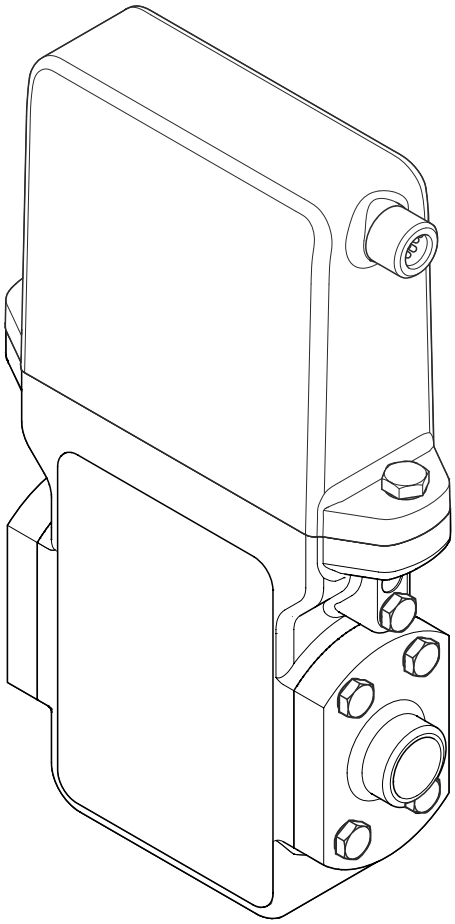
BA01321D/06/EN/03.17
71349516

Valid as of version
03.00.zz (Device firmware)



# Operating Instructions
# **Dosimag**
# **Modbus RS485**

Electromagnetic flowmeter



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 Document information

## 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 used

### 1.2.1 Safety symbols

| Symbol | Meaning |
|---|---|
| DANGER | **DANGER!**<br>This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury. |
| WARNING | **WARNING!**<br>This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury. |
| CAUTION | **CAUTION!**<br>This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury. |
| NOTICE | **NOTE!**<br>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 ground connection**<br>A terminal which must be connected to ground prior to establishing any other connections. |
| ⏚ | **Equipotential connection**<br>A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice. |

### 1.2.3 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. |

| Symbol | Meaning |
|---|---|
|  | **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 |

### 1.2.4 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 |
|  | 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:

- 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 2-D matrix code (QR code) on the nameplate.

For a detailed list of the individual documents along with the documentation code

### 1.3.1 Standard documentation

| Document type | Purpose and content of the document |
|---|---|
| Technical Information | **Planning aid for your device**<br>The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device. |
| Sensor Brief Operating Instructions | **Guides you quickly to the 1st measured value - 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 | **Guides you quickly to the 1st measured value - 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.<br>The document provides Modbus-specific information for each individual parameter in the Expert operating menu. |

### 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

**Modbus®**
Registered trademark of SCHNEIDER AUTOMATION, INC.

**TRI-CLAMP®**
Registered trademark of Ladish & Co., Inc., Kenosha, USA

**Applicator®, FieldCare®, DeviceCare ®**
Registered or registration-pending trademarks of the Endress+Hauser Group

# 2 Basic safety instructions

## 2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- Trained, qualified specialists must have a relevant qualification for this specific function and task
- Are authorized by the plant owner/operator
- Are familiar with federal/national regulations
- Before beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- Following instructions and basic conditions

The operating personnel must fulfill the following requirements:
- Being instructed and authorized according to the requirements of the task by the facility's owner-operator
- Following the instructions in these Operating Instructions

## 2.2 Designated use

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

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

To ensure that the measuring device remains in proper condition for the operation time:
- 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.
- Check the nameplate to verify if the device ordered can be put to its intended use in the approval-related area (e.g. explosion protection, pressure vessel safety).
- Use the measuring device only for media against which the process-wetted materials are adequately resistant.
- If the measuring device is not operated at atmospheric temperature, compliance with the relevant basic conditions specified in the associated device documentation is absolutely essential: "Documentation" section → 🖹 6.
- Protect the measuring device permanently against corrosion from environmental influences.

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

**⚠ WARNING**
**Danger of breakage of the sensor due to corrosive or abrasive fluids or from environmental 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.

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**
The external surface temperature of the housing can increase by max. 10 K due to the power consumption of the electronic components. Hot process fluids passing through the measuring device will further increase the surface temperature of the housing. The surface of the sensor, in particular, can reach temperatures which are close to the fluid temperature.

Possible burn hazard due to fluid temperatures!
- ▶ For elevated fluid temperature, ensure protection against contact to prevent burns.

## 2.3 Workplace safety

For work on and with the device:
- ▶ Wear the required personal protective equipment according to federal/national regulations.

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:
- ▶ It is recommended to wear gloves on account of the higher risk of electric shock.

## 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 EC directives listed in the device-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

## 2.6 IT security

We only provide a warranty 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 device settings.

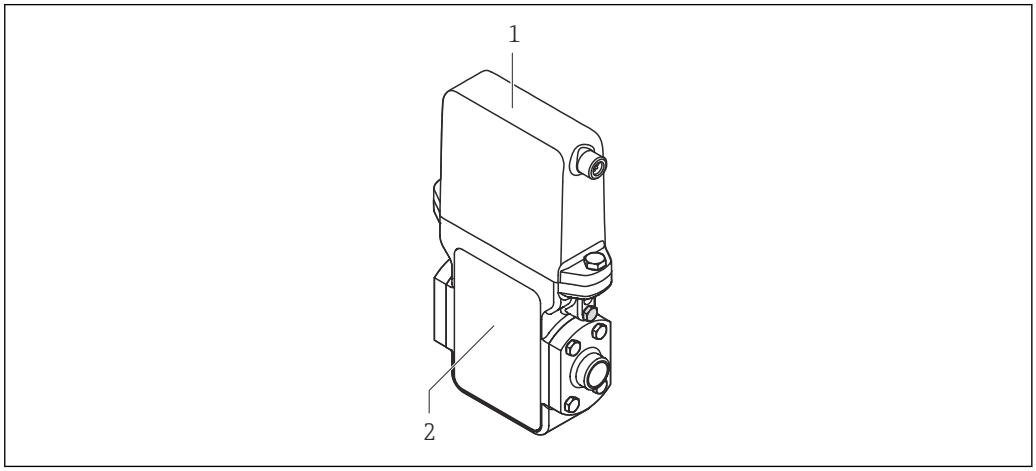
IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

# 3 Product description

The device consists of a transmitter and a sensor.

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

## 3.1 Product design

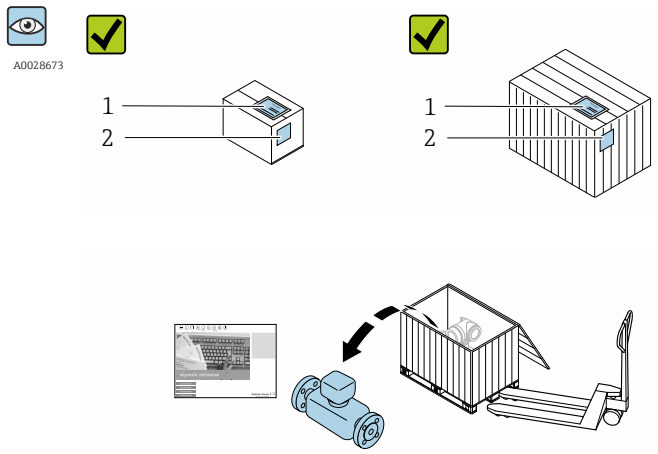



*1 Important components of the measuring device*

*1 Transmitter*
*2 Sensor*

# 4 Incoming acceptance and product identification

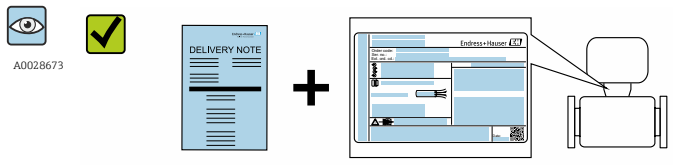
## 4.1 Incoming acceptance



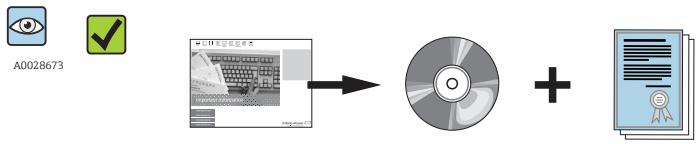

Are the order codes on the delivery note (1) and the product sticker (2) identical?

Are the goods undamaged?

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




Is the CD-ROM with the Technical Documentation (depends on device version) and documents present?



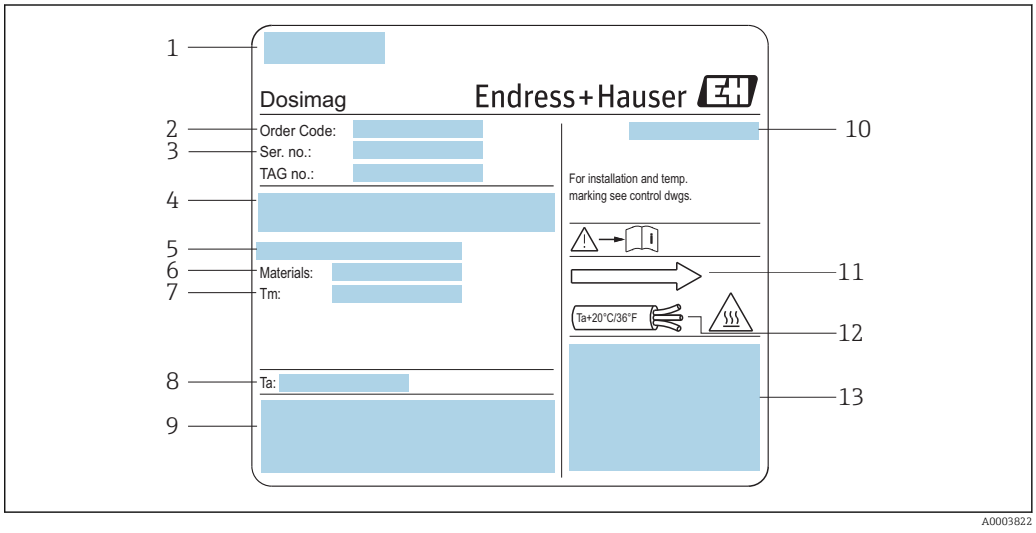

- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- Depending on the device version, the CD-ROM might not be part of the delivery! The Technical Documentation is available via the Internet or via the *Endress+Hauser Operations App*, see the "Product identification" section → 13.

## 4.2 Product identification

The following options are available for identification of the measuring device:
- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter serial numbers from nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer): All information about the measuring device is displayed.
- Enter the serial number from the nameplates into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations App*: all the information for the measuring 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" → 7 and "Supplementary device-dependent documentation" → 7
- 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 2-D matrix code (QR code) on the nameplate.

### 4.2.1 Sensor nameplate




2 *Example of sensor nameplate*

1 *Manufacturing location*
2 *Order code: see the specifications on the order confirmation for the meanings of the individual letters and digits*
3 *Serial number*
4 *Supply voltage and power consumption*
5 *Process connection*
6 *Wetted materials*
7 *Maximum process temperature*
8 *Permitted ambient temperature range*
9 *Space reserved for additional information on the device version (approvals, certificates, etc.)*
10 *Degree of protection*
11 *Flow direction*
12 *Cable temperature*
13 *Space reserved for additional information on the device version (approvals, certificates, etc.)*

**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 +).

### 4.2.2 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. |
|  | **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 lining.
- Store in a dry and dust-free place.
- Do not store outdoors.

Storage temperature→ 68

## 5.2 Transporting the product

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

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.

## 5.3 Packaging disposal

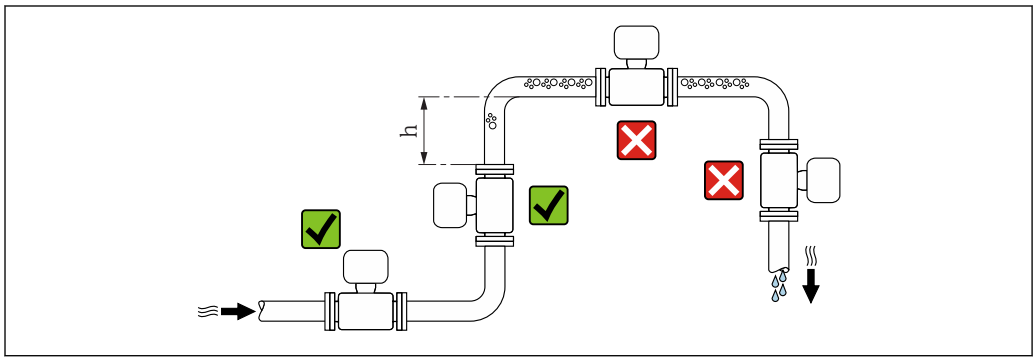
All packaging materials are environmentally friendly and 100% recyclable:
- Measuring device secondary packaging: polymer stretch film that conforms to EC Directive 2002/95/EC (RoHS).
- Packaging:
  - Wood crate, treated in accordance with ISPM 15 standard, which is confirmed by the affixed IPPC logo.
    or
  - Carton in accordance with European Packaging Directive 94/62EC; recyclability is confirmed by the affixed RESY symbol.
- Seaworthy packaging (optional): Wood crate, treated in accordance with ISPM 15 standard, which is confirmed by the affixed IPPC logo.
- Carrying and mounting hardware:
  - Disposable plastic pallet
  - Plastic straps
  - Plastic adhesive strips
- Dunnage: Paper cushion

# 6 Installation

## 6.1 Installation conditions

### 6.1.1 Mounting position

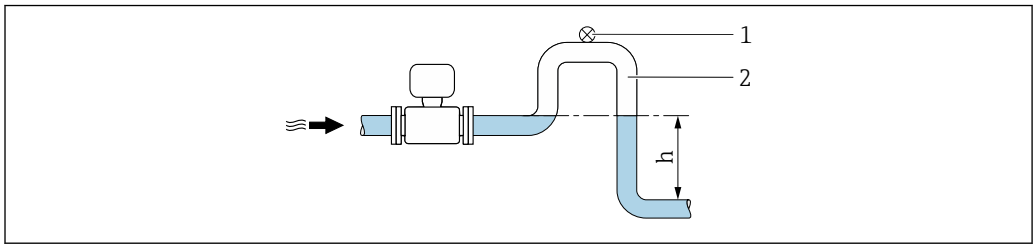
#### Mounting location




Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow: h ≥ 2 × DN

*Installation in down pipes*

Install a siphon with a vent valve downstream of the sensor in down pipes whose length h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the measuring tube. This measure also prevents the system losing prime.

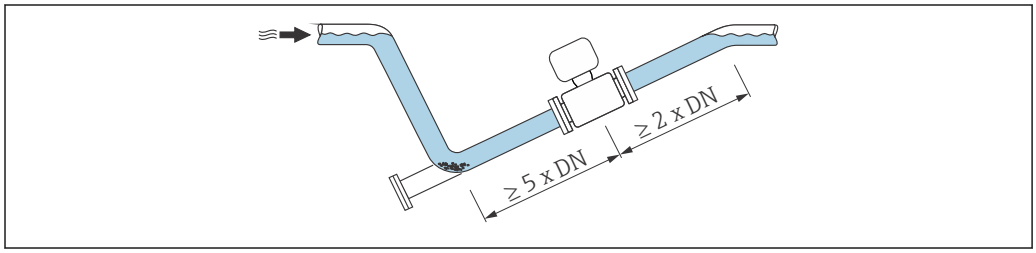



*3 Installation in a down pipe*

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

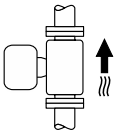
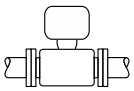
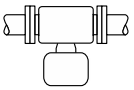
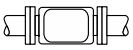
*Installation in partially filled pipes*

A partially filled pipe with a gradient necessitates a drain-type configuration.



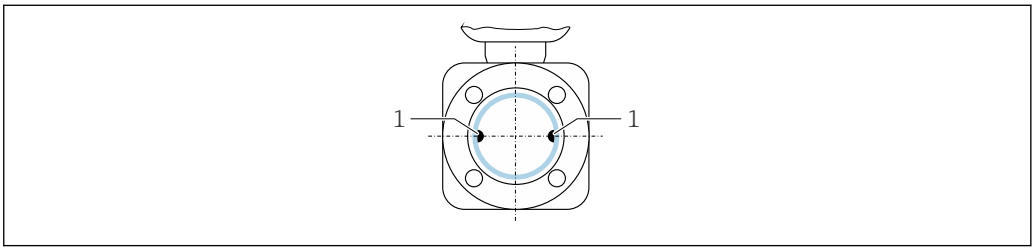
### Orientation

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 |
|---|---|---|---|
| **A** | Vertical orientation |  A0015591 | ✓✓ |
| **B** | Horizontal orientation, transmitter at top |  A0015589 | ✓✓ 1) |
| **C** | Horizontal orientation, transmitter at bottom |  A0015590 | ✓✓ 2) 3) |
| **D** | 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.

