br>▪ 26-27 (I/O 1)<br>▪ 24-25 (I/O 2)<br>▪ 22-23 (I/O 3) | – |
| I/O module 1 to n information | Shows information of the plugged I/O module. | ▪ Not plugged<br>▪ Invalid<br>▪ Not configurable<br>▪ Configurable<br>▪ HART | – |
| I/O module 1 to n type | Shows the I/O module type. | ▪ Off<br>▪ Current output *<br>▪ Current input *<br>▪ Status input *<br>▪ Pulse/frequency/switch output *<br>▪ Double pulse output *<br>▪ Relay output * | Off |
| Apply I/O configuration | Apply parameterization of the freely configurable I/O module. | ▪ No<br>▪ Yes | No |
| I/O alteration code | Enter the code in order to change the I/O configuration. | Positive integer | 0 |

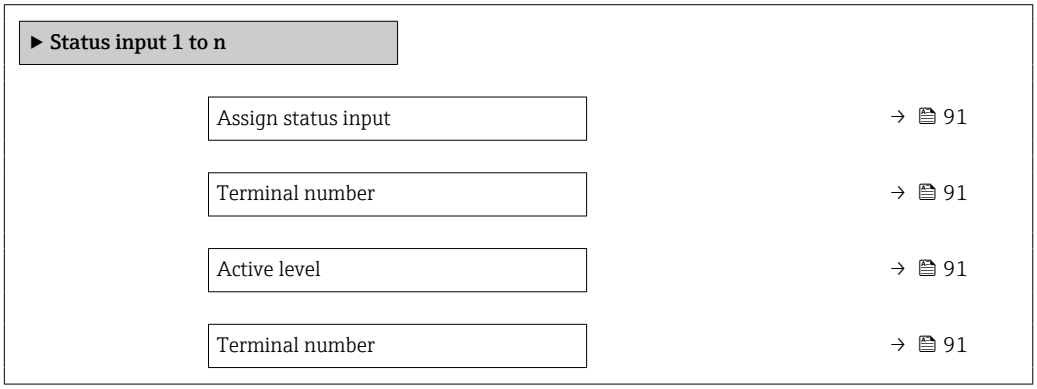
* Visibility depends on order options or device settings

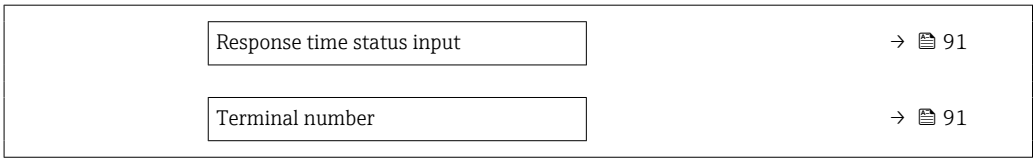
## 10.4.4 Configuring the status input

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

### Navigation

"Setup" menu → Status input 1 to n






### Parameter overview with brief description

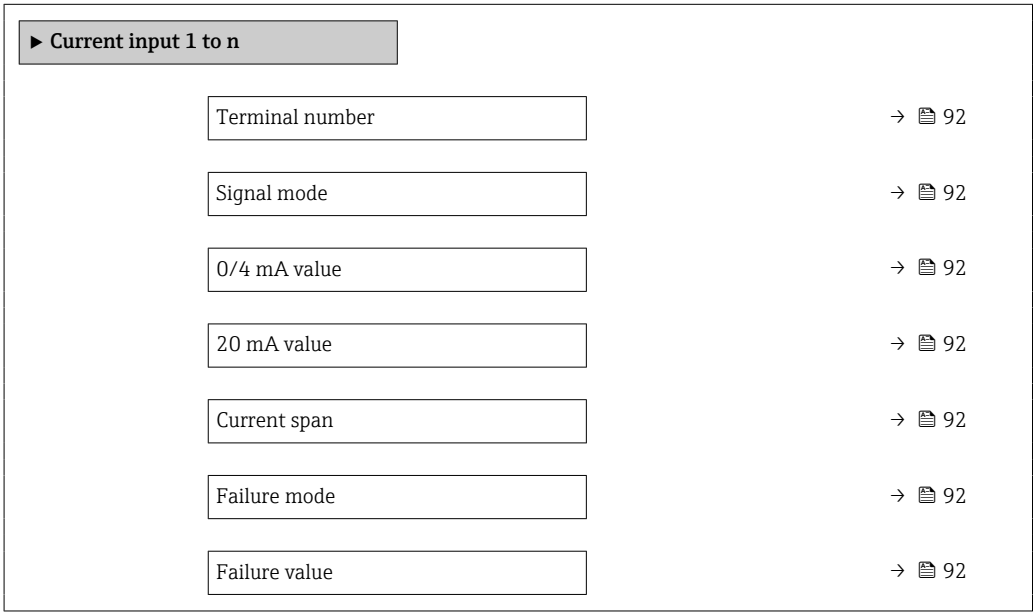
| Parameter | Description | Selection / User interface / User entry | Factory setting |
|---|---|---|---|
| Assign status input | Select function for the status input. | ▪ Off<br>▪ Reset totalizer 1<br>▪ Reset totalizer 2<br>▪ Reset totalizer 3<br>▪ Reset all totalizers<br>▪ Flow override | Off |
| Terminal number | Shows the terminal numbers used by the status input module. | ▪ Not used<br>▪ 24-25 (I/O 2)<br>▪ 22-23 (I/O 3) | – |
| Active level | Define input signal level at which the assigned function is triggered. | ▪ High<br>▪ Low | High |
| 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 | 50 ms |

## 10.4.5 Configuring the current input

The **"Current input" wizard** guides the user systematically through all the parameters that have to be set for configuring the current input.

### Navigation

"Setup" menu → Current input



**Parameter overview with brief description**

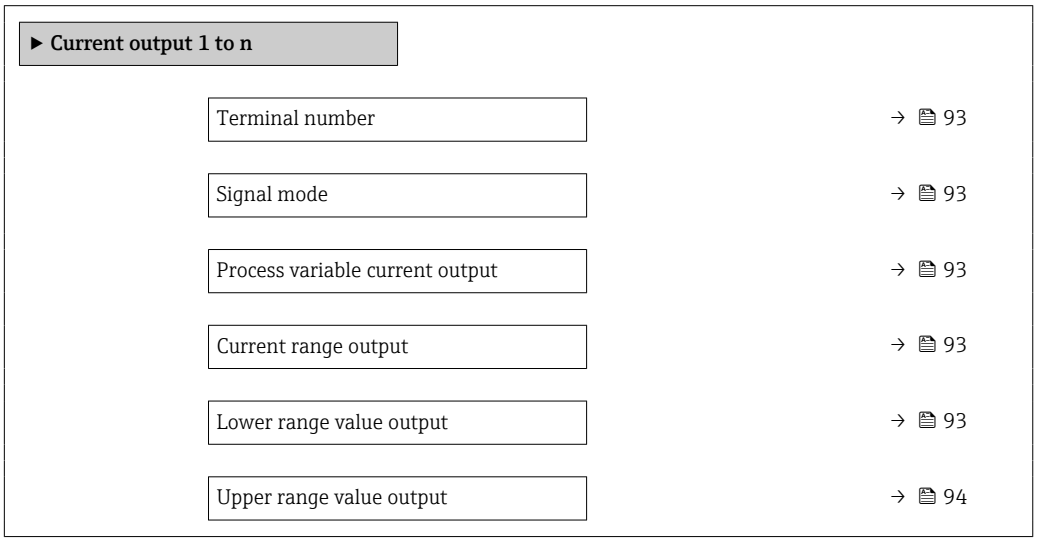
| Parameter | Prerequisite | Description | User interface / Selection / User entry | Factory setting |
|---|---|---|---|---|
| Terminal number | – | Shows the terminal numbers used by the current input module. | ▪ Not used<br>▪ 24-25 (I/O 2)<br>▪ 22-23 (I/O 3) | – |
| Signal mode | The measuring device is **not** approved for use in the hazardous area with type of protection Ex-i. | Select the signal mode for the current input. | ▪ Passive<br>▪ Active * | Active |
| 0/4 mA value | – | Enter 4 mA value. | Signed floating-point number | 0 |
| 20 mA value | – | Enter 20 mA value. | Signed floating-point number | Depends on country and nominal diameter |
| Current span | – | Select current range for process value output and upper/lower level for alarm signal. | ▪ 4...20 mA (4... 20.5 mA)<br>▪ 4...20 mA NE (3.8...20.5 mA)<br>▪ 4...20 mA US (3.9...20.8 mA)<br>▪ 0...20 mA (0... 20.5 mA) | Country-specific:<br>▪ 4...20 mA NE (3.8...20.5 mA)<br>▪ 4...20 mA US (3.9...20.8 mA) |
| Failure mode | – | Define input behavior in alarm condition. | ▪ Alarm<br>▪ Last valid value<br>▪ Defined value | Alarm |
| Failure value | In the **Failure mode** parameter, the **Defined value** option is selected. | Enter value to be used by the device if input value from external device is missing. | Signed floating-point number | 0 |

* Visibility depends on order options or device settings

## 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



| | |
|---|---|
| Fixed current | → 94 |
| Damping current output | → 94 |
| Failure behavior current output | → 94 |
| Failure current | → 94 |

## Parameter overview with brief description

| Parameter | Prerequisite | Description | User interface / Selection / User entry | Factory setting |
|---|---|---|---|---|
| Terminal number | – | Shows the terminal numbers used by the current output module. | ▪ Not used<br>▪ 26-27 (I/O 1)<br>▪ 24-25 (I/O 2)<br>▪ 22-23 (I/O 3) | – |
| Signal mode | – | Select the signal mode for the current output. | ▪ Active *<br>▪ Passive * | Active |
| Process variable current output | – | Select the process variable for the current output. | ▪ Off<br>▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Conductivity<br>▪ Electronics temperature<br>▪ Noise *<br>▪ Coil current shot time *<br>▪ Reference electrode potential against PE *<br>▪ HBSI *<br>▪ Build-up index *<br>▪ Test point 1<br>▪ Test point 2<br>▪ Test point 3 | Volume flow |
| 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 | Depends on country:<br>▪ 4...20 mA NE (3.8...20.5 mA)<br>▪ 4...20 mA US (3.9...20.8 mA) |
| Lower range value output | One of the following options is selected in the **Current span** parameter (→ 93):<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 | Depends on country:<br>▪ 0 l/h<br>▪ 0 gal/min (us) |

| Parameter | Prerequisite | Description | User interface / Selection / User entry | Factory setting |
|---|---|---|---|---|
| Upper range value output | One of the following options is selected in the **Current span** parameter (→ 🖹 93):<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 (→ 🖹 93). | 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 (→ 🖹 93) and one of the following options is selected in the **Current span** parameter (→ 🖹 93):<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 | 1.0 s |
| Failure behavior current output | A process variable is selected in the **Assign current output** parameter (→ 🖹 93) and one of the following options is selected in the **Current span** parameter (→ 🖹 93):<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 | Max. |
| 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 | 22.5 mA |

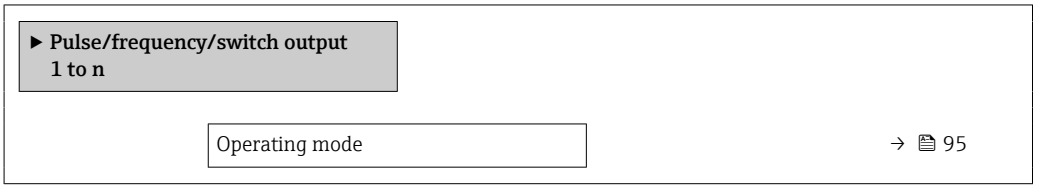
* Visibility depends on order options or device settings

## 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.

### Navigation

"Setup" menu → Advanced setup → Pulse/frequency/switch output



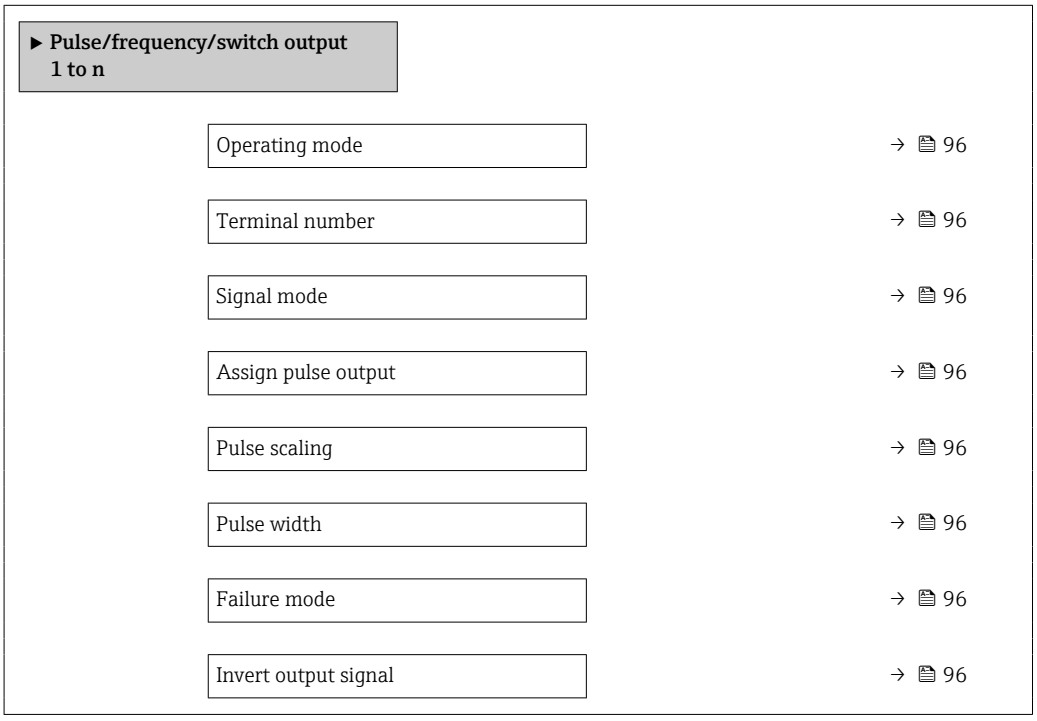

### Parameter overview with brief description

| Parameter | Description | Selection | Factory setting |
|---|---|---|---|
| Operating mode | Define the output as a pulse, frequency or switch output. | ▪ Pulse<br>▪ Frequency<br>▪ Switch | Pulse |

### Configuring the pulse output

### Navigation

"Setup" menu → Pulse/frequency/switch output



### Parameter overview with brief description

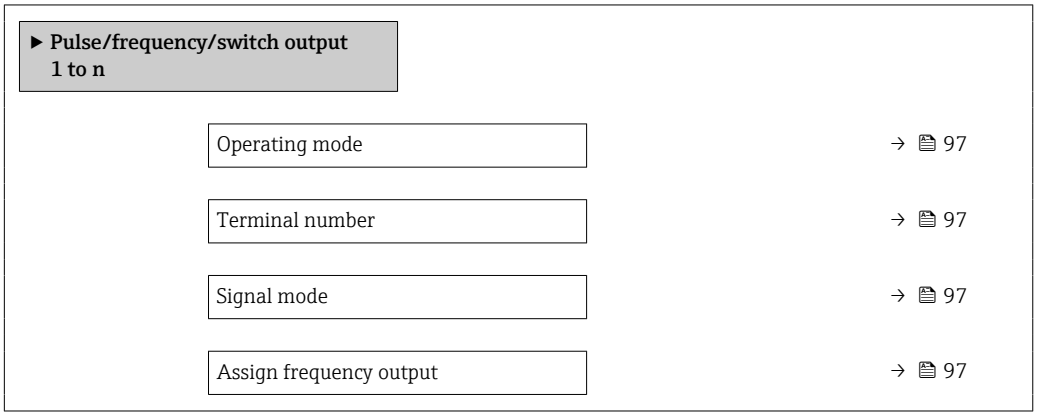
| Parameter | Prerequisite | Description | Selection / User interface / User entry | Factory setting |
|---|---|---|---|---|
| Operating mode | – | Define the output as a pulse, frequency or switch output. | ▪ Pulse<br>▪ Frequency<br>▪ Switch | Pulse |
| Terminal number | – | Shows the terminal numbers used by the PFS output module. | ▪ Not used<br>▪ 24-25 (I/O 2)<br>▪ 22-23 (I/O 3) | – |
| Signal mode | – | Select the signal mode for the PFS output. | ▪ Passive<br>▪ Active *<br>▪ Passive NE | Passive |
| Assign pulse output 1 to n | The **Pulse** option is selected in the **Operating mode** parameter. | Select process variable for pulse output. | ▪ Off<br>▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow | Off |
| Pulse scaling | The **Pulse** option is selected in the **Operating mode** parameter (→ 🖹 95) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 96). | 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 (→ 🖹 95) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 96). | Define time width of the output pulse. | 0.05 to 2 000 ms | 100 ms |
| Failure mode | The **Pulse** option is selected in the **Operating mode** parameter (→ 🖹 95) and a process variable is selected in the **Assign pulse output** parameter (→ 🖹 96). | Define output behavior in alarm condition. | ▪ Actual value<br>▪ No pulses | No pulses |
| Invert output signal | – | Invert the output signal. | ▪ No<br>▪ Yes | No |

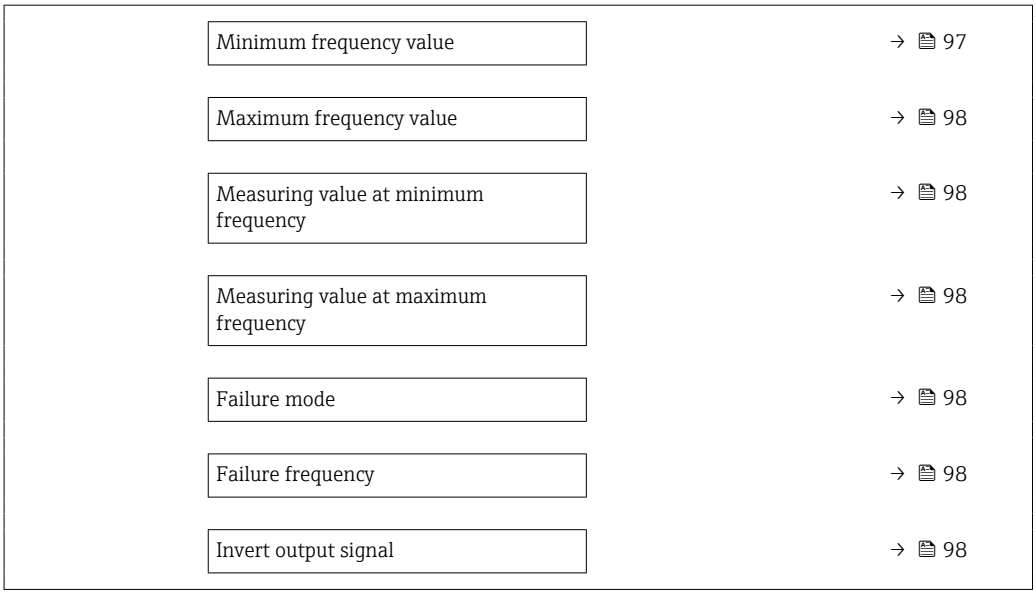
* Visibility depends on order options or device settings

### Configuring the frequency output

#### Navigation

"Setup" menu → Pulse/frequency/switch output






## Parameter overview with brief description

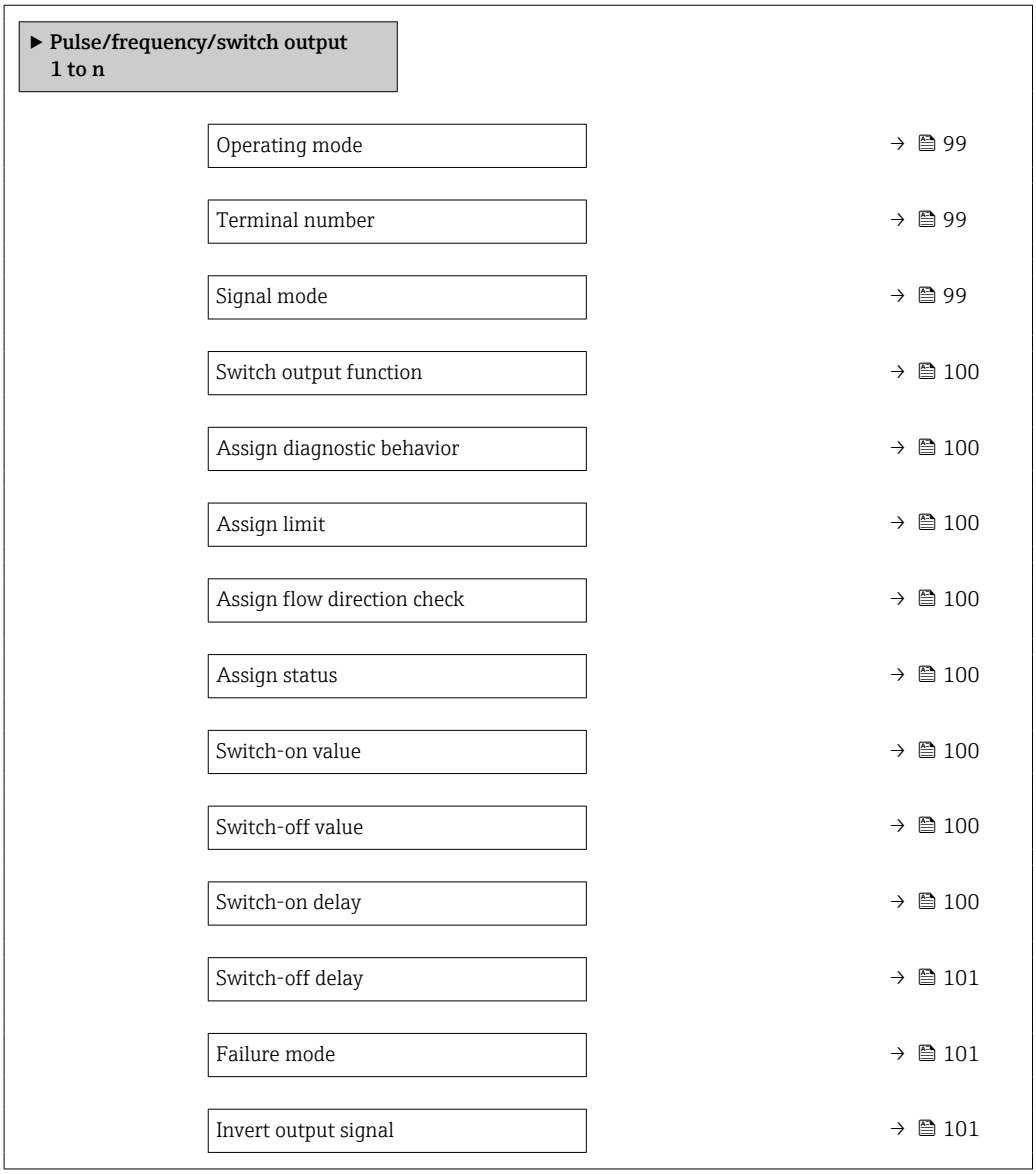
| Parameter | Prerequisite | Description | Selection / User interface / User entry | Factory setting |
|---|---|---|---|---|
| Operating mode | – | Define the output as a pulse, frequency or switch output. | ▪ Pulse<br>▪ Frequency<br>▪ Switch | Pulse |
| Terminal number | – | Shows the terminal numbers used by the PFS output module. | ▪ Not used<br>▪ 24-25 (I/O 2)<br>▪ 22-23 (I/O 3) | – |
| Signal mode | – | Select the signal mode for the PFS output. | ▪ Passive<br>▪ Active *<br>▪ Passive NE | Passive |
| Assign frequency output | In the **Operating mode** parameter (→ 95), the **Frequency** option is selected. | Select process variable for frequency output. | ▪ Off<br>▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Conductivity *<br>▪ Electronics temperature<br>▪ Noise *<br>▪ Coil current shot time *<br>▪ Reference electrode potential against PE *<br>▪ HBSI *<br>▪ Build-up index *<br>▪ Test point 1<br>▪ Test point 2<br>▪ Test point 3 | Off |
| Minimum frequency value | The **Frequency** option is selected in the **Operating mode** parameter (→ 95) and a process variable is selected in the **Assign frequency output** parameter (→ 97). | Enter minimum frequency. | 0.0 to 10000.0 Hz | 0.0 Hz |

| Parameter | Prerequisite | Description | Selection / User interface / User entry | Factory setting |
|---|---|---|---|---|
| Maximum frequency value | The **Frequency** option is selected in the **Operating mode** parameter (→ 🖹 95) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 97). | Enter maximum frequency. | 0.0 to 10 000.0 Hz | 10 000.0 Hz |
| Measuring value at minimum frequency | The **Frequency** option is selected in the **Operating mode** parameter (→ 🖹 95) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 97). | Enter measured value for minimum 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 (→ 🖹 95) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 97). | 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 (→ 🖹 95) and a process variable is selected in the **Assign frequency output** parameter (→ 🖹 97). | Define output behavior in alarm condition. | ▪ Actual value<br>▪ Defined value<br>▪ 0 Hz | 0 Hz |
| Failure frequency | In the **Operating mode** parameter (→ 🖹 95), the **Frequency** option is selected, in the **Assign frequency output** parameter (→ 🖹 97) a process variable is selected, and in the **Failure mode** parameter, the **Defined value** option is selected. | Enter frequency output value in alarm condition. | 0.0 to 12 500.0 Hz | 0.0 Hz |
| Invert output signal | – | Invert the output signal. | ▪ No<br>▪ Yes | No |

* Visibility depends on order options or device settings

### Configuring the switch output

#### Navigation
"Setup" menu → Pulse/frequency/switch output




### Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User interface / User entry | Factory setting |
|---|---|---|---|---|
| Operating mode | – | Define the output as a pulse, frequency or switch output. | ▪ Pulse<br>▪ Frequency<br>▪ Switch | Pulse |
| Terminal number | – | Shows the terminal numbers used by the PFS output module. | ▪ Not used<br>▪ 24-25 (I/O 2)<br>▪ 22-23 (I/O 3) | – |
| Signal mode | – | Select the signal mode for the PFS output. | ▪ Passive<br>▪ Active *<br>▪ Passive NE | Passive |

| Parameter | Prerequisite | Description | Selection / User interface / User entry | Factory setting |
|---|---|---|---|---|
| Switch output function | The **Switch** option is selected in the **Operating mode** parameter. | Select function for switch output. | ▪ Off<br>▪ On<br>▪ Diagnostic behavior<br>▪ Limit<br>▪ Flow direction check<br>▪ Status | Off |
| Assign diagnostic behavior | ▪ In the **Operating mode** parameter, the **Switch** option is selected.<br>▪ In the **Switch output function** parameter, the **Diagnostic behavior** option is selected. | Select diagnostic behavior for switch output. | ▪ Alarm<br>▪ Alarm or warning<br>▪ Warning | Alarm |
| Assign limit | ▪ In the **Operating mode** parameter, the **Switch** option is selected.<br>▪ In the **Switch output function** parameter, the **Limit** option is selected. | Select process variable for limit function. | ▪ Off<br>▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Conductivity *<br>▪ Totalizer 1<br>▪ Totalizer 2<br>▪ Totalizer 3<br>▪ Electronics temperature | Volume flow |
| 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>▪ Corrected volume flow | Volume flow |
| 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. | ▪ Empty pipe detection<br>▪ Low flow cut off<br>▪ Build-up index *<br>▪ HBSI limit exceeded * | Empty pipe detection |
| 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:<br>▪ 0 l/h<br>▪ 0 gal/min (us) |
| 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:<br>▪ 0 l/h<br>▪ 0 gal/min (us) |
| 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 | 0.0 s |

