BA01214D/06/EN/07.21
71541968
2022-02-01

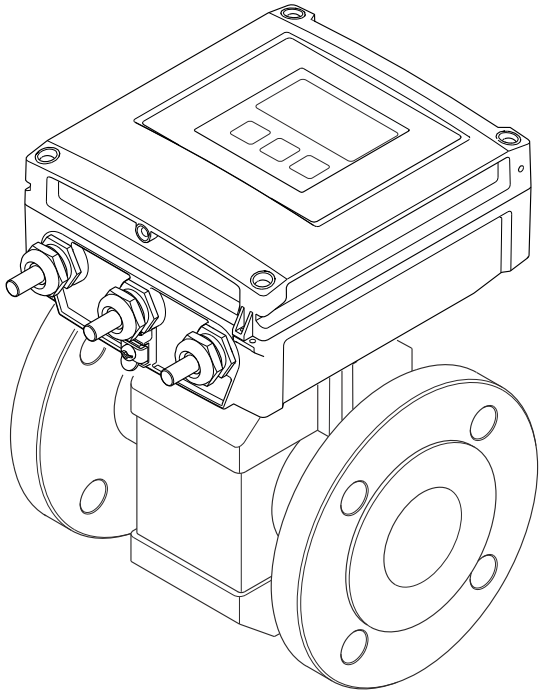
Valid as of version
02.00.zz (Device firmware)



# Operating Instructions
# **Proline Promag W 400 EtherNet/IP**

Electromagnetic flowmeter

EtherNet/IP



Endress+Hauser
People for Process Automation

- Make sure the document is stored in a safe place such that it is always available when working on or with the device.
- To avoid danger to individuals or the facility, read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser Sales Center will supply you with current information and updates to these instructions.

# Table of contents

# 1 About this document

## 1.1 Document function

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

## 1.2 Symbols

### 1.2.1 Safety symbols

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

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

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

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

### 1.2.2 Electrical symbols

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

### 1.2.3 Communication symbols

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

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

### 1.2.4 Tool symbols

| Symbol | Meaning |
|---|---|
|  | Torx screwdriver |
|  | Phillips head screwdriver |
|  | Open-ended wrench |

### 1.2.5 Symbols for certain types of information

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

### 1.2.6 Symbols in graphics

| Symbol | Meaning |
|---|---|
| **1, 2, 3, ...** | Item numbers |
| 1., 2., 3., ... | Series of steps |
| **A, B, C, ...** | Views |
| **A-A, B-B, C-C, ...** | Sections |
|  | 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

Detailed list of the individual documents along with the documentation code
→ 204

### 1.3.1 Standard documentation

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

### 1.3.2 Supplementary device-dependent documentation

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

## 1.4 Registered trademarks

**EtherNet/IP™**
Trademark of ODVA, Inc.

# 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 Designated 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 where there is an increased risk due to process pressure, are labeled 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.

The measuring device is optionally tested in accordance with OIML R49: 2006 and has an EC type-examination certificate according to Measuring Instruments Directive 2004/22/EC (MID) for service subject to legal metrological control ("custody transfer") for cold water (Annex MI-001).

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

**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

For work on and with the device:

- ▶ Wear the required personal protective equipment according to national regulations.

For welding work on the piping:

- ▶ Do not ground the welding unit via the measuring device.

If working on and with the device with wet hands:

- ▶ Due to the increased risk of electric shock, wear suitable gloves.

## 2.4 Operational safety

Risk of injury.

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

### Conversions to the device

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

- ▶ If, despite this, modifications are required, consult with Endress+Hauser.

### Repair

To ensure continued operational safety and reliability,

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

## 2.5 Product safety

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

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

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

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

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

## 2.6 IT security

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

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

## 2.7 Device-specific IT security

The device offers a range of specific functions to support protective measures on the operator's side. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. An overview of the most important functions is provided in the following section.

### 2.7.1 Protecting access via a password

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

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

#### User-specific access code

Write access to the device parameters via the local display or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code (→ 🖹 133).

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 (→ 🖹 82), 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 (→ 130).

**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 → 133

## 2.7.2 Access via Web server

The device can be operated and configured via a Web browser with the integrated Web server (→ 74). The connection is via the service interface (CDI-RJ45), signal transmission connection for EtherNet/IP (RJ45 plug) 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.

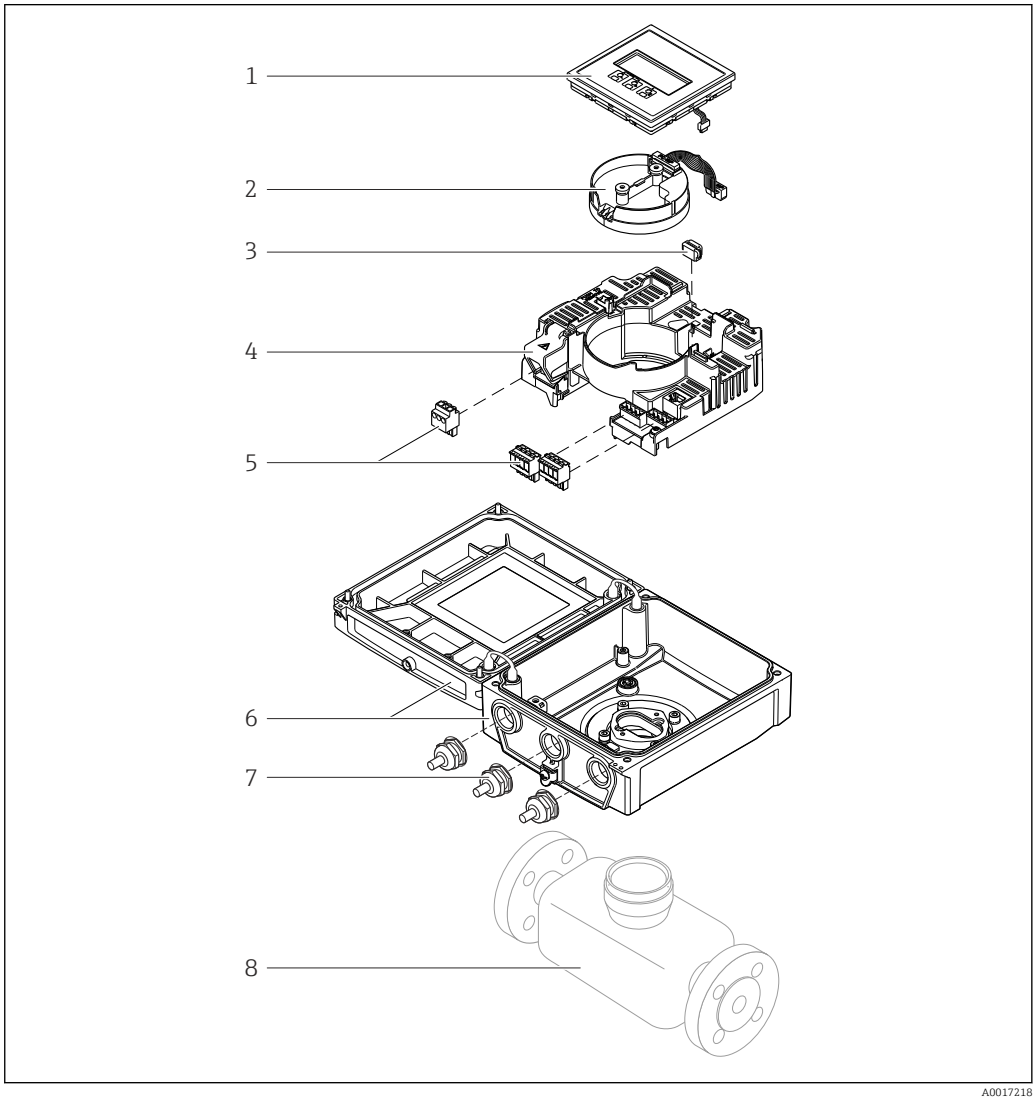
For detailed information on device parameters, see:
The "Description of Device Parameters" document → 205.

# 3 Product description

The device consists of a transmitter and a sensor.

Two device versions are available:
- Compact version - transmitter and sensor form a mechanical unit.
- Remote version - transmitter and sensor are mounted in separate locations.

## 3.1 Product design

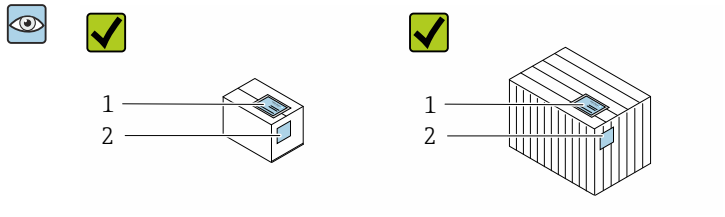



1 *Important components of the compact version*

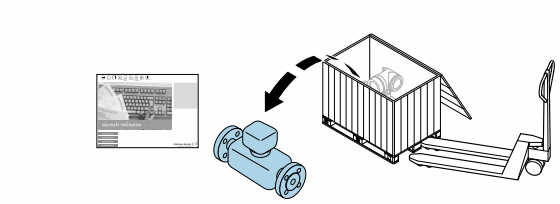
1 *Display module*
2 *Smart sensor electronics module*
3 *HistoROM DAT (plug-in memory)*
4 *Main electronics module*
5 *Terminals (screw terminals, some available as plug-in terminals) or fieldbus connectors*
6 *Transmitter housing, compact version*
7 *Cable glands*
8 *Sensor, compact version*

# 4 Incoming acceptance and product identification

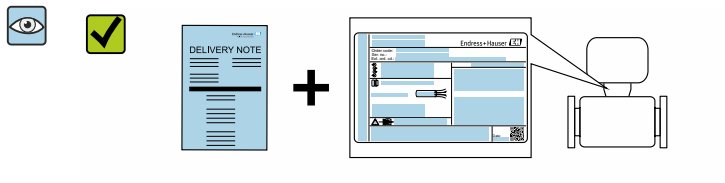
## 4.1 Incoming acceptance




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



Are the goods undamaged?




Do the nameplate data match the ordering information on the delivery note?

Is the envelope present with accompanying documents?

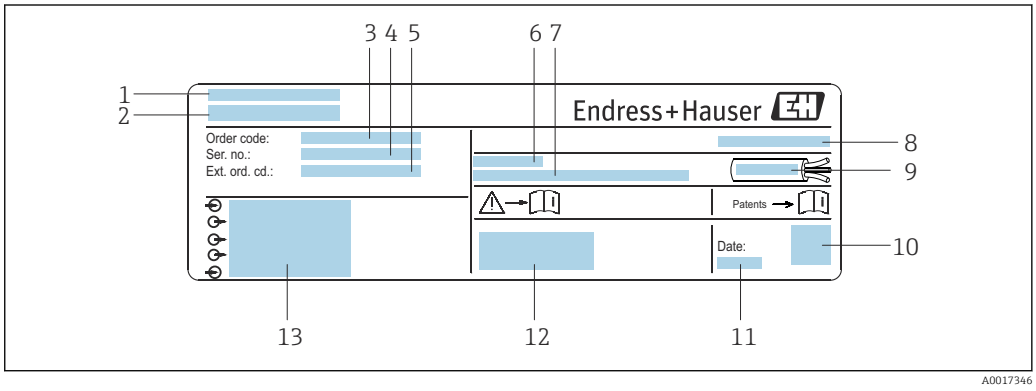
- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- The Technical Documentation is available via the Internet or via the *Endress+Hauser Operations App*, see the "Product identification" section → 15.

## 4.2 Product identification

The following options are available for identification of the device:
- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter the serial numbers from the nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer): all the information about the device is displayed.
- Enter the serial numbers from the nameplates into the *Endress+Hauser Operations App* or scan the DataMatrix code on the nameplate with the *Endress+Hauser Operations App*: all the information about the device is displayed.

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

### 4.2.1 Transmitter nameplate




2 *Example of a transmitter nameplate*

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

### 4.2.2 Sensor nameplate

**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

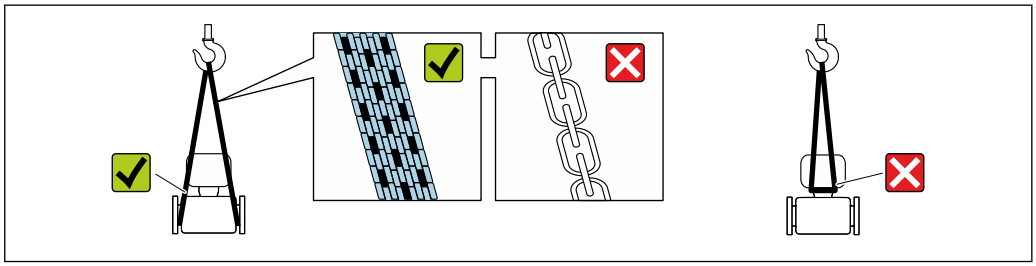
## 5.1 Storage conditions

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 tube.
- 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 → 185

## 5.2 Transporting the product

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



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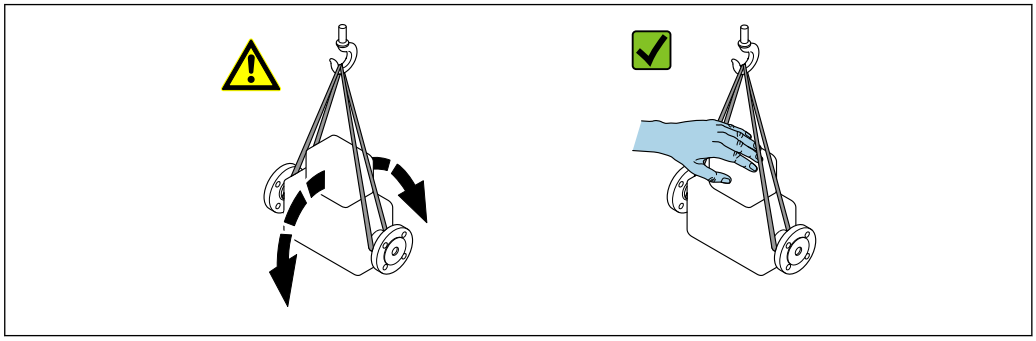
Do not remove protective covers or caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.

### 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).



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### 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.

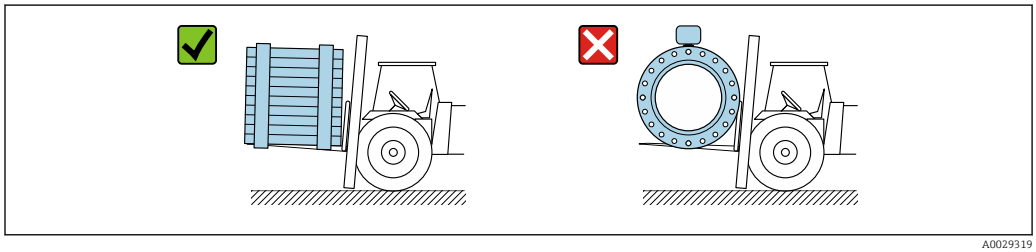
### 5.2.3 Transporting with a fork lift

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:

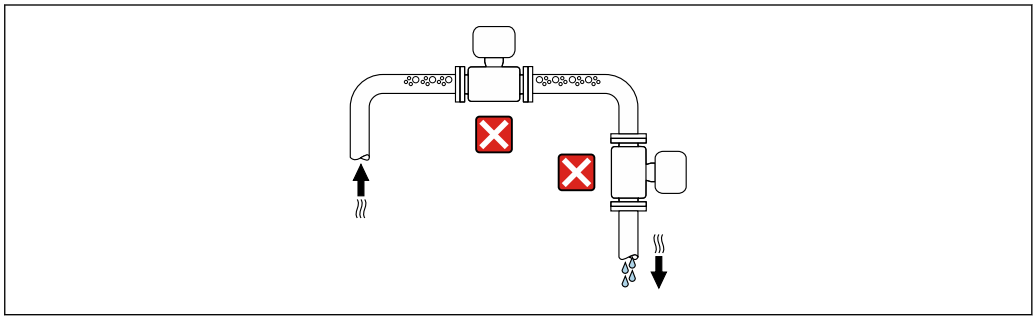
- Outer packaging of device
  Polymer stretch wrap, complying with EU Directive 2002/95/EC (RoHS)
- Packaging
  - Wooden crate treated in accordance with ISPM 15 standard, confirmed by IPPC logo
  - Cardboard box in accordance with European packaging guideline 94/62EC, recyclability confirmed by Resy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

# 6 Installation

## 6.1 Installation conditions

### 6.1.1 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.



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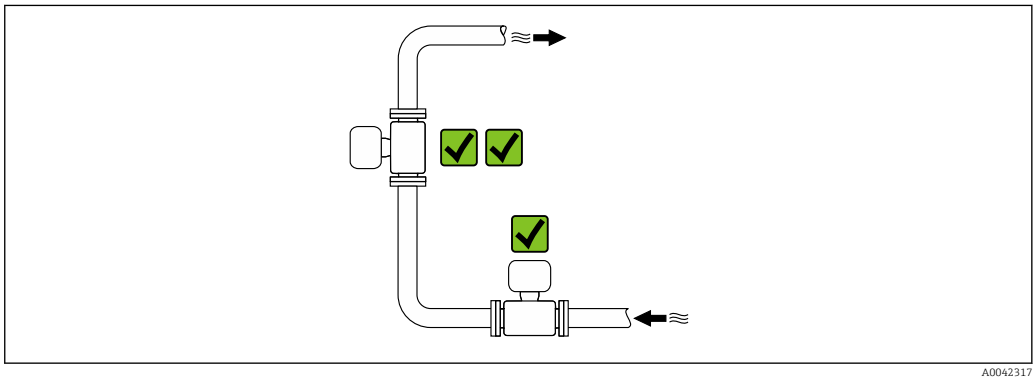
The device should ideally be installed in an ascending pipe.



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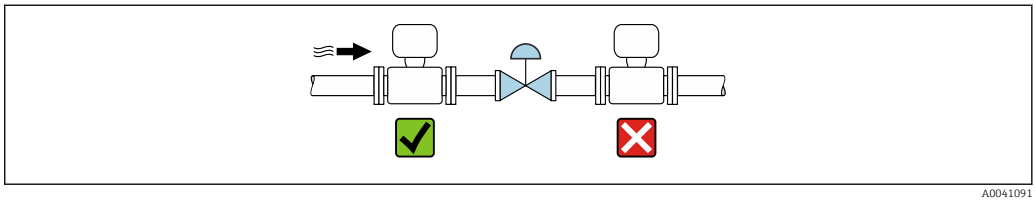
#### Installation near valves

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



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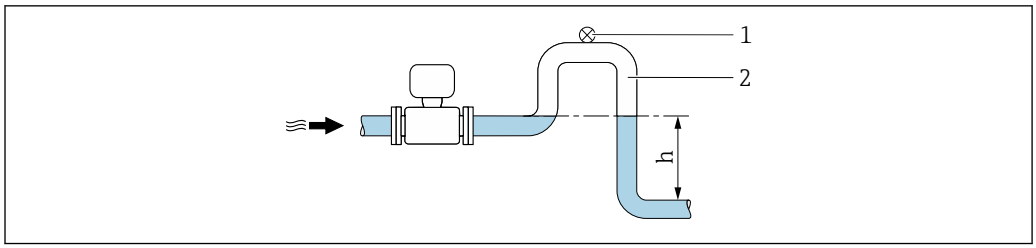
#### Installation upstream from a down pipe

NOTICE

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

▶ If installing upstream from down pipes with a length h ≥ 5 m (16.4 ft), install a siphon with a vent valve downstream from the device.

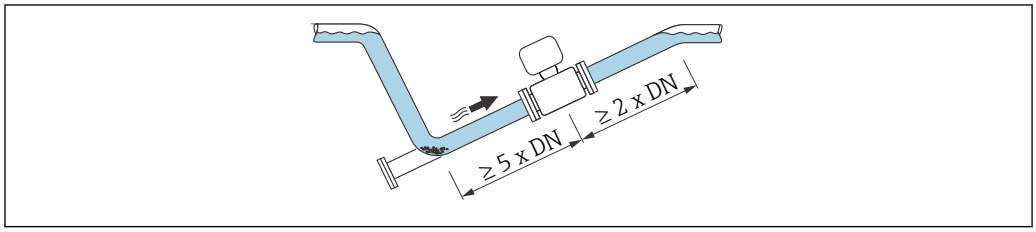
This arrangement prevents the stoppage of liquid flow and the formation of air pockets.




*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.



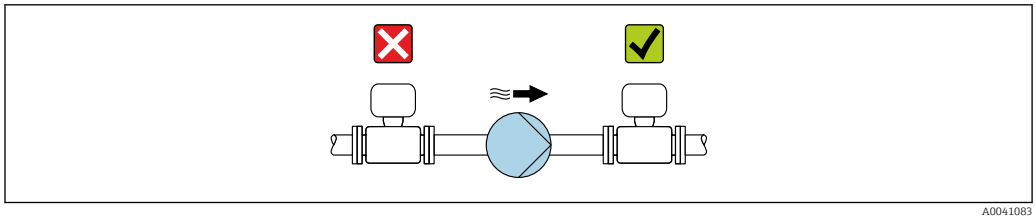

No inlet and outlet runs for devices with the order code for "Design": Option C, H, I, J or K.

### 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.




- Information on the liner's resistance to partial vacuum → 187
- Information on the measuring system's resistance to vibration and shock → 186

### Installation of very heavy devices

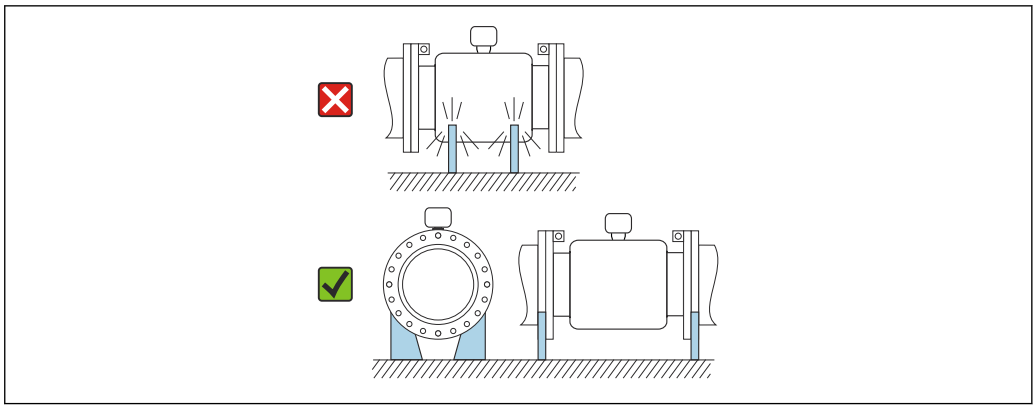
Support required for nominal diameters of DN ≥ 350 mm (14 in).

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.



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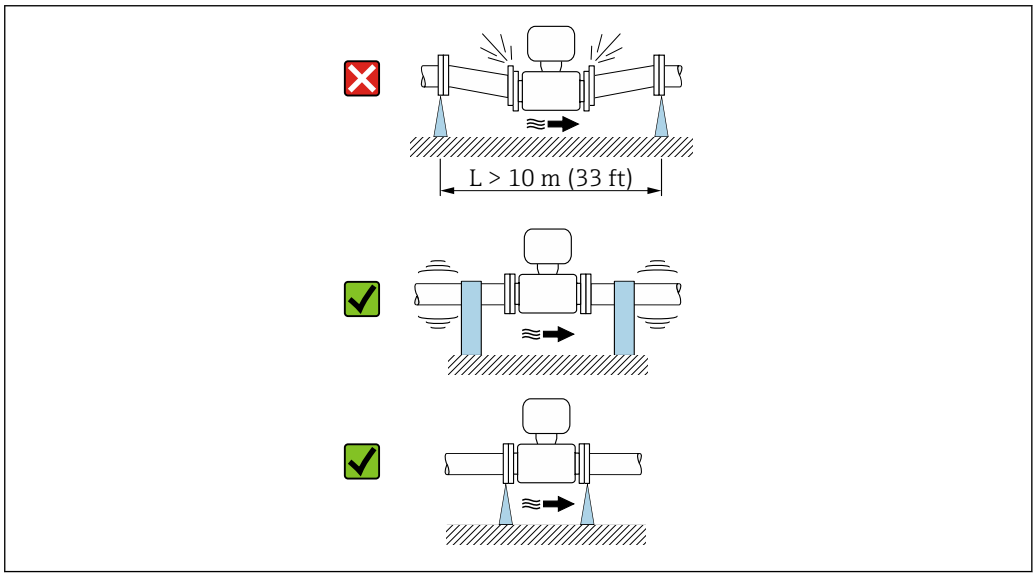
**Installation in event of pipe vibrations**

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.

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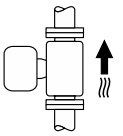
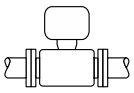
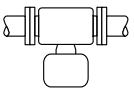
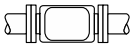
Information on the measuring system's resistance to vibration and shock → 186

## 6.1.2 Orientation

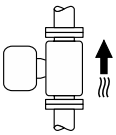
The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

| Orientation | | Recommendation |
|---|---|---|
| Vertical orientation |  A0015591 | ✓✓ |
| Horizontal orientation, transmitter at top |  A0015589 | ✓✓ 1) |
| Horizontal orientation, transmitter at bottom |  A0015590 | ✓✓ 2) 3) ✗ 4) |
| Horizontal orientation, transmitter at side |  A0015592 | ✗ |

1) Applications with low process temperatures may decrease 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 module from overheating in the case of a sharp rise in temperature (e.g. CIP or SIP processes), install the device with the transmitter component pointing downwards.
4) With the empty pipe detection function 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.



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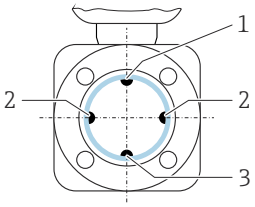
### Horizontal

- 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.

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

## 6.1.3 Inlet and outlet runs

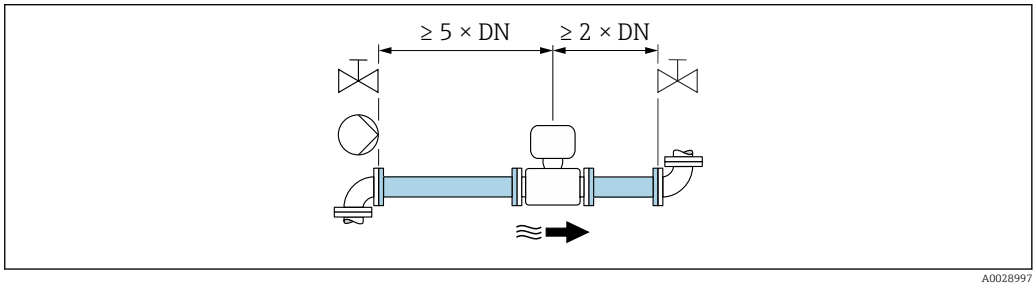
### Installation with inlet and outlet runs

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

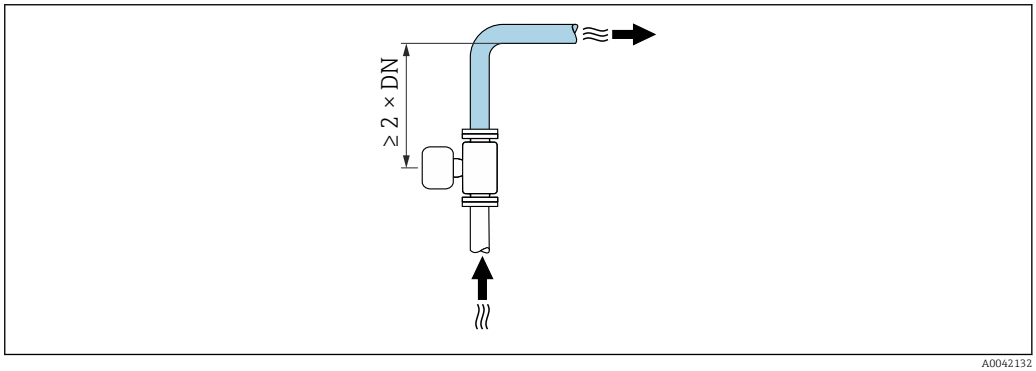
*Installation with elbows, pumps or valves*

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

Maintain straight, unimpeded inlet and outlet runs.




A0028997

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### 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*

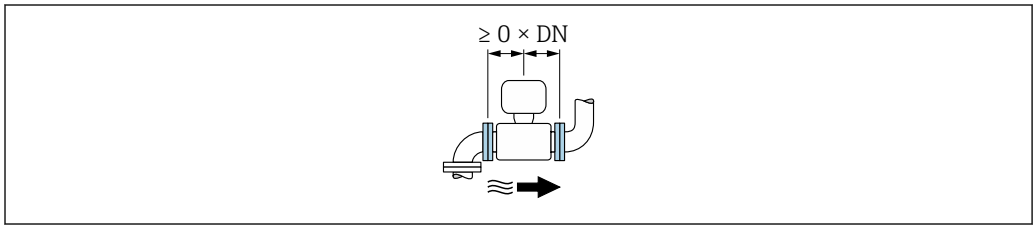
| Order code for "Design" | | |
|---|---|---|
| **Option** | **Description** | **Design** |
| C | Fixed flange, constricted measuring tube, 0 x DN inlet/outlet runs | Constricted measuring tube [1] |
| H | Lap joint flange, 0 x DN inlet/outlet runs | Full Bore [2] |
| I | Fixed flange, 0 x DN inlet/outlet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

| Order code for "Design" | | |
|---|---|---|
| **Option** | **Description** | **Design** |
| 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*

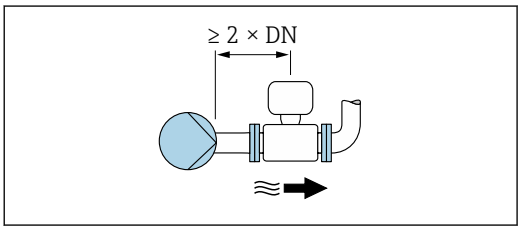
Installation without inlet and outlet runs is possible: devices with the order code for "Design", option C, H, I, J and K.




*Installation downstream of pumps*

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

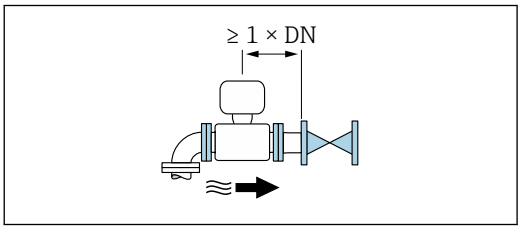
In the case of devices with the order code for "Design", option J and K, an inlet run of only ≥ 2 x DN must be taken into consideration.




*Installation upstream of valves*

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

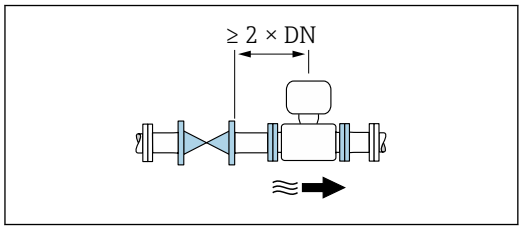
In the case of devices with the order code for "Design", option J and K, an outlet run of only ≥ 1 x DN must be taken into consideration.




*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.




### 6.1.4 Dimensions

For the dimensions and installed lengths of the device, see the "Technical Information" document, "Mechanical construction" section → 204

### 6.1.5 Environment and process requirements

#### Ambient temperature range

| | |
|---|---|
| Transmitter | −40 to +60 °C (−40 to +140 °F) |
| Local display | −20 to +60 °C (−4 to +140 °F), the legibility of the local 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)<br>If both the ambient and the medium temperatures are high, mount the sensor separately from the transmitter. |
| Liner | Do not exceed or fall below the permitted temperature range of the liner → 187. |

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.
- If the compact version of the device is insulated at low temperatures, the insulation must also include the device neck.
- Protect the display against impact.
- Protect the display from abrasion, e.g. caused by sand in desert areas.

Display guard available as an accessory → 171.

*Temperature tables*

Observe the interdependencies between the permitted ambient and fluid temperatures when operating the device in hazardous areas.

For detailed information on the temperature tables, see the separate document entitled "Safety Instructions" (XA) for the device.

#### System pressure

Installation near pumps → 20

#### Vibrations

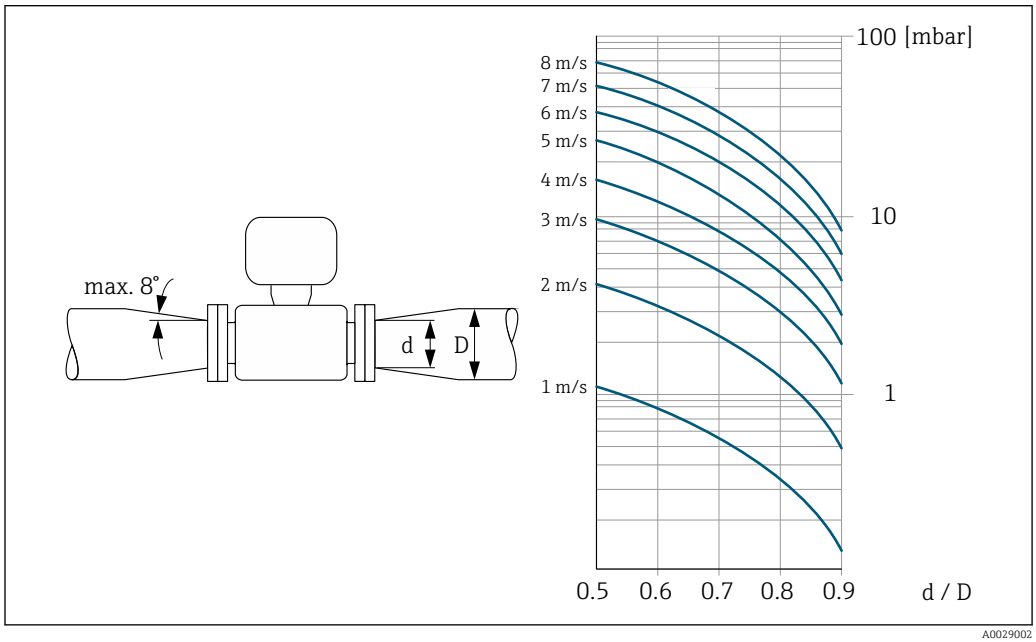
Installation in event of pipe vibrations → 21

### 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.

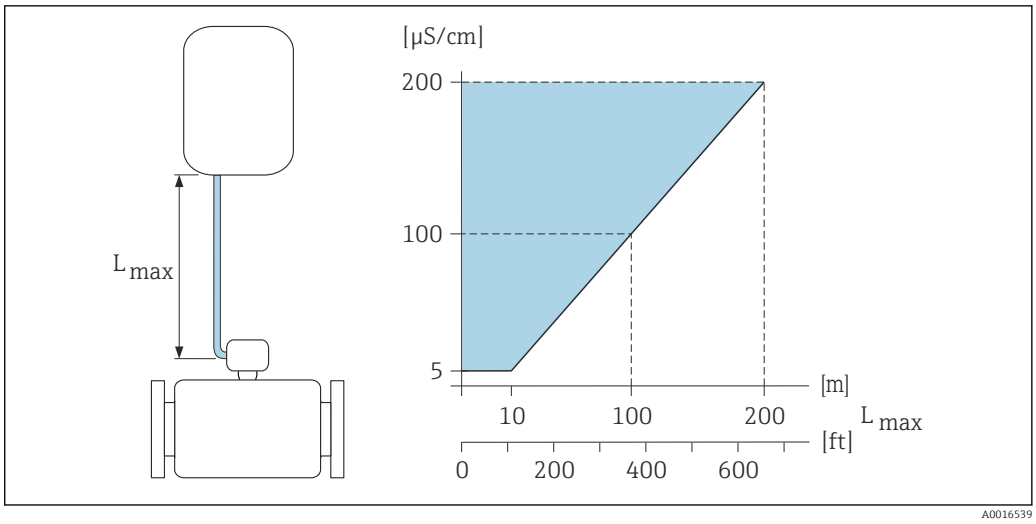
The nomogram only applies to liquids with a viscosity similar to that of water.

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.




### Length of connecting cable

To obtain correct measurement results, observe the permitted connecting cable length of $L_{max}$. This length is determined by the conductivity of the fluid. If measuring liquids in general: 5 µS/cm




3 *Permitted length of connecting cable*

*Colored area = permitted range*
*$L_{max}$ = length of connecting cable in [m] ([ft])*
*[µS/cm] = fluid conductivity*

## 6.1.6 Special mounting instructions

### Display guard

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

### Immersion in water

- Only the remote version of the device with IP68 protection, Type 6P is suitable for underwater use: order code for "Sensor option", options CB, CC, CD, CE and CQ.
- Pay attention to regional installation instructions.

NOTICE

**If the maximum water depth and operating duration is exceeded, this can damage the device!**

- Observe the maximum water depth and operating duration.

*Order code for "Sensor option", options CB, CC*

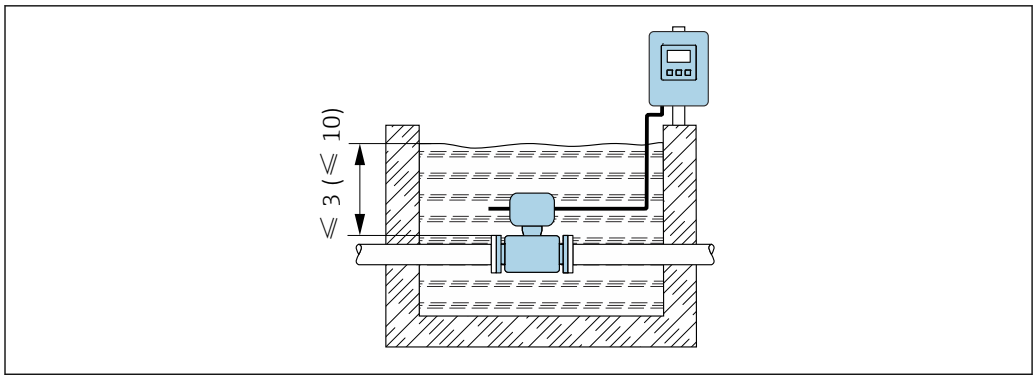
- For the operation of the device under water
- Operating duration at a maximum depth of:
  - 3 m (10 ft): permanent use
  - 10 m (30 ft): maximum 48 hours

*Order code for "Sensor option", option CQ "Temporarily water-proof "*

- For the temporary operation of the device under non-corrosive water
- Operating duration at a maximum depth of:
  3 m (10 ft): maximum 168 hours

*Order code for "Sensor option", options CD, CE*

- For the operation of the device under water and in saline water
- Operating duration at a maximum depth of:
  - 3 m (10 ft): permanent use
  - 10 m (30 ft): maximum 48 hours

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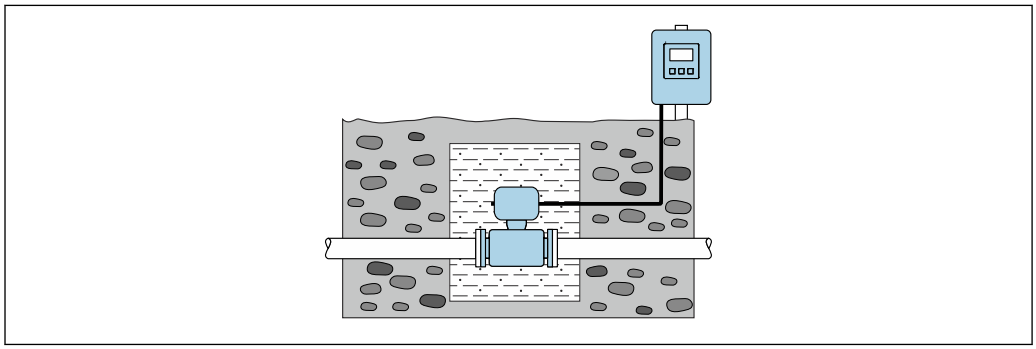
**Use in buried applications**

- Only the remote version of the device with IP68 protection is suitable for use in buried applications: order code for "Sensor option", options CD and CE.
- Pay attention to regional installation instructions.

*Order code for "Sensor option", options CD, CE*

For the use of the device in buried applications.



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## 6.2 Mounting the measuring device

### 6.2.1 Required tool

**For transmitter**

- Torque wrench
- For wall mounting:
  Open-ended wrench for hexagonal screw max. M5
- For pipe mounting:
  - Open-ended wrench AF 8
  - Phillips head screwdriver PH 2
- For turning the transmitter housing (compact version):
  - Phillips head screwdriver PH 2
  - Torx screwdriver TX 20
  - Open-ended wrench AF 7

**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

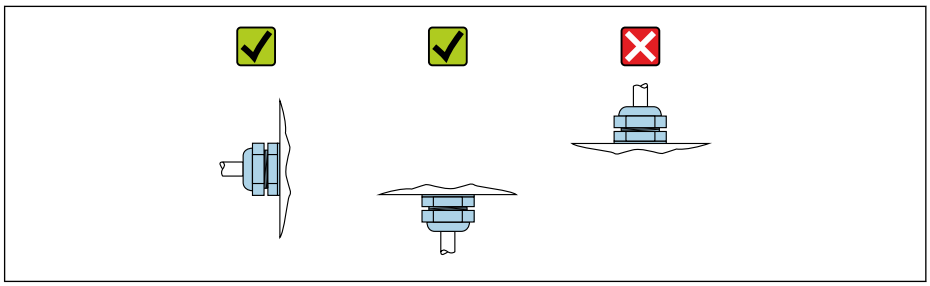
**⚠ WARNING**

**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 required screw tightening torques → 30.
5. Install the measuring device or turn the transmitter housing so that the cable entries do not point upwards.

↳



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#### 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 faces or damage the seals.

Nominal screw tightening torques → 35

*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 | – |
| | | 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 | – |

| Nominal diameter | | Pressure rating | Screws | Flange thickness | Max. screw tightening torque [Nm] | | |
|---|---|---|---|---|---|---|---|
| [mm] | [in] | [bar] | [mm] | [mm] | HG | PUR | PTFE |
| | | 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 | – | – |
| 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 | – | – |

| Nominal diameter | | Pressure rating | Screws | Flange thickness | Max. screw tightening torque [Nm] | | |
|---|---|---|---|---|---|---|---|
| [mm] | [in] | [bar] | [mm] | [mm] | HG | PUR | PTFE |
| | | 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 |

| Nominal diameter [mm] | Pressure rating [bar] | Screws [mm] | Max. screw tightening torque [Nm] | |
|---|---|---|---|---|
| | | | HG | PUR |
| 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 | – | – |
| – | 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 [mm] | Screws [mm] | Max. screw tightening torque [Nm] | |
|---|---|---|---|
| | | 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 [mm] | Screws [mm] | Max. screw tightening torque [Nm] | |
|---|---|---|---|
| | | 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 | – |
| 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 | – |

| Nominal diameter [mm] | Screws [mm] | Max. screw tightening torque [Nm] | |
|---|---|---|---|
| | | HG | PUR |
| 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 | Pressure rating | Screws | Nom. screw tightening torque [Nm] | |
|---|---|---|---|---|
| [mm] | [bar] | [mm] | 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 |

| Nominal diameter [mm] | Pressure rating [bar] | Screws [mm] | Nom. screw tightening torque [Nm] | |
|---|---|---|---|---|
| | | | HG | PUR |
| | 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 Mounting the transmitter of the remote version

**⚠ CAUTION**

**Ambient temperature too high!**

Danger of electronics overheating and housing deformation.

- ▶ Do not exceed the permitted maximum ambient temperature .
- ▶ If operating outdoors: Avoid direct sunlight and exposure to weathering, particularly in warm climatic regions.