*Horizontal*



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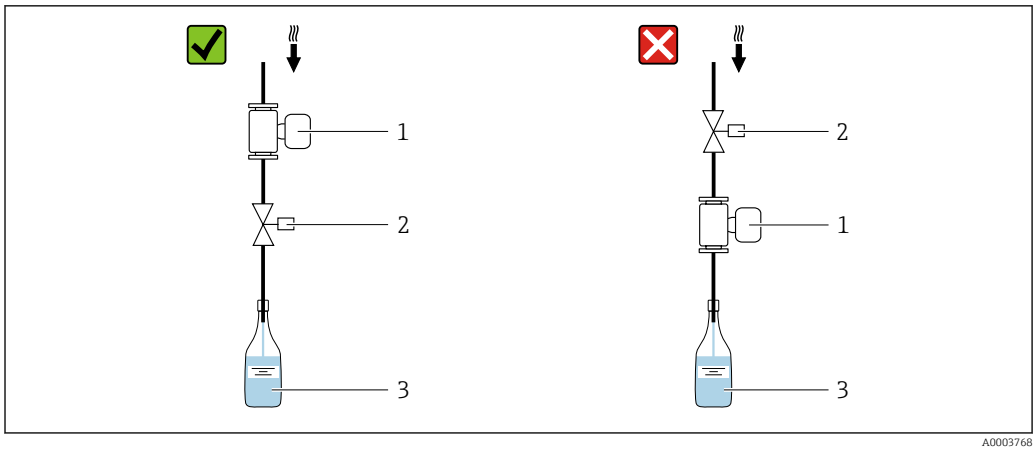
*1 Measuring electrodes for signal detection*

Ideally, the measuring electrode plane should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.

*Valves*

Never install the sensor downstream from a filling valve. If the sensor is completely empty this corrupts the measured value.

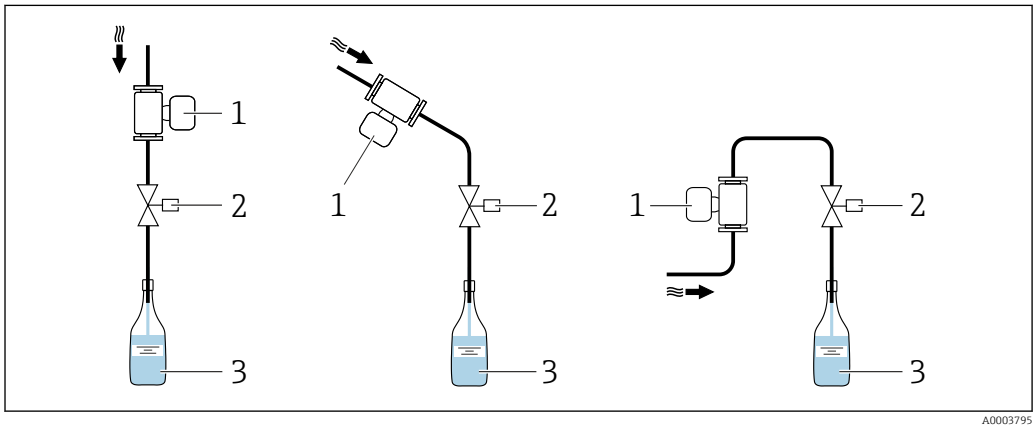
Correct measurement is only possible if the pipe is completely full. Perform sample fillings before commencing filling in production.




1 *Measuring device*
2 *Filling valve*
3 *Container*

*Filling systems*

The pipe system must be completely full to ensure optimum measurement.



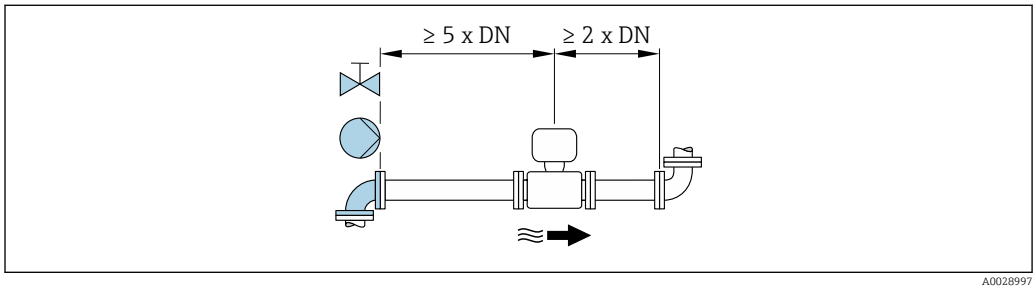

4 *Filling system*

1 *Measuring device*
2 *Filling valve*
3 *Container*

### Inlet and outlet runs

If possible, install the sensor upstream from fittings such as valves, T-pieces or elbows.

Observe the following inlet and outlet runs to comply with accuracy specifications:



*Installation dimensions*

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

## 6.1.2 Requirements from environment and process

### Ambient temperature range

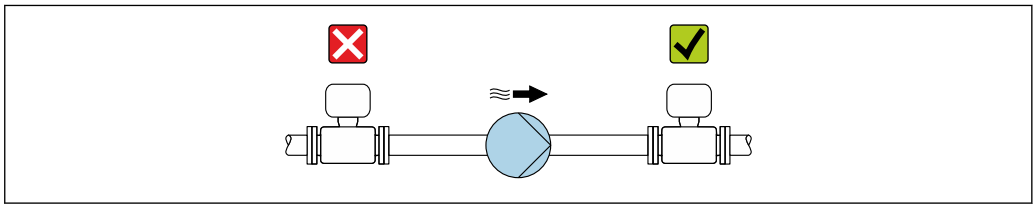
| | |
|---|---|
| Transmitter | −40 to +60 °C (−40 to +140 °F) |
| Sensor | −40 to +60 °C (−40 to +140 °F) |
| Liner | Do not exceed or fall below the permitted temperature range of the liner → 69. |

*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



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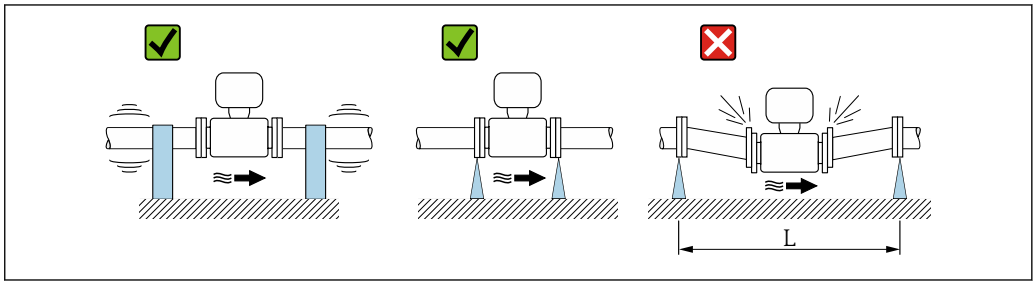
Never install the sensor on the pump suction side in order to avoid the risk of low pressure, and thus damage to the liner.

Furthermore, install pulse dampers if reciprocating, diaphragm or peristaltic pumps are used.

- For information on the liner's resistance to partial vacuum → 70
- For information on the shock resistance of the measuring system → 69
- For information on the vibration resistance of the measuring system → 69

### Vibrations




A0029004

5 *Measures to avoid device vibrations (L > 10 m (33 ft))*

In the event of very strong vibrations, the pipe and sensor must be supported and fixed.

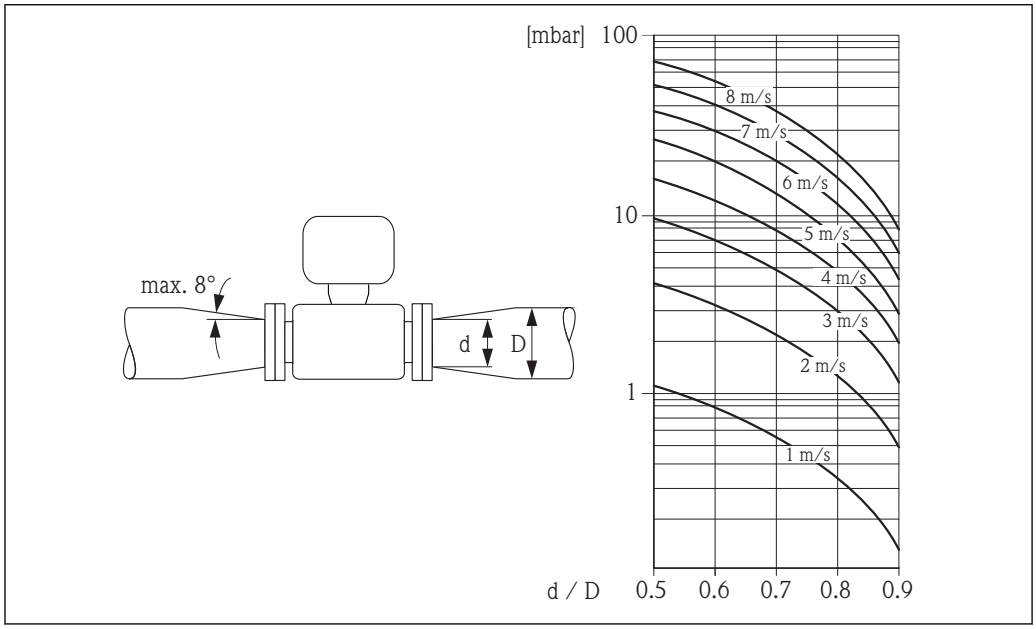
- For information on the shock resistance of the measuring system → 69
- For information on the vibration resistance of the measuring system → 69

### Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

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

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

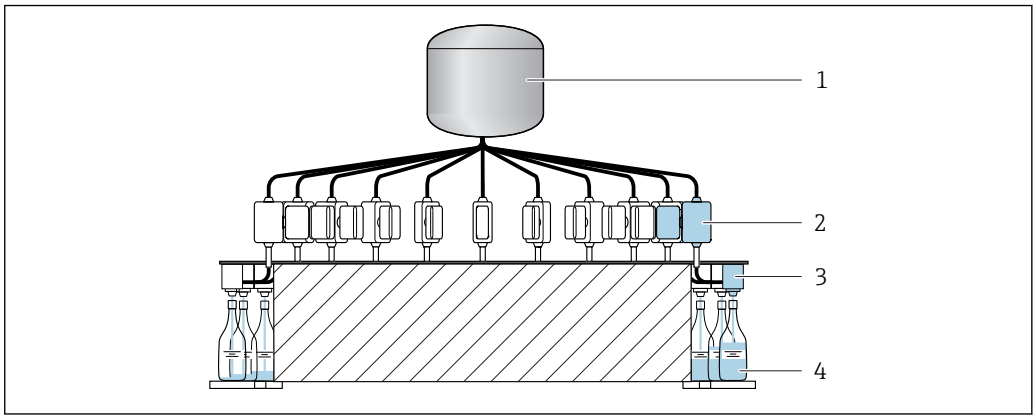



## 6.1.3 Special mounting instructions

### Information for filling systems

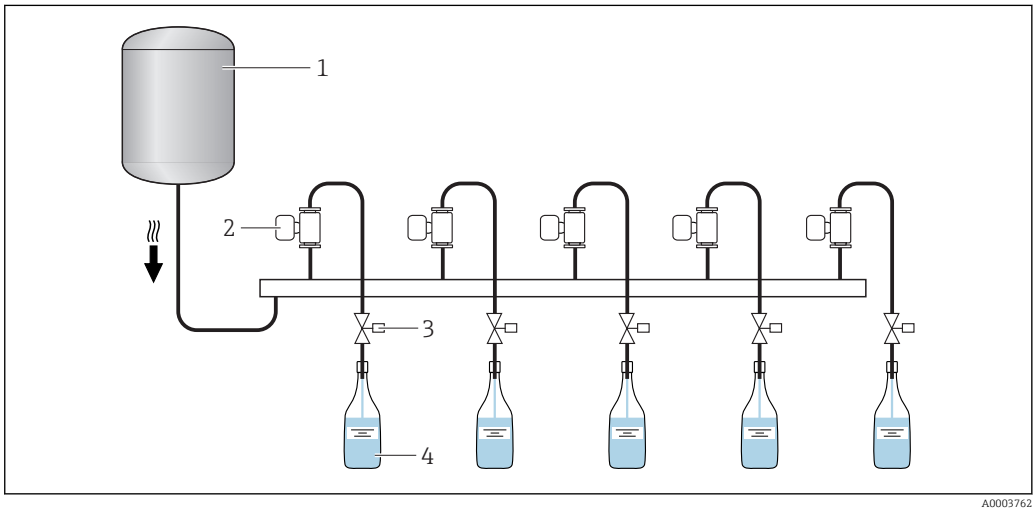
Correct measurement is possible only if the piping is completely filled. We therefore recommend that some test batches be carried out prior to production batching.

*Circular filling system*




*1 Tank*
*2 Measuring device*
*3 Batching valve*
*4 Vessel*

*Linear filling system*




*1 Tank*
*2 Measuring device*
*3 Batching valve*
*4 Vessel*

## 6.2 Mounting the measuring device

### 6.2.1 Required tools

**For sensor**

For flanges and other process connections:
- Screws, nuts, seals etc. are not included in the scope of supply and must be provided by the customer.
- Appropriate mounting tools

### 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 measuring device

**⚠ 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 gaskets are clean and undamaged.
- ▶ Install the gaskets correctly.

Depending on the order option, the measuring device is supplied with or without pre-installed process connections. Pre-installed process connections are secured to the measuring device using 4 hexagonal-headed bolts.

- ▶ Ensure that the direction of the arrow on the nameplate of the sensor matches the flow direction of the fluid.

Depending on the application and pipe length, the measuring device may need to be supported or additionally secured.

### 6.2.4 Welding the sensor into the pipe (welding connections)

**⚠ WARNING**

**Risk of destroying the electronics!**

- ▶ Make sure that the welding system is not grounded via the sensor or transmitter.

1. Tack-weld the sensor to secure it in the pipe. A suitable welding jig can be ordered separately as an accessory → 74.
2. Release the screws on the process connection flange and remove the sensor, along with the seal, from the pipe.
3. Weld the process connection into the pipe.
4. Reinstall the sensor in the pipe, and in doing so make sure that the seal is clean and in the right position.

- If thin-walled pipes carrying food are welded correctly, the seal is not damaged by the heat even when mounted. However, it is recommended to disassemble the sensor and seal.
- It must be possible to open the pipe by approx. 8 mm (0.31 in).

### 6.2.5 Cleaning with pigs

It is essential to take the internal diameters of the measuring tube and process connection into account when cleaning with pigs. All the dimensions and lengths of the sensor and transmitter are provided in the separate "Technical Information" document.

### 6.2.6 Seals

When mounting the process connections, make sure that the seals in question are dry, clean, undamaged and correctly centered.

- The screws must be firmly tightened. The process connection forms a metal connection with the sensor, which ensures a defined compression of the seal.
- Depending on the application the seals should be replaced periodically, particularly if molded seals are used (aseptic version)!
  The interval between changes depends on the frequency of the cleaning cycles, the cleaning temperature and the medium temperature.
  Replacement seals can be ordered as an accessory.

### 6.2.7 Nominal diameter and flow

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum flow velocity is between 1 to 4 m/s (3.28 to 13.12 ft/s). The velocity of flow (v), moreover, has to be matched to the physical properties of the fluid:

- v < 2 m/s (6.56 ft/s): For abrasive media such as cleaning agents etc.
- v > 2 m/s (6.56 ft/s): For media that produce buildup, such as oil and liquids that contain sugar

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

Flow characteristic values → 64

## 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<br>▪ Process pressure→ 70<br>▪ Ambient temperature → 68<br>▪ Measuring range | ❑ |
| Horizontal position of the measuring electrode plane? | ❑ |
| Has the correct orientation for the sensor been selected ?<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 direction of flow of the fluid through the piping ? | ❑ |
| Are the measuring point identification and labeling correct (visual inspection)? | ❑ |
| Is the measuring device adequately protected against vibration (attachment, support)? | ❑ |
| Are the inlet and outlet runs to respected?→ 18 | ❑ |

# 7 Electrical connection

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.

## 7.1 Connection conditions

### 7.1.1 Requirements for connecting cable

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

**Electrical safety**

In accordance with applicable federal/national regulations.

**Permitted temperature range**

- −40 °C (−40 °F) to +80 °C (+176 °F)
- Minimum requirement: cable temperature range ≥ ambient temperature +20 K

**Signal cable**

Cables are not included in the scope of delivery; they can be ordered as an accessory → 62.