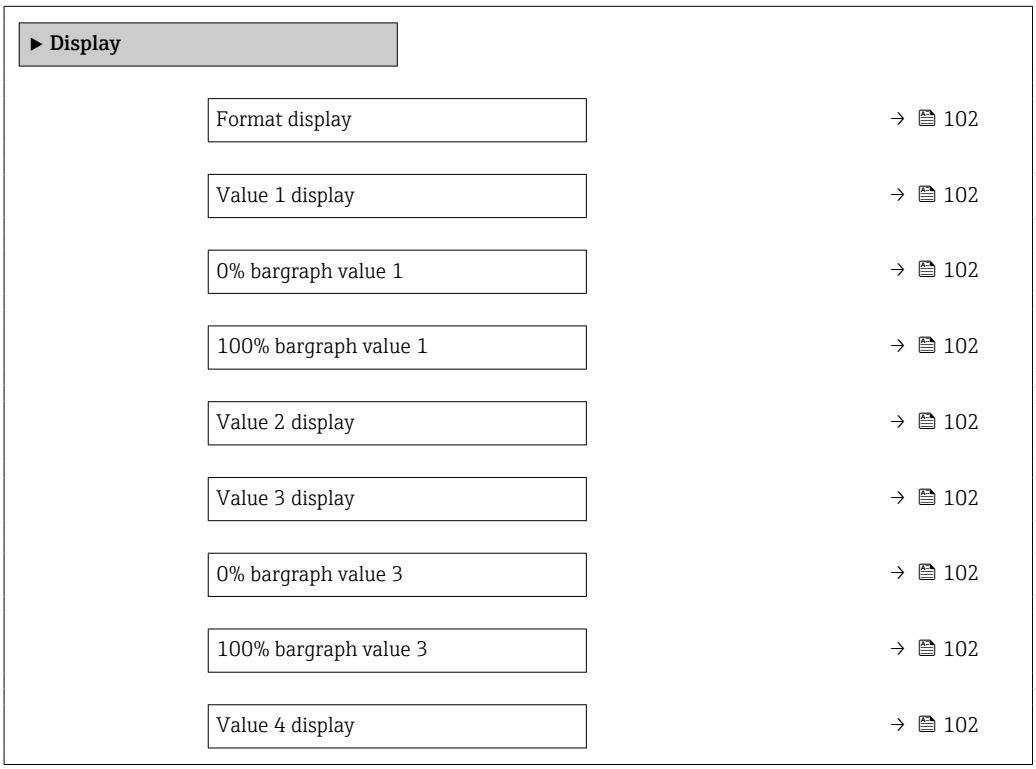
| Parameter | Prerequisite | Description | Selection / User interface / User entry | Factory setting |
|---|---|---|---|---|
| Switch-off delay | ▪ The **Switch** option is selected in the **Operating mode** parameter.<br>▪ The **Limit** option is selected in the **Switch output function** parameter. | Define delay for the switch-off of status output. | 0.0 to 100.0 s | 0.0 s |
| Failure mode | – | Define output behavior in alarm condition. | ▪ Actual status<br>▪ Open<br>▪ Closed | Open |
| Invert output signal | – | Invert the output signal. | ▪ No<br>▪ Yes | No |

* 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



## 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>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Totalizer 1<br>▪ Totalizer 2<br>▪ Totalizer 3<br>▪ Current output 1<br>▪ Current output 2 *<br>▪ Current output 3 *<br>▪ Current output 4 *<br>▪ Electronics temperature<br>▪ HBSI *<br>▪ Noise *<br>▪ Coil current shot time *<br>▪ Reference electrode potential against PE *<br>▪ Build-up index *<br>▪ Test point 1<br>▪ Test point 2<br>▪ Test point 3 | Volume flow |
| 0% bargraph value 1 | A local display is provided. | Enter 0% value for bar graph display. | Signed floating-point number | Country-specific:<br>▪ 0 l/h<br>▪ 0 gal/min (us) |
| 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. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |
| Value 3 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |
| 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:<br>▪ 0 l/h<br>▪ 0 gal/min (us) |
| 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 | 0 |
| Value 4 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |
| Value 5 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Value 6 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |
| Value 7 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |
| Value 8 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |

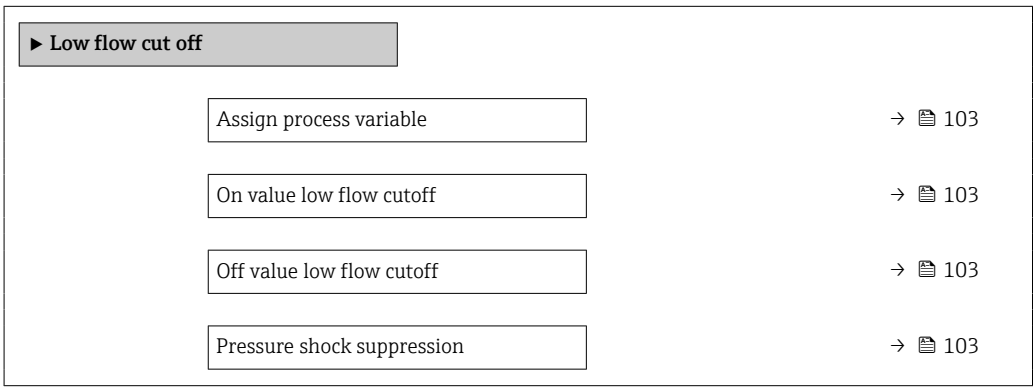
* Visibility depends on order options or device settings

## 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.

### 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>▪ Corrected volume flow | Volume flow |
| On value low flow cutoff | A process variable is selected in the **Assign process variable** parameter (→ 🖹 103). | Enter on value for low flow cut off. | Positive floating-point number | Depends on country and nominal diameter |
| Off value low flow cutoff | A process variable is selected in the **Assign process variable** parameter (→ 🖹 103). | Enter off value for low flow cut off. | 0 to 100.0 % | 50 % |
| Pressure shock suppression | A process variable is selected in the **Assign process variable** parameter (→ 🖹 103). | Enter time frame for signal suppression (= active pressure shock suppression). | 0 to 100 s | 0 s |

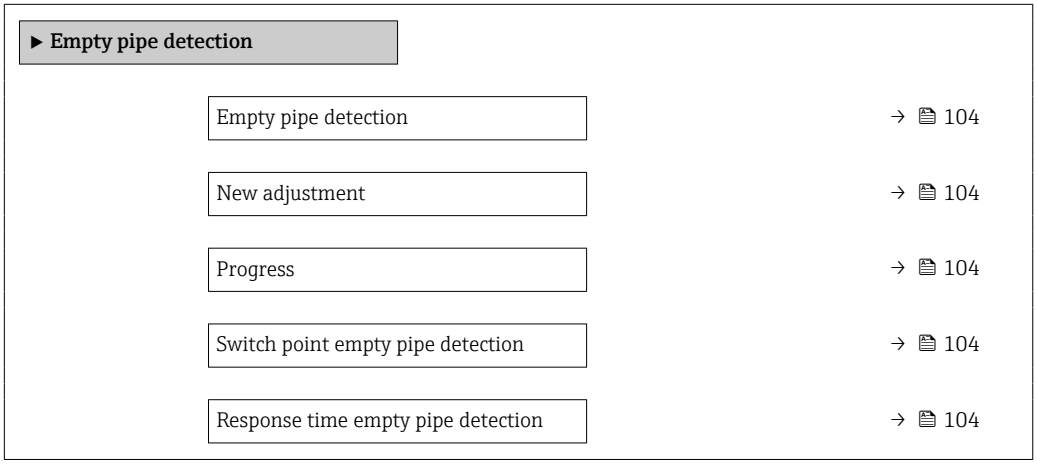
## 10.4.10 Configuring empty pipe detection

The measuring devices are calibrated with water (approx. 500 µS/cm) at the factory. For liquids with a lower conductivity, it is advisable to perform a new full pipe adjustment onsite.

The **Empty pipe detection** submenu contains parameters that must be configured for the configuration of empty pipe detection.

### Navigation

"Setup" menu → Empty pipe detection



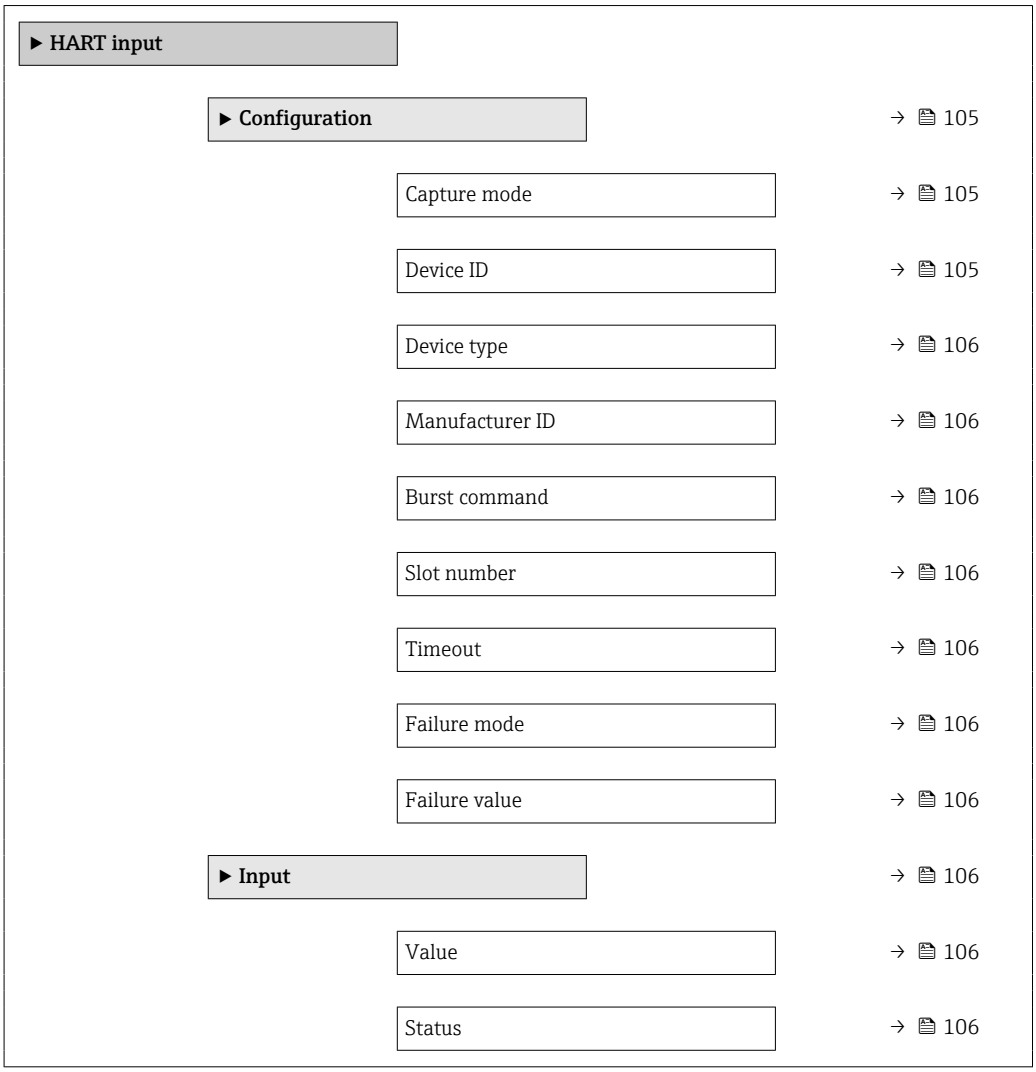

### Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User interface / User entry | Factory setting |
|---|---|---|---|---|
| Empty pipe detection | – | Switch empty pipe detection on and off. | ▪ Off<br>▪ On | Off |
| New adjustment | The **On** option is selected in the **Empty pipe detection** parameter. | Select type of adjustment. | ▪ Cancel<br>▪ Empty pipe adjust<br>▪ Full pipe adjust | Cancel |
| Progress | The **On** option is selected in the **Empty pipe detection** parameter. | Shows the progress. | ▪ Ok<br>▪ Busy<br>▪ Not ok | – |
| Switch point empty pipe detection | The **On** option is selected in the **Empty pipe detection** parameter. | Enter the switch point in % of the difference between the two adjustment values. The lower the percentage, the earlier the pipe is detected as empty. | 0 to 100 % | 50 % |
| Response time empty pipe detection | A process variable is selected in the **Assign process variable** parameter (→ 104). | Use this function to enter the minimum time (hold time) the signal must be present before diagnostic message S962 "Empty pipe" is triggered in the event of a partially filled or empty measuring pipe. | 0 to 100 s | 1 s |

## 10.4.11 Configuring the HART input

The **HART input** wizard contains all the parameters that must be configured for the configuration of the HART input.

### Navigation
"Expert" menu → Communication → HART input




## "Configuration" submenu

### Navigation
"Expert" menu → Communication → HART input → Configuration

### Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Capture mode | – | Select capture mode via burst or master communication. | ▪ Off<br>▪ Burst network<br>▪ Master network | Off |
| Device ID | The **Master network** option is selected in the **Capture mode** parameter. | Enter device ID of external device. | 6-digit value:<br>▪ Via local operation: enter as hexadecimal or decimal number<br>▪ Via operating tool: enter as decimal number | 0 |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Device type | In the **Capture mode** parameter, the **Master network** option is selected. | Enter device type of external device. | 2-digit hexadecimal number | 0x00 |
| Manufacturer ID | The **Master network** option is selected in the **Capture mode** parameter. | Enter manufacture ID of external device. | 2-digit value:<br>▪ Via local operation: enter as hexadecimal or decimal number<br>▪ Via operating tool: enter as decimal number | 0 |
| Burst command | The **Burst network** option or the **Master network** option are selected in the **Capture mode** parameter. | Select command to read in external process variable. | ▪ Command 1<br>▪ Command 3<br>▪ Command 9<br>▪ Command 33 | Command 1 |
| Slot number | The **Burst network** option or the **Master network** option is selected in the **Capture mode** parameter. | Define position of external process variable in burst command. | 1 to 8 | 1 |
| Timeout | The **Burst network** option or the **Master network** option is selected in the **Capture mode** parameter. | Enter deadline for process variable of external device.<br>If the waiting time is exceeded, the **⊗F410 Data transfer** diagnostic message is displayed. | 1 to 120 s | 5 s |
| Failure mode | In the **Capture mode** parameter, the **Burst network** option or **Master network** option is selected. | Define behavior if external process variable is missed. | ▪ Alarm<br>▪ Last valid value<br>▪ Defined value | Alarm |
| Failure value | The following conditions are met:<br>▪ In the **Capture mode** parameter, the **Burst network** option or **Master network** option is selected.<br>▪ In the **Failure mode** parameter, the **Defined value** option is selected. | Enter value to be used by the device if input value from external device is missing. | Signed floating-point number | 0 |

### "Input" submenu

### Navigation
"Expert" menu → Communication → HART input → Input

### Parameter overview with brief description

| Parameter | Description | User interface |
|---|---|---|
| Value | Shows the value of the device variable recorded by the HART input. | Signed floating-point number |
| Status | Shows the status of the device variable recorded by the HART input. | ▪ Manual/Fixed<br>▪ Good<br>▪ Poor accuracy<br>▪ Bad |

## 10.4.12 Configuring the relay output

The **Relay output** wizard guides the user systematically through all the parameters that have to be set for configuring the relay output.

**Navigation**
"Setup" menu → Relay output 1 to n


### Parameter overview with brief description

| Parameter | Prerequisite | Description | User interface / Selection / User entry | Factory setting |
|---|---|---|---|---|
| Terminal number | – | Shows the terminal numbers used by the relay output module. | ▪ Not used<br>▪ 24-25 (I/O 2)<br>▪ 22-23 (I/O 3) | – |
| Relay output function | – | Select the function for the relay output. | ▪ Closed<br>▪ Open<br>▪ Diagnostic behavior<br>▪ Limit<br>▪ Flow direction check<br>▪ Digital Output | Closed |
| Assign flow direction check | The **Flow direction check** option is selected in the **Relay output function** parameter. | Select process variable for flow direction monitoring. | ▪ Off<br>▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow | Volume flow |

| Parameter | Prerequisite | Description | User interface / Selection / User entry | Factory setting |
|---|---|---|---|---|
| Assign limit | The **Limit** option is selected in the **Relay output function** parameter. | Select process variable for limit function. | ▪ Off<br>▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Conductivity *<br>▪ Totalizer 1<br>▪ Totalizer 2<br>▪ Totalizer 3<br>▪ Electronics temperature | Volume flow |
| Assign diagnostic behavior | In the **Relay output function** parameter, the **Diagnostic behavior** option is selected. | Select diagnostic behavior for switch output. | ▪ Alarm<br>▪ Alarm or warning<br>▪ Warning | Alarm |
| Assign status | In the **Relay output function** parameter, the **Digital Output** option is selected. | Select device status for switch output. | ▪ Partially filled pipe detection<br>▪ Low flow cut off<br>▪ HBSI limit exceeded * | Partially filled pipe detection |
| Switch-off value | In the **Relay output function** parameter, the **Limit** option is selected. | Enter measured value for the switch-off point. | Signed floating-point number | Country-specific:<br>▪ 0 l/h<br>▪ 0 gal(us)/min |
| Switch-off delay | In the **Relay output function** parameter, the **Limit** option is selected. | Define delay for the switch-off of status output. | 0.0 to 100.0 s | 0.0 s |
| Switch-on value | The **Limit** option is selected in the **Relay output function** parameter. | Enter measured value for the switch-on point. | Signed floating-point number | Country-specific:<br>▪ 0 l/h<br>▪ 0 gal(us)/min |
| Switch-on delay | In the **Relay output function** parameter, the **Limit** option is selected. | Define delay for the switch-on of status output. | 0.0 to 100.0 s | 0.0 s |
| Failure mode | – | Define output behavior in alarm condition. | ▪ Actual status<br>▪ Open<br>▪ Closed | Open |

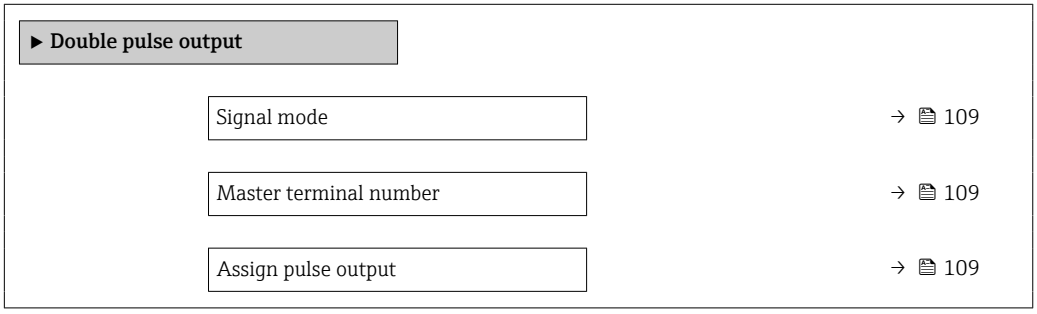
* Visibility depends on order options or device settings

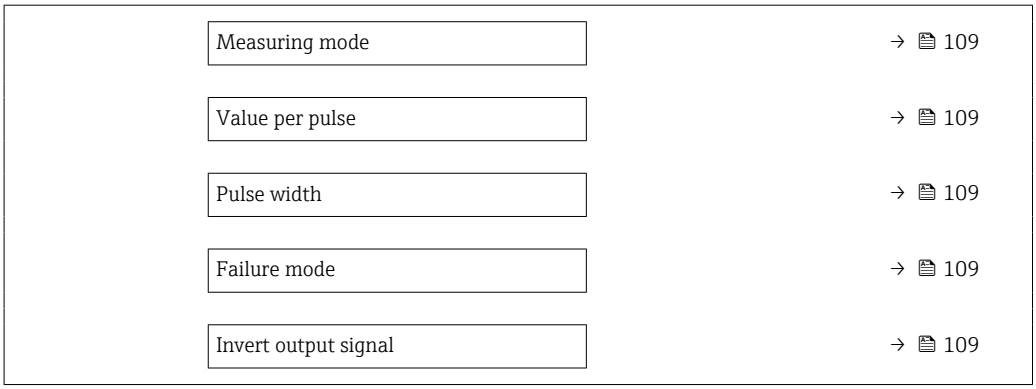
## 10.4.13 Configuring the double pulse output

The **Double pulse output** submenu guides the user systematically through all the parameters that have to be set for configuring the double pulse output.

### Navigation

"Setup" menu → Double pulse output






### Parameter overview with brief description

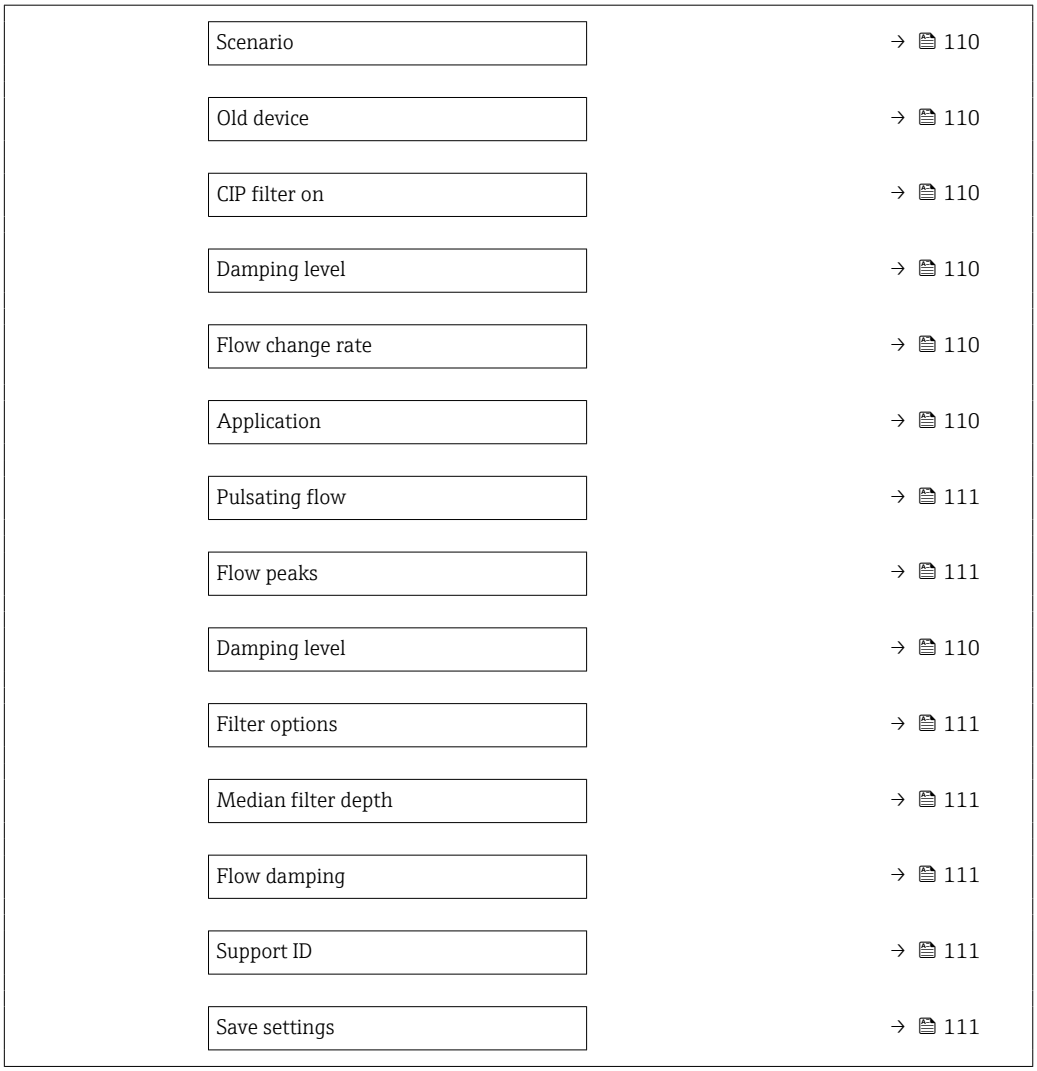
| Parameter | Description | Selection / User interface / User entry | Factory setting |
|---|---|---|---|
| Signal mode | Select the signal mode for the double pulse output. | ▪ Passive<br>▪ Active *<br>▪ Passive NE | Passive |
| Master terminal number | Shows the terminal numbers used by the master of the double pulse output module. | ▪ Not used<br>▪ 24-25 (I/O 2)<br>▪ 22-23 (I/O 3) | – |
| Assign pulse output | Select process variable for pulse output. | ▪ Off<br>▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow | Off |
| Measuring mode | Select measuring mode for pulse output. | ▪ Forward flow<br>▪ Forward/Reverse flow<br>▪ Reverse flow<br>▪ Reverse flow compensation | Forward flow |
| Value per pulse | Enter measured value at which a pulse is output. | Signed floating-point number | Depends on country and nominal diameter |
| Pulse width | Define time width of the output pulse. | 0.5 to 2 000 ms | 0.5 ms |
| Failure mode | Define output behavior in alarm condition. | ▪ Actual value<br>▪ No pulses | No pulses |
| Invert output signal | Invert the output signal. | ▪ No<br>▪ Yes | No |

* Visibility depends on order options or device settings

## 10.4.14 Configuring flow damping

The **Configure flow damping** wizard guides the user systematically through the parameters, depending on the selected scenario:
- Configuration of damping for the application
  To configure flow damping for the specific requirements of the process application.
- Replace old device
  To adopt the flow damping for the new device in the event of a device replacement.
- Restoring factory settings
  To restore the factory settings of all the parameters that are relevant for flow damping.

**Navigation**
"Setup" menu → Configure flow damping




## Parameter overview with brief description

| Parameter | Description | Selection / User interface | Factory setting |
|---|---|---|---|
| Scenario | Select the applicable scenario. | ▪ Replace old device<br>▪ Configure damping for application<br>▪ Restore factory settings | Configure damping for application |
| Old device | Select the measuring device to replace. | ▪ Promag 10 (pre-2021)<br>▪ Promag 50/53<br>▪ Promag 55 H | Promag 50/53 |
| CIP filter on | Indicate whether the CIP filter was applied for the device to be replaced. | ▪ No<br>▪ Yes | No |
| Damping level | Select the degree of damping to apply. | ▪ Default<br>▪ Weak<br>▪ Strong | Default |
| Flow change rate | Select the rate at which the flow changes. | ▪ Once a day or less<br>▪ Once an hour or less<br>▪ Once a minute or less<br>▪ Once a second or more | Once a minute or less |
| Application | Select the type of application that applies. | ▪ Display flow<br>▪ Control loop<br>▪ Totalizing<br>▪ Batching | Display flow |

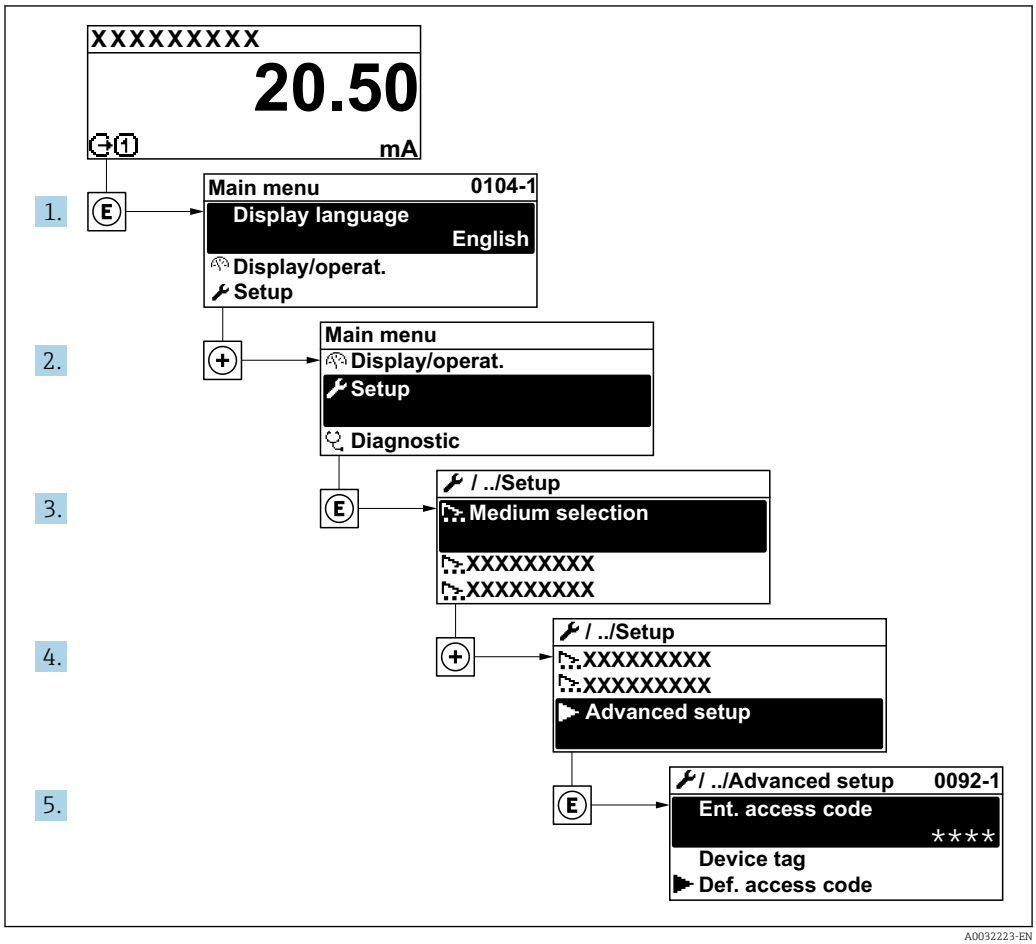
| Parameter | Description | Selection / User interface | Factory setting |
|---|---|---|---|
| Pulsating flow | Indicate whether the process is characterized by pulsating flow (e.g. due to a displacement pump). | ▪ No<br>▪ Yes | No |
| Flow peaks | Select the frequency at which flow interference peaks occur. | ▪ Never<br>▪ Sporadically<br>▪ Regularly<br>▪ Continuously | Never |
| Response Time | | ▪ Fast<br>▪ Slow<br>▪ Normal | Normal |
| Filter options | Shows the type of flow filter recommended for damping. | ▪ Adaptive<br>▪ Adaptive CIP on<br>▪ Dynamic<br>▪ Dynamic CIP on<br>▪ Binomial<br>▪ Binomial CIP on | Binomial |
| Median filter depth | Shows median filter depth recommended for damping. | 0 to 255 | 6 |
| Flow damping | Shows the flow filter depth recommended for damping. | 0 to 15 | 7 |
| Support ID | If the recommended settings are not satisfactory: please contact your Endress +Hauser service organization with the support ID displayed. | 0 to 65 535 | 0 |
| Save settings | Indicate whether to save the recommended settings. | ▪ Cancel<br>▪ Save * | Cancel |
| Filter Wizard result: | | ▪ Completed<br>▪ Aborted | Aborted |

* Visibility depends on order options or device settings

## 10.5 Advanced settings

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

*Navigation to the "Advanced setup" submenu*



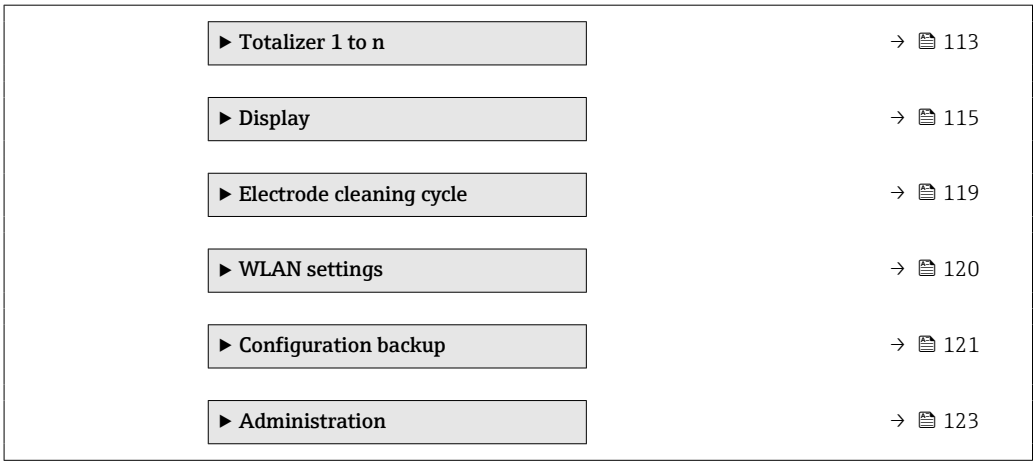

The number of submenus and parameters can vary depending on the device version and the available application packages. These submenus and their parameters are explained in the Special Documentation for the device and not in Operating Instructions.