**⚠ CAUTION**

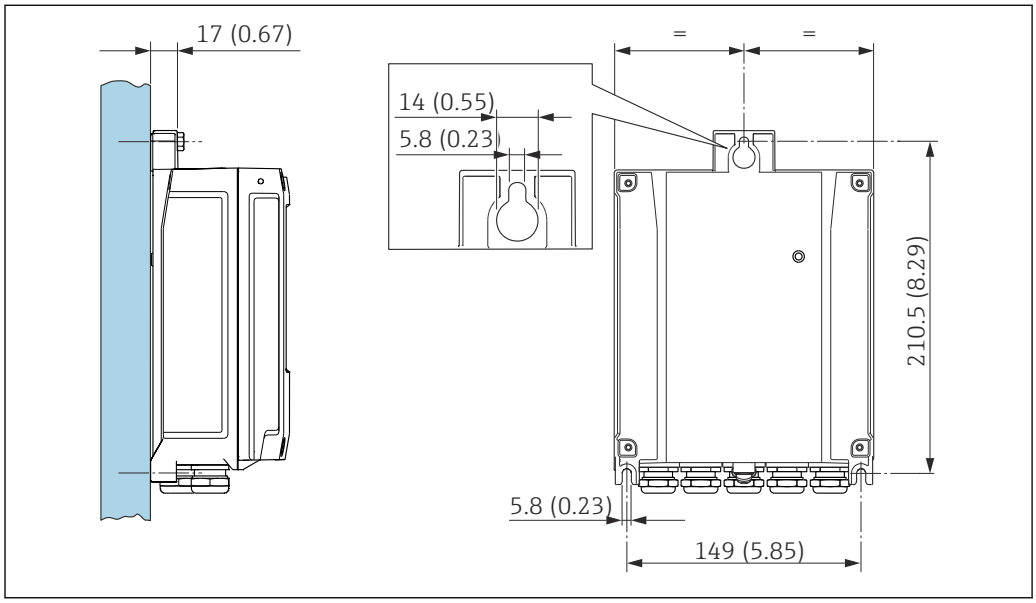
**Excessive force can damage the housing!**

- ▶ Avoid excessive mechanical stress.

The transmitter of the remote version can be mounted in the following ways:

- Wall mounting
- Pipe mounting

#### Wall mounting




4 *Engineering unit mm (in)*

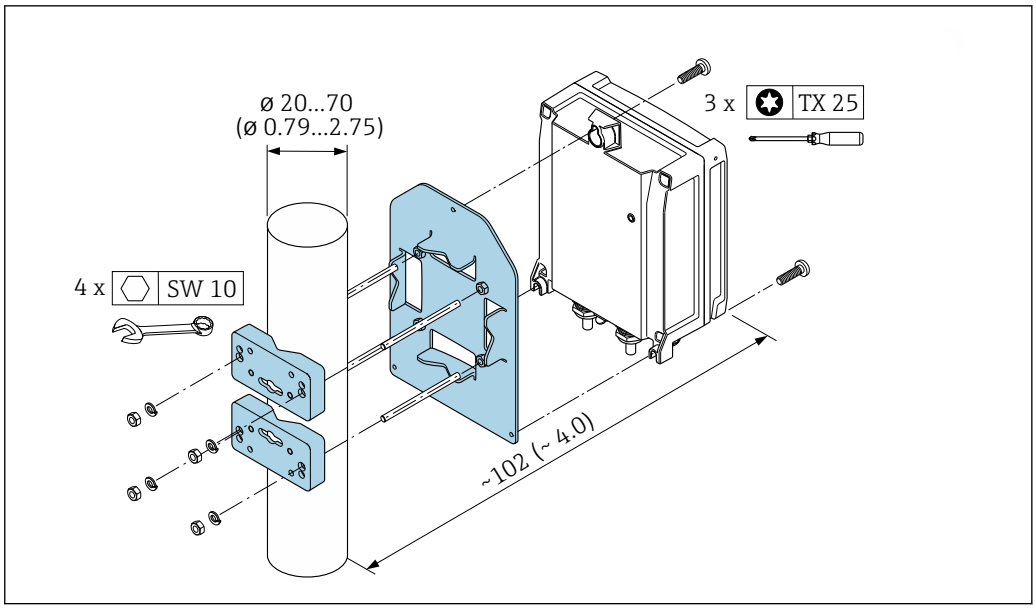
1. Drill the holes.
2. Insert wall plugs into the drilled holes.
3. Screw the securing screws in slightly.

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

**Post mounting**

**WARNING**

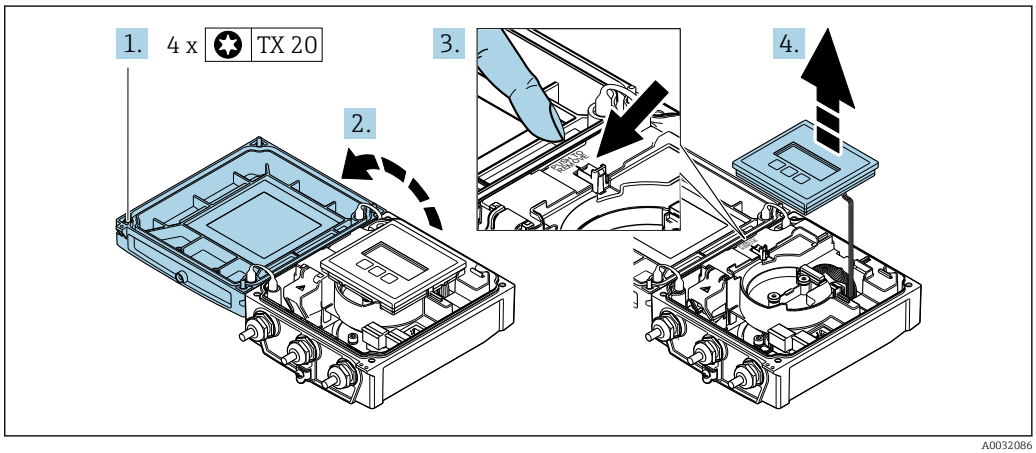
**Excessive tightening torque applied to the fixing screws!**
Risk of damaging the plastic transmitter.
▶ Tighten the fixing screws as per the tightening torque: 2 Nm (1.5 lbf ft)



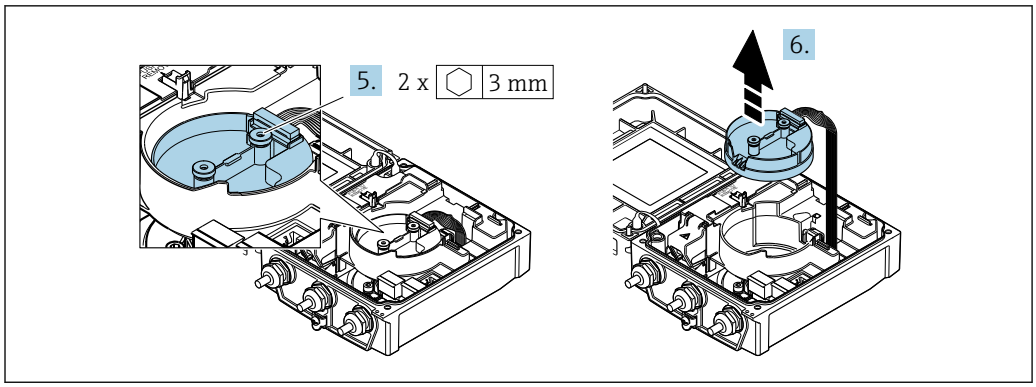

5 *Engineering unit mm (in)*

## 6.2.5 Turning the transmitter housing

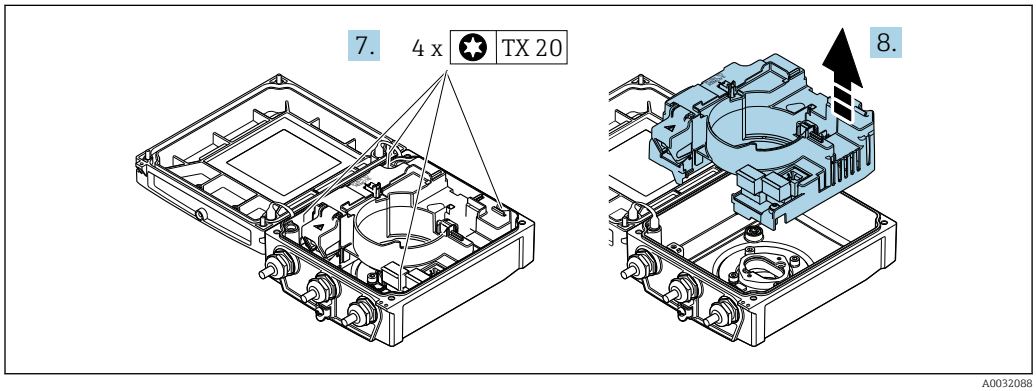
To provide easier access to the connection compartment or display module, the transmitter housing can be turned.



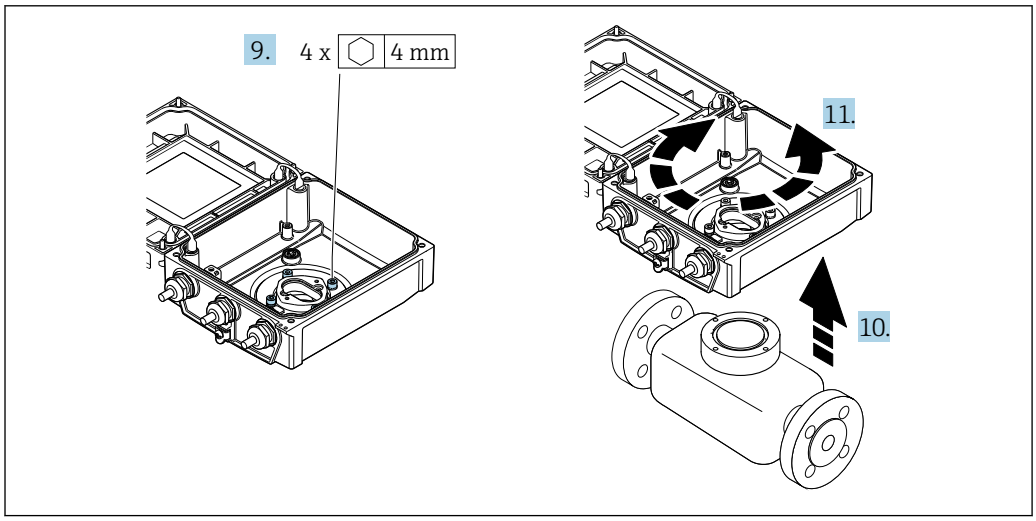

1. Loosen the fixing screws of the housing cover (when reassembling, pay attention to the tightening torque → 39).
2. Open the housing cover.
3. Unlock the display module.
4. Remove the display module.




5. Loosen the fixing screws of the smart sensor electronics module (when reassembling, pay attention to the tightening torque → 39).
6. Remove the smart sensor electronics module (when reassembling, pay attention to the coding of the plug → 39).




7. Loosen the fixing screws of the main electronics module (when reassembling, pay attention to the tightening torque → 39).
8. Remove the main electronics module.




9. Loosen the fixing screws of the transmitter housing (when reassembling, pay attention to the tightening torque → 39).
10. Lift the transmitter housing.
11. Turn the housing to the desired position in increments of 90°.

### Reassembling the transmitter housing

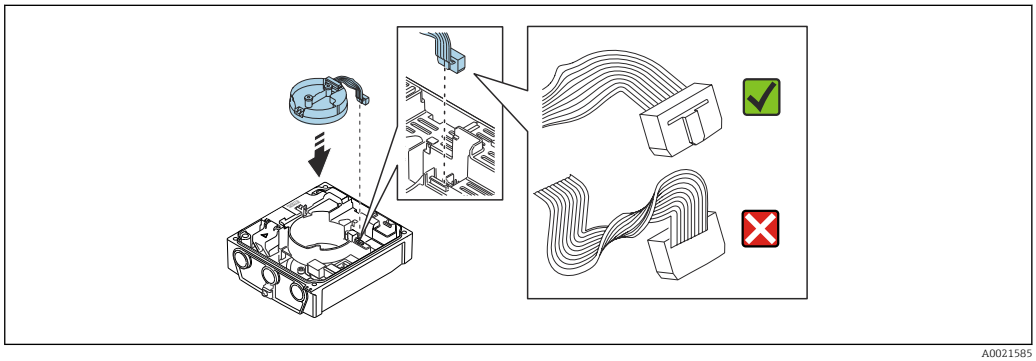
**WARNING**

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

| Step → 37 | Fixing screw | Tightening torques for housing made of: | |
|---|---|---|---|
| | | Aluminum | Plastic |
| 1 | Housing cover | 2.5 Nm (1.8 lbf ft) | 1 Nm (0.7 lbf ft) |
| 5 | Smart sensor electronics module | 0.6 Nm (0.4 lbf ft) | |
| 7 | Main electronics module | 1.5 Nm (1.1 lbf ft) | |
| 9/10 | Transmitter housing | 5.5 Nm (4.1 lbf ft) | |

**NOTICE**

**Plug of the smart sensor electronics module connected incorrectly!**
No measuring signal is output.
- ▶ Plug in the plug of the smart sensor electronics module as per the coding.



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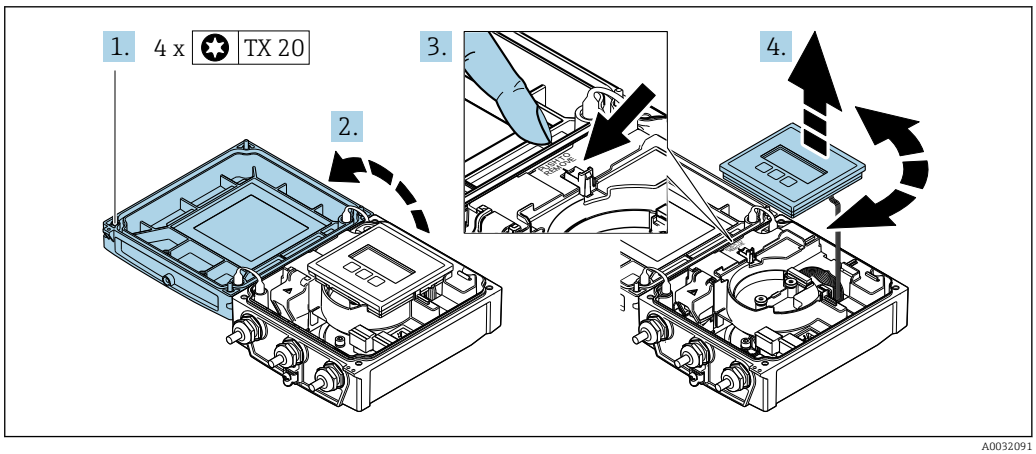
- ▶ Reverse the procedure to reassemble the measuring device.

## 6.2.6 Turning the display module

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

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1. Loosen the fixing screws of the housing cover.
2. Open the housing cover.
3. Unlock the display module.
4. Pull out the display module and turn it to the desired position in increments of 90°.

**Mounting the transmitter housing**

**⚠ WARNING**

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

1. Insert the display module and lock it when doing so.
2. Close the housing cover.
3. Tighten the fixing screws of the housing cover: tightening torque for aluminum housing 2.5 Nm (1.8 lbf ft) – plastic housing 1 Nm (0.7 lbf ft).

## 6.3 Post-installation check

| | |
|---|---|
| Is the device undamaged (visual inspection)? | ❑ |
| Does the measuring device conform to the measuring point specifications?<br>For example:<br>▪ Process temperature → 🖹 187<br>▪ Process pressure (refer to the section on "Pressure-temperature ratings" in the "Technical Information" document )→ 🖹 204<br>▪ Ambient temperature → 🖹 25<br>▪ Measuring range → 🖹 174 | ❑ |
| Has the correct orientation been selected for the sensor → 🖹 21 ?<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 → 🖹 21? | ❑ |
| 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

NOTICE

**The measuring device does not have an internal circuit breaker.**

- For this reason, assign the measuring device a switch or power-circuit breaker so that the power supply line can be easily disconnected from the mains.
- Although the measuring device is equipped with a fuse, additional overcurrent protection (maximum 16 A) should be integrated into the system installation.

## 7.1 Electrical safety

In accordance with applicable national regulations.

## 7.2 Connecting requirements

### 7.2.1 Required tools

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

### 7.2.2 Requirements for connecting cable

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

#### Permitted temperature range

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

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

Standard installation cable is sufficient.

#### Signal cable

*EtherNet/IP*

The standard ANSI/TIA/EIA-568-B.2 Annex specifies CAT 5 as the minimum category for a cable used for EtherNet/IP. CAT 5e and CAT 6 are recommended.

For more information on planning and installing EtherNet/IP networks, please refer to the "Media Planning and Installation Manual. EtherNet/IP" of ODVA Organization

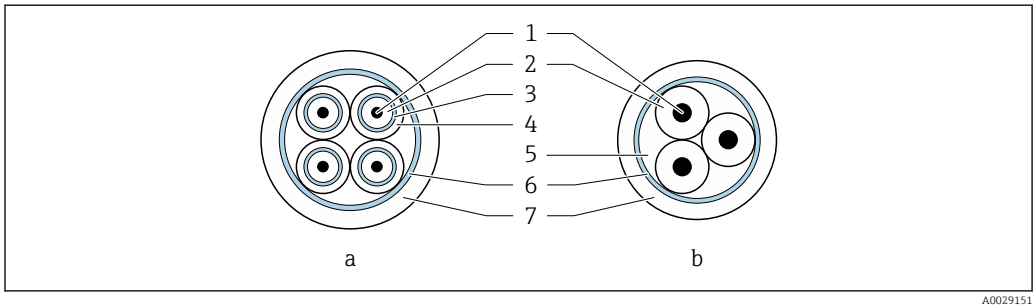
#### Connecting cable for remote version

*Electrode cable*

| | |
|---|---|
| **Standard cable** | 3 ×0.38 mm² (20 AWG) with common, braided copper shield (ϕ ~9.5 mm (0.37 in)) and individual shielded cores |
| **Cable for empty pipe detection (EPD)** | 4 ×0.38 mm² (20 AWG) with common, braided copper shield (ϕ ~9.5 mm (0.37 in)) and individual shielded cores |
| **Conductor resistance** | ≤50 Ω/km (0.015 Ω/ft) |
| **Capacitance: core/shield** | ≤420 pF/m (128 pF/ft) |
| **Operating temperature** | –20 to +80 °C (–4 to +176 °F) |

*Coil current cable*

| | |
|---|---|
| **Standard cable** | 3 ×0.75 mm² (18 AWG) with common, braided copper shield (ϕ ~9 mm (0.35 in)) |
| **Conductor resistance** | ≤37 Ω/km (0.011 Ω/ft) |
| **Capacitance: core/core, shield grounded** | ≤120 pF/m (37 pF/ft) |
| **Operating temperature** | −20 to +80 °C (−4 to +176 °F) |
| **Test voltage for cable insulation** | ≤ AC 1433 V rms 50/60 Hz or ≥ DC 2026 V |




*6 Cable cross-section*

*a Electrode cable*
*b Coil current cable*
*1 Core*
*2 Core insulation*
*3 Core shield*
*4 Core jacket*
*5 Core reinforcement*
*6 Cable shield*
*7 Outer jacket*

*Armored connecting cable*

Armored connecting cables with an additional, reinforcing metal braid should be used:
- When laying the cable directly in the ground
- Where there is a risk of damage from rodents
- Use as per IP68 degree of protection

*Operation in environments with strong electrical interference*

The measuring system meets the general safety requirements → 📄 203 and EMC specifications → 📄 187.

Grounding is by means of the ground terminal provided for the purpose inside the connection housing. The stripped and twisted lengths of cable shield to the ground terminal must be as short as possible.

### Cable diameter

- Cable glands supplied:
  - For standard cable: M20 × 1.5 with cable ϕ 6 to 12 mm (0.24 to 0.47 in)
  - For reinforced cable: M20 × 1.5 with cable ϕ 9.5 to 16 mm (0.37 to 0.63 in)
- (Plug-in) spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

## 7.2.3 Terminal assignment

### Transmitter

The transmitter can be ordered with terminals or a device plug.

| Connection methods available | | Possible options for order code "Electrical connection" |
|---|---|---|
| **Outputs** | **Power supply** | |
| EtherNet/IP (RJ45 plug) | Terminals | Option **D**: thread NPT ½" |
| Device plug → 🖹 44 | Terminals | ▪ Option **L**: plug M12x1 + thread NPT ½"<br>▪ Option **N**: plug M12x1 + coupling M20<br>▪ Option **P**: plug M12x1 + thread G ½"<br>▪ Option **U**: plug M12x1 + thread M20 |

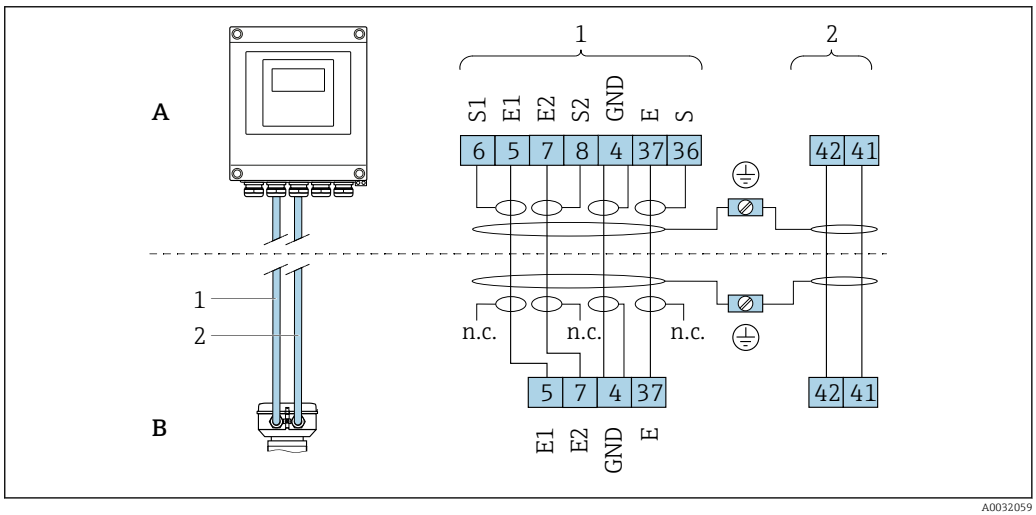
*Supply voltage*

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

*EtherNet/IP signal transmission*

| Order code for "Output" | Connection via |
|---|---|
| Option **N** | EtherNet/IP: RJ45 or M12 plug |

### Remote version




7 *Remote version terminal assignment*

*A Transmitter wall-mount housing*
*B Sensor connection housing*
*1 Electrode cable*
*2 Coil current cable*
*n.c. Not connected, insulated cable shields*

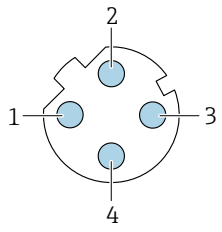
*Terminal No. and cable colors: 6/5 = brown; 7/8 = white; 4 = green; 36/37 = yellow*

### 7.2.4 Pin assignment, device plug

Order codes for the M12x1 plugs, see the "Order code for electrical connection" column: EtherNet/IP → 43

**EtherNet/IP**

*Device plug for signal transmission (device side)*




| Pin | Assignment | | Coding | Plug/socket |
|---|---|---|---|---|
| 1 | + | Tx | D | Socket |
| 2 | + | Rx | | |
| 3 | - | Tx | | |
| 4 | - | Rx | | |

### 7.2.5 Preparing the measuring device

Carry out the steps in the following order:

1. Mount the sensor and transmitter.
2. Connection housing, sensor: Connect connecting cable.
3. Transmitter: Connect connecting cable.
4. Transmitter: Connect signal cable and cable for supply voltage.

**NOTICE**

**Insufficient sealing of the housing!**

Operational reliability of the measuring device could be compromised.

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

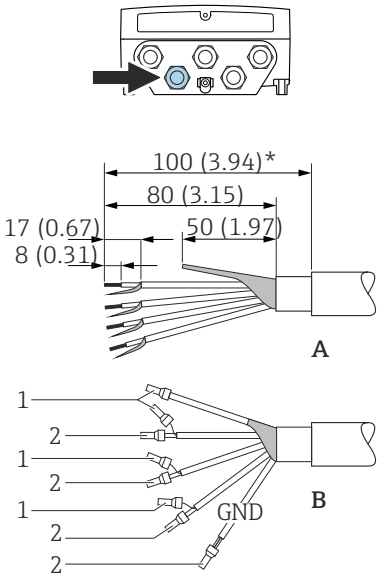
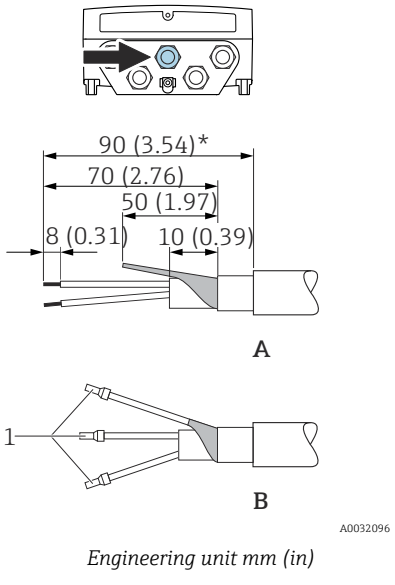
1. Remove dummy plug if present.
2. If the measuring device is supplied without cable glands:
   Provide suitable cable gland for corresponding connecting cable.
3. If the measuring device is supplied with cable glands:
   Observe requirements for connecting cables → 41.

### 7.2.6 Preparing the connecting cable for the remote version

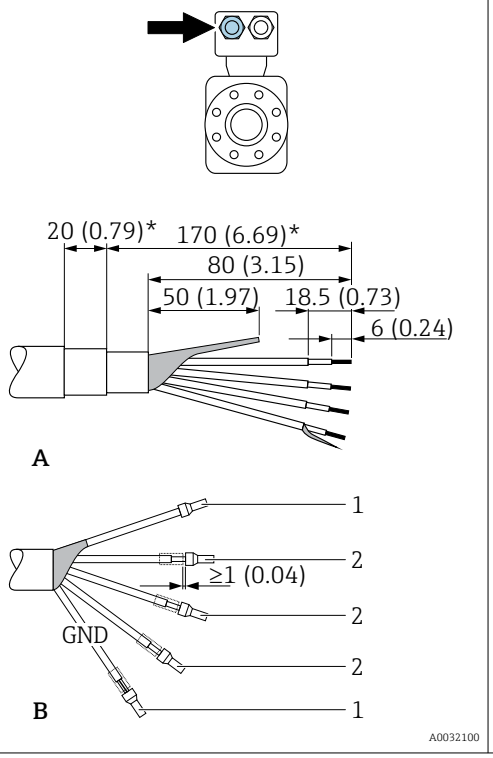
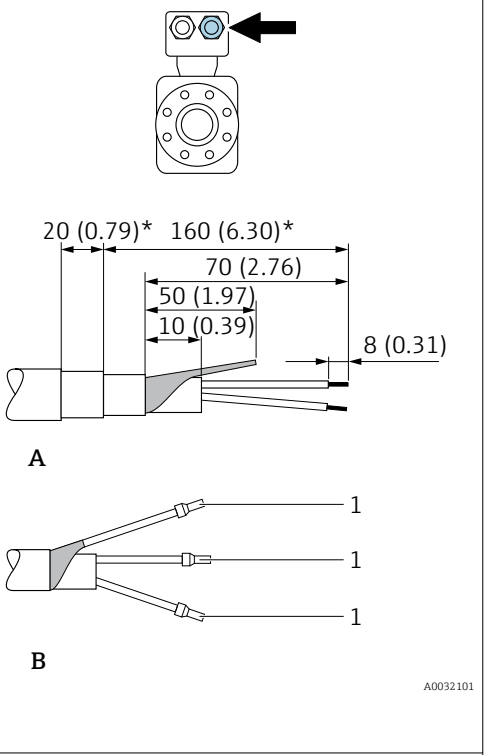
When terminating the connecting cable, pay attention to the following points:

1. In the case of the electrode cable:
   Make sure that the ferrules do not touch the core shields on the sensor side.
   Minimum distance = 1 mm (exception: green “GND” cable)
2. In the case of the coil current cable:
   Insulate one core of the three-core cable at the level of the core reinforcement. You only require two cores for the connection.
3. For cables with fine-wire cores (stranded cables):
   Fit the cores with ferrules.

*Transmitter*

| Electrode cable | Coil current cable |
|---|---|
|  *8 Engineering unit mm (in)* |  *9 Engineering unit mm (in)* |
| A = Termination of the cables<br>B = Termination of the fine-wire cores with ferrules<br>1 = Red ferrules, ϕ 1.0 mm (0.04 in)<br>2 = White ferrules, ϕ 0.5 mm (0.02 in)<br>* = Stripping only for reinforced cables | |

*Sensor*

| Electrode cable | Coil current cable |
|---|---|
|  |  |

A = Termination of the cables
B = Termination of the fine-wire cores with ferrules
1 = Red ferrules, ϕ 1.0 mm (0.04 in)
2 = White ferrules, ϕ 0.5 mm (0.02 in)
* = Stripping only for reinforced cables

## 7.3 Connecting the measuring device

**⚠ WARNING**

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

- ▶ Have electrical connection work carried out by correspondingly trained specialists only.
- ▶ Observe applicable federal/national installation codes and regulations.
- ▶ Comply with local workplace safety regulations.
- ▶ Observe grounding concept of the plant.
- ▶ Never mount or wire the measuring device while it is connected to the supply voltage.
- ▶ Before the supply voltage is applied, connect the protective ground to the measuring device.

### 7.3.1 Connecting the remote version

**⚠ WARNING**

**Risk of damaging the electronic components!**

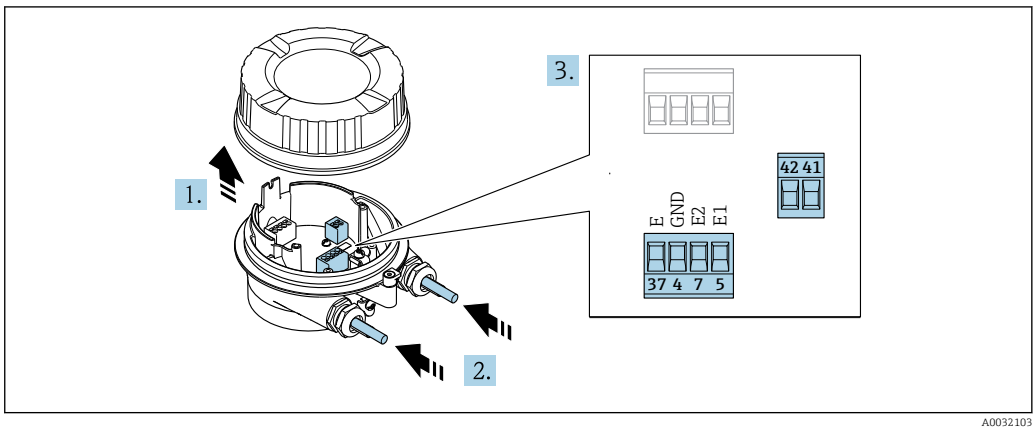
- ▶ Connect the sensor and transmitter to the same potential equalization.
- ▶ Only connect the sensor to a transmitter with the same serial number.
- ▶ Ground the connection housing of the sensor via the external screw terminal.

The following procedure (in the action sequence given) is recommended for the remote version:

1. Mount the sensor and transmitter.
2. Connect the connecting cable for the remote version.

3. Connect the transmitter.

### Connecting the connecting cable to the sensor connection housing




10 *Sensor: connection module*

1. Loosen the securing clamp of the housing cover.
2. Unscrew and lift off the housing cover.
3. NOTICE

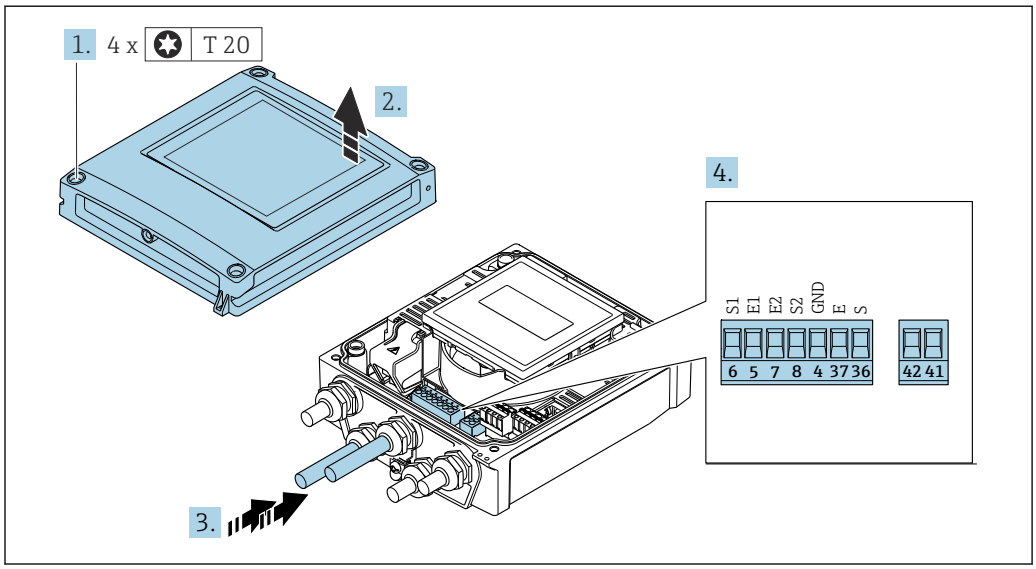
   **For conduit extensions:**
   - ▶ Fit O-ring on cable and push it back sufficiently. When inserting the cable, the O-ring must be located outside the conduit extension.

   Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules → 44.
5. Connect the cable in accordance with the terminal assignment → 43.
6. Firmly tighten the cable glands.
7. ⚠ WARNING

   **Housing degree of protection may be voided due to insufficient sealing of the housing.**
   - ▶ Screw in the screw without using any lubricant. The threads on the cover are coated with a dry lubricant.

   Reverse the procedure to reassemble the sensor.

### Connecting the connecting cable to the transmitter




11 *Transmitter: main electronics module with terminals*

1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing cover.
3. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules → 44.
5. Connect the cable in accordance with the terminal assignment → 43.
6. Firmly tighten the cable glands.
7. **WARNING**

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

   Reverse the removal procedure to reassemble the transmitter.

### 7.3.2 Connecting the transmitter

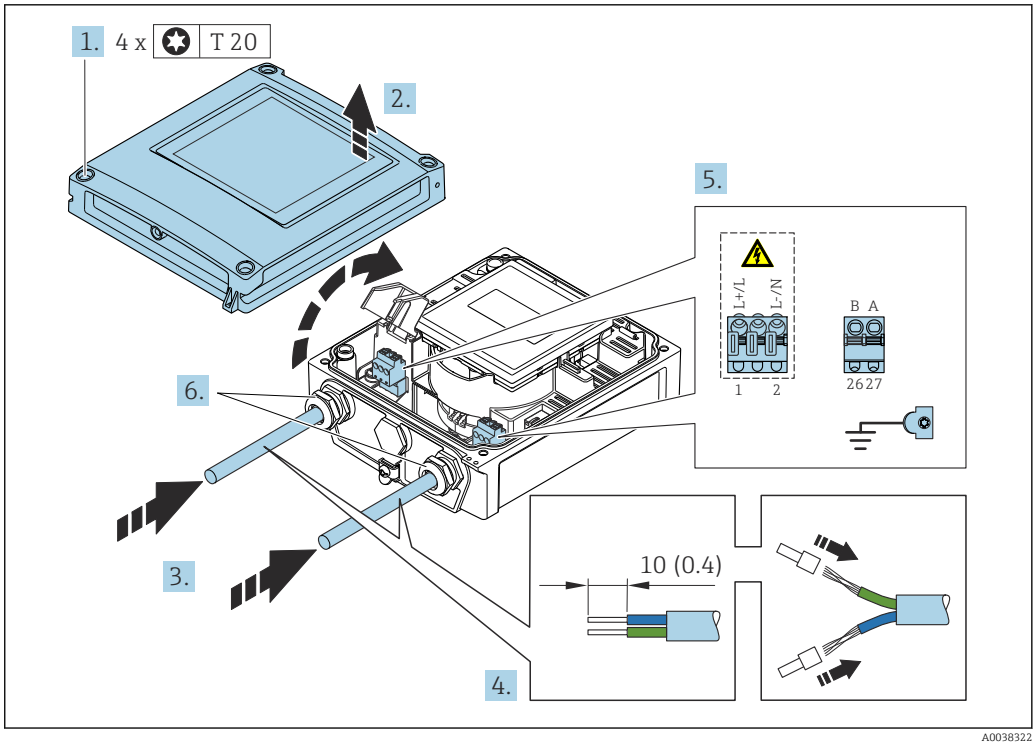
**WARNING**

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

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

*Tightening torques for plastic housing*

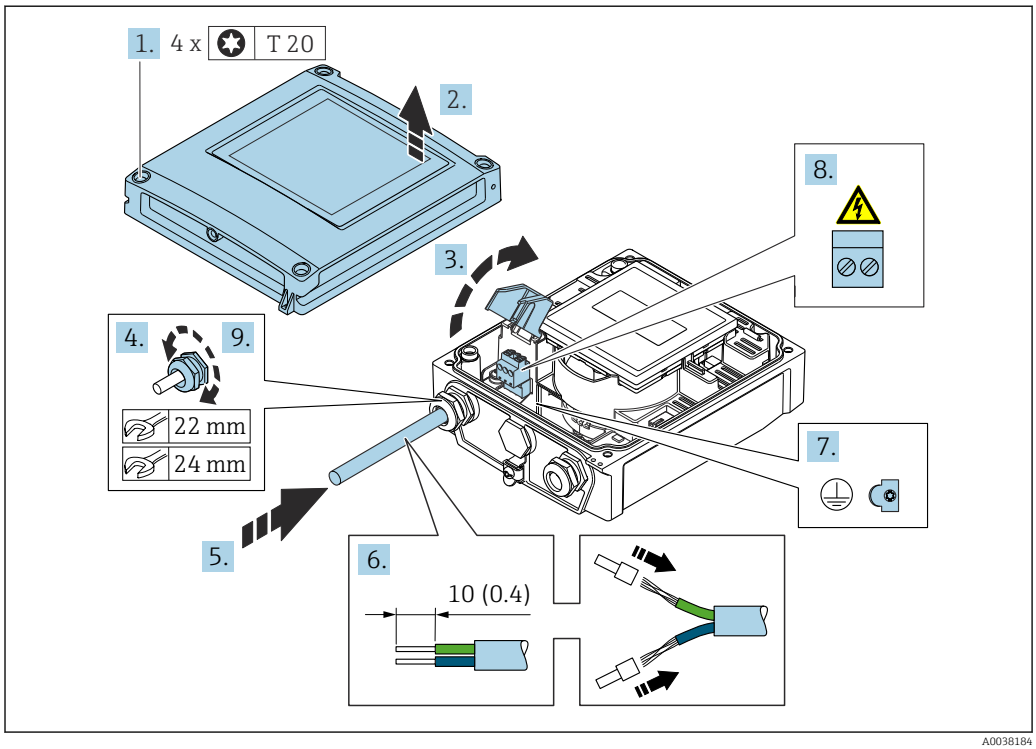
| | |
|---|---|
| **Housing cover fixing screw** | 1 Nm (0.7 lbf ft) |
| **Cable entry** | 5 Nm (3.7 lbf ft) |
| **Ground terminal** | 2.5 Nm (1.8 lbf ft) |




12 *Connecting the supply voltage and EtherNet/IP*

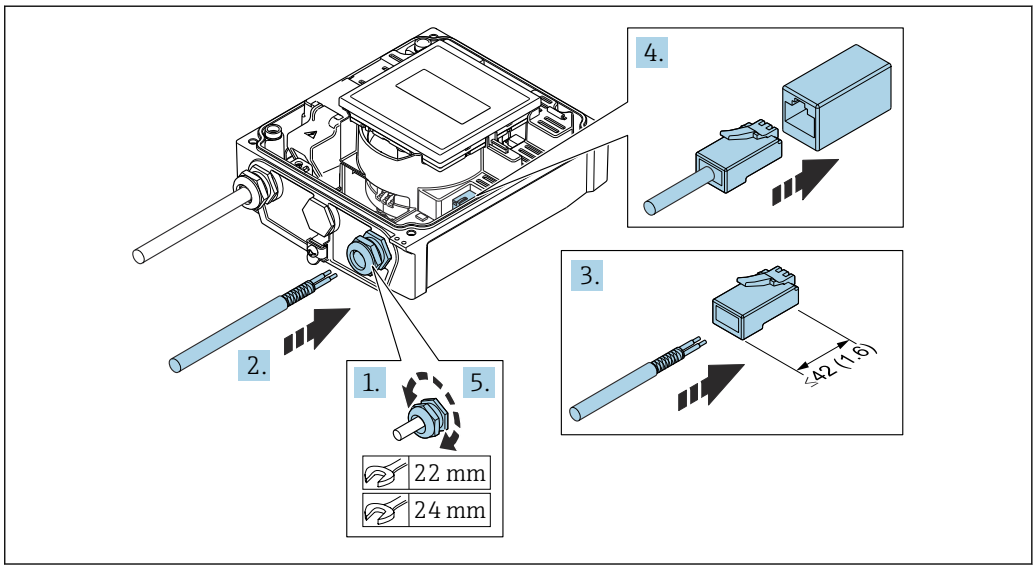
1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing cover.
3. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
5. Connect the cables according to the terminal assignment → 43 . For supply voltage: open the shock protection cover.
6. Firmly tighten the cable glands.

### Connecting the supply voltage




1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing cover.
3. Open the shock protection cover.
4. Release the cable gland.
5. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
6. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
7. Connect the protective ground.
8. Connect the cable in accordance with the terminal assignment → 📄 43.
9. Firmly tighten the cable gland.

### Mounting the RJ45 connector




A0038185

1. Release the cable gland.
2. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
3. Strip the cable and cable ends and connect to the RJ45 connector.
4. Plug in the RJ45 connector.
5. Firmly tighten the cable gland.

### Reassembling the transmitter

1. Close the shock protection cover.
2. Close the housing cover.
3. **⚠ WARNING**

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

   ▶ Screw in the screw without using any lubricant.

   Tighten the 4 fixing screws on the housing cover.

### 7.3.3 Ensuring potential equalization

#### 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.
- Any necessary potential equalization connections must be established by ground cables with a minimum cross-section of 6 $mm^2$ (0.0093 $in^2$).
- For remote device versions, the ground terminal in the example always refers to the sensor and not to the transmitter.