*Status input and switch output (batch)*

Standard installation cable is sufficient.

**Modbus RS485**

- The electrical connection of the shield to the device housing must be properly implemented (e.g. using a knurled nut).
- Observe the following with regard to cable loading:
  - Voltage drop due to the cable length and cable type.
  - Valve performance.

*Total length of cable in the Modbus network ≤ 50 m*

Use a shielded cable.

*Example:*
Terminated device plug with cable: Lumberg RKWTH 8-299/10

*Total length of cable in the Modbus network > 50 m*

Use shielded twisted pair cable for RS485 applications.

*Example:*
- Cable: Belden item no. 9842 (for 4-wire version, the same cable can be used for the power supply)
- Terminated device plug: Lumberg RKCS 8/9 (shieldable version)

### 7.1.2 Terminal assignment

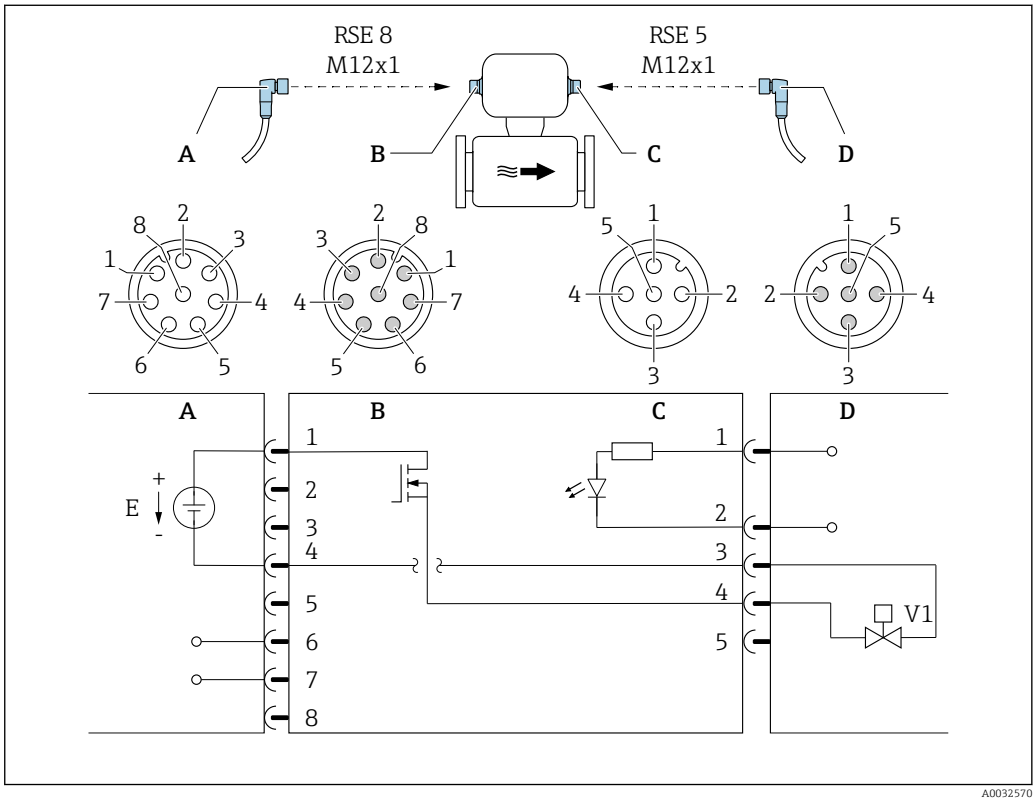
Connection is solely by means of device plug:

There are different device versions available. Order code for "Output, input":
- Option 4: Modbus RS485, 1 status output (batch),1 status input → 25
- Option 5: Modbus RS485, 2 status outputs (batch),1 status input → 26
- Option 6: Modbus RS485 (custody transfer mode)→ 27

### 7.1.3 Pin assignment, device plug

**Device version: Modbus RS485, status output and status input**

Order code for "Output, input", option 4:
Modbus RS485, 1 switch output (batch), 1 status input




6 *Connection to device*

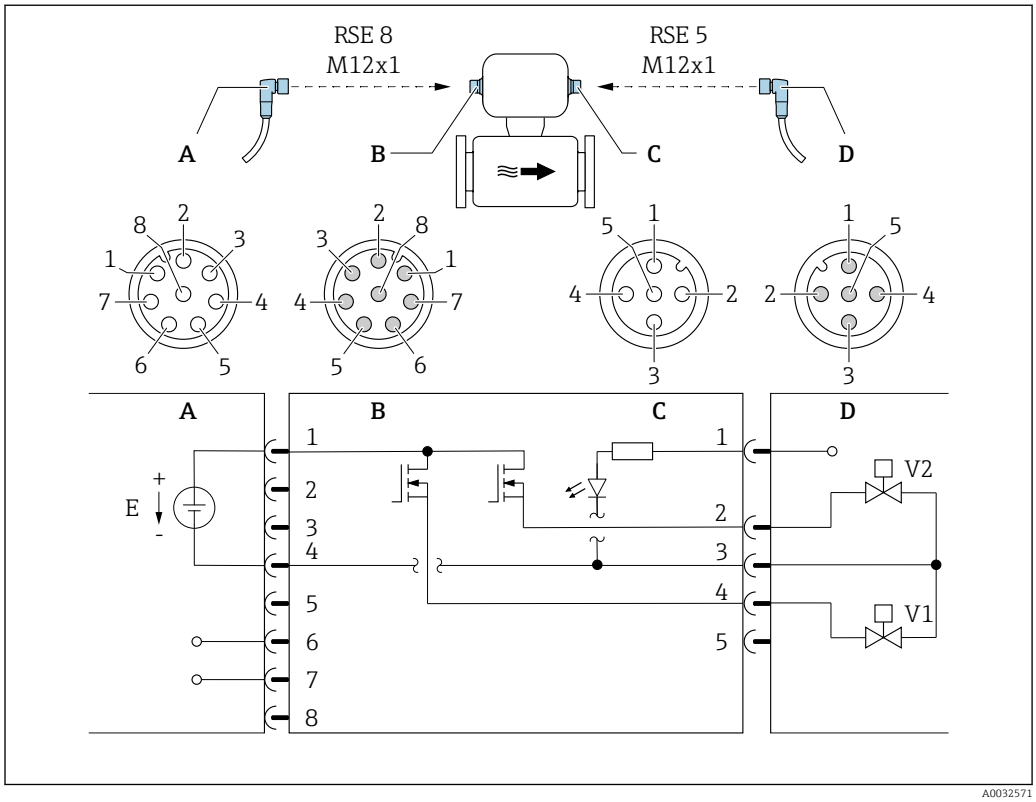
*A Coupling: Supply voltage, Modbus RS485*
*B Connector: Supply voltage, Modbus RS485*
*C Coupling: Switch output (batch), status input*
*D Connector: Switch output (batch), status input*
*E PELV or SELV power supply*
*V1 Valve 1 (batch)*
*1 to 8 Pin assignment*

*Pin assignment*

| Connection: Coupling (A) – Connector (B) | | | Connection: Coupling (C) – Connector (D) | | |
|---|---|---|---|---|---|
| Pin | Assignment | | Pin | Assignment | |
| 1 | L+ | Supply voltage | 1 | + | Status input |
| 2 | + | Service interface RX | 2 | – | Status input |
| 3 | + | Service interface TX | 3 | – | Switch output (batch) |
| 4 | L- | Supply voltage | 4 | + | Switch output (batch) |
| 5 | | Not assigned | 5 | | Not assigned |
| 6 | A | Modbus RS485 | | | |
| 7 | B | Modbus RS485 | | | |
| 8 | – | Service interface GND | | | |

**Device version: Modbus RS485 , 2 status outputs and status input**

Order code for "Output, input", option 5:
Modbus RS485, 2 switch outputs (batch), 1 status input




7 *Connection to device*

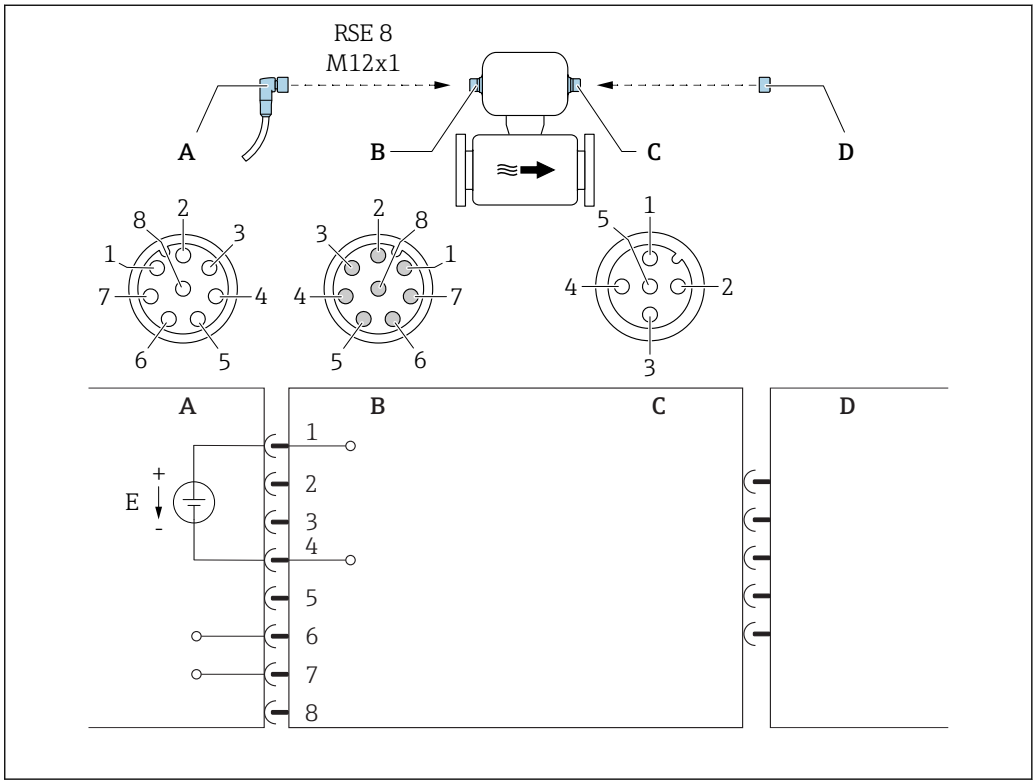
*A Coupling: Supply voltage, Modbus RS485*
*B Connector: Supply voltage, Modbus RS485*
*C Coupling: Switch outputs (batch), status input*
*D Connector: Switch outputs (batch), status input*
*E PELV or SELV power supply*
*V1 Valve (batch), level 1*
*V2 Valve (batch), level 2*
*1 to 8 Pin assignment*

*Pin assignment*

| Connection: Coupling (A) – Connector (B) | | | Connection: Coupling (C) – Connector (D) | | |
|---|---|---|---|---|---|
| Pin | Assignment | | Pin | Assignment | |
| 1 | L+ | Supply voltage | 1 | + | Status input |
| 2 | + | Service interface RX | 2 | + | Switch output (batch) 2 |
| 3 | + | Service interface TX | 3 | – | Switch outputs, status input |
| 4 | L- | Supply voltage | 4 | + | Switch output (batch) 1 |
| 5 | | Not assigned | 5 | | Not assigned |
| 6 | A | Modbus RS485 | | | |
| 7 | B | Modbus RS485 | | | |
| 8 | – | Service interface GND | | | |

### Device version: Modbus RS485 (custody transfer mode)

Order code for "Output, input", option 6 (device version for custody transfer mode): Modbus RS485




8 *Connection to device*

*A Coupling: Supply voltage, Modbus RS485*
*B Connector: Supply voltage, Modbus RS485*
*C Coupling at device*
*D Connector: Dongle (hardware write protection for custody transfer mode)*
*E PELV or SELV power supply*

*Pin assignment*

| Connection: Coupling (A) – Connector (B) | | | Connection: Coupling (C) – Connector (D) | |
|---|---|---|---|---|
| Pin | Assignment | | Pin | Assignment |
| 1 | L+ | Supply voltage | 1 | NC |
| 2 | + | Service interface RX | 2 | NC |
| 3 | + | Service interface TX | 3 | NC |
| 4 | L- | Supply voltage | 4 | + |
| 5 | | Not assigned | 5 | - |
| 6 | A | Modbus RS485 | | |
| 7 | B | Modbus RS485 | | |
| 8 | – | Service interface GND | | |

### 7.1.4 Requirements for the supply unit

**Supply voltage**

DC 24 V (nominal voltage: DC 20 to 30 V)

- The power unit must be tested to ensure that it meets safety requirements (e.g. PELV, SELV).
- The supply voltage must not exceed a maximum short-circuit current of 50 A.

## 7.2 Connecting the measuring device

NOTICE

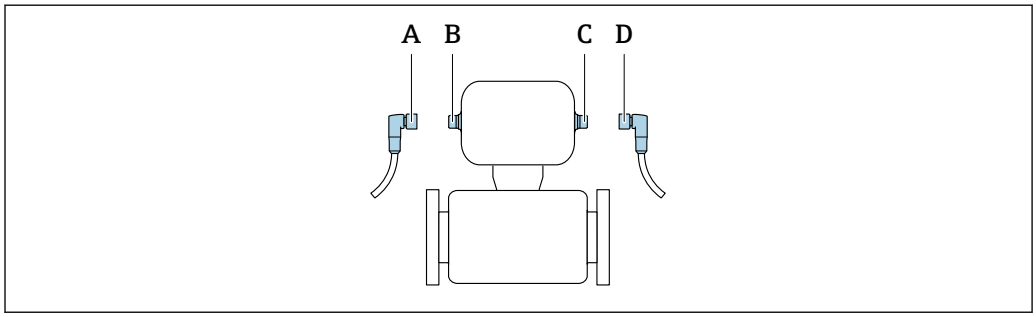
**Limitation of electrical safety due to incorrect connection!**

- ▶ 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.

### 7.2.1 Connecting the transmitter

**Connection by means of device plug**

Connection is solely by means of device plug.

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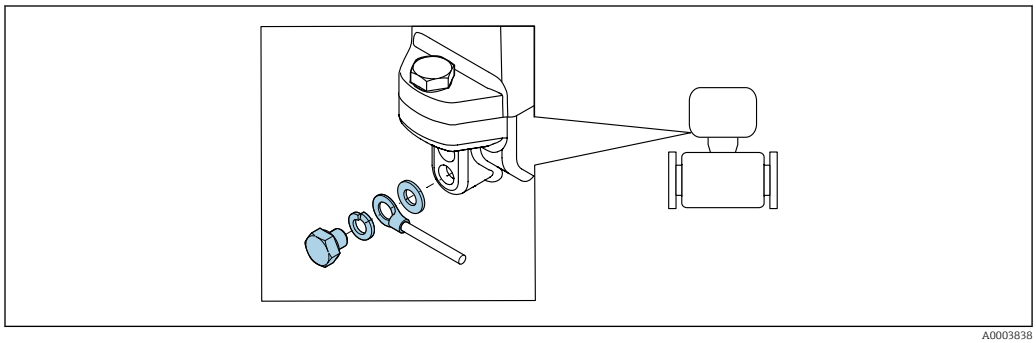
*A, C Coupling*
*B, D Plug*

**Grounding**

Grounding is by means of a cable socket.



A0003838

## 7.3 Ensuring the degree of protection

The measuring device fulfills all the requirements for IP67 degree of protection, Type 4X enclosure.

To guarantee IP67 degree of protection, Type 4X enclosure, carry out the following steps after the electrical connection:

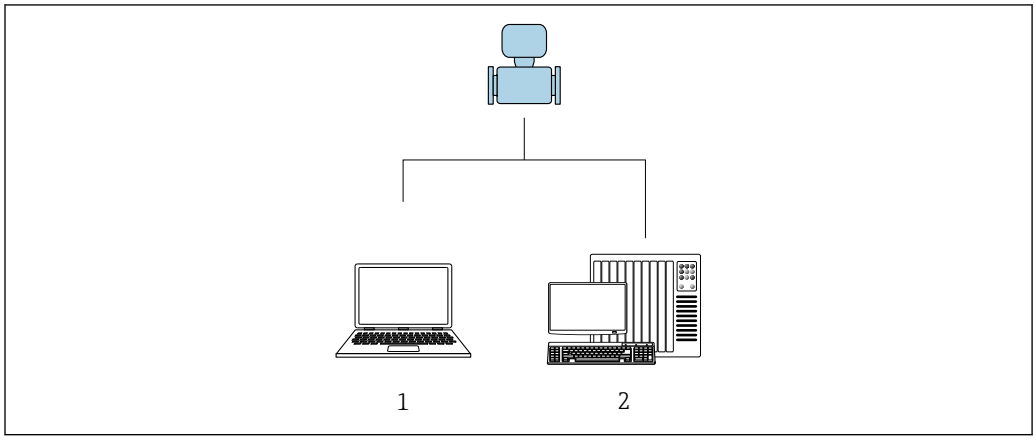
- ▶ Tighten all device plugs.