- For detailed information on the parameter descriptions for application packages: Special Documentation for the device
- For detailed information on the SIL parameter descriptions, see the Functional Safety Manual → 🖹 206

### Navigation

"Setup" menu → Advanced setup

| | | |
|---|---|---|
| ▶ Advanced setup | | |
| | Enter access code | → 🖹 113 |
| | ▶ Sensor adjustment | → 🖹 113 |




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

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

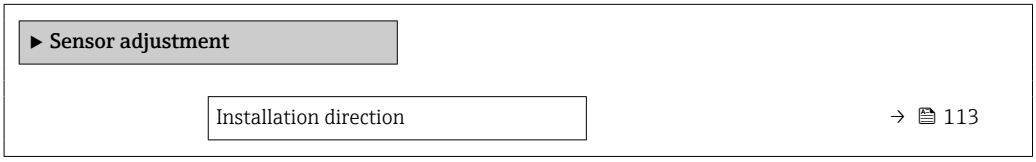
**Parameter overview with brief description**

| 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




**Parameter overview with brief description**

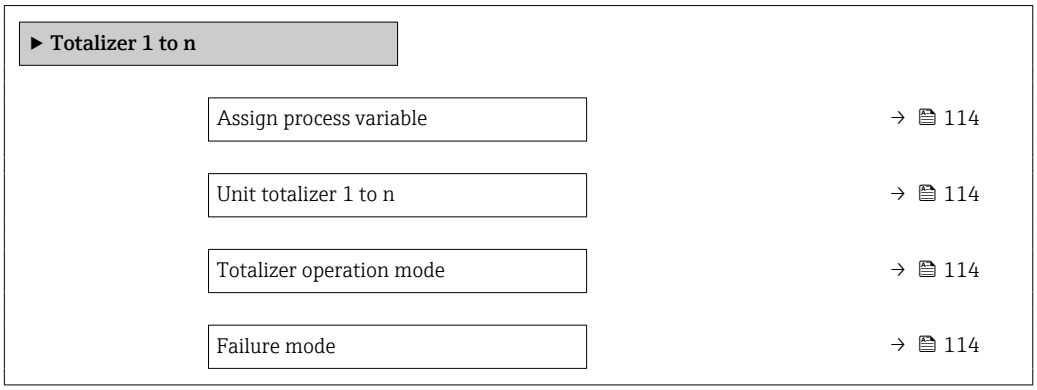
| Parameter | Description | Selection | Factory setting |
|---|---|---|---|
| Installation direction | Select sign of flow direction. | ▪ Forward flow<br>▪ Reverse flow | Forward flow |

### 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




### 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<br>▪ Corrected volume flow | Volume flow |
| Unit totalizer 1 to n | A process variable is selected in the **Assign process variable** parameter (→ 114) of the **Totalizer 1 to n** submenu. | Select the unit for the process variable of the totalizer. | Unit choose list | Depends on country:<br>▪ l<br>▪ gal (us) |
| Totalizer operation mode | A process variable is selected in the **Assign process variable** parameter (→ 114) of the **Totalizer 1 to n** submenu. | Select totalizer calculation mode. | ▪ Net<br>▪ Forward<br>▪ Reverse | Net |
| Failure mode | A process variable is selected in the **Assign process variable** parameter (→ 114) of the **Totalizer 1 to n** submenu. | Select totalizer behavior in the event of a device alarm. | ▪ Hold<br>▪ Continue<br>▪ Last valid value + continue | Hold |

### 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 | → 116 |
| Value 1 display | → 116 |
| 0% bargraph value 1 | → 116 |
| 100% bargraph value 1 | → 116 |
| Decimal places 1 | → 116 |
| Value 2 display | → 116 |
| Decimal places 2 | → 116 |
| Value 3 display | → 116 |
| 0% bargraph value 3 | → 116 |
| 100% bargraph value 3 | → 117 |
| Decimal places 3 | → 117 |
| Value 4 display | → 117 |
| Decimal places 4 | → 117 |
| Display language | → 118 |
| Display interval | → 118 |
| Display damping | → 118 |
| Header | → 118 |
| Header text | → 118 |
| Separator | → 118 |
| Backlight | → 118 |

## 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>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Totalizer 1<br>▪ Totalizer 2<br>▪ Totalizer 3<br>▪ Current output 1<br>▪ Current output 2 *<br>▪ Current output 3 *<br>▪ Current output 4 *<br>▪ Electronics temperature<br>▪ HBSI *<br>▪ Noise *<br>▪ Coil current shot time *<br>▪ Reference electrode potential against PE *<br>▪ Build-up index *<br>▪ Test point 1<br>▪ Test point 2<br>▪ Test point 3 | Volume flow |
| 0% bargraph value 1 | A local display is provided. | Enter 0% value for bar graph display. | Signed floating-point number | Country-specific:<br>▪ 0 l/h<br>▪ 0 gal/min (us) |
| 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 specified 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. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |
| 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 | x.xx |
| Value 3 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |
| 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:<br>▪ 0 l/h<br>▪ 0 gal/min (us) |

| 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 | 0 |
| 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 | x.xx |
| Value 4 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |
| Decimal places 4 | A measured value is specified in the **Value 4 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 5 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |
| 0% bargraph value 5 | An option was selected in the **Value 5 display** parameter. | Enter 0% value for bar graph display. | Signed floating-point number | Depends on country:<br>▪ 0 l/h<br>▪ 0 gal/min (us) |
| 100% bargraph value 5 | An option was selected in the **Value 5 display** parameter. | Enter 100% value for bar graph display. | Signed floating-point number | 0 |
| Decimal places 5 | A measured value is specified in the **Value 5 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<br>▪ x.xxxxx<br>▪ x.xxxxxx | x.xx |
| Value 6 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |
| Decimal places 6 | A measured value is specified in the **Value 6 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<br>▪ x.xxxxx<br>▪ x.xxxxxx | x.xx |
| Value 7 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |
| 0% bargraph value 7 | An option was selected in the **Value 7 display** parameter. | Enter 0% value for bar graph display. | Signed floating-point number | Depends on country:<br>▪ 0 l/h<br>▪ 0 gal/min (us) |
| 100% bargraph value 7 | An option was selected in the **Value 7 display** parameter. | Enter 100% value for bar graph display. | Signed floating-point number | 0 |
| Decimal places 7 | A measured value is specified in the **Value 7 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<br>▪ x.xxxxx<br>▪ x.xxxxxx | x.xx |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Value 8 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see the **Value 1 display** parameter (→ 🖹 102) | None |
| Decimal places 8 | A measured value is specified in the **Value 8 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<br>▪ x.xxxxx<br>▪ x.xxxxxx | x.xx |
| Display language | A local display is provided. | Set display language. | ▪ English<br>▪ Deutsch<br>▪ Français<br>▪ Español<br>▪ Italiano<br>▪ Nederlands<br>▪ Portuguesa<br>▪ Polski<br>▪ русский язык (Russian)<br>▪ Svenska<br>▪ Türkçe<br>▪ 中文 (Chinese)<br>▪ 日本語 (Japanese)<br>▪ 한국어 (Korean)<br>▪ tiếng Việt (Vietnamese)<br>▪ čeština (Czech) | 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 | 5 s |
| Display damping | A local display is provided. | Set display reaction time to fluctuations in the measured value. | 0.0 to 999.9 s | 0.0 s |
| Header | A local display is provided. | Select header contents on local display. | ▪ Device tag<br>▪ Free text | Device tag |
| Header text | The **Free text** option is selected in the **Header** parameter. | 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. | ▪ . (point)<br>▪ , (comma) | . (point) |
| Backlight | One of the following conditions is met:<br>▪ Order code for "Display; operation", option **F** "4-line, illum.; touch control"<br>▪ Order code for "Display; operation", option **G** "4-line, illum.; touch control +WLAN"<br>▪ Order code for "Display; operation", option **O** "Remote display 4-line illuminated; 10m/30ft cable; touch control" | Switch the local display backlight on and off. | ▪ Disable<br>▪ Enable | Enable |

* Visibility depends on order options or device settings

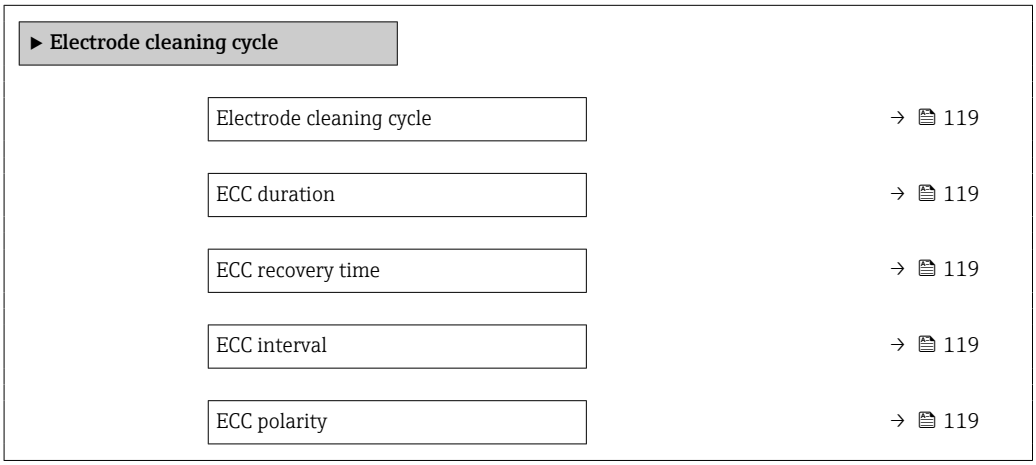
### 10.5.5 Performing electrode cleaning

The **Electrode cleaning cycle** submenu contains the parameters that must be set for the configuration of electrode cleaning.

The submenu is only available if the device was ordered with electrode cleaning.

#### Navigation

"Setup" menu → Advanced setup → Electrode cleaning cycle



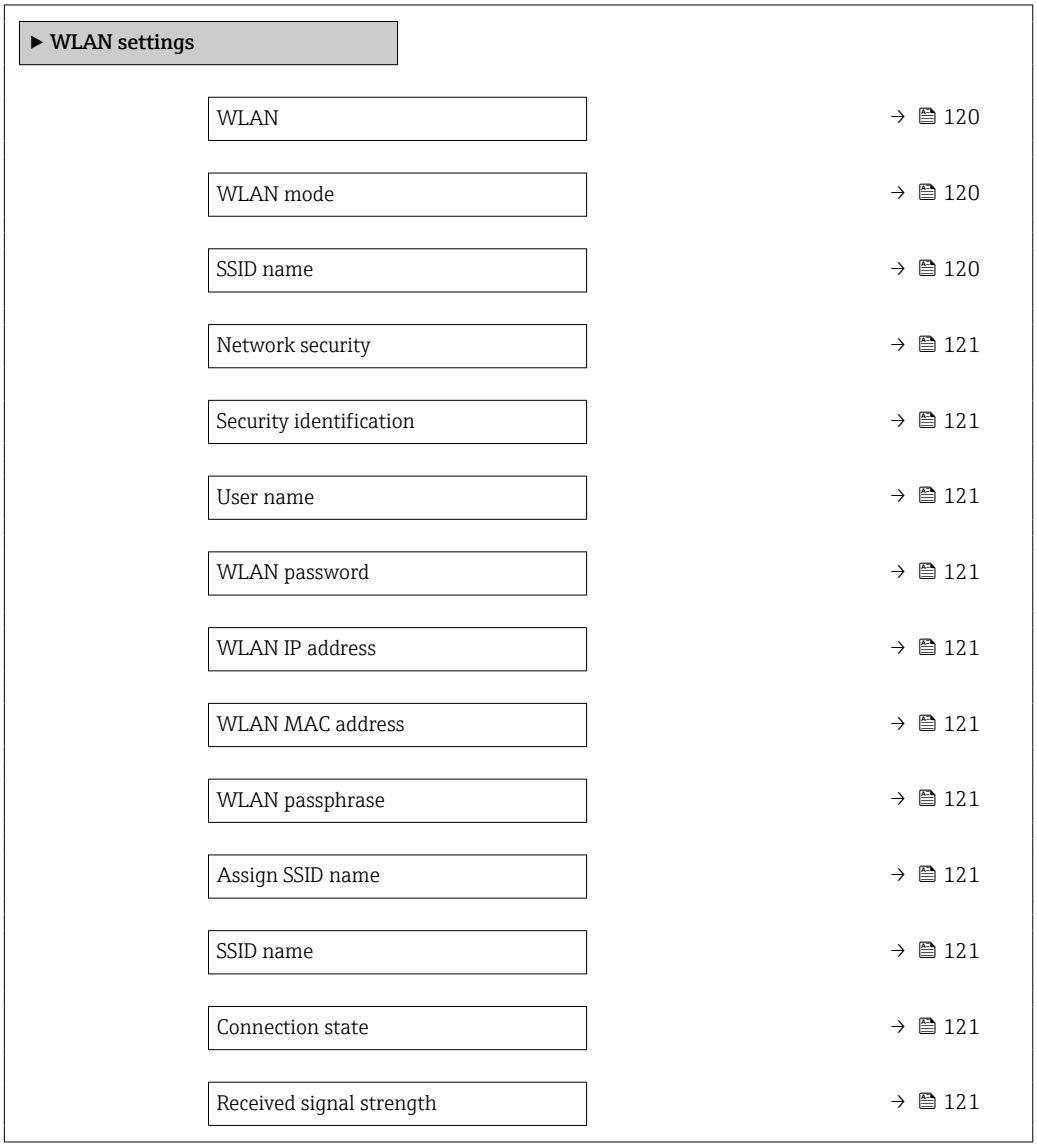

#### Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|---|---|---|---|---|
| Electrode cleaning cycle | Bei folgendem Bestellmerkmal: "Anwendungspaket", Option **EC** "ECC Elektrodenreinigung" | Switch electrode cleaning on or off. | ▪ Off<br>▪ On | On |
| ECC duration | For the following order code: "Application package", option **EC** "ECC electrode cleaning" | Specify the duration of the cleaning phase of the cycle. Diag. msg. no. 530 is displayed until the cleaning phase and recovery phase are complete. | 0.01 to 30 s | 2 s |
| ECC recovery time | For the following order code: "Application package", option **EC** "ECC electrode cleaning" | Specify the maximum timespan after the cleaning phase for recovery before measurement resumes during which the output signal values are frozen. | 1 to 600 s | 60 s |
| ECC interval | For the following order code: "Application package", option **EC** "ECC electrode cleaning" | Specify the interval between one cleaning cycle and the next. | 0.5 to 168 h | 0.5 h |
| ECC polarity | For the following order code: "Application package", option **EC** "ECC electrode cleaning" | Select the polarity of the electrode cleaning circuit. | ▪ Positive<br>▪ Negative | Depends on the electrode material:<br>▪ Tantalum: **Negative** option<br>▪ Platinum, Alloy C22, stainless steel: **Positive** option |

### 10.5.6 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




**Parameter overview with brief description**

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|---|---|---|---|---|
| WLAN | – | Switch WLAN on and off. | ▪ Disable<br>▪ Enable | Enable |
| WLAN mode | – | Select WLAN mode. | ▪ WLAN access point<br>▪ WLAN Client | WLAN access point |
| SSID name | The client is activated. | Enter the user-defined SSID name (max. 32 characters). | – | – |

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|---|---|---|---|---|
| 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 * | WPA2-PSK |
| 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) | 192.168.1.212 |
| 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>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 | 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>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_Promag_300_A 802000) |
| Connection state | – | Displays the connection status. | ▪ Connected<br>▪ Not connected | Not connected |
| Received signal strength | – | Shows the received signal strength. | ▪ Low<br>▪ Medium<br>▪ High | High |

* Visibility depends on order options or device settings

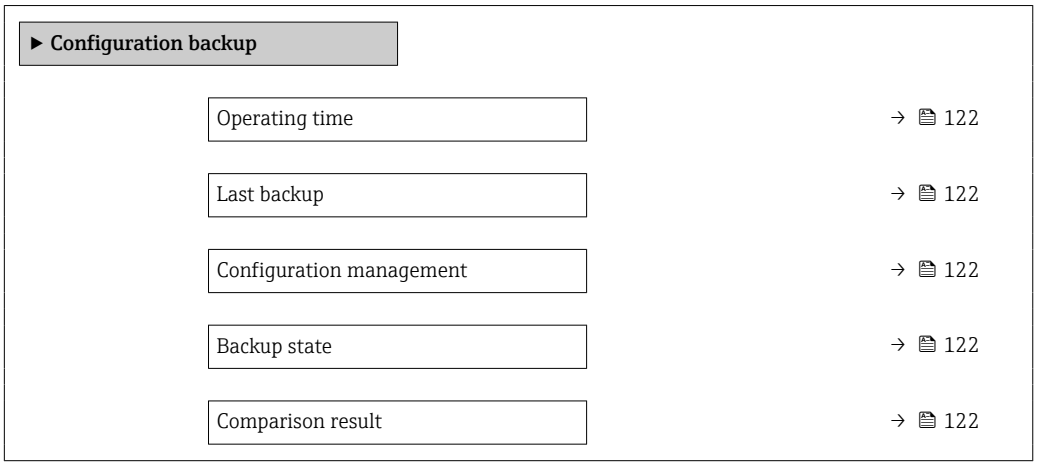
### 10.5.7 Configuration management

After commissioning, you can save the current device configurationor restore the previous device configuration.

You can do so using the **Configuration management** parameter and the related options found in the **Configuration backup** submenu.

### Navigation

"Setup" menu → Advanced setup → Configuration backup




### Parameter overview with brief description

| Parameter | Description | User interface / Selection | Factory setting |
|---|---|---|---|
| Operating time | Indicates how long the device has been in operation. | Days (d), hours (h), minutes (m) and seconds (s) | – |
| Last backup | Shows when the last data backup was saved to HistoROM backup. | Days (d), hours (h), minutes (m) and seconds (s) | – |
| Configuration management | Select action for managing the device data in the HistoROM backup. | ▪ Cancel<br>▪ Execute backup<br>▪ Restore *<br>▪ Compare *<br>▪ Clear backup data | Cancel |
| Backup state | Shows the current status of data saving or restoring. | ▪ None<br>▪ Backup in progress<br>▪ Restoring in progress<br>▪ Delete in progress<br>▪ Compare in progress<br>▪ Restoring failed<br>▪ Backup failed | None |
| Comparison result | Comparison of current device data with HistoROM backup. | ▪ Settings identical<br>▪ Settings not identical<br>▪ No backup available<br>▪ Backup settings corrupt<br>▪ Check not done<br>▪ Dataset incompatible | Check not done |

* Visibility depends on order options or device settings

### Function scope of the "Configuration management" parameter

| Options | Description |
|---|---|
| Cancel | No action is executed and the user exits the parameter. |
| Execute backup | A backup copy of the current device configuration is saved from the HistoROM backup to the memory of the device. The backup copy includes the transmitter data of the device. |
| Restore | The last backup copy of the device configuration is restored from the device memory to the device's HistoROM backup. The backup copy includes the transmitter data of the device. |

| Options | Description |
|---|---|
| Compare | The device configuration saved in the device memory is compared with the current device configuration of the HistoROM backup. |
| Clear backup data | The backup copy of the device configuration is deleted from the memory of the device. |

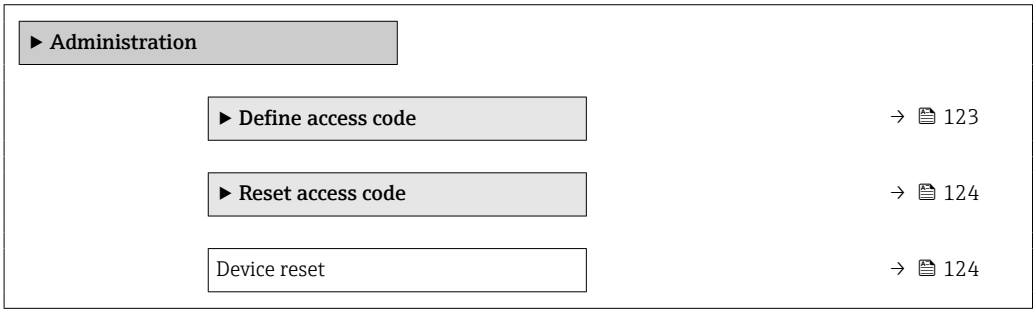
*HistoROM backup*
A HistoROM is a "non-volatile" device memory in the form of an EEPROM.

While this action is in progress, the configuration cannot be edited via the local display and a message on the processing status appears on the display.

## 10.5.8 Using parameters for device administration

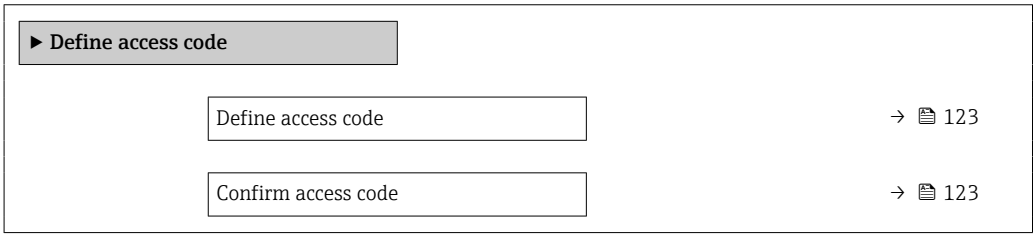
The **Administration** submenu systematically guides the user through all the parameters that can be used for device administration purposes.

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




### Using the parameter to define the access code

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

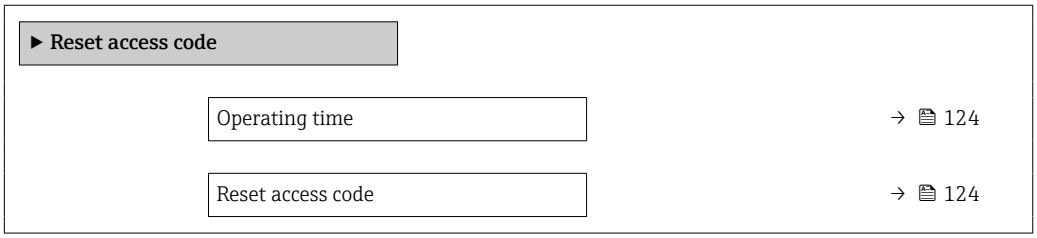



### Parameter overview with brief description

| 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




### Parameter overview with brief description

| Parameter | Description | User interface / User entry | Factory setting |
|---|---|---|---|
| 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>For a reset code, contact your Endress+Hauser service organization.<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 | 0x00 |

### Using the parameter to reset the device

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

### Parameter overview with brief description

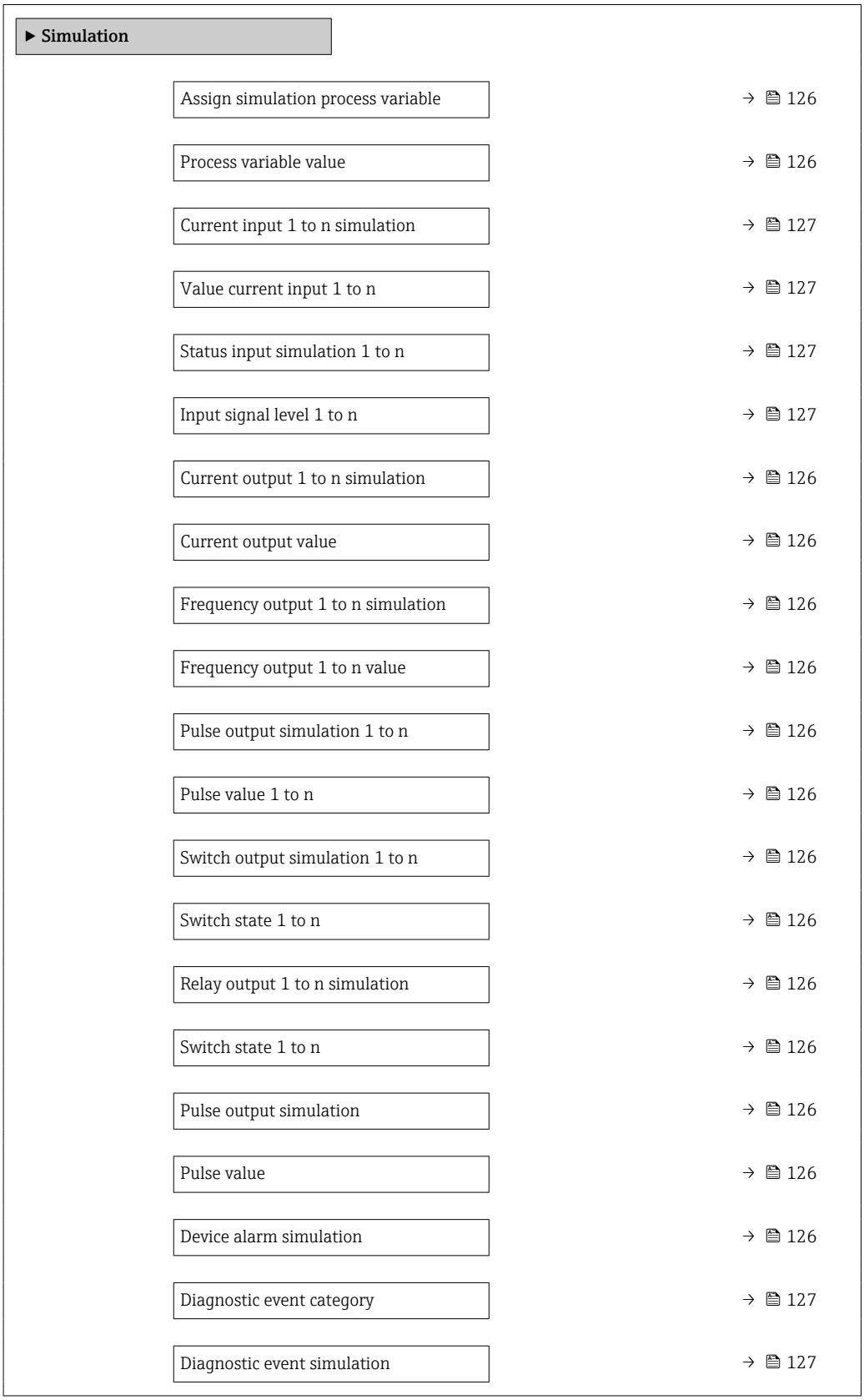
| Parameter | Description | Selection | Factory setting |
|---|---|---|---|
| Device reset | Reset the device configuration - either entirely or in part - to a defined state. | ▪ Cancel<br>▪ To delivery settings<br>▪ Restart device<br>▪ Restore S-DAT backup * | Cancel |

* 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).