You can order accessories like ground cables and ground disks from Endress+Hauser → 171

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

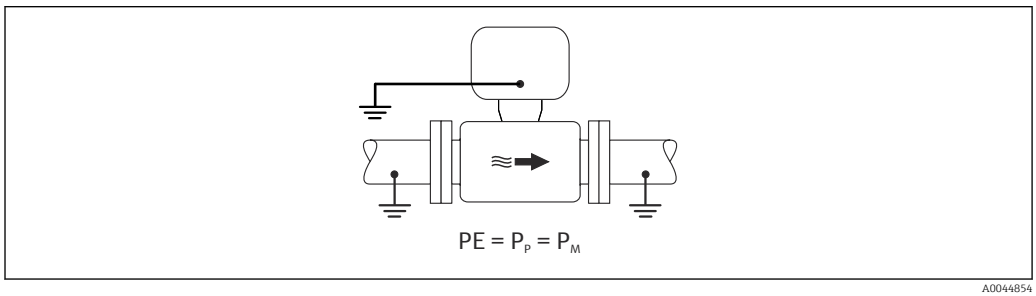
#### Abbreviations used
- PE (Protective Earth): potential at the protective earth terminals of the device
- $P_P$ (Potential Pipe): potential of the pipe, measured at the flanges
- $P_M$ (Potential Medium): potential of the medium

#### 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



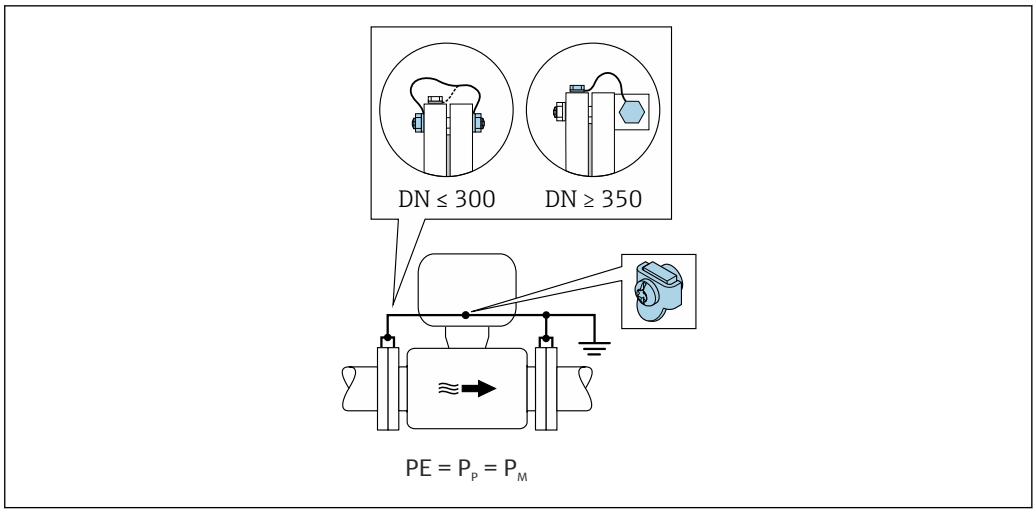

A0044854

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

*Unlined metal pipe*

- 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

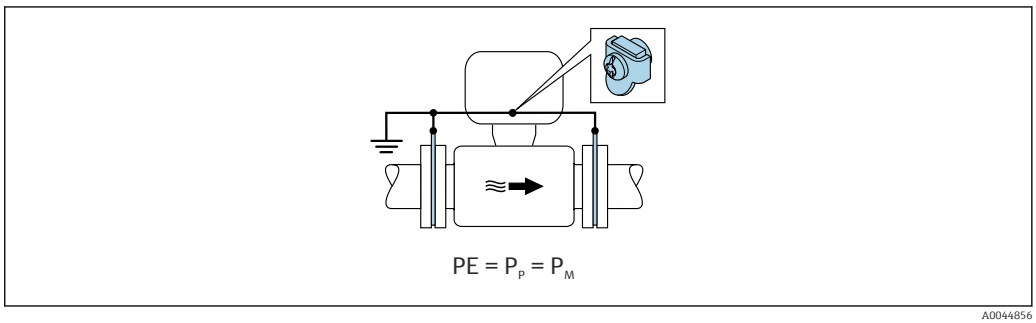
1. Connect both sensor flanges to the pipe flange via a ground cable and ground them.
2. Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for this purpose.

- For DN ≤ 300 (12"): Mount the ground cable directly on the conductive flange coating of the sensor with the flange screws.
- For DN ≥ 350 (14"): Mount the ground cable directly on the metal transport bracket. Observe 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 connection housing of the transmitter or sensor via the ground cable.
2. Connect the connection to ground potential.

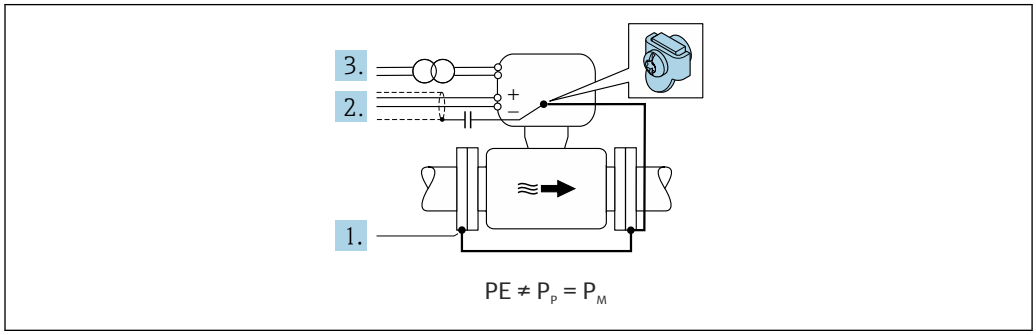
**Connection example with the potential of the medium not equal to the protective ground**

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




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).

**Connection examples with the potential of medium not equal to protective earth with the "Measurement isolated from ground" option**

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

**Introduction**

The "Measurement isolated from ground" 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 "Measurement isolated from ground" option is optionally available: order code for "Sensor option", option CV

*Operating conditions for the use of the "Measurement isolated from ground" 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 |

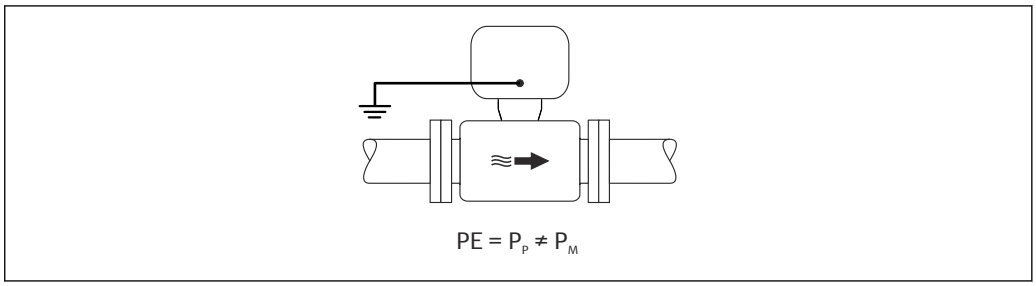
To achieve the specified conductivity measuring accuracy, a conductivity calibration is recommended when the device is installed.

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 "Measurement isolated from ground" option.

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



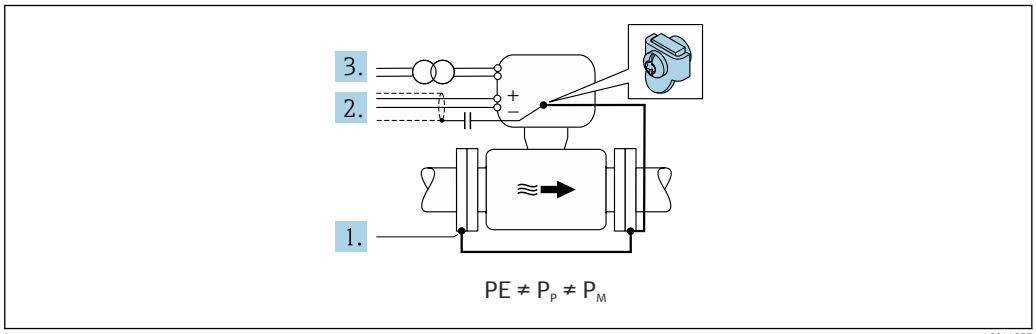

A0044855

1. Use the "Measurement isolated from ground" option, while observing the operating conditions for measurement isolated from ground.
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 "Measurement isolated from ground" 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.



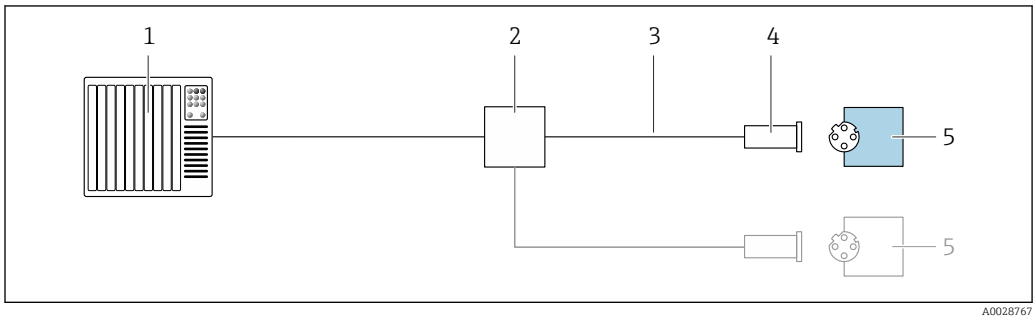

A0044857

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 "Measurement isolated from ground" option, while observing the operating conditions for measurement isolated from ground.

## 7.4 Special connection instructions

### 7.4.1 Connection examples

#### EtherNet/IP




13 *Connection example for EtherNet/IP*

1 *Control system (e.g. PLC)*
2 *Ethernet switch*
3 *Observe cable specifications*
4 *Device plug*
5 *Transmitter*

## 7.5 Hardware settings

### 7.5.1 Setting the device address

#### EtherNet/IP

The IP address of the measuring device can be configured for the network via DIP switches.

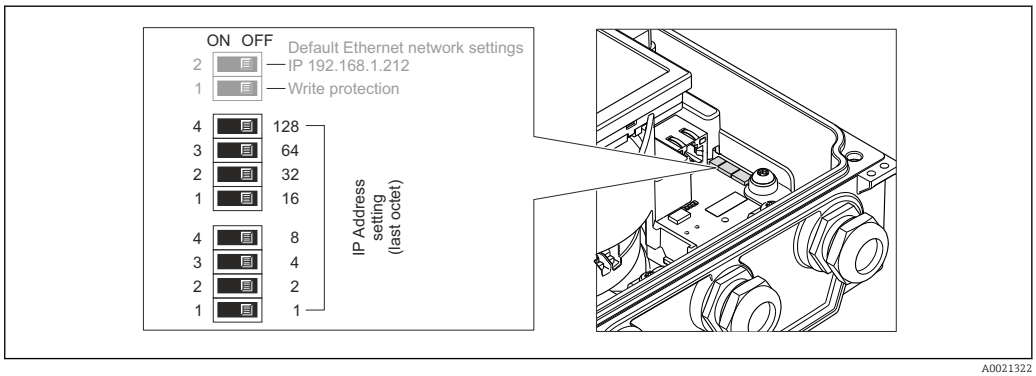
*Addressing data*

| IP address and configuration options | | | |
|---|---|---|---|
| 1st octet | 2nd octet | 3rd octet | 4th octet |
| **192.** | **168.** | **1.** | **XXX** |
| | ↓ | | ↓ |
| | Can only be configured via software addressing | | Can be configured via software addressing and hardware addressing |

| | |
|---|---|
| **IP address range** | 1 to 254 (4th octet) |
| **IP address broadcast** | 255 |
| **Addressing mode ex works** | Software addressing; all DIP switches for hardware addressing are set to OFF. |
| **IP address ex works** | DHCP server active |

For device addressing via software

*Setting the address*




1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing cover.
3. Set the desired IP address using the corresponding DIP switches on the I/O electronics module.
   ↳ Hardware addressing with the configured IP address is enabled after 10 s.
4. Reverse the removal procedure to reassemble the transmitter.

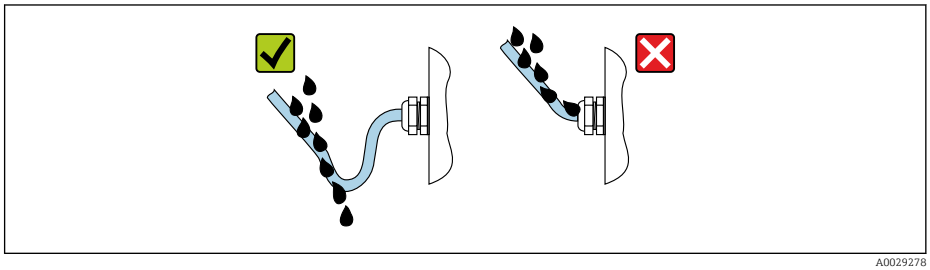
## 7.6 Ensuring the degree of protection

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

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

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

1. Check that the housing seals are clean and fitted correctly. Dry, clean or replace the seals if necessary.
2. Tighten all housing screws and screw covers.
3. Firmly tighten the cable glands.
4. To ensure that moisture does not enter the cable entry, route the cable so that it loops down before the cable entry ("water trap").
   ↳




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

**NOTICE**

**Standard dummy plugs used for transportation do not have the appropriate degree of protection and can result in damage to the device!**

- Use suitable dummy plugs corresponding to the degree of protection.

### 7.6.2 Degree of protection IP68, Type 6P enclosure, with "Cust-potted" option

Depending on the version, the sensor meets all the requirements of IP68 degree of protection, Type 6P enclosure → 🖹 185 and can be used as a remote version → 🖹 27.

The degree of protection of the transmitter is always only IP66/67, Type 4X enclosure and the transmitter must therefore be treated accordingly → 🖹 57.

To guarantee IP68 degree of protection, Type 6P enclosure for the "Cust-potted" options, carry out the following steps after the electrical connection:

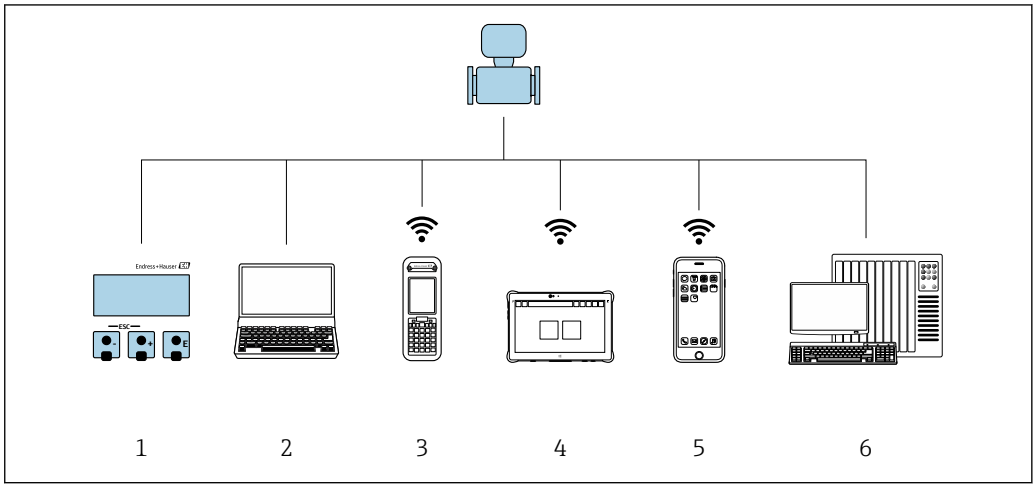
1. Firmly tighten the cable glands (torque: 2 to 3.5 Nm) until there is no gap between the bottom of the cover and the housing support surface.
2. Firmly tighten the union nut of the cable glands.
3. Pot the field housing with a potting compound.
4. Check that the housing seals are clean and fitted correctly. Dry, clean or replace the seals if necessary.
5. Tighten all housing screws and screw covers (torque: 20 to 30 Nm).

## 7.7 Post-connection check

| | |
|---|---|
| Are cables or the device undamaged (visual inspection)? | ❑ |
| Do the cables used meet the requirements → 🖹 41? | ❑ |
| Do the cables have adequate strain relief? | ❑ |
| Are all the cable glands installed, firmly tightened and leak-tight? Cable run with "water trap" → 🖹 57? | ❑ |
| Only for remote version: is the sensor connected to the right transmitter?<br>Check the serial number on the nameplate of the sensor and transmitter. | ❑ |
| Does the supply voltage match the specifications on the transmitter nameplate → 🖹 181? | ❑ |
| Is the terminal assignment correct → 🖹 43? | ❑ |
| If supply voltage is present, do values appear on the display module? | ❑ |
| Is the potential equalization established correctly ? | ❑ |
| Are all housing covers installed and the screws tightened with the correct tightening torque? | ❑ |

# 8 Operation methods

## 8.1 Overview of operation methods



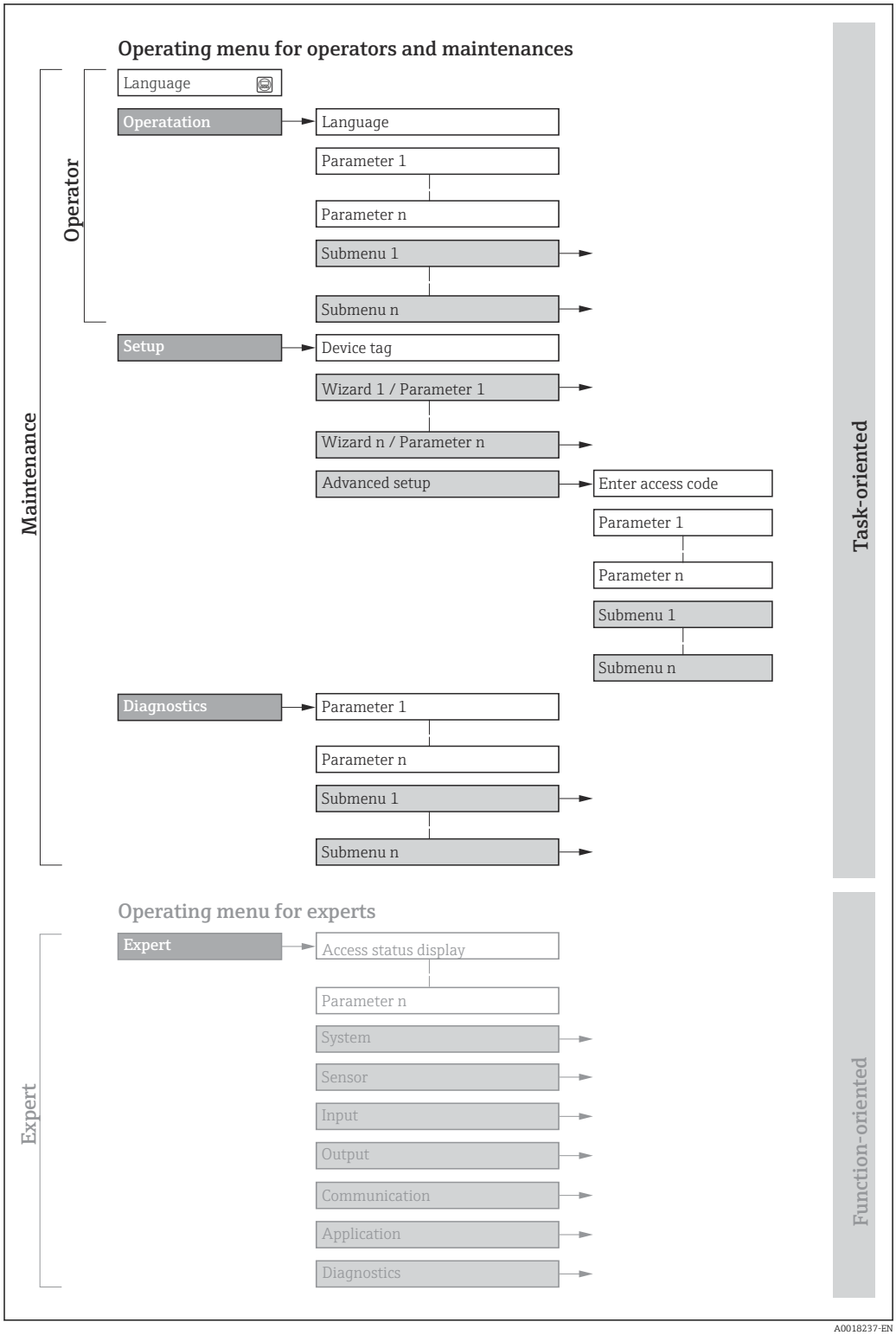

1 *Local operation via display module*
2 *Computer with Web browser (e.g. Internet Explorer) or with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM)*
3 *Field Xpert SFX350 or SFX370*
4 *Field Xpert SMT70*
5 *Mobile handheld terminal*
6 *Control system (e.g. PLC)*

For custody transfer, once the device has been put into circulation or sealed, its operation is restricted.

## 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




14 *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.

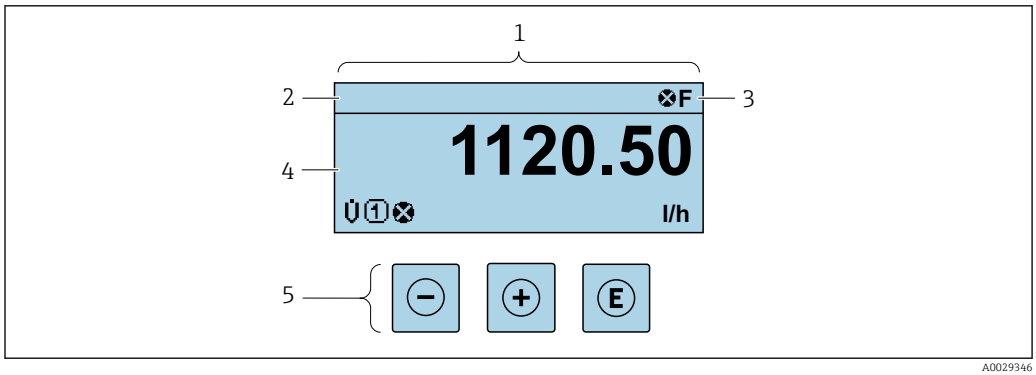
For custody transfer, once the device has been put into circulation or sealed, its operation is restricted.

| 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 | Wizards for fast commissioning:<br>▪ Setting the system units<br>▪ Setting the input<br>▪ Configuring the outputs<br>▪ Configuration of the operational display<br>▪ Defining the output conditioning<br>▪ Setting the low flow cut off<br>▪ Configuring 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>▪ Configuring the WLAN settings<br>▪ Administration (define access code, reset measuring device) |
| Diagnostics | | **"Maintenance" role**<br>Fault elimination:<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 "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. |

| Menu/parameter | | User role and tasks | Content/meaning |
|---|---|---|---|
| Expert | function-oriented | Tasks that require detailed knowledge of the function of the device:<br>▪ Commissioning measurements under difficult conditions<br>▪ Optimal adaptation of the measurement to difficult conditions<br>▪ Detailed configuration of the communication interface<br>▪ Error diagnostics in difficult cases | Contains all the parameters of the device and makes it possible to access these parameters directly using an access code. The structure of this menu is based on the function blocks of the device:<br>▪ System<br>Contains all higher-order device parameters which do not concern the measurement or the communication interface.<br>▪ Sensor<br>Configuration of the measurement.<br>▪ Input<br>Configuring 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



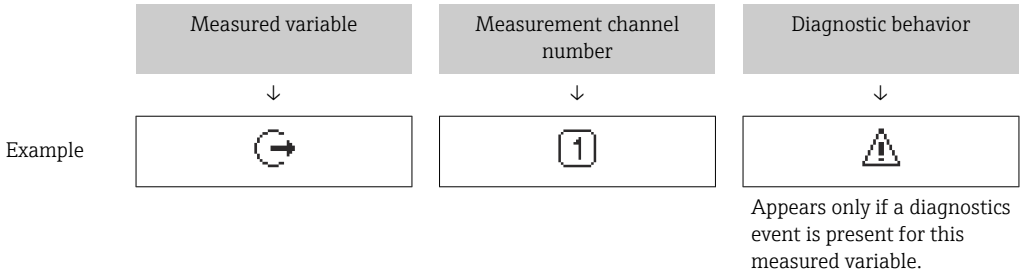

1 *Operational display*
2 *Device tag → 115*
3 *Status area*
4 *Display area for measured values (4-line)*
5 *Operating elements → 67*

#### Status area

The following symbols appear in the status area of the operational display at the top right:
- Status signals→ 146
  - **F**: Failure
  - **C**: Function check
  - **S**: Out of specification
  - **M**: Maintenance required
- Diagnostic behavior→ 147
  - : 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 |
|---|---|
| | Volume flow |
| | 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*

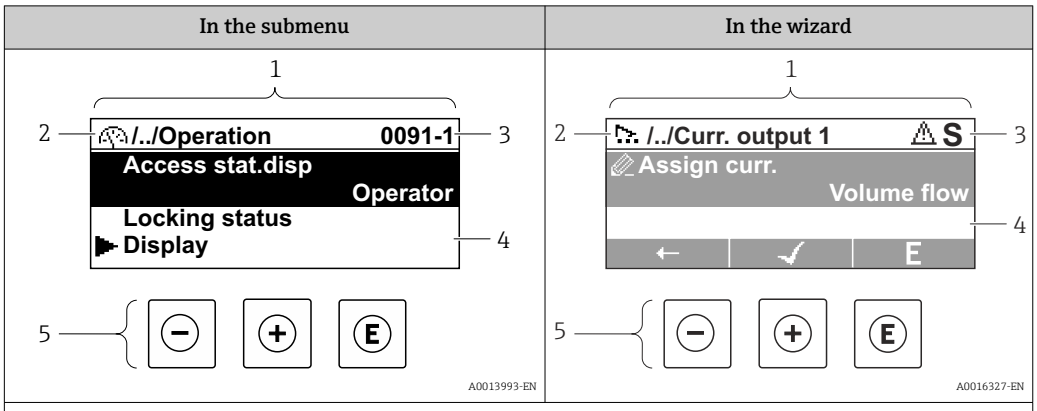
| Symbol | Meaning |
|---|---|
| 1 ... 4 | Measurement channel 1 to 4 |
| The measurement channel number is displayed only if more than one channel is present for the same measured variable type (e.g. Totalizer 1 to 3). | |

*Diagnostic behavior*

| |
|---|
| The diagnostic behavior pertains to a diagnostic event that is relevant to the displayed measured variable.<br>For information on the symbols → 147 |

The number and display format of the measured values can be configured via the **Format display** parameter (→ 119).

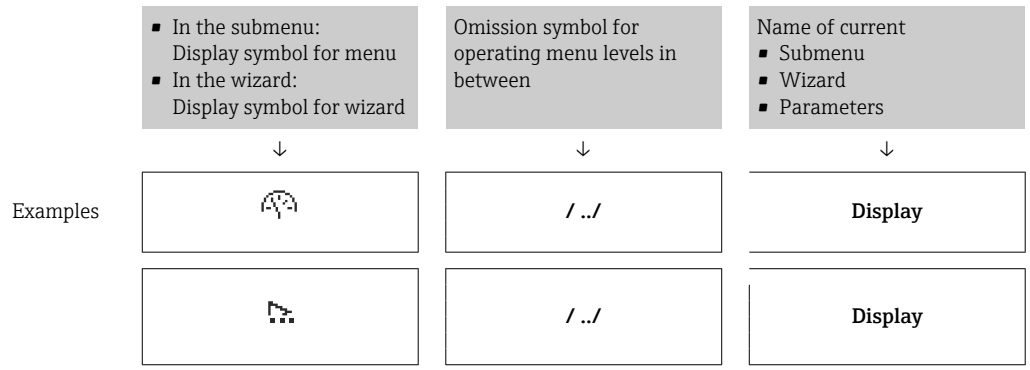
## 8.3.2 Navigation view




1 *Navigation view*
2 *Navigation path to current position*
3 *Status area*
4 *Display area for navigation*
5 *Operating elements → 67*

### 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 → 65

### 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 → 146
- For information on the function and entry of the direct access code → 70

### 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. |

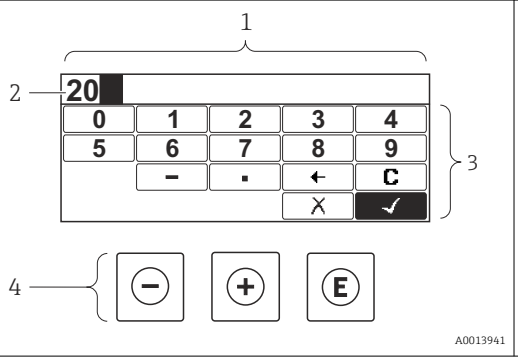
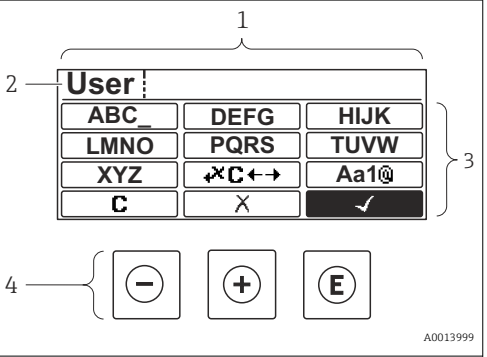
*Locking*

| 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. |
|  | Opens the editing view of the parameter. |

### 8.3.3 Editing view

| Numeric editor | Text editor |
|---|---|
|  |  |



*1 Editing view*
*2 Display area of the entered values*
*3 Input mask*
*4 Operating elements → 67*

#### Input mask

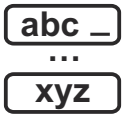
The following input symbols are available in the input mask of the numeric and text editor:

*Numeric editor*

| Symbol | Meaning |
|---|---|
| 0 … 9 | Selection of numbers from 0 to 9. |
| . | Inserts decimal separator at the input position. |
| – | Inserts minus sign at the input position. |
| ✓ | Confirms selection. |
| ← | Moves the input position one position to the left. |
| ✗ | Exits the input without applying the changes. |
| C | Clears all entered characters. |

*Text editor*

| Symbol | Meaning |
|---|---|
| Aa1@ | Toggle<br>▪ Between upper-case and lower-case letters<br>▪ For entering numbers<br>▪ For entering special characters |
| ABC_ … XYZ | Selection of letters from A to Z. |

| | |
|---|---|
|  | Selection of letters from a to z. |
|  | Selection of special characters. |
|  | Confirms selection. |
|  | Switches to the selection of the correction tools. |
|  | Exits the input without applying the changes. |
|  | Clears all entered characters. |

*Correction symbols under*

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

## 8.3.4 Operating elements

| Key | Meaning |
|---|---|
|  | **Minus key**<br>*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>In the input mask, moves the selection bar to the left (backwards). |
|  | **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>In the input mask, moves the selection bar to the right (forwards). |

| Key | Meaning |
|---|---|
| E | **Enter key**<br>*For operational display*<br>Pressing the key for 2 s opens the context menu including the selection for activating the keypad lock.<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:<br>  ▪ Opens the selected group.<br>  ▪ Carries out the selected action.<br>▪ Pressing the key for 2 s confirms the edited parameter value. |
| − + + | **Escape key combination (press keys simultaneously)**<br>*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 text or numeric editor without applying changes. |
| − + + E | **Minus/Plus/Enter key combination (press and hold down the keys simultaneously)**<br>*For operational display*<br>Enables or disables the keypad lock (only SD02 display module). |

## 8.3.5 Opening the context menu

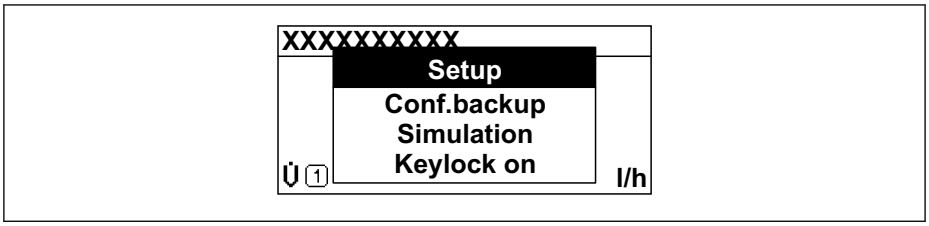
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Simulation

### Calling up and closing the context menu

The user is in the operational display.

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

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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.

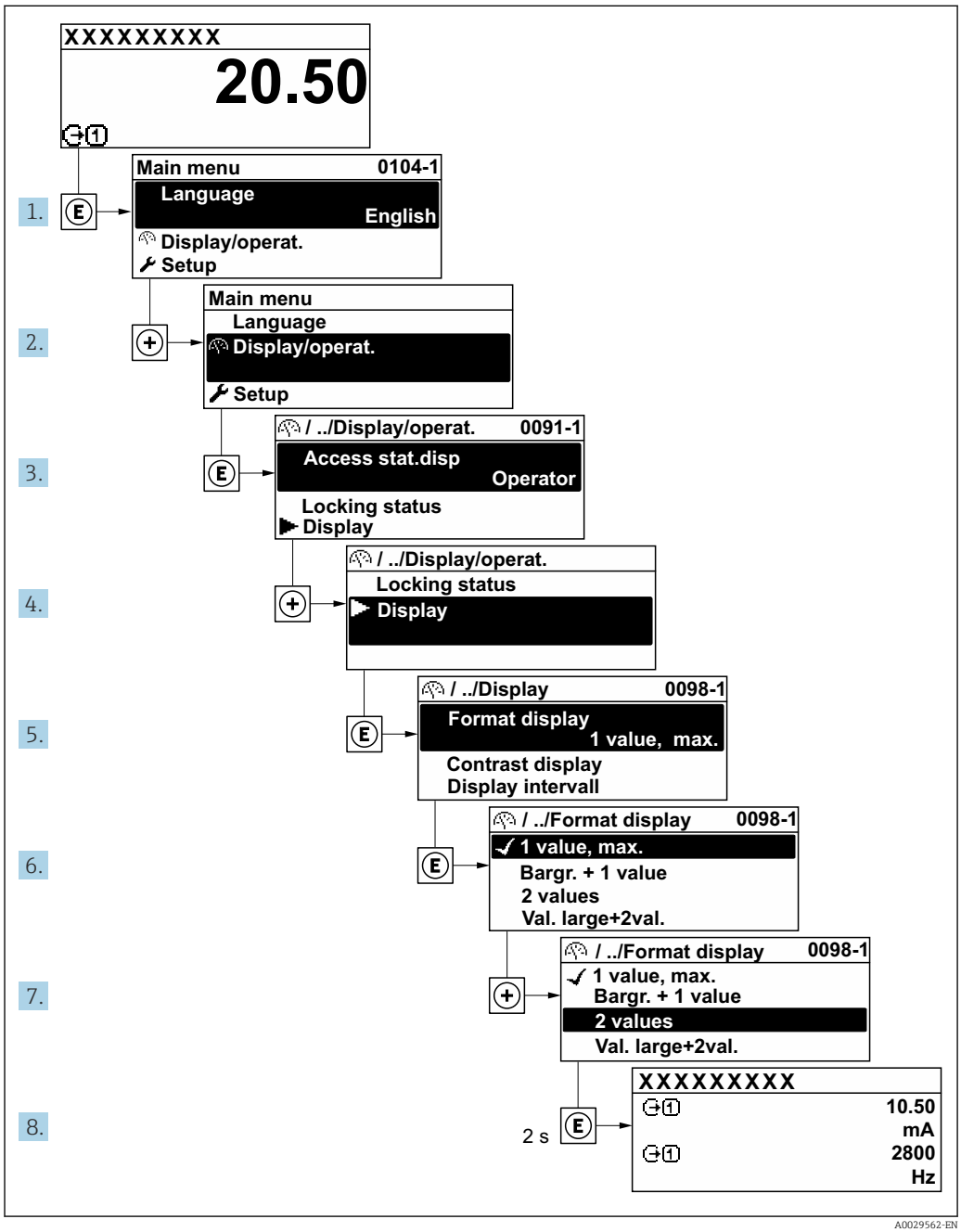
2. Press ⊞ to navigate to the desired menu.
3. Press Ⓔ to confirm the selection.
   ↳ The selected menu opens.

### 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
→ 64

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

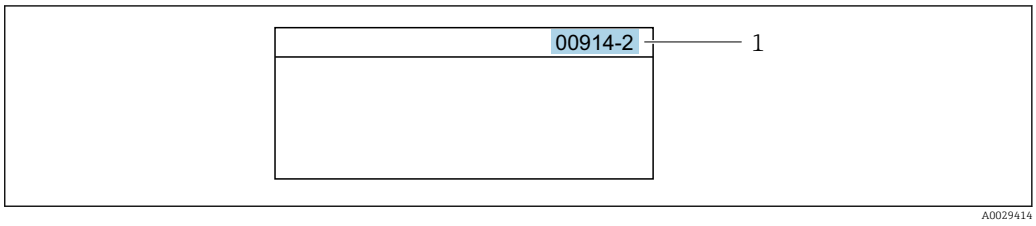



### 8.3.7 Calling the parameter directly

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

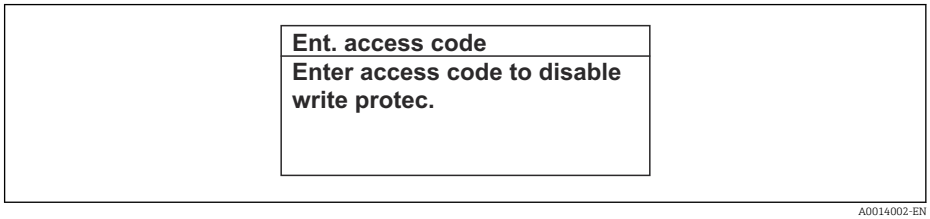
## 8.3.8 Calling up help text

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.



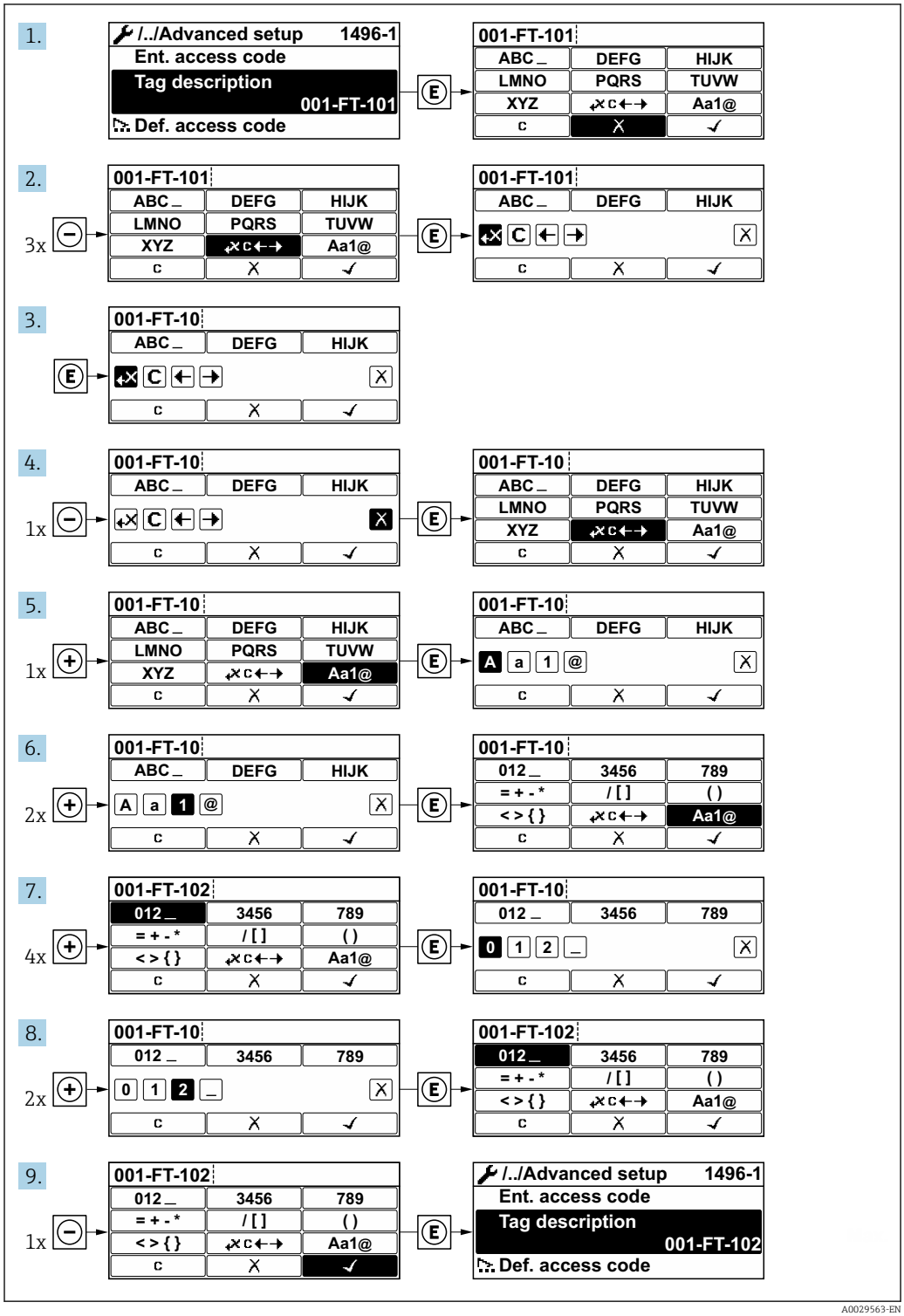

*15 Example: Help text for parameter "Enter access code"*

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

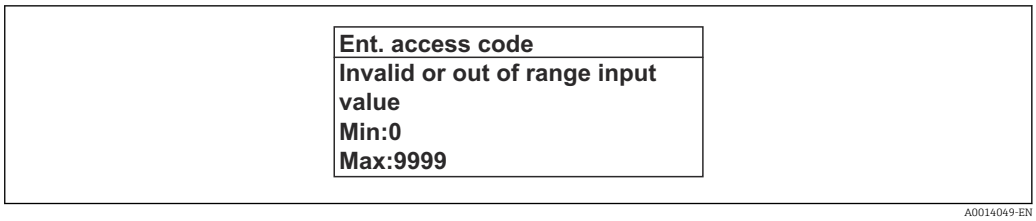
### 8.3.9 Changing the parameters

For a description of the editing view - consisting of the text editor and numeric editor - with symbols → 66, for a description of the operating elements → 67

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




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

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## 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 → 133.

### Defining access authorization for user roles

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

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

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

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

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

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

| Access code status | Read access | Write access |
|---|---|---|
| After an access code has been defined. | ✔ | -- 1) |

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

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

## 8.3.11 Disabling write protection via access code

If the 🔒-symbol appears on the local display in front of a parameter, the parameter is write-protected by a user-specific access code and its value cannot be changed at the moment using local operation → 133.

Parameter write protection via local operation can be disabled by entering the user-specific access code in the **Enter access code** parameter (→ 123) 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 a service interface (CDI-RJ45) . 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, allowing users to monitor the status of the device. Furthermore the device data can be managed and the network parameters can be configured.

For additional information on the Web server, refer to the Special Documentation for the device → 📄 205

### 8.4.2 Prerequisites

*Computer hardware*

| Hardware | Interface | |
|---|---|---|
| | CDI-RJ45 | WLAN |
| Interface | The computer must have an RJ45 interface. | The operating unit must have a WLAN interface. |
| Connection | Standard 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 | |

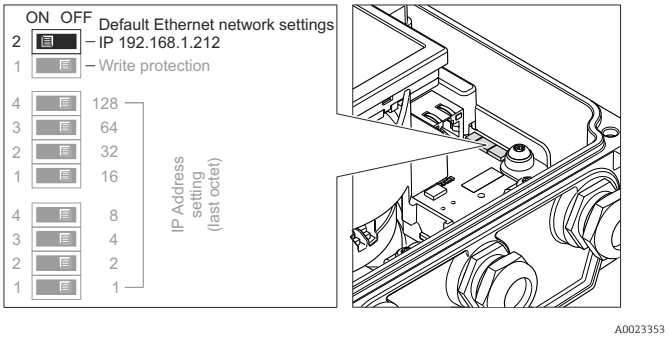
*Computer settings*

| 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 a Proxy Server for Your LAN* must be **deselected** . | |
| JavaScript | JavaScript must be enabled.<br>If JavaScript cannot be enabled: enter http://192.168.1.212/basic.html in the address line of the Web browser. A fully functional but simplified version of the operating menu structure starts in the Web browser.<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: → 144

*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 → 80 |
| IP address | If the IP address of the device is not known:<br>▪ The IP address can be read out via local operation: Diagnostics → Device information → IP address<br>▪ Communication with the Web server can be established via the default IP address 192.168.1.212. The DHCP function is enabled in the device at the factory, i.e. the device expects an IP address to be assigned by the network. This function can be disabled and the device can be set to the default IP address 192.168.1.212: set DIP switch No. 2 from **OFF** → **ON**. |

| Device | CDI-RJ45 service interface |
|---|---|
| |  <br>A0023353<br>▪ Once the DIP switch has been activated, the device must be restarted before the device uses the default IP address.<br>▪ If the default IP address is used (top DIP switch No. 2 = ON), there is no connection to the EtherNet/IP network. |

*Measuring device: via WLAN interface*

| Device | WLAN interface |
|---|---|
| Measuring device | The measuring device has a WLAN antenna:<br>Transmitter with integrated WLAN antenna |
| Web server | Web server and WLAN must be enabled; factory setting: ON<br>For information on enabling the Web server → 80 |
| IP address | If the IP address of the device is not known:<br>▪ The IP address can be read out via local operation:<br>Diagnostics → Device information → IP address<br>▪ Communication with the Web server can be established via the default IP address 192.168.1.212.<br>The DHCP function is enabled in the device at the factory, i.e. the device expects an IP address to be assigned by the network. This function can be disabled and the device can be set to the default IP address 192.168.1.212: set DIP switch No. 2 from **OFF** → **ON**.<br>▪ Once the DIP switch has been activated, the device must be restarted before the device uses the default IP address.<br>▪ If the default IP address is used (top DIP switch No. 2 = ON), there is no connection to the EtherNet/IP network. |

## 8.4.3 Establishing a connection

### Via service interface (CDI-RJ45)

*Preparing the measuring device*

*Configuring the Internet protocol of the computer*

The IP address can be assigned to the measuring device in a variety of ways:
- Dynamic Host Configuration Protocol (DHCP), factory setting:
  The IP address is automatically assigned to the measuring device by the automation system (DHCP server).
- Hardware addressing:
  The IP address is set via DIP switches .
- Software addressing:
  The IP address is entered via the **IP address** parameter (→ 118) .
- DIP switch for "Default IP address":
  To establish the network connection via the service interface (CDI-RJ45): the fixed IP address 192.168.1.212 is used .