## 7.4 Post-connection check

| | |
|---|---|
| Is the device undamaged (visual inspection)? | ❑ |
| Does the supply voltage in the system match the specifications on the device's nameplate? | ❑ |
| Do the cables used comply with the necessary specifications? | ❑ |
| Are the maximum values for voltage and current at the pulse and status output being observed? → 🖹 65 | ❑ |

# 8 Operation options

## 8.1 Overview of operation options




*1 Computer with "FieldCare" or "DeviceCare" operating tool*
*2 Control system (e.g. PLC)*

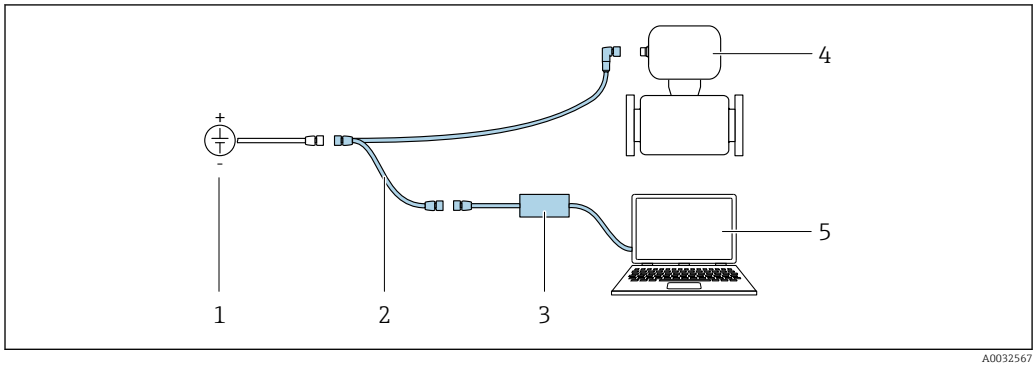
## 8.2 Access to the operating menu via the operating tool

### 8.2.1 Connecting the operating tool

**Using the service adapter and Commubox FXA291**

Operation and configuration can be performed using the Endress+Hauser FieldCare or DeviceCare service and configuration software.

The device is connected to the USB port of the computer via the service adapter and Commubox FXA291.




*1 Supply voltage 24 V DC*
*2 Service adapter*
*3 Dosimag*
*4 Commubox FXA291*
*5 Computer with "FieldCare" or "DeviceCare" operating tool*

The service adapter, cable and Commubox FXA291 are not included in the delivery. These components can be ordered as accessories → 62.

### 8.2.2 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:
Service adapter and Commubox FXA291

Typical functions:
- Configuring parameters 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 → 33

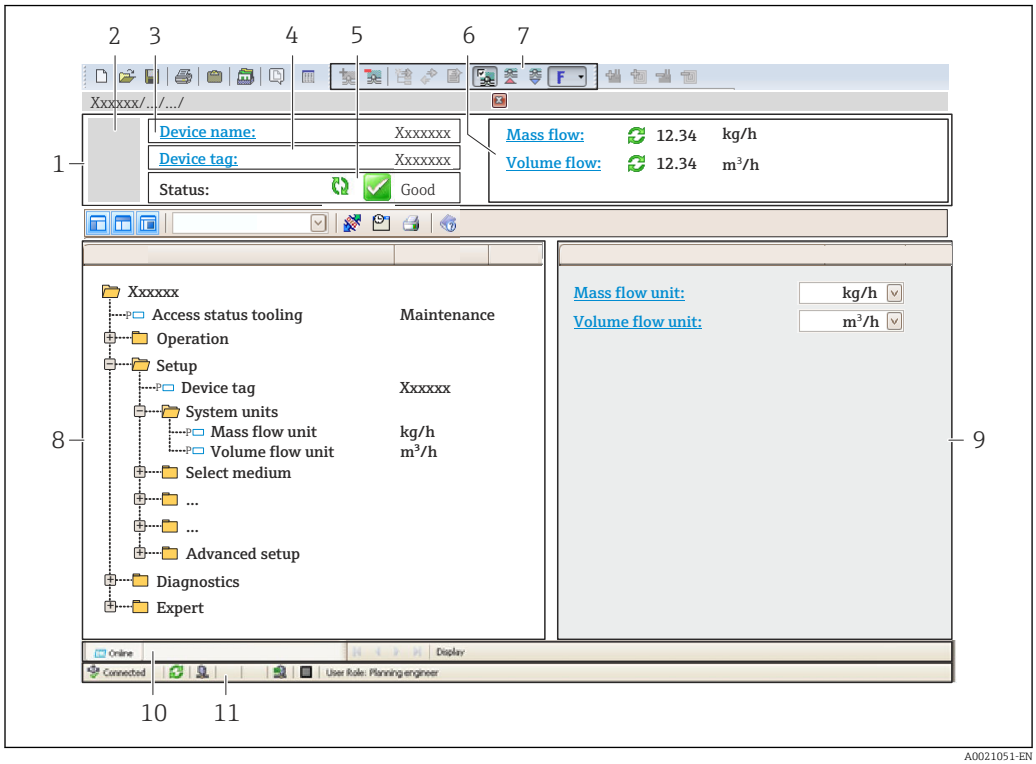
#### Establishing a connection

Service adapter, Commubox FXA291 and "FieldCare" operating tool

1. Start FieldCare and launch the project.
2. In the network: Add a device.
   ↳ The **Add device** window opens.
3. Select the **CDI Communication FXA291** option from the list and press **OK** to confirm.
4. Right-click **CDI Communication FXA291** 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.
6. Establish the online connection to the device.

For additional information, see Operating Instructions BA00027S and BA00059S

### User interface




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

## 8.2.3 DeviceCare

### Function scope

Tool to connect and configure 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 → 33

# 9 System integration

## 9.1 Overview of device description files

### 9.1.1 Current version data for the device

| | | |
|---|---|---|
| Firmware version | 03.00.zz | ▪ On the title page of the Operating instructions<br>▪ On transmitter nameplate<br>▪ Firmware version<br>**Diagnostics** menu → **Device information** submenu → **Firmware version** parameter |
| Release date of firmware version | 05.2015 | --- |

For an overview of the different firmware versions for the device → 58

### 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 | 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 Modbus RS485 information

### 9.2.1 Function codes

Function codes are used to define which read or write action is carried out via the Modbus protocol. The measuring device supports the following function codes:

| Code | Name | Description | Application |
|---|---|---|---|
| 03 | Read holding register | Master reads one or more Modbus registers from the device.<br>A maximum of 125 consecutive registers can be read with 1 telegram: 1 register = 2 bytes<br>The measuring device does not make a distinction between function codes 03 and 04; these codes therefore yield the same result. | Read device parameters with read and write access<br>Example:<br>Read volume flow |
| 04 | Read input register | Master reads one or more Modbus registers from the device.<br>A maximum of 125 consecutive registers can be read with 1 telegram: 1 register = 2 bytes<br>The measuring device does not make a distinction between function codes 03 and 04; these codes therefore yield the same result. | Read device parameters with read access<br>Example:<br>Read totalizer value |

| Code | Name | Description | Application |
|---|---|---|---|
| 06 | Write single registers | Master writes a new value to **one** Modbus register of the measuring device.<br>Use function code 16 to write multiple registers with just 1 telegram. | Write only 1 device parameter<br>Example: reset totalizer |
| 08 | Diagnostics | Master checks the communication connection to the measuring device.<br>The following "Diagnostics codes" are supported:<br>▪ Sub-function 00 = Return query data (loopback test)<br>▪ Sub-function 02 = Return diagnostics register | |
| 16 | Write multiple registers | Master writes a new value to multiple Modbus registers of the device.<br>A maximum of 120 consecutive registers can be written with 1 telegram.<br>If the required device parameters are not available as a group, yet must nevertheless be addressed with a single telegram, use Modbus data map → 34 | Write multiple device parameters |
| 23 | Read/Write multiple registers | Master reads and writes a maximum of 118 Modbus registers of the measuring device simultaneously with 1 telegram.<br>Write access is executed **before** read access. | Write and read multiple device parameters<br>Example:<br>▪ Read mass flow<br>▪ Reset totalizer |

Broadcast messages are only allowed with function codes 06, 16 and 23.

### 9.2.2 Register information

For an overview of Modbus-specific information relating to the individual device parameters: Description of device parameters.

### 9.2.3 Response time

Response time of the measuring device to the request telegram of the Modbus master: typically 3 to 5 ms

### 9.2.4 Modbus data map

#### Function of the Modbus data map

The device offers a special memory area, the Modbus data map (for a maximum of 16 device parameters), to allow users to call up multiple device parameters via Modbus RS485 and not only individual device parameters or a group of consecutive device parameters.

Grouping of device parameters is flexible and the Modbus master can read or write to the entire data block simultaneously with a single request telegram.

### Structure of the Modbus data map

The Modbus data map consists of two data sets:
- Scan list: Configuration area
  The device parameters to be grouped are defined in a list in that their Modbus RS485 register addresses are entered in the list.
- Data area
  The measuring device reads out the register addresses entered in the scan list cyclically and writes the associated device data (values) to the data area.

For an overview of device parameters with their individual Modbus register address, please refer to the additional document on Modbus RS485 register information

### Scan list configuration

For configuration, the Modbus RS485 register addresses of the device parameters to be grouped must be entered in the scan list. Please note the following basic requirements of the scan list:

| | |
|---|---|
| **Max. entries** | 16 device parameters |
| **Supported device parameters** | Only parameters with the following characteristics are supported:<br>▪ Access type: read or write access<br>▪ Data type: float or integer |

*Configuring the scan list via FieldCare*

Carried out using the operating menu of the measuring device:
Expert → Communication → Modbus data map → Scan list register 0 -15

| **Scan list** | |
|---|---|
| **No.** | **Configuration register** |
| 0 | Scan list register 0 |
| … | … |
| 15 | Scan list register 15 |

*Configuring the scan list via Modbus RS485*

Carried out using register addresses 5001 - 5016

| **Scan list** | | | |
|---|---|---|---|
| **No.** | **Modbus RS485 register** | **Data type** | **Configuration register** |
| 0 | 5001 | Integer | Scan list register 0 |
| … | … | Integer | … |
| 15 | 5016 | Integer | Scan list register 15 |

### Reading out data via Modbus RS485

The Modbus master accesses the data area of the Modbus data map to read out the current values of the device parameters defined in the scan list.

| | |
|---|---|
| **Master access to data area** | Via register addresses 5051-5081 |

| Data area | | | |
|---|---|---|---|
| **Device parameter value** | **Modbus RS485 register** | **Data type*** | **Access**** |
| Value of scan list register 0 | 5051 | Integer/float | Read/write |
| Value of scan list register 1 | 5053 | Integer/float | Read/write |
| Value of scan list register ... | ... | ... | ... |
| Value of scan list register 15 | 5081 | Integer/float | Read/write |

***** Data type depends on the device parameters entered in the scan list.
****** Data access depends on the device parameters entered in the scan list. If the device parameter entered supports read and write access, the parameter can also be accessed via the data area.

# 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 → 23
- "Post-connection check" checklist → 29

## 10.2 Switching on the measuring device

▶ The function check has been completed successfully.
Switch on the supply voltage.
↳ The measuring device runs through internal test functions.

The device is operational and operation commences.

If the device does not start up successfully, depending on the cause, a diagnostic message is displayed in the system asset management tool "FieldCare" .

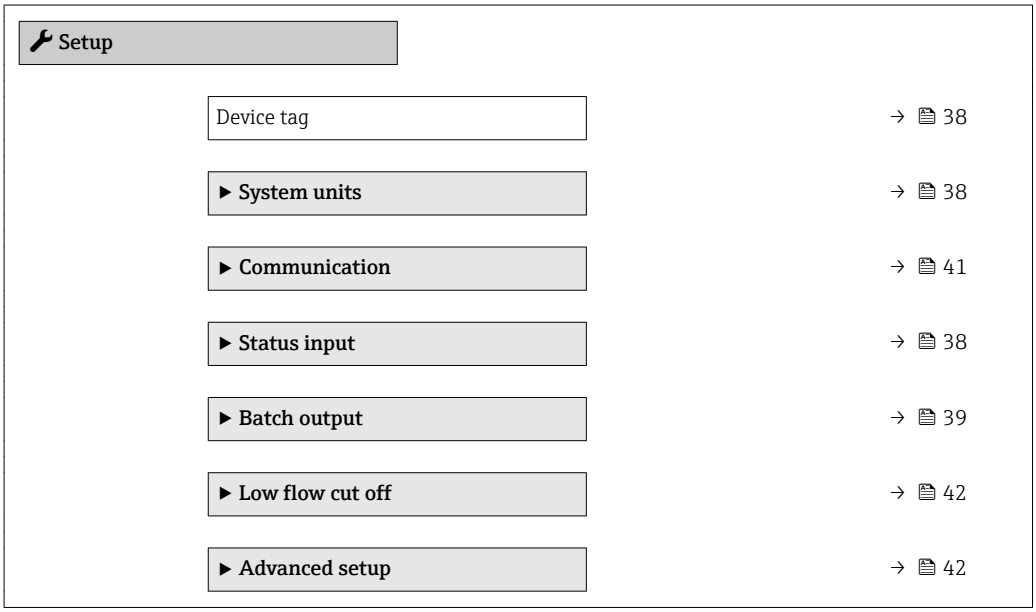
## 10.3 Establishing a connection via FieldCare

- For FieldCare connection
- For establishing a connection via FieldCare → 31
- For FieldCare user interface → 32

## 10.4 Configuring the measuring device

The **Setup** menuwith its submenus contains all the parameters needed for standard operation.

**Navigation**
"Setup" menu



### 10.4.1 Defining the tag name

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

- The number of characters displayed depends on the characters used.
- Enter the tag name in the "FieldCare" operating tool → 32

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

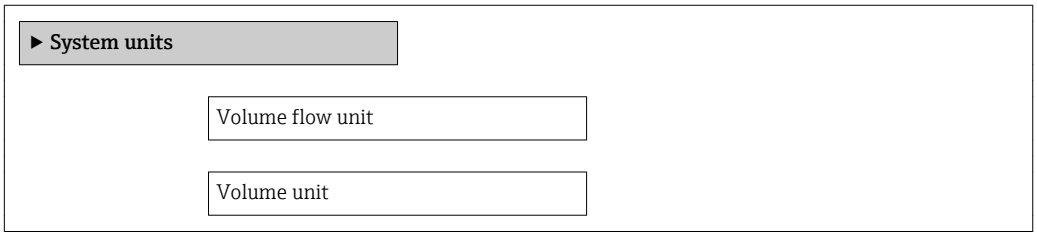
**Parameter overview with brief description**

| Parameter | Description | User entry | Factory setting |
|---|---|---|---|
| Device tag | Enter the name for the measuring point. | Max. 16 characters such as letters, numbers or special characters (e.g. @, %, /). | Dosimag |

### 10.4.2 Setting the system units

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

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




**Parameter overview with brief description**

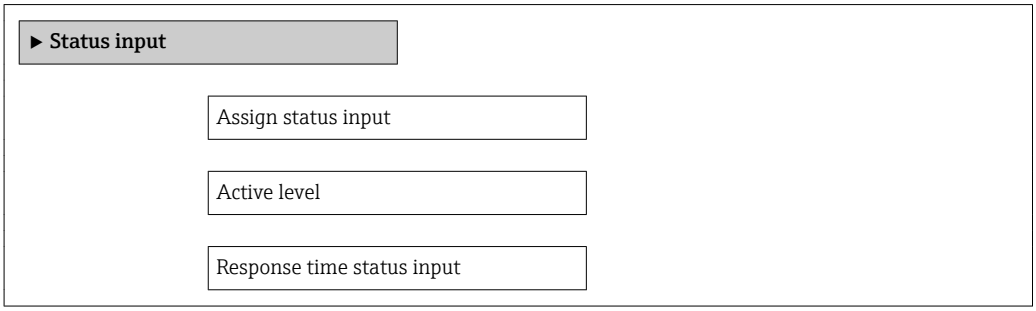
| Parameter | Description | Selection | Factory setting |
|---|---|---|---|
| Volume flow unit | Select volume flow unit.<br>*Result*<br>The selected unit applies for:<br>▪ Low flow cut off<br>▪ Simulation process variable | Unit choose list | Country-specific:<br>▪ ml/s<br>▪ fl oz/s (us) |
| Volume unit | Select volume unit. | Unit choose list | Country-specific:<br>▪ ml<br>▪ fl oz (us) |

### 10.4.3 Configuring the status input

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

**Navigation**
"Setup" menu → Status input

**Structure of the submenu**




**Parameter overview with brief description**

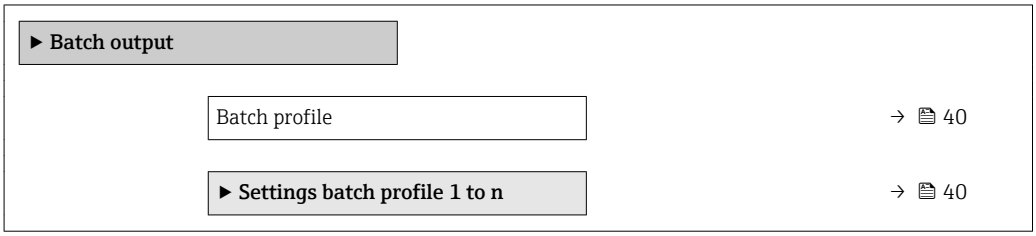
| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Assign status input | Start condition for a batching process:<br>▪ There is no diagnostic message from the **Alarm** category.<br>▪ The batch quantity must be > **0**.<br>▪ The **Batching** option is selected in the **Switch output function** parameter. | Select function for the status input. | ▪ Off<br>▪ Start batch<br>▪ Start & stop batch<br>▪ Reset totalizer 1<br>▪ Reset totalizer 2<br>▪ Reset totalizer 3<br>▪ Reset all totalizers<br>▪ Flow override | Off |
| Active level | – | Define input signal level at which the assigned function is triggered. | ▪ High<br>▪ Low | High |
| Response time status input | – | Define the minimum amount of time the input signal level must be present before the selected function is triggered. | 10 to 200 ms | 50 ms |

## 10.4.4 Configuring the switch output (batch)

A batch profile (1 to 6) can be assigned to the switch output (batch) in the **Batch output** submenu.