**Navigation**
"Diagnostics" menu → Simulation



## Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Assign simulation process variable | – | Select a process variable for the simulation process that is activated. | ▪ Off<br>▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Conductivity * | Off |
| Process variable value | A process variable is selected in the **Assign simulation process variable** parameter (→ 126). | Enter the simulation value for the selected process variable. | Depends on the process variable selected | 0 |
| Current output 1 to n simulation | – | Switch the simulation of the current output on and off. | ▪ Off<br>▪ On | Off |
| Current output value | In the **Current output 1 to n simulation** parameter, the **On** option is selected. | Enter the current value for simulation. | 3.59 to 22.5 mA | 3.59 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. | ▪ Off<br>▪ On | Off |
| 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 | 0.0 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>For **Fixed value** option: **Pulse width** parameter (→ 96) defines the pulse width of the pulses output. | ▪ Off<br>▪ Fixed value<br>▪ Down-counting value | Off |
| 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 | 0 |
| 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. | ▪ Off<br>▪ On | Off |
| Switch state 1 to n | – | Select the status of the status output for the simulation. | ▪ Open<br>▪ Closed | Open |
| Relay output 1 to n simulation | – | Switch simulation of the relay output on and off. | ▪ Off<br>▪ On | Off |
| Switch state 1 to n | The **On** option is selected in the **Switch output simulation 1 to n** parameter parameter. | Select status of the relay output for the simulation. | ▪ Open<br>▪ Closed | Open |
| Pulse output simulation | – | Set and switch off the pulse output simulation.<br>For **Fixed value** option: **Pulse width** parameter defines the pulse width of the pulses output. | ▪ Off<br>▪ Fixed value<br>▪ Down-counting value | Off |
| Pulse value | In the **Pulse output simulation** parameter, the **Down-counting value** option is selected. | Set and switch off the pulse output simulation. | 0 to 65 535 | 0 |
| Device alarm simulation | – | Switch the device alarm on and off. | ▪ Off<br>▪ On | Off |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Diagnostic event category | – | Select a diagnostic event category. | ▪ Sensor<br>▪ Electronics<br>▪ Configuration<br>▪ Process | Process |
| Diagnostic event simulation | – | Select a diagnostic event to simulate this event. | ▪ Off<br>▪ Diagnostic event picklist (depends on the category selected) | Off |
| Current input 1 to n simulation | – | Switch simulation of the current input on and off. | ▪ Off<br>▪ On | Off |
| Value current input 1 to n | In the **Current input 1 to n simulation** parameter, the **On** option is selected. | Enter the current value for simulation. | 0 to 22.5 mA | 0 mA |
| Status input simulation 1 to n | – | Switch simulation of the status input on and off. | ▪ Off<br>▪ On | Off |
| Input signal level 1 to n | In the **Status input simulation** parameter, the **On** option is selected. | Select the signal level for the simulation of the status input. | ▪ High<br>▪ Low | High |

* Visibility depends on order options or device settings

## 10.7 Protecting settings from unauthorized access

The following write protection options exist in order to protect the configuration of the measuring device from unintentional modification:
- Protect access to parameters via access code → 127
- Protect access to local operation via key locking → 68
- Protect access to measuring device via write protection switch → 129

### 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.
- Device access is protected via FieldCare or DeviceCare (via CDI-RJ45 service interface), as are the parameters for the measuring device configuration.

#### Defining the access code via local display

1. Navigate to the **Define access code** parameter (→ 123).
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 **Confirm access code** parameter (→ 123) to confirm the code.
   ↳ The -symbol appears in front of all write-protected parameters.

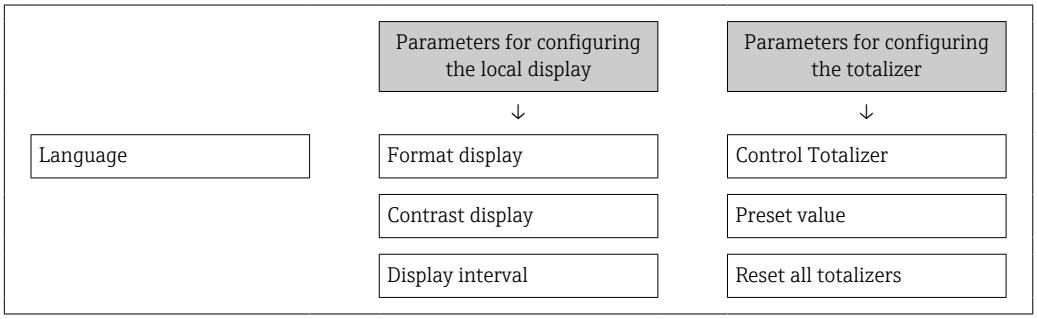
The device automatically locks the write-protected parameters again if a key is not pressed for 10 minutes in the navigation and editing view. The device locks the write-protected

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 → 67.
- The user role with which the user is currently logged on via the local display → 67 is indicated by the **Access status** parameter. Navigation path: Operation → Access status

### 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.




### Defining the access code via the Web browser

1. Navigate to the **Define access code** parameter (→ 123).
2. Define a max. 16-digit numeric code as an access code.
3. Enter the access code again in the **Confirm access code** parameter (→ 123) 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 → 67.
- The user role with which the user is currently logged on via Web browser is indicated by the **Access status** parameter. Navigation path: Operation → Access status

### Resetting the access code

If you misplace the user-specific access code, it is possible to reset the code to the factory setting. A reset code must be entered for this purpose. The user-specific access code can then be defined again afterwards.

### Via Web browser, FieldCare, DeviceCare (via CDI-RJ45 service interface), fieldbus

You can only obtain a reset code from your local Endress+Hauser service organization. The code must be calculated explicitly for every device.

1. Note down the serial number of the device.
2. Read off the **Operating time** parameter.
3. Contact the local Endress+Hauser service organization and tell them the serial number and the operating time.
   ↳ Get the calculated reset code.

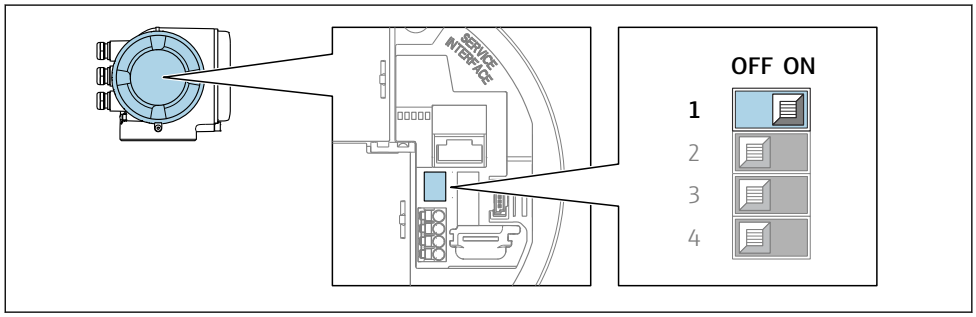
4. Enter the reset code in the **Reset access code** parameter (→ 124).
   ↳ The access code has been reset to the factory setting **0000**. It can be redefined → 127.

For IT security reasons, the calculated reset code is only valid for 96 hours from the specified operating time and for the specific serial number. If you cannot return to the device within 96 hours, you should either increase the operating time you read out by a few days or switch off the device.

### 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 HART protocol

1. 

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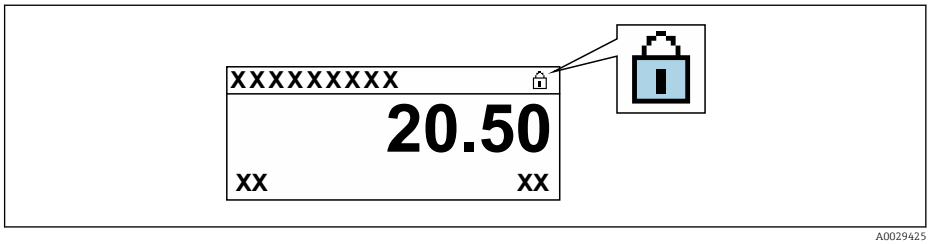
   Setting the write protection (WP) switch on the main electronics module to the **ON** position enables hardware write protection.
   ↳ In the **Locking status** parameter, the **Hardware locked** option is displayed → 130. In addition, on the local display the 🔒 symbol appears in front of the parameters in the header of the operational display and in the navigation view.



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2. Setting the write protection (WP) switch on the main electronics module to the **OFF** position (factory setting) disables hardware write protection.
   ↳ No option is displayed in the **Locking status** parameter → 130. 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.

# 11 Operation

## 11.1 Reading off 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 authorization displayed in the **Access status** parameter applies → 67. Only appears on local display. |
| Hardware locked | The DIP switch for hardware locking is activated on the PCB board. This locks write access to the parameters (e.g. via local display or operating tool) → 129. |
| SIL locked | The SIL mode is enabled. This locks write access to the parameters (e.g. via local display or operating tool). |
| 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 → 86
- For information on the operating languages supported by the measuring device → 197

## 11.3 Configuring the display

Detailed information:
- On the basic settings for the local display → 101
- On the advanced settings for the local display → 115

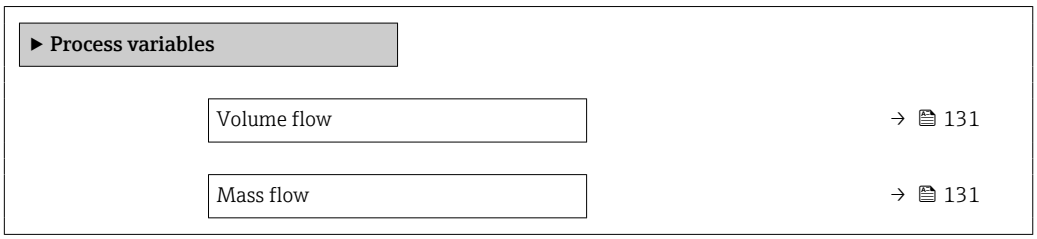
## 11.4 Reading measured values

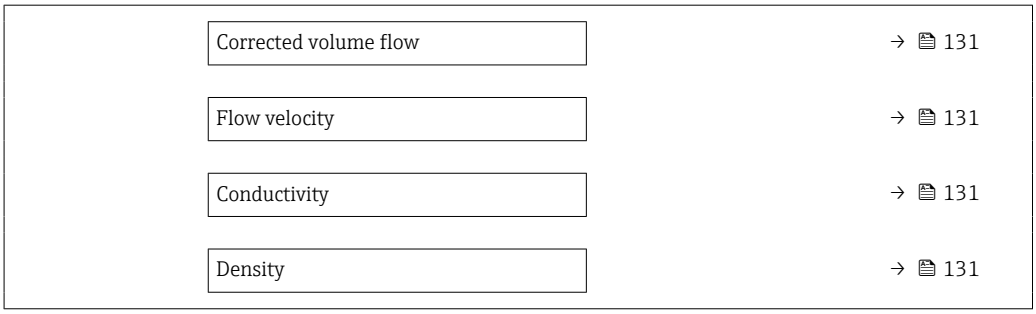
With the **Measured values** submenu, it is possible to read all the measured values.

### 11.4.1 "Process variables" submenu

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






### Parameter overview with brief description

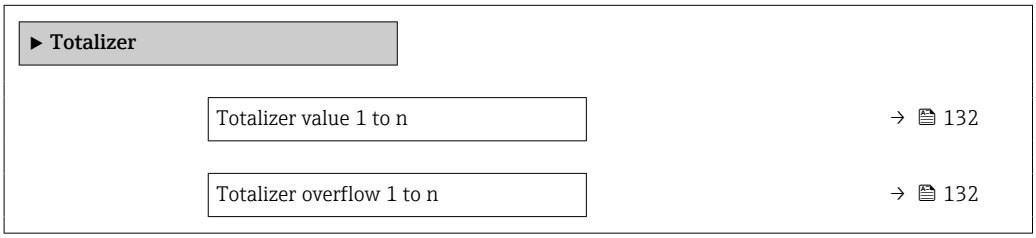
| Parameter | Description | User interface |
|---|---|---|
| Volume flow | Displays the volume flow that is currently measured.<br>*Dependency*<br>The unit is taken from: **Volume flow unit** parameter (→ 89) | Signed floating-point number |
| Mass flow | Displays the mass flow that is currently calculated.<br>*Dependency*<br>The unit is taken from the **Mass flow unit** parameter (→ 89). | Signed floating-point number |
| Corrected volume flow | Displays the corrected volume flow that is currently calculated.<br>*Dependency*<br>The unit is taken from: **Corrected volume flow unit** parameter | Signed floating-point number |
| Flow velocity | Displays the flow velocity that is currently calculated. | Signed floating-point number |
| Conductivity | Displays the conductivity that is currently measured.<br>*Dependency*<br>The unit is taken from the **Conductivity unit** parameter. | Signed floating-point number |
| Density | Displays the current fixed density or density read in from an external device.<br>*Dependency*<br>The unit is taken from the **Density unit** parameter. | Signed floating-point number |

## 11.4.2 "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



### Parameter overview with brief description

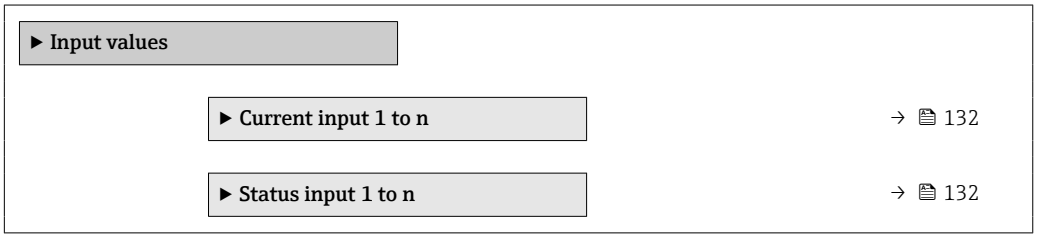
| Parameter | Prerequisite | Description | User interface |
|---|---|---|---|
| Totalizer value 1 to n | A process variable is selected in the **Assign process variable** parameter (→ 🖹 114) of the **Totalizer 1 to n** submenu. | Displays the current totalizer counter reading. | Signed floating-point number |
| Totalizer overflow 1 to n | A process variable is selected in the **Assign process variable** parameter (→ 🖹 114) of the **Totalizer 1 to n** submenu. | Displays the current totalizer overflow. | Integer with sign |

## 11.4.3 "Input values" submenu

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

### Navigation

"Diagnostics" menu → Measured values → Input values

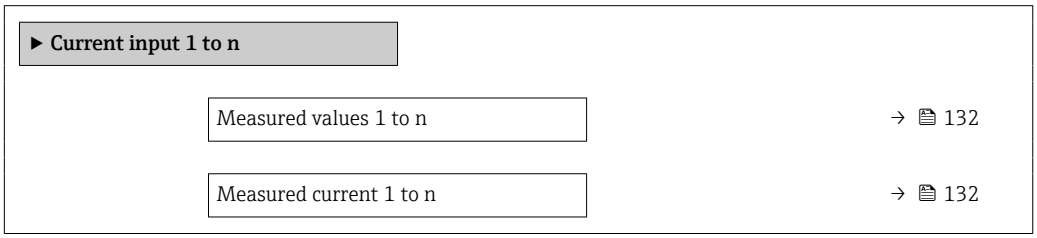



### Input values of current input

The **Current input 1 to n** submenu contains all the parameters needed to display the current measured values for every current input.

### Navigation

"Diagnostics" menu → Measured values → Input values → Current input 1 to n



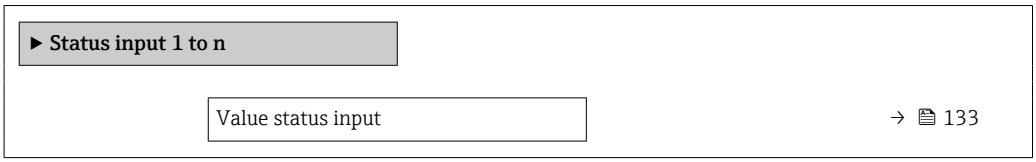

### Parameter overview with brief description

| Parameter | Description | User interface |
|---|---|---|
| Measured values 1 to n | Displays the current input value. | Signed floating-point number |
| Measured current 1 to n | Displays the current value of the current input. | 0 to 22.5 mA |

### Input values of status input

The **Status input 1 to n** submenu contains all the parameters needed to display the current measured values for every status input.

**Navigation**
"Diagnostics" menu → Measured values → Input values → Status input 1 to n



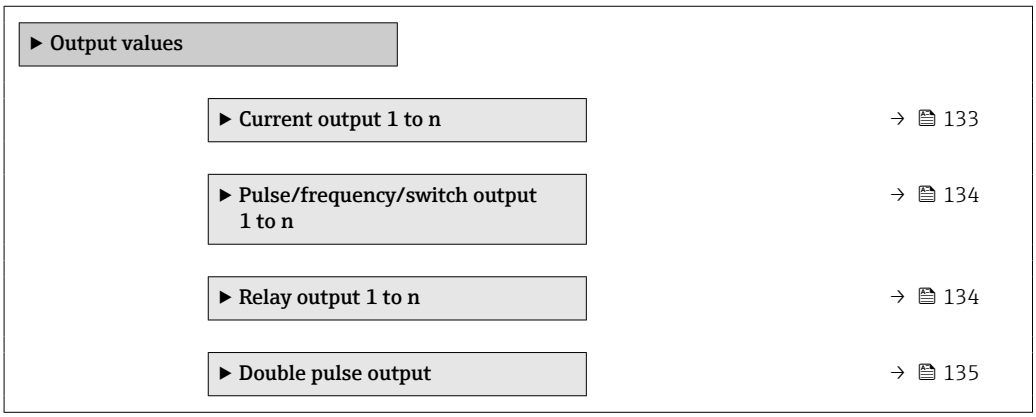

**Parameter overview with brief description**

| Parameter | Description | User interface |
|---|---|---|
| Value 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.

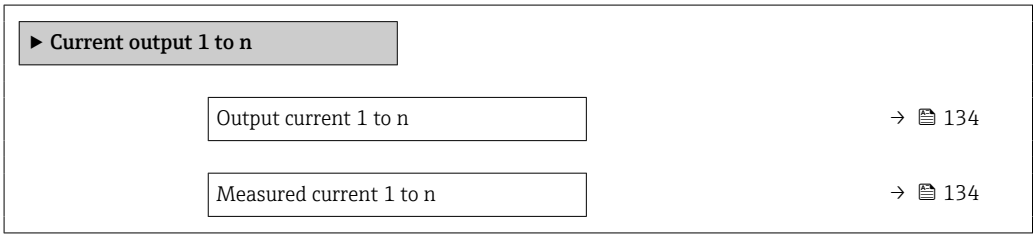
**Navigation**
"Diagnostics" menu → Measured values → Output values




### Output values of current output

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

**Navigation**
"Diagnostics" menu → Measured values → Output values → Value current output 1 to n



### Parameter overview with brief description

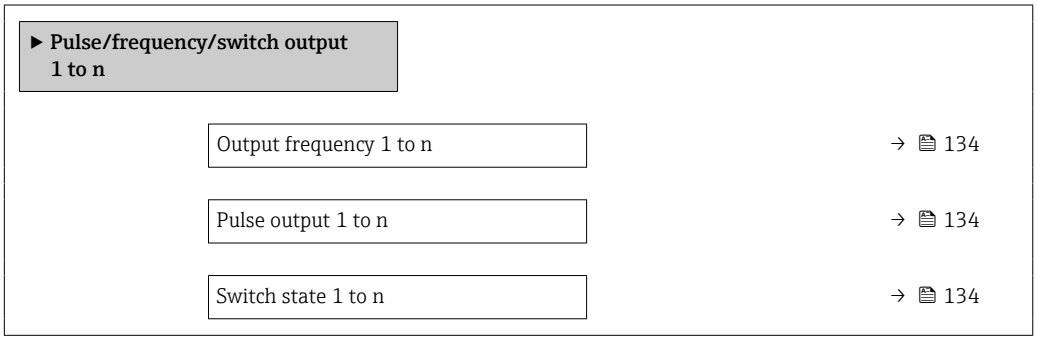
| Parameter | Description | User interface |
|---|---|---|
| Output current 1 | Displays the current value currently calculated for the current output. | 3.59 to 22.5 mA |
| Measured current | Displays the current value currently measured for the current output. | 0 to 30 mA |

### Output values for pulse/frequency/switch output

The **Pulse/frequency/switch output 1 to n** submenu contains all the parameters needed to display the current measured values for every pulse/frequency/switch output.

### Navigation

"Diagnostics" menu → Measured values → Output values → Pulse/frequency/switch output 1 to n




### Parameter overview with brief description

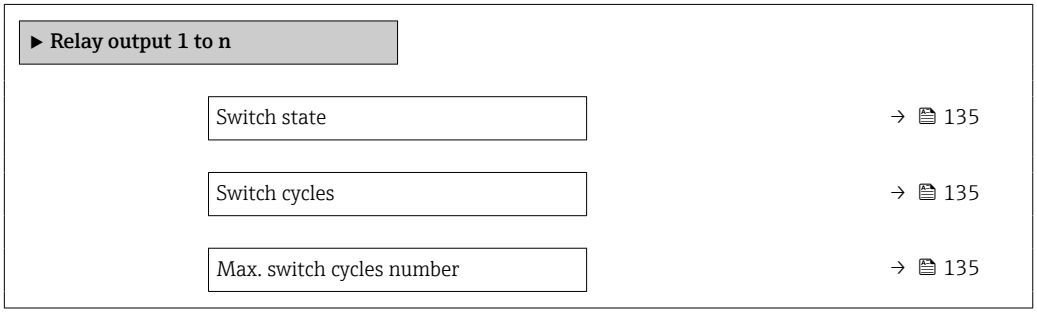
| Parameter | Prerequisite | Description | User interface |
|---|---|---|---|
| Output frequency 1 to n | In the **Operating mode** parameter, the **Frequency** option is selected. | Displays the value currently measured for the frequency output. | 0.0 to 12 500.0 Hz |
| Pulse output 1 to n | The **Pulse**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

### Output values for relay output

The **Relay output 1 to n** submenu contains all the parameters needed to display the current measured values for every relay output.

### Navigation

"Diagnostics" menu → Measured values → Output values → Relay output 1 to n



### Parameter overview with brief description

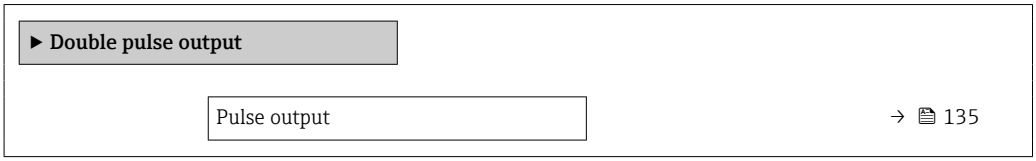
| Parameter | Description | User interface |
|---|---|---|
| Switch state | Shows the current relay switch status. | ▪ Open<br>▪ Closed |
| Switch cycles | Shows number of all performed switch cycles. | Positive integer |
| Max. switch cycles number | Shows the maximal number of guaranteed switch cycles. | Positive integer |

### Output values for double pulse output

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

#### Navigation

"Diagnostics" menu → Measured values → Output values → Double pulse output




### Parameter overview with brief description

| Parameter | Description | User interface |
|---|---|---|
| Pulse output | Shows the currently output pulse frequency. | Positive floating-point number |

## 11.5 Adapting the measuring device to the process conditions

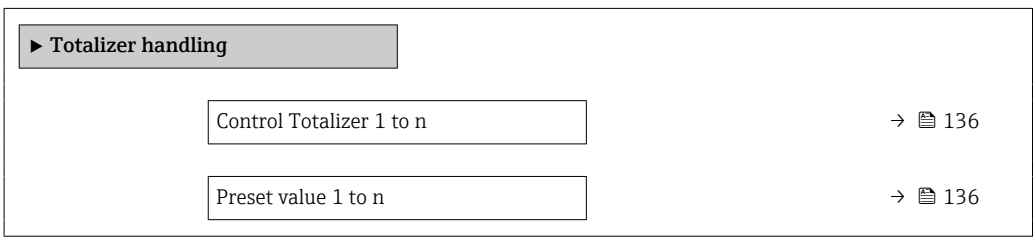
The following are available for this purpose:
- Basic settings using the**Setup** menu (→ 86)
- Advanced settings using the**Advanced setup** submenu (→ 112)

## 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 value 1 to n | → 136 |
| Reset all totalizers | → 136 |

### Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|---|---|---|---|---|
| Control Totalizer 1 to n | A process variable is selected in the **Assign process variable** parameter (→ 114) 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 * | Totalize |
| Preset value 1 to n | A process variable is selected in the **Assign process variable** parameter (→ 114) of the **Totalizer 1 to n** submenu. | Specify start value for totalizer.<br>*Dependency*<br>The unit of the selected process variable is specified for the totalizer in the **Unit totalizer** parameter (→ 114). | Signed floating-point number | 0 l |
| Totalizer value | A process variable is selected in the **Assign process variable** parameter (→ 114) of the **Totalizer 1 to n** submenu. | Displays the current totalizer counter reading. | Signed floating-point number | – |
| Reset all totalizers | – | Reset all totalizers to 0 and start. | ▪ Cancel<br>▪ Reset + totalize | Cancel |

* Visibility depends on order options or device settings

## 11.6.1 Function scope of "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 1) | 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 1) | The totalizer is set to the defined start value in the **Preset value** parameter and the totaling process is restarted. |
| Hold | Totalizing is stopped. |

1) Visible depending on the order options or device settings

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

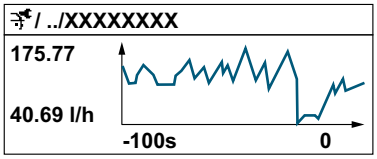
| Options | Description |
|---|---|
| Cancel | No action is executed and the user exits the parameter. |
| Reset + totalize | Resets all totalizers to 0 and restarts the totaling process. This deletes all the flow values previously totalized. |

## 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 → 78.
- Web browser

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

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- 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 | → 138 |
| Assign channel 2 | → 138 |
| Assign channel 3 | → 138 |
| Assign channel 4 | → 138 |
| Logging interval | → 138 |
| Clear logging data | → 139 |
| Data logging | → 139 |
| Logging delay | → 139 |
| Data logging control | → 139 |

| | |
|---|---|
| Data logging status | → 139 |
| Entire logging duration | → 139 |

### Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|---|---|---|---|---|
| Assign channel 1 | The **Extended HistoROM** application package is available. | Assign process variable to logging channel. | ▪ Off<br>▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Conductivity *<br>▪ Electronics temperature<br>▪ Current output 1<br>▪ Current output 2 *<br>▪ Current output 3 *<br>▪ Current output 4 *<br>▪ Noise *<br>▪ Coil current shot time *<br>▪ Reference electrode potential against PE *<br>▪ HBSI *<br>▪ Build-up index *<br>▪ Test point 1<br>▪ Test point 2<br>▪ Test point 3 | Off |
| Assign channel 2 | The **Extended HistoROM** application package is available.<br>The software options currently enabled are displayed in the **Software option overview** parameter. | Assign a process variable to logging channel. | For the picklist, see the **Assign channel 1** parameter (→ 138) | Off |
| Assign channel 3 | The **Extended HistoROM** application package is available.<br>The software options currently enabled are displayed in the **Software option overview** parameter. | Assign a process variable to logging channel. | For the picklist, see the **Assign channel 1** parameter (→ 138) | Off |
| Assign channel 4 | The **Extended HistoROM** application package is available.<br>The software options currently enabled are displayed in the **Software option overview** parameter. | Assign a process variable to logging channel. | For the picklist, see the **Assign channel 1** parameter (→ 138) | Off |
| 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 | 1.0 s |

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|---|---|---|---|---|
| Clear logging data | The **Extended HistoROM** application package is available. | Clear the entire logging data. | ▪ Cancel<br>▪ Clear data | Cancel |
| Data logging | – | Select the type of data logging. | ▪ Overwriting<br>▪ Not overwriting | 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 | 0 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 | None |
| 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 | Done |
| Entire logging duration | In the **Data logging** parameter, the **Not overwriting** option is selected. | Displays the total logging duration. | Positive floating-point number | 0 s |

* 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 → 42. |
| Local display dark and no output signals | The polarity of the supply voltage is wrong. | Correct the polarity. |
| 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 I/O electronics module correctly. Terminals are not plugged into the main electronics module correctly. | Check terminals. |
| Local display dark and no output signals | I/O electronics module is defective. Main electronics module is defective. | Order spare part → 163. |
| 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 | The cable of the display module is not plugged in correctly. | Insert the plug correctly into the main electronics module and display module. |
| Local display is dark, but signal output is within the valid range | Display module is defective. | Order spare part → 163. |
| Backlighting of local display is red | Diagnostic event with "Alarm" diagnostic behavior has occurred. | Take remedial measures → 150 |
| 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 (→ 118). |
| Message on local display:<br>"Communication Error"<br>"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 → 163. |

*For output signals*

| Error | Possible causes | Remedial action |
|---|---|---|
| Signal output outside the valid range | Main electronics module is defective. | Order spare part → 163. |
| Signal output outside the valid current range<br>(< 3.6 mA or > 22 mA) | Main electronics module is defective.<br>I/O electronics module is defective. | Order spare part → 163. |

| Error | Possible causes | Remedial action |
|---|---|---|
| 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*

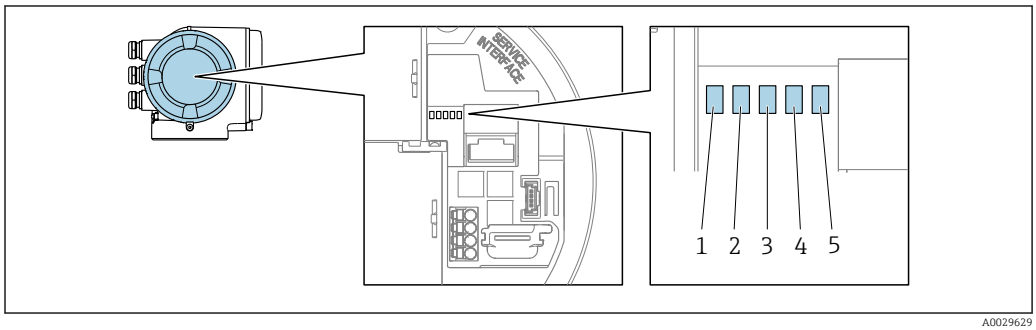
| Error | Possible causes | Remedy |
|---|---|---|
| No write access to parameters | Hardware write protection enabled | Set the write protection switch on the main electronics module to the **OFF** position → 🖹 129. |
| No write access to parameters | Current user role has limited access authorization | 1. Check user role → 🖹 67.<br>2. Enter correct customer-specific access code → 🖹 67. |
| No connection via HART protocol | Missing or incorrectly installed communication resistor. | Install the communication resistor (250 Ω) correctly. Observe the maximum load → 🖹 174. |
| 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 | Using the "FieldCare" or "DeviceCare" operating tool, check whether the Web server of the measuring device is enabled, and enable it if necessary→ 🖹 74. |
| | Incorrect settings for the Ethernet interface of the computer | 1. Check the properties of the Internet protocol (TCP/IP) → 🖹 70→ 🖹 70.<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 → 🖹 70→ 🖹 70 |
| 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 → 🖹 70. |
| | 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.<br>▪ To improve network performance, use an external WLAN antenna. |
| | 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. |

| Error | Possible causes | Remedy |
|---|---|---|
| | 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 → 🖹 69.<br>2. Clear the Web browser cache and restart the Web browser. |
| | 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://XXX.XXX.X.X.XX/servlet/basic.html as the IP address. |
| Operation with FieldCare or DeviceCare not possible 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.