The measuring device works with the Dynamic Host Configuration Protocol (DHCP), on leaving the factory, i.e. the IP address of the measuring device is automatically assigned by the automation system (DHCP server).

To establish a network connection via the service interface (CDI-RJ45): set the "Default IP address" DIP switch to **ON**. The measuring device then has the fixed IP address: 192.168.1.212. This address can now be used to establish the network connection.

1. Via DIP switch 2, activate the default IP address 192.168.1.212: .
2. Switch on the measuring device.
3. Connect to the computer using a cable .
4. 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.
5. Close any open Internet browsers.
6. 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__A802000).
2. If necessary, select the WPA2 encryption method.

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

The serial number can be found on the nameplate.

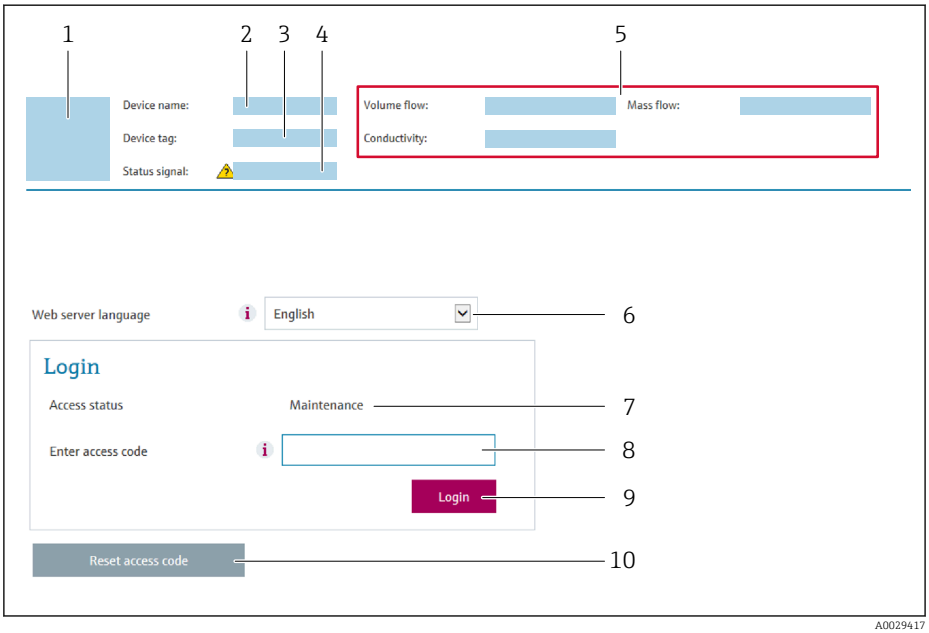
To ensure the safe and swift assignment of the WLAN network to the measuring point, it is advisable to change the SSID name. It should be possible to clearly assign the SSID name to the measuring point (e.g. tag name) as it is displayed as the WLAN network.

*Disconnecting*

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

### Starting the Web browser

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




1 *Picture of device*
2 *Device name*
3 *Device tag*
4 *Status signal*
5 *Current measured values*
6 *Operating language*
7 *User role*
8 *Access code*
9 *Login*
10 *Reset access code (→ 132)*

If a login page does not appear, or if the page is incomplete → 144

## 8.4.4 Logging on

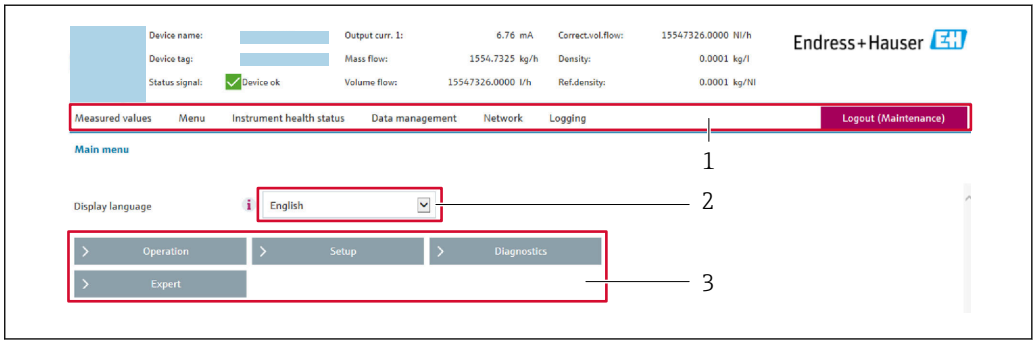
1. Select the preferred operating language for the Web browser.

2. Enter the user-specific access code.
3. Press **OK** to confirm your entry.

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

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

## 8.4.5 User interface

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*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 → 149
- 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>▪ File for system integration - If using fieldbuses, upload device drivers for system integration from the measuring device:<br>EtherNet/IP: EDS file |

| Functions | Meaning |
|---|---|
| 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>▪ On | On |

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

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

### Enabling the Web server

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

### 8.4.7 Logging out

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

1. Select the **Logout** entry in the function row.
   ↳ The home page with the Login box appears.
2. Close the Web browser.
3. If no longer needed:
   Reset modified properties of the Internet protocol (TCP/IP) → 76.

If communication with the Web server was established via the default IP address 192.168.1.212, DIP switch No. 10 must be reset (from **ON** → **OFF**). Afterwards, the IP address of the device is active again for network communication.

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

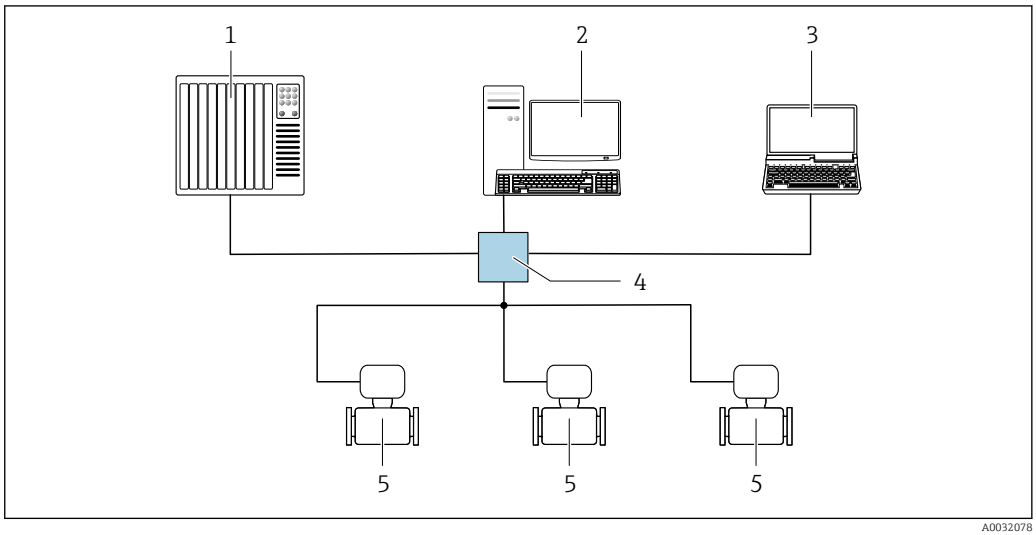
The structure of the operating menu in the operating tools is identical to operation via the local display.

### 8.5.1 Connecting the operating tool

#### Via EtherNet/IP network

This communication interface is available in device versions with EtherNet/IP.

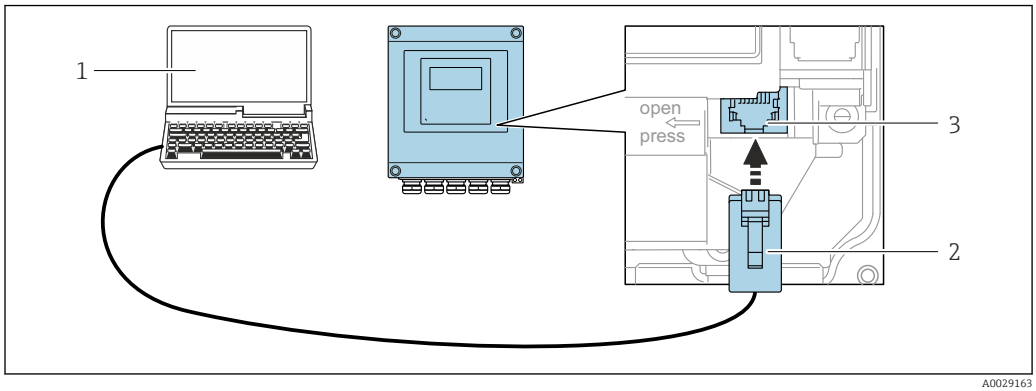
*Star topology*




*16 Options for remote operation via EtherNet/IP network: star topology*

*1 Automation system, e.g. "RSLogix" (Rockwell Automation)*
*2 Workstation for measuring device operation: with Custom Add-On Profile for "RSLogix 5000" (Rockwell Automation) or with Electronic Data Sheet (EDS)*
*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) with COM DTM "CDI Communication TCP/IP"*
*4 Ethernet switch*
*5 Measuring device*

### Via service interface (CDI-RJ45)

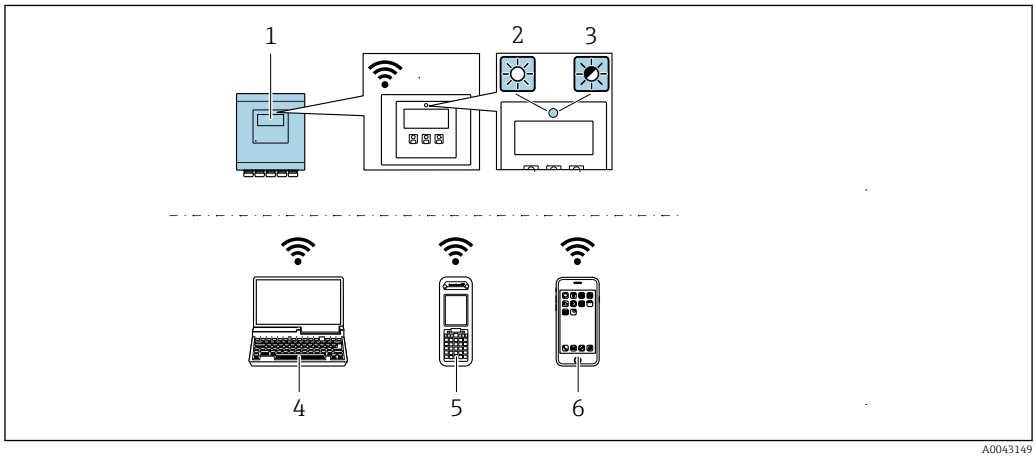



17 *Connection via service interface (CDI-RJ45)*

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

### Via WLAN interface

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




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

| | |
|---|---|
| Function | WLAN: IEEE 802.11 b/g (2.4 GHz)<br>▪ Access point with DHCP server (default setting)<br>▪ Network |
| Encryption | WPA2-PSK AES-128 (in accordance with IEEE 802.11i) |
| Configurable WLAN channels | 1 to 11 |
| Degree of protection | IP67 |
| Available antenna | Internal antenna |
| Range | Typically 10 m (32 ft) |

*Configuring the Internet protocol of the mobile terminal*

NOTICE

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

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

NOTICE

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

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

*Preparing the mobile terminal*

- Enable WLAN reception on the mobile terminal.

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

1. In the WLAN settings of the mobile terminal:
   Select the measuring device using the SSID (e.g. EH_Promag__A802000).
2. If necessary, select the WPA2 encryption method.
3. Enter the password: serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ LED on display module flashes: it is now possible to operate the measuring device with the Web browser, FieldCare or DeviceCare.

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

*Disconnecting*

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

### 8.5.2 FieldCare

**Function scope**

FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field devices in a system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.

Access is via:
CDI-RJ45 service interface

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

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

### Source for device description files

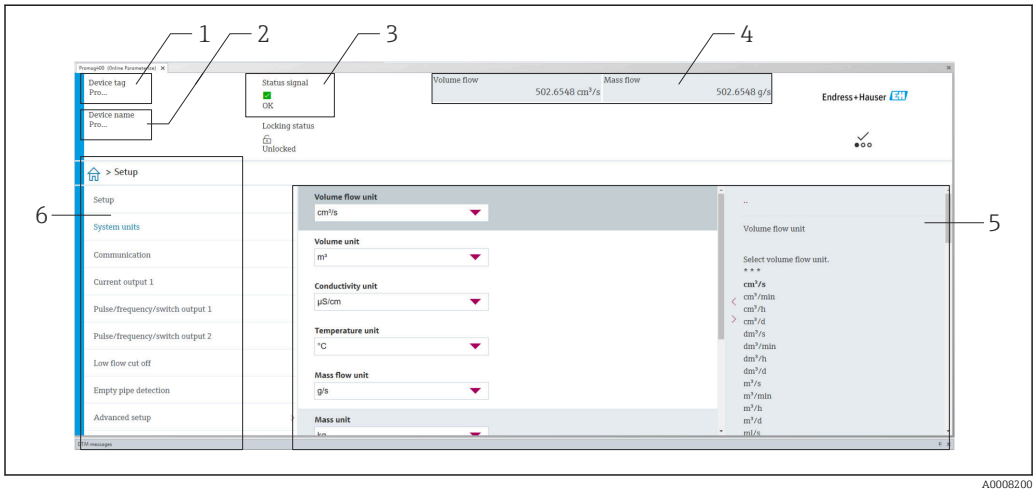
See information → 86

### Establishing a connection

1. Start FieldCare and launch the project.
2. In the network: Add a device.
   ↳ The **Add device** window opens.
3. Select the **CDI Communication TCP/IP** option from the list and press **OK** to confirm.
4. Right-click **CDI Communication TCP/IP** and select the **Add device** option in the context menu that opens.
5. Select the desired device from the list and press **OK** to confirm.
   ↳ The **CDI Communication TCP/IP (Configuration)** window opens.
6. Enter the device address in the **IP address** field: 192.168.1.212 and press **Enter** to confirm.
7. Establish the online connection to the device.

For additional information, see Operating Instructions BA00027S and BA00059S

### User interface




A0008200

1 *Device name*
2 *Tag name*
3 *Status area with status signal → 149*
4 *Display area for current measured values*
5 *Edit bar with additional functions*
6 *Navigation area with operating menu structure*

## 8.5.3 DeviceCare

### Function scope

Tool for connecting and configuring Endress+Hauser field devices.

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

For details, see Innovation Brochure IN01047S

**Source for device description files**

See information → 86

### 8.5.4 Field Xpert SMT70, SMT77

**Field Xpert SMT70**

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

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

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

Source for device description files: → 86

**Field Xpert SMT77**

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

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

Source for device description files: → 86

# 9 System integration

## 9.1 Overview of device description files

### 9.1.1 Current version data for the device

| | |
|---|---|
| Firmware version | 02.00.zz |
| Release date of firmware version | 11.2021 |
| Manufacturer ID | 0x49E |
| Device type ID | 0x1069 |
| Device revision | 4 |
| Device profile | Generic device (product type: 0x2B) |

- Protocol-specific data → 180
- Firmware versions of the device → 167

### 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 Service interface (CDI-RJ45) | 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) |

## 9.2 Overview of system files

| System files | Version | Description | How to acquire |
|---|---|---|---|
| Electronic Data Sheet (EDS system file) | ▪ Major revision 4<br>▪ Minor revision 1 | Certified in accordance with the following ODVA guidelines:<br>▪ Conformance test<br>▪ Performance test<br>▪ PlugFest<br>Embedded EDS Support (File Object 0x37) | ▪ www.endress.com → Download Area<br>▪ EDS system file integrated in the device: can be downloaded via the web browser |
| Add-on Profile | ▪ Major revision 4<br>▪ Minor revision 1 | System file for "Studio 5000" software (Rockwell Automation)<br>Add new module:<br>▪ Promag_400<br>Revision 2 = Assembly 101...104<br>▪ Promag_400_V02<br>Revision 4 = Assembly 120...127 | www.endress.com → Download Area |

## 9.3 Integrating the measuring device in the system

For detailed information on system integration, see the Operating Instructions for the device

A detailed description of how to integrate the device into an automation system (e.g. from Rockwell Automation) is available as a separate document:
www.endress.com→ Select your country → Solutions → Fieldbus planning → Fieldbus technologies → EtherNet/IP

## 9.4 Implicit data transmission

Implicit data transmission when using the device master file (GSD).

### 9.4.1 Block model

The block model shows which input and output data the measuring device makes available for implicit messaging. Implicit data exchange is performed using an EtherNet/IP scanner, e.g. a distributed control system etc.

| Measuring device | | | | | | | Control system |
|---|---|---|---|---|---|---|---|
| | Name | Assembly | Byte | Hex | Description | | |
| Transducer Block | Legacy [1] Input Assembly Fix [2] | 100 | 32 | 0x64 | → 89 | Permanently assigned input group → | EtherNet/IP |
| | Legacy Input Assembly Configurable [2] | 101 | 88 | 0x65 | → 90 | Configurable input group → | |
| | Legacy Output Assembly Fix [2] | 102 | 56 | 0x66 | → 91 | Permanently assigned output group ← | |
| | Legacy Configuration Assembly [2] | 104 | 398 | 0x68 | → 94 | Permanently assigned configuration | |
| | Dummy Configuration Assembly | 105 | 0 | 0x69 | → 99 | "Configuration Assembly" placeholder if a permanently assigned Configuration Assembly is not used | |
| | Dummy Output Assembly Fix | 199 | 0 | 0xC7 | → 99 | "Output Assembly Fix" placeholder if a permanently assigned output group is not defined | |
| | Input Assembly Fix [3] | 120 | 56 | 0x78 | → 89 | Permanently assigned input group → | |
| | Input Assembly Configurable [3] | 121 | 128 | 0x79 | → 90 | Configurable input group → | |
| | Output Assembly Fix [3] | 122 | 56 | 0x7A | → 92 | Permanently assigned output group ← | |
| | Configuration Assembly [3] | 124 | 186 | 0x7C | → 96 | Permanently assigned configuration | |
| | Volume Flow Extended Fix Input [3] | 126 | 72 | 0x7E | → 98 | Permanently assigned volume flow → | |
| | Volume Flow Universal Fix Input [3] | 127 | 40 | 0x7F | → 99 | Permanently assigned input group for electromagnetic default values → | |

1) Legacy Assembly: Assembly for devices with Device Revision 1 or 2 that continue to be used for compatibility reasons
2) Assembly can be used by devices with Device Revision 2 and 4
3) Assembly can be used by devices with Device Revision 4

### 9.4.2 Pre-defined connections

| No. | Name | O → T (Output) | T → O (Input) | Configuration |
|---|---|---|---|---|
| 1 | Legacy Fix Input/Output + Config Assembly | Assem102 | Assem100 | Assem104 |
| 2 | Legacy Fix Input + Config Assembly | – | Assem100 | Assem104 |
| 3 | Legacy Configurable Input + Fix Output + Config Assembly | Assem102 | Assem101 | Assem104 |
| 4 | Legacy Configurable Input + Config Assembly | – | Assem101 | Assem104 |
| 5 | Legacy Fix Input/Output | Assem102 | Assem100 | – |
| 6 | Legacy Fix Input | – | Assem100 | – |
| 7 | Legacy Configurable Input + Fix Output | Assem102 | Assem101 | – |
| 8 | Legacy Configurable Input | – | Assem101 | – |
| 9 | Fix Input/Output + Config Assembly | Assem122 | Assem120 | Assem124 |
| 10 | Fix Input + Config Assembly | – | Assem120 | Assem124 |
| 11 | Configurable Input + Fix Output + Config Assembly | Assem122 | Assem121 | Assem124 |
| 12 | Configurable Input + Config Assembly | – | Assem121 | Assem124 |
| 13 | Volume Flow Extended + Fix Output + Config Assembly | Assem122 | Assem126 | Assem124 |
| 14 | Volume Flow Extended + Config Assembly | – | Assem126 | Assem124 |
| 15 | Volume Flow Universal + Fix Output + Config Assembly | Assem122 | Assem127 | Assem124 |
| 16 | Volume Flow Universal + Config Assembly | – | Assem127 | Assem124 |
| 17 | Fix Input/Fix Output | Assem122 | Assem120 | – |
| 18 | Fix Input | – | Assem120 | – |
| 18 | Configurable Input + Fix Output | Assem122 | Assem121 | – |
| 20 | Configurable Input | – | Assem121 | – |
| 21 | Volume Flow Extended + Fix Output | Assem122 | Assem126 | – |
| 22 | Volume Flow Extended | – | Assem126 | – |
| 23 | Volume Flow Universal + Fix Output | Assem122 | Assem127 | – |
| 24 | Volume Flow Universal | – | Assem127 | – |

### 9.4.3 Permanently assigned input group

Output data from the device to the controller in predefined quantity and sequence.

#### Legacy Input Assembly Fix (Assem100), 32 byte

Legacy Input Assembly Fix (Assem100) is supported by devices with Device Revision 2 and 4.

| Byte | Description |
|---|---|
| 1 to 4 | File header (not visible) |
| 5 to 6 | Current diagnosis [1]: Diagnostic number |
| 7 | Current diagnosis: Status signal |
| 8 | Not used |
| 9 to 12 | Volume flow |
| 13 to 16 | Mass flow |
| 17 to 20 | Conductivity |
| 21 to 24 | Totalizer 1 |
| 25 to 28 | Totalizer 2 |
| 29 to 32 | Totalizer 3 |

1) Diagnostic information via EtherNet/IP → 104

#### Input Assembly Fix (Assem120) 56 byte

Input Assembly Fix (Assem120) is supported by devices with Device Revision 4.

| Byte | Description |
|---|---|
| 1 to 4 | File header (not visible) |
| 5 to 6 | Current diagnosis [1]: Diagnostic number |
| 7 | Current diagnosis: Status signal<br>▪ 0: Good<br>▪ 1: Failure<br>▪ 2: Function check<br>▪ 4: Maintenance required<br>▪ 8: Out of specification |
| 8 | Not used |
| 9 to 16 | Volume flow<br>Structure:<br>▪ 4: Value<br>▪ 1: Status measured value [2]<br>▪ 1: Padding<br>▪ 2: Unit [3] |
| 17 to 24 | Mass flow |
| 25 to 32 | Conductivity |
| 33 to 40 | Totalizer 1 |
| 41 to 48 | Totalizer 2 |
| 49 to 56 | Totalizer 3 |

1) Diagnostic information via EtherNet/IP → 108
2) Good (0x80), Uncertain (0x40) or Bad (0x0C)
3) Available units → 100

### 9.4.4 Configurable input group

User-configurable output data of the device to the controller. Some output data, such as Heartbeat Verification, are only optionally available.

#### Legacy Input Assembly Configurable (Assem101) 88 byte

Legacy Input Assembly Configurable (Assem101) is supported by devices with Device Revision 2 and 4.

| Description | Format |
|---|---|
| Input values 1 to 10 | Real |
| Input values 11 to 20 | Double integer |

*Possible input values*

| Possible input values 1 to 10 | | |
|---|---|---|
| ▪ Off<br>▪ Mass flow<br>▪ Volume flow | ▪ Conductivity<br>▪ Totalizer 1<br>▪ Totalizer 2 | ▪ Totalizer 3<br>▪ Electronic temperature<br>▪ Flow velocity |

| Possible input values 11 to 20 | | |
|---|---|---|
| ▪ Off<br>▪ Current diagnosis<br>▪ Previous diagnosis<br>▪ Mass flow unit<br>▪ Volume flow unit | ▪ Temperature unit<br>▪ Conductivity unit<br>▪ Totalizer 1 unit<br>▪ Totalizer 2 unit<br>▪ Totalizer 3 unit | ▪ Flow velocity unit<br>▪ Verification results [1]<br>▪ Verification status [1] |

1) Only available with the Heartbeat Verification application package.

#### Input Assembly Configurable (Assem121) 128 byte

Input Assembly Configurable (Assem121) is supported by devices with Device Revision 4.

| Description | Format |
|---|---|
| Input values 1 to 10<br><br>Structure:<br>▪ 4: Value<br>▪ 1: Status measured value [1]<br>▪ 1: Padding<br>▪ 2: Unit [2] | Real |
| Input values 11 to 15<br><br>Structure:<br>▪ 4: Value [3]<br>▪ 1: Status measured value [1]<br>▪ 3: Padding | Double integer |

1) Good (0x80), Uncertain (0x40) or Bad (0x0C)
2) Available units → 🖹 100
3) The unit is determined by the assigned measured value.

*Possible input values*

| Possible input values 1 to 10 | | |
|---|---|---|
| ▪ Off<br>▪ Mass flow<br>▪ Volume flow<br>▪ Corrected volume flow<br>▪ Conductivity<br>▪ Corrected conductivity<br>▪ Temperature | ▪ Flow velocity<br>▪ Totalizer 1<br>▪ Totalizer 2<br>▪ Totalizer 3<br>▪ Electronic temperature<br>▪ Buildup index value [1] | ▪ MonitoringCoilRiseTime [1]<br>▪ MonitoringGroundPotential [1]<br>▪ MonitoringNoise [1]<br>▪ MIDTestPoint1<br>▪ MIDTestPoint2<br>▪ MIDTestPoint3 |

1) Only available with the Heartbeat Verification application package.

| Possible input values 11 to 15 | | |
|---|---|---|
| ▪ Off<br>▪ Current diagnosis<br>▪ Previous diagnosis | ▪ Low flow cut off<br>▪ Buildup index value [1] | ▪ Verification results [1]<br>▪ Verification status [1] |

1) Only available with the Heartbeat Verification application package.

## 9.4.5 Permanently assigned output group

Input data from the controller to the device in predefined quantity and sequence.

### Legacy Output Assembly Fix (Assem102) 56 byte

Legacy Input Assembly Fix (Assem102) is supported by devices with Device Revision 2 and 4.

| Description | Byte | Bytes | Bit | Value/code: function/unit |
|---|---|---|---|---|
| Totalizer 1 control activation | 1 | 1 | 1 | ▪ 0: Disable<br>▪ 1: Enable |
| Totalizer 2 control activation | | | 2 | |
| Totalizer 3 control activation | | | 3 | |
| Reference density compensation activation | | | 4 | |
| Verification activation | | | 5 | |
| Not used | | | 6 | – |
| Not used | | | 7 | – |
| Not used | | | 8 | – |
| Not used | 2 to 4 | 3 | – | |
| Totalizer 1 – control (integer) | 5+6 | 2 | ▪ -32226: Totalize<br>▪ -32490: Reset (0) + hold<br>▪ -32228: Preset + hold<br>▪ 198: Reset (0) + start totalization<br>▪ 199: Preset + start totalization<br>Signed integers (16 bit) | |
| Not used | 7+8 | 2 | – | |
| Totalizer 2 – control (integer) | 9+10 | 2 | ▪ -32226: Totalize<br>▪ -32490: Reset (0) + hold<br>▪ -32228: Preset + hold<br>▪ 198: Reset (0) + start totalization<br>▪ 199: Preset + start totalization<br>Signed integers (16 bit) | |
| Not used | 11+12 | 2 | – | |

| Description | Byte | Bytes | Bit | Value/code: function/unit |
|---|---|---|---|---|
| Totalizer 3 – control (integer) | 13+14 | 2 | | ▪ -32226: Totalize<br>▪ -32490: Reset (0) + hold<br>▪ -32228: Preset + hold<br>▪ 198: Reset (0) + start totalization<br>▪ 199: Preset + start totalization<br>Signed integers (16 bit) |
| Not used | 15+16 | 2 | | – |
| External density (real) | 17 to 20 | 4 | | External reference density to field device in "IEEE 754" data format |
| External density unit (integer) | 21+22 | 2 | | ▪ 12040: g/cm³<br>▪ 2088: g/m³<br>▪ 2109: kg/dm³<br>▪ 12048: kg/l<br>▪ 12039: kg/m³<br>▪ 2204: SD4°C<br>▪ 2277: SD15°C<br>▪ 2230: SD20°C<br>▪ 2228: SG4°C<br>▪ 2226: SG15°C<br>▪ 2227: SG20°C<br>▪ 12044: lb/ft³<br>▪ 12043: lb/gal (us)<br>▪ 2174: lb/bbl (us;liq.)<br>▪ 2173: lb/bbl (us;beer)<br>▪ 2175: lb/bbl (us;oil)<br>▪ 2176: lb/bbl (us;tank)<br>▪ 2180: lb/gal (imp)<br>▪ 2179: lb/bbl (imp;oil)<br>Signed integers (16 bit) |
| Not used | 23+24 | 2 | | – |
| Start verification (integer) | 25+26 | 2 | | ▪ -32713: Cancel<br>▪ -32378: Start<br>Signed integers (16 bit) |
| Not used | 27 to 56 | 30 | | – |

### Output Assembly Fix (Assem122) 56 byte

Output Assembly Fix (Assem122) is supported by devices with Device Revision 4.

| Description | Byte | Bytes | Bit | Value/code: function/unit |
|---|---|---|---|---|
| Totalizer 1 control activation | 1 | 1 | 1 | ▪ 0: Disable<br>▪ 1: Enable |
| Totalizer 2 control activation | | | 2 | |
| Totalizer 3 control activation | | | 3 | |
| Reference density compensation activation | | | 4 | |
| Verification activation | | | 5 | |
| Empty pipe detection activation | | | 6 | |
| Reference temperature compensation | | | 7 | |
| Not used | | | 8 | – |
| Not used | 2 to 4 | 3 | | – |

| Description | Byte | Bytes | Bit | Value/code: function/unit |
|---|---|---|---|---|
| Totalizer 1 – control (integer) | 5+6 | 2 | | ▪ -32226: Totalize<br>▪ -32608: Stop<br>▪ -32490: Reset (0) + hold<br>▪ -32228: Preset + hold<br>▪ 198: Reset (0) + start totalization<br>▪ 199: Preset + start totalization<br>Signed integers (16 bit) |
| Not used | 7+8 | 2 | | – |
| Totalizer 2 – control (integer) | 9+10 | 2 | | ▪ -32226: Totalize<br>▪ -32608: Stop<br>▪ -32490: Reset (0) + hold<br>▪ -32228: Preset + hold<br>▪ 198: Reset (0) + start totalization<br>▪ 199: Preset + start totalization<br>Signed integers (16 bit) |
| Not used | 11+12 | 2 | | – |
| Totalizer 3 – control (integer) | 13+14 | 2 | | ▪ -32226: Totalize<br>▪ -32608: Stop<br>▪ -32490: Reset (0) + hold<br>▪ -32228: Preset + hold<br>▪ 198: Reset (0) + start totalization<br>▪ 199: Preset + start totalization<br>Signed integers (16 bit) |
| Not used | 15+16 | 2 | | – |
| External density (real) | 17+20 | 4 | | External reference density to field device in "IEEE 754" data format |
| External density unit (integer) | 21+22 | 2 | | ▪ 12040: g/cm³<br>▪ 2088: g/m³<br>▪ 2109: kg/dm³<br>▪ 12048: kg/l<br>▪ 12039: kg/m³<br>▪ 2204: SD4°C<br>▪ 2277: SD15°C<br>▪ 2230: SD20°C<br>▪ 2228: SG4°C<br>▪ 2226: SG15°C<br>▪ 2227: SG20°C<br>▪ 12044: lb/ft³<br>▪ 2173: lb/bbl (us;beer)<br>▪ 2174: lb/bbl (us;liq.)<br>▪ 2175: lb/bbl (us;oil)<br>▪ 2176: lb/bbl (us;tank)<br>▪ 12043: lb/gal (us)<br>▪ 2178: lb/bbl (imp; beer)<br>▪ 2179: lb/bbl (imp;oil)<br>▪ 2180: lb/gal (imp)<br>Signed integers (16 bit) |
| Not used | 23+24 | 2 | | – |
| Start verification (integer) | 25+26 | 2 | | ▪ -32713: Cancel<br>▪ -32378: Start<br>Signed integers (16 bit) |
| Not used | 27+28 | 2 | | – |
| Empty pipe detection | 29+30 | 2 | | ▪ 32823: Cancel<br>▪ 474: Empty pipe adjustment<br>▪ 476: Full pipe adjustment |

| Description | Byte | Bytes | Bit | Value/code: function/unit |
|---|---|---|---|---|
| Not used | 31+32 | 2 | – | |
| External temperature (real) | 33 to 36 | 4 | – | |
| External temperature unit (integer) | 37+38 | 2 | ▪ 4608: °C<br>▪ 4609: °F<br>▪ 4610: K<br>▪ 4611: °R | |
| Not used | 39+40 | 2 | – | |
| Not used | 41 to 56 | 16 | – | |

### Use of the totalizer

Example: Reset totalizer 1 in Output Assembly Fix (Assem102).

1. Activation of totalizer control function:
   In the 1st module (totalizer 1 control activation), send a 1 to the device.
2. Reset the totalizer:
   In the 10th module (totalizer 1 – control (integer)), send a 198 to the device.

## 9.4.6 Permanently assigned configuration

Permanently assigned configuration from the controller to the device. Is used for the automated configuration of the device by the controller. This is performed after each device reboot, e.g. following a power failure or a device replacement.

### Legacy Configuration Assembly (Assem104) 398 byte

Legacy Configuration Assembly (Assem104) is supported by devices with Device Revision 2 and 4.

| Byte | Bytes | Description |
|---|---|---|
| 1 to 4 | 4 | Not used |
| 5 | 1 | Write protection |
| 6 | 1 | Not used |
| 7+8 | 2 | Mass flow unit |
| 9+10 | 2 | Mass flow |
| 11+12 | 2 | Volume flow unit |
| 13+14 | 2 | Volume flow |
| 15+16 | 2 | Density unit |
| 17+18 | 2 | Temperature unit |
| 19+20 | 2 | Conductivity unit |
| 21 to 46 | 26 | Not used |
| 47+48 | 2 | Access code entry |
| 49+50 | 2 | Assign process variable totalizer 1 |
| 51+52 | 2 | Totalizer 1 unit |
| 53+54 | 2 | Operating mode totalizer 1 |
| 55+56 | 2 | Failsafe mode totalizer 1 |
| 57 to 60 | 4 | Preset value totalizer 1 |
| 61+62 | 2 | Control totalizer 1 |

| Byte | Bytes | Description |
|---|---|---|
| 63+64 | 2 | Assign process variable totalizer 2 |
| 65+66 | 2 | Totalizer 2 unit |
| 67+68 | 2 | Operating mode totalizer 2 |
| 69+70 | 2 | Failsafe mode totalizer 2 |
| 71 to 74 | 4 | Preset value totalizer 2 |
| 75+76 | 2 | Control totalizer 2 |
| 77+78 | 2 | Assign process variable totalizer 3 |
| 79+80 | 2 | Totalizer 3 unit |
| 81+82 | 2 | Operating mode totalizer 3 |
| 83+84 | 2 | Failsafe mode totalizer 3 |
| 85+88 | 2 | Preset value totalizer 3 |
| 89+90 | 2 | Control totalizer 3 |
| 91+92 | 2 | Input Assembly Position 1 |
| 93+94 | 2 | Input Assembly Position 2 |
| 95+96 | 2 | Input Assembly Position 3 |
| 97+98 | 2 | Input Assembly Position 4 |
| 99+100 | 2 | Input Assembly Position 5 |
| 101+102 | 2 | Input Assembly Position 6 |
| 103+104 | 2 | Input Assembly Position 7 |
| 105+106 | 2 | Input Assembly Position 8 |
| 107+108 | 2 | Input Assembly Position 9 |
| 109+110 | 2 | Input Assembly Position 10 |
| 111+112 | 2 | Input Assembly Position 11 |
| 113+114 | 2 | Input Assembly Position 12 |
| 115+116 | 2 | Input Assembly Position 13 |
| 117+118 | 2 | Input Assembly Position 14 |
| 119+120 | 2 | Input Assembly Position 15 |
| 121+122 | 2 | Input Assembly Position 16 |
| 123+124 | 2 | Input Assembly Position 17 |
| 125+126 | 2 | Input Assembly Position 18 |
| 127+128 | 2 | Input Assembly Position 19 |
| 129+130 | 2 | Input Assembly Position 20 |
| 131+132 | 2 | Installation direction |
| 133+134 | 2 | Assign process variable |
| 135+136 | 2 | Empty pipe detection |
| 137 to 140 | 4 | On value low flow cut off |
| 141 to 144 | 4 | Off value low flow cut off |
| 145 to 148 | 4 | Pressure shock suppression |
| 149 to 152 | 4 | Response time empty pipe detection |
| 153 to 156 | 4 | Conductivity damping |
| 157+158 | 2 | Flow override |
| 159+160 | 2 | New adjustment empty pipe detection |
| 161+162 | 2 | Density source |

| Byte | Bytes | Description |
|---|---|---|
| 163+164 | 2 | Filter options |
| 165 to 168 | 4 | Switch point empty pipe detection |
| 169 to 172 | 4 | Fixed density |
| 173 | 1 | Flow damping |
| 174 to 176 | 3 | Not used |
| 177 to 180 | 4 | Alarm delay |
| 181 | 1 | Assign behavior of diagnostic no. 832 |
| 182 | 1 | Assign behavior of diagnostic no. 833 |
| 183 | 1 | Assign behavior of diagnostic no. 834 |
| 184 | 1 | Assign behavior of diagnostic no. 835 |
| 185 | 1 | Assign behavior of diagnostic no. 862 |
| 186 | 1 | Assign behavior of diagnostic no. 531 |
| 187 | 1 | Assign behavior of diagnostic no. 937 |
| 188 | 1 | Assign behavior of diagnostic no. 302 |
| 189 to 398 | 210 | Not used |

### Configuration Assembly (Assem124) 186 byte

Configuration Assembly (Assem124) is supported by devices with Device Revision 4.

| Byte | Bytes | Description |
|---|---|---|
| 1 to 4 | 4 | Not used |
| 5 | 1 | Write protection |
| 6 | 1 | Not used |
| 7+8 | 2 | Mass flow unit |
| 9+10 | 2 | Mass flow |
| 11+12 | 2 | Volume flow unit |
| 13+14 | 2 | Volume flow |
| 15+16 | 2 | Density unit |
| 17+18 | 2 | Temperature unit |
| 19+20 | 2 | Conductivity unit |
| 21+22 | 2 | Corrected volume flow unit |
| 23+24 | 2 | Corrected volume flow |
| 25 to 26 | 2 | Not used |
| 27+28 | 2 | Access code entry |
| 29+30 | 2 | Assign process variable totalizer 1 |
| 31+32 | 2 | Totalizer 1 unit |
| 33+34 | 2 | Operating mode totalizer 1 |
| 35+36 | 2 | Failsafe mode totalizer 1 |
| 37 to 40 | 4 | Preset value totalizer 1 |
| 41+42 | 2 | Control totalizer 1 |
| 43+44 | 2 | Assign process variable totalizer 2 |
| 45+46 | 2 | Totalizer 2 unit |

| Byte | Bytes | Description |
|---|---|---|
| 47+48 | 2 | Operating mode totalizer 2 |
| 49+50 | 2 | Failsafe mode totalizer 2 |
| 51 to 54 | 4 | Preset value totalizer 2 |
| 55+56 | 2 | Control totalizer 2 |
| 57+58 | 2 | Assign process variable totalizer 3 |
| 59+60 | 2 | Totalizer 3 unit |
| 61+62 | 2 | Operating mode totalizer 3 |
| 63+64 | 2 | Failsafe mode totalizer 3 |
| 65+68 | 2 | Preset value totalizer 3 |
| 69+70 | 2 | Control totalizer 3 |
| 71+72 | 2 | Installation direction |
| 73+74 | 2 | Assign process variable |
| 75+76 | 2 | Empty pipe detection |
| 77 to 80 | 4 | On value low flow cut off |
| 81 to 84 | 4 | Off value low flow cut off |
| 85 to 88 | 4 | Pressure shock suppression |
| 89 to 92 | 4 | Response time empty pipe detection |
| 93+94 | 2 | Flow override |
| 95+96 | 2 | New adjustment empty pipe detection |
| 97+98 | 2 | Density source |
| 99+100 | 2 | Temperature source |
| 101+102 | 2 | Filter options |
| 103+104 | 2 | Conductivity measurement |
| 105 to 108 | 4 | Conductivity damping |
| 109 to 112 | 4 | Switch point empty pipe detection |
| 113 to 116 | 4 | Fixed density |
| 117 | 1 | Flow damping |
| 118 | 1 | Not used |
| 119+120 | 2 | Buildup index |
| 121 to 124 | 4 | Buildup limit |
| 125 to 128 | 4 | Hysteresis buildup limit |
| 129 | 1 | Buildup damping |
| 130 to 132 | 3 | Not used |
| 133 to 136 | 4 | Alarm delay |
| 137 | 1 | Assign behavior of diagnostic no. 832 |
| 138 | 1 | Assign behavior of diagnostic no. 833 |
| 139 | 1 | Assign behavior of diagnostic no. 834 |
| 140 | 1 | Assign behavior of diagnostic no. 835 |
| 141 | 1 | Assign behavior of diagnostic no. 862 |
| 142 | 1 | Assign behavior of diagnostic no. 531 |
| 143 | 1 | Assign behavior of diagnostic no. 937 |
| 144 | 1 | Assign behavior of diagnostic no. 302 |
| 145+146 | 2 | Assign behavior of diagnostic no. 43 |

| Byte | Bytes | Description |
|---|---|---|
| 147+148 | 2 | Assign behavior of diagnostic no. 376 |
| 149+150 | 2 | Assign behavior of diagnostic no. 377 |
| 151+152 | 2 | Assign behavior of diagnostic no. 842 |
| 153+154 | 2 | Assign behavior of diagnostic no. 938 |
| 155+156 | 2 | Assign behavior of diagnostic no. 961 |
| 157+158 | 2 | Input Assembly Position 1 |
| 159+160 | 2 | Input Assembly Position 2 |
| 161+162 | 2 | Input Assembly Position 3 |
| 163+164 | 2 | Input Assembly Position 4 |
| 165+166 | 2 | Input Assembly Position 5 |
| 167+168 | 2 | Input Assembly Position 6 |
| 169+170 | 2 | Input Assembly Position 7 |
| 171+172 | 2 | Input Assembly Position 8 |
| 173+174 | 2 | Input Assembly Position 9 |
| 175+176 | 2 | Input Assembly Position 10 |
| 177+178 | 2 | Input Assembly Position 11 |
| 179+180 | 2 | Input Assembly Position 12 |
| 181+182 | 2 | Input Assembly Position 13 |
| 183+184 | 2 | Input Assembly Position 14 |
| 185+186 | 2 | Input Assembly Position 15 |

### 9.4.7 Permanently assigned volume flow

#### Volume Flow Extended Fix Input (Assem126) 80 byte

Permanently assigned input values to the controller. Output data for the volume flow from the device to the controller in predefined quantity and sequence.