The individual batch profiles are configured in the **Settings batch profile 1 to n** submenu.

**Navigation**
"Setup" menu → Batch output



### Parameter overview with brief description

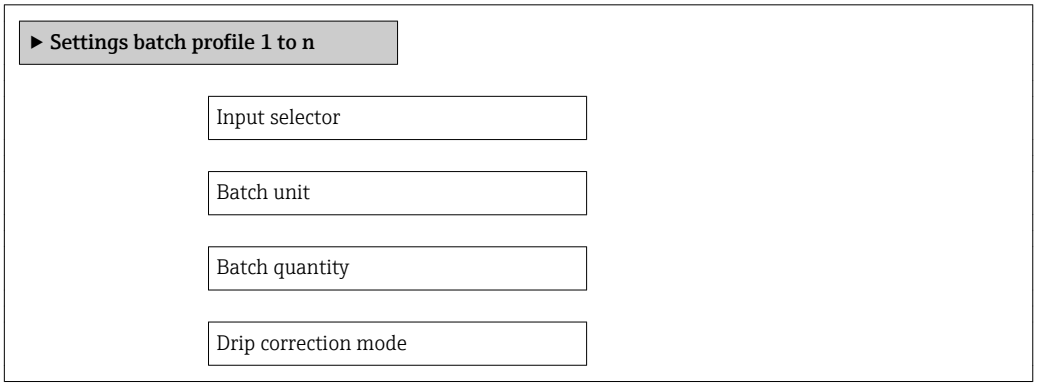
| Parameter | Description | Selection | Factory setting |
|---|---|---|---|
| Batch profile | Select suitable profile for fluid configured by customer. | ▪ Profile 1<br>▪ Profile 2<br>▪ Profile 3<br>▪ Profile 4<br>▪ Profile 5<br>▪ Profile 6 | Profile 1 |

### Batch profile settings

The **Settings batch profile 1 to n** submenu contains all the parameters that must be set for configuration of the batch profiles.

### Navigation

"Setup" menu → Batch output → Settings batch profile 1 to n



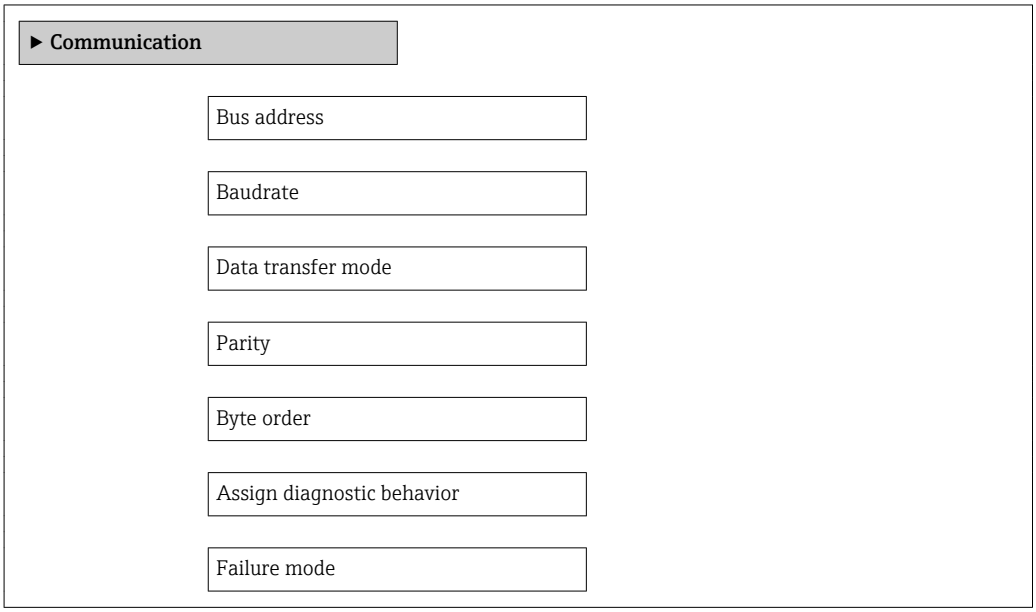

### Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Input selector | – | Select a process variable for batch profile. | ▪ Off<br>▪ Volume flow | Volume flow |
| Batch unit | One of the following options is selected in the **Input selector** parameter:<br>Volume flow | Select unit for process variable of the batch profile.<br>*Result*<br>The selected unit applies for:<br>▪ Batch quantity<br>▪ Fixed compensation quantity<br>▪ Batch unit | Unit choose list | Depending on country:<br>▪ ml<br>▪ fl oz (us) |
| Batch quantity | One of the following options is selected in the **Input selector** parameter:<br>Volume flow | Enter a quantity of selected process variable for batch profile.<br>*Dependency*<br>The unit is taken from: **Batch unit** parameter | Positive floating-point number | Depending on country:<br>▪ 0 ml<br>▪ 0 fl oz (us) |
| Drip correction mode | One of the following options is selected in the **Input selector** parameter:<br>Volume flow | Select a drip correction. | ▪ Off<br>▪ Fixed time<br>▪ Fixed time or low flow cut off | Off |

### 10.4.5 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 entry / Selection | Factory setting |
|---|---|---|---|
| Bus address | Enter device address. | 1 to 247 | 247 |
| Baudrate | Define data transfer speed. | ▪ 1200 BAUD<br>▪ 2400 BAUD<br>▪ 4800 BAUD<br>▪ 9600 BAUD<br>▪ 19200 BAUD<br>▪ 38400 BAUD<br>▪ 57600 BAUD<br>▪ 115200 BAUD | 19200 BAUD |
| Data transfer mode | Select data transfer mode. | ▪ ASCII<br>▪ RTU | RTU |
| Parity | Select parity bits. | Picklist **ASCII** option:<br>▪ 0 = **Even** option<br>▪ 1 = **Odd** option<br>Picklist **RTU** option:<br>▪ 0 = **Even** option<br>▪ 1 = **Odd** option<br>▪ 2 = **None / 1 stop bit** option<br>▪ 3 = **None / 2 stop bits** option | Even |
| Byte order | Select byte transmission sequence. | ▪ 0-1-2-3<br>▪ 3-2-1-0<br>▪ 1-0-3-2<br>▪ 2-3-0-1 | 1-0-3-2 |

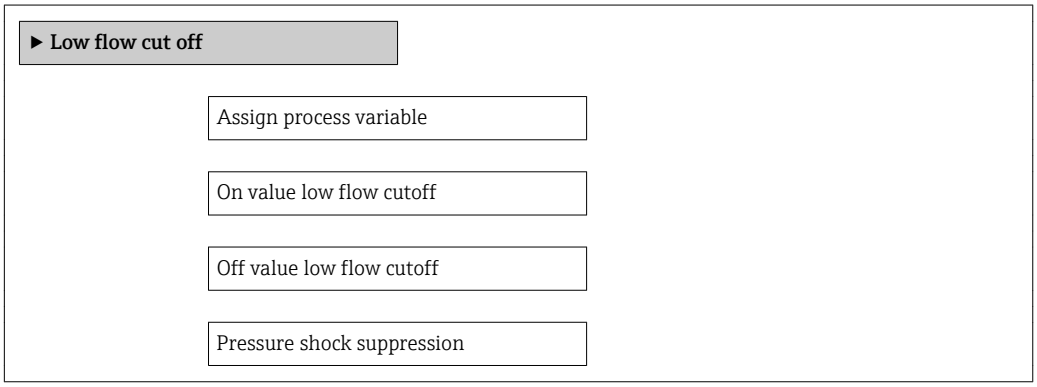
| Parameter | Description | User entry / Selection | Factory setting |
|---|---|---|---|
| Assign diagnostic behavior | Select diagnostic behavior for MODBUS communication. | ▪ Off<br>▪ Alarm or warning<br>▪ Warning<br>▪ Alarm | Alarm |
| Failure mode | Select measured value output behavior when a diagnostic message occurs via Modbus communication.<br>NaN [1] | ▪ NaN value<br>▪ Last valid value | NaN value |

1) Not a Number

### 10.4.6 Low flow cut off

The **Low flow cut off** submenu contains the parameters that must be set in order to configure the low flow cut off.

**Navigation**
"Setup" menu → Low flow cut off



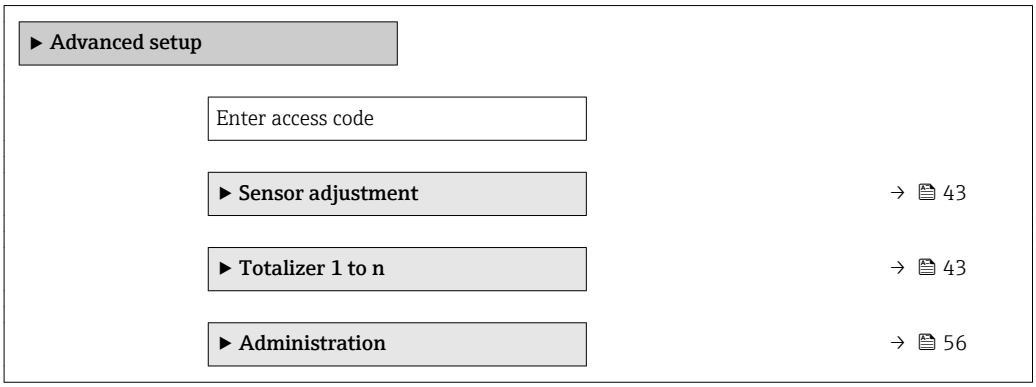

**Parameter overview with brief description**

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Assign process variable | – | Select process variable for low flow cut off. | ▪ Off<br>▪ Volume flow | Volume flow |
| On value low flow cutoff | In the **Assign process variable** parameter (→ 🖹 42), the **Volume flow** option is selected. | Enter on value for low flow cut off. | Signed floating-point number | Depends on country and nominal diameter |
| Off value low flow cutoff | In the **Assign process variable** parameter (→ 🖹 42), the **Volume flow** option is selected. | Enter off value for low flow cut off. | 0 to 100.0 % | 50 % |
| Pressure shock suppression | In the **Assign process variable** parameter (→ 🖹 42), the **Volume flow** option is selected. | Enter time frame for signal suppression (= active pressure shock suppression). | 0 to 100 s | 0 s |

## 10.5 Advanced settings

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

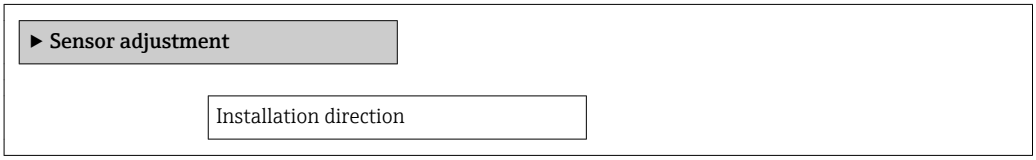
**Navigation**
"Setup" menu → Advanced setup




## 10.5.1 Sensor adjustment

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

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



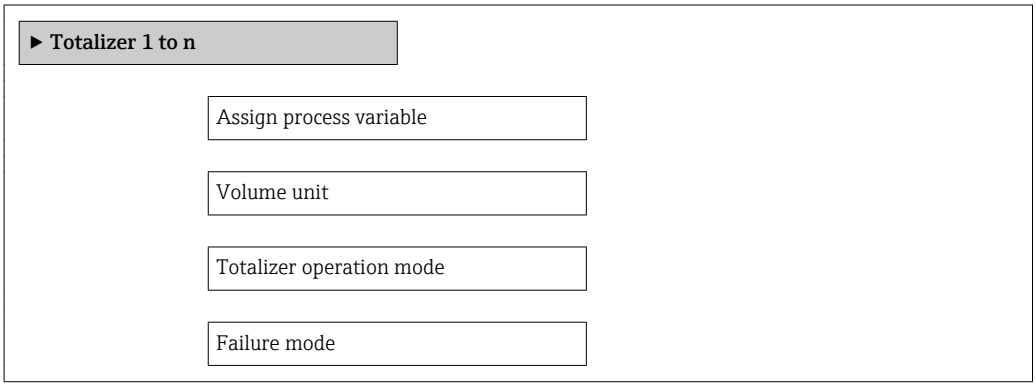

**Parameter overview with brief description**

| Parameter | Description | Selection | Factory setting |
|---|---|---|---|
| Installation direction | Set sign of flow direction to match the direction of the arrow on the sensor. | ▪ Flow in arrow direction<br>▪ Flow against arrow direction | Flow in arrow direction |

## 10.5.2 Configuring the totalizer

The totalizer in question can be configured in the **Totalizer 1 to n** submenu.