A0029629

1 *Supply voltage*
2 *Device status*
3 *Not used*
4 *Communication*
5 *Service interface (CDI) active*

| LED | | Color | Meaning |
|---|---|---|---|
| 1 | Supply voltage | Off | Supply voltage is off or too low. |
| | | Green | Supply voltage is ok. |
| 2 | Device status (normal operation) | Off | Firmware error |
| | | Green | Device status is ok. |
| | | Flashing green | Device is not configured. |
| | | Red | A diagnostic event with "Alarm" diagnostic behavior has occurred. |
| | | Flashing red | A diagnostic event with "Warning" diagnostic behavior has occurred. |

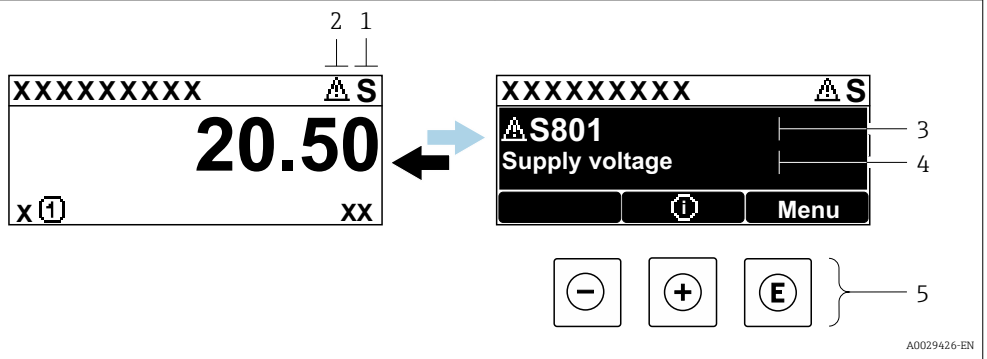
| LED | | Color | Meaning |
|---|---|---|---|
| | | Flashing red/green | The device restarts. |
| 2 | Device status (during start-up) | Flashes red slowly | If > 30 seconds: problem with the boot loader. |
| | | Flashes red quickly | If > 30 seconds: compatibility problem when reading the firmware. |
| 3 | Not used | – | – |
| 4 | Communication | Off | Communication not active. |
| | | White | Communication active. |
| 5 | Service interface (CDI) | Off | Not connected or no connection established. |
| | | Yellow | Connected and connection established. |
| | | Flashing yellow | Service interface active. |

## 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 → 154
- Via submenus → 155

#### 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

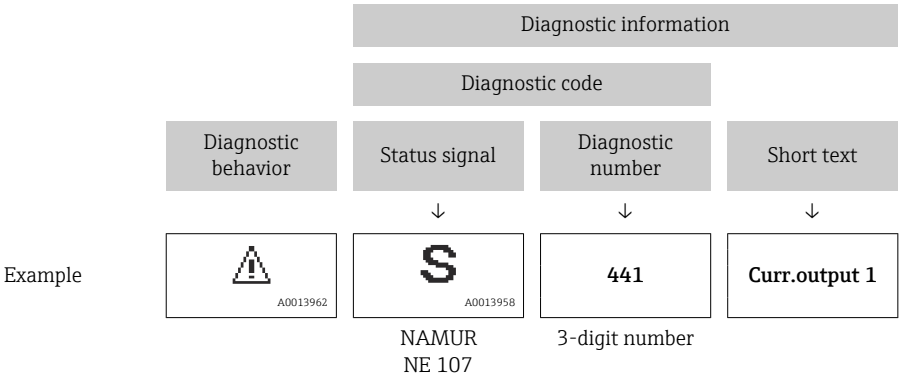
| Symbol | Meaning |
|---|---|
| F | **Failure**<br>A device error has occurred. The measured value is no longer valid. |
| C | **Function check**<br>The device is in service mode (e.g. during a simulation). |
| S | **Out of specification**<br>The device is operated:<br>▪ Outside its technical specification 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. |
|  | **Warning**<br>Measurement is resumed. The signal outputs and totalizers are not affected. A diagnostic message is generated. |

### Diagnostic information

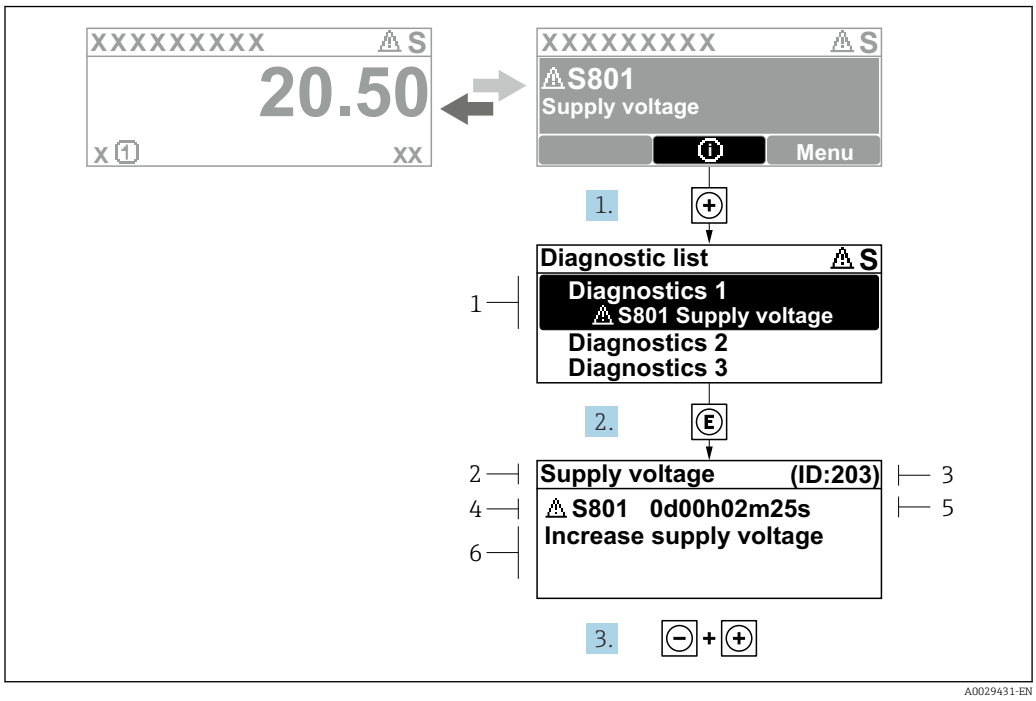
The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.




### 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




30 *Message for remedial measures*

1 *Diagnostic information*
2 *Short text*
3 *Service ID*
4 *Diagnostic behavior with diagnostic code*
5 *Operation time when error occurred*
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.

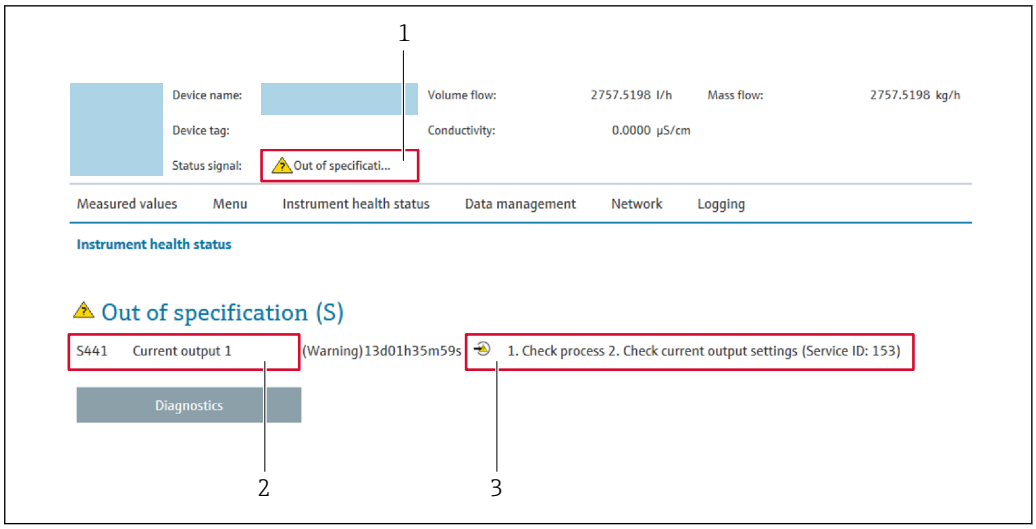
The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the **Diagnostic list** submenu or **Previous diagnostics** parameter.

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 Diagnostic information*
*3 Remedial measures with service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter → 154
- Via submenu → 155

### 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 the service mode (during a simulation, for example). |
| | **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**) |
| | **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.

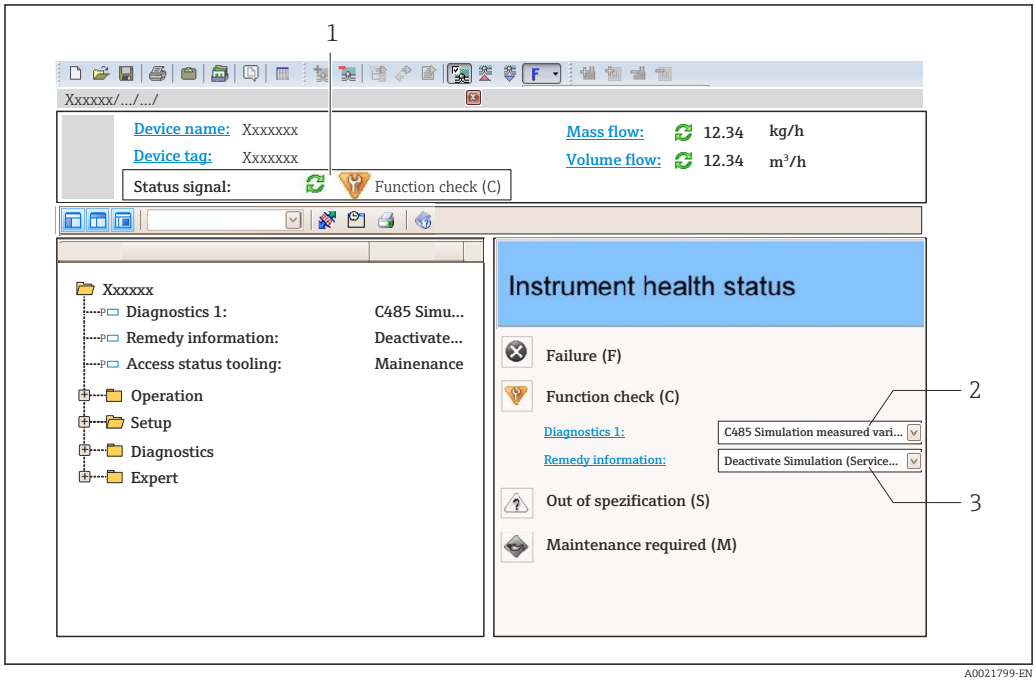
## 12.4.2 Calling up remedy information

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.

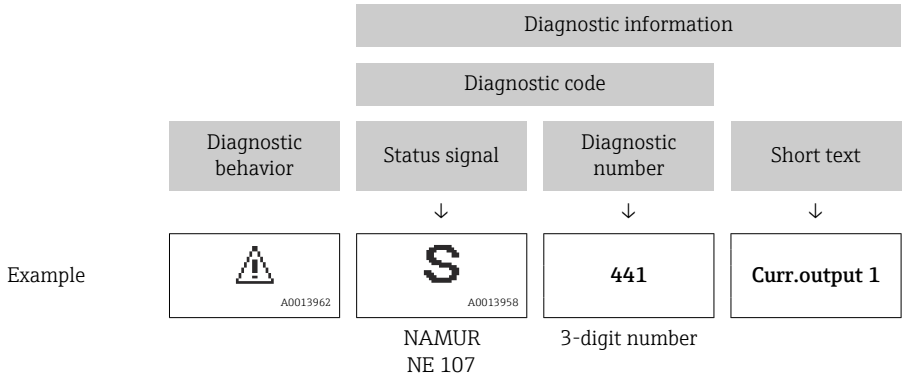



1 *Status area with status signal → 144*
2 *Diagnostics information → 145*
3 *Remedial measures with service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter → 154
- Via submenu → 155

#### 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.

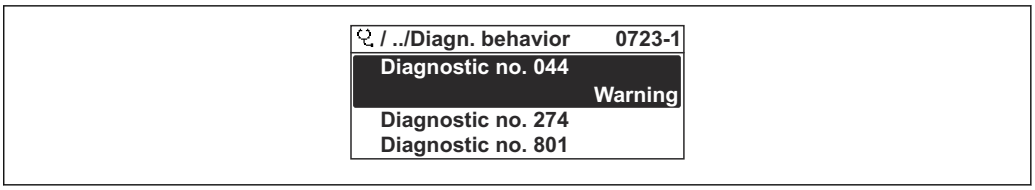
1. Call up the desired parameter.
2. On the right in the working area, mouse over the parameter.
   ↳ A tool tip with remedy information for the diagnostic event appears.

## 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




*31 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 |
|---|---|
|  A0013956 | **Failure**<br>A device error is present. The measured value is no longer valid. |
|  A0013959 | **Function check**<br>The device is in service mode (e.g. during a simulation). |
|  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**) |
|  A0013957 | **Maintenance required**<br>Maintenance is required. The measured value is still valid. |
|  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 → 149

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| **Diagnostic of sensor** | | | | |
| 043 | Sensor 1 short circuit detected | 1. Check sensor cable and sensor<br>2. Execute Heartbeat Verification<br>3. Replace sensor cable or sensor | S | Warning [1] |
| 082 | Data storage inconsistent | Check module connections | F | Alarm |
| 083 | Memory content inconsistent | 1. Restart device<br>2. Restore S-DAT data<br>3. Replace S-DAT | F | Alarm |
| 143 | HBSI limit exceeded | 1. Check if external magnetic interference is present<br>2. Check flow value<br>3. Replace sensor | M | Warning [1] |
| 168 | Build-up limit exceeded | Clean measuring tube | M | Warning |
| 169 | Conductivity measurement failed | 1. Check grounding conditions<br>2. Deactivate conductivity measurement | M | Warning |
| 170 | Coil resistance faulty | Check ambient and process temperature | F | Alarm |
| 180 | Temperature sensor defective | 1. Check sensor connections<br>2. Replace sensor cable or sensor<br>3. Turn off temperature measurement | F | Warning |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| 181 | Sensor connection faulty | 1. Check sensor cable and sensor<br>2. Execute Heartbeat Verification<br>3. Replace sensor cable or sensor | F | Alarm |
| **Diagnostic of electronic** | | | | |
| 201 | Electronics faulty | 1. Restart device<br>2. Replace electronics | F | Alarm |
| 242 | Firmware incompatible | 1. Check firmware version<br>2. Flash or replace electronic module | F | Alarm |
| 252 | Module incompatible | 1. Check electronic modules<br>2. Check if correct modules are available (e.g. NEx, Ex)<br>3. Replace electronic modules | F | Alarm |
| 262 | Module connection interrupted | 1. Check module connections<br>2. Replace electronic modules | F | Alarm |
| 270 | Main electronics defective | 1. Restart device<br>2. Replace main electronic module | F | Alarm |
| 271 | Main electronics faulty | 1. Restart device<br>2. Replace main electronic module | F | Alarm |
| 272 | Main electronics faulty | Restart device | F | Alarm |
| 273 | Main electronics defective | 1. Pay attention to display emergency operation<br>2. Replace main 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 |
| 283 | Memory content inconsistent | Restart device | F | Alarm |
| 302 | Device verification active | Device verification active, please wait. | C | Warning [1)] |
| 303 | I/O 1 to n configuration changed | 1. Apply I/O module configuration (parameter 'Apply I/O configuration')<br>2. Afterwards reload device description and check wiring | M | Warning |
| 311 | Sensor electronics (ISEM) faulty | Maintenance required!<br>Do not reset device | M | Warning |
| 330 | Flash file invalid | 1. Update firmware of device<br>2. Restart device | M | Warning |
| 331 | Firmware update failed | 1. Update firmware of device<br>2. Restart device | F | Warning |
| 332 | Writing in HistoROM backup failed | 1. Replace user interface board<br>2. Ex d/XP: replace transmitter | F | Alarm |
| 361 | I/O module 1 to n faulty | 1. Restart device<br>2. Check electronic modules<br>3. Change I/O module or main electronics | F | Alarm |
| 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 |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| 375 | I/O- 1 to n communication failed | 1. Restart device<br>2. Check if failure recurs<br>3. Replace module rack inclusive electronic modules | F | Alarm |
| 376 | Sensor electronics (ISEM) faulty | 1. Replace sensor electronic module (ISEM)<br>2. Turn off diagnostic message | S | Warning [1)] |
| 377 | Electrode signal faulty | 1. Activate empty pipe detection<br>2. Check partial filled pipe and installation direction<br>3. Check sensor cabling<br>4. Deactivate diagnostics 377 | S | Warning [1)] |
| 378 | Supply voltage ISEM faulty | 1. If available: Check connection cable between sensor and transmitter<br>2. Replace main electronic module<br>3. Replace sensor electronic module (ISEM) | F | Alarm |
| 382 | Data storage | 1. Insert T-DAT<br>2. Replace T-DAT | F | Alarm |
| 383 | Memory content | Reset device | F | Alarm |
| 387 | HistoROM data faulty | Contact service organization | F | Alarm |
| **Diagnostic of configuration** | | | | |
| 410 | Data transfer failed | 1. Retry data transfer<br>2. Check connection | F | Alarm |
| 412 | Processing download | Download active, please wait | C | Warning |
| 431 | Trim 1 to n required | Carry out trim | C | Warning |
| 437 | Configuration incompatible | 1. Update firmware<br>2. Execute factory reset | F | Alarm |
| 438 | Dataset different | 1. Check data set file<br>2. Check device parameterization<br>3. Download new device parameterization | M | Warning |
| 441 | Current output faulty | 1. Check process<br>2. Check current output settings | S | Warning [1)] |
| 442 | Frequency output faulty | 1. Check process<br>2. Check frequency output settings | S | Warning [1)] |
| 443 | Pulse output 1 to n faulty | 1. Check process<br>2. Check pulse output settings | S | Warning [1)] |
| 444 | Current input 1 to n faulty | 1. Check process<br>2. Check current input settings | S | Warning [1)] |
| 453 | Flow override active | Deactivate flow override | C | Warning |
| 484 | Failure mode simulation active | Deactivate simulation | C | Alarm |
| 485 | Process variable simulation active | Deactivate simulation | C | Warning |
| 486 | Current input simulation active | Deactivate simulation | C | Warning |
| 491 | Current output 1 to n simulation active | Deactivate simulation | C | Warning |
| 492 | Frequency output simulation active | Deactivate simulation frequency output | C | Warning |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| 493 | Pulse output simulation active | Deactivate simulation pulse output | C | Warning |
| 494 | Switch output simulation active | Deactivate simulation switch output | C | Warning |
| 495 | Diagnostic event simulation active | Deactivate simulation | C | Warning |
| 496 | Status input simulation active | Deactivate simulation status input | C | Warning |
| 502 | CT activation/ deactivation failed | Follow the sequence of the custody transfer activation/deactivation: First authorized user login, then set the DIP switch on the main electonic module | C | Warning |
| 511 | Sensor setting error | 1. Check measuring period and integration time<br>2. Check sensor properties | C | Alarm |
| 512 | ECC recovery time exceeded | 1. Check ECC recovery time<br>2. Turn off ECC | F | Alarm |
| 520 | I/O 1 to n hardware configuration invalid | 1. Check I/O hardware configuration<br>2. Replace wrong I/O module<br>3. Plug the module of double pulse output on correct slot | F | Alarm |
| 530 | Electrode cleaning active | Switch off electrode cleaning | C | Warning |
| 531 | Empty pipe adjustment faulty | Execute EPD adjustment | S | Warning [1)] |
| 537 | Configuration | 1. Check IP addresses in network<br>2. Change IP address | F | Warning |
| 540 | Custody transfer mode failed | 1. Power off device and toggle DIP switch<br>2. Deactivate custody transfer mode<br>3. Reactivate custody transfer mode<br>4. Check electronic components | F | Alarm |
| 543 | Double pulse output | 1. Check process<br>2. Check pulse output settings | S | Warning [1)] |
| 593 | Double pulse output simulation | Deactivate simulation pulse output | C | Warning |
| 594 | Relay output simulation | Deactivate simulation switch output | C | Warning |
| 599 | Custody transfer logbook full | 1. Deactivate custody transfer mode<br>2. Clear custody transfer logbook (all 30 entries)<br>3. Activate custody transfer mode | S | Warning |
| **Diagnostic of process** | | | | |
| 803 | Loop current 1 faulty | 1. Check wiring<br>2. Change I/O module | F | Alarm |
| 832 | Electronics temperature too high | Reduce ambient temperature | S | Warning [1)] |
| 833 | Electronics temperature too low | Increase ambient temperature | S | Warning [1)] |
| 834 | Process temperature too high | Reduce process temperature | S | Warning [1)] |
| 835 | Process temperature too low | Increase process temperature | S | Warning [1)] |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| 842 | Process value below limit | Low flow cut off active!<br>Check low flow cut off configuration | S | Warning [1] |
| 882 | Input signal faulty | 1. Check input signal parameterization<br>2. Check external device<br>3. Check process conditions | F | Alarm |
| 937 | Sensor symmetry | 1. Eliminate external magnetic field near sensor<br>2. Turn off diagnostic message | S | Warning [1] |
| 938 | Coil current not stable | 1. Check if external magnetic interference is present<br>2. Perform Heartbeat Verification<br>3. Check flow value | F | Alarm [1] |
| 961 | Electrode potential out of specification | 1. Check process conditions<br>2. Check ambient conditions | S | Warning [1] |
| 962 | Pipe empty | 1. Perform full pipe adjustment<br>2. Perform empty pipe adjustment<br>3. Turn off empty pipe detection | S | Warning [1] |

1) Diagnostic behavior can be changed.

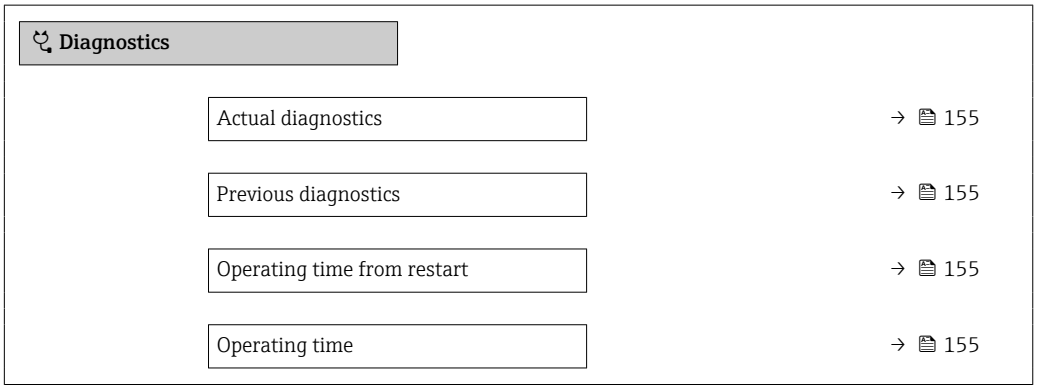
## 12.8 Pending diagnostic events

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 → 146
- Via web browser → 147
- Via "FieldCare" operating tool → 149
- Via "DeviceCare" operating tool → 149

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu → 155

**Navigation**
"Diagnostics" menu



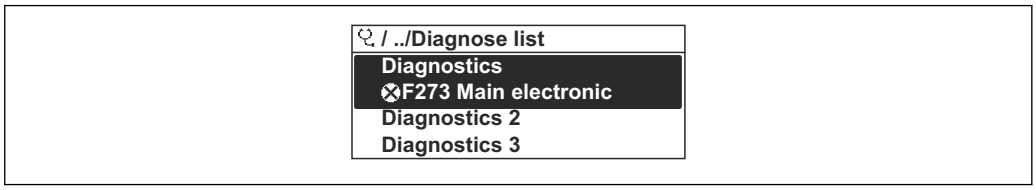
**Parameter overview with brief description**

| Parameter | Prerequisite | Description | User interface |
|---|---|---|---|
| Actual diagnostics | A diagnostic event has occurred. | Shows the current occured diagnostic event along with its diagnostic information.<br>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




32 *Taking the example of the local display*

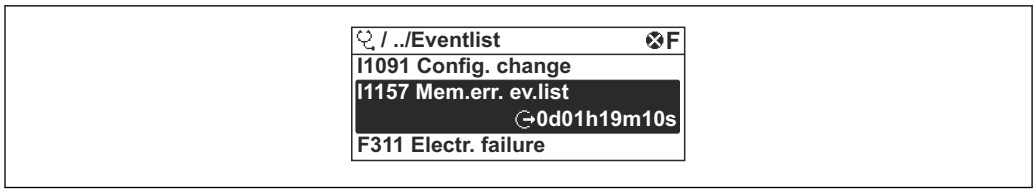
To call up the measures to rectify a diagnostic event:
- Via local display → 146
- Via web browser → 147
- Via "FieldCare" operating tool → 149
- Via "DeviceCare" operating tool → 149

## 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




33 *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 → 150
- Information events → 156

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 → 146
- Via web browser → 147
- Via "FieldCare" operating tool → 149
- Via "DeviceCare" operating tool → 149

For filtering the displayed event messages → 156

## 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 |

| Info number | Info name |
|---|---|
| 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 |
| I1264 | Safety sequence aborted |
| I1278 | I/O module restarted |
| I1335 | Firmware changed |
| I1351 | Empty pipe detection adjustment failure |
| I1353 | Empty pipe detection adjustment ok |
| I1361 | Web server: login failed |
| I1397 | Fieldbus: access status changed |
| I1398 | CDI: access status changed |
| I1443 | Build-up thickness not determined |
| 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 |
| I1517 | Custody transfer active |
| I1518 | Custody transfer inactive |
| I1554 | Safety sequence started |
| I1555 | Safety sequence confirmed |
| I1556 | Safety mode off |
| I1618 | I/O module 2 replaced |
| I1619 | I/O module 3 replaced |
| I1621 | I/O module 4 replaced |
| 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 |

| Info number | Info name |
|---|---|
| I1633 | CDI: login failed |
| I1634 | Reset to factory settings |
| I1635 | Reset to delivery settings |
| I1639 | Max. switch cycles number reached |
| I1643 | Custody transfer logbook cleared |
| I1649 | Hardware write protection activated |
| I1650 | Hardware write protection deactivated |
| I1651 | Custody transfer parameter changed |
| I1712 | New flash file received |
| I1725 | Sensor electronic module (ISEM) changed |
| I1726 | Configuration backup failed |

## 12.11 Resetting the measuring device

The entire device configuration or some of the configuration can be reset to a defined state with the **Device reset** parameter (→ 124).