Volume Flow Extended (Assem126) is supported by devices with Device Revision 4.

| Byte | Description |
|---|---|
| 1 to 4 | File header (not visible) |
| 5 to 8 | Current diagnosis [1] |
| 9 to 16 | Volume flow<br>Structure:<br>▪ 4: Value<br>▪ 1: Status measured value [2]<br>▪ 1: Padding<br>▪ 2: Unit [3] |
| 17 to 24 | Corrected volume flow |
| 25 to 32 | Conductivity |
| 33 to 40 | Temperature |
| 41 to 48 | Totalizer 1 |
| 49 to 56 | Totalizer 2 |

| Byte | Description |
|---|---|
| 47 to 64 | Corrected conductivity |
| 65 to 72 | Buildup index value |

1) Diagnostic information via EtherNet/IP → 108
2) Good (0x80), Uncertain (0x40) or Bad (0x0C)
3) Available units → 100

## 9.4.8 Permanently assigned default values

### Volume Flow Universal Fix Input (Assem127) 40 byte

Permanently assigned input group to the controller for electromagnetic default values. Output data from the device to the controller in predefined quantity and sequence.

Volume Flow Universal (Assem127) is supported by devices with Device Revision 4.

| Byte | Description |
|---|---|
| 1 to 4 | File header (not visible) |
| 5 to 8 | Current diagnosis [1] |
| 9 to 16 | Volume flow<br>Structure:<br>▪ 4: Value<br>▪ 1: Status measured value [2]<br>▪ 1: Padding<br>▪ 2: Unit [3] |
| 17 to 24 | Totalizer 1 |
| 25 to 32 | Totalizer 2 |
| 33 to 40 | Totalizer 3 |

1) Diagnostic information via EtherNet/IP → 108
2) Good (0x80), Uncertain (0x40) or Bad (0x0C)
3) Available units → 100

## 9.4.9 Dummy Assembly

If a connection is not complete, a Dummy Assembly is used to complete the connection.

Three assemblies are always used for a connection: Input Assembly, Output Assembly and Configuration Assembly. If a connection only consists of two assemblies, an additional Dummy Assembly is used to complete the connection.

### Dummy Configuration Assembly (Assem105) 0 byte

Dummy Configuration Assembly (Assem105) is supported by devices with Device Revision 4.

### Dummy Output Assembly Fix (Assem199) 0 byte

Dummy Output Assembly Fix (Assem199) is supported by devices with Device Revision 4.

### 9.4.10 Units

*Volume flow units*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2077 | $cm^3/s$ | 2095 | hl/h | 5128 | gal/s (us) | 2070 | bbl/h (us;tank) |
| 2076 | $cm^3/min$ | 2094 | hl/d | 5129 | gal/min (us) | 2069 | bbl/d (us;tank) |
| 2075 | $cm^3/h$ | 2135 | Ml/s | 5130 | gal/h (us) | 2107 | gal/s (imp) |
| 2074 | $cm^3/d$ | 2134 | Ml/min | 2087 | gal/d (us) | 2106 | gal/min (imp) |
| 2082 | $dm^3/s$ | 2133 | Ml/h | 2125 | Mgal/s (us) | 2105 | gal/h (imp) |
| 2081 | $dm^3/min$ | 2132 | Ml/d | 2124 | Mgal/min (us) | 2104 | gal/d (imp) |
| 2080 | $dm^3/h$ | 2052 | af/s | 2123 | Mgal/h (us) | 2130 | Mgal/s (imp) |
| 2079 | $dm^3/d$ | 2051 | af/min | 2122 | Mgal/d (us) | 2129 | Mgal/min (imp) |
| 5125 | $m^3/s$ | 2050 | af/h | 2063 | bbl/s (us;liq.) | 2128 | Mgal/h (imp) |
| 2086 | $m^3/min$ | 2049 | af/d | 2062 | bbl/min (us;liq.) | 2127 | Mgal/d (imp) |
| 2085 | $m^3/h$ | 2254 | $ft^3/s$ | 2061 | bbl/h (us;liq.) | 2304 | bbl/s (imp;beer) |
| 2084 | $m^3/d$ | 5122 | $ft^3/min$ | 2060 | bbl/d (us;liq.) | 2305 | bbl/min (imp;beer) |
| 5127 | ml/s | 2253 | $ft^3/h$ | 2058 | bbl/s (us;beer) | 2306 | bbl/h (imp;beer) |
| 5137 | ml/min | 2252 | $ft^3/d$ | 2057 | bbl/min (us;beer) | 2307 | bbl/d (imp;beer) |
| 5138 | ml/h | 2370 | $MMft^3/s$ | 2056 | bbl/h (us;beer) | 2102 | bbl/s (imp;oil) |
| 2143 | ml/d | 2369 | $MMft^3/min$ | 2055 | bbl/d (us;beer) | 2101 | bbl/min (imp;oil) |
| 5126 | l/s | 2368 | $MMft^3/h$ | 2067 | bbl/s (us;oil) | 2100 | bbl/h (imp;oil) |
| 5139 | l/min | 2366 | $MMft^3/d$ | 2066 | bbl/min (us;oil) | 2099 | bbl/d (imp;oil) |
| 5140 | l/h | 2164 | fl oz/s (us) | 2065 | bbl/h (us;oil) | 2302 | kgal/s (us) |
| 2120 | l/d | 2163 | fl oz/min (us) | 2064 | bbl/d (us;oil) | 2301 | kgal/min (us) |
| 2097 | hl/s | 2162 | fl oz/h (us) | 2072 | bbl/s (us;tank) | 2300 | kgal/h (us) |
| 2096 | hl/min | 2161 | fl oz/d (us) | 2071 | bbl/min (us;tank) | 2299 | kgal/d (us) |

*Corrected volume flow units*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2156 | Nl/s | 2148 | $Nm^3/d$ | 2196 | $Sft^3/h$ | 2213 | Sbbl/min (us;liq.) |
| 2155 | Nl/min | 2208 | Sl/s | 2195 | $Sft^3/d$ | 2212 | Sbbl/h (us;liq.) |
| 2154 | Nl/h | 5121 | Sl/min | 2354 | $MMSft^3/s$ | 2211 | Sbbl/d (us;liq.) |
| 2153 | Nl/d | 2207 | Sl/h | 2353 | $MMSft^3/min$ | 2193 | Sgal/s (imp) |
| 2365 | Nhl/s | 2206 | Sl/d | 2352 | $MMSft^3/h$ | 2192 | Sgal/min (imp) |
| 2364 | Nhl/min | 2203 | $Sm^3/s$ | 2351 | $MMSft^3/d$ | 2191 | Sgal/h (imp) |
| 2363 | Nhl/h | 2202 | $Sm^3/min$ | 2219 | Sgal/s (us) | 2190 | Sgal/d (imp) |
| 2362 | Nhl/d | 2201 | $Sm^3/h$ | 2218 | Sgal/min (us) | 2360 | Sbbl/s (us;oil) |
| 2151 | $Nm^3/s$ | 2200 | $Sm^3/d$ | 2217 | Sgal/h (us) | 2359 | Sbbl/min (us;oil) |
| 2150 | $Nm^3/min$ | 2198 | $Sft^3/s$ | 2216 | Sgal/d (us) | 2358 | Sbbl/h (us;oil) |
| 2149 | $Nm^3/h$ | 2197 | $Sft^3/min$ | 2214 | Sbbl/s (us;liq.) | 2357 | Sbbl/d (us;oil) |

*Volume units*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2073 | $cm^3$ | 2131 | Ml Mega | 2298 | kgal (us) | 2103 | gal (imp) |
| 2078 | $dcm^3$ | 2048 | af | 2121 | Mgal (us) | 2126 | Mgal (imp) |
| 11777 | $m^3$ | 11782 | $ft^3$ | 11788 | bbl (us;oil) | 2303 | bbl (imp;beer) |
| 11779 | ml | 2367 | $MMft^3$ | 2059 | bbl (us;liq.) | 2098 | bbl (imp;oil) |
| 11778 | l | 11787 | fl oz (us) | 2054 | bbl (us;beer) | | |
| 2093 | hl | 11784 | gal (us) | 2068 | bbl (us;tank) | | |

*Corrected volume units*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2152 | Nl | 2205 | Sl | 2350 | $MMSft^3$ | 2356 | Sbbl (us;oil) |
| 2361 | Mhl | 2199 | $Sm^3$ | 2215 | Sgal (us) | 2189 | Sgal (imp) |
| 2147 | $Nm^3$ | 2194 | $Sft^3$ | 2210 | Sbbl (us;liq.) | | |

*Mass flow units*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5133 | lb/h | 2188 | STon/s | 2186 | STon/h | | |
| 2177 | lb/d | 2187 | STon/min | 2185 | STon/d | | |

*Mass units*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9473 | g | 9475 | t | 9477 | lb | | |
| 9472 | kg | 9476 | oz | 9478 | STon | | |

*Density units*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 12040 | $g/cm^3$ | 2204 | SD4°C | 2227 | SG20°C | 2175 | lb/bbl (us;oil) |
| 2088 | $g/m^3$ | 2277 | SD15°C | 12044 | $lb/ft^3$ | 2176 | lb/bbl (us;tank) |
| 12048 | kg/l | 2230 | SD20°C | 12043 | lb/gal (us) | 2180 | lb/gal (imp) |
| 2109 | $kg/dm^3$ | 2228 | SG4°C | 2174 | lb/bbl (us;liq.) | 2178 | lb/gal (imp/ beer) |
| 12039 | $kg/m^3$ | 2226 | SG15°C | 2173 | lb/bbl (us;beer) | 2179 | lb/gal (imp/oil) |

*Conductivity units*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2271 | nS/cm | 2267 | µS/mm | 2275 | S/cm | 2263 | MS/m |
| 2265 | µS/cm | 2269 | mS/cm | 2276 | S/m | | |
| 2266 | µS/m | 2270 | mS/m | 2262 | kS/m | | |

*Temperature units*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4608 | °C | 4609 | °F | 4610 | K | 4611 | °R |

## 9.5 System integration following device/transmitter replacement

Only concerns the replacement of devices or transmitters with Device Revision 2 with a device or transmitter with Device Revision 4.

The replacement of a device/transmitter with Device Revision 2 (Firmware Version 01.00.zz or 01.01.zz) with a device/transmitter with Device Revision 4 (Firmware Version from 02.00.zz) affects the compatibility of the data transmission:
- Implicit data transmission is also compatible following a device/transmitter replacement. The values are transmitted between the device and controller without restrictions and the existing assemblies continue to be used automatically.
- Explicit data transmission (using Class Instance Attribute addresses) is no longer compatible. The new device must be integrated into the controller manually.

*Overview of compatibility in the event of a firmware version update*

| Firmware update | | Compatibility during data transmission | |
|---|---|---|---|
| **from version** | **to version** | **Implicit (cyclic)** | **Explicit (acyclic)** |
| 01.00.zz | 01.01.zz | Compatible | Compatible |
| 01.00.zz | From 02.00.zz | Compatible [1)] | Not compatible |
| 01.01.zz | From 02.00.zz | Compatible [1)] | Not compatible |

1) Compatible with connections 1 to 8 → 📄 88

Due to the incompatibility of explicit data transmission, a series of steps must be performed manually to integrate the new device/transmitter into a programmable logic controller (PLC). A variety of options are available for this purpose, and differ depending on the PLC vendor:
- Integration with Premium Driver AOP (add-on profile):
  Rockwell Automation
- Integration with Electronic Data Sheet (EDS):
  Rockwell Automation, Schneider Electric, ABB, OMRON, BOSCH, Emerson etc.

Before the new device/transmitter is integrated into a controller, the device must be updated to the latest firmware version (as of 02.yy.zz): please contact your Endress+Hauser service organization.

### 9.5.1 Integration with Premium Driver AOP (add-on profile)

- Integration with the Premium Driver AOP (add-on profile) is only possible for controllers made by Rockwell Automation.
- Update the firmware version of the device prior to integration.

1. Download the Premium Driver AOP (add-on profile) from the Endress+Hauser website to the programmable logic controller: www.endress.com → Downloads
2. Install the Premium Driver AOP (add-on profile).
3. Select the new device.
4. Integrate and configure the device: The input/output data and the device configuration (assemblies) are grouped into connections in various constellations and can be configured for digital transmission depending on the application → 📄 87.

### 9.5.2 Integration with Electronic Data Sheet (EDS)

**Provider: Rockwell Automation**

- If integrating with the Premium Driver AOP (add-on profile), it is not necessary to additionally load the Electronic Data Sheet (EDS) → 102.
- Update the firmware version of the device prior to integration.

The Electronic Data Sheet (EDS) can be loaded directly from the device using RSLinx. RSLinx is Rockwell Automation's EtherNet/IP network scanner.

1. Run a device scan with RSLinx.
2. Select the new device from the list of results.
   ↳ A pop-up window opens.
3. Select the Electronic Data Sheet (EDS).
4. Load the Electronic Data Sheet (EDS) from the device to the programmable logic controller.
5. Integrate and configure the device: The input/output data and the device configuration (assembly) are grouped into connections in various constellations and can be configured for digital transmission depending on the application → 87.

**Provider: Schneider Electric, ABB, OMRON, BOSCH, Emerson etc.**

- The Electronic Data Sheet (EDS) can be loaded directly from the device or from the Endress+Hauser website.
- Update the firmware version of the device prior to integration.

*Loading the Electronic Data Sheet (EDS) directly from the device*

1. Connect the computer with a web browser to the device via the RJ45 interface.
2. Open the integrated web server → 74.
3. Log in as maintenance: Maintenance Code 0000
4. Upload the Electronic Data Sheet (EDS) to the programmable logic controller via: Data management → Documents → Export EDS file
5. Integrate and configure the device: The input/output data and the device configuration (assemblies) are grouped into connections in various constellations and can be configured for digital transmission depending on the application → 87.

*Loading the Electronic Data Sheet (EDS) from the Endress+Hauser website*

1. Load the suitable Electronic Data Sheet (EDS) for the firmware version (e.g. 02.00.zz) from the Endress+Hauser website to the programmable logic controller: www.endress.com → Downloads
2. Integrate and configure the device: The input/output data and the device configuration (assemblies) are grouped into connections in various constellations and can be configured for digital transmission depending on the application → 87.

## 9.6 Diagnostics via EtherNet/IP

### 9.6.1 Diagnostic information (Assem100)

For additional information on diagnostics and troubleshooting, including the remedial measures for the individual diagnostics codes, see → 152.

Diagnostic number: F = Failure, C = Function Check, S = Out of Specification, M = Maintenance Required (Namur NE107)

| Current diagnostics information | Diagnostic number | Description |
|---|---|---|
| 0 | – | Device ok |
| 16777265 | F882 | Input signal |
| 16777276 | F281 | Electronic initialization |
| 16777312 | F437 | Configuration incompatible |
| 16777319 | F242 | Software incompatible |
| 16777323 | F252 | Modules incompatible |
| 16777337 | F272 | Main electronic failure |
| 16777340 | F270 | Main electronic failure |
| 16777341 | F271 | Main electronic failure |
| 16777343 | F270 | Main electronic failure |
| 16777344 | F270 | Main electronic failure |
| 16777355 | F410 | Data transfer |
| 16777368 | F273 | Main electronic failure |
| 16777375 | F270 | Main electronic failure |
| 16777376 | F083 | Memory content |
| 16777409 | F833 | Electronic temperature too low |
| 16777411 | F832 | Electronic temperature too high |
| 16777413 | F834 | Process temperature too high |
| 16777414 | F835 | Process temperature too low |
| 16777429 | F022 | Sensor temperature |
| 16777430 | F022 | Sensor temperature |
| 16777441 | F311 | Electronic failure |
| 16777445 | F273 | Main electronic failure |
| 16777447 | F082 | Data storage |
| 16777450 | F190 | Special event 1 |
| 16777483 | F273 | Main electronic failure |
| 16777490 | F390 | Special event 2 |
| 16777497 | F222 | Electronic drift |
| 16777500 | F062 | Sensor connection |
| 16777508 | F590 | Special event 3 |
| 16777509 | F990 | Special event 4 |
| 16777545 | F262 | Module connection |
| 16777546 | F537 | Configuration |
| 16777547 | F201 | Device failure |
| 16777563 | F500 | Electrode 1 potential exceeded |

| Current diagnostics information | Diagnostic number | Description |
|---|---|---|
| 16777564 | F500 | Electrode 2 potential exceeded |
| 16777565 | F500 | Electrode difference voltage too high |
| 16777581 | F382 | Data storage |
| 16777582 | F383 | Memory content |
| 16777583 | F283 | Memory content |
| 25165873 | F882 | Input signal |
| 25165884 | F281 | Electronic initialization |
| 25165920 | F437 | Configuration incompatible |
| 25165927 | F242 | Software incompatible |
| 25165931 | F252 | Modules incompatible |
| 25165945 | F272 | Main electronic failure |
| 25165948 | F270 | Main electronic failure |
| 25165949 | F271 | Main electronic failure |
| 25165963 | F410 | Data transfer |
| 25165976 | F273 | Main electronic failure |
| 25165984 | F083 | Memory content |
| 25166017 | F833 | Electronic temperature too low |
| 25166019 | F832 | Electronic temperature too high |
| 25166021 | F834 | Process temperature too high |
| 25166022 | F835 | Process temperature too low |
| 25166037 | F022 | Sensor temperature |
| 25166049 | F311 | Electronic failure |
| 25166055 | F082 | Data storage |
| 25166058 | F190 | Special event 1 |
| 25166098 | F390 | Special event 2 |
| 25166105 | F222 | Electronic drift |
| 25166108 | F062 | Sensor connection |
| 25166116 | F590 | Special event 3 |
| 25166117 | F990 | Special event 4 |
| 25166153 | F262 | Module connection |
| 25166154 | F537 | Configuration |
| 25166155 | F201 | Device failure |
| 25166171 | F500 | Electrode 1 potential exceeded |
| 25166189 | F382 | Data storage |
| 25166190 | F383 | Memory content |
| 25166191 | F283 | Memory content |
| 33554536 | C411 | Up-/download active |
| 33554537 | C411 | Up-/download active |
| 33554540 | C411 | Up-/download active |
| 33554576 | C484 | Failure mode simulation |
| 33554579 | C485 | Process value simulation |
| 33554580 | C453 | Flow override |

| Current diagnostics information | Diagnostic number | Description |
|---|---|---|
| 33554625 | C833 | Electronic temperature too low |
| 33554627 | C832 | Electronic temperature too high |
| 33554629 | C834 | Process temperature too high |
| 33554630 | C835 | Process temperature too low |
| 33554778 | C530 | Electrode cleaning is running |
| 33554782 | C495 | Diagnostic event simulation |
| 33554926 | C302 | Device verification active |
| 41943144 | C411 | Up-/download active |
| 41943184 | C484 | Failure mode simulation |
| 41943187 | C485 | Process value simulation |
| 41943188 | C453 | Flow override |
| 41943233 | C833 | Electronic temperature too low |
| 41943235 | C832 | Electronic temperature too high |
| 41943237 | C834 | Process temperature too high |
| 41943238 | C835 | Process temperature too low |
| 41943386 | C530 | Electrode cleaning is running |
| 41943390 | C495 | Diagnostic event simulation |
| 41943534 | C302 | Device verification active |
| 67108970 | M438 | Dataset |
| 67109057 | M833 | Electronic temperature too low |
| 67109059 | M832 | Electronic temperature too high |
| 67109061 | M834 | Process temperature too high |
| 67109062 | M835 | Process temperature too low |
| 67109090 | M311 | Electronic failure |
| 75497578 | M438 | Dataset |
| 75497665 | M833 | Electronic temperature too low |
| 75497667 | M832 | Electronic temperature too high |
| 75497669 | M834 | Process temperature too high |
| 75497670 | M835 | Process temperature too low |
| 134217873 | S842 | Process limit |
| 134217874 | S862 | Pipe empty |
| 134217921 | S833 | Electronic temperature too low |
| 134217923 | S832 | Electronic temperature too high |
| 134217925 | S834 | Process temperature too high |
| 134217926 | S835 | Process temperature too low |
| 134218011 | S937 | EMC interference |
| 134218013 | S004 | Sensor |
| 134218067 | S043 | Sensor short circuit |
| 134218068 | S937 | EMC interference |
| 134218071 | S322 | Electronic drift |
| 134218072 | S322 | Electronic drift |
| 134218091 | S531 | Empty pipe detection |
| 142606481 | S842 | Process limit |

| Current diagnostics information | Diagnostic number | Description |
|---|---|---|
| 142606482 | S862 | Pipe empty |
| 142606529 | S833 | Electronic temperature too low |
| 142606531 | S832 | Electronic temperature too high |
| 142606533 | S834 | Process temperature too high |
| 142606534 | S835 | Process temperature too low |
| 142606619 | S937 | EMC interference |
| 142606621 | S004 | Sensor |
| 142606675 | S043 | Sensor short circuit |
| 142606679 | S322 | Electronic drift |
| 142606699 | S531 | Empty pipe detection |
| 268435545 | I1089 | Power on |
| 268435546 | I1090 | Configuration reset |
| 268435547 | I1091 | Configuration changed |
| 268435548 | I1092 | Trend data deleted |
| 268435566 | I1110 | Write protection switch changed |
| 268435593 | I1137 | Electronic changed |
| 268435607 | I1151 | History reset |
| 268435611 | I1155 | Reset electronic temperature |
| 268435612 | I1156 | Memory error trend |
| 268435613 | I1157 | Memory error event list |
| 268435641 | I1185 | Display backup done |
| 268435642 | I1186 | Restore via display done |
| 268435643 | I1187 | Settings downloaded with display |
| 268435644 | I1188 | Display data cleared |
| 268435645 | I1189 | Backup compared |
| 268435712 | I1256 | Display: access status changed |
| 268435791 | I1335 | Firmware changed |
| 268435807 | I1351 | Empty pipe detection adjustment failure |
| 268435809 | I1353 | Empty pipe detection adjustment Ok |
| 268435817 | I1361 | Wrong web server login |
| 268435853 | I1397 | Fieldbus: access status changed |
| 268435854 | I1398 | CDI: access status changed |
| 268435900 | I1444 | Device verification passed |
| 268435901 | I1445 | Device verification failed |
| 268435913 | I1457 | Failed:Measured error verification |
| 268435915 | I1459 | Failed: I/O module verification |
| 268435917 | I1461 | Failed: Sensor verification |
| 268435918 | I1462 | Failed: Sensor electronic module verific. |

### 9.6.2 Diagnostic information (Assem120, 121, 126, 127)

For additional information on diagnostics and troubleshooting, including the remedial measures for the individual diagnostics codes, see → 152.

Diagnostic number: F = Failure, C = Function Check, S = Out of Specification, M = Maintenance Required (Namur NE107)

| Current diagnostics information | Diagnostic number | Description |
|---|---|---|
| 0 | – | Device ok |
| 65579 | F043 | Sensor short circuit |
| 65618 | F082 | Memory |
| 65619 | F083 | Memory content |
| 65706 | F170 | Coil resistance |
| 65716 | F180 | Temperature sensor defective |
| 65717 | F181 | Sensor connection |
| 65737 | F201 | Device fault |
| 65778 | F242 | Software incompatible |
| 65788 | F252 | Modules incompatible |
| 65798 | F262 | Sensor electronic connection faulty |
| 65806 | F270 | Main electronics failure |
| 65807 | F271 | Main electronics failure |
| 65808 | F272 | Main electronics failure |
| 65809 | F273 | Main electronics failure |
| 65811 | F275 | I/O module 1 defective |
| 65812 | F276 | I/O module 1 faulty |
| 65819 | F283 | Memory content |
| 65867 | F331 | Firmware update failed |
| 65868 | F332 | Writing to HistoROM backup failed |
| 65897 | F361 | I/O module 1 faulty |
| 65908 | F372 | Sensor electronics (ISEM) faulty |
| 65909 | F373 | Sensor electronics (ISEM) faulty |
| 65911 | F375 | I/O 1 communication failed |
| 65912 | F376 | Sensor electronics (ISEM) faulty |
| 65913 | F377 | Sensor electronics (ISEM) faulty |
| 65918 | F382 | Memory |
| 65919 | F383 | Memory content |
| 65923 | F387 | HistoROM backup failed |
| 65946 | F410 | Data transmission |
| 65973 | F437 | Incompatible configuration |
| 66048 | F512 | Sensor electronics (ISEM) faulty |
| 66056 | F520 | I/O 1 hardware configuration invalid |
| 66067 | F531 | Empty pipe adjustment faulty |
| 66073 | F537 | Configuration |
| 66339 | F803 | Current loop |
| 66368 | F832 | Electronic temperature too high |

| Current diagnostics information | Diagnostic number | Description |
|---|---|---|
| 66369 | F833 | Electronic temperature too low |
| 66370 | F834 | Process temperature too high |
| 66371 | F835 | Process temperature too low |
| 66418 | F882 | Input signal |
| 66473 | F937 | Sensor symmetry |
| 66474 | F938 | EMC interference |
| 66498 | F962 | Empty pipe |
| 131115 | C043 | Sensor short circuit |
| 131374 | C302 | Device verification active |
| 131448 | C376 | Sensor electronics (ISEM) faulty |
| 131449 | C377 | Sensor electronics (ISEM) faulty |
| 131484 | C412 | Processing download |
| 131503 | C431 | Trim 1 |
| 131525 | C453 | Flow override |
| 131556 | C484 | Simulation failure mode |
| 131557 | C485 | Measured variable simulation |
| 131558 | C486 | Current input 1 simulation |
| 131563 | C491 | Current output 1 simulation |
| 131564 | C492 | Simulation frequency output 1 |
| 131565 | C493 | Simulation pulse output 1 |
| 131566 | C494 | Switch output simulation 1 |
| 131567 | C495 | Diagnostic event simulation |
| 131568 | C496 | Simulation status input |
| 131583 | C511 | ISEM settings faulty |
| 131602 | C530 | Electrode cleaning is running |
| 131603 | C531 | Empty pipe adjustment faulty |
| 131666 | C594 | Relay output simulation |
| 131904 | C832 | Electronic temperature too high |
| 131905 | C833 | Electronic temperature too low |
| 131906 | C834 | Process temperature too high |
| 131907 | C835 | Process temperature too low |
| 132009 | C937 | Sensor symmetry |
| 132010 | C938 | EMC interference |
| 132034 | C962 | Empty pipe |
| 262187 | M043 | Sensor short circuit |
| 262313 | M169 | Conductivity measurement failed |
| 262447 | M303 | I/O 1 configuration changed |
| 262455 | M311 | Electronics error |
| 262474 | M330 | Flash file invalid |
| 262520 | M376 | Sensor electronics (ISEM) faulty |
| 262521 | M377 | Sensor electronics (ISEM) faulty |
| 262582 | M438 | Dataset |
| 262675 | M531 | Empty pipe adjustment faulty |

| Current diagnostics information | Diagnostic number | Description |
|---|---|---|
| 262976 | M832 | Electronic temperature too high |
| 262977 | M833 | Electronic temperature too low |
| 262978 | M834 | Process temperature too high |
| 262979 | M835 | Process temperature too low |
| 263081 | M937 | Sensor symmetry |
| 263082 | M938 | EMC interference |
| 263106 | M962 | Empty pipe |
| 524331 | S043 | Sensor short circuit |
| 524664 | S376 | Sensor electronics (ISEM) faulty |
| 524665 | S377 | Sensor electronics (ISEM) faulty |
| 524729 | S441 | Current output 1 |
| 524730 | S442 | Frequency output 1 |
| 524731 | S443 | Pulse output 1 |
| 524732 | S444 | Current input 1 |
| 524819 | S531 | Empty pipe adjustment faulty |
| 525120 | M832 | Electronic temperature too high |
| 525121 | M833 | Electronic temperature too low |
| 525122 | M834 | Process temperature too high |
| 525123 | M835 | Process temperature too low |
| 525130 | S842 | Process limit |
| 525225 | S937 | Sensor symmetry |
| 525226 | S938 | EMC interference |
| 525249 | S961 | Electrode potential out of specification |
| 525250 | S962 | Empty pipe |
| 16843027 | F275 | I/O module 2 defective |
| 16843028 | F276 | I/O module 2 faulty |
| 16843113 | F361 | I/O module 2 faulty |
| 16843127 | F375 | I/O 2 communication failed |
| 16843272 | F520 | I/O 2 hardware configuration invalid |
| 16908719 | C431 | Trim 2 |
| 16908774 | C486 | Current input 2 simulation |
| 16908779 | C491 | Current output 2 simulation |
| 16908780 | C492 | Simulation frequency output 2 |
| 16908781 | C493 | Simulation pulse output 2 |
| 16908782 | C494 | Switch output simulation 2 |
| 16908784 | C496 | Simulation status input |
| 16908882 | C594 | Relay output simulation |
| 17039663 | M303 | I/O 2 configuration changed |
| 17301945 | S441 | Current output 2 |
| 17301946 | S442 | Frequency output 2 |
| 17301947 | S443 | Pulse output 2 |

| Current diagnostics information | Diagnostic number | Description |
|---|---|---|
| 17301948 | S444 | Current input 2 |
| 33620243 | F275 | I/O module 3 defective |
| 33620244 | F276 | I/O module 3 faulty |
| 33620329 | F361 | I/O module 3 faulty |
| 33620343 | F375 | I/O 3 communication failed |
| 33620488 | F520 | I/O 3 hardware configuration invalid |
| 33685935 | C431 | Trim 3 |
| 33685990 | C486 | Current input 3 simulation |
| 33685995 | C491 | Current output 3 simulation |
| 33685996 | C492 | Simulation frequency output 3 |
| 33685997 | C493 | Simulation pulse output 3 |
| 33685998 | C494 | Switch output simulation 3 |
| 33686000 | C496 | Simulation status input |
| 33686098 | C594 | Relay output simulation |
| 33816879 | M303 | I/O 3 configuration changed |
| 34079161 | S441 | Current output 3 |
| 34079162 | S442 | Frequency output 3 |
| 34079163 | S443 | Pulse output 3 |
| 34079164 | S444 | Current input 3 |
| 50397459 | F275 | I/O module 4 defective |
| 50397460 | F276 | I/O module 4 faulty |
| 50397545 | F361 | I/O module 4 faulty |
| 50397559 | F375 | I/O 4 communication failed |
| 50397704 | F520 | I/O 4 hardware configuration invalid |
| 50594095 | M303 | I/O 4 configuration changed |

### 9.6.3 Information events

| Information events | Diagnostic code | | Description |
|---|---|---|---|
| 268435545 | I | 1089 | Power on |
| 268435546 | I | 1090 | Configuration reset |
| 268435547 | I | 1091 | Configuration changed |
| 268435548 | I | 1092 | Trend data deleted |
| 268435566 | I | 1110 | Write protection switch changed |
| 268435593 | I | 1137 | Electronic changed |
| 268435607 | I | 1151 | History reset |
| 268435611 | I | 1155 | Reset electronic temperature |
| 268435612 | I | 1156 | Memory error trend |
| 268435613 | I | 1157 | Memory error event list |
| 268435641 | I | 1185 | Display backup done |
| 268435642 | I | 1186 | Restore via display done |
| 268435643 | I | 1187 | Settings downloaded with display |

| Information events | Diagnostic code | | Description |
|---|---|---|---|
| 268435644 | I | 1188 | Display data cleared |
| 268435645 | I | 1189 | Backup compared |
| 268435712 | I | 1256 | Display: access status changed |
| 268435791 | I | 1335 | Firmware changed |
| 268435807 | I | 1351 | Empty pipe detection adjustment failure |
| 268435809 | I | 1353 | Empty pipe detection adjustment Ok |
| 268435817 | I | 1361 | Wrong web server login |
| 268435853 | I | 1397 | Fieldbus: access status changed |
| 268435854 | I | 1398 | CDI: access status changed |
| 268435900 | I | 1444 | Device verification passed |
| 268435901 | I | 1445 | Device verification failed |
| 268435913 | I | 1457 | Failed:Measured error verification |
| 268435915 | I | 1459 | Failed: I/O module verification |
| 268435917 | I | 1461 | Failed: Sensor verification |
| 268435918 | I | 1462 | Failed: Sensor electronic module verific. Sensor electr. |

# 10 Commissioning

## 10.1 Function check

Before commissioning the measuring device:

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

- "Post-installation check" checklist→ 🖹 40
- "Post-connection check" checklist→ 🖹 58

## 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" → 🖹 143.

## 10.3 Configuring the device address via software

### 10.3.1 Ethernet network and web server

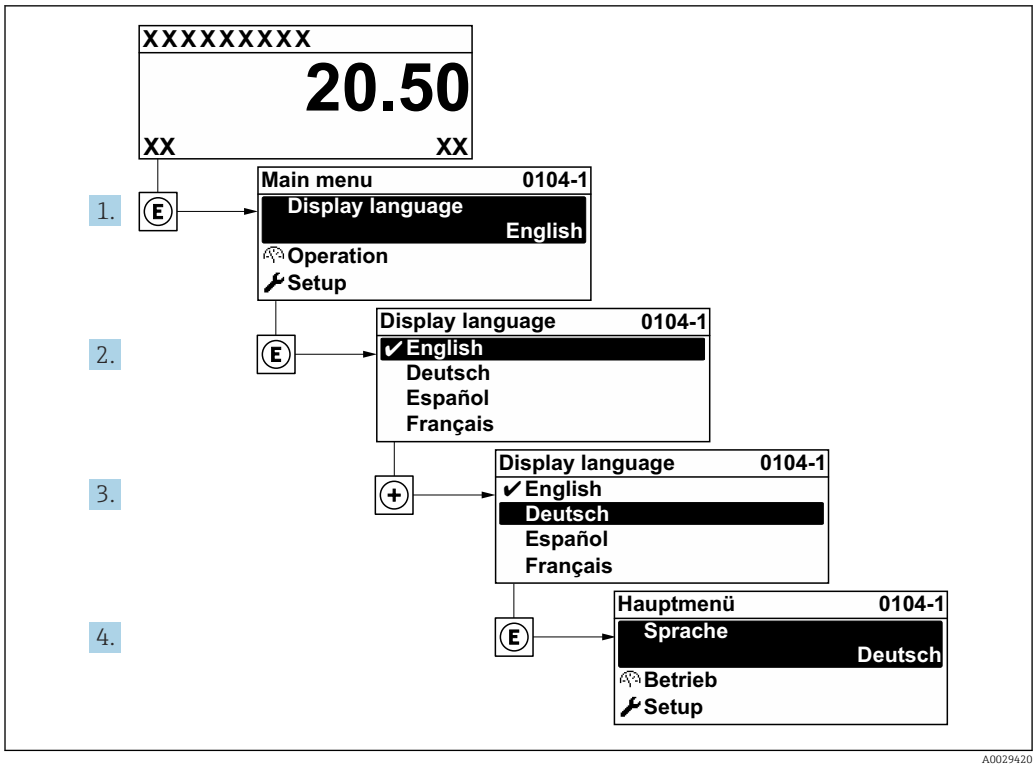
The DHCP client functionality is enabled ex works and the IP address, subnet mask and default gateway are set automatically → 🖹 117.

Identification is via the MAC address of the device.

- If hardware addressing is active, software addressing is disabled.
- If a switch is made to hardware addressing, the address configured via software addressing is retained for the first 9 places (the first three octets).
- If the IP address of the device is not known, the device address currently configured can be read out → 🖹 136.

## 10.4 Setting the operating language

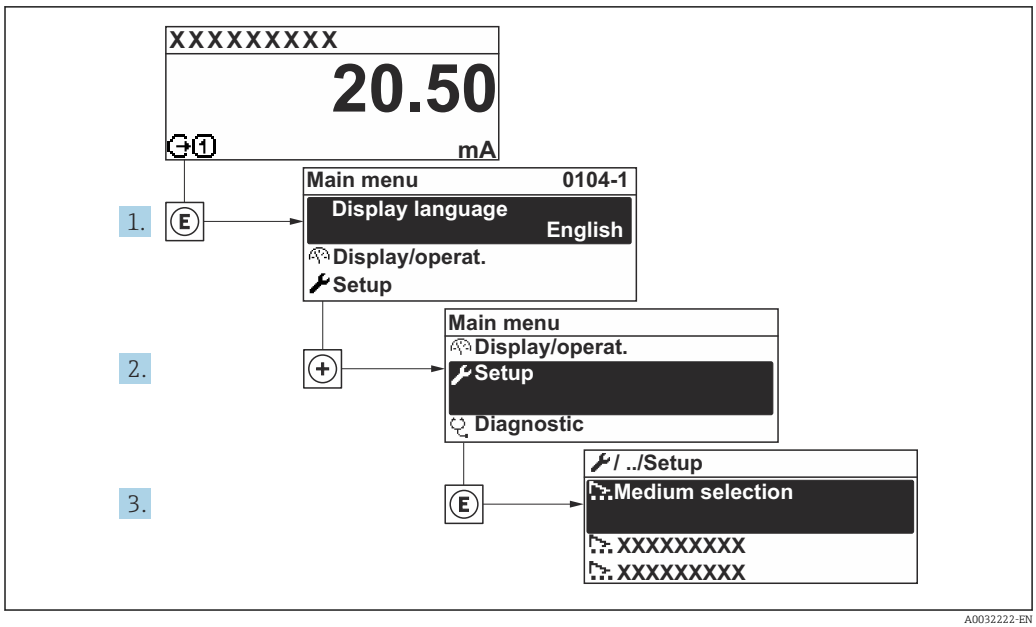
Factory setting: English or ordered local language




18 *Taking the example of the local display*

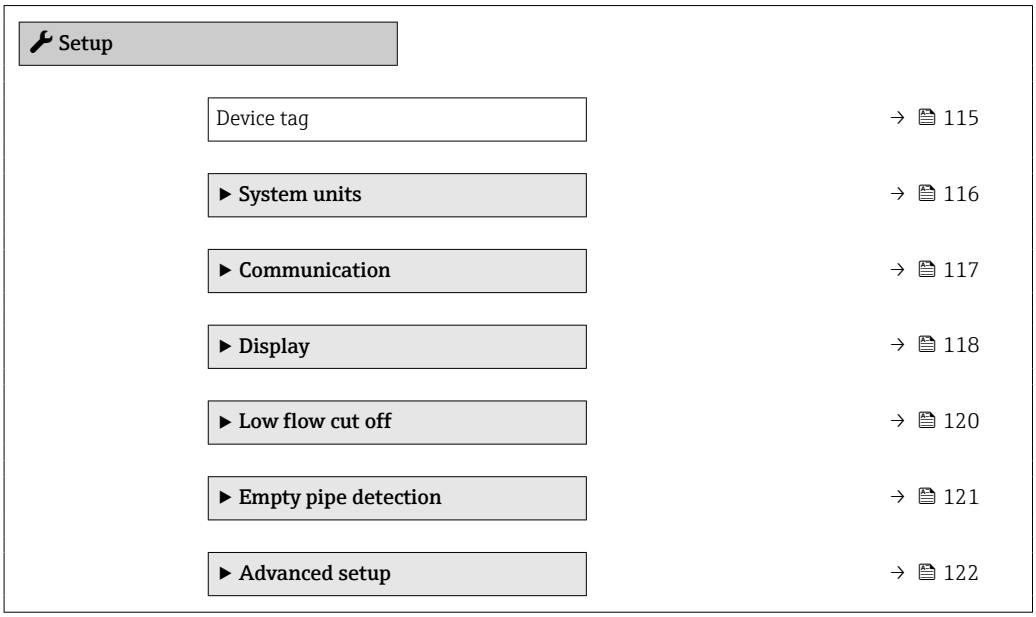
## 10.5 Configuring the measuring device

- The **Setup** menu with its guided wizards contains all the parameters needed for standard operation.
- Navigation to the **Setup** menu



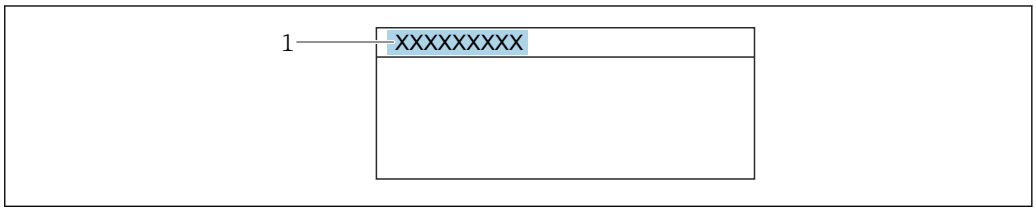

19 *Taking the example of the local display*

**Navigation**
"Setup" menu




## 10.5.1 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.




*20 Header of the operational display with tag name*

*1 Tag name*

Enter the tag name in the "FieldCare" operating tool → 84

**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 400 |

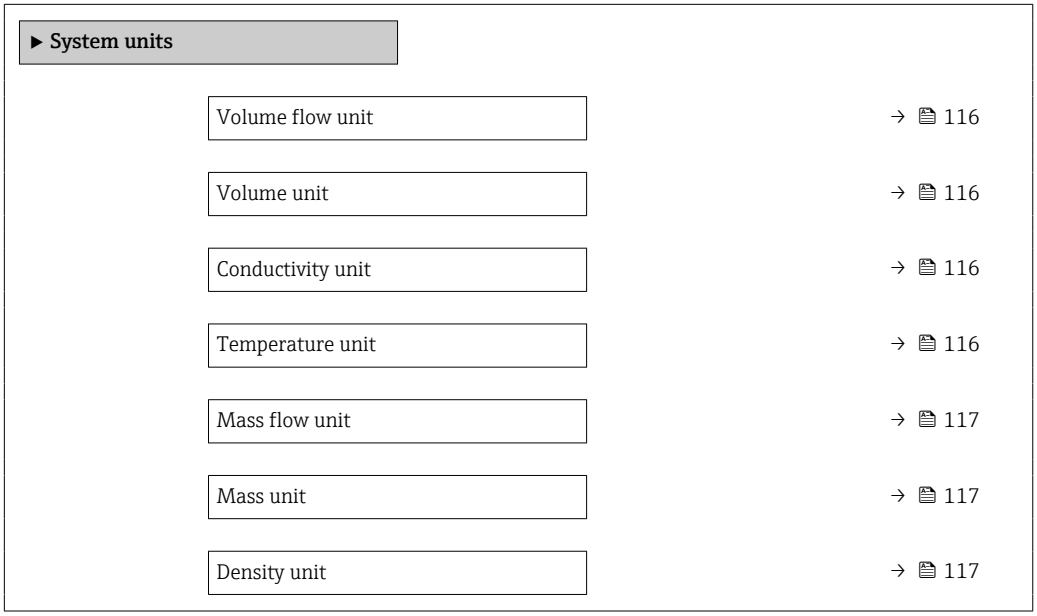
### 10.5.2 Setting the system units

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




#### Parameter overview with brief description

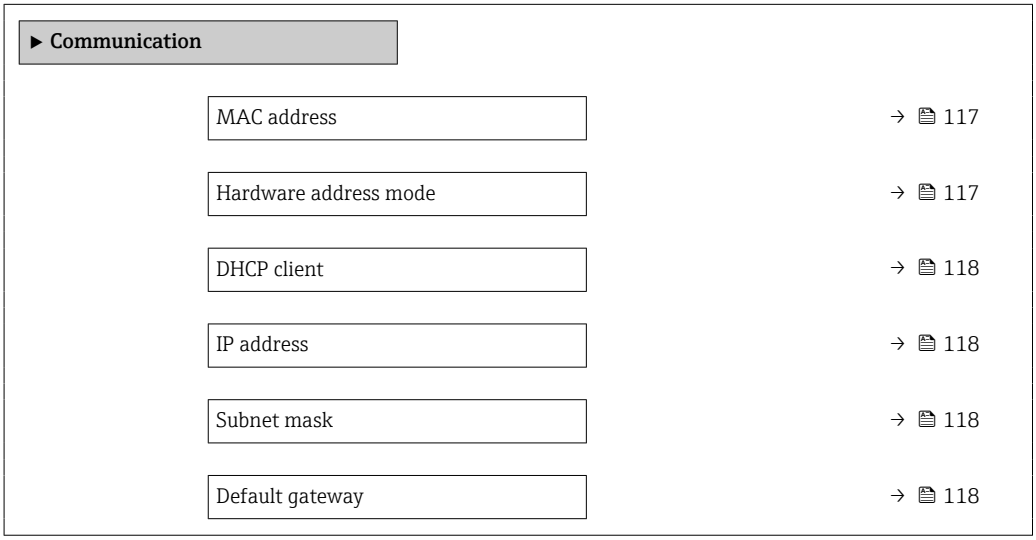
| Parameter | Prerequisite | Description | Selection | Factory setting |
|---|---|---|---|---|
| Volume flow unit | – | Select volume flow unit.<br>*Effect*<br>The selected unit applies for:<br>▪ Output<br>▪ Low flow cut off<br>▪ Simulation process variable | Unit choose list | Country-specific:<br>▪ l/h<br>▪ gal/min (us) |
| Volume unit | – | Select volume unit. | Unit choose list | Country-specific:<br>▪ $m^3$<br>▪ gal (us) |
| Conductivity unit | The **On** option is selected in the **Conductivity measurement** parameter parameter. | Select conductivity unit.<br>*Effect*<br>The selected unit applies for:<br>Simulation process variable | Unit choose list | µS/cm |
| Temperature unit | – | Select temperature unit.<br>*Effect*<br>The selected unit applies for:<br>▪ **Maximum value** parameter<br>▪ **Minimum value** parameter | Unit choose list | Country-specific:<br>▪ °C<br>▪ °F |

| Parameter | Prerequisite | Description | Selection | Factory setting |
|---|---|---|---|---|
| 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/ft³ |

## 10.5.3 Configuring the communication interface

The **Communication** submenu guides you systematically through all the parameters that have to be configured for selecting and setting the communication interface.