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



### Parameter overview with brief description

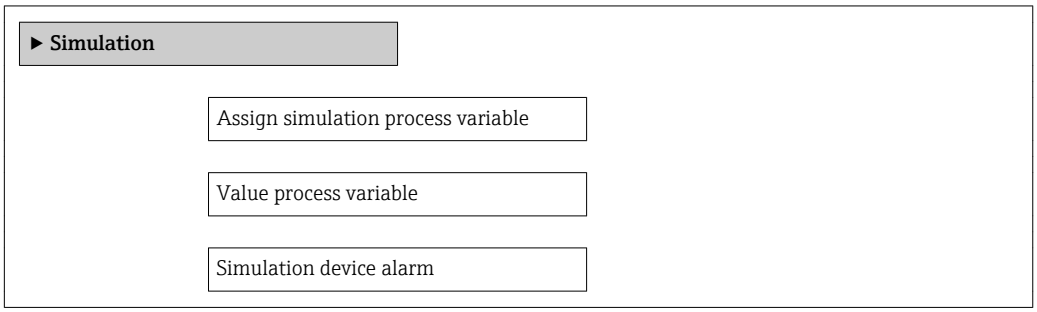
| Parameter | Prerequisite | Description | Selection | Factory setting |
|---|---|---|---|---|
| Assign process variable | – | Select process variable for totalizer. | ▪ Off<br>▪ Volume flow | Volume flow |
| Volume unit | The **Volume flow** option is selected in the **Assign process variable** parameter (→ 🖹 44) of the **Totalizer 1 to n** submenu. | Select volume unit. | Unit choose list | Depending on country:<br>▪ ml<br>▪ fl oz (us) |
| Totalizer operation mode | In the **Assign process variable** parameter (→ 🖹 44) of the **Totalizer 1 to n** submenu, the **Volume flow** option is selected. | Select totalizer calculation mode. | ▪ Net flow total<br>▪ Forward flow total<br>▪ Reverse flow total | Net flow total |
| Failure mode | In the **Assign process variable** parameter (→ 🖹 44) of the **Totalizer 1 to n** submenu, the **Volume flow** option is selected. | Define totalizer behavior in alarm condition. | ▪ Stop<br>▪ Actual value<br>▪ Last valid value | Stop |

## 10.6 Simulation

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

### Navigation

"Diagnostics" menu → Simulation




### Parameter overview with brief description

| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Assign simulation process variable | – | Select a process variable for the simulation process that is activated. | ▪ Off<br>▪ Volume flow | Off |
| Value process variable | In the **Assign simulation process variable** parameter (→ 🖹 44), the **Volume flow** option is selected. | Enter the simulation value for the selected process variable. | Depends on the process variable selected | 0 |
| Simulation device alarm | – | Switch the device alarm on and off. | ▪ Off<br>▪ On | Off |

# 11 Operation

## 11.1 Reading device locking status

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

**Navigation**
"Operation" menu → Locking status

*Function scope of "Locking status" parameter*

| Options | Description |
|---|---|
| Temporarily locked | Write access to the parameters is temporarily lock due to device-internal processing (e.g. data upload/download, reset). Once the internal processing has been completed, the parameters can be changed once again. |

**Parameter overview with brief description**

| Parameter | Description | User interface | Factory setting |
|---|---|---|---|
| Locking status | Indicates the write protection with the highest priority that is currently active. | Temporarily locked | Temporarily locked |

## 11.2 Reading access authorization status on operating software

Displaying active access authorization: **Access status tooling** parameter

**Navigation**
"Operation" menu → Access status tooling

**Parameter overview with brief description**

| Parameter | Description | User interface | Factory setting |
|---|---|---|---|
| Access status tooling | Shows the access authorization to the parameters via the operating tool. | ▪ Operator<br>▪ Maintenance | Maintenance |

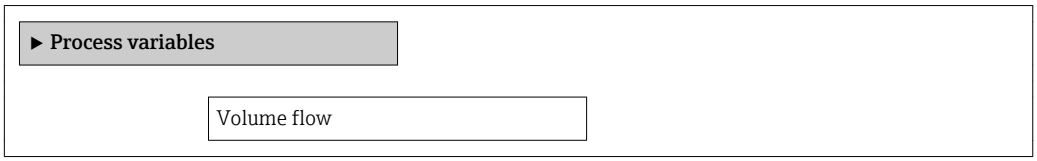
## 11.3 Reading measured values

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

### 11.3.1 Process variables

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

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



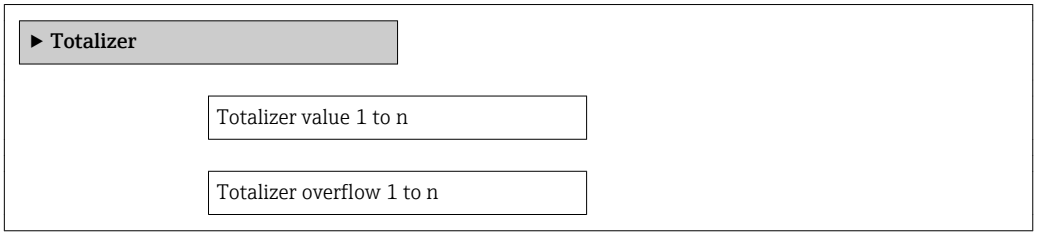

**Parameter overview with brief description**

| Parameter | Description | User interface |
|---|---|---|
| Volume flow | Displays the volume flow currently measured.<br>*Dependency*<br>The unit is taken from the **Volume flow unit** parameter | Signed floating-point number |

## 11.3.2 Totalizer

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**

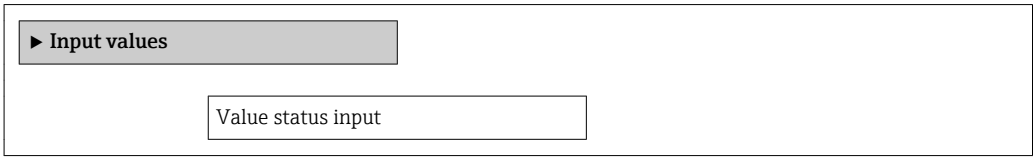
| Parameter | Prerequisite | Description | User interface |
|---|---|---|---|
| Totalizer value | In the **Assign process variable** parameter (→ 🖹 44) of the **Totalizer 1 to n** submenu, the **Volume flow** option is selected. | Displays the current totalizer counter value. | Signed floating-point number |
| Totalizer overflow | In the **Assign process variable** parameter (→ 🖹 44) of the **Totalizer 1 to n** submenu, the **Volume flow** option is selected. | Displays the current totalizer overflow. | Integer with sign |

## 11.3.3 Input values

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

### Navigation
"Diagnostics" menu → Measured values → Input values

### Structure of the submenu




### Parameter overview with brief description

| Parameter | Description | User interface |
|---|---|---|
| Value status input | Shows the current input signal level. | ▪ High<br>▪ Low |

## 11.4 Performing a totalizer reset

In the **Operation** submenu the totalizers are reset:
- Control Totalizer
- Reset all totalizers

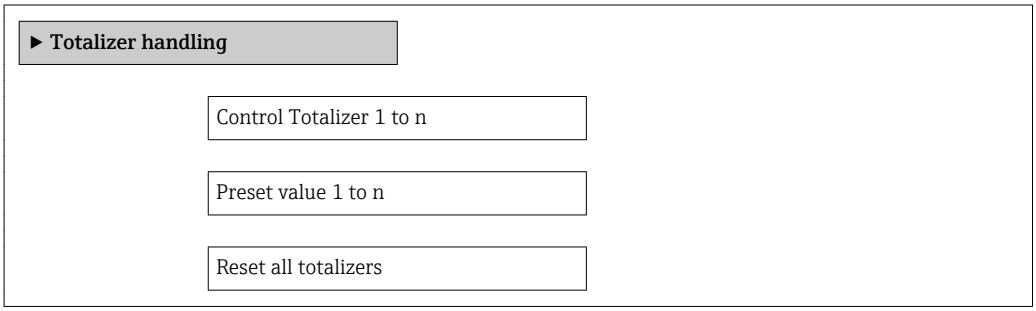
*Function scope of the "Control Totalizer" parameter*

| Options | Description |
|---|---|
| Totalize | The totalizer is started. |
| 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 in the **Preset value** parameter and the totaling process is restarted. |
| Hold | Totalizing is stopped. |

*Function scope of the "Reset all totalizers" parameter*

| Options | Description |
|---|---|
| Reset + totalize | Resets all totalizers to 0 and restarts the totaling process. This deletes all the flow values previously totalized. |

### Navigation
"Operation" menu → Totalizer handling



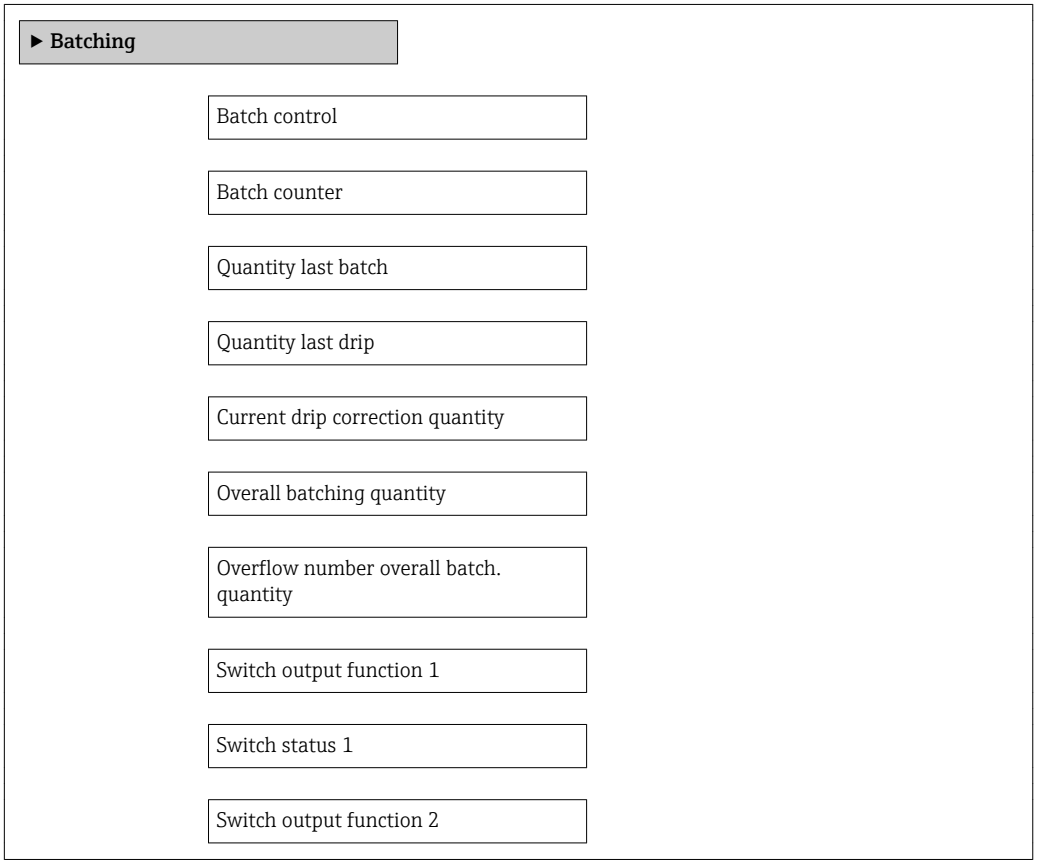
**Parameter overview with brief description**

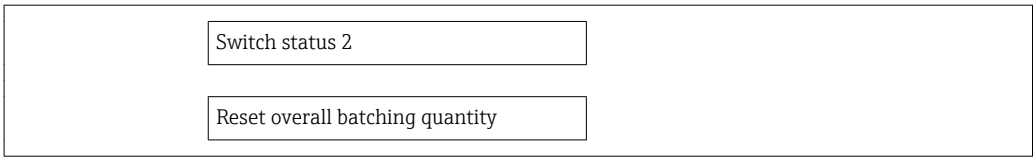
| Parameter | Prerequisite | Description | Selection / User entry | Factory setting |
|---|---|---|---|---|
| Control Totalizer | In the **Assign process variable** parameter (→ 🖹 44) of the **Totalizer 1 to n** submenu, the **Volume flow** option is selected. | Control totalizer value. | ▪ Totalize<br>▪ Reset + hold<br>▪ Preset + hold<br>▪ Reset + totalize<br>▪ Preset + totalize | Totalize |
| Preset value | In the **Assign process variable** parameter (→ 🖹 44) of the **Totalizer 1 to n** submenu, the **Volume flow** option is selected. | Specify start value for totalizer.<br>*Dependency*<br>The unit of the selected process variable is specified for the totalizer in the **Assign process variable** parameter. If the following is selected in the **Assign process variable** parameter: **Volume flow** option: **Volume flow unit** parameter | Signed floating-point number | Country-specific:<br>▪ 0 $m^3$<br>▪ 0 $ft^3$ |
| Reset all totalizers | – | Reset all totalizers to 0 and start. | ▪ Cancel<br>▪ Reset + totalize | Cancel |

## 11.5 Batching control

The **Batching** submenu contains all the parameters required for batching control.

**Navigation**
"Operation" submenu → Batching






## Parameter overview with brief description

| Parameter | Description | Selection / User interface | Factory setting |
|---|---|---|---|
| Batch control | Switch the batch on and off. | ▪ Start<br>▪ Stop | Stop |
| Batch counter | Shows number of passed batch procedures. | Positive integer | – |
| Quantity last batch | Shows total quantity of last batch.<br>*Dependency*<br>The unit is taken from: **Batch unit** parameter | Signed floating-point number | – |
| Quantity last drip | Shows drip quantity of last batch.<br>*Dependency*<br>The unit is taken from: **Batch unit** parameter | Signed floating-point number | – |
| Current drip correction quantity | Shows the drip correction quantity of current batch.<br>*Dependency*<br>The unit is taken from: **Batch unit** parameter | Signed floating-point number | – |
| Overall batching quantity | Shows the total quantity of all passed batch procedures of current profile.<br>*Dependency*<br>The unit is taken from: **Batch unit** parameter | Signed floating-point number | – |
| Overflow number overall batch. quantity | Shows how often an overflow of the overall batching quantity has occured. | –32 000.0 to 32 000.0 | – |
| Switch output function 1 to n | Select function for the switch output. | ▪ Close<br>▪ Open<br>▪ Batching | ▪ Batching (Switch output function 1)<br>▪ Open (Switch output function 2) |
| Switch status 1 to n | Display the current status of the switch output. | ▪ Closed<br>▪ Open | – |
| Reset overall batching quantity | Reset the total quantity of all passed batch procedures to 0. | ▪ Reset<br>▪ Cancel | Cancel |

# 12 Diagnostics and troubleshooting

## 12.1 General troubleshooting

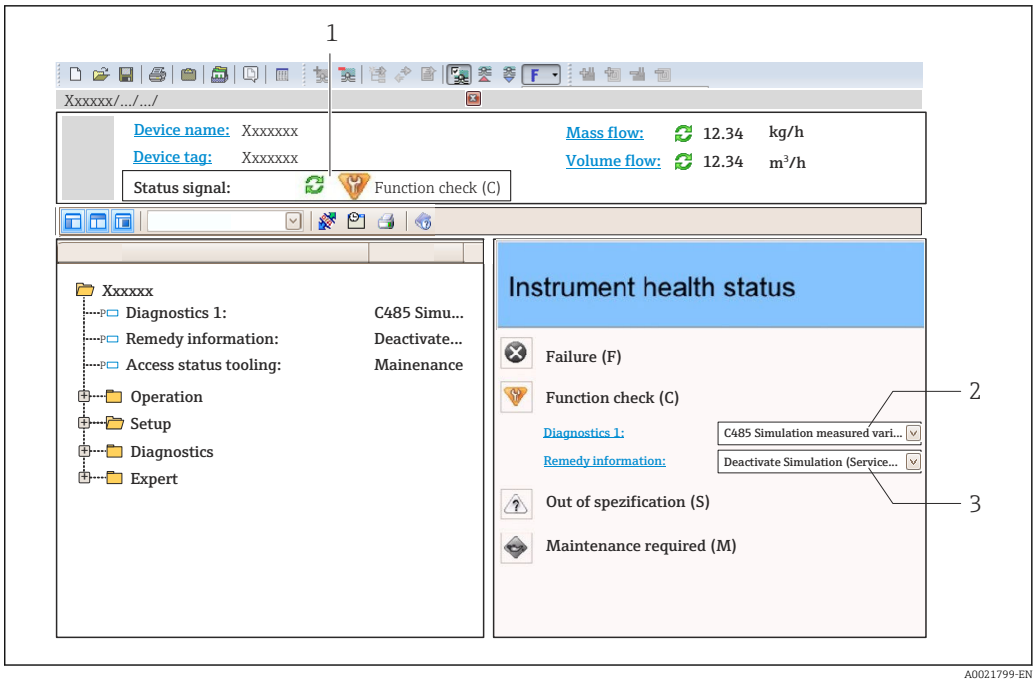
*For access*

| Problem | Possible causes | Remedy |
|---|---|---|
| No write access to parameters | Current user role has limited access authorization | Check access authorization status . |
| No connection via Modbus RS485 | Device plug connected incorrectly | Check the pin assignment of the device plug . |
| No connection via Modbus RS485 | Modbus RS485 cable incorrectly terminated | Check the terminating resistor . |
| No connection via Modbus RS485 | Incorrect settings for the communication interface | Check the Modbus RS485 configuration . |
| No connection via service adapter | Incorrect configuration of USB interface on PC or driver not installed correctly. | Observe the documentation for the Commubox.<br>FXA291: Document "Technical Information" TI00405C |

## 12.2 Diagnostic information in FieldCare

### 12.2.1 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.

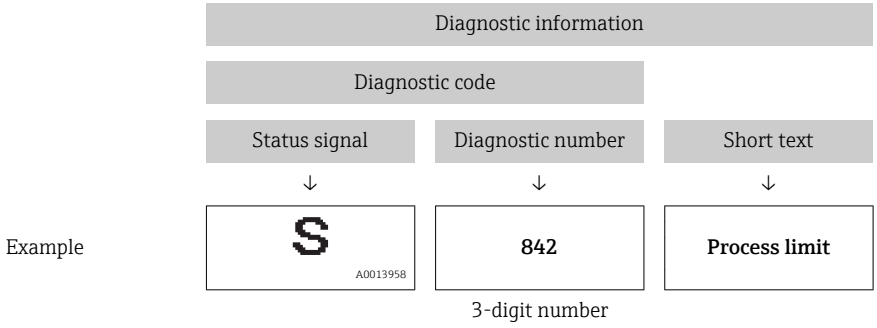



1 *Status area with status signal*
2 *Diagnostic information* → 🖹 *51*
3 *Remedy information with Service ID*

Furthermore, diagnostic events that have occurred can be viewed in the **Diagnostics** menu:
- Via parameter
- Via submenu → 🖹 55

### Diagnostic information

The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault.