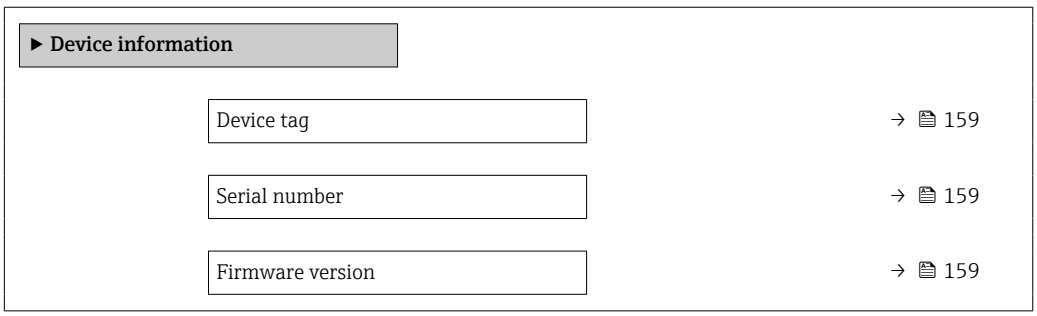
### 12.11.1 Function scope of "Device reset" parameter

| 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 the customer-specific value. All other parameters are reset to the factory setting. |
| Restart device | The restart resets every parameter with data stored in volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged. |
| Restore S-DAT backup | Restores the data that is saved on the S-DAT. Additional information: This function can be used to resolve the memory issue "083 Memory content inconsistent" or to restore the S-DAT data when a new S-DAT has been installed.<br>This option is displayed only in an alarm condition. |

## 12.12 Device information

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

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




### 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. @, %, /). | Promag |
| 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.<br>The name can be found on the nameplate of the transmitter. | Promag 300/500 | – |
| Manufacturer | Displays the manufacturer. | Character string comprising numbers, letters and special characters | Endress+Hauser |
| Order code | Shows the device order code.<br>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.<br>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 2 | Shows the 2nd part of the extended order code.<br>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 3 | Shows the 3rd part of the extended order code.<br>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 | 2.02.00 |
| Device revision | Shows the device revision with which the device is registered with the HART Communication Foundation. | 2-digit hexadecimal number | 7 |
| 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 | 0x3A (for Promag 300) |
| 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 |
|---|---|---|---|---|---|
| 08.2022 | 01.06.zz | Option **60** | ▪ HBSI (Heartbeat Technology)<br>▪ Build-up index (Heartbeat Technology)<br>▪ Flow damping configuration | Operating Instructions | BA01918D/06/EN/04.22 |
| 09.2019 | 01.05.zz | Option **64** | Various improvements | Operating Instructions | BA01918D/06/EN/01.19 |

| Release date | Firmware version | Order code for "Firmware version" | Firmware changes | Documentation type | Documentation |
|---|---|---|---|---|---|
| 10.2017 | 01.01.zz | Option **68** | ▪ OPC-UA with Security new<br>▪ Local display - enhanced performance and data entry via text editor<br>▪ Optimized keypad lock for local display<br>▪ Web server feature update<br>  ▪ Support for trend data function<br>  ▪ Heartbeat function enhanced to include detailed results (page 3/4 of the report)<br>  ▪ Device configuration as PDF (parameter log, similar to FDT print)<br>▪ Network capability of Ethernet (service) interface<br>▪ Comprehensive Heartbeat feature update<br>▪ Local display - support for WLAN infrastructure mode<br>▪ Implementation of reset code | Operating Instructions | |
| 08.2016 | 01.00.zz | Option **76** | Original firmware | Operating Instructions | |

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, see the "Device history and compatibility" section → 161

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.

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. 5W3B
    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

## 12.14 Device history and compatibility

The device model is documented in the order code on the nameplate of the device (e.g. 8F3BXX-XXX....XXXA1-XXXXXX).

| Device model | Release | Change compared with earlier model | Compatibility with earlier model |
|---|---|---|---|
| A2 | 09.2019 | I/O module with enhanced performance and functionality: see device firmware 01.05.zz → 160 | No |
| A1 | 02.2019 | – | – |

# 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.

**⚠ WARNING**

**Cleaning agents can damage the plastic transmitter housing!**

- ▶ Do not use high-pressure steam.
- ▶ Only use the permitted cleaning agents specified.

**Permitted cleaning agents for the plastic transmitter housing**

- Commercially available household cleaners
- Methyl alcohol or isopropyl alcohol
- Mild soap solutions

### 13.1.2 Interior cleaning

No interior cleaning is planned for the device.

## 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: → 🖹 165→ 🖹 167

## 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

*Device Viewer* (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 (→ 159) 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 web page for information:
   http://www.endress.com/support/return-material
   ↳ Select the region.
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 the manufacturer 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!**

- Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive media.

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

**⚠ WARNING**

**Danger to personnel and environment from fluids that are hazardous to health.**

- Ensure that the measuring device and all cavities are free of fluid residues that are hazardous to health or the environment, e.g. substances that have permeated into crevices or diffused through plastic.

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 |
|---|---|
| Proline 300 transmitter | Transmitter for replacement or storage. Use the order code to define the following specifications:<br>▪ Approvals<br>▪ Output<br>▪ Input<br>▪ Display/operation<br>▪ Housing<br>▪ Software<br>Order code: 5X3BXX<br>Installation Instructions EA01199D |
| Remote display and operating module DKX001 | ▪ If ordered directly with the measuring device:<br>Order code for "Display; operation", option O "Remote display 4-line, illuminated; 10 m (30 ft) cable; touch control"<br>▪ If ordered separately:<br>▪ Measuring device: order code for "Display; operation", option M "W/o, prepared for remote display"<br>▪ DKX001: Via the separate product structure DKX001<br>▪ If ordered subsequently:<br>DKX001: Via the separate product structure DKX001<br>**Mounting bracket for DKX001**<br>▪ If ordered directly: order code for "Accessory enclosed", option RA "Mounting bracket, pipe 1/2"<br>▪ If ordered subsequently: order number: 71340960<br>**Connecting cable (replacement cable)**<br>Via the separate product structure: DKX002<br>Further information on display and operating module DKX001→ 198.<br>Special Documentation SD01763D |
| 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>▪ The external WLAN antenna is not suitable for use in hygienic applications.<br>▪ Additional information regarding the WLAN interface → 77.<br>Order number: 71351317<br>Installation Instructions EA01238D |
| Weather protection cover | Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight.<br>Order number: 71343505<br>Installation Instructions EA01160D |
| Ground cable | Set, consisting of two ground cables for potential equalization. |

### 15.1.2 For the sensor

| Accessories | Description |
|---|---|
| Ground disks | Are used to ground the medium in lined measuring tubes to ensure proper measurement.<br>For details, see Installation Instructions EA00070D |

## 15.2 Communication-specific accessories

| Accessories | Description |
|---|---|
| Commubox FXA195 HART | For intrinsically safe HART communication with FieldCare via the USB interface.<br>Technical Information TI00404F |
| HART Loop Converter HMX50 | Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values.<br>▪ Technical Information TI00429F<br>▪ Operating Instructions BA00371F |
| 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>▪ Technical Information TI01297S<br>▪ Operating Instructions BA01778S<br>▪ Product page: www.endress.com/fxa42 |
| Field Xpert SMT50 | The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in 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>▪ Technical Information TI01342S<br>▪ Operating Instructions BA01709S<br>▪ Product page: www.endress.com/smt50 |
| 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>▪ 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>▪ 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:<br>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 |
| iTEMP | The temperature transmitters can be used in all applications and are suitable for the measurement of gases, steam and liquids. They can be used to read in the medium temperature.<br><br>"Fields of Activity" document FA00006T |

# 16 Technical data

## 16.1 Application

The measuring device is only suitable for the flow measurement of liquids with a minimum conductivity of 5 µS/cm.

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

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**

Electromagnetic flow measurement on the basis of *Faraday's law of magnetic induction*.

**Measuring system**

The device consists of a transmitter and a sensor.

The device is available as a compact version:
The transmitter and sensor form a mechanical unit.

Information on the structure of the device → 📄 14

## 16.3 Input

**Measured variable**

**Direct measured variables**

- Volume flow (proportional to induced voltage)
- Electrical conductivity

**Calculated measured variables**

Mass flow

**Measuring range**

Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Electrical conductivity: ≥ 5 µS/cm for liquids in general

*Flow characteristic values in SI units: DN 25 to 125 mm (1 to 4 in)*

| Nominal diameter | | Recommended flow | Factory settings | | |
|---|---|---|---|---|---|
| | | min./max. full scale value (v ~ 0.3...10 m/s) | Full scale value current output (v ~ 2.5 m/s) | Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s) | Low flow cut off (v ~ 0.04 m/s) |
| [mm] | [in] | [dm³/min] | [dm³/min] | [dm³] | [dm³/min] |
| 25 | 1 | 9 to 300 | 75 | 0.5 | 1 |
| 32 | – | 15 to 500 | 125 | 1 | 2 |
| 40 | 1 ½ | 25 to 700 | 200 | 1.5 | 3 |
| 50 | 2 | 35 to 1 100 | 300 | 2.5 | 5 |
| 65 | – | 60 to 2 000 | 500 | 5 | 8 |
| 80 | 3 | 90 to 3 000 | 750 | 5 | 12 |

| Nominal diameter | | Recommended flow | Factory settings | | |
|---|---|---|---|---|---|
| | | min./max. full scale value (v ~ 0.3...10 m/s) | Full scale value current output (v ~ 2.5 m/s) | Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s) | Low flow cut off (v ~ 0.04 m/s) |
| [mm] | [in] | [dm³/min] | [dm³/min] | [dm³] | [dm³/min] |
| 100 | 4 | 145 to 4700 | 1200 | 10 | 20 |
| 125 | – | 220 to 7500 | 1850 | 15 | 30 |

*Flow characteristic values in SI units: DN 150 to 3000 mm (6 to 120 in)*

| Nominal diameter | | Recommended flow | Factory settings | | |
|---|---|---|---|---|---|
| | | min./max. full scale value (v ~ 0.3...10 m/s) | Full scale value current output (v ~ 2.5 m/s) | Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s) | Low flow cut off (v ~ 0.04 m/s) |
| [mm] | [in] | [m³/h] | [m³/h] | [m³] | [m³/h] |
| 150 | 6 | 20 to 600 | 150 | 0.025 | 2.5 |
| 200 | 8 | 35 to 1100 | 300 | 0.05 | 5 |
| 250 | 10 | 55 to 1700 | 500 | 0.05 | 7.5 |
| 300 | 12 | 80 to 2400 | 750 | 0.1 | 10 |
| 350 | 14 | 110 to 3300 | 1000 | 0.1 | 15 |
| 375 | 15 | 140 to 4200 | 1200 | 0.15 | 20 |
| 400 | 16 | 140 to 4200 | 1200 | 0.15 | 20 |
| 450 | 18 | 180 to 5400 | 1500 | 0.25 | 25 |
| 500 | 20 | 220 to 6600 | 2000 | 0.25 | 30 |
| 600 | 24 | 310 to 9600 | 2500 | 0.3 | 40 |
| 700 | 28 | 420 to 13500 | 3500 | 0.5 | 50 |
| 750 | 30 | 480 to 15000 | 4000 | 0.5 | 60 |
| 800 | 32 | 550 to 18000 | 4500 | 0.75 | 75 |
| 900 | 36 | 690 to 22500 | 6000 | 0.75 | 100 |
| 1000 | 40 | 850 to 28000 | 7000 | 1 | 125 |
| – | 42 | 950 to 30000 | 8000 | 1 | 125 |
| 1200 | 48 | 1250 to 40000 | 10000 | 1.5 | 150 |
| – | 54 | 1550 to 50000 | 13000 | 1.5 | 200 |
| 1400 | – | 1700 to 55000 | 14000 | 2 | 225 |
| – | 60 | 1950 to 60000 | 16000 | 2 | 250 |
| 1600 | – | 2200 to 70000 | 18000 | 2.5 | 300 |
| – | 66 | 2500 to 80000 | 20500 | 2.5 | 325 |
| 1800 | 72 | 2800 to 90000 | 23000 | 3 | 350 |
| – | 78 | 3300 to 100000 | 28500 | 3.5 | 450 |
| 2000 | – | 3400 to 110000 | 28500 | 3.5 | 450 |
| – | 84 | 3700 to 125000 | 31000 | 4.5 | 500 |
| 2200 | – | 4100 to 136000 | 34000 | 4.5 | 540 |
| – | 90 | 4300 to 143000 | 36000 | 5 | 570 |
| 2400 | – | 4800 to 162000 | 40000 | 5.5 | 650 |

| Nominal diameter | | Recommended flow | Factory settings | | |
|---|---|---|---|---|---|
| | | min./max. full scale value (v ~ 0.3...10 m/s) | Full scale value current output (v ~ 2.5 m/s) | Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s) | Low flow cut off (v ~ 0.04 m/s) |
| [mm] | [in] | [m³/h] | [m³/h] | [m³] | [m³/h] |
| – | 96 | 5000 to 168000 | 42000 | 6 | 675 |
| – | 102 | 5700 to 190000 | 47500 | 7 | 750 |
| 2600 | – | 5700 to 191000 | 48000 | 7 | 775 |
| – | 108 | 6500 to 210000 | 55000 | 7 | 850 |
| 2800 | – | 6700 to 222000 | 55500 | 8 | 875 |
| – | 114 | 7100 to 237000 | 59500 | 8 | 950 |
| 3000 | – | 7600 to 254000 | 63500 | 9 | 1025 |
| – | 120 | 7900 to 263000 | 65500 | 9 | 1050 |

*Flow characteristic values in SI units: DN 50 to 200 mm (2 to 8 in) for order code for "Design", option C "Fixed flange, constricted measuring tube, 0 x DN inlet/outlet runs"*

| Nominal diameter | | Recommended flow | Factory settings | | |
|---|---|---|---|---|---|
| | | min./max. full scale value (v ~ 0.12...5 m/s) | Full scale value current output (v ~ 2.5 m/s) | Pulse value (~ 4 Pulse/s at v ~ 2.5 m/s) | Low flow cut off (v ~ 0.01 m/s) |
| [mm] | [in] | [dm³/min] | [dm³/min] | [dm³] | [dm³/min] |
| 50 | 2 | 15 to 600 | 300 | 1.25 | 1.25 |
| 65 | – | 25 to 1000 | 500 | 2 | 2 |
| 80 | 3 | 35 to 1500 | 750 | 3 | 3.25 |
| 100 | 4 | 60 to 2400 | 1200 | 5 | 4.75 |
| 125 | – | 90 to 3700 | 1850 | 8 | 7.5 |
| 150 | 6 | 145 to 5400 | 2500 | 10 | 11 |
| 200 | 8 | 220 to 9400 | 5000 | 20 | 19 |

*Flow characteristic values in SI units: DN 250 to 300 mm (10 to 12 in) for order code for "Design", option C "Fixed flange, constricted measuring tube, 0 x DN inlet/outlet runs"*

| Nominal diameter | | Recommended flow | Factory settings | | |
|---|---|---|---|---|---|
| | | min./max. full scale value (v ~ 0.12...5 m/s) | Full scale value current output (v ~ 2.5 m/s) | Pulse value (~ 4 Pulse/s at v ~ 2.5 m/s) | Low flow cut off (v ~ 0.01 m/s) |
| [mm] | [in] | [m³/h] | [m³/h] | [m³] | [m³/h] |
| 250 | 10 | 20 to 850 | 500 | 0.03 | 1.75 |
| 300 | 12 | 35 to 1300 | 750 | 0.05 | 2.75 |

*Flow characteristic values in US units: DN 1 to 48 in (25 to 1200 mm)*

| Nominal diameter | | Recommended flow | Factory settings | | |
|---|---|---|---|---|---|
| | | min./max. full scale value (v ~ 0.3...10 m/s) | Full scale value current output (v ~ 2.5 m/s) | Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s) | Low flow cut off (v ~ 0.04 m/s) |
| [in] | [mm] | [gal/min] | [gal/min] | [gal] | [gal/min] |
| 1 | 25 | 2.5 to 80 | 18 | 0.2 | 0.25 |
| – | 32 | 4 to 130 | 30 | 0.2 | 0.5 |
| 1 ½ | 40 | 7 to 185 | 50 | 0.5 | 0.75 |
| 2 | 50 | 10 to 300 | 75 | 0.5 | 1.25 |
| – | 65 | 16 to 500 | 130 | 1 | 2 |
| 3 | 80 | 24 to 800 | 200 | 2 | 2.5 |
| 4 | 100 | 40 to 1250 | 300 | 2 | 4 |
| – | 125 | 60 to 1950 | 450 | 5 | 7 |
| 6 | 150 | 90 to 2650 | 600 | 5 | 12 |
| 8 | 200 | 155 to 4850 | 1200 | 10 | 15 |
| 10 | 250 | 250 to 7500 | 1500 | 15 | 30 |
| 12 | 300 | 350 to 10600 | 2400 | 25 | 45 |
| 14 | 350 | 500 to 15000 | 3600 | 30 | 60 |
| 15 | 375 | 600 to 19000 | 4800 | 50 | 60 |
| 16 | 400 | 600 to 19000 | 4800 | 50 | 60 |
| 18 | 450 | 800 to 24000 | 6000 | 50 | 90 |
| 20 | 500 | 1000 to 30000 | 7500 | 75 | 120 |
| 24 | 600 | 1400 to 44000 | 10500 | 100 | 180 |
| 28 | 700 | 1900 to 60000 | 13500 | 125 | 210 |
| 30 | 750 | 2150 to 67000 | 16500 | 150 | 270 |
| 32 | 800 | 2450 to 80000 | 19500 | 200 | 300 |
| 36 | 900 | 3100 to 100000 | 24000 | 225 | 360 |
| 40 | 1000 | 3800 to 125000 | 30000 | 250 | 480 |
| 42 | – | 4200 to 135000 | 33000 | 250 | 600 |
| 48 | 1200 | 5500 to 175000 | 42000 | 400 | 600 |

*Flow characteristic values in US units: DN 54 to 120 in (1400 to 3000 mm)*

| Nominal diameter | | Recommended flow | Factory settings | | |
|---|---|---|---|---|---|
| | | min./max. full scale value (v ~ 0.3...10 m/s) | Full scale value current output (v ~ 2.5 m/s) | Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s) | Low flow cut off (v ~ 0.04 m/s) |
| [in] | [mm] | [Mgal/d] | [Mgal/d] | [Mgal] | [Mgal/d] |
| 54 | – | 9 to 300 | 75 | 0.0005 | 1.3 |
| – | 1400 | 10 to 340 | 85 | 0.0005 | 1.3 |
| 60 | – | 12 to 380 | 95 | 0.0005 | 1.3 |
| – | 1600 | 13 to 450 | 110 | 0.0008 | 1.7 |
| 66 | – | 14 to 500 | 120 | 0.0008 | 2.2 |
| 72 | 1800 | 16 to 570 | 140 | 0.0008 | 2.6 |

| Nominal diameter | | Recommended flow | Factory settings | | |
|---|---|---|---|---|---|
| | | min./max. full scale value (v ~ 0.3...10 m/s) | Full scale value current output (v ~ 2.5 m/s) | Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s) | Low flow cut off (v ~ 0.04 m/s) |
| [in] | [mm] | [Mgal/d] | [Mgal/d] | [Mgal] | [Mgal/d] |
| 78 | – | 18 to 650 | 175 | 0.0010 | 3.0 |
| – | 2000 | 20 to 700 | 175 | 0.0010 | 2.9 |
| 84 | – | 24 to 800 | 190 | 0.0011 | 3.2 |
| – | 2200 | 26 to 870 | 210 | 0.0012 | 3.4 |
| 90 | – | 27 to 910 | 220 | 0.0013 | 3.6 |
| – | 2400 | 31 to 1030 | 245 | 0.0014 | 4.0 |
| 96 | – | 32 to 1066 | 265 | 0.0015 | 4.0 |
| 102 | – | 34 to 1203 | 300 | 0.0017 | 5.0 |
| – | 2600 | 34 to 1212 | 305 | 0.0018 | 5.0 |
| 108 | – | 35 to 1300 | 340 | 0.0020 | 5.0 |
| – | 2800 | 42 to 1405 | 350 | 0.0020 | 6.0 |
| 114 | – | 45 to 1503 | 375 | 0.0022 | 6.0 |
| – | 3000 | 48 to 1613 | 405 | 0.0023 | 6.0 |
| 120 | – | 50 to 1665 | 415 | 0.0024 | 7.0 |

*Flow characteristic values in US units: DN 2 to 12 in (50 to 300 mm) for order code for "Design", option C "Fixed flange, constricted measuring tube, 0 x DN inlet/outlet runs"*

| Nominal diameter | | Recommended flow | Factory settings | | |
|---|---|---|---|---|---|
| | | min./max. full scale value (v ~ 0.12...5 m/s) | Full scale value current output (v ~ 2.5 m/s) | Pulse value (~ 4 Pulse/s at v ~ 2.5 m/s) | Low flow cut off (v ~ 0.01 m/s) |
| [in] | [mm] | [gal/min] | [gal/min] | [gal] | [gal/min] |
| 2 | 50 | 4 to 160 | 75 | 0.3 | 0.35 |
| – | 65 | 7 to 260 | 130 | 0.5 | 0.6 |
| 3 | 80 | 10 to 400 | 200 | 0.8 | 0.8 |
| 4 | 100 | 16 to 650 | 300 | 1.2 | 1.25 |
| – | 125 | 24 to 1000 | 450 | 1.8 | 2 |
| 6 | 150 | 40 to 1400 | 600 | 2.5 | 3 |
| 8 | 200 | 60 to 2500 | 1200 | 5 | 5 |
| 10 | 250 | 90 to 3700 | 1500 | 6 | 8 |
| 12 | 300 | 155 to 5700 | 2400 | 9 | 12 |

### Recommended measuring range

Flow limit → 🖹 186

| | |
|---|---|
| Operable flow range | Over 1000 : 1 |

Input signal

### External measured values

To increase the accuracy of certain measured variables or to calculate the mass flow, the automation system can continuously write different measured values to the measuring device:
- Medium temperature enables temperature-compensated conductivity measurement (e.g. iTEMP)
- Reference density for calculating the mass flow

Various pressure and temperature measuring devices can be ordered from Endress +Hauser: see "Accessories" section → 167

It is recommended to read in external measured values to calculate the corrected volume flow.

*HART protocol*

The measured values are written from the automation system to the measuring device via the HART protocol. The pressure transmitter must support the following protocol-specific functions:
- HART protocol
- Burst mode

*Current input*

The measured values are written from the automation system to the measuring device via the current input → 173.

### Current input 0/4 to 20 mA

| | |
|---|---|
| **Current input** | 0/4 to 20 mA (active/passive) |
| **Current span** | ▪ 4 to 20 mA (active)<br>▪ 0/4 to 20 mA (passive) |
| **Resolution** | 1 µA |
| **Voltage drop** | Typically: 0.6 to 2 V for 3.6 to 22 mA (passive) |
| **Maximum input voltage** | ≤ 30 V (passive) |
| **Open-circuit voltage** | ≤ 28.8 V (active) |
| **Possible input variables** | ▪ Temperature<br>▪ Density |

### Status input

| | |
|---|---|
| **Maximum input values** | ▪ DC −3 to 30 V<br>▪ If status input is active (ON): $R_i$ >3 kΩ |
| **Response time** | Configurable: 5 to 200 ms |
| **Input signal level** | ▪ Low signal: DC −3 to +5 V<br>▪ High signal: DC 12 to 30 V |
| **Assignable functions** | ▪ Off<br>▪ Reset the individual totalizers separately<br>▪ Reset all totalizers<br>▪ Flow override |

# 16.4 Output

Output signal

## Current output 4 to 20 mA HART

| | |
|---|---|
| **Order code** | "Output; input 1" (20):<br>Option BA: current output 4 to 20 mA HART |
| **Signal mode** | Can be set to:<br>▪ Active<br>▪ Passive |
| **Current range** | Can be set to:<br>▪ 4 to 20 mA NAMUR<br>▪ 4 to 20 mA US<br>▪ 4 to 20 mA<br>▪ 0 to 20 mA (only if the signal mode is active)<br>▪ Fixed current |
| **Open-circuit voltage** | DC 28.8 V (active) |
| **Maximum input voltage** | DC 30 V (passive) |
| **Load** | 250 to 700 Ω |
| **Resolution** | 0.38 µA |
| **Damping** | Configurable: 0 to 999.9 s |
| **Assignable measured variables** | ▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Conductivity<br>▪ Electronics temperature |

## Current output 4 to 20 mA HART Ex i

| | |
|---|---|
| **Order code** | "Output; input 1" (20) choose from:<br>▪ Option CA: current output 4 to 20 mA HART Ex i passive<br>▪ Option CC: current output 4 to 20 mA HART Ex i active |
| **Signal mode** | Depends on the selected order version. |
| **Current range** | Can be set to:<br>▪ 4 to 20 mA NAMUR<br>▪ 4 to 20 mA US<br>▪ 4 to 20 mA<br>▪ 0 to 20 mA (only if the signal mode is active)<br>▪ Fixed current |
| **Open-circuit voltage** | DC 21.8 V (active) |
| **Maximum input voltage** | DC 30 V (passive) |
| **Load** | ▪ 250 to 400 Ω (active)<br>▪ 250 to 700 Ω (passive) |
| **Resolution** | 0.38 µA |
| **Damping** | Configurable: 0 to 999.9 s |
| **Assignable measured variables** | ▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Conductivity<br>▪ Electronics temperature |

### Current output 4 to 20 mA

| | |
|---|---|
| **Order code** | "Output; input 2" (21), "Output; input 3" (022):<br>Option B: current output 4 to 20 mA |
| **Signal mode** | Can be set to:<br>▪ Active<br>▪ Passive |
| **Current span** | Can be set to:<br>▪ 4 to 20 mA NAMUR<br>▪ 4 to 20 mA US<br>▪ 4 to 20 mA<br>▪ 0 to 20 mA (only if the signal mode is active)<br>▪ Fixed current |
| **Maximum output values** | 22.5 mA |
| **Open-circuit voltage** | DC 28.8 V (active) |
| **Maximum input voltage** | DC 30 V (passive) |
| **Load** | 0 to 700 Ω |
| **Resolution** | 0.38 µA |
| **Damping** | Configurable: 0 to 999.9 s |
| **Assignable measured variables** | ▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Conductivity<br>▪ Electronics temperature |

### Current output 4 to 20 mA Ex i passive

| | |
|---|---|
| **Order code** | "Output; input 2" (21), "Output; input 3" (022):<br>Option C: current output 4 to 20 mA Ex i passive |
| **Signal mode** | Passive |
| **Current span** | Can be set to:<br>▪ 4 to 20 mA NAMUR<br>▪ 4 to 20 mA US<br>▪ 4 to 20 mA<br>▪ Fixed current |
| **Maximum output values** | 22.5 mA |
| **Maximum input voltage** | DC 30 V |
| **Load** | 0 to 700 Ω |
| **Resolution** | 0.38 µA |
| **Damping** | Configurable: 0 to 999 s |
| **Assignable measured variables** | ▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Conductivity<br>▪ Electronics temperature |

## Pulse/frequency/switch output

| | |
|---|---|
| **Function** | Can be configured as pulse, frequency or switch output |
| **Version** | Open collector<br>Can be set to:<br>▪ Active<br>▪ Passive<br>▪ Passive NAMUR<br>Ex-i, passive |
| **Maximum input values** | DC 30 V, 250 mA (passive) |
| **Open-circuit voltage** | DC 28.8 V (active) |
| **Voltage drop** | For 22.5 mA: ≤ DC 2 V |
| **Pulse output** | |
| **Maximum input values** | DC 30 V, 250 mA (passive) |
| **Maximum output current** | 22.5 mA (active) |
| **Open-circuit voltage** | DC 28.8 V (active) |
| **Pulse width** | Configurable: 0.05 to 2 000 ms |
| **Maximum pulse rate** | 10 000 Impulse/s |
| **Pulse value** | Configurable |
| **Assignable measured variables** | ▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow |
| **Frequency output** | |
| **Maximum input values** | DC 30 V, 250 mA (passive) |
| **Maximum output current** | 22.5 mA (active) |
| **Open-circuit voltage** | DC 28.8 V (active) |
| **Output frequency** | Configurable: end value frequency 2 to 10 000 Hz($f_{max}$ = 12 500 Hz) |
| **Damping** | Configurable: 0 to 999.9 s |
| **Pulse/pause ratio** | 1:1 |
| **Assignable measured variables** | ▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Conductivity<br>▪ Electronics temperature |
| **Switch output** | |
| **Maximum input values** | DC 30 V, 250 mA (passive) |
| **Open-circuit voltage** | DC 28.8 V (active) |
| **Switching behavior** | Binary, conductive or non-conductive |
| **Switching delay** | Configurable: 0 to 100 s |

| | |
|---|---|
| **Number of switching cycles** | Unlimited |
| **Assignable functions** | ▪ Off<br>▪ On<br>▪ Diagnostic behavior<br>▪ Limit value:<br>  ▪ Off<br>  ▪ Volume flow<br>  ▪ Mass flow<br>  ▪ Corrected volume flow<br>  ▪ Flow velocity<br>  ▪ Conductivity<br>  ▪ Totalizer 1-3<br>  ▪ Electronics temperature<br>▪ Flow direction monitoring<br>▪ Status<br>  ▪ Empty pipe detection<br>  ▪ Buildup index<br>  ▪ HBSI limit value exceeded<br>  ▪ Low flow cut off |

## Double pulse output

| | |
|---|---|
| **Function** | Double pulse |
| **Version** | Open collector<br>Can be set to:<br>▪ Active<br>▪ Passive<br>▪ Passive NAMUR |
| **Maximum input values** | DC 30 V, 250 mA (passive) |
| **Open-circuit voltage** | DC 28.8 V (active) |
| **Voltage drop** | For 22.5 mA: ≤ DC 2 V |
| **Output frequency** | Configurable: 0 to 1 000 Hz |
| **Damping** | Configurable: 0 to 999 s |
| **Pulse/pause ratio** | 1:1 |
| **Assignable measured variables** | ▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow<br>▪ Flow velocity<br>▪ Conductivity<br>▪ Electronics temperature |

## Relay output

| | |
|---|---|
| **Function** | Switch output |
| **Version** | Relay output, galvanically isolated |
| **Switching behavior** | Can be set to:<br>▪ NO (normally open), factory setting<br>▪ NC (normally closed) |

| | |
|---|---|
| **Maximum switching capacity (passive)** | ▪ DC 30 V, 0.1 A<br>▪ AC 30 V, 0.5 A |
| **Assignable functions** | ▪ Off<br>▪ On<br>▪ Diagnostic behavior<br>▪ Limit value:<br>  ▪ Off<br>  ▪ Volume flow<br>  ▪ Mass flow<br>  ▪ Corrected volume flow<br>  ▪ Flow velocity<br>  ▪ Conductivity<br>  ▪ Totalizer 1-3<br>  ▪ Electronics temperature<br>▪ Flow direction monitoring<br>▪ Status<br>  ▪ Empty pipe detection<br>  ▪ Buildup index<br>  ▪ HBSI limit value exceeded<br>  ▪ Low flow cut off |

### User-configurable input/output

**One** specific input or output is assigned to a user-configurable input/output (configurable I/O) during device commissioning.