**Navigation**
"Setup" menu → Communication




### Parameter overview with brief description

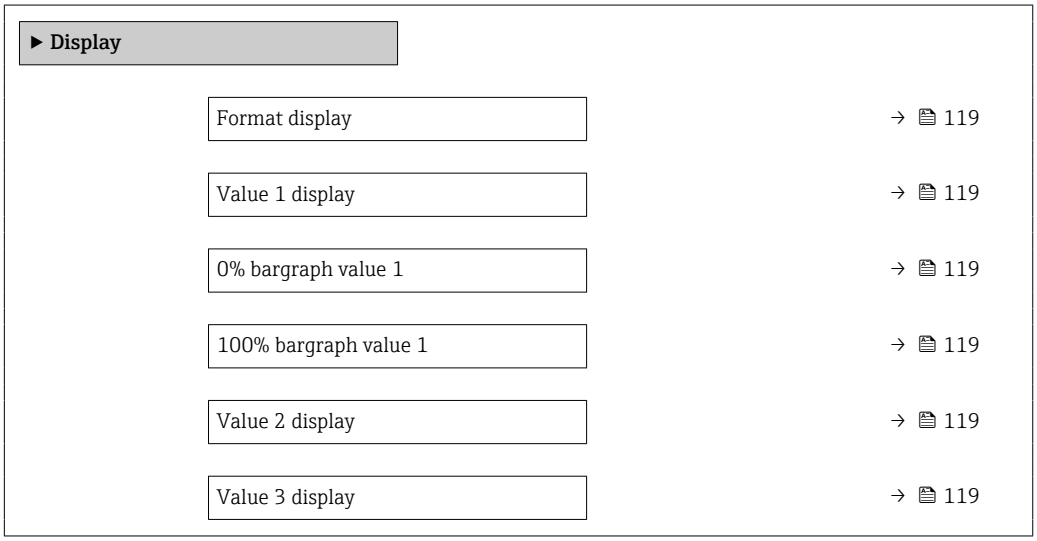
| Parameter | Description | User interface / Selection / User entry | Factory setting |
|---|---|---|---|
| MAC address | Displays the MAC address of the measuring device.<br>MAC = Media Access Control | Unique 12-digit character string comprising letters and numbers, e.g.:<br>00:07:05:10:01:5F | Each measuring device is given an individual address. |
| Hardware address mode | Select whether to restore network settings. | ▪ Off<br>▪ On | Off |

| Parameter | Description | User interface / Selection / User entry | Factory setting |
|---|---|---|---|
| DHCP client | Select to activate/deactivate DHCP client functionality.<br>**Effect**<br>If the DHCP client functionality of the web server is selected, the IP address, Subnet mask and Default gateway are set automatically.<br>▪ Identification is via the MAC address of the measuring device.<br>▪ The IP address in the **IP address** parameter is ignored as long as the **DHCP client** parameter is active. This is also the case, in particular, if the DHCP server cannot be reached. The IP address in the parameter of the same name is only used if the **DHCP client** parameter is inactive. | ▪ Off<br>▪ On | On |
| IP address | IP address of the Web server integrated in the measuring device.<br>If the DHCP client is switched off and write access is enabled, the IP address can also be entered. | 4 octet: 0 to 255 (in the particular octet) | 192.168.1.212 |
| Subnet mask | Displays the subnet mask.<br>If the DHCP client is switched off and write access is enabled, the Subnet mask can also be entered. | 4 octet: 0 to 255 (in the particular octet) | 255.255.255.0 |
| Default gateway | Displays the default gateway.<br>If the DHCP client is switched off and write access is enabled, the Default gateway can also be entered. | 4 octet: 0 to 255 (in the particular octet) | 0.0.0.0 |

### 10.5.4 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



| | |
|---|---|
| 0% bargraph value 3 | → 119 |
| 100% bargraph value 3 | → 120 |
| Value 4 display | → 120 |

### 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>▪ Conductivity *<br>▪ Corrected conductivity *<br>▪ Electronics temperature<br>▪ Totalizer 1<br>▪ Totalizer 2<br>▪ Totalizer 3<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 (→ 119) | 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 (→ 119) | 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 |
| 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 (→ 🖹 119) | None |

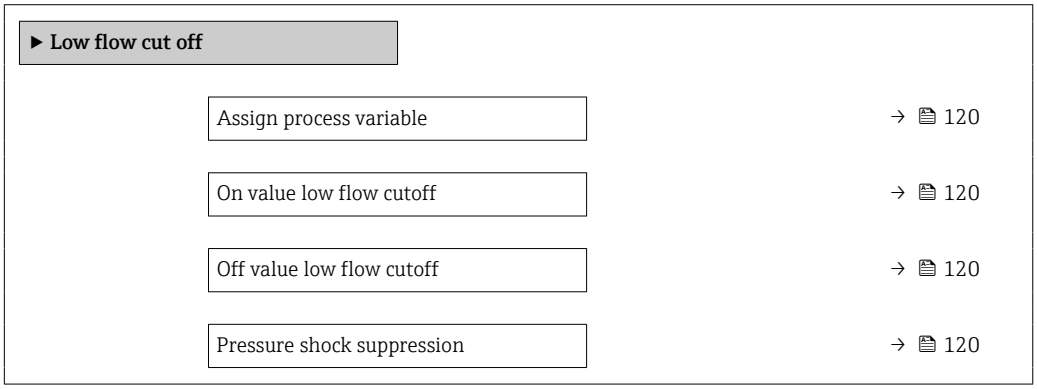
* Visibility depends on order options or device settings

## 10.5.5 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

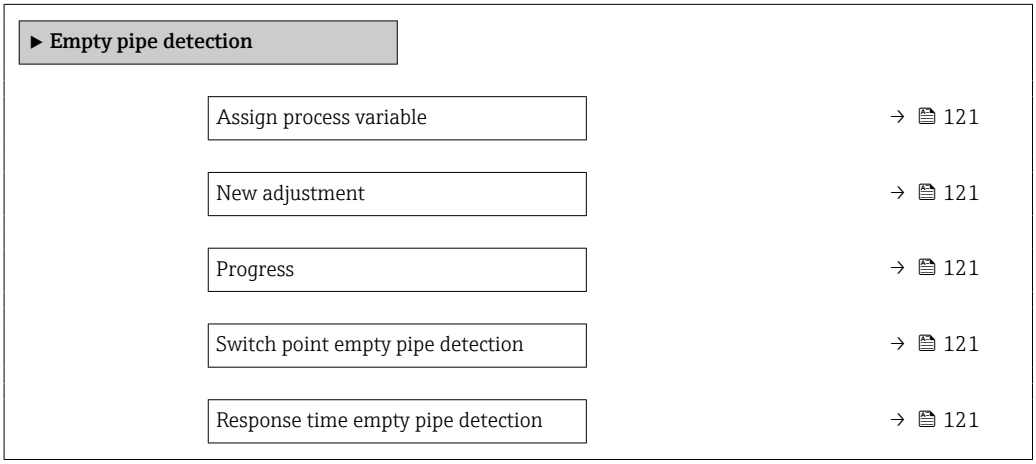
| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Assign process variable | – | Select process variable for low flow cut off. | ▪ Off<br>▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow | Volume flow |
| On value low flow cutoff | A process variable is selected in the **Assign process variable** parameter (→ 🖹 120). | 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 (→ 🖹 120). | 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 (→ 🖹 120). | Enter time frame for signal suppression (= active pressure shock suppression). | 0 to 100 s | 0 s |

### 10.5.6 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.
- It is recommended to perform a new empty pipe adjustment onsite if a cable longer than 50 meters is used.

The **Empty pipe detection** wizard guides you systematically through all the parameters that have to be set for configuring empty pipe detection.

**Navigation**
"Setup" menu → Empty pipe detection



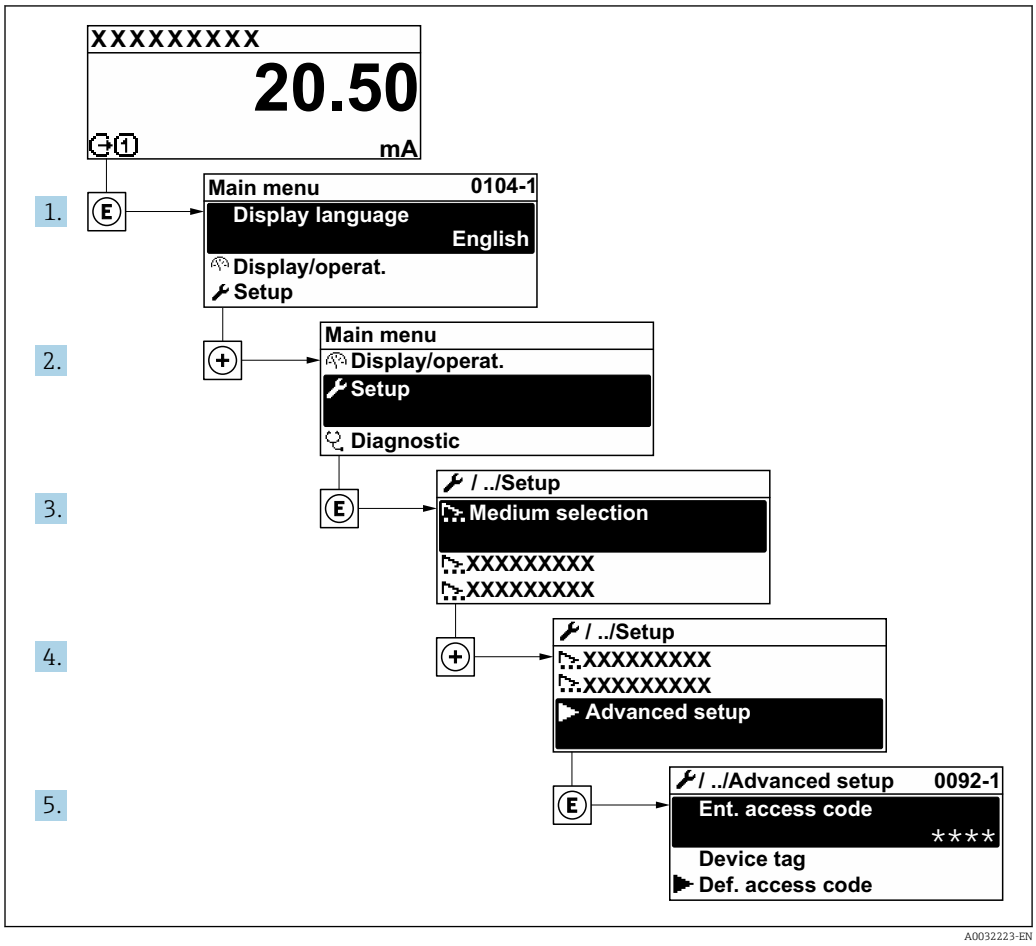

**Parameter overview with brief description**

| Parameter | Prerequisite | Description | Selection / User interface / User entry | Factory setting |
|---|---|---|---|---|
| Assign process variable | – | 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 hysteresis in %, below this value the measuring tube will detected as empty. | 0 to 100 % | 50 % |
| Response time empty pipe detection | A process variable is selected in the **Assign process variable** parameter (→ 121). | Enter the time before diagnostic message S862 "Pipe empty" is displayed for empty pipe detection. | 0 to 100 s | 1 s |

## 10.6 Advanced settings

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

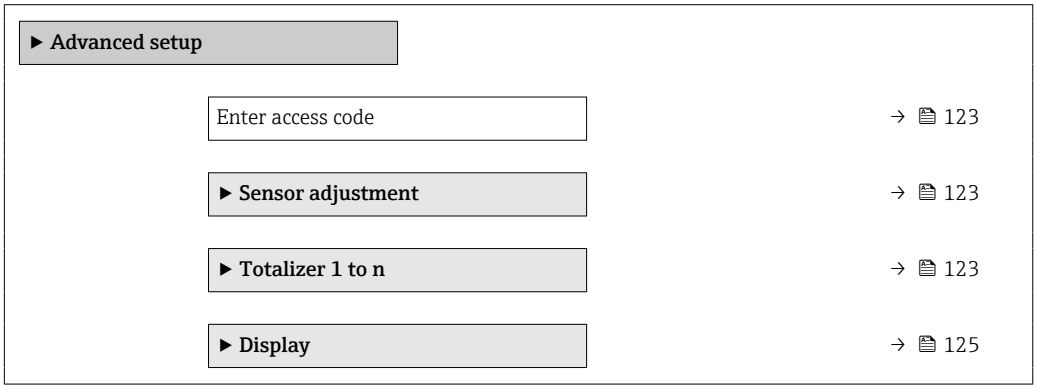
*Navigation to the "Advanced setup" submenu*

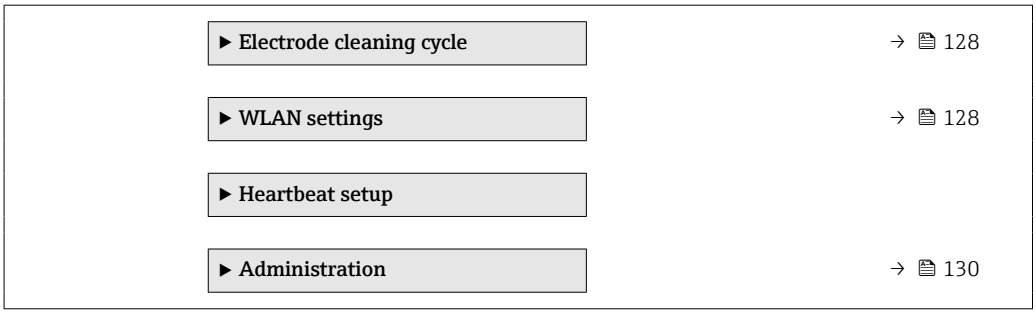



The number of submenus and parameters can vary depending on the device version. Certain submenus and parameters in these submenus are not described in the Operation Instructions. Instead a description is provided in the Special Documentation for the device (→ "Supplementary documentation" section).

### Navigation

"Setup" menu → Advanced setup






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

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

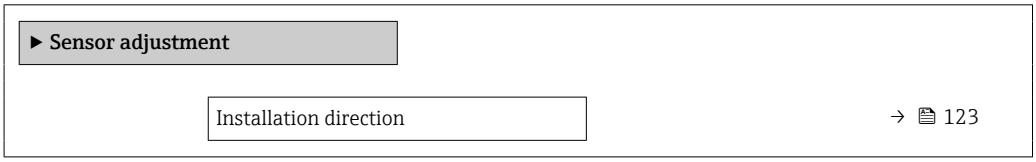
**Parameter overview with brief description**

| 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 |

### 10.6.2 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



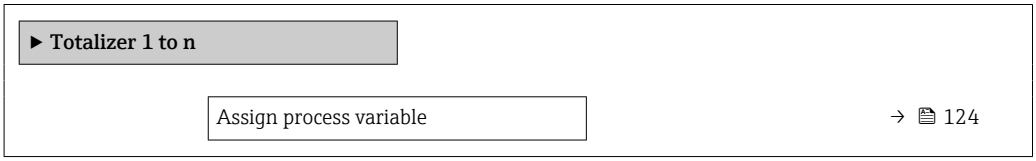

**Parameter overview with brief description**

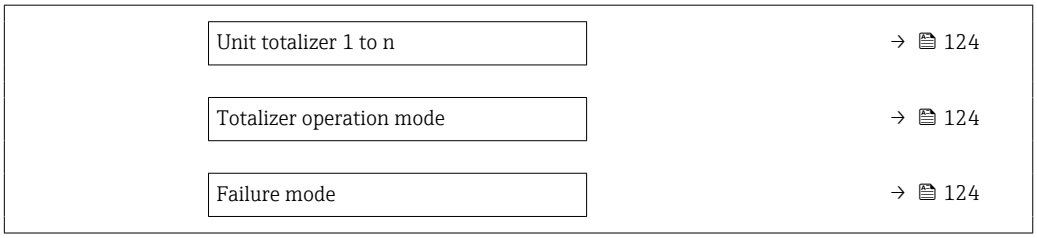
| Parameter | Description | Selection | Factory setting |
|---|---|---|---|
| Installation direction | Select sign of flow direction. | ▪ Forward flow<br>▪ Reverse flow | Forward flow |

### 10.6.3 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





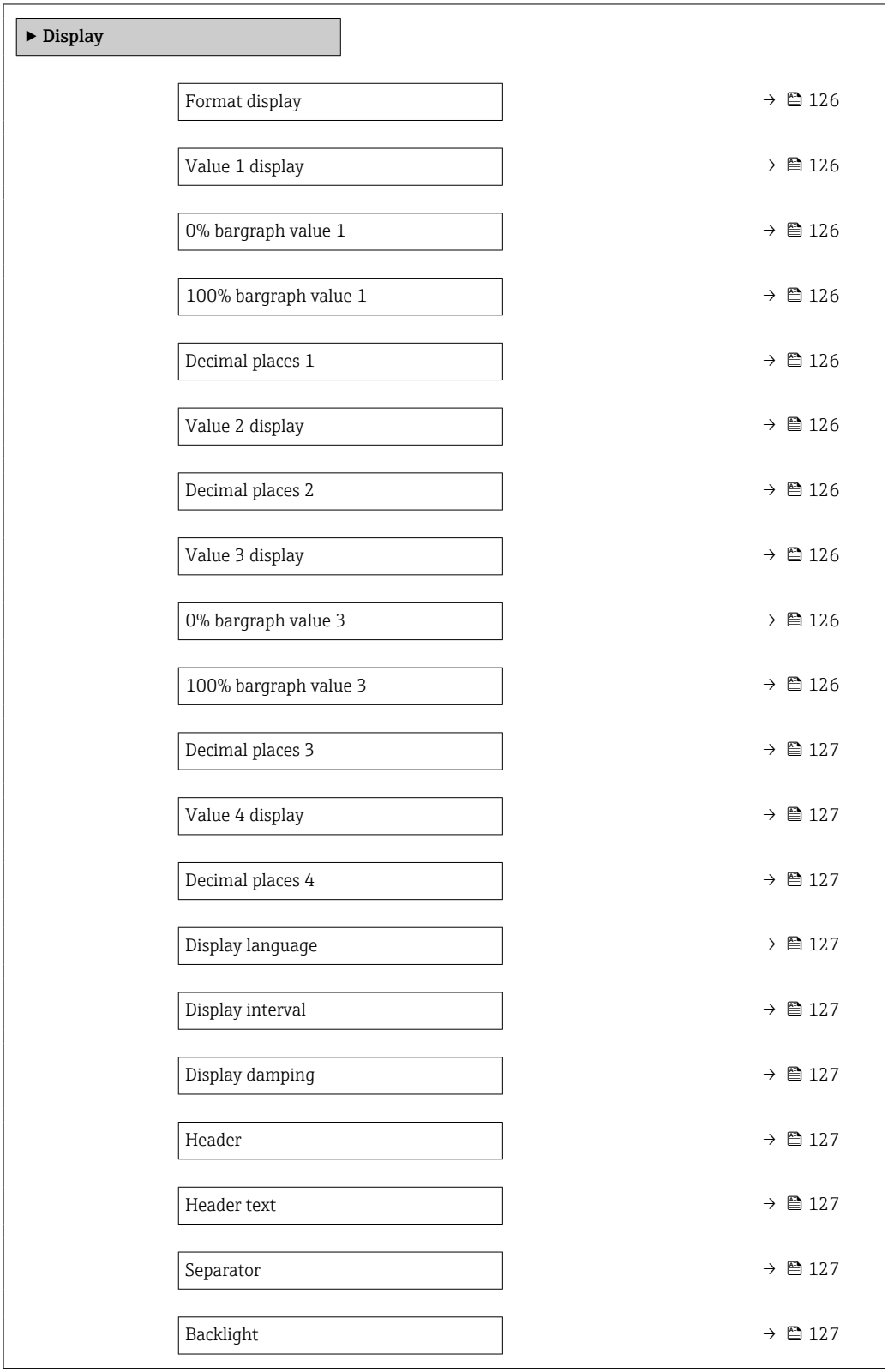

### Parameter overview with brief description

| 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 (→ 124) of the **Totalizer 1 to n** submenu. | Select the unit for the process variable of the totalizer. | Unit choose list | Country-specific:<br>▪ l<br>▪ gal (us) |
| Totalizer operation mode | A process variable is selected in the **Assign process variable** parameter (→ 124) of the **Totalizer 1 to n** submenu. | Select totalizer calculation mode. | ▪ Net flow total<br>▪ Forward flow total<br>▪ Reverse flow total | Net flow total |
| Failure mode | A process variable is selected in the **Assign process variable** parameter (→ 124) of the **Totalizer 1 to n** submenu. | Select totalizer behavior in the event of a device alarm. | ▪ Stop<br>▪ Actual value<br>▪ Last valid value | Stop |

### 10.6.4 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



## 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>▪ Conductivity *<br>▪ Corrected conductivity *<br>▪ Electronics temperature<br>▪ Totalizer 1<br>▪ Totalizer 2<br>▪ Totalizer 3<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 defined in the **Value 1 display** parameter. | Select the number of decimal places for the display value. | ▪ x<br>▪ x.x<br>▪ x.xx<br>▪ x.xxx<br>▪ x.xxxx | x.xx |
| Value 2 display | A local display is provided. | Select the measured value that is shown on the local display. | For the picklist, see the **Value 1 display** parameter (→ 🖹 119) | 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 (→ 🖹 119) | 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 |

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| 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 (→ 🖹 119) | 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 |
| 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>▪ العَرَبِيَة (Arabic) *<br>▪ Bahasa Indonesia<br>▪ ภาษาไทย (Thai) *<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 | In the **Header** parameter, the **Free text** option is selected. | Enter display header text. | Max. 12 characters such as letters, numbers or special characters (e.g. @, %, /) | ---------- |
| Separator | A local display is provided. | Select decimal separator for displaying numerical values. | ▪ . (point)<br>▪ , (comma) | . (point) |
| Backlight | A local display is provided. | Switch the local display backlight on and off. | ▪ Disable<br>▪ Enable | Enable |

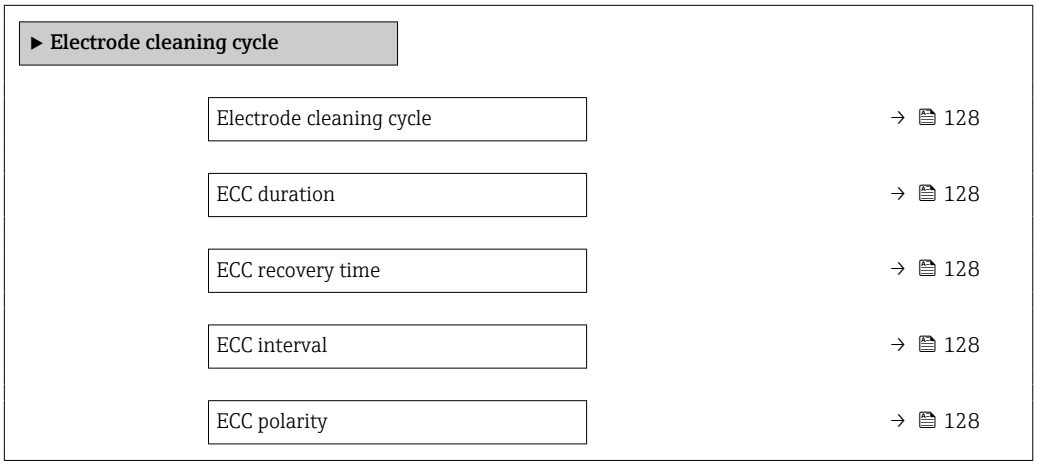
* Visibility depends on order options or device settings

### 10.6.5 Performing electrode cleaning

The **Electrode cleaning circuit** wizard guides the user systematically through all the parameters that have to be set for configuring electrode cleaning.

The wizard only appears if the device was ordered with an electrode cleaning circuit.

**Navigation**
"Setup" menu → Advanced setup → Electrode cleaning cycle



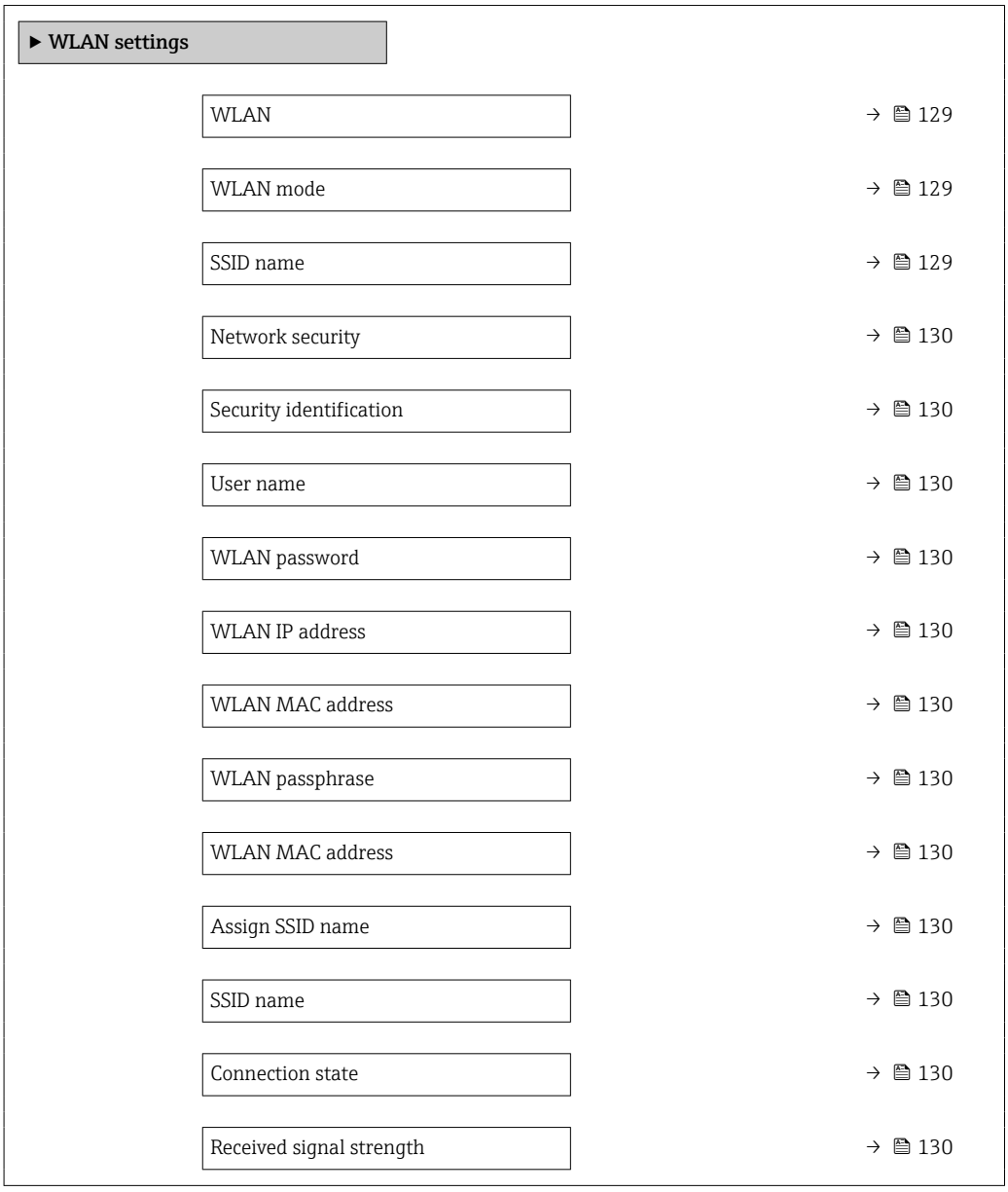

**Parameter overview with brief description**

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|---|---|---|---|---|
| Electrode cleaning cycle | For the following order code: "Application package", option **EC** "ECC electrode cleaning" | Switch electrode cleaning on or off. | ▪ Off<br>▪ On | Off |
| ECC duration | For the following order code: "Application package", option **EC** "ECC electrode cleaning" | Enter the duration of the electrode cleaning cycle. | 0.01 to 30 s | 2 s |
| ECC recovery time | For the following order code: "Application package", option **EC** "ECC electrode cleaning" | Specify the recovery time after electrode cleaning to prevent interference.The output signal values will be frozen for the duration of the recovery. | 1 to 600 s | 5 s |
| ECC interval | For the following order code: "Application package", option **EC** "ECC electrode cleaning" | Enter the pause duration between electrode cleaning cycles. | 0.5 to 168 h | 0.7 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 |

### 10.6.6 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 | WLAN access point |
| SSID name | The client is activated. | Enter the user-defined SSID name (max. 32 characters). | – | – |

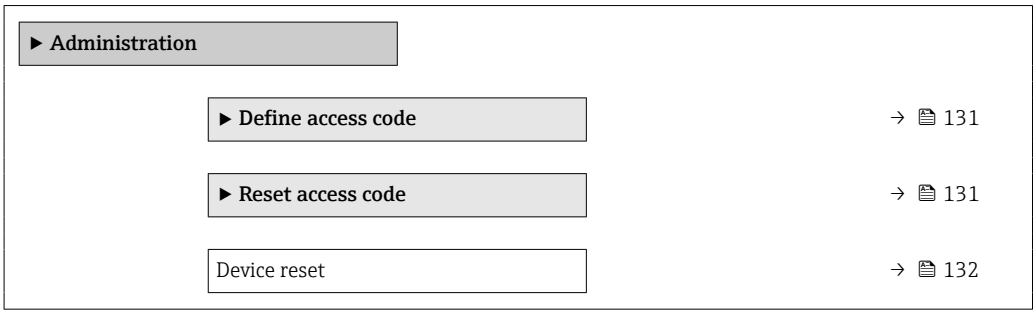
| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|---|---|---|---|---|
| Network security | – | Select the security type of the WLAN network. | ▪ Unsecured<br>▪ WPA2-PSK<br>▪ EAP-PEAP with MSCHAPv2 *<br>▪ EAP-PEAP MSCHAPv2 no server authentic. *<br>▪ 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 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) |
| 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. |
| 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 | |
| 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

### 10.6.7 Using parameters for device administration

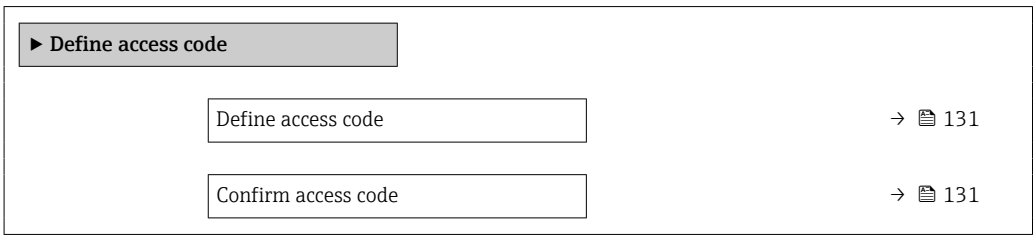
The **Administration** submenu systematically guides the user through all the parameters that can be used for device administration purposes.

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




### Using the parameter to define the access code

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

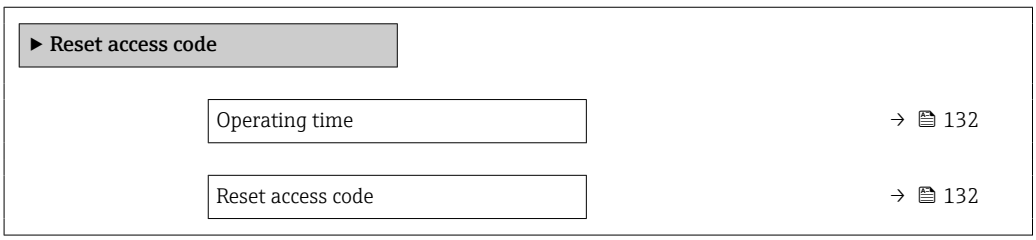



### Parameter overview with brief description

| 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 |

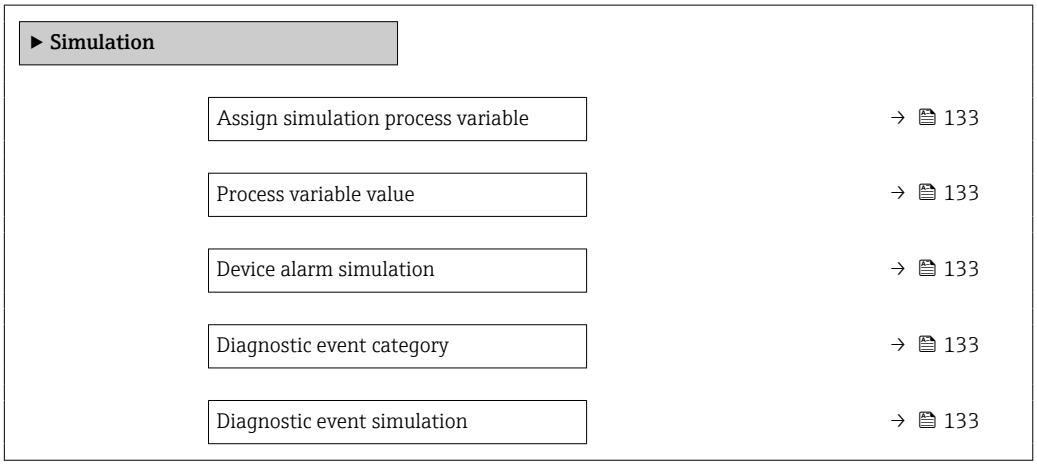
* Visibility depends on order options or device settings

## 10.7 Simulation

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

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

**Navigation**
"Diagnostics" menu → Simulation



**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 *<br>▪ Corrected conductivity *<br>▪ Temperature * | Off |
| Process variable value | A process variable is selected in the **Assign simulation process variable** parameter (→ 133). | Enter the simulation value for the selected process variable. | Depends on the process variable selected | 0 |
| Device alarm simulation | – | Switch the device alarm on and off. | ▪ Off<br>▪ On | Off |
| 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 |

* Visibility depends on order options or device settings

## 10.8 Protecting settings from unauthorized access

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

### 10.8.1 Write protection via access code

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

**Defining the access code via local display**

1. Navigate to the **Define access code** parameter (→ 131).
2. Define a max. 16-digit character string comprising numbers, letters and special characters as the access code.
3. Enter the access code again in the to confirm the code.
   ↳ The -symbol appears in front of all write-protected parameters.

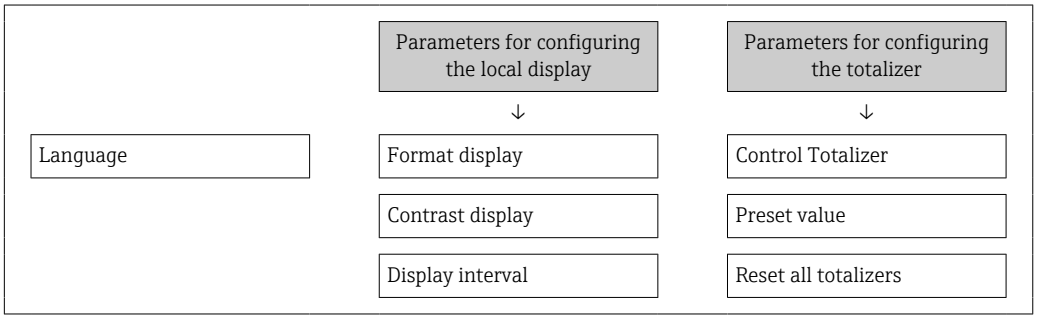
The device automatically locks the write-protected parameters again if a key is not pressed for 10 minutes in the navigation and editing view. The device locks the write-protected

parameters automatically after 60 s if the user skips back to the operational display mode from the navigation and editing view.

- If parameter write protection is activated via an access code, it can also only be deactivated via this access code → 🖹 73.
- The user role with which the user is currently logged on via the local display → 🖹 73 is indicated by the **Access status display** parameter. Navigation path: Operation → Access status display

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

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




### Defining the access code via the Web browser

1. Navigate to the **Define access code** parameter (→ 🖹 131).
2. Define a max. 16-digit numeric code as an access code.
3. Enter the access code again in the to confirm the code.
   ↳ The Web browser switches to the login page.

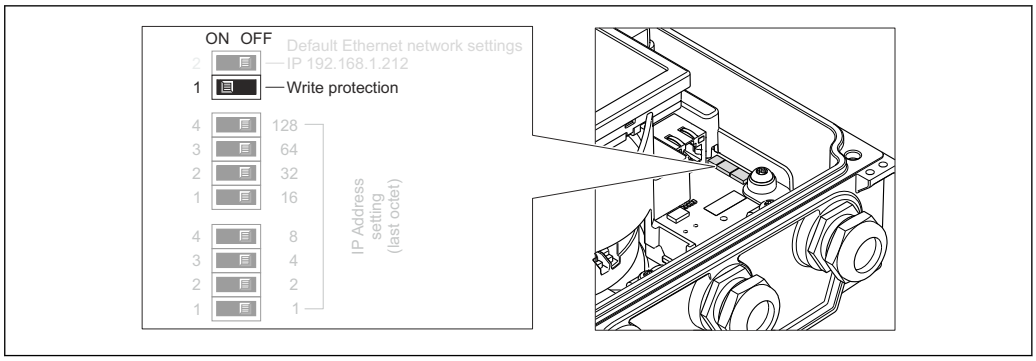
If no action is performed for 10 minutes, the Web browser automatically returns to the login page.

- If parameter write protection is activated via an access code, it can also only be deactivated via this access code → 🖹 73.
- The user role with which the user is currently logged on via Web browser is indicated by the **Access status tooling** parameter. Navigation path: Operation → Access status tooling

## 10.8.2 Write protection via write protection switch

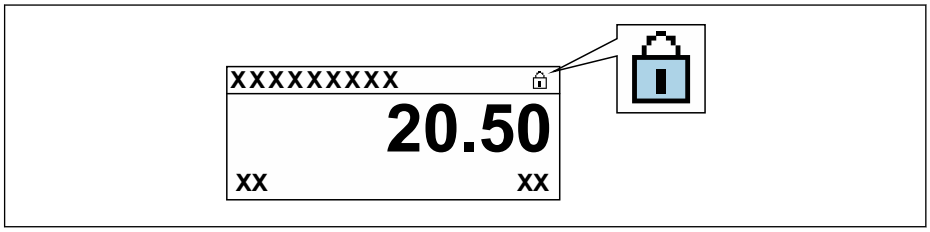
Unlike parameter write protection via a user-specific access code, this allows the user to lock write access to the entire operating menu - apart from the **"Contrast display" parameter**.

The parameter values are now read only and cannot be edited any more (exception **"Contrast display" parameter**):
- Via local display
- Via EtherNet/IP protocol




A0023059

1. Loosen the 4 fixing screws on the housing cover and open the housing cover.
2. Setting the write protection switch (WP) on the main electronics module to the **ON** position enables the hardware write protection. Setting the write protection switch (WP) on the main electronics module to the **OFF** position (factory setting) disables the hardware write protection.
   ↳ If the hardware write protection is enabled: The **Hardware locked** option is displayed in the **Locking status** parameter . In addition, on the local display the 🔒 symbol appears in front of the parameters in the header of the operational display and in the navigation view.

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

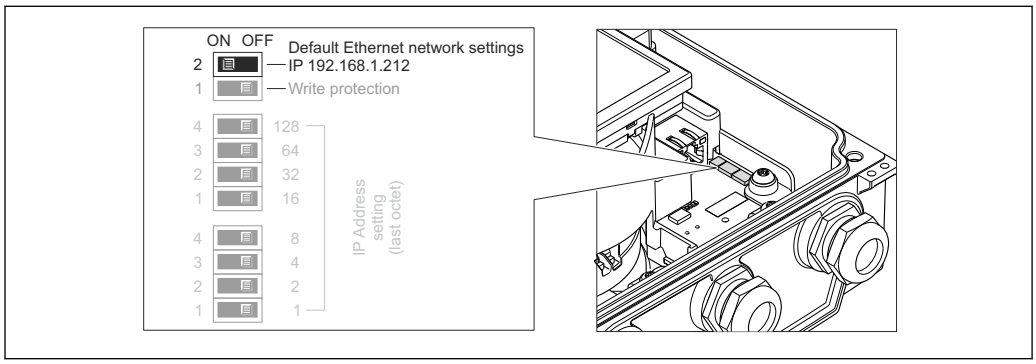
3. **⚠ WARNING**
   **Excessive tightening torque applied to the fixing screws!**
   Risk of damaging the plastic transmitter.
   ▶ Tighten the fixing screws as per the tightening torque .

   Reverse the removal procedure to reassemble the transmitter.

# 11 Operation

## 11.1 Read out and modify current Ethernet settings

If the Ethernet settings such as the IP address of the measuring device are unknown, they can be read out and modified as explained in the following example for an IP address.




**Prerequisite**

- Software addressing is enabled: All the DIP switches for hardware addressing are set to **OFF**.
- Measuring device is switched on.

1. Set the DIP switch for "Default Ethernet network settings, IP 192.168.1.212" from **OFF** → **ON**.
2. Restart the device.
   ↳ The device's Ethernet settings are reset to their factory settings: IP address: 192.168.1.212; Subnet mask: 255.255.255.0; Default gateway: 192.168.1.212
3. Enter the default setting for the IP address in the address line of the Web browser.
4. Navigate to **IP address** parameter in the operating menu: Setup → Communication → IP address
   ↳ The parameter displays the configured IP address.
5. Change the IP address of the device if necessary.
6. Set the DIP switch for "Default Ethernet network settings, IP 192.168.1.212" from **ON** → **OFF**.
7. Restart the device.
   ↳ The modified IP address of the device is now enabled.