## 12.2.2 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.

## 12.3 Diagnostic information via communication interface

### 12.3.1 Reading out diagnostic information

Diagnostic information can be read out via Modbus RS485 register addresses.

- Via register address **6821** (data type = string): diagnosis code, e.g. F270
- Via register address **6859** (data type = integer): diagnosis number, e.g. 270

For an overview of diagnostic events with diagnosis number and diagnosis code → 53

### 12.3.2 Configuring error response mode

Error response mode for Modbus RS485 communication can be configured in the **Communication** submenu using 2 parameters.

**Navigation path**
"Setup" menu → Communication

*Parameter overview with brief description*

| Parameter | Description | Options | Factory setting |
|---|---|---|---|
| Assign diagnostic behavior | Select diagnostic behavior for MODBUS communication. | ▪ Off<br>▪ Alarm or warning<br>▪ Warning<br>▪ Alarm | Alarm |
| Failure mode | Select measured value output behavior when a diagnostic message occurs via Modbus communication.<br>This parameter operates in accordance with the option selected in the **Assign diagnostic behavior** parameter. | ▪ NaN value<br>▪ Last valid value<br>NaN ≡ not a number | NaN value |

## 12.4 Adapting the diagnostic information

### 12.4.1 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 certain 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 | Measurement is interrupted. Measured value output via Modbus RS485 and totalizers assume the defined alarm condition. A diagnostic message is generated. |
| Warning | Measurement is resumed. Measured value output via Modbus RS485 and totalizers are not affected. A diagnostic message is generated. |
| Logbook entry only | The device continues to measure. The diagnostic message is entered in the Event logbook (events list) submenu only and is not displayed in alternation with the measured value display. |
| Off | The diagnostic event is ignored, and no diagnostic message is generated or entered. |

## 12.5 Overview of diagnostic information

In the case of some items of diagnostic information, the status signal and the diagnostic behavior can be changed. Change the diagnostic information → 52

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| **Diagnostic of sensor** | | | | |
| 004 | Sensor | 1. Change sensor<br>2. Contact service | S | Alarm |
| 062 | Sensor connection | 1. Check sensor connections<br>2. Contact service | F | Alarm |
| 082 | Data storage | 1. Check module connections<br>2. Contact service | F | Alarm |
| 083 | Memory content | 1. Restart device<br>2. Contact service | F | Alarm |
| **Diagnostic of electronic** | | | | |
| 242 | Software incompatible | 1. Check software<br>2. Flash or change main electronics module | F | Alarm |
| 270 | Main electronic failure | Change main electronic module | F | Alarm |
| 271 | Main electronic failure | 1. Restart device<br>2. Change main electronic module | F | Alarm |
| 272 | Main electronic failure | 1. Restart device<br>2. Contact service | F | Alarm |
| 273 | Main electronic failure | Change electronic | F | Alarm |
| 281 | Electronic initialization | Firmware update active, please wait! | F | Alarm |
| 311 | Electronic failure | 1. Reset device<br>2. Contact service | F | Alarm |
| 322 | Electronic drift | 1. Perform verification manually<br>2. Change electronic | S | Warning |
| **Diagnostic of configuration** | | | | |
| 410 | Data transfer | 1. Check connection<br>2. Retry data transfer | F | Alarm |
| 411 | Up-/download active | Up-/download active, please wait | C | Warning |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| 438 | Dataset | 1. Check data set file<br>2. Check device configuration<br>3. Up- and download new configuration | M | Warning |
| 442 | Frequency output 1 to n | 1. Check process<br>2. Check frequency output settings | S | Warning [1] |
| 443 | Pulse output 1 to n | 1. Check process<br>2. Check pulse output settings | S | Warning [1] |
| 453 | Flow override | Deactivate flow override | C | Warning |
| 484 | Simulation failure mode | Deactivate simulation | C | Alarm |
| 485 | Simulation measured variable | Deactivate simulation | C | Warning |
| 500 | Electrode difference voltage too high | 1. Check process cond.<br>2. Increase system pressure | F | Alarm |
| **Diagnostic of process** | | | | |
| 832 | Electronic temperature too high | Reduce ambient temperature | S | Warning [1] |
| 833 | Electronic temperature too low | Increase ambient temperature | S | Warning [1] |
| 834 | Process temperature too high | Reduce process temperature | S | Warning [1] |
| 835 | Process temperature too low | Increase process temperature | S | Warning [1] |
| 937 | EMC interference | Change main electronic module | S | Warning [1] |
| 938 | EMC interference | 1. Check ambient conditions regarding EMC influence<br>2. Change main electronic module | F | Alarm |
| 991 | Batch time exceeded | Check process conditions | F | Warning [1] |
| 991 | Maximum flow rate exceeded | | F | Warning [1] |

1) Diagnostic behavior can be changed.

## 12.6 Pending diagnostic events

The **Diagnostics** menu provides the option of displaying the current and previous diagnostic event separately.

To call up the measures to rectify a diagnostic event:
Via the DeviceCare and FieldCare operating tool→ 📄 51

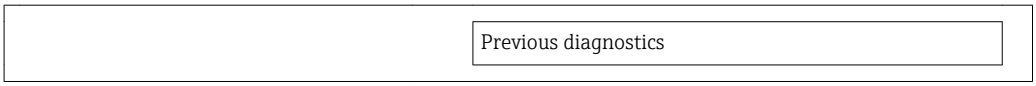
Other pending diagnostic events can be displayed in the **Diagnostic list** submenu
→ 📄 55

### Navigation

"Diagnostics" menu

### Structure of the submenu

| Diagnostics | → | Actual diagnostics |
|---|---|---|




**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. |

## 12.7 Diagnostic list

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

**Navigation path**
**Diagnostics** menu → **Diagnostic list** submenu

To call up the measures to rectify a diagnostic event:
Via "FieldCare" operating tool → 51

## 12.8 Event logbook

### 12.8.1 Event history

To call up the measures to rectify a diagnostic event:
Via "FieldCare" operating tool → 51

For filtering the displayed event messages → 55

### 12.8.2 Filtering the event logbook

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

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

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

### 12.8.3 Overview of information events

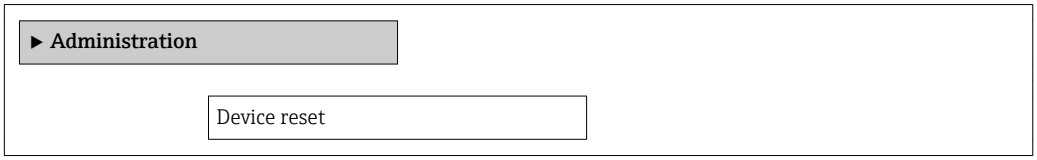
Unlike a diagnostic event, an information event is displayed in the event logbook only and not in the diagnostic list.

| Info number | Info name |
|---|---|
| I1000 | --------(Device ok) |
| I1089 | Power on |
| I1090 | Configuration reset |
| I1091 | Configuration changed |
| I1110 | Write protection switch changed |
| I1151 | History reset |

## 12.9 Resetting the measuring device

The device can be reset in the**Administration** submenu.

**Navigation**
"Expert" menu → System → Administration



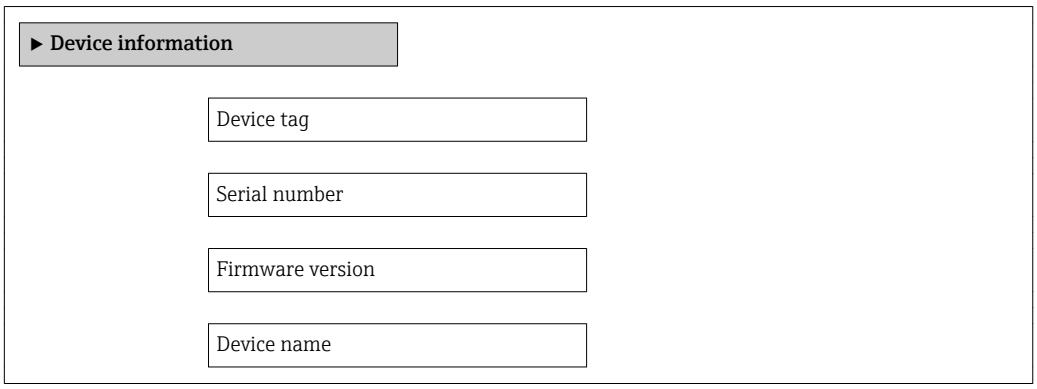

**Parameter overview with brief description**

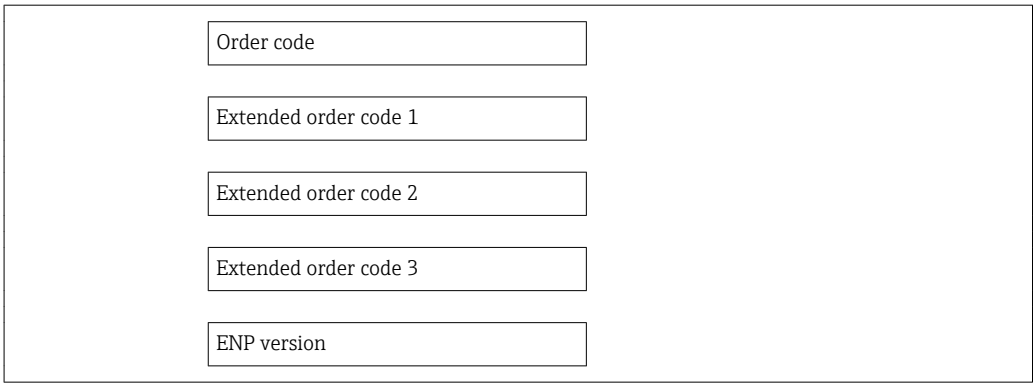
| Parameter | Description | Selection | Factory setting |
|---|---|---|---|
| Device reset | Reset the device configuration - either entirely or in part - to a defined state. | ▪ Cancel<br>▪ To delivery settings<br>▪ Restart device | Cancel |

## 12.10 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 | Display the name for the measuring point. | Max. 32 characters such as letters, numbers or special characters (e.g. @, %, /) | Dosimag |
| Serial number | Shows the serial number of the measuring device. | A maximum of 11-digit character string comprising letters and numbers. | – |
| Firmware version | Shows the device firmware version installed. | Character string with the following format: xx.yy.zz | 03.00 |
| Device name | Shows the name of the transmitter.<br>The name can be found on the nameplate of the transmitter. | Dosimag | – |
| Order code | Shows the device order code.<br>It can be found in the "Order code" field on the nameplate. | 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>It can be found in the "Ext. ord. cd." field on the nameplate. | 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). | | 2.02.00 |

## 12.11 Firmware history

| Release date | Firmware version | Order code for "Firmware version" | Firmware changes | Documentation type | Documentation |
|---|---|---|---|---|---|
| 09.2015 | 03.00.zz | Option **A** | No change in firmware | Operating Instructions | BA01321D/06/EN/02.15 |
| 08.2014 | 03.00.zz | Option **A** | ▪ Original firmware<br>▪ Can be operated via FieldCare and DeviceCare | Operating Instructions | BA01321D/06/EN/01.14 |

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 Downloads area of the Endress+Hauser web site: www.endress.com → Downloads
- Specify the following details:
  - Product root: e.g. 5RH
  - Text search: Manufacturer's information
  - Media type: Documentation – Technical Documentation

# 13 Maintenance

## 13.1 Maintenance tasks

No special maintenance work is required.

### 13.1.1 Exterior cleaning

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

### 13.1.2 Interior cleaning

Observe the following points for CIP and SIP cleaning:
- Use only cleaning agents to which the process-wetted materials are adequately resistant.
- Observe the maximum permitted medium temperature for the measuring device .

### 13.1.3 Replacing seals

The sensor's seals (particularly aseptic molded seals) must be replaced periodically.

The interval between changes depends on the frequency of the cleaning cycles, the cleaning temperature and the medium temperature.

Replacement seals (accessory part) → 62

## 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.

For a list of some of the measuring and test equipment, refer to the "Accessories" chapter of the "Technical Information" document for the device.

## 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 notes

**Repair and conversion concept**
The Endress+Hauser repair and conversion concept provides for the following:
- The measuring device cannot be converted.
- If the measuring device is defective, the entire device is replaced.
- It is possible to replace seals.

**Information on replacing wear parts (seals)**
Please note the following when replacing wear parts:
- Use only original Endress+Hauser spare parts.
- Replace the part 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.

## 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 in the **Device information** submenu → 56.

## 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 measuring device must be returned if it is need of repair or a factory calibration, or if the wrong measuring device has been delivered or ordered. Legal specifications require Endress+Hauser, as an ISO-certified company, to follow certain procedures when handling products that are in contact with the medium.

To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at http://www.endress.com/support/return-material

## 14.5 Disposal

### 14.5.1 Removing the measuring device

1. Switch off the device.

2. **⚠ WARNING**

**Danger to persons from process conditions.**

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

Carry out the mounting and connection steps from the chapters "Mounting the measuring device" and "Connecting the measuring device" in the logically reverse sequence. 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 sensor

| Accessories | Description | Order code |
|---|---|---|
| Seal set | For regular replacement of the seals on the process connections. | DK5G**-*** |
| Housing seal | To seal the transmitter | 50102857 |
| Mounting set | Consists of:<br>▪ 2 process connections<br>▪ Screws<br>▪ Seals | DKH**-**** |

## 15.2 Communication-specific accessories

| Accessories | Description |
|---|---|
| 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>For details, see Operating Instructions BA00027S and BA00059S |
| DeviceCare | Tool for connecting and configuring Endress+Hauser field devices.<br>For details, see Innovation brochure IN01047S |
| 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>For details, see the "Technical Information" document TI405C/07 |
| Adapter connection | Adapter connections for installation on other electrical connections:<br>▪ Adapter FXA291 (order number: 71035809)<br>▪ Adapter RSE8 (order number: 50107169)<br>RSE8 connection jack, 8-pin adapter (RSE8), 24 V DC, pulse, status<br>▪ Adapter RSE5 (order number: 50107168 )<br>RSE8 connection jack, 5-pin adapter (RSE5), 24 V DC, pulse, status<br>▪ Adapter RSE4 (order number: 50107167)<br>RSE8 connection jack, 4-pin adapter (RSE4), 24 V DC, pulse |
| Connecting cable RSE8 | Cable RKWTN8-56/5 P92, length: 5 m<br>(Order number: 50107895) |

## 15.3 Service-specific accessories

| Accessories | Description |
|---|---|
| Applicator | Software for selecting and sizing Endress+Hauser measuring devices:<br>▪ Calculation of all data required to determine the optimum flowmeter: e.g. nominal diameter, pressure loss, accuracy or process connections.<br>▪ Graphic illustration of the calculation results<br>Administration, documentation and access to all project-related data and parameters throughout the entire life cycle of a project.<br>Applicator is available:<br>▪ Via the Internet: https://wapps.endress.com/applicator<br>▪ On CD-ROM for local PC installation. |
| W@M | Life cycle management for your plant<br>W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant information is available for every measuring device over time entire life cycle, such as the Device status, spare parts, device-specific documentation.<br>The application already contains the data of your Endress+Hauser device. Endress +Hauser also takes care of maintaining and updating the data records.<br>W@M is available:<br>▪ Via the Internet: www.endress.com/lifecyclemanagement<br>▪ On CD-ROM for local PC installation. |
| 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>For details, see Operating Instructions BA00027S and BA00059S |
| DeviceCare | Tool for connecting and configuring Endress+Hauser field devices.<br>For details, see Innovation brochure IN01047S |
| 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>For details, see "Technical Information" TI00405C |

# 16 Technical data

## 16.1 Application

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

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

## 16.2 Function and system design

Measuring principle

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

Measuring system

The device consists of a transmitter and a sensor.