The following inputs and outputs are available for assignment:
- Choice of current output: 4 to 20 mA (active), 0/4 to 20 mA (passive)
- Pulse/frequency/switch output
- Choice of current input: 4 to 20 mA (active), 0/4 to 20 mA (passive)
- Status input

Signal on alarm

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

### Current output 0/4 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 20.5 mA |

### 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 ($f_{max}$ 2 to 12 500 Hz) |
| **Switch output** | |
| **Failure mode** | Choose from:<br>▪ Current status<br>▪ Open<br>▪ Closed |

### Relay 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. |

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<br>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>Diagnostic information via light emitting diodes → 142 |

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

Galvanic isolation

The outputs are galvanically isolated:
- from the power supply
- from one another
- from the potential equalization (PE) terminal

Protocol-specific data

| | |
|---|---|
| **Manufacturer ID** | 0x11 |
| **Device type ID** | 0x3C |
| **HART protocol revision** | 7 |
| **Device description files (DTM, DD)** | Information and files under:<br>www.endress.com |
| **HART load** | Min. 250 Ω |
| **System integration** | Information on system integration → 82.<br>▪ Measured variables via HART protocol<br>▪ Burst Mode functionality |

## 16.5 Power supply

Terminal assignment

→ 42

Supply voltage

| Order code for "Power supply" | Terminal voltage | | Frequency range |
|---|---|---|---|
| Option **D** | DC 24 V | ±20% | – |
| Option **E** | AC 100 to 240 V | −15 to +10% | 50/60 Hz, ±4 Hz |
| Option **I** | DC 24 V | ±20% | – |
| | AC 100 to 240 V | −15 to +10% | 50/60 Hz, ±4 Hz |

Power consumption

**Transmitter**

Max. 10 W (active power)

| | |
|---|---|
| **switch-on current** | Max. 36 A (<5 ms) as per NAMUR Recommendation NE 21 |

Current consumption

**Transmitter**

- Max. 400 mA (24 V)
- Max. 200 mA (110 V, 50/60 Hz; 230 V, 50/60 Hz)

Power supply failure

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

Overcurrent protection element

The device must be operated with a dedicated circuit breaker, as it does not have an ON/OFF switch of its own.
- The circuit breaker must be easy to reach and labeled accordingly.
- Permitted nominal current of the circuit breaker: 2 A up to maximum 10 A.

Electrical connection

→ 42

| | |
|---|---|
| Potential equalization | → 📄 45 |
| Terminals | Spring-loaded terminals: Suitable for strands and strands with ferrules.<br>Conductor cross-section 0.2 to 2.5 mm² (24 to 12 AWG). |
| Cable entries | ▪ Cable gland: M20 × 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in)<br>▪ Thread for cable entry:<br>  ▪ NPT ½"<br>  ▪ G ½"<br>  ▪ M20 |
| Cable specification | → 📄 39 |

Overvoltage protection

| | |
|---|---|
| **Mains voltage fluctuations** | → 📄 180 |
| **Overvoltage category** | Overvoltage category II |
| **Short-term, temporary overvoltage** | Up to 1200 V between cable and ground, for max. 5 s |
| **Long-term, temporary overvoltage** | Up to 500 V between cable and ground |

## 16.6 Performance characteristics

Reference operating conditions

- Error limits following DIN EN 29104, in future ISO 20456
- Water, typically: +15 to +45 °C (+59 to +113 °F); 0.5 to 7 bar (73 to 101 psi)
- Data as indicated in the calibration protocol
- Accuracy based on accredited calibration rigs according to ISO 17025

Maximum measured error

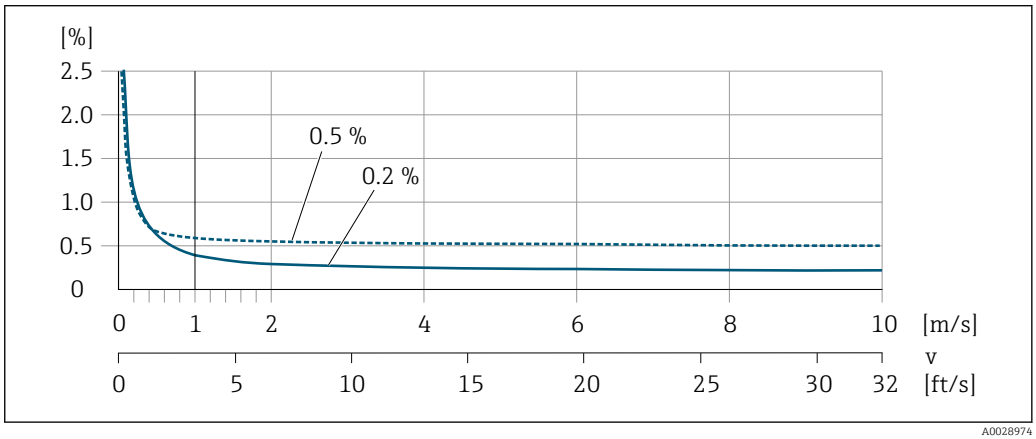
o.r. = of reading

**Error limits under reference operating conditions**

*Volume flow*

- ±0.5 % o.r. ± 1 mm/s (0.04 in/s)
- Optional: ±0.2 % o.r. ± 2 mm/s (0.08 in/s)

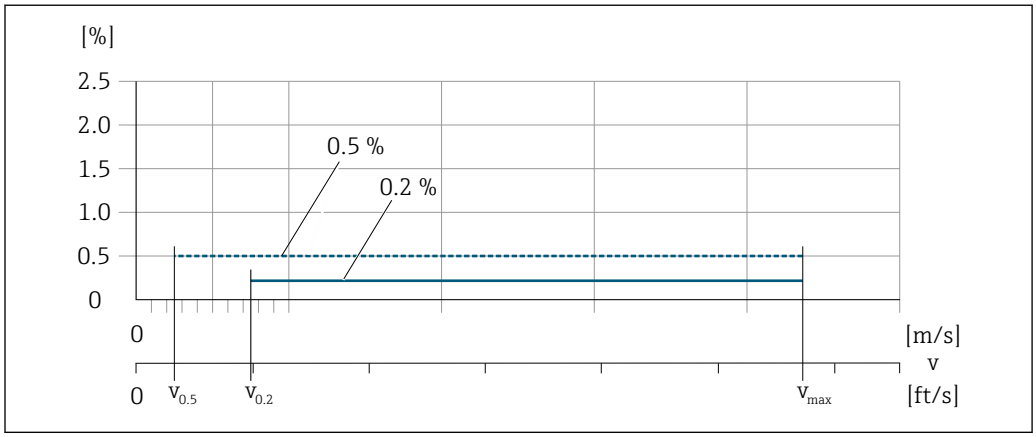
Fluctuations in the supply voltage do not have any effect within the specified range.




34 *Maximum measured error in % o.r.*

*Flat Spec*

In the case of Flat Spec, the measured error is constant in the range from $v_{0.5}$ ($v_{0.2}$) to $v_{max}$.




35 *Flat Spec in % o.r.*

*Flat Spec flow values 0.5 %*

| Nominal diameter | | $v_{0.5}$ | | $v_{max}$ | |
|---|---|---|---|---|---|
| [mm] | [in] | [m/s] | [ft/s] | [m/s] | [ft/s] |
| 25 to 600 | 1 to 24 | 0.5 | 1.64 | 10 | 32 |
| 50 to 300 [1] | 2 to 12 | 0.25 | 0.82 | 5 | 16 |

1) Order code for "Design", option C

*Flat Spec flow values 0.2 %*

| Nominal diameter | | $v_{0.2}$ | | $v_{max}$ | |
|---|---|---|---|---|---|
| [mm] | [in] | [m/s] | [ft/s] | [m/s] | [ft/s] |
| 25 to 600 | 1 to 24 | 1.5 | 4.92 | 10 | 32 |
| 50 to 300 [1] | 2 to 12 | 0.6 | 1.97 | 4 | 13 |

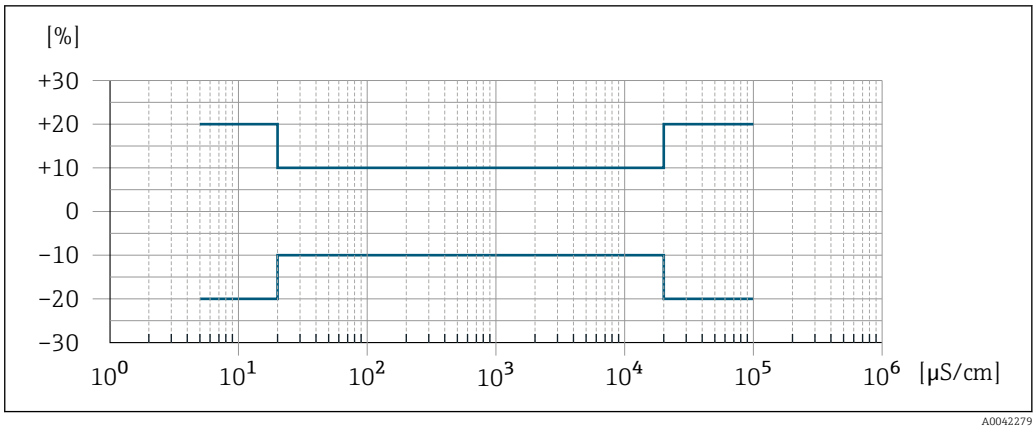
1) Order code for "Design", option C

*Electrical conductivity*

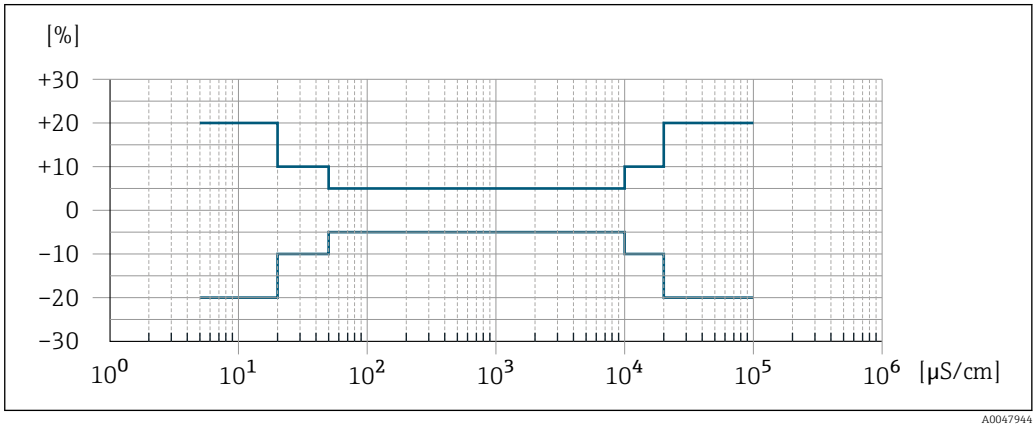
The values apply for:
- Devices installed in a metal pipe or in a non-metal pipe with ground disks
- Devices whose potential equalization was performed according to the instructions in the associated Operating Instructions
- Measurements at a reference temperature of 25 °C (77 °F). At different temperatures, attention must be paid to the temperature coefficient of the medium (typically 2.1 %/K)

| Conductivity [µS/cm] | Measured error [%] of reading |
|---|---|
| 5 to 20 | ± 20% |
| > 20 to 50 | ± 10% |
| > 50 to 10 000 | ▪ Standard: ± 10%<br>▪ Optional [1]: ± 5% |
| > 10 000 to 20 000 | ± 10% |
| > 20 000 to 100 000 | ± 20% |

1) Order code for "Calibrated conductivity measurement", option CW




36 *Measured error (standard)*




37 *Measured error (optional: order code for "Calibrated conductivity measurement", option CW)*

### Accuracy of outputs

The outputs have the following base accuracy specifications.

*Current output*

| | |
|---|---|
| **Accuracy** | ±5 µA |

*Pulse/frequency output*

o.r. = of reading

| | |
|---|---|
| **Accuracy** | Max. ±50 ppm o.r. (over the entire ambient temperature range) |

Repeatability

o.r. = of reading

**Volume flow**
Max. ±0.1 % o.r. ± 0.5 mm/s (0.02 in/s)

**Electrical conductivity**
Max. ±5 % o.r.

Influence of ambient temperature

**Current output**

| | |
|---|---|
| **Temperature coefficient** | Max. 1 µA/°C |

**Pulse/frequency output**

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

## 16.7 Installation

Installation conditions

→ 20

## 16.8 Environment

Ambient temperature range

→ 27

Storage temperature

The storage temperature corresponds to the operating temperature range of the transmitter and the sensor → 27.

- Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus or bacteria infestation can damage the liner.
- If protection caps or protective covers are mounted these should never be removed before installing the measuring device.

Relative humidity

The device is suitable for use in outdoor and indoor areas with a relative humidity of 4 to 95%.

Operating height

According to EN 61010-1
- ≤ 2 000 m (6 562 ft)
- > 2 000 m (6 562 ft) with additional overvoltage protection (e.g. Endress+Hauser HAW Series)

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

**Optional**

Order code for "Sensor option", option C3
- IP66/67, type 4X enclosure
- Fully welded, with protective coating as per EN ISO 12944 C5-M
- For the operation of the device in corrosive environments

**External WLAN antenna**

IP67

Vibration- and shock-resistance

**Sinusoidal vibration according to IEC 60068-2-6**

- 2 to 8.4 Hz, 3.5 mm peak
- 8.4 to 2 000 Hz, 1 g peak

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

- 10 to 200 Hz, 0.003 $g^2$/Hz
- 200 to 2 000 Hz, 0.001 $g^2$/Hz
- Total: 1.54 g rms

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

6 ms 30 g

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

Mechanical load

Transmitter housing:
- Protect against mechanical effects, such as shock or impact
- Do not use as a ladder or climbing aid

Electromagnetic compatibility (EMC)

As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)

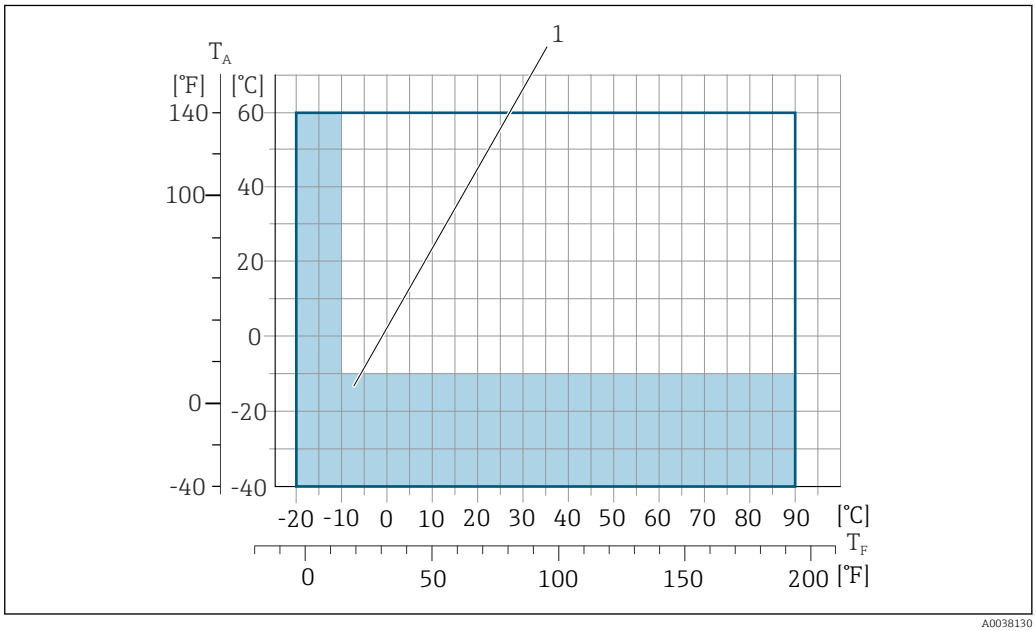
Details are provided in the Declaration of Conformity.

This unit is not intended for use in residential environments and cannot guarantee adequate protection of the radio reception in such environments.

## 16.9 Process

Medium temperature range

- 0 to +80 °C (+32 to +176 °F) for hard rubber, DN 50 to 3000 (2 to 120")
- –20 to +50 °C (–4 to +122 °F) for polyurethane, DN 25 to 1200 (1 to 48")
- –20 to +90 °C (–4 to +194 °F) for PTFE, DN 25 to 300 (1 to 12")




$T_A$ *Ambient temperature*
$T_F$ *Medium temperature*
*1 Colored area: The ambient temperature range of –10 to –40 °C (+14 to –40 °F) and the medium temperature range of –10 to –20 °C (+14 to –4 °F) only apply for stainless flanges*

Conductivity

≥5 µS/cm for liquids in general.

## Pressure-temperature ratings

For an overview of the pressure-temperature ratings for the process connections, see the Technical Information

## Pressure tightness

*Liner: hard rubber*

| Nominal diameter | | Limit values for absolute pressure in [mbar] ([psi]) for medium temperatures: | | |
|---|---|---|---|---|
| [mm] | [in] | +25 °C (+77 °F) | +50 °C (+122 °F) | +80 °C (+176 °F) |
| 50 ... 3000 | 2 ... 120 | 0 (0) | 0 (0) | 0 (0) |

*Liner: polyurethane*

| Nominal diameter | | Limit values for absolute pressure in [mbar] ([psi]) for medium temperatures: | |
|---|---|---|---|
| [mm] | [in] | +25 °C (+77 °F) | +50 °C (+122 °F) |
| 25 ... 1200 | 1 ... 48 | 0 (0) | 0 (0) |

*Liner: PTFE*

| Nominal diameter | | Limit values for absolute pressure in [mbar] ([psi]) for medium temperatures: | |
|---|---|---|---|
| [mm] | [in] | +25 °C (+77 °F) | +90 °C (+194 °F) |
| 25 | 1 | 0 (0) | 0 (0) |
| 40 | 2 | 0 (0) | 0 (0) |
| 50 | 2 | 0 (0) | 0 (0) |
| 65 | 2 ½ | 0 (0) | 40 (0.58) |
| 80 | 3 | 0 (0) | 40 (0.58) |
| 100 | 4 | 0 (0) | 135 (2.0) |
| 125 | 5 | 135 (2.0) | 240 (3.5) |
| 150 | 6 | 135 (2.0) | 240 (3.5) |
| 200 | 8 | 200 (2.9) | 290 (4.2) |
| 250 | 10 | 330 (4.8) | 400 (5.8) |
| 300 | 12 | 400 (5.8) | 500 (7.3) |

## Flow limit

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum velocity of flow is between 2 to 3 m/s (6.56 to 9.84 ft/s). Also match the velocity of flow (v) to the physical properties of the medium:

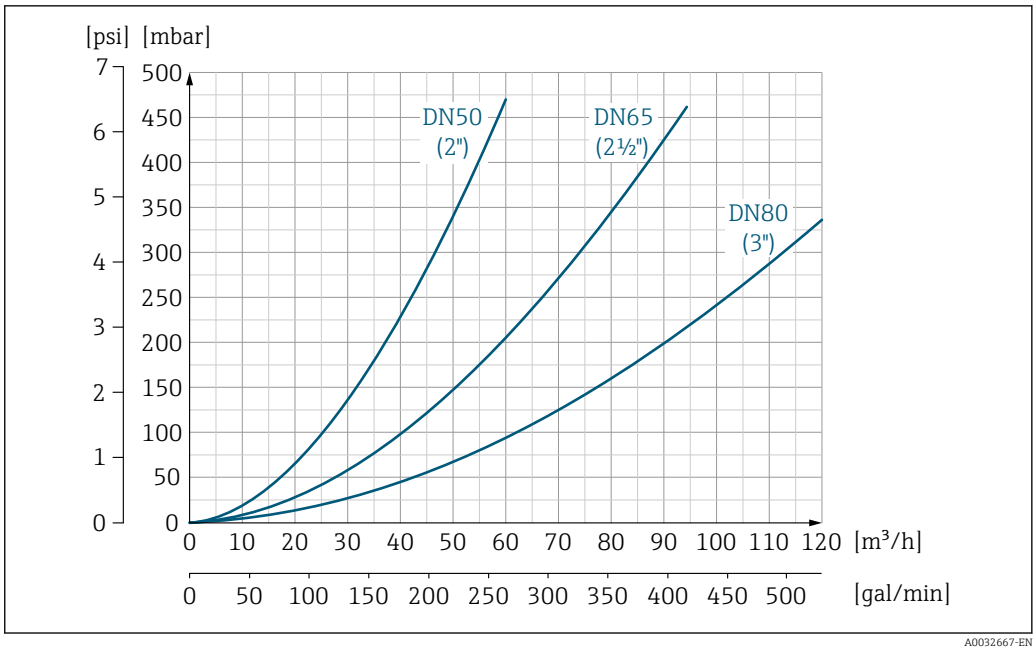
- v < 2 m/s (6.56 ft/s): for abrasive media (e.g. potter's clay, lime milk, ore slurry)
- v > 2 m/s (6.56 ft/s): for media producing buildup (e.g. wastewater sludge)

A necessary increase in the flow velocity can be achieved by reducing the sensor nominal diameter.

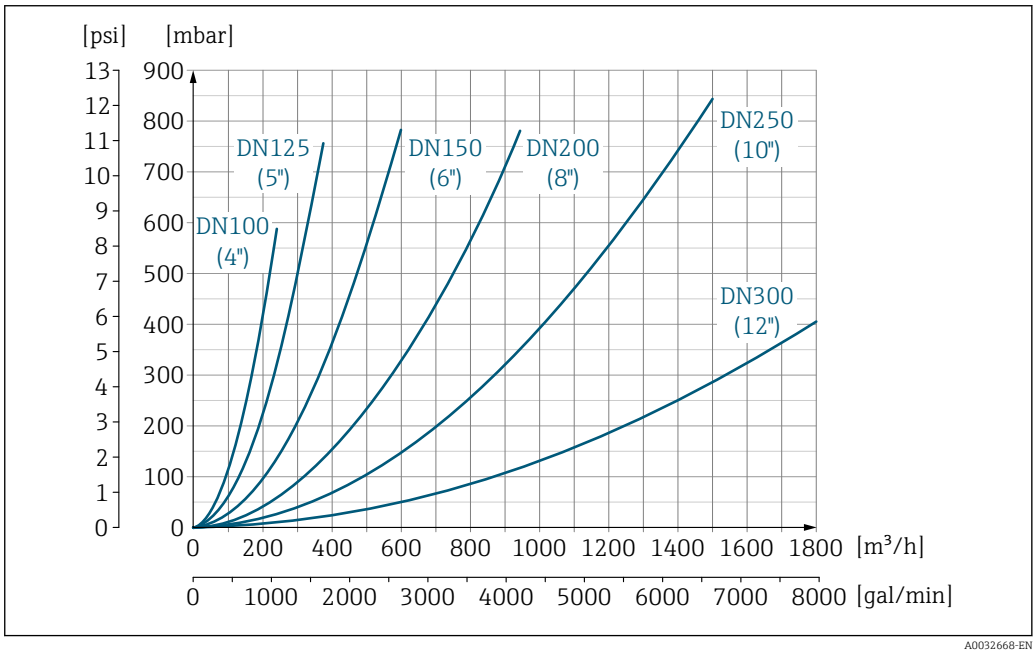
For an overview of the full scale values for the measuring range, see the "Measuring range" section

## Pressure loss

- No pressure loss occurs if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 → 27




38 *Pressure loss DN 50 to 80 (2 to 3") for order code for "Design", option C "Fixed flange, constricted measuring tube", 0 x DN inlet/outlet runs"*




39 *Pressure loss DN 100 to 300 (4 to 12") for order code for "Design", option C "Fixed flange, constricted measuring tube", 0 x DN inlet/outlet runs"*

System pressure → 27

Vibrations → 27

## 16.10 Custody transfer mode

The measuring device is optionally tested in accordance with OIML R49 and has an EU type-examination certificate according to Measuring Instruments Directive 2014/32/EU for service subject to legal metrological control ("custody transfer") for cold water (Annex III).

The permitted medium temperature in these applications is 0 to +50 °C (+32 to +122 °F).

The device is used with a legally controlled totalizer on the local display and optionally with legally controlled outputs.

Measuring devices subject to legal metrological control totalize in both directions, i.e. all the outputs consider flow components in the positive (forward) and negative (reverse) flow direction.

Generally a measuring device subject to legal metrological control is secured against tampering by seals on the transmitter or sensor. These seals may normally only be opened by a representative of the competent authority for legal metrology controls.

After putting the device into circulation or after sealing the device, operation is only possible to a limited extent.

Detailed ordering information is available from your local Endress+Hauser sales center for national approvals (outside Europe) as cold water meters based on OIML R49.

## 16.11 Mechanical construction

Design, dimensions

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

Weight

All values (weight exclusive of packaging material) refer to devices with flanges of the standard pressure rating.
The weight may be lower than indicated depending on the pressure rating and design.
Weight specifications including transmitter as per order code for "Housing", option A "Aluminum, coated".