## 11.2 Reading the device locking status

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

Operation → Locking status

*Function scope of the "Locking status" parameter*

| Options | Description |
|---|---|
| None | The access status displayed in the **Access status display** parameter applies → 🖹 73. Only appears on local display. |
| Hardware locked | The DIP switch for hardware locking is activated on the main electronics module. This locks write access to the parameters (e.g. via local display or operating tool) → 🖹 134. |
| 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. |

## 11.3 Adjusting the operating language

Detailed information:
- To configure the operating language → 🖹 113
- For information on the operating languages supported by the measuring device → 🖹 199

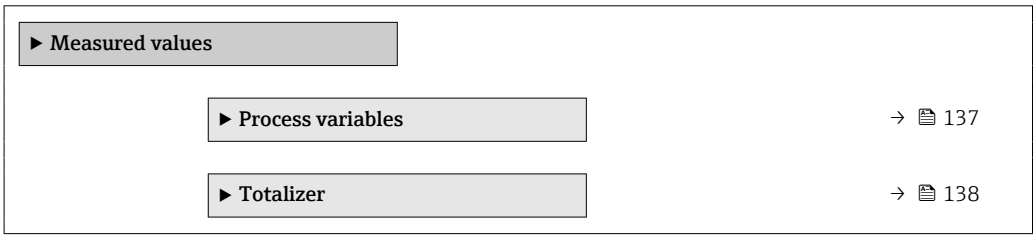
## 11.4 Configuring the display

Detailed information:
- On the basic settings for the local display → 🖹 118
- On the advanced settings for the local display → 🖹 125

## 11.5 Reading measured values

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

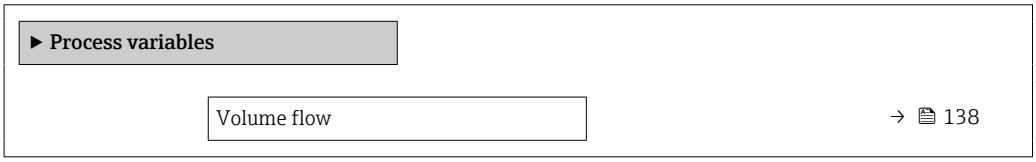
**Navigation**
"Diagnostics" menu → Measured values → Output values

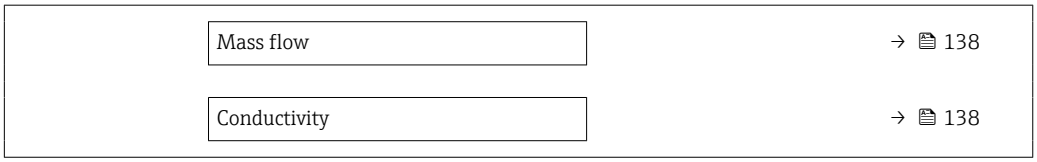



### 11.5.1 Process variables

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

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






### Parameter overview with brief description

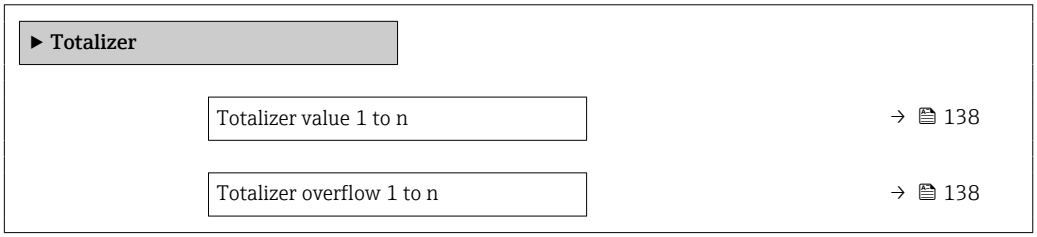
| Parameter | Prerequisite | Description | User interface |
|---|---|---|---|
| Volume flow | – | Displays the volume flow that is currently measured.<br>*Dependency*<br>The unit is taken from the **Volume flow unit** parameter (→ 116). | Signed floating-point number |
| Mass flow | – | Displays the mass flow that is currently calculated.<br>*Dependency*<br>The unit is taken from the **Mass flow unit** parameter (→ 117). | Signed floating-point number |
| Conductivity | The **On** option is selected in the **Conductivity measurement** parameter. | Displays the conductivity that is currently measured.<br>*Dependency*<br>The unit is taken from the **Conductivity unit** parameter (→ 116). | Signed floating-point number |

## 11.5.2 "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

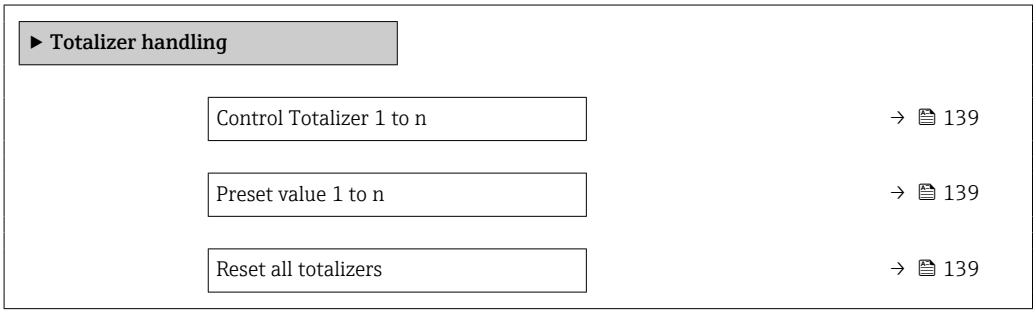
| Parameter | Prerequisite | Description | User interface |
|---|---|---|---|
| Totalizer value 1 to n | One of the following options is selected in the **Assign process variable** parameter (→ 124) of the **Totalizer 1 to n** submenu:<br>▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow | Displays the current totalizer counter reading. | Signed floating-point number |
| Totalizer overflow 1 to n | One of the following options is selected in the **Assign process variable** parameter (→ 124) of the **Totalizer 1 to n** submenu:<br>▪ Volume flow<br>▪ Mass flow<br>▪ Corrected volume flow | Displays the current totalizer overflow. | Integer with sign |

## 11.6 Adapting the measuring device to the process conditions

The following are available for this purpose:
- Basic settings using the **Setup** menu (→ 114)
- Advanced settings using the **Advanced setup** submenu (→ 122)

## 11.7 Performing a totalizer reset

**Navigation**
"Operation" menu → Totalizer handling




**Parameter overview with brief description**

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Control Totalizer 1 to n | A process variable is selected in the **Assign process variable** parameter (→ 124) 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 (→ 124) 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 (→ 124). | Signed floating-point number | 0 l |
| Reset all totalizers | – | Reset all totalizers to 0 and start. | ▪ Cancel<br>▪ Reset + totalize | Cancel |

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

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

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

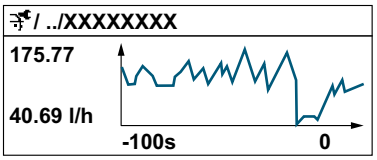
| Options | Description |
|---|---|
| Cancel | No action is executed and the user exits the parameter. |
| Reset + totalize | Resets all totalizers to 0 and restarts the totaling process. This deletes all the flow values previously totalized. |

## 11.8 Showing 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 → 83.
- Web browser

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

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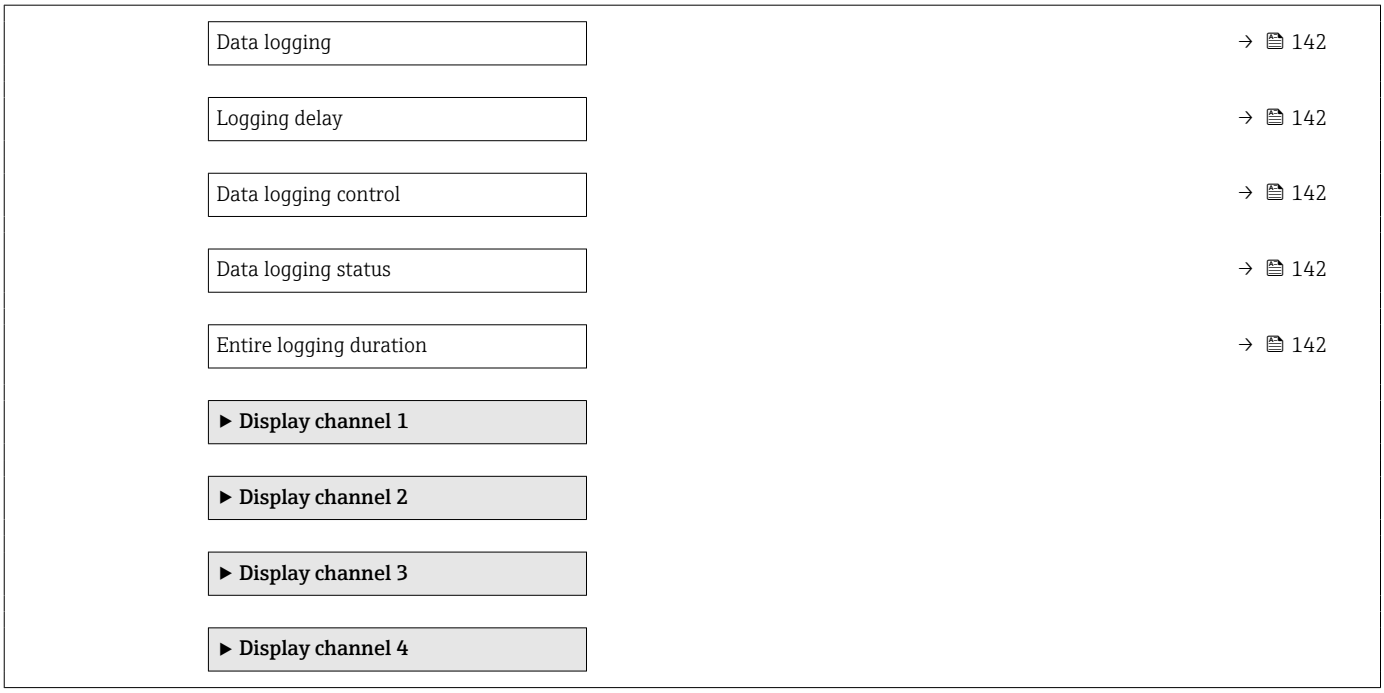
- x-axis: depending on the number of channels selected displays 250 to 1000 measured values of a process variable.
- y-axis: displays the approximate measured value span and constantly adapts this to the ongoing measurement.

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 | → 141 |
| Assign channel 2 | → 141 |
| Assign channel 3 | → 142 |
| Assign channel 4 | → 142 |
| Logging interval | → 142 |
| Clear logging data | → 142 |




## 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>▪ Corrected conductivity *<br>▪ Temperature<br>▪ Electronics temperature<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 | 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 process variable to logging channel. | For the picklist, see the **Assign channel 1** parameter (→ 141) | Off |

| Parameter | Prerequisite | Description | Selection / User entry / User interface | Factory setting |
|---|---|---|---|---|
| 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 process variable to logging channel. | For the picklist, see the **Assign channel 1** parameter (→ 141) | 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 process variable to logging channel. | For the picklist, see the **Assign channel 1** parameter (→ 141) | 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 |
| Clear logging data | The **Extended HistoROM** application package is available. | Clear the entire logging data. | ▪ Cancel<br>▪ Clear data | Cancel |
| Data logging | – | Select the data logging method. | ▪ 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 → 49. |
| Local display dark and no output signals | No contact between connecting cables and terminals. | Check the connection of the cables and correct if necessary. |
| Local display dark and no output signals | Terminals are not plugged into the main electronics module correctly. | Check terminals. |
| Local display dark and no output signals | Main electronics module is defective. | Order spare part → 169. |
| Local display dark and no output signals | The connector between the main electronics module and display module is not plugged in correctly. | Check the connection and correct if necessary. |
| Local display dark and no output signals | The connecting cable is not plugged in correctly. | 1. Check the connection of the electrode cable and correct if necessary.<br>2. Check the connection of the coil current cable and correct if necessary. |
| Local display is dark, but signal output is within the valid range | Display is set too bright or too dark. | ▪ Set the display brighter by simultaneously pressing ⊞ + Ⓔ.<br>▪ Set the display darker by simultaneously pressing ⊟ + Ⓔ. |
| Local display is dark, but signal output is within the valid range | Display module is defective. | Order spare part → 169. |
| Backlighting of local display is red | Diagnostic event with "Alarm" diagnostic behavior has occurred. | Take remedial measures → 152 |
| 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 (→ 127). |
| 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 → 169. |

*For output signals*

| Error | Possible causes | Solution |
|---|---|---|
| Signal output outside the valid range | Main electronics module is defective. | Order spare part → 169. |
| Device shows correct value on local display, but signal output is incorrect, though in the valid range. | Configuration error | Check and correct the parameter configuration. |
| Device measures incorrectly. | Configuration error or device is operated outside the application. | 1. Check and correct parameter configuration.<br>2. Observe limit values specified in the "Technical Data". |

*For access*

| Error | Possible causes | Remedial action |
|---|---|---|
| No write access to parameters | Hardware write protection enabled | Set the write protection switch on the main electronics module to the **OFF** position → 🖹 134. |
| No write access to parameters | Current user role has limited access authorization | 1. Check user role → 🖹 73.<br>2. Enter correct customer-specific access code → 🖹 73. |
| No connection via EtherNet/IP | Device plug connected incorrectly | Check the pin assignment of the device plug . |
| 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→ 🖹 80. |
| | Incorrect settings for the Ethernet interface of the computer | 1. Check the properties of the Internet protocol (TCP/IP) → 🖹 76→ 🖹 76.<br>2. Check the network settings with the IT manager. |
| No connection to Web server | ▪ Incorrect IP address<br>▪ IP address is not known | 1. If addressing via hardware: open the transmitter and check the IP address configured (last octet).<br>2. Check the IP address of the measuring device with the network manager.<br>3. If the IP address is not known, set DIP switch no. 10 to ON, restart the device and enter the factory IP address 192.168.1.212.<br>EtherNet/IP communication is interrupted by enabling the DIP switch. |
| | Web browser setting "Use a Proxy Server for Your LAN" is enabled | Disable the use of the proxy server in the Web browser settings of the computer.<br>Using the example of MS Internet Explorer:<br>1. Under *Control Panel* open *Internet options*.<br>2. Select the *Connections* tab and then double-click *LAN settings*.<br>3. In the *LAN settings* disable the use of the proxy server and select *OK* to confirm. |
| | Apart from the active network connection to the measuring device, other network connections are also being used. | ▪ Make sure that no other network connections are established by the computer (also no WLAN) and close other programs with network access on the computer.<br>▪ If using a docking station for notebooks, make sure that a network connection to another network is not active. |
| Web browser frozen and operation no longer possible | Data transfer active | Wait until data transfer or current action is finished. |
| | Connection lost | 1. Check cable connection and power supply.<br>2. Refresh the Web browser and restart if necessary. |

| Error | Possible causes | Remedial action |
|---|---|---|
| Content of Web browser incomplete or difficult to read | Not using optimum version of Web server. | 1. Use the correct Web browser version → 🖹 74.<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://192.168.1.212/basic.html as the IP address. |
| Operation with FieldCare or DeviceCare via CDI-RJ45 service interface (port 8000) | Firewall of computer or network is preventing communication | Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access. |
| Flashing of firmware with FieldCare or DeviceCare via CDI-RJ45 service interface (via port 8000 or TFTP ports) | Firewall of computer or network is preventing communication | Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access. |

## 12.2 Diagnostic information via light emitting diodes

### 12.2.1 Transmitter

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

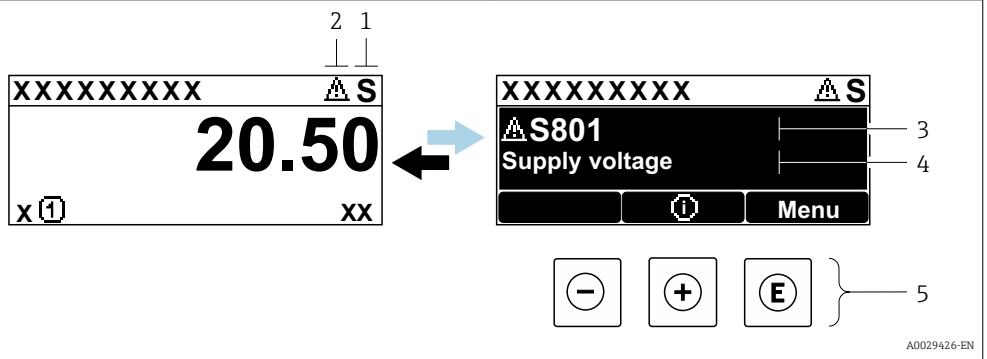
| LED | Color | Meaning |
|---|---|---|
| Supply voltage | Off | Supply voltage is off or too low |
| | Green | Supply voltage is ok |
| Device status | Green | Device status is ok |
| | Flashing red | A device error of diagnostic behavior "Warning" has occurred |
| | Red | A device error of diagnostic behavior "Alarm" has occurred |
| | Alternately flashing red/ green | Boot loader is active |
| Network status | Off | Device has no EtherNet/IP address |
| | Green | Device's EtherNet/IP connection is active |
| | Flashing green | Device has EtherNet/IP address but no EtherNet/IP connection |
| | Red | EtherNet/IP address of the device has been assigned twice |
| | Flashing red | Device's EtherNet/IP connection is in timeout mode |
| Link/Activity | Orange | Link available but no activity |
| | Flashing orange | Activity present |
| Alarm | Green | Measuring device is ok |
| | Flashing green | Measuring device not configured |
| | Off | Firmware error |
| | Red | Main error |
| | Flashing red | Error |
| | Flashing red/green | Start measuring device |

## 12.3 Diagnostic information on local display

### 12.3.1 Diagnostic message

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

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




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

If two or more diagnostic events are pending simultaneously, only the message of the diagnostic event with the highest priority is shown.

Other diagnostic events that have occurred can be displayed in the **Diagnostics** menu:
- Via parameter → 161
- Via submenus → 162

#### 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

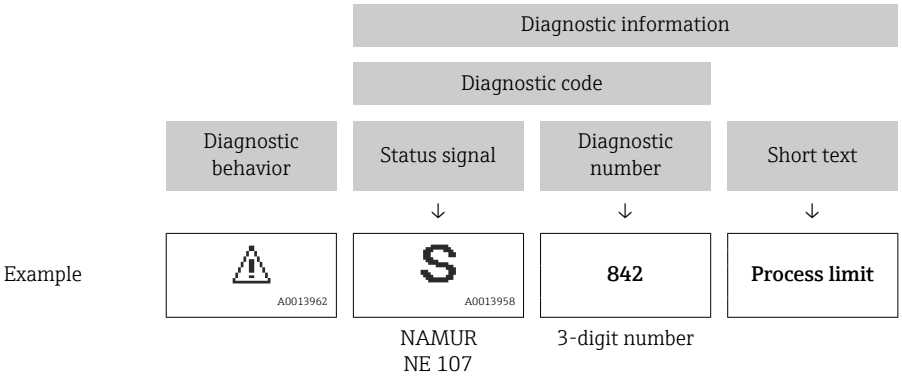
| Symbol | Meaning |
|---|---|
| F | **Failure**<br>A device error has occurred. The measured value is no longer valid. |
| C | **Function check**<br>The device is in service mode (e.g. during a simulation). |
| S | **Out of specification**<br>The device is operated:<br>Outside its technical specification limits (e.g. outside the process temperature range) |
| M | **Maintenance required**<br>Maintenance is required. The measured value remains valid. |

### Diagnostic behavior

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

### Diagnostic information

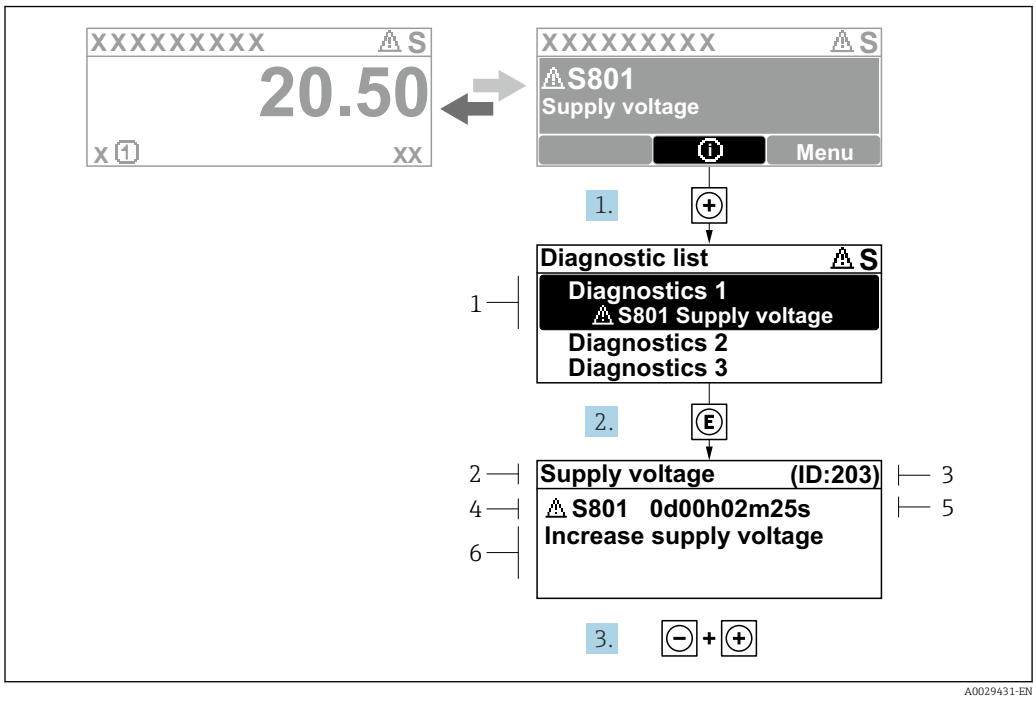
The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.




### Operating elements

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

### 12.3.2 Calling up remedial measures




21 *Message about remedial measures*

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

1. The user is in the diagnostic message.
   Press ⊞ (ⓘ symbol).
   ↳ The **Diagnostic list** submenu opens.
2. Select the desired diagnostic event with ⊞ or ⊟ and press Ⓔ .
   ↳ The message about the remedial measures opens.
3. Press ⊟ + ⊞ simultaneously.
   ↳ The message about the remedial measures closes.

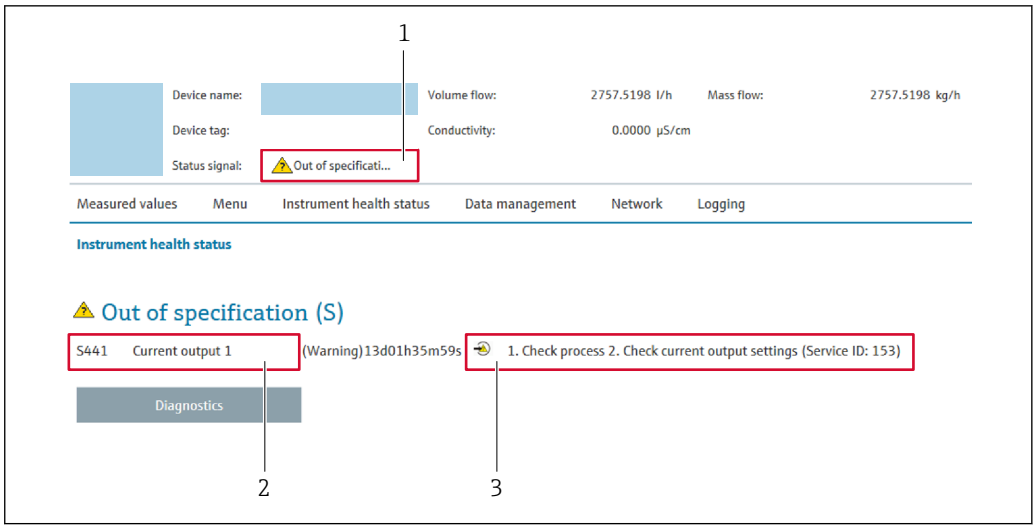
The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the **Diagnostic list** submenu or **Previous diagnostics** parameter.

1. Press Ⓔ.
   ↳ The message for the remedial measures for the selected diagnostic event opens.
2. Press ⊟ + ⊞ simultaneously.
   ↳ The message for the remedial measures closes.

## 12.4 Diagnostic information in the Web browser

### 12.4.1 Diagnostic options

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

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*1 Status area with status signal*
*2 Diagnostics information → 147*
*3 Remedial measures with service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter → 161
- Via submenu → 162

### Status signals

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

| Symbol | Meaning |
|---|---|
| | **Failure**<br>A device error has occurred. The measured value is no longer valid. |
| | **Function check**<br>The device is in service mode (e.g. during a simulation). |
| | **Out of specification**<br>The device is operated:<br>Outside its technical specification limits (e.g. outside the process temperature range) |
| | **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.

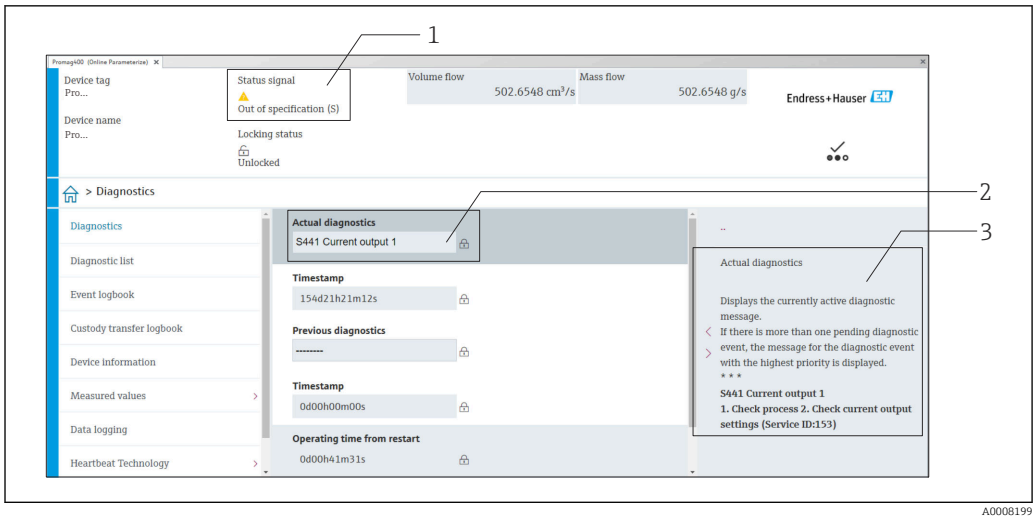
## 12.4.2 Calling up remedy information

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.

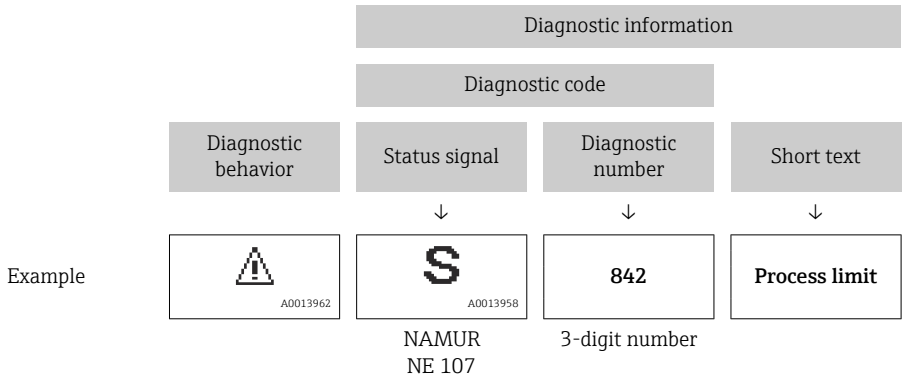



1 *Status area with status signal* → 🖹 *146*
2 *Diagnostics information* → 🖹 *147*
3 *Remedial measures with service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter → 🖹 161
- Via submenu → 🖹 162

### 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 Diagnostic information via communication interface

### 12.6.1 Reading out diagnostic information

The current diagnostic event and associated diagnostic information can be read out: **Input Assembly Fix** → 🖹 89

| Input Fix Assembly byte 1 to 8 | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| File header (not visible) | | | | Diagnostic number → 🖹 104 | | Status signal → 🖹 89 | – |

## 12.7 Adapting the diagnostic information

### 12.7.1 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

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

| Options | Description |
|---|---|
| Alarm | The device stops measurement. The 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 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. |

## 12.8 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 diagnostic behavior can be changed. Adapting the diagnostic information → 151

### 12.8.1 Diagnostic of sensor

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 043 | Sensor short circuit | | 1. Check sensor cable and sensor<br>2. Execute Heartbeat Verification<br>3. Replace sensor cable or sensor | 0x8000153 |
| | Status signal | S | | |
| | Diagnostic behavior [from the factory] [1] | Warning | | |

1) Diagnostic behavior can be changed.

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 082 | Data storage | | 1. Check module connections<br>2. Change electronic modules | 0x10000E7 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 083 | Memory content | | 1. Restart device<br>2. Restore HistoROM S-DAT backup ('Device reset' parameter)<br>3. Replace HistoROM S-DAT | 0x10000A0 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 168 | Build-up limit exceeded | | Clean measuring tube | 0x40003D0 |
| | Status signal | M | | |
| | Diagnostic behavior | Warning | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 169 | Conductivity measurement failed | | 1. Check grounding conditions<br>2. Deactivate conductivity measurement | 0x400038A |
| | Status signal | M | | |
| | Diagnostic behavior | Warning | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 170 | Coil resistance | | Check ambient and process temperature | ▪ 0x10002D8<br>▪ 0x10002D9 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 180 | Temperature sensor defective | | 1. Check sensor connections<br>2. Replace sensor cable or sensor<br>3. Turn off temperature measurement | ▪ 0x10000D5<br>▪ 0x10000D6 |
| | Status signal | F | | |
| | Diagnostic behavior | Warning | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 181 | Sensor connection | | 1. Check sensor cable and sensor<br>2. Execute Heartbeat Verification<br>3. Replace sensor cable or sensor | ▪ 0x100011C<br>▪ 0x10002E0 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

## 12.8.2 Diagnostic of electronic

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 201 | Device failure | | Restart device | 0x100014B |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 242 | Software incompatible | | 1. Check software<br>2. Flash or change main electronic module | 0x1000067 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 252 | Modules incompatible | | 1. Check electronic modules<br>2. Check if correct modules are available (e.g. NEx, Ex)<br>3. Replace electronic modules | 0x100006B |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 252 | Modules incompatible | | 1. Check if correct electronic module is plugged<br>2. Replace electronic module | 0x10002C0 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 262 | Sensor electronics connection faulty | | 1. Check/replace connection cable between sensor electronic module (ISEM) and main electr.<br>2. Check/replace module cartridge, ISEM, main electr. | 0x1000149 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 270 | Main electronics failure | | Change main electronic module | ▪ 0x100007C<br>▪ 0x1000080<br>▪ 0x100009F |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 271 | Main electronics failure | | 1. Restart device<br>2. Change main electronic module | 0x100007D |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 272 | Main electronics failure | | Restart device | 0x1000079 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 273 | Main electronics failure | | Change electronics | ▪ 0x1000098<br>▪ 0x10000E5 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 275 | I/O module defective | | Change I/O module | 0x100007A |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 276 | I/O module faulty | | 1. Restart device<br>2. Change I/O module | ▪ 0x100007B<br>▪ 0x1000081 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 283 | Memory content | | Reset device | 0x10000E1 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 283 | Memory content | | Restart device | 0x100016F |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 302 | Device verification in progress | | Device verification active, please wait. | 0x20001EE |
| | Status signal | C | | |
| | Diagnostic behavior | Warning | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 311 | Electronic failure | | 1. Do not reset device<br>2. Contact service | 0x40000E2 |
| | Status signal | M | | |
| | Diagnostic behavior | Warning | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 372 | Sensor electronics (ISEM) faulty | | 1. Restart device<br>2. Check if failure recurs<br>3. Replace sensor electronic module (ISEM) | ▪ 0x10002CB<br>▪ 0x10002CC<br>▪ 0x10002CD<br>▪ 0x10002CE<br>▪ 0x10002CF<br>▪ 0x10002D0 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 373 | Sensor electronics (ISEM) faulty | | Transfer data or reset device | 0x10002D1 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 376 | Sensor electronics (ISEM) faulty | | 1. Replace sensor electronic module (ISEM)<br>2. Turn off diagnostic message | ▪ 0x8000119<br>▪ 0x800016A<br>▪ 0x80002DA<br>▪ 0x80002DB<br>▪ 0x80002DC<br>▪ 0x80002DD<br>▪ 0x80002DF |
| | Status signal | S | | |
| | Diagnostic behavior [from the factory] [1] | Warning | | |

1) Diagnostic behavior can be changed.

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 377 | Sensor electronics (ISEM) 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 | 0x80002DE |
| | Status signal | S | | |
| | Diagnostic behavior [from the factory] [1] | Warning | | |

1) Diagnostic behavior can be changed.

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 378 | Supply voltage ISEM faulty | | Check supply voltage to the ISEM | 0x10003F0 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 382 | Data storage | | 1. Insert T-DAT<br>2. Replace T-DAT | 0x100016D |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 383 | Memory content | | 1. Restart device<br>2. Delete T-DAT via 'Reset device' parameter<br>3. Replace T-DAT | 0x100016E |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 387 | HistoROM data faulty | | Contact service organization | 0x1000288 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 512 | Sensor electronics (ISEM) faulty | | 1. Check ECC recovery time<br>2. Turn off ECC | 0x1000120 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

### 12.8.3 Diagnostic of configuration

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 410 | Data transfer | | 1. Check connection<br>2. Retry data transfer | 0x100008B |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 412 | Processing download | | Download active, please wait | 0x2000204 |
| | Status signal | C | | |
| | Diagnostic behavior | Warning | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 437 | Configuration incompatible | | Restart device | 0x1000060 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 438 | Dataset | | 1. Check data set file<br>2. Check device configuration<br>3. Up- and download new configuration | 0x400006A |
| | Status signal | M | | |
| | Diagnostic behavior | Warning | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 453 | Flow override | | Deactivate flow override | 0x2000094 |
| | Status signal | C | | |
| | Diagnostic behavior | Warning | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 484 | Failure mode simulation | | Deactivate simulation | 0x2000090 |
| | Status signal | C | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 485 | Measured variable simulation | | Deactivate simulation | 0x2000093 |
| | Status signal | C | | |
| | Diagnostic behavior | Warning | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 491 | Current output 1 simulation | | Deactivate simulation | 0x200000E |
| | Status signal | C | | |
| | Diagnostic behavior | Warning | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 495 | Diagnostic event simulation | | Deactivate simulation | 0x200015E |
| | Status signal | C | | |
| | Diagnostic behavior | Warning | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 511 | ISEM settings faulty | | 1. Check measuring period and integration time<br>2. Check sensor properties | 0x200031C |
| | Status signal | C | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 530 | Electrode cleaning is running | | Turn off ECC | 0x200015A |
| | Status signal | C | | |
| | Diagnostic behavior | Warning | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 531 | Empty pipe adjustment faulty | | Execute EPD adjustment | 0x800016B |
| | Status signal | S | | |
| | Diagnostic behavior [from the factory] [1] | Warning | | |

1) Diagnostic behavior can be changed.

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 537 | Configuration | | 1. Check IP addresses in network<br>2. Change IP address | 0x100014A |
| | Status signal | F | | |
| | Diagnostic behavior | Warning | | |

### 12.8.4 Diagnostic of process

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 832 | Electronics temperature too high | | Reduce ambient temperature | 0x80000C3 |
| | Status signal | S | | |
| | Diagnostic behavior [from the factory] [1] | Warning | | |

1) Diagnostic behavior can be changed.

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 833 | Electronics temperature too low | | Increase ambient temperature | 0x80000C1 |
| | Status signal | S | | |
| | Diagnostic behavior [from the factory] [1] | Warning | | |

1) Diagnostic behavior can be changed.

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 834 | Process temperature too high | | Reduce process temperature | 0x80000C5 |
| | Status signal | S | | |
| | Diagnostic behavior [from the factory] [1] | Warning | | |

1) Diagnostic behavior can be changed.

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 835 | Process temperature too low | | Increase process temperature | 0x80000C6 |
| | Status signal | S | | |
| | Diagnostic behavior [from the factory] [1] | Warning | | |

1) Diagnostic behavior can be changed.

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 842 | Process limit | | Low flow cut off active!<br>1. Check low flow cut off configuration | 0x8000091 |
| | Status signal | S | | |
| | Diagnostic behavior [from the factory] [1] | Warning | | |

1) Diagnostic behavior can be changed.

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 882 | Input signal | | 1. Check input configuration<br>2. Check external device or process conditions | 0x1000031 |
| | Status signal | F | | |
| | Diagnostic behavior | Alarm | | |

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 937 | Sensor symmetry | | 1. Eliminate external magnetic field near sensor<br>2. Turn off diagnostic message | 0x8000154 |
| | Status signal | S | | |
| | Diagnostic behavior [from the factory] [1] | Warning | | |

1) Diagnostic behavior can be changed.

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 938 | EMC interference | | 1. Check ambient conditions regarding EMC influence<br>2. Turn off diagnostic message | 0x100011B |
| | Status signal | F | | |
| | Diagnostic behavior [from the factory] [1] | Alarm | | |

1) Diagnostic behavior can be changed.

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 961 | Electrode potential out of specification | | 1. Check process conditions<br>2. Check ambient conditions | 0x8000155 |
| | Status signal | S | | |
| | Diagnostic behavior [from the factory] [1] | Warning | | |

1) Diagnostic behavior can be changed.

| Diagnostic information | | | Remedy instructions | Coding of diagnostic information (hex) |
|---|---|---|---|---|
| No. | Short text | | | |
| 962 | Pipe empty | | 1. Perform full pipe adjustment<br>2. Perform empty pipe adjustment<br>3. Turn off empty pipe detection | 0x8000092 |
| | Status signal | S | | |
| | Diagnostic behavior [from the factory] [1] | Warning | | |

1) Diagnostic behavior can be changed.

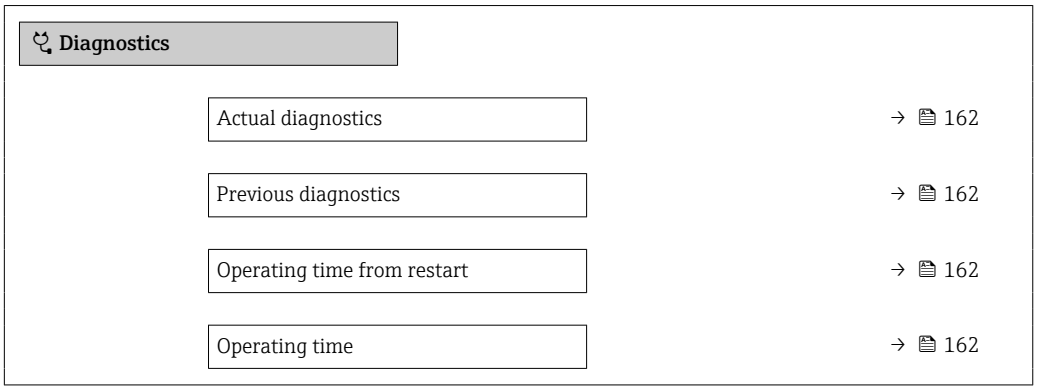
## 12.9 Pending diagnostic events

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 → 148
- Via web browser → 149
- Via "FieldCare" operating tool → 150
- Via "DeviceCare" operating tool → 150

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu → 162

**Navigation**
"Diagnostics" menu



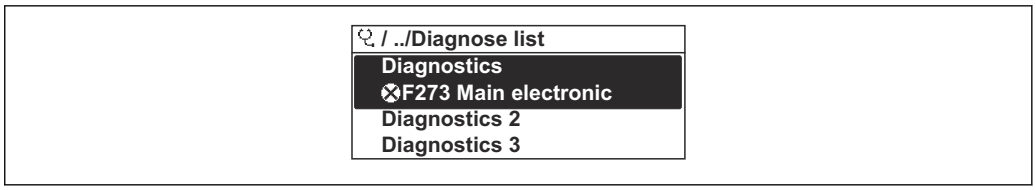

**Parameter overview with brief description**

| 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) |

## 12.10 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




22 *Taking the example of the local display*

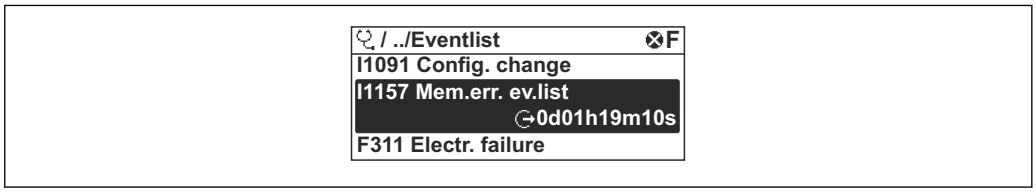
To call up the measures to rectify a diagnostic event:
- Via local display → 148
- Via web browser → 149
- Via "FieldCare" operating tool → 150
- Via "DeviceCare" operating tool → 150

## 12.11 Event logbook

### 12.11.1 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




23 *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 → 152
- Information events → 164

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 → 148
- Via web browser → 149
- Via "FieldCare" operating tool → 150
- Via "DeviceCare" operating tool → 150

For filtering the displayed event messages → 164

### 12.11.2 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)

### 12.11.3 Overview of information events

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

| Info number | Info name |
|---|---|
| I1000 | --------(Device ok) |
| I1079 | Sensor changed |
| I1089 | Power on |
| I1090 | Configuration reset |
| I1091 | Configuration changed |
| I1092 | HistoROM backup deleted |
| I1137 | Electronics changed |
| I1151 | History reset |
| I1155 | Reset electronics temperature |
| I1156 | Memory error trend |
| I1157 | Memory error event list |
| I1256 | Display: access status changed |
| 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 |

| Info number | Info name |
|---|---|
| I1515 | Upload finished |
| I1622 | Calibration changed |
| I1624 | All totalizers reset |
| I1625 | Write protection activated |
| I1626 | Write protection deactivated |
| I1627 | Web server: login successful |
| I1628 | Display: login successful |
| I1629 | CDI: login successful |
| I1631 | Web server access changed |
| I1632 | Display: login failed |
| I1633 | CDI: login failed |
| I1634 | Reset to factory settings |
| I1635 | Reset to delivery settings |
| I1649 | Hardware write protection activated |
| I1650 | Hardware write protection deactivated |
| I1725 | Sensor electronic module (ISEM) changed |

## 12.12 Resetting the measuring device

Using the**Device reset** parameter (→ 🖹 132) it is possible to reset the entire device configuration or some of the configuration to a defined state.