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

For information on the structure of the device → 🖹 11→ 🖹 11

## 16.3 Input

Measured variable

**Direct measured variables**

Volume flow (proportional to induced voltage)

Measuring range

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

*Flow characteristic values in SI units*

| Nominal diameter | Recommended flow | Factory settings | |
|---|---|---|---|
| | Max. full scale value | Pulse value | Low flow cut off (v ~ 0.04 m/s) |
| [mm] | [l/s] | [ml] | [ml/s] |
| 4 | 0.14 | 0.005 | 0.5 |
| 8 | 0.5 | 0.02 | 2 |
| 15K [1)] | 1.2 | 0.1 | 7 |
| 15 | 1.66 | 0.1 | 7 |
| 25 | 5 | 0.2 | 16 |

1) Conical version (corresponds to DN 12)

*Flow characteristic values in US units*

| Nominal diameter [in] | Recommended flow<br>Max. full scale value [gal/s] | Factory settings<br>Pulse value [oz fl] | Factory settings<br>Low flow cut off (v ~ 0.13 ft/s) [oz fl/s] |
|---|---|---|---|
| 5/32 | 0.035 | 0.0002 | 0.02 |
| 5/16 | 0.13 | 0.001 | 0.08 |
| ½K 1) | 0.32 | 0.004 | 0.25 |
| ½ | 0.44 | 0.004 | 0.25 |
| 1 | 1.33 | 0.007 | 0.53 |

1) Conical version (corresponds to DN 12)

### Recommended measuring range

"Flow limit" section → 70

Operable flow range

Over 1000 : 1

Input signal

### Status input

The batching process is controlled by the automation system via the device's status input.

| | |
|---|---|
| **Maximum input values** | ▪ DC 30 V<br>▪ 6 mA |
| **Response time** | Adjustable: 10 to 200 ms |
| **Input signal level** | ▪ Low level: 0 to 1.5 V<br>▪ High level: 3 to 30 V |
| **Assignable functions** | ▪ Off<br>▪ Start batching process<br>▪ Start and stop batching process<br>▪ Reset totalizers 1-3 separately<br>▪ Reset all totalizers<br>▪ Flow override |

## 16.4 Output

Output signal

### Modbus RS485

| | |
|---|---|
| **Physical interface** | In accordance with EIA/TIA-485-A standard |

### Switch output (batch: valve control)

Depending on the device version, the device has one or two switch outputs.

| **Switch output** | |
|---|---|
| **Version** | Active, open emitter |
| **Maximum input values** | ▪ DC 30 V<br>▪ 500 mA |
| **Switching behavior** | Binary, conductive or non-conductive |

| | |
|---|---|
| **Number of switching cycles** | Unlimited |
| **Assignable functions** | ▪ Open<br>▪ Closed<br>▪ Batching |

Signal on alarm

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

**Modbus RS485**

| | |
|---|---|
| **Failure mode** | Choose from:<br>▪ NaN value instead of current value<br>▪ Last valid value |

Low flow cut off

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

Galvanic isolation

- Device version: Modbus RS485, 1 switch output (batch), 1 status input
  (Order code for "Output, input": option 4)
  Switch outputs (batch) and status input on supply potential
- Device version: Modbus RS485, 2 switch outputs (batch), 1 status input
  (Order code for "Output, input", option 5:)
  – Switch outputs (batch) on supply potential.
  – Status input, galvanically isolated.

Protocol-specific data

**Modbus RS485**

| | |
|---|---|
| Protocol | Modbus Applications Protocol Specification V1.1 |
| Device type | Slave |
| Slave address range | 1 to 247 |
| Broadcast address range | 0 |
| Function codes | ▪ 03: Read holding register<br>▪ 04: Read input register<br>▪ 06: Write single registers<br>▪ 08: Diagnostics<br>▪ 16: Write multiple registers<br>▪ 23: Read/write multiple registers<br>▪ 43: Read device identification |
| Broadcast messages | Supported by the following function codes:<br>▪ 06: Write single registers<br>▪ 16: Write multiple registers<br>▪ 23: Read/write multiple registers |
| Supported baud rate | ▪ 1200 BAUD<br>▪ 2400 BAUD<br>▪ 4800 BAUD<br>▪ 9600 BAUD<br>▪ 19200 BAUD<br>▪ 38400 BAUD<br>▪ 57600 BAUD<br>▪ 115200 BAUD |
| Data transfer mode | ▪ ASCII<br>▪ RTU |
| Data access | Each device parameter can be accessed via Modbus RS485.<br>For Modbus register information → 74 |

## 16.5 Power supply

Terminal assignment

→ 24

Pin assignment, device plug

→ 25

Supply voltage

DC 24 V (nominal voltage: DC 20 to 30 V)

- The power unit must be tested to ensure that it meets safety requirements (e.g. PELV, SELV).
- The supply voltage must not exceed a maximum short-circuit current of 50 A.

Power consumption

4.5 W

Current consumption

| Order code for "Output, input": | Maximum Power consumption |
|---|---|
| Option **4**: Modbus RS485, 1 switch output (batch), 1 status input | 225 mA + 500 mA [1] |
| Option **5**: Modbus RS485, 2 switch outputs (batch), 1 status input | 225 mA + 1000 mA [1] |
| Option **6**: Modbus RS485 (custody transfer mode) | 225 mA |

1) Additional 500 mA per switch output (batch) used.

Switch-on current: max. 1 A (< 8 ms)

Power supply failure

- Totalizers stop at the last value measured.
- Error messages (incl. total operated hours) are stored.

Electrical connection

→ 28

Potential equalization

**Requirements**

No potential matching is needed for grounded steel lines.

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

Cable specification

→ 24

## 16.6 Performance characteristics

Reference operating conditions

**In accordance with DIN EN 29104**

- Medium temperature: +28 ± 2 °C (+82 ± 4 °F)
- Ambient temperature: +22 ± 2 °C (+72 ± 4 °F)
- Warm-up period:30 min

**Installation**
- Inlet run > 10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

Maximum measured error

**Error limits under reference operating conditions**

o.r. = of reading

**Volume flow**
- ±0.25 % o.r. ± 1 to 4 m/s (3.3 to 13 ft/s) or
- ±0.5 % o.r. ± 1 mm/s (0.04 in/s) or
- ±5 % o.r.

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

Repeatability

o.r. = of reading

*DN 25 (500 ml/s), DN 15 (200 ml/s), DN 8 (50 ml/s), DN 4 (10 ml/s); 400 µS/cm*

| Batch time $t_a$ [s] | Relative standard deviation in relation to the batched volume [%] |
|---|---|
| 1.5 s < $t_a$ < 3 s | 0.4 |
| 3 s < $t_a$ < 5 s | 0.2 |
| 5 s < $t_a$ | 0.1 |

*DN 15K (200 ml/s); 400 µS/cm*

| Batch time $t_a$ [s] | Relative standard deviation in relation to the batched volume [%] |
|---|---|
| 1.5 s < $t_a$ < 3 s | 0.25 |
| 3 s < $t_a$ < 5 s | 0.12 |
| 5 s < $t_a$ | 0.08 |

## 16.7 Installation

"Mounting requirements"

## 16.8 Environment

Ambient temperature range

**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.

Storage temperature

The storage temperature corresponds to the ambient temperature range of the transmitter and sensor.

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

| | |
|---|---|
| Degree of protection | As standard: IP67, type 4X enclosure |
| Shock resistance | Acceleration up to 2 g based on IEC 60068-2-6 |
| Vibration resistance | Acceleration up to 2 g based on IEC 60068-2-6 |
| Interior cleaning | ▪ Cleaning in place (CIP)<br>▪ Sterilization in place (SIP)<br>Observe the maximum medium temperatures → 69 |
| Electromagnetic compatibility (EMC) | According to IEC/EN 61326<br>For details, refer to the Declaration of Conformity. |

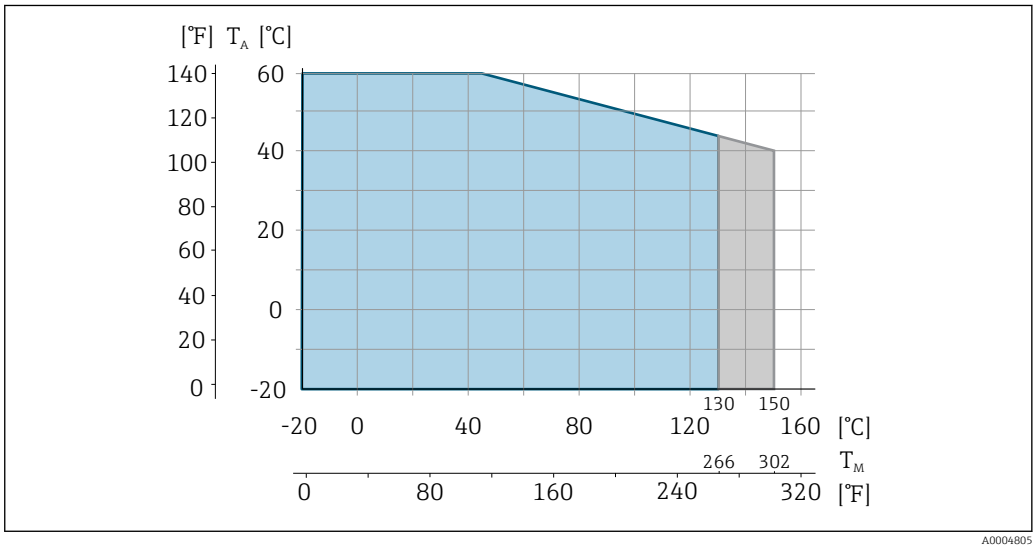
## 16.9 Process

Medium temperature range

**Sensor**
–20 to +130 °C (–4 to +266 °F)

**Cleaning**
+150 °C (+302 °F) / 60 min for CIP and SIP processes

**Seals**
- EPDM: –20 to +130 °C (–4 to +266 °F) (max. +150 °C (302 °F) for cleaning
- Silicon:–20 to +130 °C (–4 to +266 °F)
- Viton:0 to +150 °C (+32 to +302 °F)




A0004805

$T_A$ Ambient temperature

$T_M$ Medium temperature

Light-gray area: standard fluid temperature range

Dark-gray area: fluid temperature range for cleaning

**Conductivity**

- ≥ 5 µS/cm for liquids in general
- ≥ 10 µS/cmfor demineralized water

**Pressure-temperature ratings**

An overview of the pressure-temperature ratings for the process connections is provided in the "Technical Information" document

**Pressure tightness**

*Liner: PFA*

| Nominal diameter | | Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures: | |
|---|---|---|---|
| [mm] | [in] | +25 °C (+77 °F) | +150 °C (+302 °F) |
| 4 to 25 | 5/32 to 1 | > 1 mbar (0.402 in$H_2O$) (0) | > 1 mbar (0.402 in$H_2O$) (0) |

**Flow limit**

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum flow velocity 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 fluid:

- v < 2 m/s (6.56 ft/s): For abrasive media (e.g. cleaning agents)
- v > 2 m/s (6.56 ft/s): For media that produce buildup (e.g. liquids containing oil and sugar)

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 → 64

**Pressure loss**

- For DN 8 (5/16"), DN 15 (½") and DN 25 (1") 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 → 20

**System pressure**

→ 19

**Vibrations**

## 16.10 Mechanical construction

**Design, dimensions**

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

Weight

**Compact version**

*Weight in SI units*

| DN [mm] | Weight [kg] |
|---|---|
| 4 | 2.8 |
| 8 | 2.8 |
| 15 | 2.8 |
| 25 | 4.3 |

*Weight in US units*

| DN [in] | Weight [lbs] |
|---|---|
| 5/32 | 6.17 |
| 5/16 | 6.17 |
| ½ | 6.17 |
| 1 | 9.48 |

Materials

**Transmitter housing**

- Acid and alkali-resistant outer surface
- Stainless steel 1.4308 (304)

**Device plugs**

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

**Sensor housing**

- Acid and alkali-resistant outer surface
- Stainless steel 1.4301 (304)

**Measuring tube**

Stainless steel 1.4301 (304)

*Liner*

PFA

**Electrodes**

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

**Process connections**

- Weld-in nipple: 1.4404 (316L)
- Weld-in nipple, aseptic: 1.4404 (316L)
- Tri-Clamp: 1.4404 (316L)
- Couplings: 1.4404 (316L)

List of all available process connections → 72

**Seals**

Molded seal (EPDM, silicone, Viton)

Fitted electrodes

- Standard: stainless steel 1.4435 (316L)
- Optional: Alloy C22, 2.4602 (UNS N06022), platinum, tantalum

Process connections

**With O-ring seal**

**Welded connections**
- DIN EN ISO 1127
- ODT/SMS

**Coupling**
ISO 228/DIN 2999

**With aseptic molded seal:**

**Welded connections**
- EN 10357, DIN 11850
- ODT/SMS

**Tri-Clamp**
L14 AM7

For information on the different materials used in the process connections → 72

Surface roughness

Stainless steel electrodes, 1.4435 (304L); Alloy C22, 2.4602 (UNS N06022), platinum, tantalum:
0.3 to 0.5 µm (11.8 to 19.7 µin)

Liner with PFA:
≤ 0.4 µm (15.7 µin)

Process connection:
≤ 0.8 µm (31 µin)
(All data relate to parts in contact with fluid)

## 16.11 Operability

Local operation

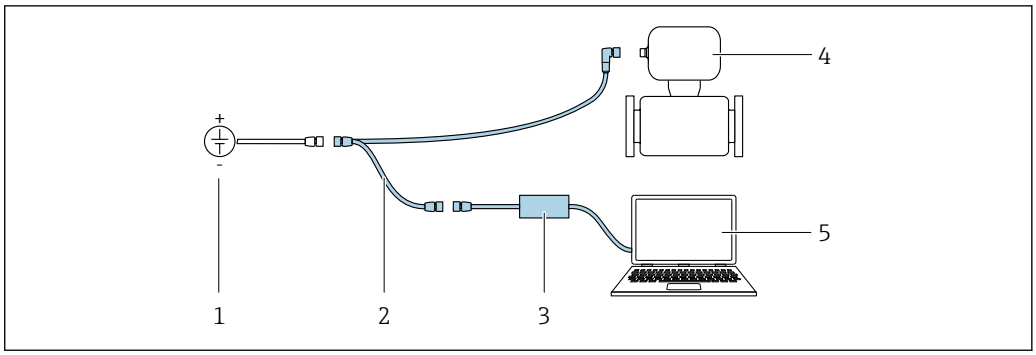
This device cannot be operated locally using a display or operating elements.

Remote operation

**Using service adapter and Commubox FXA291**

Operation and configuration can be performed using the Endress+Hauser FieldCare or DeviceCare service and configuration software.

The device is connected to the USB port of the computer via the service adapter and Commubox FXA291.




*1 Supply voltage 24 V DC*
*2 Service adapter*
*3 Commubox FXA291*
*4 Measuring device*
*5 Computer with "FieldCare" or "DeviceCare" operating tool*

The service adapter, cable and Commubox FXA291 are not included in the delivery. These components can be ordered as accessories → 62.

## 16.12 Certificates and approvals

| | |
|---|---|
| CE mark | The measuring system is in conformity with the statutory requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied.<br>Endress+Hauser confirms successful testing of the device by affixing to it the CE mark. |
| C-Tick symbol | The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)". |
| Ex approval | The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate. |
| Sanitary compatibility | ▪ 3A approval and EHEDG-certified<br>▪ Seals → FDA-compliant |
| Pressure Equipment Directive | ▪ With the PED/G1/x (x = category) marking on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential Safety Requirements" specified in Annex I of the Pressure Equipment Directive 97/23/EC.<br>▪ Devices not bearing this marking (PED) are designed and manufactured according to good engineering practice. They meet the requirements of Art.3 Section 3 of the Pressure Equipment Directive 97/23/EC. The range of application is indicated in tables 6 to 9 in Annex II of the Pressure Equipment Directive. |
| Measuring instrument approval | Dosimag is suitable as an (optional) component for recording volume in legally regulated measuring systems for AdBlue / DEF (Diesel Exhaust Fluid) in accordance with Appendix MI-005 of the European Measuring Instruments Directive 2014/32/EU. Dosimag is certified in accordance with OIML R117-1:2007 / OIML R117-2:2014 and has an MID evaluation certificate confirming conformity with the basic requirements of the Measuring Instruments Directive. |

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
- IEC/EN 61326
  Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- CAN/CSA C22.2 No. 61010-1-12
  Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements
- ANSI/ISA-61010-1 (82.02.01)
  Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 1: General Requirements

## 16.13 Accessories

Overview of accessories available for order → 62

## 16.14 Supplementary documentation

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

- 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 2-D matrix code (QR code) on the nameplate.

Standard documentation

### Brief Operating Instructions

| Measuring device | Documentation code |
|---|---|
| Dosimag | KA01175D |

### Description of device parameters

| Measuring device | Documentation code |
|---|---|
| | Pulse/frequency/status output<br>Option 3 |
| Dosimag | GP01049D |

| Measuring device | Documentation code |
|---|---|
| | Modbus RS485<br>Options 4, 5 and 6 |
| Dosimag | GP01048D |

### Technical Information

| Measuring device | Documentation code |
|---|---|
| Dosimag | TI00066D |

Supplementary device-dependent documentation

### Safety Instructions

| Contents | Documentation code |
|---|---|
| ATEX/IECEx Ex nA | XA01332D |
| cCSAus | FES0231 |
| UL Class 1 Division 2 | XA01377D |

### Special Documentation

| Contents | Documentation code |
|---|---|
| Information on Custody Transfer Measurement | SD01514D |

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