Different values due to different transmitter versions:
Transmitter version for the hazardous area
(Order code for "Housing", option A "Aluminum, coated"; Ex d): +2 kg (+4.4 lbs)

### Weight in SI units

| Order code for "Design", option C, D, E, H, I : DN 25 to 400 mm (1 to 16 in) | | | |
|---|---|---|---|
| Nominal diameter | | Reference values EN (DIN), AS, JIS | |
| [mm] | [in] | Pressure rating | [kg] |
| 25 | 1 | PN 40 | 10 |
| 32 | – | PN 40 | 11 |
| 40 | 1 ½ | PN 40 | 12 |
| 50 | 2 | PN 40 | 13 |
| 65 | – | PN 16 | 13 |
| 80 | 3 | PN 16 | 15 |
| 100 | 4 | PN 16 | 18 |
| 125 | – | PN 16 | 25 |
| 150 | 6 | PN 16 | 31 |
| 200 | 8 | PN 10 | 52 |
| 250 | 10 | PN 10 | 81 |
| 300 | 12 | PN 10 | 95 |
| 350 | 14 | PN 6 | 106 |
| 375 | 15 | PN 6 | 121 |
| 400 | 16 | PN 6 | 121 |

| Order code for "Design", option F, J: DN 450 to 2 000 mm (18 to 78 in) | | | |
|---|---|---|---|
| | | Reference values | |
| Nominal diameter | | EN (DIN) (PN16) | AS (PN 16) |
| [mm] | [in] | [kg] | [kg] |
| 450 | 18 | 142 | 138 |
| 500 | 20 | 182 | 186 |
| 600 | 24 | 227 | 266 |
| 700 | 28 | 291 | 369 |
| – | 30 | – | 447 |
| 800 | 32 | 353 | 524 |
| 900 | 36 | 444 | 704 |
| 1000 | 40 | 566 | 785 |
| – | 42 | – | – |
| 1200 | 48 | 843 | 1 229 |
| – | 54 | – | – |

| Order code for "Design", option F, J: DN 450 to 2 000 mm (18 to 78 in) | | | |
|---|---|---|---|
| | | Reference values | |
| Nominal diameter | | EN (DIN) (PN16) | AS (PN 16) |
| [mm] | [in] | [kg] | [kg] |
| 1400 | – | 1204 | – |
| – | 60 | – | – |
| 1600 | – | 1845 | – |
| – | 66 | – | – |
| 1800 | 72 | 2357 | – |
| – | 78 | 2929 | – |
| 2000 | – | 2929 | – |

| Order code for "Design", option F, J: DN 2 200 to 3 000 mm (84 to 120 in) | | |
|---|---|---|
| | | Reference values |
| Nominal diameter | | EN (DIN) (PN6) |
| [mm] | [in] | [kg] |
| – | 84 | – |
| 2200 | – | 3422 |
| – | 90 | – |
| 2400 | – | 4094 |
| – | 96 | – |
| – | 102 | – |
| 2600 | – | 6433 |
| – | 108 | – |
| 2800 | – | 7195 |
| – | 114 | – |
| 3000 | – | 8567 |
| – | 120 | – |

| Order code for "Design", option G, K: DN 450 to 2 000 mm (18 to 78 in) | | |
|---|---|---|
| | | Reference values |
| Nominal diameter | | EN (DIN) (PN 6) |
| [mm] | [in] | [kg] |
| 450 | 18 | 161 |
| 500 | 20 | 156 |
| 600 | 24 | 208 |
| 700 | 28 | 304 |
| – | 30 | – |
| 800 | 32 | 357 |
| 900 | 36 | 485 |
| 1000 | 40 | 589 |
| – | 42 | – |
| 1200 | 48 | 850 |

| Order code for "Design", option G, K: DN 450 to 2 000 mm (18 to 78 in) | | |
|---|---|---|
| Nominal diameter | | Reference values EN (DIN) (PN 6) |
| [mm] | [in] | [kg] |
| – | 54 | 850 |
| 1400 | – | 1 300 |
| – | 60 | – |
| 1600 | – | 1 845 |
| – | 66 | – |
| 1800 | 72 | 2 357 |
| – | 78 | 2 929 |
| 2000 | – | 2 929 |

## Weight in US units

| Order code for "Design", option C, D, E, H, I: DN 1 to 16 in (25 to 400 mm) | | |
|---|---|---|
| Nominal diameter | | Reference values ASME (Class 150) |
| [mm] | [in] | [lb] |
| 25 | 1 | 11 |
| 32 | – | – |
| 40 | 1 ½ | 15 |
| 50 | 2 | 20 |
| 65 | – | – |
| 80 | 3 | 31 |
| 100 | 4 | 42 |
| 125 | – | – |
| 150 | 6 | 73 |
| 200 | 8 | 115 |
| 250 | 10 | 198 |
| 300 | 12 | 284 |
| 350 | 14 | 379 |
| 375 | 15 | – |
| 400 | 16 | 448 |

| Order code for "Design", option F, J: DN 18 to 120 in (450 to 3 000 mm) | | |
|---|---|---|
| Nominal diameter | | Reference values ASME (Class 150), AWWA (Class D) |
| [mm] | [in] | [lb] |
| 450 | 18 | 421 |
| 500 | 20 | 503 |
| 600 | 24 | 666 |
| 700 | 28 | 587 |
| – | 30 | 701 |
| 800 | 32 | 845 |

| Order code for "Design", option F, J: DN 18 to 120 in (450 to 3 000 mm) | | |
|---|---|---|
| Nominal diameter | | Reference values ASME (Class 150), AWWA (Class D) |
| [mm] | [in] | [lb] |
| 900 | 36 | 1036 |
| 1000 | 40 | 1294 |
| – | 42 | 1477 |
| 1200 | 48 | 1987 |
| – | 54 | 2807 |
| 1400 | – | – |
| – | 60 | 3515 |
| 1600 | – | – |
| – | 66 | 4699 |
| 1800 | 72 | 5662 |
| – | 78 | 6864 |
| 2000 | – | 6864 |
| – | 84 | 8280 |
| 2200 | – | – |
| – | 90 | 10577 |
| 2400 | – | – |
| – | 96 | 15575 |
| – | 102 | 18024 |
| 2600 | – | – |
| – | 108 | 20783 |
| 2800 | – | – |
| – | 114 | 24060 |
| 3000 | – | – |
| – | 120 | 27724 |

| Order code for "Design", option G, K: DN 18 to 78 in (450 to 2 000 mm) | | |
|---|---|---|
| Nominal diameter | | Reference values ASME (Class 150), AWWA (Class D) |
| [mm] | [in] | [lb] |
| 450 | 18 | 562 |
| 500 | 20 | 628 |
| 600 | 24 | 893 |
| 700 | 28 | 882 |
| – | 30 | 1014 |
| 800 | 32 | 1213 |
| 900 | 36 | 1764 |
| 1000 | 40 | 1984 |
| – | 42 | 2426 |
| 1200 | 48 | 3087 |
| – | 54 | 4851 |

| Order code for "Design", option G, K: DN 18 to 78 in (450 to 2 000 mm) | | |
|---|---|---|
| Nominal diameter | | Reference values ASME (Class 150), AWWA (Class D) |
| [mm] | [in] | [lb] |
| 1400 | – | – |
| – | 60 | 5 954 |
| 1600 | – | – |
| – | 66 | 8 158 |
| 1800 | 72 | 9 040 |
| – | 78 | 10 143 |
| 2000 | – | – |

Measuring tube specification

The values are reference values and can vary depending on the pressure rating, design and order option.

| Nominal diameter | | Pressure rating | | | | Measuring tube internal diameter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EN (DIN) | ASME AWWA | AS 2129 AS 4087 | JIS | Hard rubber | | Polyurethane | | PTFE | |
| [mm] | [in] | | | | | [mm] | [in] | [mm] | [in] | [mm] | [in] |
| 25 | 1 | PN 40 | Class 150 | – | 20K | – | – | 24 | 0.93 | 25 | 1.00 |
| 32 | – | PN 40 | – | – | 20K | – | – | 32 | 1.28 | 34 | 1.34 |
| 40 | 1 ½ | PN 40 | Class 150 | – | 20K | – | – | 38 | 1.51 | 40 | 1.57 |
| 50 | 2 | PN 40 | Class 150 | Table E, PN 16 | 10K | 50 | 1.98 | 50 | 1.98 | 52 | 2.04 |
| 50 [1] | 2 | PN 40 | Class 150 | Table E, PN 16 | 10K | 32 | 1.26 | – | – | – | – |
| 65 | – | PN 16 | – | – | 10K | 66 | 2.60 | 66 | 2.60 | 68 | 2.67 |
| 65 [1] | – | PN 16 | – | – | 10K | 38 | 1.50 | – | – | – | – |
| 80 | 3 | PN 16 | Class 150 | Table E, PN 16 | 10K | 79 | 3.11 | 79 | 3.11 | 80 | 3.15 |
| 80 [1] | 3 | PN 16 | Class 150 | Table E, PN 16 | 10K | 50 | 1.97 | – | – | – | – |
| 100 | 4 | PN 16 | Class 150 | Table E, PN 16 | 10K | 101 | 3.99 | 104 | 4.11 | 104 | 4.09 |
| 100 [1] | 4 | PN 16 | Class 150 | Table E, PN 16 | 10K | 66 | 2.60 | – | – | – | – |
| 125 | – | PN 16 | – | – | 10K | 127 | 4.99 | 130 | 5.11 | 129 | 5.08 |
| 125 [1] | – | PN 16 | – | – | 10K | 79 | 3.11 | – | – | – | – |
| 150 | 6 | PN 16 | Class 150 | Table E, PN 16 | 10K | 155 | 6.11 | 158 | 6.23 | 156 | 6.15 |
| 150 [1] | 6 | PN 16 | Class 150 | Table E, PN 16 | 10K | 102 | 4.02 | – | – | – | – |
| 200 | 8 | PN 10 | Class 150 | Table E, PN 16 | 10K | 204 | 8.02 | 207 | 8.14 | 202 | 7.96 |
| 200 [1] | 8 | PN 16 | Class 150 | Table E, PN 16 | 10K | 127 | 5.00 | – | – | – | – |
| 250 | 10 | PN 10 | Class 150 | Table E, PN 16 | 10K | 258 | 10.14 | 261 | 10.26 | 256 | 10.09 |
| 250 [1] | 10 | PN 16 | Class 150 | Table E, PN 16 | 10K | 156 | 6.14 | – | – | – | – |
| 300 | 12 | PN 10 | Class 150 | Table E, PN 16 | 10K | 309 | 12.15 | 312 | 12.26 | 306 | 12.03 |
| 300 [1] | 12 | PN 16 | Class 150 | Table E, PN 16 | 10K | 204 | 8.03 | – | – | – | – |
| 350 | 14 | PN 10 | Class 150 | Table E, PN 16 | 10K | 337 | 13.3 | 340 | 13.4 | – | – |
| 375 | 15 | – | – | PN 16 | 10K | 389 | 15.3 | 392 | 15.4 | – | – |
| 400 | 16 | PN 10 | Class 150 | Table E, PN 16 | 10K | 387 | 15.2 | 390 | 15.4 | – | – |
| 450 | 18 | PN 10 | Class 150 | – | 10K | 436 | 17.2 | 439 | 17.3 | – | – |

| Nominal diameter | | Pressure rating | | | | Measuring tube internal diameter | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EN (DIN) | ASME<br>AWWA | AS 2129<br>AS 4087 | JIS | Hard rubber | | Polyurethane | | PTFE | |
| [mm] | [in] | | | | | [mm] | [in] | [mm] | [in] | [mm] | [in] |
| 500 | 20 | PN 10 | Class 150 | Table E, PN 16 | 10K | 487 | 19.2 | 490 | 19.3 | – | – |
| 600 | 24 | PN 10 | Class 150 | Table E, PN 16 | 10K | 585 | 23.0 | 588 | 23.1 | – | – |
| 700 | 28 | PN 10 | Class D | Table E, PN 16 | 10K | 694 | 27.3 | 697 | 27.4 | – | – |
| 750 | 30 | – | Class D | Table E, PN 16 | 10K | 743 | 29.3 | 746 | 29.4 | – | – |
| 800 | 32 | PN 10 | Class D | Table E, PN 16 | – | 794 | 31.3 | 797 | 31.4 | – | – |
| 900 | 36 | PN 10 | Class D | Table E, PN 16 | – | 895 | 35.2 | 898 | 35.4 | – | – |
| 1000 | 40 | PN 6 | Class D | Table E, PN 16 | – | 991 | 39.0 | 994 | 39.1 | – | – |
| – | 42 | – | Class D | – | – | 1 043 | 41.1 | 1 043 | 41.1 | – | – |
| 1200 | 48 | PN 6 | Class D | Table E, PN 16 | – | 1 191 | 46.9 | 1 197 | 47.1 | – | – |
| – | 54 | – | Class D | – | – | 1 339 | 52.7 | – | – | – | – |
| 1400 | – | PN 6 | – | – | – | 1 402 | 55.2 | – | – | – | – |
| – | 60 | – | Class D | – | – | 1 492 | 58.7 | – | – | – | – |
| 1600 | – | PN 6 | – | – | – | 1 600 | 63.0 | – | – | – | – |
| – | 66 | – | Class D | – | – | 1 638 | 64.5 | – | – | – | – |
| 1800 | 72 | PN 6 | – | – | – | 1 786 | 70.3 | – | – | – | – |
| – | 78 | – | Class D | – | – | 1 989 | 78.3 | – | – | – | – |
| 2000 | – | PN 6 | – | – | – | 1 989 | 78.3 | – | – | – | – |
| – | 84 | – | Class D | – | – | 2 099 | 84.0 | – | – | – | – |
| 2200 | – | PN 6 | – | – | – | 2 194 | 87.8 | – | – | – | – |
| – | 90 | – | Class D | – | – | 2 246 | 89.8 | – | – | – | – |
| 2400 | – | PN 6 | – | – | – | 2 391 | 94.1 | – | – | – | – |
| – | 96 | – | Class D | – | | 2 382 | 93.8 | – | – | – | – |
| – | 102 | – | Class D | – | | 2 533 | 99.7 | – | – | – | – |
| 2600 | – | PN 6 | – | – | | 2 580 | 101.6 | – | – | – | – |
| – | 108 | – | Class D | – | | 2 683 | 105.6 | – | – | – | – |
| 2800 | – | PN 6 | – | – | | 2 780 | 109.5 | – | – | – | – |
| – | 114 | – | Class D | – | | 2 832 | 111.5 | – | – | – | – |
| 3000 | – | PN 6 | – | – | | 2 976 | 117.2 | – | – | – | – |
| – | 120 | – | Class D | – | | 2 980 | 117.3 | – | – | – | – |

1) Order code for "Design", option C

## Materials

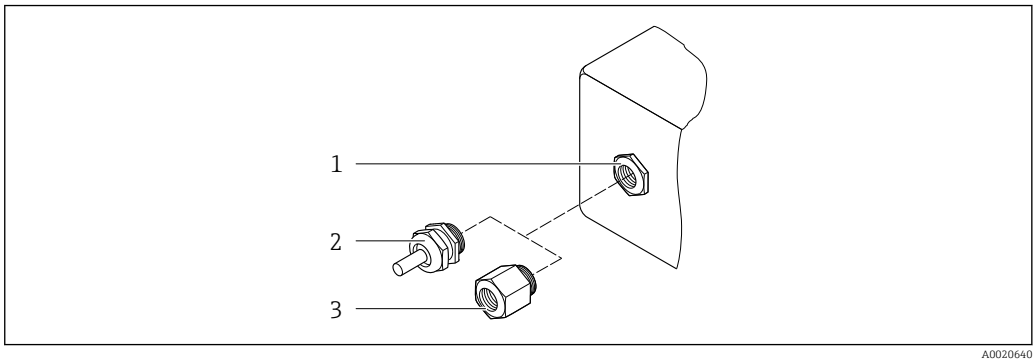
### Transmitter housing

Order code for "Housing":
Option **A** "Aluminum, coated": aluminum, AlSi10Mg, coated

*Window material*

Order code for "Housing":
Option **A** "Aluminum, coated": glass

### Cable entries/cable glands




40 *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"*

*Order code for "Housing", option A "Aluminum, coated"*

The various cable entries are suitable for hazardous and non-hazardous areas.

| Cable entry/cable gland | Material |
|---|---|
| Compression fitting M20 × 1.5 | Non-Ex: plastic |
| | Z2, D2, Ex d/de: brass with plastic |
| Adapter for cable entry with female thread G ½" | Nickel-plated brass |
| Adapter for cable entry with female thread NPT ½" | |

### Sensor housing

- DN 25 to 300 (1 to 12")
  - Aluminum half-shell housing, aluminum, AlSi10Mg, coated
  - Fully welded carbon steel housing with protective varnish
- DN 350 to 3000 (14 to 120")
  Fully welded carbon steel housing with protective varnish

### Measuring tubes

- DN 25 to 600 (1 to 24")
  Stainless steel: 1.4301, 1.4306, 304, 304L
- DN 700 to 3000 (28 to 120")
  Stainless steel: 1.4301, 304

*Liner*

- DN 25 to 300 (1 to 12"): PTFE
- DN 25 to 1200 (1 to 48"): polyurethane
- DN 50 to 3000 (2 to 120"): hard rubber

### Electrodes

- Stainless steel, 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)
- Tantalum

### Process connections

For flanges made of carbon steel:
- DN ≤ 300 (12"): with Al/Zn protective coating or protective varnish
- DN ≥ 350 (14"): protective varnish

All carbon steel lap joint flanges are supplied with a hot-dip galvanized finish.

*EN 1092-1 (DIN 2501)*

Fixed flange
- Carbon steel:
  - DN ≤ 300: S235JRG2, S235JR+N, P245GH, A105, E250C
  - DN 350 to 3000: P245GH, S235JRG2, A105, E250C
- Stainless steel:
  - DN ≤ 300: 1.4404, 1.4571, F316L
  - DN 350 to 600: 1.4571, F316L, 1.4404
  - DN 700 to 1000: 1.4404, F316L

Lap joint flange
- Carbon steel DN ≤ 300: S235JRG2, A105, E250C
- Stainless steel DN ≤ 300: 1.4306,1.4404, 1.4571, F316L

Lap joint flange, stamped plate
- Carbon steel DN ≤ 300: S235JRG2 similar to S235JR+AR or 1.0038
- Stainless steel DN ≤ 300: 1.4301 similar to 304

*ASME B16.5*

Fixed flange, lap joint flange
- Carbon steel: A105
- Stainless steel: F316L

*JIS B2220*

- Carbon steel: A105, A350 LF2
- Stainless steel: F316L

*AWWA C207*

Carbon steel: A105, P265GH, A181 Class 70, E250C, S275JR

*AS 2129*

Carbon steel: A105, E250C, P235GH, P265GH, S235JRG2

*AS 4087*

Carbon steel: A105, P265GH, S275JR

### Seals

As per DIN EN 1514-1, form IBC

### Accessories

*Protective cover*

Stainless steel, 1.4404 (316L)

*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

*Ground disks*

- Stainless steel, 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)
- Tantalum

Fitted electrodes

Measurement, reference and empty pipe detection electrodes available as standard with:
- 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)
- Tantalum

Process connections

- EN 1092-1 (DIN 2501)
- ASME B16.5
- JIS B2220
- AS 2129 Table E
- AS 4087 PN 16
- AWWA C207 Class D

For information on the different materials used in the process connections → 196

Surface roughness

Electrodes with 1.4435 (316L); Alloy C22, 2.4602 (UNS N06022); tantalum:
< 0.5 µm (19.7 µin)

(All data refer to parts in contact with the medium)

## 16.12 Operability

Languages

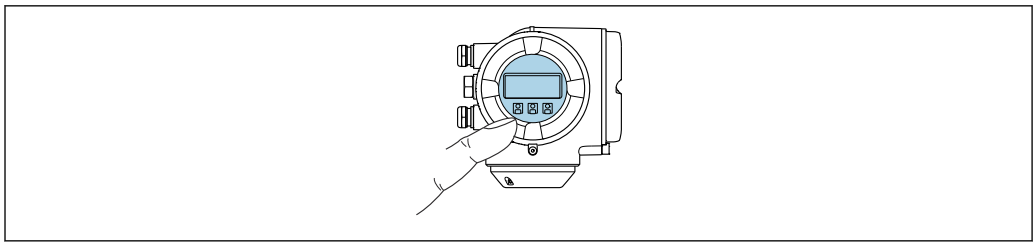
Can be operated in the following languages:
- Via local operation
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Vietnamese, Czech, Swedish
- Via Web browser
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Vietnamese, Czech, Swedish
- Via "FieldCare", "DeviceCare" operating tool: English, German, French, Spanish, Italian, Chinese, Japanese

Local operation

**Via display module**

Equipment:
- Order code for "Display; operation", option F "4-line, illuminated, graphic display; touch control"
- Order code for "Display; operation", option G "4-line, illuminated, graphic display; touch control + WLAN"

Information about WLAN interface → 77



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*41 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.

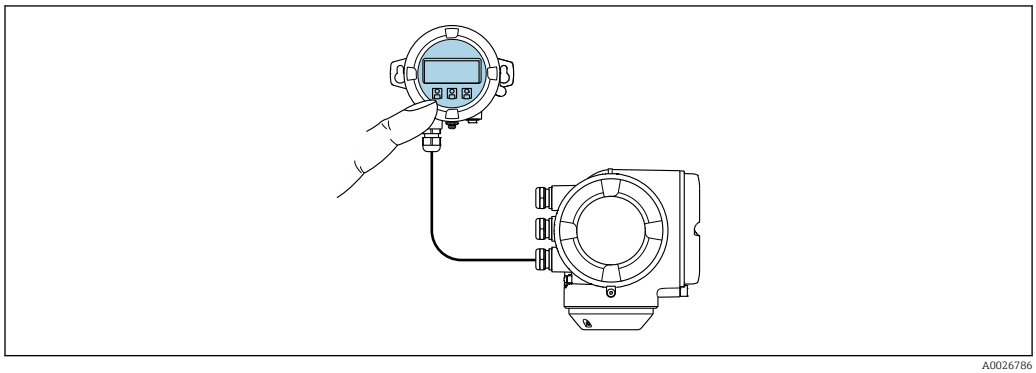
*Operating elements*

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

**Via remote display and operating module DKX001**

The remote display and operating module DKX001 is available as an optional extra → 🖹 165.

- The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring device. Display or operation at the transmitter is not possible in this case.
- If ordered subsequently, the remote display and operating module DKX001 may not be connected at the same time as the existing measuring device display module. Only one display or operation unit may be connected to the transmitter at any one time.



A0026786

*42 Operation via remote display and operating module DKX001*

*Display and operating elements*

The display and operating elements correspond to those of the display module → 🖹 197.

*Housing material*

| Transmitter housing | | Remote display and operating module |
|---|---|---|
| **Order code for "Housing"** | **Material** | **Material** |
| Option **A** "Aluminum, coated" | AlSi10Mg, coated | AlSi10Mg, coated |

*Cable entry*

Corresponds to the choice of transmitter housing, order code for "Electrical connection".

*Connecting cable*

→ 📄 40

*Dimensions*

Information about dimensions:
"Mechanical construction" section of the "Technical Information" document.

Remote operation

→ 📄 75

Service interface

→ 📄 76

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 | → 📄 167 |
| FieldCare SFE500 | Notebook, PC or tablet with Microsoft Windows system | ▪ CDI-RJ45 service interface<br>▪ WLAN interface<br>▪ Fieldbus protocol | → 📄 167 |

| Supported operating tools | Operating unit | Interface | Additional information |
|---|---|---|---|
| Field Xpert | SMT70/77/50 | ▪ All fieldbus protocols<br>▪ WLAN interface<br>▪ Bluetooth<br>▪ CDI-RJ45 service interface | Operating Instructions BA01202S<br>Device description files: Use update function of handheld terminal |
| SmartBlue app | Smart phone or tablet with iOs or Android | WLAN | → 167 |

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.process.honeywell.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 the service interface (CDI-RJ45) or via the WLAN interface. The structure of the operating menu is the same as for the local display. In addition to the measured values, device status information is also displayed and allows users 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; operation", 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, configuration backup)
- 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
- Visualize up to 1000 saved measured values (only available with the **Extended HistoROM** application package → 204)

Web server special documentation → 206

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.

When the device is delivered, the factory settings of the configuration data are stored as a backup in the device memory. This memory can be overwritten with an updated data record, for example after commissioning.

### 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>▪ Parameter data record backup<br>▪ Device firmware package | ▪ Measured value logging ("Extended HistoROM" order option)<br>▪ Current parameter data record (used by firmware at run time)<br>▪ Maximum indicators (min/max values)<br>▪ Totalizer values | ▪ Sensor data: nominal diameter etc.<br>▪ Serial number<br>▪ Calibration data<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 | In the sensor plug in the transmitter neck part |

### 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
- If exchanging the electronics module (e.g. I/O electronics module): Once the electronics module has been replaced, the software of the module is compared against the current device firmware. The module software is upgraded or downgraded where necessary. The electronics module is available for use immediately afterwards and no compatibility problems occur.

#### Manual

Additional parameter data record (complete parameter settings) in the integrated device memory HistoROM backup for:

- Data backup function
  Backup and subsequent restoration of a device configuration in the device memory HistoROM backup
- Data comparison function
  Comparison of the current device configuration with the device configuration saved in the device memory HistoROM backup

### 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

## 16.13 Certificates and approvals

Current certificates and approvals that are available for the product can be selected via the Product Configurator at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Configuration**.

| | |
|---|---|
| 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>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.<br>Contact address Endress+Hauser UK:<br>Endress+Hauser Ltd.<br>Floats Road<br>Manchester M23 9NF<br>United Kingdom<br>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 "Safety Instructions" (XA) document. Reference is made to this document on the nameplate. |

| | |
|---|---|
| Drinking water approval | ▪ ACS<br>▪ KTW/W270<br>▪ NSF 61<br>▪ WRAS BS 6920 |
| HART certification | **HART interface**<br>The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:<br>▪ Certified according to HART 7<br>▪ The device can also be operated with certified devices of other manufacturers (interoperability) |
| Radio approval | The measuring device has radio approval.<br>For detailed information on the radio approval, see the Special Documentation |
| Other standards and guidelines | ▪ EN 60529<br>Degrees of protection provided by enclosures (IP code)<br>▪ EN 61010-1<br>Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements<br>▪ IEC/EN 61326-2-3<br>Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).<br>▪ NAMUR NE 21<br>Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment<br>▪ NAMUR NE 32<br>Data retention in the event of a power failure in field and control instruments with microprocessors<br>▪ NAMUR NE 43<br>Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.<br>▪ NAMUR NE 53<br>Software of field devices and signal-processing devices with digital electronics<br>▪ NAMUR NE 105<br>Specifications for integrating fieldbus devices in engineering tools for field devices<br>▪ NAMUR NE 107<br>Self-monitoring and diagnosis of field devices<br>▪ NAMUR NE 131<br>Requirements for field devices for standard applications<br>▪ ETSI EN 300 328<br>Guidelines for 2.4 GHz radio components.<br>▪ EN 301489<br>Electromagnetic compatibility and radio spectrum matters (ERM). |

## 16.14 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.

Diagnostic functionality

Order code for "Application package", option EA "Extended HistoROM"

Comprises extended functions concerning the event log and the activation of the measured value memory.

Event log:
Memory volume is extended from 20 message entries (standard version) to up to 100 entries.

Data logging (line recorder):
- Memory capacity for up to 1000 measured values is activated.
- 250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user.
- Measured value logs can be accessed via the local display or operating tool e.g. FieldCare, DeviceCare or Web server.

For detailed information, see the Operating Instructions for the device.

Heartbeat Technology

Order code for "Application package", option EB "Heartbeat Verification + Monitoring"

**Heartbeat Verification**
Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 7.6 a) "Control of monitoring and measuring equipment".
- Functional testing in the installed state without interrupting the process.
- Traceable verification results on request, including a report.
- Simple testing process via local operation or other operating interfaces.
- Clear measuring point assessment (pass/fail) with high test coverage within the framework of manufacturer specifications.
- Extension of calibration intervals according to operator's risk assessment.

**Heartbeat Monitoring**
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:
- Draw conclusions - using these data and other information - about the impact the process influences (e.g. formation of buildup, magnetic field interference etc.) have on measuring performance over time.
- Schedule servicing in time.
- Monitor the process or product quality.

For detailed information, see the Special Documentation for the device.

Cleaning

Order code for "Application package", option EC "ECC electrode cleaning "

The electrode cleaning circuit (ECC) function has been developed to have a solution for applications where magnetite ($Fe_3O_4$) deposits frequently occur (e.g. hot water). Since magnetite is highly conductive this build up leads to measuring errors and ultimately to the loss of signal. The application package is designed to avoid build-up of very conductive matter and thin layers (typical of magnetite).

For detailed information, see the Operating Instructions for the device.

OPC-UA Server

Order code for "Application package", option EL "OPC-UA Server"

The application package provides an integrated OPC-UA server for comprehensive device services for IoT and SCADA applications.

For detailed information, see the Special Documentation for the device.

## 16.15 Accessories

Overview of accessories available for order → 165

## 16.16 Supplementary documentation

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

Standard documentation

### Brief Operating Instructions

*Brief Operating Instructions for the sensor*

| Measuring device | Documentation code |
|---|---|
| Proline Promag W | KA01266D |

*Brief Operating Instructions for transmitter*

| Measuring device | Documentation code |
|---|---|
| Proline 300 | KA01308D |

### Technical Information

| Measuring device | Documentation code |
|---|---|
| Promag W 300 | TI01414D |

### Description of Device Parameters

| Measuring device | Documentation code |
|---|---|
| Promag 300 | GP01051D |

Supplementary device-dependent documentation

### Safety instructions

Safety instructions for electrical equipment for hazardous areas.

| Contents | Documentation code |
|---|---|
| ATEX/IECEx Ex d/Ex de | XA01414D |
| ATEX/IECEx Ex ec | XA01514D |
| cCSAus XP | XA01515D |
| cCSAus Ex d/ Ex de | XA01516D |
| cCSAus Ex nA | XA01517D |
| INMETRO Ex d/Ex de | XA01518D |
| INMETRO Ex ec | XA01519D |
| NEPSI Ex d/Ex de | XA01520D |
| NEPSI Ex nA | XA01521D |
| EAC Ex d/Ex de | XA01656D |

| Contents | Documentation code |
|---|---|
| EAC Ex nA | XA01657D |
| JPN Ex d | XA01775D |

*Remote display and operating module DKX001*

| Contents | Documentation code |
|---|---|
| ATEX/IECEx Ex i | XA01494D |
| ATEX/IECEx Ex ec | XA01498D |
| cCSAus IS | XA01499D |
| cCSAus Ex nA | XA01513D |
| INMETRO Ex i | XA01500D |
| INMETRO Ex ec | XA01501D |
| NEPSI Ex i | XA01502D |
| NEPSI Ex nA | XA01503D |

### Functional Safety Manual

| Contents | Documentation code |
|---|---|
| Promag 300 | SD01740D |

### Special Documentation

| Contents | Documentation code |
|---|---|
| Information on the Pressure Equipment Directive | SD01614D |
| Radio approvals for WLAN interface for A309/A310 display module | SD01793D |
| Web server | SD01658D |
| Remote display and operating module DKX001 | SD01763D |
| OPC-UA Server | SD02043D |

| Contents | Documentation code |
|---|---|
| Heartbeat Technology | SD01640D |
| Web server | SD01654D |

### Installation Instructions

| Contents | Comment |
|---|---|
| Installation instructions for spare part sets and accessories | ▪ Access the overview of all the available spare part sets via *Device Viewer* → 163<br>▪ Accessories available for order with Installation Instructions → 165 |

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