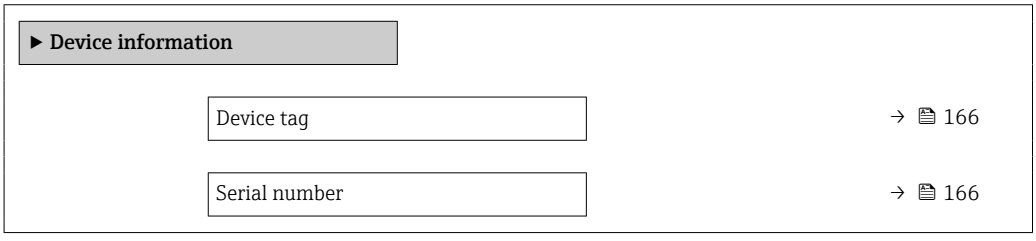
### 12.12.1 Function scope of the "Device reset" parameter

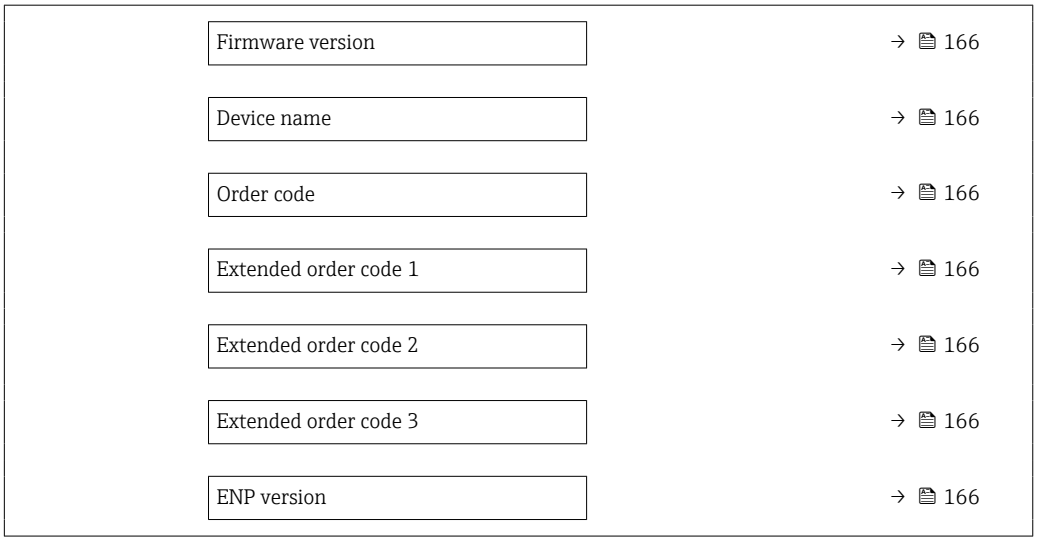
| Options | Description |
|---|---|
| Cancel | No action is executed and the user exits the parameter. |
| To delivery settings | Every parameter for which a customer-specific default setting was ordered is reset to this customer-specific value. All other parameters are reset to the factory setting.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

## 12.13 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. | Max. 32 characters such as letters or numbers. | Promag 400 EIP |
| 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 | – |
| 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 |

## 12.14 Firmware history

| Release date | Firmware version | Order code for "Firmware version" | Firmware changes | Documentation type | Documentation |
|---|---|---|---|---|---|
| 02.2022 | 02.00.zz | Option **66** | ▪ Web server: Extended function scope<br>▪ Heartbeat Technology: Extended function scope and extended report<br>▪ Buildup detection | Operating Instructions | BA01214D/06/EN/07.21 |
| 07.2014 | 01.01.zz | Option **74** | Update | Operating Instructions | BA01214D/06/EN/02.14 |
| 10.2013 | 01.00.zz | Option **77** | Original firmware | Operating Instructions | BA01214D/06/EN/01.13 |

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

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

The manufacturer's information is available:
- In the Download Area of the Endress+Hauser web site: www.endress.com → Downloads
- Specify the following details:
  - Text search: Manufacturer's information
  - Media type: Documentation – Technical Documentation

# 13 Maintenance

## 13.1 Maintenance tasks

No special maintenance work is required.

### 13.1.1 Exterior cleaning

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

**⚠ 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: → 171→ 172

## 13.3 Endress+Hauser services

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

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

# 14 Repair

## 14.1 General information

### 14.1.1 Repair and conversion concept

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

### 14.1.2 Notes for repair and conversion

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

## 14.2 Spare parts

*W@M Device Viewer* (www.endress.com/deviceviewer):
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 (→ 166) in the **Device information** submenu.

## 14.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

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

## 14.4 Return

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

1. Refer to the website for more information:
   http://www.endress.com/support/return-material
2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

## 14.5 Disposal

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

### 14.5.1 Removing the measuring device

1. Switch off the device.

**⚠ WARNING**

**Danger to persons from process conditions!**

- 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 |
|---|---|
| Promag 400 transmitter | Transmitter for replacement or storage. Use the order code to define the following specifications:<br>▪ Approvals<br>▪ Output/input<br>▪ Display/operation<br>▪ Housing<br>▪ Software<br>For details, see Installation Instructions EA00104D |
| Display guard | Is used to protect the display against impact or scoring, for example from sand in desert areas.<br>Order number: 71228792<br>Installation Instructions EA01093D |
| Connecting cable for remote version | Coil current and electrode cables, various lengths, reinforced cables available on request. |
| Ground cable | Set, consisting of two ground cables for potential equalization. |
| Post mounting kit | Post mounting kit for transmitter. |
| Compact → Remote conversion kit | For converting a compact device version to a remote device version. |
| Conversion kit Promag 50/53 → Promag 400 | For converting a Promag with transmitter 50/53 to a Promag 400. |

### 15.1.2 For the sensor

| Accessory | 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 FXA291 | Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop.<br>Technical Information TI405C/07 |

| | |
|---|---|
| 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 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>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>Operating Instructions BA00027S and BA00059S |
| DeviceCare | Tool for connecting and configuring Endress+Hauser field devices.<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>▪ Technical Information TI00133R<br>▪ Operating Instructions BA00247R |

# 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.

Two device versions are available:
- Compact version - transmitter and sensor form a mechanical unit.
- Remote version - transmitter and sensor are mounted in separate locations.

For information on the structure of the device → 13

## 16.3 Input

**Measured variable**

**Direct measured variables**

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

In custody transfer: only volume flow

**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 |

| 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] |
| 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 |
| 100 | 4 | 145 to 4 700 | 1 200 | 10 | 20 |
| 125 | – | 220 to 7 500 | 1 850 | 15 | 30 |

*Flow characteristic values in SI units: DN 150 to 3 000 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 1 100 | 300 | 0.05 | 5 |
| 250 | 10 | 55 to 1 700 | 500 | 0.05 | 7.5 |
| 300 | 12 | 80 to 2 400 | 750 | 0.1 | 10 |
| 350 | 14 | 110 to 3 300 | 1 000 | 0.1 | 15 |
| 375 | 15 | 140 to 4 200 | 1 200 | 0.15 | 20 |
| 400 | 16 | 140 to 4 200 | 1 200 | 0.15 | 20 |
| 450 | 18 | 180 to 5 400 | 1 500 | 0.25 | 25 |
| 500 | 20 | 220 to 6 600 | 2 000 | 0.25 | 30 |
| 600 | 24 | 310 to 9 600 | 2 500 | 0.3 | 40 |
| 700 | 28 | 420 to 13 500 | 3 500 | 0.5 | 50 |
| 750 | 30 | 480 to 15 000 | 4 000 | 0.5 | 60 |
| 800 | 32 | 550 to 18 000 | 4 500 | 0.75 | 75 |
| 900 | 36 | 690 to 22 500 | 6 000 | 0.75 | 100 |
| 1000 | 40 | 850 to 28 000 | 7 000 | 1 | 125 |
| – | 42 | 950 to 30 000 | 8 000 | 1 | 125 |
| 1200 | 48 | 1 250 to 40 000 | 10 000 | 1.5 | 150 |
| – | 54 | 1 550 to 50 000 | 13 000 | 1.5 | 200 |
| 1400 | – | 1 700 to 55 000 | 14 000 | 2 | 225 |
| – | 60 | 1 950 to 60 000 | 16 000 | 2 | 250 |
| 1600 | – | 2 200 to 70 000 | 18 000 | 2.5 | 300 |
| – | 66 | 2 500 to 80 000 | 20 500 | 2.5 | 325 |
| 1800 | 72 | 2 800 to 90 000 | 23 000 | 3 | 350 |
| – | 78 | 3 300 to 100 000 | 28 500 | 3.5 | 450 |
| 2000 | – | 3 400 to 110 000 | 28 500 | 3.5 | 450 |
| – | 84 | 3 700 to 125 000 | 31 000 | 4.5 | 500 |

| 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] |
| 2200 | – | 4100 to 136000 | 34000 | 4.5 | 540 |
| – | 90 | 4300 to 143000 | 36000 | 5 | 570 |
| 2400 | – | 4800 to 162000 | 40000 | 5.5 | 650 |
| – | 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 → 🖹 188

For custody transfer, the applicable approval determines the permitted measuring range, the pulse value and the low flow cut off.

Operable flow range

Over 1000 : 1

For custody transfer, the operable flow range is 100 : 1 to 630 : 1, depending on the nominal diameter. Further details are specified by the applicable approval.

Input signal

**External measured values**

Various pressure transmitters and temperature measuring devices can be ordered from Endress+Hauser: see "Accessories" section → 173

It is recommended to read in external measured values to calculate the following measured variables:
Mass flow

*Digital communication*

The measured values are written from the automation system to the measuring device via EtherNet/IP.

**Status input**

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

## 16.4 Output

Output signal

**EtherNet/IP**

| | |
|---|---|
| **Standards** | In accordance with IEEE 802.3 |

Signal on alarm

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

**EtherNet/IP**

| | |
|---|---|
| **Device diagnostics** | Device condition can be read out in Input Assembly |

**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:
  EtherNet/IP
- 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>▪ EtherNet/IP network available<br>▪ EtherNet/IP connection established<br>Diagnostic information via light emitting diodes → 145 |

Low flow cut off

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

Galvanic isolation

The following connections are galvanically isolated from each other:
- Outputs
- Power supply

Protocol-specific data

### EtherNet/IP

| | |
|---|---|
| **Protocol** | ▪ The CIP Networks Library Volume 1: Common Industrial Protocol<br>▪ The CIP Networks Library Volume 2: EtherNet/IP Adaptation of CIP |
| **Communication type** | ▪ 10Base-T<br>▪ 100Base-TX |
| **Device profile** | Generic device (product type: 0x2B) |
| **Manufacturer ID** | 0x49E |
| **Device type ID** | 0x1069 |
| **Baud rates** | Automatic 10/100 Mbit with half-duplex and full-duplex detection |
| **Polarity** | Auto-polarity for automatic correction of crossed TxD and RxD pairs |
| **Supported CIP connections** | Max. 3 connections |
| **Explicit connections** | Max. 5 connections |
| **I/O connections** | Max. 6 connections (scanner) |
| **Configuration options for measuring device** | Configuration options for measuring device<br>▪ DIP switches on the electronics module for IP addressing<br>▪ Manufacturer-specific software (FieldCare)<br>▪ Custom Add-on Profile for Rockwell Automation control systems<br>▪ Web browser<br>▪ Electronic Data Sheet (EDS) integrated in the measuring device |

| | |
|---|---|
| **EtherNet interface configuration options** | Configuration of the EtherNet interface<br>▪ Speed: 10 MBit, 100 MBit, auto (factory setting)<br>▪ Duplex: half-duplex, full-duplex, auto (factory setting) |
| **Device address configuration options** | Configuration of the device address<br>▪ DIP switches on the electronics module for IP addressing (last octet)<br>▪ DHCP<br>▪ Manufacturer-specific software (FieldCare)<br>▪ Custom Add-on Profile for Rockwell Automation control systems<br>▪ Web browser<br>▪ EtherNet/IP tools, e.g. RSLinx (Rockwell Automation) |
| **Device Level Ring (DLR)** | No |
| **Assembly** | ▪ Legacy Input Assembly Fix (Assem 100)<br>▪ Legacy Input Assembly Configurable (Assem 101)<br>▪ Legacy Output Assembly Fix (Assem 102)<br>▪ Legacy Configuration Assembly (Assem 104)<br>▪ Input Assembly Fix (Assem 120)<br>▪ Input Assembly Configurable (Assem 121)<br>▪ Output Assembly Fix (Assem 122)<br>▪ Configuration Assembly (Assem 124)<br>▪ Volume Flow Extended Fix Input (Assem 126)<br>▪ Volume Flow Universal Fix Input (Assem 127)<br>▪ Dummy Output Assembly Fix (Assem 199) |
| **Requested Packet Interval (RPI)** | 5 ms to 10 s (factory setting: 20 ms) |
| **System integration** | → 🖹 86 |

## 16.5 Power supply

Terminal assignment → 🖹 43

Pin assignment, device plug → 🖹 44

Supply voltage

### Transmitter

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

Power consumption

| Order code for "Output" | Maximum power consumption |
|---|---|
| Option **N**: EtherNet/IP | 30 VA/8 W |

Current consumption

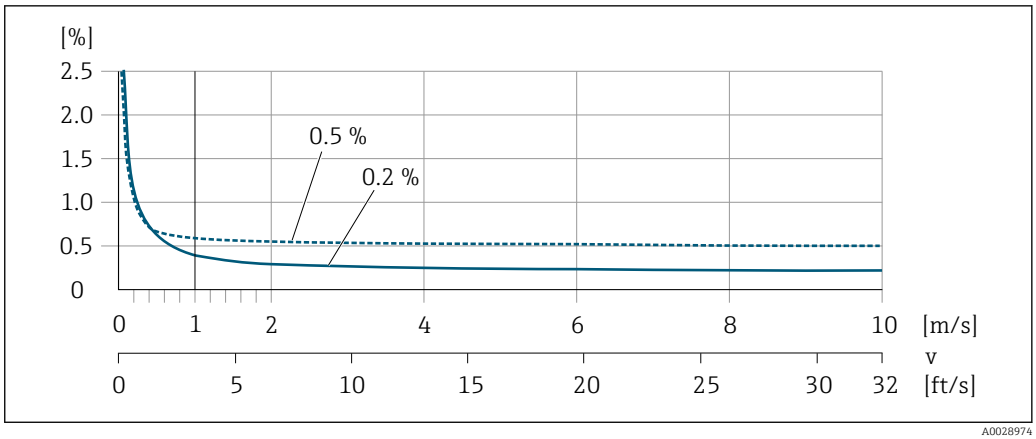
### Transmitter

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

| | |
|---|---|
| Power supply failure | ▪ Totalizers stop at the last value measured.<br>▪ Depending on the device version, the configuration is retained in the device memoryor in the pluggable data memory (HistoROM DAT).<br>▪ Error messages (incl. total operated hours) are stored. |
| Electrical connection | → 46 |
| Potential equalization | → 52 |
| Terminals | **Transmitter**<br>▪ Supply voltage cable: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)<br>▪ Signal cable: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)<br>▪ Electrode cable: spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)<br>▪ Coil current cable: spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)<br>**Sensor connection housing**<br>Spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG) |
| Cable entries | **Cable entry thread**<br>▪ M20 x 1.5<br>▪ Via adapter:<br>  ▪ NPT ½"<br>  ▪ G ½"<br>**Cable gland**<br>▪ For standard cable: M20 × 1.5 with cable ϕ 6 to 12 mm (0.24 to 0.47 in)<br>▪ For armored cable: M20 × 1.5 with cable ϕ 9.5 to 16 mm (0.37 to 0.63 in)<br>If metal cable entries are used, use a grounding plate. |
| Cable specification | → 41 |

## 16.6 Performance characteristics

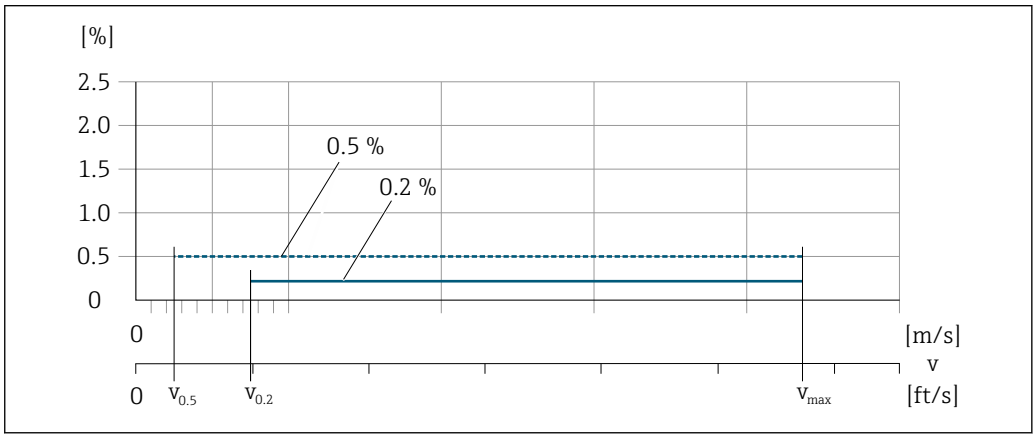
| | |
|---|---|
| Reference operating conditions | ▪ Error limits following DIN EN 29104, in future ISO 20456<br>▪ Water, typically +15 to +45 °C (+59 to +113 °F); 0.5 to 7 bar (73 to 101 psi)<br>▪ Data as indicated in the calibration protocol<br>▪ Accuracy based on accredited calibration rigs according to ISO 17025 |
| Maximum measured error | **Error limits under reference operating conditions**<br>*Volume flow*<br>▪ ±0.5 % o.r. ± 1 mm/s (0.04 in/s)<br>▪ Optional: ±0.2 % o.r. ± 2 mm/s (0.08 in/s)<br>Fluctuations in the supply voltage do not have any effect within the specified range. |




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

*Flat Spec*

For Flat Spec in the range $v_{0.5}$ ($v_{0.2}$) up to $v_{max}$ the measured error is constant.




25 *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 %*

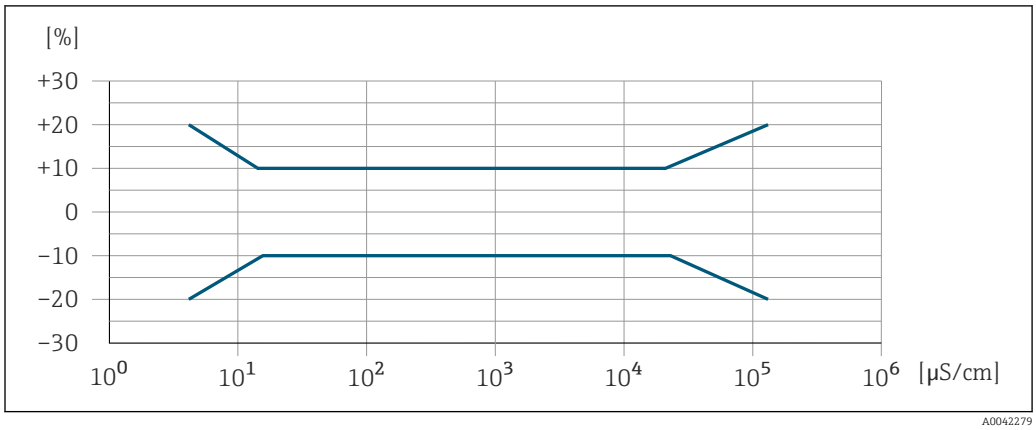
| Nominal diameter | | $v_{0.2}$ | | $v_{max}$ | |
|---|---|---|---|---|---|
| [mm] | [in] | [m/s] | [ft/s] | [m/s] | [ft/s] |
| 25 to 600 | 1 to 24 | 1.5 | 4.92 | 10 | 32 |
| 50 to 300 [1)] | 2 to 12 | 0.6 | 1.97 | 4 | 13 |

1) Order code for "Design", option C

*Electrical conductivity*

The values apply for:
- 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)
- Device version: compact version - transmitter and sensor form a mechanical unit
- 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

| Conductivity [µS/cm] | Measured error [%] o. r. |
|---|---|
| 5 to 20 | ± 20% |
| 20 to 20 000 | ± 10% |
| 20 000 to 100 000 | ± 20% |




*26 Measured error*

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**

o.r. = of reading

| | |
|---|---|
| **Temperature coefficient** | Max. ±0.005 % o.r./°C |

**Pulse/frequency output**

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

## 16.7 Installation

Installation conditions

→ 19

## 16.8 Environment

| | |
|---|---|
| Ambient temperature range | → 25 |
| Storage temperature | The storage temperature corresponds to the operating temperature range of the transmitter and the sensor → 25.<br>▪ Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures.<br>▪ Select a storage location where moisture cannot collect in the measuring device as fungus or bacteria infestation can damage the liner.<br>▪ If protection caps or protective covers are mounted these should never be removed before installing the measuring device. |
| Atmosphere | If a plastic transmitter housing is permanently exposed to certain steam and air mixtures, this can damage the housing.<br>In cases of doubt, please contact the Sales Center. |
| Degree of protection | **Transmitter**<br>▪ IP66/67, type 4X enclosure<br>▪ When housing is open: IP20, type 1 enclosure<br>▪ Display module: IP20, type 1 enclosure<br><br>**Sensor**<br>*Compact and remote version*<br>IP66/67, type 4X enclosure<br><br>*Optionally available for compact and remote version:*<br>Order code for "Sensor option", option CA, C3<br>▪ IP66/67, type 4X enclosure<br>▪ Fully welded, with protective coating as per EN ISO 12944 C5-M<br>▪ For the operation of the device in corrosive environments<br><br>*Optionally available for remote version:*<br>Order code for "Sensor option", option CB, CC<br>▪ IP68, type 6P enclosure<br>▪ Fully welded, with protective coating as per EN ISO 12944 C5-M/Im1 and EN 60529<br>▪ For the operation of the device under water<br>▪ Operating duration at a maximum depth of:<br>  ▪ 3 m (10 ft): permanent use<br>  ▪ 10 m (30 ft): maximum 48 hours<br>Order code for "Sensor option", option CQ<br>▪ IP68, type 6P, temporarily waterproof<br>▪ Sensor with aluminum half-shell housing<br>▪ For the temporary operation of the device under non-corrosive water<br>▪ Operating duration at a maximum depth of:<br>3 m (10 ft): maximum 168 hours |

Order code for "Sensor option", option CD, CE
- IP68, type 6P enclosure
- Fully welded, with protective coating as per EN ISO 12944 Im2/Im3 and EN 60529
- For the operation of the device in buried applications
- For the operation of the device under water and in saline water
- Operating duration at a maximum depth of:
  - 3 m (10 ft): permanent use
  - 10 m (30 ft): maximum 48 hours

Vibration- and shock-resistance

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

Compact version; order code for "Housing", option A "Compact, aluminum, coated"
- 2 to 8.4 Hz, 3.5 mm peak
- 8.4 to 2 000 Hz, 1 g peak

Compact version; order code for "Housing", option M "Compact, polycarbonate"
- 2 to 8.4 Hz, 7.5 mm peak
- 8.4 to 2 000 Hz, 2 g peak

Remote version; order code for "Housing", option N "Remote, polycarbonate" and option P "Remote, aluminum, coated"
- 2 to 8.4 Hz, 7.5 mm peak
- 8.4 to 2 000 Hz, 2 g peak

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

Compact version; order code for "Housing", option A "Compact, aluminum, coated"
- 10 to 200 Hz, 0.003 $g^2$/Hz
- 200 to 2 000 Hz, 0.001 $g^2$/Hz
- Total: 1.54 g rms

Compact version; order code for "Housing", option M "Compact, polycarbonate"
- 10 to 200 Hz, 0.01 $g^2$/Hz
- 200 to 2 000 Hz, 0.003 $g^2$/Hz
- Total: 2.70 g rms

Remote version; order code for "Housing", option N "Remote, polycarbonate" and option P "Remote, aluminum, coated"
- 10 to 200 Hz, 0.01 $g^2$/Hz
- 200 to 2 000 Hz, 0.003 $g^2$/Hz
- Total: 2.70 g rms

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

- Compact version; order code for "Housing", option A "Compact, aluminum, coated"
  6 ms 30 g
- Compact version; order code for "Housing", option M "Compact, polycarbonate"
  6 ms 50 g
- Remote version; order code for "Housing", option N "Remote, polycarbonate" and option P "Remote, aluminum, coated"
  6 ms 50 g

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

Mechanical load
- Protect the transmitter housing against mechanical effects, such as shock or impact; the use of the remote version is sometimes preferable.
- Never use the transmitter housing as a ladder or climbing aid.

Electromagnetic compatibility (EMC)

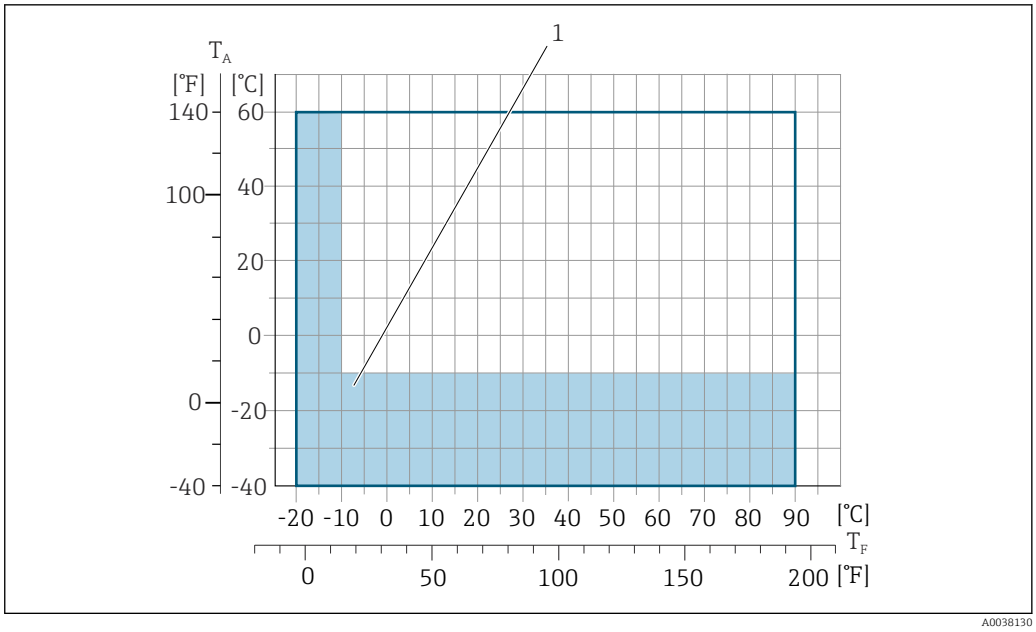
- As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)
- Complies with emission limits for industry as per EN 55011 (Class A)

Details are provided in the Declaration of Conformity.

## 16.9 Process

Medium temperature range

- 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*

The permitted fluid temperature in custody transfer is 0 to +50 °C (+32 to +122 °F).

Conductivity

≥5 µS/cm for liquids in general.

- Note that in the case of the remote version, the requisite minimum conductivity additionally depends on the length of the connecting cable → 26.
- Maximum measured error for electrical conductivity → 184.

Pressure-temperature ratings

For an overview of the pressure-temperature ratings for the process connections, see the Technical Information → 204

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)

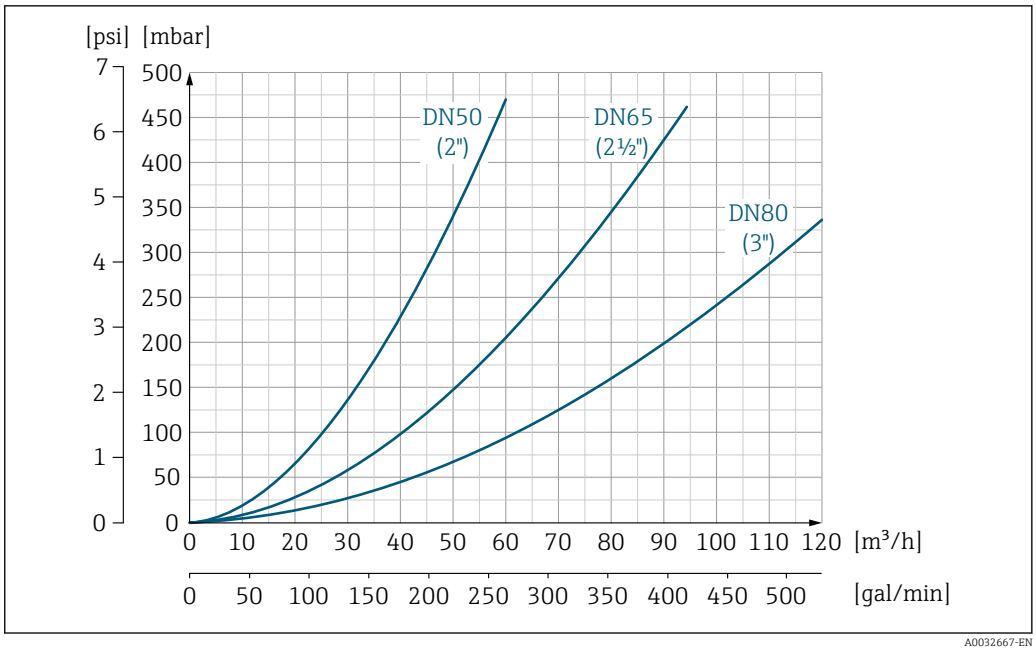
A necessary increase in the flow velocity can be achieved by reducing the sensor nominal diameter.

For an overview of the full scale values for the measuring range, see the "Measuring range" section → 174

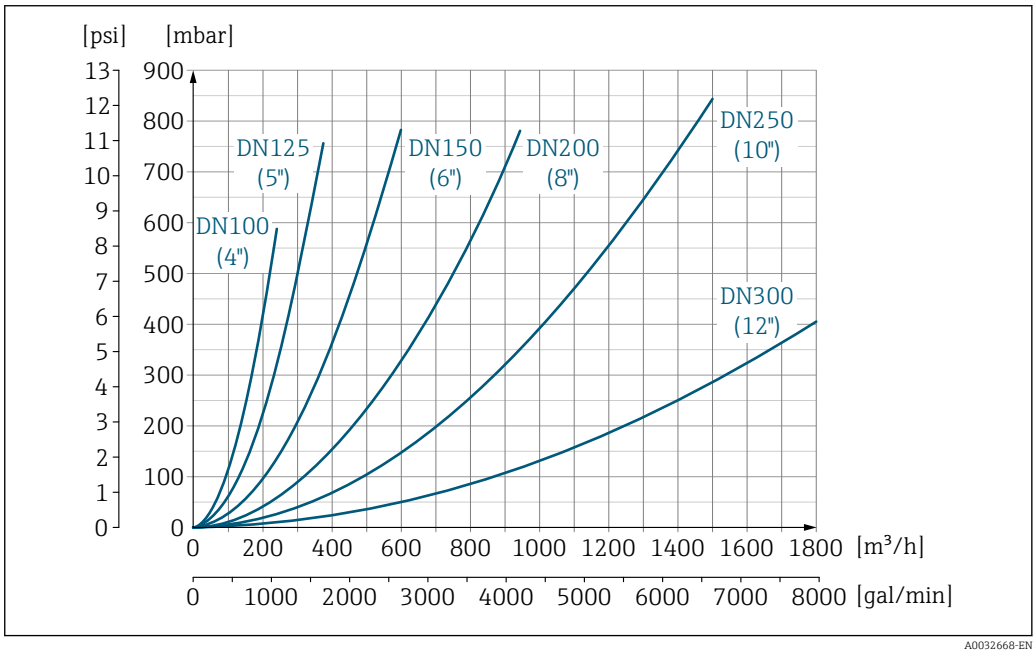
For custody transfer, the applicable approval determines the permitted measuring range.

## 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 → 26




27 *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"*




28 *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 | Installation near pumps → 20 |
| Vibrations | Installation in event of pipe vibrations → 21 |

## 16.10 Mechanical construction

| | |
|---|---|
| Design, dimensions | For the dimensions and installed lengths of the device, see the "Technical Information" document, "Mechanical construction" section → 204 |

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 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 | – | – |
| 1400 | – | 1 204 | – |
| – | 60 | – | – |
| 1600 | – | 1 845 | – |
| – | 66 | – | – |

| 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] |
| 1800 | 72 | 2 357 | – |
| – | 78 | 2 929 | – |
| 2000 | – | 2 929 | – |

| 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 | – | 3 422 |
| – | 90 | – |
| 2400 | – | 4 094 |
| – | 96 | – |
| – | 102 | – |
| 2600 | – | 7 601.5 |
| – | 108 | – |
| 2800 | – | 9 466.5 |
| – | 114 | – |
| 3000 | – | 11 911 |
| – | 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 |
| – | 54 | 850 |
| 1400 | – | 1 300 |
| – | 60 | – |
| 1600 | – | 1 845 |

| 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] |
| – | 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 |
| 900 | 36 | 1036 |
| 1000 | 40 | 1294 |
| – | 42 | 1477 |
| 1200 | 48 | 1987 |

| 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] |
| – | 54 | 2 807 |
| 1400 | – | – |
| – | 60 | 3 515 |
| 1600 | – | – |
| – | 66 | 4 699 |
| 1800 | 72 | 5 662 |
| – | 78 | 6 864 |
| 2000 | – | 6 864 |
| – | 84 | 8 280 |
| 2200 | – | – |
| – | 90 | 10 577 |
| 2400 | – | – |
| – | 96 | 15 574.6 |
| – | 102 | 18 023.9 |
| 2600 | – | – |
| – | 108 | 20 783.0 |
| 2800 | – | – |
| – | 114 | 24 060.2 |
| 3000 | – | – |
| – | 120 | 27 724.3 |

| 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 | 1 014 |
| 800 | 32 | 1 213 |
| 900 | 36 | 1 764 |
| 1000 | 40 | 1 984 |
| – | 42 | 2 426 |
| 1200 | 48 | 3 087 |
| – | 54 | 4 851 |
| 1400 | – | – |
| – | 60 | 5 954 |
| 1600 | – | – |
| – | 66 | 8 158 |

| Order code for "Design", option G, K: DN 18 to 78 in (450 to 2000 mm) | | |
|---|---|---|
| Nominal diameter | | Reference values ASME (Class 150), AWWA (Class D) |
| [mm] | [in] | [lb] |
| 1800 | 72 | 9040 |
| – | 78 | 10143 |
| 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 | – | – |
| 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 | – | – |

| 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] |
| 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 | – | – | 1043 | 41.1 | 1043 | 41.1 | – | – |
| 1200 | 48 | PN 6 | Class D | Table E, PN 16 | – | 1191 | 46.9 | 1197 | 47.1 | – | – |
| – | 54 | – | Class D | – | – | 1339 | 52.7 | – | – | – | – |
| 1400 | – | PN 6 | – | – | – | 1402 | 55.2 | – | – | – | – |
| – | 60 | – | Class D | – | – | 1492 | 58.7 | – | – | – | – |
| 1600 | – | PN 6 | – | – | – | 1600 | 63.0 | – | – | – | – |
| – | 66 | – | Class D | – | – | 1638 | 64.5 | – | – | – | – |
| 1800 | 72 | PN 6 | – | – | – | 1786 | 70.3 | – | – | – | – |
| – | 78 | – | Class D | – | – | 1989 | 78.3 | – | – | – | – |
| 2000 | – | PN 6 | – | – | – | 1989 | 78.3 | – | – | – | – |
| – | 84 | – | Class D | – | – | 2099 | 84.0 | – | – | – | – |
| 2200 | – | PN 6 | – | – | – | 2194 | 87.8 | – | – | – | – |
| – | 90 | – | Class D | – | – | 2246 | 89.8 | – | – | – | – |
| 2400 | – | PN 6 | – | – | – | 2391 | 94.1 | – | – | – | – |
| – | 96 | – | Class D | – | | 2382 | 93.8 | – | – | – | – |
| – | 102 | – | Class D | – | | 2533 | 99.7 | – | – | – | – |
| 2600 | – | PN 6 | – | – | | 2580 | 101.6 | – | – | – | – |
| – | 108 | – | Class D | – | | 2683 | 105.6 | – | – | – | – |
| 2800 | – | PN 6 | – | – | | 2780 | 109.5 | – | – | – | – |
| – | 114 | – | Class D | – | | 2832 | 111.5 | – | – | – | – |
| 3000 | – | PN 6 | – | – | | 2976 | 117.2 | – | – | – | – |
| – | 120 | – | Class D | – | | 2980 | 117.3 | – | – | – | – |

1) Order code for "Design", option C

## Materials

### Transmitter housing

*Compact version*

- Order code for "Housing", option **A** "Compact, alu, coated": Aluminum, AlSi10Mg, coated
- Order code for "Housing", option **M**: polycarbonate plastic
- Window material:
  - For order code for "Housing", option **A**: glass
  - For order code for "Housing", option **M**: plastic

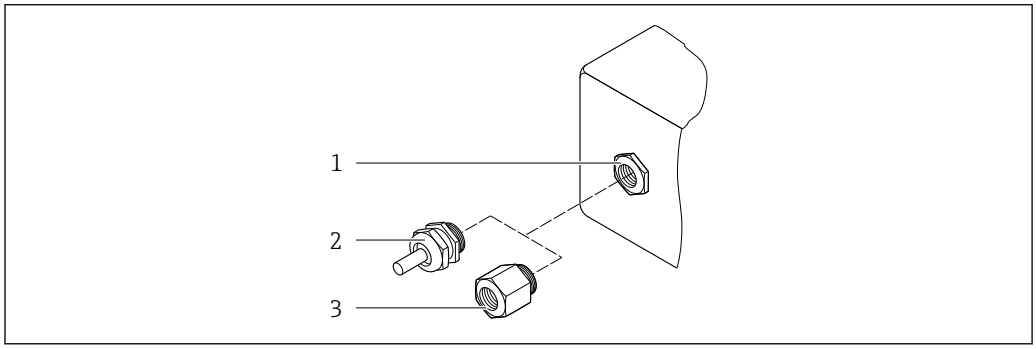
*Remote version (wall-mount housing)*

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

### Sensor connection housing

- Aluminum, AlSi10Mg, coated
- Polycarbonate plastic (only in conjunction with order code for "Sensor option", options CA, C3, CB, CC, CD, CD)

### Cable entries/cable glands




29 *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"*

*Compact and remote versions and sensor connection housing*

| Cable entry/cable gland | Material |
|---|---|
| Cable gland M20 × 1.5 | ▪ Plastic<br>▪ Nickel-plated brass |
| Remote version: cable gland M20 × 1.5<br>Option of armored connecting cable | ▪ Sensor connection housing: Nickel-plated brass<br>▪ Transmitter wall-mount housing: Plastic |
| Adapter for cable entry with female thread G ½" or NPT ½" | Nickel-plated brass |

### Device plug

| Electrical connection | Material |
|---|---|
| Plug M12x1 | ▪ Socket: Stainless steel, 1.4404 (316L)<br>▪ Contact housing: Polyamide<br>▪ Contacts: Gold-plated brass |

### Remote version connecting cable

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

Electrode and coil current cable:
- Standard cable: PVC cable with copper shield
- Armored cable: PVC cable with copper shield and additional steel wire braided jacket

### 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**

*Display guard*

Stainless steel, 1.4301 (304L)

*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 → 197

Surface roughness

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

(All data relate to parts in contact with medium)

## 16.11 Human interface

**Languages**

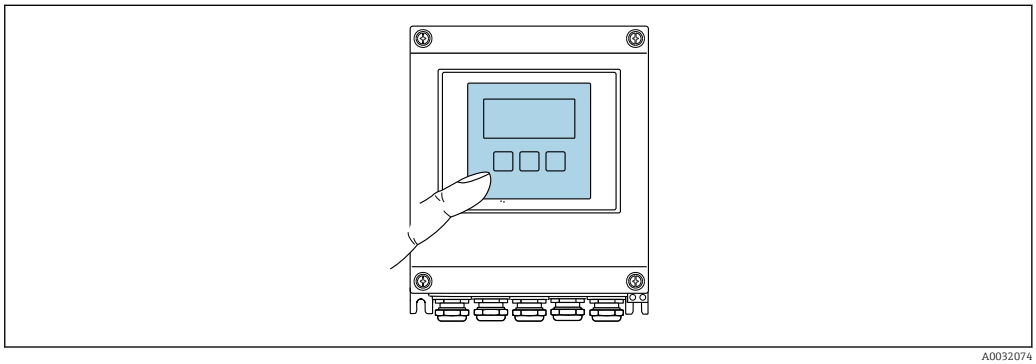
Can be operated in the following languages:
- Via local operation:
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech, Swedish
- Via "FieldCare", "DeviceCare" operating tool:
  English, German, French, Spanish,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

**Local operation**

**Via display module**

Equipment:
- Standard features 4-line, illuminated, graphic display; touch control
- Order code for "Display; operation", option BA "WLAN" offers standard equipment features in addition to access via Web browser

Information about WLAN interface → 82




*30 Operation with touch control*

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

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

**Remote operation**

→ 81

**Service interface**

→ 82

## 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<br>▪ Ethernet-based fieldbus (EtherNet/IP) | 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 | → 172 |
| FieldCare SFE500 | Notebook, PC or tablet with Microsoft Windows system | ▪ CDI-RJ45 service interface<br>▪ WLAN interface<br>▪ Fieldbus protocol | → 172 |

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:

- Field Device Manager (FDM) from Honeywell → www.honeywellprocess.com
- FieldMate from Yokogawa → www.yokogawa.com
- PACTWare → www.pactware.com

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

### Web server

Thanks to the integrated Web server, the device can be operated and configured via a Web browser and via a service interface (CDI-RJ45) . 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, allowing users to monitor the status of the device. Furthermore the device data can be managed and the network parameters can be configured.

*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 → 205

## HistoROM data management

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

### Additional information on the data storage concept

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

| | HistoROM backup | T-DAT | S-DAT |
|---|---|---|---|
| **Available data** | ▪ Event logbook such as diagnostic events for example<br>▪ Device firmware package<br>▪ Driver for system integration for exporting via Web server, e.g: EDS for EtherNet/IP | ▪ Measured value logging ("Extended HistoROM" order option)<br>▪ Current parameter data record (used by firmware at run time)<br>▪ Peakhold indicator (min/max values)<br>▪ Totalizer values | ▪ Sensor data: 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

#### 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)
- Transmission of the drivers for system integration via Web server, e.g.: EDS for EtherNet/IP

#### 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 1 000 measured values via 1 to 4 channels
- User configurable recording interval
- Record up to 250 measured values via each of the 4 memory channels
- Export the measured value log via a variety of interfaces and operating tools e.g. FieldCare, DeviceCare or web server

## 16.12 Certificates and approvals

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

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

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

| | |
|---|---|
| CE mark | The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.<br>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 "Control Drawing" document. Reference is made to this document on the nameplate. |
| Drinking water approval | ▪ ACS<br>▪ KTW/W270<br>▪ NSF 61<br>▪ WRAS BS 6920 |
| EtherNet/IP certification | The measuring device is certified and registered by the ODVA (Open Device Vendor Association). The measuring system meets all the requirements of the following specifications:<br>▪ Certified in accordance with the ODVA Conformance Test<br>▪ EtherNet/IP Performance Test<br>▪ EtherNet/IP PlugFest compliance<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 regarding radio approval, see the Special Documentation → 205 |

Measuring instrument approval

The measuring device is (optionally) approved as a cold water meter (MI-001) for volume measurement in service subject to legal metrological control in accordance with the European Measuring Instruments Directive 2014/32/EU (MID).

The measuring device is qualified to OIML R49: 2013.

Other standards and guidelines

- EN 60529
  Degrees of protection provided by enclosures (IP code)
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- IEC/EN 61326-3-2
  Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- ANSI/ISA-61010-1 (82.02.01)
  Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1 General Requirements
- CAN/CSA-C22.2 No. 61010-1-12
  Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1 General Requirements
- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32
  Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
  Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 105
  Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107
  Self-monitoring and diagnosis of field devices
- NAMUR NE 131
  Requirements for field devices for standard applications

## 16.13 Application packages

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

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

Cleaning

| Package | Description |
|---|---|
| Electrode cleaning circuit (ECC) | 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). |

Diagnostics functions

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

Heartbeat Technology

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

## 16.14 Accessories

Overview of accessories available for order → 171

## 16.15 Supplementary documentation

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

Standard documentation

**Technical Information**

| Measuring device | Documentation code |
|---|---|
| Promag W 400 | TI01046D |

### Brief Operating Instructions

*Brief Operating Instructions for the sensor*

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

*Brief Operating Instructions for the transmitter*

| Measuring device | Documentation code |
|---|---|
| Proline 400 | KA01418D |

### Description of device parameters

| Measuring device | Documentation code |
|---|---|
| Promag 400 | GP01046D |

Supplementary device-dependent documentation

### Special Documentation

| Content | Documentation code |
|---|---|
| Web server | SD01814D |
| Heartbeat Verification + Monitoring application package | SD02570D |
| Display modules A309/A310 | SD01793D |

### Installation Instructions

| Content | Comment |
|---|---|
| Installation instructions for spare part sets and accessories | ▪ Access the overview of all the available spare part sets via *W@M Device Viewer* → 169<br>▪ Accessories available for order with Installation Instructions → 171 |

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## S



## T

## U



## V



## W


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